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GENERAL REEVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR WEST ONSLOW BEACH AND NEW RIVER INLET, NORTH CAROLINA

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY, CIVIL WORKS, THE DEPARTMENT OF THE ARMY

TRANSMITTING

THE FINAL INTEGRATED GENERAL REEVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT FOR WEST ONSLOW BEACH AND NEW RIVER INLET, NORTH CAROLINA

MAY 13, 2010.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

APR 23 2010

Honorable Nancy Pelosi
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

Dear Madam Speaker:

Section 101(b)(7) of the Water Resources Development Act of 1992 authorized a hurricane and storm damage reduction (HSDR) project in West Onslow Beach and New River Inlet (Topsail Beach), North Carolina. A General Reevaluation (GRR) of the original authorized project was prepared in response to the Energy and Water Development Appropriations Act of Fiscal Year 2001, Public Law 106-377. The Secretary of the Army supports the reauthorization and plans to implement the project through the normal budget process. The recommended project is described in the report of the Chief of Engineers dated September 28, 2009, which includes other pertinent reports and comments. The views of the State of North Carolina, the U.S. Departments of the Interior and Commerce, and the U.S. Environmental Protection Agency are set forth in the enclosed communications.

The project authorized in 1992, was never constructed because the non-Federal sponsor, the town of Topsail Beach determined they could not support the cost of the project or the 46 percent of the cost that would have been required as the non-Federal contribution. In March of 1993, the town of Topsail Beach decided not to execute the Project Cooperation Agreement.

Topsail Island was damaged by multiple storms in the late 1990s including hurricanes Bertha, Fran, Bonnie and Floyd between 1996 and 1999. These storms renewed the sponsor's interest in coastal storm damage reduction and a General Reevaluation Report (GRR) was directed by PL 106-377 to study and reformulate the authorized project. The GRR was completed in March 2008 and recommended the locally preferred plan (LPP). The LPP is comprised of a 26,200-foot long dune and berm system to be constructed to an elevation of 12 feet National Geodetic Vertical Datum (NGVD) fronted by a 50-foot wide berm at an elevation of 7-foot NGVD, with a main fill length of 23,200 feet and a 2,000-foot transition length on the north end into the Town of Surf City and a 1,000-foot transition on the south end. The recommended plan also includes periodic nourishment estimated at $9,492,000 at 4-year intervals for a total cost of $113,904,000 over the 50-year life of the project. Other associated features of the project are dune vegetation and construction of 23 dune walkover structures

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for public access. The recommended project will reduce average annual storm damages by 84 percent and will have no significant adverse effects on fish and wildlife resources.

The recommended plan is not the National Economic Development Plan (NED), but the smaller scale locally preferred plan (LPP). The project sponsor supports this plan over the NED Plan because both plans move the shoreline significantly seaward; the LPP costs 24 per cent less, but only reduces net benefits by 2.3 percent; the LPP has the greatest HSDR benefit to cost ratio, and the second highest total benefit to cost ratio; the LPP has a lower cost to the Town and lower Congressional appropriation requirements, and the LPP extends the protection 400 feet to the Godwin Avenue area, which includes 17 remaining properties in the community that are vulnerable to coastal storm damage (funded entirely by the non-Federal sponsor). An exception to the NED plan was approved by former Secretary John Paul Woodley on May 8, 2009.

Based on October 2009 price levels, the total first cost of the recommended project is estimated at $38,504,000. By comparison, the total project cost of the NED Plan is estimated at $51,389,000. The total expected annual costs for the recommended plan, based on a discount rate of 4.375 percent and a 50-year period of analysis, are estimated to be $4,468,000, including monitoring and operation, maintenance, repair, replacement, and rehabilitation. For the NED plan, the annual costs are estimated at $5,112,000. Total expected annual benefits for the recommended plan are estimated to be $15,103,000, with net annual benefits of $10,635,000. The annual benefits attributed to HSDR are estimated to be $9,516,000 with annual incidental recreation benefits estimated to be $5,500,000 and reduced annual emergency costs at $87,000. The benefit-cost ratio for the recommended plan is approximately 3.4 for the total project (including recreation benefits) and 2.1 for HSDR only. By comparison, the NED plan has estimated annual project costs of $5,112,000 with annual project benefits of $16,183,000 and net benefits of $11,071,000. Under the NED plan, annual benefits attributed to HSDR are estimated to be $10,596,000 with annual incidental recreation benefits estimated to be $5,500,000 and reduced emergency costs at $87,000, which are identical to the recommended plan. The benefit-cost ratio for the NED plan is approximately 3.2 for the total project (including recreation benefits) and 2.1 for HSDR only.

Cost sharing for the construction of the recommended project is applied in accordance with the provisions of Section 103 of WRDA 1986, as amended by Section 215 of WRDA 1999. The Federal share of the total cost for the LPP is estimated to be $27,455,000 and the non-Federal share is estimated to be $15,103,000, but will be based upon conditions of public ownership and use of the shore when the Project Partnership Agreement is signed. The non-Federal share of the initial construction cost is 35.6 percent and includes $1,885,600 cash during the period of construction; $1,481,000 creditable lands, easements,

rights-of-way, relocations, and dredged or excavated material disposal areas (LERRD) and $320,000 for the incremental cost of the 400-foot berm and dune extension. Based on WRDA 1996, as amended, subject to the availability of funds, periodic nourishment is cost-shared 50 percent Federal and 50 percent non-Federal, based upon conditions of public ownership and use of the shore. The Federal share of each periodic nourishment cost is estimated to be $4,846,000 (50 percent) and the non-Federal share is estimated to be $4,846,000 (50 percent). The project also includes annual monitoring costs totaling $281,000. The Town of Topsail Beach is legally capable of fulfilling the requirements for being the non-Federal sponsor.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress and concludes that the report recommendation is consistent with the policy and programs of the President. A copy of its letter is enclosed. I am providing a copy of this transmittal and the OMB letter dated April 14, 2010 to the House Committee on Appropriations' Subcommittee on Energy and Water Development and the House Committee on Transportation and Infrastructure's Subcommittee on Water Resources and Environment.

Very truly yours,

jo-ellen darcy

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Enclosures

11 Enclosures

1. Chief's Report, Sept 28, 2009
2. DOI letter, dated Sept 2, 2009
3. EPA letter, dated, Sept 12, 2009
4. USDA letter, dated Aug 11, 2009
5. North Carolina Department of Administration letter, dated Sept 15, 2009
6. North Carolina DENR letter, dated Sept 12, 2009
7. North Carolina Dept of Crime control & Public Safety –Division of Emergency Management letter, dated, Sept 7, 2009
8. Town of Topsail Beach letter, dated Mar 5, 2008
9. Record of Decision, dated, April 23, 2010
10. OMB Clearance Letter, dated, April 14, 2010
11. General Reevaluation Report, March 2008

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
441 G Street N.W.
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

SEP 28 2009

CECW-SAD (1105-2-10a)

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

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on hurricane and storm damage reduction along a 5-mile reach of Atlantic Ocean shoreline at Topsail Beach, North Carolina. It is accompanied by the report of the district and division engineers. These reports are in final response to the Energy and Water Development Appropriations Act for Fiscal Year 2001, Public Law 106-377, which included funds for the U.S. Army Corps of Engineers to initiate a General Reevaluation Report (GRR) of the West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project, and the remaining shoreline at Topsail Beach. The original project was authorized in Section 101(15) of the Water Resources Development Act (WRDA) of 1992 at a total cost of $14,100,000, with an estimated Federal cost of $7,600,000, and an estimated non-Federal cost of $6,500,000. The authorized project was never constructed. Several recent coastal storms and hurricanes along many portions of North Carolina's shoreline and increasing threats to existing and new development within the Town of Topsail Beach led to initiation of this post-authorization investigation. Preconstruction engineering and design activities for Topsail Beach will be continued under the authorities above.

2. The reporting officers recommend a new authorization for a locally preferred plan (LPP) to reduce hurricane and storm damages by construction of a sand dune and berm along the Topsail Beach shoreline. The recommended plan includes a 26,200-foot long dune and berm system to be constructed to an elevation of 12 feet National Geodetic Vertical Datum (NGVD) fronted by a 50-foot wide berm at an elevation of 7-foot NGVD, with a main fill length of 23,200 feet and a 2,000-foot transition length on the north end into the Town of Surf City and a 1,000-foot transition on the south end. The recommended plan also includes periodic nourishment at four-year intervals. Other associated features of the project are dune vegetation and construction of 23 dune walkover structures for public access. The estimated in-place volume of fill for the initial project construction is 2,387,000 cubic yards, which does not include placement of 690,000 cubic yards for the first nourishment. Fill material for the sand dune and berm construction and nourishment will be dredged from offshore borrow sites identified off the coast of Topsail Beach. The recommended plan also includes post-construction monitoring over the life of the project to ensure project performance. Since the recommended plan does not have any significant adverse effects, no mitigation measures (beyond management practices and avoidance) or compensation measures are required. Compared to the National Economic Development (NED) Plan, the LPP has a dune three feet lower and extends the main fill protection 400-feet southwest to include properties south of Godwin Avenue that are vulnerable

to coastal storm damage. The Assistant Secretary of the Army (Civil Works) approved a policy exception allowing the Corps of Engineers to recommend the LPP by letter dated May 8, 2008. The 400-foot project extension costs an additional $320,000, and is not economically justified. The extension will therefore be funded entirely by the non-Federal sponsor. All features are located in North Carolina.

3. Based on October 2008 price levels the estimated total first cost of the NED plan is $50,332,000, of which $32,712,000 (65 percent) is Federal and $17,620,000 (35 percent) is non-Federal. The estimated first cost of the LPP is $37,712,000. The total initial cost of the recommended plan, including sunk preconstruction engineering and design (PED) costs from project authorization in 1992 through completion of this GRR and Environmental Impact Statement (EIS), is $42,558,000. These sunk PED costs include initial project PED costs of $616,000 and the GRR and EIS cost of $4,230,000, for a total of $4,846,000. The sunk PED costs for the original project are cost shared 75 percent Federal and 25 percent non-Federal and the expanded portion of the project is cost shared 50 percent Federal and 50 percent non-Federal. The total initial project construction cost is composed of both the total first cost of the LPP plus sunk PED costs. Cost sharing for the construction of the project is applied in accordance with the provisions of Section 103 of WRDA 1986, as amended by Section 215 of WRDA 1999. The Federal share of the total cost for the LPP is estimated to be $27,455,000 and the non-Federal share is estimated to be $15,103,000, but will be based upon conditions of public ownership and use of the shore when the Project Partnership Agreement is signed. The non-Federal share includes $320,000 for the incremental cost of the 400-foot berm and dune extension. The estimated cost of lands, easements, rights-of-way, relocations, and dredged or excavated material disposal areas (LERRD) is $ 1,654,000, of which $1,481,000 is estimated to be creditable to the non-Federal sponsor's share.

4. Total periodic nourishment costs for the LPP are estimated to be $113,904,000 (October 2008 price level) over the 50-year period following initiation of construction. These costs are based on an estimated cost for each periodic nourishment of $9,492,000 occurring at four year intervals subsequent to completion of the initial construction (year zero) and include engineering and design and monitoring. The ultimate project cost, which includes initial construction, project monitoring, and periodic nourishment is estimated to be $170,032,000 (October 2008 price level). The equivalent annual cost of periodic nourishment is estimated to be $2,190,000, based on a Federal discount rate of 4.625 percent and a 50-year period of analysis. Based on WRDA 1996, as amended, subject to the availability of funds, periodic nourishment is cost-shared 50 percent Federal and 50 percent non-Federal, based upon conditions of public ownership and use of the shore. The Federal share of each periodic nourishment cost is estimated to be $4,746,000 (50 percent) and the non-Federal share is estimated to be $4,746,000 (50 percent). The project includes beach fill and environmental monitoring costs estimated at $269,000. Annual beach fill monitoring includes semi-annual beach profile surveys ($137,000), annual hydrographic surveys of New Topsail Inlet ($6,000), annual aerial photography of the inlet and beach (cost included in inlet hydrographic survey), an annual monitoring report ($93,000), and monitoring program coordination ($15,000). Annual environmental monitoring includes sea turtle nesting ($17,000) and sea beach amaranth surveys ($1,000), and a one-time cost for benthic invertebrate monitoring ($120,000). The estimated Federal share of annual monitoring costs is $134,500 (50 percent) and the estimated non-Federal share is $134,500 (50 percent). The estimated

Federal share of the one-time benthic invertebrate monitoring is $60,000 (50 percent) and the estimated non-Federal share is $60,000 (50 percent). The Town of Topsail Beach is the non-Federal cost-sharing sponsor for all features and is responsible for the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project after construction, a cost currently estimated at about $22,000 per year.

5. Based on a 4.625-percent discount rate and a 50-year period of analysis, the total equivalent average annual costs of the project are estimated to be $4,450,000, including monitoring and OMRR&R. The equivalent average annual benefits are estimated to be $13,328,000 with net average annual benefits of $8,878,000. The benefit-cost ratio is three to one.

6. The goals and objectives included in the Campaign Plan of the U.S. Army Corps of Engineers have been fully integrated into the Topsail Beach study process. From inception, the district has implemented an effective comprehensive systems approach with full stakeholder participation. The study included an integrated analysis of the Topsail Beach shoreline system and cumulative environmental effects. A statistical, risk based model was used to formulate and evaluate the project. The study report describes risks associated with residual coastal storm damages and risks that will not be reduced such as sound side flooding and wind damages. Loss of life is prevented by the existing procedure of evacuating the barrier island completely well before expected hurricane landfall, removing people from harm's way. The study recommends continuation of the evacuation policy both with and without the project. The selected plan would reduce average annual coastal storm damages by about 84 percent and would leave average annual residual damages estimated at $1,543,000. Additional institutional nonstructural measures to be implemented by the local government are contained in the study report recommendation. The project contains adaptive management measures through the development of borrow area contingency plans to be applied during construction and by an annual project monitoring program to reevaluate and adjust the periodic renourishment actions. The project monitoring program will be a useful research tool for other beach and shoreline studies.

7. I concur with the findings, conclusions, and recommendations of the reporting officers. The plan developed is technically sound, economically justified, and environmentally and socially acceptable. The plan conforms to essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other administrative and legislative policies and guidelines. Also, the views of interested parties, including Federal, State, and local agencies have been considered. Substantive comments concerned borrow material compatibility, potential existence of near shore hard bottom areas, and avoiding impacts to sea turtles and piping plover. The comments resulted in some changes to the text of the GRR and EIS, but did not change the design of the recommended plan. Independent external peer review (IEPR) was not undertaken for this project, since it was not considered to be unusually complex, novel approaches or methods were not employed, there is no significant threat to public safety from project failure, and it was not controversial. Additionally, the project did not generate significant interagency interest, and only negligible adverse impacts would result.

8. Accordingly, I recommend that the plan to reduce hurricane and storm damages at Topsail Beach, North Carolina be authorized in accordance with the reporting officers' recommended

plan at an October 2008 estimated cost of $42,558,000 with such modifications as in the discretion of the Chief of Engineers may be advisable. My recommendation is subject to cost sharing, financing, and other applicable requirements of Federal and State laws and policies, including Section 103 of WRDA 1986, as amended by Section 215 of WRDA 1999. The non-Federal sponsor would provide the non-Federal cost share and all LERRD. Further, the non-Federal sponsor would be responsible for all OMRR&R. This recommendation is subject to the non-Federal sponsors agreeing to comply with all applicable Federal laws and policies.

9. I further recommend that construction of the proposed project be contingent on the project sponsor giving written assurances satisfactory to the Secretary of the Army that it will:

a. Provide 35 percent of initial construction costs assigned to hurricane and storm damage reduction plus 100 percent of initial construction costs assigned to protecting privately owned shores where use is limited to private interests, and as further specified below:

1. Provide 25 percent of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;

2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs;

3. Provide all lands, easements, and rights-of-way, including those required for relocations, the borrowing of material, and the disposal of dredged or excavated material; perform or ensure the performance of all relocations; and construct all improvements required on lands, easements, and rights-of-way to enable the disposal of dredged or excavated material all as determined by the Government to be required or to be necessary for the construction, operation, and maintenance of the project; and

4. Provide, during initial construction, any additional funds necessary to make its total contribution equal to 35 percent of project costs assigned to hurricane and storm damage reduction plus 100 percent of costs assigned to protecting privately owned shores where use is limited to private interests.

b. Provide during the periodic nourishment period, 50 percent of periodic nourishment costs and 50 percent of monitoring costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs and 100 percent of monitoring assigned to protecting privately owned shores where use is limited to private interests.

c. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share therefore, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

d. Prevent obstructions or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) such as any new developments on project lands, easements, and rights-of-way or the addition of facilities which might reduce the outputs produced by the project, hinder operation and maintenance of the project, or interfere with the project's proper function;

e. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the project, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

f. For so long as the project remains authorized, operate, maintain, repair, rehabilitate, and replace the project, or functional portions of the project, including any mitigation features, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

h. Hold and save the United States free from all damages arising from the construction, periodic nourishment, operation, maintenance, repair, rehabilitation, and replacement of the project and any betterments, except for damages due to the fault or negligence of the United States or its contractors;

i. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of three years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*), and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

k. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such

investigations unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

l. Assume, as between the Federal Government and the non-Federal sponsor, complete financial responsibility for all necessary cleanup and response costs of any hazardous substances regulated under CERCLA that are located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction, operation, and maintenance of the project;

m. Agree, as between the Federal Government and the non-Federal sponsor, that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, repair, rehabilitate, and replace the project in a manner that will not cause liability to arise under CERCLA;

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103(j) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213(j)), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until each non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element;

o. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

p. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;

q. Comply with Section 402 of the Water Resources Development Act of 1986, as amended, (33 U.S.C. 701b-12) , which requires a non-Federal interest to prepare a floodplain management plan within one year from signing a project partnership agreement., and to implement such plan not later than one year after completion of construction of the project;

r. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

s. For so long as the project remains authorized, the non-Federal Sponsor shall ensure continued conditions of public ownership, access, and use of the shore upon which the amount of Federal participation is based;

t. Provide and maintain necessary access roads, parking areas, and other public use facilities , open and available to all on equal terms; and

u. At least twice annually at no cost to the Federal Government, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal Government.

10. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to Congress, the sponsor, the State of North Carolina, interested Federal agencies, and other parties will be advised of any significant modifications and will be afforded an opportunity to comment further.

FOR,

R. L. VAN ANTWERP
Lieutenant General, US Army
Chief of Engineers

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Washington, DC 20240

Ms. Robyn Colosmio
U.S. Army Corps of Engineers, Headquarters
CECW-P (SA)
7701 Telegraph Road
Alexandria, Virginia 22315-3860

SEP 0 2 2008

Dear Ms. Colosimo:

Thank you for the opportunity to review the U.S. Army Corps of Engineers' Final Integrated General Reevaluation Report / Environmental Impact Statement (GRR/EIS) and proposed report of the Chief of Engineers on the West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project. Comments on the documents can be found below.

The GRR/EIS identifies several borrow areas on the Outer Continental Shelf (OCS), under the jurisdiction of the Minerals Management Service (MMS), that may be used to obtain sand for this shore protection project. Since the MMS was not a cooperating agency during the development of the EIS, we may adopt, revise for our purposes, and recirculate the EIS and/or execute an independent Record of Decision to support future leasing decisions. If new information becomes available between the publication of this EIS, the publication of the Supplemental EIS being prepared for the Topsail Beach Interim Beach Fill Project, and a future lease request, the MMS reserves the right to undertake or require supplemental NEPA evaluation.

GRR/EIS Comments

General

Table 5.3, in the Plan Formulation and Evaluation of Alternatives chapter, provides a comparative matrix of environmental impacts for types of possible actions. Council on Environmental Quality (CEQ) regulations on the preparation of EISs require that the environmental effects of reasonable alternatives be addressed in the Environmental Consequences section (40 CFR Parts 1502.14 and 1502.16). This table could be referenced or incorporated in the introductory material of the Environmental Consequences section. If, through the Corps Plan Formulation, Evaluation, and Selection Process, alternatives were determined to be unreasonable, justification could be provided for their exclusion. Moreover, the Corps could specify why the environmental effects of specific alternatives (no action and National Economic Development [NED] Plan) are not explored in further detail. Although the Locally-Preferred Plan (i.e., preferred alternative) and NED Plan have similar types of impacts, the actual impacts may differ with respect to intensity and duration.

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Specific

- The timing of initial construction of the proposed shore protection project should be consistent in the Supplemental EIS and FEIS. The Draft Supplemental EIS, recently circulated by the Regulatory Branch of the Wilmington District for comment, uses an initial construction scenario of 2016 compared to the 2011 baseline assumed in this NEPA document.

- The Physical Oceanography material presented in Affected Environment and Environmental Consequences sections may be inadequate, as only waves and longshore transport are explicitly addressed. Wind- and tidally-driven currents and along-shelf and across-shelf sediment transport outside of the surf zone maybe important in the vicinity of the offshore borrow areas. In other areas of the Mid- and South Atlantic Bight, such currents have been shown to be important to borrow pit infilling, sand shoal / wave migration, and spatial/temporal variability in the exposure and burial of hard bottom.

- In Table 5.3, the list of potential impacts under beach fill alternatives excludes the potential to adversely affect sea turtles.

- In addition to the mitigation measures proposed concerning the potential encounter of ordnance in the offshore borrow areas (Section 8.08.3), additional screening and/or observing on the dredge may be necessary if unexploded ordnance is discovered during the dredging process. A contingency plan could be developed in case of such a scenario, especially if there is evidence that the ordnance is no longer centrally located.

- The Environmental Consequences section indicates that an offshore pipeline routing plan will be developed for the submerged placement of pipelines in order to avoid impacts to known or suspected hard bottom areas. A similar plan could be developed to avoid direct impacts by spudding and/or anchoring by dredges, barges, booster pumps, and support vessels in the vicinity of hard bottom areas. If existing information about the location of hard bottom areas provided in the geotechnical report in Appendix C, the archaeological report, and new geophysical surveys conducted by Coastal Planning and Engineering is determined insufficient for offshore areas outside the proposed borrow areas, additional mapping may be necessary.

- The air quality analysis included in the Environmental Consequences section fails to demonstrate compliance with National Ambient Air Quality Standards (NAAQS). A more thorough analysis would present calculated emissions rates given different dredging and construction scenarios project, including both pipeline and hopper dredging operations.

- The archaeological report, *Archaeological Remote Sensing Survey of Topsail and West Onslow Beaches Offshore Borrow Areas*, should be included in the appendices, since it is directly referenced in sections concerning the borrow areas, hard bottom habitat, and potential impacts to cultural resources.

- One of the most probable and potentially significant adverse impacts of the proposed action is dredge entrainment of protected sea turtles. Although this risk is adequately handled in the biological assessment (Appendix I in the GRR/FEIS, available in electronic format only), it would be helpful to include a summary of the direct and indirect effects on sea turtles in the Environmental Consequences section, instead of solely incorporating the information by reference.

Proposed Chief of Engineer's Report

No comment.

If you would like to discuss any of these comments, please contact Geoffrey Wikel at (703) 787-1283 or Geoffrey.Wikel@mms.gov.

Sincerely,

James F. Bennett
Chief, Bureau of Environmental Assessment
Environmental Division

cc: Colonel John E. Pulliam
U.S. Army Corps of Engineers, Wilmington District

Ms. Loretta Sutton
U.S. Department of the Interior, Office of Environmental Policy and Compliance

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET NW
WASHINGTON, D.C. 20314-1000

MAY 19 2009

CECW-SAD

Mr. James F. Bennett
Chief, Bureau of Environmental Assessment
Environmental Division
Minerals Management Service
Washington, DC 20240

Dear Mr. Bennett:

Thank you for your letter dated September 2, 2008, providing comments on the Final Integrated General Reevaluation Report and Environmental Impact Statement (GRR/EIS) for Shore Protection, West Onslow Beach and New River Inlet (Topsail Beach), North Carolina. We appreciate your evaluation of the GRR/EIS for this important shore protection project, and have enclosed additional information to address your concerns.

We trust that the attached information and explanations, sufficiently addresses your concerns. If you would like to discuss these issues further, please contact Mr. Douglas Greene, our Wilmington District Project Manager, at 910-251-4553.

Enclosure

Sincerely,

Theodore A. Brown

THEODORE A. BROWN, P.E.
Chief, Planning and Policy
Division Directorate of Civil Works

Enclosure:
Corps of Engineers Responses
To Minerals Management Service Review Comments
Final GRR and EIS for Shore Protection
West Onslow Beach and New River Inlet (Topsail Beach), North Carolina

Comment 1: Table 5.3, in the Plan Formulation and Evaluation of Alternatives chapter, provides a comparative matrix of environmental impacts for types of possible actions. Council on Environmental Quality (CEQ) regulations on the preparation of EISs require that the environmental effects of reasonable alternatives be addressed in the Environmental Consequences section (40 CPR Parts 1502.14 and 1502.16). This table could be referenced or incorporated in the introductory material of the Environmental Consequences section.

Response 1: Concur. Table 5.3 will be referenced in the introductory material of the Environmental Consequences section.

Comment 2: If, through the Corps Plan Formulation, Evaluation, and Selection Process, alternatives were determined to be unreasonable, justification could be provided for their exclusion. Moreover, the Corps could specify why the environmental effects of specific alternatives (no action and National Economic Development [NED] Plan) are not explored in further detail. Although the Locally-Preferred Plan (i.e., preferred alternative) and NED Plan have similar types of impacts, the actual impacts may differ with respect to intensity and duration.

Response 2: The alternatives considered, but eliminated, are discussed in the GRR and EIS and consist of a non-structural plan, a no action plan and various dune and berm designs. Although potential environmental effects of all plans are considered and summarized in Table 5.3 of the GRR and EIS, the Corps only undertakes detailed study of the potential environmental effects of the Recommended Plan. The variations of the beachfill plans would result in very minor differences in potential environmental effects. The other plans considered but eliminated could also result in impacts that are not discussed in detail in the GRR and EIS, however, it is not cost effective to develop detailed impact assessments on plans not recommended for implementation. The Corps agrees that the documents should specify why the environmental effects of specific alternatives are not explored in further detail.

Comment 3: The timing of initial construction of the proposed shore protection project should be consistent in the Supplemental EIS and FEIS. The Draft Supplemental EIS, recently circulated by the Regulatory Branch of the Wilmington District for comment, uses an initial construction scenario of 2016 compared to the 2011 baseline assumed in this NEPA document.

Response 3: The DSEIS will be updated and clarified to reflect consistency between the FEIS and DSEIS in the identification of the FY 2012 (15 November 2011 through 30 April 2012) initial construction timeline for the federal project.

Comment 4: The Physical Oceanography material presented in Affected Environment and Environmental Consequences sections may be inadequate, as only waves and longshore transport are explicitly addressed. Wind- and tidally-driven currents and along-shelf and across-shelf sediment transport outside of the surf zone maybe important in the vicinity of the offshore borrow areas. In other areas of the Mid- and South Atlantic Bight, such currents have been shown to be important to borrow pit infilling, sand shoal/wave migration, and spatial/temporal variability in the exposure and burial of hard bottom.

Response 4: The Corps recognizes that wind and tidally driven currents may result in transport of sediments offshore of the littoral zone. However, the borrow areas designated for the Topsail Beach project do not rely on any infilling due to sediment transport by any mechanism to satisfy the borrow requirements for the project. Additionally, considering their distance offshore and the depth of dredge cuts within the borrow areas, impacts to wave transformation and subsequent shoreline response were not expected. Therefore, no models were run in the offshore borrow sites to assess shoreline response or infilling rates; however, some infilling of sediments are anticipated and expected to aid in recovery of benthic invertebrate communities. As discussed in Sections 2.01.10 and 8.01.8.2; though the Corps recognizes that wind and tidally driven sediment transport mechanisms are important contributors to the ephemeral nature of low lying hard bottom communities in the offshore environment, based on the side scan surveys performed within the borrow areas for this project, no hard bottom communities were identified within the borrow area limits

Comment 5: In Table 5.3, the list of potential impacts under beach fill alternatives excludes the potential to adversely affect sea turtles.

Response 5: Concur. Table 5.3 has been updated to address adverse impacts to sea turtles. The revised table now includes the following language under the "Resource" row titled "Threatened and Endangered Species": Beachfill Alternatives - 3.May adversely affect loggerhead, green, and Kemp's Ridley sea turtle species through lethal entrainment within hopper dredge dragheads; Non-Structural Alternative - 3. Status quo maintained; No Action - 3. Status quo maintained. Numbers 3, 4, and 5 within this row have been updated to 4,5, and 6 for each alternative.

Comment 6: In addition to the mitigation measures proposed concerning the potential encounter of ordnance in the offshore borrow areas (Section 8.08.3), additional screening and/or observing on the dredge may be necessary if unexploded ordnance is discovered during the dredging process. A contingency plan could be developed in case of such a scenario, especially if there is evidence that the ordnance is no longer centrally located.

Response 6: Agree. The following language will be added to the report: *The contract specifications for the proposed project would direct the contractor to immediately stop work and*

inform the contracting officer if unexploded ordnance is encountered during dredging or disposal. At that time, additional measures will be implemented, as necessary, including inspection of dredged material on the beach and installation of outflow screens on the dredge pipeline. Any unexploded ordnance found on the beach would be promptly removed.

Comment 7: The Environmental Consequences section indicates that an offshore pipeline routing plan will be developed for the submerged placement of pipelines in order to avoid impacts to known or suspected hard bottom areas. A similar plan could be developed to avoid direct impacts by spudding and/or anchoring by dredges, barges, booster pumps, and support vessels in the vicinity of hard bottom areas. If existing information about the location of hard bottom areas provided in the geotechnical report in Appendix C, the archaeological report, and new geophysical surveys conducted by Coastal Planning and Engineering is determined insufficient for offshore areas outside the proposed borrow areas, additional mapping may be necessary.

Response 7: All benthic interactions associated with the dredging and beach construction activities for this project (including spudding and/or anchoring by dredges, barges, booster pumps and support vessels) will require supporting benthic mapping data to confirm that no direct or indirect impacts to hard bottom communities will occur at a given location. Of the borrow areas identified for the Topsail Beach shore protection project, only borrow area A has been identified to be dredged using a hydraulic cutterhead dredge during initial construction. Therefore, all spudding and/or anchoring by the cutterhead dredge and associated barges will occur within the limits of borrow area A have already been surveyed for hard bottom. All existing nearshore and offshore hard bottom mapping data will be utilized to develop a pipeline route that avoids hard bottom communities. All benthic interactions associated with hopper dredges will be confined to the surveyed borrow areas. No spudding, anchoring, etc. is required as a component of hopper dredge operations. It is anticipated that pump out stations associated with hopper dredge activates will require anchoring; however, they will be located within the previously surveyed nearshore environment which did not contain any hard bottom resources. For any site specific component of this project which will require benthic interaction, if previously collected information about the location of hard bottom areas is determined insufficient for the selected site, additional mapping will be conducted or a new site will be selected where surveys have already been performed.

Comment 8: The air quality analysis included in the Environmental Consequences section fails to demonstrate compliance with National Ambient Air Quality Standards (NAAQS). A more thorough analysis would present calculated emissions rates given different dredging and construction scenarios project, including both pipeline and hopper dredging operations.

Response 8: A more thorough air quality analysis has been completed and will be included in the final report.

Comment 9: The archaeological report, Archaeological Remote Sensing Survey of Topsail and West Onslow Beaches Offshore Borrow Areas, should be included in the appendices, since it is

directly referenced in sections concerning the borrow areas, hard bottom habitat, and potential impacts to cultural resources.

Response 9: Concur. The archaeological report will be included as Appendix U to the Final report.

Comment 10: One of the most probable and potentially significant adverse impacts of the proposed action is dredge entrainment of protected sea turtles. Although this risk is adequately handled in the biological assessment (Appendix I in the GRR/FEIS, available in electronic format only), it would be helpful to include a summary of the direct and indirect effects on sea turtles in the Environmental Consequences section, instead of solely incorporating the information by reference.

Response 10: Concur. The FEIS will be updated to include Section 8.02.4 "Endangered and Threatened Species" in order to summarize project direct and indirect impacts to E&T species, specifically sea turtles. The following new Section and associated language will be added to the FEIS: Section 8.02.4 Endangered and Threatened Species . The direct and indirect impacts from the proposed project to endangered and threatened species are discussed in detail in the biological assessment (Appendix I). In summary, it has been determined that the project may affect, but is not likely to adversely affect, piping plover and seabeach amaranth as well as nesting leatherback, loggerhead, and green sea turtles. However, proposed hopper dredging activities may occur in areas used by migrating turtles; therefore, hopper dredging activities associated with this project may affect, and are likely to adversely affect the loggerhead, green, Kemp's ridley, and hawksbill sea turtles in the water within the vicinity of the dredging operation. Cutterhead pipeline dredges have not been known to take sea turtles; however, hopper dredges potentially pose the greatest risk to sea turtles through physical injury or death by entrainment. Hopper dredges move rapidly over the bottom sediments and can injure or kill loggerhead, green, and Kemp's ridley sea turtles lying on the sea bottom. Based on historic hopper dredging take data, leatherback sea turtles are not known to be impacted by hopper dredging operations. In order to minimize potential impacts, hopper dredges would be used only from 1 December to 31 March of any year when water temperatures are cooler, generally <14°C (57.2°F). However, because some sea turtle species may be found year-round in the offshore area, hopper dredging activities may occur during low levels of sea turtle migration. The Corps will strictly adhere to Regional Biological Opinion and incidental take statement provided by the NMFS for the continued hopper dredging of channels and borrow areas in the southeastern United States dated 25 September, 1997 and will maintain observers on hopper dredges for the periods prescribed by NMFS to document any incidental takes of sea turtle species and to ensure that turtle deflector dragheads are used properly.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

09/12/08

Mr. Theodore A. Brown, Acting Chief
Planning and Policy Division, Civil Works
U.S. Army Corps of Engineers
CECW-P (SA)
7701 Telegraph Road
Alexandria, VA 22315-3860

Subject: West Onslow Beach and New River Inlet (Topsail Beach), North Carolina Shore Protection, General Reevaluation Report and Final Environmental Impact Statement - ERP: COE-E11060-NC - CEQ: 20080310

Dear Mr. Brown:

Pursuant to Section 309 of the Clean Air Act (CAA) and Section 102(2)(C) of the National Environmental Policy Act (NEPA), the U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the U. S. Army Corps of Engineers' (Corps) Final Environmental Impact Statement (FEIS) for beach restoration at Topsail Beach, NC. Under Section 309 of the CAA, EPA is responsible for reviewing and commenting on major federal actions significantly affecting the quality of the human environment.

The FEIS evaluates the proposed federally funded project for hurricane protection and beach erosion control for a 5-mile portion of Topsail Island, a barrier island northeast of Wilmington. Construction would involve dredging of approximately 3.2 million cubic yards of sand taken from borrow areas offshore, impacting approximately 6.5 square miles of ocean bottom. Beach renourishment and associated maintenance on a 4-year interval is also part of the project as well as monitoring.

EPA reviewed the 2006 Draft EIS and provided substantive comments to the Corps in a letter dated August 15, 2006. Reviewing the responses to our comments we find that the Corps has responded adequately to most of EPA's comments made on the Draft EIS. However, there are several additional follow-up points we wish to offer at this time.

It would be prudent to shorten the 50-year project period because so much could change environmentally and economically in that length of time. After a number of years of borrow site use, monitoring of the sediments and trends in offshore borrow site topography could indicate substantial changes occurring to the island and the near-shore environment. If unexpected erosion loss of borrow site sediment is detected, it could necessitate major revisions to the long term shoreline maintenance plan. Any loss of the existing hard bottom features offshore should be investigated promptly to determine causal factors and appropriate action. From a biological perspective, increased

knowledge and trends of fish migrations, turtle nesting, and shore bird nesting behavior could also require modification of the maintenance plan. The plan, therefore, should have required periodic adaptive management.

We note from the responses to our comments that the Corps' GRANDUC plan formulation accounts for variability in storm events from year to year. Future protection from beach erosion requires dealing with the probabilities of storm events in terms of their frequency and severity. While little can be done reasonably to protect shoreline fully from damage caused by category 4 and 5 storms, it could be the duration and repetition of minor tropical storms and winter Northeasters that exact huge shoreline alterations coupled with an accelerated rate of sea level rise. We note from the Corps' responses to comments that the GRANDUC plan formulation factors in variability of storm events from year to year. However, it does not account for potential escalation in the severity of storms over the 50 year project period. If federal participation for more frequent supplementary actions becomes unavailable, it is uncertain whether the local community could sustain constant annual emergency restorations.

With further regard to the GRANDUC Program not assigning value to recreational benefits to the Nonstructural Alternatives (Section 5.05.2), this in turn undervalues all passive recreational pursuits by a growing subset of visitors seeking less developed/undeveloped barrier beaches. Resources in short supply logically command the higher value. GRANDUC, therefore, is over-weighted to erosion protection for developed beachfront. Perhaps it would be appropriate, also, for the non-structural alternatives screening to assess the proximity of structures to the mean high tide line resulting from a series of storm events rather than a predefined setback from the beach vegetation line. Barrier island beaches do not reshape uniformly.

EPA commented at the Draft EIS stage requesting technical reference for expected water quality impacts due to eroding of deposited fill material. This comment was responded to adequately. Additionally, EPA did not find mention in Section 8.07.2 of the post-construction water quality within the borrow sites. Substantial depressional features in the bottom contour would result at the borrow sites, and possibly expose oxygen-demanding sediments and accumulate organic silts that could result in chronically lowered dissolved oxygen due to reduced water circulation. Unless relevant data are available to address this topic, we request that the monitoring plan include periodic documentation of water quality within the borrow sites.

In summary, EPA continues to have some environmental concerns about this large project which warrants continued scrutiny during and after construction. Since EPA is in receipt of the DSEIS for Topsail Beach Interim Beach Fill Project, we may supplement the comments above as part of our response, under separate cover, to the Interim project. Please provide the Record of Decision to EPA and include us in notifications of interagency meetings on any remaining issues.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET NW
WASHINGTON, D.C. 20314-1000

MAY 19 2009

CECW-SAD

Mr. Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management
Environmental Protection Agency, Region 4
Atlanta Federal Center
61 Forsyth Street
Atlanta, GA 30303-8960

Dear Mr. Mueller:

Thank you for your letter dated September 12, 2008, providing comments on the Final Integrated General Reevaluation Report and Environmental Impact Statement (GRR/EIS) for Shore Protection, West Onslow Beach and New River Inlet (Topsail Beach), North Carolina. We appreciate your evaluation of the GRR/EIS for this important shore protection project, and have enclosed additional information to address your concerns.

We trust that the attached information and explanations, sufficiently addresses your concerns. If you would like to discuss these issues further, please contact Mr. Douglas Greene, our Wilmington District Project Manager, at 910-251-4553.

Enclosure

Sincerely,

Theodore A. Brown

THEODORE A. BROWN, P.E.
Chief, Planning and Policy
Division Directorate of Civil Works

Enclosure:
Corps of Engineers Responses
To Environmental Protection Agency Review Comments
Final GRR and EIS for Shore Protection
West Onslow Beach and New River Inlet (Topsail Beach), North Carolina

Comment 1: It would be prudent to shorten the 50-year project period because so much could change environmentally and economically in that length of time. After a number of years of borrow site use, monitoring of the sediments and trends in offshore borrow site topography could indicate substantial changes occurring to the island and the near-shore environment. If unexpected erosion loss of borrow site sediment is detected, it could necessitate major revisions to the long term shoreline maintenance plan. Any loss of the existing hard bottom features offshore should be investigated promptly to determine causal factors and appropriate action. From a biological perspective, increased knowledge and trends of fish migrations, turtle nesting, and shore bird nesting behavior could also require modification of the maintenance plan. The plan, therefore, should have required periodic adaptive management.

Response 1: The GRR has determined that a 50-year project authorization is feasible. Reevaluation may be conducted in the future if there are significant new conditions – physically, environmentally, or economically. The plan includes both beachfill monitoring and environmental monitoring as described in Sections 7.03.5 and 7.03.6 of the GRR, and the monitoring data may be used to help determine if future changes to the plan are necessary.

Comment 2: We note from the responses to our comments that the Corps' GRANDUC plan formulation accounts for variability in storm events from year to year. Future protection from beach erosion requires dealing with the probabilities of storm events in terms of their frequency and severity. While little can be done reasonably to protect shoreline fully from damage caused by category 4 and 5 storms, it could be the duration and repetition of minor tropical storms and winter Northeasters that exact huge shoreline alterations coupled with an accelerated rate of sea level rise. We note from the Corps' responses to comments that the GRANDUC plan formulation factors in variability of storm events from year to year. However, it does not account for potential escalation in the severity of storms over the 50 year project period. If federal participation for more frequent supplementary actions becomes unavailable, it is uncertain whether the local community could sustain constant annual emergency restorations.

Response 2: The storm history used in GRANDUC does fully reflect the severity of Atlantic hurricanes over the past century (since 1893), so any historical escalation in intensity over that time frame would be reflected; however, no future potential escalation has been accounted for. It is anticipated that the net benefits of a shore protection project would be even greater should any potential increase in future storm severity be considered. As stated above, if conditions change significantly then the project, including the renourishment interval, could be reassessed. Additionally, pursuant to NEPA, a supplement to the FEIS is required if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed

action or its impacts. Lastly, if the project sustains significant damage from a hurricane, PL84-99 authorizes the repair of that project so long as it is economically justified.

Comment 3: With further regard to the GRANDUC Program not assigning value to recreational benefits to the Nonstructural Alternatives (Section 5.05.2), this in turn undervalues all passive recreational pursuits by a growing subset of visitors seeking less developed/undeveloped barrier beaches. Resources in short supply logically command the higher value. GRANDUC, therefore, is over-weighted to erosion protection for developed beachfront. Perhaps it would be appropriate, also, for the non-structural alternatives screening to assess the proximity of structures to the mean high tide line resulting from a series of storm events rather than a predefined setback from the beach vegetation line. Barrier island beaches do not reshape uniformly.

Response 3: Further analysis of changes in recreation value of the nonstructural plan would most likely result in a negative value of recreational benefits, because there would be less lodging available for visitors. The recreation value of the beach is very sensitive to beach width. The beach width would continue to decrease with the nonstructural plan. We believe this decrease would far outweigh the benefits that would be gained from smaller numbers of visitors seeking undeveloped beaches. The nonstructural plan benefit to cost ratio of 0.9 was developed using the most optimistic assumptions regarding project costs. In our experience additional analysis of an infeasible plan tend to result in higher costs estimates. Other variations of nonstructural plans were considered, but no feasible nonstructural alternative could be identified.

Comment 4: EPA commented at the Draft EIS stage requesting technical reference for expected water quality impacts due to eroding of deposited fill material. This comment was responded to adequately. Additionally, EPA did not find mention in Section 8.07.2 of the post-construction water quality within the borrow sites. Substantial depressional features in the bottom contour would result at the borrow sites, and possibly expose oxygen-demanding sediments and accumulate organic silts that could result in chronically lowered dissolved oxygen due to reduced water circulation. Unless relevant data are available to address this topic, we request that the monitoring plan include periodic documentation of water quality within the borrow sites.

Response 4: The FEIS indicates that significant infilling is not expected; however, some sediment characterization differences may occur as a result of finer sediments falling out in the borrow site or changes in sediment type as a result of dredging through sediment layers. This assumption is based on the fact that the proposed borrow areas are located beyond the depth of closure and outside the range of the predominant influence of longshore and crosshore sediment transport. Though the proposed borrow area locations are outside of the nearshore range where frequent sediment transport occurs, the benthic environment offshore of the depth of closure is still physically dominated by wind generated currents driven by infrequent storm events (Wright *et al.*, 1991; Kim *et al.*, 1997). Furthermore, based on the vibracore analyses for all proposed borrow areas (A-F), the mean dredging depth ranges between 3 and 4 feet. Borrow area A is the only borrow area which identified thicker deposits of sand (three borings indicated volumes of compatible material between 7 feet and 9 feet) that could be efficiently dredged using a hydraulic

cutterhead dredge. Though an isolated portion of the borrow area may be dredged as deep as 9 feet, the mean dredging depth for borrow area A is 4.4 feet. Assuming existing depths of 40 feet to 50 feet, the maximum post dredging depth will be 60 feet. All renourishment intervals using borrow areas A-F will be performed by hopper dredges which will be dredging shallower depths of approximately 3 feet over larger areas rather than dredging to greater depths and smaller areas. Based on the (1) proposed borrow area use plan, (2) the subsequent maximum and mean dredging depths proposed for this project, and (3) the offshore wind and tidal driven current patterns and subsequent sediment advection associated with infrequent storm events, the Corps does not anticipate accumulation of organic silts that could result in chronically lowered dissolved oxygen due to reduced water circulation. Based on the average dredging depths and subsequent post dredging changes in elevation throughout the proposed borrow areas, the Corps doe not anticipate a reduction in water circulation. Though these instances are documented in the literature, it is also suggested that these concerns are more related to deep estuarine type borrow sites, not within the proposed offshore borrow sites with a widely dispersed average dredge depth of 3 to 4 feet.

References:

Wright, D., J. Boon, S. Kim, and J. List, 1991. Modes of cross-shore sediment transport on the shoreface of the Middle Atlantic Bight. Marine Geology, 96, 19-51.

Kim, S.-C., L.D. Wright, and B.-O. Kim, 1997. The combined effects of synoptic-scale and local-scale meteorological events on bed stress and sediment transport on the inner shelf of the Middle Atlantic Bight. Continental Shelf Research, 17(4), 407-433.

Comment 5: Please provide the Record of Decision to EPA and include us in notifications of interagency meetings on any remaining issues.

Response 5: Agree. The Record of Decision will be provided to EPA and EPA will be notified of interagency meetings on any remaining issues.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
4407 Bland Road, Suite 117
Raleigh, North Carolina 27609

Phone: (919) 873-2134
Fax: (919) 873-2154
Email: mike.hinton@nc.usda.gov

August 11, 2008

U. S. Army Corps of Engineers
Attn: CECW-P (IP)
7701 Telegraph Road
Alexandria, VA 22315-3860

Dear Sir/Madam:

Thank you for the opportunity to provide comments on the Final Environmental Impact Statement of the West Onslow Beach and New River Inlet, North Carolina.

The Natural Resources Conservation Service does not have any comments at this time.

If you need additional information, please feel free to contact me at (919) 873-2134.

Sincerely,

Michael J. Hinton
Planning Specialist

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North Carolina
Department of Administration

Michael F. Easley, Governor

Britt Cobb, Secretary

September 15, 2008

Mr. Theodore A. Brown
Dept. of the Army Corps of Engineers
CECW-P (SA)
7701 Telegraph Road
Alexandria, VA 22315-3860

Re: SCH File # 09-E-0000-0040; FEIS; Shore Protection West Onslow Beach and New River Inlet (Topsail Beach) - construction of sand dune and beach berm along 23,200 feet with 2 transition fill zones in Pender County

Dear Mr. Brown:

The above referenced environmental impact information has been submitted to the State Clearinghouse under the provisions of the National Environmental Policy Act. According to G.S. 113A-10, when a state agency is required to prepare an environmental document under the provisions of federal law, the environmental document meets the provisions of the State Environmental Policy Act. Attached to this letter for your consideration are the comments made by agencies in the course of this review.

If any further environmental review documents are prepared for this project, they should be forwarded to this office for intergovernmental review.

Should you have any questions, please do not hesitate to call.

Sincerely,

Valerie W. McMillan (SJK)

Valerie W. McMillan, Director
State Environmental Policy Act

Attachments

cc: Region O

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail valerie.w.mcmillan@doa.nc.gov

Location Address:
116 West Jones Street
Raleigh, North Carolina

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XXX

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

Post-it® Fax Note 7671	Date 9/12/08	# of pages ▸ 5
To VALERIE McMILLAN	From KAREN CANAVACIOL	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

MEMORANDUM

TO: Valerie McMillan
State Clearinghouse

FROM: Melba McGee
Environmental Review Coordinator

SUBJECT: 09-0040 West Onslow Beach and New River Inlet (Topsail Beach in Pender County

DATE: September 12, 2008

The Department of Environment and Natural Resources has reviewed the proposed information. The attached comments are for the applicant's information.

Thank you for the opportunity to review.

Attachments

1601 Mail Service Center, Raleigh, North Carolina 27699-1601
Phone: 919-733-4984 \ FAX: 919-715-3060 \ Internet: www.enr.state.nc.us/ENR/

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AUG 2 9 2008

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

Inter-Agency Project Review Response

Project Number 09-0040

County Pender

Project Name US Army Corps of Engineers - Wilmington District

Type of Project Shoreline protection - West Onslow Beach and New River Inlet (Topsail Beach).

RECEIVED AUG 15 2008 BY:

Comments provided by:

☑ Regional Program Person Heidi Rare Cox.

☒ Regional Supervisor for Public Water Supply Section

☐ Central Office program person

Name Debra Benoy- Wilmington RO Date 08/13/2008

Telephone number: (910) 796-7215

Program within Division of Environmental Health:

☐ Public Water Supply

☐ Other, Name of Program: _____

Response (check all applicable):

☐ No objection to project as proposed

☐ No comment

☐ Insufficient information to complete review

☐ Comments attached

☒ See comments below

If water lines are relocated, plans + specs should be submitted to PWSS.
Please note there are public water supply wells on the island. please ensure the grading or other topographic changes do not effect the well lots by causing flooding etc to site or wellhead.

Return to:
Public Water Supply Section
Environmental Review Coordinator for the
Division of Environmental Health

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

Project Number
09-0040
County
Pender

Inter-Agency Project Review Response

Project Name US Army Corps of Engineers - Wilmington District Type of Project Shoreline protection - West Onslow Beach and New River Inlet (Topsail Beach).

☒ The applicant should be advised that plans and specifications for all water system improvements must be approved by the Division of Environmental Health prior to the award of a contract or the initiation of construction (as required by 15A NCAC 18C .0300et. seq.). For information, contact the Public Water Supply Section, (919) 733-2321.

☐ This project will be classified as a non-community public water supply and must comply with state and federal drinking water monitoring requirements. For more information the applicant should contact the Public Water Supply Section, (919) 733-2321.

☐ If this project is constructed as proposed, we will recommend closure of _____ feet of adjacent waters to the harvest of shellfish. For information regarding the shellfish sanitation program, the applicant should contact the Shellfish Sanitation Section at (252) 726-6827.

☐ The soil disposal area(s) proposed for this project may produce a mosquito breeding problem. For information concerning appropriate mosquito control measures, the applicant should contact the Public Health Pest Management Section at (919) 733-6407.

☐ The applicant should be advised that prior to the removal or demolition of dilapidated structures, an extensive rodent control program may be necessary in order to prevent the migration of the rodents to adjacent areas. For information concerning rodent control, contact the local health department or the Public Health Pest Management Section at (919) 733-6407.

☐ The applicant should be advised to contact the local health department regarding their requirements for septic tank installations (as required under 15A NCAC 18A. 1900 et. sep.). For information concerning septic tank and other on-site waste disposal methods, contact the On-Site Wastewater Section at (919) 733-2895.

☐ The applicant should be advised to contact the local health department regarding the sanitary facilities required for this project.

☒ If existing water lines will be relocated during the construction, plans for the water line relocation must be submitted to the Division of Environmental Health, Public Water Supply Section, Technical Services Branch, 1634 Mail Service Center, Raleigh, North Carolina 27699-1634, (919) 733-2321.

☒ For Regional and Central Office comments, see the reverse side of this form.

Jim McRight	PWSS	08/13/08
Reviewer	Section/Branch	Date

Tech Services, PWSS

State of North Carolina
Department of Environment and Natural Resources

Reviewing Office: WIRO

INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

Project Number: 09-0040 Due Date: 9/8/08

After review of this project it has been determined that the ENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of the form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to construct & operate wastewater treatment facilities, sewer system extensions & sewer systems not discharging into state surface waters.	Application 90 days before begin construction or award of construction contracts. On-site inspection. Post-application technical conference usual.	30 days (90 days)
☐	NPDES - permit to discharge into surface water and/or permit to operate and construct wastewater facilities discharging into state surface waters.	Application 180 days before begin activity. On-site inspection. Pre-application conference usual. Additionally, obtain permit to construct wastewater treatment facility granted after NPDES. Reply time, 30 days after receipt of plans or state of NPDES permit-whichever is later.	90-120 days (N/A)
☐	Water Use Permit	Pre-application technical conference usually necessary	30 days (N/A)
☐	Well Construction Permit	Complete application must be received and permit issued prior to the installation of a well.	7 days (15 days)
☒	Dredge and Fill Permit	Application copy must be served on each adjacent riparian property owner. On-site inspection. Pre-application conference usual. Filing may require Easement to Fill from N.C. Department of Administration and Federal Dredge and Fill Permit.	55 days (90 days)
☐	Permit to construct & operate Air Pollution Abatement facilities and/or Emission Sources as per 15 A NCAC (2Q.0100 thru 2Q.0300)	Application must be submitted and permit received prior to construction and operation of the source. If a permit is required in an area without local zoning, then there are additional requirements and timelines (2Q.0113).	90 days
☐	Permit to construct & operate Transportation Facility as per 15 A NCAC (2D.0800, 2Q.0601)	Application must be submitted at least 90 days prior to construction or modification of the source.	90 days
☐	Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900	N/A	60 days (90 days)
☐	Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 2D.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950		
☐	Complex Source Permit required under 15 A NCAC 2D.0800		
☐	The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres is to be disturbed. Plan filed with proper Regional Office (Land Quality Section) At least 30 days before beginning activity. A fee of $65 for the first acre or any part of an acre. An express review option is available with additional fees.		20 days (30 days)
☐	Sedimentation and erosion control must be addressed in accordance with NCDOT's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable stormwater conveyances and outlets.		(30 days)
☐	Mining Permit	On-site inspection usual. Surety bond filed with ENR Bond amount varies with type mine and number of acres of affected land. Any are mined greater than one acre must be permitted. The appropriate bond must be received before the permit can be issued.	30 days (60 days)
☐	North Carolina Burning permit	On-site inspection by N.C. Division Forest Resources if permit exceeds 4 days	1 day (N/A)
☐	Special Ground Clearance Burning Permit - 22 counties in coastal N.C. with organic soils	On-site inspection by N.C. Division Forest Resources required "if more than five acres of ground clearing activities are involved. Inspections should be requested at least ten days before actual burn is planned."	1 day (N/A)
☐	Oil Refining facilities	N/A	90-120 days (N/A)
☐	Dam Safety Permit	If permit required, application 60 days before begin construction. Applicant must hire N.C. qualified engineer to: prepare plans, inspect construction, certify construction is according to ENR approved plans. May also require permit under mosquito control program. And a 404 permit from Corps of Engineers. An inspection of site is necessary to verify Hazard Classification. A	30 days (60 days)

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to drill exploratory oil or gas well	File surety bond of $5,000 with ENR running to State of NC conditional that any well opened by drill operator shall, upon abandonment, be plugged according to ENR rules and regulations.	10 days N/A
☐	Geophysical Exploration Permit	Application filed with ENR at least 10 days prior to issue of permit. Application by letter. No standard application form.	10 days N/A
☐	Dam Lakes Construction Permit	Application fee based on structure size is charged. Must include descriptions & drawings of structure & proof of ownership of riparian property.	15-20 days N/A
☒	401 Water Quality Certification	N/A	60 days (130 days)
☐	CAMA Permit for MAJOR development	$250.00 fee must accompany application	55 days (150 days)
☐	CAMA Permit for MINOR development	$50.00 fee must accompany application	22 days (25 days)
☐	Several geodetic monuments are located in or near the project area. If any monument needs to be moved or destroyed, please notify: N.C. Geodetic Survey, Box 27687 Raleigh, NC 27611		
☐	Abandonment of any wells, if required must be in accordance with Title 15A, Subchapter 2C.0100.		
☐	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.		
☐	Compliance with 15A NCAC 2H 1000 (Coastal Stormwater Rules) is required.		45 days (N/A)
☐	Tar Pamlico or Neuse Riparian Buffer Rules required.		

* Other comments (attach additional pages as necessary, being certain to cite comment authority)

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

☐ **Asheville Regional Office**
2090 US Highway 70
Swannanoa, NC 28778
(828) 296-4500

☐ **Fayetteville Regional Office**
225 North Green Street, Suite 714
Fayetteville, NC 28301-5043
(910) 433-3300

☐ **Mooresville Regional Office**
610 East Center Avenue, Suite 301
Mooresville, NC 28115
(704) 663-1699

☐ **Raleigh Regional Office**
3800 Barrett Drive, Suite 101
Raleigh, NC 27609
(919) 791-4200

☐ **Washington Regional Office**
943 Washington Square Mall
Washington, NC 27889

☒ **Wilmington Regional Office**
127 Cardinal Drive Extension
Wilmington, NC 28405
(910) 796-7215

☐ **Winston-Salem Regional Office**
585 Waughtown Street
Winston-Salem, NC 27107
(336) 771-5000

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

RECEIVED
AUG 13 2008
HISTORIC PRESERVATION OFFICE

STATE NUMBER: 09-E-0000-0497
DATE RECEIVED: 08/12/2008
AGENCY RESPONSE: 09/08/2008
REVIEW CLOSED: 09/12/2008

MS RENEE GLEDHILL-EARLEY
CLEARINGHOUSE COORD
DEPT OF CUL RESOURCES
ARCHIVES-HISTORY BLDG - MSC 4617
RALEIGH NC

CH 01-0497

A - NC 8/22/08

REVIEW DISTRIBUTION
CAPE FEAR COG
CC&PS - DEM, NFIP
DEHNR - COASTAL MGT
DENR LEGISLATIVE AFFAIRS
DEPT OF AGRICULTURE
DEPT OF CUL RESOURCES
DEPT OF TRANSPORTATION

S - NC 8/28/08

PROJECT INFORMATION
APPLICANT: Dept. of the Army Corps of Engineers
TYPE: National Environmental Policy Act
ERD: Final Environmental Impact Statement
DESC: Shore Protection West Onslow Beach and New River Inlet (Topsail Beach) - construction of sand dune and beach berm along 23,200 feet with 2 transition fill zones in Pender County

Due 8/28/08

CROSS-REFERENCE NUMBER: 01-E-0000-0497 06-E-0000-0378

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.
If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED:

- [x] NO COMMENT
- [ ] COMMENTS ATTACHED

SIGNED BY: Renee Gledhill-Earley by MAM

DATE: 9/4/08

SEP 2008
RECEIVED
State Office
DOA

AUG 14 2008

NORTH CAROLINA STATE CLEARINGHOUSE
DEPARTMENT OF ADMINISTRATION
INTERGOVERNMENTAL REVIEW

STATE NUMBER: 09-E-0000-0040 H05
DATE RECEIVED: 08/12/2008
AGENCY RESPONSE: 09/08/2008
REVIEW CLOSED: 09/12/2008

MR JOHN GERBER
CLEARINGHOUSE COORD
CC&PS - DEM, NFIP
MSC # 4716
RALEIGH NC

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DEPT OF TRANSPORTATION

RECEIVED
AUG 15 2008
NC Floodplain Mapping Program

PROJECT INFORMATION
APPLICANT: Dept. of the Army Corps of Engineers
TYPE: National Environmental Policy Act
ERD: Final Environmental Impact Statement
DESC: Shore Protection West Onslow Beach and New River Inlet (Topsail Beach) - construction of sand dune and beach berm along 23,200 feet with 2 transition fill zones in Pender County
CROSS-REFERENCE NUMBER: 01-E-0000-0497 06-E-0000-0378

The attached project has been submitted to the N. C. State Clearinghouse for intergovernmental review. Please review and submit your response by the above indicated date to 1301 Mail Service Center, Raleigh NC 27699-1301.
If additional review time is needed, please contact this office at (919)807-2425.

AS A RESULT OF THIS REVIEW THE FOLLOWING IS SUBMITTED:

☐ NO COMMENT
☒ COMMENTS ATTACHED

SIGNED BY: Dennis Hole

DATE: 9/7/08

North Carolina Department of Crime Control and Public Safety
Division of Emergency Management
Office of Geospatial and Technology Management
4719 Mail Service Center • Raleigh, NC 27699-4719

Michael F. Easley
Governor

Bryan E. Beatty
Secretary

September 7, 2008

Ms. Valerie McMillian
State Clearinghouse
N.C. Department of Administration
1301 Mail Service Center
Raleigh, North Carolina 27699-1301

Subject: Intergovernmental Review State Number: 09-E-0000-0040
Proposed Shore Protection of West Onslow Beach and the New River Inlet (Topsail Beach) – Construction of Sand Dune and Beach Berm along 23,200 Feet with 2 Transition Fill Zones in Pender County

Dear Ms. McMillian:

As requested by the North Carolina State Clearinghouse, the North Carolina Department of Crime Control and Public Safety Division of Emergency Management Geospatial and Technology Management Office (GTMO) reviewed the proposed project listed above and has provided comments herein. It is our understanding that the US Army Corps of Engineers (USACE) Wilmington District proposes to construct 23,200 feet of sand dune and beach berm along West Onslow Beach, near New River Inlet, and in transitional zones in Pender County.

The GTMO has the following comments:

1) The NC Floodplain Mapping Program (NCFMP), in partnership with FEMA, is conducting new coastal flood hazard analyses for the NC coast. Based on the timing of this proposed sand dune and beach berm project, the NCFMP's analyses and resulting modifications to the coastal flood hazard analyses on the Digital Flood Insurance Rate Maps (DFRIMs) and Flood Insurances Studies (FIS) for Onslow and Pender counties will not reflect the proposed beach profiles associated with the USACE's project. Any modifications to the coastal flood hazards and DFIRMs in the USACE's project area should be included as requirements of this project.

2) FEMA has delegated the authority to produce and maintain DFIRMs and FIS in NC to the State of North Carolina. The NCFMP formally requests the USACE Wilmington

District to coordinate with the NCFMP in regards to any revisions to the coastal flood hazards, coastal flood risk, and local DFIRMs and FIS.

3) Local governments and the general public have shown an expectation that beach nourishment projects and dune construction projects will lower coastal flood hazards and coastal flood risk. Section 10.08 Executive Order 11988 (Flood Plain Management) of the provided Final Integrated General Reevaluation Report and Environmental Impact Statement – Shore Protection – West Onslow Beach and New River Inlet (Topsail Beach dated March 2008 states "*Placement of beachfill will occur in the floodplain of area beaches. This placement will be conducted specifically for its beneficial effect in offsetting erosion and restoring damaged beaches, and is, therefore judged acceptable. The action is expected to have an insignificant effect on the floodplain, therefore, the proposed action is in compliance with the requirements of Executive Order 11988 and with State/local flood plain protection standards*". The NCFMP formally requests the UASCE Wilmington District to assist in outreach to the elected officials, local government staff, the local Floodplain administrators, and the citizens of Onslow and Pender counties in regard to the project and the project's impact, or lack thereof, on coastal flood hazards and coastal DFIRMs for these areas.

Thank you for your cooperation and consideration. If you have any questions concerning the above comments, please contact me at (919) 715-5711, by email at kashe@ncem.org or at the address shown on the footer of this document.

Sincerely,

Kenneth W. Ashe, P.E., CFM
Assistant Director

c: Randy Mundt, Acting NC NFIP State Coordinator
Tammy Riddle, NC Eastern NFIP Planner

XXXIX

TOWN OF TOPSAIL BEACH NORTH CAROLINA

820 S. Anderson Blvd.
Topsoil Beach, North Carolina 28445
Telephone (910) 328-5841
Fox (910) 328-1560

March 5, 2008

Colonel John E. Pulliam, Jr.
Department of the Anny, Corps of Engineers
Wilmington District
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Dear Colonel Pulliam:

The purpose of this correspondence is to express and confirm our continued support of the proposed West Onslow Beach and New River Inlet (Topsail Beach) Shoreline Protection Project that was authorized by Section 101 of the Water Resources Development Act of 1992 and to thank you for the work that your office has accomplished.

We support Plan 1250x as our locally preferred plan, We understand the obligation of the local sponsor(s) to share the construction costs at a rate of64.5% federal and 35.5% non federal, and the obligation of the local sponsor(s) to share in the post construction renourishment costs at a rate of 50% federal and 50% non federal.

We have been informed by the USACE that the project will be required to provide public beach access at a minimum of one access point, and associated parking for everyone half mile of the proposed project, which the Town will provide. Further, we have been informed that the estimated construction costs on the project as estimated based on October 2007 price levels will be approximately $32,131 ,000.00, and that the periodic renourishment efforts, which will occur approximately every four years, win cost an estimated $9,202,000.00. Estimated operating and maintenance cost will be approximately $21,000 per year.

The Town is in agreement with the project as presented and intends to sign a Project Cooperation Agreement when and as required. The Town gives its endorsement to the project and urges its early completion.

Mr. Steven Foster, Town Manager, will be the staff contact and Mr. Edward (Butch) Parrish will be the Topsail Beach Shoreline Protection Committee point of contact. The Town of Topsail Beach looks forward to our continued working with you and your staff on this important and needed project.

Sincerely,

Howard M. Braxton, Jr,
Mayor

RECORD OF DECISION

WEST ONSLOW BEACH and NEW RIVER INLET
(TOPSAIL BEACH), PENDER COUNTY, NORTH CAROLINA

The Final Integrated General Reevaluation Report (GRR) and Environmental Impact Statement (EIS), dated March 2008, describes a plan of improvement for hurricane and storm damage reduction along the Topsail Beach shoreline, Pender County, North Carolina. Based on the report, the reviews of other Federal, State, and local agencies, input from the public, and the review by my staff, I find that the plan recommended by the Chief of Engineers is technically feasible, cost effective, in compliance with environmental statutes, and in the public interest.

The Final GRR and EIS was prepared under the authority provided in the Energy and Water Development Appropriations Act for Fiscal Year 2001 (Public Law 106-377). The West Onslow Beach and New River Inlet (Topsail Beach) project was originally authorized in the Water Resources Development Act of 1992 but was never constructed. The Final GRR and EIS recommends construction of the Locally Preferred Plan (LPP), which includes a sand berm and dune system along an approximately five-mile-long reach of Atlantic Ocean coastline in the community of Topsail Beach using offshore borrow material. The report will be provided to Congress for authorization because the LPP is significantly different from the previously authorized project.

The LPP would consist of construction of an approximately 26,200 foot long berm and dune system, including 23,200 feet for the main fill, 2,000 feet for a transition fill at the north end of the project, and 1,000 feet for a transition at the south end. The berm would be about 50-feet wide with an elevation of 7 feet above the National Geodetic Vertical Datum (NGVD). The sand dune would have an elevation of 12 feet above NGVD. The recommended plan also includes periodic nourishment estimated to be required at 4-year intervals over the 50-year life of the project. Other associated features are dune vegetation and construction of 23 dune walkover structures for public access. For comparison purposes to the LPP, the difference between the National Economic Development (NED) plan and the LPP is that the NED plan included the construction of a sand dune to an elevation of 15 feet above NGVD, with a transition at the south end of the project 400 feet shorter than the LPP.

A broad array of alternatives was evaluated in the development of the recommended plan, and those alternatives are hereby incorporated into this Record of Decision. In addition to a "no action" plan, numerous structural alternatives were evaluated for hurricane and storm damage reduction including constructing sand dunes at varying heights along with different configurations of beach fill, and a terminal groin structure constructed at the southern terminus of the community. Non-structural alternatives considered included relocation and demolition of homes along the coastline

to reduce risk from the natural forces during hurricane and storm events. These measures were evaluated independently and in combination with each other to develop alternative plans. Both the draft and the final reports were circulated for public review and comment.

Compared to the future without project condition, the recommended plan would reduce average annual storm damages by about 84 percent in the Topsail Beach community. All practical means were employed to avoid or minimize the environmental and socio-economic harm from implementing the plan. Monitoring and adaptive management will be performed to ensure compliance with environmental laws and to confirm the expected finding of no significant negative impacts. The recommended plan is identified as the environmentally preferred alternative.

Technical, environmental, economic, and risk criteria used in the formulation of alternative plans were those specified in the Water Resource Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, Executive Orders, regulations and local government plans were considered in the evaluation of alternatives. Based on review of these evaluations, I find that the public interest would be best served by implementing the recommended plan. This Record of Decision completes the National Environmental Policy Act process.

apr 22, 2010
Date

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

April 14, 2010

The Honorable Jo-Ellen Darcy
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon, Room 3E446
Washington, D.C. 20310-0108

Dear Ms. Darcy:

As required by Executive Order 12322, the Office of Management and Budget has completed its review of your recommendation of the West Onslow Beach and New River Inlet (Topsail Beach), North Carolina hurricane and storm damage risk reduction project.

Our review found that the project is consistent with the policy and programs of the President. We note that the sea level rise projections included in the Corps' analysis are based on data from the Intergovernmental Panel on Climate Change 2007 report, rather than more recent research, such as the 2009 U.S Global Change Research Program's "Global Climate Change Impacts in the United States". However, the Corps conducted a sensitivity analysis of the project under various sea level rise assumptions, which showed that the recommended plan would continue to provide net project benefits and would continue to reduce the risk of hurricane and storm damages to the project area at much higher levels of sea level rise. As sea level rise and climate change models are updated over time, the Corps should continue to work with the National Oceanographic Atmospheric Administration and U.S. Geological Survey so that future project plans and analyses are based on the most accurate data available on sea level rise and other factors related to climate change.

The Office of Management and Budget does not object to you submitting the recommendation and report to Congress for reauthorization.

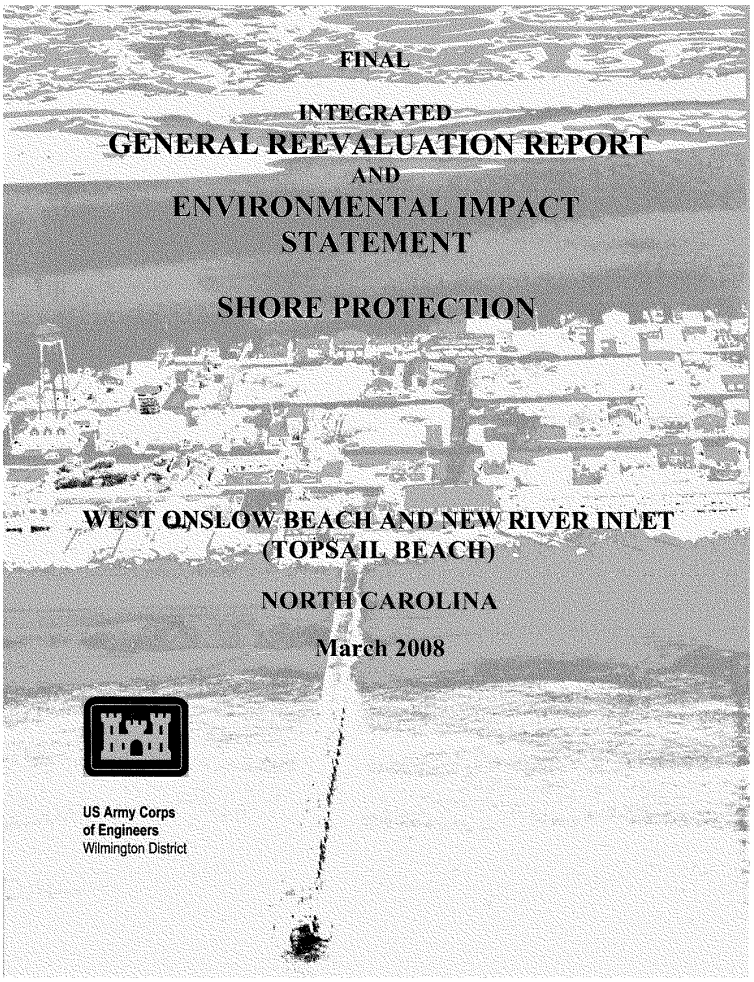
Sincerely,

Richard A. Mertens
Deputy Associate Director
Energy, Science, and Water

NOTICE

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

Since Congress has authorized the project, the Army Corps of Engineers does not request that the report be printed. If there are any questions about this, please call Stacey Brown of the SAD-RIT at Corps Headquarters. You can reach Stacey Brown at (202) 761-4106.


FINAL
INTEGRATED
GENERAL REEVALUATION REPORT
AND
ENVIRONMENTAL IMPACT
STATEMENT
SHORE PROTECTION
WEST ONSLOW BEACH AND NEW RIVER INLET
(TOPSAIL BEACH)
NORTH CAROLINA
March 2008
US Army Corps
of Engineers
Wilmington District

FINAL

INTEGRATED

GENERAL REEVALUATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

SHORE PROTECTION

WEST ONSLOW BEACH AND NEW RIVER INLET
(TOPSAIL BEACH)

NORTH CAROLINA

EXECUTIVE SUMMARY

This General Re-evaluation Report (GRR) summarizes efforts directed at evaluating the continued feasibility of not yet constructed hurricane and storm damage reduction features along the coastline adjacent to the Town of Topsail Beach, on Topsail Island, North Carolina. Originally authorized as the West Onslow Beach and New River Inlet, NC shore protection project in the Water Resources Development Act (WRDA) of 1992, the local sponsor was not able to execute the Project Cooperation Agreement, and it was not subsequently constructed. During the intervening years, increasing storm damage has occurred along many portions of the shoreline of this part of North Carolina, notably by Hurricanes Bertha and Fran in 1996, and Hurricane Floyd in 1999. This increased coastal erosion threat, along with the increasing threat to existing and new development within the Town of Topsail Beach, led to initiation of this post-authorization General Re-evaluation study in 2001. This report was prepared in compliance with the Energy and Water Development Appropriations Act of 2001 that pertains to the authorized project for Topsail Beach.

The study area consists of the Town of Topsail Beach, its shoreline, and adjacent borrow areas off the coast. The remainder of Topsail Island to the north of the Town of Topsail Beach is being studied under a separate study authority. This study serves as a re-evaluation of the original report to the Congress of the United States and to identify if there are technically, environmentally, and economically feasible means of reducing damages caused by coastal hurricanes and storms within the identified study area. It also serves to examine the feasibility of providing hurricane and storm damage reduction features along a portion of the shoreline not originally authorized for construction, within the Town of Topsail Beach.

The study team integrated representatives of Federal, State, and local governments, in the effort to identify cost-effective and environmentally- and technically-sound alternatives to reduce damages within the Town of Topsail Beach, and to its adjacent shoreline. The process fully integrated the Corps' "Twelve Actions for Change", in all aspects of the study process. The study effort identified a "National Economic Development" (NED) plan, which would maximize net benefits to the nation through reduction of future storm damages, as well as a "Locally-Preferred Plan (LPP), which is a plan that the local sponsor, the Town of Topsail Beach, supports. The recommended plan of action is construction of the Locally-Preferred Plan.

The recommended plan, referred to in the GRR as "Plan 1250X", consists of a sand dune constructed to an elevation of 12 feet above the National Geodetic Vertical Datum (NGVD), fronted by a 50-foot wide beach berm constructed to an elevation of 7 feet above NGVD. This dune and berm feature would extend 23,200 feet, with a 2,000 foot northern transition fill, and a 1,000 foot southern transition fill, for a total length of 26,200 feet. This total project length exceeds the originally authorized project length of 19,200 feet.

The recommended plan will provide for expected annual benefits estimated at $13,590,000, at October 2007 price levels, at estimated annual costs of $4,119,000, for an overall benefit to cost ratio of 3.3 to 1. The originally authorized plan segment of the LPP possesses a benefit-cost ratio of 2.5 to 1, while the newly-proposed increment not originally authorized possesses a benefit-cost ratio of 6.3 to 1. For construction beginning in late 2011, the estimated cost of the recommended plan would be $34,873,000.

The more significant departures from the Authorized Plan to the recommended plan are the borrow site location, the project length increase, the lowering of the dune, and change in renourishment interval. Since original project authorization in 1992, Topsail Beach has changed both physically and economically. The total structure value has increased and therefore the resulting increase in storm damage reduction benefits can now justify a longer project. The south end of the island between New Topsail Inlet and the project area has been accreting and New Topsail Inlet has shifted southwest and away from the project area. This has reduced the renourishment requirements. The new inlet location places the original borrow site in a CBRA zone. Changes in the project plan are shown schematically in Figure i.

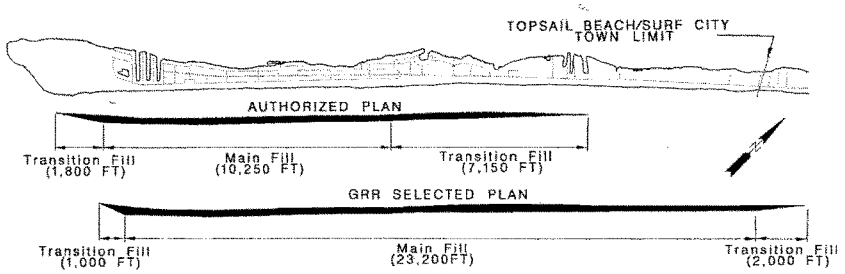


Figure i. Authorized Plan (HD 393/102/2) and GRR Selected Plan, Plan view

Detailed comparisons of the changes in geographic scope, project features, and source borrow area, are summarized in Table i. Detailed comparisons of the differences and incremental increases in first costs, annual costs, annual and net benefits, and benefit-cost ratios between the recommended Locally-Preferred Plan and the Authorized Plan, made at October 2006 levels are shown in Table ii.

Table i. Plan Comparison Table, October 2006 levels, 4.875% interest rate. The Locally Preferred Plan (LPP) (bold text) is the selected plan.

Dimensions	Plan		
	Authorized # HD 393/102/2	**GRR, LPP, Plan 1250X**	GRR, NED, Plan 1550
Dune, topwidth,	25 feet	25 feet	25 feet
Dune, elevation, NGVD	13.6 feet	12 feet	15 feet
Dune, landward slope	5H:1V	5H:1V	5H:1V
Dune, seaward slope	5H:1V	10H:1V	10H:1V
Dune and storm berm, width	35 feet	None	None
Dune and storm berm, elevation, NGVD	9.6 feet	None	None
Dune and storm berm, seaward slope	5H:1V	None	None
Beach berm, width	40 feet	50 feet	50 feet
Beach berm, elevation, NGVD	7.6 feet	7 feet	7 feet
Beach berm, seaward slope	12H:1V	15H:1V	15H:1V
Dune and berm fill, length	10,250 feet	23,200 feet	22,800 feet
North transition section, length	7,150 feet	2,000 feet	2,000 feet
South transition section, length	1,800 feet	1,000 feet	1,400 feet
Total Length	19,200 feet	26,200 feet	26,200 feet
Volume, initial, in-place CY	*2,659,000 CY	2,387,000	3,420,000
Volume, renourishment, in place, CY	372,000 CY	690,000	690,000
Renourishment interval	2 years	4 years	4 years
Borrow source	Banks Channel	Off shore	Off shore

*including 372,000 CY advance nourishment # revised volumes from DM.

Table ii. Incremental Analysis, in thousands. October 2006 levels, 4.875% interest rate

Item	Segments		
	GRR Selected (LPP)	Authorized	Incremental
Total First Cost	$31,051	$23,761	$7,290
Interest During Construction	$266	$204	$62
Total Investment Cost	$31,317	$23,965	$7,352
Renourishment, every 4 years	$8,893	$6,992	$1,901
Present Value, TIC & Renourish.	$69,401	$53,910	$15,491
Annual Costs			
Interest and Amortization	$3,728	$2,896	$832
Monitoring	$240	$240	$0
OMRR&R	$21	$15	$6
Total	$3,989	$3,151	$838
HSDR Benefits	$7,717	$4,847	$2,870
Net Benefits (HSDR only)	$3,728	$1,696	$2,032
BCR (HSDR only)	1.9	1.5	3.4
Recreation and Other Benefits	$5,587	$3,143	$2,444
Total Benefits (all)	$13,304	$7,990	$5,314
Net Benefits (all)	$9,315	$4,839	$4,476
BCR (all)	3.3	2.5	6.3

The Section 902 limit for the authorized project is $26,160,000, as updated to October 2007 price levels, and applies to initial construction. Because the cost of both the NED and Locally-Preferred Plans exceeds that of the Section 902 limit, and the recommended plan's physical scope exceeds the length of the authorized project, this new recommended plan requires re-authorization by the Congress.

The recommendation for implementation of a Locally-Preferred Plan is based on the sponsor's need for the lower first cost of this plan when compared to the NED Plan, its higher benefit-to-cost ratio, and the apparent greater protection it may provide to the southern end of town adjacent to Godwin Avenue. The sponsors understand that the Locally-Preferred Plan has a greater risk of damage, due to the lower height of the LPP as compared to the NED plan.

Based on the recommendation of use of public funds for the reduction of damages along this shoreline, the Sponsors will provide public access and parking in accordance with Corps of Engineers guidelines, at intervals of no more than a half mile, throughout the reach of Topsail Beach protected by the cost-shared project.

The recommended plan of improvement is considered to be environmentally acceptable. Piping plover were documented to feed along the primary study area. This species is common throughout the year in North Carolina as either a migrant or winter resident and frequently uses the surf zone. The project may affect piping plover foraging distribution on the beach since beach food resources may be affected by beachfill operations. The green sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle, and leatherback sea turtle are known to nest in North Carolina and could nest in the project area. For this reason, they could be affected by initial project construction and periodic nourishment. These sea turtles occur in offshore waters and may also be affected if hopper dredges are used. Periodic nourishment activities will be timed, to the extent practicable, to avoid the sea turtle nesting season and avoid hopper dredging during months when water temperatures are warm and turtles may be present. This combined GRR and Final Environmental Impact Statement (GRR/FEIS) includes a biological assessment of project impacts as Appendix I. This biological assessment pursuant to Section 7 of the Endangered Species Act of 1973 has been provided to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Consultation with these agencies will continue concurrently with the circulation and public review of the GRR/FEIS. The requirements of Section 404(r) of Public Law 92-500, as amended, have been met.

Independent Technical Review (ITR) was conducted in accordance with the Corps' "Peer Review of Decision Documents" process, has been reviewed by Corps staff outside the originating office, conducted by a regional and national team of experts in the field, and coordinated by the National Center of Expertise in Hurricane and Storm Damage Protection, North Atlantic Division, U.S. Army Corps of Engineers. Comments and responses will accompany the report to the Assistant Secretary of the Army for Civil Works (ASA(CW)) and the Office of Management and Budget (OMB). Documentation of ITR certification will accompany the final report.

In analyzing potential measures, the study team considered, in all cases where technically sound and environmentally feasible, both structural and non-structural measures. Non-structural measures, such as removal and relocation, were found to be of greater cost than benefits, and therefore, were not recommended for the purposes of storm damage reduction. However, the recommendations of the study team that accompany all structural recommendations for dune and berm construction is that of continued and vigilant attention to the need for pro-active hurricane and storm threat education, storm and hurricane warning and evacuation planning procedures, floodplain management, and other non-structural activities directed at both damage reduction and preservation of life and safety, and are thus, provided as recommended actions, although many do not fall within current Corps implementation authorities.

The analyses and design of the recommendations contained in this report comply with the National Environmental Policy Act (NEPA). A separate Environmental Impact Statement (EIS) will not be provided, as the draft document is a fully-integrated report that complies with both NEPA requirements and the Corps (and Federal) water resources planning process and its requirements. The report complies with all applicable environmental statutes.

The draft report fully discusses areas of risk, uncertainty, and consequences, where that information is appropriate, and describes them with sufficient detail that decisions can be made with knowledge of the degree of reliability of the estimated benefits and costs and of the effectiveness of alternative plans. All recommendations made in the report are capable of being adaptively managed, should that capability be needed, as re-nourishment may be needed more often or less often, depending on the occurrence of large storms and accompanying erosion.

It should be noted that the Administration's position on funding support for hurricane and storm damage reduction projects is as follows: "The Office of Management and Budget advises that while the Water Resources Development Act of 1999 (WRDA 99) changed the cost-sharing formula for the long-term sand renourishment component of certain future shore protection projects, these changes did not go far enough considering the long-term cost of most of these projects. Further, because WRDA 99 delayed the effect of the change in cost sharing for up to a decade or more, it did not address current constraints on Federal spending. The Administration intends to work with Congress to address these problems. However, until these issues are satisfactorily resolved, the Administration will not support authorization of new shore protection projects that involve significant long-term Federal investments beyond the initial construction of these projects, and will give new shore protection projects that are already authorized low priority for funding." As stated above, the Administration has expressed concern about significant long-term Federal investments associated with hurricane and storm damage reduction projects. Clearly, substantial long-term Federal investments would be required to implement the current project proposal. The Administration's projections of future inflation are effectively 2.0 percent annually. Based on these data, the total inflation

adjusted (fully funded) project costs are estimated to be $268,000,000 over the 50-year period of Federal participation for the recommended plan of improvement. The Federal share of the fully funded project costs is currently estimated at $138,000,000. The non-Federal share of the fully funded costs is currently estimated at $130,000,000. Given the Administration's declared budgetary concerns, potential long-term costs associated with the proposed project may be vital to decision making. As previously indicated, the total project benefit-cost ratio is 3.3, which means that for every dollar spent for the project there are 3 dollars and 30 cents realized in National Economic Development (NED) benefits from the project.

Recommendations

Hurricane Risk Education

Numerous people die each year as a result of hurricanes, primarily due to the failure to evacuate to an area of safety. Any loss of life is tragic, and any number of those deaths may have been prevented. Even one death prevented is sufficient reason to improve our methods of educating the public on hurricane and storm threats, and to ensure that all is done to warn all those residents or visitors to the coastline of North Carolina as to the dual hazards of wind and surge/waves. It is particularly vital to inform the public as to the potential for hurricane occurrence, particularly within the dangerous hurricane season, so they pay continued attention to media reports on weather. Education needs to include articulation of effects related to the potential magnitude of the threat, the urgency to heed potential calls to evacuate, and providing the means by which to make wise choices on evacuation methods and route (see recommendations given below under "Hurricane Evacuation Planning"). The following are suggested guidelines for implementation by State and local government, in the interests of good education on hurricane storm threats:

- Provide good science and information to the residents and visitors to coastal North Carolina, so they can understand the nature of the threat, and its possibility of happening at any time within the hurricane season. This information should be provided in both written form, and as an initial "page" on televisions provided in visitor's housing, and also in a variety of venues, including:
    - Posting and televised education in supermarkets, libraries, and public buildings;
    - Teacher-provided, posted and televised education in schools and at public meetings and gatherings, at intervals not to exceed 1 year;
    - Publically-posted and visitor-housing-posted information on evacuation routes, and procedures, on publicly-accessible websites, updated regularly (minimum 1 yr.).

There is nothing humanly possible to maintain the lives and safety of coastal North Carolina residents and visitors, if they do not have sufficient warning, and if they then do not use that knowledge to evacuate in a timely manner.

Education of hurricane risks is an on-going effort of multiple agencies and educational institutions, and not a funded program under existing Corps authorities. Updating of websites containing evacuation routes and procedures should be done under existing programs implemented by the state and local governments.

Hurricane and Storm Warning

Residents and visitors to the coast of North Carolina need to recognize that they live in, or visit, a high-hazard area. Although certain times of the year pose less risk than others, each year's hurricane season provides a strong possibility of hurricane impact somewhere along the coast of North Carolina. All residents and visitors need to be made aware of the current hurricane threat, but first meteorological conditions must be evaluated, and any threat must be assessed and characterized by experts with the National Oceanic and Atmospheric Administration's National Weather Service, and that interpretation passed to national and local media for dissemination. Continued support of NOAA's program, and the following supportive activities is critical to an adequate warning process:

- On-going efforts to upgrade the existing system of NOAA buoys, transmission capabilities, and advanced warning measures that provide data on the location and nature of weather conditions.
- Efforts directed at the interpretation of that data and its dissemination to the media and public, through the National Weather Service.
- Public appreciation for the need to be aware at all times of, and the need to listen to weather reports and advice given on various media. Television weather reports, radio, and the internet all provide excellent up-to-date information on weather conditions, and the development of threatening situations. Simply living in or visiting the barrier islands of North Carolina should be sufficient to create a consistent and on-going process of being exceptionally aware of the weather, and its potential consequences.
- The vital importance of heeding the advice of experts. One should know what needs to be done in the event of an approaching storm. Family members should conduct evacuation drills, keep needed phone numbers and travel supplies on hand, and be prepared to leave on short notice. One should be aware of evacuation routes, keeping a full tank of gas during the hurricane season, and having a plan for where one should go, how to maintain contact with other family members, and where one will re-locate temporarily, particularly if this turns out to be longer than expected.

Hurricane Evacuation Planning Upgrading

The critical need for adequate evacuation planning was borne out by Hurricanes Bertha, Fran, and Floyd, of the late 1990's, and brought even more to the forefront by the monumental impacts of Hurricane Katrina in 2005. An evacuation plan is an essential component of a comprehensive plan for ensuring the safety of residents of, and visitors, to the coast of North Carolina. The preservation of life is the single most important goal and objective of the recommendations. Joint Federal Emergency Management Agency

(FEMA)/ NOAA/Corps/State of North Carolina studies of evacuation routes and populations along the coastline has provided a tremendous amount of value to-date in aiding local government, individual and family readiness, in the face of approaching events. Support for this program is a critical element of the recommendations for the Town of Topsail Beach, in support of its residents and visitors. The following are important recommendations in support of efforts to support Hurricane Evacuation Planning:

- There is still much that can be done to update this on-going effort, and to provide new, and more widely-disseminated data and tools for evacuation planning by the State and the Town of Topsail Beach, and also for use by individuals and families in their preparation for an impending event.
- Evacuation route signage is an important part of a successful evacuation campaign. Maintenance of hurricane evacuation route signage is viewed as a vital link in ensuring the safety of residents and visitors alike.
- The provision of additional signage illustrating surge height achieved during past events would be an added and continual link to on-going education efforts. This could take the form of signs placed in locations in which there is significant traffic, such as major thoroughfares, where pedestrians walk, and particularly in those highest hazard zones based on elevation/depth data.

Evacuation Planning is an on-going effort of multiple agencies, including the Corps of Engineers, but its implementation is not a funded program under existing Corps authorities. Updating of websites containing evacuation routes and procedures should be periodically updated under existing programs implemented by the State of North Carolina.

Floodplain Management

Management of the floodplain is a non-Federal responsibility, yet is considered a key component of all plans for hurricane and storm damage reduction. The Town of Topsail Beach participates in the National Flood Insurance Program, which requires the town to engage in active and responsible floodplain management. The majority of residences and businesses within the Town of Topsail Beach possess flood insurance. Since so much of the Town of Topsail Beach is within a recognized floodplain, the Town continues to engage in activities that reduce threats to existing and potential future development, including structure setbacks, building code and construction monitoring, and flood zone management. The Town of Topsail Beach is encouraged to continue to update building codes, and encourage strong pursuit of activities such as first-floor elevation and building code upgrading, in the effort to reduce the potential for future structural and content damage.

Building Codes

The Town of Topsail Beach has adopted the International Building Code (IBC) to guide the design and construction of residential and commercial structures in the study area. In order to assure that the latest design and construction techniques are being used that apply

to hurricane-resistant construction, all future construction is encouraged to follow the latest version of the IBC (2007) and ensure enforcement of the codes through diligent building permit processing and on-site inspections of construction. Annual training classes on the use and enforcement of the new IBC should be encouraged. In addition, the Town of Topsail Beach should consider adopting the document "FEMA 550 Guidelines for Elevating Residential Structures on the Gulf Coast" as a part of their updated building codes for construction, due to the possibility of surge inundation associated with hurricane events.

Long-term Critical Infrastructure and Services Upgrading

The upgrading of critical infrastructure and services, such as Fire and Police services, is considered a vital recommendation in the reduction of threats to lives and property. The need to bring these services up to immediate restoration in the wake of a hurricane is of vital importance to the community. The methodical upgrading of the Town's Fire and Police services facilities as past of their Capital Improvement Program will provide long-term savings in capital outlay, and potentially save lives and residential and commercial property damage. This program may be instituted under a modified Capital Improvement Program, where structures reaching the end of their economic life are successively replaced by upgraded structures, locating vital communications and power supplies above the elevation of a Maximum Probable Surge event, and capable of surviving the ravages of wind and/or surge, as funds become available.

Upgrading or replacement of services is primarily a local charge, implemented through Capital Improvement Plans, with funding from a variety of Federal, State, and local resources, and will take many years to accomplish, due to the varying age and condition of each facility.

Structural Damage Reduction Features

Structural damage reduction features recommended for implementation include the previously-discussed sand dune constructed shoreward of the Town of Topsail Beach, at an elevation of 12 feet above the National Geodetic Vertical Datum (NGVD), fronted by a 50-foot wide beach berm constructed to an elevation of seven feet above NGVD. The dune and berm complex would extend 23,200 feet, with a 2,000 foot northern transition fill, and a 1,000 foot southern transition fill, for a total length of 26,200 feet. The recommended plan would provide for expected annual benefits estimated at $13,590,000, at October 2007 price levels, at an estimated annual cost of $4,119,000, for a benefit to cost ratio of 3.3 to 1. For construction beginning in late 2011, the estimated cost of the recommended plan would be $34,873,000.

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FINAL
INTEGRATED GENERAL REEVALUATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

SHORE PROTECTION

WEST ONSLOW BEACH AND NEW RIVER INLET (TOPSAIL BEACH)

NORTH CAROLINA

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1. STUDY OVERVIEW

This General Reevaluation Report presents the results of studies to reexamine the feasibility of Federal shore protection for the Town of Topsail Beach, which is located on the southern end of Topsail Island. Topsail Island lies in Pender and Onslow Counties, North Carolina as indicated in Figure 1.1, Location and Vicinity Map. Topsail Beach was included in a Federal project for hurricane protection and beach erosion control that was authorized by Section 101 of the Water Resources Development Act (WRDA) of 1992. However, the project was not implemented, and the project was then placed in the inactive status. The island suffered storms and erosion in the late 1990s and the Town of Topsail Beach requested reactivation of the project. Following authorization by the Energy and Water Development Appropriations Act for Fiscal Year 2001, the General Reevaluation Study was started. The Town of Topsail Beach is the project sponsor. The study has evaluated alternative plans for protecting the commercial and residential structures and infrastructure of Topsail Beach. The study has resulted in a recommendation to modify the authorized project to meet current economic and environmental criteria. The scale and costs of the project have been optimized to produce the maximum net economic benefits, or National Economic Development (NED) Plan, as directed by Federal planning guidelines. The Town of Topsail Beach has chosen another feasible plan as the Locally Preferred Plan (LPP). The selected plan is the Locally Preferred Plan.

Comparisons of alternatives and selections of the NED Plan and the LPP were conducted at October 2004 price levels and interest rates. Detailed economic evaluations of the NED Plan and the LPP are presented at October 2006 price levels and interest rates. Total costs and benefits are also presented at October 2007 price levels and interest rates.

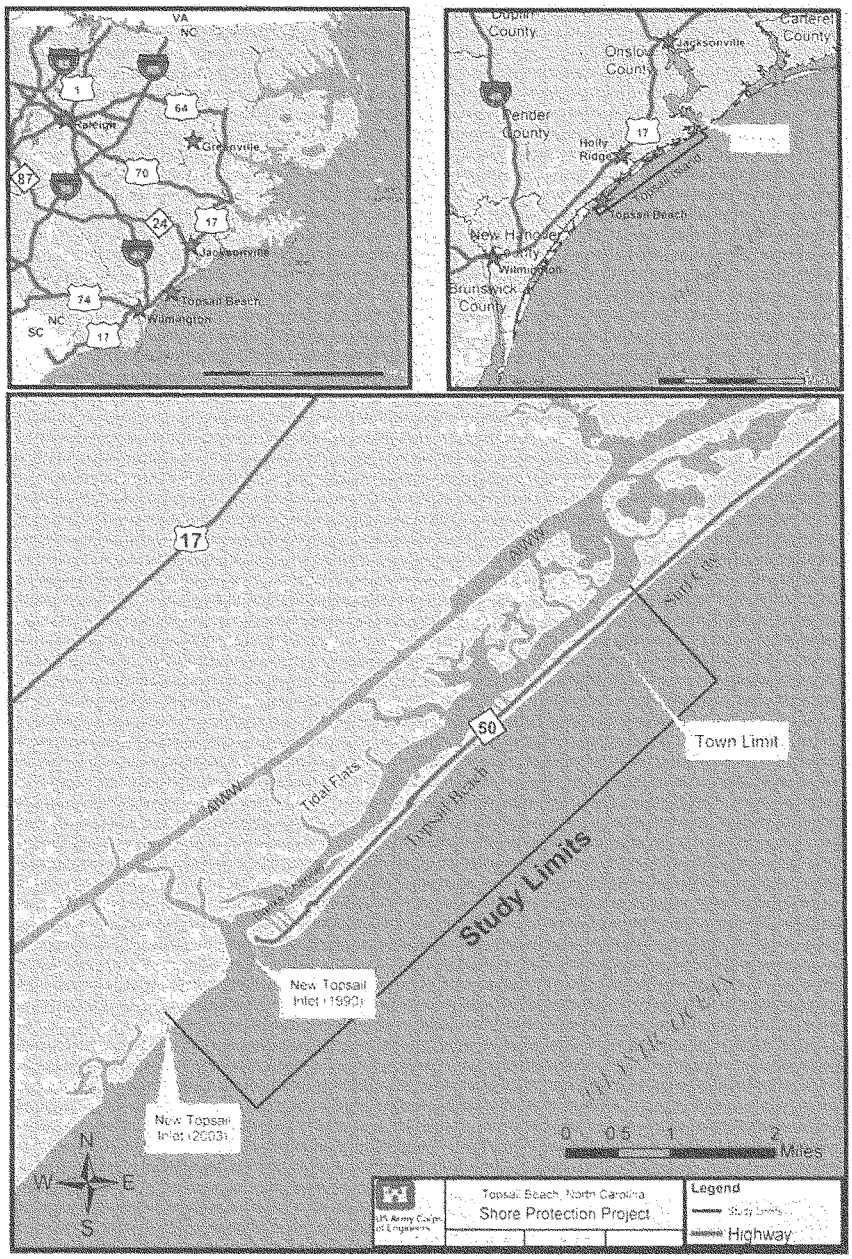

Figure 1.1 Location and Vicinity Map

1.01 Study Authority

Section 101 of the Water Resources Development Act (WRDA) of 1992 authorized the construction or implementation of the West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project At Topsail Beach, Pender County, North Carolina. Applicable sections of WRDA92 are copied below.

> TITLE I – WATER RESOURCES PROJECTS
>
> SEC. 101. PROJECT AUTHORIZATIONS.
>
> Except as provided in this section, the following projects for water resources development and conservation and other purposes are authorized to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, recommended in the respective reports designated in this section:
> (15) WEST ONSLOW AND NEW RIVER INLET, NORTH CAROLINA. – The project for flood control, West Onslow and New River Inlet, North Carolina: Report of the Chief of Engineers, dated November 19, 1991, at a total cost of $14,100,000, with an estimated Federal cost of $7,600,000 and an estimated non-Federal cost of $6,500,000.

This authorization was based upon information presented in House Document Number 393, 102nd Congress, 2nd Session, dated September 23, 1992, entitled "Final Feasibility Report and Environmental Impact Statement on Hurricane Protection and Beach Erosion Control, West Onslow Beach and New River Inlet, North Carolina (Topsail Beach)". This document will herein be referred to as "HD 393/102/2." The authorized project consisted of a dune, beach fill, and transition sections to improve shoreline conditions of the south end of Topsail Beach. More detailed description of the authorized project is provided in Section 1.09.

Authority to continue the preconstruction, engineering, and design (PED) investigations is contained in the Resolution adopted November 14, 1979, by the United States House of Representatives in accordance with Section 110 of the River and Harbor Act of 1962. The Design Memorandum prepared under PED was published in August 1992. However, the Project Cooperation Agreement was not executed and the project was then placed in the inactive status. The project was reactivated in 2000 at the request of the Town of Topsail Beach. The Energy and Water Development Appropriations Act for Fiscal Year 2001, Public Law 106-377, included funds for the Government to initiate a General Reevaluation Report (GRR) of the currently authorized West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project, and the remaining shoreline at Topsail Beach. The scope of the study includes the entire shoreline of the town of Topsail Beach.

This General Reevaluation Report has been prepared in response to the April 9, 2001 letter from the Town of Topsail Beach and the Appropriations Act. The town's letters appear in Appendix H.

1.02 Study Area

The focus of the General Reevaluation Study is the 6-mile long ocean shoreline of the Town of Topsail Beach. Topsail Beach is located at the southern end of Topsail Island adjacent to New Topsail Inlet in Pender County on the central North Carolina coast. Topsail Island is a 22-mile long and 0.5-mile wide barrier island located approximately 40 miles northeast of Wilmington, North Carolina. Due to the northeast-southwest orientation of the coastline, the island faces the Atlantic Ocean on the southeast. Other waterbodies in the vicinity include New Topsail Inlet immediately to the southwest, Banks Channel and the Atlantic Intracoastal Waterway (AIWW) to the northwest, and New River Inlet at the far northeastern end of the island. The study area is shown on Figure 1.1. More detailed maps of the study area are in Section 7, Figure 7.2 and in Appendix A, Figures A-7 and A-8.

Topsail Beach is uniformly developed with few undeveloped lots and a wide range of structures consisting mostly of single-family dwellings, some multi-unit apartment and condominium buildings, about 30 commercial buildings of various sorts, a few hotels and a sea turtle hospital. Most of the land in Topsail Beach suitable for development is already occupied with structures. Roadway access to the mainland is provided via N.C. Highway 50 to Surf City and then by bridges on N.C. Highway 50/210 at Surf City and N.C. Highway 210 at North Topsail Beach. Public access to the beach is provided by numerous parking areas and dune walkovers.

Over the past 35 years Topsail Beach has developed rapidly as a family ocean resort community for outdoor recreation. The Town of Topsail Beach estimates the peak seasonal population at more than 7,000. In the off-season the population drops to about 500 residents. During the summer months a large portion of the homes within the study area are available as summer rentals to vacationers primarily from inland North Carolina and other locations around the Eastern United States. There is one fishing pier in the project area.

1.03 Purpose and Need for Action

The purpose and need for action includes reduction of potential future damages from hurricanes and storms suffered by residential and commercial properties and public infrastructure, and the need to address erosion of the shoreline as protection of the above. There is also a need to reduce erosion of the shoreline as an environmental resource in itself, in its protection to the terrestrial environment inland, and as a recreational resource to the public.

1.04 Scope of Study

This study consists of reevaluation of the authorized improvement for the Town of Topsail Beach. A reevaluation study may reaffirm the previous plan, reformulate and modify the plan based on analysis of additional alternatives, or determine that no plan of improvement is justified under current planning criteria and policies.

1.05 Study Process

The US Army Corps of Engineers (USACE) studies for water and related land resources follow detailed guidance provided in the Planning Guidance Notebook (Engineer Regulation 1105-2-100). This guidance is based upon the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies that were developed pursuant to Section 103 of the Water Resources Planning Act (P.L. 89-80) and Executive Order 11747, which were approved by the U.S. Water Resources Council in 1982 and by the President in 1983. A defined six-step process is used to identify and respond to problems and opportunities associated with the Federal objective and specific State and local concerns. The process involves an orderly and systematic approach to making evaluations and decisions at each step so that the public and the decision makers can be informed of basic assumptions made, the data and information analyzed, risk and uncertainty, the reasons and rationales used, and the significant implications of each alternative plan. The process concludes with the selection of a plan for recommendation. Specific aspects of this process are described in more detail in other sections of this document.

1.06 National Objective

The Federal objective of water and related land resources project planning is to contribute to national economic development in a manner consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. If the projected benefits of shore protection measures at Topsail Beach exceed their estimated costs and are judged environmentally acceptable, their construction as a Federal project would contribute to this objective.

1.07 Prior Studies and Reports

The USACE has conducted a number of prior studies regarding the Topsail Island area and has prepared a number of related engineering, planning, and environmental reports. These studies have addressed shoreline erosion and hurricane protection as well as navigation needs. Reports particularly pertinent to the present study are briefly described below. Other reports related to the study area are cited in the Section 15, References.

Hurricane Protection and 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 the 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 11.7 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 August 5, 1977. The reason for this deauthorization was that there was no apparent non-Federal interest in the project following authorization.

- House Document No. 393, 102nd Congress, 2nd Session, "West Onslow Beach and New River Inlet, North Carolina." This report (HD 393/102/2) was conducted pursuant to four congressional resolutions adopted between 1970 and 1979. The resolutions addressed beaches, channels and inlets in the greater vicinity of Topsail Island. Studies for navigation purpose were conducted separately. The recommendation of the Final Feasibility Report and Environmental Impact Statement on Hurricane Protection and Beach Erosion Control was a dune and berm system at Topsail Beach as described below in Section 1.09, Authorized Project.

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 AIWW from Beaufort to the Cape Fear River, with dimensions of 12 feet deep by 90 feet wide.

- 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 deep by 90-foot wide 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 traffic and no improvements are being considered.

- House Document No. 691, 75th Congress, "Channel to New River Inlet." This house document, approved by Congress June 20, 1938, authorized construction of a 6-foot deep by 90-foot wide channel from the AIWW through New River Inlet to the Atlantic Ocean.

- "Detailed Project Report on Improvement of Navigation, New Topsail Inlet and Connecting Channels." This July 1965 report, approved by the Chief of Engineers April 7, 1966, authorized construction of a channel 8 feet deep by 150 feet wide through New Topsail Inlet. A connecting channel through Banks Channel to the Atlantic Intracoastal Waterway was also authorized under Continuing Authorities Program, Section 107 of the River and Harbor Act of July 14, 1960.

- "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.

1.08 Existing Federal Projects

The nearest Federal hurricane and shore protection project is at Wrightsville Beach, which is 12 miles to the southwest and beyond this study area. A number of Federal navigation projects are located in this study area. They are listed and briefly described below.

- **Atlantic Intracoastal Waterway (AIWW)** - The AIWW provides an important inland navigation route from Norfolk, Virginia to the St. Johns River, Florida. The 308-mile-long North Carolina portion is the state's only north-south commercial navigation thoroughfare. The authorized project includes a navigation channel with a depth of 12 feet and widths varying from 90 feet in land cuts to 300 feet in open waters; side channels and basins at a number of locations; and five highway bridges. The Beaufort to Cape Fear River Section was authorized by House Document No. 450, 69th Congress, "Inland Waterway, Beaufort – Cape Fear River." The main channel of the AIWW in North Carolina was completed in 1940, and it has since been maintained by dredging to remove shoals that develop periodically. Some of the dredged material removed during maintenance activities is beach quality sand. This material is placed directly on nearby ocean beaches, when practicable; otherwise, it is stockpiled in confined disposal areas near the shoreline of the AIWW. This sand can serve as a viable source of beach fill where it exists in sufficiently large volumes and in proximity to beaches.

- **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 AIWW. The connecting channels are through Old Topsail Creek (1.42 miles) and Banks Channel (6.27 miles), both between the AIWW and New Topsail Inlet.

- **New River Inlet** – Channel 6 feet deep and 90 feet wide through New River Inlet to the AIWW, a length of 2.3 miles. The channel continues another 18.8 miles from the AIWW to highway US 17 at Jacksonville, NC, but has not been maintained.

1.09 Authorized Project

The plan authorized by HD 393/102/2 consisted of a dune and beach fill over a total of 19,200 feet of the south end of Topsail Beach, as shown in Figure 1.2. Reaches covered by the authorized project included a 1,800-foot south transition, a 10,250-foot main fill section, and a 7,150-foot north transition section. In the authorizing documents, elevations are referenced to mean sea level (m.s.l.), which in this study area is equivalent to +0.6 feet, National Geodetic Vertical Datum (NGVD), the currently used datum. The authorized project cross section consisted of a dune of 25-foot crest width at elevation 13 feet m.s.l. (13.6 feet NGVD) fronted by a storm berm of 35-foot width at elevation 9 feet m.s.l. (9.6 feet NGVD), and a beach berm of 40-foot width at elevation 7 feet m.s.l. (7.6 feet NGVD), as shown in Figure 1.3. The estimated in-place volume required was 4,566,000 cubic yards of sand including 644,000 of advance beach nourishment. The borrow source for the authorized project was a 1,000-foot by 5,000-foot site in Banks Channel, just north of New Topsail Inlet. The estimated frequency of renourishment was 2 years.

That plan authorized by HD 393/102/2 was a locally preferred plan formulated specifically to comply with the laws of the state of North Carolina prohibiting a terminal groin. The estimated Average Annual Cost for the authorized plan was $2,362,000 (October 1989 price levels). The National Economic Development plan presented in HD 393/102/2 (Old 1990 NED plan) included a terminal groin and an estimated frequency of renourishment of 4 years. The estimated Average Annual Cost for the Old 1990 NED plan was $2,057,000 (October 1989 price levels). Therefore the authorized plan was more costly than the Old 1990 NED plan, and the authorized plan's incremental cost would have been 100% non-federal cost. The resulting overall cost sharing was 54% Federal and 46% non-federal. In March 1993 Topsail Beach determined they could not support this incremental cost and did not execute the Project Cooperation Agreement.

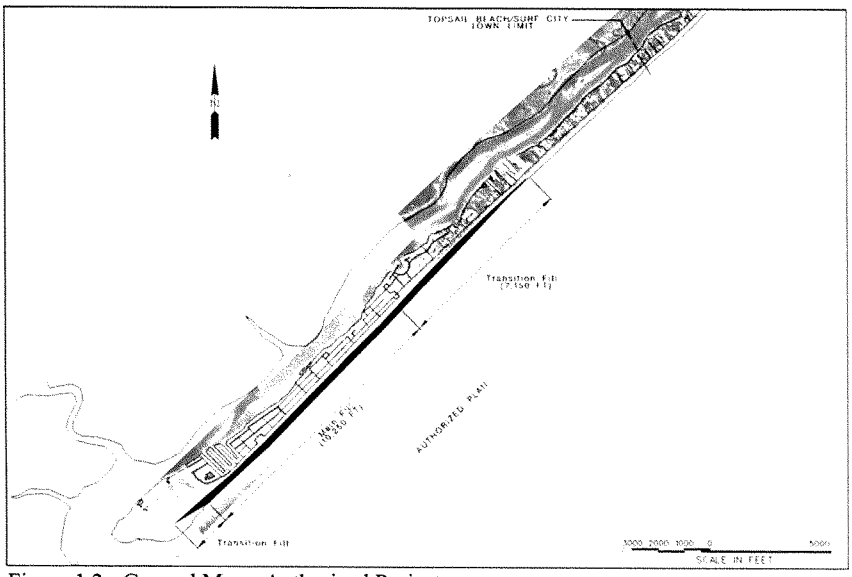

Figure 1.2 - General Map - Authorized Project

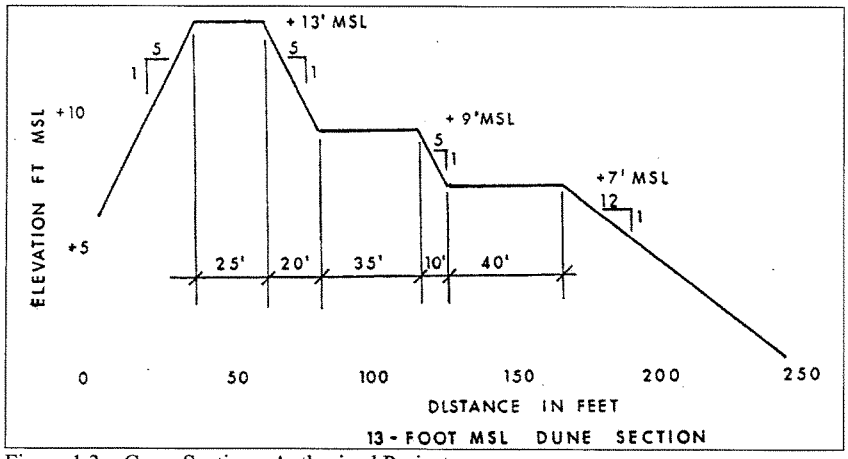

Figure 1.3 – Cross Section - Authorized Project

1.10 Section 902 Limit

The Authorized Project Cost was $14,100,000 at price levels of October 1992. The Water Resources Development Act of 1986, Section 902, provides for an explicit limit to the cost increases which may be incurred in any water resources development project without further authorization by the Congress.

Project cost increases are limited to any modifications which do not materially alter the scope of the project and do not increase total project costs by more than 20 percent plus increases for inflation and for changes specifically authorized or required under Federal law. The originally authorized project cost, $14,100,000 was for initial construction and no administrative limit on nourishment was established for this project. The Section 902 limit for the project is $26,160,000 as calculated for October 2007 and applies only for initial construction. Table 1.1 provides a short summary of the development of the cost limit for this project.

Table 1.1 – Section 902 limit, authorized project, as of October 2007.

Line 1	
a. Current Project estimate at current price levels, October 2007	$36,678,000
b. Current project cost estimate, inflated through construction	$38,834,000
c. Ratio: Line 1b/Line 1a	1.0465
d. Authorized cost at current price levels	$22,303,000
e. Authorized cost , inflated through construction, line 1c x line 1d:	$23,340,000
Line 2	
Cost of modifications required by law (none)	$0
Line 3:	
20 percent of authorized cost, 0.2 x $14,100,000	$2,820,000
Line 4:	
Maximum cost of limited by Section 902, Line 1e + Line 2 + Line 3:	$26,160,000

2. AFFECTED ENVIRONMENT

The project is located on Topsail Beach in Pender County, North Carolina. Topsail Beach is located on the southern portion of Topsail Island, a 26-mile long barrier island on North Carolina's central coast consisting of three communities; North Topsail Beach, Surf City, and Topsail Beach. Significant Resources found within the vicinity of the project area, in both the marine and terrestrial environment, are described below. Physical resources, socioeconomic resources, recreation and aesthetic resources, cultural resources, Section 122, P.L. 91-611 Resources, and water quality conditions are also discussed in this section.

2.01 Marine Environment

Marine waters in the vicinity of the beach nourishment area and offshore borrow sites provide habitat for a variety of ocean fish and are important commercial and recreational fishing grounds (Appendix A, Figure A-1). Kingfish, spot, bluefish, weakfish, spotted sea trout, flounder, red drum, king mackerel, and Spanish mackerel are actively fished from boats, the beach, and local piers. Offshore marine waters serve as habitat for the spawning of many estuarine dependent species. These species, according to Dr. Stan Warlen (NMFS letter dated January 5, 1993), "compose approximately 75 percent of commercially and recreationally important catch of fish and invertebrates in North Carolina". The surf zone typically exhibits a high diversity of fish fauna. Based on data collected from surf zone seine sampling along the South Atlantic Bight, 130 species of fishes are known from the surf zone between North Carolina and southern Georgia of which 47 species have been recorded from North Carolina beaches. The major recruitment period for juvenile fishes to surf zone nurseries is late spring through early summer. These waters also accumulate juvenile, ocean spawning, and estuarine dependent fish and invertebrates in the late winter and early spring prior to their transport through New Topsail and New River Inlets (Hackney *et al.*, 1996).

The intertidal zone within the proposed beach nourishment area serves as habitat for invertebrates including mole crabs, coquina clams, amphipods, isopods, and polychaetes, which are adapted to the high energy, sandy beach environment. These species are not commercially important; however, they provide an important food source for surf-feeding fish and shore birds. Offshore bottoms also provide habitat for benthic-oriented organisms. Special concerns are hardbottom areas, which generally support a diversity of soft corals, anemones and sponges and provide habitat for reef fish such as black seabass, red porgy, and groupers. Hardbottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia.

2.01.1 Wetlands and Flood Plains

Coastal wetlands of the project vicinity include tidal salt marshes, which occur along the shorelines and island fringes along the backside of Topsail Island (Appendix A, Figure A-2). Intertidal wetlands of the area are very important ecologically due to their high

primary productivity, their role as nursery areas for larvae and juveniles of many marine species, and their refuge/forage value to wildlife. In addition, they provide esthetically valuable natural areas. Many types of wetland communities are present in the project area; smooth cordgrass marsh, needlerush marsh, saltmeadows, and high marsh. All are important primary producers of organic matter and, therefore, serve as part of the base of the aquatic food chain. Smooth cordgrass (*Spartina alterniflora*) marshes occur within the intertidal zone along the sounds and tidal creeks, and provide valuable nursery habitat for many commercially valuable species of marine and estuarine organisms. The frequent removal of organic material and the daily tidal sedimentation processes make salt marsh communities very productive (Schafale and Weakley, 1990). Needlerush marsh is dominated by black needlerush (*Juncus romerianus)* and occurs in areas that are irregularly flooded. Saltmeadows are essentially pure stands of salt meadow cordgrass (*Spartina patens*), which can occur between 3.5-5.0 feet above mean sea level. Salt grass (*Distichlis spicata*), sea lavender (*Limonium carolinianum*), glasswort (*Salicornia* Spp.), and sea ox-eye (*Borrichia frutescens*) are also prominent plants in this community. High marsh is a transitional community between high ground areas and wetlands and, depending on location and frequency of flooding, may have characteristics of either. It is important in stabilizing the shifting sands of the barrier island. Given time and protection, it will eventually become vegetated with dominant shrub species such as marsh elder (*Iva frutescens*), wax myrtle (*Myrica cerifera*), and yaupon (*Ilex vomitoria*) (Wilson, 1981).

The State of North Carolina defines Primary Nursery Areas (PNA) as tidal saltwaters, which provide essential habitat for the early development of commercially important fish and shellfish (Appendix A, Figure A-3). It is in these estuarine areas that many fish species undergo initial post-larval development. Primary Nursery Areas are designated by the North Carolina Marine Fisheries Commission and currently total 80,144 acres statewide. With the exception of navigation channels, these include most estuarine waters of the project vicinity, including those bounded by New River (north), Mason Inlet (south), AIWW (west), and the landward side of Topsail Island. Protection of juvenile fish is provided in these areas through prohibition of many commercial fishing activities, including the use of trawls, seines, dredges, or any mechanical methods of harvesting clams or oysters (http://www.ncfisheries.net/rules.htm; 15 NC Administrative Code 3B .1405).

2.01.2 Inlet, Flats, and Sounds

New Topsail Inlet separates Topsail Island to the northeast from Lea Island to the southwest and serves as the major ocean outlet for the waters of the Atlantic Intracoastal Waterway through Howard's Creek, Topsail Creek, and Banks Channel. The mean minimum inlet width for the past 60 years has been 1,575 feet and over the past decade, the average rate of migration has been southwest 98 feet per year (Cleary and Marden, 1999). The inlet is a critical migratory pathway for many organisms entering and exiting the sounds, including larval fishes and crustaceans (Section 2.01.5), and anadromous and catadromous fishes. Portions of the sound located around New Topsail Inlet contain large

intertidal shoals and mud flats, which are very important to migrating and wintering waterbirds, including the Piping Plover.

Topsail Sound is a large estuarine system separated from the ocean by barrier islands. Many variables influence the character of the sound including wind direction and force, inlet flows, etc. Salinity near the inlet varies depending on tides and freshwater discharge and normally ranges between 10 and 32 parts per thousand (Hettler and Barker, 1993). Tides near the inlet normally follow those of the sea; however, there are times when the combined forces of freshwater discharge and wind overwhelm incoming tides and force water out of the inlet throughout the tidal cycle. Below the surface of the sound is a mosaic of shifting sand habitats. Seagrass beds could potentially grow in this environment; however, none have been documented at Topsail Beach (Fritz Rhode, pers. comm.). The Carolina diamondback terrapin is a state listed species of concern for Pender County, North Carolina and may be found on the soundside of Topsail Beach in brackish water areas and feeds mostly feed on clams, shrimp, crabs, snails, and small fish. They have been known to eat some vegetation but they are primarily carnivores (http://www.chelonia.org/).

2.01.3 Nearshore Ocean

Sand excavation and material disposal for beach and berm construction will occur in the near shore ocean in an area described by Day *et al.* (1971) as the "turbulent zone". The turbulent zone includes ocean waters from below low tide to a depth of about 60 feet NGVD (National Geodetic Vertical Datum). Identified sediment borrow areas proposed for project construction and periodic nourishment are located beyond the –30 foot NGVD contour to approximately 5.5 miles offshore (Appendix A, Figure A-6). Those borrow sites located beyond 3 nautical miles offshore are subject to federal mining requirements imposed by the Minerals Management Service (MMS). Beach nourishment will introduce fill into nearshore waters with a depth of closure of about 23 feet. Benthic organisms, phytoplankton, and seaweeds are the major primary producers in this community with species of *Ulva* (sea lettuce), *Fucus*, and *Cladocera* (water fleas) being fairly common where suitable habitat occurs. Many species of fish-eating birds are typically found in this area including gulls, terns, cormorants, loons, and grebes (Section 2.02.3). Marine mammals and sea turtles also are frequently seen in this area (See Appendix I). Fishes and benthic resources of this area are discussed in Sections 2.01.7 and 2.01.9 respectively.

2.01.4 Surf Zone Fishes

The surf zone along the area beaches provides important fishery habitat of which some species are dependent. Surf zone fisheries are typically diverse, and 47 species have been identified from North Carolina; however, the actual species richness of fishes using the North Carolina surf area for at least part of their life history is much higher (Ross, 1996; Ross and Lancaster, 1996). According to Ross (1996), the most common species in the South Atlantic Bight surf zone are Atlantic menhaden (*Brevoortia tyrannus*), striped

anchovy (*Anchoa hepsetus*), bay anchovy (*Anchoa mitchilli*), rough silverside (*Membras martinica*), Atlantic silverside (*Menidia menidia*), Florida pompano (*Trachinotus carolinus*), spot (*Leiostomus xanthurus*), Gulf kingfish (*Menticirrhus littoralis*), and striped mullet (*Mugil cephalus*). Two species in particular, the Florida pompano and gulf kingfish (*Menticirrhus littoralis*) seem to use the surf zone exclusively as a juvenile nursery area and are rarely found elsewhere. The major recruitment time for juvenile fishes to surf zone nurseries is late spring through early summer (Hackney *el al.*, 1996). Recent studies by Ross and Lancaster (1996) indicate that the Florida pompano and gulf kingfish may have high site fidelity to small areas of the beach and extended residence time in the surf zone suggesting its function as a nursery area. Major surf zone species consume a variety of benthic and planktonic invertebrates, with most of the prey coming from the water column. The dominant benthic prey are coquina clams (*Donax variabilis*); however, this is not the dominant food item throughout the South Atlantic Bight. Furthermore, many surf zone fishes exhibit prey switching in relation to prey availability, which could mitigate impacts from beach nourishment (Ross, 1996).

2.01.5 Larval Fishes

New Topsail and New River Inlets are important passageways for the larvae of many species of commercially or ecologically important fish. Spawning grounds for many marine fishes are believed to occur on the continental shelf with immigration to estuaries during the juvenile stage. The shelter provided by the marsh and creek systems within the sound serves as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

Transport from offshore shelves to estuarine nursery habitats occurs in three stages: offshore spawning grounds to nearshore, nearshore to the locality of an inlet or estuary mouth, and from the mouth into the estuary (Boehlert and Mundy, 1988). Hettler *et al.* (1997) documented, through analysis of larvae otoliths, that a large number of young Atlantic menhaden (*B. tyrannus*) larvae averaging 55 days post hatch arrived in mid-March on the date of maximum observed daily concentration (160 larvae per 100 m^3 (3,531 ft^3). For all species recorded in this study, abundance varied as much as an order of magnitude from night to night. The methods these larvae use to traverse large distances over the open ocean and find inlets are uncertain. Various studies have hypothesized such mechanisms as passive wind and depth-varying current dispersal and active horizontal swimming transport. However, little is known regarding larval distribution in the nearshore area.

Little research has been conducted within the New Topsail Inlet system in regards to larval species composition and abundance. However, the Beaufort Inlet system located about 60 miles north/northeast of New Topsail Inlet has been thoroughly studied and significant amounts of data have been collected in regards to larval transport of commercially and ecologically important fish. Considering the close proximity of these two inlet systems and their similar tidal prisms it can be expected that species composition would be similar (Larry Settle, pers. comm.; Thomas Lankford, pers.

comm.). During the winters of 1992-1993 and 1993-1994, Hettler and Hare (1998) conducted an experiment at Beaufort Inlet, North Carolina in order to further understand the estuarine ingress of offshore spawning species. A complex lateral structure in estuarine circulation, independent of the inlet opening size, was found in regards to larval concentration with significant interactions among inlet side, distance offshore, and date of ichthyoplankton tows. Length of species caught varied by cruise, inlet side, and distance offshore. The differences in larval concentration offshore and inshore and the species differences in length suggest species-specific rates controlling the net number of larvae entering the nearshore from offshore, the net number of larvae entering the inlet mouth from nearshore, and the larval mortality in the nearshore zone. Results from this study suggest two bottlenecks for offshore-spawning fishes with estuarine juveniles: the transport of larvae into the nearshore zone and the transport of larvae into the estuary from the nearshore zone (Hettler and Hare, 1998).

Egg and larval transport from offshore spawning grounds to the inshore environment of Beaufort Inlet was studied by Hettler and Hare (1998) in seven estuarine dependent species, including Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), pinfish (*Lagodon rhomboides*), summer flounder (*Paralichthys dentatus*), southern flounder (*P. lethostigma*) and Gulf flounder *(P. albigutta)*. Research conducted by the National Marine Fisheries Service (NMFS) Beaufort Laboratory through June 2002 collected a total of 120 species of larval fish fauna off the Beaufort Inlet and adjacent waters. According to Hettler and Hare (1998), average weekly concentration (number per 100 m^3 (3,531 ft^3) for all of the above estuarine dependent species, with the exception of Gulf flounder, was calculated during the October 1994 to April 1995 immigration season. Concentrations were 22.9, 4.8, 25.7, 12.4, 0.3, and 0.8 larvae/100m^3 (3,531 ft^3) respectively (Hettler and Hare, 1998). According to the spring tide flow calculated by Jarrett (1976) and the calculated daily larval concentration within the water column, approximately 32.5, 6.8, 36.5, 17.6, 0.43, and 1.1 million larvae pass through the inlet during a single spring tide for each respective species. Concentrations for all species combined (Attachment 1 of Appendix I) entering the inlet during a single tidal prism range from 0.5 to 5 larvae/m^3. Therefore, daily calculated larval concentration at Beaufort Inlet for all species within the tidal prism ranges between 66 to 710 million (Larry Settle, Pers. Comm.).

2.01.6 Anadromous Fishes

A number of anadromous fish species occur in ocean waters along the North Carolina coast and migrate into rivers and their tributaries to spawn in freshwater. These include the striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnosed sturgeon (*Acipenser brevirostrum*), as well as several members of the herring family (Clupeidae) such as the American shad *(Alosa sapidissima*), hickory shad (*Alosa mediocris*), alewife (*Alosa pseudoharengus*), and blueback herring (*Alosa aestivalis*). Historically, most accessible coastal streams in North Carolina were utilized by these species, and highest use occurred from mid-winter to mid-spring during the spawning runs. Sampling in the New River in 1974 and 1975 by the NC Division of Marine Fisheries

(NCDMF) identified the presence of blueback herring, alewife, American shad, and Atlantic sturgeon, although egg-netting results indicated very poor spawning success for all anadromous species. This study concluded that anadromous fish stocks in New River were very low and that, as a result, there was little or no utilization of the fishery (Sholar, 1975). Recent reports from the NCDMF indicate that there are no recent records of shortnose sturgeon in the project area (F. Rhode 2004, pers. comm.) (See Biological Assessment Appendix I). Because of the lack of suitable freshwater spawning areas in the project area and the requirement of low salinity waters by juveniles, any shortnose sturgeons present would most likely be non-spawning adults (NMFS, 1998).

2.01.7 Nekton

Nekton collectively refers to aquatic organisms capable of controlling their location through active movement rather than depending upon water currents or gravity for passive movement. Nekton of the nearshore Atlantic Ocean along Topsail Island, North Carolina can be grouped into three categories: estuarine dependent species; permanent resident species; and seasonal migrant species. The most abundant nekton of these waters are the estuarine dependent species, which inhabit the estuary as larvae and the ocean as juveniles or adults. This group includes species which spawn offshore, such as the Atlantic croaker (*Micropogon undulatus*), spot (*Leiostomus xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), star drum (*Stellifer lanceolatus*), southern kingfish (*Menticirrhus americanus*), flounders (*Paralichthys* spp.), mullets (*Mugil* spp.), anchovies (*Anchoa* spp.), blue crab (*Callinectes sapidus*), and penaeid shrimp (*Farfantepenaeus* spp. and *Lilopenaeus* sp.), as well as species which spawn in the estuary, such as red drum (*Sciaenops ocellatus*) and weakfish (*Cynoscion regalis*). Species which are permanent residents of the nearshore marine waters include the black sea bass (*Centropristis striata*), longspine porgy (*Stenotomus caprinus*), Atlantic bumper (*Chloroscombrus chrysurus*), inshore lizardfish (*Synodus foetens*), and searobins (*Prionotus* spp.). Common warm water migrant species include the bluefish (*Pomatomus saltatrix*), Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), Florida pompano (*Trachinotus carolinus*), and spiny dogfish (*Squalus acanthias*). Oceanic large nekton located offshore of Topsail Island are composed of a wide variety of bony fishes, sharks, and rays, as well as fewer numbers of marine mammals and reptiles. Marine mammals and reptiles that may be present in the offshore borrow sites are addressed in the biological assessment (see Appendix I).

2.01.8 Benthic Resources -Beach and Surf Zone

The intertidal zone of the beach shoreface is extremely dynamic and is characterized as the area from mean low tide landward to the high tide mark. This area serves as habitat for invertebrate communities adapted to the high-energy sandy beach environment. Important invertebrates of the surf zone and beach/dune community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis*), polychaete worms, amphipods, and ghost crabs (*Ocypode quadrata*). Mole crabs and coquinas represent the largest component of the total macrofaunal biomass of North Carolina intertidal beaches, and

they are consumed in large numbers by important fish species such as flounders, pompanos, silversides, mullets, and kingfish (Reilly and Bellis, 1978; Leber, 1982; Johnson, 1994). Beach intertidal macrofauna are also a seasonally important food source for numerous shorebird species.

Through recent studies supported by the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, the distributions and abundance of these animals on nearby beaches is fairly well documented. Extensive sampling of the intertidal and nearshore beach environment was performed and documented in the USACE New York District's biological monitoring report titled, "Final Report for The Army Corps of Engineers New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Sea Bright to Manasquan Inlet, Beach Erosion Project (2001)." Results from this study indicate that the intertidal infaunal assemblage was dominated by rhynchocoels, the polychaetes *Scolelepis squamata, Protodriloides (LPIL)*, and *Microphthalmus* spp., oligochaetes, the mole crab *Emerita talpoida*, as well as a number of haustoriid amphipods. The nearshore infaunal assemblage included many of the same taxa, but was dominated by the wedge clam, *Donax variabilis,* the polychaete *Magelona papillicornis*, the clams *Spisula solidissima* and *Tellina agilis*, and the amphipods *Acanthohaustorius millsi* and *Psammonyx nobilis*, and the polychaete *Asabellides oculata*. These documented infaunal assemblages are consistent with other studies throughout the Atlantic Coast (Burlas et. al., 2001). In North Carolina, along Bogue Banks and Topsail Island, infaunal assemblages are dominated by *Donax variabilis, Donax parvula*, and *Emerita talpoida* which function as an important first link in the flow of energy within the intertidal system (Leber, 1982; Reilly and Bellis, 1978). Other organisms occurring less frequently are Amphipods (Haustorius canadensis, Talorchestia megalopthalma, and *Amphiporia virginiana*) and Polychaetes (*Scolelepis squamata* and *Nephtys picta*) (Lindquist and Manning, 2001; Nelson, 1993; Leber, 1982; Reilly and Bellis, 1978).

2.01.9 Benthic Resources – Nearshore Ocean

Aquatic organisms that live in close association with the bottom, or substrate, of a body of water, are collectively called the benthos. Benthos communities provide a link between planktonic and benthic production and commercially important fish species (Posey, 1991). Benthic communities of the project area exhibit a wide range of organism composition and density, and community structure may vary considerably depending on substrate type and salinity regime. Most nearshore benthic invertebrates tend to be r-strategists, which are characteristically small-bodied, short-lived, and have high fecundity, efficient dispersal mechanisms, and rapid growth rates. Thus, recolonization of a disturbed area is generally initiated by r-strategists (Bowen and Marsh, 1988).

Benthic surveys of three nearshore ocean sites located off Virginia Beach were conducted for the USDOI Minerals Management Service in 1996 and 1997 by Cutter and Diaz (1998). They collected a total of 119 taxa from 13 Smith-MacIntrye grabs collected in 1996. Half of the top 14 taxa (occurrence and abundance) were polychaetes. The remainder included representatives from the amphipods, decapods, bivalves, nemerteans,

tanaids, echinoderms, and chordates. They found the overall community composition to be typical for sandy shallow continental shelf habitats and with similar species composition for similar depths and sediment types reported by Day *et al.* (1971) for North Carolina (Table 2.1). Day *et al.* (1971) defines the nearshore ocean as the "turbulent zone", which includes ocean waters from below low tide to a depth of about 60 feet. According to Day *et al.*, polychaete species are highly represented in this zone with pelecypods, decapods, amphipods, echinoderms, and cephalochordates also present. Benthic resources in the proposed borrow areas off of Topsail Island are similar to those found during other similar studies. Appendix S, Technical Memorandum, Topsail Beach Benthic Community Characterization Survey, Pender County, NC, May 2007, concluded that the benthic community found within the six proposed borrow sites off Topsail Beach is similar in composition and taxa dominance to those described in other studies along the North Carolina and South Carolina coasts (Byrnes *et al.* 2003; USACE 2002, 2006; and Posey and Alphin 2000, 2002). However, the study concluded that the number of species present and abundance were noticeably lower off Topsail Beach than off Kure Beach (Posey and Alphin 2000) and Dare County (USACE 2006). It is likely that the differences between the benthic community off Topsail Beach and the two referenced studies are due to the more extensive sampling effort associated with baseline monitoring programs as compared to a less intensive sampling regime for a general characterization study (e. g. ten sampling stations per site off Dare County as compared to three to five stations per site for the Topsail Beach benthic characterization study).

Table 2.1. Abundant benthic species within the turbulent zone near Cape Lookout North Carolina. (Day et. al. 1971)

Group and Species	Depth, meters			
	3	5	10	20
Archiannelida				
Polygordius sp.	X	X	X	X
Polychaeta				
Palaenous heteroseta		X	X	X
Pseudeurythoe ambigua			X	X
Exogone dispar			X	X
Goniadides n.sp			X	X
Magelona papillicornis	X	X	X	
Ophelia denticulata		X	X	X
Macroclymene zonalis				
Amphipoda				
Platyischnopus n.sp	X	X	X	
Maera sp.1		X	X	X
Decapoda				
Dissodactylus mellitae	X	X	X	
Pelecypoda				
Spisula ravenelli	X	X	X	X
Gastropoda				
Olivella adelae	X		X	X
O. mutica	X	X	X	
Echinoidea				
Mellita quinquiesperforata	X	X	X	X
Cephalochordata				
Branchiostoma caribbaeum		X	X	X

Biological characterization results from field surveys performed by the Minerals Management Service (MMS) of offshore shallow shelf habitats in the Outer Banks, North Carolina identified members of the major invertebrate and vertebrate groups commonly found in the general area. Dominant infaunal groups consisted of crustaceans, echinoderms, mollusks, and polychaetes, while epifaunal taxa consisted primarily of decapods, sea stars, and squid. Dominant demersal fish species included clearnose skate (*Raja eglanteria*), flounder (*Paralichthys* sp.), scup (*Stenotomus chrysops*), and searobin (*Prionotus scitulus*) (Byrnes *et al.*, 2003). Posey and Alphin (2000), collected offshore benthic infaunal samples at depths of 30-40 ft. from pre-borrow sites of Kure Beach, North Carolina. Results indicate that the benthic community was very diverse, with over 600 species, and largely dominated by polychaetes, with crustaceans and bivalves comprising most of the remaining taxa. Of the 104 total taxa collected for the one-time sampling performed for Topsail Beach, polycheates also dominated the community, comprising over 30% of the relative abundance at four of the six borrow sites (USACE, 2007).

2.01.10 Hardbottoms

Localized areas not covered by unconsolidated sediments, where the ocean floor consists of hard substrate, are known as hardbottoms. Hardbottoms are found along the continental shelf off the North Carolina coasts. Hardbottoms are also called "live-bottoms" because they support a rich diversity of invertebrates such as corals, anemones, and sponges, which are refuges and food sources for fish and other marine life. They provide valuable habitat for reef fish such as black sea bass, red porgy, and groupers. Hardbottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia. While hardbottoms are most abundant in southern portions of North Carolina, they are located along the entire coast (USFWS, 1990).

Offshore (>-23 ft. NGVD)

Hardbottom communities in the vicinity of Topsail Beach are within state waters. Shallow limestone and siltstone rock units offshore of Topsail Beach dominate and control the nearsurface geology and submarine landscape (USACE, 2004). According to Cleary (2003), the area offshore of Topsail Beach is characterized as a broad, shallow, high-energy shelf system with a thin and variable unconsolidated sediment cover as indicated by a large frequency of rock outcrops. The Topsail Beach shoreface consists of a thin patchy veneer of modern sediments covering the low relief Oligocene limestone and siltstone hardbottoms (Cleary, 2003). This thin veneer of sediment is ephemeral and easily reworked during storms; thus, exposing rock units in areas where the sediment cover is thin.

Seismic profile coverage, vibracores, and diver surveys have provided information, between the active beach (-23 ft NGVD) and three miles offshore of Topsail Beach, on the subcrop units that are frequently exposed as hardbottom. Sidescan sonargraphs offshore of the project area depict areas of high acoustic reflectance representing rock hardbottoms. Six shore normal fathometer sonargraphs were collected along Topsail Beach in order to determine the distribution of major hardbottom scarps and intervening low areas. From these sonargraphs, Cleary (2003) identified four limestone hardbottom scarps located at around 36 ft. deep between one and two miles offshore. The largest contiguous area of exposed rock occurs offshore of the southern 2.2 miles of Topsail Beach. The hardbottom protrudes above the seafloor as scarps exhibiting relief of 2-15 ft. with relatively low relief (2.5 ft.) hummocky limestone hardbottom in the areas between. Using existing information from researchers, recreational divers, and fisherman, Moser and Taylor (1995) developed a database of the distribution and aerial extent of hardbottoms within North Carolina waters. The location of the hardbottom communities identified in this study are found in Table 2.2. Data from the Southeast Monitoring and Assessment Program (SEAMAP) indicate that three areas of identified hardbottom and two areas of potential hardbottom are located offshore of the 3-mile state line and within about 1-mile of the proposed borrow areas (SEAMAP, 2001). However, only one hardbottom identified by SEAMAP falls near the proposed offshore borrow areas (borrow area B) (Appendix A, Figure A-1).

Table 2.2. Hard Bottom locations within waters off Topsail Beach, North Carolina according to Moser and Taylor (1995).

Location According to Moser and Taylor (1995)	Nearest Inlet Access	Vertical Distances		Reef Site Location	
		Approximate Water Depth (feet)	Relief *	Latitude	Longitude
14	New Topsail	35-40	High	34° 20.29'	77° 36.35'
15	New Topsail	35-40	High	34° 19.96'	77° 36.20'
16	New Topsail	35-40	High	34° 20.11'	77° 36.69'
17	New Topsail	35-40	Low	34° 20.83'	77° 33.94'
18	New Topsail	35-40	Low	34° 20.93'	77° 33.96'
19	New Topsail	35-40	Moderate	34° 21.19'	77° 33.81'
20	New Topsail	35-40	Moderate	34° 21.11'	77° 33.78'
21	New Topsail	35-40	Moderate	34° 21.03'	77° 33.54'
22	New Topsail	35-40	Moderate	34° 21.41'	77° 33.70'
23	New Topsail	35-40	Moderate	34° 21.73'	77° 34.00'
77	New Topsail	35-40	N/A	34° 20.27'	77° 35.21'
106	New Topsail	35-40	Low	34° 20.65'	77° 34.96'
116	New Topsail	35-40	N/A	34° 20.55'	77° 36.30'
151	New Topsail	35-40	N/A	34° 22.00'	77° 36.00'

* Low relief (L) was defined as <0.5m, Moderate relief (M) was defined as 0.5-2.0 m, and High relief (H) was defined as profiles >2 m (Moser and Taylor, 1996).

Nearshore (<-23 ft NGVD)

In order to confirm the presence or absence of hardbottom within the nearshore environment (<-23 ft. NGVD) of Topsail Beach, sidescan and multibeam survey techniques were performed. A summary evaluation and detailed survey reports are provided in Appendix R. Based on the survey data collected, the Corps concludes that no hard bottom features are located within the -23 depth of closure limits of the West Onslow Beach and New River Inlet (Topsail Beach) Shore Protection Project. After review of the data, the high backscatter depressional features identified through side scan and multi beam sonar, as well as the surface sediment samples collected within and outside of theses features, are consistent with previous descriptions in the available literature of Rippled Scour Depressions (RSD), Rippled Channel Depressions (RCD), and/or sorted bedform features. Furthermore, these features are identified in the North Carolina CHPP as soft bottom habitat and are not considered Essential Fish Habitat, Habitat Area of Particular Concern, Primary Nursery Area, or Strategic Habitat Area. Impacts to soft bottom habitat are discussed in detail in Sections 2.01.8 and 2.01.9 and 8.01.6 and 8.01.7.

Artificial Reef

The State of North Carolina, Department of Environment and Natural Resources, Division of Marine Fisheries Artificial Reef Program manages 6 reefs that are located off Topsail

Beach. They are AR 355, AR 360, AR 362, AR 364, AR 366, and AR 368. Of these managed reefs, AR360 "Topsail Reef" is within close proximity of the proposed offshore borrow areas and is located at 34° 20' 59" N and 77° 36' 11" W (Table 2.3). It was deployed in 1984 and modified in 1992 and consists of about 49,000 tires and 850 4'x8' pieces of concrete pipe. Currently this reef no longer exists in its confined location but rather, is broken up and spread out well beyond its original footprint and is exposed or buried at different locations. The location of these hard bottom habitats and artificial reef sites, in relation to project features, is shown in Appendix A, Figure A-1.

Table 2.3 Artificial reefs, NC Division of Marine Fisheries.

NC Reef Site No.	Nearest Inlet Access and Distance	Approx. Water Depth	LORAN Position Coordinates	Latitude and Longitude	Comment
355	New River 9.7 miles	60 feet	27210.0 39324.4	34°21'11" 77°20'00"	230' Bridge span
360	New Topsail 2.5 miles	44 feet	27256.9 39252.5	34° 20'59" 77°36'11"	Concrete pieces
362	New Topsail 8.7 miles	54 feet	27233.1 39244.5	34°15'43" 77°30'27"	Concrete pieces
364	New Topsail 6.0 miles	44 feet	27267.4 39169.6	34°14'50" 77°42'50"	174' JELL II Boat mold
366	New Topsail 13.9 miles	66 feet	27214.6 39255.0	34°12'57" 77°25'15"	
368	New Topsail 15.5 miles	66 feet	27211.7 39195.0	34°09'34" 77°25'50"	Small vessel

(http://www.ncfisheries.net/reefs/lok2fear.htm)

Since the placement of tire-based artificial reefs throughout North Carolina, many have broken loose from their original footprint and wash up consistently throughout the North Carolina beaches. In 2001 (December – April), during Phase I of the Bogue Banks Beach Nourishment project in Bogue Banks, North Carolina, the dredging contractor encountered about 5,000 tires within the borrow sites that had broken free from an artificial reef site. Based on this history, the NCDMF has identified concerns that, though the historical placement of AR 360 is outside of the identified borrow sites, there is a potential for loose tires to be located within the borrow sites. However, the NCDCM's artificial reef program has a team to document and pick up tires that wash up on the local beaches. Based on this database, it appears that the tires from AR360 have moved in a North and Northwest direction from the original location and would, more than likely, not be found in the identified borrow areas (Jim Francesconi, pers. comm.) (Appendix A, Figure A-1).

2.01.11 Essential Fish Habitat (EFH)

The 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (PL 94-265) set forth new requirements for the National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other Federal agencies to identify and protect important marine and anadromous fish habitat. These amendments established procedures for the identification of Essential Fish Habitat (EFH) and a requirement for interagency coordination to further the conservation of Federally managed fisheries. Table 2.4 lists the Federally managed fish species of North Carolina for which Fishery Management Plans have been developed by the South Atlantic Fishery Management Council (SAFMC), Mid-Atlantic Fishery Management Council (MAFMC), and National Marine Fisheries Service (NMFS). In addition, this table shows EFH by fish lifestage and ecosystem type for those species that have designated EFH. Table 2.5 shows the categories of EFH and Habitat Areas of Particular Concern (HAPC) for managed species, which were identified in the Fishery Management Plan Amendments affecting the South Atlantic area. The fish species and habitats shown in these tables require special consideration to promote their viability and sustainability. The potential impacts of the proposed action on these fish and habitats are discussed in Section 8.01.8 of this report.

Table 2.4. Essential Fish Habitat (EFH) Species for Coastal North Carolina.[1]

	MANAGEMENT PLAN AGENCY[2]	MANAGEMENT PLAN SPECIES GROUP	COMMON NAME OF SPECIES	SCIENTIFIC NAME OF SPECIES	EFH for LIFE STAGES BY ECOSYSTEM[3] Marine	Estuarine	GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC) (North Carolina Locations Only)
1	SAFMC	Calico Scallop	Calico scallop	*Argopecten gibbus*	A		
2	SAFMC	Coastal Migratory Pelagics	Cobia	*Rachycentron canadum*	E L P J A	L P J A	Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
3	SAFMC	Coastal Migratory Pelagics	Dolphin	*Coryphaena hippurus*	L P J A		Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
4	SAFMC	Coastal Migratory Pelagics	King mackerel	*Scomberomorus cavalla*	J A		Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
5	SAFMC	Coastal Migratory Pelagics	Spanish mackerel	*Scomberomorus maculatus*	L J A	J	Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom
6	SAFMC	Coral & Coral Reef	Corals	100s of species	Florida only		Big Rock; Ten Fathom Ledge; The Point
7	SAFMC	Golden Crab	Golden crab	*Chaceon fenneri*	A		
8	SAFMC	Red Drum	Red drum	*Sciaenops ocellatus*	E L A	P J S A	tidal inlets, state nursery, spawning sites, SAV
9	SAFMC	Shrimp	Brown shrimp	*Farfantepenaeus aztecus*	E L A	P J S	tidal inlets, state nursery, overwintering habitats
10	SAFMC	Shrimp	Pink shrimp	*Farfantepenaeus duorarum*	E L A	P J S	tidal inlets, state nursery, overwintering habitats
11	SAFMC	Shrimp	Rock shrimp	*Sicyonia brevirostris*	A		
12	SAFMC	Shrimp	Royal red shrimp	*Pleoticus robustus*	A		
13	SAFMC	Shrimp	White shrimp	*Litopenaeus setiferus*	E L A	P J S	tidal inlets, state nursery, overwintering habitats
14	SAFMC	Snapper Grouper	Blackfin snapper	*Lutjanus buccanella*	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
15	SAFMC	Snapper Grouper	Blueline tilefish	*Caulolatilus microps*	E A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
16	SAFMC	Snapper Grouper	Golden tilefish	*Lopholatilus chamaeleonticeps*	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
17	SAFMC	Snapper Grouper	Gray snapper	*Lutjanus griseus*	L A	P J A	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
18	SAFMC	Snapper Grouper	Greater amberjack	*Seriola dumerili*	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
19	SAFMC	Snapper Grouper	Jewfish	*Epinephelus itajara*	Florida only	Florida only	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
20	SAFMC	Snapper Grouper	Mutton snapper	*Lutjanus analis*	Florida only	Florida only	hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
21	SAFMC	Snapper Grouper	Red porgy	*Pagrus pagrus*			
22	SAFMC	Snapper Grouper	Red snapper	*Lutjanus campechanus*	L P J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
23	SAFMC	Snapper Grouper	Scamp	*Mycteroperca phenax*	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
24	SAFMC	Snapper Grouper	Silk snapper	*Lutjanus vivanus*	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
25	SAFMC	Snapper Grouper	Snowy grouper	*Epinephelus niveatus*	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
26	SAFMC	Snapper Grouper	Speckled hind	*Epinephelus drummondhayi*	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
27	SAFMC	Snapper Grouper	Vermillion snapper	*Rhomboplites aurorubens*	J A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
28	SAFMC	Snapper Grouper	Warsaw grouper	*Epinephelus nigritus*	E A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
29	SAFMC	Snapper Grouper	White grunt	*Haemulon plumieri*	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
30	SAFMC	Snapper Grouper	Wreckfish	*Polyprion americanus*	A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
31	SAFMC	Snapper Grouper	Yellowedge grouper	*Epinephelus flavolimbatus*	E L A		hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills
32	SAFMC	Spiny Lobster	Spiny Lobster	*Panulirus argus*	L J A	L J A	Spiny lobster EFH and HAPC located only in Florida
1	MAFMC	Atlantic Mackerel, Squid, Butterfish	Atlantic butterfish	*Peprilus triacanthus*			
2	MAFMC	Atlantic Mackerel, Squid, Butterfish	Atlantic mackerel	*Scomber scombrus*			
3	MAFMC	Atlantic Mackerel, Squid, Butterfish	Long finned squid	*Loligo pealei*			
4	MAFMC	Atlantic Mackerel, Squid, Butterfish	Short finned squid	*Illex illecebrosus*			
5	MAFMC	Atlantic Surfclam & Ocean Quahog	Ocean quahog	*Artica islandica*			
6	MAFMC	Atlantic Surfclam & Ocean Quahog	Surfclam	*Spisula solidissima*			
7	MAFMC	Bluefish	Bluefish	*Pomatomus saltatrix*	L J A	J A	
8	MAFMC	Spiny Dogfish	Spiny dogfish	*Squalus acanthias*	J A		
9	MAFMC	Summer Flounder, Scup, Black Sea Bass	Black sea bass	*Centropristis striata*			
10	MAFMC	Summer Flounder, Scup, Black Sea Bass	Scup	*Stenotomus chrysops*			
11	MAFMC	Summer Flounder, Scup, Black Sea Bass	Summer flounder	*Paralichthys dentatus*	L J A	L J A	SAV for larvae and juveniles
1	NMFS	Billfish	Blue marlin	*Makaira nigricans*	E L J A		
2	NMFS	Billfish	Longbill spearfish	*Tetrapturus pfluegeri*	J A		
3	NMFS	Billfish	Sailfish	*Istiophorus platypterus*	E L J A		
4	NMFS	Billfish	White marlin	*Tetrapturus albidus*	J A		

Table 2.4 (Continued). Essential Fish Habitat (EFH) Species for Coastal North Carolina.[1]

	MANAGEMENT PLAN AGENCY[3]	MANAGEMENT PLAN SPECIES GROUP	COMMON NAME OF SPECIES	SCIENTIFIC NAME OF SPECIES	EFH for LIFE STAGES BY ECOSYSTEM[2] Marine	Estuarine	GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC) (North Carolina Locations Only)
5	NMFS	Sharks	Atlantic angel shark	*Squatina dumerili*			
6	NMFS	Sharks	Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	J A	J	
7	NMFS	Sharks	Basking shark	*Cetorhinos maximus*			
8	NMFS	Sharks	Big nose shark	*Carcharhinus altimus*	J		
9	NMFS	Sharks	Bigeye sand tiger shark	*Odontaspis noronhai*			
10	NMFS	Sharks	Bigeye sixgill shark	*Hexanchus vitulus*			
11	NMFS	Sharks	Bigeye thresher shark	*Alopias superciliosus*	E L P J S A		
12	NMFS	Sharks	Blacknose shark	*Carcharhinus acronotus*	J A		
13	NMFS	Sharks	Blacktip shark	*Carcharhinus limbatus*	J A		
14	NMFS	Sharks	Blue shark	*Prionace glauca*	J S A		
15	NMFS	Sharks	Bonnethead	*Sphyrna tiburo*	J A	J A	
16	NMFS	Sharks	Bull shark	*Carcharhinus leucas*	J	J	
17	NMFS	Sharks	Carribean reef shark	*Carcharhinus perezi*	Florida only		
18	NMFS	Sharks	Carribean sharpnose sha	*Rhizoprionodon porosus*			
19	NMFS	Sharks	Dusky shark	*Carcharhinus obscurus*	A	J A	
20	NMFS	Sharks	Finetooth shark	*Carcharhinus isodon*	E L P J S A		
21	NMFS	Sharks	Galapagos shark	*Carcharhinus galapagensis*			
22	NMFS	Sharks	Great hammerhead	*Sphyrna mokarran*	J A		
23	NMFS	Sharks	Lemon shark	*Negaprion brevirostris*	J A	J A	
24	NMFS	Sharks	Longfin mako shark	*Isurus paucus*	E L P J S A		
25	NMFS	Sharks	Narrowtooth shark	*Carcharhinus brachyurus*			
26	NMFS	Sharks	Night shark	*Carcharhinus signatus*	J A		
27	NMFS	Sharks	Nurse shark	*Ginglymostoma cirratum*	J A		
28	NMFS	Sharks	Oceanic whitetip shark	*Carcharhinus longimanus*	J S A		
29	NMFS	Sharks	Porbeagle shark	*Lamna nasus*			
30	NMFS	Sharks	Sand tiger shark	*Odontaspis taurus*	J A		
31	NMFS	Sharks	Sandbar shark	*Carcharhinus plumbeus*	J A	J A	Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore
32	NMFS	Sharks	Scalloped hammerhead	*Sphyrna lewini*	J A		
33	NMFS	Sharks	Sharpnose sevengill sha	*Heptranchias perlo*			
34	NMFS	Sharks	Shortfin mako shark	*Isurus oxyrinchus*	E L P J S A		
35	NMFS	Sharks	Silky shark	*Carcharhinus falciformis*	J		
36	NMFS	Sharks	Sixgill shark	*Hexanchus griseus*			
37	NMFS	Sharks	Smalltail shark	*Carcharhinus porosus*			
38	NMFS	Sharks	Smooth hammerhead	*Sphyrna zygaena*			
39	NMFS	Sharks	Spinner shark	*Carcharhinus brevipinna*	J A		
40	NMFS	Sharks	Thresher shark, common	*Alopias vulpinus*			
41	NMFS	Sharks	Tiger shark	*Galeocerdo cuvieri*	J S A		
42	NMFS	Sharks	Whale shark	*Rhincodon typus*			
43	NMFS	Sharks	White shark	*Carcharodon carcharias*	J		
44	NMFS	Swordfish	Swordfish	*Xiphias gladius*	E L J S A		
45	NMFS	Tuna	Albacore	*Thunnus alalunga*	A		
46	NMFS	Tuna	Atlantic bigeye tuna	*Thunnus obesus*	J A		
47	NMFS	Tuna	Atlantic Yellowfin tuna	*Thunnus albacares*	E L J S A		
48	NMFS	Tuna	Skipjack tuna	*Katsuwonus pelamis*	E L J S A		
49	NMFS	Tuna	Western Atlantic bluefin t	*Thunnus thynnus*	E L J S A		

Notes:
1. These Essential Fish Habitat species were compiled from **Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies**. February 1999 (Revised 10/2001) (Appendices 2, 3, 6, 7, and 8). Although 49 species are listed in Appendix 3 under National Marine Fisheries Service management, only 35 of these species have EFH listed in Appendix 8.
2. Organizations responsible for Fishery Management Plans include:
   SAFMC = South Atlantic Fishery Management Council;
   MAFMC = Mid-Atlantic Fishery Management Council;
   NMFS = National Marine Fisheries Service.
3. Life stages include:
   E = Eggs, L = Larvae, P = PostLarvae, J = Juveniles, S = SubAdults, A = Adults

Table 2.5. Categories of Essential Fish Habitat and Habitat Areas of Particular Concern identified in Fishery Management Plan Amendments affecting the South Atlantic Area.[1, 2]

ESSENTIAL FISH HABITAT	GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN
Estuarine Areas	**Area - Wide**
Estuarine Emergent Wetlands	Council-designated Artificial Reef Special Management Zones
Estuarine Scrub / Shrub Mangroves	Hermatypic (reef-forming) Coral Habitat & Reefs
Submerged Aquatic Vegetation (SAV)	Hard Bottoms
Oyster Reefs & Shell Banks	Hoyt Hills
Intertidal Flats	*Sargassum* Habitat
Palustrine Emergent & Forested Wetlands	State-designated Areas of Importance of Managed Species
Aquatic Beds	Submerged Aquatic Vegetation
Estuarine Water Column[2]	
Seagrass	
Creeks	
Mud Bottom	
Marine Areas	**North Carolina**
Live / Hard Bottoms	Big Rock
Coral & Coral Reefs	Bogue Sound
Artificial / Manmade Reefs	Pamlico Sound at Hatteras / Ocracoke Islands
Sargassum	Capes Fear, Lookout, & Hatteras (sandy shoals)
Water Column[2]	New River
	The Ten Fathom Ledge
	The Point

[1]Essential Fish Habitat areas are identified in Fishery Management Plan Amendments for the South Atlantic and Mid-Atlantic Fishery Management Councils. Geographically Defined Habitat Areas of Particular Concern are identified in Fishery Management Plan Amendments affecting the South Atlantic Area. Information in this table was derived from Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. February 1999 (Revised 10/2001) (Appendices 4 and 5).

[2]EFH for species managed under NMFS Billfish and Highly Migratory Species generally falls within the marine and estuarine water column habitats designated by the Fishery Management Councils.

2.02 Terrestrial Environment

2.02.1 Maritime Shrub Thickets

This community normally occurs landward of the dune where it is protected from salt spray and the full force of ocean winds. Maritime shrub thicket is located sporadically throughout Topsail Beach, occurring on the backside of the island, west of the highway, and is interspersed with marsh areas, which border the sound. Dominant shrubs and trees in this community are wax myrtle (*Myrica cerifera*), yaupon (*Ilex vomitoria*), red cedar (*Juniperus virginica*), live oak (*Quercus virginiana*), and loblolly pine (*Pinus taeda*). Vines are also common with greenbriar (*Smilax bona-nox*), pepper-vine (*Ampelopsis arborea*) and grape (*Vitus rotundifolia*) being particularly abundant. This community type offers excellent cover for neo-tropical migrating songbirds. Other important species that may be found in the maritime thicket include the seaside sparrow, painted bunting, saltmarsh sharp-tailed sparrow, Nelson's sharp-tailed sparrow, and marsh and sedge wrens. Raptors may also be common during migration (e.g. American kestrel, merlin, peregrine falcon, bald eagle, northern harrier) (Sue Cameron, pers. comm.).

2.02.2 Beach and Dune

Terrestrial areas that may be influenced by the new proposed actions include 5.0 miles of Topsail Beach, from about 1,500 ft. south of Godwin Avenue (~2,500 ft. North of New Topsail Inlet) to the Topsail Beach/Surf City town limit (extending about 2,000 ft. into the Southern end of Surf City), and roadway rights-of-way utilized as corridors for dredge pipelines. Terrestrial habitat types within these areas include sandy or sparsely vegetated beaches and vegetated dune communities. The first line of stable vegetation is outside or landward of the proposed project limits. Utility corridors may have herbaceous or shrub cover. Barren areas are also widespread due to the disturbed nature of the utility corridors. Mammals occurring within this environment are opossums, cottontails, gray foxes, raccoons, feral house cats, shrews, moles, voles, and house mice.

Among North Carolina's upland habitats, the beach and dune community could be considered depauperate in both plants and animals. The beach environment is severe due to constant exposure to salt spray, shifting sands, wind, and sterile soils with low water retention capacity. Common vegetation of the upper beach includes beach spurge (*Euphorbia polygonifolia*), sea rocket (*Cakile edentula*) and pennywort (*Hydrocotyle bonariensis*). The dunes are more heavily vegetated, and common species include American beach grass (*Ammophila breviligulata*), panic grass (*Panicum amarum*), sea oats (*Uniola paniculata*), broom straw (*Andropogon virginicus*), seashore elder (*Iva imbricata*), and salt meadow hay (*Spartina patens*). Seabeach amaranth is present throughout Topsail Beach and is addressed in Appendix I. Important invertebrates of the beach/dune community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilis*) (See Section 2.01.8), and ghost crabs (*Ocypode quadrata*).

Ghost crabs occupy the upper zone of the beach environment and functions as an important predator in the beach community. Up to 60% of their diet consists of mole crabs up to 25% consists of coquina clams (Wolcott, 1978). During the sea turtle nesting season, ghost crabs are also known to prey on incubating sea turtle eggs and newly hatched sea turtle hatchlings. *Ocypode quadrata* is the only ghost crab occurring in the southeastern United States and, though little is know regarding its life history aspects, the various reproductive and larval components most likely reflect that of other decapods. Though timing of recruitment is poorly understood, it most likely occurs between late spring and early fall (Hackney *et al.*, 1996).

2.02.3 Birds

Birds common to the nearshore ocean in the project area include loons, grebes, gannets, cormorants, scoters, red-breasted mergansers, gulls, and terns (Table 2.6). The waters off of Topsail Island and Onslow Beach are very important to migrating and wintering northern gannets, loons and grebes because of the abundant hard bottom habitat (Sue Cameron, pers. comm.); however, most of the significant nearshore high-relief hardbottom habitat supporting abundant prey species are located north of the project area (Bill Cleary, pers. comm.; Hall, 2004). The USFWS indicate that sea ducks raft in large numbers in the nearshore ocean waters of the project area during spring and fall migrations. Ducks, geese, and many kinds of shorebirds may also be found here during the spring and fall.

The beaches of the project vicinity are heavily used by migrating shorebirds. However, dense development and high public use of project area beaches may reduce their value to shorebirds. Along the ocean beach, blackbellied plovers, ruddy turnstones, whimbrels, willets, knots, semi-palmated sandpipers, and sanderlings may be found. Table 2.6 provides a more complete list of waterbirds found in the project area. The dunes of the project area support fewer numbers of birds but can be very important habitats for resident species and for other species of songbirds during periods of migration. In the herbaceous dune areas, the American kestrel, merlin, bald eagle, peregrine falcon, northern harrier, and other raptors may be found during migration. Other birds occurring in this area are mourning doves, swallows, fish crows, starlings, meadowlarks, red-winged blackbirds, boat tailed grackles, and savannah sparrows.

Table 2.6. List of waterbirds that occur within the Topsail Beach project area and their status (LeGrand et al, 2001).

Common Name	Scientific Name	Season[1]	NC Status[2]
Red-throated loon	*Gavia stellata*	M, W	
Common loon	*Gavia immer*	M, W	
Horned Grebe	*Podiceps auritus*	M, W	
Brown pelican	*Pelecanus occidentalis*	B, M, W	SR
Double-crested cormorant	*Phalacrocorax auritus*	B, M, W	SR
Northern Gannet	*Morus bassanus*	M, W	
Great blue heron	*Ardea herodias*	B, M, W	
Great egret	*Ardea albus*	B, M, W	
Snowy egret	*Egretta thula*	B, M	SC
Reddish egret	*Egretta rufescens*	M	
Tricolored heron	*Egretta tricolor*	B, M	SC
Little blue heron	*Egretta caerulea*	B. M. W	SC
Black-crowned night heron	*Nycticorax nycticorax*	B, M, W	
White ibis	*Eudocimus albus*	B, M, W	
Glossy ibis	*Plegadis falcinellus*	B, M	SC
Osprey	*Pandion haliaetus*	B, M	
Clapper rail	*Rallus longirostris*	B, M, W	
Black-bellied plover	*Pluvialis squatarola*	M, W	
Wilson's plover	*Charadrius wilsonia*	B, M	SR
Semipalmated plover	*Charadrius semipalmatus*	M	
Piping plover	*Charadrius melodus*	B, M, W	T (T)
Killdeer	*Charadrius vociferus*	B, M, W	
American oystercatcher	*Haematopus palliatus*	B, M, W	SR
American avocet	*Recurvirostra americana*	M	
Black-necked stilt	*Himantopus mexicanus*	B, M	SR
Greater yellowlegs	*Tringa melanoleuca*	M, W	
Lesser yellowlegs	*Tringa flavipes*	M, W	
Willet	*Catoptrophorus semipalmatus*	B, M, W	
Spotted sandpiper	*Actitis macularia*	M	
Whimbrel	*Numenius phaeopus*	M	
Marbled godwit	*Limosa fedoa*	M, W	
Ruddy turnstone	*Arenaria interpres*	M, W	

[1] Season
B = Breeding; M = Migrating; W = Wintering

[2] NC Status
Endangered (E); Threatened (T); Special Concern (SC); Significantly Rare (SR). E, T, and SC status species are given legal protection status by the NC Wildlife Resources Commission. SR status is defined as any species which has not been listed by the NC Wildlife Resources Commission as E, T, or SC species, but which exists in the state in small numbers and has been determined by the NC Natural Heritage Program to need monitoring. Federal status is indicated in parentheses.

Table 2.6. List of waterbirds that occur within the Topsail Beach project area and their status (LeGrand et al, 2001). – (continued).

Sanderling	*Calidris alba*	M, W	
Semipalmated sandpiper	*Calidris pusilla*	M	
Western sandpiper	*Calidris mauri*	M, W	
Least sandpiper	*Calidris minutilla*	M, W	
Red Knot	*Calidris canutus*	M, W	
Dunlin	*Calidris alpina*	M, W	
Short-billed dowitcher	*Limnodromus griseus*	M, W	
Bonaparte's gull	*Larus philadelphia*	M, W	
Laughing gull	*Larus atricilla*	B, M	
Ring-billed gull	*Larus delawarensis*	M, W	
Herring gull	*Larus argentatus*	B, M, W	
Great black-backed gull	*Larus marinus*	B, M, W	
Gull-billed tern	*Sterna nilotica*	B, M	T
Caspian tern	*Sterna caspia*	B, M, W	SR
Royal tern	*Sterna maxima*	B, M, W	
Sandwich tern	*Sterna sandvicensis*	B, M	
Common tern	*Sterna hirundo*	B, M	SC
Forster's tern	*Sterna forsteri*	B, M, W	
Least tern	*Sterna antillarum*	B, M	SC
Black tern	*Chlidonias nigra*	M	
Black skimmer	*Rynchops niger*	B, M	SC

[1] Season
B = Breeding; M = Migrating; W = Wintering

[2] NC Status
Endangered (E); Threatened (T); Special Concern (SC); Significantly Rare (SR). E, T, and SC status species are given legal protection status by the NC Wildlife Resources Commission. SR status is defined as any species which has not been listed by the NC Wildlife Resources Commission as E, T, or SC species, but which exists in the state in small numbers and has been determined by the NC Natural Heritage Program to need monitoring. Federal status is indicated in parentheses.

On 10 July 2001, the USFWS designated 1,114 acres (Unit NC-11) of critical habitat for wintering piping plovers *(Charadrius melodus)* of which the southern spit of Topsail Beach is included. The unit extends southwest from 1.0 km northeast of Mean Lower Low Water (MLLW) of New Topsail Inlet on Topsail Island to 0.53 km southwest of MLLW of Rich Inlet on Figure Eight Island. It includes both Rich Inlet and New Topsail Inlet and the former Old Topsail Inlet. All land, including emergent sandbars, from MLLW on the Atlantic Ocean and sound side to where densely vegetated habitat begins and where constituent elements no longer occur (Federal Register, 2001). Bird surveys have been sporadically performed on Topsail Beach since 1987 and since then 61 piping plovers have been identified as individuals or pairs. Since 1987, a total of 7 nests were

identified of which only 1 was successful in 1999 (Sue Cameron, pers. comm.) (See Biological Assessment (Appendix I)).

Colonially nesting waterbirds (gulls, terns, and wading birds) are an important part of the project area ecosystem. These species formerly nested primarily on the barrier islands of the region but have had most of these nesting sites usurped by development or recreational activities. With the loss of their traditional nesting areas, these species have retreated to the relatively undisturbed dredged material disposal islands, which border the navigation channels throughout the State. These islands often offer ideal nesting areas as they are close to food sources, well removed from human activities, and are isolated from mammalian egg and nestling predators. Other species also use the islands for loafing or roosting during migratory periods or the winter months including painted buntings. Surveys by the NCWRC for American oystercatchers and Wilson's plovers this year indicated that the dredge islands, natural islands and shell rakes behind Topsail Island are very important nesting areas for these species. However, dredged material islands within the immediate vicinity of the project area that are diked are used by only a small number of nesting waterbirds. Though most of the project area is heavily developed, the southern end of Topsail Island, as well as nearby Lea and Hutaff islands, provide important and unique undeveloped habitat for breeding birds including terns (*Sterna spp.*), skimmers (*Rynchops niger)*, piping plovers (*Charadrius melodus)*, Wilson's plovers (*Charadrius wilsonia)*, and American oystercatchers (*Haematopus palliates)*. These undeveloped barrier island areas are rare within the project vicinity and are very important breeding habitats for these species.

The black skimmer (*Rynchops niger)*, least tern *(Sterna antillarum)* , and common tern (*Sterna hirundo)* are State listed species of concern for Pender County, North Carolina and are found on Topsail Beach year round during both the breeding season and during migration, with peak abundance occurring in the summer months. Terns feed by diving from the air upon insects and small fish and the black skimmer feeds on shrimp or small fish by flying just above the water with the tip of the long lower mandible shearing the surface. All of these bird species may use Topsail Beach for roosting, foraging, breeding, and nesting (Potter *et al.*, 1980).

2.02.4 Endangered and Threatened Species

Updated lists of federally endangered and threatened (E&T) species for the project area were obtained from NMFS (Southeast Regional Office, St. Petersburg, FL on August 16, 2004) and the U.S. Fish and Wildlife Service (USFWS) website (http://nc-es.fws.gov/es/es.html). These were combined to develop the composite list shown in Table I-1 of the biological assessment (Appendix I), which includes federally listed E&T species that could be present in the area based upon their historical occurrence or potential geographic range. However, the actual occurrence of a species in the area depends upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance, migratory habits, and other factors. The likelihood of

occurrence and potential project impacts regarding E&T species are summarized in the Biological Assessment (Appendix I.)

An updated list of state listed species for Pender County, North Carolina was obtained from the North Carolina Natural Heritage Program website (http://www.ncnhp.org/). From this list, species that may be present within the project vicinity are the black skimmer (*Rynchops niger*) (species of concern), least tern (*Sterna antillarum*) (species of concern), common tern (*Sterna hirundo*) (species of concern), gull billed tern (Sterna nilotica) (threatened), Wilson's plover (*Charadrius wilsonia*) (significantly rare), American oystercatcher (*Haematopus palliatus*) (significantly rare), and Carolina diamondback terrapin (*Malaclemys terrapin centrata*) (Species of Concern). Bird species are addressed within Sections 2.02.3 and 8.02.3 and the Carolina diamondback terrapin is addressed in Sections 2.01.2 and 8.01.2 of this EIS.

2.03 Physical Resources

2.03.1 Wave Conditions

Waves selected as input for the study were taken from the Corps of Engineers' Coastal and Hydraulics Laboratory Wave Information Study (WIS). Updated WIS wave hindcast data for Station 292, located about 10 miles offshore of Topsail Island, for the period 1990 to 1999 were used. Based on these data, waves commonly approach the southeast-facing study area from east through south directions (nearly two-thirds of the time), with east-southeast and southeast approaching waves occurring most frequently (nearly one-third of the time). Annually, the most frequently occurring wave heights range from 1.6 to 3.2 feet, with a mean wave height of about 3.3 feet. In winter, the most frequently occurring wave heights range from 1.6 up to 4.9 feet due to storms, with easterly to northeasterly approaching waves increasing in frequency. Summer wave conditions have more of a southeasterly component and are commonly in the 1 to 3 foot range, except for tropical systems that can generate the infrequent, but extreme waves of 15 feet or more.

2.03.2 Shoreline and Sand Transport

Long-term shoreline changes between 1963 and 2002 were determined by comparing MHW shoreline positions for each reach. Shoreline change rates were relatively low in the northern half of the study area (less than one foot per year), with some slight accretion along the interior reaches 13 through 22 (about 10,000 feet). In the southern portion of the study area, erosion rates gradually increase to over 3 feet of erosion per year (reaches 5 to 7). In the immediate vicinity of the inlet (reaches 1 to 4), inlet migration has resulted in accretion. These 1,000-foot long study reaches are visible in Section 7, Figure 7.2 and in Appendix A, Figures A-7 and A-8.

Sediment transport modeling of all of Topsail Island indicates an average net sediment transport of about 200,000 cubic yards per year to the north in the Topsail Beach study area. This northerly sediment transport is consistent with the findings of the August 1992

Design Memorandum for the project, which reported a northerly transport rate of 325,000 cubic yards/year for Topsail Beach.

2.03.3 Geology and Sediments

The Topsail Beach Project study area is located in the Atlantic Coastal Plain Physiographic Province bordering Onslow Bay. The geomorphology of the area is characterized by beaches, dunes, and marshes typical of a barrier island complex. The Atlantic Coastal Plain and Onslow Bay are both underlain by relatively flat-lying sedimentary units which gently dip and thicken to the southeast. This large sedimentary wedge includes both sediments which have not been indurated or cemented and rock units. These sedimentary units range in age from Cretaceous to Quaternary and overlie crystalline basement rock. A patchy veneer of Holocene sands and gravels overlies the Quaternary strata. The sand soils found on the Topsail Island beaches are classified as fine-to-medium-grained poorly-graded sands (SP) according to the Unified Soils Classification System.

The small rivers and streams entering Onslow Bay contribute small sediment loads as a significant fraction is deposited within the estuaries. This in turn contributes to the sand-starved nature of the coast in this area.

2.04 Socio-Economic Resources

The local economic impact area includes all of Topsail Island and the nearby areas of both Pender and Onslow Counties, North Carolina. Topsail Island includes not only Topsail Beach on the south end of the island but also Surf City and North Topsail Beach on the north end of Topsail Island. Highways 50 and 210 connect the island to the mainland portion of the two counties.

2.04.1 Demographics

Demographics for the existing economic conditions for the two-county study area include census data for population, housing, and personal income are shown in Table 2.7. The total population of the two county area was over 190,000 in 2000. The Town of Topsail Beach had 471 permanent residents in 2000; however, the peak seasonal population is estimated to exceed 7,000.

Table 2.7 - Socioeconomic Conditions Pender and Onslow Counties, NC

	Pender County	**Onslow County**	**Town of Topsail Beach**
Population, 2000	41,082	150,355	471
Ave. Household size	2.49	2.72	1.87
Housing Units	20,798	55,726	1,149
Occupied year-round	16,054	48,122	252
Seasonal or vacant	4,744	7,604	897
Estimated peak season population			7,252
In labor force	19,087	85,054	209
Per capita income	17,882	14,853	35,838
Per Capita Personal Income 2002	21,720	25,317	N/A

Source: U.S. Census Bureau (http://factfinder.ensus.gov) and U.S. Dept. of Commerce – Bureau of Economic Analysis (http://bea.doc.gov/bea)

The population of Pender County grew from 28,855 in 1990 to 41,082 in 2000, an increase of 42 percent. Onslow County population was virtually unchanged during the same period. The State of North Carolina grew by 21 percent during that same period. Personal per capita income for Pender and Onslow counties was reported to be $27,720 and $25,317 respectively. Personal per capita income for the State of North Carolina was $20,307.

Historical population growth for Pender and Onslow counties are shown in Figure 2.2, as well as historical and projections by the NC State Demographer through 2029 are shown in Figure 2.3.

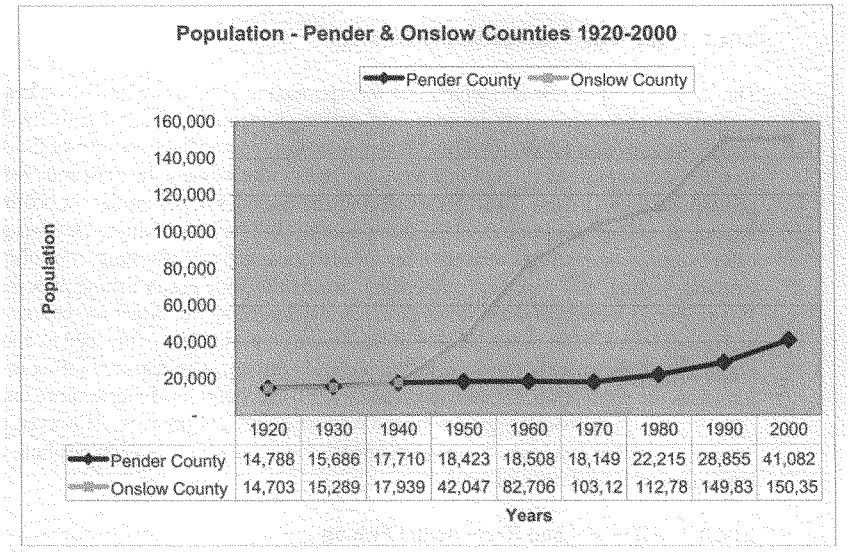

Figure 2.2 Population history

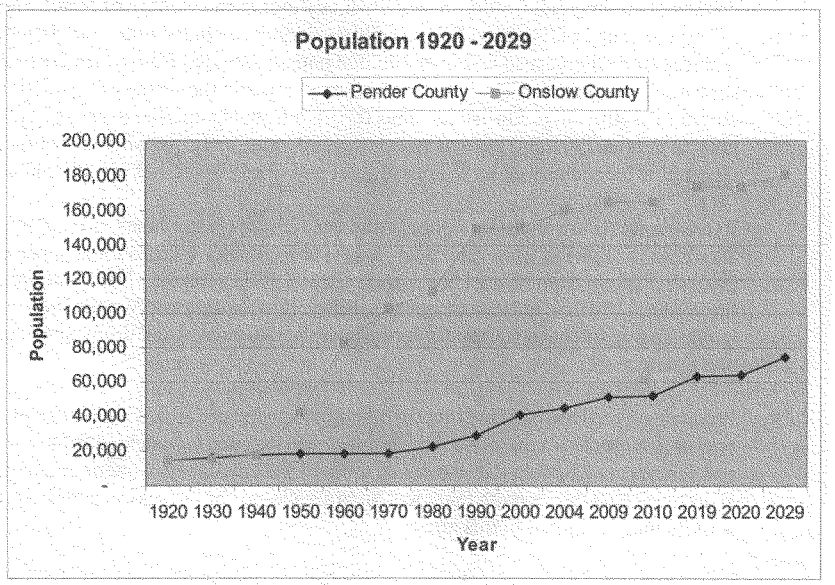

Figure 2.3 Projected population.

2.04.2 Esthetic and Recreational Resources

The Town of Topsail Beach, which was incorporated in 1963, is an urbanized beach community characterized by paved streets, parking lots, hotels, single-family dwellings, hotels, and low-rise condominiums. A scenic setting is provided by waters of the Atlantic Ocean, New Topsail Inlet, Topsail Creek, and Banks Channel and the numerous vessels common to these waters. The marine environment provides opportunities for boating and fishing, as well as an escape from the faster pace of land-based activities. Beaches generally offer extensive recreational opportunities for activities such as swimming, sunbathing, walking, surfing, bird watching, and fishing. In addition, one ocean fishing pier, the Jolly Roger Pier, is located in the study area and is considered an important recreational facility at Topsail Beach. The esthetic value of this beach community is evidenced by the popularity of the area for family oriented use and tourism. The seasonal influx of tourists increases the population from approximately 425 year round residents to more than 7,000 (http://www.topsailbeach.org/) during the warmer months of the year. However, the Topsail Beach has lost some of its visual appeal due to the severe erosion resulting from the hurricanes of 1996-1999 and 2003.

2.04.3 Commercial and Recreational Fishing

The North Carolina Division of Marine Fisheries (NCDMF) reported nearly 600,000 pounds of commercial finfish and shellfish landings in the vicinity of New Topsail Inlet in both 2003 and 2004. Significant shellfish landings included over 200,000 pounds reported from Hampstead and over 100,000 pounds reported from Surf City in 2003. As shown in Appendix A, Figure A-4, only 2 small areas in the vicinity of Topsail Beach are closed to shellfishing. Finfish landings reported from Hampstead exceeded 100,000 pounds in both 2003 and 2004. The commercial value of all finfish and shellfish landings reported in the vicinity of New Topsail Inlet was nearly $800,000 in both 2003 and 2004.

Recreational fishing includes fishing from head boats, charter boats, private boats, piers, and the surf. Fishing from head boats is best in the winter months for snapper and grouper. Fishing from charter boats is excellent for King mackerel and bottomfish during the winter. Offshore, gulfstream species, like yellowfin tuna and Wahoo are available. Inside fishing has been successful for inshore species such as red drum, speckled trout, and flounder.

Private boat anglers can find bluefin tuna in the nearshore area, king mackerel and other bottomfish species in the offshore, and other species such as speckled trout, red drum, and flounder can be found in the inside areas of the creeks and Atlantic Intracoastal Waterway. NCDMF reports that most piers are closed for the season and shore fishing activity will be limited in this area.

2.05 Cultural Resources

The six proposed borrow areas are located 1 to 5.5 miles offshore of New Topsail Inlet and the Town of Topsail Beach. This area has seen significant maritime activity since at least the early 18th century when permanent settlement began. One of the earliest land grants included the inlet and area surrounding the sound, and by 1755 New Topsail Sound was designated as an official inspection point for export commodities in New Hanover County, along with counties Brunswick, Wilmington, and New Exeter. Inspections were conducted for export commodities of fish, flour, butter, flax seed, beef, pork, rice, tar, pitch and turpentine, staves and headings, sawed lumber and shingles. Throughout the Colonial Period, the inlet was relatively stable and was suitable for passage by schooners and small sloops. During the latter part of the eighteenth century and throughout most of the nineteenth century, New Topsail Inlet migrated significantly to the north. According to Wilson Anglely's (1984) analysis, the Mouzon Map of 1775 and the Price-Strother Map of 1808, the inlet migrated northward some two miles. While the Mac Rae-Brazier Map of 1833 indicates no significant change, the U.S. Coast Survey Map of 1865 shows that an additional migration of two miles occurred during that period. The migration appears to have abated during the end of that century, as is suggested by review of the Kerr-Cain Map of 1882 and the Post Route Map of 1896. A detailed U.S. Coast Survey Map of 1885 indicates that the New Topsail Inlet was approximately 3,000 feet wide at that time.

At least eleven vessels are reported or believed to have been lost in the area of Topsail Inlet (Table 2.8). This number includes the loss of four vessels in 1750, part of the Spanish Plate Fleet. One of those ships, packet boat *El Salvador* was lost in the vicinity of Topsail Inlet on August 18, 1750. Due to the shifting sands, the surviving remains were buried in a matter of days, making salvaging operations difficult.

Table 2.8. NC Division of Archives and History, Underwater Archaeology Section Shipwreck Files

Wreck Name	Date Lost	Type Vessel	Location
El Salvador	18 Aug 1750	Nao	Topsail Inlet (suspected)
Unknown Brig	Sep 1769	Brigantine	Below Topsail Inlet
Betsy	1771	Merchant	Old Topsail Inlet
Adelaide	22 Oct 1862	Schooner	Mouth of New Topsail Inlet
Alexander Cooper	22 Aug 1863	Schooner	New Topsail Inlet
Industry	2 Feb 1863	Schooner	5 miles north of Topsail Inlet
Phantom	23 Sep 1863	Steamer	200 yards offshore in 30 feet of water, Topsail Inlet
Unknown Schooner	22 Jan 1863	Schooner	Westward of Stump Inlet
Wild Dayrell	3 Feb 1864	Side-wheel Steamer	Rich Inlet
Mary Bear	9 Sep 1881	Schooner	New Topsail Inlet
William H. Sumner	7 Sep 1919	Schooner	Topsail Inlet

Before the Civil War, the following vessels were lost in the vicinity: schooner *Superior*, driven ashore November 24,1841; an unknown brig in September 1769, run ashore below Topsail Inlet; English merchantman *Betsy* in 1771 at Old Topsail Inlet. The Civil War also resulted in a number of wrecks, including the schooner *Adelaide* of Halifax an unidentified schooner west of Stump Inlet, the iron-hulled steamer *Phantom*, and the schooner *Industry*. During the late 19th and early 20th centuries the following losses are recorded: the schooner *Mary Bear* on September 9, 1881, at New Topsail Inlet; and schooner *William H. Sumner* on September 7, 1919, grounded at Topsail Inlet.

The inlet area was active in salt production. An 1864 military map shows at least 2 Confederate salt works situated on either side of Holmes Landing. The presence of the salt works is further substantiated in a letter of November 1,1862, written by USS Lieutenant William Cushing to his superior.

In 1932, a 12-feet deep and ninety-feet wide segment of the Intracoastal Waterway between Beaufort and the Cape Fear south of Wilmington was completed. The channel allowed for an increase in vessel traffic from 33,710 tons in 1932 to 243,000 tons in 1939. As reported the previous year, the character of the vessel traffic – of around 9,000 vessel trips – consisted of approximately 8,500 motor vessels, 300 tugs, 200 barges, and a smattering of pleasure craft. Cargo vessels transported agricultural commodities, lumber, petroleum products, seafood, fertilizer, and general merchandise.

2.06 Water Resources

2.06.1 Hydrology

Tides in the area are semidiurnal and the mean tidal range is about 3.0 feet at New River Inlet and at New Topsail Inlet. Regular reversals of flow occur with each tidal cycle except during periods of high fresh water flow. The salinity of the area varies due to many factors including freshwater inflow, tidal action, and wind. From 2002 to 2004, average salinities in the Topsail Island vicinity range from an average of 14.2 parts per thousand (ppt) near New River Inlet, to 23.9 ppt in the Atlantic Intracoastal Waterway behind Topsail Island, to 35.9 ppt in the nearshore ocean at the Surf City Pier (Stan Sherman, pers. comm).

2.06.2 Water Quality Classification

All surface waters in North Carolina are assigned a primary classification by the NC Division of Water Quality (NCDWQ)(15A NC Administrative Code 02B .0301 to .0317). Waters in the vicinity of Topsail Island fall into three of these classifications. Waters of the Atlantic Ocean between Drum Inlet and Baldhead Island are classified as "SB," and are suitable for primary recreation, including frequent or organized swimming and all "SC" uses (secondary recreation such as fishing, boating, and other activities involving minimal skin contact; aquatic life propagation and survival; and wildlife). Stormwater controls are required under the Coastal Area Management Act (CAMA), and there are no categorical restrictions on discharges.

All other surface waters of the vicinity, including the New River, Atlantic Intracoastal Waterway (AIWW), Topsail Sound, and Banks Channel, meet the "SA HQW" classification and are suitable for shellfishing for marketing purposes as well as all "SB" and "SC" uses (See Appendix A, Figure A-5). All "SA" waters are "HQW" (High Quality Waters) by definition, and stormwater controls are required and domestic discharges are prohibited. Waters of the AIWW from Daybeacon # 17 (between Chadwick Bay and Alligator Bay) to Morris Landing (south of Spicer Bay) and waters of Topsail Sound southward from approximately New Topsail Inlet to Middle Sound are classified as "SA ORW." The "ORW" (Outstanding Resource Waters) designation is a supplemental classification intended to protect unique and special waters having excellent water quality and an exceptional state or national ecological or recreational significance. Waters of this classification must have one of the following outstanding resource values:

- Outstanding fish habitat or fisheries,
- Unusually high level of water based recreation,
- Some special designation such as North Carolina or National Wild/Scenic/Natural/Recreational River, National Wildlife Refuge, etc.,
- Important component of state or national park or forest, or
- Special ecological or scientific significance (rare or endangered species habitat, research, or educational areas).

- No new or expanded wastewater discharges are allowed in these waters. ORW are HQW by definition.

2.06.3 Groundwater

The sole source of water supply for both public and private systems in Pender County is groundwater. A vast aquifer system from which potable water can be drawn lies below the County. The water bearing groundwater units on Topsail Island are the surficial aquifer and the deeper 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 3 wells that draw from the cretaceous aquifer that is recharged on the mainland (Town of Topsail Beach Core Land Use Plan 2005). Regionally, the horizontal groundwater movement is eastward with some southeast movement. The resultant groundwater movement is toward the coast.

2.07 Other Significant Resources (Section 122, P.L. 91-611)

Section 122 of P.L. 91-611 identifies other significant resources that must be considered during project development. These resources, and their occurrence in the study area, are described below.

2.07.1 Air, Noise, and Water Pollution

Areas of the country where air pollution levels persistently exceed the national ambient air quality standards may be designated "non-attainment." All of Topsail Island is in an attainment area. There are no known air quality problems in the study area.

Noise is a prominent feature in the study area due to the sound of the breakers and at times, tourists and traffic on the beach. The sounds of breakers are tranquil and add to the pleasure experienced by visitors. Noise at Topsail Beach is regulated by a noise ordinance that is enforced 24 hours a day.

Water quality is discussed in Section 2.06.2 and in the Section 404(b)(1) (PL 95-217) evaluation that is included as Attachment G of this document.

2.07.2 Man-made and Natural Resources, Esthetic Values, Community Cohesion, and the Availability of Public Facilities and Services

Only one pier, Jolly Roger Pier, is located at Topsail Beach and it is within the proposed beach fill area. The Jolly Roger pier complex includes a convenience store and bait and tackle shop with small restaurant facilities. This 854-foot ocean pier, at the southern end of the island, is open from March through November. Esthetic values are discussed in Section 2.04.2.

The Town's drainage system is comprised of several street catch basins, drop inlets and sock tile drains installed by the North Carolina Department of Transportation (NCDOT), and a few ditches to alleviate water runoff. There are no stormwater drainage outlets that discharge to the beach.

Water is supplied to Topsail Beach via three town water wells that draw water from a deep aquifer. The wells are located between Banks Channel and Highway NC50. No wells are located near the beach. The water systems of Topsail Beach and Surf City are connected and have an agreement for emergency use and to purchase water when necessary. (Town of Topsail Beach Core Land Use Plan 2005)

Septic tanks and two privately owned wastewater treatment plants handle the sanitary waste disposal needs of the community. Pender East Emergency Medical Services squad provides rescue and advanced life support services within the Town's limits. Electricity is provided by Jones-Onslow Electric Membership Corporation. Sprint provides telecommunications service within the town limits, and the cable television franchise is operated by Charter Communications.

Topsail Beach is the home of the Karen Beasley Sea Turtle Rehabilitation and Rescue Center, which is open to the Public during the summer months.

Public Accesses from public roads and streets to the beach are provided at 22 designated access points. There are a total of 374 parking spaces available to the general public near these access points. In addition, the town has indicated in a more recent count during the summer of 2004, there may be at least 300 additional parking spaces unaccounted for on the rights of way (ROW) along town streets. (Appendix F)

2.07.3 Contaminated Sediments

Due to past military activities in the project area, the presence of contaminated sediments warrants discussion. The potential for encountering contaminated sediments in the project area is discussed below as documented in the Defense Environmental Restoration Program For Formerly Used Defense Sites (DERP-FUDS), Ordnance And Explosive Waste, Archives Search Report, Findings For The Former Camp Davis, Holly Ridge, North Carolina, Project Number 104nc001702, May 1994.

In 1941 Camp Davis was established as an Anti-Aircraft Training Center at Holly Ridge, North Carolina. Acquisition of land for Camp Davis took place from 1941 through 1943. A total of approximately 46,682 acres was acquired by lease from numerous individuals, corporations, and governmental agencies by the War Department for a World War II Army Air Corps training facility. The Training Center was later used as a convalescent hospital and rehabilitation center and became home to various military units. Coast Artillery Anti-Aircraft Regiments were the dominant groups, moving thousands of recruits through basic training and anti-aircraft weaponry. Although the main part of Camp Davis was located on the mainland, northwest of Topsail Island, the Coastal Gunnery Range Emplacement Area was located on Topsail Island near the Surf City

bridge and the Coastal Gunnery Potential Range Impact Area was located offshore of Topsail Island (Figure A-1, Appendix A).

The Gunnery Emplacement area, was located four and a half miles southeast of the main portion of the former Camp Davis. The site was known as the Sears Landing and occupied a narrow strip of land between the inland waterway and the Ocean. As a gun emplacement, the ordnance used on site would have been fired or returned to the point of issue; therefore, the possibility of ordnance residue is extremely remote. The inspection team did not observe any Ordnance or Explosive Wastes (OEW) in this area and there were no reports of OEW within the gun emplacement area.

The Coastal Gunnery Range Impact Area, which was located offshore of Topsail Island, was viewed by inspectors from the beach and no offshore survey was conducted. Inspectors only surveyed the beach area to the water's edge. The AA coastal gunnery range impact area has potential ordnance contamination based upon its use when it was active, however, no evidence of residual OEW contamination has been found or documented since the anti-aircraft gunnery range was closed. No records or documentation were located as to the exact types of ordnance used, although it is presumed that mostly practice rounds were used based upon the fact that gunners fired at a target that was pulled/towed behind an aircraft. Practice round sizes would have varied, but are presumed to include the following: 37 mm (1.46 inches), 40 mm (1.57 inches), 3-Inch, 9O mm (3.54 inches), 105 mm (4.13 inches), and 155 mm (6.10 inches).

After World War II, Camp Davis was assumed by the Navy for their secret guided missile testing program, code-named "Operation Bumblebee." Topsail Island was the third of three widespread test sites established along the Atlantic seaboard in the closing years of World War II, and the first permanent ground for missile testing. The Topsail Island site, placed in operation in March 1947, incorporated rigid structures that were designed and built for specific uses related to the assembly, firing, monitoring and perfecting of experimental ramjet missiles. The Navy used only a small portion of Camp Davis for the testing of rocket motor propulsion systems. An arsenal center for the assembly and storage of rockets was built on the sound-side of the island, and launching pads were constructed on the oceanfront. Concrete observation towers were built throughout the island to monitor the experimental launchings and many of the military structures remain standing today. During the 18 months that Operation Bumblebee was active at Topsail, an estimated 200 experimental rockets, each measuring six inches in diameter and between three and 13 feet in length, were fabricated at the Assembly Building, dispatched to the launch site, and fired along a northeasterly angular deflection of 15 degrees to the shoreline for a maximum clear distance of 40 miles. Despite the initial success of the US Naval Ordnance Testing facility at Topsail Island, its location did not fulfill completely the needs of a permanent base because weather conditions and increased sea traffic interfered with testing, and the facility was abandoned and its equipment moved to other sites (http://www.cr.nps.gov/nr/travel/aviation/usn.htm).

Although, over 200 rocket launchings took place on the island between 1946 and 1948, no OEW was associated with the testing procedures and all leased land was returned to the original landowners. Currently, most of the former Camp Davis lands are being used for state wildlife game lands (Holly Shelter) and for the production of forestry products.

Several databases were reviewed to obtain information pertaining to releases, treatment, storage, and disposal of hazardous substances in the project area These databases included EPA Superfund (Comprehensive Environmental Response, Contamination and Liability Information System (CERCLIS)), Resource Conservation and Recovery Act (RCRA) and Brownsfields. Also reviewed was the State listing of hazardous wastes sites. Based on this review and the review of the Camp Davis Archives Search Report, referenced above, there are no documented active or inactive hazardous waste sites on Topsail Island.

3. PROBLEMS, NEEDS, AND OPPORTUNITIES

The main public concerns identified at Topsail Beach are economic losses resulting from (1) damages to structures and their contents due to hurricane and storm activity, and (2) the loss of beachfront land due to progressive shoreline erosion. In addition, periods of severe shoreline recession have adversely affected nesting habitat for endangered and threatened sea turtles. These economic losses and environmental concerns are discussed below.

3.01 Hurricane and Storm Damage

Being located between Cape Lookout and Cape Fear, Topsail Island is a frequent target for hurricanes and tropical storms tracking along the mid-Atlantic coast. Table 3.1 is excerpted from hurricane history information on the State Climate Office of North Carolina website and shows the frequency and severity of hurricanes and tropical storms directly affecting southeastern North Carolina since 1800. In addition to these direct landfalling storms, many storms that have passed offshore without making landfall have also impacted the study area. Local impacts to Topsail Beach varied depending on the landfall location and strength of the storm. However, Bertha and Fran in 1996 and Floyd in 1999 were among the most damaging and costly storms ever to hit North Carolina.

3.02 Beach Erosion

Over the last 40 years, the most serious long-term erosion has been occurring in the southern half of the study area, where erosion rates gradually increase from near zero in reach 13 to over 3 feet per year in reaches 5 to 7 (refer to Figure A-7 in Appendix A for reach locations). Long-term shoreline change rates along the northern half of the study area have remained relatively low, generally ranging from –1 to +1 foot per year. However, major storms in the late 1990s caused significant erosion and decimated the island's natural dunes, resulting in major property damage.

3.03 Beach Recreation

All reaches within the Topsail Beach study area are available for typical beach recreation activities – swimming, surfing, wading, walking, sightseeing, picnicking, sunbathing, surf fishing, jogging, and so on. The concern regarding beach recreation is that shore erosion will continue, resulting in a narrowing of the width between the surf, especially at high tide, and the landward limits of recreational use. Such landward limits are the toe of the dune, streets, or existing structures. As the available width decreases, some of these activities are hindered and eventually prevented.

Table 3.1 Direct Landfalling Hurricanes and Tropical Storms in Southeastern North Carolina Since 1800.

Approximate Date of Landfall	Storm Name	Saffir-Simpson Intensity at Landfall	Approximate Location of Landfall	Estimated Wind Speed (kt)	Storm Surge (ft.)
9/16/1999	Floyd	2	Topsail Island	95	
8/26/1998	Bonnie	3	Cape Fear	100	6-8
9/6/1996	Fran	3	Cape Fear	100	8-12
7/13/1996	Bertha	2	Topsail Beach	90	5
9/9/1984	Diana	1	Long Beach	80	5-6
9/11/1960	Donna	2	East of Wilmington	95	6-8
8/17/1955	Diane	1	Carolina Beach	75	5-9
10/15/1954	Hazel	4	NC/SC border	125	10-20
7/6/1946		Tropical Storm	Wilmington	60	
8/1/1944		1	Southport	80	
12/2/1925		1	Wilmington/Hatteras	65	
9/22/1920		1	Topsail Beach	65	
9/6/1916		Tropical Storm	Southport	35	
10/31/1899		1	Wrightsville Beach	80	8
9/11/1883		1	Southport	85	
9/9/1881		NA	Wilmington/Wrightsville		
08/18/1879		4	Wilmington/Cape Lookout	120	
9/17/1876		Tropical Storm	NC/SC border	60	
11/10/1875		NA	Long Beach		
9/28/1874		NA	Southport	60	
8/19/1871		NA	Southport		
9/4/1856		NA	Wrightsville Beach		
8/18/1837		NA	Cape Fear		
9/4/1834		NA	NC/SC border		
9/3/1815		NA	Wilmington/New Bern		10

3.04 Public Access

Many public beach access points and parking areas are present within the limits of the study area. The access points consist of small parking areas and wooden walkways to the beach. There are 22 beach access points located within the Topsail Beach study area, mostly in the southern part of town. There are only 2 areas of the study area, both near the north end of town, in which the distances between access points exceed ½ mile. The distance between access points O#4 and O#5 is 3,590 feet. This results in a 950 foot long

access deficiency in reaches 17 and 18 in the 1100 block of North Anderson Boulevard. The distance between access points O#2 and O#3 is 2,970 feet. This results in a 330 foot long access deficiency in reach 22, located near the 700 block of North Anderson Boulevard.

There are presently 374 public parking spaces available within 1/4 mile of the ocean-side access points. These public parking spaces are found at the following locations: 1) directly adjacent to the 22 access sites, 2) along nearby streets, 3) at 2 parking lots near the center of town, and 4) at sound side access points along the Banks Channel side of the island. The parking space count was conducted in June 2003 by the Wilmington District and a representative from the Town of Topsail Beach. In addition, the town has indicated in a more recent count during the summer of 2004, that there may be at least 300 additional parking spaces unaccounted for on the rights of way (ROW) along town streets. Currently, the town does meet the minimum requirement of 10 spaces per access point for parking at most of the established public access points. Figure 3.1 shows existing and proposed access locations. Appendix F describes the access and parking needs in detail.

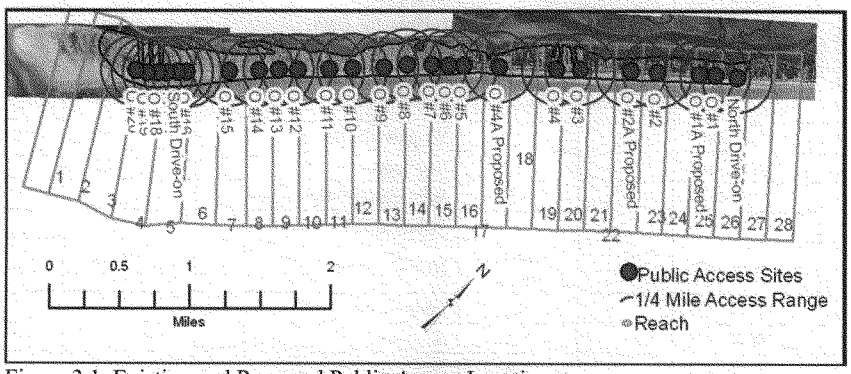

Figure 3.1 Existing and Proposed Public Access Locations.

3.05 Loss of Sea Turtle Nesting Habitat

A shoreface comprised of beach, berm, and dune components can provide valuable nesting habitat for sea turtles. The loggerhead and green sea turtles, which are on the Federal list of threatened and endangered species, have been documented to nest on Topsail Beach. However, long-term shoreline erosion processes coupled with historical short-term hurricane events have led to significant sediment losses from the shoreface. As a result of these existing erosional activities, substantial portions of the berm and dune system have been lost as the shoreline is being "squeezed" between the ocean and adjacent development. This puts nesting sea turtles at risk since little nesting habitat remains in these eroded areas. In some cases, nests laid in high erosion areas where available nesting habitat is lost need to be relocated to avoid tidal inundation (Jean Beasley, pers. comm.) (See Biological Assessment, Appendix I).

Persistent erosion along the town of Topsail Beach could lead to complete loss of nesting habitat; however, as short-term erosional processes scour the existing shoreface and the nesting beach environment slowly erodes away, large scarps may form at the toe of the primary dune; thus, preventing a turtle from encountering suitable nesting habitat above the mean high tide line. Re-establishment of a berm and dune system with a gradual slope can enhance nesting success of sea turtles by providing suitable nest sites without escarpment obstacles and away from tidal inundation.

3.06 Existing Shore Condition

In March 2002, beach profile surveys were taken along Topsail Beach at 1000-foot intervals to determine existing conditions of the project shoreline. Of the 26 shoreline profiles, 6 profiles were selected as representative of the existing condition and used for analysis. These typical profiles are shown in Figure 3.2.

The existing condition includes a fairly substantial constructed dune that was rebuilt following the decimation of the existing dune by Hurricane Fran in 1996. The existing dune varies in height from 15 to 20 feet along most of Topsail Beach, however, the dune has very little crest width, if any, and very steep side slopes. At the time of the surveys, the dry beach width from the base of the dune (at about elevation 7 ft-NGVD) out to the MHW line (at elevation 2.1 ft-NGVD) was rather narrow, generally averaging only about 60 feet. No well-defined berm feature existed either, with the beachface generally sloping directly from the base of the dune seaward.

Over the last 25 to 30 years, material resulting from maintenance dredging of the AIWW and connecting channels has been placed on the southern reaches of the study area in the vicinity of reaches 5 and 6. This placement has occurred on an irregular basis, however, placement has generally occurred every 3 to 4 years on average, with dredging quantities varying considerably from 15,000 to 150,000 cubic yards and averaging less than 100,000 cubic yards per event. An exception to this was a one-time emergency placement of over 200,000 cubic yards of dredged material in 1997 following hurricane Fran.

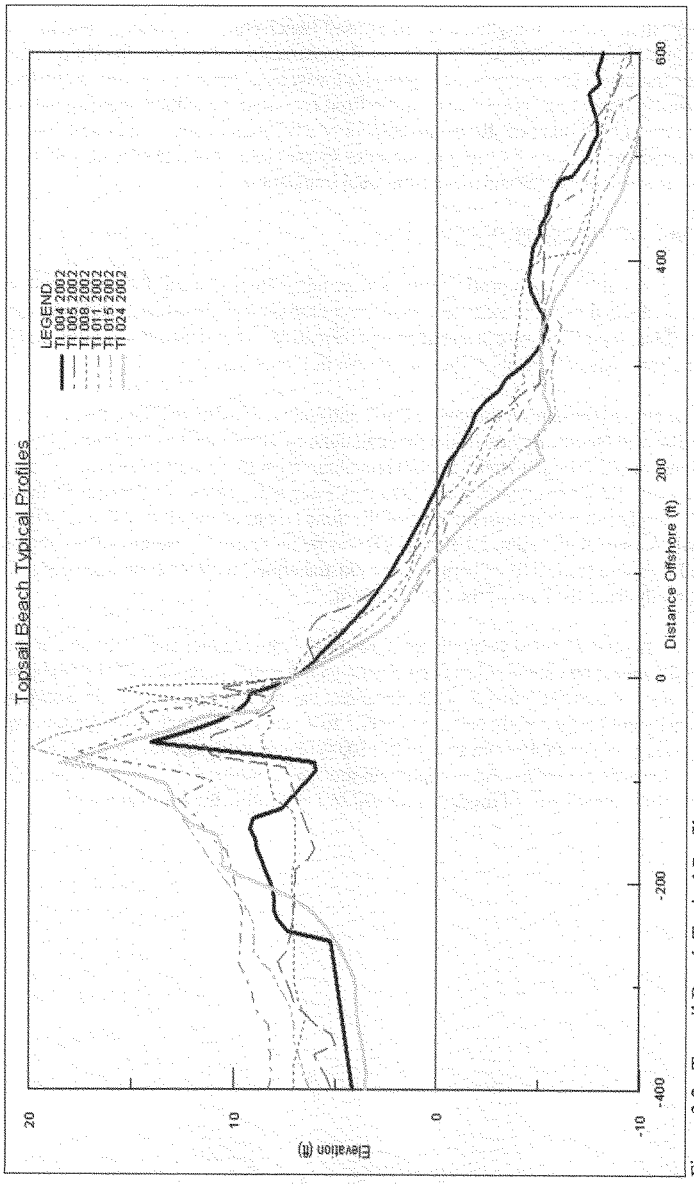

Figure 3.2. Topsail Beach Typical Profiles

3.07 Without Project Hydraulic Analysis

The without project condition was analyzed to establish the base condition for alternative evaluation. A range of storm responses (erosion distance, water level, volume lost, etc.) was determined for each of the typical existing profiles using several coastal engineering models, including SBEACH, GENESIS, and ADCIRC. The study area was subdivided into reaches of approximately 1,000 feet each. Reach 1 is located near New Topsail Inlet and reach 26 ends at the Topsail Beach – Surf City town boundary. Based on 1,000 different 50-year storm simulations, in conjunction with existing long-term erosion rates, average land losses and structure damages for each reach were computed to allow for comparative economic analysis of alternatives using the Generalized Risk AND Uncertainty - Coastal (GRANDUC) model. No allowance was made for future placement of maintenance dredging material because of the sporadic and variable nature of this work.

3.08 Without Project Economic Analysis

The study area will be fully developed and any remaining vacant lots are expected to be developed by the base year in 2011. New structures built on vacant lots or replacing existing structures will be required to meet certain building codes for reducing storm damages. There is a horizontal setback 60 feet landward from the established line of vegetation. Vertically, the first living floor will be elevated on pilings, well above the Base Flood Elevation. Additionally pilings for all first row replacement structures will be 16 feet below grade or 5 feet below mean sea level. Even with these building codes applied to new structures, the potential for hurricane-wave damage will increase without a project given the weakened natural dune system in this area. 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. Hurricane and storm damages in the Topsail Beach study area include damages to structures and contents, and to transportation infrastructure. Average annual hurricane and storm damages for the study area were computed using Wilmington District's computer models. These models integrate coastal engineering data, including storm frequency, storm surge, and long term erosion rates, with economic data, including the values of structures which could be damaged or destroyed, and the value of land which could be lost to erosion. This subject is addressed in greater detail in Appendix D, Coastal Processes.

Average annual hurricane and storm damages were estimated at $7,848,000 (see Table 3.2). This number includes damages to structures due to short-term erosion during storm events, as well as inundation damage due to storm surge. It also includes damages from long term, progressive erosion. Long-term erosion damages are discussed in Section 3.02. Without project damages will slightly increase because it will include structures expected to be built. Average annual preventable emergency costs from hurricanes and storms are estimated to be $87,000, based on records from hurricanes Bertha, Fran, Bonnie, and Floyd. All direct wind caused damages are excluded from the study.

Table 3.2 – Average annual damages, without project. October 2004 levels, 5.375% interest rate.

Reach	Storm Erosion	Flood	Wave	Land/LTE	Total Damage
3	$39,163	$9,209	$699	$71,710	$120,981
4	$136,475	$3,581	$38,714	$69,430	$248,201
5	$249,558	$5,224	$44,432	$86,664	$385,877
6	$536,534	$1,845	$30,386	$115,582	$684,348
7	$482,538	$6,179	$40,526	$109,582	$638,824
8	$437,188	$4,264	$30,803	$101,217	$573,472
9	$303,417	$4,337	$35,037	$111,059	$453,851
10	$446,482	$8,236	$55,345	$59,468	$569,531
11	$156,150	$2,898	$7,519	$26,922	$193,489
12	$123,686	$21,026	$7,557	$13,225	$165,495
13	$108,879	$5,925	$136	$5,549	$120,489
14	$123,360	$8,830	$70	$5,301	$137,561
15	$239,231	$11,318	$1,609	$5,613	$257,772
16	$303,811	$4,104	$163	$5,476	$313,554
17	$143,359	$629	$0	$5,336	$149,324
18	$158,376	$3,004	$433	$5,382	$167,195
19	$530,041	$4,726	$466	$7,448	$542,681
20	$582,645	$14	$0	$7,421	$590,080
21	$197,505	$18,257	$328	$5,411	$221,503
22	$273,698	$990	$0	$5,251	$279,939
23	$271,378	$1,726	$535	$5,450	$279,089
24	$293,849	$289	$380	$6,031	$300,548
25	$224,875	$4,972	$4,087	$5,920	$239,853
26	$200,400	$774	$3,113	$9,569	$213,855
Totals	$6,562,597	$132,360	$302,337	$850,217	$7,847,510

Included in the estimate of damages are the direct costs of rebuilding highway NC50, the only road linking Topsail Beach to Surf City and the mainland. Such costs include replacing fill, erosion protection for new fill, base course material, pavement, and associated utilities. The estimate omits the indirect costs incurred if NC50 is damaged to the point of being impassable. If NC50 should become impassable at the north end of town, then Topsail Beach loses all land access. This would create the need to use more expensive transportation alternatives to the highway, such as boats, barges, or helicopters. It also would limit the emergency response capabilities available in cases of medical emergencies or fires.

3.09 Without Project Environmental Analysis

Only those resources that have the potential to be affected by the no action alternative are included in the analysis, below.

Sea Turtles. There are no documented nesting attempts of hawksbill, leatherback, and Kemp's ridley sea turtles on Topsail Island. Topsail Island is considered to be one of the

more heavily nested areas along the North Carolina coast for loggerhead and green sea turtles, with an average of 98 nests per season. Without the proposed project, continued erosion of the beach would result in losses of sea turtle nesting habitat and possible poor nest site selection by females.

Seabeach Amaranth. Since 1992 the USACE has surveyed Topsail Beach for seabeach amaranth. From 1992 until 2004, the average number of plants found on Topsail Beach during any given year was 2687. The number of plants typically declines immediately following a hurricane, however, beach erosion is probably the primary threat to the continued presence of seabeach amaranth in the area. Failure to construct the proposed project could result in loss of seabeach amaranth habitat.

Water Resources. Continued erosion could result in the destruction of oceanfront residences, businesses and infrastructure, potentially resulting in pollution of the adjacent ocean waters.

Esthetic and Recreational Resources. Continued erosion of the beach would result in a continually narrowing beach front that is squeezed between the ocean and existing development, thus adversely affecting the recreation experience and esthetics of Topsail Beach.

Community Cohesion, public facilities and services. Ongoing erosion of the beach and degradation of the dune system by erosion and storms, could result in damage to public facilities, such as roads and utilities, and threats to human lives. All of which would adversely affect services and community cohesion.

Beach and Dune. The currently eroding beach and dune complex would continue to deteriorate, thus endangering public infrastructure, public and private property, human lives, and important habitat for a variety of plants and animals.

4. PLANNING OBJECTIVES

4.01 Goals

Identification and consideration of the problems, needs, and opportunities of the study area in the context of Federal authorities, policies, and guidelines resulted in the establishment of the following goals:

a. Reduce the adverse economic and environmental effects of hurricanes and other storms at Topsail Beach.

b. Find problem solutions that are protective of the environment through avoidance or minimization of impacts to natural resources, including beach invertebrates, shorebirds, marine fish, marine mammals, and their habitats, throughout the economic life of any proposed Federal action.

c. Protect endangered and threatened species and their habitats within the project area.

4.02 Constraints

The planning process is subject to the limitations imposed by the following constraints:

a. Geographic limits of the study authority but including the affected area of the environment.

b. Applicable Federal and State laws.

c. Current limits of knowledge, information, and predictive ability.

5. PLAN FORMULATION AND EVALUATION OF ALTERNATIVES

Following identification of existing conditions, problems, needs, opportunities, planning goals and planning constraints, this section describes the plan formulation process. A number of alternatives are usually identified early in the planning process, and their number is reduced by screening, evaluation, and comparison in an iterative sequence in increasing levels of detail to lead to identification of the selected plan.

This General Reevaluation Report (GRR) follows a previous feasibility study for Topsail Beach completed in December 1990. That feasibility study described a National Economic Development (NED) and a locally preferred plan. The locally preferred plan was the recommended plan, which was a beachfill consisting of a 25-foot top width dune at elevation 13 feet NGVD, fronted by a 35-foot wide storm berm at elevation 9 feet NGVD and a 40-foot wide beach berm at elevation 7 feet NGVD. The southern end of the main beachfill was located at the north end of reach 2 of the present GRR. The total project length was 19,200 feet, including 10,250 feet of the main fill, 7,150 feet of the northern transition fill, and 1,800 feet of the southern transition fill. The difference between the NED plan and the recommended plan involved the southern termination of the project and resulting differences in renourishment interval. The NED plan terminated with a 1,010-foot long terminal groin and had a 4-year renourishment interval. The recommended plan terminated with the transition fill and had a 2-year renourishment interval.

Several conditions have changed in the years between completion of the 1990 feasibility study and the initiation of the GRR in February 2001. The value and numbers of structures have increased significantly. Repeated storms in the 1990's eroded much of the beach and destroyed several structures. New Topsail Inlet moved southward approximately 2,000 feet as shown in Figure 5.1. Therefore in this GRR, the plan formulation process has been reinitiated rather than merely updating the costs, benefits, and impacts of the originally formulated plans. The goals and constraints of the plans remain effectively the same.

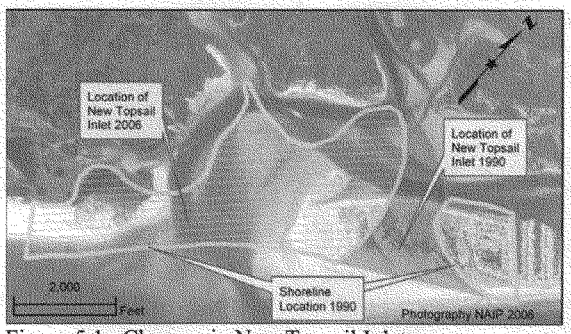

Figure 5.1 Changes in New Topsail Inlet

Plan formulation for this study consisted of the following: (1) establishment of criteria by which alternatives would be evaluated; (2) identification, analysis, and screening of measures; (3) identification of alternative plans; (4) screening of alternative plans; and (5) evaluation of alternative plans. The costs and benefits described in Section 5, Plan Formulation And Evaluation of Alternatives, and in Table 5.2 were developed during Fiscal Year 2005 and use October 2004 costs and prices and the Federal Water Resources FY 2005 interest rate of 5.375%. After comparative evaluations of the alternatives in Section 5 and identifications of the NED Plan and LPP in Section 6, detailed evaluations of the NED plan and the LPP are made in Section 7 at October 2006 costs and prices and the FY2007 interest rate of 4.875%.

5.01 Formulation and Evaluation Criteria

Alternative plans are evaluated through application of numerous, rigorous criteria. These include basic, general criteria as well as four categories of technical criteria, including (1) engineering, (2) economic, (3) environmental, and (4) institutional items. These are as follows:

General Criteria

- Plan must comply with applicable Federal laws and regulations;
- Plan must comply with applicable State and local laws and regulations, to the maximum extent practicable;
- Plan must comply with Corps of Engineers regulations.

Engineering Criteria

- Must represent sound, acceptable, and safe engineering solution;

Economic Criteria

- Plan must contribute benefits to National Economic Development;
- Tangible benefits of a plan must exceed economic costs;
- Each separable unit of improvement must provide benefits at least equal to costs;
- Recreation benefits may not be more than 50 percent of the total benefits required for economic justification;
- Plan implementation may not preclude development of more economical means of accomplishing the same purpose;

Environmental Criteria

- Plan will fully comply with all relevant environmental laws, regulations, policies, executive orders;
- Plan will represent an appropriate balance between economic benefits and environmental sustainability;

Plan will be developed in a manner that is consistent with the Corps' Environmental Operating Principles (EOP);

- Adverse impacts to the environment will be avoided. In cases where adverse impacts cannot be avoided, mitigation shall be provided to minimize impacts to at least a level of insignificance.

Institutional Criteria

- Plan must satisfactorily address the identified needs and concerns of the public;
- Plan must be implementable with respect to financial and institutional capabilities;
- Plan must be implementable with regard to public support

5.02 Identification, Examination, and Screening of Measures

There are an extremely large variety of potential measures that might be considered in the formulation of plans. The measures generally are categorized as either structural or nonstructural. Structural measures are those that directly affect conditions that cause storm damage and erosion. The nonstructural measures are those taken to reduce damages without directly affecting those conditions. Finally there is the No-Action Plan where no nonstructural or structural measure is applied.

A wide variety of structural measures are possible. They are beachfills, breakwaters, seawalls, and groins. Beachfill measures consist of berms, dunes, and terminal sections. The beachfill measures are considered some of the most appropriate, since they mimic the natural environment and can be shaped to maximize net storm damage reduction benefits. Groins can be a terminal groin near an inlet, or can be installed as a repetitive groin field throughout the project length. A terminal groin at New Topsail Inlet was identified as a measure in the NED plan in the original report. This measure was retained for consideration. Groin fields can be used to prolong the life of a beach nourishment project. However, groin fields create the risk of potential adverse affects on adjacent shorelines due to trapping or shunting sand offshore. Groin fields have high initial costs, don't provide storm protection, have the potential to negatively impact turtles seeking beach nesting sites, and would require an extensive monitoring program with triggers that would initiate remediation. There are situations that warrant the acceptance of the risk that accompanies the use of a groin field. These situations include short beach fills, hot spots, areas adjacent to sediment sinks, and offset or convex shorelines. The study area does not include any of the situations which warrant the use of a groin field. Seawalls, bulkheads, and revetments are appropriate for reducing structural damage, however they would not meet the goal of preserving recreational and environmental value of the beach profile and were rejected as measures. Breakwaters can be used in erosional hotspots where it is difficult to maintain a beachfill, however, no such condition appropriate for breakwaters was found in the project area. Moreover, while offshore breakwaters may reduce erosion in their lee, these benefits may be offset by accelerated erosion of the downdrift shoreline due to interruption of the littoral drift. Vegetation and sand fencing help retain windblown sand, but do not provide adequate storm protection for moderate to severe storms.

Nonstructural measures considered are changes in regulations and physical modifications to reduce damages. Some regulatory measures are coastal building codes, building construction setbacks, and floodplain regulations. Most regulatory measures are no longer considered for potential in the alternative plans because these measures have already been implemented, they do not affect older structures, and there are few remaining vacant lots, suitable for development, which would benefit. These measures are considered as part of the existing conditions. They have reduced damages from past events, and as older structures are replaced, will help to reduce future damages. Another category of nonstructural measures is reduction of the damage threat by removing beachfront structures from the threat. The three removal measures are retreat, relocation, and demolition. Retreat is moving an existing structure away from the shoreline a short distance within the same property parcel. Relocation is moving an existing structure away from the shoreline a longer distance to a vacant property. Acquisition of the property and demolition of the structure is a third measure where retreat or relocation is not feasible. These removal measures were retained for consideration in the nonstructural alternative. Additional non-structural measures considered for implementation include hurricane and storm education efforts, support for hurricane warning activities, updating of hurricane evacuation planning, building code upgrading, and long-term critical infrastructure and services upgrades.

The selected structural measures for detailed evaluation and consideration are beach fills and a terminal groin. The selected non-structural measures for detailed evaluation and consideration are retreat, relocation, and demolition. These measures can be applied independently and in combinations with each other to develop alternative plans.

5.03 Identification of Initial Alternative Plans

Beachfill plans were initially developed to extend the entire length of the town. The two basic types of beachfills are a berm only and a berm and dune together. For all plans the berm elevation is 7 feet-NGVD, the locally natural berm elevation for this coast. This is a reduction in berm elevation from the previously authorized plan's berm elevation of 7.6 feet-NGVD. The authorized plan's 9.6 feet-NGVD storm berm was eliminated because of concerns that the artificially high berm would result in persistent scarping along the beach face. The north end of the beachfill plans would be a tapered transition section. The two alternatives for the south end of the beachfill plans are a transition section and a terminal groin. The nonstructural plans consist of retreats, relocations, and demolitions applied to threatened structures on an individual case basis. Combinations of beachfill and nonstructural plans were also considered.

5.04 Screening of Alternative Plans

All but two of the initial alternative plans developed using the selected measures were considered to have sufficient potential for feasibility to be continued into economic evaluations of costs and benefits. One plan screened out was a combination beachfill and nonstructural plan. That combination plan would relocate any structures that were

identified as being substantially closer to the beach than nearby structures and place the overall location of the beachfill more landward, reducing the beachfill volume. After a close examination of the area no such structures were identified and the combination plan was dropped from further consideration. Another plan dropped during the screening process was the terminal groin and beachfill plan. This plan was dropped for two reasons. First, New Topsail Inlet has migrated southward far enough that a tapered beachfill transition could now be situated at the southern terminus of the project to reduce end losses, instead of a terminal groin. Second, the terminal groin had a higher initial cost, approximately $2,900,000, than the tapered beachfill transition initial cost, approximately $600,000, yet did not reduce renourishment costs nor provide any additional project benefits. Therefore, the terminal groin was dropped for both technical and economic feasibility reasons.

5.05 Evaluation of Alternative Plans

5.05.1 Beachfill Evaluations.

The remaining alternative plans would now be evaluated based on costs and benefits. Benefits of all the plans were evaluated using the GRANDUC program. The program estimates the present worth of average annual damages for the no-action plan, and the various alternative plans, including the nonstructural plan. GRANDUC estimates present worth costs for the alternative plans based on initial sand volumes and renourishment sand volumes needed to replenish sand lost due to long-term and storm erosion. GRANDUC applies unit costs for dredging these sand volumes and applies mobilization and demobilization costs for each job. Other costs included are engineering and design costs and contract supervision and administration. Other minor costs for tilling, vegetation, and walkover structures were omitted from the beachfill formulation process because the incremental differences between plans are negligible. These costs would later be included in the evaluation of the final plans.

A common assumption of all beachfill plans was regarding borrow material. While geotechnical, environmental and cultural resource surveys of the borrow sites were conducted, plans were being simultaneously evaluated. It was assumed that sufficient quantity of off-shore sand was available for the project within 5.5 miles and that a pipeline dredge would perform the initial construction with following renourishments performed by hopper dredges. Costs for all beachfill alternatives used the same mobilization costs and unit costs per cubic yard of dredging. A common loss factor between volume dredged and volume placed was used for all beachfill plans.

To evaluate alternative plan benefits, a comparison was made of without project damages with the with-project residual damages. This difference defines the damage reduction benefits. These benefits were determined for each reach and for each alternative. Recreation benefits were not included at this level of plan evaluation.

To assist in incremental analysis of the beachfill plans, costs and benefits of the beachfill plans were computed for each reach. The process of identifying potentially feasible reaches was called scoping. A mid-range dune and berm cross section was chosen as being representative for reach scoping. For this project, the cross section chosen had a dune with a 25-foot top width at elevation 13 feet NGVD fronted by a 50-foot wide berm at elevation 7 feet NGVD.

The results of the scoping showed most reaches had relatively good net benefits, some had very high net benefits, and a few had negative net benefits. Reaches 1 and 2 do not have shorefront development and were dropped from additional study. Located together at the southern endpoint of the project, reach 3 had negative net benefits and was considered not to have further potential for feasibility. These were the only reaches excluded by the scoping analysis.

5.05.2 Nonstructural Evaluation.

Costs for moving structures are very specific and vary greatly depending on site conditions, travel route, and on structure size and construction. Several broad assumptions were necessary to make a manageable evaluation of this plan. Structures were categorized as one of three general relocation types, plus large commercial structures such as hotels. Because of the rapid rate of development in Topsail Beach, only one third of the existing vacant lots were assumed available for relocation. Costs for each relocation type of structure were estimated for each of the three measures – retreat, relocation, and demolition. The costs for each structure were subtotaled by project reach and for the entire project area. More detailed discussion of the nonstructural plan is contained in Appendix P, Nonstructural Alternatives

The GRANDUC program was also used to evaluate benefits of the nonstructural plan. The structure database was modified to delete all first row structures, whether actually planned for retreat or for removal. The without project condition damages were recomputed based on this revised database to estimate residual damages for the nonstructural plan. The difference in residual damages represented the present worth of average annual storm damage reduction benefits. Because the nonstructural plan does not prevent beach erosion, no recreation benefits were assigned. The nonstructural plan does not benefit highway NC50 where it is threatened by erosion at the north end of town.

The present value economics of the nonstructural plan are displayed in Table 5.1. The overall net benefits are less than zero with a benefit to cost ratio of 0.9, and is not economically feasible. Combination plans of nonstructural measures in some reaches with beachfill in other reaches were also considered, but no applicable reach was found in this project area. Because the nonstructural plan is not economically feasible, it was not further evaluated for technical feasibility or for acceptability.

Table 5.1. Nonstructural plan economics, present worth, October 2004 levels, 5.375% interest rate.

Benefits	Costs	Net Benefits
$108,000,000	$117,300,000	-$9,300,000

5.06 Optimization and Comparison of Alternative Plans

Evaluation of plans at this point has narrowed the alternatives to beachfills in reaches 4 through 26 with tapered transition sections at each end. The end of the south transition section is limited to the middle of reach 2 by an area identified by USFWS as foraging habitat for the piping plover, an endangered species. Cost estimates were now developed using the MCACES format based on construction quantities produced from the GRANDUC evaluations. Plans were designated in the format, Plan DDBB, where DD represents the dune elevation in feet NGVD datum, and BB represent the berm width from the seaward toe of dune to the top of the foreshore slope. For example, a plan with a 12 foot elevation dune and a 25 foot wide berm is named Plan 1225.

5.06.1 Cross sections.

Higher storm dunes and wider berms result in both higher benefits and higher costs. Initially, dune elevations of 11, 13, and 15 feet were evaluated for berm widths of 25, 50, and 75 feet, and the 50-foot wide berm was found to consistently yield the greatest net benefits. Next various dune elevations were evaluated with the preferred 50-foot berm width. Dune elevations between 11 and 17 feet were all found to be economically feasible. There was little difference in net benefits for dune elevations between 13 and 16 feet with Plan 1550 having the maximum net benefits.

5.06.2 Modifications.

Before identifying Plan 1550 as the NED plan a modification to the southern transition was considered. During the prior scoping analysis reach 3 did not appear to have sufficient expected annual damages to support a project. However, the distribution of damages within that reach is unbalanced. Of the $120,981 in Total Average Annual Damages for reach 3 shown in Table 3.2, $33,014 is in the southern 600 feet and $87,967 is in the northern 400 feet. A plan to extend the 1550 dune and berm to include the more developed shoreline in the northern 400 feet of reach 3 was developed and named 1550X. The south transition of Plan 1550X was shortened to 1,000 feet to end at the piping plover foraging habitat in reach 2, the same endpoint as with Plan 1550. This modification was also applied to the other plans to create Plans 1150X, 1250X, 1350X, 1450X, and 1650X.

5.06.3 Borrow Site Comparisons.

The preliminary identification of borrow areas for the project included New Topsail Inlet, the connecting channel between the AIWW and New Topsail Inlet, Banks Channel behind Topsail Island, and ocean waters off Topsail Beach in water depths greater than 30 feet below NGVD. The results of a geophysical investigation conducted by Ocean Surveys, Inc. (OSI) were used to define the boundaries of the offshore borrow areas.

As identified in Section 2 (b) of the Coastal Barrier Resources Act CBRA, Public Law 97-348 (96 Stat. 1653; 16 U.S.C. 3501 et seq.), the purpose of CBRA is to "minimize the loss of human life, wasteful expenditure of Federal revenues, and the damage to fish, wildlife, and other natural resources associated with the coastal barriers along the Atlantic and Gulf coasts by restricting future Federal expenditures and financial assistance which have the effect of encouraging development of coastal barriers, by establishing a Coastal Barrier Resources System, and by considering the means and measures by which the long-term conservation of these fish, wildlife, and other natural resources may be achieved." The CBRA designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System (CBRS). Areas so designated were made ineligible for direct or indirect Federal financial assistance that might support development, including flood insurance, except for emergency life-saving activities. These areas included in the System are to be reviewed by the Secretary of the Interior "at least once every five years in order to make minor and technical modifications to the boundaries of system units as are necessary solely to reflect changes that have occurred in the size or location of any system units as a result of natural forces." The last such boundary modification occurred in 1990, and at the time extended the northern boundary of the Lea Island CBRS (aka Lea Island CBRA Zone L07) to the middle of New Topsail Inlet. Subsequent realignment of that inlet through natural causes now places the entire inlet, and portions of the south end of Topsail Island and Banks channel, completely within the Lea Island CBRS (Appendix A, Figure A-1). New reviews of the CBRS boundaries are currently underway, but whether or how those boundaries may be adjusted was unknown during preparation of this report.

In general, no Federal funding may be used for physical or planning activities carried out within a CBRS area. However, exceptions for certain activities identified in Section 6 of the CBRA allow Federal expenditures or financial assistance within the CBRS. Specifically, "the maintenance of existing channel improvements and related structures, such as jetties, and including the disposal of dredge materials related to such improvements...scientific research, including but not limited to aeronautical, atmospheric, space, geologic, marine, fish and wildlife and other research, development, and applications...[and] nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore natural stabilization systems" are exempt from CBRA restrictions. As such, Corps geological studies of the area are authorized, as is maintenance dredging of the existing navigational channel within New Topsail Inlet. The Department of the Interior, however, reads CBRA to prohibit the transfer of sand from within a CBRS to a location outside the CBRS. While Wilmington District does not necessarily agree with this interpretation, it does acknowledge that in combination with other environmental factors, which include the constituent elements of piping plover habitat and other estuarine resources, the CBRA issue makes it impractical to pursue borrow sites within CRBA zones as viable alternatives at this time.

A sediment compatibility analysis was performed for all potential borrow areas for this project. The analysis compared the grain size of the "native beach" or the "reference beach" with the material in the potential borrow area. The overfill ratio is the primary indicator of the compatibility of the borrow material to the beach material, with a value of 1.00 indicating that one cubic yard of borrow material is needed to match one cubic yard of beach material. The procedure for calculating the overfill ratio for borrow areas in relation to the reference beach was performed in accordance with the U.S. Army Corps of Engineers Coastal and Hydraulics Laboratory Automated Coastal Engineering System (ACES) software version 4.01. This procedure is discussed in section V-4-1.e.(2)i. of the U.S. Army Corps of Engineers Engineer Manual (EM) 1110-2-1100, part V, titled Coastal Engineering Manual. As stated in this manual, an overfill ratio of 1.00 to 1.05 is considered optimum for sediment compatibility. However, obtaining this level of compatibility is not always possible due to limitations in available borrow sites. A compatibility analysis was conducted for the New Topsail Inlet and the connecting channel between the AIWW and New Topsail Inlet. The analysis indicated New Topsail Inlet material was compatible with native material at Topsail Beach with an overfill ratio of 1.02. The overfill ratio for the connecting channel material was 4.55 indicating the material would not be compatible with native material due to presence of finer material in the channel which would produce losses at a high rate. Regardless, the New Topsail Inlet and the connecting channel between the AIWW and New Topsail Inlet were eliminated as borrow areas because they are currently located within the Lea Island complex (L07) of the CBRS, and contain constituent elements of piping plover habitat and other estuarine resources to the extent that other alternatives are environmentally preferable.

As discussed in section 1.01, a Federal shore protection project was authorized for Topsail Beach in 1992. The proposed borrow area for this 1992 project is shown in

Appendix A, Figure A-6 and included a portion of Banks Channel. Banks Channel was also considered as a potential borrow area for this current Federal project. Banks Channel is a Federal authorized connecting channel of 7 feet deep (+2 feet) and 80 feet wide extending from the CBRA zone at the New Topsail Inlet to the AIWW for an approximate length of 6.27 miles. The USACE, Wilmington District, collected 32 vibracore borings in Banks Channel from June to August 2003. A total of 82 samples were tested for grain size analysis and a compatibility analysis was conducted to compare the grain size of the native Topsail Beach to the material in Banks Channel. The analysis determined an overfill ratio of 1.08 which indicates the material in Banks Channel is compatible with the native material at Topsail Beach. Hydrographic surveys of Banks Channel were conducted by USACE, Wilmington District from July 2001 to February 2003. A conservative estimate of the volume of sediment available in the Federally authorized navigation boundaries of Banks Channel is approximately 94,000 cubic yards.

The use of Banks Channel to supplement a renourishment cycle would require the mobilization of a second dredge for a negligible amount of material. In addition, expansion of the borrow area in Banks Channel beyond the authorized navigation channel boundaries to the 1992 borrow area boundaries, would require extensive coordination with the environmental agencies. Also, this would potentially increase mitigation requirements, due to the fact that this area contains the constituent elements of piping plover habitat as well as other estuarine resources. Therefore, Banks Channel is eliminated as a borrow area for this project.

Six offshore borrow areas were identified for the further evaluation as potential borrow sources for Topsail Beach. These borrow areas are discussed in more detail in section 7.04.

5.06.4 Economic Comparisons.

Table 5.2 presents the economic comparisons of the plans as described in section 5.06. All values are shown as average annual equivalent value discounted at the FY2005 federal water resources interest rate of 5 3/8 % over a 50-year project life. The GRANDUC model estimates damages in three categories and selects the greatest of the three for both the with and without project conditions, preventing the double counting of benefits in the analysis. Regarding the increase in flood damages indicated in Table 5.2, as storm erosion and long-term land losses are reduced, flood damages begin to dominate. Also, structures that might have otherwise been taken out by storm and wave damage without a project are now subject to additional flood damages. Recreation benefits will be included as incidental benefits in the total benefit accounting, but they are not included in Table 5.2 in the formulation of the project with respect to size and scope.

Table 5.2 Economic Comparisons, Average Annual Values in Thousands. October 2004 levels. 5.375% interest rate.

Plan	Benefits						Costs	Net Benefits
	Storm Erosion	Flood	Wave	Land & Long Term Erosion	Reduced Emergency Costs	Total		
1150	$5,432	$(53)	$68	$850	$87	$6,383	$2,927	$3,456
1150X	$5,437	$(54)	$68	$850	$87	$6,387	$2,943	$3,444
1250	$5,633	$(55)	$69	$850	$87	$6,584	$3,013	$3,571
1250X	$5,638	$(55)	$69	$850	$87	$6,588	$3,027	$3,561
1350	$5,772	$(62)	$128	$850	$87	$6,775	$3,185	$3,590
1350X	$5,781	$(63)	$128	$850	$87	$6,783	$3,204	$3,579
1450	$5,984	$(69)	$150	$850	$87	$7,002	$3,321	$3,681
1450X	$5,995	$(70)	$150	$850	$87	$7,012	$3,337	$3,675
1550	$6,136	$(74)	$168	$850	$87	$7,168	$3,440	$3,728
1550X	$6,149	$(76)	$168	$850	$87	$7,179	$3,463	$3,716
1650	$6,250	$(75)	$189	$850	$87	$7,301	$3,574	$3,727
1650X	$6,263	$(77)	$189	$850	$87	$7,312	$3,596	$3,716
1750	$6,322	$(77)	$204	$849	$87	$7,385	$3,705	$3,680

5.06.5 Environmental Comparisons of Plans.

In addition to the economic comparison, the impacts of the major categories of plans on the resources described in Section 2.00, Affected Environment, are considered. Table 5.3 presents the comparative impacts on these resources. The "No Action" alternative is defined as no action by the Federal government on this particular proposed shore protection project.

Table 5.3 Comparative Impacts of the Proposed Plan to the Nonstructural and No Action Alternative

Resource	Beachfill Alternatives	Nonstructural Alternative	No Action
Socioeconomic Resources	1. Improved recreational quality on expanded beach 2. Greater protection of oceanfront land, roads/utilities, structures, and personal property 3. Economically Justified	1. More remote undisturbed beach 2. Eliminates need for future protection of structures, land loss continues 3. Displaces beachfront homeowners and businesses. Reduced tax base. Expected cost exceeds benefits.	1. Continued deterioration of the existing beach 2. Continued threat to oceanfront land, roads/utilities, structures, and personal property 3. NED benefits foregone
Recreational and Aesthetic Resources	1. Improved appearance of beach will enhance recreational experience. Wider berm would increase recreation area. 2. Temporary inconvenience to beach users during initial construction and future maintenance.	1. More natural appearance along the beach. Recreation capacity would decrease as the beach erodes. 2. Temporary inconvenience to beach users during demolition or removal of structures.	1. Continued deterioration of beach appearance and berm width 2. Status quo maintained

Table 5.3 (continued) Comparative Impacts of the Proposed Plan to the Nonstructural and No Action Alternative

Resource	Beachfill Alternatives	Nonstructural Alternative	No Action
Marine Resources	1. Benthic organisms in borrow areas will be removed, but will be recolonized by opportunistic species 2. Temporary impacts on intertidal microfauna in the immediate vicinity of the beach nourishment 3. Reduces needs for bulldozing, beach scraping, and sand bags 4. Short term, recurring impacts to fishing areas 5. Temporary impacts to adult, larval, and juvenile fish due to turbidity and reduced benthic food in dredging and disposal areas.	1. Status quo maintained 2. Status quo maintained 3. Eliminates needs for bulldozing, beach scraping, and sand bags. Eliminates re-occurring loss of invertebrates along beach. 4. Temporary inconvenience to beach fishermen during demolition or removal of structures. Status quo maintained in near shore waters. 5. Status quo maintained.	1. Status quo maintained 2. Status quo maintained 3. Status quo maintained. 4. Status quo maintained. 5. Status quo maintained
Natural Communities	1. The dune and berm would be re-established and the dune vegetated, resulting in an extended shoreline 2. Bottom substrate and bathymetry within 4,210 acres of nearshore ocean would be modified.	1. The beach would continue to erode, existing overwash areas would expand and new overwash areas would form. 2. Status quo maintained	1. The beach would continue to erode, existing overwash areas would expand and new overwash areas would form. 2. Status quo maintained

Table 5.3 (continued) Comparative Impacts of the Proposed Plan to the Nonstructural and No Action Alternative

Resource	Beachfill Alternatives	Nonstructural Alternative	No Action
Threatened and Endangered Species	1. Placement of fill will increase nesting habitat for sea turtles. 2. Placement of fill may increase beach hardness and alter other physical characteristics of the beach that may affect the nesting environment of sea turtles. 3. May affect piping plover foraging, sheltering, and roosting areas. 4. Placement of fill would increase seabeach amaranth habitat. 5. Minimal threat of collision with whales during dredging operations.	1. Conditions for loggerhead and green sea turtle nesting would be improved by reduced disturbance and artificial lighting 2. Status quo maintained 3. Conditions for piping plover may be improved by reduced disturbance and new overwash areas. 4. Conditions for seabeach amaranth may be improved by reduced disturbance 5. Status quo maintained	1. Continued erosion of the beach would result in losses of sea turtle nesting habitat and possible poor site selection by females. 2. Status quo maintained 3. Status quo maintained 4. Continued erosion of beaches would result in loss of seabeach amaranth habitat 5. Status quo maintained
Water Quality	1. Temporary elevated turbidities over existing conditions during initial construction and nourishment in nearshore areas and offshore borrow areas.	Status quo maintained	1. Status quo maintained

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Table 5.3 (continued) Comparative Impacts of the Proposed Plan to the Nonstructural and No Action Alternative

Resource	Beachfill Alternatives	Nonstructural Alternative	No Action
Cultural Resources	1. No effects	1. Potential resource impacted by natural processes or storms. Relocation could affect any historic structures.	1. Potential resource impacted by natural processes or storms.
Contaminated Sediments	1. Remote possibility exists that OEW (anti-aircraft ammunition) could be present in the material to be dredged from offshore borrow areas and placed on the beach. The only ordnance that would be expected to be encountered would be spent shells from anti-aircraft target practice. In 1994, inspectors surveyed the beach area to the water's edge and did not find evidence of ordnance. Offshore areas were not surveyed . 2. Remote possibility that dredging in offshore borrow areas could encounter a missile (no OEW) and place it on beach. The missiles that were tested during Operation Bumblebee contained no OEW and were fired approximately 40 miles offshore, well beyond the project area, so the likelihood of encountering them in an offshore borrow area is remote.	1. Status quo maintained 2. Status quo maintained	1. Status quo maintained 2. Status quo maintained

Resource	Beachfill Alternatives	Nonstructural Alternative	No Action
Other significant resources	1. Temporary noise increases during construction and maintenance events 2. Minor, short-term increases in boat/floating plant traffic 3. Beneficial effects of the storm protection project on community cohesion, public facilities (including roads and utilities) and services.	1. Temporary noise increases during demolition or removal of structures 2. Status quo maintained 3. Initially detrimental to community cohesion, public facilities (near beach) and some services.	1. Status quo maintained 2. Status quo maintained 3. Continued erosion of beaches would be detrimental to community cohesion and public facilities.

6. PLAN SELECTION

6.01 National Economic Development Plan

The National Economic Development (NED) Plan is the alternative among plans with the greatest net economic benefits. The dune and berm plan, named 1550, having the greatest net economic benefits, is the NED plan. Plan 1550 consists of a 26,200-foot long dune and berm system to be constructed to an elevation of 15 feet NGVD fronted by a 7-foot NGVD (50-foot wide) beach berm with a main fill length of 22,800 feet, from Godwin Avenue to the Topsail Beach town limit, and having 2,000-foot transition length on the north end and a 1,400-foot transition on the south end.

6.02 Locally Preferred Plan (LPP)

The Town of Topsail Beach has selected Plan 1250X as the Locally Preferred Plan. Plan 1250X consists of a 26,200-foot long dune and berm system to be constructed to an elevation of 12 feet NGVD fronted by a 7-foot NGVD (50-foot wide) beach berm with a main fill length of 23,200 feet, from a point 400 feet southwest of Godwin Avenue to the Topsail Beach town limit, and having 2,000-foot transition length on the north end and a 1,000-foot transition on the south end.

6.03 Other Plans

No other plan has been proposed as being the selected plan.

6.04 Selected Plan

In some instances there are reasons for selection of a plan other than the NED plan. Plans which are smaller than the NED plan will normally be considered favorable for an exception to the NED requirements. Affordability is a valid reason for selecting a plan smaller and less costly than the NED plan.

The Locally Preferred Plan, Plan 1250X, is the selected plan to be recommended for Federal action. The LPP has a dune 3 feet lower and 400 feet longer than the NED Plan. The initial construction cost of the LPP is lower than the NED plan, and the renourishment costs are about the same.

The lower elevation dune of the LPP does not provide as much storm damage reduction as the NED plan. Average annual storm damage reduction benefits as shown in Table 5.2 are $7,168,000 for the NED plan and for the LPP are $6,588,000, a reduction of $580,000, or 8% from the NED plan. Recreation benefits are the same for both plans.

Average annual costs of shown in Table 5.2 are $3,440,000 for the NED plan and for the LPP are $3,027,000. The renourishment volumes and cost for both plans are the same, with the cost differences originating from initial construction of the project.

The comparative costs and benefits described in this section and in Table 5.2 were developed during Fiscal Year 2005 and use October 2004 costs and prices and the Federal Water Resources FY 2005 interest rate of 5.375%. This concludes comparative evaluations of the alternatives. Detailed evaluations of costs and benefits in Section 7 of the Final GRR of the NED plan and the Locally Preferred Plan are conducted at October 2006 costs and prices and the FY2007 interest rate of 4.875%. Total costs and benefits are updated to October 2007 costs and benefits.

7. THE SELECTED PLAN

The purpose of this report section is to centralize information concerning the Selected Plan. The Selected Plan is discussed in terms of features, construction, maintenance, real estate requirements, accomplishments, and economic feasibility.

7.01 Plan Description and Components

The Selected Plan is Plan 1250X, which is the Locally Preferred Plan. Plan 1250X consists of a 26,200-foot long dune and berm system. Sand for the beachfill would be delivered from offshore borrow areas by dredge. A cross section is shown in Figure 7.1. A plan view is shown in Figure 7.2, and in more detail in Appendix A, Project Maps.

7.01.1 Main fill

The plan has a main fill length of 23,200 feet, from approximately 400 feet southwest of Godwin Avenue, in reach 3, to the Topsail Beach town limit in reach 26. The two essential features of the selected plan are the dune and the berm.

The plan has a dune at an elevation of 12 feet NGVD and with a crest width of 25 feet. The side slopes of the dune are 5H:1V on the landward side and 10H:1V on the seaward side to the berm.

The plan includes a berm seaward of the dune. The berm has a flat, level section with an elevation of 7-feet NGVD and an optimum width of 50 feet. The seaward slope of the berm extends the beach fill approximately another 100 feet at a slope of approximately 15H:1V down to Mean Low Water (MLW) elevation (-1.9 feet-NGVD), below which the with-project profile parallels the existing profile out to a closure depth of 23 feet.

The landward construction line for the project is placed to minimize impacts on existing structures, to parallel the existing shoreline, to allow the Perpetual Beach Storm Damage Reduction Easement to extend about 20 feet landward of the dune toe, and to tie the fill into a minimum elevation of 7 feet NGVD.

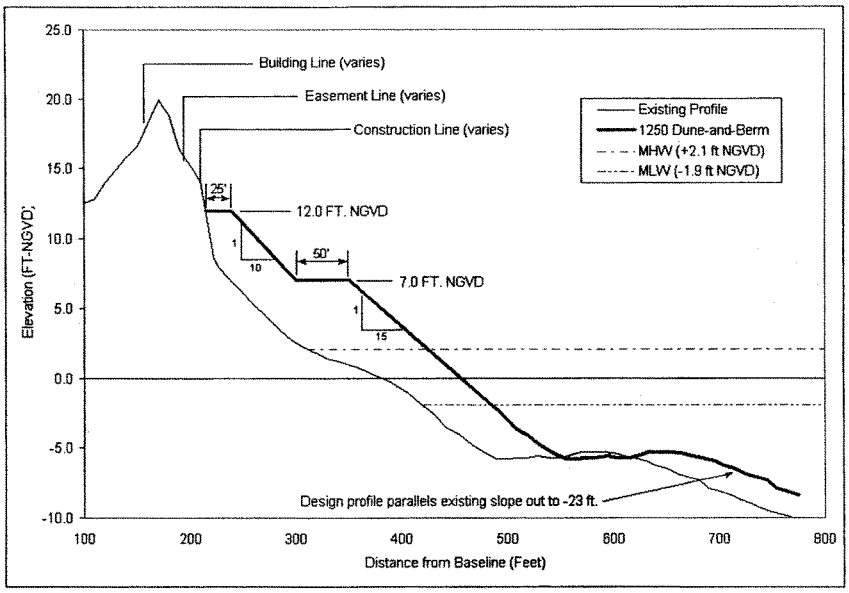

Figure 7.1 Plan 1250X, Locally Preferred Plan, Cross Section

7.01.2 Transition Sections

The transition sections at both ends of the main fill are necessary to improve project stability and reduce end losses. The 2,000-foot northern transition consists of a tapered berm only, with the dune not extending beyond the limits of the main fill section, resulting in a starting transition berm width of 155 feet that uniformly tapers to zero. The southern transition section is similar to the northern transition, except for the length of 1,000 feet.

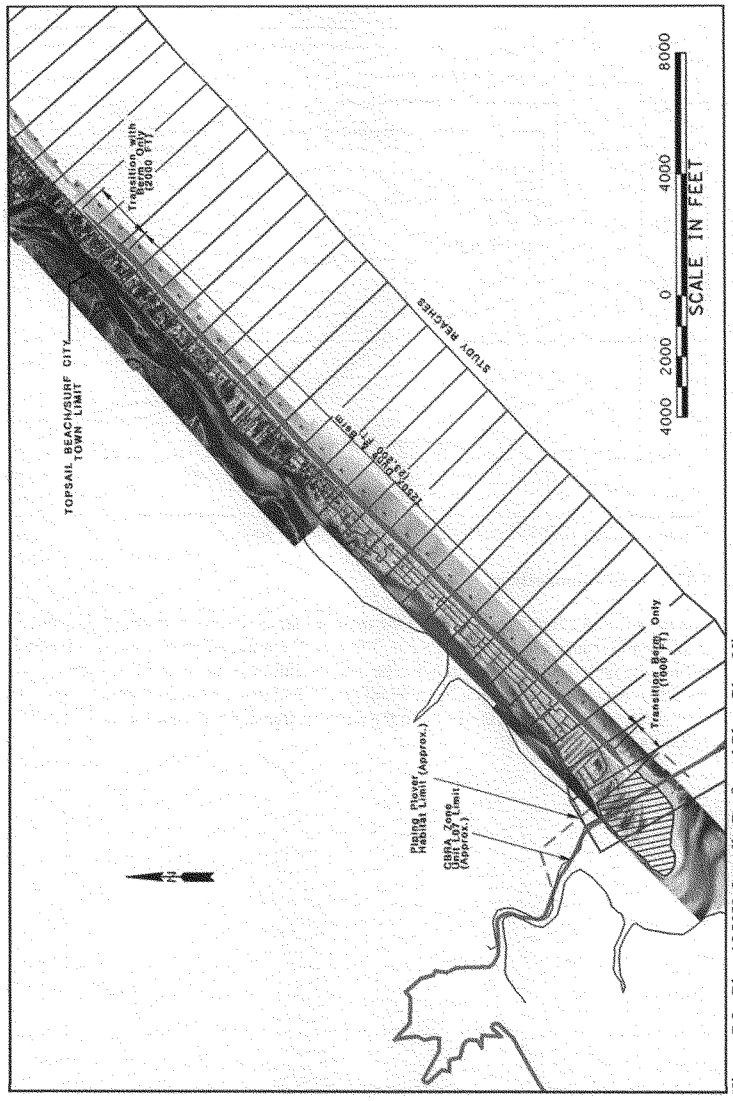

Figure 7.2 Plan 1250X, Locally Preferred Plan, Plan View

7.02 Rationale for Support of the Locally Preferred Plan

The Town of Topsail Beach notified Wilmington District of the town's support for Plan 1250X as the Locally Preferred Plan. The letter from Topsail Beach, dated January 13, 2006, is contained in Appendix H. The Town's letter indicated that some of the reasons for preferring Plan 1250X over NED Plan 1550 are;

1. both plans move the shoreline significantly seaward,
2. Plan 1250X costs 24% less, but reduces net benefits 2%,
3. Plan 1250X has the greatest HSDR benefit to cost ratio, and the second highest total benefit to cost ratio,
4. Plan 1250X has a lower cost to the Town,
5. Plan 1250X will have lower Congressional appropriation requirements, and
6. Plan 1250X provides better protection to the Godwin Avenue area.

7.03 Design and Construction Considerations

7.03.1 Initial Construction and Renourishment

Initial construction will require approximately 3,223,000 cubic yards (CY) of sand from the borrow area with an overfill ratio of 1.35. The material will be pumped to the beach by pipeline dredge and shaped on the beach by earth moving equipment. The initial construction profile will extend seaward of the final design berm profile a variable distance to cover anticipated sand movement during and immediately following construction. This variable distance will generally range from 100 to 200 feet along the project depending upon foreshore slopes established by the fill material. Once sand redistribution along the foreshore occurs, the adjusted profile should resemble the design berm profile. Initial beachfill construction will take 5 months to complete. The project will be constructed in FY2012 (November 2011 – April 2012), subject to availability of funds. Periodic renourishment will require approximately 866,000 CY of sand from the borrow areas with an overfill ratio of 1.25 at intervals of 4 years. The renourishment material will be removed from the borrow areas by hopper dredge. Delivery of sand could occur by hauling filled scows to a pumping station buoy or by hopper dredge hauling sand to the pipeline buoy. In both initial construction and during renourishment the delivery pipeline will be placed to avoid the piping plover habitat areas along the south end of the beach and material between the toe of dune and mean high water line would be tilled to prevent compaction. Over the 50 year life of the project 13,615,000 CY of sand will be placed on Topsail Beach. The volumes required are reported as borrow volumes including overfill ratios, not actual volume in place, which is less.

7.03.2 Dune vegetation

The dune portion of the project will be stabilized against wind losses by planting appropriate native beach grasses. Dune stabilization would be accomplished by the vegetative planting of the dune during the optimum planting seasons and following the berm and dune construction. Planting stocks will consist of a variety of native dune

plants including sea oats (*Uniola paniculata*), American beachgrass (*Ammophila breviligulata*), panic grass (*Panicum amarum*), and seaside little bluestem (*Littoralis variety*). The vegetative cover shall extend from the landward toe of the dune to the seaward intersection with the storm berm for the length of the dune. Plant spacing guidelines will follow the recommendations provided by the North Carolina Sea Grant publication, "The Dune Book." Sea oats will be the predominant plant with American beach grass and panic grass as a supplemental plant. Seaside little bluestem will be planted on the backside of the dune away from the most extreme environment. The total area for dune plantings is estimated to be 48 acres.

7.03.3 Access

The Town now has 22 public access sites, most with wooden dune walkovers. Two of theses access sites are designated as a drive-over for vehicles. The drive-over sites will provide access during construction of the beachfill for delivery and removal of the dredge pipeline and for other construction equipment. The widest, most suitable site for access is at Drum Avenue. Most of the existing dune walkovers will be totally or partially removed prior to beachfill construction. After the beachfill is completed, new walkovers will be built and remaining walkovers will be extended over the dune. Including 3 proposed public access sites, the total number of walkovers required is estimated to be 23. Of these, approximately 5 will be constructed to allow wheelchairs to cross the dune. The walkovers are to be constructed as a shared project construction cost. The cost of providing the access locations is not part of the project cost and is not creditable.

7.03.4 Renourishment Interval

An analysis of various renourishment intervals from 2 to 8 years determined that a 7-year periodic nourishment interval results in slightly higher net benefits. Net benefits increase as a function of renourishment interval from 2 to 4 years, beyond which net benefits change about 1 percent as the interval increases. Longer renourishment intervals increase the risks between renourishment events of allowing accumulated erosion to create escarpments, narrow the non-dune portion of the beachfill, erode the toe of the dune, and damage dune vegetation. The potential reduction in the project's ability to sustain recreational uses and to provide a suitable habitat for sea turtles and other species on the beach outweigh the slight gain in net storm damage reduction benefits. Therefore the recommended renourishment interval is 4 years which captures over 97% of the maximum economic benefits and better sustains other benefits.

7.03.5 Beachfill Monitoring

A comprehensive monitoring program in accordance with USACE guidance (Coastal Engineering Manual, Part V, Chapter 4 and Coastal and Hydraulics Engineering Technical Note II-35) is planned for the Topsail Beach shore protection project to assess and ensure project functionality throughout its design lifetime. Estimated annual costs for beachfill monitoring are $240,000. The annual monitoring plan will consist of (1)

semi-annual beach profile surveys, $130,800, (2) annual hydrographic survey of New Topsail Inlet, $5,800, (3) annual aerial photography of the inlet and beach (cost included in inlet hydrographic survey), (4) an annual monitoring report, $89,000, and (5) monitoring program coordination, $14,400. Beach profile surveys will allow assessment of anticipated beachfill performance and determination of renourishment volume requirements. In addition, whenever sporadic maintenance dredging of navigation channels results in dredged material being placed in the southern project area, surveys can account for this additional material and determine if upcoming renourishment quantities can possibly be reduced accordingly. Hydrographic surveys of New Topsail Inlet will be useful for identifying any unanticipated project impacts on the adjacent inlet and evaluating sediment transport in the project area vicinity. An aerial photographic record of the inlet and beach will further facilitate assessment of the beachfill performance and inlet response. An annual monitoring report will be prepared that presents the data collected and the corresponding analysis of project performance, including recommendations on renourishment requirements.

7.03.6 Environmental Monitoring and Commitments.

The environmental goal of this project is to avoid and minimize adverse impacts to the maximum extent practicable. The following list is a summary of environmental commitments to protect species and habitat types related to the construction and maintenance of the proposed project. This summary includes commitments to federally listed threatened and endangered species as identified in Appendix I.

Species / Habitat	Commitments to Reduce Environmental Impacts
Sediment Compatibility	(1) Total project volume results in a 70% utilization of available material from the borrow areas allowing for contingency due to unforeseen pockets of incompatible sediment. (2) During the P&S phase of this project additional borings and/or geophysical surveys will be performed to better delineate the borrow area boundaries and material types. (3) If necessary, the Wilmington District will make the decision on a suitable contingency measure which may include moving the dredge to another site within the borrow area or to another borrow area and will notify the agencies of this contingency measure.
Piping Plover & Other Shorebirds	(4) The Corps will adhere to appropriate windows to the maximum extent practicable.

(5) During initial nourishment, when project construction will extend into the nesting timeframe (1-30 April), the Corps will coordinate with the NCWRC to plan construction activities around potential nesting areas as well as monitor the pipeline route for any potential nests prior to de-mobilization. If a nest is encountered, pipe segments within the vicinity of the nest will be left in place until approval has been obtained from NCWRC for their removal.

(6) During initial construction, as well as each re-nourishment event, the order of work for beach template construction will be from south to north so that construction activities will be north of the breeding and nesting habitat, located at the inlet spit, during the March and April time-frame; thus, further minimizing project impacts. Furthermore, all pipeline and associated construction activities will avoid the piping plover critical habitat.

Manatee

(7) The Corps will implement precautionary measures for avoiding impacts to manatees during construction activities as detailed in the "Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters" established by the USFWS.

Sea turtles

(8) The National Marine Fisheries Service Regional Biological Opinion for the continued hopper dredging of channels and borrow areas in the southeastern United States dated 25 September, 1997 will be strictly adhered to. Furthermore, Hopper dredging activities will comply with the South Atlantic Division Corps of Engineers hopper dredging protocol which requires a hopper dredging window of 1 December to 31 March, the use of turtle deflecting dragheads, inflow and/or overflow screening, and NMFS certified turtle and whale observers.

(9) In order to determine the potential taking of whales, turtles and other species by hopper dredges, NMFS certified observers will be on board the hopper dredges during construction. To the maximum extent feasible, the observers will record all species taken along with length and weight and any unusual circumstances that might have led to the species capture. Observers will also record all

whale observations within the project vicinity

(10) The Corps will avoid the sea turtle nesting season to the maximum extent practicable during initial construction.

(11) If the nesting window cannot be adhered to, the Corps will implement a sea turtle nest monitoring and relocation plan through coordination with USFWS and NCWRC.

(12) The beach will be monitored for escarpment formation prior to each nesting season. Escarpments that are identified prior to and/or during the nesting season that interfere with sea turtle nesting (exceed 18 inches in height for a distance of 100 ft.) will be leveled. If it is determined that escarpment leveling is required during the nesting or hatching season, leveling actions should be directed by the USFWS

(13) USFWS compaction assessment guidelines will be followed and tilling will be performed as deemed necessary by the USFWS and NCWRC.

(14) Throughout the duration of each nourishment contract, during initial construction and each periodic nourishment event, the Contractor will be required to monitor for the presence of stranded sea turtles, live or dead. If a stranded sea turtle is identified, the Contractor will immediately notify the NCWRC of the stranding and implement the appropriate measures, as directed by the NCWRC. Construction activities will be modified appropriately as not to interfere with stranded animals.

(15) The Corps is interested in understanding the threshold of sediment color change and resultant heat conduction on impacting temperature dependent sex determination of sea turtles. The Corps will contribute funds for the NCWRC to continue its temperature studies in order to gather nest temperatures on nourished beaches throughout the state, including Topsail Beach, in comparison to non-nourished native sediment temperatures. This data could be used to help develop management criteria for sediment color guidelines

Seabeach amaranth

(16) Monitoring for seabeach amaranth on Topsail Beach will be performed by the Corps to assess the pre- and post-

	nourishment presence of plants.
Benthic Invertebrates	(17) The anticipated construction timeframe for initial and periodic nourishment events (November 16-April 30), will avoid peak recruitment and abundance time period for surf zone fishes and benthic invertebrates.
	(18) The Corps will convene a work group to identify study objectives that answer questions regarding critical life cycle requirements of benthic invertebrates and will contribute funds to carry out subsequent scientific investigations.
Shellfishing	*(19)* The Corps will contact the North Carolina Shellfish Sanitation and Recreational Water Quality Section prior to start of work, so the project area may be posted as required.
Erosion/Sediment Control	(20) If required, an erosion and sediment control plan will be developed and approved.
Water Quality	(21) Prior to construction, the Corps will obtain Section 401 Water Quality Certification from the North Carolina Division of Water Quality.
Terrestrial Impacts	(22) Land-based equipment necessary, for beach nourishment work shall be brought to the site through existing accesses. Should the work result in any damage to existing accesses, the accesses will be restored to pre-project conditions immediately upon project completion.
Other Commitments	(23) Prior to construction the existing Mean High Water (MHW) line will be surveyed, and a copy provided to the NC Division of Coastal Management. If construction is not initiated within sixty days (60) and/or there is a major shoreline change prior to the commencement of beach nourishment, a new survey will be conducted.
	(24) Prior to construction the first line of stable natural vegetation will be surveyed. This survey must be conducted no more than 60 days prior to project initiation and be coordinated with the NC Division of Coastal Management.

7.04 Borrow Area

Six borrow areas are located in the ocean between 1 mile and 5.5 miles from the shoreline, as shown in Appendix A, Figure A-6. These areas are between the 30-foot and 60-foot NGVD depth contour. The largest and closest site, borrow area A, has a sufficient sand layer thickness and volume to be designated as the borrow source for initial construction. The total volume of suitable material available from all six sites is approximately 21,100,000 CY. This volume is sufficient to meet the project requirements. Detailed information on borrow areas is contained in Appendix C.

7.04.1 Borrow Area Use Plan

There are many possible sequences and methods for placing available material on the beach for the project. The purpose of this plan is to discuss the following subjects: borrow area characteristics; dredging specifics; project construction plan; project sand requirements, and borrow area utilization. The economic optimization of the use of the borrow areas for the life of the project will be further evaluated when the final borrow area data has been collected and fully analyzed during the Plans and Specifications (P&S) phase. Additional vibracore boring data will be collected and made a part of the final borrow area use plan, but for now, the currently defined borrow areas will be utilized. In addition to borrow area parameters (material quantities and location), the dredging production rates and dredging window are critical to selection of the optimum borrow use plan.

7.04.1.1 Borrow Area Parameters

The offshore borrow areas as shown in Figure A-6, Appendix A are located beyond the 30-foot NGVD depth contour to approximately 5.5 miles offshore. The offshore borrow areas beyond 3 nautical miles offshore will be subject to federal mining requirements of the Minerals Management Service (MMS). The borrow areas have been configured based on a geotechnical evaluation (Appendix C, Geotechnical Analysis) and results of the compatibility analysis (Appendix E, Sand Compatibility Analysis).

Of the six (6) identified offshore borrow areas (A, B, C, D, E, and F), approximately 62% of the sand is located in borrow area A. The characteristics of each borrow area is shown in Table 7.1. Borrow area A is located approximately 1.5 miles south of New Topsail Inlet and will be the sole source of sand for initial construction of the proposed project and the major source of sand for the project. Pipeline/hopper dredging distances from area A are approximately 3.5 miles to the project area. The material in borrow areas B, D, E, and F is limited and will only be used for periodic nourishment cycles. Borrow area C will only be used for contingency purposes, due to the relative long distance to the project area (over 5 miles). Based on preliminary evaluations, borrow area F may be incompatible with native material at Topsail Beach. However, additional characterization of the borrow areas will be conducted prior to use to confirm compatibility.

Table 7.1 Topsail Beach Project Borrow Area Characteristics

Borrow Area	Composite Grain Size	Material Passing #200 Sieve	Final Overfill Ratio	Estimated Volume (CY) and size (AC)	Distance Offshore (miles)	Surface Elevation (FT. MLLW)
A	2.35 phi (0.20 mm)	7.6%	1.35	13,200,000 2,297	1 to 3	-38.5 to -48.2
B	2.17 phi (0.22 mm)	5.0%	1.23	820,000 158	1.5 to 2.5	-42.2 to -43.2
C	2.32 phi (0.20 mm)	4.4%	1.45	2,570,000 600	4 to 5.5	-45.5 to -47.7
D	2.13 phi (0.23 mm)	6.0%	1.22	1,860,000 467	3.5 to 4.5	-43.5 to -46.9
E	2.15 phi (0.23 mm)	3.4%	1.04	1,390,000 406	4.5 to 5.5	-49 to -50
F	0.80 phi (0.57 mm)	4.9%	1.20	1,290,000 282	4.5 to 5.5	-47 to -48
Total	-	-	-	21,200,000 3,870	-	-

7.04.1.2 Dredging Production

Dredging production refers to the average volume transported per day and relates to factors such as plant, material, distance, and weather. This information is used to estimate project cost and construction time. Production rates are estimated to average 31,000 CY/day for a 30-inch pipeline dredge for the initial construction and 14,000 CY/day for hopper dredges for periodic nourishment.

7.04.1.3 Dredging Window

In determining the optimum borrow use plan, pipeline dredging window restrictions for initial construction were evaluated, with respect to nesting sea turtles, using a November 16 to April 30 dredging window. This plan considers that the initial construction will be performed in one season for the project. In order to complete initial construction in one season, the project will extend into the first 30 days of the bird nesting window of 1 April - 31 August.

A 4-year periodic nourishment cycle using hopper dredges is considered for the 50-year life of the project. Hopper dredging operations for this project will work in accordance with the "1997 National Marine Fisheries Service (NMFS) South Atlantic Regional Biological Opinion (SARBO) for the continued hopper dredging of channels and borrow areas in the Southeastern United States". Though the NMFS SARBO does not window hopper dredging operations from Pawley's Island, SC through North Carolina, both the USACE South Atlantic Division (SAD) office and South Atlantic Wilmington (SAW) District office recommend implementation of a December 1 to March 31 dredging

window, to the extent practicable, in order to minimize impacts to sea turtles in the offshore environment. A summary for the recommended construction plan follows with a brief discussion of start-stop times, number of contracts required, type and number of dredges required, and dredging presence in the project area during the life of the project.

7.04.1.4 Recommended Construction Plan

Initial construction would begin November 16 of year 0 for the project. The initial construction would consist of pipeline dredging from Borrow Area A and proceed until completion before April 30 of the following year. Periodic nourishment would begin in year 4 and consist of hopper dredging due to limited thickness of available material in the borrow areas and long haul distances. Periodic nourishment for the project would use a combination of offshore borrow areas. Because the potential for sea turtle interactions using hopper dredges is higher during the warmer months, periodic nourishment cycles would adhere to the hopper-dredging window and begin December 1 for each cycle and proceed until completion before March 31 of the following year. In summary, every 4 years one hopper dredge would be expected to complete the renourishment within the designated hopper-dredging window. The plan would require separate contracts for initial construction and for each periodic nourishment cycle.

7.04.1.5 Borrow Sand Requirements

The initial construction volume for the project is 3,223,000 CY. The periodic renourishment will require 866,000 CY at 4-year intervals. Over 50 years the total of the 12 renourishment events is 10,392,000 CY. With the initial construction volume, the total project requirement over the 50 year life is 13,615,000 CY. These volumes are borrow quantities that have been adjusted for overfill factors. For example to achieve the required 690,000 CY in place on the beach, 866,000 CY of material from the borrow area is needed.

7.04.1.6 Borrow Area Utilization

The recommended borrow area use plan for initial construction calls for the project to take material by pipeline dredge from borrow area A. During periodic nourishment, the plan calls for the project to take material by hopper dredge from a combination of borrow areas B, D, E, and F and the remainder of A for 12 periodic nourishment cycles. Table 7.1 identified approximately 21.1 million CY available in the borrow areas. The total project volume required is approximately 15 million CY. Therefore, the total project volume results in a 70% utilization of available material from the borrow areas. By not fully utilizing all of the borrow areas, there will be flexibility to refine the borrow use plan in future investigations as a contingency due to unforeseen pockets of non-compatible sand. Areas to be used for borrow will be further defined during the Plans and Specifications phase of this project. Additional borings and/or geophysical surveys will be performed to better delineate the borrow area boundaries and material types.

Vibracore borings will be performed in a grid pattern, on a 500 foot to 1000 foot spacing, in any area prior to its use as a borrow source.

7.04.1.7 Borrow Area Contingency Plan

Borrow area compatibility is determined based on grain size analyses from borings taken prior to construction, during both the feasibility study and plans and specifications phase. The borings conducted during the plans and specifications phase will provide any additional data necessary to help further refine borrow area compatibility limits. The final spacing of both sets of borings will range from 500 ft. to 1000 ft. apart. This additional characterization of the borrow material will increase the level of confidence for borrow material compatibility and decrease the degree of interpolation between boring locations. Qualitative visual characterizations of the in-place material will be made by representatives of the U.S. Army Corps of Engineers (USACE) construction and environmental offices throughout the project construction.

Furthermore, dredging production rates are specific to each dredge and its operation and can be quantified. The recommended construction plan identified in Section 7.04.1.4 discusses the use of a hydraulic cutterhead pipeline dredge during initial construction and the use of hopper dredges during each periodic nourishment event. For hydraulic cutterhead pipeline dredges, once production rates are known for a given contract, a prediction can be made of the dredging time and volume of material between the instantaneous dredge location and the next known boring location of suitable material. Thus, a qualitative and quantitative assessment can be made of whether this volume of potentially incompatible material is significant relative to the overall project. Results from these calculations will be used by appropriate USACE personnel to determine whether the cutterhead dredge should continue in the dredge's present location or relocate. During periodic nourishment events, hopper dredges will utilize pumpout facilities for each dredged hopper load. Considering hopper dredges have a maximum capacity per load and are self propelled, potential incompatible material can feasibly be managed by the Corps.

Federal and state environmental agencies will be notified if, and how much, potentially incompatible material is encountered during dredging operations. If necessary, the Wilmington District will make the decision on a suitable contingency measure which may include moving the dredge to another site within the borrow area or to one of the other designated borrow areas, depending on availability of sediment, and will notify the agencies of this contingency measure.

7.05 Real Estate Considerations

Real estate requirements for the Selected Plan include lands, easements, rights-of-way and relocations, and disposal/borrow areas, which are referred to as LERRD. Real estate requirements in each of these categories are discussed and followed by a summary of estimated real estate costs. There is no major improvement that will be impacted by the

proposed project. There is one pier located within the study area, Jolly Roger Pier, which will not be acquired. Impacts to the pier are not anticipated. There will be no utility relocation. There is no existing Federal project within the acquisition area.

7.05.1 Borrow Areas

Proposed borrow areas are located offshore. Coordination and concurrence for the sand removal from the offshore borrow areas will be required from appropriate state and/or federal agencies.

7.05.2 Pipeline

Material for initial project construction and beach nourishment will be dredged by pipeline dredge and hopper dredge from the offshore borrow areas, then moved by pipeline to the beach. The pipeline will be routed along the ocean shoreline, where it will be placed either below Mean High Water or within the acquired Perpetual Beach Storm Damage Reduction Easements.

7.05.3 Construction Area

The project limits, including both main fill and transition sections, extend from the north end of reach 2 to the north end of reach 28, a total length of 26,200 feet. The northern 2,000 feet is a transition section and is located within the town limits of Surf City. The southern transition is 1,000 feet long and extends into reach 2. The estate to be acquired for the project will be a Perpetual Beach Storm Damage Reduction Easement for approximately 397 parcels. Based on project maps and ground examination, no structures appear to be impacted. There will be no relocation of landowners. Improvements (other than the pier) within the project include walkover structures that allow beach access from private and public property. The easement specifies that construction of walkover structures shall not violate the integrity of the constructed dune. Approval of plans and specifications for construction of new walkover structures must be obtained from the Project Sponsor.

7.05.4 Real Estate Costs

Estimated real estate costs for the Selected Plan of Improvement are shown in Table 7.2. The land value for the Perpetual Beach Storm Damage Reduction Easements is $0. As "off setting benefits" applies, a determination is made that the project will not reduce the value of the land. Rather it will remain the same or increase after construction of the project. A value of $29,000 is used for planning purposes for a temporary work area easement for a staging area. It is possible that valuation under Federal rules may conclude that the benefits do not fully offset the value of the temporary work area easement. The estimated real estate costs include federal and non-Federal administrative fees for acquiring the required easements. Administrative costs are those costs incurred for verifying ownership of lands, certification of those lands required for project

purposes, legal opinions, analysis or other requirements that may be necessary during acquisition.

Table 7.2 Real Estate Costs – Selected Plan, Code of Accounts, October 2006 levels.

CODE	CATEGORY	FEDERAL	NON-FEDERAL	TOTALS
01A	PROJECT PLANNING			
	Project Cooperation Agreement	$	$	$
01AX	Contingencies (25%)	$	$	$
	Subtotal	$	$	$
01B	LANDS AND DAMAGES			
01B40	Acq/Review of PS	$ 158,800	$	$ 158,800
01B20	Acquisition by PS	$	$ 1,191,000	$ 1,191,000
01BX	Contingencies (15%)	$ 23,820	$ 178,650	$ 202,470
	Subtotal	$ 182,620	$ 1,369,650	$ 1,552,270
01H	AUDIT			
01H10	Real Estate Audit	$	$	$
01HX	Contingencies (15%)	$	$	$
	Subtotal	$	$	$
01R	REAL ESTATE LAND PAYMENTS			
01R1B	Land Payments by PS	$	$ 29,000	$ 29,000
01R2B	PL91-646 Relocation Pymt by PS	$	$ -	$ -
01R2D	Review of PS	$	$	$
01RX	Contingencies (15%)	$	$ 4,350	$ 4,350
	Subtotal	$	$ 33,350	$ 33,350
TOTALS		**$ 182,620**	**$ 1,403,000**	**$ 1,585,620**

7.06 Operation and Maintenance Considerations

Operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) requirements will consist of project inspections and dune vegetation maintenance. Periodic renourishment is classified as continuing construction, not as OMRR&R. Dune vegetation maintenance includes watering, fertilizing, and replacing dune plantings as needed. Other maintenance is reshaping of any minor dune damage, repairs to walkover structures and vehicle accesses, and grading of any large escarpments. Estimated OMRR&R annual costs are $21,000.

7.07 Plan Accomplishments

The Selected Plan will significantly reduce expected annual damages to structures and roads from storm and hurricane damages along the project reaches 3 though 26. It also will significantly reduce damages due to long-term progressive erosion.

The Selected Plan will reduce, but not entirely eliminate, damages due to short term erosion, inundation, and wave overwash during storms. Although the Selected Plan will substantially reduce damages due to hurricane-wave overwash, it should be noted that the plan 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 channel landward of Topsail Island.

The Selected Plan will reduce emergency costs and other damages and will increase the width of beach available for recreation and for beach habitat, providing incidental benefits. Topsail Beach was included in a study of recreation demand and benefits to four barrier islands on the North Carolina coast. A contingent valuation on-site and telephone survey was used to gather information about willingness to pay for recreation or improvement of Topsail Beach along with information about socio-economic and other characteristics of the respondents. These data were used to predict annual and peak visitation by day visitors at Topsail Beach. In addition, the survey data was used to determine NED recreation benefits for the with-project conditions. It is predicted from analysis of the survey data that an increase in beach width will increase both demand for and the willingness to pay for beach recreation at Topsail Beach. The Selected Plan will increase the useable recreation beach width by 45 feet for Topsail Beach (see Appendix O). The expected average annual benefit (AAB) for Topsail beach for the with-project condition tentative selected alternative of the Selected Plan is estimated at $5,500,000.

A summary of economic benefits for the Selected Plan is presented in section 7.08.1, "Selected Plan - Benefits."

7.08 Economics of the Selected Plan

Many suitable plans were identified that have benefits that exceed costs. The Selected Plan is the Locally Preferred Plan (LPP). The NED plan has the greatest net benefits. Benefits and costs of the Selected Plan are developed and evaluated in this section at October 2006 price levels. The Water Resources Interest Rate for Fiscal Year 2007 of 4 7/8 percent is used to develop present values and annual values for benefits, costs, and net benefits. For comparisons purposes similar data for the NED plan is also presented. Total costs and benefits are also presented at October 2007 price levels and interest rates.

7.08.1 Selected Plan - Benefits

The total expected annual benefits for the Selected Plan are estimated at $13,304,000. An itemized listing of expected annual benefits is presented in Table 7.3. Updated to October 2007, the annual benefits are estimated at $13,590,000 for the Selected Plan and at $14,255,000 for the NED Plan.

Table 7.3, Expected Annual Benefits, October 2006 levels, 4.875% interest rate.

Benefit Category	Expected Annual Benefit	
	Selected Plan, LPP	NED
Hurricane and Storm Damage Reduction		
Storm Erosion	$6,130,400	$6,691,800
Flood*	$(64,400)	$(86,000)
Wave	$71,300	$181,400
Land and Long Term Erosion	$1,580,000	$1,580,200
Subtotal, rounded	$7,717,000	$8,367,000
Emergency Costs and Other Damage Reduction	$ 87,000	$ 87,000
Recreation	$ 5,500,000	$ 5,500,000
Sub Total Annualized Benefits	$13,304,000	$13,954,000
Benefits During Construction, negligible	$ 0	$ 0
TOTAL EXPECTED ANNUAL BENEFITS, SELECTED PLAN OF IMPROVEMENT	**$13,304,000**	**$13,954,000**

*See Section 5.06.4 regarding flood benefits.

7.08.2 Selected Plan - Costs

Determination of the economic costs of the Selected Plan consists of four basic steps. First, project First Costs are computed. First Costs include expenditures for project design and initial construction and related costs of supervision and administration. First Costs also include the lands, easements, and rights of way for initial project construction and periodic nourishment. Total First Costs are estimated to be $31,052,000 at October 2006 price levels as presented in Table 7.4. The baseline cost estimate for construction in FY2012 is $34,873,000. For comparison, the NED plan Total First Costs are estimated to be $41,581,000 at October 2006 price levels. As of October 2007 the Total First Costs are estimated at $32,131,000 for the Selected Plan and at $43,028,000 for the NED Plan.

Table 7.4 Project First Costs – Selected Plan, LPP (October 2006 price levels)

ACCT. CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTIN-GENCY	TOTAL COST
01	LANDS AND DAMAGES						
	Acquisition				$1,350,000	$202,000	$1,552,000
	Land Payments				$29,000	$4,000	$33,000
	Subtotal						$1,585,000
17	BEACH REPLENTISHMENT						
	Mobilization and Demobilization	1	JOB	LS	$2,230,000	$450,000	$2,680,000
	Dredging and Beach Fill	3,223,000	CY	$6.15	$19,821,000	$3,964,000	$23,785,000
	Dune Vegetation	48	AC	$8,000	$384,000	$58,000	$442,000
	Beach Tilling	68	AC	$600	$41,000	$6,000	$47,000
	Public Walkovers	23	EA	$35,761	$823,000	$123,000	$946,000
	Subtotal						$27,900,000
30	PLANNING, ENGINEERING, AND DESIGN				$930,000	$186,000	$1,116,000
31	CONSTRUCTION MANAGEMENT				$375,000	$75,000	$450,000
	TOTAL FIRST COST						**$31,051,000**

Second, Interest During Construction is added to the project First Cost. Interest During Construction is computed from the start of PED through the 1 year initial construction period. Interest During Construction for the Selected Plan is estimated to be $266,000. The project First Cost plus Interest During Construction represents the Total Investment Cost required to place the project into operation. Total Investment Cost for the Selected Plan is estimated to be $31,317,000 as shown in Table 7.5. As of October 2007 the Interest During Construction is estimated at $275,000 for the Selected Plan resulting in Total Investment Costs of $32,406,000.

Table 7.5 Total Investment Cost – Selected Plan,, Oct. 2006 levels, 4.875% interest rate.

ITEM	AMOUNT
Total First Cost	$31,051,000
Interest During Construction	$266,000
Total Investment Cost	$31,317,000

Third, Scheduled Renourishment Costs are computed. These costs are incurred in the future for each renourishment. At this point neither discounting to present value, nor escalation for anticipated inflation is included. Renourishment Costs are estimated to be $8,893,000 as shown in Table 7.6. As of October 2007 the Renourishment Costs are estimated at $9,202,000.

Table 7.6 Project Renourishment Costs – Selected Plan, LPP October 2006 levels.

ACCT. CODE	ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTIN-GENCY	TOTAL COST
17	BEACH RENOURISHMENT						
	Mobilization and Demobilization	1	JOB	LS	$930,000	$370,000	$1,300,000
	Dredging and Beach Fill	866,000	CY	$6.49	$5,620,000	$1,124,000	$6,744,000
	Beach Tilling	30	AC	$600	$18,000	$3,000	$21,000
	Subtotal						$8,065,000
30	PLANNING, ENGINEERING, AND DESIGN				$520,000	$78,000	$598,000
31	CONSTRUCTION MANAGEMENT				$200,000	$30,000	$230,000
	TOTAL RENOURISHMENT COST						**$8,893,000**

Fourth, Expected Annual Costs are computed. These costs consist of interest and amortization of the Total Investment Cost, and the equivalent annual cost of project operation, maintenance, and renourishment. The Expected Annual Costs provide a basis for comparing project costs to expected annual benefits. Expected Annual Costs for the Selected Plan are estimated to be $3,989,000. A summary of the computations involved in each of these three steps is presented in Table 7.7. By comparison the Expected Annual Costs for the NED plan are $4,560,000. As of October 2007 the Expected Annual Costs are estimated at $4,119,000 for the Selected Plan and at $4,710,000 for the NED Plan.

Table 7.7 Project Annual Costs – Selected Plan, LPP, Plan 1250X
October 2006 price levels, 4.875% interest rate.

ITEM	YEAR	AMOUNT	PRESENT VALUE, 2011
Total Investment Cost	2011	$31,317,000	$31,317,000
Renourishment	2015	$8,893,000	$7,351,000
Renourishment	2019	$8,893,000	$6,077,000
Renourishment	2023	$8,893,000	$5,023,000
Renourishment	2027	$8,893,000	$4,152,000
Renourishment	2031	$8,893,000	$3,432,000
Renourishment	2035	$8,893,000	$2,837,000
Renourishment	2039	$8,893,000	$2,345,000
Renourishment	2043	$8,893,000	$1,939,000
Renourishment	2047	$8,893,000	$1,603,000
Renourishment	2051	$8,893,000	$1,325,000
Renourishment	2055	$8,893,000	$1,095,000
Renourishment	2059	$8,893,000	$905,000
Total Investment Cost, Present Value			**$69,401,000**
Annual Costs			
Interest & Amortization, 50 years at 4 7/8 %			$3,728,000
Monitoring			$240,000
OMRR&R			$21,000
Total Annual Cost			**$3,989,000**

7.08.3 Benefit to Cost Ratio

With expected annual benefits of $13,304,000 and average annual costs of $3,989,000 the benefit to cost ratio for the Selected Plan, Plan 1250X, is 3.3 to 1. The annual net benefits are $9,315,000. By comparison, for the NED plan, Plan 1550, the benefit to cost ratio is 3.1 to 1 and the annual net benefits are $9,394,000. When updated to October 2007 levels and interest rates the Selected Plan has expected annual benefits of $13,590,000, average annual costs of $4,119,000, annual net benefits of $9,471,000, and a benefit to cost ratio of 3.3 to 1. When updated to October 2007 levels and interest rates the NED Plan has expected annual benefits of $14,255,000, average annual costs of $4,710,000, annual net benefits of $9,545,000, and a benefit to cost ratio of 3.0 to 1.

7.08.4 Section 902 Analysis

The Section 902 analysis of the Selected Plan covers changes in scope, changes in cost, and an incremental analysis of the change.

7.08.4.1 Change in Scope

HD 393/102/2 contains descriptions of the Old 1990 NED Plan and the Authorized Plan. The terminal groin was not part of the Authorized Plan. Changes in the scope of the project from the Authorized Plan to the GRR Selected Plan, Plan 1250X, and to the GRR NED Plan, Plan 1550 are shown in Table 7.8. For comparison purposes volumes shown in Table 7.8 for both plans are estimated in-place volumes of fill on the beach. Volumes shown elsewhere in the GRR volumes are estimated borrow volumes including losses. Estimated project construction volumes were revised in the Design Memorandum, dated August 1992.

Table 7.8 Plan Comparison Table

Dimensions	Plan		
	Authorized # HD 393/102/2	**GRR, LPP, Plan 1250X**	GRR, NED, Plan 1550
Dune, topwidth	25 feet	25 feet	25 feet
Dune, elevation, NGVD	13.6 feet	12 feet	15 feet
Dune, landward slope	5H:1V	5H:1V	5H:1V
Dune, seaward slope	5H:1V	10H:1V	10H:1V
Dune and storm berm, width	35 feet	None	None
Dune and storm berm, elevation, NGVD	9.6 feet	None	None
Dune and storm berm, seaward slope	5H:1V	None	None
Beach berm, width	40 feet	50 feet	50 feet
Beach berm, elevation, NGVD	7.6 feet	7 feet	7 feet
Beach berm, seaward slope	12H:1V	15H:1V	15H:1V
Dune and berm fill, length	10,250 feet	23,200 feet	22,800 feet
North transition section, length	7,150 feet	2,000 feet	2,000 feet
South transition section, length	1,800 feet	1,000 feet	1,400 feet
Total Length	19,200 feet	26,200 feet	26,200 feet
Volume, initial, in-place	*2,659,000 CY	2,387,000 CY	3,420,000 CY
Volume, renourishment, in place	372,000 CY	690,000 CY	690,000 CY
Renourishment interval	2 years	4 years	4 years
Borrow source	Banks Channel	Off shore	Off shore

*including 372,000 CY advance nourishment # revised volumes from DM.

The two most significant changes in scope are the increased lengths, first the length of the dune and berm fill, and second the total project length. The Authorized Plan and the GRR LPP, Plan 1250X are compared schematically in Figure 7.3.

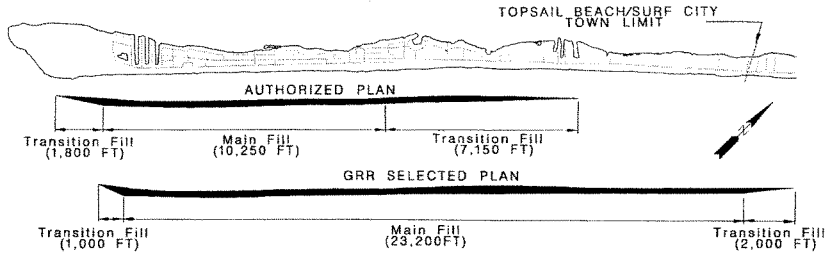

Figure 7.3 Authorized Plan (HD 393/102/2) and GRR Selected Plan, Plan view

The other changes in the scope are in widths and heights of the components, shown in Figure 7.4. These changes in cross section are not as significant as the length increases. The overall cross section of the Selected Plan, Plan 1250X is lower and slightly smaller than the cross section of the Authorized Plan.

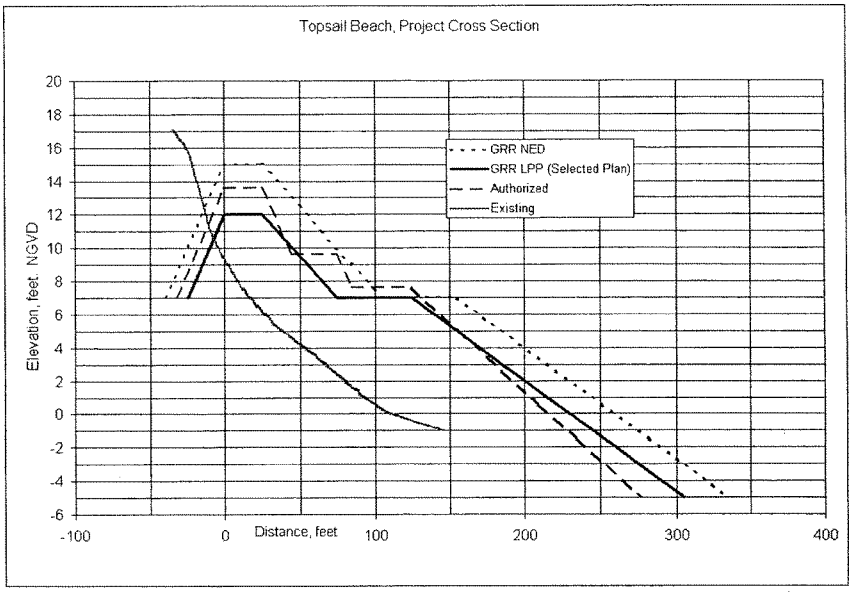

Figure 7.4 Authorized Plan (HD 393/102/2) and GRR LPP Plan 1250X, Cross section view

7.08.4.2 Change in Costs

The GRR Selected Plan (Plan 1250X) has a Total First Cost of $32,131,000 at October 2007 levels and a baseline cost in FY2012 of $34,873,000. As reported in Section 1.10, the maximum cost of initial construction limited by Section 902 is $26,160,000. The Total First Costs and the Baseline Costs of both the NED Plan and the GRR Selected Plan all exceed the Section 902 limit for this project. These amounts are presented in Table 7.9. For some shore protection projects Section 902 applies to both initial construction and to continued renourishment. No administrative limit on renourishment was established for this project. As shown in Table 7.8 the renourishment volumes are very similar per event. However because the Authorized Plan would be renourished every 2 years, the overall total renourishment costs of the GRR Selected Plan with a renourishment cycle of 4 years, as explained in Section 7.03.4, would be less than the total renourishment costs of the Authorized Plan.

Table 7.9 Cost Comparison Table, Updated to October 2007 levels.

Description	Amount
Section 902 limit, October 2007	$26,160,000
GRR Selected Plan, Plan 1250X, Total First Cost, October 2007	$32,131,000
GRR Selected Plan, Plan 1250X, Baseline Cost, October 2011	$34,873,000
GRR NED Plan, Plan 1550, Total First Cost, October 2007	$43,028,000
GRR NED Plan, Plan 1550, Baseline Cost, October 2011	$46,700,000

7.08.4.3 Incremental Analysis

The incremental analysis of project scope is an evaluation of the incremental costs and benefits of the one-step increase in project length. The GRR Selected Plan can be separated into two segments; the original authorized length and the incremental increase in length. Most cost estimate line items can be prorated based on length, volume, or time. Mobilization and demobilization costs are incurred entirely in the cost of the first segment, no mobilization and demobilization cost is incurred in the second segment. Benefits were also separated into the two segments. Most reaches were entirely within or entirely outside of the Authorized Plan reaches and the benefits were assigned to the appropriate reach. Through the Authorized Plan transition zone, benefits were prorated between the two segments. Table 7.10 presents the results of the incremental analysis of the two segments. Both with and without consideration of recreation benefits, the incremental benefits exceed the incremental costs. The incremental benefit to cost ratio is 3.4 to 1 for HSDR benefits only and 6.3 to 1 for all benefits, including incidental recreation benefits.

Table 7.10 Incremental Analysis, in thousands, October 2006 levels and interest rates.

Item	Segments		
	GRR Selected	Authorized	Incremental
Total First Cost	$31,051	$23,761	$7,290
Interest During Construction	$266	$204	$62
Total Investment Cost, Initial Construction	$31,317	$23,965	$7,352
Renourishment, every 4 years	$8,893	$6,992	$1,901
Present Value, TIC & Renourish.	$69,401	$53,910	$15,491
Annual Costs			
Interest and Amortization	$3,728	$2,896	$832
Monitoring	$240	$240	$0
OMRR&R	$21	$15	$6
Total	$3,989	$3,151	$838
HSDR Benefits	$7,717	$4,847	$2,870
Net Benefits (HSDR only)	$3,728	$1,696	$2,032
BCR (HSDR only)	1.9	1.5	3.4
HSDR Benefits	$7,717	$4,847	$2,870
Recreation and Other Benefits	$5,587	$3,143	$2,444
Total Benefits (all)	$13,304	$7,990	$5,314
Net Benefits (all)	$9,315	$4,839	$4,476
BCR (all)	3.3	2.5	6.3

7.09 Evaluation of Risk and Uncertainty

GRANDUC's lifecycle approach to plan formulation explicitly incorporates risk and uncertainty into the formulation process. Three significant variables in GRANDUC are currently programmed to incorporate uncertainty, namely:

1) erosion distance – plus or minus 5.0 feet
2) structure distance – plus or minus 2.0 feet
3) structure elevation – plus or minus 0.1 feet

Given the probabilistic nature of the analysis, the dune-and-berm alternatives were evaluated to determine the percent chance that the given alternative would have positive net benefits, or conversely, the risk of having negative net benefits. Based on analysis of 1,000 lifecycles, the selected plan (12-ft dune elevation with 50-ft berm and modified southern transition) has a 99.3 percent chance of having positive net benefits (i.e., less than a 1 percent risk of negative net benefits in any given year).

7.10 Residual Risks

The proposed beachfill plan would greatly reduce average annual storm damages. The selected plan, 1250X will reduce damages by 84%. Some damages will still occur, estimated to average $1,521,000 per year over the 50-year period of analysis. The project is designed to protect mainly against storm waves and storm-induced erosion, two major categories of storm damage. The project will not prevent any damage from sound side flooding, therefore any ground level floors of structures, ground level floor contents, vehicles, landscaping, and property stored outdoors on the ground will still be subject to saltwater flooding that will flow in through New Topsail Inlet and Banks Channel. Structures will continue to be subject to damage from hurricane winds and windblown debris. Damages from flooding and winds will decrease as older structures are replaced with those meeting floodplain ordinances and wind hazard building construction standards. But even new construction is not immune damage, especially from severe storm events. Also, the condition of the HSDR project at the time of storm occurrence can affect the performance of the project for that event. Updated to October 2007 levels, with the Selected Plan, residual damages are predicted to average $1,554,000 per year.

The proposed beachfill reduces damages, but does not have a specific design level. In other words, the project is not designed to fully withstand a certain category of hurricane or a certain frequency storm event. The project purpose is storm damage reduction, and the berm-and-dune is not designed to prevent loss of life. Loss of life is prevented by the existing procedures of evacuating the barrier island completely well before expected hurricane landfall and removing the residents from harms way. The erratic nature and unpredictability of hurricane path and intensity require early and safe evacuation. This policy should be continued both with or without the storm damage reduction project.

Table 7.11 Residual Risks - Average Annual Values, 50 year duration, 4 7/8% interest rate, October 2006 costs levels.

Plan	Residual Damages	HSDR Benefits
No Action	$9,238,000	$0
Plan 1550, NED	$871,000	$8,367,000
Plan 1250X, LPP	$1,521,000	$7,717,000

8. ENVIRONMENTAL EFFECTS

This section describes the probable consequences (impacts and effects) of the selected alternative on significant environmental resources within the project area. Natural communities that would be affected by the proposed action include the beach and dune and nearshore ocean as described below. Wetlands and floodplains, inlets, flats, sounds and Maritime shrub habitat would not be affected.

8.01 Marine Environment

8.01.1 Wetlands and Floodplains

The six proposed borrow areas for this project are located between 1 and 5.5 miles offshore; therefore, dredging operations will not adversely impact wetlands or floodplains of Topsail Beach. The selected 1250X beach nourishment plan consists of a 26,200-foot long dune and berm system which is within the floodplain. The plan has a main fill length of 23,200 feet, from approximately 400 feet southwest of Godwin Avenue, in reach 3, to the Topsail Beach town limit in reach 26 (See Section 7.01.1). A 2,000-foot northern transition and a 1,000 southern transition will extend beyond the limits of the main fill. The transition areas will consist of a tapered berm only resulting in a starting transition berm width of 155 feet that uniformly tapers to zero (See Section 7.01.2). Although, fill will be placed in the floodplain, nourishment operations would not adversely impact floodplains. No wetlands would be affected by the proposed project.

8.01.2 Inlet, Flats, and Sounds

The six proposed borrow areas for this project are located between 1 and 5.5 miles offshore and will not adversely impact the inlet, flats, and sound of Topsail Beach. Considering that no sediment will be removed from the inlet complex for beach nourishment, impacts to inlet dynamics will not occur. In order to achieve the initial construction template consisting of a 12 ft. dune and a 50 ft. berm, approximately 3.2 million cubic yards of sediment will be placed on the beach. In order to maintain the project template, renourishment of approximately 866,000 cubic yards of sediment will be placed on the beach at four-year intervals. Total volume of material required to construct and maintain the 50-year project is approximately 13.6 million CY. The total volume of sediment added to the littoral system will not significantly increase the volume of sand in the littoral system. Therefore, the placement of additional sediment to the beach would not significantly impact sand flat and shoal development within New Topsail inlet. This additional material would only accentuate the natural dynamics of the sand sharing system that currently exists. Therefore, nourishment operations will not adversely impact the inlet, flats, and sounds.

8.01.3 Surf Zone Fishes

The surf zone is a dynamic environment of which the community structure of organisms that inhabit it (ex. surf zone fishes and invertebrates) is not well understood. Representative organisms of both finfish and the invertebrate inhabitants of which they consume exhibit similar recruitment time periods. In North Carolina, the majority of invertebrate species recruit between May and September (Hackney *et al.*, 1996; Diaz, 1980; Reilly and Bellis, 1978) and surf zone fish species from March through September (Hackney *et al.*, 1996). The anticipated construction timeframe for this project is from 16 November to 30 April and would avoid a majority of the peak recruitment and abundance time period of surf zone fishes and their benthic invertebrate prey source.

The surf zone represents habitat areas of particular concern (HAPC) for some species, including adult bluefish and red drum, which feed extensively in this portion of the ocean. The surf zone is suggested to be an important migratory area for larval/juvenile fish moving in and out of inlets and estuarine nurseries (Hackney *et al.*, 1996). Placement of beach quality sand along the beach can result in increased turbidity and mortality of intertidal macrofauna, which serves as food sources for these and other species. Therefore, feeding activities of these species may be interrupted in the immediate area of beach sand placement. These mobile species are expected to temporarily relocate to other areas as the project proceeds along the beach. However, some species like Florida pompano and Gulf kingfish exhibit strong site fidelity during the middle portion (summer) of nursery area (Ross and Lancaster, 2002) and may not avoid secondary impacts (turbidity) from disposal. Considering that this project will avoid impacts to the surf zone during the summer months, it is expected that this project will not impact this period of strong site fidelity. Though a short-term reduction in prey availability may occur in the immediate disposal area, only a small area is impacted at any given time, and once complete, organisms can recruit into the nourished area. This recovery will begin immediately following disposal activity if the material is similar to the native beach (See Benthic Resources – Beach and Surf Zone Section 8.01.6).

According to Ross (1996) some surf zone fishes exhibit prey switching in relation to prey availability. Therefore, during periods of low prey availability, as a result of short-term impacts to the benthic invertebrate population during beach disposal activities, surf zone fishes may temporarily utilize alternative food sources. Considering the dynamic nature of the surf zone, this opportunistic behavior of avoidance and prey switching may enable some surf zone fishes to adapt to disturbances like beach nourishment. A combination of short-term prey switching and temporary relocation capabilities may help mitigate short-term prey reductions during beach disposal operations. Once the placement operation has passed, physical conditions in the impact zone quickly recover and biological recovery soon follows. Surf-feeding fish can then resume their normal activities in these areas. This is supported in Ross and Lancaster's (2002) study in which Florida pompano and Gulf kingfish appeared to remain as long near a recently nourished beach as a beach that was not recently nourished.

Sand placement and subsequent turbidity increases may have short-term impacts on surf zone fishes and prey availability. However, the opportunistic behavior of these organisms within the dynamic surf zone environment enables them to adapt to short-term disturbances. Considering the adaptive ability of representative organisms in this area and the avoidance of peak recruitment and abundance timeframes with a 16 November to 30 April construction timeframe, these impacts are considered temporary and minor.

8.01.4 Larval Entrainment

For many marine fishes, spawning grounds are believed to occur on the continental shelf with immigration to estuaries during the juvenile stage through active or passive transport. According to Hettler and Hare (1998), research suggests two bottlenecks that occur for offshore-spawning fishes with estuarine juveniles: the transport of larvae into the nearshore zone and the transport of larvae into the estuary from the nearshore zone. During this immigration period from offshore to inshore environments, the highest concentration of larvae generally occurs within the inlets as the larvae approach the second bottleneck into the estuary. Once through the inlet, the shelter provided by the marsh and creek systems within the sound serve as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

These free floating planktonic larvae lack efficient swimming abilities and are therefore, susceptible to entrainment by an operating hydraulic or hopper dredge. Susceptibility to this effect is largely dependent on proximity to the cutter-head or drag-head and the pumping rate of the dredge. Those larvae present near the channel bottom would be closer to the dredge area and would, therefore, be subject to higher risk of entrainment. Assessment of the significance of this entrainment is difficult. Assuming the very small volumes of water pumped by dredges relative to the total amount of water in the vicinity, a small proportion of organisms are presumed to be impacted. Potential reasons for low levels of impact include the extremely large numbers of larvae produced by most estuarine-dependent species and the extremely high natural mortality rate for early life stages of many fish species. Since natural larval mortalities may approach 99 percent (Dew and Hecht, 1994; Cushing, 1988), entrainment by a hydraulic dredge should not pose a significant additional risk in most circumstances.

Assessment of potential entrainment impacts of the proposed action may be viewed in a more site-specific context by comparing the pumping rate of a dredge with the amount of water present in the water body affected. (For the purposes of this assessment, assumptions will be made that inlet bottlenecks would have the highest concentrations of larvae as they are transported into the estuarine environment form the nearshore zone. Larval impacts from dredging to this concentrated system would be greater than dredging in offshore borrow areas.) The largest hydraulic dredge likely to work in the offshore borrow areas would have a discharge pipe about 30 inches in diameter and would be capable of transporting about 30,600 m^3 of sand per day if operated 24 hours (due to breakdown, weather, etc., dredges generally do not work 24 hours per day, 7 days per week). The dredged sediment would be pumped as slurry containing about 15% sand and

about 85% water by volume. The volume of water discharged would, thus, be about 173,000 m^3 per day, or about 2.0 m^3 per second. In contrast, the calculated spring tide flow through Beaufort inlet (a representative North Carolina inlet) is approximately 142,000,000 m^3 * 2 = 284,000,000 m^3 (i.e. two tides a day) of water and 264,000,000 m^3 during neap tide. Thus, the dredge would entrain only 0.0006 to 0.0007 percent of the daily volume flux through the inlet. The percentage of the daily flux of larvae entrained during a spring and neap tide is very low regardless of larval concentration and the distribution of larvae within the channel. Under the worst-case scenario with the highest concentrations of larvae possible based on spatial and temporal distribution patterns, the maximum percentage entrained barely exceeds 0.1 % per day (see Attachment 1 of Appendix I for a more detailed analysis). Though any larvae entrained (914 to 1.8 million depending on the initial concentration within the tidal prism) will likely be killed, the impact at the population level would be insignificant.

8.01.5 Nekton

Any entrainment of adult fish, and other motile animals in the vicinity of the borrow area during dredging is expected to be minor because of their ability to avoid the disturbed areas. Fish species are expected to leave the area temporarily during the dredging operations and return when dredging ceases (Pullen and Naqvi, 1983). Larvae and early juvenile stages of many species pose a greater concern than adults because their powers of mobility are either absent or poorly developed, leaving them subject to transport by tides and currents. This physical limitation makes them potentially more susceptible to entrainment by an operating hydraulic or hopper dredge (See Larval Entrainment, Section 8.01.4). Organisms close to the dredge cutterhead or draghead may be captured by the effects of its suction and may be entrained in the flow of dredged sediment and water. As a worst-case, it may be assumed that entrained animals experience 100 percent mortality, although some small number may survive. Susceptibility to this effect depends upon avoidance reactions of the organism, the efficiency of its swimming ability, its proximity to the cutterhead, the pumping rate of the dredge, and possibly other factors. Behavioral characteristics of different species in response to factors such as salinity, current, and diurnal phase (daylight versus darkness) are also believed to affect their concentrations in particular locations or strata of the water column. Any organisms present near the ocean bottom would be closer to the dredge cutterhead or draghead and, therefore, subject to higher risk of entrainment.

The biological effect of hydraulic entrainment has been a subject of concern for more than a decade, and numerous studies have been conducted nationwide to assess its impact on early life stages of marine resources, including larval oysters (Carriker *et al.*, 1986), post-larval brown shrimp (Van Dolah *et al.*, 1994), striped bass eggs and larvae (Burton *et al.*, 1992), juvenile salmonid fishes (Buell, 1992), and Dungeness crabs (Armstrong *et al.*, 1982). These studies indicate that the primary organisms subject to entrainment by hydraulic dredges are bottom-oriented fishes and shellfishes. The significance of entrainment impact depends upon the species present; the number of organisms entrained; the relationship of the number entrained to local, regional, and total population numbers;

and the natural mortality rate for the various life stages of a species. Assessment of the significance of entrainment is difficult, but most studies indicate that the significance of impact is low. Impacts of dredging activities on marine mammals and sea turtles are addressed in the biological assessment (Appendix I). A dredge operating in the open ocean would pump such a small amount of water in proportion to the surrounding water volume that any entrainment impacts of dredging of borrow material for the this project are expected to be insignificant.

8.01.6 Benthic Resources – Beach and Surf Zone

Beach nourishment may have negative impacts on intertidal macrofauna through direct burial, increased turbidity in the surf zone, or changes in the sand grain size or beach profile. Literature dating back to the early 1970's along the southeast coast indicate that opportunistic infauna species (ex. *Emerita* and *Donax*) found in the nourished areas are subject to direct mortality from burial, however, recovery often occurs within 1 year (Hayden and Dolan, 1974; Saloman and Naughton, 1984; Van Dolah *et al.*, 1992; Van Dolah *et al.*, 1993; Jutte, P.C. *et al.*, 1999) especially if compatible material is placed on the beach (Hayden and Dolan, 1974; Reilly and Bellis, 1978; Saloman and Naughton, 1984; Nelson, 1989; Van Dolah *et al.*, 1992; Van Dolah *et al.*, 1993; Hackney *et al.*, 1996; Jutte, P.C. *et al.*, 1999; Peterson *et al.*, 2000). In North Carolina, post-nourishment studies have documented similar reductions in abundance of coquina clams (*Donax* spp.), mole crabs (*Emerita talpoida*), and amphipods (*Haustoriid* spp.) immediately following disposal with recovery times persisting between 1 and 3 seasons after project construction depending on sediment compatibility (Reilly and Bellis 1983;, Peterson *et al.*, 2000; and Coastal Science Associates *Inc.*, 2002).

Temporary impacts on intertidal macrofauna in the immediate vicinity of the beach nourishment project are expected as a result of discharges of nourishment material on the beach. Any reduction in the numbers and/or biomass of intertidal macrofauna present immediately after beach nourishment may have localized limiting effects on surf-feeding fishes and shorebirds due to a reduced food supply. In such instances, these animals may be temporarily displaced to other locations.

Reilly and Bellis (1978) stated, "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." Similar findings were reached by Van Dolah (1992) in a study of the impacts of a beach nourishment project in South Carolina. A study by Dolan *et al.* (1992) of the effects of beach fill activities on mole crabs at the Pea Island National Wildlife Refuge, Dare County, North Carolina, indicates that while nourishment has a dramatic impact on mole crabs in the area where beachfill is placed, mole crabs returned to the beach areas that were nourished soon after pumping stopped.

While beach nourishment may produce negative effects on intertidal macrofauna, these are localized in the vicinity of the nourishment operation. Beach nourishment conducted

as a component of the proposed action would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or about 200 feet per day). This rate of progress is slow enough that surf-feeding fishes and shorebirds may move to other areas that are not affected by the nourishment operation. As the dredging operation passes by a given section of beach, that area is soon available for recolonization by invertebrates.

In a 1999 Environmental Report on the use of Federal offshore sand resources for beach and coastal restoration, US Department of Interior, Minerals Management Service provided the following assessment of potential impacts to beach fauna from beach nourishment.

> Because benthic organisms living in beach habitats are adapted to living in high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al. 1994; Levisen and Van Dolah, 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are more common. Because of a lower diversity of species compared to other intertidal and shallow subtidal habitats (Hackney et al. 1996), the vast majority of beach habitats are re-colonized by the same species that existed before nourishment (Van Dolah et al. 1992; Nelson 1985; Levisen and Van Dolah, 1996; Hackney et al. 1996).

While the proposed beach nourishment will adversely impact intertidal macrofauna, these effects will be localized, short-term, and reversible.

Project construction is expected to run from about 16 November 2011 through 30 April 2012 and will occur during the overwintering period of intertidal organisms on the beach. Beach nourishment will be completed prior to the onshore recruitment of most intertidal organisms. In North Carolina, the majority of invertebrate species recruit between May and September (Hackney *et al.*, 1996; Diaz, 1980; Reilly and Bellis, 1978). Any loss of intertidal organisms would be temporary, as re-population would be expected to begin as soon as the nourishment operation ends. Intertidal organisms are expected to recover upon completion of project construction from recolonization of the beach by organisms from adjacent areas and offshore.

8.01.7 Benthic Resources – Nearshore Ocean

Monitoring studies of post construction borrow areas in the southeast indicate that borrow areas can fill in and return to near pre-dredging conditions when there is adequate transport of sediment under the influence of strong currents in the area (Bowen and Marsh, 1988). The selected borrow areas for this project are located in waters with depths between 40 and 50 feet and the anticipated maximum depth of dredging is approximately 10 ft. Currents in the area are expected to contribute to some filling of the borrow area with material from sloughing of undisturbed areas adjacent to the

construction sites; however, it is expected that the bathymetric feature of the post-dredging borrow area will persist.

Dredging in the selected borrow areas should not have an adverse impact on any hardbottoms in the area. Based on magnetometer and side-scan sonar survey of the selected borrow areas, there was no indication of any hardbottoms within the areas surveyed (Hall, 2004).

Impacts to estuarine-dependent organisms are not expected to be significant since construction-related activities in the offshore borrow areas and on beaches proposed for nourishment would be localized. A study of nearshore borrow areas after dredging offshore of South Carolina revealed no long-term impacts to fishery and planktonic organisms, as a result of the dredging (Van Dolah *et al.*, 1992).

Impacts associated with dredging methods may differ depending on type of dredge and associated equipment used. Dredging impacts on benthic invertebrates would be similar, since the sediment surface where the organisms are found would be removed with an associated loss of all inhabitants under all scenarios. A hopper dredge takes a shallower and wider cut that may impact a larger surface area during a given event. Since a hopper dredge drag head operates at or above the bottom surface and pipeline cutterhead would be operated below the sediment surface the ability of benthic fish to avoid the dredge may be different. Hopper dredges also include associated risks of collision with marine mammals (See Appendix I). Methods that use pipelines to transport dredged material may have temporary impacts to any benthic organism covered by the pipeline. The environmental differences are considered insignificant.

Borrow areas A, B, C, D, E, and F are located beyond the –30 foot NGVD contour to approximately 5.5 miles offshore of Topsail Beach. Areas A, B, D, E, and F will be dredged for sediment at some point throughout the life of the project (Figures A-1 and A-6, Appendix A). Relative to all of the borrow areas, borrow area C is the greatest distance from the project area and is the least cost effective. Therefore, borrow area C will be reserved for contingency purposes. The offshore borrow areas beyond 3 nautical miles offshore are subject to federal mining requirements of the Minerals Management Service (MMS). Excavation will directly impact an area of about 4,210 acres (6.58 square miles) when completely utilized (year 50). Initial construction will impact a total area of about 2,297 acres (3.59 square miles) of sandy ocean bottom in borrow area A using a pipeline dredge (Table 7.1) from 16 November to 30 April. Periodic re-nourishment will occur every four years using a hopper dredge and will utilize a combination of offshore borrow areas (A, B, C, D, E, and F). The proposed window for hopper dredging is 1 December to 31 March. Multiple dredging areas within a given borrow area may be used to reduce material transport and/or allow for concurrent operation of more than one dredge in a given area. Existing depths at the proposed borrow areas range from about 40 feet to 50 feet. The depth of cut will vary depending on the availability of suitable sandy material and dredge plant capabilities. The average proposed cut for initial construction in borrow area A, using a pipeline dredge, is 6 feet to

10 feet. Optimum thickness of material necessary for efficient use of a pipeline dredge is only found in borrow area A; thus, maximum cuts of 10' will occur using a pipeline dredge and all other hopper dredge work will remove shallower cuts. Some refilling from sedimentation and side sloughing is expected over time. It is expected, however, that the depression created by the removal of sand will persist. Considering the existing depths (40 feet to 50 feet) of the borrow areas and an anticipated maximum dredge cut of 10 feet, post project borrow area depressions will not exceed about 50 feet to 60 feet.

Benthic organisms within the defined borrow areas dredged for construction and periodic nourishment will be lost. However, re-colonization by opportunistic species is expected to begin soon after the dredging activity stops. Rapid recovery is expected from re-colonization from the migration of benthic organisms from adjacent areas and by larval transport. Monitoring studies of post dredging effects and recovery rates of borrow areas indicates that most borrow areas usually show significant recovery by benthic organisms approximately 1 to 2 years after dredging (Naqvi and Pullen, 1982, Bowen, *et al.* 1988, Johnson and Nelson, 1985, Saloman *et al.*, 1982, and, Van Dolah *et al.*, 1984, and Van Dolah *et al.* 1992). According to Posey and Alphin (2000), benthic fauna associated with sediment removal from borrow areas off of Carolina Beach recovered quickly with greater inter-annual variability than differences from the effects of direct sediment removal. However, some changes in species composition and population may occur (Johnson and Nelson, 1985, Van Dolah *et al.*, 1984). Differences in community structure may occur that may last 2-3 years after initial density and diversity levels recover (Wilber and Stern, 1992). Specifically, large, deeper-burrowing infauna can require as much as 3 years to reach pre-disturbance abundance.

Considering that all proposed offshore borrow areas (A, B, C, D, E, and F) are located beyond the –30 foot contour and the proposed depth of closure for this project is 23 foot, it is anticipated that no significant infilling of the borrow areas will occur. Though the borrow areas are beyond the depth of closure and are outside of the normal littoral transport of sediment, some infilling of sediments will still occur at less significant rates. The infilling rate, the quality, and the type of the material would be factors in the recovery of the area dredged. Data collected by Saloman (1974) indicated that low densities and diversities of benthic fauna within the borrow area compared to control sites can be attributed to thick deposits of gelatinous, organic-rich sediments that lead to low dissolved oxygen concentrations. The Minerals Management Service (1999) indicates that the bottom substrate at and near a borrow area may be modified in several ways. A change in bottom contour may be evident throughout the project life and post-construction populations may differ from pre-construction conditions. A change in the hydrologic regime as a consequence of altered bathymetry may result in the deposition or scour of fine sediments, which may result in a layer of sediment that differs from the existing substrate. Also, once material in the borrow areas is dredged, it is possible that different post-dredging underlying sediment types will be exposed and will be different from pre-dredging sediment types. Some infilling from sedimentation and sloughing of bottom substrate from surrounding areas is expected.

In a 1999 Environmental Report on the use of Federal offshore sand resources for beach and coastal restoration, the US Department of Interior Minerals Management Service provided the following assessment of potential turbidity impacts.

> *The impacts from turbidity on benthic organisms during dredging operations were reviewed in detail by Pequegnat et al. (1978) and Stern and Stickle (1978). Both studies concluded that impacts to the benthic populations of the marine ecosystem from turbidity are local and temporary but not permanent. Similarly, recent studies show that benthic impacts may be limited to the immediate vicinity of dredging operations (e.g., Hitchcock et al. 1998; MMS 1996).*

8.01.8 Essential Fish Habitat

The Fishery Management Plan Amendments of the South Atlantic Fishery Management Council identify over 30 categories of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC), which are listed in Tables 8.1. While all of these habitat categories occur in waters of the southeastern United States, only a few occur in the immediate project vicinity and/or the project impact zone. Those absent include estuarine scrub/shrub mangroves which require a more tropical environment and several areas that are geographically removed from the project area including: Hoyt Hills located in the Blake Plateau area in water 450-600 meters deep, the Point located off Cape Hatteras near the 200-meter contour, and sandy shoals off Cape Hatteras and Cape Fear. In addition, there are no Council-designated Artificial Reef Special Management Zones, Estuarine Emergent Wetlands, Palustrine Emergent & Forested Wetlands, Intertidal Flats, Oyster Reefs & Shell Banks, Aquatic Beds, Wetlands, Creeks, Seagrass Beds, or Submerged Aquatic Vegetation in the potential project impact area. Impacts on habitat categories potentially present in the project vicinity are discussed in the following subsections.

Table 8.1. Categories of Essential Fish Habitat and Habitat Areas of Particular Concern in the Project Vicinity and Potential Impacts.

ESSENTIAL FISH HABITAT	Potential Presence		Potential Impacts	
Estuarine Areas	**In / Near Project Vicinity**	**Project Impact Area**	**Dredge Plant Operation**	**Sediment Disposal Activities**
Estuarine Emergent Wetlands	no	no	no	no
Estuarine Scrub / Shrub Mangroves	no	no	no	no
Submerged Aquatic Vegetation (SAV)	no	no	no	no
Oyster Reefs & Shell Banks	no	no	no	no
Intertidal Flats	no	no	no	no
Palustrine Emergent & Forested Wetlands	no	no	no	no
Aquatic Beds	no	no	no	no
Estuarine Water Column	yes	no	no	insignificant
Seagrass	no	no	no	no
Creeks	no	no	no	no
Mud Bottom	no	no	no	no
Marine Areas				
Live / Hard Bottoms	nearshore ocean	no	insignificant	insignificant
Coral & Coral Reefs	offshore	no	no	no
Artificial / Manmade Reefs	2 miles offshore	no	no	no
Sargassum	offshore	no	no	no
Water Column	yes	yes	insignificant	insignificant

Table 8.1. (Continued) Categories of Essential Fish Habitat and Habitat Areas of Particular Concern in the Project Vicinity and Potential Impacts.

GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN

Area - Wide				
Council-designated Artificial Reef Special Management Zones	no	no	no	no
Hermatypic (reef-forming) Coral Habitat & Reefs	offshore	no	no	no
Hard Bottoms	nearshore ocean	no	insignificant	insignificant
Hoyt Hills	no	no	no	no
Sargassum Habitat	offshore	no	insignificant	no
State-designated Areas of Importance of Managed Species (PNAs)	yes	no	no	insignificant
Submerged Aquatic Vegetation (SAV)	no	no	no	no
North Carolina				
Big Rock	distant offshore	no	no	no
Bogue Sound	no	no	no	no
Pamlico Sound at Hatteras / Ocracoke Islands	no	no	no	no
Cape Fear sandy shoals	no	no	no	no
Cape Hatteras sandy shoals	no	no	no	no
Cape Lookout sandy shoals	no	no	no	no
New River	no	no	no	no
The Ten Fathom Ledge	distant offshore	no	no	no
The Point	distant offshore	no	no	no

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8.01.8.1 Impacts on the Estuarine Water Column

All 6 proposed borrow areas are located approximately 1 to 5.5 miles offshore beyond the -30 foot NGVD contour; thus, dredging operations will not directly impact the estuarine water column. However, the selected 1250X beach nourishment plan consists of a 26,200-foot long dune and berm system. The plan has a main fill length of 23,200 feet, from approximately 400 feet southwest of Godwin Avenue, in reach 3, to the Topsail Beach town limit in reach 26 (See Section 7.01.1). A 2,000-foot northern transition and a 1,000 southern transition will extend beyond the limits of the main fill. The transition areas will consist of a tapered berm only resulting in a starting transition berm width of 155 feet that uniformly tapers to zero (See Section 7.01.2). Potential turbidity from the beach nourishment operation may extend into the New Topsail Inlet vicinity and the estuarine water column from longshore currents and tidal influx. Though elevated turbidity levels may occur during the nourishment operation, it is expected that they will be short-term, depending on the location of the outflow pipe and the movement of longshore and tidal currents, and will be no more significant than turbidity from a natural storm event. Therefore, turbidity impacts to the estuarine water column are insignificant.

8.01.8.2 Impacts on Hardbottoms

Hardbottom communities in the vicinity of Topsail Beach are within state waters and are potentially vulnerable to shoreline alterations (Moser and Taylor, 1995). During both the dredging (hopper dredge and cutterhead pipeline dredge) and placement process, identified live hardbottom communities will be avoided (offshore pipeline routes will be developed to avoid live hardbottom); thus, no direct impacts will occur. However, the long-term and short-term limits of cross-shore sediment transport are important in engineering and environmental considerations of beach profile response. Significant quantities of sand-sized sediments can be transported and deposited seaward as a result of short-term erosional events. Over time, the evolving profile advances seaward into deeper water until it approaches equilibrium; however, sediment particles may be in motion at greater depths than those at which profile readjustment occurs. The seaward limit of effective profile fluctuation over long-term time scales is referred to the "closure depth". Based on calculations derived from the USACE Coastal Engineering Manual (2002), the calculated depth of closure for this study is 23 ft.

Offshore (>-23 ft. NGVD)

Though construction activities will not directly impact offshore hardbottom through crushing or burial, it is possible that secondary impacts through sedimentation and/or chronic turbidity may occur beyond the equilibrium depth. A study by Thieler *et. al.* (1999) traced sediment dispersal on nourished beaches in Wrightsville Beach, NC and Folly Beach, SC. Data from both sites demonstrate significant quantities of nourishment sediment are being transported seaward onto the inner shelf as a result of severe storms and enhanced bottom stresses. Sedimentation accumulation from over 30 years of beach

nourishment on Wrightsville Beach appears to have exceeded shoreface accommodation space resulting in deposition onto the inner shelf. This seaward thinning wedge of sediment extends over a kilometer onto the inner shelf to depths of nearly 46 ft (14 m). Roughly 2 million m^3 of nourishment sediment has dispersed to the lower shoreface and inner shelf seaward of the assumed 28 ft (8.5 m) depth of closure used for project design. About 950,000 m^3 of this material is within the inner shelf (Thieler *et al.*, 1999).

Though, according to Thieler *et al.* (1999) it is possible that sedimentation may occur beyond the 23 ft. depth of closure calculated for Topsail Beach, the available information of hardbottom off the coast of Topsail Beach indicate that these hardbottom areas of influence are low lying and ephemeral (Moser and Taylor, 1995; Cleary, 2002; Greenhorne & O'Mara, 2004) and sedimentation would not impact high relief significant live hardbottom. According to Lybolt and Tate (2003), most nearshore low vertical relief hardbottoms are ephemeral, and short-term buried hardbottom is not necessarily dead. Data from a study in Florida indicate that in some surveyed transects, portions of hardbottom were covered for at least 2-days and exposed one week later with macroalgae and coral colonies still present. Nevertheless, on Topsail Beach the potential for sedimentation of low lying, and ephemeral hardbottom located offshore of the closure depth (-23 ft. NGVD) still exists. As identified by Thieler *et. al.* (1999), the potential may exist for these communities to be gradually buried by the movement of sand during equilibrium profile translation. Though not anticipated, if sedimentation occurs beyond the 23 ft depth of closure, it is possible that more stable epibenthic hardbottom communities located offshore may shift towards less diverse more stressed ephemeral hardbottom communities. However, high value live hardbottom of significant relief is not expected to be subject to burial at depths beyond 23 ft. Therefore, though the potential for sedimentation exists, its effects on low lying ephemeral hardbottom communities are not expected to be significant and high relief hardbottom should be outside the zone of influence.

During dredging operations, offshore hardbottom can be impacted by turbidity and sediment plumes generated from filling and overflow of the hopper dredge depending on the characteristics and suspension time of the sediment being dredged. Dredging in five (B, C, D, E, and F) of the six borrow areas is expected to be solely performed by hopper dredge. Hopper dredge suction arms hydraulically remove sediment from the sand flat and discharge the material into the storage hoppers on the dredge. During filling, fine sediments (primarily silt, clays, and fine-sands) are washed overboard to maximize the load of course sand for transport to the beach. This washing and overflow process is the source of turbidity plumes and sedimentation generated by the hopper dredge. The distance that sediment plumes may extend is dependent upon the type of dredge, how it is operated, currents, and the nature of the sediments within the borrow area. Elevated sediment levels from hopper dredge operations have been recorded at about 1,100 feet from the borrow area (Blair *et al.* 1990). Furthermore, according to Neff (1981 and 1985), concentrations of 1000 ppm immediately after discharge decreased to 10 ppm within one hour. The minimal impact of settling particles from hopper dredge turbidity plumes was further supported by a study from Poopetch (1982), which found that the

initial hopper dredge overflow concentrations of 3,500 mg/l were reduced to 500 mg/l within 50 m.

According to Hall (2004), side scan sonar was used to define hardbottom locations throughout all six proposed borrow areas (A, B, C, D, E, and F). A review of these acoustic records indicate that there was no evidence of any hard bottom within the borrow area boundaries. In areas of moderate acoustic return, grab samples were performed to ground truth the acoustic records. Grab samples of areas of harder return confirmed that these areas were course sand associated with sand waves of 6" to 1' in height. Of all the proposed borrow area sites, only areas D and F are within the vicinity of identified offshore hardbottom. However, the nearest point of both D and F is still about 2,000 ft away from the identified hardbottom and is, thus, beyond the zone of elevated sediment levels according to Blair *et al.* (1990).

Though elevated turbidity levels may occur from hopper dredging overflow, the overflow process only occurs during dredging. Considering that maximum load efficiency will be attained before transit to the nearshore pumpout location, overflow of material will not occur once the dredging process is complete. Therefore, though the hopper dredge will transit over hardbottom locations in route to the beach, no significant turbidity or sedimentation will occur during this process. Once at the pumpout location, all turbid water generated by the hopper dredge slurry for pumpout will be retained in the hopper. Considering that: (1) hopper dredge turbidity and sedimentation plumes will be confined to the offshore borrow areas during the dredging operation, (2) based on side scan sonar, no hardbottom was identified in these borrow areas, and (3) only 2 of the six borrow areas are within the vicinity of offshore hardbottom and the nearest point to the borrow area is about 2,000 ft., the effects of turbidity and sedimentation plumes on offshore hardbottom will be insignificant.

Nearshore (<-23 ft. NGVD)

As identified in Appendix R, the side scan and multibeam survey results did not identify hardbottom resources within the -23' depth of closure limit of the project but rather very shallow depressional features located perpendicular to shore. These features are consistent with Rippled Scour Depressions (RSD's), Rippled Channel Depressions (RCD's), and or sorted bedforms as identified in the literature. During the equilibration process, the nourished sediment will move offshore as the constructed beach profile equilibrates to a more natural beach profile. The total area of the RSD, RCD, and/or sorted bedform features that occurs within the -23 ft. depth of closure limit is 0.3834 acres. Though nourished sediment could gradually move within the depressional features, it is likely that the features will be maintained as a preferential morphologic state through the repeating, self-reinforcing pattern of forcing and sedimentary response which causes the features to be maintained as sediment starved bedforms responding to both along-and across shore flows (Thieler *et. al.*, 2001).

8.01.8.3 Impacts on Reef-forming Corals

Hermatypic, or reef-forming, corals consist of anemone-like polyps occurring in colonies united by calcium encrustations. Reef-forming corals are characterized by the presence of symbiotic, unicellular algae called zooxanthellae, which impart a greenish or brown color. Since these corals derive a very large percentage of their energy from these algae, they require strong sunlight and are, therefore, generally found in depths of less than 150 feet. They require warm water temperatures (68° to 82° F) and generally occur between 30°N and 30°S latitudes. Off the east coast of the United States, this northern limit roughly coincides with northern Florida; however, they may occur off the North Carolina coast. The identified borrow areas for this project have been surveyed using side scan sonar and no significant hardbottom communities were identified. Furthermore, according to Cleary (2003), hardbottom communities offshore of Topsail Beach are low lying and ephemeral (See Section 2.01.10 Hardbottoms). Therefore, suitable habitat is not known within the immediate project vicinity, and they should not be affected by the proposed action.

8.01.8.4 Impacts to Artificial / Manmade Reefs

The State of North Carolina, Department of Environment and Natural Resources, Division of Marine Fisheries Artificial Reef Program (NCARP) manages 6 reefs that are located off Topsail Beach. They are AR 355, AR 360, AR 362, AR 364, AR 366, and AR 368. Of these managed reefs, AR360 "Topsail Reef" is within about two-miles of the nearest proposed offshore borrow area and about two-miles from the shore and is located at 34° 20.983N and 077° 36.183W (Table 2.3). Though artificial reefs are within the proposed project area, dredging and placement of material on Topsail Beach will not be done in close proximity to any of these artificial reefs, so no adverse impacts would occur. Turbidity plumes may be produced by dredging and by placement of the dredged material

on Topsail Beach in the nearshore area as fine sediments are washed away by littoral processes. If such plumes are still detectable as far offshore as the NCARP reefs, their effects should be minor, temporary, and should quickly dissipate. The proposed action will not significantly impact any NCARP reefs.

8.01.8.5 Impacts on Sargassum

Sargassum is pelagic brown algae, which occurs in large floating mats on the continental shelf, in the Sargasso Sea, and in the Gulf Stream. Most pelagic *Sargassum* circulates between 20° N and 40° N latitudes and 30° W longitude and the western edge of the Florida Current / Gulf Stream and forms a dynamic structural habitat with a diverse assemblage of marine organisms including fungi, micro-and macro-epiphytes, at least 145 species of invertebrates, 100 species of fishes, four species of sea turtle, and numerous marine birds. It is a major source of productivity in a nutrient-poor part of the ocean. Unregulated commercial harvest of *Sargassum* for fertilizer and livestock feed has prompted concerns over the potential loss of this important resource. *Sargassum* is positively buoyant and, depending on the prevailing surface currents, will remain on the continental shelf for extended periods or be cast ashore. Though *Sargassum* species may drift through the vicinity of the dredge plant operation, it typically occurs much further offshore; thus, impacts will be insignificant. In any case, since it occurs in the upper few feet of the water column, it is not subject to impacts from dredging or sediment disposal activities associated with the proposed action (South Atlantic Fishery Management Council, 1998.)

8.01.8.6 Impacts on the Marine Water Column

The potential water quality impacts of dredging and beachfill placement are addressed in Section 8.07.2. Dredging and beachfill placement conducted during project construction and periodic nourishment may create impacts in the marine water column in the immediate vicinity of the activity potentially affecting the surf zone and nearshore ocean. These impacts may include minor and short-term suspended sediment plumes and related turbidity, as well as the release of soluble trace constituents from the sediment. In the case of overflowing hopper dredges or scows to obtain economic loading, sediment which is more than 90 percent sand is not likely to produce significant turbidity or other water quality impacts (USACE, 1997). Overall water quality impacts of the proposed action are expected to be short-term and minor. Living marine and estuarine resources dependent upon good water quality are not expected to experience significant adverse impacts due to water quality changes.

Scientific data are very limited with regard to the effects of beach nourishment on fishery resources. These effects may be similar, on a smaller scale, to the effects of storms; storm effects may include increased turbidity and sediment load in the water column and in some cases, changes in fish community structure (Hackney *et al.*, 1996). Storms of great severity, such as hurricanes, have been documented to create conditions resulting in fish kills, but such situations are not usually associated with beach nourishment.

In a 1999 Environmental Report on the use of Federal offshore sand resources for beach and coastal restoration, the US Department of Interior Minerals Management Service provided the following assessment.

> *In order to assess if turbidity causes an impact to the ecosystem, it is essential that the predicted turbidity levels be evaluated in light of conditions such as during storms. Storms on the Mid-Atlantic shelf may generate suspended matter concentrations of several hundred mg/l (e.g., Styles and Glenn 1999). Concentrations in plumes decrease rapidly during dispersion. Neff (1981, 1985) reported that solids concentrations of 1000 ppm two minutes after discharge decreased to 10 ppm within one hour. Poopetch (1982) showed that the initial concentration in the hopper overflow of 3,500 mg/l decreased rapidly to 500 mg/l within 50 m. For this reason, the impact of the settling particles from the turbidity plume is expected to be minimal beyond the immediate zone of dredging.*

Beach nourishment can affect fishery resources and EFH through increases in turbidity and sedimentation that, in turn, may create localized stressful habitat conditions, and may result in temporary displacement of fish and other biota. However, the sediment proposed for beach placement on Topsail Beach would average 90 percent or more sand (See Appendix C, Geotechnical Analysis). Because of the low silt/clay content, water column impacts are expected to be localized, short-term, and minor. Furthermore, the beach nourishment operation is expected to proceed at a slow rate. Mobile biota, including juvenile and adult fish, should be able to relocate outside the more stressful conditions of the immediate nourishment operation. Cumulative effects of multiple simultaneous beach nourishment operations could be potentially harmful to fishes of the surf zone. The high quality of the sediment selected for beach fill and the small amount of beach affected at any point in time would not suggest that this activity poses a significant threat.

8.01.8.7 Impacts on State-designated Areas Important for Managed Species

Primary Nursery Areas (PNA's) are designated by the NC Marine Fisheries Commission and are defined by the State of North Carolina as tidal saltwaters which provide essential habitat for the early development of commercially important fish and shellfish (http://www.ncfisheries.net/rules.htm; 15 NC Administrative Code 3B .1405). Many fish species undergo initial post-larval development in these areas. Primary nursery Areas will not be directly impacted by this project. However, PNA's located adjacent to the New Topsail Inlet vicinity may experience indirect and short-term elevated turbidity levels from the nourishment operation on the shoreface. These turbidity effects are dependent on the location of the outflow pipe and the direction of longshore and tidal currents. Considering these elevated turbidity levels will be short-term and within the range of elevated turbidity from natural storm events, the impacts to state-designated PNA's are insignificant.

8.01.8.8 Impacts to Big Rock and Ten Fathom Ledge

Big Rock and the Ten Fathom Ledge are located south of Cape Lookout, North Carolina. Ten Fathom Ledge is located at 95-120 m (312-394 feet) depth on the Continental Shelf in Onslow Bay, North Carolina and consists of 136 square miles of ocean floor containing patch reefs and rock outcroppings. Big Rock is located approximately 36 miles south of Cape Lookout at about 50-100 meters (164-328 feet) of water. Hard substrate consists of algal limestone and calcareous sandstone. Both of these sites are located offshore of the proposed borrow areas and would not be impacted by the project (South Atlantic Fishery Management Council, 1998).

8.01.8.9 Impacts to The Point

The Point is located near Cape Hatteras near the 200-meter (656 feet) contour and is a confluence zone of six major water masses including the Gulf Stream, Western Boundary Under Current (WBUC), Mid-Atlantic Shelf Water (MASW), Slope Sea Water (SSW), Carolina Capes Water (CCW), and the Virginia Coastal water. A result of the convergence of these currents is a dynamic and highly productive environment. This area is located well offshore of the proposed project and would not be affected (South Atlantic Fishery Management Council, 1998).

8.01.8.10 Impact Summary for Essential Fish Habitat

The proposed action is not expected to cause any significant adverse impacts to Essential Fish Habitat of EFH species. Impacts are expected to be minor on an individual and cumulative effects basis.

8.02 Terrestrial Environment

8.02.1 Maritime Shrub Thicket

The maritime shrub thicket community is located sporadically throughout Topsail Beach, occurring on the backside of the island, west of the highway, and is interspersed with marsh areas, which border the sound. Since this community is located landward of the proposed project construction limits, no significant impacts are expected.

8.02.2 Beach and Dune

Under the proposed plan, approximately 26,200 feet of beach berm and dune (including transition areas) would be constructed. Constructed dunes will be waterward of the first line of stable vegetation, will tie into existing dunes where practical, and be re-vegetated with native dune grasses to minimize impacts. This will result in a seaward movement of the shoreline.

Project construction and periodic nourishment is not expected to have an adverse impact on wildlife found along the beach or that utilizes the dune areas. However, short-term transient impacts may occur to mammalian species using the dune and fore-dune habitat, but these species are mobile and would be expected to move to other, undisturbed areas of habitat during construction and periodic nourishment events. Re-vegetation of dune areas would be expected to increase the amount and quality of habitat available to mammal and avian species dependent on those areas.

Project construction will result in disturbance and removal of some of the existing vegetation along the seaward side of the existing dune. However, construction would be followed by measures designed to stabilize the constructed dunes. Dune stabilization would be accomplished by the vegetative planting of the dune during the optimum planting seasons and following the berm and dune construction. Planting stocks shall consist of sea oats (*Uniola paniculata*), American beachgrass (*Ammophila breviligulata*), panic grass (*Panicum amarum*), and seaside little bluestem (*Littoralis* variety). The vegetative cover shall extend from the landward toe of the dune to the seaward intersection with the storm berm for the length of the dune. Sea oats will be the predominant plant with American beach grass and panic grass as a supplemental plant. Seaside little bluestem will be planted on the backside of the dune away from the most extreme environment. Planting would be accomplished during the season best suited for the particular plant. Periodic nourishment of the project would involve placing material along the berm. Therefore, minimal impacts to dune vegetation should occur.

It is expected that the nourishment operation on Topsail Beach may directly impact ghost crabs through burial (USACE, 2004; Lindquist and Manning, 2001; Peterson *et. al.*, 2000; Reilly and Bellis, 1983). Considering that ghost crabs are vulnerable to changes in sand compaction, it is possible that short-term impacts may occur from changes in sediment compaction and grain size. According to Hackney *et al.* (1996), management strategies are recommended to enhance recovery after beach nourishment are: (1) timing activities so that they occur prior to recruitment and, (2) providing beach sediment that favors prey species and burrow construction. This project will avoid the recruitment timeframe by nourishing between 16 November and 30 April. Furthermore, considering that, based on the boring samples and subsequent grain size analyses (See Appendix C, Geotechnical Analysis), only compatible borrow material will be used; impacts to the prey species should be short-term. Compaction measurements will be performed post-construction and, if deemed necessary, compact portions of the beach will be tilled (post-construction tilling is a mitigation measure proposed for sea turtles; however, secondary benefits may occur for ghost crabs); thus, impacts to burrow construction should be minor.

Ghost crabs are present on the project beach year-round (Hackney *et al.*, 1996); therefore, direct impacts from burial may occur during the proposed construction timeframe. However, the peak larval recruitment timeframe will be avoided and, considering that only compatible borrow material will be used, it is expected that ghost crab populations will recover within one-year post-construction (USACE, 2004; Lindquist and Manning,

2001; Peterson *et. al.*, 2000; Reilly and Bellis, 1983). Considering that ghost crabs recover from short-term impacts and that recommended management strategies to avoid long-term impacts are adhered to, it is expected that no significant long-term impacts to the ghost crab population will occur.

8.02.3 Birds

The waters off of Topsail Island and Onslow Beach are very important to migrating and wintering northern gannets, loons and grebes because of the abundant hard bottom habitat. It has been suggested that migrating and wintering birds key on the hardbottom areas (Sue Cameron, pers. comm.) because such habitat supports significant prey species for these birds. However, dredging activities will not be conducted in hardbottom areas that have been identified, so disturbance of birds using those areas is expected to be minimal. Nonetheless, distribution patterns of sea ducks or other birds using the offshore environment within the project vicinity could be affected during dredging operations for construction and periodic nourishment. Congregation or rafting of sea ducks in these areas is primarily for loafing (Bob Nofsinger, pers. com.). Due to the depth in these areas (greater than 30'), they are not expected to provide a benthic food source for sea ducks. It is expected that since the area of ocean disturbed is small when compared to available loafing or foraging areas, any impacts would be minor.

Migratory shorebirds may use the project area for foraging and roosting habitat. As mentioned in Section 8.01.6 of this report, beach nourishment activities may temporarily impact the intertidal macrofauana community, a component of shorebird foraging habitat; however, recovery often occurs within 1 year if nourishment material is compatible with native sediments. Though these temporary impacts may occur to the shorebird prey base, adjacent un-impacted foraging habitat would be available while foraging habitat in the immediate disposal areas approach pre-project population levels. Considering that: 1.) areas of diminished prey base are temporary and isolated, 2.) recovery occurs within 1 year if material is compatible, and 3.) adjacent un-impacted foraging habitat is available throughout the project; foraging habitat will not be significantly impacted by the proposed action. A recent 2-year study in Brunswick County, NC documents in detail shorebird use there (USACE, 2003). This report indicated that beach nourishment had no measurable impact to bird use.

Though it is possible that shorebird nesting may occur within the project area during the spring and summer months (1 April – 31 August), most of these bird species have been displaced by development pressures and heavy recreational use along the beach; thus, traditional nesting areas on the project beach have been lost. Many of these bird species have retreated to the relatively undisturbed dredged material disposal islands, which border the navigation channels in the area. Nonetheless, it is possible that shorebird species may still attempt to nest in the project area (Sue Cameron, pers. comm.). To protect bird nesting, the North Carolina Wildlife Resources Commission (NCWRC) discourages beach work between 1 April and 31 August.

Though initial nourishment activities will extend into the 1 April bird nesting timeframe, to the maximum extent practicable the Corps will work with the NCWRC to plan construction around designated nesting areas. Under normal conditions, no construction should occur after 1 May, which is the established sea turtle nesting window. Based on the following considerations, the proposed construction activities will not significantly impact breeding and nesting shorebirds or colonial waterbirds within the project area: 1.) timing of the initial construction activities should only extend into the first month of the bird nesting timeframe with subsequent periodic nourishments adhering to the 1 April to 31 August bird nesting window 2.) for the period of time when construction will extend into the nesting timeframe, the Corps will coordinate with the NCWRC to plan construction activities around potential nesting areas, and 3.) beach nourishment and construction activities would avoid the designated Piping Plover Critical Habitat at the south end of Topsail Island. This area is most likely to support potential nesting shorebirds.

8.03 Physical Resources

8.03.1 Wave Conditions

Localized deepening of offshore borrow areas is the only potential source of impacts on wave conditions, however, these changes are not expected to be significant. The borrow area use plan identifies six detached, relatively small borrow areas scattered across an 8 or 9 mile swath in water depths of 40 to 50 feet, which should have less impact on wave conditions than dredging of a large, contiguous area. Initial construction will involve the deepest dredging, with an average cut of about 6 feet over roughly one-quarter of borrow area A. Renourishment will utilize (1) the remainder of borrow area A (with about 3 to 4 feet of average deepening) and (2) the other five, much smaller borrow areas that will involve only about 2 to 3 feet of deepening, which should result in negligible changes in wave conditions along the project shoreline.

8.03.2 Shoreline and Sand Transport

Existing water depths in the borrow areas range from 40 to 50 feet, which is substantially deeper than the estimated active profile depth of 23 feet. Therefore no impacts to the active profile are expected due to borrow area dredging.

Planform evaluation indicates that without project erosion rates of 0 to 3 feet per year will increase to 4 to 17 feet per year with a beachfill project in place, with rates increasing toward the ends of the project. Renourishment will take place every 4 years to replenish these losses, unless project monitoring indicates that renourishment can be reasonably delayed. Net movement of this material will be predominantly to the north based on transport analysis, with northerly sediment transport being roughly twice that of southerly transport on average.

8.03.3 Geology and Sediments

8.03.3.1 Borrow Area Dredging

About 6.5 square miles of sandy ocean bottom will be affected over the 50-year economic life of the project. Within the borrow areas (Figures A-1 and A-6, in Appendix A) existing water depths (greater than –30-foot NGVD) will be deepened, and recolonization of affected areas is expected within 1-3 years. Dredging in the selected borrow areas should not have an adverse impact on any hardbottoms in the area. Based on magnetometer and side-scan sonar survey of the selected borrow areas, there was no indication of any hardbottoms within the areas surveyed. See sections 8.0.1.7 and 8.0.1.8.2 for more information regarding borrow area dredging impacts and impacts to hardbottoms.

8.03.3.2 Beachfill Construction

Both pipeline and hopper dredging methods will be used during the construction phase. Pipeline dredging will be used in initial construction and hopper dredging will be used in later renourishment. Pipeline routes will extend from the seaward borrow areas to the beach and then follow the shoreline. Negative impacts during the construction phase will be minor and temporary. Potential impacts associated with this type of operation include:

1) Increased turbidity in the surf zone, and
2) Sedimentation of hardbottoms.

Impacts should be insignificant considering turbidity and sedimentation plumes will be confined to the offshore borrow areas during hopper dredging operations and hardbottoms were only identified within the vicinity of 2 of the 6 offshore borrow areas. No hardbottoms were found in the nearshore zone. See Section 8.01.8.2 for more information.

During nourishment operations, there will be an increase in the turbidity in the surf zone in the immediate area of sand deposition. Deposition and subsequent turbidity increases may have short-term impacts on surf zone fishes and prey availability. The anticipated construction timeframe for the project is from November 16 to April 30 and avoids the peak recruitment and abundance timeframe of the surf zone fishes. Considering the construction timeframe and the adaptive availability of representative organisms, the impacts should be temporary and minor. See Section 8.01.3 for more information.

8.03.3.3 Sediment Compatibility

The compatibility analysis compared the grain size of the "native beach" or the "reference beach" with the material in the proposed borrow areas. The overfill ratio is the primary indicator of the compatibility of the borrow material to the beach material, with a value of 1.00 indicating that one cubic yard of borrow material is needed to match one cubic yard

of beach material. The procedure for calculating the overfill ratio for borrow areas in relation to the reference beach was performed in accordance with the U.S. Army Corps of Engineers Coastal and Hydraulics Laboratory Automated Coastal Engineering System (ACES) software version 4.01. This procedure is discussed in section V-4-1.e.(2)i. of the U.S. Army Corps of Engineers Engineer Manual (EM) 1110-2-1100, part V, titled Coastal Engineering Manual. As stated in this manual, an overfill ratio of 1.00 to 1.05 is considered optimum for sediment compatibility. However, obtaining this level of compatibility is not always possible due to limitations in available borrow sites. The overfill ratios for all of the potential borrow areas for the Topsail Beach project are shown in Table 7.1. Table 7.1 also illustrates the average silt content (#200 sieve) was less than 10% for all borrow areas. Post construction studies conducted for beach erosion control projects have concluded the effects of beach fill operations on short-term turbidity appeared to be limited to the immediate area of the operation. Total suspended sediment concentrations outside the swash zone seldom exceed 25 milligrams per liter, a value comparable to concentrations many species experience in estuaries or during storms (USACE New York District, 2001). Because the project borrow area sediment generally consists of a low percentage of silt, post-project impacts to water quality are expected to be minimal. See Appendix E, Sand Compatibility Analysis, for additional information.

8.04 Socioeconomic Resources

8.04.1 Commercial and Recreational Fisheries

The economic impacts of the Selected Plan or other nourishment plans during construction are not expected to be significant. Impacts on shore fishing would be limited to the area where material is being placed on the beach. This localized temporary impact can easily be avoided by anglers in the area. Nearshore fishing boats can operate around the dredging equipment operating in the area. The beach nourishment plan is not expected to impact inside fishing or the operation of commercial fishing boats operating inside or going through New Topsail Inlet. Unless there is extreme weather, the ocean going dredge will operate continuously. Therefore, the economic impact of commercial and recreational fishing is not expected to change with the project construction.

8.05 Recreation and Esthetic Resources

Implementation of the proposed action may cause temporary reduction of esthetic appeal and interference with recreational activities in the areas of project construction. However, since project construction will be conducted in relatively small areas at any particular point in time, recreational and esthetic impacts will be localized. Also, construction and maintenance would be done between November 16 and 30 April, thereby avoiding the peak summer tourist season. Upon completion of work activities in any area, esthetic values and recreational opportunities will be restored or enhanced as construction equipment is moved away.

The ocean and navigable waters in the vicinity of Topsail Beach will be affected to only a minor extent in that dredges, barges, and other watercraft associated with the work would be on-site for several months during construction and during renourishment events. However, this is judged to be an insignificant effect.

Placement of beachfill will result in temporary use of dredge pipeline, bulldozers, and other equipment on the beach, and these objects will detract from the normal appearance of the beach. Also, recreational activities on beaches may experience some interruption or interference during work periods, but the degenerated, eroded conditions of the beaches already present recreational constraints. After work is completed on any beach and the heavy equipment is removed, the resulting wider beach is expected to represent an esthetic enhancement and an improvement for recreation.

One ocean pier, the Jolly Roger Pier is within the construction area. The placement of beach fill under this pier may temporarily reduce the area available for fishing. Beach nourishment during the fishing season may also impact the recreational catch. During past projects at Wrightsville Beach and Carolina Beach, no special provisions were made during placement of beach-fill around the piers and no major objections were raised during the process. However, for Atlantic Beach, during the pumpout of Brandt Island, the beach-fill was wider than usual, thus raising concerns from fishing interests. The Topsail Beach project is similar to the Wrightsville and Carolina Beach projects. In the vicinity of the pier, immediately following construction, the shoreline may extend out approximately 300 feet from its present position. However, natural forces will reshape the beach area and within a few months, beach fill material will be more evenly distributed throughout the nearshore zone. Following this redistribution of material it is expected that the new beach profile will extend out approximately 150 feet beyond its current position, thus having minimal impact on the 854-foot long pier. Any turbidity that may occur during placement will be dissipated during several tidal cycles and should have no significant long-term impact on fishing from either the pier or the surf zone. These impacts are not expected to significantly reduce public use at the pier.

Overall, esthetic and recreational impacts of the proposed action represent minor improvements.

8.06 Cultural Resources

Whereas the Topsail Beach vicinity is know to have had an active historical maritime trade, the Wilmington District, in consultation with the North Carolina Division of Archives and History, undertook contracted remote sensing survey designed to meet the intent of the National Historic Preservation Act and the Abandoned Shipwreck Act. During summer and fall of 2004, Mid-Atlantic Technology and Environmental Research, Inc conducted a magnetometer and side-scan sonar survey of the eight proposed borrow areas. The results of that survey are reported in *Archaeological Remote Sensing Survey of Topsail and West Onslow Beaches Offshore Borrow Areas (*Contract DACW54-03-D-0002, Order 0003, Wes Hall, Principal Investigator, December 2004). Data was collected

along parallel lines spaced at 65-foot (20-meter) intervals. Magnetic data, along with corresponding positioning data, was recorded at one-second sample intervals (or approximately every 8 feet along a track line at 5 knots).

No single, isolated magnetic anomalies or acoustic targets were identified during the survey of the eight borrow areas and no further cultural resources studies are anticipated for the project. By letter of November 2, 2004, the North Carolina State Historic Preservation Officer concurred with the reported findings.

No prehistoric sites were specifically considered in the survey. While there has been some success developing upland-offshore site location correlates in Florida and perhaps elsewhere, the methodology is not very well developed for sites within the Carolinas region, nor are there a significant number of upland locations that could be used to model settlement in now inundated areas. Monitoring may be a way to determine if such sites were encountered during dredging, but the use of heavy equipment throughout the renourishment process might make precise relocation of sites very difficult. The District will discuss the option of monitoring with archaeologists from the UAB. In their reviews of the project, the UAB has not mentioned prehistoric sites or impacts to other types of sites; shipwrecks have been the major concern. The SHPO letter accepting the final report of investigations is dated March 1, 2005 and is included in Appendix H of the integrated GRR/FEIS.

8.07 Water Resources

8.07.1 Hydrology

Marine waters of the project area display considerable daily variation in current and salinity conditions due to fresh water inflow, tides, and wind. Within the ocean environment, any project-induced changes in the vicinity of the proposed work would be very small (if any) in comparison and are, therefore, considered to be insignificant.

8.07.2 Water Quality

Dredging in the selected borrow areas would involve mechanical disturbance of the bottom substrate and subsequent redeposition of suspended sediment and turbidity generated during dredging. Factors that are known to influence sediment spread and turbidities are grain size, water currents and depths. Monitoring studies done on the impacts of offshore dredging indicate that sediments suspended during offshore are generally localized and rapidly dissipate when dredging ceases (Naqvi and Pullen, 1983; Bowen and Marsh, 1988, and Van Dolah *et al.*, 1992). Some infilling of the borrow area after dredging is expected from side sloughing of native bottom sediments which consist of predominately sandy material with a small amount of fine or organic material.

During construction, there will be elevated turbidity and suspended solids in the immediate area of sand deposition when compared to the existing non-storm conditions

of the surf zone. Significant increases in turbidity are not expected to occur outside the immediate construction/maintenance area (turbidity increases of 25 nephelometric turbidity units ((NTUs)) or less are not considered significant). Turbid waters (increased turbidity relative to background levels but not necessarily above 25 NTU's) will hug the shore and be transported with waves either northeast or southwest depending on wind conditions. Due to the low percentage of silt and clay in the borrow areas (<10 percent), turbidity impacts are not expected to be greater than the natural increase in turbidity and suspended material which occurs during storm events. Any increases in turbidity in the borrow areas during project construction and maintenance are expected to be temporary and limited to the area surrounding the dredging. Turbidity levels are expected to return to background levels in the surf zone upon cessation of dredging.

Overall water quality impacts of the proposed action are expected to be short-term and minor. Living marine resources dependent upon good water quality should not experience significant adverse impacts due to water quality changes.

A Section 401 Water Quality Certificate under the Clean Water Act of 1977 (PL 95-217), as amended, is required for the proposed project and is being requested from the North Carolina Division of Water Quality.

Pursuant to Section 404 of the Clean Water Act, the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) Guidelines Analysis in Appendix G. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404 (b)(1) Guidelines Analysis.

8.07.3 Groundwater

Dredging with beach placement of material will not adversely affect groundwater of the area. Groundwater in the area moves generally east and southeast along a regional gradient of about 8 feet per mile. The potential for saltwater intrusion into groundwater does not exist unless a reversal of hydrologic gradient occurs due to excessive groundwater pumping. Water supplies of nearby communities will not be affected by the proposed action.

8.08 Other Significant Resources (as per Sect. 122 of P. L. 91-611)

8.08.1 Air, Noise, and Water Pollution

Temporary increases in exhaust emissions from construction equipment are expected during the construction and periodic nourishment period, however, the pollution produced will be similar to that produced by other large pieces of machinery and should be readily dispersed. All dredges must comply with the applicable EPA standards. Additionally, ozone is North Carolina's most widespread air quality problem, particularly during the warmer months. High ozone levels generally occur on hot sunny days with

little wind, when pollutants such as nitrogen oxides and hydrocarbons react in the air. High levels of fine particles are more of a problem in the western Piedmont region but can occur throughout the year, particularly during episodes of stagnant air and wildfires. With the exception of initial construction, which will extend into April, the project will be constructed outside of ozone season. The air quality in Pender County, North Carolina, is designated as an attainment area. The State of North Carolina has a State Implementation Plan ("SIP") approved or promulgated under Section 110 of the Clean Air Act (CAA), however, for the following reasons, a conformity determination is not required:

a. 40 CFR 93.153 (b), "For Federal actions not covered by paragraph (a) of this section, a conformity determination is required for each pollutant where the total of direct and indirect emissions in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates in paragraphs (b) (1) or (2) of this section." Pender County has been designated by the State of North Carolina as an attainment area.

b. The direct and indirect emissions from the project fall below the prescribed deminimus levels (58 Fed. Reg. 93.153(c)(1)) and, therefore, no conformity determination would be required.

c. The project is located within the jurisdiction for air quality of the Wilmington Regional Office of the NCDENR. The ambient air quality for Pender County has been determined to be in compliance with the National Ambient Air Quality Standards. This project is not anticipated to create any adverse effect on the air quality of this attainment area and the project is in compliance with Section 176 (c) of the Clean Air Act, as amended.

Noise from construction equipment is slightly out of character for some of the project area; however, construction sounds will be readily attenuated by background sounds from wind and surf. Water quality impacts are discussed in Section 8.07.2 and in the Section 404(b)(1) (P.L. 95-217) evaluation included with this document as Appendix G.

8.08.2 Man-made and Natural Resources, Esthetic Values, Community Cohesion, and the Availability of Public Facilities and Services

Beach nourishment will require the extension of dune crossover structures along the beach. Dredging in the offshore borrow areas is not expected to cause significant interference with commercial and recreational boat traffic. The mobility of a hopper dredge will preclude any interference with regular commercial ship traffic as a result of travel to and from the borrow areas. For a hydraulic pipeline dredge, the pipeline from the borrow area to the disposal beach will be submerged until it reaches nearshore waters. The pipeline would be marked to let commercial and recreational boaters know of its presence along the bottom. Work barges and other appurtenances associated with a pipeline dredge operating in open water would be moored so as to minimize interference with boat traffic in the area.

Impacts to esthetic values are discussed in Section 8.05. Impacts to natural resources are discussed previous through Sections 8. Impacts to cultural resources are discussed in Section 8.06. Hurricane protection and beach erosion control will benefit numerous roads, business, and residences. The Selected Plan will have beneficial effects on community cohesion and will protect many public facilities and services (i.e. roads and utilities) from storm events.

8.08.3 Contaminated Sediments

The U.S. Army Corps of Engineers standard tiered approach for analyzing the potential for encountering contaminated sediments in the potential borrow areas was used to assess the potential borrow areas for contaminated sediments. According to this analysis, before any chemical or physical testing of sediments is conducted, a reason to believe that the sediments may be contaminated must be established. The sources of the sediments in the selected borrow areas are derived from sediment transport and deposition by ocean currents. The probability of the areas being contaminated by pollutants is low, however, the beach front (potential nourishment area) and the potential borrow areas are located in areas that were impacted by the operations of Camp Davis and the Navy's Operation Bumblebee.

Due to the location of the project area relative to Camp Davis operations, a very remote possibility exists that OEW could be present in the material to be dredged from offshore borrow areas. However, the only ordnance that would be expected to be encountered would be spent shells from anti-aircraft target practice. The missiles that were tested during Operation Bumblebee contained no OEW and were fired approximately 40 miles offshore, well beyond the project area and the likelihood of encountering them in an offshore borrow area is remote.

As described in Section 2.07, the anti-aircraft shells that were fired from the beach during WWII were presumed to range in size from 37 mm (1.46 inches) to 155 mm (6.10 inches). A cultural resources survey, which utilized magnetometer and side-scan sonar was completed for all proposed offshore borrow areas. Survey line spacing was 20 meters and no anomalies were found within the areas surveyed (See Section 8.06 for Cultural Resources summary). Although the cultural resources survey would have identified large anomalies, it was not intended to, nor capable of identifying smaller anomalies, such as anti-aircraft shells. Since the survey did not identify any anomalies, it is presumed that any materials found offshore would be small and therefore would not impede the dredging and disposal operations and would not present a safety hazard to workers on the dredge or to anyone on the beach. However, to mitigate the very remote chance of encountering ordnance, the beach will be inspected on a daily basis and any ordnance discovered will be handled in accordance with the Military Munitions Rule, 40 CFR 260-270. The Marine Corps Base Explosive Ordnance Disposal Team will be available ("on call") during the dredging process.

The bottom sediments that will be dredged from the borrow areas and placed on the beach will consist of predominately fine-to-medium grain size with some shell. Therefore, no further analyses or physical and chemical testing of the sediments is recommended. It is not expected that any hazardous and toxic waste sites would be encountered during construction or periodic nourishment. However, if any hazardous and toxic waste sites are identified, response plans and remedial actions will be the responsibility of the local sponsor.

8.08.4. SUMMARY OF CUMULATIVE EFFECTS

The detailed analysis of cumulative effects is included as Appendix J. The assessment of cumulative effects focused on impacts of dredging from the proposed ocean borrow sites, and impacts of placement of sand material on the beach (whether for beach nourishment or disposal of dredge maintenance material) on significant coastal shoreline resources In completing the cumulative effects analysis, we reviewed two Environmental Reports prepared for and published by the U.S. Department of the Interior, Minerals Management Service, entitled "Use of Federal Offshore Sand Resources for Beach and Coastal Restoration in New Jersey, Maryland, Delaware, and Virginia," dated November 1999 (DOI 1999) and "Collection of Environmental Data Within Sand Resource Areas Offshore North Carolina and the Environmental Implications of Sand Removal for Coastal and Beach Restoration," dated 2003 (Byrnes *et al.* 2003); the U.S. Army Corps of Engineers Dare County Beaches (Bodie Island Portion) Final Feasibility Report and EIS on Hurricane Protection, dated September 2000; and the U.S. Army Corps of Engineers Draft Evaluation Report and Environmental Assessment, Morehead City Harbor Section 933, dated May 2003, the last two of which included comprehensive assessments of state-wide cumulative impacts. In discussing the potential cumulative impacts of offshore borrow area dredging and beach nourishment, we considered time crowded perturbations, and space crowded perturbations, as defined below, to be pertinent to this action.

> ***Time crowded perturbations*** *– repeated occurrence of one type of impact in the same area.*
> ***Space crowded perturbations*** *– a concentration of a number of different impacts in the same area.*

Relatively small portions of North Carolina beaches (approximately 12 percent) are presently affected by these activities. With the proposed action, the impact area would not increase significantly since portions of the areas proposed for fill have previously had sand deposition. On a statewide scale, the existing and approved disposal sites are well distributed in northern, central and southern parts of the state with undeveloped protected beaches (i.e., National/Federal and State Parks and Estuarine Reserves) in between. It is unlikely that cumulative impacts from space crowded perturbation are occurring or will occur due to the construction of this project. The analysis suggests that the potential impact area from the proposed and existing actions is small relative to the area of available similar habitat on a vicinity and statewide basis. Also, for some species such as sea turtles and seabeach amaranth, beach projects will improve habitat by replacing beach material lost to erosion. Lastly, all impacted areas are expected to recover invertebrates, which should continue to be available as food resources.

9. PLAN IMPLEMENTATION

9.01 Project Schedule

Table 9.1 shows the schedule through initial construction for the Selected Plan. This schedule assumes expeditious review and approval of the project through all steps, including authorization and funding. Actual project implementation could take longer.

Table 9.1 – Project Schedule

Milestones	Forecast Date
Initiate General Re-evaluation	February 2001
Alternative Formulation Briefing	July 2004
Initial Draft GRR and EIS Begin 45-day Public Review	June 2006
Final Draft GRR and EIS Begin 30-day Public Review	April 2008
Signed Record of Decision	July 2008
Initiate Initial Plans & Specs	August 2008
Project Authorization	November 2008
Complete Initial Plans & Specs.	April 2009
Execute Project Cooperation Agreement	May 2009
Initiate Real Estate Acquisition	June 2009
Initiate Final Plans & Specs.	December 2010
Complete Real Estate Acquisition	May 2011
Complete Final Plans & Specs.	June 2011
Advertise Initial Construction Contract	July 2011
Open Bids for Initial Construction Contract	August 2011
Award Initial Construction Contract	September 2011
Complete Initial Beachfill Construction	April 2012
Complete Initial Construction All Items	June 2012

9.02 Division of Plan Responsibilities

9.02.1 General

Federal policy requires that costs for water resources projects be assigned 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 Section 103 of the Water Resources Development Act of 1986 (PL 99-662). For projects that provide protection to publicly owned shores, the purposes are usually (1) hurricane and storm damage reduction and (2) separable recreation. For the Topsail Beach project there is no separable recreation component.

9.02.2 Cost Sharing

The Selected Plan presented in this report is longer than that currently authorized and exceeds the Section 902 limit; therefore, implementation will require modification of the existing congressional authority.

Cost sharing for initial construction of the Selected Plan would be consistent with that specified in Section 103(c)(5) of WRDA 86 as amended by WRDA 96 (generally 65 percent Federal and 35 percent non-Federal). Non-Federal interests are required to provide all lands, easements, rights of way, and dredged material disposal areas and perform all necessary relocations (LERRD) necessary for the project. The value of the non-Federal portion of the LERRD is $1,403,000 (Table 7.2) and is included in the non-Federal share of initial project construction costs.

Cost sharing for the Locally Preferred Plan is modified to account for the extension of the dune at the south end. In reaches 3.1 and 3.2 Plan 1250X and 1250 have almost the same benefits, but Plan 1250X has a higher cost. The incremental analysis of the 2 plans shows that present value net benefits decrease by $136,000 (October 2004, 5.375% evaluation) as the scope of the plan is increased from Plan 1250 to Plan 1250X. Comparisons at other interest rates and price levels both against the 1250 plan and the 1550 plan for same project portion still resulted in a decrease in present value net benefits in the range of $120,000 to $180,000. Compared to the overall present value net benefits of roughly $70,000,000, this loss of net benefits is very small, but still is a decrease. As a result the cost difference is not cost shared and is a non-federal cost.

This cost difference can be estimated at October 2006 price levels based on quantity differences between Plan 1250X (LPP) and Plan 1250. The increase in cost is shown in Table 9.2. The cost difference escalated to October 2007 price levels is $273,000.

Table 9.2 Incremental Cost of Locally Preferred Plan, October 2006 levels

Item	Plan 1250X	Plan 1250	Increase	Unit cost	Cost, rounded
Beachfill, CY	3,223,000	3,188,000	35,000	$7.38 / CY	$258,000
Dune Vegetation, AC	48	47	1	$9,200 / AC	$9,000
Total Increase					$267,000

The incremental cost increase of $273,000 is not cost shared. The remaining initial cost of $31,858,000 is cost shared 65% Federal, or $20,707,700. This represents 64.4% of the total cost of $32,131,000. The overall non-Federal cash portion is $10,020,300. Including the non-Federal LERRD cost the resulting non-Federal share is $11,423,300, which is 35.6% of the total initial cost. Cost sharing for initial project costs is shown in Table 9.3.

Table 9.3 Initial Project Construction Cost Allocation and Apportionment, October 2007 price levels

INITIAL PROJECT CONSTRUCTION COSTS					
Project Purpose	Project First Cost	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Hurricane & Storm Damage Reduction	$32,131,000	-	-	-	-
Locally Preferred Plan, Incremental Cost	$273,000	100%	0%	$273,000	$0
Locally Preferred Plan, Shared Costs	$31,858,000	35%	65%	$11,150,300	$20,707,700
LERRD Credit				$1,403,000	$0
Cash Portion, Shared Costs				$9,747,300	$20,707,700
Hurricane & Storm Damage Reduction	$32,131,000	-	-	-	-
Locally Preferred Plan, Resulting Costs					
Cash Portion, Shared Costs				$9,747,300	$20,707,700
Cash Portion, Incremental Costs				$273,000	$0
Cash Portion, Resulting				$10,020,300	$20,707,700
LERRD Credit				$1,403,000	$0
Total and Effective Cost Sharing	$32,131,000	35.6%	64.4%	$11,423,300	$20,707,700

Costs incurred in the PED phase from project authorization in 1992 through completion of the GRR are classified as Sunk PED Costs. These Sunk PED costs include initial project PED costs of $616,000 and the GRR cost of $4,230,000 for a total of $4,846,000 and both are cost shared 75% federal and 25% non-federal. The Total Financial Initial Project Construction Costs is composed of both the Sunk PED Costs and the estimated Initial Project Construction Costs.

Cost sharing for periodic nourishment (continuing construction) would be consistent with Section 215 of WRDA 99, which requires that such costs be shared 50 percent Federal and 50 percent non-Federal.

Annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs, such as inspection costs and dune vegetation maintenance costs, are 100 percent non-Federal responsibility. The Federal Government is responsible for preparing and providing an OMRR&R manual to the sponsor.

As noted previously, current Federal policy requires that, unless there are other, overriding considerations, the plan that produces the maximum net benefits, the (NED) plan, will be the selected plan recommended for implementation. In this case, the selected plan recommended for implementation is the not NED plan, but is a smaller scope, Locally Preferred Plan (LPP). Cost sharing for all aspects of the LPP is shown in Table 9.4 at October 2007 price levels.

The sponsor is in the process of obtaining the required public access sites and public parking to meet the definition of a public shoreline. The cost apportionment is computed to expect that 100% of the project will be a public shoreline by the time the PCA is

executed. There will be no private-use shores. All project costs are allocated to the purpose of hurricane and storm damage reduction.

Table 9.4 Cost Allocation and Apportionment, October 2007 price levels

INITIAL PROJECT CONSTRUCTION COSTS					
Project Purpose	Project First Cost	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Hurricane & Storm Damage Reduction	$32,131,000	35.6%	64.4%	$11,423,300	$20,707,700
LERRD Credit				$1,403,000	
Cash Portion				$10,020,300	$20,707,700
TOTAL FINANCIAL INITIAL PROJECT CONSTRUCTION COSTS					
Project Purpose	Project First Cost	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Hurricane & Storm Damage Reduction	$32,131,000	35.6%	64.4%	$11,423,300	$20,707,700
Sunk PED Costs, Initial PED, Auth. Project	$616,000	25%	75%	$154,000	$462,000
Sunk PED Costs, GRR	$4,230,000	25%	75%	$1,057,500	$3,172,500
PED Cost share catch-up from 75/25 to 65/35				$484,600	($484,600)
Total Financial Cost	$36,977,000	35.5%	64.5%	$13,119,400	$23,857,600
PERIODIC RENOURISHMENT COSTS					
Project Purpose	Cost per Operation	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Hurricane & Storm Damage Reduction	$9,202,000	50%	50%	$4,601,000	$4,601,000
Project Purpose	Cost per Year	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
Monitoring	$240,000	50%	50%	$120,000	$120,000
ANNUAL OMRR&R COSTS					
Project Purpose	Cost per Year	Apportionment %		Apportionment $	
		Non-Federal	Federal	Non-Federal	Federal
General Repair, Maintenance, Inspection	$21,000	100%	0%	$21,000	$0

9.02.3 Financial Analysis

The non-Federal sponsor has submitted financial plans and statements of financial capability. Documentation of the sponsor's financial capability is provided in Appendix H.

9.02.4 Project Cooperation Agreement

The model Project Cooperation Agreement (PCA), based on the selected plan, was fully discussed with the non-Federal sponsor. The non-Federal sponsor has a clear understanding of the type of agreement that must be signed prior to the start of project construction. The terms of local cooperation to be required in the PCA are described in

Section 13.0, Recommendations. Letters of intent from the non-Federal sponsor are to be provided in Appendix H.

Federal commitments regarding a construction schedule or specific provisions of the PCA cannot be made to the non-Federal sponsor on any aspect of the recommended plan or separable element until:

- The recommended plan is authorized by Congress;
- Construction funds are provided by Congress, apportioned by the Office of Management and Budget, and their allocation is approved by the Assistant Secretary of the Army for Civil Works (ASA {CW}); and
- The draft PCA has been reviewed and approved by the ASA (CW).

The PCA would not be executed nor would construction be initiated on this project or any separable element until compliance requirements have been met for applicable Federal and state statutes. Compliance is met once the Final Environmental Impact Statement has been fully coordinated and a Record of Decision has been signed.

After this report is approved and the project budgeted for construction, Wilmington District can conduct negotiations with the non-Federal sponsor regarding the PCA, and submit a draft PCA package to higher authority for review and approval by the ASA (CW). The PCA would be executed only after approval of this report and enactment into law of an Appropriations Bill providing funds for this project. Federal construction funds for the project will not be allocated by the Chief of Engineers until the ASA (CW) approves the non-Federal sponsor's financing plan and the PCA has been executed.

9.03 Views of the Non-Federal Sponsor

The Selected Plan of Improvement is acceptable to the non-Federal sponsor. Letters of support from the Town of Topsail Beach are provided in Appendix H. The most recent is copied on the next page.

9.04 Views of the State of North Carolina

The State of North Carolina, Department of Environment and Natural Resources, Division of Water Resources (DWR) has supported beachfill as a measure to reduce coastal storm damages. DWR currently provides partial funding of the non-Federal cost share to the existing beachfill project sponsors.

9.05 Views of the U.S. Fish & Wildlife Service

Views of the USFWS are provided in the attached Final Fish and Wildlife Coordination Act Report in Appendix L. The recommendations of the USFWS and responses by USACE are presented in Section 11.02, Fish & Wildlife Coordination, of this report.

TOWN OF TOPSAIL BEACH NORTH CAROLINA

820 S. Anderson Blvd
Topsail Beach, North Carolina 28445
Telephone (910) 328-5841
Fax (910) 328-1560

March 5, 2008

Colonel John E. Pulliam, Jr.
Department of the Anny, Corps of Engineers
Wilmington District
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Dear Colonel Pulliam:

The purpose of this correspondence is to express and confirm our continued support of the proposed West Onslow Beach and New River Inlet (Topsail Beach) Shoreline Protection Project that was authorized by Section 101 of the Water Resources Development Act of 1992 and to thank you for the work that your office has accomplished.

We support Plan 1250x as our locally preferred plan. We understand the obligation of the local sponsor(s) to share the construction costs at a rate of 64.5% federal and 35.5% non federal, and the obligation of the local sponsor(s) to share in the post construction renourishment costs at a rate of 50% federal and 50% non federal.

We have been informed by the USACE that the project will be required to provide public beach access at a minimum of one access point, and associated parking for everyone half mile of the proposed project, which the Town will provide. Further, we have been informed that the estimated construction costs on the project as estimated based on October 2007 price levels will be approximately $32,131,000.00, and that the periodic renourishment efforts, which will occur approximately every four years, win cost an estimated $9,202,000.00. Estimated operating and maintenance cost will be approximately $21,000 per year.

The Town is in agreement with the project as presented and intends to sign a Project Cooperation Agreement when and as required. The Town gives its endorsement to the project and urges its early completion.

US Anny Corps of Engineers- Page 2

Mr. Steven Foster, Town Manager, will be the staff contact and Mr. Edward (Butch) Parrish will be the Topsail Beach Shoreline Protection Committee point of contact. The Town of Topsail Beach looks forward to our continued working with you and your staff on this important and needed project.

Sincerely,

Howard M. Braxton, Jr.

Howard M. Braxton, Jr.
Mayor

10. COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

10.01 General

The following paragraphs summarize the relationship of the proposed action to the most pertinent Federal, State, and local requirements. Table 10.1 lists the compliance status of all Federal Laws and Policies that were considered for the proposed Topsail Beach project.

10.02 Water Quality

10.02.1 Section 401 of Clean Water Act of 1977

A Section 401 Water Quality Certificate under the Clean Water Act of 1977 (PL 95-217), as amended, is required for the proposed project and is being requested from the North Carolina Division of Water Quality. Work will not proceed until the certificate is received.

10.02.2 Section 404 of Clean Water Act of 1977

Pursuant to Section 404 of the Clean Water Act, the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) evaluation in Appendix G. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404 (b)(1) Guidelines Analysis.

10.03 Marine, Protection, Research, and Sanctuaries Act

In 1972,Congress enacted the Marine Protection, Research and Sanctuaries Act (MPRSA), declaring that it is the policy of the United States to regulate the dumping of all types of materials into ocean waters. The Act is designed to prevent or strictly limit the dumping into ocean waters of any material, which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. The proposed shoreline protection project does not involve ocean disposal of dredged material. Therefore, the project is considered to be in compliance with the requirements of the MPRSA.

10.04 Essential Fish Habitat

Potential project impacts on Essential Fish Habitat species and their habitats have been evaluated and are addressed in Section 8.01.8 of this document. It has been determined that the proposed action will not have a significant adverse effect on these resources. By coordination of this document with the National Marine Fisheries Service, consultation is

officially initiated and concurrence with our findings is requested. Compliance obligations related to Essential Fish Habitat provisions of the 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265) will be fulfilled prior to initiation of the proposed action.

10.05 Fish and Wildlife Resources

The Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661, et seq), requires that the Corps of Engineers coordinate and obtain comments from the USFWS, the National Marine Fisheries Service, where applicable, and appropriate state fish and wildlife agencies, including the North Carolina Division of Marine Fisheries and the North Carolina Wildlife Resources Commission. A Final Fish and Wildlife Coordination Act Report (Appendix L) has been provided by the USFWS under the Fish and Wildlife Coordination Act.

10.06 Endangered and Threatened Species

A biological assessment evaluating the potential impacts of the proposed action on endangered and threatened species has been prepared (Appendix I) and is being coordinated with the USFWS (jurisdiction over the Florida manatee, nesting sea turtles, piping plovers, and seabeach amaranth) and NMFS (jurisdiction over other protected marine and aquatic species which may occur in the project vicinity) pursuant to Section 7 of the Endangered Species Act of 1973 (PL 93-205), as amended. Based on correspondence with the USFWS (Attachment C - USFWS letter dated January 9, 2007), informal consultation is appropriate for meeting Section 7 requirements for the proposed project. All compliance obligations under Section 7 will be satisfied prior to implementation of the proposed action.

10.06.1 Commitments To Reduce Impacts To Listed Species

The following list is a summary of environmental commitments to protect listed species related to the construction and maintenance of the proposed project. These commitments address agreements with agencies, mitigation measures, and construction practices and should be considered preliminary. The list of commitments may be modified pending new information acquired through the public and agency review process.

1. The National Marine Fisheries Service Regional Biological Opinion for the continued hopper dredging of channels and borrow areas in the southeastern United States dated 25 September, 1997 will be strictly adhered to. Furthermore, Hopper dredging activities will comply with the South Atlantic Division Corps of Engineers hopper dredging protocol which requires a hopper dredging window of 1 December to 31 March, the use of turtle deflecting dragheads, inflow and/or overflow screening, and NMFS certified turtle and whale observers.

2. In order to determine the potential taking of whales, turtles and other species by hopper dredges, NMFS certified observers will be on board the hopper dredges during

construction. To the maximum extent feasible, the observers will record all species taken along with length and weight and any unusual circumstances that might have led to the species capture. Observers will also record all whale observations within the project vicinity

3. Monitoring of sea turtle nesting activities in beach nourishment areas will be required to assess post nourishment nesting activity. This will include daily surveys beginning at sunrise from May 1 until September 15. Information on false crawl location, nest location, and hatching success of all nests will be recorded. The beach will be monitored for escarpment formation prior to each nesting season. If an escarpment exceeds 18 inches for a distance of 100 ft. it will be leveled.

4. Monitoring for seabeach amaranth on Topsail Beach will be required to assess the post nourishment presence of plants. This survey will be broken down into 5 survey reaches (A1, A2, A3, A4, B) in accordance with the designated USACE seabeach amaranth survey reaches from 1991-2004 in order to maintain consistent data and survey techniques over time.

5. The Corps will implement precautionary measures for avoiding impacts to manatees during construction activities as detailed in the "Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters" established by the USFWS.

10.07 Cultural Resources

Significant impacts to known archaeological or historic resources are not anticipated due to the proposed work. Project-specific historic survey data have been coordinated with the NCSHPO, and concurrence has been obtained that the proposed action will not cause significant adverse impacts to submerged cultural resources.

No prehistoric sites were specifically considered in the survey. While there has been some success developing upland-offshore site location correlates in Florida and perhaps elsewhere, the methodology is not very well developed for sites within the Carolinas region, nor are there a significant number of upland locations that could be used to model settlement in now inundated areas. Monitoring may be a way to determine if such sites were encountered during dredging, but the use of heavy equipment throughout the renourishment process might make precise relocation of sites very difficult. The need for monitoring will be discussed with archaeologists from the NC Division of Archives and History Underwater Archeology Branch (UAB). In past reviews of the project, the UAB has not mentioned prehistoric sites or impacts to other types of sites; shipwrecks have been the major concern. The SHPO letter accepting the final report of investigations is dated March 1, 2005 and is included in Appendix H.

10.08 Executive Order 11988 (Flood Plain Management)

This Executive Order was enacted to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. IWR Report 96-PS-1, FINAL REPORT: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program, June 1996 states: "The presence of a Corps project has little effect on new housing production. The econometric results presented imply that general economic growth of inland communities is sufficient by itself to drive residential development of beachfront areas at a rapid pace. The statistical evidence indicates that the effect of the Corps on induced development is, at most, insignificant, compared to the general forces of economic growth which are stimulating development in these areas, many of which are induced through other municipal infrastructure developments such as roads, wastewater treatment facilities, etc. The results presented for beachfront housing price appreciation are consistent with the findings from the more general econometric model of real estate development in beachfront communities. The increasing demand for beachfront development can be directed related to the economic growth occurring in inland areas. There is no observable significant effect on the differential between price appreciation in inland and beachfront areas due to Corps activity. The housing price study could not demonstrate that Corps shore protection projects influence development. Corps activity typically **follows** significant development." In fact, the requirements for Federal participation in coastal storm damage reduction projects essentially dictate that these projects be constructed along areas that have a high degree of development. Placement of beachfill will occur in the floodplain of area beaches. This placement will be conducted specifically for its beneficial effect in offsetting erosion and restoring damaged beaches, and is, therefore judged acceptable. The action is expected to have an insignificant effect on the floodplain, therefore, the proposed action is in compliance with the requirements of Executive Order 11988 and with State/local flood plain protection standards.

10.09 Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 directs all Federal agencies to issue or amend existing procedures to ensure consideration of wetlands protection in decision making and to ensure the evaluation of the potential impacts of any new construction proposed in a wetland. The proposed action would not require filling any wetlands and would not produce significant changes in hydrology or salinity affecting wetlands. The proposed action is in compliance with Executive Order 11990.

10.10 Executive Order 13186 (Responsibilities of Federal Agencies To Protect Migratory Birds)

Executive Order 13186 directs departments and agencies to take certain actions to further implement the Migratory Bird Treaty Act (MBTA). Specifically, the Order directs Federal agencies, whose direct activities will likely result in the take of migratory birds, to develop and implement a Memorandum of Understanding (MOU) with the FWS that shall promote the conservation of bird populations. The proposed project would not adversely affect migratory birds and therefore, is in compliance with EO 13186.

10.11 Executive Order 12898 (Environmental Justice)

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, states that each Federal agency must make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high adverse human health and environmental effects of its programs, policies, and activities on minority populations and low income populations, particularly when such analysis is required by NEPA. The EO emphasizes the importance of NEPA's public participation process, directing that each Federal agency shall provide opportunities for community input in the NEPA process. Agencies are further directed to identify potential effects and mitigation measures in consultation with affected communities. The proposed project will improve and stabilize a degraded, erosive shoreline. All project impacts will be addressed and the NEPA document, which will be fully coordinated with the public. Therefore, the project will comply with EO 12898.

10.12 Outer Continental Shelf Lands Act

The Outer Continental Shelf (OCS) law provides the Secretary of the Interior, on behalf of the Federal Government, with authority to manage the mineral resources, including oil and gas, on the OCS. The Minerals Management Service (MMS) Leasing Division is charged with environmentally responsible management of Federal Outer Continental Shelf (OCS) sand and gravel resources. The OCS is a zone that generally extends from 3 nautical miles seaward of the coastal State boundaries out to nautical 200 miles. Approximately 60% of the potential borrow material for the Topsail Beach project is located within the OCS. Public Law 102-426 (43 U.S.C. 1337(k)(2)), enacted 31 October 1994, gave MMS the authority to negotiate, on a noncompetitive basis, the rights to OCS sand, gravel, and shell resources for shore protection, beach or wetlands restoration projects, or for use in construction projects funded in whole or part by or authorized by the Federal government.

Under Public Law 103-426 (see Appendix 1), both agencies, in this case the Corps or Engineers and MMS, will sign a Memorandum of Agreement (MOA) that describes the project and procedures, ensuring environmental and administrative requirements are met. Coordination with MMS is ongoing and the required MOA will be signed prior to

completion of the Chief of Engineers Report and the signing of the Record of Decision (ROD). The MOA will indicate that the MMS is working with Federal, State, or local governments on a negotiated agreement for the sand. The MMS then will notify the appropriate party that a request for a negotiated agreement is needed. The MMS will not issue a lease until all applicable Federal requirements have been appropriately satisfied. Coordination with MMS is ongoing and all MMS requirements will be met prior to start of construction.

10.13 North Carolina Coastal Management Program

The proposed action will be conducted in the designated coastal zone of the State of North Carolina. Pursuant to the Federal Coastal Zone Management Act (CZMA) of 1972, as amended (PL 92-583), Federal activities are required to be consistent, to the maximum extent practicable, with the Federally approved coastal management program of the state in which their activities will occur. The components of the proposed action have been evaluated and determined to be consistent with the NC Coastal Management Program and local land use plans. Concurrence with this determination is being requested from the NC Division of Coastal Management.

10.13.1 Areas of Environmental Concern (15A NCAC 07H .0204)

The selected plan would take place in areas under the North Carolina Coastal Management Program designated as AEC (15A NCAC 07H). Specifically, the activities may affect the following AECS: Coastal Wetlands, Estuarine Waters, Public Trust Areas, Coastal Shorelines, and Ocean Hazard Areas. The following determination has been made regarding the consistency of the proposed project with the State's management objective for each AEC affected:

Coastal Wetlands. Coastal wetlands are defined as any salt marsh or other marsh subject to regular or occasional flooding by tides, including wind tides (whether or not the tide waters reach the marshland areas through natural or artificial watercourses), provided this shall not include hurricane or tropical storm tides. The highest priority of use shall be allocated to the conservation of existing coastal wetlands. Second priority of coastal wetland use shall be given to those types of development activities that require water access and cannot function elsewhere. Unacceptable land uses may include, but would not be limited to, the following examples: restaurants and businesses; residences, apartments, motels, hotels, and trailer parks; parking lots and private roads and highways; and factories. Examples of acceptable land uses may include utility easements, fishing piers, docks, and agricultural uses, such as farming and forestry drainage, as permitted under North Carolina's Dredge and Fill Act or other applicable laws. The management objective is to conserve and manage coastal wetlands so as to safeguard and perpetuate their biological, social, economic and esthetic values; to coordinate and establish a management system capable of conserving and utilizing coastal wetlands as a natural resource essential to the functioning of the entire estuarine system. Although dredge pipelines may cross coastal wetlands during renourishment events, impacts would be

minor and temporary and therefore, consistent with the management objective for this AEC.

Estuarine Waters. Estuarine waters are defined in G.S. 113A-113(b)(2) to include all the waters of the Atlantic Ocean within the boundary of North Carolina and all the waters of the bays, sounds, rivers and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters. The highest priority of use shall be allocated to the conservation of estuarine waters and their vital components. Second priority of estuarine waters use shall be given to those types of development activities that require water access and use which cannot function elsewhere such as simple access channels; structures to prevent erosion; navigation channels; boat docks, marinas, piers, wharfs, and mooring pilings. The management objective is to conserve and manage the important features of estuarine waters so as to safeguard and perpetuate their biological, social, esthetic, and economic values; to coordinate and establish a management system capable of conserving and utilizing estuarine waters so as to maximize their benefits to man and the estuarine and ocean system. The selected plan would not involve estuarine waters and therefore will not be detrimental to estuarine waters.

Public Trust Areas. These areas include (1) waters of the Atlantic Ocean and the lands thereunder from the mean high water mark to the 3 nautical mile limit of state jurisdiction, (2) all natural bodies of water subject to measurable lunar tides, and all lands thereunder, to the mean high water mark, and (3) all navigable natural bodies of water, and all lands thereunder, except privately owned lakes to which the public has no right of access. Acceptable uses include those that are consistent with protection of the public rights for navigation and recreation, as well as conservation and management to safeguard and perpetuate the biological, economic, and esthetic value of these areas. The management objective is to protect public rights for navigation and recreation and to conserve and manage the public trust areas so as to safeguard and perpetuate their biological, economic and esthetic value. Placement of beach compatible material on Topsail Beach will result in a wider, more stable beach, thus enhancing recreational opportunities, biological habitat and economic and aesthetic values. For a more thorough discussion of project impacts, please see Section 8 Environmental Effects, of the FEIS, specifically Sections 8.05 Recreational and Esthetic Resources, 8.04 Socio-Economic Resources, 8.01 Marine Environment, and 8.02 Terrestrial Environment. The selected plan is an acceptable use within public trust areas and will not be detrimental to the biological and physical functions of Public Trust Areas.

Coastal Shorelines. The Coastal Shorelines category includes estuarine shorelines and public trust shorelines. Estuarine shorelines AEC are those non-ocean shorelines extending from the normal high water level or normal water level along the estuarine waters, estuaries, sounds, bays, fresh and brackish waters, and public trust areas. Acceptable uses shall be limited to those types of development activities that will not be detrimental to the public trust rights and the biological and physical functions of the estuarine and ocean system. The management objective is to ensure that shoreline development is compatible with both the dynamic nature of coastal shorelines as well as

the values and the management objectives of the estuarine and ocean system. Other objectives are to conserve and manage the important natural features of the estuarine and ocean system so as to safeguard and perpetuate their biological, social, esthetic, and economic values; to coordinate and establish a management system capable of conserving and utilizing these shorelines so as to maximize their benefits to the estuarine and ocean system and the people of North Carolina. The selected plan would not involve estuarine shorelines and therefore will not be detrimental to these areas. Please see the paragraph above regarding Public Trust Areas and the references to pertinent sections of the FEIS for information regarding public trust shorelines. Additionally, as discussed in Appendix J (Cumulative Effects) of the FEIS, on a regional basis, renourishment projects add material to the longshore transport system, thus providing positive impacts. Although a regional sediment budget analysis has not been completed, it is expected that the proposed action and the combined effects of all other existing and proposed beach projects will have a minimal effect on shoreline and sand transport. Therefore, the proposed project would not be expected to negatively impact coastal shorelines.

Ocean Hazard Areas. These areas are considered natural hazard areas along the Atlantic Ocean shoreline where, because of their special vulnerability to erosion or other adverse effects of sand, winds, and water, uncontrolled or incompatible development could unreasonably endanger life or property. Ocean hazard areas include beaches, frontal dunes, inlet lands, and other areas in which geologic, vegetative and soil conditions indicate a substantial possibility of excessive erosion or flood damage. The specific Ocean Hazard Areas and potential project impacts are described below.

Ocean Erodible Area. This is the area in which there exists a substantial possibility of excessive erosion and significant shoreline fluctuation. The seaward boundary of this area is the mean low water line. The landward extent of this area is determined as follows:

(a) a distance landward from the first line of stable natural vegetation to the recession line that would be established by multiplying the long-term annual erosion rate times 60, provided that, where there has been no long-term erosion or the rate is less than two feet per year, this distance shall be set at 120 feet landward from the first line of stable natural vegetation. For the purposes of this Rule, the erosion rates shall be the long-term average based on available historical data. The current long-term average erosion rate data for each segment of the North Carolina coast is depicted on maps entitled "Long Term Annual Shoreline Change Rates updated through 1998 and approved by the Coastal Resources Commission on January 29th, 2004 (except as such rates may be varied in individual contested cases, declaratory or interpretive rulings). Erosion rates are variable along Topsail Beach. See Appendix D (Figure D-5) for a comparison of the shoreline rate change, referenced above, to recently computed erosion rates at Topsail Beach.

(b) a distance landward from the recession line established in Sub-Item (1)(a), above, to the recession line that would be generated by a storm having a one percent chance of being equaled or exceeded in any given year.

Construction of the proposed beach template, which consists of 12-foot elevation dune (NGVD) and 50-foot wide berm, will result in a wider, more stable beach, thus providing significant benefits to the ocean erodible area. Beach-related work, including the discharge of dredged material, the associated temporary operation of heavy equipment, and placement of dredge pipeline, would not cause any significant adverse effects to the ocean erodible area.

High Hazard Flood Area. This is the area subject to high velocity waters (including, but not limited to, hurricane wave wash) in a storm having a one percent chance of being equaled or exceeded in any given year, as identified as zone V1-30 on the flood insurance rate maps of the Federal Insurance Administration, U.S. Department of Housing and Urban Development. Placement of beach nourishment on the beach would provide short-term protection benefits for high hazard flood areas.

Inlet Hazard Area. The inlet hazard areas are natural-hazard areas that are especially vulnerable to erosion, flooding and other adverse effects of sand, wind, and water because of their proximity to dynamic ocean inlets. This area shall extend landward from the mean low water line a distance sufficient to encompass that area within which the inlet will, based on statistical analysis, migrate, and shall consider such factors as previous inlet territory, structurally weak areas near the inlet (such as an unusually narrow barrier island, an unusually long channel feeding the inlet, or an overwash area), and external influences such as jetties and channelization. In all cases, this area shall be an extension of the adjacent ocean erodible area and in no case shall the width of the inlet hazard area be less than the width of the adjacent ocean erodible area. While components of the proposed action may involve the movement of equipment across these areas, no construction or periodic nourishment activities are proposed for these areas, and no adverse impacts are anticipated.

10.13.2 Use Standards (15A NCAC 07H .0208)

Primary Nursery Areas. With the exception of navigation channels, these include most estuarine waters of the project vicinity, including those bounded by New River (north), Mason Inlet (south), AIWW (west), and the landward side of Topsail Island. Protection of juvenile fish is provided in these areas through prohibition of many commercial fishing activities, including the use of trawls, seines, dredges, or any mechanical methods of harvesting clams or oysters (http://www.ncfisheries.netirules.htm; 15 NC Administrative Code 3B .1405). Primary nursery Areas (Figure A-3) will not be directly impacted by this project. However, PNA's located adjacent to the New Topsail Inlet vicinity may experience indirect and short-term elevated turbidity levels from the nourishment operation on the shoreface. These turbidity effects are dependent on the location of the outflow pipe and the direction of longshore and tidal currents. Considering these elevated

turbidity levels will be short-term and within the range of elevated turbidity from natural storm events, the impacts to state-designated PNA's are insignificant (FEIS Section 8.01.8.7).

Outstanding Resource Waters. Waters of the AIWW from Daybeacon 17 (between Chadwick Bay and Alligator Bay) to Morris Landing (south of Spicer Bay) and waters of Topsail Sound southward from approximately New Topsail Inlet to Middle Sound are classified as "SA ORW" (Figure A-5). As stated above, waters in the vicinity of New Topsail Inlet may experience temporary elevated turbidities over existing conditions during initial construction and renourishment. Monitoring studies done on the impacts of offshore dredging indicate that sediments suspended during offshore are generally localized and rapidly dissipate when dredging ceases (Naqvi and Pullen, 1982: Bowen and Marsh, 1988, and Van Dolah *et al.*, 1992). Overall water quality impacts of the proposed action are expected to be short-term and minor. Living marine resources dependent upon good water quality should not experience significant adverse impacts due to water quality changes. Therefore, no impacts to ORW in the vicinity of the project, with the exception of minor, short-term impacts in the vicinity of New Topsail Inlet, would be expected. See Section 8.07.2 of the FEIS for more information on water quality.

Submerged Aquatic Vegetation (SAV). As depicted in the FEIS, Table 8.1 Categories of Essential Fish Habitat and Habitat Areas of Particular Concern in the Project Vicinity and Potential Impacts, SAV does not occur in or near the project vicinity and would not be directly or indirectly impacted by the proposed project. Please see section 10.13.8 for compliance with 15A NCAC 07H. 0208(b)(12) Submerged Lands Mining.

10.13.3 Shoreline Erosion Policies (15A NCAC 07M .0202)

Pursuant to Section 5, Article 14 of the North Carolina Constitution, proposals for shoreline erosion response projects shall avoid losses to North Carolina's natural heritage. All means should be taken to identify and develop response measures that will not adversely affect estuarine and marine productivity. As discussed in detail in Section 8.01 Marine Environment and Appendix J Cumulative Effects of the FEIS, the project is not expected to result in adverse impacts to estuarine and marine productivity.

The public right to use and enjoy the ocean beaches must be protected. The protected uses include traditional recreational uses (such as walking, swimming, surf fishing, and sunbathing) as well as commercial fishing and emergency access for beach rescue services. The Army Corps of Engineers has several requirements that must be met in order to fully cost share in a shore protection project (see ER 1105-2-100 and ER 1165-2-130). One of these requirements is that the beaches must be available for public use. As described in ER 1165-2-130 (Federal Participation in Shore Protection, paragraph 6.h.) public use implies reasonable access and parking. The Corps' Wilmington District, additionally, has developed more specific public access and parking requirements for

participation in shore protection projects within the District's boundaries of North Carolina and Virginia. Public Access and Parking is discussed in detail in Appendix F of the FEIS.

Erosion response measures designed to minimize the loss of private and public resources to erosion should be economically, socially, and environmentally justified. The FEIS demonstrates that the proposed shore protection project at Topsail Beach is economically, socially and environmentally justified. Pertinent sections of the FEIS include: Section 7.08 Economics of the Selected Plan, Section 8.00 Environmental Effects, Appendix B Economic Analyses, Appendix I Biological Assessment, and Appendix J Cumulative Effects.

The following are required with state involvement (funding or sponsorship) in beach restoration and sand renourishment projects: The entire restored portion of the beach shall be in permanent public ownership and it shall be a local government's responsibility to provide adequate parking, public access, and services for public recreational use of the restored beach. Public ownership of the shore in the town of Topsail Beach includes dedicated roads and lands below mean high water (MHW) owned by the State of North Carolina. Other parcels are owned by the Town of Topsail Beach, including the following: Coastal Area Management Act (CAMA) public access points, ends of all roads, and six beach front parcels maintained for public use. The primary ownership of oceanfront parcels is private, including one fishing pier. The entire restored portion of the beach is in public ownership. Other information related to ownership of the shoreline is contained in Appendix M - Real Estate. Parking, public access and services for the public recreational use of the restored beach are addressed in preceding paragraphs, above. Additionally, details are available in Appendix F of the FEIS.

10.13.4 Shorefront Access Policies (15A NCAC 07M .0300)

Pursuant to 15A NCAC 07M .0300, the public has traditionally and customarily had access to enjoy and freely use the ocean beaches and estuarine and public trust waters of the coastal region for recreational purposes and the State has a responsibility to provide continuous access to these resources. It is the policy of the State to foster, improve, enhance and ensure optimum access to the public beaches and waters of the 20 county coastal region. Access shall be consistent with rights of private property owners and the concurrent need to protect important coastal natural resources such as sand dunes and coastal marsh vegetation. At Topsail Beach, public access from public roads and streets to the beach are provided at 22 designated access points. There are a total of 374 parking spaces available to the general public near these access points. In addition, the town has indicated in a more recent count during the summer of 2004, there may be at least 300 additional parking spaces unaccounted for on the rights of way (ROW) along town streets. (Appendix F). As previously stated, the Army Corps of Engineers has several requirements that must be met in order to fully cost share in a shore protection project (see ER 1105-2-100 and ER 1165-2-130). ER1165-2-130 stipulates that in order to qualify for Federal cost sharing of Hurricane and Storm Damage Reduction projects,

the local community must, at a minimum, provide public access every 1/2 mile and parking with a 1/4 mile radius of those access points. The Wilmington District has further established a ten-space minimum for parking lots within 1/4 mile of each required public access point (Appendix F of the FEIS).

10.13.5 Mitigation Policy (15A NCAC 07M .0701)

It is the policy of the State of North Carolina to require that adverse impacts to coastal lands and waters be mitigated or minimized through proper planning, site selection, compliance with standards for development, and creation or restoration of coastal resources. Coastal ecosystems shall be protected and maintained as complete and functional systems by mitigating the adverse impacts of development as much as feasible by enhancing, creating, or restoring areas with the goal of improving or maintaining ecosystem function and areal proportion. Section 7.03.6 Environmental Monitoring and Commitments of the FEIS, provides a brief summary of environmental commitments to protect listed species related to the construction and maintenance of the proposed project. Further information on the development and details of these commitments is contained in Appendix I, Biological Assessment. Additionally, recently, as a mitigation condition of the 401 water quality certificate for the Morehead City 933 project, the Corps participated in funding a study performed by Philip S. Kemp Jr., of the Carteret Community College, to investigate the feasibility of harvesting, holding, and culturing Donax spp. for resource enhancement aquaculture. The Corps will consider providing funds to continue this type of data collection in order to develop management guidelines and effective measures to mitigate identified impacts to these resources. Such a funding action would be fully coordinated with all concerned agencies. The existing commitments with agencies and construction practices may be modified following public review of the EIS and resolution of comments received.

10.13.6 Coastal Water Quality Policies (15A NCAC 07M .0800)

Pursuant to 15A NCAC 07M.0800, no land or water use shall cause the degradation of water quality so as to impair traditional uses of the coastal waters. Protection of water quality and the management of development within the coastal area is the responsibility of many agencies. The general welfare and public interest require that all state, federal and local agencies coordinate their activities to ensure optimal water quality. Overall water quality impacts of the proposed action are expected to be short-term and minor. Living marine and estuarine resources dependent upon good water quality are not expected to experience significant adverse impacts due to water quality changes. A Section 401 Water Quality Certificate under the Clean Water Act of 1977 (PL 95-217), as amended, is required for the proposed project and will be requested from the North Carolina Division of Water Quality at the appropriate time. Project construction will not begin until a Water Quality Certification has been received. For a full discussion of water resources and potential project impacts, please see Sections 2.06 and Section 8.07 Water Resources, of the FEIS, which address hydrology, water quality and groundwater. Pursuant to Section 404 of the Clean Water Act, the impacts associated with the

discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) Guidelines Analysis in Appendix G. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404 (b)(1) Guidelines Analysis. Pursuant to the Sedimentation Pollution Control Act of 1973, a State approved soil erosion and sedimentation control plan would be implemented during construction to minimize soil loss and erosion.

10.13.7 Policies On Beneficial Use And Availability Of Materials Resulting From The Excavation Or Maintenance Of Navigational Channels (15A NCAC 07M .1100)

It is the policy of the State of North Carolina that material resulting from the excavation or maintenance of navigation channels be used in a beneficial way wherever practicable. Policy statement .1102 (a) indicates that "clean, beach quality material dredged from navigation channels within the active nearshore, beach, or inlet shoal systems must not be removed permanently from the active nearshore, beach, or inlet shoal system unless no practicable alternative exists. Preferably, this dredged material will be disposed of on the ocean beach or shallow active nearshore area where environmentally acceptable and compatible with other uses of the beach." Several navigation channels are within the Topsail Beach project vicinity. They are the Atlantic Intracoastal Waterway (AIWW), New Topsail Inlet and Connecting Channels and New River Inlet. When practicable, beach compatible, maintenance dredged material from these navigation channels will be placed on the nourished beach. However, dredged material from navigation channels would be purely supplemental material that would help maintain the project profile.

10.13.8 Policies on Ocean Mining (15A NCAC 07M .1200) and 15A NCAC 07H. 0208(b)(12) Submerged Lands Mining

Mining activities impacting the federal jurisdiction ocean and its resources can, and probably would, also impact the state jurisdictional ocean and estuarine systems and vice-versa. Therefore, it is state policy that every avenue and opportunity to protect the physical ocean environment and its resources as an integrated and interrelated system will be utilized. Cultural resources and hardbottom surveys of the offshore borrow areas have been completed. No single, isolated magnetic anomalies or acoustic targets were identified during the survey of the eight borrow areas and no further cultural resources studies are anticipated for the project. By letter of November 2, 2004, the North Carolina State Historic Preservation Officer concurred with the reported findings. Based on side scan sonar, no hardbottom was identified in the proposed borrow areas, and only 2 of the six borrow areas are within the vicinity of offshore hardbottom with the nearest distance to hardbottom being approximately 2,000 feet. Appendix S, Technical Memorandum, Topsail Beach Benthic Community Characterization Survey, Pender County, NC, May 2007, concluded that the benthic community found within the six proposed borrow sites off Topsail Beach is similar in composition and taxa dominance to those described in other studies along the North Carolina and South Carolina coasts (Byrnes *et al.* 2003;

Versar 2002, 2006; and Posey and Alphin 2000, 2002). Dredging impacts to the benthic populations of the marine ecosystem from turbidity are local and temporary but not permanent. Similarly, recent studies show that benthic impacts may be limited to the immediate vicinity of dredging operations. Also, to minimize impacts work will be performed between November 16 and April 30 of any given year, during times of low biological activity. Considering that: (1) no cultural resources sites are present in the area, (2) no hardbottoms were identified in or near the proposed offshore disposal sites, and (3) the effects of turbidity and sedimentation plumes on offshore hardbottom will be insignificant, the project is not expected to adversely impact the state jurisdictional ocean and estuarine systems. Please refer to the following sections of the FEIS for more detailed information: Section 2.01 Marine Environment, 2.05 Cultural Resources, 7.04.1 Borrow Area Use Plan, 8.01 Marine Environment, 8.06 Cultural Resources, Appendix I Biological Assessment, and Appendix J Cumulative Effects.

The proposed shore protection project at Topsail Beach conforms to the relevant enforceable policies of Subchapters 7H and 7M of Title 15A of North Carolina's Administrative Code.

10.13.9 Other State Policies

The proposed project has been determined to be consistent with other state policies found in the State's Coastal Management Program document that are applicable. These include:

North Carolina Mining Act. The removal of material from the offshore borrow areas that are within three nautical miles of shore have been reviewed by the North Carolina Division of Land Resources and a determination has been made that removal of sand from the sea floor within the three nautical miles territorial limits is not an activity that would be classified as mining under the North Carolina Mining Act (G. S. 74-7). "Mining" is defined as:

(a) The breaking of the surface soil in order to facilitate or accomplish the extraction or removal of mineral, ores, or other solid matter.
(b) Any activity or process constituting all or part of a process for the extraction or removal of minerals, ores, soils, and other solid matter from their original location.
(c) The preparation, washing, cleaning, or other treatment of minerals, ores, or other solid matter so as to make them suitable for commercial, industrial, or construction use.

North Carolina Dredge and Fill Law (G.S. 113-229). Pursuant to the North Carolina Dredge and Fill Law clean, beach quality material dredged from navigational channels within the active nearshore, beach or inlet shoal systems shall not be removed permanently from the active nearshore, beach or inlet shoal system. This dredged material shall be disposed of on the ocean beach or shallow active nearshore area where it is environmentally acceptable and compatible with other uses of the beach. As previously discussed, when practicable, clean, beach quality material from maintenance dredging of

navigation channels will be placed on the nourished beach at Topsail Beach. Any dredged material from navigation channels would be purely supplemental material that would help maintain the project profile.

Clean Water Act. A Section 401 Water Quality Certificate under the Clean Water Act of 1977 (PL 95-217), as amended, is required for the proposed project and will be requested from the North Carolina Division of Water Quality. Work will not proceed until the 401 Certification is received.

Pursuant to Section 404 of the Clean Water Act, the impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) Guidelines Analysis in Appendix G of the FEIS. Discharges associated with dredging in the offshore borrow areas are considered incidental to the dredging operation, and therefore, are not being considered as being a discharge addressed under the Section 404 (b)(1) Guidelines Analysis.

Sedimentation and Erosion Control. Pursuant to the Sedimentation Pollution Control Act of 1973, a State approved soil erosion and sedimentation control plan would be implemented during construction to minimize soil loss and erosion.

10.13.10 Local Land Use Plans

The shoreline at Topsail Beach is zoned "Residential." According to the Town of Topsail Beach Core Land Use Plan, dated 2005, "Topsail Beach is proud of its wide, sandy beaches that have benefited from an ongoing beach renourishment program. All areas of our beach can be accessed and used, even at the highest tides. A dune protection program has resulted in high dunes, anchored by a thick cover of vegetation that protects our town and our beach. The Town is actively pursuing, and will continue to pursue a Corps of Engineers project that involves both beach renourishment and construction of a groin."

Although, a groin is no longer proposed, the Topsail Beach Land Use Plan fully supports beach renourishment, and specifically a project with the Corps of Engineers, therefore, the currently proposed shore protection project is consistent with the Topsail Beach Land Use Plan.

Based on information contained in the 1991 Pender County Land Use Plan Update, ocean beaches and shorelines are valuable for public and private recreation and are located within natural hazard areas. Pender County's overall policy and management objective for the estuarine system is to "give the highest priority to their protection to perpetuate their biological, social, economic, and esthetic values to ensure that development occurring within these AEC's is compatible with natural characteristics so as to minimize the likelihood of significant loss of private property and public resources." (15 NCAC 07H .0203). Also, stated in the Fender County Land Use Plan, is "Beach

nourishment projects shall be the responsibility of Surf City and Topsail Beach. The proposed shore protection project at Topsail Beach is sponsored by the Town of Topsail Beach in conjunction with the Corps.

The project will result in a wider, more stable beach, thus enhancing the recreational opportunities, biological habitat, and economic and aesthetic values of the beach as specifically mentioned in the Land Use Plan Update. Therefore, the proposed project is consistent with the Pender County Land Use Plan.

Based on the information presented within the final GRR and FEIS, the proposed project is consistent with the North Carolina Coastal Management Program. This determination is being provided to the State for its review and concurrence.

10.14 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) of 1982 (P.L. 97-348) prohibits expenditure of Federal funds for activities within the designated limits of the Coastal Barrier Resources System unless specifically exempted by Section 6 of the Act. As stated in that Section, Federal expenditures are allowable in association with maintenance of existing channel improvements, including disposal of dredged material related to such improvements. The U. S. Fish and Wildlife Service's designated maps (dated October 1990), which show all sites included in the system in North Carolina, indicate that the Lea Island Complex (L07) is within the Coastal Barrier Resource System and protected under the Coastal Barrier Improvement Act of 1990. This site is within the study area (Figure 1.1) but would not be affected by the selected plan (Appendix A, Figure A-7).

10.15 Estuary Protection Act

The Estuary (Estuarine) Protection Act provides a means to protect, conserve, and restore estuaries in a manner that maintains balance between the need for natural resource protection and conservation and the need to develop estuarine areas to promote national growth. The act authorizes the Secretary of the Interior to work with the States and other Federal agencies in undertaking studies and inventories of estuaries of the United States. The proposed project would have minimal impact on the estuarine environment, as discussed in Section 8 of this report, therefore the project is in compliance with the Estuary Protection Act.

10.16 Sedimentation and Erosion Control

Pursuant to the Sedimentation Pollution Control Act of 1973, a State approved soil erosion and sedimentation control plan would be implemented during construction to minimize soil loss and erosion.

10.17 Prime and Unique Agriculture Land

According to the Soil Survey of Pender County, North Carolina, 1991 Update, the soils on the beach that may be impacted by the proposed project are not designated by the Natural Resource Conservation Service (NRCS) as prime or unique agriculture lands. No impacts to prime and unique agriculture lands will occur.

Table 10.1. The relationship of the proposed action to Federal Laws and Policies. Items identified as being in "Full Compliance" assumes their compliance status upon completion of the NEPA process.

Title of Public Law	US CODE	Compliance Status
Abandoned Shipwreck Act of 1987	43 USC 2101	Full Compliance
American Indian Religious Freedom Act	42 USC 1996	Not Applicable
Agriculture and Food Act (Farmland Protection Policy Act) of 1981	7 USC 4201 et seq.	Not Applicable
American Folklife Preservation Act of 1976, As Amended	20 USC 2101	Not Applicable
Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 a et seq.	Full Compliance
Antiquities Act of 1906, As Amended	16 USC 431	Full Compliance
Archeological and Historic Preservation Act of 1974, As Amended	16 USC 469	Full Compliance
Archeological Resources Protection Act of 1979, As Amended	16 USC 470	Full Compliance
Bald Eagle Act of 1972	16 USC 668	Not Applicable
Buy American Act	41 USC 102	Full Compliance
Civil Rights Act of 1964 (Public Law 88-352)	6 USC 601	Full Compliance
Clean Air Act of 1972, As Amended	42 USC 7401 et seq.	Full Compliance
Clean Water Act of 1972, As Amended	33 USC 1251 et seq.	Full Compliance
Coastal Barrier Resources Act of 1982	16 USC 3501-3510	Full Compliance
Coastal Zone Management Act of 1972, As Amended	16 USC 1451 et seq.	Full Compliance
Comprehensive Environmental Response, Compensation and Liability Act of 1980	42 USC 9601	Not Applicable
Conservation of Forest Lands Act of 1960	16 USC 580 mn	Not Applicable
Contract Work Hours	40 USC 327	Full Compliance
Convict Labor	18 USC 4082	Full Compliance
Copeland Anti-Kickback	40 USC 276c	Full Compliance
Davis Bacon Act	40 USC 276	Full Compliance
Deepwater Port Act of 1974, As Amended	33 USC 1501	Not Applicable
Emergency Flood Control Funds Act of 1955, As Amended	33 USC 701m	Not Applicable
Emergency Wetlands Resources Act	16 USC 3901-3932	Full Compliance
Endangered Species Act of 1973	16 USC 1531	Full Compliance
Estuary Program Act of 1968	16 USC 1221 et seq.	Full Compliance

Equal Opportunity	42 USC 2000d	Full Compliance
Farmland Protection Policy Act	7 USC 4201 et seq.	Not Applicable
Federal Environmental Pesticide Act of 1972	7 USC 136 et seq.	Full Compliance
Federal Water Project Recreation Act of 1965, As Amended	16 USC 4601	Full Compliance
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance
Flood Control Act of 1944, As Amended, Section 4	16 USC 460b	Full Compliance
Food Security Act of 1985 (Swampbuster)	16 USC 3811 et seq.	Not Applicable
Hazardous Substance Response Revenue Act of 1980, As Amended	26 USC 4611	Not Applicable
Historic and Archeological Data Preservation	16 USC 469	Full Compliance
Historic Sites Act of 1935	16 USC 461	Full Compliance
Jones Act	46 USC 292	Full Compliance
Land and Water Conservation Fund Act of 1965	46 USC 4601	Not Applicable
Magnuson Fishery Conservation and Management Act	16 USC 1801	Full Compliance
Marine Mammal Protection Act of 1972, As Amended	16 USC 1361	Full Compliance
Marine Protection, Research and Sanctuaries Act of 1972	33 USC 1401	Full Compliance
Migratory Bird Conservation Act of 1928, As Amended	16 USC 715	Full Compliance
Migratory Bird Treaty Act of 1918, As Amended	16 USC 703	Full Compliance
National Environmental Policy Act of 1969, As Amended	42 USC 4321 et seq.	Full Compliance
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance
National Historic Preservation Act Amendments of 1980	16 USC 469a	Full Compliance
Native American Religious Freedom Act of 1978	42 USC 1996	Not Applicable
Native American Graves Protection and Repatriation Act	25 USC 3001	Full Compliance
Native American Religious Freedom Act of 1978	16 USC 469a	Not Applicable
National Trails System Act	16 USC 1241	Not Applicable
Noise Control Act of 1972, As Amended	42 USC 4901 et seq.	Full Compliance
Rehabilitation Act (1973)	29 USC 794	Full Compliance
Reservoir Salvage Act of 1960, As Amended	16 USC 469	Not Applicable
Resource Conservation and Recovery Act of 1976	42 USC 6901-6987	Not Applicable
River and Harbor Act of 1888, Sect 11	33 USC 608	Not Applicable
River and Harbor Act of 1899, Sections 9, 10, 13	33 USC 401-413	Full Compliance
River and Harbor and Flood Control Act of 1962, Section 207	16 USC 460	Not Applicable
River and Harbor and Flood Control Act of 1970, Sections 122, 209 and 216	33 USC 426 et seq.	Full Compliance
Safe Drinking Water Act of 1974, As Amended	42 USC 300f	Full Compliance
Shipping Act	46 USC 883	Full Compliance
Submerged Lands Act of 1953	43 USC 1301 et seq.	Full Compliance
Superfund Amendments and Reauthorization Act of 1986	42 USC 9601	Not Applicable
Surface Mining Control and Reclamation Act of 1977	30 USC 1201-1328	Not Applicable
Toxic Substances Control Act of 1976	15 USC 2601	Not Applicable
Uniform Relocation and Assistance and Real Property Acquisition Policies Act of 1970, As Amended	43 USC 4601 et seq.	Full Compliance
Utilization of Small Business	15 USC 631, 644	Full Compliance
Vietnam Veterans	38 USC 2012	Not Applicable
Executive Orders		

Protection and Enhancement of Environmental Quality	11514/11991	Full Compliance
Protection and Enhancement of the Cultural Environment	11593	Full Compliance
Floodplain Management	11988	Full Compliance
Protection of Wetlands	11990	Full Compliance
Federal Compliance with Pollution Control Standards	12088	Full Compliance
Environmental Effects Abroad of Major Federal Actions	12114	Not Applicable
Offshore Oil Spill Pollution	12123	Full Compliance
Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances	12843	Full Compliance
Federal Compliance with Right-To-Know Laws and Pollution Prevention	12856	Full Compliance
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	12898	Full Compliance
Implementation of the North American Free Trade Agreement	12889	Full Compliance
Energy Efficiency and Water Conservation at Federal Facilities	12902	Full Compliance
Federal Acquisition and Community Right-To-Know	12969	Full Compliance
Protection Of Children from Environmental Health Risks and Safety Risks	13045	Full Compliance
Coral Reef Protection	13089	Full Compliance
Greening the Government through Waste Prevention, Recycling and Federal Acquisition	13101	Full Compliance
Invasive Species	13112	Full Compliance
Greening the Government Through Leadership in Environmental Management	13148	Full Compliance
Marine Protected Areas	13158	Full Compliance
Consultation and Coordination with Indian Tribal Governments	13175	Not Applicable
Responsibilities of Federal Agencies to Protect Migratory Birds	13186	Full Compliance
Executive Order Facilitation of Cooperative Conservation	13352	Full Compliance

11. SUMMARY OF AGENCY AND PUBLIC INVOLVEMENT

11.01 NEPA Coordination

On February 14, 2001, a scoping letter was sent to agencies, interest groups, and the public to request identification of significant resources and issues of concern. Eleven (11) letters of comment were received. The scoping letter, a list of respondents and comment letters appear in Appendix K. Comments received addressed various aspects of the project and generally (1) identified resource concerns or (2) other aspects of the project, such as alternatives analysis, dredging window, cumulative impact analysis, etc. needing to be thoroughly addressed. All comments received were considered during the continuation of project planning and design. Several resource agency representatives participated in project planning and will continue to participate throughout the NEPA process. These agencies include the U. S. Fish and Wildlife Service, National Marine Fisheries Service, North Carolina Department of Archives and History, North Carolina Wildlife Resources Commission and the Mineral Management Service.

On June 23, 2006 the Draft GRR/EIS was mailed to Federal and State agencies and the interested public for a 45-day review and comment period. Recipients of the Draft and Final GRR/EIS are listed in Section 11.04. Comments on the Draft EIS were received from the following:

Federal Agencies
- US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- US Department of Agriculture, Natural Resources Conservation Service
- US Environmental Protection Agency, Region IV
- US Department of the Interior, Fish and Wildlife Service
- US Department of the Interior, Minerals Management Service

State Agencies
- NC Department of Administration
- NC Department of Environment and Natural Resources
- NC Division of Coastal Management
- NC Department of Cultural Resources
- NC Division of Water Quality
- NC Wildlife Resources Commission
- NC Division of Marine Fisheries

Local Agencies/Municipalities
- Town of Topsail Beach, Town Manager

Conservation Groups
- Environmental Defense

Appendix T includes comments received on the Draft GRR/EIS and the U. S. Army Corps of Engineers, Wilmington District, response to each comment. Scanned copies of the letters and correspondence are included as Attachment 1 at the end of Appendix T in the CDROM version of the Final GRR and Final EIS, but not in the printed copy.

11.02 Fish & Wildlife Coordination

The Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661, et seq.), requires that the Corps of Engineers coordinate and obtain comments from the USFWS, the National Marine Fisheries Service, where applicable, and appropriate state fish and wildlife agencies, including the North Carolina Division of Marine Fisheries and the North Carolina Wildlife Resources Commission. The USFWS provided a Planning Aid Report (PAR), dated September 10, 2003, and a Draft Fish & Wildlife Coordination Report, dated May 25, 2005, which provided recommendations that have been considered during project development. Information regarding the components of the proposed action, potential alternatives, and related environmental issues have been coordinated with the USFWS, and their views are documented in a Final Fish & Wildlife Coordination Act (FWCA) Report, dated June 2007 (Appendix L). Specific fish and wildlife recommendations and USACE responses are presented in the following paragraphs:

1. USFWS Recommendation: There should be a clear presentation of the federal interest in the project area. The discussion should distinguish between efforts to reduce damage during storms and efforts to replace land lost as rising sea level pressures the island to move landward. There should be an acknowledgement that the ocean does not create permanent damage on the natural communities of barrier islands. What appears to be recession of the beach and dune results from movement of sand across the island to nourish the natural communities on the sound side, part of the natural, adaptive process of island movement. The reduction in beach width is actually the result of the area being squeezed between the rising ocean and a fixed line of man-made structures. A clear presentation of the nature of the problem will provide the foundation for determining the federal interest and the development of alternatives.

Corps Response: Federal interest is demonstrated by the fact that this project was authorized by Congress in WRDA 1992, that the project has a favorable benefit to cost ratio, and protects a public shoreline. The dune and berm project will reduce damages and prevent land losses due to both storm related, short term erosion and from long term erosion. In the without-project condition, erosion will continue to narrow the beach in front of existing structures, which will both reduce the suitability of the beach for recreation and for natural habitat. In addition, Topsail Beach is a fully developed barrier island, where sound-side deposition of sand by natural overwash processes is already severely restricted.

2. USFWS Recommendation: The efficacy of any program for replacing inundated beaches with imported fill material over 50 years will depend on global sea level rise during the period. Sea level rise along with more intense hurricanes will contribute to the

destruction of a beach constructed, at least partially, in shallow ocean waters. Information from the Intergovernmental Panel on Climate Change (IPCC 2007) and analysis such as Rahmstorf (2007) should be used in project planning.

Corps Response: The sea level rise value used in the GRR of 9.6 inches (0.8 feet) over the next 100 years is within the likely range of sea level rise reported for all but the most pessimistic scenario family presented in the IPCC 2007, Special Report on Emissions Scenarios (SRES), as shown below:

SRES Scenario Family	Likely Range of Sea Level Rise
Scenario B1 (most optimistic)	7 to 15 inches
Scenario A1T	8 to 18 inches
Scenario B2	8 to 17 inches
Scenario A1B	8 to 19 inches
Scenario A2	9 to 20 inches
Scenario A1FI (most pessimistic)	10 to 23 inches

Over the 50-yr project life, the difference between the GRR value and the average sea level rise values for each of the IPCC 2007 scenarios range from 0.7 to 3.45 inches, with all but the two most pessimistic scenarios being less than 2 inches difference. A tremendous amount of effort would be required to generate the revised storm responses for these relatively small differences in sea level. The computational precision, rounding, curve-fitting, built-in uncertainty, etc. that comprises the analysis could possibly mask much of the expected differences in outcome. Further, it is likely that the without-project condition (with its diminished dune and berm) is going to be more sensitive to sea level rise than the with-project condition will be, which will only increase the net benefits for the beachfill project.

3. USFWS Recommendation: The Corps is within the executive branch and is therefore required to comply with Executive Order (EO) 11988. This EO was enacted to avoid, to the extent possible, the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative (USACE 206, p. 118). Most of Topsail Island is in the 100-year floodplain (Pilkey et al. 1998, p. 171) and most of the island would be largely underwater in a category one or two hurricane and nearly completely submerged in a category three hurricane (Pilkey et al. 1998, p. 173). These dangers are reflected in the fact that the northern portion of Topsail Island is included in the Coastal Barrier Resource System (CBRS). Areas included the CBRS were generally considered unsuitable for development because they are vulnerable to hurricanes and other storm damage and because natural shoreline recession and the movement of unstable sediments undermine manmade structures. The current project area was excluded from the CBRS because it was developed at the time of the legislation and not because the development was at less risk. Since the 50-year program of beach construction is intended, in part, to "ensure that current growth trends in population and recreational visitation will continue," any action under the control of an executive branch

agency must determine whether the action contributes to unwise development within a hazardous floodplain. The Corps should present a comprehensive discussion of the justification for the conclusion that "the proposed action is in compliance with the requirements of Executive Order 11988" (USACE 2006, p. 119). Compliance with this EO should not be based on the high cost of removing the structures, but rather whether the presence of existing structures and the additional growth that would be supported by the federal action represents unwise development in a hazardous floodplain.

Corps Response: As discussed fully in **Section 10.08 Executive Order 11988,** IWR Report 96-PS-1, FINAL REPORT: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program, June 1996 states: "The presence of a Corps project has little effect on new housing production. The econometric results presented imply that general economic growth of inland communities is sufficient by itself to drive residential development of beachfront areas at a rapid pace. The housing price study could not demonstrate that Corps shore protection projects influence development. Corps activity typically **follows** significant development." In fact, the requirements for Federal participation in coastal storm damage reduction projects essentially dictate that these projects be constructed along areas that have a high degree of development. Placement of beachfill will occur in the floodplain of area beaches. This placement will be conducted specifically for its beneficial effect in offsetting erosion and restoring damaged beaches, and is, therefore judged acceptable. The action is expected to have an insignificant effect on the floodplain, therefore, the proposed action is in compliance with the requirements of Executive Order 11988 and with State/local flood plain protection standards.

4. **USFWS Recommendation:** The goal of reducing storm damage could be achieved with less environmental harm by using non-structural measures. However, the Draft GRR/EIS determined (USACE 2006, p. 54) that the non-structural plan was not economically feasible and was not fully evaluated for technical feasibility or acceptability. This decision was based on consideration of the costs of removing or relocating structures, but without any economic consideration of the economic benefits to the natural resources of the area. There was an assumption that a non-structural approach would continue to result in land losses (USACE 2006, p. 59). Information presented in this report indicates that the non-structural approach, if implemented at all levels of government, would allow the formation of a wide, natural beach as Topsail Island is pushed landward. The remote, undisturbed beach which is recognized by the Corps (USACE 2006, p. 59) would support tourism and provide significant economic benefits for the region. The Service recommends that the economic benefits of the non-structural alternative receive greater consideration in the selection of the preferred course for federal action.

Corps Response: Further analysis of changes in recreation value of the nonstructural plan would most likely result in a negative value of recreational benefits, because there would be less lodging available for visitors. The B/C ratio of 0.92 was developed using the most optimistic assumptions.

5. USFWS Recommendation: If beach construction is ultimately undertaken, the fill material should have a high degree of compatibility with the native beach. The North Carolina Sediment Criteria Rule, contained in the Technical Standards for Beach Fill Projects (15A NCAC 07H .0312), should be used in regard to grain size and percent weigh of calcium carbonate. In addition, compatibility should be established for other important characteristics such as organic content, heavy mineral content, and color.

Corps Response: The proposed borrow area sediments for this project will comply with grain size and percent weight requirements specified in 15A NCAC 07H .0312, Technical Standards for Beach Fill Projects. However, there are no Federal or State requirements for compatibility in regards to organic content, heavy mineral content, or color. Therefore, a compatibility analysis for these items will not be conducted.

6. USFWS Recommendation: If beach construction is ultimately undertaken, there should be a plan to monitor the quality of the fill material as it placed on the beach. There should be an effective procedure for stopping operations if inappropriate material is being pumped onto the beach. Since such real time protective measures may not be completely effective, there should also be a plan for inspecting the constructed beach for areas of incompatible material and removing such material before the start of the nest sea turtle nesting season.

Corps Response: See Section 7.04.1.7 of the final report titled, "Borrow Area Contingency Plan." This section thoroughly discusses the Corps intent to perform rigorous boring analyses of proposed borrow areas in order to minimize the risk of placing incompatible material on the beach as well as contingency measures for cutterhead pipeline and hopper dredge operations if incompatible material is unexpectedly encountered. Throughout the duration of construction operations, the Corps employs full time construction inspection personnel to perform on-sight inspections of the project operations to assure quality control and compliance with contract specifications. Furthermore, the Corps receives daily production reports from the contractor that provide detailed information pertaining to the Contractor's daily operations. All incompliance issues pertaining to compatibility concerns identified in the on-sight inspections or the daily reports are immediately forwarded to the Corps environmental staff as discussed in Section 7.04.1.7. Federal and state environmental agencies will be notified if, and how much, potentially incompatible material is encountered during dredging operations. If necessary, the Wilmington District will make the decision on a suitable contingency measure which may include moving the dredge to another site within the borrow area or to another borrow area, depending on availability of sediment, and will notify the agencies of this contingency measure. However, there is still a risk that some incompatible material is placed on the beach since real time protective measures are not 100% effective. Therefore, the Corps construction inspection personnel will inspect the beach for any significant amount of incompatible material within the project limits throughout the contract duration and if any incompatible material is identified within the constructed berm, the Corps will coordinate with the appropriate

agencies to identify the quantity of material and discuss the methods of removal and disposal prior to the sea turtle nesting season.

7. USFWS Recommendation: Offshore sediment extraction and sediment disposal should be scheduled during the least sensitive period of the year for the organisms dependent on the habitats to be affected. Every effort should be made to complete all beach work, both actual placement and shaping, by the end of March for the benefit of important beach invertebrates and migratory shorebirds.

Corps Response: The majority of work will take place in the winter months, during the period of low biological activity for most species. Specifically, the anticipated construction timeframe for initial and periodic nourishment events will avoid peak recruitment and abundance time period for surf zone fishes and benthic invertebrates. Additionally, the Corps will convene a work group to identify study objectives that answer questions regarding critical life cycle requirements of benthic invertebrates and will contribute funds to carry out subsequent scientific investigations.

Section 2.02.3 Birds, provides a review of piping plover nesting activity on Topsail Beach and documents historical nesting activity in the southern spit portion of the island, outside of the project limits. Though construction during initial nourishment and during each re-nourishment interval will extend through April 30, no construction activities or disposal of sediment will occur in the designated piping plover critical habitat where most historical nesting has occurred. Prior to each nourishment event, the Corps will coordinate with the NCWRC and USFWS to address any new piping plover concerns within the project area and will work with the agencies to reduce any impacts to the maximum extent practicable. Heavy development and beach use and a lack of the constituent elements necessary for good piping plover nesting habitat have limited nesting activity on the developed portions of the island. The Corps will plan, to the maximum extent practicable, to commence nourishment operations at the southern limits during the winter months and work away from the designated critical habitat area so that by 1 April the project construction is at its northern limits.

Corps Response: During initial construction and throughout each re-nourishment interval, the Corps intends, to the maximum extent practicable, to observe the sensitive sea turtle nesting season (1 May – 15 November). Initial construction and each re-nourishment interval can be completed within the turtle window if no un-expected obstacles are encountered. However, considering the larger quantities of sediment that are needed during initial construction, completion of construction activities within the turtle window could be very tight. Therefore, the Corps will likely coordinate with the North Carolina Wildlife Resources Commission (NCWRC) and the Fish and Wildlife Service (USFWS), during initial construction, to begin placing pipe on the beach by 1 November so that pumping could commence on 15 November. The Corps will work with the NCWRC and the sea turtle coordinator for the Town of Topsail Beach in order to relocate any nests laid late in the season that may have an incubation period through 15 November and would be within the initial point of construction within the project area.

Considering that only a small portion of the Topsail Island will be impacted with construction activities during this 15-day timeframe within the observed sea turtle nesting season, there will be several places throughout the island to relocate nests to outside of construction activities if necessary. Nonetheless, a commitment to observe the sea turtle nesting season during initial construction and re-nourishment will be adhered to, to the maximum extent practicable.

8. USFWS Recommendation: The Corps should ensure that no offshore hardbottom habitats are affected by sedimentation produced by the project, either as a result of offshore dredging or sediment washing off the beach. This goal may be accomplished by actual surveys of the offshore sediment extraction sites. A sufficient buffer should be required between the dredging operation and hardbottoms. At a minimum, sediment extraction should comply with the North Carolina law (15A NCAC 07H. 0208(b)(12)(A)(iv)) requiring that mining of submerged land should not be conducted on or within 500 meters (1,640 feet) of significant biological communities, such as high relief hardbottom areas. If offshore hardbottoms are adversely affected, the project should include specific measures to mitigate any adverse impacts.

Corps Response: As discussed in detail in **Section 8.01.8.2 Impacts to Hardbottoms**, Considering that: (1) hopper dredge turbidity and sedimentation plumes will be confined to the offshore borrow areas during the dredging operation, (2) based on side scan sonar, no hardbottom was identified in these borrow areas, and (3) only 2 of the six borrow areas are within the vicinity of offshore hardbottom and the nearest point to the borrow area is about 2,000 ft., the effects of turbidity and sedimentation plumes on offshore hardbottom will be insignificant.

9. USFWS Recommendation: While the use of highly compatible fill material would minimize turbidity and sedimentation due to runoff from the constructed beach, small inclusion of mud and silt pose a risk to nearshore hardbottoms. Project planning should establish a program to monitor the location, areal extent, and major organisms of nearshore hardbottoms prior to initial construction. These areas should be surveyed after initial construction to determine an adverse sedimentation and change in the biological community. If it appears likely that nearshore hardbottoms could be covered by sediment moving off the constructed beach, it may be necessary to have a monitoring program to detect any overall loss of exposed hardbottoms and to develop and implement appropriate mitigation measures. Mitigation measures could include a reduction in the amount of beach fill near vulnerable hardbottoms.

Corps Response: As identified in Appendix R, the side scan and multibeam survey results did not identify hardbottom resources within the -23' depth of closure limit of the project but rather very shallow depressional features located perpendicular to shore. These features are consistent with Rippled Scour Depressions (RSD's), Rippled Channel Depressions (RCD's), and or sorted bedforms as identified in the literature. During the equilibration process, the nourished sediment will move offshore as the constructed beach profile equilibrates to a more natural beach profile. The total area of the RSD, RCD,

and/or sorted bedform features that occurs within the -23 ft. depth of closure limit is 0.3834 acres. Though nourished sediment could gradually move within the depressional features, it is likely that the features will be maintained as a preferential morphologic state through the repeating, self-reinforcing pattern of forcing and sedimentary response which causes the features to be maintained as sediment starved bedforms responding to both along-and across shore flows (Thieler *et. al.*, 2001).

10. USFWS Recommendation: Project plans should include measures to avoid adverse impacts associated with placement of the sediment pipeline and measures to monitor and mitigate any spills from the pipeline. During both initial construction and reconstruction events, the delivery pipeline should be placed to avoid the piping plover habitat areas around New Topsail Inlet. Pipeline placement should avoid all hardbottom areas. There should be a plan to monitor pipelines for leaks and an established plan of action in the case a joint in the dredge pipe should break. This plan should describe measures to contain and clean the spill.

Corps Response: As identified in Section 3.02.8 and 4.0 of Appendix I, construction operations will avoid the piping plover critical habitat area within the vicinity of the inlet spit at New Topsail Inlet. During initial construction, as well as each re-nourishment event, the order of work will be from south to north so that construction activities will be north of the piping plover breeding and nesting habitat, located at the inlet spit, during the March and April time-frame.

As identified in Section 7.03.1 of the report, initial construction will be performed by a cutterhead pipeline dredge and re-nourishment will be performed by a hopper dredge. For a cutterhead pipeline dredge, material will be hydraulically pumped from the borrow site to the beach via a submerged pipeline. The pipeline will approach the shoreface at a selected location and will then traverse the beach to the disposal area. For hopper dredging activities, material will be hydraulically dredged and placed in the hopper of the dredge. For beach nourishment projects, depending on the specific dredge used, the maximum hopper load ranges between 6,000 CY and 12,000 CY. Upon completion of a full load, the hopper dredge will sail to a "pumpout" location just offshore of the beach. The hopper dredge will pump the material out of the hopper into a submerged pipeline which will approach the beach at a given area and extend to the disposal area. Therefore, for both a cutterhead pipeline and hopper dredge, both submerged (in water) and exposed (on the beach) pipeline will transport the sediment to the disposal area. For pipeline that is located on dry beach, the Contractor will be required to monitor the pipeline for leaks no less frequently than once every two hours. If a leak is detected, an assessment will be performed by the Contractor and the appropriate fix will be implemented to correct the problem. All pipeline inspections are logged and submitted daily to the Corps in order to document their completion.

For submerged pipeline, the Contractor will be required to traverse the pipeline via a boat to perform a visual assessment for indications of a pipe leak. In addition to visual surveys, Contractors can track pipe breaks or leaks using density gauges and meters.

According to the standard contract specifications, any pipe leak in the water or on land is considered displaced material and its removal will be required based on an assessment of the severity of the situation. Upon completion of an assessment of the leak by the Contractor and the Corps and after coordinating the assessment with the appropriate agencies, a clean up measure will be implemented.

As identified in Section 2.01.10 of the Final report as well as in Appendix R, bathymetric surveys, including side scan sonar and multibeam techniques, have been performed by the Corps throughout the nearshore (<-23 ft. NGVD) and offshore (>-23 ft. NGVD) environment, including the borrow sites, to assess for the presence of hard bottom communities. Furthermore, seismic profile coverage, vibracores, and diver surveys have provided information, between the active beach (-23 ft NGVD) and three-miles offshore of Topsail Beach. As identified in the report, using the bathymetric surveys performed by the Corps, as well as other data identifying hard bottom communities within the existing literature, the submerged pipeline routes will avoid identified hard bottom communities in accordance with the 500 m buffer rule identified by the State. Offshore submerged pipeline routes, extending from the borrow site to the beach, will only be necessary for cutterhead pipeline dredging operations during initial construction. Each re-nourishment interval will be performed using a hopper dredge. Hopper dredge operations will only require a submerged pipeline from the pumpout location, located just offshore of the surfzone, to the beach. Detailed nearshore sidescan and multibeam surveys did not identify any hardbottom within the vicinity of any proposed pumpout stations within the nearshore environment (See Appendix R).

11. USFWS Recommendation: The project should include an annual monitoring program on beach and subtidal invertebrates that form an important food resource for shorebirds and surf fishes. While other monitoring programs have been implemented in North Carolina, each project has unique features such as the sediment source and the responses of invertebrates at one location may not be application to each beach construction effort. The project should include a requirement for a pre-project assessment of beach invertebrate biomass and community composition, i.e., the number of species present. The program should have adequate control areas such as Hutaff Island, south of the project area. After construction, the Corps should monitor the recovery of intertidal and near shore invertebrate populations. If any assessment indicates a significant decline in either biomass or the number of species present when compared to control areas, there should be definite procedures in place to develop mitigation for this community. Data from these studies will be especially important if the reconstruction interval is reduced as sea level continues to rise. While the Corps notes (USACE 2006, p. 130) that benthic populations may recovery within one to four years after large-scale sediment placement, a gradual reduction of the reconstruction interval could preclude adequate recovery and threaten these organisms which form an important base to the coastal food chain. The overall project plan should include funding for developing procedures to better understand mole crab and coquina clam life history requirements and developing effective measures to mitigate adverse impacts to these important resources.

Corps Response: Section 8.01.6 Benthic Resources – Beach and Surf Zone, addresses beach nourishment impacts to the benthic invertebrate community and discusses a thorough literature review indicating short term impacts to benthic invertebrate populations with recovery occurring between 1-4 years depending on sediment compatibility. For study sites where nourished sediments were compatible with the native beach, recovery occurred within 1-year. Several Corps contracts addressing beach nourishment impacts to benthic invertebrate populations have recently been completed or are ongoing throughout the North Carolina beaches including Bogue Banks, Brunswick Beaches, and Dare County. The data that that has come back from these studies continue to support the large historical database, which indicates an initial impact to the benthic invertebrate resource with recovery occurring immediately after nourishment when the sediment is compatible with the native beach. Furthermore, the Dare County Beaches shore protection project has a significant monitoring plan, which includes a pre- and post-construction benthic invertebrate assessment. Considering the large historical monitoring database, the consistency of the data from these studies, and the continuing monitoring studies that are underway on other beach projects in North Carolina, the Corps does not plan to collect additional monitoring data for Topsail Beach. However, the Corps is encouraged by the Services recommendation to develop procedures to better understand benthic invertebrate life history requirements and the relationship these requirements have to beach activities, instead of additional monitoring studies. Recently, as a mitigation condition of the 401 water quality certificate for the Morehead City 933 project, the Corps participated in funding a study performed by Philip S. Kemp Jr., of the Carteret Community College, to investigate the feasibility of harvesting, holding, and culturing Donax spp. for resource enhancement aquaculture. The Corp will consider providing funds to continue this type of data collection in order to develop management guidelines and effective measures to mitigate identified impacts to these resources. Such a funding action would be fully coordinated with all concerned agencies. Additionally, the Corps will convene a work group to identify study objectives that answer questions regarding critical life cycle requirements of benthic invertebrates and will contribute funds to carry out subsequent scientific investigations.

12. USFWS Recommendation: A program for beach construction should include surveys for seabeach amaranth both before and for three years after sediment placement in order to avoid direct burial and to monitor recovery of the plant. With the proposed four-year reconstruction cycle, surveys for this endangered plant would be made every year. If data indicate a declining trend in the presence of this federally threatened species, the development of mitigation measures may be required. The project should also monitor beach vitex in the project as part of an effort to eradication this harmful invasive foreign plant.

Corps Response: Monitoring for seabeach amaranth on Topsail Beach will be performed by the Corps to assess the pre- and post-nourishment presence of plants. Beach vitex surveys are ancillary to seabeach amaranth surveys. Surveyors note the presence of beach vitex during amaranthus surveys and the data is coordinated with Dale Suiter of the USFWS, which in turn is shared with the Carolinas Beach Vitex Task

Force.

13. USFWS Recommendation: Nesting by sea turtles will benefit from strict sediment compatibility standards and work schedules that avoid the nesting season. Current plans for beach construction avoid the recognized nesting and incubation season of May 1 through November 15. However, artificial beaches pose a risk to sea turtle nesting due to: (1) sediment compaction; (2) escarpment formation; and, (3) altered sand temperature which may occur as a result of a change in sediment color. To mitigate sediment compaction, the Service recommends that compaction monitoring should occur after each construction event and for three subsequent years. Considering that reconstruction is scheduled for every four years between 2010 and 2058, a sediment compaction survey should be made each year of the project. However, compaction monitoring would not be required if the sediment used to construct the beach is completely washed away. Beach tilling should only be performed as a result of an identified compaction problem and not performed routinely in place of compaction monitoring. Similarly, visual surveys for escarpments should be made along the constructed beach immediately after completion of the sediment placement and prior to May 1. Additional surveys should be made for three years following initial construction. As with compaction monitoring, escarpment survey should be made each year of the project. Survey results should be submitted to the Service prior to any action being taken. After discussion with the Service, escarpments that interfere with sea turtle nesting or exceed 18 inches in height for a distance of 100 feet should be leveled to the natural beach contour by May 1. The Service should be contacted immediately if new escarpments that interfere with sea turtle nesting or exceed 18 inches in height for a distance of 100 feet form during the nesting and hatching season to determine the appropriate action to be taken. If it is determined that escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. A program for detecting and securing appropriate care for stranded sea turtles should be part of the project.

Corps Response: As identified in Section 3.02.5 and Section 4.0 of Appendix I (Biological Assessment), the Corps is committed assessing post nourishment beach compaction, escarpment formation, and sea turtle nest temperature relative to sediment color. As identified in Section 3.02.5, sediment compaction may occur from the project and could impact the nesting environment of sea turtles. Though sediment placed on the beach will be compatible with the native material, the risk of sediment compaction and subsequent impacts to the nesting environment of sea turtles still exists. The USFWS has traditionally provided guidelines for assessing beach compaction which include the use of a cone penetrometer instrument to assess compaction across 500-ft. spaced transects at varying stations and depths across the beach profile. A threshold value of 500 psi was used as an indicator for tilling requirements. Recent studies indicate that due to the variability of compaction measurement values among users (Piatkowski et al., 2001), among compaction instrumentation (Ferrell et al., 2001), as well as variability of compaction throughout a given beach (Davis et al., 1999), care should be taken when performing quantitative assessments of sediment compaction. Based on the results and

recommendations of these studies, the Wilmington District has modified its approach towards assessing beach compaction for nourishment and disposal projects and has been working with the NCWRC and the USFWS towards a more qualitative evaluation of post construction compaction conditions relative to native beach conditions. The results of this new coordinated process in evaluating post project beach compaction have been successful. Therefore, for initial construction and during each nourishment event, the Corps will work with the Town of Topsail Beach and the NCWRC to continue this new compaction assessment protocol, but will not adhere to the traditional USFWS compaction guidelines. Tilling will only be performed if deemed necessary by the technical staff of the NCWRC, USFWS, and USACE, based on compaction assessment results.

As identified in Section 4.0 of Appendix I, the beach will be monitored for escarpment formation prior to each nesting season. If an escarpment exceeds 18 inches for a distance of 100 ft. during construction operations it will be leveled. Furthermore, if it is determined that escarpment leveling is required during the nesting or hatching season, the Town of Topsail Beach or the Corps will coordinate with the USFWS to receive authorization that describes methods to be used to reduce the likelihood of impacting existing nests. Escarpment surveying and leveling will be performed by the Corps during initial construction and each nourishment interval and the Town of Topsail Beach will be responsible for surveys and, if necessary, leveling prior to the nesting season in the years between nourishment intervals.

As identified in Section 4.0 of Appendix I, throughout the duration of each nourishment event, both initial construction and periodic nourishment, the Contractor will be required to monitor for the presence of stranded sea turtles, live or dead. If a stranded sea turtle is identified, the Contractor will immediately notify the NCWRC of the stranding and implement the appropriate measures as directed. The Town of Topsail Beach is home to the Karen Beasley sea turtle hospital which has the facilities to provide care for stranded and injured sea turtles.

Literature Cited:

Davis, R.A.: Fitzgerald, M.V., and Terry, J., 1999. Turtle nesting on adjacent nourished beaches with different construction styles: Pinellas County, Florida. Journal of Coastal Research, 15(1), 111-120.

Ferrell, C., Webster, D., and D. Piatkowski. 2002. Comparison of five soil compaction measurement devices. Proceedings Twenty-Second International Sea Turtle Symposium, Miami, Fl., USA.

Piatkowski, D., and Webster, W.D., 2001. Efficacy of the cone and Lang penetrometers: management implications for beach re-nourishment in sea turtle nesting habitat. Proceedings Twenty First International Sea Turtle Symposium, Philadelphia, PA. USA.

14. USFWS Recommendation: Plans to exclude the southern part of the Town from sediment placement will benefit federal trust resources such as migratory shorebirds. However, piping plovers are especially susceptible to human disturbance during territory establishment and early nesting attempts and after the chicks have hatched. Therefore, the work on each construction event should start at the south end of the project area, near New Topsail Inlet, and move north during construction. This construction method would place the final phase of each construction event in the more developed, northern areas of the project area, habitat less likely to be used for nesting by the piping plover. Current plans to place the delivery pipeline away from areas that might be used by piping plovers would also reduce adverse impacts on the species.

Corps Response: As previously stated, the Corps will plan, to the maximum extent practicable, to commence nourishment operations at the southern limits during the winter months and work away from the designated critical habitat area so that by 1 April the project construction is at the northern limits of the project area.

15. USFWS Recommendation: While the West Indian manatee is not likely to be in the project area during the proposed construction period, protective measures should be in place to safeguard this endangered species. Corps plans call for the implementation of the Service's "Precautions for General Construction in Areas Which May Be Used by the West Indian Manatee in North Carolina." These guidelines should provide adequate protection for this species.

Corps Response: The Corps will implement precautionary measures for avoiding impacts to manatees during construction activities as detailed in the "Guidelines for Avoiding Impacts to the West Indian Manatee in North Carolina Waters" established by the USFWS.

11.03 Coordination of this Document

This FEIS is being provided to a standard list of Federal, State, and local agencies; elected officials; environmental groups; and known interested individuals for review and comment. After a 30-day review period, all input received will be considered in preparation of the Record of Decision.

We invite your comments and suggestions regarding the proposed action. In accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) for implementing the National Environmental Policy Act (NEPA), your comments should be as specific as possible and should be made with recognition that NEPA documents must focus on the issues that are truly significant to the proposed action rather than amassing needless detail. The NEPA process is intended to help public officials make decisions based upon an understanding of environmental consequences. NEPA directs that Federal activities be conducted so as to attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences. As individual resources and stakeholder interests increasingly

compete for priority, public officials are challenged to make management decisions that reflect a balance of the overall public interest. Please respond with a focus on essential issues that will be useful in guiding our decisions and actions as the Topsail Beach project proceeds. Statement recipients are listed in Section 11.04.

11.04 Recipients of this Document

Federal Agencies

Advisory Council on Historic Preservation
Center for Disease Control and Prevention
Federal Emergency Management Administration
National Marine Fisheries Service, Southeastern Regional Office
National Marine Fisheries Service, Habitat Conservation Division, Beaufort Marine Fisheries Center, Beaufort, NC
National Park Service, Southeast Archeological Center
US Coast Guard, Fifth District, Portsmouth, Virginia
US Coast Guard, Marine Safety Office, Wilmington, NC
US Forest Service, Southern Region, Atlanta, GA
US Department of Agriculture, State and Area Conservationists, Natural Resources Conservation Service
US Department of Energy, Office of Environmental Compliance
US Department of Interior, Energy and Resources Division
US Department of Interior, Office of Environmental Policy and Compliance
US Department of Interior, Minerals Management Service, Herndon, VA
US Department of Housing and Urban Development, Greensboro, NC
US Department of Transportation, Federal Highway Administration, Raleigh, NC
US Environmental Protection Agency, Region 4, Atlanta, GA
US Environmental Protection Agency, Office of Federal Activities, Washington, D. C.
US Fish and Wildlife Service, Raleigh Field Office
US Marine Corps Base, Camp Lejeune, NC

State Agencies

NC Commission of Indian Affairs
NC Department of Environment and Natural Resources (NC State Clearinghouse)
NC Department of Transportation
NC Division of Coastal Management
NC Division of Marine Fisheries, Wilmington, NC
NC Division of Marine Fisheries, Shellfish Sanitation, Beaufort, NC
NC Department of Cultural Resources, Division of Archives and History
NC National Estuarine Research Reserve
NC Wildlife Resources Commission

Local Agencies

CAMA Officer, Surf City, NC
CAMA, Topsail Beach, NC
Cape Fear Council of Governments
North Topsail Town Manager
Pender County Emergency Management
Pender County Manager
Pender County Planning Coordinator
Pender County Health Department
Surf City Town Manager
Town of Surf City
Town of Topsail Beach, NC
Topsail Beach Town Manager
Sea Turtle Hospital, Topsail Beach

Elected Officials

Honorable Elizabeth Dole, US Senate
Honorable Richard Burr, US Senate
Honorable Walter B. Jones, US House of Representatives
Honorable Mike McIntyre, U.S. House of Representatives
Honorable Harry Brown, NC House of Representatives
Honorable George G. Cleveland, NC House of Representatives
Honorable Carolyn H. Justice, NC House of Representatives
Honorable R. C. Soles, Jr., North Carolina Senate
Honorable Russell E. Tucker, NC House of Representatives
Honorable Thomas E. Wright, NC House of Representatives
Pender County Board of Commissioners
Onslow County Board of Commissioners
Topsail Beach, Board of Commissioners

Conservation Groups

National Audubon Society
North Carolina Coastal Federation
North Carolina Coastal Land Trust
North Carolina Environmental Defense Fund
North Carolina Nature Conservancy
Pender Watch
Tar River Land Conservancy

Libraries, Museums, and News Media

NC Collection, Joyner Library, East Carolina University, Greenville, NC

Pender Chronicle

Interested Businesses, Groups, and Individuals

Cape Fear Community College (Jason Rogers)
Duke University, Department of Department of Earth and Ocean Sciences(Geology), Dr. Orrin Pilkey
Land Management Group, Inc.
Mr. Ed Flynn
Mr. Glenn Hargett
South Carolina Indian Affairs Committee
UNC-Wilmington, Center for Marine Science (Troy Alphin)

12. CONCLUSIONS

The coastal storm problems and needs of the study area have been reviewed and evaluated with regard to the overall public interest and with consideration of engineering, economic, environmental, social, and cultural concerns. The conclusions of this study are as follows:

a. The Topsail Beach shoreline is susceptible to major damage and erosion from coastal storms.

b. The selected plan, consisting of a 26,200-foot long dune system to be constructed to a height of 12 feet NGVD fronted by a 7-foot NGVD (50-foot wide) beach berm with a main fill length of 23,200 feet, from approximately 400 feet southwest of Godwin Avenue to the Topsail Beach town limit, and having 2,000-foot transition length on the north end and a 1,000-foot transition length on the south end, would substantially reduce economic losses due to storm activity and progressive erosion.

c. The selected plan is feasible based on engineering and economic criteria and is acceptable by environmental, cultural, and social laws and standards.

d. The selected plan is supported by the non-Federal sponsor, the Town of Topsail Beach. The sponsor has the capability to provide the necessary non-Federal requirements identified and described in report Section 9.02, Division of Plan Responsibilities.

13. RECOMMENDATIONS

This study has addressed the needs for hurricane and storm damage protection and beach erosion control for the portion of Topsail Island, which includes the Town of Topsail Beach, the non-Federal sponsor. The remaining portion of Topsail Island will be addressed in a separate report at a later date. The following recommendations include items for implementation by Federal, State of North Carolina, and local governments and agencies, including the structural coastal storm damage reduction project.

Hurricane Risk Education

Numerous people die each year as a result of hurricanes, primarily due to the failure to evacuate to an area of safety. Any loss of life is tragic, and any number of those deaths may have been prevented. Even one death prevented is sufficient reason to improve our methods of educating the public on hurricane and storm threats, and to ensure that all is done to warn all those residents or visitors to the coastline of North Carolina as to the dual hazards of wind and surge/waves. It is particularly vital to inform the public as to

the potential for hurricane occurrence, particularly within the dangerous hurricane season, so they pay continued attention to media reports on weather. Education needs to include articulation of effects related to the potential magnitude of the threat, the urgency to heed potential calls to evacuate, and providing the means by which to make wise choices on evacuation methods and route (see recommendations given below under "Hurricane Evacuation Planning"). The following are suggested guidelines for implementation by State and local government, in the interests of good education on hurricane storm threats:

- Provide good science and information to the residents and visitors to coastal North Carolina, so they can understand the nature of the threat, and its possibility of happening at any time within the hurricane season. This information should be provided in both written form, and as an initial "page" on televisions provided in visitor's housing, and also in a variety of venues, including:
    - Posting and televised education in supermarkets, libraries, and public buildings;
    - Teacher-provided, posted and televised education in schools and at public meetings and gatherings, at intervals not to exceed 1 year;
    - Publically-posted and visitor-housing-posted information on evacuation routes, and procedures, on publicly-accessible websites, updated regularly (minimum 1 yr.).

There is nothing humanly possible to maintain the lives and safety of coastal North Carolina residents and visitors, if they do not have sufficient warning, and if they then do not use that knowledge to evacuate in a timely manner.

Education of hurricane risks is an on-going effort of multiple agencies and educational institutions, and not a funded program under existing Corps authorities. Updating of websites containing evacuation routes and procedures should be done under existing programs implemented by the state and local governments.

Hurricane and Storm Warning

Residents and visitors to the coast of North Carolina need to recognize that they live in, or visit, a high-hazard area. Although certain times of the year pose less risk than others, each year's hurricane season provides a strong possibility of hurricane impact somewhere along the coast of North Carolina. All residents and visitors need to be made aware of the current hurricane threat, but first meteorological conditions must be evaluated, and any threat must be assessed and characterized by experts with the National Oceanic and Atmospheric Administration's National Weather Service, and that interpretation passed to national and local media for dissemination. Continued support of NOAA's program, and the following supportive activities is critical to an adequate warning process:

- On-going efforts to upgrade the existing system of NOAA buoys, transmission capabilities, and advanced warning measures that provide data on the location and nature of weather conditions.

- Efforts directed at the interpretation of that data and its dissemination to the media and public, through the National Weather Service.
- Public appreciation for the need to be aware at all times of, and the need to listen to weather reports and advice given on various media. Television weather reports, radio, and the internet all provide excellent up-to-date information on weather conditions, and the development of threatening situations. Simply living in or visiting the barrier islands of North Carolina should be sufficient to create a consistent and on-going process of being exceptionally aware of the weather, and its potential consequences.
- The vital importance of heeding the advice of experts. One should know what needs to be done in the event of an approaching storm. Family members should conduct evacuation drills, keep needed phone numbers and travel supplies on hand, and be prepared to leave on short notice. One should be aware of evacuation routes, keeping a full tank of gas during the hurricane season, and having a plan for where one should go, how to maintain contact with other family members, and where one will re-locate temporarily, particularly if this turns out to be longer than expected.

Hurricane Evacuation Planning Upgrading

The critical need for adequate evacuation planning was borne out by Hurricanes Bertha, Fran, and Floyd, of the late 1990's, and brought even more to the forefront by the monumental impacts of Hurricane Katrina in 2005. An evacuation plan is an essential component of a comprehensive plan for ensuring the safety of residents of, and visitors, to the coast of North Carolina. The preservation of life is the single most important goal and objective of the recommendations. Joint Federal Emergency Management Agency (FEMA)/ NOAA/Corps/State of North Carolina studies of evacuation routes and populations along the coastline has provided a tremendous amount of value to-date in aiding local government, individual and family readiness, in the face of approaching events. Support for this program is a critical element of the recommendations for the Town of Topsail Beach, in support of its residents and visitors. The following are important recommendations in support of efforts to support Hurricane Evacuation Planning:

- There is still much that can be done to update this on-going effort, and to provide new, and more widely-disseminated data and tools for evacuation planning by the State and the Town of Topsail Beach, and also for use by individuals and families in their preparation for an impending event.
- Evacuation route signage is an important part of a successful evacuation campaign. Maintenance of hurricane evacuation route signage is viewed as a vital link in ensuring the safety of residents and visitors alike.
- The provision of additional signage illustrating surge height achieved during past events would be an added and continual link to on-going education efforts. This could take the form of signs placed in locations in which there is significant traffic, such as major thoroughfares, where pedestrians walk, and particularly in those highest hazard zones based on elevation/depth data.

Evacuation Planning is an on-going effort of multiple agencies, including the Corps of Engineers, but its implementation is not a funded program under existing Corps

authorities. Updating of websites containing evacuation routes and procedures should be periodically updated under existing programs implemented by the State of North Carolina.

Floodplain Management

Management of the floodplain is a non-Federal responsibility, yet is considered a key component of all plans for hurricane and storm damage reduction. The Town of Topsail Beach participates in the National Flood Insurance Program, which requires the town to engage in active and responsible floodplain management. The majority of residences and businesses within the Town of Topsail Beach possess flood insurance. Since so much of the Town of Topsail Beach is within a recognized floodplain, the Town continues to engage in activities that reduce threats to existing and potential future development, including structure setbacks, building code and construction monitoring, and flood zone management. The Town of Topsail Beach is encouraged to continue to update building codes, and encourage strong pursuit of activities such as first-floor elevation and building code upgrading, in the effort to reduce the potential for future structural and content damage.

Building Codes

The Town of Topsail Beach has adopted the International Building Code (IBC) to guide the design and construction of residential and commercial structures in the study area. In order to assure that the latest design and construction techniques are being used that apply to hurricane-resistant construction, all future construction is encouraged to follow the latest version of the IBC (2007) and ensure enforcement of the codes through diligent building permit processing and on-site inspections of construction. Annual training classes on the use and enforcement of the new IBC should be encouraged. In addition, the Town of Topsail Beach should consider adopting the document "FEMA 550 Guidelines for Elevating Residential Structures on the Gulf Coast" as a part of their updated building codes for construction, due to the possibility of surge inundation associated with hurricane events.

Long-term Critical Infrastructure and Services Upgrading

The upgrading of critical infrastructure and services, such as Fire and Police services, is considered a vital recommendation in the reduction of threats to lives and property. The need to bring these services up to immediate restoration in the wake of a hurricane is of vital importance to the community. The methodical upgrading of the Town's Fire and Police services facilities as past of their Capital Improvement Program will provide long-term savings in capital outlay, and potentially save lives and residential and commercial property damage. This program may be instituted under a modified Capital Improvement Program, where structures reaching the end of their economic life are successively replaced by upgraded structures, locating vital communications and power supplies above

the elevation of a Maximum Probable Surge event, and capable of surviving the ravages of wind and/or surge, as funds become available.

Upgrading or replacement of services is primarily a local charge, implemented through Capital Improvement Plans, with funding from a variety of Federal, State, and local resources, and will take many years to accomplish, due to the varying age and condition of each facility.

Structural Damage Reduction Features

Based on the conclusions of this study, I recommend the implementation of the selected plan, identified as Plan 1250X. Plan 1250X consists of a 26,200-foot long dune system to be constructed to a height of 12 feet NGVD fronted by a 7-foot NGVD (50-foot wide) beach berm with a main fill length of 22,800 feet, from 400 feet southwest of Godwin Avenue to the Topsail Beach town limit, and having 2,000-foot transition length on the north end and a 1,000-foot transition length on the south end, with such modifications thereof as in the discretion of the Commander, USACE, may be advisable, at an initial construction cost estimated at $32,131,000 (October 2007 price levels). The baseline cost estimate for construction in FY2012 is $34,873,000.

As a result of the GRR study recommendations, I recommend that the project as authorized under Section 101 of the Water Resources Development Act (WRDA) of 1992 be re-authorized and implemented in accordance with the findings of the GRR.

I further recommend that construction of the proposed project be contingent on the project sponsor giving written assurances satisfactory to the Secretary of the Army that it will:

a. Provide 35 percent of initial project costs assigned to hurricane and storm damage reduction, plus 50 percent of initial project costs assigned to protecting undeveloped public lands, plus 50 percent of initial project costs assigned to recreation, plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

(1). Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2). Provide, during the first year of construction, any additional funds needed to cover the non-federal share of design costs;

(3). Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project;

(4). Provide, during construction, any additional amounts as are necessary to make its total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 50 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. Operate, maintain, and repair the completed project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal Sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the non-Federal Sponsor of responsibility to meet the non-Federal Sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total costs of construction of the Project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response,

Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal Sponsor with prior specific written direction, in which case the non-Federal Sponsor shall perform such investigations in accordance with such written direction;

g. Assume, as between the Federal Government and the non-Federal Sponsor, complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree that, as between the Federal Government and the non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by (42 U.S.C. 4601 – 4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards and requirements, including but not limited to, 40 U./S.C. 3141 – 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying, and enacting without substantial change the provisions of the Davis- Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S. C. 276c et seq.);

k. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires the non-Federal interest to participate

in and comply with applicable Federal floodplain management and flood insurance programs, prepare a floodplain management plan within one year after the date of signing a Project Cooperation Agreement, and implement the plan not later than one year after completion of construction of the project;

l. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

m. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

n. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

o. Prevent obstructions of or encroachment on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the level of protection it affords, hinder operation and maintenance or future periodic nourishment, or interfere with its proper function, such as any new developments on project lands or the addition of facilities which would degrade the benefits of the project;

p. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

q. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

r. For so long as the project remains authorized, the non-Federal Sponsor shall ensure continued conditions of public ownership, access, and use of the shore upon which the amount of Federal participation is based;

s. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

t. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal Government; and

u. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 22130, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

The non-Federal sponsor has indicated that they have available the necessary funds to provide the non-Federal share of the project first costs and periodic renourishment costs. I am confidant that the non-Federal sponsor will provide their share.

This recommendation is subject to the cost-sharing policies as outlined in this report and is endorsed, provided that, prior to construction, the non-Federal sponsor enters into a written PCA, as required by Section 221 of Public Law 91-611, as amended.

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 implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

The Administration's projections of future inflation are 2.0 percent annually. Based on these data, the total inflation adjusted (fully funded) project costs are estimated to be $268,000,000 over the 50-year period of Federal participation for the recommended plan of improvement. The Federal share of the fully funded project costs is currently estimated at $138,000,000. The non-Federal share of the fully funded costs is currently estimated at $130,000,000. Given the Administration's declared budgetary concerns, potential long-term costs associated with the proposed project may be vital to decision making. As previously indicated, the total project benefit-cost ratio is 3.3, which means that for every dollar spent for the project there are 3 dollars and 30 cents realized in National Economic Development (NED) benefits from the project.

These recommendations comply with Section 215 of the Water Resources Development Act of 1999, which sets cost sharing for periodic renourishment at 50 per cent Federal and 50 per cent non-federal. In recent years the Federal share of periodic renourishment costs of new shore protection projects has been limited by the availability of funds. However, I recommend that this General Reevaluation Report be approved, as a basis for the initiation of construction of the project in the event that the Administration's budgetary policy changes.

John E. Pulliam, Jr.
Colonel, U.S. Army
District Engineer

14. POINT OF CONTACT

Any comments or questions regarding this final GRR and final EIS should be addressed to Mr. Glenn McIntosh, Project Manager, U.S. Army Corps of Engineers, Post Office Box 1890, Wilmington, North Carolina 28402-1890, telephone (910) 251-4671.

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16. LISTS OF PREPARERS

16.01 Preparers

The following people provided major support in the development and preparation of this final General Revaluation Report and final Environmental Impact Statement.

NAME (FEIS Role)	EXPERTISE	DISCIPLINE
Doug Piatkowski FEIS Preparation	Environmental Impact Statement	Marine Biology
Jenny Owens FEIS Preparation	Environmental Compliance	Physical Scientist
Glenn McIntosh Project Management	Project Management	Civil Engineering
Tony Young Project Engineer	Coastal Engineering Modeler	Coastal Engineering
Ray Livermore Geotechnical	Geotechnical Analysis	Environmental Engineering
John Caldwell Cost Engineering	Cost Engineering	Civil Engineering
Garry Pennington Nonstructural Plans	Structural Engineering	Civil Engineering
Frank Snipes Economic Analysis	Economic & Social Analysis	Economics & Water Resources
Doug Greene Lead Planner	Planning	Civil Engineering
Richard Kimmel Cultural Resources	Historical & Underwater Archaeology	Anthropology
Belinda Estabrook	Real Estate	Real Estate

16.02 Reviewers

The following people provided major support in the technical review of this final General Revaluation Report and final Environmental Impact Statement.

NAME (District)	EXPERTISE	DISCIPLINE
Jane Jablonski (Philadelphia)	Lead and Plan Formulation	Planning
Beth Brandreth (Philadelphia)	Environmental	Biology/Ecology
Robert Dunn (Philadelphia)	Cultural Resources	Cultural Resources
Bob Selsor (Philadelphia)	Economics	Economics
Ed Rossman (Tulsa)	Econ-Recreation	Econ-Recreation
Mike Carnivale (Philadelphia)	Geotechnical	Geotechnical
Randy Wise (Philadelphia)	Coastal/H&H	Coastal/H&H
Bill Welk (Philadelphia)	Cost Engineering	Cost Engineering
Frank Palmer (Baltimore)	Real Estate	Real Estate
Jennifer Laning (Philadelphia)	Civil Engineering	Civil Engineering

Final
General Reevaluation Report
and
Environmental Impact Statement

on

Hurricane Protection and Beach Erosion Control

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

Appendix A

Project Maps

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Appendix A

Project Maps

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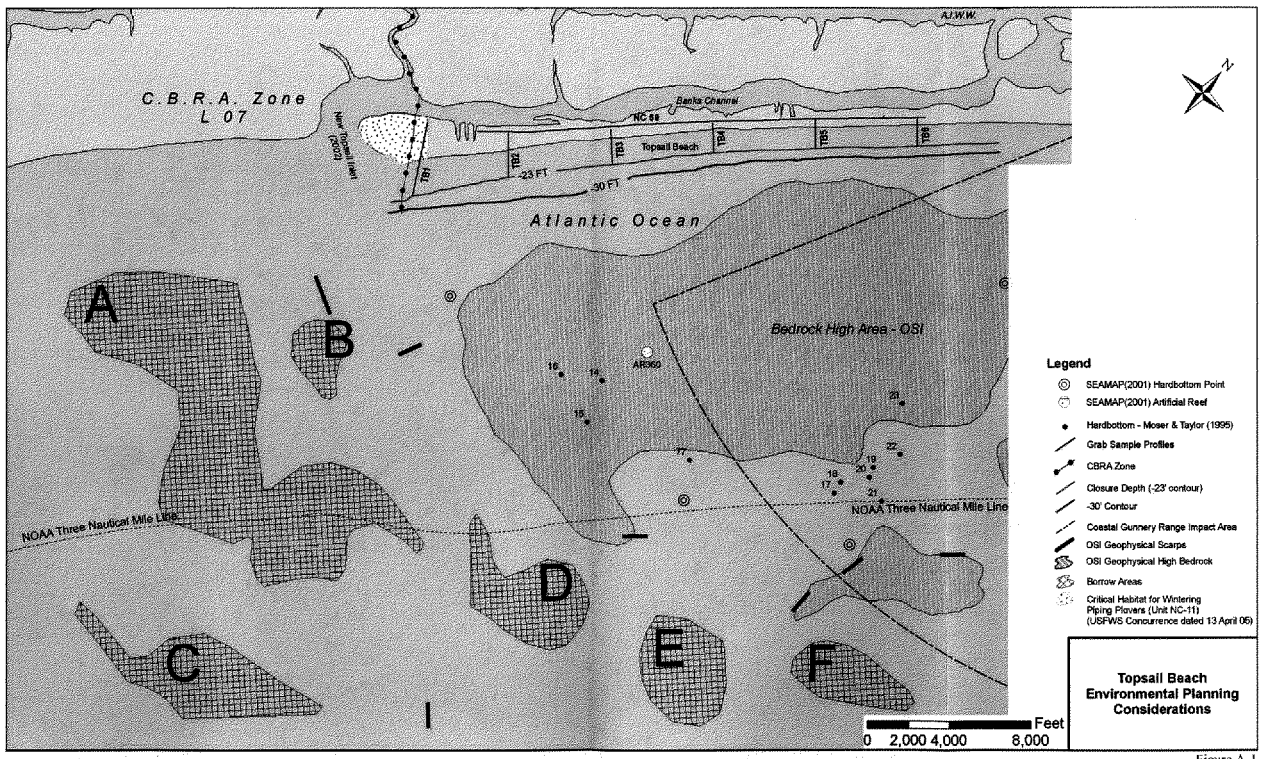

C.B.R.A. Zone
L 07
New Topsail Inlet (2002)
A.I.W.W.
Banks Channel
NC 58
Topsail Beach
TB1
TB2
TB3
TB4
TB5
TB6
-23 FT
-30 FT
Atlantic Ocean
Bedrock High Area - OSI
AR360
NOAA Three Nautical Mile Line
NOAA Three Nautical Mile Line
A
B
C
D
E
F
Legend
SEAMAP(2001) Hardbottom Point
SEAMAP(2001) Artificial Reef
Hardbottom - Moser & Taylor (1995)
Grab Sample Profiles
CBRA Zone
Closure Depth (-23' contour)
-30' Contour
Coastal Gunnery Range Impact Area
OSI Geophysical Scarps
OSI Geophysical High Bedrock
Borrow Areas
Critical Habitat for Wintering Piping Plovers (Unit NC-11) (USFWS Concurrence dated 13 April 05)
Feet
0 2,000 4,000 8,000
Topsail Beach Environmental Planning Considerations

Figure A-1

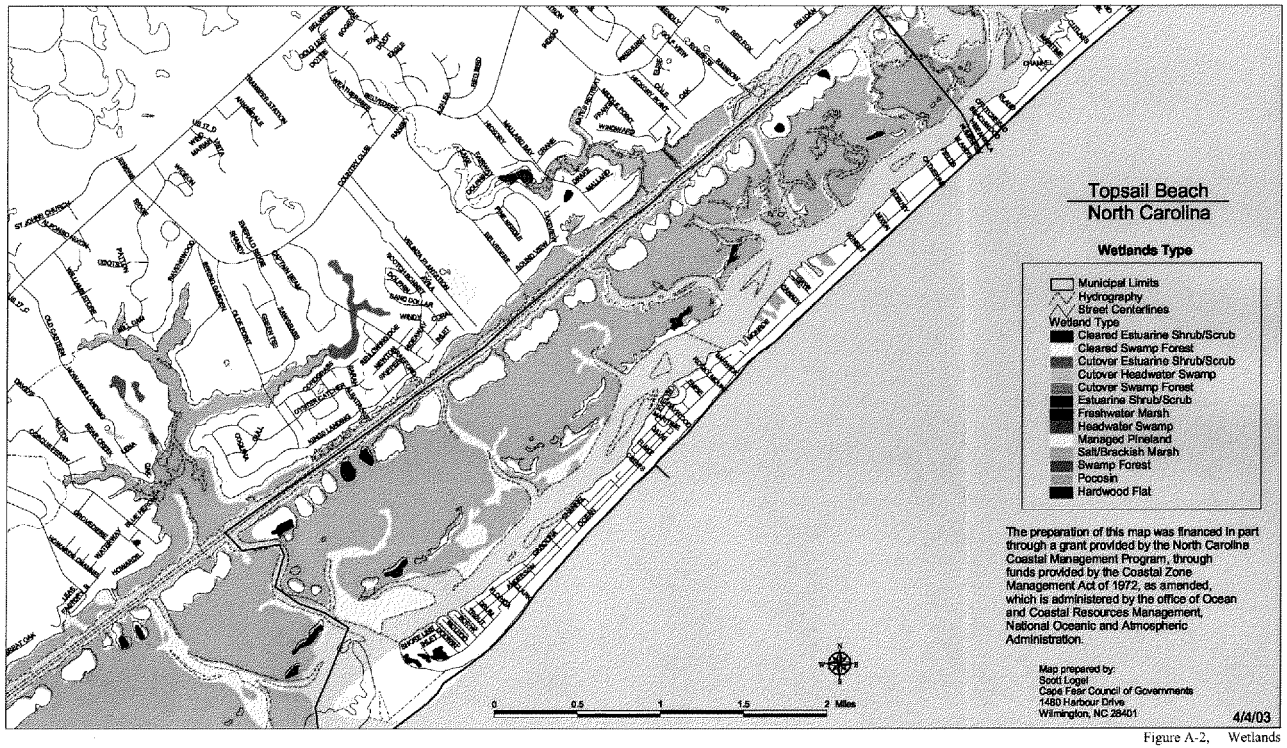


Figure A-2, Wetlands

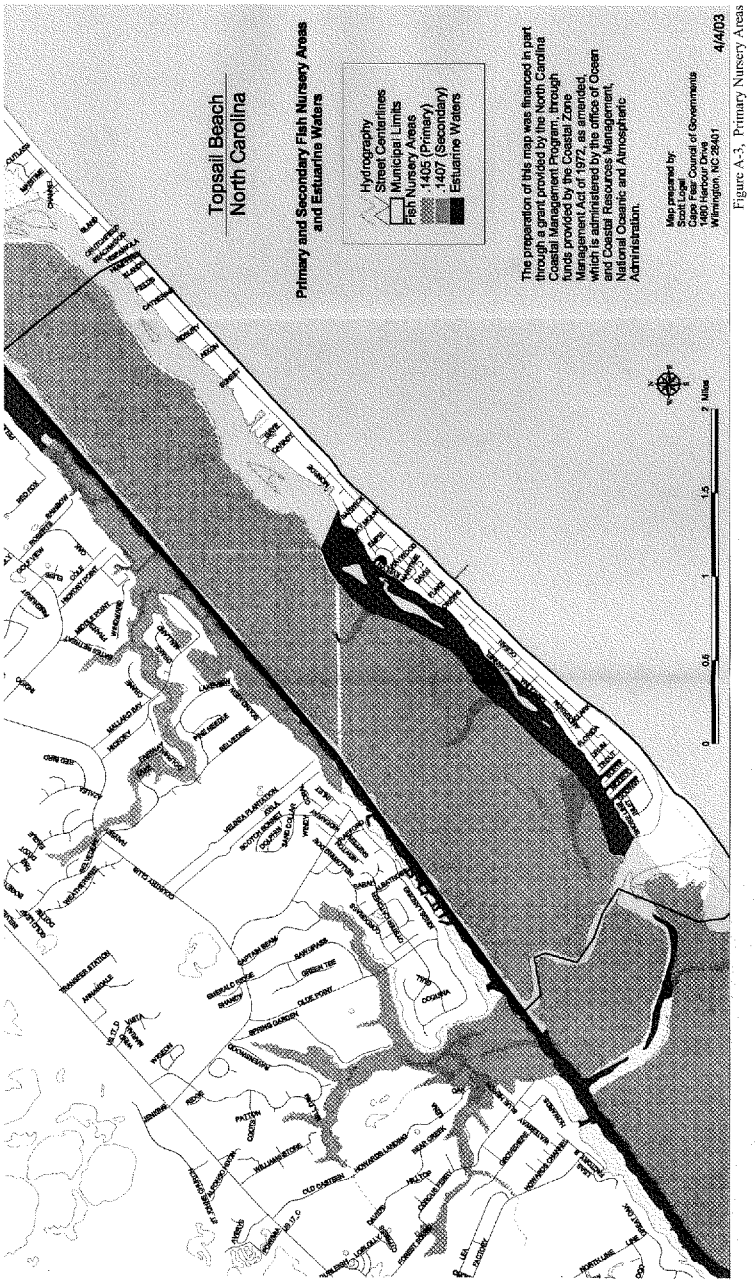


Figure A-3, Primary Nursery Areas

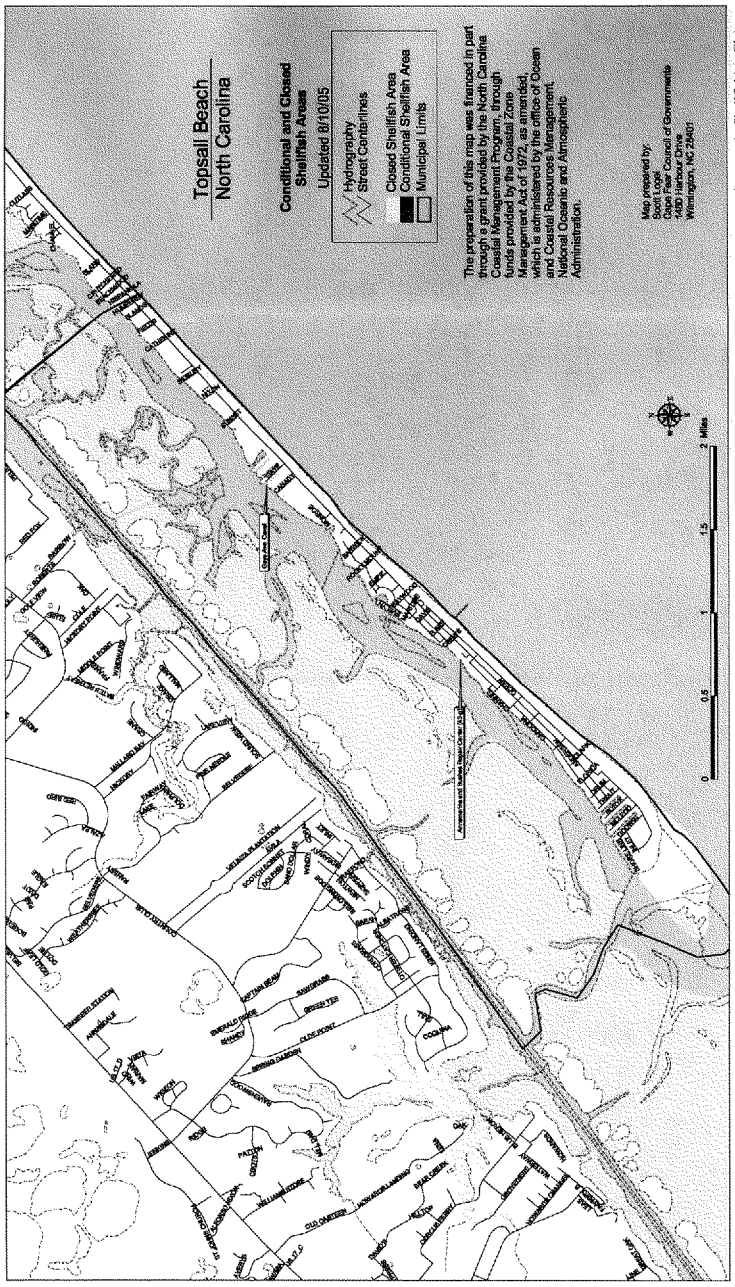


Figure A-4. Shellfishing Closures

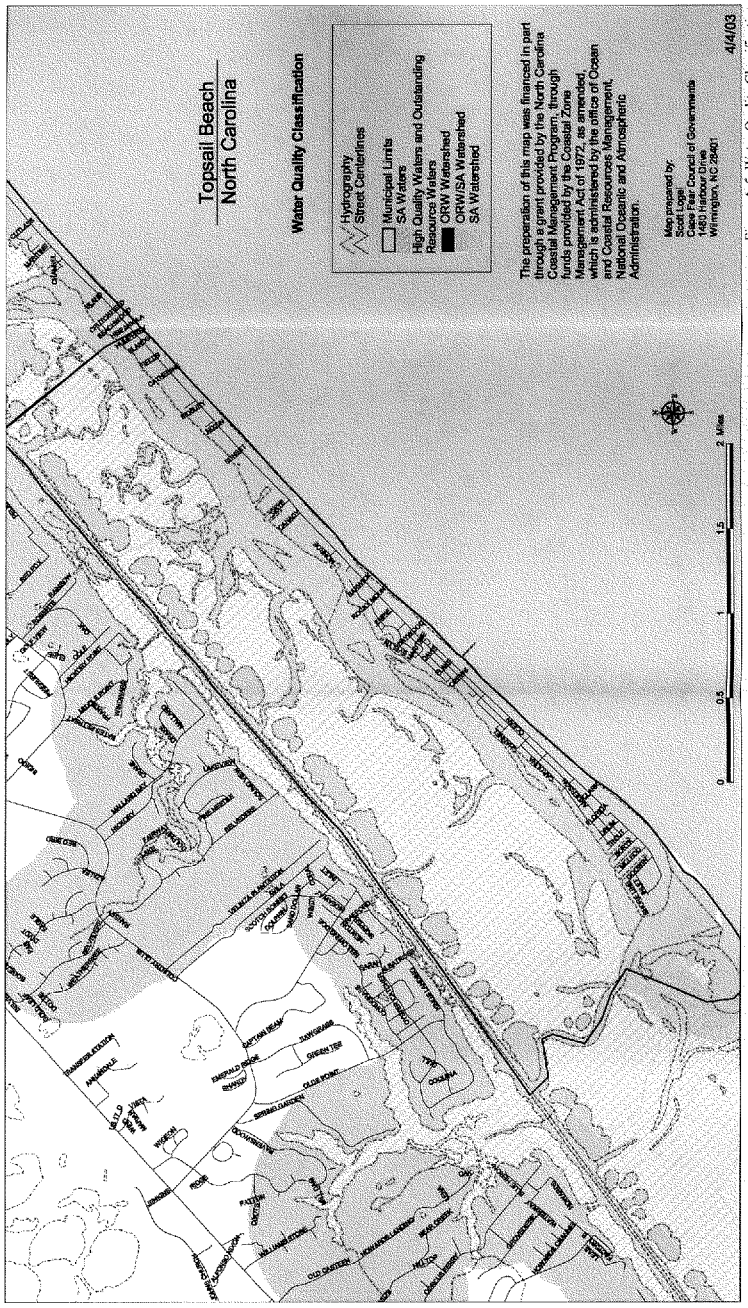


Figure A-5. Water Quality Classification

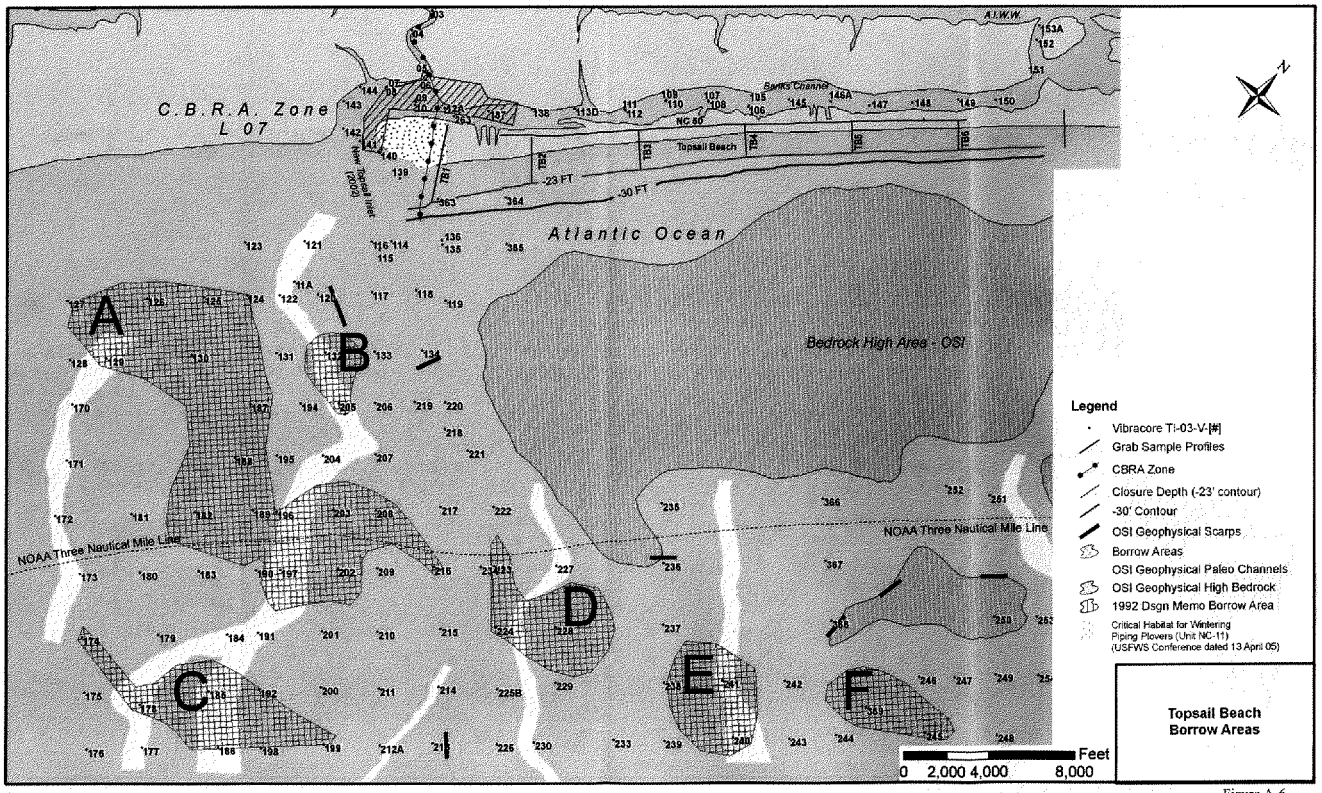

C.B.R.A. Zone
L 07
Atlantic Ocean
Bedrock High Area - OSI
Topsail Beach
NC 50
-23 FT
-30 FT
NOAA Three Nautical Mile Line
A
B
C
D
E
F
Legend
Vibracore TI-03-V-[#]
Grab Sample Profiles
CBRA Zone
Closure Depth (-23' contour)
-30' Contour
OSI Geophysical Scarps
Borrow Areas
OSI Geophysical Paleo Channels
OSI Geophysical High Bedrock
1992 Dsgn Memo Borrow Area
Critical Habitat for Wintering Piping Plovers (Unit NC-11) (USFWS Conference dated 13 April 05)
Feet
0 2,000 4,000 8,000
Topsail Beach
Borrow Areas

Figure A-6

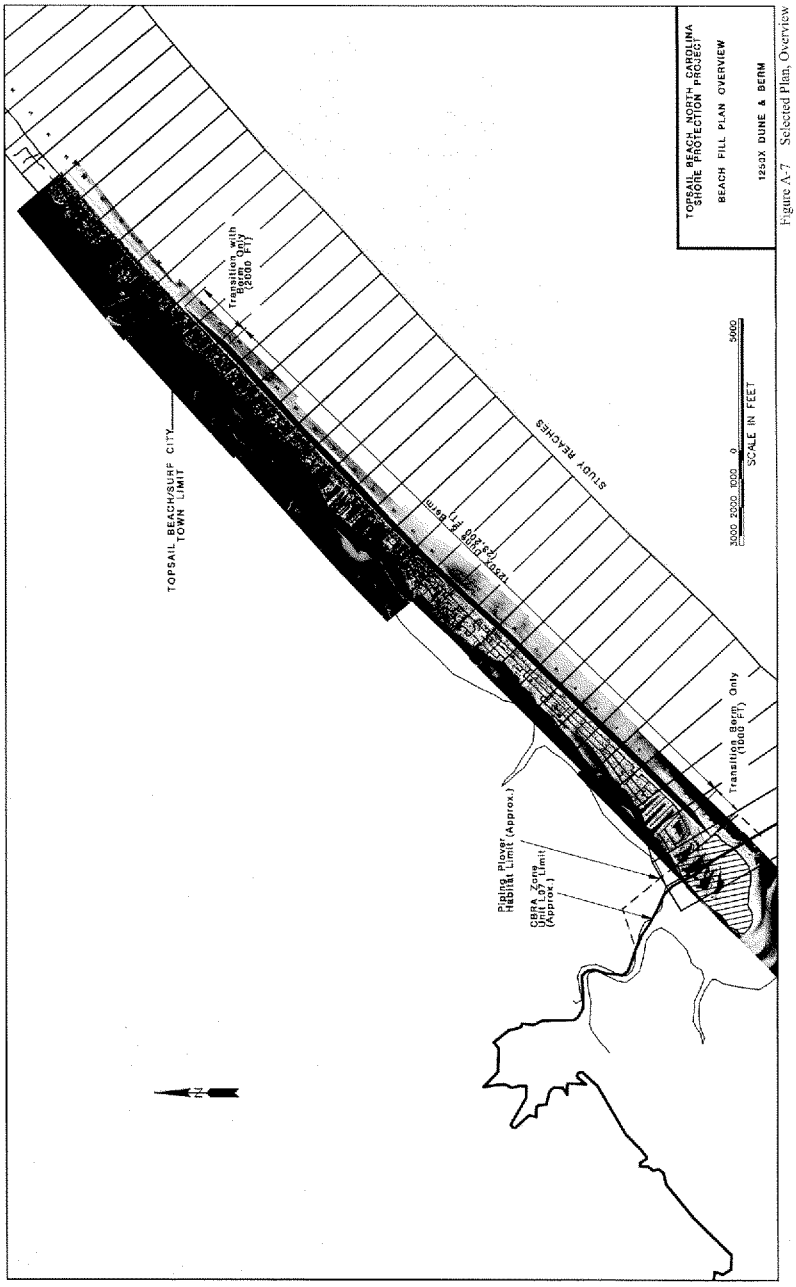
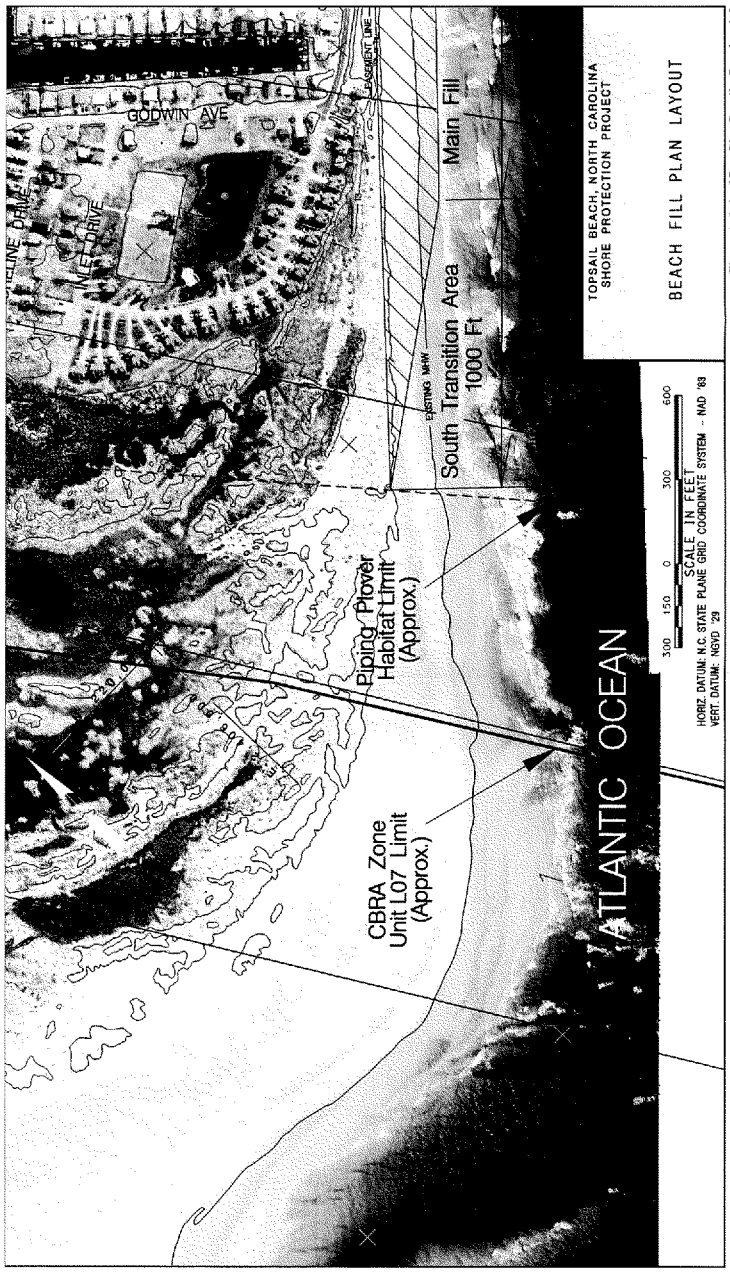


Figure A-7 Selected Plan, Overview



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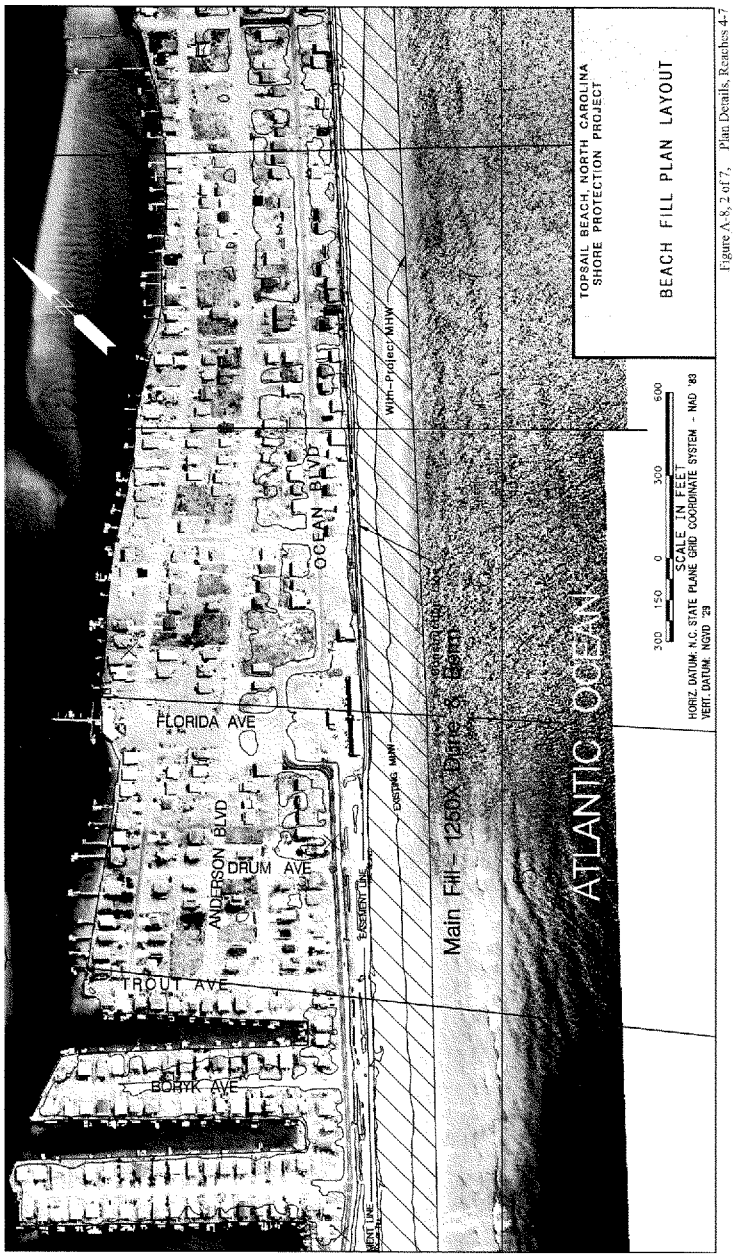

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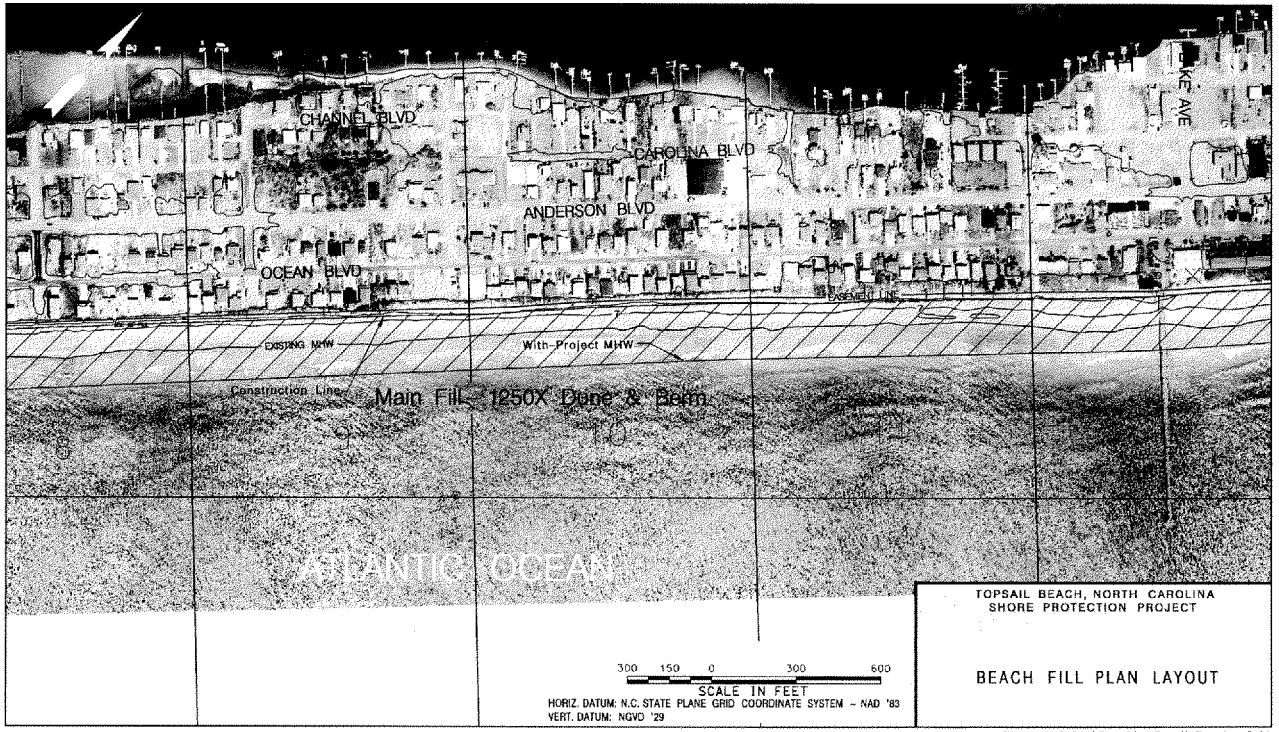

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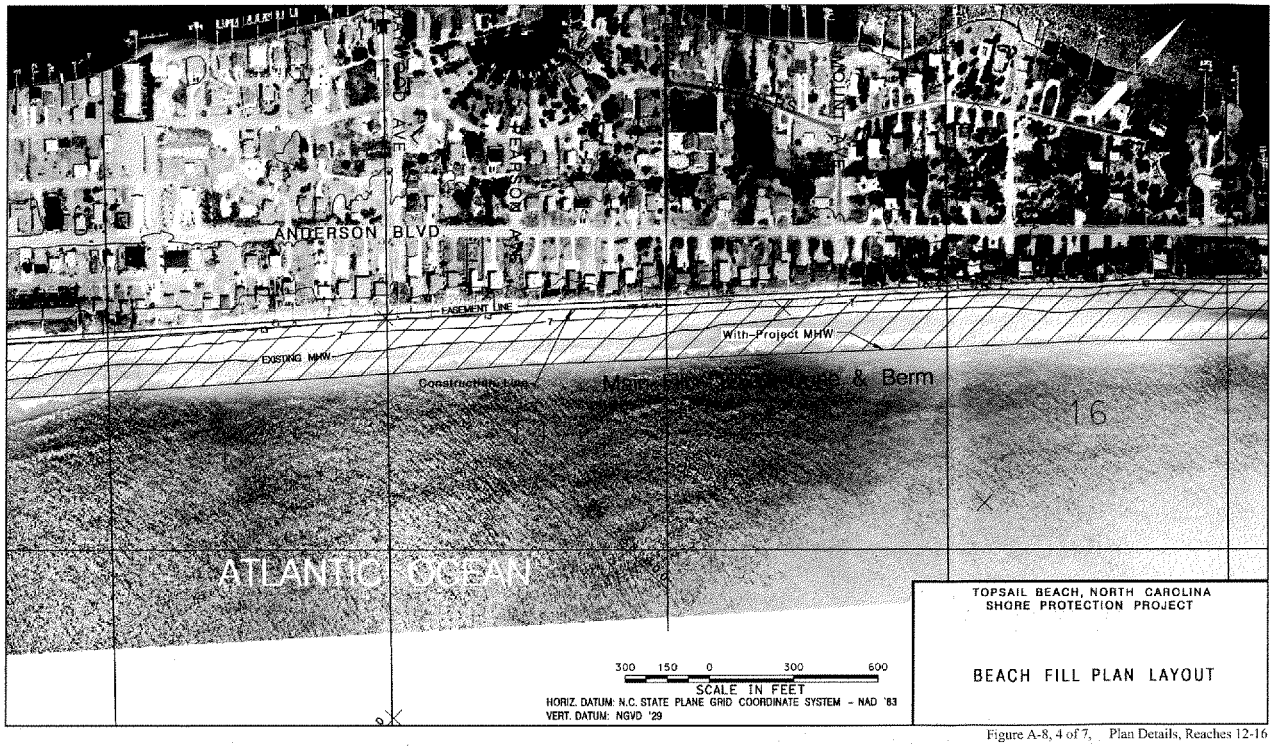

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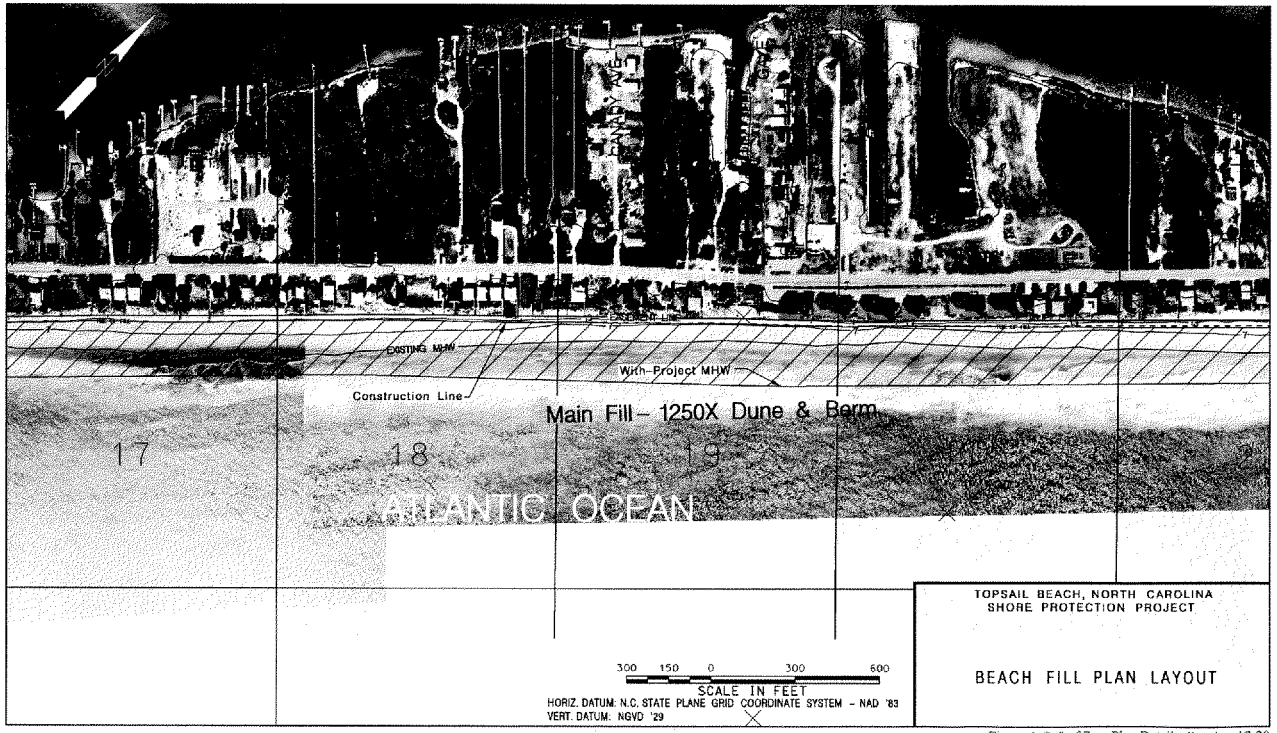

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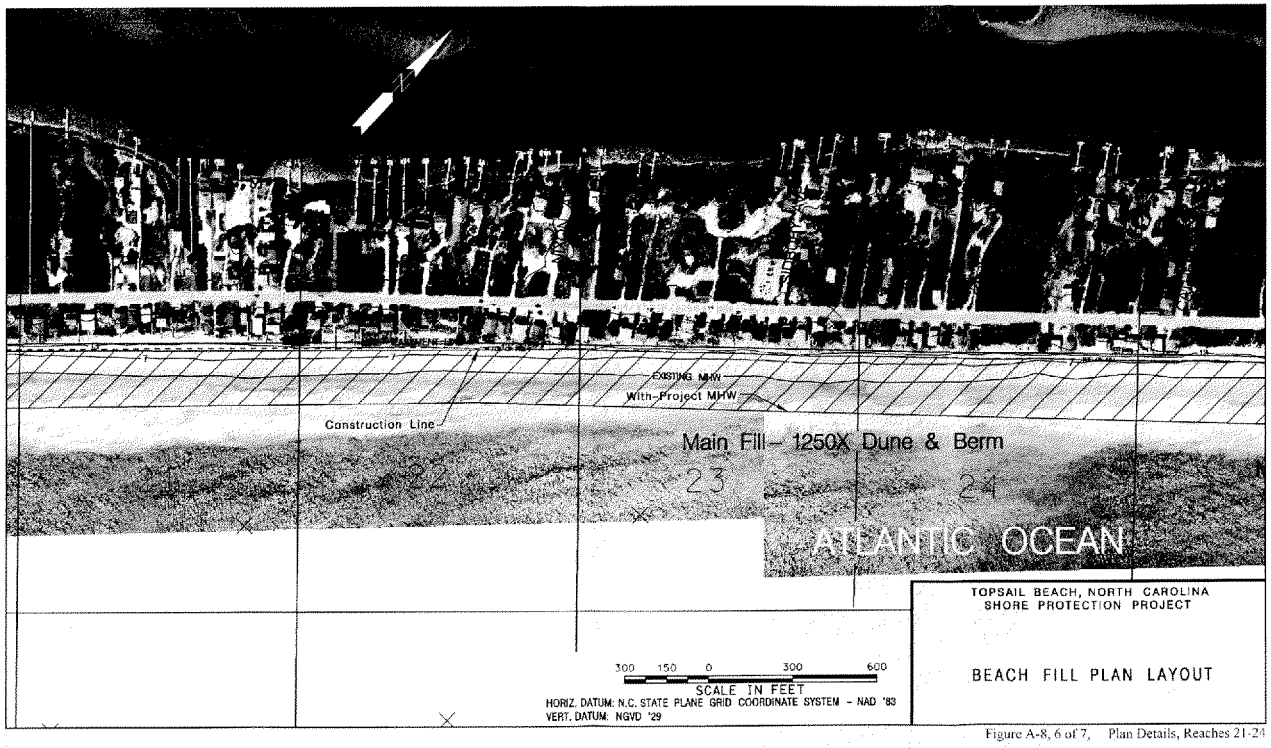

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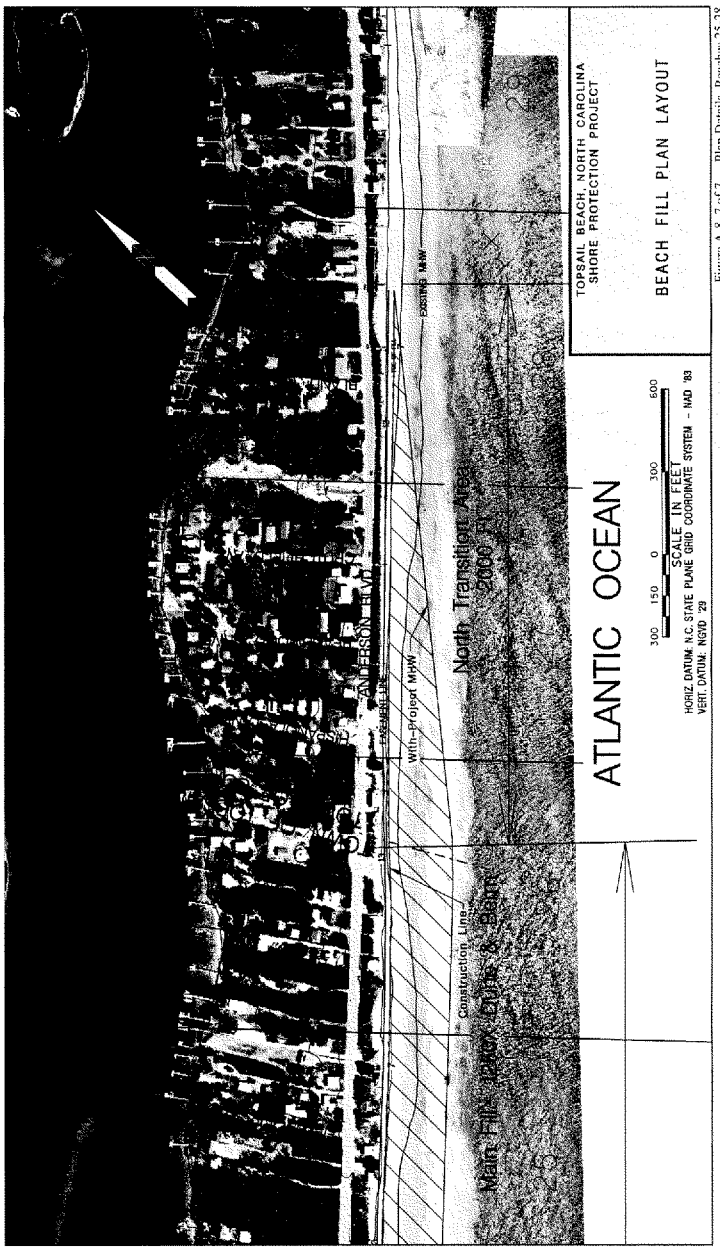

Figure A-8, 7 of 7, Plan Details, Reaches 25-28