BRUNSWICK COUNTY BEACHES PROJECT

BRUNSWICK COUNTY, NORTH CAROLINA

DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT

Prepared by:

Howard F. Hall and Tracy M. Rice

Under the Supervision of:

Dr. Garland B. Pardue
Ecological Services Supervisor

U.S. Fish and Wildlife Service
Ecological Services Raleigh Field Office
Raleigh, North Carolina

August 2000

EXECUTIVE SUMMARY

Introduction (Section 1) - This report is provided under authority of Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) of 1958 (48 Stat. 401, as amended; 16 U.S.C. 661-667d). The FWCA established fish and wildlife conservation as a coequal objective of federally funded or permitted water resources development projects. Consultation during project planning is intended to allow state and federal resource agencies to determine the potential adverse impacts on fish and wildlife resources and develop recommendations to avoid, minimize, and/or compensate for detrimental impacts.

The current project is part of the larger Brunswick County Beaches Project authorized by Public Law 89-789 (House Document 511; 89th Congress) dated November 6, 1966 (Flood Control Act of 1966). The area considered in the Congressional authorization extended from the Cape Fear River westward to the North Carolina/South Carolina state line. The bill called for dune and beach restoration fills covering a coastline reach of 25.2 miles. In August 1999 the Wilmington District, U. S. Army Corps of Engineers (Corps), initiated coordination with the Service for their General Reevaluation Report (GRR) for the Brunswick County Beaches project. At that time the project was focused on the areas (from east to west) of Caswell Beach, Yaupon Beach, and Long Beach. In December 1999 the project was extended westward to include 37,600 linear feet (7.1 miles) of Holden Beach

There have been several prior studies and reports on this projects and similar projects in Brunswick County. Basic designs for storm protection structures were considered in a 1973 General Design Memorandum (GDM) for five of the six coastal political entities of Brunswick County. In 1989 the Town of Ocean Isle Beach requested a reevaluation of the portion of the project in that town. In November 1989, the Brunswick County Beaches - Ocean Isle Beach, Beach Erosion Control and Hurricane Wave Protection Project was separated from the larger Brunswick County project. Wilmington Harbor is a federal navigation project. In 1999 the Corps proposed several significant modifications to the enlargement of the ship channel. The Service released a Final FWCA Report (USFWS 2000) on these modifications. The Sea Turtle habitat Restoration Project within the Town of Long Beach called for moving sand from a disposal area along the Atlantic Intracoastal Waterway (AIWW) to create a main beach fill section of 8,900 feet (1.7 miles) in length.

Study Area Description (Section 2)

The project is located in the southern coastal area of Brunswick County which consists of a chain of sandy, barrier islands. The islands are separated from the mainland by elongated lagoons containing expansive marshes, tidal streams, and the Atlantic Intracoastal Waterway (AIWW).

The project area consists of a diversity of land forms. Caswell Beach is mostly a low, narrow strip of sand that forms the eastern third of Oak Island. Within Yaupon Beach the central part of the island is relict mainland. From this high central area the land slopes to the beach without an

intervening marsh. Long Beach also has a high, forested landward section from the AIWW to Big Davis Canal. The seaward part of Long Beach is extremely low with poor to moderate vegetation cover. The island of Holden Beach is low and narrow.

The coastal islands of southeastern North Carolina were created approximately 5,000-8,000 years ago at a time when sea level was much lower. Sea level has risen approximately 3.9-7.8 inches during the past century. As sea level rises, it pushes the islands landward up the continental shelf. This movement is called island onshore migration or transgression. The rate of sea level rise is likely to increase in the future. The major processes which produce island migration are: (1) island overwashes from the ocean; and, (2) the incorporation of flood tide shoals, primarily the flood tide delta.

Hurricanes are the dominant type of storm affecting Brunswick County beaches due to their southward facing orientation. The area experienced 71 hurricanes during the period form 1804 to 1971, an average of one storm every 2.4 years.

The Phase 1 GDM gives an excellent summary of shoreline change in the project area (Appendix B in USACOE 1973). Different section of the shoreline changed at different rates. Data from the period 1859-1970 indicate that Yaupon and Long Beaches had an annual average shoreline regression of 3.6 feet (USACOE 1973, p. 16). For the period of 1933-1970 Yaupon Beach had an annual shoreline regression rate of 5.7 feet. The major factor in worldwide shoreline recession, or beach erosion, is rising sea level. When the process of island migration is considered, shoreline recession is a natural, long-term ocean process that does not destroy the barrier islands.

The project envisioned in the 1973 GDM would directly or indirectly impact 19 biological communities. Furthermore, the storm damage reduction provided by the proposed work would facilitate addition development that would impact many estuarine and upland biological communities either directly or indirectly. These communities are: offshore pelagic, offshore benthic (soft substrate), offshore benthic (hard substrate), nearshore pelagic, nearshore benthic, shoreface and intertidal (wet) beach, beach - subaerial (dry), dunes, overwash flats, low shrub/grasslands , maritime shrub thicket, herbaceous swale and other freshwater wetlands, maritime forest and other upland communities, high marsh, low marsh, estuarine waters and tidal creeks, estuarine benthic, unvegetated, intertidal, estuarine flats (mudflat and sandflats), and artificial/disturbed areas. These communities contain species of plants and invertebrates that are adapted to the unique conditions present.

Fish and Wildlife Service Concerns and Planning Objectives (Section 3) -Fish, wildlife, and their habitats are valuable public resources which are conserved and managed for the people by state and federal governments. The Service seeks to mitigate losses of fish, wildlife, and their habitats and to provide information and recommendations that fully support the Nation's needs for fish and wildlife resource conservation as well as sound economic and social development through balanced, multiple use of the Nation's natural resources.

The proposed project seeks to reduce storm damage which is a worthwhile goal. The key issue is the alternatives that will be considered and the extent to which all short- and long-term adverse environmental impacts of each alternative will be weighed in the selection of the preferred alternative. The Service's first concern is that important habitat values are not eliminated or degraded. The process for selecting of a method for reducing storm damage should look beyond the short-term advantages or disadvantage of any particular technology and fully evaluate and compare the long-term consequences of each alternative.

Planning should include a thorough evaluation of all available technologies to reduce storm damage. If construction of an artificial beach and dune is the preferred alternative, the long-term consequences of this alternative should be fully explored. Offshore sand mining should be done in a manner and at a time of year so as to avoid negative impacts primary productivity, live bottoms, nationally significant fish wintering grounds, and other marine resources, including marine mammals. The transportation of sand to and placement on the beaches should be done in a manner and at a time of year so as to avoid significant adverse impacts to beach organisms, nearshore aquatic ecosystems, nesting sea turtles, and migratory shorebirds.

Evaluation Methods (Section 4) - Descriptions of natural resources within the study area and the assessment of project impacts are based on previous studies for similar projects, published literature, and personal communications with knowledgeable individuals. A valuable source of information was a 1999 report on the availability of sand for beachfill offshore of Oak Island in Brunswick County by Dr. W. J. Cleary. The Corps' 1973 Phase 1 General Design Memorandum contained extensive information on the geological aspects and biological resources in the area.

Existing Fish and Wildlife Resources (Section 5) -The vertebrate fauna in the project area is dominated by fish and birds. Amphibians, terrestrial reptiles, and mammals are limited in the project area.

The variety of upland, pelagic, and wetland communities on the Brunswick County coast provides a host of habitats for birds, both permanent and seasonal species. Coastal barrier islands probably harbor a greater variety of bird species than any other ecosystem in the continental United States.

Marine mammals occur in offshore and inshore waters of North Carolina. Twenty-nine species of cetaceans have been recorded along the coast of the Carolinas, Virginia, and Maryland. Bottle-nosed dolphins are common in this area.

The Florida manatee, an endangered species, may move north along the Atlantic Coast and occasionally make their way into the coastal waters of North Carolina. There are nine reports of this species from Dare County.

All five Atlantic sea turtles may occur in the coastal waters of North Carolina. The presence of sea turtles in nearshore and estuarine waters of North Carolina appears to be seasonal. Sea turtles

are present in the offshore water of North Carolina throughout the year and present in inshore waters from April through December. The loggerhead sea turtle is the most common sea turtle along the North Carolina coast. In the 12 years from 1988 through 1999, the combined area of Caswell, Long, and Holden Beaches reported four green sea turtle nests and 1,868 loggerhead sea turtle nests. A single nesting by the Kemp's ridley sea turtle was reported from Long Beach in 1992.

The project area provide important habitat for shorebirds. Piping plovers within the project area are part of the Atlantic Coast population, and are federally listed as threatened. The project has received limited use by breeding, migrating, and overwintering piping plovers. The areas east of both Shallotte Inlet (on Holden Beach) and Lockwoods Folly Inlet (on Long Beach) are proposed as critical habitat for overwintering piping plovers. When the Corps establishes the precise limits for sand placement, the extent of impacts on these areas must be coordinated with the Service. The federally endangered roseate tern generally breeds along the Atlantic Coast. The species is considered a rare coastal transient in North Carolina It may be present from late March to mid-May and from late July to October.

Future of Project Area Without the Project (Section 6) - With the exception of marine fishes that are subject to commercial harvesting, populations of wildlife and other fisheries resources are likely to maintain present population trends in the near future if the artificial beach-dune system is not constructed. If natural shoreline recession is allowed to continue, the beach will not disappear, but simply migrate landward. To the extent that natural beach movement is allowed to continue, developers may find the risks of construction near the beach to be too great. Any reduction of construction near the shore would be beneficial to sea turtles and shorebirds. The absence of artificial dunes would also facilitate the natural process of island overwash. Such overwashes would benefit early successional wildlife, such as piping plovers, and allow for natural replenishment of sound side marshes.

Overall, any adverse impacts to fish and wildlife resources due to implementing the storm damage reduction project must be fully considered in all environmental documentation. There are no justifications for excluding such impacts on the grounds that other factors would diminish these resources.

Alternatives Considered (Section 7) - The 1973 GDM stated that project would consist of the construction of a levee-type fill having the general geometric configuration of an integrated dune and beach profile. Encircling the developed portion of the Brunswick County barrier islands with a dike and/or floodwalls was considered. Early planning also considered the construction of offshore breakwaters that could partially or completely shield the shoreline by intercepting incoming wave energy. The preauthorization study considered a series of detached, offshore breakwaters to reduce wave impacts on the shoreline. No consideration was given to the storm damage reduction potential of removing structures from the inherently dangerous shoreline.

The Service believes that the Corps has not presented all alternatives to meet the stated project goal and has not considered an approach that would integrate several nonstructural options. While the construction of the artificial beach-dune system may be the only alternative that the Corps could undertake unilaterally, it is not the only action alternative which could reduce storm damage. In accordance with the National Environmental Policy Act (NEPA), planning should go beyond alternatives that would be constructed by the Corps and consider alternatives that could be implemented by, or in cooperation with, other agencies, e.g., Federal Emergency Management Agency, state agencies, and local governments.

A key step in developing all possible alternatives would be to clearly define three project goals: (1) the categories or intensity level of storms for which protection would be provided; (2) the type(s) of damage which the project is intended to reduce; and (3) the exact area that would receive protection. Both hurricanes and winter storms (northeasters) can vary greatly in intensity and the damage produced is related to the magnitude of winds, flooding, and storm surges produced. Data for hurricane categories should be used in establishing the approximate level of damage which the project would seek to mitigate. The five major processes of high winds, storm waves, storm surge from the ocean, storm surge ebb (water flowing overland from the sound), and high rainfall should be considered. The development of alternatives should state the types of damages which are to be reduced.

As a storm damage reduction option, creation of an artificial beach has several attributes that must be considered. The protection provided is extremely temporary. In its present offshore location, the sand removed from offshore areas to create the beach may benefit the shoreline by reducing wave energy offshore. The removal of offshore sand may alter wave refraction patterns and/or wave energy striking the beach. The physical characteristics of the sand placed on the beach may not be compatible with the existing beach sand.

Construction standards and techniques can reduce structural storm damage. The best and most common method of minimizing flood damage due to waves or storm surge is to raise the lowest floor of all structures above the expected highest water level. The Kitty Hawk Land Use Plan recognizes this. In addition to the advantages that better building codes and enforcement would provide to building owners, such measures would benefit the entire community by reducing missiling (flying debris), rafting (floating debris), and ramrodding (floating debris). Zoning and land use planning may be employed to reduce storm damage.

Selection of the Preferred Alternative (Section 8) - The basic alternative for storm damage reduction and beach erosion control in Brunswick County was established before the passage of NEPA (USACOE 1973, p. 1). In accordance with federal legislation, the Wilmington Corps District conducted investigations as part of a larger effort directed at hurricane damage on the eastern and southern seaboards. The Corps made recommendations for a "dune and beach restoration fills" that was subsequently authorized by the Flood Control Act of November 7, 1966.

Alternative selection in the 1973 GDM appeared dominated by a single factor: cost. The GDM rejected the option of constructing a series of offshore breakwaters solely on the basis of cost. The Corps also determined that the cost of a dike around each island "far exceeded the economic benefits" (USACOE 1973, p. 19). Data from the preauthorization study indicated that current benefits accruing from the provision of total flood protection would still be "incommensurate with the cost required to effect that type of solution."

By letter dated August 16, 1999, the Corps informed the Service that the project would, in concept, consist of the construction and maintenance of a berm and dune system that would tie into the existing dune and vegetation line. The Service has no information regarding the selection process of the preferred alternative. In fact, many aspects of the actual project have not been determined. The process used to select the preferred alternative has not been discussed. The selection among the alternatives appears to be confused by the degree to which the purposes of storm damage reduction have been intertwined with the unstated goal of erosion control/beach restoration. Although beach/dune restoration may seem to be a reasonable option for erosion control/beach nourishment, it is potentially the most environmentally harmful among options for storm damage reduction. The selection of the preferred alternative should also consider present beach erosion rates in the project area. The issue of long-term impacts on other coastal features must be addressed in an Environmental Impact Statement (EIS).

After the development of alternatives, the EIS should clearly indicate the factors leading the selection of the preferred alternative. In general, the major factors, which may overlap to some extent, would be: (1) effectiveness; (2) sustainability; and, (3) the long-term impacts to other coastal features. The selection of the preferred alternative should be presented in a section of the EIS distinct from the section that develops alternatives.

Description of the Preferred Alternative (Section 9)- The Phase I GDM for Yaupon and Long Beaches called for a continuous dune and beach restoration fill extending a distance of 47,600 linear feet (9.0 miles) along the oceanfront from the west end of Long Beach to and including Yaupon Beach

In planning for the GRR, the Corps has provided the Service with a general overview of the project. Some important aspects of the project have not been established. The eastern part would extend approximately 62,200 linear feet (11.78 miles) from Fort Caswell near the mouth of the Cape Fear River westward to Lockwoods Folly Inlet. On Holden Beach, west of the inlet, the project would extend 37,600 feet (7.12 miles) from the inlet westward to the end of the public road. Overall, the total project limits would cover 99,800 feet (18.9 miles). The work proposed along the beach would involve the construction and maintenance of a berm and dune system that will tie into the existing dune and vegetation line. The exact amount of required fill has not been determined and will not be known until project dimensions are finalized. The Corps estimates that the frequency of maintenance (beach renourishment) will be every three years. Four borrow sources were evaluated initially. An offshore additional sites along with the four sites mentioned

above are under consideration for the Holden Beach section. In late July 2000 the Corps added a fifth potential borrow area, Frying Pan Shoals, directly south of Cape Fear.

I**mpacts of the Preferred Alternative (Section 10)** - Project impacts fall into three broad categories: direct, indirect, and cumulative. Direct impacts refer to those consequences of a given action which occur at generally same time as the action and in the immediate vicinity of the action. Direct impacts are generally easier to observe and quantify, but they are not necessarily the most serious and long-lasting impacts. In fact, even dramatic, direct impacts to organisms and habitats may soon dissipate and resilient ecosystems can return to pre-project levels in relatively short spans of time. Indirect impacts are conditions resulting from the project, but are separated from the project area in time and/or space. The long-term consequences of a project that maintains an artificial beach-dune system for 50 years may provide the most significant impacts. Cumulative impact analysis refers to the consideration of impacts resulting from present project when added to all other past, present, and reasonably foreseeable actions of a similar nature regardless of the agency (federal or non-federal) or persons that would undertake such other actions.

The preferred alternative would kill the plants and animals within the sand removed from borrow sites and increase turbidity during the dredging of the borrow sediments. Silt and clay particles within the borrow material would become suspended by the dredge. The increased turbidity would be harmful to planktonic invertebrates, fish, and marine mammals. The suspended sediment would reduce light penetration beyond the actual area dredged and reduce primary production.

Hardbottom areas indicated by SEAMAP (1998), Riggs et al. (1996, 1998), Cleary (1999, 2000a, 2000b), and McLeod et al. (2000) could be destroyed by sedimentation associated with dredge and fill activities. However, sediment with certain characteristics, e.g., high silt and clay content and currents, could cover hardbottom areas many miles from the dredging site with a damaging layer of sediment.

The mining of offshore sand in areas used for wintering by commercially important fish could adversely affect these species. The project could jeopardize the spawning stock biomass of inter-jurisdictional species which provide recruits for much of the mid-Atlantic coast. Fish in the area would be disturbed by the turbidity caused by initial construction and periodic dredging for replacement of sand. Dredging may remove habitat used by these species, such as hardbottoms or underwater sand berms or mounds that provide shelter. Dredging would destroy benthic prey organisms and could cause mobile prey species to move out of the work area.

Fish and invertebrates may smother when gills are clogged due to high levels of suspended solids. Reduced light penetration decreases primary productivity. Planktonic larvae of both vertebrates and invertebrates found in the surf zone may be adversely affected by high turbidity levels (NRC 1995, p. 114). Van Dolah et al. (1992) found that macrofaunal communities in the lower intertidal zone and subtidal areas of the beach declined after nourishment. However,

recovery was rapid and this was attributed to the similarity of beach fill material to the natural sediments and to the placement of fill material high on the beach.

Placement of sediment on the beach will kill the existing infauna through suffocation or loss of access to food. The burial of organisms, such as coquina clams, mole crabs, amphipods, polychaetes and other invertebrates in both the surf zone and beach will usually result in temporary elimination of these organisms with the exception of highly mobile species or species able to withstand prolonged periods of burial.

The Service is concerned that the perpetual beach fill maintenance, particularly when combined with beach disposal of dredged sediments from the Wilmington Harbor deepening project, may have cumulative impacts to the hardbottom ecosystem as millions of cubic yards of sediment are introduced to the nearshore system on a regular basis either from turbidity and siltation or from potentially increased erosion rates on adjacent beaches.

Sediment placement during the sea turtle nesting and hatching season, May 1 through November 15, can lower reproductive success. Creation of the artificial beach-dune system during this season could result in the loss of sea turtles through disruption of adult nesting activity and by burial or crushing of nests or hatchlings. Besides the potential for missing nests during a nest relocation program, there is a potential for eggs to be damaged by their movement or for unknown biological mechanisms to be affected. Nest relocation can have adverse impacts on incubation temperature (and hence sex ratios), gas exchange parameters, the hydric environment of nests, hatching success, and hatchling emergence. A final concern about nest relocation is that it may concentrate eggs in an area resulting in a greater susceptibility to catastrophic events. Hatchlings released from concentrated areas also may be subject to greater predation rates from both land and marine predators, because the predators learn where to concentrate their efforts.

The placement of pipelines and the use of heavy machinery on the beach during a construction project may have adverse effects on sea turtles. This equipment can create barriers to nesting females emerging from the surf and crawling up the beach, causing a higher incidence of false crawls and unnecessary energy expenditure. Human and macroinvertebrate traffic (e.g., ghost crabs) can also be impeded by this heavy equipment.

Another impact to sea turtles is disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchlings from artificial lighting. Construction lights along a project beach and on the dredging vessel may deter females from coming ashore to nest, disorient females trying to return to the surf after a nesting event, and disorient and misorient emergent hatchlings from adjacent non-project beaches.

Depending on the time of year for sediment placement, work on the beach would disrupt feeding and roosting by shorebirds, including the piping plover. The elimination of beach infauna would remove a food source in the project area.

Marine mammals are highly mobile and range widely along the Atlantic coast. While dredging and beach disposal may be disruptive to normal travel routes and foraging patterns, these animals are likely to move to less disturbed areas. However, the dredging vessels must avoid hitting marine mammals and special observers may be necessary to watch for marine mammals.

Removal of sand from the offshore borrow areas may permanently alter the physical characteristics of the areas and impact the benthic flora and fauna adapted to existing conditions. The recovery period for benthic communities that are lost to dredging is quite variable, ranging from a few months to several years (NRC 1995, p. 120). While the abundance and diversity of benthic fauna may return to pre-dredging values, several studies have documented changes in the species composition of the benthos that lasted more than a year, particularly in areas where bottom sediment composition was altered (Johnson and Nelson 1985, Bowen and Marsh 1988, Van Dolah et al. 1992, 1993, Wilber and Stern 1992). Benthic organisms inhabiting the potential offshore borrow areas serve as food for commercially important species and are essential in marine food chains.

The cumulative effects of the project on offshore fisheries may be the transformation of formerly preferred habitat into unsuitable or unusable habitat. This change could occur as a result of altered substrate characteristics, depth, or other physical parameters. In addition to harming commercial and recreational fishermen, the loss or degradation of this important fish habitat would adversely impact marine birds, such as the northern gannet and eastern brown pelican, and marine mammals, such as the humpback whale.

In addition to changes in species composition and abundance, the removal of offshore sand may also reduce primary productivity. Reduced primary productivity could result from the greater depth in the borrow areas after sand removal. The greater depth would reduce solar energy reaching the new bottom. Furthermore, even minor sedimentation reaching distant hardbottom areas would reduce productivity.

The sedimentation resulting from finer grain material washing off the artificial beach-dune system is similar to, but distinct from, that produced by dredging. Nearshore reef habitats that lie within the nearshore littoral zone may be destroyed by sand burial resulting from the redistribution of beach fill material (NRC 1995, p. 113-114). Studies have indicated that sand placed on Wrightsville Beach has washed off the beach and buried extensive hardbottoms on the inner continental shelf (Riggs 1994, p. 17). These hardbottoms were prime fishing locations, but are now out of production due to a covering of two to six inches of sand.

When a beach is nourished, large volumes of sand are placed within the supralittoral and intertidal zones. Beach invertebrate populations are eliminated or greatly reduced. As noted, the direct, adverse impacts may be dramatic, but longer-term, indirect impacts related to altered beach characteristics and recruitment of a recovery population may have the greater impact on fish and wildlife resources that depend on beach invertebrates as a food source. Sand placement

disturbs the indigenous biota inhabiting the subaerial habitats, which in turn affects the foraging patterns of the species that feed on those organisms (NRC 1995, p. 108).

Peterson et al. (2000) documented invertebrate populations following dredge spoil disposal from Bogue Sound placed on the beaches of Bogue Banks to be reduced by 86-99% (compared to control beaches) 5 to 10 weeks following fill placement. Donoghue (1999) found the timing of beach fill placement, the time interval between fill placement episodes, the size and type of fill, and the compatibility of the fill material to the native sediments to be critical to the short- and long-term impacts to beach invertebrate populations. Reilly and Bellis (1978) state that species of beach infauna recruited from pelagic larval stocks, such as mole crabs and coquina clams, will recover if nourishment activity ends before larval recruitment begins in the spring. While species which move on and off the beaches during their life cycle may recolonize the new beach in time, species spending their entire life cycles in the intertidal regions of the beach may be more severely impacted by massive sand placement (Hurme and Pullen 1988).

Reilly and Bellis (1978) indicated that numbers of migrating, invertebrate consumers such as the speckled crab (*Arenaeus cribarius*), lady crab (*Ovalipes ocellatus*), ghost crab (*Ocypode quadrata*) and blue crab (*Callinectes sapidus*) were drastically reduced after nourishment activities. This may be attributable to greater turbidity causing resident populations to move elsewhere, a change in beach slope and offshore bars making approach to the beach difficult, or more likely a reduction in the abundance of prey. Vertebrate consumers, such as fish and shorebirds, may also be adversely affected by a reduction in prey species.

Donoghue (1999) and Bowman and Dolan (1985) found that these dominant invertebrate species are also influenced by hydrodynamic parameters. Abundances of coquina clams, for instance, are concentrated on the downdrift sides of beach cusps, and there is evidence that these clams surf from one beach cusp to another on the wave swash (Donoghue 1999). The abundance of these patches of clams decreases with smaller cusps and changes in the hydrodynamic conditions. The ability to maintain burrows and optimize filter feeding appears to be directly related to both grain size and hydrologic parameters, both of which can be drastically altered by an artificial beach fill project.

The slope of a nourished beach in the intertidal zone is generally steeper after nourishment until the beach reaches a more stable profile (NRC 1995, p. 108). Beach nourishment on Bogue Bank caused the beach slope in the intertidal zone to increase from three to five percent (Reilly and Bellis 1978). The steeper slope of the artificial beaches allow waves of greater energy to strike the shoreline, altering the hydrodynamics of the beach.

There are also indirect effects resulting from the lack of internal structure in an artificially constructed beach as opposed to a natural beach. The fill material may vary significantly in its mineralogical composition, organic content, grain size distribution and sedimentary characteristics. Over the lifespan of the project, with the continual maintenance of this artificial

beach, there will be a semi-permanent to permanent change in the beach, which supports an entire ecosystem.

Targeting inlet areas as borrow sources poses additional indirect impacts. Removal of substantial amounts of material from the tidal deltas at Lockwood's Folly Inlet or the Cape Fear River mouth may increase the fluctuation of adjacent shoreline erosion rates. The borrow pits may serve as a sediment sink and divert more sediment from the longshore transport system than background levels. The barrier spit habitats adjacent to tidal inlets in the project area are important habitats for fish and wildlife resources, which rely on the dynamic and ephemeral nature of inlets. Wave and current patterns and energies may be significantly altered, which may disrupt the natural cycle of dynamic equilibrium at the inlets.

Beach fill adds to the coastal sediment budget (Davison et al. 1992). Storms are especially likely to remove large quantities of sand from the artificial beach. While some of it will be washed out to sea, a large quantity of sand will undoubtedly be picked up in the longshore current. Down current drift of sediment may accelerate the filling of navigation channels in down current areas, which would increase the frequency of dredging required to maintain the channel (NRC 1995, p. 113). The Corps anticipates these greater erosion rates and incorporate them into a project's maintenance needs (USACOE 2000a, 2000b), but it is not well known if the greater erosion rates alter the entire dynamics of the coastal ecosystem.

The security offered by an artificial beach-dune system on a barrier island surrounded by a rising sea can only be temporary. Burgess (1994, p. 21) states that "Some contend that these blankets of shuttled sand are giving coastal residents a false sense of security and discouraging responsible building." In some respects, an artificial beach-dune system may be considered a seawall made from smaller particles, sand grains instead of giant boulders.

Additional growth and population increases will put pressure on existing freshwater supplies, stress existing facilities for wastewater disposal, and may eliminate nesting and overwintering habitat for shorebirds in the area.

Large-scale, long-term beach construction projects such as this proposal for Oak Island and Holden Beach also have direct and indirect impacts on people. The heavy equipment used to construct the proposed project may be present for many months. This equipment blocks recreational access, is noisy during operation, and if used at night the lights and noise may prevent adjacent property-owners from a peaceful night's rest. Recreational and commercial fishermen will be prevented from using waters in and near the borrow areas for months. Escarpments impede recreational access to and from the water. Surf fishermen are already advised to stay away from nourished and bulldozed beaches as they "become 'dead' beaches, without natural life" (Simpson 2000). Bird watchers likely follow the same advice since shorebirds will have nothing more to feed upon than the surf fishes.

Aside from the impacts considered above, the initiation of a program to create and maintain an artificial beach-dune system has serious ramifications for the entire barrier island ecosystem. First, this program represents a commitment to protect structures in their present location despite a rising sea level that would, under natural conditions, force the island to move landward. Second, this commitment will be extremely difficult to reverse. Pilkey et al. (1998, p. 107) note that once shoreline engineering is started, it can't be stopped. Third, maintaining structures in their present location will become increasingly expensive. Current plans for renourishment at three year intervals may shrink to a two year cycle and after several decades annual sediment placement could be required. However, renourishment at any interval depends on an economical source of sand and at some point the cost of moving sand will become prohibitive. At this point, the value of the structures behind the artificial beach-dune system will have increased many times over. Where a phased-in program of relocation and retreat from the beaches would cause serious social and economic hardships in the present, by the middle of the next century such a program could be out of the question and seawalls may be the only politically acceptable solution to preserve development. Seawalls, on both the beaches and sound side marshes, would eventually eliminate existing habitat values at the margins of the barrier island.

The cumulative impacts of the proposed project will be significant. Federal and private nourishment projects already occur at or are planned for Ocean Isle, Caswell Beach, Bald Head Island, Kure Beach, Carolina Beach, Masonboro Island, Wrightsville Beach, and Figure Eight Island. The Wilmington Harbor deepening project will dispose of almost 5 million cubic yards of material on Bald Head, Caswell, Oak Island and part of Holden Beach. Thus Sunset Beach is the only developed beach in all of Brunswick and New Hanover Counties that would not be regularly disrupted with beach construction projects.

The cumulative impacts of this widespread artificial beach-dune construction are immense. Few to no natural beaches will be left to supply spawning and recruitment populations for invertebrates to recolonize the artificial beaches. The Service is concerned that this extensive and perpetual human disruption of the natural beach ecosystem will lead to permanently depressed or eliminated invertebrate populations in New Hanover and Brunswick Counties. The invertebrates serve as indicator species for the health and integrity of the entire sandy beach ecosystem. Shorebirds and juvenile fish will not be able to forage on the beaches. Research is indicating that the surf zone is an important nursery area for some species of fish, and that these fish have high site fidelities (Ross and Lancaster 1996). The surf zone has been designated as Essential Fish Habitat by the South Atlantic Marine Fisheries Council because of the ecological functions it provides for aquatic resources. Any semi-permanent artificial modification of that habitat may lead to significantly depressed fish populations. Likewise, migratory avifauna may not be able to stop over in southern North Carolina and fuel up for continuation of their long migration journeys.

The integrity of the benthic and pelagic nearshore and offshore ecosystem will also be compromised by a 50 year commitment to repetitively remove portions of the substrate all over New Hanover and Brunswick Counties. Hundreds of millions of cubic yards of sediment will be

dredged out of the benthic ecosystem and used to bury large portions of the nearshore benthic ecosystem. Several studies have shown that nourishment sediment moves offshore the project beach (Reed and Wells 2000; Thieler et al. 1995), and that over time the need for sediments increases over the life of the project rather than decreases (Trembanis et al. 1998). The cumulative impacts of these massive dredge and fill projects is the wholesale manipulation of the continental shelf and its associated habitats. The perpetual artificial relocation of hundreds of millions of cubic yards of sediment from one place to another will lead to a long-term, far-reaching degradation of the seafloor and both its hardbottom and sandy habitats.

Comparison of Impacts (Section 11)

There is a range of alternatives that can contribute to reducing the damage caused by coastal storms. In general these options may be divided in two broad categories. First, artificial barriers may be thrown up in an attempt to keep out the ocean. These options do nothing to prevent wind damage and unless they are extremely high and very water tight do little to prevent flooding and storm surge damage in major storms. Second, there can be a combination of land use polices and construction standards which attempt to move buildings out of harm's way and fortify them when, not if, high wind, waves, and wave reach them. These options apply to storm damage reduction and not directly to problems associated with shoreline recession which are not within the scope of the stated objective for this project.

Creation of the artificial beach-dune system is much more harmful to the environment than a combined program of higher construction standards and land use planning. In fact, the latter produces none of the adverse impacts associated with the former.

Conservation Measures and Recommendations (Sections 12 and 13) -
Fish and wildlife conservation measures, as specified in the FWCA, consist of "...means and measures that should be adopted to prevent the loss of or damage to such wildlife resources (mitigation), as well as to provide concurrently for the development and improvement of such resources (enhancement)."

The Service believes that conservation measures associated with any storm damage reduction endeavors on Brunswick County beaches fall into three categories. First, the NEPA planning process must be employed to clearly define the project purpose and develop the widest range of alternatives. Second, specific measures to minimize adverse direct impacts of the preferred alternative must be developed. Finally, measures to eliminate or reduce the serious, long-term indirect impacts of the preferred alternative must be considered.

A clear presentation of the steps taken in the NEPA planning process is essential. In the first step, the statement of purpose and need, the need for storm damage reduction is clear. However, the purpose of this specific project requires greater attention. A clear statement of purpose would

serve to disentangle the goals of storm damage reduction from the restoration a recreational beach lost to a rising sea. While these goals are often viewed as two sides of the same coin, the options for each goal are different. Table 16 indicates that the alternatives for beach replacement and storm damage reduction projects have, with some overlap, a different array of alternatives. For example, creating an artificial beach is the least environmentally damaging alternative for beach stabilization, but the most environmentally damaging alternative for storm damage reduction. To fully explain the NEPA planning process, the Service recommends the following measures:

1. An EIS that includes all of the available scientific data developed since the 1973 General Design Memorandum for this project should be prepared due to the significance of the environmental impacts. The EIS should define the level of storm for which protection is sought; the type(s) of storm damage which would be reduced; and, those locations within the project area for which protection is desired.

2. Regarding the project purpose, the Service recommends that the EIS clarify the relationship between reducing damage to structures and shoreline stabilization, i.e., beach erosion control. If shoreline stabilization is sought to reduce damage to structures, it is redundant to mention it in addition to damage reduction. If the Corps seeks to stabilize the shoreline for reasons other than reducing property damage, this goal may be independent of damage reduction, but the rationale for seeking shoreline stabilization independent of damage reduction should be explained. This clarification is requested because a recent Draft EIS for the Dare County Project (USACOE 2000b, p. 8-3) noted that relocating all buildings away from the shoreline would reduce storm damage, but would not halt shoreline recession. This statement suggests that shoreline stabilization is sought for reasons other than reduction in property damage.

3 On a dynamic coastline such as the project area, a clear understanding of major natural forces is essential in developing effective alternatives. In that regard, the EIS should incorporate the latest information on global sea level rise and the role that a rising ocean has on ocean encroachment on fixed man-made structures. Furthermore, the EIS should explain the differences between inland erosion and the adjustment of coastal shorelines to a rising sea. Inland erosion does, in fact, pick up sediment and carry it away from its site of origin and may move sediment from the mountains to the sea. On the other hand, coastal shoreline adjustment may simply move sediment from the ocean side of a barrier island to the back side of the island by the process of island overwash. This is a natural geologic mechanism whereby the islands are able to move to higher ground and remain above a rising sea. Therefore, the Service recommends that the EIS fully consider the positive role of shoreline adjustment and differentiate coastal shoreline adjustment from inland forms of erosion.

4 The EIS should have a separate section to develop the entire range of alternatives that achieve the desired storm damage reduction. This section may discuss costs, social

impacts, and agencies other than the Corps which would implement a given alternative. However, no alternative should be eliminated in this section. Two references (Bush et al. 1996 and Pilkey et al. 1998) should be consulted. The alternatives analysis should include an evaluation of using hazard mitigation grant program buy-outs or relocations, elimination of subsidies on hazardous development, an in-lieu fee program for buy-outs to compensate the local tax base, and doing nothing.

5 Once all alternatives have been completely developed, the EIS should have a separate section that clearly outlines the selection of the preferred alternative. The Corps should balance the desired level of storm damage reduction against social and environmental impacts in the selection of the preferred alternative. Important issues that the EIS should address regarding the artificial beach-dune alternative are:

a. The EIS should discuss the impact of rising sea level on the project over its 50 year lifespan The targeted borrow areas may be depleted of sediments at the end of 50 years, yet the perceived need for the project will remain the same or increase due to more development pressure. The EIS should compare a one-time capital cost of structure relocation compare to a commitment to maintain the beach as a storm buffer virtually forever.

b. The proposed artificial beach-dune system may provide protection against only low intensity storms (e.g., hurricane categories 1 and 2) and protect structures in a very limited area. The EIS should determine whether a program of selective relocation, strict zoning/setback requirement, retrofitting existing buildings, and stricter building codes for new buildings is more cost efficient than the large and unpredictable costs of building and maintaining an artificial beach-dune system.

c. Appendix B lists the potential direct, indirect and cumulative impacts to the physical component of the ecosystems affected by the proposed project. The EIS should discuss the potential direct, indirect and cumulative impacts to the biological and chemical components of these ecosystems resulting from these physical impacts.

d. The EIS should completely evaluate the cumulative impacts of maintaining an artificial beach-dune system on every developed beach in New Hanover and Brunswick Counties except Sunset Beach. A full cumulative impacts analysis as outlined by the Council on Environmental Quality (CEQ 1997) and as required by case law (i.e., Montana Council of Trout Unlimited, et al, v. U.S. Army Corps of Engineers et al, U.S. District Court, Montana District, Billings Division, May 11, 2000) should be conducted.

6. The EIS should include an analysis of changes in wave patterns and wave energy striking the shoreline that would occur as a result of removing sand from offshore borrow pits and inlet sand bodies. The analysis should present a determination on the impacts that changes in the offshore and nearshore bathymetry would have on wave energy reaching the beaches and the possibility for even greater rates of sediment removal and shoreline recession. This analysis should specifically discuss wave energy impacts that would exist in the 50th year of the project when depths in some offshore areas may be increased by several feet.

Current plans call for the construction of an artificial beach-dune system. This alternative would produce direct, adverse impacts on fish and wildlife resources and their habitats. Adverse impacts should be avoided where possible, and where they cannot be avoided they should be mitigated. The Service offers the following recommendations to avoid, minimize, or mitigate these direct impacts:

7. The Corps should establish a program to monitor dredging impacts on primary productivity and benthic invertebrate community composition. The monitoring program currently under development for the Wilmington Harbor deepening project may serve as a baseline, guidance and/or starting point to gather data for this project's EIS. The program should assess the biomass and species composition of organisms that recolonize borrow areas. The program should include pre-project baseline data and post-project data at one-, three-, five-, and ten-years after dredging. The program should use at least one area among each of the two targeted islands and five borrow areas, plus control areas for each. At three, five, and ten years after sediment removal, data collected should be compared with offshore fisheries data (e.g., species composition, diversity, food habits, landings, catch per unit effort, and other appropriate information) to produce an overall evaluation of dredging impacts on offshore fisheries. If these comprehensive evaluations indicate that fisheries resources have been adversely affected, the Corps should work with the Service, National Marine Fisheries Service (NMFS), North Carolina Wildlife Resources Commission (NCWRC), and the North Carolina Division of Marine Fisheries (NCDMF) to develop a mitigation program for the remaining decades of the project.

8. The Corps should provide contractual opportunities to local universities to conduct aquatic resource surveys before, during and after the project construction period to document and gather important data on valuable fish and wildlife resources and impacts to their populations and distributions in all borrow and fill areas. These data should be made available to the Service, NMFS, NCWRC, NCDMF, and all interested parties.

9. To minimize both the direct and indirect impacts of turbidity and subsequent sedimentation, the Corps should ensure that the project does not use sediment which consists of more than ten percent silt and clay particles. These construction restrictions would not only reduce turbidity, but would also prolong the life of the artificial beach-

dune system and thereby increase the time between beach-dune reconstructions. The project EIS should contain a Sand Suitability Analysis in accordance with procedures of the Corps' Coastal Engineering Research Center or those currently under development with the Service's geologist. Borrow sediments should match the native grain size distribution and sorting level, mineral composition, color, shape and organic content to better mimic the native habitat.

10. A Tier One Assessment according to the Inland Testing Manual (ITM) adopted by the Corps and the EPA in 1998 should be conducted on borrow sediments for the project that are removed from disposal islands, inland waterways and navigational channels, and such documentation should be included in the EIS. Should any sediments contain contaminants or toxins that exceed EPA standards, appropriate measures should be taken to manage the contaminants.

11. Since there is no single period of the year when work could be scheduled to avoid adverse impacts to all the fish and wildlife resources in the project area (Table 19), the best way to minimize adverse impacts is to reduce the duration of construction. Reduced construction time can be achieved by the simultaneous use of more than one dredge. On balance, the most limited resources, e.g., an undisturbed beach, would benefit from dredging during the winter months. Therefore, the Service recommends that initial construction be accomplished by using at least two dredging vessels that commence work on or after November 15. These vessels would work as weather allows through the winter and attempt to finish initial construction by March 31. If some work remained after March 31, these vessels would continue work into the spring until work was completed. Sediment replacement operations should follow a similar pattern, but with a reduced work period. Sand replacement operations should be limited to the period from November 15 through the end of February. Scheduling beach disposal outside the larval recruitment period of beach invertebrates will ensure better recovery for these species.

12. The interval between renourishment episodes should be as long as possible to minimize the potential for severe semipermanent to permanent cumulative impacts to the ecosystems in the project area. Beach fill should be monitored with subaerial and subaqueous profiles on a regular basis (perhaps quarterly and after every storm) to determine the longevity of the material's placement, and thus how long the material affects the biological substrate.

13. The project length should be as short as possible to reduce impacts to invertebrate populations and facilitate recovery via recruitment from nearby undisturbed areas. Caswell Beach should be considered for exclusion as a placement area due to its receipt of maintenance dredging materials from the Wilmington Harbor deepening and realignment project.

14. Heavy equipment used to manipulate fill sediments placed on the beach should be kept to a minimum, perhaps only one regular size bulldozer on any given beach at any given time. Heavy equipment should not be stored on the beach, and night work should use the minimum amount of light necessary (which may require shielding) or low pressure sodium lighting during project construction.

15. All dredging activities should comply with existing agreements with the NMFS and the U.S. Fish and Wildlife Service as to timing and types of allowable dredges. Hopper dredges should not be used during the summer sea turtle nesting season or spring and fall migration periods when species numbers in inland waters are high. Observers should be present on all hopper dredges to monitor for incidental takes of sea turtles year-round. All takes should be documented and reported to the Service and NMFS, and appropriate conservation measures coordinated in the event of excess takes. The Corps should coordinate with the NMFS to develop procedures to avoid adverse impacts to marine mammals that may occur in the area of the offshore borrow sites.

Beyond the broad measures given above, the Service recommends the following measures to benefit specific resources:

16. Dredging activities should not occur adjacent to disposal islands during the colonial waterbird nesting season of April 1 to October 31 to minimize disturbance to such nests. Construction activities that could disturb colonial waterbirds with noise, lights and fumes should be minimized at all times of the year. Potential screening/blocking or other appropriate conservation measures should be coordinated with the North Carolina Colonial Waterbird Management Committee and other relevant agencies.

17. Spoil islands should not be pumped out or refilled during the colonial waterbird nesting season to minimize disturbances to nesting habitat and existing nests.

18. If sediment placement extends into the sea turtle nesting and hatching season, May 1 through November 15 of any year, the Corps must initiate formal consultation in accordance with Section 7 of the Endangered Species Act. Sediment placement during this period will require a program of sea turtle nest monitoring and relocation. Furthermore, the Corps should incorporate into formal project plans measures designed to help state-approved sea turtle monitoring programs.

19. The Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act of 1996 (Public Law 104-297) requires that essential fish habitat (EFH) be identified. The surf zone, live/hardbottoms, artificial reefs and Frying Pan Shoals have already been designated as EFH. The Corps must consult with the NMFS regarding the

impact of the proposed project on those species for which the proposed borrow sites and adjacent areas have been determined to constitute EFH. Fishery management councils are mandated to comment to the Corps regarding the impact of the proposed project on anadromous species; therefore, the New England, Mid-Atlantic and South Atlantic Fishery Management Councils (SAFMC), as well as the Atlantic States Marine Fisheries Commission, should be contacted and provided with an opportunity to review the Corps' environmental documents for the proposed project.

The consultation process in the Southeast Region of the NMFS is addressed in NMFS (1999) that contains a list of the species managed by the SAFMC and NMFS, their EFH, and the geographically defined Habitat Areas of Particular Concern (HAPC) identified in Council Fishery Management Plans. In North Carolina, the SAFMC identified the sandy shoals of Cape Fear, within the study area, as an HAPC.

Consultation requirements in the Magnuson-Stevens Fishery Conservation and Management Act direct federal agencies to consult with NMFS when any of their activities may have an adverse effect on EFH (NMFS 1999; see also National Oceanic and Atmospheric Administration (NOAA) 1999 for information on the NMFS northeast region). The EFH rules define an **adverse effect** as "any impact which reduces quality and/or quantity of EFH...[and] may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions." Since the proposed project would result in the removal from the study area of several million cubic yards of substrate during the course of the proposed 50-year project life, it would appear that this project meets the criteria for constituting an adverse effect and that the Southeast Region of NMFS should be contacted by the Corps for that purpose.

20. Beach fill should be monitored for compaction and escarpment formation. Immediately after completion of sand disposal on beaches and prior to sea turtle nesting seasons, monitoring should be conducted to determine if escarpments are present and escarpments should be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities.

21. The project should include an annual monitoring program on beach and subtidal invertebrates that form an important food resource for shorebirds and surf fishes. 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, and incorporate data expected to be gathered during monitoring of the Wilmington Harbor deepening project and from the New Jersey Erosion Control Project (Asbury Park to Manasquan Section Beach; see Appendix C for the Executive Summary). The program should have adequate control areas such as Sunset Beach and the area to the south of Fort Fisher. There should be an additional requirement to quantify changes in biomass and

community composition at one-. three-, five-, and ten years after initial construction. If an 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.

The most significant environmental impacts of the proposed 50-year effort of sand removal and beach placement will be indirect. In this regard, it is necessary to look beyond the impacts of the initial construction and consider the many sand replacement operations that are currently scheduled at three year intervals, but over the decades are likely to become more frequent.

The loss of the offshore benthic community during dredging is a direct project impact. However, the more serious issue regarding this community is its ability to recover from dredging and continue to provide the primary production to support consumers at higher trophic levels in offshore waters. The avoidance of any significant increase in depth along with maintenance of the sediment characteristics of offshore bottoms would help maintain primary productivity. While the assessments in Recommendation 7 would seek to quantify impacts on the benthic community, the Service recommends the following measures to minimize the long-term impacts on all offshore benthic organisms:

22. Dredging should leave a sufficient layer of sediment that matches as closely as possible the original surface layer to avoid exposing a dissimilar sediment; and,

23. Dredging should not create numerous deep pits that are likely to refill with much finer material and permanently alter the nature of the substrate.

24. The Corps should ensure that no 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 borrow sites and the review of data provided by the Southeast Monitoring and Assessment Program (SEAMAP). If hardbottoms are adversely affected, the project should include specific measures to mitigate any adverse impacts.

Fish and wildlife resources will benefit by prolonging the life of the artificial beach-dune system. Measures which prolong the life of the beach-dune system will minimize all the direct impacts discussed in Section 10 as well as minimize the cumulative impacts by allowing time for impacted population to recover. Therefore, the Service recommends that:

25. Borrow areas should be located seaward of the active shoreface of the beach and inlet systems to avoid significant changes in the bathymetry over which waves approach project area beaches.

26. Existing offshore sand shoals or sand bars should not be removed for use in creating the beach-dune system.

27. The borrow area should be monitored regularly with both bathymetric surveys (preferably multi-beam or Scanning Hydrographic Operational Airborne LIDAR Survey (SHOALS)) and benthic organism surveys to establish recolonization rates and success or failure. Bathymetric surveys would generate data on changes to the borrow pit due to altered current or wave patterns, which could suspend portions of sediments and lead to siltation or increased local turbidity levels. Any measured impacts over the life of the project should be mitigated through coordination with the Service, NMFS and other relevant agencies.

28. Beaches scheduled to receive periodic sand placements in perpetuity should be monitored long-term for increased erosion rates, decreased biological productivity and cumulative impacts to fish and wildlife resources, especially Federally-listed species such as sea turtles, piping plovers, and seabeach amaranth. Any measured, long-term impacts arising over the lifespan of the project and its maintenance should be mitigated through coordination with the Service, NMFS and other relevant agencies.

To ensure that this project does not exacerbate navigation of nearby inlets, the Service recommends:

29. The EIS should fully discuss: (1) the potential rates of sediment losses from the beach fill based on grain size data (the Sand Suitability Analysis); (2) the impact of using inlet sand bodies as borrow materials on inlet shoaling, wave patterns and adjacent shoreline erosion rates; (3) the likely pathways that may carry over a million cubic yards of sand per year for 50 years away from the beach; and, (4) the likely locations that would ultimately receive the sediment carried away from the beach.

Summary of Findings and Position of the Service (Section 14) -The data and analysis presented in this report have led the Service to a number of findings. Barrier islands and spits are inherently dangerous places for any man-made structures such as roads, houses, or utility infrastructure. The Service recognizes the increasing risk of storm damage and supports the goal of reducing such damage. The Service is also concerned that constructing artificial beaches is often presented as the only way to save the recreational beach. The real issue is not whether the barrier islands will have recreational beaches, but where these beaches will be located. Overall, the preservation of recreational beaches and the tourist economy which they support provides no justification for constructing artificial beaches.

The Service supports the goal of storm damage reduction. The Service also supports the planning process of the NEPA. However, at the current time the Corps has not clearly defined either the type of damage to be reduced or the area to be protected. Such definitions are necessary to fully develop and evaluate the widest possible range of alternatives. Furthermore,

current planning has not adequately considered the unique nature and geological forces acting on a barrier island. These considerations are critical in fully describing the long range, secondary impacts of the project. In regard to a very serious, potential project impact, the Corps and the Service must work together to ensure that the placement of millions of cubic yards of sand on project area beaches is not allowed to result in semi-permanent to permanent secondary or cumulative impacts.

The key question is not whether to seek storm damage reduction, but the best method to achieve this goal on a barrier island. The Corps, with the support of local interests, has proposed the creation of an artificial beach-dune system between the ocean and structures on the shoreline. Current planning documents do not fully explain the alternatives that were considered or the reasoning leading to the selection of this alternative. The Service finds that this decision requires greater support than has been made available to date. The majority of the targeted borrow and fill areas are within areas designated as Essential Fish Habitat, for instance, and the Corps has not provided justification for disturbing these areas to meet the project purpose and need.

Our desire for greater justification is based on three points. First, the creation of an artificial beach-dune system from sand dredged in other areas of the coastal system is not the innocuous procedure that it may once have been considered. Second, there is a fundamental difference in the long-term ramifications between constructing beaches and dunes on a mainland shoreline and the same construction on a barrier island. Third, there are proven alternatives to constructing beaches and dunes for storm damage reduction that have not been adequately considered.

Current planning for storm damage reduction in Brunswick County has not presented evidence that all direct and indirect environmental impacts of constructing an artificial beach-dune system were fully considered in the selection of the beach-dune system. The construction and maintenance of such a system would have profound impacts on the barrier island ecosystem over the 50 years of official project life. The project EIS should demonstrate an understanding of these impacts in the selection of best means to reduce storm damage in the project area.

While the Service has serious reservations about the long-term efficacy of an artificial beach-dune system to protect existing structures on a barrier island, the decision to postpone the day of reckoning ultimately lies with the citizens of the project area and their elected representatives. If the thorough evaluation of all social and environmental factors required by the NEPA planning process should confirm that an artificial beach-dune system is the best overall alternative, the incorporation of the Service's recommendations given in this report into the design and construction of the project will avoid or minimize many of the most serious adverse impacts on the fish and wildlife resources in the project area. Those impacts that cannot be avoided should be mitigated.

TABLE OF CONTENTS

Section Page

Section Page

Section Page

Page

LIST OF FIGURES

Page

Page

Page

LIST OF TABLES

Page

Page