United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecosystem Office
P.O. Box 2676
Vero Beach, Florida 32961-2676

October 28, 1997

Colonel Joe R. Miller
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-4019

Attn: Planning Division

Dear Colonel Miller:

In accordance with the Fiscal Year 1997 Transfer Fund Agreement between the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers, Jacksonville District (COE), I am providing this final Fish and Wildlife Coordination Act Report on the Fort Pierce Beach Erosion Control Project. The COE requested an evaluation on the environmental effects of nourishing approximately 2.3 miles of beach along a segment of the Atlantic coastline in St. Lucie County, Florida, with material dredged from an offshore borrow area. This information is needed to enable the COE to reformulate and evaluate the authorized project to assure that it conforms to current environmental needs and criteria. This report is submitted in accordance with the Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. 661 *et seq.*).

Copies of this report were sent to the U.S. National Marine Fisheries Service and the Florida Game and Fresh Water Fish Commission for their concurrence. Their comments are included in the attachment section of this report.

If you have any questions or require additional information, please contact Mr. Charles Sultzman at (561) 562-3909.

Sincerely,

For James J. Slack
Project Leader
South Florida Field Office

cc:
NMFS, St. Petersburg, FL
GFC, Vero Beach, FL

Final

FISH AND WILDLIFE COORDINATION ACT REPORT

FORT PIERCE BEACH PROJECT
ST. LUCIE COUNTY, FLORIDA

Submitted to: U.S. Army Corps of Engineers, Jacksonville, Florida
Prepared by: Charles W. Sultzman, Project Biologist
Approved by: James J. Slack, Project Leader

U.S. Fish and Wildlife Service
South Florida Field Office
Vero Beach, Florida

October 1997

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (COE) requested a Fish and Wildlife Coordination Act Report from the U.S. Fish and Wildlife Service (FWS) on the environmental effects of a proposed beach nourishment project in St. Lucie County, Florida. The project includes a fill area 2.3 miles long located in the City of Fort Pierce, St. Lucie County, Florida. Material for this project would be obtained from a borrow area approximately three miles offshore.

Significant nearshore reef area is present seaward of the proposed fill area. The COE has estimated that 7.9 acres of this reef could be buried by the fill. The FWS recommends that aerial photographs be taken before and after project construction to determine the actual extent of reef burial. A limestone artificial reef of equivalent surface area should then be deployed to mitigate for natural reef loss. In addition, the area around the proposed borrow area should be surveyed with side scan sonar for reefs. Any reefs detected in this area should be monitored for dredging impacts.

The currently proposed project may affect the threatened loggerhead sea turtle (*Caretta caretta*) as well as the endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and hawksbill sea turtle (*Eretmochelys imbricata*). Adverse effects to threatened and endangered sea turtles due to this beach nourishment project will be discussed in detail in our forthcoming Biological Opinion.

INTRODUCTION

The Fort Pierce Beach Erosion Control Project was authorized by the Rivers and Harbor Act of 1965, as recommended in House Document 84 of the 89th Congress. The authorized project consists of creating a 1.3 mile-long protective and recreational beach south of Fort Pierce Inlet. The currently proposed project includes a one-mile extension southward of the fill area.

II. PROJECT DESCRIPTION

The location and limits of the project segments are shown in Figure 1. With the proposed extension, approximately 1,970,000 cubic yards of material would be placed along 2.3 miles of beach at Fort Pierce. The 1.3 mile-long fill area would extend from Florida Department of Environmental Protection (DEP) marker R-34 to DEP marker R-41. If the southward extension is deemed feasible, the fill area would extend to R-46. The construction berm would be 50 feet wide at an elevation of +10 feet mean low water.

The proposed sand source for this renourishment project is a borrow area southeast of Fort Pierce Inlet at an area known as Capron Shoal. To our knowledge, the ocean bottom near the borrow area has not been surveyed for reefs which could be affected by the dredging. The average silt/clay content of the source material is reported to be 2.0 percent.

III. DESCRIPTION OF STUDY AREA

The State of Florida occupies part of a larger geographic unit, the Floridian Plateau, which separates the deep waters of the Gulf of Mexico from the Atlantic Ocean. The east coast of Florida, from the Georgia state line to South Miami Beach, consists of a series of sandy barrier islands separated occasionally by inlets. The project area is located on a barrier island which separates the Indian River Lagoon from the Atlantic Ocean.

IV. FISH AND WILDLIFE RESOURCES

Fish and wildlife habitats in the project area which could be affected by this project include the supralittoral beach zone, which serves as nesting habitat for four species of sea turtles, the intertidal beach zone, nearshore reefs which could be buried by beach fill, and reefs in the vicinity of the borrow area.

A. Community Descriptions

Beach Zone

The beaches of St. Lucie County are typical of other Atlantic Coast beaches in Florida which are subject to the full force of ocean waves. These beaches usually have low species diversity, but populations of individual species are often very large. Species such as ghost crabs (*Ocypode*

quadrata), mole crabs (*Emerita talpioda*), and polychaetes are highly specialized to survive in this high-energy environment.

Florida has approximately 744 miles of beaches, mainly along the shorelines of barrier islands. Wind and waves are constantly changing the shape of barrier islands and their beaches. On the east coast of Florida, general patterns of sand transport or littoral drift have been well-documented. During winter, littoral drift is to the south, whereas during summer, the transport of sand may retreat slightly to the north when southeasterly winds prevail. Inlets, such as those at Fort Pierce, inhibit littoral drift. As a result, beaches on the up-drift or north side of these inlets accumulate sand while those on the down-drift side are deprived of this sand.

Florida's beaches function as nesting habitat for four species of federally listed sea turtles: the threatened loggerhead turtle as well as the endangered green turtle, leatherback turtle, and hawksbill turtle. Approximately 40 percent of all loggerhead nesting occurs in the southeastern United States, primarily in Florida. The FWS is currently preparing a Biological Opinion for this project, which will provide the COE with details on nesting for all four sea turtle species in the project area.

Thirteen species of birds nest on Florida's beaches. Due to urban development and other human activities, many of these species have abandoned certain areas while some species, such as the least tern (*Sterna antillarum*), have found alternative nesting sites.

Nearshore and Offshore Reefs

Limestone reefs provide a stationary foothold to which filter-feeding organisms attach themselves. Wind- and wave-generated currents bring nutrient-rich plankton to these filter feeders, which can, with sufficient growth, contribute to the basic structure of the reef. This structure provides an array of habitats for other plants and animals. Florida is endowed with several reef types: subtropical coral reefs, live bottom communities, nearshore sabellariid worm (*Phragmatopoma lapidosa*) reefs, vermetid reefs and deep-water *Oculina varicosa* reefs.

Coral reefs are best developed in the U.S. in Florida. Most of the Florida Keys' coral reefs are well known due to the clarity of the water and the popularity of SCUBA diving. Farther north, through Dade and Broward counties on the east coast and Collier County on the west coast, water clarity and temperature declines, as do reef-building corals. The solid substrate is increasingly populated by soft corals (gorgonians) in these higher latitudes. Continuing north, soft corals are fewer, and "live bottom" communities are more prevalent. Live bottom communities within the project area are populated by sponges, small (ahermatypic) hard corals, tunicates, bryozoans, algae and sabellariid worms.

Sabellariid worms can dominate the reef community and form a unique reef type known as "worm reef." These are most often formed in high-energy surf zones particularly between

Martin and Brevard counties on the east coast. Such reefs are composed of sand particles loosely cemented together by a mucus secreted by the worms when building their casing. *Oculina* reefs occur in depths greater than 100 feet from St. Lucie County to Jacksonville. Intertidal vermetid reefs off of the Ten Thousand Islands are a remnant of structures formed by the reef-building gastropod, *Petaloconchus* sp.

The reefs of the project area could be classified as sabellariid wormrock and live bottom communities with scattered hard coral. The extent of reefs is well known in Dade, Broward, and Palm Beach counties because the sea floor out to the 60-foot depth contour has recently been mapped with side scan sonar by the COE. Other mapped areas include Venice Beach in Sarasota County, Hutchinson Island in Martin County (both of these areas have been recently renourished), and Vero Beach in Indian River County. Nevertheless, with deeper reef areas taken into account, we estimate that less than one percent of areas statewide which may contain live bottom communities have been mapped.

B. Important Species and Taxa

Epibiota

Reef fauna may be divided into sessile and motile components. The sessile component contains the primary producers, some grazers or first order consumers, planktivores, and filter feeders. Hard corals occupy niches as both producer and consumer. Zooxanthellic algae within coral polyps photosynthesize while the polyps themselves capture planktonic organisms for consumption. As with the hard corals, carbon fixed far offsite is also concentrated on the reefs by tunicates, sabellariid worms and sponges. These attached filter-feeding organisms contribute to the organic base by trapping nutrient-rich plankton as it is swept past the reef by wave- and wind-generated currents. Tunicates, sponges and sabellariid worms add structure to the reef, providing shelter from predation for the numerous fishes of the reef.

Fishes and motile invertebrates

The motile invertebrates include sea urchins, conch, octopus, polychaetes, and decapod crustaceans, which include penaeid shrimp (*Penaeus* spp.), portunid crab (*Portunus* spp.), stone crab (*Menippe mercenaria*), and spiny lobster (*Panulirus argus*). Herbivory in the invertebrates is well documented (Odum 1969). Crustaceans consume sessile and epiphytic algae and are, in turn, consumed by higher predators such as the grunts (Pomadasydae) and snappers (Lutjanidae). Gastropods graze on algae, thereby passing nutrients and energy produced on the reef up the food web. The predators of gastropods include other invertebrates such as the spiny lobster (Lellis pers. comm. 1992).

The spiny lobster makes up the most popular fishery of the nearshore reefs. After spending its early post-larval life stages in estuarine habitats, young lobsters move to the nearshore reefs

where they may spend a good part of their adult lives. Many of these adults move farther offshore seasonally (Lyons *et al.* 1981).

Fish and motile invertebrates are attracted to the reef by its structure. The numerous crevices, holes, undercut ledges, and epibiotic structure provide these organisms with a refuge from larger predatory fish. The reef also provides a barrier to currents and substrate for attaching demersal eggs. In addition to these features, the sessile organisms of the reef provide a large diverse food base on which some fish species feed directly; others benefit from this indirectly by feeding on invertebrates and other smaller fish which are nurtured by sessile plant material.

The "food fish" species observed on St. Lucie County reefs include the hogfish (*Lachnolaimus maximus*), porkfish (*Anisotremus virginicus*), gray snapper (*Lutjanus griseus*), spadefish (*Chaetodipterus faber*) and gray triggerfish (*Balistes carpiscus*). Species such as the gray snapper use shallow nearshore reefs as a staging area before being recruited into the offshore commercial and recreational fishery (Stark and Schroeder 1970). All reef fish species are of ecological or scientific importance and of some value to recreational divers. Many species are collected for aquariums, such as angelfish (Pomacanthidae), butterflyfish (Chaetodontidae), wrasses (Labridae), damselfish (Pomacentridae) and doctorfish (Acanthuridae).

Sea Turtles

St. Lucie County supports 7.7 percent of Florida's total sea turtle nesting (Meylan *et al.* 1995). Three species are known to nest in St. Lucie County. The loggerhead turtle constitutes by far the largest percentage (approximately 95%) of St. Lucie County's total nesting activity. Small numbers of green and leatherback nests are also present. Sea turtle nesting activity will be discussed in greater detail in our Biological Opinion, which will address project impacts to nesting sea turtles.

V. DISCUSSION

Beach zones

Sandy beaches are populated by small, short-lived organisms with great reproductive potential. As a result, these communities tend to recover quickly from environmental disturbances. The effects of this beach erosion project on the beach zone fauna will depend primarily on the quality of the nourishment material. Since the sand proposed to be used for this project is reported to contain 2.0 percent silt and clay, recovery of the beach fauna should occur within one year. Similarly, adverse effects to sea turtles should be brief.

Nearshore reefs

The COE (1993) has estimated that approximately 7.9 acres of nearshore reef could be buried by the beach fill which extends beyond the surfzone. Sea Byte (1994), a consultant for St. Lucie

County, has identified some of the species of epibiota (listed in Table 1) which inhabit these nearshore reef areas.

Table 1. Epibentos identified by Sea Byte.

Chlorophyta:
- *Caulerpa racemosa*
- *Caulerpa prolifera*
- *Caulerpa sertularoides*
- *Caulerpa taxifolia*
- *Chaetomorpha aerea*
- *Codium isthocladium*
- *Codium interextum*
- *Cladophora* sp.
- *Halimeda discoidea*
- *Padina gymnospora*
- *Padina vichersiae*

Phaeophyta:
- *Colopomwni sinuosa*
- *Dictyota bartayresii*
- *Dictyota dichotoma*
- *Dictyota cervicornis*
- *Dictyota volubilis*
- *Dictyopteris delicutula*
- *Dilophus guineensis*

Rhodophyta:
- *Bryothamnion seaforthii*
- *Bryothamnion triquetrum*
- *Bryocladia cuspidata*
- *Ceramium fastigiatum*
- *Chondra colinsiana*
- *Gracilaria mammilaris*
- *Gracilaria verrucosa*
- *Halymenia floresia*
- *Hypnea musciformis*
- *Jania rubens*
- *Solieria filaformis*
- *Spermothamnion investiens*

Polychaeta:
- *Phragmatopoma lapidosa*

Porifera:
- *Anthosigmella varians*
- *Calcispongidae*sp.
- *Cliona lampa*
- *Cinachyra alloclada*
- *Microciona spinosa*
- *Pseudaxinella lunaecharta*
- *Tethya* sp.

Coelenterata:
- *Halopteris carnata*
- *Macrorhynchia philippina*
- *Obelia hyalina*
- *Oculina varicosa*
- *Palythoa variabilis*
- *Sertularia flowersi*
- *Siderastrea radians*
- *Thyroscyphus marginatus*

Bryozoans:
- *Amathia alternata*
- *Cryptosula pallasiana*
- *Exechonella antillea*
- *Schizoporella unicornis*

Echinodermata:
- *Eucidaris tribuloides*
- *Echinometra lucunter*
- *Lytechinus variegatus*

Ascideans:
- *Clavelina* sp.
- *Didemnum candidum*
- *Perophora viridis*
- *Rhopalea abdominalis*

Sea Byte (1994) also listed thirty-five species of fishes which were identified at the project site. Gilmore *et al.* (1981) has identified 107 fish species which may be found in this habitat. While fishes depend on the epibiota listed above, they are expected to leave the project area during construction, thus avoiding direct effects. However, Lindeman (1997) provides evidence that nearshore hard bottom habitat provides important nursery functions to such species as mullet

(*Mugil cephalus* and *M. curema*), snapper (*Lutjanus griseus* and *L. chrysurus*), pompano (*Trachinotus carolinus*) and bluefish (*Pomatomus saltatrix*). Loss of this habitat could be significant if no substitute habitat is provided as compensatory mitigation.

Offshore reefs

While direct destruction of deep reefs near the borrow area is not planned, such destruction has occurred on at least two occasions in Dade County. During the Sunny Isles renourishment project in 1988, the drag arm of the dredge ran up onto the reef (Dade County 1988). This also occurred during dredging for the Bal Harbor project; however, the greatest amount of damage during the Bal Harbor project occurred as a result of suspended sediment resettling onto the adjacent reef areas. Of the 7.7 acres surveyed for damages, more than half of the hard coral colonies were killed (Dade County 1990). Similar incidents have been reported from Broward and Palm Beach counties (Paul Davis, pers. comm.).

Based on this history, it is possible that another incident resulting in direct damage to reef areas may occur during dredging for the Fort Pierce project. This potential for direct contact between the dredge and the reefs adjacent to the dredge area can be reduced by designing buffer zones between the dredge area and the reefs which are of sufficient size to allow for navigation and positioning errors by the dredge. During the most recent renourishment of the Sunny Isles project, unmapped reef areas which protruded into the dredge area were damaged.

Secondary effects caused by dispersion and settling of sediment suspended by dredging are also possible. The establishment of sufficiently large buffer zones and a monitoring program generally prevent these impacts. Numerous studies have been conducted to assess the effects of dredging on nearby reef epifauna in an attempt to define the appropriate size of buffer zones to prevent these secondary effects (Goldberg 1980, Goldberg 1984). Unfortunately, the diversity of tropical reef epifauna and the variety of responses to sedimentation observed from different taxonomic groups has made these effects difficult to evaluate. For example, flat hard corals are intolerant of silt and may die back within a study area. Conversely, erect soft corals which shed sediment more easily may increase.

The DEP had established a maximum of 29 nephelometric turbidity units (NTU) which should not be exceeded during coastal construction projects. This level of turbidity may be high enough to cause a decline in some hard corals. Telesnicki and Goldberg (1995) have shown that respiration exceeds photosynthesis in the hard corals *Dichocoenia stokesii* and *Meandrina meandrites* when exposed to 28 to 30 NTU, even when light levels are maintained above saturation. During a dredging project, light levels may actually be reduced below saturation, and the corals could experience a more pronounced metabolic decline than observed in the subject study. The state standard of 29 NTU should be reevaluated in the light of this recent study.

Changing currents tend to reduce the effectiveness of buffer zones. A 500-foot buffer zone may protect reefs up-current but not offer any protection for down-current reefs. While the current

usually flows from south to north in St. Lucie County, current direction can change and even reverse. Finally, the strength of the current plays an important part in determining where suspended sediment will settle. A fixed buffer zone may protect down-current reefs in a weak current but may be ineffective during a strong current. Thus, it is imperative that project activities are sufficiently monitored and immediate remedial measures are taken (within 24 hours) as soon as effects are observed. On-site adjustments of work activity is critical to reduce reef damages.

VI. RECOMMENDATIONS

In developing the FWS Mitigation Policy (Federal Register 46 (15), January 23, 1981), the FWS used the definition of mitigation contained in the Council on Environmental Quality's National Environmental Policy Act regulations (40 CFR Part 1508.20[a-e]). By definition, mitigation can include:

(1) avoiding the impact all together by not taking a certain action or parts of an action;

(2) minimizing impacts by limiting the degree of magnitude of the action and its implementation;

(3) rectifying the impacts by repairing, rehabilitating, or restoring the affected environment;

(4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and

(5) compensating for the impact by replacing or providing substitute resources, or environments.

This definition recognizes mitigation as a stepwise process that incorporates both careful project planning and compensation for unavoidable losses and represents the desirable sequence of steps in the mitigation planning process. Initially, project planning should attempt to ensure that adverse effects to fish and wildlife resources are avoided or minimized as much as possible. In many cases, however, the prospect of unavoidable adverse effects will remain in spite of the best planning efforts. In those instances, compensation for unavoidable adverse effects is the last step to be considered and should be used only after the other steps have been exhausted.

The FWS Mitigation Policy focuses on the mitigation of fish and wildlife habitat values, and it recognizes that not all habitats are equal. Thus, four resource categories, denoting habitat type of varying importance from a fish and wildlife resource perspective, are used to ensure that the mitigation planning goal will be consistent with the importance of the fish and wildlife resources involved. These categories are based on the habitat's value for the fish and wildlife species in the project area (evaluation species) and the habitat's scarcity on a national,

regional or local basis. Resource Category 1 is of the highest value and Resource Category 4, the lowest. Mitigation goals are established for habitats in each resource category.

The mitigation goal for Resource Category 1 habitats is no loss of habitat value since these unique areas cannot be replaced. The goal for Resource Category 2 habitats is no net loss of in-kind habitat value. Thus, a habitat in this category can be replaced by only the same type of habitat (i.e., in-kind mitigation). The mitigation goal for Resource Category 3 habitats is no net loss of overall habitat value. In-kind replacement of these habitats is preferred, but limited substitution of different types of habitat (out-of-kind mitigation) perceived to be of equal or greater value to replace the lost habitat value may be acceptable. The mitigation goal for Resource Category 4 habitats (considered to be of marginal value) is to avoid or minimize losses, and compensation is generally not required.

Priority species using the project area include the epibenthos of the nearshore reefs and those of any reefs which may be present in the vicinity of the borrow area. These species are considered by the FWS to be in Resource Category 2, and no net loss of in-kind habitat value is recommended.

The FWS recommends that the following measures be included in future project planning. Implementation of these measures should reduce adverse environmental effects of the proposed project.

1 Complete aerial or side scan mapping of reefs in the vicinity of the borrow site. Reconfigure the site to maintain a 500-foot buffer zone, if necessary.

2. Monitor only reef edges existing within 1000 feet of the borrow area for sedimentation effects during dredging. Corrective action should be taken if adverse effects are observed.

3 Produce pre- and post-project aerial photographs of the nearshore reef. From these aerials, calculate the actual extent of reef burial which occurs.

4. Develop a mitigation plan which includes the deployment of an artificial reef constructed of limestone or limestone embedded in concrete modules. The resulting reef should have the same surface area as the natural reef which is lost due to burial by beach fill. An estimate of the area of required mitigative reef should be made prior to project construction, and at least half of that acreage should be deployed before construction to provide refuge habitat for fishes and motile invertebrates which may be displaced by the project.

5. Comply with the Terms and Conditions of our forthcoming Biological Opinion

LITERATURE CITED

Dade County, 1988. Sunny Isles Beach Restoration Project: Mechanical Damage to the Reefs Adjacent to the Borrow Area. Dade County Department of Environmental Resources Management Technical Report 88-14. Dade County, Miami, Florida.

Dade County, 1990. Environmental Impacts of the 1990 Bal Harbor Beach Renourishment Project: Mechanical and Sedimentation Impact on Hard-Bottom Areas Adjacent to the Borrow Area. Dade County Department of Environmental Resources Management Technical Report 90-15. Dade County, Miami, Florida.

Gilmore, R.G., C.J. Donohoe, D.W. Cooke and D.J. Harrema. 1981. Fishes of the Indian River Lagoon and Adjacent Waters. Harbor Branch Foundation, Inc. Technical Report No. 41.

Goldberg, W.M. 1980. Impact of beach restoration on the coral communities off the southeast Florida coast. Geomorphology, species composition, and zonation. Bulletin of Marine Science. 23:465-488.

Goldberg, W.M. 1984. Long-term effects of beach restoration in Broward County, Florida: A three-year overview. Coral Reef Associates, Inc. Florida International University, Miami, Florida.

Lindeman, K. C. 1997. Development of grunts and snappers of southeast Florida: cross-shelf distributions and effects of beach management alternatives. Ph.D. Dissertation, University of Miami, Miami, Florida.

Lyons, W., D.G. Barber, S.M. Faster, F.S. Kennedy, Jr., and F.R. Milano. 1981. The Spiny Lobster, Panulirus argus, in the middle and upper Florida Keys: Population Structure, Seasonal Dynamics and Reproduction. Florida Department of Natural Resources, Publication No. 38. Marine Research Laboratory, St. Petersburg, Florida.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52, St. Petersburg, Florida.

Odum, W.E. 1969. The structure of detritus-based food chains in a south Florida mangrove system. Unpublished Ph.D. Dissertation; University of Miami, Miami Florida.

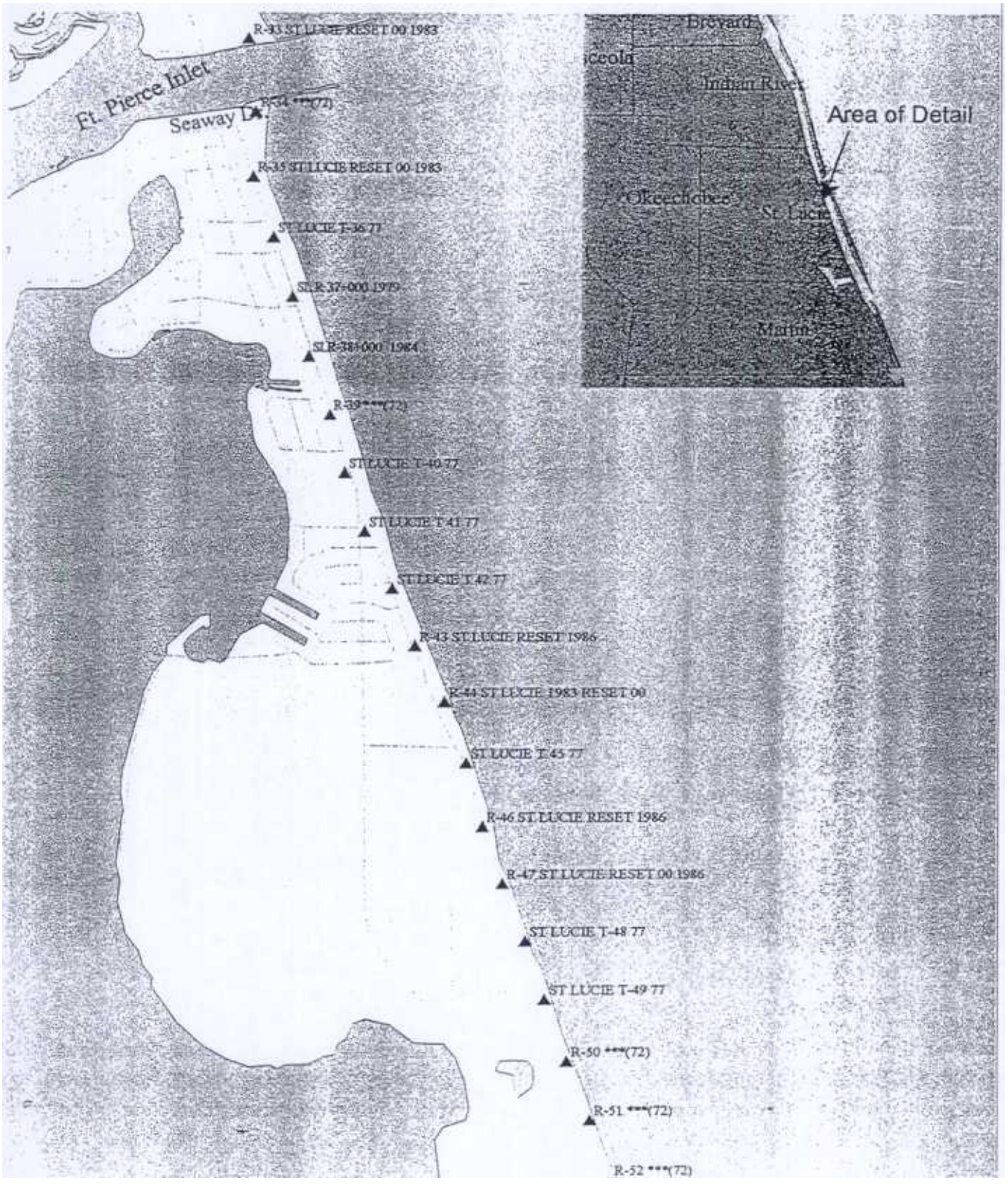
Sea Byte, Inc. 1994. Shore Protection Project. Ft. Pierce, St. Lucie County, Florida: Mapping & Biological Characterization of Nearshore Hardbottom Habitats. Unpublished report submitted to St. Lucie County Government. Fort Pierce, Florida.

Stark, W.A. and R.E. Schroeder. 1970. Investigations on the Gray Snapper, *Lutjanus griseus*. *In*: Studies in Tropical Oceanography 10: pp 15-224. Editors: C. Richard Robins, W. Henry Leigh, and Donald P. de Sylva. University of Miami Press, Miami, Florida.

Telesnicki, Guy J. And W. M. Goldberg. 1995. Comparison of turbidity measurements by nephelometry and transmissometry and its relevance to water quality standards. Bulletin of Marine Science. 57(2):527-539.

U.S. Army Corps of Engineers. 1993. Fort Pierce, Florida Shore Protection Project. Reevaluation Report Section 934 Study with Environmental Assessment. U. S. Army Corps of Engineers, Jacksonville, Florida.

Figure 1: Ft. Pierce Beach Renourishment Project



United States Department of the Interior

FISH AND WILDLIFE SERVICE
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October 9, 1997

Colonel Joe R. Miller
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Attn Planning Division FWS Log No. 4-1-91-F-212

Dear Colonel Miller:

The U.S. Fish and Wildlife Service (FWS) has reviewed the Fort Pierce Shore Protection Project. This letter represents the FWS's biological opinion on the effects of the planned actions in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). We have reassigned FWS log number 4-1-91-F-212 to this consultation.

This biological opinion is based on information provided from the following sources: field investigations, previous biological opinions prepared for similar actions in the action area as well as other published and unpublished sources of information. A complete administrative record of this consultation is on file in the FWS's South Florida Ecosystem Office in Vero Beach, Florida.

CONSULTATION HISTORY

On October 30, 1990, the FWS issued a Biological Opinion for the deposition of fill in an area between 1,000 and 3,000 feet south of Fort Pierce Inlet.

By letter dated July 7, 1997, the U.S. Army Corps of Engineers (COE) requested verification from the FWS whether the Terms and Conditions of the 1990 Biological Opinion would apply to the larger 2.3 mile-long project area.

By letter dated August 5, 1997, the FWS replied that the larger project area would need to be considered according to more current policies and requested the COE to initiate formal consultation under section 7 of the ESA. The letter also stated that the FWS determined that the proposed project may adversely affect threatened and endangered sea turtles.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

St. Lucie County proposes to nourish approximately 1.3 miles of shoreline on Hutchinson Island, St. Lucie County, Florida. The feasibility of extending the project an additional mile to the south is also being considered. With the proposed extension, approximately 1,970,000 cubic yards of material would be placed along 2.3 miles of beach south of Fort Pierce Inlet. The initial 1.3 mile-long fill area would extend from Florida Department of Environmental Protection (DEP) marker R-34 to DEP marker R-41. If the southward extension is deemed feasible, the fill area would extend to R-46. The construction berm would be 50 feet wide at an elevation of +10 feet mean low water. The proposed sand source for this renourishment project is a borrow area southeast of Fort Pierce Inlet at an area known as Capron Shoal. The average silt/clay content of the source material is reported to be two percent. The action area encompasses the 2.3 miles of shoreline where fill is proposed to be deposited.

The FWS has determined that the planned actions may affect sea turtle nesting. Our records indicate that the threatened loggerhead sea turtle (*Caretta caretta*) as well as the endangered green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), and hawksbill sea turtle (*Eretmochelys imbricata*) may nest on the beaches in St. Lucie County.

II. STATUS OF THE SPECIES

The FWS has responsibility for protecting sea turtles when they come ashore to nest. The National Marine Fisheries Service (NMFS) has responsibility over sea turtles in the marine environment. In applying the jeopardy standard under the ESA, the FWS has determined that sea turtle species occurring in the U.S. represent populations that qualify for separate consideration under section 7 of the ESA. Therefore, even though sea turtles are wide ranging and have distributions outside the U.S., the FWS only considers the U.S. populations of sea turtles when making jeopardy or no jeopardy determinations under section 7.

The reproductive strategy of sea turtles involves producing large numbers of offspring to compensate for the high natural mortality through their initial years of life. For at least two decades, several human-caused mortality factors have contributed to the decline of sea turtle populations along the Atlantic coast and in the Gulf of Mexico (National Research Council 1990a). These factors include commercial over utilization of eggs and turtles, incidental catches in commercial fishing operations, degradation of nesting habitat by coastal development, and marine pollution and debris. Therefore, human activities that affect the behavior and/or survivability of turtles on the remaining nesting beaches, particularly the few high density nesting beaches, could seriously reduce our ability to protect sea turtles.

Loggerhead turtle

The loggerhead turtle, listed as a threatened species on July 28, 1978 (43 FR 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead turtles nest within the continental U.S. from Louisiana to Virginia. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (Hopkins and Richardson 1984). Total estimated nesting in the southeastern U.S. is approximately 50,000 to 70,000 nests per year (NMFS and FWS 1991b).

From a global perspective, the southeastern U.S. nesting aggregation is of paramount importance to the survival of the species and is second in size only to that which nests on islands in the Arabian Sea off Oman (Ross 1982, Ehrhart 1989, NMFS and FWS 1991b). The status of the Oman colony has not been evaluated recently, but its location in a part of the world that is vulnerable to disruptive events (e.g., political upheavals, wars, catastrophic oil spills) is cause for considerable concern (Meylan *et al.* 1995). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia account for about 88 percent of nesting worldwide (NMFS and FWS 1991b). About 80 percent of loggerhead nesting in the southeastern U.S. occurs in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward (NMFS and FWS 1991b).

Recent genetic analyses using restriction fragment analysis and direct sequencing of mitochondrial DNA have been employed to resolve management units among loggerhead nesting cohorts of the southeastern U.S. (Bowen *et al.* 1993; B.W. Bowen, University of Florida, Gainesville, in lit., November 17, 1994, and October 26, 1995). Assays of nest samples from North Carolina to the Florida Panhandle have identified three genetically distinct nesting populations: (1) northern nesting population - Hatteras, North Carolina, to Cape Canaveral, Florida; (2) South Florida nesting population - Cape Canaveral to Naples, Florida; and (3) Florida Panhandle nesting population - Eglin Air Force Base and the beaches around Panama City, Florida. These data indicate that gene flow between the three regions is very low. If nesting females are extirpated from one of these regions, regional dispersal will not be sufficient to replenish the depleted nesting population (Bowen *et al.* 1993, B.W. Bowen, University of Florida, Gainesville, in lit., October 26, 1995).

Green turtle

The green turtle, listed as an endangered species on July 28, 1978 (43 FR 32800), has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic Ocean occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Breeding populations of the green turtle in Florida and along the Pacific coast of Mexico are listed as endangered; all other populations are listed as threatened.

Within the U.S., green turtles nest in small numbers in the U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties (NMFS and FWS 1991a). Nesting also has been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (DEP, unpub. data). Green turtles have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources, unpub. data) and they nest sporadically in North Carolina (North Carolina Wildlife Resources Commission, unpub. data). No green turtle nesting has been documented in South Carolina (S. Murphy, South Carolina Department of Natural Resources, in litt., November 8, 1995). Unconfirmed nesting of green turtles in Alabama has been reported (R. Dailey, Bon Secour National Wildlife Refuge, pers. comm.).

Leatherback turtle

The leatherback turtle, listed as an endangered species on June 2, 1970 (35 FR 8491), is found in the Atlantic, Pacific and Indian Oceans. It has been recorded as far north as Labrador and Alaska and as far south as Chile and the Cape of Good Hope. Nesting grounds are distributed circumglobally, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad (NMFS and FWS 1992, National Research Council 1990a).

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia (NMFS and FWS 1992). Leatherback turtles have been known to nest in Georgia and South Carolina, but only on rare occasions (Georgia and South Carolina Departments of Natural Resources, unpub. data). Leatherback nesting also has been reported on the west coast of Florida on St. Vincent National Wildlife Refuge (LeBuff 1990), St. Joseph Peninsula State Park (DEP, unpub. data), and St. George Island (T. Lewis, St. Vincent National Wildlife Refuge, pers. comm.); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Hawksbill turtle

The hawksbill turtle, listed as an endangered species on June 2, 1970 (35 FR 8491), is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. Within the continental U.S., hawksbill turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys in Monroe County (Meylan 1992, Meylan *et al.* 1995). Hawksbill tracks are difficult to differentiate from those of loggerheads and may not be recognized by surveyors. Therefore, surveys in Florida likely underestimate actual hawksbill nesting numbers (Meylan *et al.* 1995). In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (NMFS and FWS 1993).

III. ENVIRONMENTAL BASELINE

Meylan *et al.* (1995) tabulates the results of nesting surveys throughout Florida between 1979 and 1992. Unpublished data are also available from DEP for the years 1993-1995. The following discussion of sea turtle nesting in St. Lucie County is based on data from these sources.

Approximately 7.7 percent of Florida's sea turtle nesting occurs annually in St. Lucie County. During the nesting seasons from 1979 to 1992, loggerhead turtles laid 7.8 percent of their Florida nests within St. Lucie County; green turtles laid 5.78 percent; and leatherbacks laid 13.2 percent. No hawksbill turtle nests were reported from St. Lucie County during the same period. However, St. Lucie County lies within the nesting range of the hawksbill turtle.

Loggerhead turtle nests account for the vast majority of nesting reported in St. Lucie County (98.2 percent from 1979 to 1992). During this same period, green turtle nests amounted to 1.6 percent of nesting, and leatherbacks laid 0.2 per cent of St. Lucie County nests. As previously stated, no hawksbill nests were reported from St. Lucie County. However, St. Lucie County is within the nesting range of the hawksbill turtle and under reporting of hawksbill nests undoubtedly occurs as a result of their extended nesting season. Most seasonal beach surveys end in the late summer or early fall. Thus, hawksbill nests laid in late fall or early winter would not be included in the survey. Under reporting of leatherback nesting also occurs because leatherbacks begin nesting prior to the beginning of annual beach surveys. The nesting and hatching seasons for each species within St. Lucie County are given below.

Species	**Nesting and Hatching Dates**
Loggerhead turtle	March 15 to November 30
Green turtle	May 1 to November 30
Leatherback turtle	February 15 to November 15
Hawksbill turtle	June 1 to December 31

The four kilometers (2.5 miles) of beach south of Ft. Pierce Inlet has been monitored for sea turtle nesting by Florida Power and Light Company since 1989. Nesting density for loggerheads increases from north to south. This increase in nesting activity is shown in Table 1.

Table 1. Average number of nests in the 4 km area south of Ft. Pierce Inlet from 1989 to 1996 (Area A is northernmost)

AREA	MEAN NUMBER OF NESTS
A	17.1
B	42.0
C	53.8
D	74.6

IV. EFFECTS OF THE PROPOSED ACTION

State-wide, previously authorized projects have had a substantial effect on sea turtle nesting. The new proposed project would add to these effects by increasing incidental take due to nest relocation during construction, through missed nests, and through changes in the nesting environment after project construction. Conversely, nesting habitat within St. Lucie County will be increased over that which would exist without beach nourishment and renourishment.

Direct effects

Although beach nourishment may increase the potential nesting area, there are significant adverse effects to sea turtles that may result if protective measures are not incorporated as a result of consultation. Placement of sand on an eroded section of beach or an existing beach in an of itself likely will not provide suitable nesting habitat for sea turtles.

Nourishment and sand transfer during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of offspring from human-caused mortality and may significantly affect the long-term survival of the species. For instance, projects conducted during the nesting and hatching season could result in the loss of sea turtles through disruption of adult nesting activity and by burial or crushing of nests or hatchlings. While a nest monitoring and egg relocation program would reduce these effects, nests may be inadvertently missed or misidentified as false crawls during daily patrols. In addition, nests may be destroyed by operations at night prior to beach patrols being performed. Even under the best of conditions, about seven percent of the nests can be missed by experienced turtle nest surveyors (Schroeder 1994).

1 Nest relocation

Besides the potential for missing nests during a 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 effects on incubation temperature (hence, sex ratios), gas exchange parameters, hydric environment of nests, hatching success, and hatchling emergence (Limpus *et al.* 1979, Ackerman 1980, Parmenter 1980, Spotila *et al.* 1983, McGehee 1990). Relocating nests into sand deficient in oxygen or moisture can result in mortality, morbidity, and reduced behavioral competence of hatchlings. Water availability is known to influence the incubation environment of the embryos and hatchlings of turtles with flexible-shelled eggs, which has been shown to affect nitrogen excretion (Packard *et al.* 1984), mobilization of calcium (Packard and Packard 1986), mobilization of yolk nutrients (Packard *et al.* 1985), hatchling size (Packard *et al.* 1981, McGehee 1990), energy reserves in the yolk at hatching (Packard *et al.* 1988), and locomotory ability of hatchlings (Miller *et al.* 1987).

DEP has noted significant variations in comparing hatching success and emergence success between *in situ* and relocated nests (unpublished data). A 1994 study of hatching and emergence success of *in situ* and relocated nests at seven sites in Florida found that hatching success was lower for relocated nests in five of seven cases with an average decrease for all seven sites of 5.01 percent (range = 7.19 percent increase to 16.31 percent decrease). Emergence success was lower for relocated nests in all seven cases by an average of 11.67 percent (range = 3.6 to 23.36 percent) (A. Meylan, DEP, in litt., April 5, 1995).

A final concern with nest relocation is that it may concentrate eggs in an area resulting in a greater susceptibility to catastrophic events. Hatchlings released from concentrated areas may be subject to greater predation rates from both land and marine predators, who have adapted to concentrate their foraging efforts.

2 Equipment

The placement of pipelines and the use of heavy machinery on the beach during a construction project may also have adverse effects on sea turtles. They 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.

3 Changes in the physical environment

Beach nourishment may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand (Nelson and Dickerson 1988a). These changes could result in adverse effects on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987, Nelson 1988).

4 Compaction

Beach compaction and unnatural beach profiles that may result from beach nourishment activities could adversely affect sea turtles regardless of the timing of the projects. Very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson *et al.* 1987, Nelson and Dickerson 1988a). Significant reductions in nesting success have been documented on severely compacted nourished beaches (Fletemeyer 1980, Raymond 1984, Nelson and Dickerson 1987, Nelson *et al.* 1987). Increased false crawls result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests, again, causing increased physiological stress to the animals (Nelson and Dickerson 1988c). These effects can be minimized by using suitable sand and by tilling the beach after nourishment. Nelson and Dickerson (1988b) concluded that, in general, beaches nourished from offshore borrow sites

are harder than natural beaches, and while some may soften over time through erosion and accretion of sand, others may remain hard for 10 years or more.

5 Escarpments

On nourished beaches, steep escarpments may develop along their water line interface as they adjust from an unnatural construction profile to a more natural beach profile (Coastal Engineering Research Center 1984, Nelson *et al.* 1987). These escarpments can hamper or prevent access to nesting sites. Female turtles coming ashore to nest can be discouraged by the formation of an escarpment, leading to situations where they choose marginal or unsuitable nesting areas to deposit eggs (e.g., in front of the escarpments which often results in failure of nests due to tidal inundation). This effect can be minimized by leveling the beach prior to the nesting season.

6 Sediment color

A change in sediment color on a beach could change the natural incubation temperatures of nests in an area which, in turn, could alter natural sex ratios. To provide the most suitable sediment for nesting sea turtles, the color of the nourished sediments must resemble the natural beach sand in the area. Natural reworking of sediments and bleaching from exposure to the sun would help to lighten dark nourishment sediments; however, the time frame for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

7. Disorientation

Another effect to sea turtles is disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchlings from artificial lighting. Visual cues are the primary sea-finding mechanism for hatchlings (Mrosovsky and Carr 1967, Mrosovsky and Shettleworth 1968, Dickerson and Nelson 1989, Witherington and Bjorndal 1991). Artificial beachfront lighting is a well documented cause of hatchling disorientation and misorientation on nesting beaches (Philbosian 1976, Mann 1977, DEP unpub. data). In addition, research has also documented significant reduction in sea turtle nesting activity on beaches illuminated with artificial lights (Witherington 1992). Therefore, 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. Any source of bright lighting can profoundly affect the orientation of hatchlings, both during the crawl from the beach to the ocean and once they begin swimming offshore. Hatchlings attracted to light sources on dredging barges may not only suffer from interference in migration, but may also experience higher probabilities of predation to predatory fishes that are also attracted to the barge lights. This effect could be reduced by using the minimum amount of light necessary, require shielding, or use low pressure sodium lighting during project construction.

Indirect effects

Future erosion of nesting beaches is a potential indirect effect of nourishment projects on sea turtles. Dredging sand offshore from a project area has the potential to cause erosion of the newly created beach or other areas on the same or adjacent beaches by creating a sand sink. The remainder of the beach system responds to this sand sink by providing sand from the beach in an attempt to reestablish equilibrium (National Research Council 1990b).

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

VI. CONCLUSION

After reviewing the current status of the loggerhead, green, leatherback and hawksbill turtles, the environmental baseline for the action area, the effects of the proposed beach nourishments, and the cumulative effects, it is the FWS's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of the sea turtles listed above.

No critical habitat has been designated for the loggerhead or green turtles. Critical habitat has been designated for leatherback turtles (St. Croix, U.S. Virgin Islands) and for hawksbill turtles (Mona, Culebrita, and Culebra Islands, Puerto Rico). The proposed action does not affect those areas, thus, there is no effect on designated critical habitat for these two species.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity covered by this incidental take statement. If the COE (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

AMOUNT OR EXTENT OF INCIDENTAL TAKE

With the prescribed Reasonable and Prudent Measures, the FWS estimates that two sea turtle nests could be missed by surveyors and subsequently buried by fill due to the proposed 2.3 mile-long project. This would amount to approximately 240 sea turtle eggs. An additional 70 eggs could be rendered inviable by relocation.

EFFECT OF THE TAKE

In the accompanying biological opinion, the FWS determined that this level of anticipated take is not likely to result in jeopardy to the species.

REASONABLE AND PRUDENT MEASURES

The FWS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of loggerhead, green, leatherback and hawksbill turtles in St. Lucie County.

Only beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence shall be used on the project site.

2 In Areas C and D, beach nourishment activities shall not occur from May 1 through October 31, the period of peak sea turtle egg laying and egg hatching, to reduce the possibility of sea turtle nest burial or crushing of eggs. If the project is constructed in the spring, nourishment may continue until May 15 in Area B and until May 30 in Area A.

3 If the beach nourishment project will be conducted during the period from March 1 through May 30, surveys for early nesting sea turtles shall be conducted. If nests are constructed in the area of beach nourishment, the eggs shall be relocated.

4 If the beach nourishment project will be conducted during the period from October 31 through November 30, surveys for late nesting sea turtles shall be conducted. If nests are constructed in the area of beach nourishment, the eggs shall be relocated.

5. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, beach compaction shall be monitored and tilling shall be conducted as required by March 1 to reduce the likelihood of affecting sea turtle nesting and hatching activities. The March 1 deadline is required to reduce effects to leatherbacks that nest in greater frequency along the South Atlantic coast of Florida than elsewhere in the contiguous United States.

6. Immediately after completion of the beach nourishment project and prior to the next three nesting seasons, monitoring shall be conducted to determine if escarpments are present and escarpments shall be leveled as required to reduce the likelihood of affecting sea turtle nesting and hatching activities.

7 The applicant shall ensure that contractors doing the beach nourishment work fully understand the sea turtle protection measures detailed in this incidental take statement.

8. During the early and late portions of the nesting season, construction equipment and pipes shall be stored in a manner that will minimize effects to sea turtles to the maximum extent practicable.

9. During the early and late portions of the nesting season, lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1 Fill material placed on the beach shall be sand that is similar to that already existing at the beach site in both coloration and grain size. All such fill material shall be free of construction debris, rocks, or other foreign matter and shall not contain, on average, greater than 10 percent fines (i.e., silt and clay) passing the #200 sieve and shall not contain, on average, greater than 5 percent coarse gravel or cobbles, exclusive of shell material retained by the #4 sieve.

2. Beach nourishment shall be started after October 31 and be completed before May 30. During the March 15 through October 31 period, no construction equipment or pipes shall be stored on the beach.

3. If the beach nourishment project will be conducted during the period from March 1 through Mary 15 daily early morning surveys for sea turtle nests shall be conducted within the period

from March 1 through May 30 that the project is being conducted, and eggs shall be relocated per the following requirements.

a. Nest surveys and egg relocations shall only be conducted by personnel with prior experience and training in nest survey and egg relocation procedures. Surveyors shall have a valid DEP permit. Nest surveys shall be conducted daily between sunrise and 9 a.m. Surveys shall be performed in such a manner so as to ensure that construction activity does not occur in any location prior to completion of the necessary sea turtle protection measures.

b. Only those nests that may be affected by construction activities shall be relocated. Nests requiring relocation shall be moved no later than 9 a.m. the morning following deposition to a nearby self-release beach site in a secure setting where artificial lighting will not interfere with hatchling orientation. Nest relocations in association with construction activities shall cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days shall be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zone shall be clearly marked, and all mechanical equipment shall avoid nests by at least 10 feet.

4. If the beach nourishment project will be conducted during the period from November 1 through November 30, daily early morning surveys for sea turtle nests shall be conducted 65 days prior to project initiation and continue through September 30, and eggs shall be relocated in accordance with the preceding requirements.

5 Immediately after completion of the beach nourishment project and prior to March 1 for three subsequent years, sand compaction shall be monitored in the area of restoration in accordance with protocol agreed to by the FWS, the DEP, and the applicant. At a minimum, the protocol provided under 5a and 5b below shall be followed. If required, the area shall be tilled to a depth of 36 inches. Except in the first year when construction timing may not allow it, all tilling activity must be completed prior to March 1. A report on the results of compaction monitoring shall be submitted to the FWS prior to any tilling actions being taken. An annual summary of compaction surveys and the actions taken shall be submitted to the FWS. This condition shall be evaluated annually and may be modified, if necessary, to address sand compaction problems identified during the previous year.

a. Compaction sampling stations shall be located at 500-foot intervals along the project area. One station shall be at the seaward edge of the dune/bulkhead line (when material is placed in this area); one station shall be midway between the dune line and the high water line (normal wrack line); and one station shall be located just landward of the high water line. At each station, the cone penetrometer shall be pushed to a depth of 6, 12, and 18 inches three times (three replicates). Material may be removed from the hole if necessary to ensure accurate readings of successive levels of sediment. The penetrometer may need

to be reset between pushes, especially if sediment layering exists. Layers of highly compact material may lay over less compact layers. Replicates shall be located as close to each other as possible, without interacting with the previous hole and/or disturbed sediments. The three replicate compaction values for each depth shall be averaged to produce final values for each depth at each station. Reports shall include all 27 values for each transect line, and the final nine averaged compaction values.

b. If the average value for any depth exceeds 500 psi for any two or more adjacent stations, then that area shall be tilled prior to March 1. If values exceeding 500 psi are distributed throughout the project area but in no case do those values exist at two adjacent stations at the same depth, then consultation with the FWS shall be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling shall not be required.

6. Visual surveys for escarpments along the project area shall be made immediately after completion of the beach nourishment project and prior to March 1 for three subsequent years. Results of the surveys shall be submitted to the FWS prior to any action being taken. Escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet shall be leveled to the natural beach contour by March 1. The FWS shall be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 inches in height for a distance of 100 feet occurs 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 FWS will provide a brief written authorization that describes methods to be used to reduce the likelihood of affecting existing nests. An annual summary of escarpment surveys and actions taken shall be submitted to the FWS.

7. The applicant shall arrange a meeting between representatives of the contractor, the FWS, the DEP, and the permitted person responsible for egg relocation at least 30 days prior to the commencement of work on this project. At least 10 days advance notice shall be provided prior to conducting this meeting. This will provide an opportunity for explanation and/or clarification of the sea turtle protection measures.

8. From March 1 through March 15 and November 1 through November 30, staging areas for construction equipment shall be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all construction pipes that are placed on the beach shall be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes shall be off the beach to the maximum extent possible. Temporary storage of pipes on the beach shall be in such a manner so as to affect the least amount of nesting habitat and shall likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline is recommended as the method of storage).

9. From March 15 through April 30 and November 1 through November 30, all on-beach lighting associated with the project shall be limited to the immediate area of active construction only. Such lighting shall be shielded low pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters should be placed over vehicle headlights (i.e., bulldozers, front-end loaders). Lighting on offshore equipment shall be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.

10. A report describing the actions taken to implement the terms and conditions of this incidental take statement shall be submitted to the South Florida Ecosystem Office within 60 days of completion of the proposed work for each year when the activity has occurred. This report will include the dates of actual construction activities, names and qualifications of personnel involved in nest surveys and relocation activities, descriptions and locations of hatcheries, nest survey and relocation results, and hatching success of nests.

1 In the event a sea turtle nest is excavated during construction activities, the permitted person responsible for egg relocation for the project should be notified so the eggs can be moved to a suitable relocation site.

12. Upon locating a dead, injured, or sick threatened or endangered sea turtle specimen, initial notification must be made to the FWS's Law Enforcement Office in Miami, Florida, at (305) 526-2789. Care should be taken in handling sick or injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Appropriate native salt-resistant dune vegetation should be established on the restored dunes. The DEP's Bureau of Beaches and Coastal Systems can provide technical assistance on the specifications for design and implementation.

2. Surveys for nesting success of sea turtles should be continued for a minimum of three years following beach nourishment to determine whether sea turtle nesting success has been adversely affected.

3. Educational signs should be placed where appropriate at beach access points explaining the importance of the area to sea turtles and/or the life history of sea turtle species that nest in the area.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the action(s) outlined in the initiation request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation in the effort to protect threatened and endangered sea turtles and their nesting habitat. If you any questions regarding this biological opinion, please do not hesitate to contact Chuck Sultzman of our office at (561) 562-3909.

Sincerely,

Thomas E. Grahl, Acting Field Supervisor
South Florida Ecosystem Office

cc:
FWS, Jacksonville, FL (Attn: Sandy MacPherson)
DEP (OPSM), Tallahassee, FL
NMFS, St. Petersburg, FL

LITERATURE CITED

Ackerman, R.A. 1980. Physiological and ecological aspects of gas exchange by sea turtle eggs. American. Zoologist 20:575-583.

Bowen, B., J.C. Avise, J.I. Richardson, A.B. Meylan, D. Margaritoulis, and S.R. Hopkins-Murphy. 1993. Population structure of loggerhead turtles (*Caretta caretta*) in the northwestern Atlantic Ocean and Mediterranean Sea. Conservation Biology 7(4):834-844.

Coastal Engineering Research Center. 1984. Shore Protection Manual, Volumes I and II. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Dickerson, D.D. and D.A. Nelson. 1989. Recent results on hatchling orientation responses to light wavelengths and intensities. Pages 41-43 *in* Eckert, S.A., K.L. Eckert, and T.H. Richardson (compilers). Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFC-232. National Marine Fisheries Service, Miami, Florida

Ehrhart, L.M. 1989. Status report of the loggerhead turtle. Pages 122-139 *in* Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the 2nd Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFC-226. National Marine Fisheries Service, Panama City, Florida.

Fletemeyer, J. 1980. Sea turtle monitoring project. Report to Broward County Environmental Quality Control Board, FL. 88 pp. Broward County, Florida.

Florida Department of Environmental Protection. 1994. Unpublished data on file at: U.S Fish and Wildlife Service, Vero Beach, Florida.

Georgia Department of Natural Resources. Unpublished data on file at: U.S. Fish and Wildlife Service, Vero Beach, Florida.

Hopkins, S.R. and J.I. Richardson, eds. 1984. Recovery plan for marine turtles. National Marine Fisheries Service, St. Petersburg, Florida. 355 pp.

LeBuff, C.R., Jr. 1990. The loggerhead turtle in the eastern Gulf of Mexico. Caretta Research, Inc., Sanibel Island, Florida. 236 pp.

Limpus, C.J., V. Baker, and J.D. Miller. 1979. Movement induced mortality of loggerhead eggs. Herpetologica 35(4):335-338.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. M.S. thesis. Florida Atlantic University, Boca Raton, Florida. 100 pp

McGehee, M.A. 1990. Effects of moisture on eggs and hatchlings of loggerhead sea turtles (*Caretta caretta*). Herpetologica 46(3):251-258.

Meylan, A. 1992. Hawksbill turtle *Eretmochelys imbricata*. Pages 95-99 *in* Moler, P.E. (ed.). Rare and Endangered Biota of Florida, Volume III. University Press of Florida, Gainesville, Florida.

Meylan, A. B. 1995. Unpublished Data. On file at U.S. Fish and Wildlife Service, Vero Beach, Florida.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52, St. Petersburg, Florida. 51 pp.

Miller, K., G.C. Packard, and M.J. Packard. 1987. Hydric conditions during incubation - influence locomotor performance of hatchling snapping turtles. Journal of Experimental Biology 127:401-412.

Mrosovsky, N. and A. Carr. 1967. Preference for light of short wavelengths in hatchling green sea turtles (*Chelonia mydas*), tested on their natural nesting beaches. Behavior 28:217-231.

Mrosovsky, N. and S.J. Shettleworth. 1968. Wavelength preferences and brightness cues in water finding behavior of sea turtles. Behavior 32:211-257.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery plan for U.S. population of Atlantic green sea turtle (*Chelonia mydas*). National Marine Fisheries Service, Washington, D.C. 52 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991b. Recovery plan for U.S. population of loggerhead turtle (*Caretta caretta*). National Marine Fisheries Service, Washington, D.C. 64 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1992. Recovery plan for leatherback turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1993. Recovery plan for hawksbill turtle (*Eretmochelys imbricata*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida. 52 pp.

National Research Council. 1990a. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 259 pp.

National Research Council. 1990b. Managing coastal erosion. National Academy Press, Washington, D.C. 182 pp.

Nelson, D.A. 1988. Life history and environmental requirements of loggerhead turtles. U.S. Fish and Wildlife Service Biological Report 88(23). U.S. Army Corps of Engineers TR EL-86-2 (Rev.). 34 pp.

Nelson, D.A. and D.D. Dickerson. 1987. Correlation of loggerhead turtle nest digging times with beach sand consistency. Abstract of the 7th Annual Workshop on Sea Turtle Conservation and Biology. National Marine Fisheries Service, Miami, Florida.

Nelson, D.A. and D.D. Dickerson. 1988a. Effects of beach nourishment on sea turtles. *In* Tait, L.S. (ed.). Proceedings of the Beach Preservation Technology Conference '88. Florida Shore & Beach Preservation Association, Inc., Tallahassee, Florida.

Nelson, D.A. and D.D. Dickerson. 1988b. Hardness of nourished and natural sea turtle nesting beaches on the east coast of Florida. Unpub. report. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi. 27 pp.

Nelson, D.A. and D.D. Dickerson. 1988c. Response of nesting sea turtles to tilling of compacted beaches, Jupiter Island, Florida. Unpub. report. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi. 26 pp.

Nelson, D.A., K. Mauck, and J. Fletemeyer. 1987. Physical effects of beach nourishment on sea turtle nesting, Delray Beach, Florida. Technical Report EL-87-15. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi. 56 pp.

North Carolina Wildlife Resources Commission. 1995 Unpublished data on file at: U.S. Fish and Wildlife Service, Vero Beach, Florida

Packard, M.J., and G.C. Packard. 1986. Effect of water balance on growth and calcium mobilization of embryonic painted turtles (*Chrysemys picta*). Physiological Zoology 59(4):398-405.

Packard, G.C., M.J. Packard, and T.J. Boardman. 1984. Influence of hydration of the environment on the pattern of nitrogen excretion by embryonic snapping turtles (*Chelydra serpentina*). Journal of Experimental Biology 108:195-204.

Packard, G.C., M.J. Packard, and W.H.N. Gutzke. 1985. Influence of hydration of the environment on eggs and embryos of the terrestrial turtle *Terrapene ornata*. Physioogical Zoology 58((5):564-575.

Packard, G.C., M.J. Packard, T.J. Boardman, and M.D. Ashen. 1981. Possible adaptive value of water exchange in flexible-shelled eggs of turtles. Science 213:471-473.

Packard G.C., M.J. Packard, K. Miller, and T.J. Boardman. 1988. Effects of temperature and moisture during incubation on carcass composition of hatchling snapping turtles (*Chelydra serpentina*). Journal of Comparative Physiology B: Biochemical 158:117-125.

Parmenter, C.J. 1980. Incubation of the eggs of the green sea turtle, *Chelonia mydas*, in Torres Strait, Australia: the effect of movement on hatchability. Australian Wildlife Research 7:487-491.

Philbosian, R. 1976. Disorientation of hawksbill turtle hatchlings (*Eretmochelys imbricata*) by stadium lights. Copeia 1976:824.

Raymond, P.W. 1984. The effects of beach restoration on marine turtles nesting in south Brevard County, Florida. Unpublished M.S. thesis. University of Central Florida, Orlando, Florida. 121 pp.

Ross, J.P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. Pages 189-195 *in* Bjorndal, K.A. (ed.). Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Schroeder, B.A. 1994. Florida index nesting beach surveys: Are we on the right track? Pages 132-133 *in* Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (compilers). Proceedings of the 14th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351. National Marine Fisheries Service, Miami, Florida.

South Carolina Department of Natural Resources. 1996. Unpublished data on file at: U.S Fish and Wildlife Service, Vero Beach, Florida.

Spotila, J.R., E.A. Standora, S.J. Morreale, G.J. Ruiz, and C. Puccia. 1983. Methodology for the study of temperature related phenomena affecting sea turtle eggs. U.S. Fish and Wildlife Service Endangered Species Report 11. 51 pp.

Witherington, B.E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. Herpetologica 48:31-39.

Witherington, B.E. and K.A. Bjorndal. 1991. Influences of artificial lighting on the seaward orientation of hatchling loggerhead turtles (*Caretta caretta*). Biological Conservation 55:139-149.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecosystem Office
P.O. Box 2676
Vero Beach, Florida 32961-2676

January 29, 1998

Colonel Joe R. Miller
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

Attn: Planning Division

Dear Colonel Miller:

Thank you for your letter dated December 18, 1997, regarding your concerns with the lighting requirements under the incidental take statements for several beach renourishment projects. Accordingly, the U.S. Army Corps of Engineers (COE) identified a number of potential problems associated with the restricted lighting requirement, in particular, the absence of sea turtles nesting on beaches where construction is occurring. As such, the COE requests that the red filters and low pressure sodium light requirements be deleted from all existing and future beach nourishment projects as well as from the framework of the biological opinions for such projects.

On October 24, 1996, the U.S. Fish and Wildlife Service (FWS) issued the Coast of Florida Study Region III Biological Opinion. Term and Condition number 9 of the Biological Opinion required that all vehicle headlights, including heavy equipment, should be covered with red filters during sea turtle nesting season. Since sea turtles tend to avoid nesting near beach construction sites, the FWS revises Term and Condition number 9 to read as follows:

9. From March 1 through April 30 and November 1 through November 30, all on-beach lighting associated with the project shall be limited to the immediate area of active construction only. Shielded low pressure sodium vapor lights are recommended to minimize illumination of the nesting beach and near shore waters. Lighting on offshore equipment shall be minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded low pressure sodium vapor lights are highly recommended for lights on offshore equipment that cannot be eliminated.

Please implement this modification to Term and Condition number 9 for any project to which the Coast of Florida Study Biological Opinion was applicable. This would include but may not be

limited to the Boca Raton, Bal Harbour, Fort Pierce, and Juno Beach projects.

Thank you for the opportunity to provide these comments. Should you require further clarification or assistance, please contact Chuck Sultzman of our office at (561) 562-3909.

Sincerely yours,

James J. Slack
Project Leader
South Florida Field Office

cc:
FWS, Jacksonville, FL (Attn: Sandy MacPherson)
DEP(BPSM), Tallahassee, FL

Appendix D

EXAMPLE OF PROPOSED HARDGROUND HABITAT MITIGATION PLAN

Fort Pierce Shore Protection Project
Refer to Environmental Assessment
Section 4.02 (Fish and Wildlife Resources)
for additional information

GENERAL RE-EVALUATION REPORT WITH
ENVIRONMENTAL ASSESSMENT

Fort Pierce, St. Lucie County, Florida