APRIL 2008

PALM BEACH COUNTY, FLORIDA, SHORE PROTECTION PROJECT (FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT

FOR NORTH BOCA RATON SECOND PERIODIC RENOURISHMENT

WITH ENVIRONMENTAL ASSESSMENT

Rev. February 2005
December 2005
August 2006
February 2007
September 2007

US ARMY CORPS
OF ENGINEERS
JACKSONVILLE DISTRICT

CITY OF BOCA RATON

FLORIDA

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

CESAJ-PD-PN

MAY 0 9 2008

MEMORANDUM FOR CDR, SOUTH ATLANTIC DIVISION (CESAJ-PDS)

SUBJECT: Limited Reevaluation Report (LRR) and Environmental Assessment (EA) for Second Periodic Re-nourishment of the Florida Shore Protection Project, Palm Beach County, Florida

1. The subject report is being submitted for SAD/HQ approval. The enclosed LRR and EA have been fully coordinated and revised to incorporate comments and address concerns CESAD-PDS review. Enclosure 1 contains the 17 December 2007 memo from CESAD-PDS providing Division comments. Enclosure 2 provides SAJ responses and indicates how the package has been revised. The Assistant Secretary of the Army (Civil Works) (ASA (CW)) letter dated 30 September 1997 enclosed, allows re-nourishment of this segment of the project for 50 years, in accordance with Section 506(b)(2) of WRDA 1996. The ASA (CW) letter also indicates that the approved 1997 General Design Memorandum Addendum should serve as the decision document for the planned non-federal re-nourishment and for Federal reimbursement, should Congress provide funds for the project.

2. Transmitted with this memorandum are six copies of the QA/QC documentation, the Post-Authorization Decision Document Checklist, Project Study Issues Checklist, legal opinion, signed FONSI, and the revised LRR and EA

4. If you have any questions or need any additional information the POC for this report is Ernie Clarke, CESAJ-PD-PN, at 904-232-1199.

Encls

PAUL L GROSSKRUGER
Colonel, Corps of Engineers
Commanding

ENCLOSURE 1 - SAD comments on the LRR and EA

DEPARTMENT OF THE ARMY
SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS
ROOM 9M15, 60 FORSYTH ST., S.W.
ATLANTA, GEORGIA 30303-8801

REPLY TO
ATTENTION OF

CESAD-PDS-P 17 December 2007

MEMORANDUM FOR Commander, Jacksonville District (CESAJ-PD/Burns)

SUBJECT: Limited Reevaluation Report (LRR) and Environmental Assessment (EA) for Second Periodic Renourishment of the Florida Shore Protection Project, Palm Beach County Florida

1. Reference memorandum, CESAJ-PD-PN, 12 October 2007, subject as above requesting Limited Reevaluation Report (LRR) approval (copy enclosed).

2. The following SAD comments must be addressed in the subject report and re-submitted to SAD for review before final approval.

a. Plan Formulation:

1. It is not apparent from discussion in the report that the proper structure valuation method of replacement cost less depreciation, as required by ER 1105-2-100, has been used to value structures susceptible to storm damages that would benefit from this project. On page C-5 paragraph C-19, "Use of values obtained from the County's Property Appraiser's Office (pg C-5, para C-19) may overstate the value of structures at risk. Please explain how structures were valued. If replacement cost minus depreciation was not used please explain the rational behind that decision.

2. Pg 8 end of 1st paragraph – please explain "Under the LCA the Government's participation is the cost of periodic nourishment is limited to renourishment completed during the 10-year period following completion of the initial nourishment project. Does this project have a LCA or a PCA as the construction agreement? Given ASA decision on 30 Sep 1997 to extend federal participation to 50 years, explain this statement or remove it from the report. Issue is also referenced pg C-1 Para C-1.

3. Pg 18 – Para 55 – Project life is normally indefinite but federal participation and the period for economic evaluation in renourishment in this case is limited to 50 years. (also noted Para 64 on page 24 and other places in the report). Please clarify and correct.

4. Pg 33 Para 87 – Note, all real estate easements should be perpetual as the project has an indefinite authorized life at this time.

5. Pg 41 Para 126 – "be modified ..." I do not understand what modification to the project is being recommended other than possibly a 60 ft extension southward (report is unclear on this

as well) of the termination point. Please clarify this statement or remove it from the recommendation. Pg 3 para 10 states no modifications? Also it appears but is unclear if the 60 ft southward shift of the project boundary was a change made during initial construction, the 1st renourishment or is a change sought under the proposed renourishment?

6. Project Study Checklist – Appendix H, Exhibit H-2 of ER 1105-2-100

a. question 8.c. – The entry/response is confusing in that it states a mitigation plan is required yet the issue is resolved by avoidance? Please clarify that no mitigation is required for the renourishment being recommended by this report.

b. Question 42 – Are privately owned shores being protected? The reply needs to include that privately owned shores are being protected but that these are the same as in original project and first renourishment. Additional response is needed to include an explanation of any project cost share changes.

c. Question 48 – Please add discussion on how the current parcel ownership and available parking compares with the original project and the previous renourishment?

d. Recreation Component of the checklist – questions 69 to 74 – Why have these questions not been addressed? Since a significant portion of the benefits are recreation based, these questions need to be answered.

e. Report package needs to include Appendix A of ER 1165-2-502 as well before report can be approved.

7. QA/QC Section of the report – IS2 – who or what is "RD"? Please clarify

8. Q 4 pg 8 – clarification of life of project – The life of the project is indefinite, it is considered authorized until Congress takes action to deauthorize or take other action or the sponsor takes action to "break" the project cooperation agreement. The federal participation period for project renourishment, and economic evaluation period, is set for 50 years. The difference in the project authorization period and the federal cost sharing period should be noted. Perpetual easements should reflect the indefinite authorization period. Real Estate easements should not expire in 2038.

9. Syllabus, last line – "The project sponsor requests that the project cooperation agreement extend for the remaining life of the project with future costs allocated by a letter report". Please explain the intent this sentence?

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SUBJECT: Limited Reevaluation Report (LRR) and Environmental Assessment (EA) for Second Periodic Renourishment of the Florida Shore Protection Project, Palm Beach County, Florida

10. Pg 20 para 62 states mitigation for the renourishment is not expected, has environmental investigation progressed far enough to make this conclusion?

11. As this project was approved prior to WRDA 1986, please confirm this project does not have a Sec 902 limit for renourishment costs?

12. Pg C-7 Once a structure is destroyed in model runs what assumptions are made about it being rebuilt? Not rebuilt, rebuilt once to original specifications, replaced with current building requirements, etc?

b. Environmental:

1. Main Report:

a. Page 37, Cultural Resources, paragraph 106-109, the report discusses the timeline of correspondence with the SHPO from 1986 to 2006. In paragraph 108 the report discusses the TAR 2006 investigation and recommended buffer distances and the report archeologist recommended a 100 meter radius buffer and the report stated the "Florida SHPO concurred with the recommendation following consultation with the USACE." The report needs to document this concurrence by specifically naming who concurred with the date and time. Should SAJ have an email of this concurrence then it should be included in Appendix D and citied in paragraph 108. SAJ needs to provide SAD with SHPO concurrence documentation.

b. On page 40, Endangered Species Act, paragraph 120, SAJ discusses coordinating with USFWS and NFMS on ESA and cite a letter dated Aug 14, 2007 from NFMS as documentation of coordination. The Aug 14, 2007 NFMS memo is for Essential Fish Habitat, which is a requirement of the Magnuson-Stevens Fishery Conservation and Management Act not ESA. ESA and Magnuson-Stevens coordination are two separate and different coordinations. The District needs to provide documentation that they coordinated with both the USFWS and NFMS regarding ESA requirements.

c. Appendix D, USFWS memo dated May 20, 1997. The draft Fish and Wildlife Coordination Act Report (CAR) that is provided as documentation is over 10 years old. It is also a "Draft" report. SAJ needs to provide SAD with an updated Final CAR or documentation from USFWS that an update CAR was not necessary.

2. Environmental Assessment:

a. Page 15, table 5, column Environmental Factors row Sea Turtles. The table doesn't explain the impact on sea turtles. The table should show these impacts.

b. Page 21, Section 3.3.1 Federally Listed Species Occurring in Palm Beach County. The report states that the "affect" determination was coordinated with USFWS and NFMS. The

USFWS concurrence with the "may affect not likely to affect" determination is well documented, but there is no coordination of ESA with NFMS? SAJ must provide SAD with documentation of their coordination with NFMS regarding this determination and possible Threatened and Endangered species impacts.

c. Page 41, section 4.5 Historic Properties. The report states, "Consultation with the State Historic Preservation Officer (DHR No 2007-xxxx) concurred with this buffer." What does the xxxx refer to? SAJ needs to provide documentation that the SHPO concurs with SAJ's decision to have 100 meter radius buffers around the historic resources.

d. Page 51, Section 4.20.2 Endangered Species Act of 1973, second paragraph. The report discusses its coordination with NFMS regarding the EFH, (Magnuson-Stevens), but this is not an ESA compliance issue and should be placed in a separate paragraph entitled Magnuson-Stevens Fishery Conservation and Management Act. EFH is a completely different compliance issue than ESA. The report further states, "This project has been fully coordinated under the Endangered Species Act, and is in full compliance with the Act." The NFMS coordination documentation that SAJ has provided does not sufficiently show compliance with ESA. SAJ must provide SAD documentation of coordination with NFMS regarding Threatened and Endangered species.

e. Page 43, Section 4.15, Cumulative Impacts. The report provides a definition of cumulative impacts, but does not describe the cumulative impacts of this project. SAJ must document the cumulative impacts of the project.

f. Page 52, Section 4.20.3 Fish and Wildlife Coordination Act. The report discusses the BO and its close coordination with the UFSWS. It makes no mention of the status of the CAR. SAJ needs to provide SAD with documentation that a CAR was completed by USFWS.

g. Page 52, Section 4.20.5 National Historic Preservation Act. The report doesn't clearly explain the status of the SHPO concurrence with the proposed buffer. SAJ needs to provide documentation that the SHPO has concurred with SAJ's proposed buffer.

h. Page 52, Section 4.20.8 Coastal Zone Management Act. In this section, the report states that the CZMA consistency documentation can be found in Appendix C. There is no CZMA consistency documentation in Appendix D. SAJ provided comments to FDEP responses regarding CZMA, but there is no FDEP CZMA consistency letter. SAJ must provide SAJ CZMA consistency documentation.

i. Page 52, Section 4.20.5 Clean Water Act. The report discusses being in full compliance with FDEP 401 water quality certification and cites a letter dated July 26, 2007 in Appendix A as documentation. This letter is not in Appendix A. SAJ needs to provide SAD with FDEP 401 certification documentation or documentation that they have at least coordinated with FDEP and that there is some reasonable assurance that FDEP will issue the 401 certification.

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c. Real Estate: Non-concur with the use of a 50-year easement. The requirement for a "perpetual storm damage reduction easement" has been addressed on many occasions. The bottom line is that a "PERPETUAL" easement is required. Neither "the period of economic analysis" nor the "authorized period of Federal participation" define "project life". HQ OC has repeatedly reminded us that a project remains authorized until it is de-authorized by Congress. The estate is driven by the PCA requirement that the Sponsor O&M the project for so long as it remains authorized. The only approved estate for storm damage reduction projects is the STANDARD PERPETUAL STORM DAMAGE REDUCTION EASEMENT.

d. Office of Counsel: ER 1165-2-502 requires a legal opinion in the transmittal documentation in addition to a written certification that the report is legally sufficient. Although there are legal certifications contained in the Project Study Issue Checklist and the ITR document, a written legal opinion appears to have been omitted. SAJ needs to include a written legal opinion.

3. It is recommended that SAJ schedule an Issue Resolution Conference Call with SAD to clarify these comments.

4. If you have any questions or need any additional information the point of contact for this report is Jamie Higgins, CESAD-PDS-M, (404) 562-5223.

Eldn Gatwood
for WILBERT V. PAYNES
Chief, Planning and Policy Community
Of Practice

ENCLOSURE 2 - SAJ responses to SAD comments on the LRR and EA

SAD comments and SAJ responses are included below.

a. Plan Formulation:

1. It is not apparent from discussion in the report that the proper structure valuation method of replacement cost less depreciation, as required by ER 1105-2-100, has been used to value structures susceptible to storm damages that would benefit from this project. On page C-5 paragraph C-19, "Use of values obtained from the County's Property Appraiser's Office (pg C-5, para C-19) may overstate the value of structures at risk. Please explain how structures were valued. If replacement cost minus depreciation was not used please explain the rational behind that decision.

District response: Strahan Realty performed a property appraisal of eight condominiums within the project area. The estimate of project damages were reassessed using the replacement minus depreciation cost developed by Strahan Realty. Text and values throughout the Economic Appendix (Appendix C) were revised following this analysis. Alterations were also made to the Syllabus and main text.

2. Pg 8 end of 1st paragraph – please explain "Under the LCA the Government's participation is the cost of periodic nourishment is limited to renourishment completed during the 10-year period following completion of the initial nourishment project. Does this project have a LCA or a PCA as the construction agreement? Given ASA decision on 30 Sep 1997 to extend federal participation to 50 years, explain this statement or remove it from the report. Issue is also referenced pg C-1 Para C-1.

District response: The initial LCA was executed April 25, 1988 and provided for an initial period of 10 years of Federal participation in cost sharing. The city completed initial construction in 1988 and completed the first renourishment May 1998, which was within the 10 year period provided for in the initial cost sharing under that existing LCA. Therefore, under the 1988 LCA Federal cost sharing was limited to 10 years. An LCA Amendment package was sent to CESAD-PM by CESAJ-DP-I memo dated May 2, 2000 for the second periodic nourishment following initial construction (next renourishment) by the city. At that time, the city anticipated completing the next renourishment in 2006, however, that renourishment did not occur. The ASA(CW) memo dated September 30, 1997 indicated; "In accordance with Section 506(b)(2) of the Water Resources Development Act of 1996, the time period for the periodic beach nourishment for the Boca Raton segment is authorized for a period of 50 years from the beginning on the date of initial construction." A LCA Amendment, or PCA, will be needed for the next renourishment by the city, which is currently scheduled for winter 2008/spring 2009.

3. Pg 18 – Para 55 – Project life is normally indefinite but federal participation and the period for economic evaluation in renourishment in this case is limited to 50 years. (also noted Para 64 on page 24 and other places in the report). Please clarify and correct.

District response: It is agreed that project life is indefinite, and that the project remains authorized until Congress takes action to deauthorize the project. The Federal participation

period according to the ASA(CW) memo dated September 30, 1997 in accordance with Section 506(b)(2) of WRDA 1996, is 50 years beginning on the date of initial construction.

The following changes in the LRR were made to be compatible with this response:

Pg 18 – Para 55. The text, "extend for the remainder of the project life" has been replaced with "perpetual". The following text has been removed: "However, project authorization has defined this project as a 50 year life. As this document is considered the decision document, it is requested that the included Beach Storm Damage Reduction Easement until 2039, be approved."

Pg 24 – Para 64. The following text has been added: "While the project life is normally indefinite, federal participation and the period for economic evaluation is limited to 50 years."

Syllabus – 5th Para. The word "entire" has been replaced with "50-year project life with Federal Participation".

Syllabus – 6th Para. The text, "with Federal Participation" has been added after "remaining project life".

Pg 18 – Para 55. The word "entire" has been replaced with "50-year".

4. Pg 33 Para 87 – Note, all real estate easements should be perpetual as the project has an indefinite authorized life at this time.

District response: Easements were changed to perpetual storm damage reduction easements. Pg 33 - Para 87. The following text has been removed: "The easements will allow public access through the remaining life of the project (December 31, 2038)." The following text has been added: "Perpetual easements have been acquired to allow public access.

5. Pg 41 Para 126 – "be modified ..." I do not understand what modification to the project is being recommended other than possibly a 60 ft extension southward (report is unclear on this as well) of the termination point. Please clarify this statement or remove it from the recommendation. Pg 3 para 10 states no modifications? Also it appears but is unclear if the 60 ft southward shift of the project boundary was a change made during initial construction, the 1st renourishment or is a change sought under the proposed renourishment?

District response: Pg 41 – Para 126. Several minor changes were made to the authorized project, prior to the first construction, in 1988. These changes are listed on Page 3, paragraph 9. The 60-foot southward shift was included at this time

Paragraph 10 states that there were no changes to the design from the initial construction to the first renourishment in 1998. No changes are requested from the first renourishment to the second renourishment (the proposed project) either. The only changes to the authorized project were made in 1988, prior to initial construction.

6. Project Study Checklist - Appendix H, Exhibit H-2 of ER 1105-2-100

a. question 8.c. – The entry/response is confusing in that it states a mitigation plan is required yet the issue is resolved by avoidance? Please clarify that no mitigation is required for the renourishment being recommended by this report.

District response: Agree that the response is confusing. The answer for 8c, Cultural and Historical Preservation, has been change to "no". However the remarks related to avoidance of suspected cultural resource target remain in the checklist. Note that mitigation was required or the initial construction to the one time coverage of benthic resource. This mitigation was constructed in association with the initial construction. No additional mitigation is necessary.

b. Question 42 – Are privately owned shores being protected? The reply needs to include that privately owned shores are being protected but that these are the same as in original project and first renourishment. Additional response is needed to include an explanation of any project cost share changes.

District response: Privately owned shores are being protected. These are the same as in the original project and first renourishment. There has been a change in the cost share due to revisions from the previous cost apportionment. The Ocean Reef Towers is located within the taper and was thus ineligible to be used in the participation calculation. The Oceanview-Lakeview Trust property was determined to be more than 0.25 miles from a public access and was thus removed from the cost apportionment calculation.

c. Question 48 – Please add discussion on how the current parcel ownership and available parking compares with the original project and the previous renourishment?

District response: Current parcel ownership is identical to the previous renourishment. No structures have been removed or added within the project limits. Available parking was reassessed during development of the LRR. The number of parking spaces was reduced from 1,481 to 1,348. The majority of this reduction was due to the parking lot on the west side of the Spanish River Bridge being restricted. The number of parking spaces was also reduced to 883 from 930 in Spanish River Park due to improvements within the park boundaries.

d. Recreation Component of the checklist – questions 69 to 74 – Why have these questions not been addressed? Since a significant portion of the benefits are recreation based, these questions need to be answered.

District response: Concur. Question 69 through 74 have been added.

e. Report package needs to include Appendix A of ER 1165-2-502 as well before report can be approved.

District response: Concur. Appendix A of ER 1165-2-502 has been included.

7. QA/QC Section of the report – IS2 – who or what is "RD"? Please clarify

District response: RD stands for Regulatory Division. The QA/QC has been revised to reflect this.

8. Q 4 pg 8 – clarification of life of project – The life of the project is indefinite, it is considered authorized until Congress takes action to deauthorize or take other action or the sponsor takes action to "break" the project cooperation agreement. The federal participation period for project renourishment, and economic evaluation period, is set for 50 years. The difference in the project authorization period and the federal cost sharing period should be noted. Perpetual easements should reflect the indefinite authorization period. Real Estate easements should not expire in 2038.

District response: It is agreed that project life is indefinite, and that the project remains authorized until Congress takes action to deauthorize the project. The Federal participation period according to the ASA(CW) memo dated September 30, 1997 in accordance with Section 506(b)(2) of WRDA 1996, is 50 years beginning on the date of initial construction.

Easements were changed to perpetual storm damage reduction easements.

9. Syllabus, last line – "The project sponsor requests that the project cooperation agreement extend for the remaining life of the project with future costs allocated by a letter report". Please explain the intent this sentence?

District response: The sponsor desires that the new cost sharing agreement (LCA Amendment or PCA) be executed for the remainder of the period of Federal participation in cost sharing and that the new cost sharing agreement allow for cost sharing for the future renourishments (ie., more than just one renourishment event).

10. Pg 20 para 62 states mitigation for the renourishment is not expected, has environmental investigation progressed far enough to make this conclusion?

District response: Yes.

11. As this project was approved prior to WRDA 1986, please confirm this project does not have a Sec 902 limit for renourishment costs?

District response: We have confirmed that the project does not have a Sec 902 limit for renourishment costs. No change was made as a result of this comment.

12. Pg C-7 Once a structure is destroyed in model runs what assumptions are made about it being rebuilt? Not rebuilt, rebuilt once to original specifications, replaced with current building requirements, etc?

District response: Paragraph C-17 discusses when a building is condemned and excluded from further model runs. If the building is not condemned, it is assumed that it is repaired to

original specifications and is included in future model runs. The existing buildings are all pile supported structures and assumed to meet the current building code.

b. Environmental:

1. Main Report:

a. Page 37, Cultural Resources, paragraph 106-109, the report discusses the timeline of correspondence with the SHPO from 1986 to 2006. In paragraph 108 the report discusses the TAR 2006 investigation and recommended buffer distances and the report archeologist recommended a 100 meter radius buffer and the report stated the "Florida SHPO concurred with the recommendation following consultation with the USACE." The report needs to document this concurrence by specifically naming who concurred with the date and time. Should SAJ have an email of this concurrence then it should be included in Appendix D and citied in paragraph 108. SAJ needs to provide SAD with SHPO concurrence documentation.

District response: A December 15, 2007 concurrence letter from the SHPO was placed in Appendix D of the LRR. This replaces the January 27, 2005 SHPO letter.

b. On page 40, Endangered Species Act, paragraph 120, SAJ discusses coordinating with USFWS and NFMS on ESA and cite a letter dated Aug 14, 2007 from NFMS as documentation of coordination. The Aug 14, 2007 NFMS memo is for Essential Fish Habitat, which is a requirement of the Magnuson-Stevens Fishery Conservation and Management Act not ESA. ESA and Magnuson-Stevens coordination are two separate and different coordinations. The District needs to provide documentation that they coordinated with both the USFWS and NFMS regarding ESA requirements.

District response: By letter dated 30 March 2007, the NMFS-Protective Resources Division concluded that the project's effects on listed species would be "discountable or insignificant based on (1) the probability of sea turtles and smalltooth sawfish impacts associated with non-hopper type dredging is very low; (2) sea turtles and smalltooth sawfish potentially present in the project area are highly mobile and can avoid the slow-moving dredge; (3) foraging habitat for sea turtles and smalltooth sawfish would not be lost; (4) turbidity effects on water quality will be temporary and minimal and (5) dredged material would be placed on the beach with suspended particle settling out within a short time frame without measurable effects on water quality (or on listed species directly).

NMFS further commented that potential effects on elkhorn and staghorn coral are discountable as no coral exists in the identified borrow area, or in the predominantly sandy substrate along the pipeline corridor. The project would not occur in critical designated habitat for Johnson's, swimming sea turtles, or the small toothed sawfish. NMFS recommended that issuance of the DA permit contain special conditions for swimming sea turtles and the smalltooth sawfish. Protective construction conditions for the species have been placed as special conditions to the DA permit. The project would be in full compliance with this Act with incorporation of the agreed to environmental commitments.

c. Appendix D, USFWS memo dated May 20, 1997. The draft Fish and Wildlife Coordination Act Report (CAR) that is provided as documentation is over 10 years old. It is also a "Draft" report. SAJ needs to provide SAD with an updated Final CAR or documentation from USFWS that an update CAR was not necessary.

District response: The North Boca Raton Second Shoreline Renourishment is a post-authorization activity. Pursuant to accordance with Planning Regulation ER1105-2-100, Appendix G, Part G-14, a CAR is required if all of the following conditions exist:

1. The acknowledgment by the Corps in the feasibility report, or accompanying NEPA document, that sufficient uncertainty exists concerning impacts the recommended plan could have on fish or wildlife resources to warrant further investigations and analysis during postauthorization planning, engineering and design activities;
2. Modification or supplementation of the authorized plans require the development of a supplement to the FEIS;
3. New information or factors are identified during postauthorization project activities that appreciably change the extent to which the authorized project would or could impact upon fish and wildlife resources beyond what was documented in the feasibility report;
4. The authorized project contains major fish and wildlife mitigation or enhancement features, and the further planning, siting, designing and construction of such features would benefit from involving the FWS, NMFS or State resources agencies in these activities; or,
5. District and Division professional staff determine that continued involvement of the FWS, NMFS or State resources agencies during postauthorization project activities would better assure public and agency acceptance of the water resources development project, including authorized fish and wildlife features included in the project.

The purpose of this Act is to require the Corps to consult with the USFWS and the appropriate State fish and wildlife agencies to seek their expert input into how best to manage and modify adverse project related impacts to biological resources. The Corps has been in close communication with the State resource officials, NOAA-NMFS, and the USFWS throughout this evaluation process. According to the USFWS email communication dated January 9, 2008, a CAR is not required for the North Boca Raton Shoreline Renourishment Project. The proposed impacts have been fully evaluated under the environmental documents listed in Section 1.7 of this EA. Project avoidance and minimizations have been incorporated by reducing the template of advance renourishment to the existing and authorized footprint. Construction buffers would be in place to ensure that ephemeral hard bottom resources located outside the authorized template are not buried by renourishment activities.

The proposed action meets the threshold test as established under ER 1105-2-100, Appendix G, Part G-14 h.). Namely, (1) there is no sufficient uncertainty concerning impacts on fish and wildlife resources to warrant further investigations and analysis for this post authorization activity; (2) the proposed action does not require an Environmental Impact Statement (EIS) or Supplemental EIS;(3) no new information or factors were identified during post authorization that would appreciably change impacts documented in existing CARs; (4) the project does not contain major fish and wildlife mitigation or enhancement features; and, (5) the continued

involvement of the FWS, NMFS or State resources agencies during post-authorization project activities would not better assure public and agency acceptance of the project. The project complies with the requirements as set forth in this Act.

2. Environmental Assessment:

a. Page 15, table 5, column Environmental Factors row Sea Turtles. The table doesn't explain the impact on sea turtles. The table should show these impacts.

District response: Text describing impacts to sea turtles has been included. Construction may affect nesting sea turtles. Nests would be monitored and relocated if necessary. Other environmental commitments would also ensure protection of marine and terrestrial sea turtles. The project also provides benefits to nesting sea turtles with the proposed renourishment and increase to nesting habitat.

b. Page 21, Section 3.3.1 Federally Listed Species Occurring in Palm Beach County. The report states that the "affect" determination was coordinated with USFWS and NFMS. The USFWS concurrence with the "may affect not likely to affect" determination is well documented, but there is no coordination of ESA with NFMS? SAJ must provide SAD with documentation of their coordination with NFMS regarding this determination and possible Threatened and Endangered species impacts.

District response: Please see response to comment 2.b.1.b above.

c. Page 41, section 4.5 Historic Properties. The report states, "Consultation with the State Historic Preservation Officer (DHR No 2007-xxxx) concurred with this buffer." What does the xxxx refer to? SAJ needs to provide documentation that the SHPO concurs with SAJ's decision to have 100 meter radius buffers around the historic resources.

District response: A December 15, 2007 concurrence letter from the SHPO was placed in Appendix C of the EA. This replaces the January 27, 2005 SHPO letter.

d. Page 51, Section 4.20.2 Endangered Species Act of 1973, second paragraph. The report discusses its coordination with NFMS regarding the EFH, (Magnuson-Stevens), but this is not an ESA compliance issue and should be placed in a separate paragraph entitled Magnuson-Stevens Fishery Conservation and Management Act. EFH is a completely different compliance issue than ESA. The report further states, "This project has been fully coordinated under the Endangered Species Act, and is in full compliance with the Act." The NFMS coordination documentation that SAJ has provided does not sufficiently show compliance with ESA. SAJ must provide SAD documentation of coordination with NFMS regarding Threatened and Endangered species.

District response: Please see response to comment 2.b.1.b above.

e. Page 43, Section 4.15, Cumulative Impacts. The report provides a definition of cumulative impacts, but does not describe the cumulative impacts of this project. SAJ must document the cumulative impacts of the project.

District response: The following text has been added to the EA section on cumulative impacts:

> Historical survey data of 1974, 1985 and 1988 determined the project shoreline receded a total width of 17 feet over a 14-year period, with a loss of approximately 151,000 cubic yards of beach shoreline. The Corps using data from the State DEP beach profiles from 1974 and 1990 concluded that a total 284,000 cubic yards of beach shoreline in the project area was loss to littoral drift/transport each year. In 1988 with the first renourishment of the project area, 1,070,700 cubic yards of material from an offshore borrow area was placed along the beach shoreline, with 692,300 cubic yards placed with the first renourishment. The proposed project (second renourish-ment) would place 699,000 cubic yards of material within the same beach renourishment template, with a design width of 50 feet and 78 feet of advance width at equilibrium
>
> Littoral transport is usually to the south during the winter with a seasonal reversal to the north in summer. This highly dynamic process under the influence of wind, waves, tides, currents and sea level also deplete and replenish the 45.3 miles of Palm Beach County coastal shoreline (FDEP, 2006). The shoreline is also affected by structures or armoring constructed to control erosion (i.e., groins, jetties, riprap revetment, seawalls). This continuous loss of beach shoreline requires intervention with nourishment activities. There are a minimum of seven active beach nourishment projects (Inlet and sand transfer projects are not included) from Jupiter-Carlin (north) to South Boca Raton. Cumulative, the continuous requirements for beach nourishment keep the ecosystem in a constant state of upheaval with sediments resuspension. The discharge of several hundreds or millions of cubic yards during each renourishment activities has the potential to slow down the ecosystem's ability to achieve equilibrium or environmental recovery. This characteristic would eventual impact the biodiversity and abundance of nearshore and offshore environmental values, species habitat, and food chain production. Juvenile fishery species such as grunts that are dependent on invertebrates/algae provided by low-relief vertical hard bottom rock outcrop could be reduced in this area. Low-relief vertical outcrops afford some protection to developing offshore corals and reef communities that are foraging and habitat areas for sea turtle, snook, snapper, grouper, lobster, worm rock, and gorgonians. Depletion of these resources could diminish the abundance of fishery, recreational, and economic benefits provided to the local economy, in addition to, reducing resources important to fish and wildlife species.

f. Page 52, Section 4.20.3 Fish and Wildlife Coordination Act. The report discusses the BO and its close coordination with the UFSWS. It makes no mention of the status of the CAR. SAJ needs to provide SAD with documentation that a CAR was completed by USFWS.

District response: Please see response to comment 2.b.1.c above.

g. Page 52, Section 4.20.5 National Historic Preservation Act. The report doesn't clearly explain the status of the SHPO concurrence with the proposed buffer. SAJ needs to provide documentation that the SHPO has concurred with SAJ's proposed buffer.

District response: A December 15, 2007 concurrence letter from the SHPO was placed in Appendix C of the EA. This replaces the January 27, 2005 SHPO letter.

h. Page 52, Section 4.20.8 Coastal Zone Management Act. In this section, the report states that the CZMA consistency documentation can be found in Appendix C. There is no CZMA consistency documentation in Appendix D. SAJ provided comments to FDEP responses regarding CZMA, but there is no FDEP CZMA consistency letter. SAJ must provide SAJ CZMA consistency documentation.

District response: A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix B. The Corps determined the project proposes no unacceptable environmental impacts and is consistent with the Florida Coastal Management Plan (CZM). In accordance with the Memorandum of Understanding (1979) and the Addendum to the Memorandum (1983) concerning acquisition of Water Quality Certifications and other state authorizations, the EA and Section 404 (b)(1) Evaluation were submitted for review and consistency with the CZM Plan. No adverse comments were received. The issuance of the State permit certification and DA permit (Appendix C) are also consistent with this Act. The project is in compliance with this Act.

i. Page 52, Section 4.20.5 Clean Water Act. The report discusses being in full compliance with FDEP 401 water quality certification and cites a letter dated July 26, 2007 in Appendix A as documentation. This letter is not in Appendix A. SAJ needs to provide SAD with FDEP 401 certification documentation or documentation that they have at least coordinated with FDEP and that there is some reasonable assurance that FDEP will issue the 401 certification.

District response: Section 401 water quality certification has been obtained from the FDEP (permit # . 0261499-001-JC). The permit requires compliance with existing water quality standards, monitoring during construction activities, and use of turbidity protection measures. The State's water quality requirements are made part of the project's specifications to ensure compliance during all phases of construction. A Section 404(b) evaluation was conducted and is contained in Appendix A. The project would be in full compliance with this Act.

c. Real Estate: Non-concur with the use of a 50-year easement. The requirement for a "perpetual storm damage reduction easement" has been addressed on many occasions. The bottom line is that a "PERPETUAL" easement is required. Neither "the period of economic analysis" nor the "authorized period of Federal participation" define "project life". HQ OC has repeatedly reminded us that a project remains authorized until it is de-authorized by Congress. The estate is driven by the PCA requirement that the Sponsor O&M the project for so long as it remains authorized. The only approved estate for storm damage reduction projects is the STANDARD PERPETUAL STORM DAMAGE REDUCTION EASEMENT.

District response: Easements were changed to perpetual storm damage reduction easements. The following changes have been made to the LRR to reflect the acquisition of Perpetual Storm Damage Reduction Easements.

Pg 18 - Para 55. The text, "As the easement extend for the remainder of the project life, no administrative cost…" has been altered to state, "As the easements are perpetual, no administrative cost...". The following text has been removed: "However, project authorization has defined this project as a 50 year life. As this document is considered the decision document, it is requested that the included Beach Storm Damage Reduction Easement until 2039, be approved."

Pg 18 - Para 56. The word "perpetual" has been added in front of "beach storm damage reduction easement".

Pg F-1 - Para F4. The text "beach storm damage reduction easements extending for the remainder of the project life will be obtained…" has been replace with "Perpetual beach storm damage reduction easements will be obtained…"

Pg F-5 - Para F26. This text has been revised to remove all reference to easements extending for a term concurrent with the project life and replaced with perpetual beach storm damage reduction easements.

d. Office of Counsel: ER 1165-2-502 requires a legal opinion in the transmittal documentation in addition to a written certification that the report is legally sufficient. Although there are legal certifications contained in the Project Study Issues Checklist and the ITR document, a written legal opinion appears to be omitted. SAJ needs to include a legal opinion.

District response: A legal opinion is included in the report package.

3. It is recommended that SAJ schedule an Issue Resolution Conference Call with SAD to clarify these comments.

District response: Thank you for meeting with us on 19 December 2007.

APPENDIX A of EC 1165-2-205
PROJECT STUDY ISSUE CHECKLIST

GENERAL PROJECT INFORMATION

Project Name: PALM BEACH COUNTY, FLORIDA SHORE PROTECTION PROJECT, LIMITED REEVALUATION REPORT FOR NORTH BOCA RATON SECOND PERIODIC RENOURISHMENT WITH FINAL ENVIRONMENTAL ASSESSMENT

Project Description: The Federal Shore Protection project for Palm Beach County, Florida, from Martin County line to Lake Worth Inlet and from South Lake Worth Inlet to the Broward County line was authorized by Section 101 of the River and Harbor Act of October 23, 1962. The initial authorization provided for Federal participation in the cost of the nourishment for a period of 10 years. Federal participation in the cost of the periodic nourishment was extended to 50 years under the authority of Section 506 (b) (2) of the Water Resources Development Act of 1996.

The authorized project provided for a 100-foot seaward extension of the mean high water line, with a berm elevation 9 feet above mean sea level along a 2.7 mile long segment of beach in southern Highland Beach and northern Boca Raton. Initial nourishment took place in 1988 along the northern 1.45 mile long stretch which had project limits that were shifted 60 feet southward from the original design. Approximately 1,102,000 cubic yards of sand were placed. This design increased the design width from 25 feet to 50 feet. The first renourishment project was constructed in 1998 placing 680,000 cubic yards of sand.

The recommended project is the 1.45 mile long stretch nourished in 1988 and would place approximately 699,000 cubic yards of sand for approximately $4,212,100 Federal and $3,109,100 Non-Federal in 2007 dollars. The benefit to cost ratio was determined to be 3.0.

Cost Sharing: Based on a new evaluation conducted in accordance with the cost sharing procedures outlined in ER 1165-2-130 the cost allocation has changed to 57.53% Federal/42.47% Non-Federal. The Federal cost share is 1.3% lower than in the 1998 project. A property-by-property determination of Federal participation is presented in Table 8 of the LRR.

1. Has a NEPA document been completed?
Response: YES ✓ **NO** __*
Remarks:

2. Will the NEPA Documentation be more than 5 years old at the time of PCA signing or construction initiation?
Response: YES* ___ **NO** ✓
Remarks:

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

3. Will the ESA Findings be more than 3 years old at the time of PCA signing or construction initiation? [Note: Findings refers to Corps documentation and/or US Fish and Wildlife Service's opinions and recommendations]
Response: YES* ___ **NO** ✓
Remarks:

4. Is ESA coordination complete?
Response: YES ✓ **NO** ___*
Remarks:

5. If an EIS/EA was completed for the project, has the Record of Decision /Finding of No Significant Impact been signed?
Response: YES ✓ **NO**____ *
Remarks:

6. Is the proposed project consistent with the ROD/FONSI?
Response: **YES** ✓ NO____*
Remarks:

7. Have there been any changes in Federal environmental laws or Administration or Corps policy since original project authorization that make updating necessary? [e.g., change to the Clean Air Act status for the project area.. going from attainment to non-attainment]
Response: YES *___ **NO** ✓
Remarks:

8. Is there a mitigation plan?
Response:
a. Fish and Wildlife: YES* ___ **NO** ✓
b. Flood Damage: YES* ___ **NO** ✓
c. Cultural and Historic Preservation: **YES*** ✓ NO___
d. Recreation: YES *___ **NO** ✓

Remarks: [If yes, identify and describe what is being mitigated and cost shared. Describe the authority for the cost sharing.] In the 2006 magnetometer report, several anomalies were reported in the borrow area B. These areas were determined to warrant avoidance. Buffer zones of 200 and 300 feet were recommended by the sponsor for an avoidance area around these targets. Updated analysis of the cultural resource surveys has led to a Corps recommendation of a 100 meter buffer unless the suspected targets are identified as not historic by diver evaluations.

9. Are the mitigation plan(s) that are now being proposed the same as the authorized plan?
Response:
a. Fish and Wildlife: **YES** ✓ NO___*
b. Flood Damage: **YES** ✓ NO___*
c. Cultural and Historic Preservation: YES ___ **NO** ✓ *
d. Recreation: **YES** ✓ NO___*

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

Remarks: The authorized plan identified a 200 feet buffer around anomalies identified by the original underwater cultural resource survey. The proposed cultural resource mitigation plan is based on the current practices.

10. Is there an incremental analysis/cost effectiveness analysis of the fish and wildlife mitigation features based on an approved method and using an accepted model?
Response: YES ___ **NO** ✓ *
Remarks: No Fish and Wildlife Mitigation is being offered, thus no incremental analysis is called for.

11. Is it expected that the project's fully funded cost would exceed the cost limit of Section 902 of WRDA 1986? [Note: for hurricane and storm damage reduction projects there are two separate 902 limits, one for initial project construction and one for periodic renourishment]
Response: YES *___ **NO** ✓
Remarks: [In this section provide the authorized project cost, price level, and current and fully funded project cost estimates and price levels]

12. Does the project involve HTRW clean-up?
Response: YES *___ **NO** ✓
Remarks:

13. Does the work involve CERCLA covered materials?
Response: YES *___ **NO** ✓
Remarks:

14. Are the project purposes now being proposed different than the authorized project? [Note: different than specifically noted in authorization or noted in Chief's report and is it measured by project outputs]
Response: YES *___ **NO** ✓
Remarks:

15. Are there any proposed scope changes to the authorized project? [Reference: ER1105-2-100]
Response: YES *___ **NO** ✓
Remarks: [Describe the authority that would enable the project to proceed without additional Congressional modification]

16. Is Non-Federal work-in-kind included in the project?
Response: YES *___ **NO** ✓
Remarks: [Note: Credit to a non-Federal sponsor for work-in-kind must be based upon having an existing authority. Need to identify the authority and if not a general authority such as Sec 215, provide a copy of the authority.] No work in-kind is being sought by the sponsor. This is a reimbursable project where the sponsor bears all of the costs and seeks reimbursement based upon an approved LRR and PCA.

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

17. Does project have work-in-kind authority? [Note: If there is no existing authority, as determined in conjunction with District Counsel, the only other vehicle is to propose work-in-kind and rationale in the decision document and submit to HQUSACE for specific Congressional authorization.]
Response: YES ___ **NO** ✓ *
Remarks: No work in-kind is being sought by the sponsor. This is a reimbursable project where the sponsor bears all of the costs and seeks reimbursement based upon an approved LRR and PCA.

18. Are there multiple credit authorities (e.g., Sec. 104 & 215) including LERRDs, Work-In-Kind and Ability to Pay? [Note: See App. B of ER 1165-2-131. Describe the authority for work-in-kind and if authority exists, the PM should submit a completed App. B through the vertical team.]
Response: YES *___ **NO** ✓
Remarks:

19. Is an Ability to Pay cost sharing reduction included in the proposed project? [If yes, fully describe the proposal, citing how this authority is applicable. Include a table showing the cost sharing by project purpose and expected Ability to Pay reductions.]
Response: YES *___ **NO** ✓
Remarks:

20. Is the recommended plan different from the NED plan? [Note: if this answer is yes, then a series of questions arise that will need to be addressed in the Remarks section... is plan less costly than NED plan, is the plan more costly with the same cost sharing as NED plan (exception), is plan more costly with all costs exceeding the cost of the NED plan at 100% non-Federal cost, or has ASA(CW) already granted an exception]
Response: YES *___ **NO** ✓
Remarks:

21. Was a standard accepted Corps methodology/model used to calculate NED benefits?
Response: **YES** ✓ NO___ *
Remarks:

22. Are there non-standard benefit categories? [Reference ER 1105-2-100].
Response: YES *___ **NO** ✓
Remarks:

HURRICANE AND STORM DAMAGE REDUCTION COMPONENT

41. Is there a Hurricane and Storm Damage Reduction component in the project?
Response: **YES** ✓ NO___
Remarks:
[If Yes, answer each of the following questions.]

42. Does the project provide for protection of privately owned shores?

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

Response: **YES** *✓ NO___
Remarks: Perpetual Public Easements have been obtained/verified prior to PCA for those lands that are owned by private owners and are affected by the shore protection project.

43. Does the project provide for protection of undeveloped lands?
Response: **YES** *✓ NO___
Remarks: Three Ocean Strand segments, identified in Table 8 of the main text, are on undeveloped park lands. One segment is privately owned and the other two segments are publicly owned and are covered 0%, 50% and 50% Federal cost sharing, respectively for each segment.

44. Does the project provide for protection of Federally owned shoreline at Federal cost? [If yes, describe what is to be protected and who bears the federal cost.]
Response: YES *___ **NO**✓
Remarks:

45. Does the project involve tidal or fluvial flooding, i.e. is it clear what the project purpose is and has the project been formulated as a hurricane and storm damage reduction project or flood damage reduction project?
Response: YES *___ **NO**✓
Remarks: Strictly a hurricane and storm damage reduction project.

46. Is there any recommendation to cost share any interior drainage facilities?
Response: YES *___ **NO**✓
Remarks:

47. Is recreation> 50% of total project benefits needed to justify the project?
Response: YES *___ **NO**✓
Remarks:

48. Are there any parking or public access issues [no public access or none provided within 1/2 mile increments]?
Response: **YES** *✓ NO___
Remarks: The Ocean Strand is a publicly owned, undeveloped park. The parcels currently do not contain posted public access and parking, though an access is used by local residents. Access and parking is claimed for the southern two parcels through Red Reef Park in this analysis.

49. Are easements being provided to ensure public use and access?
Response: **YES** ✓ NO___ * N/A ___
Remarks:

50. Is there a Sec. 934 of WRDA 1986 extension of the period of authorized Federal participation?
Response: YES *___ **NO**✓
Remarks:

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

51. Are there any Sec. 111 of Rivers and Harbors Act of 1968, as amended proposals?
Response: YES *___ **NO** ✓
Remarks:

RECREATION COMPONENT

69. Is there a recreation component as part of the project?

Response: YES_X_ NO____.

If Yes, answer each of the following questions.

70. Is the cost of proposed recreation development > 10 % of the Federal project cost without recreation [except for nonstructural flood damage reduction and hurricane and storm damage projects]?

Response: YES___* NO_✓

Remarks: [Describe the proposal and whether ASA(CW) approval has been granted.]

71. Are there recreation features located on other than project lands?

Response: YES___* NO_✓

Remarks:

72. Does the project involve/provide for waterfront development?

Response: YES___* NO_✓

Remarks:

73. Does the project involve the need to reallocate authorized storage (Section III, App. E, ER 1105-2-100]?

Response: YES___* NO_✓

Remarks:

74. Does the project include non-standard recreation facilities (refer to ER 1105-2-100, App. E, Exhibit E-2)?

Response: YES___* NO_✓

Remarks:

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

CONCURRENCE

Date: 6 May 2008 — Project Manager

Date: 25 Apr 08 — Chief, Planning Division

Date: 1 May 08 — District Counsel

Date: 7-MAY-08 — DDE (PM)

Date: _____ — Planning and Policy CoP (MSC)

Date: _____ — MSC Counsel

* Response where a "*" requires coordination through vertical team and complete description of issues under "Remarks", before decision to approve project/report can be delegated.

APPENDIX C

POST-AUTHORIZATION DECISION DOCUMENT CHECKLIST

I. BASIC INFORMATION:

a. Name of Authorized Project: Palm Beach County, Florida, Shore Protection Project (from Martin County line to Lake Worth Inlet and from south Lake Worth Inlet to Broward County line)

b. Name of Separable Element: Boca Raton segment

c. PWI Number: 074382

d. Authorizing Document: "Beach Erosion Report on Cooperative Study of Palm Beach County, Florida" published as House Document 164/87/1, 23 October 1962

e. Law/Section/Date of Project Authorization (attach copy to checklist): Rivers and Harbor Act of 1962/Flood Control Act of 1962 (Public Law 87-874), 23 October 1962

f. Laws/Sections/Dates of Any Post-Authorization Modification: Section 506 (b)(2) of the Water Resources Development Act of 1996 extended Federal participation in the cost of periodic beach nourishment for a period of 50 years from initial construction if determined to be necessary by the Secretary of the Army

g. Non-Federal Sponsor(s): City of Boca Raton, Florida

h. Project/Separable Element Purpose(s): Storm Damage Reduction

i. Congressional Interests (Senator(s), Representative(s) and District(s)): Senator Mel Martinez, Senator Bill Nelson, Representative Ron Klein, Florida's 22nd Congressional District

II. PROJECT DOCUMENTS:

a. Type of Decision Document: Limited Reevaluation Report

b. Approval Authority of Decision Document: CECW_____

c. Project Management Plan Approval Date: 23 April 2002

d. Independent Technical Review (ITR) Approval Date: Quality Assurance/Quality Control Review completed September 2007

e. Mitigation Authorized: ____Yes ?_X_No Cost of Mitigation: _____

Describe Type of Mitigation and Whether Included in Project Report: No mitigation is included in the report. Successful mitigation was conducted in conjunction with the 1988 beach nourishment.

(Note: Project report is the one that supports the authorization for the mitigation.

Ensure that mitigation is authorized as part of the project cost)

f. Current M-CACES Estimate: $7,333,725 Date Prepared & Price Level: Aug 07, FY07

g. Section 902 Cost Limit: $ n/a Fully Funded as of n/a

h. Date of Latest Economic Analysis: Fiscal Year 2007

i. Current Economics: BCR 3.0 @ 4.875% FY07 (Period of analysis: 1988 - 2038)

RBRCR 3.4 @ 4.875% FY07 (Period of analysis: 2007 - 2038)

III. COST SHARING SUMMARY:

Purpose (s)	Non-Fed Cash	Non-Fed LERRD	Non-Fed Const. Credit	Total Non-Fed Share	Federal Share (%)	Total Project Cost
Total					**58.8**	**$216,703,000**
No. Boca						$51,710,000

a. Projected Credit for Section 215 Work and Date 215 Agreement Signed: N/A

b. Projected Credit for Section 104 or Other Authorized Creditable Work and Date Work: N/A until a new PCA Amendment is signed in order to allow cost sharing of eligible E&D costs by the sponsor for the upcoming (2009) renourishment. Prior executed PCA's for initial construction in 1988 and for the first periodic renourishment in 1998 have allowed E&D cost sharing. A new PCA amendment is needed for cost sharing of the E&D and renourishment contract costs for the upcoming renourishment in 2009, since the initial 10 year period of Federal participation has expired in 1998. The ASA(CW) memo dated 9/30/97 allows for renourishment of this project segment for 50 years in accordance with Sec. 506.b.2. of WRDA 1996.

Approved by ASA(CW) or Agreement Addressing Work Signed:

c. Annual Non-Fed OMRR&R Costs (1 Oct FY Price Levels): $3,000,000

IV. FUNDING HISTORY

a. Appropriations History for Project/Separable Element:

This information below is for the entire Palm Beach County project including the North Boca element.

FY	Conference Amount	EOY Allocation
Pre-1980	$1,806,287	$1,806,287
1980	$0	$0
1981	$0	$0
1982	$0	$0
1983	$0	$40,000
1984	$2,300,000	$300,000
1985	$2,100,000	$2,050,000
1986	$0	-$300,000

FY	Conference Amount	EOY Allocation
1994	$200,000	$2,972,000
1995	$0	-$49,400
1996	$0	$20,000
1997	$4,000,000	$200,000
1998	$3,500,000	$5,312,000
1999	$0	-$195,000
2000	$0	$132,113
2001	$0	$2,868,000

FY	Conference Amount	EOY Allocation
1987	$1,700,000	$234,000
1988	$0	$0
1989	$350,000	$0
1990	$0	$200,000
1991	$0	$0
1992	$3,575,000	$93,000
1993	$0	$25,000

FY	Conference Amount	EOY Allocation
2002	$2,000,000	$815,300
2003	$2,500,000	$1,689,000
2004	$1,500,000	$920,000
2005	$2,712,000	$2,645,000
2006	$7,450,000	$7,425,000
2007	$0	$0
Total	**$35,693,287**	**$29,202,300**

V. CERTIFICATION FOR DELEGATED DECISION DOCUMENTS: YOU MUST ANSWER "YES" TO ALL OF THE FOLLOWING QUESTIONS TO APPROVE THE DECISION DOCUMENT UNDER DELEGATED AUTHORITY.

a. PROJECT PLAN

Has the project study issue checklist been completed and all issues resolved? _X_ **Yes** ___No (Note: Is the project the same as contained in the project report supporting authorization; if not, is it within the 902 limit, who has the authority to allow the change by regulation ...district, division, Chief, Congress)

Does the non-Federal sponsor concur in the project plan as submitted?_X_ **Yes** ___No

Has project plan as submitted been reviewed and concurred in by the non-Federal sponsor's counsel?_X_ **Yes** ___No

b. AUTHORITY

Has authority been delegated to the MSC for approval of the project report?_X_ **Yes** ___No

Is authority adequate to complete the project as proposed?_X_ **Yes** ___No

c. POLICY /LEGAL/TECHNICAL COMPLIANCE

Has the District Counsel reviewed and approved the decision document for legal sufficiency?

_X_ **Yes** (Certification included in decision document package submittal) ___No

Have all aspects of ITR been completed with no unresolved issues remaining?_X_ **Yes** ___No

Has the District Commander documented policy/legal/technical compliance of the decision document?_X_ **Yes** ___No

Has the MSC certified the policy/legal/technical compliance of the decision document? _X_ **Yes** _X_ **No** The City of Boca Raton does not have an office of council and their attorneys are not usually involved in the LRR document development and review

process. Jennifer Bistyga, Senior Financial Analyst, and Bob DiChristopher, Director of Municipal Services, are the two representatives from the City who have reviewed the document.

VI. AUTHENTICATION:

6 May 2008	Charles F. Stone
Date:	Project Manager
25 Apr 108	Rebecca S Griffith
Date:	Chief, Planning Div
1 May 2008	Patricia A. Morris
Date:	District Counsel
8 May 2008	
Date:	DDE (PM)
8 May 2008	
Date:	District Commander
Date:	Planning and Policy CoP (MSC)
Date:	MSC Counsel
Date:	MSC Commander

LEGAL OPINION

Paragraph 2(d) of the December 17, 2007 comments from CESAD-PDS-P on the Limited Reevaluation Report (LRR) for the North Boca Raton Segment Second Periodic Renourishment, Palm Beach County, Florida Shore Protection Project notes that a legal opinion should be included in transmittal documentation pursuant to ER 1165-2-502. Paragraph H-2.d.(4) of Appendix H of ER 1105-2-100, Policy Compliance Review and Approval of Decision Documents, provides that "Division Engineers are responsible for ensuring policy and legal compliance, and documenting technical, policy and legal compliance for decision documents that have been delegated to MSCs for review and approval in accordance with ER 1165-2-502." ER 1165-2-502, Delegation of Review and Approval Authority for Post-Authorization Decision Documents, paragraph 8, provides that transmittal documentation for post-authorization reports "will include the District Counsel's legal opinion documenting the authority for all post authorization changes as well as the District Counsel's written certification that the report is legally sufficient."

I have reviewed the LRR for the North Boca Raton Segment Second Periodic Renourishment, Palm Beach County, Florida Shore Protection Project. The project was authorized by Section 101 of the River and Harbor Act of 1962 (PL 87-874) with Federal participation for a period of 10 years. Federal participation was extended to 50 years from the date of initiation of initial construction (1988) by Section 506(b)(2) of the Water Resources Development Act of 1996 (PL 99-662), provided the Secretary made a determination that periodic nourishment was necessary for the project. Such a determination was made for the Boca Raton Segment on September 30, 1997.

The 1987 General Design Memorandum (GDM) for initial nourishment, as amended by a 1988 Addendum, evaluated implementation of a 1.45 mile long stretch of the 2.7 mile long authorized project. The GDM and Addendum called for an increased width of from 25 to 50 feet (because of an error in transferring tables in the report) and a shift in project limits to the south by 60 feet. There was no modification to the design for the first renourishment in 1998, and no modifications are proposed for the second.

This proposed second renourishment is within the footprint of initial construction and within the footprint of the first renourishment. It is proposed to occur within 50 years of the date of initial construction. Accordingly, I conclude that the proposed second renourishment is within Corps authority.

Brooke W Moore 2/29/08
Assistant District Counsel

18 September 2007

QUALITY ASSURANCE/QUALITY CONTROL REVIEW
PALM BEACH COUNTY, FLORIDA SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)
LIMITED REEVALUATION REPORT (LRR)
FOR NORTH BOCA RATON SECOND PERIODIC RENOURISHMENT
DATED September 18, 2007

The subject document was prepared by the project sponsor and submitted to the Jacksonville District Corps of Engineers on 28 February 2007 for: a Quality Assurance/Quality Control review. This document has since been updated by the Jacksonville District (May and August 2007). In March 2005 the following team was established to review the LRR:

Dan Haubner PD-PN
Tom Martin EN-HC
Jimmy Matthews EN-TI
Lynn Zediak RE-A
Bill Lang PD-E
Brian Hughes EN-D
Chris Papiernik EN-GG
Brooks Moore OC

Review guidance was based upon direction in the Jacksonville District Engineering Independent Technical Review/Quality Assurance Standard Operating Procedures and the Corps Engineering Circular 1165-2-205 dated 31 March 2004. The following listings of comments are intended to provide an update to both the resolved and outstanding or unclear issues and to ensure technical, policy and legal compliance is achieved.

Issue Summary – Environmental Coordination

IS1. August 2007: Fish and Wildlife Coordination Act Report has not been updated.

Action Taken – August 2007: A CAR for the LRR would not be required as this is a Post-Authorization activity and a CAR was obtained at project authorization. SAJ revised the EA to reflect this, and sponsor's consultant made corresponding revisions to the LRR.

Response to Action Taken: **Response is satisfactory**

IS2. August 2007: ESA consultation has not yet been concluded.

Action Taken – August 2007: SAJ Regulatory Division has initiated the consultation. According to FWS, the BO is dated 20 July. SAJ has received a copy. (PD-E is relying on RD to complete this ESA consultation.) SAJ revised the EA to reflect this, and sponsor's consultant made corresponding revisions to the LRR.

Response to Action Taken: **Response is satisfactory**

IS3. August 2007: Coastal Zone Consistency determination from the state has not been obtained.

Action Taken – August 2007: Final consistency would be achieved upon receipt of the DEP permit which includes the water quality certification as well as the coastal zone consistency. To date, the state has determined that the proposed action is consistent with the fl coastal mgmt program. The funding permit application must however, address the concerns identified by DEP and other state reviewing agencies prior to project implementation. SAJ revised the EA to reflect this, and sponsor's consultant made corresponding revisions to the LRR. Specifically, the consultant included: 1) a July 2007 letter from the FDEP in LRR Appendix D (Pertinent Correspondence) that references current status of the consistency determination, and 2) text in paragraph 114 to reflect this inclusion and current status.

Response to Action Taken: **Response is satisfactory**

IS4. August 2007: SHPO coordination is not complete.

Action Taken – August 2007: The SHPO does not have a problem with the proposed buffers. While the SHPO has not responded in writing to our coordination, they concede (by telephone conversation with SAJ-PD-E) that the time for response has past which indicates a fulfillment of our responsibility to provide "reasonable opportunity" to comment. SAJ revised the EA to reflect this, and sponsor's consultant made corresponding revisions to the LRR. Specifically, the consultant included: 1) language provided by the USACE concerning buffer distance around the magnetic anomolies, and 2) revised figures in Appendix B showing amended borrow area limits.

Response to Action Taken: **Response is satisfactory**

IS5. August 2007: Consultation with NMFS under Magnuson-Stevens has not concluded.

Action Taken – August 2007: Through the coordination process, a letter has been sent from NMFS stating once information is obtained from the sponsor on 5 outstanding requests, coordination will be considered complete. The Sponsor has provided this information and has asked for written confirmation that all requirements have been met. SAJ revised the EA to reflect this, and sponsor's consultant made corresponding revisions to the LRR. Specifically, the consultant included: 1) the NMFS letter in Appendix D (Pertinent Correspondence), and 2) text to reflect this inclusion.

Response to Action Taken: **Response is satisfactory**

Issue Summary – Fiscal Year Interest Rates, Cost, and Benefit Updates

IS6: August 2007: Costs will need to be updated to current price levels in order to provide the approving authority an accurate depiction of costs in today's dollars for their review; this is in accordance with ER 1105-2-100, Appendix D. Proper NED analysis requires that project NED

costs and benefits be compared at a common point in time. All NED costs shall be based on current costs adjusted by the project discount rate to the beginning of the period of analysis. Current costs shall be based on the price level at the time of the analysis. These costs have to be updated in the year the project is submitted for authorization and/or appropriations.

Main Report Pages 21-23, STANDARD CODE OF ACCOUNT, Table 6-A presents the project cost for the recommended plan in the Civil Works Breakdown System (CWBS) code of accounts as required by USACE regulations. The regulations also require that the final plan cost estimate also be in MCACES (MII) as part of the Engineering Appendix section of the report (Appendix A). Recommend creating an MCACES (MII) project cost report using the same CWBS format shown on Table 6-A. Additionally, all benefits and interest rates should be updated and incorporated throughout the LRR. Sponsor will update the LRR and provide corrected pages to SAJ.

Action Taken – August 2007: Sponsor provided an updated cost estimate in MII (sub-appendix A-2) and updated report pages to reflect the new costs, benefits and interest rates. Updates were made using 2007 dollars and the current interest rate of 4.875%.

Response to Action Taken: **Response is satisfactory**

IS7: August 2007: Main Report Page 14, PROJECT COSTS, Para. 49. – Last sentence "The project cost may increase at construction, as the estimates are based on a survey that was collected prior to the passage of Hurricanes Jeanne and Wilma." should be deleted. It is not clear how the cost would go up as a result of the hurricanes or is it that the actual volume of beach fill required may increase therefore the actual construction cost would go up as well?

Action Taken – August 2007: This statement has been removed.

Response to Action Taken: **Response is satisfactory**

IS8: August 2007: Appendix A – Engineering Appendix, page A-35, PROJECT COSTS, Para. A-81 should be deleted entirely other than the reference made to the unit cost being comparable to the 2004 Central Boca Raton Restoration Project in the third sentence. You may also want to reference the costs from the Ocean Ridge Segment and Delray Beach Segment hurricane restoration FCCE projects administered by the COE in 2005. These costs appear to support the North Boca Raton LRR cost as well.

Action Taken – August 2007: The text in paragraph A-81 was revised to read, "The price levels for ocean dredging in the south Florida areas were reevaluated in August 2007. A mobilization/demobilization cost of $1,400,000 and a unit cost of $5.50 per cubic yard of sand in place on the renourished beach was used as an estimate when dredging sand from borrow area B. A unit cost of $4.75 per cubic yard was used for dredging from borrow area A. These cost estimates are conservative based on the present dredging market and will allow for the extra cost of wintertime dredging if necessary."

Response to Action Taken: **Response is satisfactory**

IS9: August 2007: Benefits – The benefits contained in the report must be at current price levels commensurate with the costs. Please revise the report accordingly.

Action Taken – August 2007: All benefits and costs have been update to current price levels using 2007 dollars and a current interest rate.

Response to Action Taken: **Response is satisfactory**

Other Comments:

IS10: August 2007: A statement should be incorporated into the LRR to reflect that the remainder of the 50-year project life is considered as opposed to a one time second renourishment effort.

Action Taken – August 2007: All costs have been amortized over the 50-year project life, as well as the remaining 31-year project life. The following text was added to paragraph 75. "It should be noted that these cost sharing percentages are tentative and will be updated to reflect current shore ownership and use at the time of construction. These values are as of August 2007." Text has also been added to the syllabus stating that, "The project sponsor requests that the project cooperation agreement extend for the remaining life of the project with future costs allocated by a letter report.".

Response to Action Taken: **Response is satisfactory**

Engineering Design Section:

Reported no comments on the LRR.

Coastal Navigation Section:

1. PD-PN Comment: PRICE LEVELS - Starting in the Syllabus and continuing throughout the document it is very difficult to determine what price levels were used for the construction costs and the benefits. Benefit valuations older than 3 years are required to be updated; in addition, comparison of average annual costs and benefits must be done at the same price levels as well as the same interest rates. At one point in the document (paragraph 84) Price Levels of 2005 are mentioned, but it should be clear throughout the document. This will assist greatly when the document is several years older and used as a reference for research.

Action Needed to Resolve: At key points in the document, and when labeling Tables, clearly call out the price level used for the costs or the benefits that are being discussed.

Action Taken: The price level was called out when labeling tables and key points in the document to highlight that the 2005 price level was used. Notes were added to the Pertinent Data Sheet, and the bottom of Tables 3, 4, 5, 6-A through 6-C, 7, 9-A through 9-C, and C-4 through C-8. (Note: Tables C-4 through C-8 are now labeled A-21 through A-25, February 2007)

Text in Paragraphs C-20, D-1, and D-2 were also revised to highlight that 2005 dollars were used. (Note: These paragraphs are now labeled A-87, C-1, and C-2 respectively, February 2007)

Storm damage benefits in Appendix D were recalculated using 2005 price levels for upland buildings and backfill. Automobile operation costs were calculated using 2004 price levels, as highlighted in the Appendix D revised text and tables. Median incomes (revised p. D-22, paragraph D-70) are based on estimates for the year 2000. (Note: Appendix D has been relabeled to Appendix C, and p. D-22, paragraph D-70 is now C-22, paragraph C-70, February 2007).

Response to Action Taken (June 2006): **Response is satisfactory.**

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2. PD-PN Comment: ECONOMIC EVALUATION - The total project costs have not been accounted for in the analysis of the Average Annual costs and therefore the Benefit to Cost Ratio. The reported AAEQ Cost of $805,000 represents the 2006, 2016, and 2026 renourishment efforts only; they do not account for the sunk costs of past renourishments and associated costs over the entire project life. This directly impacts the comparison of the costs (2006 - 2038 end of 50 year life) to the benefits, which are stated as being computed over a 50-year life on Page D-7 of the Economics Appendix. (Note: Page D-7 is now page C-8 of the Economics Appendix,

February 2007) Benefits and Costs most be at the same price level and interest rate and be computed over the same period. In addition, the cost figures in Tables 6 do not match the costs reported in Table 4, which are used in the AAEQ Cost calculations. PED costs in Table 6 seem excessive for the level of effort. It should also be noted that the benefits reported in paragraph 84 do not match the other benefit values shown in the report.

The Storm Damage Model inventory that is presented in Sub-Appendix D1 appears to be utilizing upland development located within the northern and southern tapers of the project. (Note: The Economic Sub-Appendix D1 is now labeled C1, February 2007) The tapers do not provide the full 50-foot berm protection and report erroneous damages and therefore benefits. The GDM description of 1.45 miles (Table 8 totals 1.51 miles) is somewhat vague when referenced to available information; north boundary is located 500 feet south of the northern city limits of Boca Raton, south boundary is located 520 feet north of north limit of Red Reef Park. These limits are hard to discern with exact limits on given information, but it appears that the tapers are being included in the total project length. The tapers are built at the terminus of the Federal project instead of within the project limits, because their reduced width would not provide the same level of HSDR benefits as the design berm. Therefore, benefits are claimed based on the design berm for the project limits, and the tapers go beyond the limits being claimed or benefits since they contribute very little to the HSDR benefits. Appendix C, table C-1 shows Design volume for profile R-212 and only 2 years of advance maintenance remaining; this indicates that this is a Design section but the report only shows a minor amount of material being placed at this location. In addition to Table 8 of the main text, there is a discrepancy in Appendix C Table C-3 with respect to project length that will need to be cleared up. (Note: Appendix C has been combined with Appendix A, so Table C-1 and C-3 are now A-18 and A-20, February 2007)

The SDM input table in Sub-Appendix D1 has a few discrepancies that should be cleared up in the text of Appendix D somewhere (Note: Appendix D and Sub-Appendix D1 are now called Appendix C and Sub-Appendix C1). The recession-frequency data for the 200-year storm could not be found in Appendix A with the other data. Armor indices 2 through 4 seem confusing; the unit costs and level of protection afforded for #3 seems out of line with the rest of the armor scenarios. It appears that this is intended to be an increment to #2 but it is unclear on how this would be handled in the model. The assumptions made for the "replacement armor category should be clearly documented in the report; will the county and the state permit such actions? The fact that the erosion will have to work through Hwy A1A to affect a large number of structures does not seem to be reflected in the model. It would appear that the asphalt rubble and road base would provide some level of protection to these structures, and certainly the reverse should be true that a structure, even if it's being compromised will be providing protection from wave attack on the Highway and therefore reducing the erosive factors. The $ per sqft value for loss of land was not found in the appendix.

The SDM utilizes an erosion rate of 3.8 feet per year and references Appendix A. Review of pages A-20 - A- 22 does not reveal where this number was generated.

Action Needed to Resolve: Recompute the AAEQ Costs for the life of the project and re-determine the AAEQ Benefits over this same time period so that when benefits are compared to costs they represent the same analysis and generate a valid BCR. This will validate the project justification over the entire economic life. It may be of use to compare the AAEQ Costs and Benefits over the remaining project life (2006 - 2038) to determine remaining BCR. The recent round of PL 84-99 reports generated a great deal of interest in these types of analysis and will likely be a comment from the Division review that will completed after the District submits the report for approval. Cost and Benefit amounts need to be scrubbed in the report. It appears that Table 6 double counts some of the costs within the Table (effects PED), but this should be verified and accurate costs reported.

The report needs to show the exact project limits as stated in the 1987 GDM and denote where the city limits and Red Reef Park boundaries are with respect to the project. The benefit analysis needs to remove the structures between R-205 – R-206 and T-211 – R-212 or extend the design berm to those locations and have the tapers pushed out; whichever is the accurate description of the authorized project.

Resolve the armor questions mentioned above by supporting documentation within the text of the appendix and point out the value used for the loss of land valuation within the model. Clarify the erosion rate of 3.8 feet per year in the SDM.

Action Taken (December 2005): The AAEQ Costs were recomputed and the costs of the 1988 and 1998 projects were included in the cost analysis.

The AAEQ costs and benefits over the remainder of the project (2006 to 2038) were also computed separately. Text and tables were added and modified throughout the report to outline the costs, benefits, and benefit to cost ratio of both the entire project life (1988 to 2038) and remaining project life (2006 to 1988).

Table 6 was revised. Easement costs were removed from the federal cost sharing calculations. The City of Boca Raton will obtain beach storm damage reduction easements that extend through December 31, 2038 (the end of the project).

The project plates were changed to show the Boca Raton City Limit and the limit of Red Reef Park.

The 200-year storm recession was added to Table A-10.

Storm damage and recreational benefits are computed only for the full project cross-section extending from monuments R-206 to T-211.

The loss of land value was calculated to be $31 per square foot. This is based on 2005 data. The calculation is described in paragraph D-27 (Note: This paragraph is now labeled C-27, February 2007).

An explanation of the 3.8 feet/year erosion rate appears on revised page D-3, paragraph D-12 (Note: The page and paragraph numbers are now page C-3, paragraph C-12, February 2007). The number of armor types in the storm damage model was reduced to 2: no armor and a rubble revetment. These are armor types are based on what currently exists along the project area (no armor), and what has been constructed nearby when State Highway A1A is in danger of being undermined (revetment).

Treating State Highway A1A as coastal armoring structure would likely overstate the level of protection provided by the road. If the road were overwashed but otherwise left intact, damages to landward structures could still occur with the transport of overwash into the first floors of the landward buildings. Alternatively, the pavement could cave-in as waves undermine the road. In either case, the road would not able to prevent damages to landward buildings. For these reasons the level of protection offered by State Highway A1A was assumed to be negligible.

Response to Action Taken (June 2006): **Response is satisfactory.**

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3. PD-PN Comment: PROJECT MODIFICATION - The USACE approval of an increase in design width was not available in Appendix E (Note: This Appendix is now labeled Appendix D, February 2007).

Action Needed to Resolve: Provide documentation.

Action Taken (December 2005): The approval has been included in Appendix E (Note: This Appendix is now labeled Appendix D, February 2007).

Response to Action Taken (June 2006): **Response is satisfactory.**

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4. PD-PN Comment REAL ESTATE/PUBLIC ACCESS/COST SHARING - The location of the fill with respect to the securing of perpetual public use easements is unclear in the report. Reference Item (j.) on page 7 of the main text. Paragraph 55 on page 18 mentions obtaining easements for private property but it is unclear if these are for temporary staging areas or for the actual placement of material. Perpetual easements are required to assure that the project lands are open to the public and remain so for the life of the Federal project. The fact that the Design berm is located behind the ECL (according to cross sections on the plates) implies that the Federal project lies on privately owned lands; it needs to be stated clearly within the report that all lands required for the Federal project have been obtained and have the Perpetual Public Access easements needed for the project cost sharing. The 1987 DM, as approved in the 12 November 1987 SAD memorandum, states that the Federal project is a 50-foot extension of the 1986 MHW line. These items will be examined very closely during Division review and need to be extremely explicit. Paragraph 87 will need to be adjusted.

Beach tilling immediately following the construction of a shore protection project is a permit requirement to facilitate the nesting of sea turtles. Since this is a required action for permit compliance, it is therefore deemed as a construction activity and can be cost shared as such.

The LERR costs shown in Table 9-A are a local responsibility, which are not cost shared per se, however, credit is given against the non-Federal share for the LERR costs, reducing the sponsor's cash contribution. Further guidance is available in ER 1105-2-100 para.E-25.b.(1) and ER 1165-2-130 para.9.d.(I).

Table 9-A of the main report implies that the non-Federal sponsor would also provide the entire cost of all fill material placed on the undeveloped lands and developed private lands, which are inaccessible to the public, landward of the Erosion Control Line (ECL). Public access to and use of privately owned lands within the footprint of the project, both landward and seaward of the ECL) must be provided and maintained for as long as the Federal project remains authorized. If real estate interests can not be obtained to provide such public access and use, the cost of the entire fill volume, both landward and seaward of the ECL, within the footprint of the project must be apportioned as 100% non-Federal. Refer to ER 1165-2-130.

Action Needed to Resolve: Clearly define what type of easements have been secured for this project and where they are located with respect to the project. If the easements are for the foot print of the Federal project and extend back to the +9 foot contour of the original project (design berm seems buried); then the material behind the ECL is cost shareable; on the other hand, latest guidance is that if those easements are not in place then the entire volume of material on that lot is not cost shareable. If applicable easements have been secured, remove delineation of material in front of and behind the ECL; show easements obtained along the length of the project.

Adjust cost share table to reflect participation in beach tilling.

Table 9 should show no Federal cost share for the LERR (0% Federal), and then at the end reduce the total non-Federal cost by the LERR amount.

Ensure that perpetual (or possibly 50-year) public use and access easements are secured for the project footprint.

Action Taken (December 2005): The City of Boca Raton is obtaining beach storm damage reduction easements that extend through to December 31, 2038 (the duration of the project). For development of the LRR, we have assumed that we will receive all eleven private easements and we will submit these prior to construction. If easements have not been obtained prior to construction, the Federal cost share will be reduced accordingly.

Table 9 has been revised so that beach tilling is included in the Federal cost share and the LERR has been removed from the Federal cost share. The percentage of the Federal share has also been revised based on distances from public access points and Federal cost sharing of fill in front of and on a private easement.

Response to Action Taken (June 2006): Easements still not fully defined. If easements have already been obtained for prior work, they should be listed. Confusion as to whether there are 11 or 12 private easements. Paragraphs mention 11 easements, but Plates 1B-C show 12.

Action Taken (August 2006): There are 11 private easements. Plate 1D has been changed. The City is in the process of obtaining perpetual storm damage easements for the extent of the project life (December 31, 2038).

The following text has been added to paragraph G-26 to define the type of easement, "The project sponsor will provide beach storm damage reduction easements (described below) landward of the erosion control line for the placement of material on private shores (11) for a term concurrent with the life of the project (December 31, 2038)". Paragraph G-26 has also been revised to include the language suggested in Comment 16 (Note: Paragraph G-26 is now labeled F-26, February 2007).

Response to Action Taken (January 2007 meeting): **Response is satisfactory.**

Additional Issues Raised: There is a 25 ft segment of beach that has numerous owners. The City of Boca Raton can get over 50% of the people to sign easements at present. Missing at least 6 of the owners. How will this impact process? Also, when will certification of lands be required?

SAJ-RE Response: As long as The City of Boca Raton's Office of Counsel is in support, USACE RE is ok with it. If owners cannot be found to sign at all, the land would just be taken out of cost sharing calculations. Certification of lands is required after PCA is executed.

Action to be Taken: Coastal Planning & Engineering, Inc will do a quick benefit to cost assessment without those properties, in case they are not acquired.

Response to Action to be Taken: **Response is satisfactory.**

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5. PD-PN Comment: BEACH NOURISHMENT PERFORMANCE/RENOURISHMENT - The actual performance of the project and the calculated renourishment rate, as presented in the report are somewhat confusing. Just as a baseline reference for this discussion, the 1987 GDM calculated a 56,000 cy per year renourishment rate. Paragraph 35 of the main text discusses a loss of volume from the project on the order of 396,000 cy over a 10-year period, and states that this equates to a loss of 56,500 cy per year. This correlates to the GDM figure, but the math is not apparent to the reviewer; wouldn't this be closer to 39,600 cy per year (396k/10 years)? It should also be noted that the figure of 706,235 cubic yards in this paragraph does not match the value reported in Table A-13. Similar questions concerning paragraph 37 with respect to the 1998 renourishment, 470,800 cy lost over 6 years is reported as an average loss of 50,900 cy per year loss rate. Reviewer estimates this to be closer to 78,000 cy per year.

Beach profiles for the project are not present for the report; the plates have one representative profile on each plate. The R monument profiles should be provided in the report. The report claims that there are no impacts to the design berm, yet the profile for T -211 shows a design berm breach in the September 2004 survey.

Renourishment scheduled for 2006 is estimated at 568,200 cy of material; this is intended to protect the design berm for 10 years or 2016 (assuming existing advance nourishment is being accounted for in this estimate). At which time 822,300 cy of material is estimated to be placed in order to protect the berm for 10 years or 2026. In 2026 it is estimated that 966,900 cy of material will be required to protect the design berm until 2038 at the end of the project life.

Action Needed to Resolve: Clarify how the average erosion rates are derived and then how they translate into the current renourishment volumes that will be used for future renourishments. This plays heavily into performance and eventually the overall project cost and justification. Ensure that the main text and Appendices A and C reference the same numbers through out. Provide Beach profiles within Appendix C for each R monument similar to those located on the plates (Note: Appendix C has been combined with Appendix A, February 2007). Determine if the Design berm has been breached and reflect that within the report (T-211).

Clarify the logic in the volumes for future renourishments and how those values were obtained.

Action Taken (December 2005): The erosion rates have been clarified with the volumes listed and the time period used to develop the rate. The May 1998 to September 2004 erosion rate within the project footprint was used to calculate the advanced fill volume required for the 10-year nourishment interval.

Beach profiles at each monument have been provided in the plates.

A comment was added in paragraph 36 to highlight that the design section was breached at R-210, T-211, and R-212.

Response to Action Taken (June 2006): **Response is satisfactory.**

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6. PD-PN Comment: COST APPORTIONMENT - Figure 4 seems to be in error. According to the provided scale, public access runs north from Red Reef Park to just north of Ocean Strand Park (no parking at Ocean Strand precludes its use as a public access point unless public transportation can be utilized) as opposed to the hatched area shown going well north of Ocean Strand. Coming south from the end of Spanish River Park the 1/4 mile access should reach own past the gap currently shown in the hatched area. It appears that the distance is the same, but that it's misrepresented on the map (the gap in access needs to be shifted to the south). Also paragraph 75 on page 27, last sentence, references the First renourishment, it's suspected that this should read "Second" renourishment.

Table 8 of the main text needs to reflect the Federal project limits. The project is 1.45 miles in length according to the GDM; this table tabulates to 1.51 miles. The discussions in Comment #2 will apply to this as well; properties outside of the project limits will need to be reviewed and the table adjusted accordingly. The property labeled Oceanview-Lakeview Trust falls outside the ¼ mile access limits; the lot widths immediately to the north sum up to ¼ mile, leaving the Ocean View lot outside the access minimum.

Action Needed to Resolve: This portion of the report needs to be carefully reviewed and documentation will need to be changed to reflect the items discussed above. Also note LERR and Beach Tilling remarks from Comment #4.

Action Taken (December 2005): The access limits shown on the plans extend ¼ mile from the access point on the property (the middle of Ocean Strand) and an underpass from Spanish River Park. These public beach accesses are shown on Plates 1-B and 1-C, respectively.

The text has been revised to read "second".

Tables 8, 9-A, 9-B, and 9-C have been revised. LERR and beach tilling remarks from comment #4 have been incorporated.

Response to Action Taken (June 2006): Para 72 needs revising to explain access points and make reference to details of Plates 1B and 1C.

Action Taken (August 2006): The following text has been added to paragraph 72 to discuss the access points: "...is publicly accessible through walkways down to the beach and access tunnels under State Road A-1-A that connect to Spanish River Park (Plates 1-A, 1-B, and 1-C)."

Figure 4 has been revised to shift the accessible shorefront.

Response to Action Taken (January 2007 meeting): CP&E has revised paragraph 72 and added text: "is publicly accessible..." **Response is satisfactory.**

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7. PD-PN Comment: FINANCIAL STATEMENT - Paragraph 90 states that the financing plan has been completed and will be submitted for District Review.

Action Needed to Resolve: Provide the plan for review.

Action Taken (December 2005): A letter from the City of Boca Raton showing that they are capable of funding their portion of the project will be provided under separate cover prior to finalizing the PCA.

Response to Action Taken (June 2006): Add the statement to text that was presented under action taken.

Action Taken (August 2006): Text has been revised as suggested.

Response to Action Taken (November 2006): Sponsor provided Financial Capability documents (package) with their letter dated Sept 27, 2006 to CESAJ-DP-C. DP-C has forwarded this package on 16 Nov 2006 to CESAJ-PD-PN (White), CESAJ-PD-D (Holland for use in DE Finding of Financial Capability for PCA package) and CESAJ-OC (Moore).

Action Needed to Resolve: SAJ to review Sponsor's Financial Capability documents (package) provided with their letter dated 27 Sept 2006.

Action Taken (January 2007 meeting): The sponsor provided financial documents in September. Charlie Stevens (PM) received those financial documents. They have since been passed onto Eric Raasch (PD-D) who will put together a schedule of federal and non federal payments by year.

Sponsor has also submitted letter dated Sept 27, 2006 to show financial sources and availability of funds. (See also Comment #22) This letter is being reviewed by Economics to make sure it complies with needed information for PCA package. This is a separable item from the LRR but will be done before the June deadline and prior to the PCA package being submitted.

The financial letter from sponsor can be included in LRR (CP&E will insert). Sponsor will deliver report to SAJ by Feb 1. SAJ will submit report to SAD by March 8. Charlie stated that once the LRR is approved by SAD, the PCA package can be sent up to USACE HQ.

Response to Action Taken (February 2007): A copy of the financial capability letter was included in Appendix E (Note: Appendix E has now been labeled Appendix D, February 2007). The last sentence in Paragraph 88 has been replaced with, "The City of Boca Raton submitted a letter of financial capability to the USACE on September 27, 2006. A copy of this letter is included in Appendix D." The last sentence in Paragraph 89 has been revised from, "...will be provided under separate cover", to, "was submitted to CESAJ for approval. A copy of the letter is included in Appendix D." **Response is satisfactory.**

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8. PD- PN Comment: CULTURAL RESOURCES - Paragraph 107 discusses the magnetometer hits in the borrow areas and the associated SHPO Coordination. From the text, it appears that no coordination has occurred since 1986; it may be prudent to re-coordinate with SHPO to determine if any further information has been revealed in this area.

Action Needed to Resolve: Consider correspondence with SHPO to evaluate borrow area.

Action Taken (December 2005): A second cultural resources investigation was performed in 2003. Coastal Planning & Engineering and the archeologist that oversaw the study coordinated with SHPO to clear the area for use. The cultural resource report, submitted to SHPO,

recommended a 200' buffer around target anomaly BR-02. SHPO concurred with the buffer recommendation of the marine archeologist and found the report to be complete and sufficient in accordance with Chapter 1A-46. A copy of the correspondence is included in Appendix E (Note: Appendix E has now been labeled Appendix D, February 2007). The text has been revised to highlight that there has been additional coordination.

Response to Action Taken (June 2006): Concur. Paragraph may need revising in lieu of recent events.

Action Taken (August 2006): Text has been revised to add the paragraph from the response to the initial PD-PN comment.

Response to Action Taken (January 2007 meeting): Grady Caulk stated the report has been revised (See comments 12, 24, 28, & 35 [most critical]).

Question (asked by Ken Dugger) to CPE: What are the boundaries of the proposed borrow area? SAJ staff needs to be notified of any changes that may occur in the borrow area and it must be consistent with LRR. {Also Ref. 35 under additional comments.}

Action Taken (February 2007): All changes have been incorporated into the LRR during the previous submittals. The EA needs to reflect the new borrow area limits. USACE SAJ is developing the revised EA.

Response to Action Taken (July 2007): **Response is satisfactory.**

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9. PD-PN Comment: ENVIRONMENTAL COORDINATION - Paragraph 116 discusses the CAR; with recent permitting events and the current back log of work at the Vero Office the anticipated schedule for the CAR should be documented.

Endangered Species Act is mentioned in Paragraph 119, this coordination needs to be initiated, documented and completed as necessary.

Action Needed to Resolve: Documentation of the previous Record of Decision or Finding of No Significant Impact should be added to the report. Add a table of potential "show stoppers" with respect to Environmental Coordination along with the proposed schedule to ensure compliance prior to construction.

Action Taken (December 2005): Coordination with the U. S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service will be initiated by the USACE Regulatory office in West Palm Beach once the Public Notice for the project has been issued. Considering that the proposed project represents the third beach nourishment within the project area using the same template and sand source, significant objections based on ESA issues to the project are not anticipated. Based on recent coordination with the USACE Regulatory office and USFWS on

similar projects in Palm Beach County, it is anticipated that once the Public Notice for the project has been issued, the Biological Opinion will be prepared and issued within 90 days. This schedule is consistent with the overall project schedule and does not present a significant concern from a timing and coordination standpoint.

Regarding the issuance of a CAR, the USFWS has recently moved toward issuance of a Biological Opinion for beach renourishment projects as the mechanism for addressing ESA issues. In the event that the USACE Project Management Division believes that a CAR is required in addition to the Biological Opinion for this project, please notify the City of Boca Raton, so that additional coordination on this issue can be initiated between the USACE Regulatory office and USFWS.

Response to Action Taken (June 2006): **Response is satisfactory.**

Response to Action Taken (January 2007 meeting): Ken Dugger (PD-ER) stated that the existing CAR is sufficient. Existing copy will be included in the LRR.

Action Taken (February 2007): The USACE and project sponsor agreed to have SAJ develop an updated Environmental Assessment. The new EA will accompany the LRR. The 1997 CAR has been included in Appendix D – Pertinent Correspondence.

Geotechnical:

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10. EN-GG Comment Paragraph 47. Sentence not correct, should state that the borrow area has MORE volume of material for the life of the project.

Action Needed to Resolve: Revise paragraph.

Action Taken (December 2005): Text has been revised to state that the borrow area has more volume of material than is required.

Response to Action Taken (January 2007 meeting): Chris Papiernik (EN-G) has reviewed new text. **Response is satisfactory.**

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11. EN-GG Comment: Figure B-2 and B-3, for historical reference, it would be helpful to show the 1988 and 1998, dredged areas as shown in Figure-2.

Action Needed to Resolve: Modify Figures B-2 and B-3.

Action Taken (December 2005): The figures have been modified.

Response to Action Taken: **Response is satisfactory.**

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12. EN-GG Comment: Paragraphs, B-10 & B-18. The avoidance buffer of a potential significant cultural resource is based on a SHPO recommendation that is 20 years old and likely outdated. The buffer zone requirement is likely to increase, thus affecting the borrow area and quantities.

Action Needed to Resolve: Re-coordinate with SHPO to determine effects.

Action Taken (December 2005): In a letter to SHPO, dated 12/16/2004, Coastal Planning & Engineering requested approval of the North Boca Borrow Areas and specified the use of a 200 ft. buffer around target anomaly BR-02. The request was approved in a letter dated 1/27/2005. Copies of both letters are presented in Appendix E

Action Taken (February 2007): Appendix E has been relabeled Appendix D.

Action Taken (July 2007): SHPO coordination was updated in 2007.

Response to Action Taken (July 2007): **Response is satisfactory.**

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13. EN-GG Comment: Paragraph. B-25a, what is the percentage of carbonate vs. quartz content in the borrow areas, Paragraph B-6 provides regional information, but not detailed enough for the borrow area. Permitting will require the percentage of carbonate.

Action Needed to Resolve: Update the paragraph to include borrow area specific data.

Action Taken (December 2005): An analysis of the carbonate content was not conducted for the borrow area, as it had not been required for the previous two beach nourishment projects, constructed in 1988 and 1998. More importantly, the carbonate component of the borrow material has not caused cementation and has not adversely effected turtle nesting along the nourished beach since sand was originally placed in 1988. The sand source is the same sand source as was used in 1988 and 1998. The geotechnical study conducted for the proposed 2006 project was an expansion of the borrow area in order to provide sufficient material for the project.

The amount of carbonate analysis required to adequately evaluate the borrow area would be extensive, and would require additional funding to conduct. Since there have not been any problems with hardening or cementation of the beach based on the results of the construction of two projects, we request the requirement for carbonate analysis be waived.

Action Needed to Resolve (November 2006): Samples assumed not tested for carbonate. Similar to the regional description most likely close enough.

Action Taken: The same borrow area has been used for the past two renourishments and meets the State's requirements for fill.

Response to Action Taken: **Response is satisfactory.**

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14. EN-GG Comment: Figure B-4, B-6, borrow area A, has been segmented significantly to maximize the areas potential, I assume that the borrow area depths limits will be made simpler for construction. When construction begins will the dredgers be restricted to certain parts of the borrow area for what is only needed for the 3rd renourishment

Action Needed to Resolve: Describe proposed dredging plan within the text of the appendix.

Action Taken (December 2005): A discussion on construction details has been added to Appendix B (paragraphs B-36 and B-37). It is anticipated that a cutterhead dredge will be used to construct the project, which will allow the dredge contractor to access the various segments of the borrow area. Therefore, the borrow area depth limits will likely be left as is. The dredge contractor will not be limited to a particular section of the borrow area but will be required to uniformly excavate the borrow area to the maximum depth allowable.

Action Taken (February 2007): The following text has been added to paragraph B-35 to clarify that the Contractor will be required to dredge borrow area B. "The contractor will be required to dredge borrow area B during the 2007 renourishment project." Borrow area B is the preferred borrow area as it has the most recent cultural resources survey and has been cleared for use by SHPO.

Action Taken (July 2007): Text discussing SHPO coordination in the main body of the LRR has been revised to reflect the most recent June coordination.

Response to Action Taken (July 2007): **Response is satisfactory.**

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15. EN-GG Comment: Sub-Appx. B-10. The photographs of the core are too far away and are not very representative of the material.

Action Needed to Resolve: Provide more relevant data if available.

Action Taken (December 2005): No other data is available.

Action Needed to Resolve (November 2006): Original photos taken at poor resolution and assumed to be unreproducible.

Response to Action Taken: **Response is satisfactory.**

Real Estate:

16. RE-A Comment: Appendix G – If lands landward of the ECL are a part of the Federal Project, a Perpetual Storm Damage Reduction Easement must be acquired and it must include "public use and access". This should be consistent throughout the report. (Note: The Real Estate Supplement has been relabeled from Appendix G to Appendix F)

Action Needed to Resolve: Provide easements or certification of easements for the footprint of the Federal project that meets the standard criteria below:

PERPETUAL BEACH STORM DAMAGE REDUCTION EASEMENT

A perpetual and assignable easement and right-of-way in on, over and across (the land described in Schedule A) (Tracts No. -) for use by the Project Sponsor. its representatives, agents, contractors and assigns, to construct: preserve: patrol; operate; maintain: repair; rehabilitate; and replace; a public beach (a dune system) and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land: to construct berms (and dunes); to nourish and renourish periodically; to move store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the Project together with the right of public use and access; (to plant vegetation on said dunes and berms; to erect maintain and remove silt screens and snow fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas;) to trim, cut fell and remove from said land all trees underbrush, debris, obstructions, and any other vegetation structures and obstacles within the limits of the easement (except); (reserving, however, to the grantor(s), (his) (her) (Its) (their) (heirs), successors and assigns the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape dimension or function and that prior approval of the plans and specifications for such structures is obtained from the (designated representative or the Project Sponsor) and provided rurlher that such structures are subordinate to the construction operation. maintenance, repair rehabilitation and replacement of the project; and further} reserving to the grantor(s). (his) (her) (Its) (their) (heirs) successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired: subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

Action Taken (December 2005): The City of Boca Raton will obtain beach storm damage reduction easements that extend through December 31, 2038, which is the end of the project life, prior to construction. If easements are not obtained prior to construction, the Federal cost sharing will be reduced accordingly.

Response to Action Taken: **Response is satisfactory.**

RE Comments as a result of project life determination (June 2006)

1. RE-A Comment: G-26 should read: "The project sponsor will provide beach storm damage reduction easements (described below) landward of the ECL for the placement of material on private shores (approximately 11) for a term concurrent with the life of the project (December 31, 2038)."

Action Taken (September 2006): Text has been revised as suggested.

Response to Action Taken (November 2006): **Response is satisfactory.**

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2. RE-A Comment: Delete a. Perpetual Storm Damage Reduction Easement and all language.

Action Taken (September 2006): Text has been revised as suggested.

Response to Action Taken (November 2006): **Response is satisfactory.**

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3. RE-A Comment: Delete tab and b., but leave in easement language and change to "Beach Storm Damage Reduction Easement."

Action Taken (September 2006): Text has been revised as suggested.

Response to Action Taken (November 2006): **Response is satisfactory.**

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4. RE-A Comment: Replace "temporary construction easements" to "Beach Storm Damage Reduction Easements"

Action Taken (September 2006): Text has been revised as suggested throughout the report.

Response to Action Taken (November 2006): **Response is satisfactory.**

Action Taken (February 2007): In paragraph F-24 (Previously G-24), the word "temporary" has been removed from the sentence and the date has been changed to April 2007. The sentence now states, "Construction access easements will be provided by the City of Boca Raton by April 2007."

Response to Action Taken (January 2007 meeting): Resolution is to take out the word "temporary" and replace with "construction access easements". Action was completed during meeting. **Response is satisfactory.**

Office of Counsel:

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17. OC Comment: PROJECT AUTHORIZATION, Page 3, first paragraph. The correct citation to the house document is H.R. Doc. No. 164 (1987).

Action Needed to Resolve: Correct Text.

Action Taken (December 2005): The citation has been revised in paragraph 5 of the main text and paragraph G-2 of Appendix G – Real Estate Supplement.

Action Taken (February 2007): Appendix G was relabeled Appendix F.

Response to Action Taken: **Response is satisfactory.**

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18. OC Comment: PROJECT AUTHORIZATION, Page 3, second paragraph. First sentence is fine. In the second sentence add "initiation of" before "initial construction." Replace the last two sentences in the paragraph with the following: "Section 506(b)(2) of the Water Resources Development Act of 1996 provided that if the Secretary of the Army determined that periodic beach nourishment is necessary for the project, the Secretary shall carry out periodic beach nourishment for the project for a period of fifty (50) years from the date of initiation of construction. The Acting Assistant Secretary of the Army for Civil Works made such a determination for this project on September 30, 1997."

Action Needed to Resolve: Revise Text.

Action Taken (December 2005): Text revised as requested.

Action Needed to Resolve: Still requires acceptable response.

Action Taken (February 2007): The text has been revised to: The initial project authorization also provided for Federal participation in the cost of the nourishment for a period of 10 years. Federal participation in the cost of the periodic nourishment was extended to 50 years, beginning on the date of initiation of initial construction (1988), under the authority of Section 506 (b) (2) of the Water Resources Development Act of 1996 (PL 99-662). Section 506(b)(2) of the Water Resources Development Act of 1996 provided that if the Secretary of the Army determined that periodic beach nourishment is necessary for the project, the Secretary shall carry out periodic beach nourishment for the project for a period of fifty (50) years from the date of initiation of construction. The Acting Secretary of the Army for Civil Works made such a determination for this project on September 30, 1997.

Response to Action Taken (January 2007 meeting): **OC stated response is satisfactory.**

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19. OC Comment: LANDS, page 18, paragraph 55. I suggest reworking the first sentence. I like the following instead: "The sponsor is responsible for providing lands, easements, and rights-of-way and is obtaining easements from the State of Florida for dredging material from the borrow area and placing land seaward of the ECL, temporary construction access easements through one City owned park, and twelve private temporary construction access easements."

Action Needed to Resolve: Revise text.

Action Taken (December 2005): The text in paragraph 55 has been revised to reflect comments 16 and 19.

Action Needed to Resolve: Still requires acceptable response.

Action Taken (February 2007): The text in paragraph 55 has been revised to, "The sponsor is responsible for providing lands, easements, and rights-of-way and is obtaining easements from the State of Florida for dredging material from the borrow area and placing land seaward of the ECL, construction access easements through one city owned park, and storm damage reduction easements. The easements will assure that the project lands are open to the public and remain so for the life of the project. The costs related to these easements are administrative in nature and are expected to be $12,500 for the second renourishment project. The cost of obtaining the easements are excluded from Federal cost sharing. As the easements extend for the remainder of the project life, no administrative costs related to easements are expected for the projected 2016 and 2026 renourishment projects."

Response to Action Taken (January 2007 meeting): A draft was presented during the meeting. **OC stated response is satisfactory.**

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20. OC Comment.: LANDS, page 18, paragraph 56. This says sand will be placed landward of the ECL. State what estate will be acquired for this area.

Action Needed to Resolve: Similar to Comments #4 and #16.

Action Taken (December 2005): The City of Boca Raton will obtain beach storm damage reduction easements that extend through to the end of the project life (December 31, 2038). If these easements are not obtained prior to project construction, the cost sharing will be revised accordingly. Paragraph 56 has been revised.

Response to Action Taken: **Response is satisfactory.**

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21. OC Comment: NON-FEDERAL RESPONSIBILITY, page 30, paragraph 78. Clarify that the clock starts to tick at "initiation of" initial construction.

Action Needed to Resolve: Revise text.

Action Taken (December 2005): Text in Paragraph 78 revised as requested. The sentence now states, "The project sponsor will be responsible for 100% of the cost of the project after 50 years from the initiation of construction of the initial nourishment (June 1988)."

Response to Action Taken: **Response is satisfactory.**

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22. OC Comment_: FINANCIAL ANALYSIS, page 33, paragraph 88. Do we have a financial

analysis? We say one is required. Don't we have it?

Action Needed to Resolve: Similar to Comment #7.

Action Taken (December 2005): A letter from the City of Boca Raton indicating the capability to pay for the project will be submitted under separate cover prior to finalizing the PCA.

Action Taken (September 2006): Sponsor provided Financial Capability documents (package) with their letter dated Sept 27, 2006 to CESAJ-DP-C.

Response to Action Taken (November 2006): Sponsor provided Financial Capability documents (package) with their letter dated Sept 27, 2006 to CESAJ-DP-C. DP-C has forwarded this package on 16 Nov 2006 to CESAJ-PD-PN (White), CESAJ-PD-D (Holland for use in DE Finding of Financial Capability for PCA package) and CESAJ-OC (Moore).

Action Needed to Resolve: SAJ to review Sponsor's Financial Capability documents (package) provided with their letter dated 27 Sept 2006.

Action Taken (February 2007): A copy of the financial capability letter was included in Appendix D (formerly Appendix E). The last sentence in Paragraph 88 has been replaced with, "The City of Boca Raton submitted a letter of financial capability to the USACE on September 27, 2006. A copy of this letter is included in Appendix D." The last sentence in Paragraph 89 has been revised from, "...will be provided under separate cover", to, "was submitted to CESAJ for approval. A copy of the letter is included in Appendix D."

Response to Action Taken (January 2007 meeting): **OC stated response is satisfactory.**

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23. OC Comment: PUBLIC ACCESS, page 37, paragraph 109. See page 18. We need to mention the interest where sand is to be placed landward of the ECL

Action Needed to Resolve: Revise accordingly.

Action Taken (December 2005): The text has been revised to discuss sand placed landward of the ECL. Paragraph 109 has been renumbered paragraph 110.

Response to Action Taken (January 2007 meeting): A draft was presented during the meeting. **OC stated response is satisfactory.**

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24. OC Comment: NATIONAL HISTORIC PRESERVATION ACT, page 30. What have we done to comply?

Action Needed to Resolve: Similar to Comment #8.

Action Taken (December 2005): A cultural resources investigation of the geotechnical study area was performed in 2003. The marine archeologist that prepared the cultural resource report, submitted to the State Historic Preservation Office (SHPO), recommended a 200' buffer around target anomaly BR-02. SHPO concurred with the buffer recommendation of the marine archeologist and found the report to be complete and sufficient in accordance with Chapter 1A-46. A copy of the report and relevant correspondence is included in Appendix E (Note: Appendix E is now labeled Appendix D, February 2007).

Action Needed to Resolve (SAJ-PD-E): See response for #36 under action needed to resolve.

Response to Action Taken (January 2007 meeting): Grady Caulk (Archeology) stated that this comment is appropriately referring to Comment 36 for resolution. Grady verified that the buffer size is established at 200 ft, via SHPO letter dated Dec. 16, 2006.

Action Taken (February 2007): There was an error in the original report. A revised report was submitted by Tidewater Atlantic that that the BR06-02 "signature is suggestive of modern material, no additional investigation of the target is recommended".

The first sentence in Paragraph 108 has been revised to state: "A cultural resources investigation of the northern portion of borrow area B was performed in 2003."

Paragraph 109 has been changed to state: "In compliance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, the U.S. Army Corps of Engineers has determined that the beach renourishment will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places. Additionally, the use of the northern portion of Borrow area B as a sand source, as described by the 2003 Cultural Resource Investigation an Magnetometer Survey (CPE, 2005), will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places contingent on the maintenance of a buffer of no less than 200 feet around anomaly BR-02."

Action Taken (July 2007): Text discussing SHPO coordination in the main body of the LRR has been revised to reflect the most recent June coordination.

Response to Action Taken (July 2007): **Response is satisfactory.**

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25. OC Comment: FISH AND WILDLIFE COORDINATION ACT, page 39. When do we expect a CAR? And why don't we have it yet?

Action Needed to Resolve: Similar to Comment #9.

Action Taken (December 2005): As stated in the Comment 9 Action Taken response, consultation on ESA issues will be undertaken once the USACE Regulatory office has issued the

Public Notice for the project in response to submittal of a request for permit issuance. The timing of issuance of the USFWS Biological Opinion for the project will likely occur within 90 days of issuance of the Public Notice and does not present a significant obstacle to project approval.

Action Needed to Resolve (SAJ-PD-E) (November 2006): The USFWS comments received on the Corps Regulatory permit action should be relevant to the LRR. If the 1997 CAR still has some relevance to the proposed renourishment, reference it in your summary and include the CAR under Pertinent Correspondence.

Response to Action Taken (January 2007 meeting): OC recommends updating the 1997 CAR. Ken Dugger (PD-ER) disagrees with that assessment. Ken will forward email correspondence from Dennis Barnett (SAD) regarding acceptable environmental documentation to OC for concurrence.

Action Taken (February 2007): The 1997 CAR has been included in the Pertinent Correspondence section of the LRR. The text in Paragraph 117 has been changed to: "This project will be coordinated with the U.S. Fish and Wildlife Service. A Coordination Act Report from 1997 has been included in Appendix D (Pertinent Correspondence). The project will be in full compliance with the act prior to its construction." The USACE SAJ has undertaken development of an Environmental Assessment, which will accompany the LRR.

Response to Action Taken: **Response is satisfactory.**

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26. OC Comment: ENDANGERED SPECIES AND MAGNUSON STEVENS, page 39. No coordination under either of these acts. Where do we stand?

Action Needed to Resolve: Similar to Comment #9.

Action Taken (December 2005): As stated in the Comment 9 Action Taken response, consultation on ESA and fisheries issues will be undertaken once the USACE Regulatory office has issued the Public Notice for the project in response to submittal of a request for permit issuance.

Action Needed to Resolve (SAJ-PD-E): Need to include an EFH (Essential Fish Habitat Assessment) sub-heading (under the Environmental Heading). Provide a summary of the potential adverse effects, if any, of the action on EFH and the managed species as required by Section 305(b)(2) of the MSA (Magnuson-Stevens Fishery Conservation and Management Act (MSA;16 U.S.C. 1855(b)).

Also state how the MSA requirements for consultation would be addressed through the Corps Regulatory permitting actions. Indicate, the coordination would determine if conservation recommendations are needed to avoid and/or minimize adverse effects to EFH.

Response to Action Taken (January 2007 meeting): OC is satisfied with response. Team agreed project still needs revised/updated Biological Opinion. Unsure if lead for this action will go to Regulatory or Planning Environmental. Discussion to take place between Regulatory and Planning to discuss responsibilities.

Additionally, the Public Notice has still not yet been posted on Regulatory website. Catherine Brooks and Ken Dugger (PD-ER) will coordinate with Regulatory ASAP (Tuesday 1/16/2007) and decide on language in public notice. Determination will follow who is to take the lead.

Action Taken (February 2007): The Public Notice was issued on January 22, 2007. The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop an Environmental Assessment and provide necessary documentation to fulfill the Endangered Species and Magnuson Stevens Act. The EA will accompany the LRR.
Response to Action Taken: **Response is satisfactory.**

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27. OC Comment: ENVIRONMENTAL ASSESSMENT, Section 6.3. Sounds like we know what needs to be done to protect species but we have not consulted on this project. Is that correct?

Action Needed to Resolve: Provide clarification.

Action Taken (December 2005): The City of Boca Raton expects that the existing Environmental Assessment will be accepted by the Federal resource protection agencies in recognition that that project design has remained unchanged since the EA was prepared for the project. Protected species conservation measures will be included in the project Biological Opinion developed by the USFWS once the Public Notice has been issued by the USACE Regulatory Branch.

Action Needed to Resolve (SAJ-PD-E) (November 2006): Summarize past coordination efforts under the existing 1997 EA, past and pending Corps Regulatory action and relevance to proposed action. Indicate whether any adverse affects are anticipated to fish and wildlife species from project action. Outline environmental commitments that would be adopted to protective the resources as with past project action and in accordance with conservation recommendations of the pending USFWS biological opinion.

Action Taken (February 2007): The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop an Environmental Assessment and provide necessary documentation to fulfill the Endangered Species and Magnuson Stevens Act. The EA will accompany the LRR.

Response to Action Taken: **Response is satisfactory.**

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28. OC Comment: ENVIRONMENTAL ASSESSMENT, Sections 7.2, 7.3, 7.4. No ESA consultation, no CAR, incomplete compliance with the National Historic Preservation Act.

Action Needed to Resolve: Similar to OC comments above.

Action Taken (December 2005): As stated in the Comment 9 Action Taken response, consultation on ESA issues will be undertaken once the USACE Regulatory office has issued the Public Notice for the project in response to submittal of a request for permit issuance. The timing of issuance of the USFWS Biological Opinion for the project will likely occur within 90 days of issuance of the Public Notice and does not present a significant obstacle to project approval.

A cultural resources investigation of the geotechnical study area was performed in 2003. The marine archeologist that prepared the cultural resource report submitted it to the State Historic Preservation Office (SHPO) and SHPO concurred with a buffer recommendation and found the report to be complete and sufficient in accordance with Chapter 1A-46. A copy of the report and relevant correspondence is included in Appendix E (Note: Appendix E is now labeled Appendix D, February 2007).

Action Needed to Resolve (SAJ-PD-E) (November 2006): See statement under #'s 9, 35, and 36

Action Taken (February 2007): The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop an Environmental Assessment and provide necessary documentation to fulfill the Endangered Species and Magnuson Stevens act. The EA will accompany the LRR.

The 1997 CAR has been included in the Pertinent Correspondence section of the LRR.

Documentation of coordination with SHPO has been included in the Pertinent Correspondence section of the LRR.

Action Taken (July 2007): Text discussing SHPO coordination in the main body of the LRR has been revised to reflect the most recent June coordination. New EA has also been drafted and included with this report.

Response to Action Taken (July 2007): **Response is satisfactory.**

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29. OC Comment: ENVIRONMENTAL ASSESSMENT, Sections 7.5. Are we processing an application for a 404 permit?

Action Needed to Resolve: Provide clarification.

Action Taken (December 2005): The City of Boca Raton is currently developing a Joint Coastal Permit application package that will be submitted to the Florida Department of Environmental Protection and U. S. Army Corps of Engineers Regulatory Branch. With issuance of the FDEP permit, the project will be in compliance with the 404 requirements.

Action Needed to Resolve (SAJ-PD-E) (November 2006): Expand narrative to reference past permitted action and anticipated impacts associated with project action. Also, indicate the status of the pending Corps Regulatory permit action and anticipated outcome and compliance with the Section 404(b)(1) Guidelines.

Action Taken (February 2007): This is the second renourishment project and the fill extents have not changed so no additional impacts are expected. Therefore, it is anticipated that permits will be forthcoming for this project. A JCP permit application was submitted in February 2006.

The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop the Environmental Assessment. The public notice for this project was issued on January 22, 2007. The new EA will accompany the LRR.

Response to Action Taken: **Response is satisfactory.**

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30. OC Comment: ENVIRONMENTAL ASSESSMENT, Sections 7-7. No consistency determination to date. When is this expected? Are there unresolved issues?

Action Needed to Resolve: Provide Clarification.

Action Taken: The City of Boca Raton is currently developing a Joint Coastal Permit application package that will be submitted to the Florida Department of Environmental Protection and U. S. Army Corps of Engineers Regulatory Branch. With issuance of the FDEP permit, the project will undergo the standard consistency determination at the state level. Project conditions have not changed and are in compliance with federal consistency requirements.

Action Needed to Resolve (SAJ-PD-E) (November 2006): Develop narrative further to indicate past consistency determination under existing 1997 EA, State the proposed project action has given consideration to protection of coastal resources, no anticipated adverse impacts, and project would be consistent with existing statutes.

Action Taken (February 2007): The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop an Environmental Assessment and provide necessary documentation to fulfill the Endangered Species and Magnuson Stevens act. The new EA will accompany the LRR.

Response to Action Taken: **Response is satisfactory.**

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31. OC Comment: ENVIRONMENTAL ASSESSMENT, Sections 7.13. No EFH consultation yet.

Action Needed to Resolve: Provide Clarification.

Action Taken: EFH consultation will be initiated as part of the USACE regulatory review process that will be undertaken once the project Public Notice has been issued by the USACE.

Response to Action Taken (SAJ-PD-E) (November 2006): See #35 for action needed to resolve.

Action Taken (February 2007): The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would undertake the review. The public notice for this project was issued on January 22, 2007. The Planning Section will develop an Environmental Assessment to satisfy the EFH requirements.

Response to Action Taken: **Response is satisfactory.**

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32. OC Comment: ENVIRONMENTAL ASSESSMENT, Sections 7.17. Project not yet coordinated with NMFS.

Action Needed to Resolve: Provide Clarification.

Action Taken: EFH and protected species consultation with NMFS will be initiated as part of the USACE regulatory review process that will be undertaken once the project Public Notice has been issued by the USACE.

Action Needed to Resolve (SAJ-PD-E) (November 2006): See #35 for action needed to resolve.

Response to Action Taken (January 2007 meeting): OC stated response from Ken Dugger is satisfactory.

Action Taken (February 2007): The public notice for this project was issued on January 22, 2007, which started the coordination with NMFS. There is no change in the project limits except for extending the borrow area to the north. It is anticipated that the necessary documents and approvals will be obtained prior to construction.

Response to Action Taken: **Response is satisfactory.**

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33. OC Comment; Note that pursuant to a memorandum from CECW-PE dated 3 October 1997, any estate other than the Perpetual Beach Storm Damage Reduction Easement will require approval as a non-standard estate.

Action Needed to Resolve: Similar to Comments #4 and #16.

Action Taken (December 2005): The City of Boca Raton will obtain beach storm damage reduction easements that extend through to the end of the project life (December 31, 2038). If these easements are not obtained prior to project construction, the cost sharing will be revised accordingly.

Action Needed to Resolve (November 2006): Still requires acceptable response.

Response to Action Taken (January 2007 meeting): OC states that these easements are not perpetual, only "50 year project life" (actually 33 years of remaining life). Thus, OC recommends that the RE Appendix should reference the 1997 Ocean Ridge memo. If any approval is necessary then it can be done through approval of LRR. Lynn Zediak (RE) will provide writeup to Gordon Thomson (CP&E) by Tuesday 1-16-07. Lynn will also provide to CP&E "canned language" for easement requirements.

Action Taken (February 2007): The City of Boca Raton has obtained several storm damage reduction easements using the language provided by the USACE. A few easements still remain outstanding but are expected to be received by the City prior to the start of construction. If the remaining easements are not obtained prior to project construction, the cost sharing will be revised accordingly.

Response to Action Taken: **Response is satisfactory.**

Environmental Branch:

34. PD-E Comment: A new Regulatory Environmental Assessment has been mentioned in conjunction with permit issuance.

Action Needed to Resolve: Ensure this is followed through.

Action Taken (December 2005): The City of Boca Raton expects that the existing Environmental Assessment will be accepted by the Federal resource protection agencies in recognition that that project design has remained unchanged since the EA was prepared for the project. Protected species conservation measures will be included in the project Biological Opinion developed by the USFWS once the Public Notice has been issued by the USACE Regulatory Branch.

Action Needed to Resolve (SAJ-PD-E) (November 2006): Need a reference also to the EA (1997) for the First Renourishment Project. Summarize how the existing EA document meets the NEPA requirements, given no expansion of project scope is proposed. Also include a summary of the pending environmental assessment that would be conducted by Corps Regulatory and the anticipated outcome.

Response to Action Taken (January 2007 meeting): This will be an LRR with an EA attached. There is an existing 10 year old EA which will not be used. Regulatory will be writing a new concise EA and will need to incorporate all of the review comments from this document. Planning (Environmental) needs to coordinate with Regulatory (Leah Oberlin). Catherine Brooks will compile a table to summarize main EA points and how legal policies were satisfied, as well as State Clearinghouse activities, which will also assist Regulatory write their EA.

Catherine can complete Table in 2 weeks. It is thought that much of the old EA can be "cut and pasted" to expedite new draft EA. CP&E and City of Boca Raton are concerned about timetable to completion of draft EA; therefore, CP&E will coordinate and assist Regulatory in drafting EA to expedite process. OC and Environmental (PD-ER) will review draft Regulatory EA.

Action Taken (February 2007): The project sponsor, USACE Regulatory Permitting and Planning sections agreed that the Planning section would develop an Environmental Assessment and provide necessary documentation to fulfill the Endangered Species and Magnuson Stevens Act. The new EA will accompany the LRR. The 1998 EA was removed from the LRR.

Response to Action Taken: **Response is satisfactory.**

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35. PD-E Comment: New Law requires that an Essential Fish Habitat assessment be completed. This can be done independently of the current NEPA documentation.

Action Needed to Resolve: Initiate EFH consultations.

Action Taken (December 2005): EFH consultation will be initiated as part of the USACE regulatory review process that will be undertaken once the project Public Notice has been issued by the USACE. The City of Boca Raton is prepared to develop an EFH assessment should the NMFS and USACE determine that the evaluation conducted previously is insufficient in light of the new regulations.

Action Needed to Resolve (SAJ-PD-E) (November 2006): Need to include an EFH (Essential Fish Habitat Assessment) sub-heading (under the Environmental Heading). Provide a summary of the potential adverse effects, if any, of the action on EFH and the managed species as required by Section 305(b)(2) of the MSA (Magnuson-Stevens Fishery Conservation and Management Act (MSA;16 U.S.C. 1855(b)).

Also state how the MSA requirements for consultation would be addressed through the Corps Regulatory permitting actions. Indicate, the coordination would determine if conservation recommendations are needed to avoid and/or minimize adverse effects to EFH.

Additional comment:

Borrow Site sub-heading needed. Identify the borrow area to be excavated, benthic and fishery species inhabiting/occurring in the area, anticipated affects, and efforts taken to avoid or minimize impacts, if applicable. Summarize any existing and pending submerged resource surveys conducted at the southernmost borrow area 1000-foot extension. Include statement that a final determination would be provided during the regulatory action.

Response to Action Taken (January 2007 meeting): **Response is satisfactory.** See related comments.

Action Taken (February 2007): The Public Notice for this project was issued January 22, 2007. Paragraphs (B-35 and B-37) have been revised to state that borrow area B will be dredged during the 2007 renourishment project. There is no change in the project limits except for extending the borrow area to the north. The necessary documents and approvals to dredge this borrow area will be obtained prior to construction.

Two sentences have been added to paragraph 121. Paragraph 121 now states, "Pursuant to this act (MSA), the U.S. Army Corps of Engineers, Jacksonville District will initiate Essential Fish Habitat (EFH) consultation with the National Marine Fisheries Service. The coordination will determine if conservation recommendations are needed to avoid and/or minimize adverse effects to EFH. A Public Notice has been issued and this coordination is underway. The project will be in full compliance with the act prior to its construction."

Response to Action Taken: **Response is satisfactory.**

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36. PD-E Comment: The original, 1986, consultation for the North Boca Raton Renourishment project identified two clusters of magnetic anomalies that needed to be protected by a 150-foot buffer. This avoidance was supposedly included as a requirement in the earlier renourishment projects. The current project contains a greatly expanded sand source area. The Geotechnical Appendix (B-6) indicates that Tidewater Atlantic Research conducted a Magnetometer survey of the project area in 2004. The results of this survey have not been provided to the Corps for evaluation. This study purported to identify three anomalies. It discounts two of these as possible modem debris; however, according to the low detailed map in the appendix these anomalies appear to be relatively close to the one that is recommended as having a potential to be an historic resource. The report also does not identify the anomalies that were recommended for avoidance in 1986. The report also recommends a 200-foot buffer for the one identified anomaly. While 200 foot was considered acceptable 20 years ago this is not necessarily the standard today. The report includes a copy of the 1986 consultation between Coastal Engineers and the Florida SHPO but does not include a copy of the 1996 consultation between the Corps and SHPO.

Since the currently proposed sand source includes the original sand sources the lack of identification of the previously protected areas raises considerable concern that the buffer may have been ignored during previously renourishment cycles and the protective measures were not

adequate or were ignored.

Paragraph 108, Page 37, states that "in compliance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, the U.S. Army Corps of Engineers has determined that this undertaking will have no effect upon cultural resources listed on, or eligible for listing on, the National Register for Historic Places." As far as I know there has been no consultation in accordance with the NHPA or 36CFR800 with the Florida State Historic Preservation Officer for the current project and no determinations have been made. Because of the change in the borrow area the 1996 consultation is no longer applicable.

Action Needed to Resolve: Initiate consultation with SHPO.

Action Taken (December 2005): A report was submitted to SHPO based on a November 2003 underwater remote sensing survey conducted by Tidewater Atlantic. A letter from SHPO stating that they concurred with the report and deemed the report complete and sufficient is included in Appendix E. (Note: Appendix E is now labeled Appendix D, February 2007)

Action Needed to Resolve (SAJ-PD-E): In looking at the draft LLR and the cultural resource report, CP&E's cover letter, the 200 foot buffer does appear to have been part of the SHPO consultation.

The Cultural Resource section paragraph 108 should be modified to indicate that the 2003 survey only covered the northern portion of Borrow Area B.

Paragraph 109 should read: Include correspondence under Pertinent Correspondence.
In compliance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, the U.S. Army Corps of Engineers has determined that the beach renourishment will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places.

Additionally, the use of the northern portion of Borrow area B as a sand source, as described by the 2003 Cultural Resource Investigation an Magnetometer Survey (CPE, 2005), will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places contingent on the maintenance of a buffer of no less than 200 feet around anomaly BR-02. Include correspondence under Pertinent Correspondence.

Response to Action Taken (January 2007 meeting): No effect as long as the northern area of borrow site B is being used. **Response is satisfactory.** See related comments.

Action Taken (February 2007): There was an error in the original report. A revised report was submitted by Tidewater Atlantic that that the BR06-02 "signature is suggestive of modern material, no additional investigation of the target is recommended".

The first sentence in Paragraph 108 has been revised to state: "A cultural resources investigation

of the northern portion of borrow area B was performed in 2003."

Paragraph 109 has been changed to state: "In compliance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, the U.S. Army Corps of Engineers has determined that the beach renourishment will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places. Additionally, the use of the northern portion of Borrow area B as a sand source, as described by the 2003 Cultural Resource Investigation an Magnetometer Survey (CPE, 2005), will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places contingent on the maintenance of a buffer of no less than 200 feet around anomaly BR-02."

Action Taken (July 2007): Text discussing SHPO coordination in the main body of the LRR has been revised to reflect the most recent June coordination.

Response to Action Taken (July 2007): **Response is satisfactory.**

Coastal Design Section:

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37. EN-HC Comment: An editorial comment: On the syllabus the cost is given as $5,838,000. On the pertinent data sheet the cost is $ 5,837,000.

Action Needed to Resolve: Clarify costs for consistency.

Action Taken (December 2005): The costs have been revised.

Action Needed to Resolve (November 2006): Both costs were revised, but are now in agreement.

Response to Action Taken: **Response is satisfactory.**

---

38. EN-HC Comment: Page 9, paragraph 28. The source of the recession values in Table 1 should be mentioned.

Action Needed to Resolve: Document source.

Action Taken (December 2005): Source provided. Federal Emergency Management Agency, 1984. Flood Insurance Study, City of Boca Raton, FL.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

39. EN-HC Comment: Page 10, paragraph 29. It should be stated that the Florida Current has no

significant effect on the project area, due to the distance between the landward edge of the current and shore. The current may indirectly influence nearshore processes by its affect on wave refraction.

Action Needed to Resolve: Revise text accordingly.

Action Taken (December 2005): Text revised to add the following statement, "The Florida current has no significant effect on the project area, due to the distance between the landward edge of the current and the shore. The current may indirectly influence nearshore processes by its affect on wave refraction."

Response to Action Taken (November 2006): **Response is satisfactory.**

---

40. EN-HC Comment; Page 10, paragraph 32. Is the estimated volumetric loss presented in this paragraph (-833,000 cy) based solely on the profile recession? If so how was the recession-to-volume relationship derived?

Action Needed to Resolve: Document process.

Action Taken (December 2005): The volumetric losses and shoreline recession values are based on a report by the USACE (1987).

Response to Action Taken (November 2006): **Response is satisfactory.**

---

41. EN-HC Comment: Page 11, paragraph 37. The second to last sentence in this paragraph. Begins, "The September 2004 was. ..". Should this read" The September 2004 survey was.. ,"'?

Action Needed to Resolve: Revise text accordingly.

Action Taken (December 2005): Text revised accordingly.

Response to Action Taken (November 2006): **Text rearranged, but satisfactory.**

---

42. EN-HC Comment: Page 13, paragraph 44. Does the 568,200 cubic yard renourishment volume include the additional 24,400 cy which is to be placed landward of the ECL?

Action Needed to Resolve: Clarify.

Action Taken (December 2005): The fill placed landward of the ECL is included in the renourishment volume. The text was revised to clarify this point.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

43. EN-HC Comment: Page 13, paragraph 47. This paragraph is confusing. It is apparent from this statement that the borrow area contains more material than is needed for the life of the project, unless an overfill value is being considered. If so, the overfill value should be given.

Action Needed to Resolve: Provide further clarification on this paragraph and intent.

Action Taken (December 2005): This paragraph has been revised.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

44. EN-HC Comment: Page 14, paragraph 48, Lidar surveys were taken along the SE Florida coast following the hurricanes of 2004. These surveys could be used to determine what significant effects, if any, these storms may have had on the proposed volumes of renourishment.

Action Needed to Resolve: Obtain Lidar data and evaluate volumes.

Action Taken (December 2005): The City has collected annual beach surveys since 1988 to document the volume of sand remaining in the project area. These surveys have proven to provide the necessary data to monitor the beach and determine appropriate volume of renourishments.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

45. EN-HC Comment: Page 14, paragraph 49. As stated in this paragraph, the 10-year: and 12-year renourishment intervals each correspond to the lowest annual cost. First, the rationale for selecting the 10-year renourishment interval over the 12-year interval should be presented. Second, the annual cost should be calculated for every one-year increment (add the 11-year and 13-year intervals). It seems very likely that the 'annual cost vs. renourishment interval' curve would "bottom-out" between years 10 and 12, at year 11.

Action Needed to Resolve: Demonstrate that the 10-year interval is the most economically efficient cycle.

Action Taken (December 2005): The 11-year renourishment cycle was added. The 10-year renourishment interval has the lowest annual cost and has been chosen as the renourishment interval for this project.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

46. EN-HC Comment: Page 16, paragraph 50. Some explanation should be provided as to how the total renourishment volume over the life of the project (2.36 MCY) was calculated. Judging from the values in Table 4 on page 15, the renourishment volume increases over time (568kcy in 2006/822kcy in 2016/966k.cy in 2026). This is contrary to past experience at most beach fill projects, where the fill stabilizes over time.

Action Needed to Resolve: Clarify total volume required and why the requirement is expected to increase in next 10 years.

Action Taken (December 2005): The volumes have been altered slightly due to a change in the depth of closure and associated changes in erosion rates. The volume of the 2016 project is expected to be higher than the volume of the 2006 project because there is some advanced fill remaining within the project in 2006. This reduces the volume of advanced fill needed in 2006. However, it is assumed that all of the advanced fill will have eroded by 2016 and will need to be replaced. The 2026 project has a higher volume than the 2016 project because 2 additional years (a total of 12 years) of advanced fill are needed to reach the end of the project life in 2038.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

47. EN-HC Comment: Page 16, paragraphs 51-53. This section is titled "Estimated Cost of Construction". On page 14 is a similar section titled "Project Costs". These two sections contain the same data and could be combined.

Action Needed to Resolve: Revise as needed.

Action Taken (December 2005): Text revised as requested.

Response to Action Taken (November 2006): **Response is satisfactory.**

---

48. EN-HC Comment: Page 16, paragraph 53. The last sentence of this paragraph contradicts the statement in paragraph 47.

Action Needed to Resolve: Resolve discrepancy.

Action Taken (December 2005): Discrepancy resolved. There is sufficient sand available to construct the project.

Action Needed to Resolve: Text rearranged – I can't tell if comment was addressed.

Action Taken (February 2007): There is sufficient material in the borrow area to construct the entire economic life of the project. The text in paragraph 47 was altered to state: "The proposed

borrow area contains approximately 3,370,000 cubic yards of beach compatible sand which is more than the volume required for the entire economic life of the project (2,548,000 cubic yards)."

Response to Action Taken: **Response is satisfactory.**

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49. EN-HC Comment: Page 31, paragraph 80. This text does not agree completely with the text in paragraph 43, page 13.

Action Needed to Resolve: Resolve discrepancy.

Action Taken (December 2005): The text has been revised.

Action Needed to Resolve: Text rearranged – I can't tell if comment was addressed

Action Taken (February 2007): The text has been revised to make it clear that this project is identical to the previous projects and only differs slightly (60 feet) from the original authorized project. The text has been revised from:
"The 1.45 mile long proposed renourishment project length is identical to the Boca Raton segment (Reach 10) that was authorized in the 1987 GDM and constructed in 1988 and 1998 (Table 10), except that the project limits have been shifted 60 feet to the south.
to:
"The 1.45 mile long proposed renourishment project length is similar to the Boca Raton segment (Reach 10) that was authorized in the 1987 GDM. The difference is only that the project limits have been shifted 60 feet to the south. The proposed construction is identical to the projects constructed in 1988 and 1998 (Table 10)."

Response to Action Taken: **Response is satisfactory.**

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50. EN-HC Comment; Page 31, paragraph 82. Second sentence. Future renourishment rates should not be based on hurricane losses.

Action Needed to Resolve; Resolve discrepancy.

Action Taken (December 2005): The volume of periodic nourishment is based on updated survey data. The text in paragraph 82 has been revised.

Response to Action Taken (November 2006): **Response is satisfactory.**

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51. EN-HC Comment: Appendix A should be renamed "Engineering Appendix".

Action Needed to Resolve: Revise accordingly.

Action Taken (December 2005): To maintain consistency with the 1996 North Boca Raton LRR, Appendix A has been labeled "Problem Identification" and Appendix C has been labeled "Engineering Appendix".

Action Needed to Resolve (November 2007): Comment was not addressed.

Response to Action Taken (January 2007 meeting): CP&E stated reasons for labeling: There are 2 Appendices, A& C. App A related more to history, shoreline changes, etc. App C deals more with design. Therefore CP&E has called App C "Engineering Appendix". CP&E could re-label all appendices, but this will take extensive and additional effort and time to re-label.

Decision needs to made ASAP by EN-WC and Planning to determine if this change should be made to avoid confusion later on by Division or if appendices can stay as they are. Since more time is available due to Regulatory coordination, CP&E agreed to revise Appendix titles as requested.

Action Taken (February 2007): Appendices A and C have been combined and relabeled "Engineering Appendix". Appendices following Appendix B have been relabeled.

Response to Action Taken: **Response is satisfactory.**

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52. EN-HC Comment: .Page A-22, "Volumetric Changes" section. It may be worthwhile to reiterate in this section that the most recent survey (September 2004) was taken shortly after the nearby landfall of Hurricane Jeanne, and may reflect higher than average erosional losses.

Action Needed to Resolve: Revise accordingly.

Action Taken (December 2005): Text has been added to highlight that the survey was taken after the passage of Hurricane Frances but prior to the passage of Hurricane Jeanne, and that this may affect the average erosional losses. Paragraph A-47 was revised. (Note: Paragraph A-47 is now labeled A-48, February 2007)

Response to Action Taken (November 2006): **Response is satisfactory.**

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53. EN-HC Comment: Page A-28, paragraph A-58. The longshore transport rates presented in this paragraph for the southern end of the project area, and for the southern end of the study area, do not agree with the values shown in Figure A-3. (Note: Paragraph A-58 is now located on Page A-22, February 2007)

Action Needed to Resolve: Clarify discrepancy.

Action Taken (December 2005): The values and Figure have been revised.

Action Needed to Resolve: The transport rates as described in paragraphs A-54 through A-57 still do not agree with Figure A-3. (Note: Paragraphs A-54 through A-57 have been relabeled as A-55 through A-58, February 2007)

Response to Action Taken (January 2007 meeting): CP& E states that the figure is correct. Text will be revised again and some additional text will be added to more clearly explain the figures and transport rates. A-58 has been moved to the corresponding figure.

Action Taken (February 2007): The transport rates refer the estimated transport rates that are referenced. Different transport rates have actually been developed based on volumetric change though the transport rate of 131,000 cubic yards/year has assumed to be correct. The text in Paragraph A-58 has been changed to make this more clear. Paragraph A-58 now states: "The net littoral drifts into and out of the project area have been estimated at 131,000 and 156,000 cubic yards per year, respectively, to the south (USACE, 1995). These estimates are based on the 1974 to 1990 survey period, which does not completely reflect the higher erosion rate caused by the placement of the fill in 1988. Assuming that the transport of 131,000 cubic yards into the project area is correct, then the calculations developed during this LRR suggest that the sediment transport out of the project site is 184,800 cubic yards/year."

Paragraph A-59 then goes on to describe how these calculations were developed. Paragraph A-59 has been moved in front of Figure A-3.

Response to Action Taken: **Response is satisfactory.**

Technical Review Section:

54. EN-TI Comment: Main Report and EA. The borrow areas shown for the next renourishment have a larger and different footprint from the borrow areas depicted in the EA. Enlargement of this magnitude needs to be discussed in the main report and EA. Address environmental aspects, water quality certification and SHPO cultural resources coordination.

Action Needed to Resolve: Address these NEPA requirements.

Action Taken (December 2005): Additional vibracore, seismic, side scan sonar and magnetometer surveys were performed in 2004 in order to extend the borrow area that was dredged in 1988 and again in 1998. The resulting footprint of the 2004 borrow areas is larger than the 1988 or 1998 borrow areas. A 400 ft hardbottom buffer has been maintained for borrow area extensions. The material within the study area has little variability, and the borrow area extensions are composed of material that is similar to the previously dredged material.

A report was submitted to SHPO based on a November 2003 underwater remote sensing survey

conducted by Tidewater Atlantic. A letter from SHPO stating that they concurred with the report and deemed the report complete and sufficient is included in Appendix E. (Note: Appendix E has been relabeled to Appendix D, February 2007)

The EA was written in 1996 for the first renourishment of North Boca Raton. It addressed the potential impacts related to that project. The EA is relevant to this project because the current borrow area (2004) is limited to an extension of the existing borrow area referenced in the EA document (dredged in 1998). The environmental impact is not expected to change as the borrow area characteristics and proximity to hardbottom are similar to the 1998 borrow area.

Response to Action Taken (November 2006): Response is satisfactory.

Response to Action Taken (January 2007 meeting): Same as response to Comment 36 by Grady Caulk.

Action Taken (July 2007): The USACE Planning Division has developed a new EA to accompany the LRR. The new EA has incorporated the expanded borrow area.

Response to Action Taken (July 2007): **Response is satisfactory.**

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55. EN-TI Comment: Para. 124. Suggestion. Add to end of paragraph. "and will comply with the project Active Status requirements for the Civil Emergency Management Program Rehabilitation Assistance for Hurricane/Shore Protection Projects.

Action Needed to Resolve: Revise text.

Action Taken (December 2005): Text revised as suggested. Note the paragraph number is now 125.

Response to Action Taken (November 2006): **Response is satisfactory.**

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56. EN-TI Comment: Provide Independent Technical Review Certification.

Action Needed to Resolve: This is a requirement and the document can not go forward until documentation of ITR has been provided.

Action Taken (December 2005):

An independent technical review, completed by Douglas W. Mann, P.E. is attached.

Response to Action Taken (November 2006): **Response is satisfactory.**

Reference:

U.S. Army Corps of Engineers, 1987. *Beach Erosion Control Projects for Palm Beach County, Florida, General Design Memorandum with Environmental Impact Statement.* U.S. Army Corps of Engineers, Jacksonville District.

CERTIFICATION QUALITY ASSURANCE/QUALITY CONTROL REVIEW

The Limited Reevaluation Report for North Boca Raton, Palm Beach County, Florida is complete. Notice is hereby given that a quality assurance/quality control review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan. All concerns resulting from the review have been satisfied.

Dan Haubner, formerly of Plan Formulation Branch

Tom Martin, Water Resources Engineering Branch

Jimmy Matthews, Technical Services Branch

Lynn Zediak, Acquisition Branch

Catherine Brooks, Environmental Branch

Brian Hughes, Design Branch

Chris Papiernik, Geo-Technical Branch

Independent Technical Review Certification

for the
Palm Beach County, Florida
Shore Protection Project
Limited Reevaluation Report
North Boca Raton
Second Periodic Renourishment, dated December 2005

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

Part I, Certification by Consultant for Non-Federal Sponsor (City of Boca Raton):

1. Reference: Palm Beach County, Florida, Shore Protection Project (From Martin County Line To Lake Worth Inlet and From South Lake Worth Inlet To South County Line), Limited Reevaluation Report for North Boca Raton Second Periodic Renourishment, dated December 2005.

2. The Consultant for the Non-Federal Sponsor (City of Boca Raton, Florida) has completed the above referenced report. Notice is hereby given that an Independent Technical Review, that is appropriate to the level of risk and complexity inherent in the project, has been conducted as defined in the Quality Control Plan. During the Independent Technical Review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the product meets the customer's needs consistent with law and existing Corps policy. This Independent Technical Review was accomplished by below personnel. All comments resulting from ITR have been resolved.

REVIEWED BY:

Richard H. Spadoni, Coastal Engineer
(Name/Specialty)

Doug Mann, P.E. Coastal Engineer
(Name/Specialty)

CERTIFIED BY:

Richard H. Spadoni
Senior Vice President
COASTAL, PLANNING AND ENGINEERING, INC.

Part II, U.S. Army Corps of Engineers Quality Assurance Review:

Notice is hereby given that a Quality Assurance (QA) Review was conducted as defined in the Quality Control Plan. The QA Review affirmed compliance with established policy principles and procedures, including whether the product meets the customer's needs consistent with law and existing Corps policy. All QA comments have been resolved.

Independent Technical Review Certification

for the
Palm Beach County, Florida
Shore Protection Project
Limited Reevaluation Report
North Boca Raton
Second Periodic Renourishment, dated December 2005

CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW:

As noted above, all concerns resulting from the Independent Technical Review and the Quality Assurance Review of this project have been considered. The report and all associated documents required by the National Environmental Policy Act have been fully reviewed.

Acting Chief — 24 SEP 2007

for Stuart. J. Appelbaum
Chief, Planning Division

25 SEPT 07

FOR Stephen. C. Duba
Chief, Engineering Division

28 Sep 07

Bart. J. Wivell
Chief, Real Estate Division

CERTIFICATION OF LEGAL REVIEW:

This Limited Reevaluation Report, including all associated documents required by the National Environmental Policy Act, has been fully reviewed by the Office of Counsel, Jacksonville District and is approved as legally sufficient.

9/28/07

Brooks W. Moore
Office of Counsel

PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

April 2008

SYLLABUS

Of the two authorized Federal shore protection projects for Palm Beach County, the 1962 authorization (HD-164/87/1) provides for protection of two sections of the coast, north and south of Palm Beach Island, and for independent construction of projects within each section. The General Design Memorandum was prepared in 1987. This report concerns the second renourishment of the 1.45 miles of the Boca Raton shoreline.

This report is an addendum to the 1987 General Design Memorandum. This report summarizes the results of the engineering, economic and environmental studies undertaken for the second renourishment of the Boca Raton segment. In addition, the report includes an analysis of the Boca Raton beach based on applicable current policies and guidelines, and the environmental assessment.

The recommended plan provides for the renourishment of the Boca Raton beach with 699,000 cubic yards of material from an offshore borrow area. This volume restores the design section and places 10 years of advanced nourishment.

The current fiscal year (2007) interest rate is 4.875%. The estimated construction cost of the recommended plan is $7,321,200. The total project cost is $7,690,500.

The estimated average annual cost over the 50-year project life (1988 to 2038) with Federal participation is $1,486,800 with annual benefits of $4,419,000. The benefit to cost ratio is 3.0.

The estimated average annual cost over the remaining project life with Federal participation (2007 to 2038) is $960,300 with annual benefits of $3,262,000. The benefit to cost ratio is 3.4.

The project sponsor, the City of Boca Raton, has complied with all of the items in the project cooperation agreement. The project sponsor requests that the project cooperation agreement extend for the remaining life of the project with future costs allocated by a letter report.

PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

PERTINENT DATA

Item	Amount [1]
Physical Data:	
Project Length (mi.)	1.45
Volume of Nourishment (1,000's cy)	699.0
Berm Height (ft. above NGVD)	9
Nourishment Interval (yrs.)	10
Borrow Area Location	Offshore Borrow Area
Financial Data ($1,000's):	
Renourishment Construction Contract Cost	7,321.2
Investment Cost	7,690.5
Annual Cost [2]	1,486.8
Annual Benefits	
Damage Reduction	1,007.0
Loss of Land	209.0
Recreation	3,203.0
Total	4,419.0
Net Benefits ($1,000's)	2,932.2
Benefit-to-Cost Ratio	3.0
Interest Rate (%)	4.875%
Cost Apportionment of Construction ($1,000's)	
Federal [3]	4,212.1
Non-Federal	3,109.1

[1] Dollar amounts given at 2007 price levels.
[2] Includes interest during construction, and operation and maintenance costs.
[3] This is 57.53% of costs eligible for apportionment.

PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

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PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

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PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

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PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT
FOR NORTH BOCA RATON
SECOND PERIODIC RENOURISHMENT

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PALM BEACH COUNTY, FLORIDA
SHORE PROTECTION PROJECT
(FROM MARTIN COUNTY LINE TO LAKE WORTH INLET AND FROM SOUTH LAKE WORTH INLET TO SOUTH COUNTY LINE)

LIMITED REEVALUATION REPORT FOR NORTH BOCA RATON SECOND PERIODIC RENOURISHMENT

INTRODUCTION

1. This report summarizes the results of detailed engineering, environmental and economic analyses related to the second periodic renourishment of the Boca Raton segment of the Federal Shore Protection Project for Palm Beach County, Florida. It is an addendum to the General Design Memorandum (GDM) for shore protection projects within Palm Beach County prepared by the Jacksonville District, U.S. Army Corps of Engineers (USACE, 1987). Analyses presented in the April 1987 GDM are readdressed based on current conditions, and Federal laws, policies and guidelines. This addendum also describes how the selected plan differs from the Highland Beach - Boca Raton project described in the original 1962 authorization, the project as modified by the 1987 GDM, and the nourishment project that was constructed in 1988.

2. Additional or updated information has been incorporated into the report. Recent data collected for this addendum included geotechnical investigations for beach compatible sand sources offshore of the project area, and hydrographic and topographic surveys of the project area. Economic information, including an appraisal of the value of shore-front development in the project area, was updated. Historical and recent environmental data relative to the project area were also included in this addendum.

3. The analyses of the additional and/or updated information within the purview of current Federal law, policies, and guidelines are summarized in this addendum. Also included are the details of the proposed project, the estimated project costs, the economic justification of the proposed project, the degree of Federal participation in project cost, and an analysis of the potential environmental effects associated with the proposed project. The allocation of project costs in this report is in accordance with the 1986 Water Resources Development Act (Public Law 99-662), and current Federal policies and guidelines.

PROJECT LOCATION

4. The project area is located in southern Palm Beach County on the east coast of Florida, approximately 40 miles north of Miami and 25 miles south of West Palm Beach (Figure 1). It is situated on an Atlantic barrier island and is separated from the mainland by the Intracoastal Waterway. The project area is entirely with the limits of the City of Boca Raton and is not part of the coastal barrier resources system.

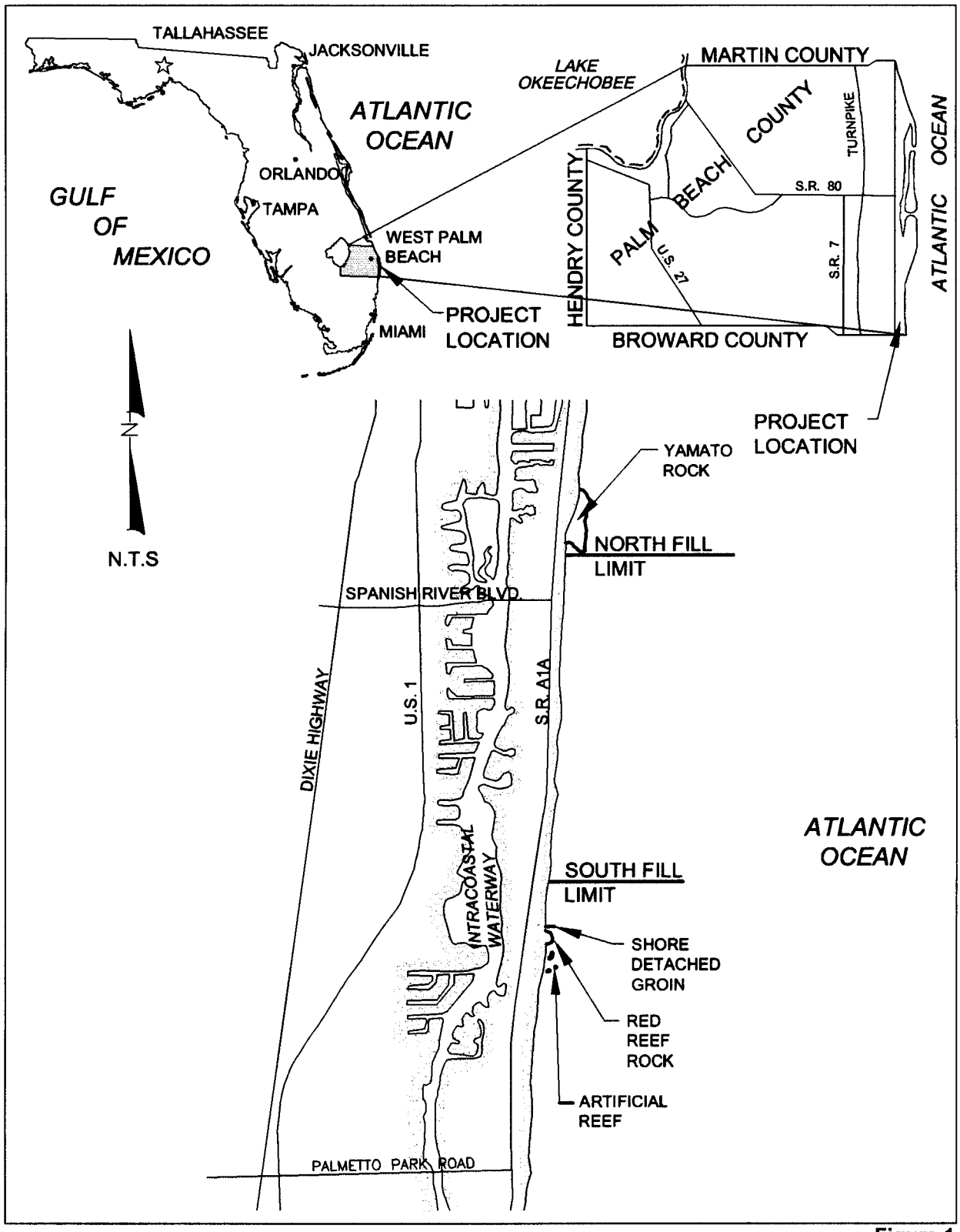


Figure 1

North Boca Raton, Palm Beach County, FL Location Map

PROJECT AUTHORIZATION

5. The Federal shore protection project for Palm Beach County, Florida, from Martin County Line to Lake Worth Inlet and from South Lake Worth Inlet to the Broward County Line was authorized by Section 101 of the River and Harbor Act of October 23, 1962 (Public Law 87-874). The project was described in H.R. Doc. No. 164 (1987).

6. The initial project authorization also provided for Federal participation in the cost of the nourishment for a period of 10 years. Federal participation in the cost of the periodic nourishment was extended to 50 years, beginning on the date of initiation of initial construction (1988), under the authority of Section 506 (b) (2) of the Water Resources Development Act of 1996 (PL 99-662). Section 506(b)(2) of the Water Resources Development Act of 1996 provided that if the Secretary of the Army determined that periodic beach nourishment is necessary for the project, the Secretary shall carry out periodic beach nourishment for the project for a period of fifty (50) years from the date of initiation of construction. The Acting Secretary of the Army for Civil Works made such a determination for this project on September 30, 1997.

PROJECT MODIFICATIONS

7. The 1962 authorization included the nourishment of a 2.7 mile long segment of beach in southern Highland Beach and northern Boca Raton. The authorized project provided for a 100-foot seaward extension of the mean high water line, with a berm elevation 9 feet above mean sea level (+10 feet mean low water). Under the original plan, an estimated 1,300,000 cubic yards of material were to be pumped from Lake Wyman (Figure 2), and placed along the project area. The plan also called for an additional 65,000 cubic yards of material to be trucked into the project area on an annual basis.

8. In the 1987 GDM, a portion of the 2.7 mile long Boca Raton/Highland Beach segment (Reach 10) was evaluated for implementation along a 1.45 mile long stretch of beach in northern Boca Raton (USACE, 1987). The project described in the 1987 GDM called for a design width of 25 feet, plus 8 years of advanced nourishment. The design berm elevation was +9 feet, NGVD. The estimated volume of fill required for the initial beach nourishment was 634,000 cubic yards, and included 8 years of advanced nourishment. Fill for the project was to be obtained from an offshore borrow area.

9. At the time of the initial nourishment in 1988, the USACE approved an increase in the design width from 25 feet to 50 feet (Appendix D). The Local Cooperation Agreement (LCA) allowed for the placement of an estimated 875,000 cubic yards of material and approved a design elevation of +9 feet NGVD. The limits of the project were shifted 60 feet south.

10. There were no modifications to the design for the first renourishment project in 1998 and no modifications of the project dimensions are proposed or authorized for the second renourishment project.

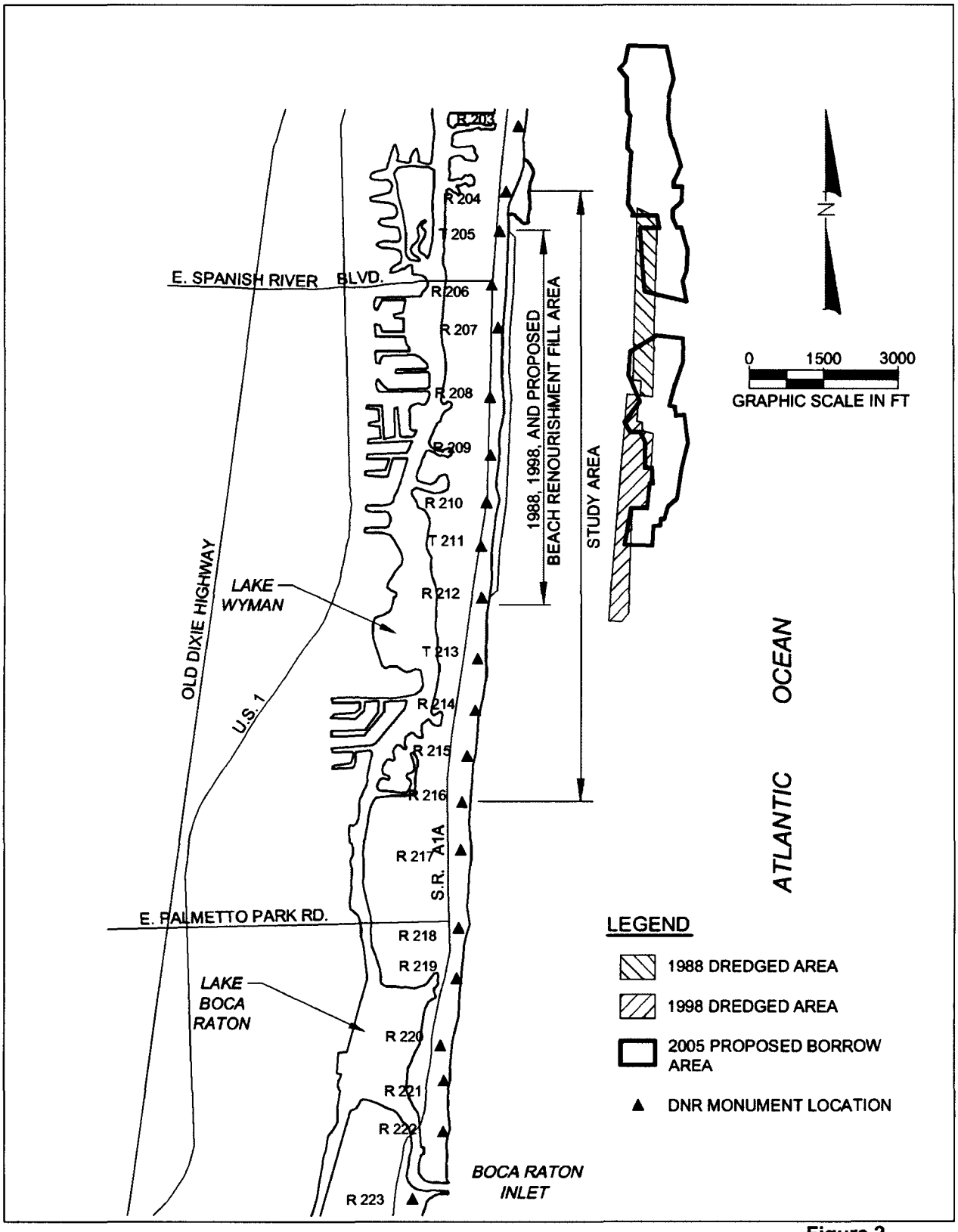


Figure 2

Borrow Area Locations and Beach Nourishment Project Area

PROJECT HISTORY

11. The initial beach nourishment project was constructed between July and August 1988. The pre-construction surveys indicated that in order to build the 50-foot width design berm, 980,000 cubic yards were required because of continuing erosion of the beach and dunes. Based on post-construction surveys, an estimated 1,102,000 cubic yards of sand were placed by the contractor along the 1.45-mile long project area. This represents an as-built volume and not a pay volume of sand. The design width was 50 feet. The project also included the placement of 95 feet of advanced nourishment fill based on the expected equilibrium profile. The design berm elevation for the initial project was +9 feet NGVD.

12. The first renourishment project was constructed between March and April 1998. Based on comparison of pre and post-construction surveys, an estimated 680,000 cubic yards of sand were placed along the 1.45-mile project length. The beach was constructed to meet a design beach width of 50 feet and design berm elevation of +9 feet, NGVD.

RECOMMENDED PROJECT

13. The recommended project involves the second periodic renourishment of the Boca Raton segment of the Federal shore protection project for Palm Beach County, Florida (hereinafter referred to as the project) using an offshore, shore parallel borrow area. The recommended project will place approximately 699,000 cubic yards of beach compatible material. The recommended project will restore the 50-foot design width, as needed (approximately 58,900 cubic yards), and will provide 640,100 cubic yards of advanced nourishment along the 1.45 mile long project area (T-205 to R-212). The design berm height for the project is +9 feet NGVD. This estimate is based on a post-Hurricane Frances survey. Volume increases may be required at the time of construction due to increased erosion due to Hurricane Jeanne. Fill will be placed over 12.8 acres above MHW while the construction template will cover 39.1 acres below MHW.

PROJECT SPONSORSHIP

14. The City of Boca Raton, acting by and through the City Council of the City of Boca Raton, is the non-Federal project sponsor for the Boca Raton segment of the Palm Beach County Shore Protection Project. The project is being administered for the City Council by the City's Municipal Services Department.

PROJECT COOPERATION AGREEMENT

15. In the authorizing documents, Federal participation in the cost of the Palm Beach County Erosion Control Project was subject to the condition that non-Federal interests would comply with certain requirements (USACE, 1987). The U.S. Army Corps of Engineers and Palm Beach County entered into a contract concerning these requirements on January 23, 1973 (DACW17-73-A-0007). In a letter dated October 28, 1985, the County identified the City of Boca Raton as the non-Federal co-sponsor for the Boca Raton segment of the Federal erosion control project.

16. On April 25, 1988, the City of Boca Raton entered into a Local Cooperation Agreement (LCA) with the U.S. Army Corps of Engineers. The terms of the LCA are summarized below. Under the LCA, Federal participation is recommended provided that the non-Federal sponsor will:

a. Accept responsibility for the design, engineering, construction, operation, maintenance, and replacement when necessary of the project, or any functional element thereof. The non-Federal sponsor shall either construct or contract for construction of the project, provided that all construction shall be accomplished in accordance with Corps of Engineers criteria unless otherwise agreed to by the non-Federal sponsor and the District Commander. All designs, plans, and specifications shall be submitted to the District Commander or his authorized representative, for review and approval prior to the initiation of any construction pursuant to the LCA.

b. Provide periodic nourishment of the protective beaches at suitable intervals over the economic life of the project.

c. Submit to the District Commander for approval, the detailed plans, specifications, data for analysis of design, and a general program outlining the order, rate of prosecution and method (contract or hired labor) of accomplishing the major items of work and setting forth the estimated cost thereof, prior to issuing invitations for bids. In the event the non-Federal sponsor prosecutes the work by contract, all bids received and the proposed provisions of any contract shall be subject to review by the Government prior to award. Any such contract shall contain all applicable provisions required by Federal law and regulations, including, but not necessarily limited to, applicable labor and equal opportunity provisions.

d. Secure competitive bids, by advertising, for all work to be performed by contract.

e. Shall submit to the District Commander a detailed estimate of cost, a tabulation of all bids received and, request for approval of award of a contract to the lowest qualified bidder; furnish copies of the contract as may be required and submit to the Contracting Officer, for approval, any amendments or modifications thereof.

f. Submit to the District Commander, prior to award of a contract, satisfactory guaranty of availability of sufficient funds to pay all estimated costs of the project that are not borne by the Government.

g. Shall provide adequate and continuous engineering inspection, and submit monthly progress reports showing the work done throughout the construction of the project.

h. Provide necessary facilities and access for inspection of the project by the District Commander.

i. Keep accurate and adequate cost accounts and records, open at all times for inspection and audit by the District Commander.

j. Provide proof of acquisition of all lands, easements and rights-of-ways, and disposal areas, and perform all relocations and alterations of existing facilities, structures or improvements determined by the Government to be necessary for project construction. Agree to dedicate such project lands for the purposes of the project in perpetuity or until such time as the District Commander determines that they are no longer required for this purpose.

k. Obtain all necessary Federal, State and local permits for the construction, and operation of the project, prior to initiation of any activity that requires such permits.

l. Be solely responsible for the operation, maintenance, repair, replacement and rehabilitation of the project once the Government determines that the project is complete.

m. Provide and maintain, without cost to the Government, clearly marked beach access parking areas, and other public use facilities available to all on equal terms for the economic life of the project.

n. Maintain continued public ownership and public use of the shore upon which the amount of Federal participation is based during the economic life of the project in accordance with the existing law and based on shore ownership and use at the time of construction. Should ownership and use change, the Federal participation, including that for periodic nourishment, shall be adjusted based on the new ownership and use.

o. Control water pollution to the extent necessary to safeguard the health of bathers.

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

q. Maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the LCA to the extent and in such detail so as to accurately reflect total project costs. Such information shall be maintained for a minimum of three years after completion of construction of the project.

r. Agree to comply with all applicable Federal and State laws and regulations during the construction and operation of the project.

s. Take specific actions during construction and operation to control environmental pollution, which could result from project related activities and to comply with applicable Federal, State and local laws and regulations concerning environmental pollution.

17. The allocation of project costs in the LCA is in accordance with the 1986 Water Resources Development Act (Public Law 99-662). As provided in the LCA, the Government shall, subject to appropriations applicable thereto or funds available therefore reimburse the local sponsor 65% of the total project cost allocated to storm damage prevention at public shores, 50% of the total project cost allocated to the protection of non-Federal public parks, and 0% of the

total project cost allocated to storm damage prevention at privately owned shores where public use of the shore is restricted for the economic life of the project. Based on these criteria, the Federal Government's share of the total project cost is estimated to be 57.53%. Under the LCA, the Government's participation in the cost of the periodic nourishment is limited to renourishment completed during the 10-year period following completion of the initial nourishment project. Such reimbursement shall not take precedence over other pending projects of higher priority for improvements.

PREVIOUS AUTHORIZED PROJECT RELATED ACTIVITIES

18. Delray Beach Nourishment Program. As authorized by PL87-874, the Delray Beach shoreline was initially restored in 1973. Project renourishments were undertaken in 1978, 1984, 1992, and 2002 to maintain the shore protection along 2.7 miles of beach. Federal funds were contributed to the cost of these projects.

19. Boca Raton Beach Nourishment Program. As authorized by PL87-874, the north Boca Raton shoreline (1.45 miles) was initially restored in 1988 and then renourished in 1998. Federal funds were contributed to both of these projects.

20. Jupiter/Carlin Beach Nourishment Program. As authorized by PL87-874, a 1.1 mile stretch of beach fronting Jupiter Inlet Park and Carlin Park was initially restored in 1995 and then renourished in 2002. Federal funds were contributed to these projects.

21. Lake Worth Inlet Sand Transfer Plant. As authorized by PL85-500, a sand transfer plant was constructed in 1958 at the north jetty of Lake Worth Inlet to bypass sand to Palm Beach Island. Federal funds were available for the construction of the plant and the first 10 years of operation.

22. Other projects related to sand bypassing and the preservation of the shoreline have been performed by Federal and non-Federal interests since the 1920's.

PROBLEM IDENTIFICATION

23. The natural forces that shape the project area coastline include wind, waves, and tides. During storm conditions, these forces are amplified, posing a threat to the structures and properties that border the project area. Coastal currents and sea level rise further compound the erosion problem. Available data suggests that natural forces have contributed to an active erosion problem within the project area dating back to at least 1929.

WINDS

24. Winds indirectly cause the littoral transport of sand by generating waves and currents. Data related to the occurrences of wind speed and direction by month in the Boca Raton area are presented in Appendix A. Winds affecting the project area are primarily from the northeast.

WAVES

25. The project area is situated such that the Bahama Banks limits the fetch for eastern, southeastern, and some northeastern waves. The distribution of wave heights and directions for the project area is provided in Figure A-2. In Boca Raton, the average onshore wave height is 3.1 feet, with a period of 4.8 seconds (USACE, 2004). These waves typically come from the east-northeast. The maximum significant deepwater wave hindcasted near the project area is approximately 24 feet.

TIDES

26. The mean high water line along Boca Raton's Atlantic coastline is at +1.93 feet NGVD (Thompson, 1994). The mean tidal range is 2.7 feet (Thompson, 1994).

STORM SURGES

27. The project area is subject to infrequent storm surges due to tropical storms and northeasters. The relationship between the storm return period and storm surge for the project area is shown in Table 1. The highest elevation of the sea surface ever measured in Palm Beach County (+11.2 feet) occurred during the hurricane of September 6 - 20, 1928 (USACE, 1987).

Table 1
Storm Surge and Storm Recession
for the Boca Raton Project Area

Return Period (years)	Frequency ($year^{-1}$)	Surge Elevation[1] (ft, NGVD)	Storm Recession[2] (ft)
2	0.50	2.7	74.3
5	0.20	3.8	103.0
10	0.10	4.6	116.0
20	0.05	5.4	124.0
50	0.02	6.5	136.0
100	0.01	7.3	153.0

Notes:
1. FEMA, 1984.
2. Distance is measured from mean high water to landward most 0.5-foot change contour.

STORM RECESSION

28. Storm induced beach profile recession, or storm recession as it is commonly called, is a direct result of the storm surge and wave action. For the purpose of this report, storm recession is defined as the horizontal distance from the pre-storm mean high water shoreline to the furthest landward extent of the post-storm erosion envelope. The relationship of storm recession versus the return period for the project area is shown in Table 1.

CURRENTS

29. Dominant currents within the study area include the Florida Current (also termed the Gulf Stream) and wave induced longshore currents. The Florida Current flows north approximately 1 mile offshore and is parallel to the Palm Beach County shoreline. The Florida Current has an average speed of 1 foot per second, and a maximum measured speed of 8.2 feet per second (USACE, 1987). The Florida current has no significant effect on the project area, due to the distance between the landward edge of the current and the shore. The current may indirectly influence nearshore processes by its affect on wave refraction. Longshore currents near the project area are generally less than 1 foot per second, with a maximum estimated speed of 7.5 feet per second observed at the Lake Worth Pier, 20 miles north of Boca Raton (USACE, 1987).

LITTORAL TRANSPORT

30. Since most waves affecting the project area are from the northeast, the annual net movement of sand is to the south, however, a seasonal reversal in the direction of littoral transport does occur (south in the winter, north in the summer). The USACE (1995) calculated the net littoral transport rates in Palm Beach County using the 1974 and 1990 FDEP beach profiles. It was concluded that the net littoral transport rate within the project area increases from an estimated 131,000 cubic yards per year to the south in the northern portion of the project area, to approximately 156,000 cubic yards per year to the south in the southern portion of the project area.

SEA LEVEL RISE

31. While there is widespread agreement that sea level is rising, the magnitudes of the predictions vary. The closest measurement to the project area is at Miami, Florida, where the sea level is rising at a rate of 0.0076 feet per year (Hicks and Hickman, 1988). Using Bruun's (1962) equilibrium profile relationship (Appendix A) this rate of sea level rise will result in 0.25 feet/year of beach recession within the project area. Nevertheless, the National Research Council (1987) estimates that sea level rise may accelerate in the future to a rate of approximately 0.04 feet/year. Bruun's equilibrium profile relationship indicates that this extreme rate of sea level rise would result in a recession rate of 1.3 feet/year within the project area. However, until a higher rate of sea level rise is documented, no change in the recommended plan is warranted.

HISTORICAL BEACH EROSION

32. The combined effect of wind, waves, tides, currents, and sea level rise have resulted in a net southerly transport of sand out of the project area. Historic shoreline changes recorded within the project area indicated that the project beach shoreline receded 99.3 feet in width, or 2.0 feet/year, between 1929 and 1979 (Appendix A). The USACE (1987) estimated the project area lost 833,000 cubic yards of material, or 16,660 cubic yards/year, in this time frame.

33. Surveys conducted in 1974, 1985 and 1988 (pre-construction) indicate that the project area shoreline receded a total of 17 feet of width over the 14-year time frame (Appendix A), or about 1.2 feet/year. From 1974 to 1988, approximately 151,000 cubic yards of sand eroded from the project area. This averaged to a volumetric erosion rate of 10,800 cubic yards/year, for the 14-year period.

PERFORMANCE OF INITIAL BEACH NOURISHMENT PROJECT

34. In July and August 1988, an estimated 1,070,700 cubic yards of sand were dredged from an offshore borrow area and placed within the project area. Between June 1988 (pre-construction) and January 1998 (pre-construction), the average shoreline change within the project area was +50.4 feet. The shoreline locations at profile lines R-209 to R-212, at the southern end of the project, were landward of the design beach width (June 1988 MHW+50 feet) at the beginning of the first renourishment project in 1998. Shoreline locations at the four remaining project area profile lines (T-205 to R-208) were an average of 79 feet seaward of the design beach.

35. A comparison of the June 1988 and January 1998 profiles indicated that there was an increase of 721,100 cubic yards of material within the project area. However, the initial nourishment placed 1,070,700 cubic yards of sand within the project limits. Therefore, 349,600 cubic yards eroded from the project area within that time interval (9.6 years), a loss of 36,400 cubic yards/year.

PERFORMANCE OF FIRST BEACH RENOURISHMENT PROJECT

36. The first renourishment project, constructed between March and April 1998, extended the shoreline an average of 137 feet. The shoreline has receded an average of 124 feet following construction, based on the May 1998 (post-construction) and September 2004 surveys. This recession also includes recession due to equilibration of the beach profile. The September 2004 shoreline is an average of 13 feet seaward of the design shoreline. However, the design section was breached at R-210, T-211, and R-212, as the shoreline receded beyond the design shoreline in September 2004.

37. Approximately 692,300 cubic yards were placed in the project area during the 1998 construction. Since the May 1998 nourishment project, approximately 497,400 cubic yards have eroded from within the project area (T-205 to R-212) based on the September 2004 survey. The average erosion rate within the project area is therefore 78,400 cubic yards/year. This value is slightly higher (79,500 cubic yards/year) if the erosion rate within the footprint of the fill plan is measured. The erosion rate to calculate the required advanced nourishment was based on the erosion rate within the fill footprint (79,500 cubic yards/year).

PLAN OBJECTIVES AND FORMULATION

38. The project recommended for construction in this addendum provides for the protection of 1.45 miles of shoreline by placing periodic nourishment. This addendum describes the

proposed work using current price levels, field data, policy, and law. The framework under which the proposed project was developed is discussed in the following paragraphs.

PLANNING OBJECTIVES AND CONSTRAINTS

39. The "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (The Principles and Guidelines, or P&G) are the principle guidelines for planning by Federal agencies involved in water resource development (USWRC, 1983). Although each project presents unique problems and opportunities, a consistent set of decision criteria was used to determine participation in project planning and construction. There are three basic criteria: (1) that there be an economically justified and environmentally acceptable project, (2) that Federal participation be otherwise warranted, and (3) that the project meets current Administration budget priorities.

FEDERAL OBJECTIVE

40. The Federal objective is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Federal planning concerns other than economic include environmental protection and enhancement, human safety, social well-being, and cultural and historical resources. Environmental and safety considerations are of prime importance.

PLAN FORMULATION

41. An assortment of project alternatives were examined in the 1987 GDM as possible solutions to the erosion and storm damage problems in Palm Beach County. Various alternative plans were formulated during these studies to ensure that all reasonable alternatives were evaluated. The No Action plan was examined. Non-structural alternatives were also investigated including zoning changes, building code modifications, a moratorium on construction, condemnation of land and structures, and a no-growth program. Structural alternatives included beach fill with periodic nourishment, groins, revetments, offshore breakwaters, seawalls, and improvements in sand transfer at inlets. As a result of these earlier studies, the beach fill with periodic nourishment plan met the Federal objectives in the most economically efficient and environmentally acceptable manner. The No Action plan failed to meet Federal objectives and was unacceptable to the non-Federal project sponsor.

42. A plan that reasonably maximized net national economic development (NED) benefits, consistent with the Federal objective, was formulated and was identified by earlier studies as the NED plan. The authorized project as outlined in the LCA is a 50-foot seaward extension of the beach profile at MHW with periodic nourishment. The purpose of this Limited Reevaluation Report is to verify the economics of the authorized project based on current Federal law and regulations. Details of the engineering analyses and costs for the project are presented in Appendix A. Details of the economic analyses for the project are presented in Appendix C.

THE RECOMMENDED PROJECT

43. The project limits include the 1.45 mile stretch of beach from Florida Department of Environmental Protection (FDEP) beach monument T-205 to a point 181 feet south of beach monument R-212. The recommended project limits are similar to Reach 10 as described in the 1987 GDM, but the limits are shifted approximately 60 feet south of the limits described in the 1987 GDM. The proposed project limits are 1.25 miles shorter than the plan that was authorized in 1962.

PROJECT DESCRIPTION

44. The proposed project involves the renourishment of the 1.45 mile long project area using an estimated 699,000 cubic yards of material dredged from an offshore borrow area. Sand will be dredged from the borrow area using a cutterhead dredge. The material will be pumped from the borrow area to the beach using a series of submerged and floating pipelines. The project will provide for a 50-foot wide design beach, plus an average of 78 feet of advanced nourishment, at equilibrium. The design berm elevation will be +9 feet NGVD. Approximately 24,400 cubic yards of material will be placed landward of the ECL. This volume is included in the 699,000 cubic yard fill volume.

BORROW AREA

45. The project will use fill dredged from borrow area B. The proposed borrow area is located approximately 0.5 miles offshore of the project area, between FDEP monuments R-201 and R-206 (see Appendix B, Figure B-1). Borrow area B is approximately 5,200 feet long (shore parallel) and 930 feet wide (east to west). Depths within borrow area B range from -32 to -58 feet NAVD.

46. The volume of beach compatible sand in borrow area B is estimated to be 1,715,000 cy, which is almost 2.5 times the volume needed to construct the 2007 nourishment project. Beach compatible sand is also available for subsequent nourishment projects from borrow area A, which is estimated to contain 1,290,000 cy. The expected volume of beach quality sand, and the mean grain size and silt/clay contents for the two proposed borrow sites are summarized in Table 2. The grain size characteristics of sediments found within the borrow sites are similar to those found at the project beach (mean grain size = 0.26 mm, silt/clay content = 1.06%). Detailed results of geotechnical investigations performed within the offshore borrow area are presented in Appendix B.

47. The proposed borrow areas contain approximately 3,005,000 cubic yards of beach compatible sand, which is more than the volume required for the entire economic life of the project (2,246,700 cubic yards).

Table 2
Expected Volume of Beach Quality Sand
Mean Grain Size and Silt/Clay Content
Data from the Proposed Borrow Sites

Borrow Area	Expected Volume of Beach Quality Sand (cy)	Mean Grain Size (mm)	Silt/Clay Content (%)
A	1,290,000	0.26	1.15
B	1,715,000	0.28	1.61

PROJECT COSTS

48. The proposed renourishment project will place 699,000 cubic yards of beach quality sand along the Boca Raton shoreline from Florida Department of Environmental Protection monument T-205 to a point 181 feet south of R-212. The source of the borrow material will be an offshore, shore parallel sand deposit located 2,500 feet offshore of the project area. The investment cost of the second renourishment is $7,690,500. As indicated, investment costs include the construction cost, interest during construction and operation and maintenance costs. These costs are discussed in the following paragraphs. Interest during construction is based on an interest rate of 4.875%.

49. The estimated cost of construction for the 2007 renourishment of the Boca Raton segment is $6,655,630 The construction cost estimate includes mobilization/demobilization, beach fill placement and dressing, beach and environmental monitoring, beach tilling costs, 15% contingency, engineering and design, and supervision and administration. This cost and the cost of future renourishments are summarized in Table 3. All costs are based on August 2007 price levels and an interest rate of 4.875%. Using an estimated dredging rate of 300,000 cy/month, construction of the renourishment project is estimated to take slightly more than 2 months.

50. Beach fill placement construction costs are based on a unit cost of $5.50 per cubic yard for sand from borrow area B, which will be used for the 2007 nourishment project, and a mobilization/demobilization cost of $1,400,000. The dredge contractor is expected to utilize a 30-inch diameter cutterhead dredge. The production of the dredge is expected to be at least 300,000 cy/month while pumping over a maximum of 7,000 feet. This production rate includes the effect of anticipated weather delays. For the cost estimate it was assumed that borrow area B would be used for the 2007 project but that subsequent projects would dredge sand from borrow area A, due to its closer proximity and thus lower cost. The estimated cost of dredging sand from borrow area A is $4.75 per cubic yard. Borrow area A is expected to be depleted during the 2027 renourishment project, requiring the use of sand from borrow area B. The unit price of beach fill has been weighted based on the volumes dredged from each borrow area. There is sufficient sand in the Boca Raton region for the life of the project (Appendix B).

Table 3
Estimate of Contract and Construction Costs for 10-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)		
						2007	2017	2027
Mobilization			Lump Sum	1	$1,400,000	$1,400.0	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	699,000	$5.50	$3,844.5		
	2017	Offshore	C.Y.	737,000	$4.75		$3,501	
	2027	Offshore	C.Y.	810,700	$4.99			$4,045
Beach Tilling			Acre	43	$300	$13.0	$13	$13
Project Monitoring			Lump Sum	1	$530,000	$530.0	$530	$530
Subtotal						$5,787.5	$5,444	$5,988
Contingency (15%)						$868.1	$817	$898
Renourishment Contract Cost						$6,655.6	$6,260	$6,887
E&D + S&A (10%)						$665.6	$626	$689
Total Construction Cost						**$7,321.2**	**$6,886**	**$7,576**

Summary-Investment and Annual Costs for 10-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)				
	1988	1998	2007	2017	2027
Construction Cost	$3,100	$2,420	$7,321.2	$6,886	$7,576
Interest During Construction	-	-	$69.3	-	-
Operation and Maintenance Cost	$300	$240	$300.0	$300	$300
Total Investment Cost	**$3,400**	**$2,660**	**$7,690.5**	**$7,186**	**$7,876**
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	$7,690.5	$4,465	$3,040
Total Present Worth (1988 through 2038)	$27,676				
Total Present Worth (2007 through 2038)	$15,195				

Average Annual Cost over 50-year project life ($1,000's) $1,486.8 (2007 $'s at 4.875% interest rate)
Average Annual Cost over 31-year project life ($1,000's) $960.3 (2007 $'s at 4.875% interest rate)

OPTIMAL RENOURISHMENT INTERVAL

51. Details of project costs and quantities are presented in Appendix A and summarized in Table 4 below. Table 4 presents the annualized project cost over the 50-year project life (1988 to 2038) and the remaining project life (2007 to 2038). A 10-year renourishment interval was chosen as it has the lowest annual cost.

Table 4
Summary of Renourishment Interval Optimization

Renourishment Interval (years)	Annual Cost ($'s) 1988 to 2038	Annual Cost ($'s) 2007 to 2038
8	1,505,400	982,200
9	1,508,700	986,100
10	1,486,800	960,300
11	1,492,400	966,900
12	1,501,300	977,300

Notes:
1. Values given in 2007 $'s.

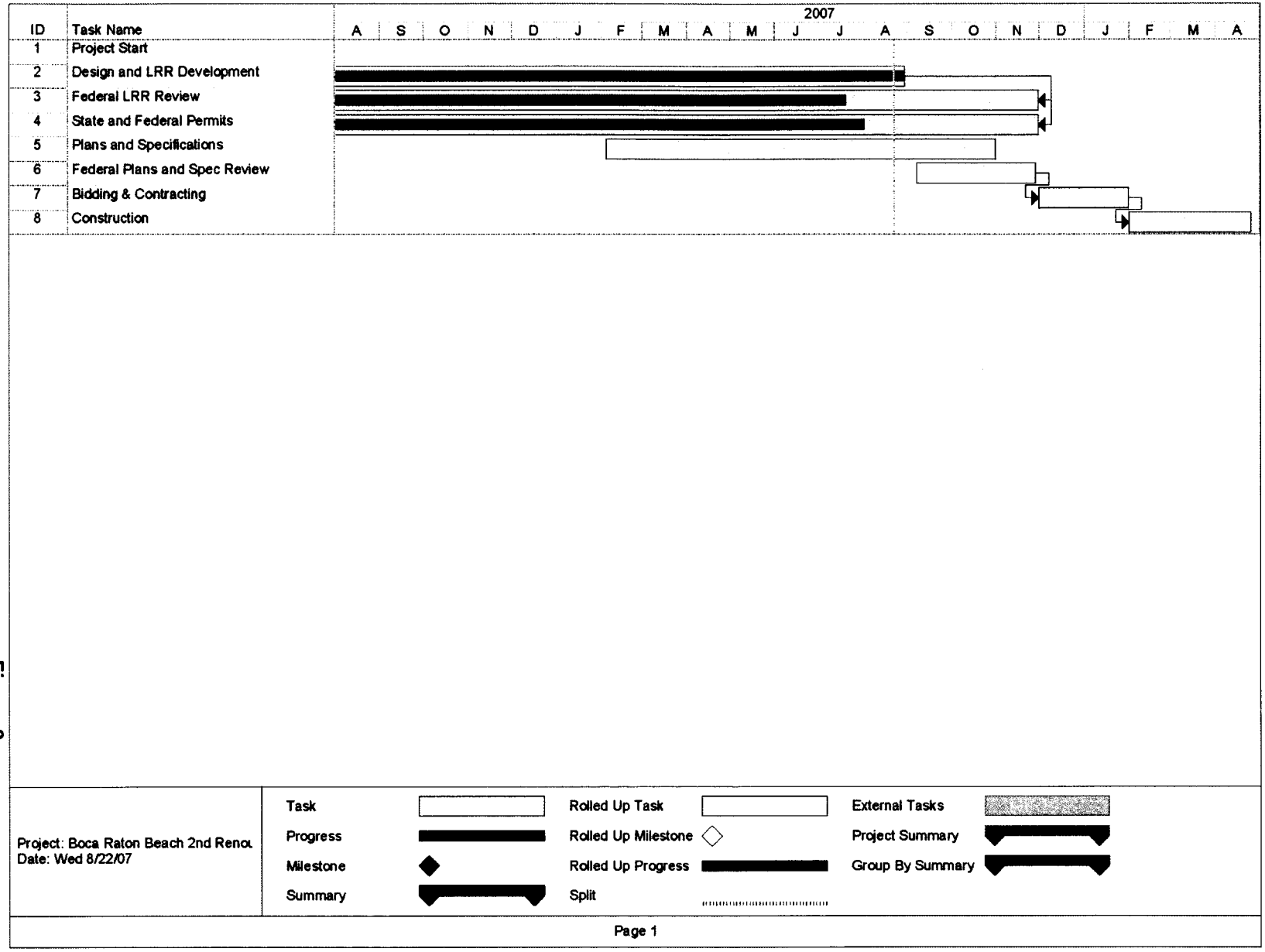
VOLUME OF MATERIAL

52. The volume of fill for the 2007 renourishment and future renourishments, given a 10-year renourishment interval, is shown in Table 3. An estimated 699,000 cubic yards of sand will be placed on the project beach during the 2007 renourishment. The total volume of fill required for the remaining economic life of the project (50 years) is 2,246,700 cubic yards. The volumes of fill presented were calculated based on previous project performance and expected losses from the fill area. Expected losses include the background erosion, end losses resulting from placing fill on the beach, and sediment characteristics (overfill).

53. Note in Table 3 that the fill volume for the 2017 project is larger than the fill volume for 2007. The 2007 renourishment volume benefits from advanced fill volume that remains within the project area. However, it is assumed that there is no advanced fill remaining in 2017. The volume for the 2027 renourishment is larger than the volume for the 2017 renourishment because 1 additional year of advanced fill is required to extend to the end of the project life (2038).

PROJECT SCHEDULE

54. A project schedule is provided in Figure 3. The schedule shows a tentative bid date of December 2007, and a construction start date in February 2008. The project is expected to take 3 months to complete.



Project Schedule

Figure 3

LAND EASEMENTS AND RIGHT-OF-WAY

55. The sponsor is responsible for providing lands, easements, and rights-of-way and is obtaining easements from the State of Florida for dredging material from the borrow area and placing land seaward of the ECL, construction access easements through one city owned park, and storm damage reduction easements. The easements will assure that the project lands are open to the public and remain so for the life of the project. The costs related to these easements are administrative in nature and are expected to be $12,500 for the second renourishment project. The cost of obtaining the easements are excluded from Federal cost sharing. As the easements are perpetual, no administrative costs related to easements are expected for the projected 2017 and 2027 renourishment projects. According to memorandum (included in Appendix D), dated 9 July 1996, "Approval of Perpetual Beach Storm Damage Reduction Easement", is the only standard estate for all Shore Protection Projects.

56. An ECL has been established for the fill area, so the landward boundary of the public beach that fronts private property has been fixed. A small volume of fill (24,400 cubic yards) will be placed landward of the ECL. Perpetual beach storm damage reduction easements will be obtained by the project sponsor to allow placement of this fill.

57. The uplands bordering the project area consist of both publicly and privately owned property (Plates 1A-1D). Of the 1.45 mile fill length, 55.7% of the uplands are publicly held. The public lands are comprised of two city owned parks, one at the northern end of the project area (Spanish River Park) and one near the center of the project area (Ocean Strand Park). Public access is available to all but 628 feet of the 1.45 mile-long project area, with accesses through the city owned park in the northern portion of the project area, and through the city owned park located just south of the project area (Red Reef Park).

58. Implementation of the project will not require any relocation of utilities or acquisition of any facilities. No persons or businesses need to be relocated as a result of the Federal project; therefore, no PL91-646 benefits are required. However, in order to obtain easements for the use of State lands, all State permitting requirements must be met. A detailed description of all the real estate requirements necessary to construct the project is outlined in the Real Estate Supplement (Appendix F).

FILL SITE AND BORROW AREA MONITORING SURVEYS

59. Bathymetric and environmental surveys of the borrow area will comply with the requirements of the State permits (Appendix E). Bathymetric and onshore surveys of the beach will be conducted along DEP profile lines from R-204 to R-219. The monitoring program will include land and hydrographic surveys, analyses, and the preparation of a report following each monitoring. A cost schedule for the monitoring of the project is provided in Table 5.

Table 5
Summary of Monitoring Costs
for the Second Renourishment of the Boca Raton Shore Protection Project

Item	Cost ($)	Time of Monitoring	Annual Cost[1] ($)
Physical Monitoring		At each nourishment	
Beach Profiles	25,000	Pre-Construction	3,218
	25,000	Immediate Post-Construction	3,218
	240,000[2]	Years 1,2,3,5,7, & 9	25,157
Borrow Area	17,500	Pre-Construction	2,253
	70,000[3]	Years 1,3,5, & 7	7,491
Environmental Monitoring			
Pre-Construction Phase		Prior to nourishment	
- Hardbottom Monitoring	20,000		2,574
Construction Phase		Each nourishment	
- Hardbottom Monitoring	20,000		2,574
- Sedimentation Rate	10,000		1,287
- Turbidity Monitoring	20,000		2,574
- Sea Turtle Monitoring	10,000		1,287
Post-Construction Phase		After each nourishment	
- Hardbottom Monitoring	52,500[3]	Years 1, 2 & 4	6,058
- Sedimentation Rate	20,000	Year 1	2,574
TOTAL	$530,000		$60,266

Notes:
1. Annual cost is based on a 50-year project life, a 10-year nourishment interval, and an interest rate of 4.875%.
2. Monitoring cost is $40,000/event. Recent permits have required annual monitoring for the first three years and biannual monitoring thereafter.
3. Monitoring cost is $17,500/event.
4. All costs given at 2007 price levels.

ENVIRONMENTAL MONITORING

60. Monitoring of the environment near the project area will be carried out prior to, during, and after construction, as required by project permits. Biological monitoring stations will be established at the nearshore, patch, and barrier hardbottom formations near the project area. In addition, water quality monitoring will be conducted during construction to determine if water quality outside of State authorized mixing zones meets State water quality standards. Costs related to these activities are included in Table 5.

61. The City of Boca Raton has an ongoing sea turtle monitoring program for the entire Boca Raton Atlantic shoreline. Additional funds to monitor sea turtle nesting activities following

project construction will not be required. The project will be constructed between February and April. Additional sea turtle monitoring may be required after February 15 due to construction activities. The costs related to this additional construction phase sea turtle monitoring is included in Table 5.

ENVIRONMENTAL MITIGATION

62. Mitigation for the burial of low relief, ephemeral nearshore rock outcrops within and immediately south of the project area was constructed in conjunction with the 1988 beach nourishment project. The mitigation structures that were constructed included six (6) high relief artificial reef units and a protective shore-detached groin. The structures have successfully mitigated for the effects of nearshore hardbottom burial within the project area; therefore, the requirement for additional mitigation for the renourishment project is not expected.

STANDARD CODE OF ACCOUNTS

63. Tables 6A-6C present the uniform cost estimate breakdown for the second renourishment project and each subsequent renourishment project. In the tables, each major feature of the project is further divided into sub-features such as construction, mobilization/demobilization, contingencies, and each sub-feature is given a standard account code.

Table 6-A
Estimate of Beach Fill Costs
Renourishment No. 2: Winter 2007

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingency	Total Project Cost
17.--.--	Beach Renourishment						
17.00.01	Mob/Demob	1	Job	L.S.	$1,400,000	$210,000	$1,610,000
	Mob/Demob Time	1	months				
	Dredging Production Rate	300,000	C.Y./month				
	Beach Fill						
	Design Fill	58,900	C.Y.				
	Advanced Nourishment	640,100	C.Y.				
17.00.16	Beach Fill Volume	699,000	C.Y.	5.50	$3,844,500	$576,675	$4,421,180
	Construction Time	2.3	months				
	Associated General Items						
17.00.99	Beach Tilling	43.3	acres	300	$13,000	$1,950	$14,950
	General Items Time	0.3	months				
17.00.99	Project Monitoring	1	Job	L.S.	$530,000	$79,500	$609,500
	Sub-total Construction Costs				$5,787,500		
	Contingency @15%					$868,125	
	Total Construction Time	3.6	months				
17.--.--	Beach Renourishment Total Cost						$6,655,630
30.--.--	Planning, Engineering & Design (5.0%)	1	Job	L.S.	$332,782		$332,780
31.--.--	Construction Management (S&A) (5.0%)	1	Job	L.S.	$332,782		$332,780
	Project Construction Costs						$7,321,190

Table 6-B
Estimate of Beach Fill Costs
Renourishment No. 3: Winter 2017

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingency	Total Project Cost
17.--.--	Beach Renourishment						
17.00.01	Mob/Demob	1	Job	L.S.	$1,400,000	$210,000	$1,610,000
	Mob/Demob Time	1	months				
	Dredging Production Rate	300,000	C.Y./month				
	Beach Fill						
	Design Fill	0	C.Y.				
	Advanced Nourishment	737,000	C.Y.				
17.00.16	Beach Fill Total Volume	737,000	C.Y.	4.75	$3,500,750	$525,110	$4,025,860
	Construction Time	2.5	months				
	Associated General Items						
17.00.99	Beach Tilling	43.3	acres	300	$13,000	$1,950	$14,950
	General Items Time	0.3	months				
17.00.99	Project Monitoring	1	Job	L.S.	$530,000	$79,500	$609,500
	Sub-total Construction Costs				$5,443,750		
	Contingency @15%					$816,560	
	Total Construction Time	3.8	months				
17.--.--	Beach Renourishment Total Cost						$6,260,310
30.--.--	Planning, Engineering & Design (5.0%)	1	Job	L.S.	$313,020		$313,020
31.--.--	Construction Management (S&A) (5.0%)	1	Job	L.S.	$313,020		$313,020
	Project Construction Costs						$6,886,350

Table 6-C
Estimate of Beach Fill Costs
Renourishment No. 4: Winter 2027

Account Code	Item	Quantity	Unit	Unit Price	Amount	Contingency	Total Project Cost
17.--.--	Beach Renourishment						
17.00.01	Mob/Demob	1	Job	L.S.	$1,400,000	$210,000	$1,610,000
	Mob/Demob Time	1	months				
	Dredging Production Rate	300,000	C.Y./month				
	Beach Fill						
	Design Fill	0	C.Y.				
	Advanced Nourishment	810,700	C.Y.				
17.00.16	Beach Fill Total Volume	810,700	C.Y.	4.99	$4,045,390	$606,810	$4,652,200
	Construction Time	2.7	months				
	Associated General Items						
17.00.99	Beach Tilling	43.3	acres	300	$13,000	$1,950	$14,950
	General Items Time	0.3	months				
17.00.99	Project Monitoring	1	Job	L.S.	$530,000	$79,500	$609,500
	Sub-total Construction Costs				$5,988,390		
	Contingency @15%					$898,260	
	Total Construction Time	4.0	months				
17.--.--	Beach Renourishment Total Cost						$6,886,650
30.--.--	Planning, Engineering & Design (5.0%)	1	Job	L.S.	$344,330		$344,330
31.--.--	Construction Management (S&A) (5.0%)	1	Job	L.S.	$344,330		$344,330
	Project Construction Costs						$7,575,310

ECONOMIC EVALUATION

64. The purpose of this section is to summarize the project economic information contained in Appendix C. While the project life is normally indefinite, federal participation and the period for economic evaluation is limited to 50 years. The analyses contained in Appendix C are based on a 50-year project life, August 2007 price levels, and an interest rate of 4.875%. The tangible economic justification of the project is ascertained by comparing the projected equivalent average annual charges with an estimate of the equivalent average annual benefits. A summary of the results of these economic analyses is presented in Table 7.

Table 7
Summary of Economic Analyses

Item	Amount (1) (1998 to 2038)	Amount (2) (2007 to 2038)
Annual Benefits		
Damage prevention (Primary Benefit)	$1,007,000	$693,000
Loss of Land Prevented (Primary Benefit)	$209,000	$175,000
Recreation (Incidental Benefit)	$3,203,000	$2,394,000
Total Project Benefits	$4,419,000	$3,262,000
Annual Project Cost	$1,486,800	$960,300
Net Benefits		
Primary Benefits	($270,800)	$868,000
Total Benefits	$2,932,200	$2,301,700
Benefit-to-Cost Ratio	3.0	3.4
Ratio of Primary Benefits to Project Cost	0.8	0.9

Notes:
1. Annual project costs include 1988 and 1998 projects.
2. Annual projects costs do not include 1988 and 1998 projects.
3. All analyses assume an interest rate of 4.875% and 2007 price levels.

65. The development of costs and benefits follow standard Corps of Engineers practice. The values of all goods and services that will be used in the project are estimated on the cost side. The damages prevented, loss of land, and recreational values are estimated on the benefit side.

STORM DAMAGE REDUCTION BENEFITS

66. Storm damage reduction benefits were calculated as the difference between the average annual storm damage that would occur without restoration and the average annual storm damage that would occur with continued periodic nourishment. The average annual damages were calculated by integrating the frequency damage curve.

67. As a result of beach loss from long term erosion, damage to shorefront structures from a given storm will increase with time. Consequently, for the "without project" conditions, damage-frequency curves were prepared to reflect the position of the shoreline at 1-year intervals. The final annual damages with and without the project were computed as the sum of the present worth of these annual damages amortized over the 50-year economic life of the project. The recession frequency relationship listed in Table 2 was used in the analysis. Implementation of the project is expected to result in an annual storm damage reduction benefit of $1,007,000 for the project area. A detailed discussion of project storm protection benefits is given in Appendix C.

LOSS OF LAND BENEFITS

68. Implementation of the shore protection project will also restore lost land due to shoreline recession. Loss of land benefits are based on the difference between the expected shoreline location without renourishment and the expected shoreline location with continued renourishment throughout the economic life of the project. These projected shoreline locations are used as the basis for determining the expected difference in the available surface area of land. Erosion trends presented in Appendix A provide the basis for these loss of land calculations. Details of these calculations are provided in Appendix C.

69. Loss of land benefits related to private lands are regarded as primary benefits. Maintaining the shore protection project will result in an annual loss of land prevention of $209,000 for the project area.

70. Loss of land benefits related to non-Federal public lands reflect the special use for which the land is designated. Since the public shores within the project area are dedicated as parks, the benefits derived from stabilizing these shorelines are related to expected losses in recreational activities (see next section). Therefore, shoreline stability benefits along public shores are considered incidental benefits.

RECREATIONAL BENEFITS

71. Recreational benefits are the primary incidental benefit produced by a shore protection project. These benefits result from an increased capacity for a recreational activity with an existing or expected surplus demand (which may be limited by public parking or access). Recreational benefits may be attributed to a beach project if the new beach surface increases the capacity for recreational beach activity. All recreational benefits related to shoreline protection projects are considered incidental and do not influence the optimization of the project design.

72. The annual recreational benefits attributed to the proposed shoreline protection project are $3,203,000. Public parking areas and accesses are shown on Figure 4. The majority (7,028 feet) of the project is publicly accessible through walkways down to the beach and access tunnels under State Road A-1-A that connect to Spanish River Park (Plates 1-A, 1-B and 1-C). There is a 628-foot section of the project that is more than a quarter of a mile from a public access.

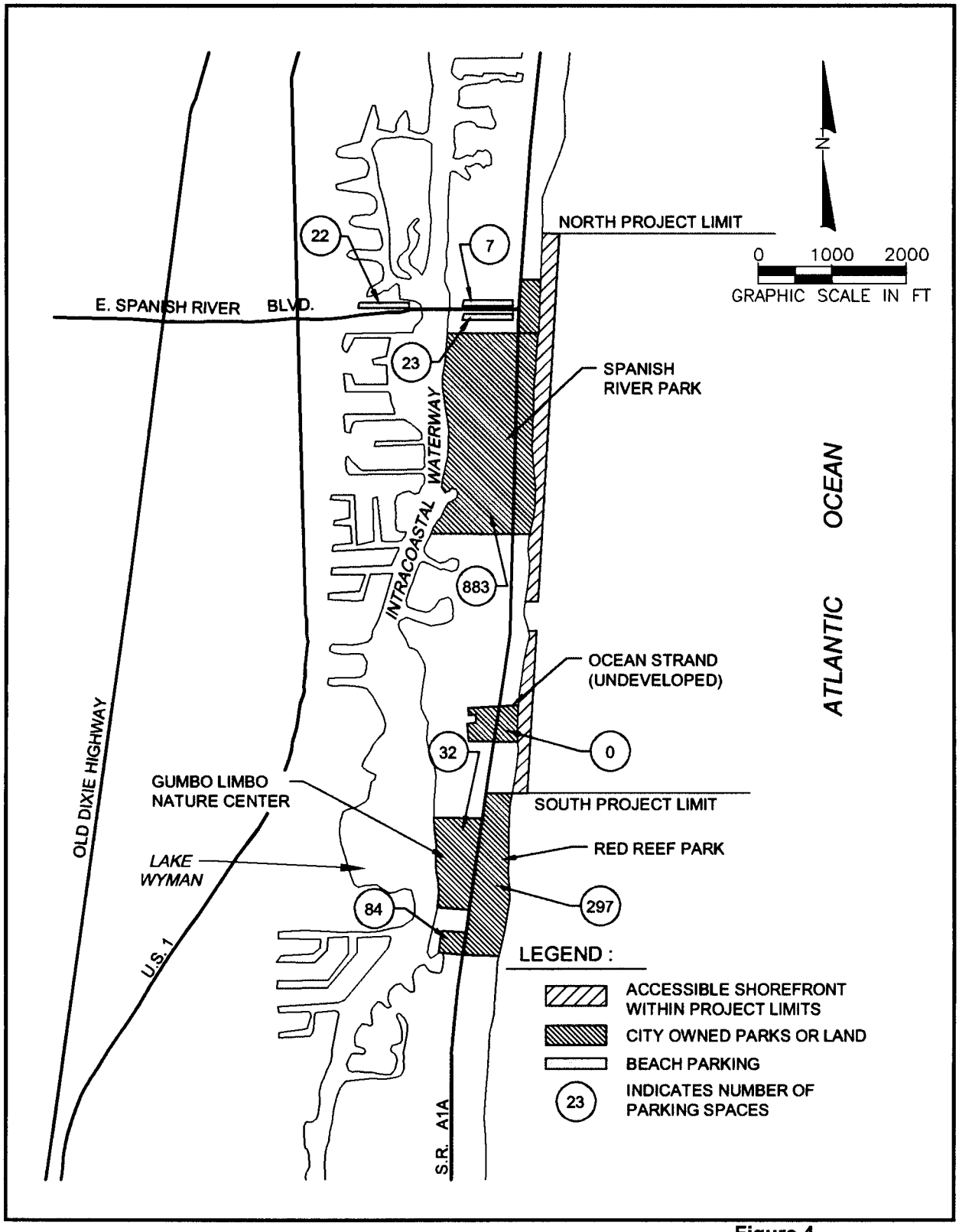


Figure 4

North Boca Raton Parking and Access

SUMMARY

73. Table 7 summarizes the results of economic analyses performed in conjunction with the proposed project. Annual benefits that would be derived from the implementation of the project are $4,419,000. The benefit to cost ratio over the entire project life project is 3.0.

COST APPORTIONMENT

74. Costs were apportioned in accordance with the cost sharing procedures outlined in ER 1165-2-130. A property-by-property determination of Federal participation was developed in Table 8. Federal participation was determined by public accessibility and public parking serving the public accesses.

75. The delineation of Federal and non-Federal responsibility is legally defined in the LCA. As is shown in Table 8, the Federal cost share apportionment is 57.53%. The cost apportionment for each renourishment is estimated in Tables 9A-9C. The Federal share of the cost for the second renourishment is $4,212,100. It should be noted that these cost sharing percentages are tentative and will be updated to reflect current shore ownership and use at the time of construction. These values are as of August 2007.

Table 8
Cost Apportionment

Parcel Description	Shorefront Length (feet)	Is the Parcel within 0.25 miles from Public Access?	Is the Parcel within 0.25 miles from Public Parking?	Shore Ownership and Project Purpose	Federal Cost Sharing	Length x Cost Sharing
Sea Ranch Club of Boca Raton	870	Yes	Yes	IIA	65%	566
City of Boca Raton (A1A)	400	Yes	Yes	IIA	65%	260
Spanish River Blvd.	100	Yes	Yes	IIA	65%	65
City of Boca Raton (A1A)	200	Yes	Yes	IIA	65%	130
City of Boca Raton (A1A)	1125	Yes	Yes	IIA	65%	731
City of Boca Raton (A1A)	1000	Yes	Yes	IIA	65%	650
City of Boca Raton (A1A)	850	Yes	Yes	IIA	65%	553
San Remo	440	Yes	Yes	IIA	65%	286
Yacht and Racquet Club	760	Yes	Yes	IIA	65%	494
East Corp	125	Yes	Yes	IIA	65%	81
Oceanview-Lakeview Trust	150	No	No	III	0%	0
Mizner Del Mar	87	No	No	III	0%	0
Ocean Club Condominium	290	No	No	III	0%	0
Private Access	25	No	No	III	0%	0
Petruzzelli et al	76	No	No	III	0%	0
Ocean Strand	150	No	No	III	0%	0
Ocean Strand	150	Yes	Yes	IIB	50%	75
Ocean Strand	298	Yes	Yes	IIB	50%	149
Private Access	20	Yes	Yes	IIA	65%	13
Aegean Condominium	209	Yes	Yes	IIA	65%	136
Athena Condominium	105	Yes	Yes	IIA	65%	68
Ocean Reef Towers, Inc.	242	Yes	Yes	IIA	65%	157

Total Shorefront Length (ft) **7,672**

Total Length of Federal Participation (ft) **4,414**

Federal Participation Percentage Rate **57.53%**

Ownership & Project Purpose
I. Federal property.
IIA. Public and privately owned, yielding public benefits from storm damage reduction.
IIB. Public and privately owned, yielding public benefits from incidental recreation.
III. Privately owned, yielding private benefits.

Notes: The Ocean Strand is a publicly owned, undeveloped park. The parcels currently do not contain posted public access and parking, though an access is used by local residents. Access and parking is claimed for the southern two parcels through Red Reef Park in this analysis.

Table 9-A
Cost Apportionment Summary
Renourishment No. 2: Winter 2007

Item	Total Cost [1] ($1,000's)	Federal Share (%)	Federal Cost ($1,000's)	Non-Federal Cost ($1,000's)
Dredge Mob/Demobilization	$1,400	57.53%	$805.5	$594.5
Beach Fill	$3,845	57.53%	$2,211.8	$1,632.7
Environmental Monitoring	$530	57.53%	$304.9	$225.1
Environmental Mitigation	$0.0	57.53%	$0.0	$0.0
Beach Tilling	$13.0	57.53%	$7.5	$5.5
Subtotal	$5,787.5		$3,329.7	$2,457.8
Contingency (15%)	$868.1	57.53%	$499.5	$368.7
Construction Total	$6,655.6		$3,829.2	$2,826.5
E&D & S&A (10.0%)	$665.60	57.53%	$382.9	$282.7
Project Total (without LERR)	**$7,321.2**		**$4,212.1**	**$3,109.1**
Project Percentages			57.53%	42.47%
Land Easements etc.	$12.5	0.00%	$0.0	$12.5
Land Easement Contingency	$3.1		$0.0	$3.1
Project Total (with LERR)			**$4,212.1**	**$3,124.8**

Notes: 1. Costs taken from Table 6-A, which used 2007 price levels.

Table 9-B
Cost Apportionment Summary
Renourishment No. 3: Winter 2017

Item	Total Cost [1] ($1,000's)	Federal Share (%)	Federal Cost ($1,000's)	Non-Federal Cost ($1,000's)
Dredge Mob/Demobilization	$1,400	57.53%	$805.5	$594.5
Beach Fill	$3,501	57.53%	$2,014.1	$1,486.7
Environmental Monitoring	$530	57.53%	$304.9	$225.1
Environmental Mitigation	$0.0	57.53%	$0.0	$0.0
Beach Tilling	$13.0	57.53%	$7.5	$5.5
Subtotal	$5,443.8			
Contingency (15%) [2]	$816.6	57.53%	$469.8	$346.8
Construction Total	$6,260.3			
E&D & S&A (10.0%)	$626.0	57.53%	$360.2	$265.9
Project Total	$6,886.3		$3,961.9	$2,924.5
Project Percentages			57.5%	42.5%

Notes: 1. Costs taken from Table 6-B, which used 2007 price levels.

Table 9-C
Cost Apportionment Summary
Renourishment No. 4: Winter 2027

Item	Total Cost [1] ($1,000's)	Federal Share (%)	Federal Cost ($1,000's)	Non-Federal Cost ($1,000's)
Dredge Mob/Demobilization	$1,400	57.53%	$805.5	$594.5
Beach Fill	$4,045	57.53%	$2,327.4	$1,718.0
Environmental Monitoring	$530	57.53%	$304.9	$225.1
Environmental Mitigation	$0.0	57.53%	$0.0	$0.0
Beach Tilling	$13.0	57.53%	$7.5	$5.5
Subtotal	$5,988.4			
Contingency (15%) [2]	$898.3	57.53%	$516.8	$381.5
Construction Total	$6,886.7			
E&D & S&A (10.0%)	$688.7	57.53%	$396.2	$292.5
Project Total	$7,575.3		$4,358.3	$3,217.0
Project Percentages			57.5%	42.5%

Notes: 1. Costs taken from Table 6-C, which used 2007 price levels.

FEDERAL RESPONSIBILITY

76. The estimated implementation cost of the authorized project, excluding interest during construction, is $7,321,200. The Federal share of the authorized project is $4,212,100. The Federal cost sharing by project feature for the authorized project is summarized in Tables 9-A through 9-C. Federal reimbursement will be subject to the appropriation of funds by Congress.

77. The U.S. Army Corps of Engineers (USACE) will be responsible for Federal funding. A USACE permit will be required for the project. The USACE will review the pre-construction, engineering and design report, and the contract plans and specifications. Prior to project construction, the USACE will review the operation and maintenance (O & M) manual prepared by the City of Boca Raton. USACE approval of these items is required prior to construction of the project. The City will construct the project features. The USACE will monitor the project construction, and will perform an audit and inspection at the completion of the physical work.

NON-FEDERAL RESPONSIBILITY

78. The total non-Federal responsibility of the second renourishment is $3,109,100. The project sponsor will be responsible for 100% of the cost of the project after 50 years from the initiation of construction of the initial nourishment (June 1988).

79. The non-Federal project sponsor, the City of Boca Raton, will construct the project features. The non-Federal project sponsor will provide all lands, easements, permits, and rights-of-way required for the project. The non-Federal project sponsor will prepare the O & M Manual for the project and will submit it to the USACE for approval. The O & M Manual will describe the project sponsor's obligations toward operation, maintenance, repair, replacement,

monitoring, and rehabilitation of the completed project. The non-Federal project sponsor will satisfy all requirements of the project cooperation agreement (LCA). Other general non-Federal responsibilities, such as continuing public use of the project beach for which benefits are claimed in the economic justification of the project, and controlling water pollution to safeguard the health of bathers, will be assumed by the non-Federal project sponsor prior to project construction.

COMPARISON TO THE 1998 GDM ADDENDUM

BEACH FILL LENGTH

80. The 1.45 mile long proposed renourishment project length is similar to the Boca Raton segment (Reach 10) that was authorized in the 1987 GDM. The difference is only that the project limits have been shifted 60 feet to the south. The proposed construction is identical to the projects constructed in 1988 and 1998 (Table 10).

DESIGN CROSS-SECTION

81. The design cross section of the proposed renourishment project includes a design berm elevation of +9 ft NGVD, and a design width of 50 feet (Table 10). The proposed design template (berm elevation, design width and construction slope) are identical to the design template approved in the 1998 GDM Addendum. Plates 1A – 1G show the proposed cross section.

VOLUME OF PERIODIC NOURISHMENT

82. The amount of periodic (advanced) nourishment that will be placed under the proposed project is greater than the volume of fill placed during the 1998 project, as the design renourishment interval is 10 years compared to 8 years (Table 10). The estimate of annual advanced fill required has also been increased based on updated survey information. Under the proposed project, an estimated 79,500 cubic yards/year of periodic nourishment will be placed within the project area. This is approximately 9,000 cubic yards/year more than the volume that was estimated in the 1996 Limited Reevaluation Report.

Table 10
Comparison of Proposed Renourishment Project with the 1998 Project

Item	1998 Beach Project [1]	Proposed Project	Departure of Proposed Project from 1998 Project
Beach Fill Length (miles)	1.45	1.45	0
Berm Elevation (ft, NGVD)	9	9	0
Design Berm Width (ft)	50	50	0
Design Section Volume (cy/ft)	53	53	0
Periodic Nourishment Volume (cy/yr)	70,500	79,500	9000
Renourishment Interval (yr)	8	10	2
Interest Rate (%)	7.625	4.875	-2.75
Annual Benefits ($)	2,666,000	4,419,000	1,753,000
Annual Cost ($)	780,000	1,486,800	706,800
Net Benefit ($)	1,886,000	2,932,200	1,046,200
Benefit to Cost Ratio	3.4	3.0	-0.4
Federal Cost Share(%)	58.80%	57.53%	-1.3%
Non-Federal Cost Share(%)	41.20%	42.47%	1.3%
Initial Cost ($)	2,420,000	7,321,200	4,901,200

Notes:
1. From CPE, 1996.

RENOURISHMENT INTERVAL

83. The renourishment interval was chosen based on the lowest annual cost. The 10-year renourishment intervals had the lowest annual costs. This is 2 years greater than the renourishment interval established in the 1987 GDM and 1996 LRR. The annual cost of the project has increased due to the inclusion of all project costs in the interval optimization procedure. There has also been a significant increase in the mobilization costs from $700,000 to $1,400,000. This results in longer nourishment intervals being more cost effective.

PROJECT COSTS

84. Annual project costs for the proposed renourishment project are expected to be $1,486,800. This includes the cost of mobilization/demobilization, fill placement, environmental monitoring, beach tilling, compaction tests, a 15% contingency, and 10% for engineering, design, supervision and contract administration. Annual costs and benefits were estimated using an interest rate of 4.875%. All costs are based on estimated August 2007 price levels. The annual cost is almost double the annual project cost for the 1998 project due to the increased cost of dredging. The 1988 and 1998 project costs were also included in the average annual cost calculation.

PROJECT BENEFITS

85. Project benefits have been calculated for storm damage prevention, loss of land prevention and recreational enhancement using current policies and guidelines. The total annual benefits are $4,419,000. This is an increase of $1,753,000 from the 1998 project. This increase is primarily due to increased property values within the project area and increased recreation benefit due to a revised value of the average visit.

86. The benefit to cost ratio for the 2007 renourishment project is 3.0. This is lower than the benefit to cost ratios provided by the 1998 project due to a decrease in the damage prevention benefits.

FEDERAL COST SHARE

87. The Federal cost share for the proposed renourishment is expected to be 57.53%. This is 1.3% lower than the Federal cost share in the 1998 project. The City of Boca Raton will obtain all easements required to construct the project. Perpetual easements have been acquired to allow public access.

FINANCIAL ANALYSIS

88. A financial analysis is required for any plan being considered for Corps of Engineers implementation that involves non-Federal cost sharing. The ultimate purpose of the financial analysis is to ensure that the non-Federal sponsor understands the financial commitment involved and has a reasonable plan for meeting that commitment. The financial analysis includes (1) the non-Federal sponsor's statement of financial capability; (2) the non-Federal sponsor's financing plan; and (3) an assessment of the sponsor's financial capability, to be made by the Corps of Engineers. The City of Boca Raton submitted a letter of financial capability to the USACE on September 27, 2006. A copy of this letter is included in Appendix D.

PROJECT SPONSOR FINANCING PLAN AND FINANCIAL STATEMENT

89. The project sponsor, the City of Boca Raton, has prepared its financial plan and the statement of financial capability. The City's statement of financial capability and financing plan will be submitted to the District Engineer for review. A letter from the City of Boca Raton showing that they are capable of funding their portion of the project was submitted to CESAJ for approval. A copy of the letter is included in Appendix D.

90. The sponsor's share of the project cost does not depend upon the contribution of funds by a third party. The local sponsor has, however, applied for a State of Florida grant for project construction. The State of Florida has authority to provide funds to County or City governments for shore protection projects, as provided by Chapter 161, Florida Statutes. State funds are expected to be available July 1, 2006. Once appropriated, the state funds will be placed in an escrow account, pending project construction. The local sponsor is prepared to construct the

project utilizing its own funding. The sponsor has applied for (requested) reimbursable funding from both the Federal and State government. Reimbursable funding is anticipated after project construction.

91. The City of Boca Raton was established by action of the Florida Legislature (Chapter 65-1264, Special Laws, Laws of Florida, as amended). Under the provisions of the action, the City was granted authority to make contracts and enter into agreements; to acquire and hold lands and property by any lawful means; to exercise the power of eminent domain; to construct, acquire, operate and maintain public works projects and facilities; and to tax property or issue bonds to meet the cost of public works. The Greater Boca Raton Taxing District was established by action of the Florida Legislature (Chapter 74-423, Laws of Florida) as a special taxing district. The sole purposes and obligations of the taxing district is to reimburse the City of Boca Raton for the actual costs of acquisition, maintenance, operation, and improvements related to existing and future beach or park properties.

92. The City of Boca Raton has also been provided a companion Authority under Chapter 161 of the Florida Statutes to make contracts and enter into agreements; to acquire and hold lands and property by any lawful means; to exercise the power of eminent domain; and to tax property or issue bonds for the purpose of the City's beach erosion control program. Chapter 161 of the Florida Statutes also provides for the City to act as the local shore preservation authority and for State financial assistance in funding beach erosion control and shore preservation projects. Any County/City may apply to the Bureau of Beaches and Coastal Systems, Florida Department of Environmental Protection, for State funds for these projects. For Federal projects, the State is authorized to fund up to 75% of the non-Federal construction and maintenance costs of projects authorized by the Congress of the United States, subject to certain restrictions. The State is authorized to expend funds from the Erosion Control Trust Fund account for such projects.

93. The City Council has the authority and financial capability to provide the required non-Federal cash contribution for project construction, and to fulfill the other items of local cooperation. The City, through the assistance of the Florida Department of Environmental Protection and the Trustees of the State Internal Improvement Trust Fund, has resolved the paramount issue of riparian rights by establishing an erosion control line, and thereby is in compliance with the non-Federal responsibility to furnish all lands, easements, and rights-of-way needed for project construction.

ENVIRONMENTAL CONSIDERATIONS, COMMITMENTS AND COMPLIANCE

94. An Environmental Assessment (EA) for the recommended project is attached to this document. The environmental considerations and commitments detailed in the EA are summarized in this section.

95. The project is expected to have little or no long-term adverse environmental effect at the borrow area. Dredging of the borrow area would cause a depletion of sand in the borrow area. However, no seagrasses, reefs, hardbottom, or other significant habitat would be altered by the

use of the proposed borrow area. Although infauna at the borrow area will be unavoidably lost as a result of the project, these losses will be temporary since infauna from outside of the borrow area will quickly colonize the disturbed portion of the borrow area.

96. Likewise, the placement of sand at the fill site will cause no long-term adverse effects on the beach ecosystem. The placement of sand on the project beach will help maintain a valuable sea turtle nesting habitat and will help protect the adjacent dune habitat. Most of the infauna within the fill site will be unavoidably lost as a result of the project. However, these losses will be temporary since infauna from outside the effected area will quickly colonize any disturbed areas. Although it is possible that one or more ephemeral rock outcrops south of the project area may be exposed at the time of project construction, impacts to ephemeral rock outcrops have already been mitigated for through the construction of an artificial reef and shore-detached groin during the 1988 project.

97. Various measures to minimize potential adverse effects of the proposed dredge and fill operation have been incorporated into the planning of the project. Additional considerations will be taken during project construction. Specific measures to avoid and/or minimize environmental impacts will also be incorporated into the project specifications. Measures to reduce potential environmental impacts related to the project include the use of lighted buoys during project construction to mark the limits of the borrow area; the precision positioning of the dredge; limiting anchoring and pipeline placement to pre-determined locations in the sand; requiring that the dredge be pushed or towed using polypropylene line from the 150 foot contour line landward; the careful selection of the borrow area to limit the amount of fine sediments dredged; the monitoring of the patch and barrier hardbottom (reef) before, during and after project construction; the monitoring of water quality at the borrow area and fill site during construction; and the implementation of special procedures to minimize potential impacts to threatened and endangered species (primarily sea turtles and manatees).

98. The proposed project will be in compliance with all applicable Federal environmental laws, policies and guidelines, and with all applicable State environmental laws and policies. Prior to project construction, a Corps of Engineers permit and a Florida Department of Environmental Protection permit will be obtained.

AESTHETIC CONSIDERATIONS

99. Aesthetic resources were evaluated in accordance with procedures outlined in ER 1105-2-100. Results of this evaluation are summarized below and are discussed in the attached EA.

AESTHETIC RESOURCE INVENTORY

100. The project area consists of 1.45 miles of Atlantic coast fronting the City of Boca Raton, Florida. The area is characterized by an eroding beach. The sand within the project area is a mixture of the brown and tan sand and shell fragments and light gray sand from the original nourishment and first renourishment projects. Structures along the beach/dune system are

limited to a few lifeguard structures, a handicap accessible dune overwalk, and accesses to three pedestrian tunnels.

101. The City of Boca Raton has preserved most of the coastal ecosystem within its city limits. An extensive shore-parallel vegetated dune exists throughout the project area. This dune and the clear blue waters of the adjacent Atlantic Ocean are two of the most pleasing visual resources provided by the area.

102. Many of the uplands adjacent to the project area are publicly owned. Development within these areas is limited to parking areas, pedestrian tunnels and other park related facilities. Development in the privately owned properties adjacent to the project beach includes three single-family homes and several large multi-family residences. State Road (S.R.) A-1-A is located just west of the dune crest throughout most of the project area.

WITHOUT CONDITIONS

103. Without beach nourishment, the shoreline will continue to erode. This will result in the loss of the existing beach, park facilities, and will eventually threaten the vegetated shore-parallel dune and adjacent road. Without renourishment, the City and private property owners will be forced to construct new coastal protection structures to protect their upland properties and the adjacent hurricane evacuation route (S.R. A-1-A).

CONSIDERATIONS IN DESIGN

104. In an effort to minimize the formation of a scarp along the new beach fill, the face of the beach fill will be sloped during construction to reflect a stabilized condition. The beach fill will be shaped and graded so as to absorb wave energy. The elevation of the beach berm will be set to limit the formation of a ridge along the crest of the berm and reduce the impact of storm waves. A sand source with a low silt/clay content will be used to reduce the amount of turbidity that could occur during construction. No existing permanent structures will be removed, relocated, or altered as a result of the project.

WITH RENOURISHMENT CONDITIONS AND IMPACTS

105. The renourishment of the beach will help maintain a relatively wide beach that will be visually appealing. Although the sand from the borrow area will originally be medium gray in color, it will bleach to a more appealing light gray color over a period of several months. Construction of the beach will result in some short-term turbidity at the dredge site and at the discharge point on the beach. Nevertheless, water quality will return to pre-construction conditions after completion. The presence of construction equipment will temporarily reduce the aesthetic appeal of the beach. Nevertheless, this effect will be restricted to the construction phase. The proposed project will reduce the need for less aesthetically appealing shore protection structures, such as seawalls, revetments, or groins. The renourishment of the beach will also help to protect and enhance the adjoining vegetated dune habitat.

CULTURAL RESOURCES

106. A magnetometer survey of the proposed borrow area was performed on November 20 and 21, 2003 (TAR, 2006). During the survey, four potentially significant magnetic anomalies were identified. Two of the anomalies were located within the borrow area, while one was located within 200 feet of its boundary. A review of the National Register of Historic Places indicates that no cultural resources listed in the register are found near the project area.

107. In a letter dated March 14, 1986, the State Historic Preservation Officer (SHPO) reported that nine scattered anomalies within and immediately adjacent to the borrow area were unlikely to be culturally or historically significant (see Percy, 1986 in Appendix D). The remaining fourteen anomalies, however, fell into two clusters and were identified by SHPO as potential cultural or historical resources. Prior to the 1988 project, the SHPO recommended the establishment of a 150-foot buffer zone around each of the two clusters of anomalies to avoid impacts to these potential resources (Percy, 1986). The USACE recommends a 100-meter buffer zone around the potential cultural resource areas during the proposed renourishment project.

108. A cultural resources investigation of the northern portion of borrow area B, to be used for this renourishment, was performed in 2003 (TAR, 2006). This report recommends a 600-foot diameter buffer around target anomaly BR06-05 and 400-foot diameter buffers around target anomalies BR06-01, BR06-06, and BR06-08. Review by the USACE archeologist recommended a 100-meter radius buffer around all of the potentially significant anomalies. Florida SHPO concurred with this recommendation following consultation with the USACE.

109. In compliance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, the USACE has determined that the beach renourishment will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places. Additionally, the use of the northern portion of borrow area B as a sand source, as described by the 2003 Cultural Resource Investigation an Magnetometer Survey (TAR, 2006), will have no effect on historic properties listed on or eligible for listing on the National Register of Historic Places contingent on the maintenance of a buffer of no less than 100-meters around anomalies BR06-01, BR06-05, BR06-06, and BR06-08. These buffers may be removed based on diver identification that the anomalies are not historic resources. Prior to the removal of the buffers the USACE will have to reconsult with the Florida SHPO.

PUBLIC ACCESS

110. An Erosion Control Line (ECL) was established for the project area in 1986. During the proposed project, beach fill will be placed on public property seaward of the ECL. Fill to be placed landward of the ECL will be covered by beach storm damage reduction easements that allows public access and use. Plates 1A-1D show the access points and available parking spaces near the project area. Public access is available to all but 628 feet of the 1.45 mile-long project area, with accesses through the city owned park in the northern portion of the project area, and access through the city owned park located just south of the project. The public beach, created

by the establishment of the ECL, as well as public access to the beach will be maintained throughout the economic life of the project.

COMPLIANCE WITH APPLICABLE FEDERAL LAWS

FLOOD PLAIN DEVELOPMENT

111. The proposed project is in the base flood plain (100-year flood) and has been evaluated in accordance with Executive Order 11988. Relocation of the proposed project outside the flood plain would not be responsive to the problems and needs of the study area, and was not considered further. A non-flood plain alternative for the potential development with the project would be to restrict all future development to those areas outside the flood plain or elevated above the flood plain. Potential flood plain development with the project area would be restricted as a result of local ordinances and State law. Any induced potential damage as a result of project implementation would be minimal. The project would have minimum impact on the natural and beneficial values of the flood plain. In the without project flood plain (that area immediately adjacent to the proposed project), there will be minimal loss of natural resources due to potential development. Implementation of any non-structural plans that would minimize potential damage to or within the flood plain beyond those laws and regulations already adopted by local and State interests are not viable solutions under the planning constraints of this study.

FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE PROGRAMS COMPLIANCE

112. Section 402 of the Water Resources Development Act of 1986 (PL 99-662) as amended by Section 14 of the Water Resources Development Act of 1988 (PL 100-676) states, "Before construction of any project for local flood protection or any project for hurricane or storm damage reduction, the non-Federal interests shall agree to participate in and comply with applicable Federal flood plain management and flood insurance programs." The City of Boca Raton is in compliance with the national Flood Insurance Program. The project sponsor is eligible to receive Federal funding for the recommended storm damage reduction project.

COASTAL BARRIER RESOURCES ACT

113. The project shoreline is not part of the Coastal Barrier Resource System. Therefore, the project is not in conflict with the Coastal Barrier Resource Act.

COASTAL ZONE MANAGEMENT ACT

114. The Coastal Zone Management (CZM) Act of 1972, as amended (PL-92-583) requires that all Federal activities inside or outside a state's coastal zone be consistent with the state's coastal zone management plan if the activities affect natural resources, land uses, or water uses within the coastal zone. By issuance of State Water Quality Certifications on completed beach erosion control projects, the State has determined that the authorized projects for which initial

construction has been completed were consistent with the State CZM Act. A letter is included in Appendix D stating that based on data reviewed to date, the proposed 2007 project is consistent with the Florida Coastal Zone Management Program. The State will review future project work required to determine if it is consistent with the State's coastal zone management plan prior to future nourishments.

THE CLEAN WATER ACT OF 1972 (CWA)

115. An application for a Section 401 water quality certification to discharge fill into State waters was submitted to the Florida Department of Environmental Protection in the project permit application. A request for a variance from State imposed mixing zone was requested. The State has typically issued a one time only variance for similar projects. All State water quality standards will be met. The project will be in full compliance with the Act prior to its construction.

NATIONAL HISTORIC PRESERVATION ACT OF 1966 (NHPA)

116. The project will be in full compliance with the act prior to its construction.

FISH AND WILDLIFE COORDINATION ACT OF 1958 (FWCA)

117. A Coordination Act Report was developed in 1997 has been included in Appendix D (Pertinent Correspondence). Even though there is a previous CAR, the current project is being coordinated with US Fish and Wildlife Service. The project will be in full compliance with the act prior to its construction.

HAZARDOUS, TOXIC AND RADIOACTIVE WASTES (HTRW)

118. The nature and composition of the fill material is similar to that of the native beach. There is no indication that hazardous, toxic, or radioactive waste is present or would be introduced into the water column or transferred to the project area. There is a potential for hydrocarbon spills with dredging and construction equipment in the area, but accident and spill prevention plans delineated in the contract specifications should prevent most spills. The project will be in full compliance with the act prior to its construction.

THE MIGRATORY BIRD TREATY ACT

119. No migratory birds would be affected by the project activities. The project will be in full compliance with the act prior to its construction. The proposed bird monitoring plan submitted to the State is included in Appendix D.

ENDANGERED SPECIES ACT

120. The U.S. Army Corps of Engineers, Jacksonville District coordinated with the U.S. Fish and Wildlife Service and National Marine Fisheries Service as provided by the Endangered Species Act. A letter dated August 14, 2007 stating that the regulations for implementing EFH requirements will be met by including special conditions in the permit. A copy of this letter is included in Appendix D, Pertinent Correspondence.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

121. Pursuant to this act, the U.S. Army Corps of Engineers, Jacksonville District initiated Essential Fish Habitat (EFH) consultation with the National Marine Fisheries Service. A letter from NOAA stating that the procedural goals of the Magnuson-Stevens Fishery Conservation and Management Act have been met with inclusion of special conditions in the permit is included in Appendix D, Pertinent Correspondence.

USE OF OUTER CONTINENTAL SHELF LANDS

122. The Outer Continental Shelf Lands Act (OCSLA) enacted August 7, 1953, as amended grants the Secretary of the Interior authority to grant to qualified persons offering the highest competitive bid leases of any mineral other than oil, gas, and sulfur in any area of the Outer Continental Shelf. Section 1 of Public Law 103-426, October 31, 1994 amended the OCSLA. The Secretary of the Interior may negotiate the use of Outer Continental Shelf, sand, gravel and shell resources for use in a program of, or project for, shore protection, beach restoration or coastal wetlands restoration undertaken by a Federal, State or local government agency; or for a project that is funded in whole or in part by or authorized by the Federal Government. Section 1(a)(2)(B) of the 1994 amendment prohibits the assessment of any fees against an agency of the Federal government, directly, or indirectly.

123. Any Federal agency that proposes to make use of sand, gravel and shell resources subject to the OCSLA shall enter into a Memorandum of Agreement with the Secretary of the Interior. The Secretary of the Interior is also required to notify the Committee on Merchant Marine and Fisheries and the Committee on Natural Resources of the House of Representatives, and the Committee on Energy and Natural Resources of the Senate on any proposed project for the use of those resources prior to use of those resources.

124. The primary borrow source for the authorized project for the Boca Raton Segment is located offshore of the project. The borrow areas developed in the Geotechnical Appendix contains approximately 3,370,000 cubic yards of beach quality material and is located completely within three miles of the adjacent shoreline. As such, the borrow areas are not regulated under the authority of the OCSLA.

PROJECT OPERATION AND MAINTENANCE

125. A project operation and maintenance manual (O & M Manual) will be developed by the project sponsor with review by the Jacksonville District prior to finalization. The project sponsor will implement all requirements of the operation and maintenance plan and will comply with the project Active Status requirements for the Civil Emergency Management Program Rehabilitation Assistance for Hurricane/Shore Protection Projects.

RECOMMENDATIONS

126. It is recommended that the authorized project for Palm Beach County from the Martin County Line to Lake Worth Inlet, and from South Lake Worth Inlet to the Broward County Line be modified and Federal construction be funding provided in accordance with the selected plan herein, with such modifications as in the discretion of the Chief of Engineers may be advisable.

DISCLAIMER

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

Paul L. Grosskruger
Colonel, U.S. Army
District Engineer, Jacksonville, FL

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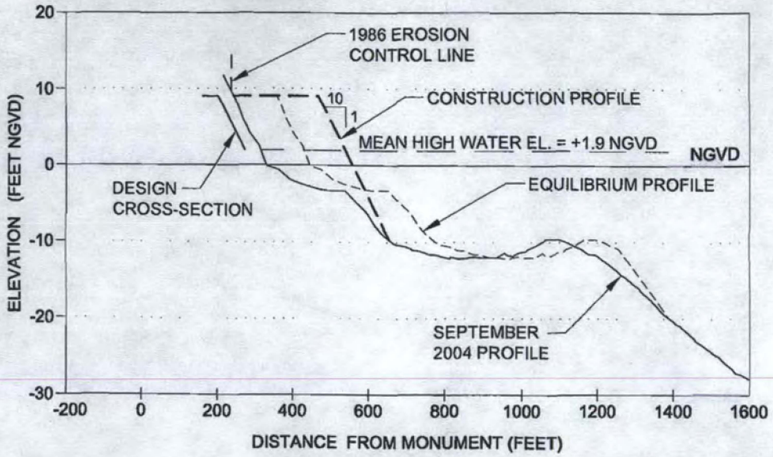
DATE OF AERIAL PHOTOGRAPHY : FEB. 2004.

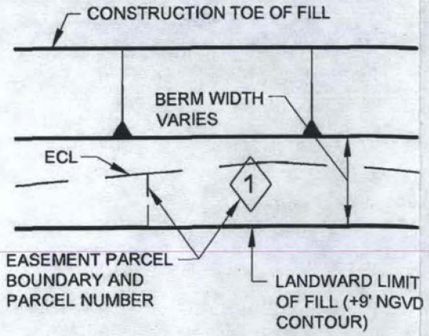
22 (WEST OF INTRACOASTAL WATERWAY BRIDGE)



R-206

LEGEND :

- 22 — NUMBER OF PARKING SPACES FOR PUBLIC USE
- ▲ — PROFILE LINE MONUMENT
- PUBLIC BEACH ACCESS
- CONSTRUCTION ACCESS
- 1 — BEACH STORM DAMAGE REDUCTION EASEMENT PARCEL & BOUNDARY



PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

DEPARTMENT OF THE ARMY

JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

TO ACCOMPANY LIMITED REEVALUATION REPORT
DATED : OCT 2004
FILE NO.

PLATE 1-A

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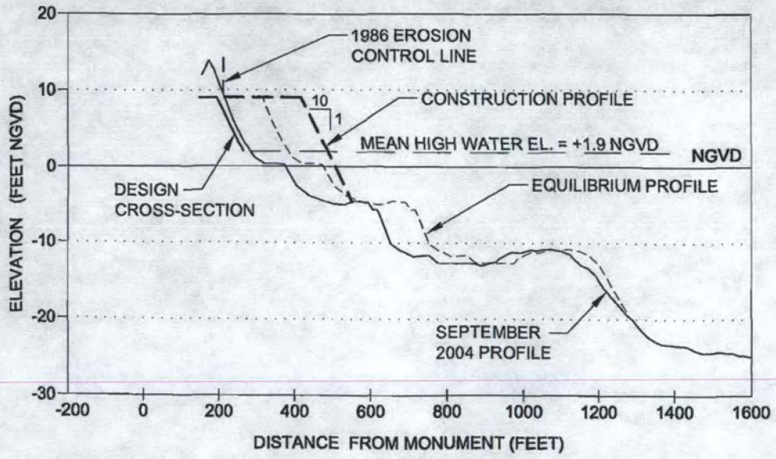
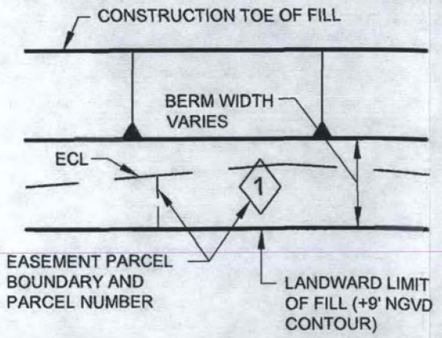
DATE OF AERIAL PHOTOGRAPHY : FEB. 2004.



R-207

LEGEND :

- (22) NUMBER OF PARKING SPACES FOR PUBLIC USE
- ▲ PROFILE LINE MONUMENT
- PUBLIC BEACH ACCESS
- CONSTRUCTION ACCESS
- (1) BEACH STORM DAMAGE REDUCTION EASEMENT PARCEL & BOUNDARY



PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

DEPARTMENT OF THE ARMY

JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

TO ACCOMPANY LIMITED REEVALUATION REPORT
DATED : OCT 2004
FILE NO.

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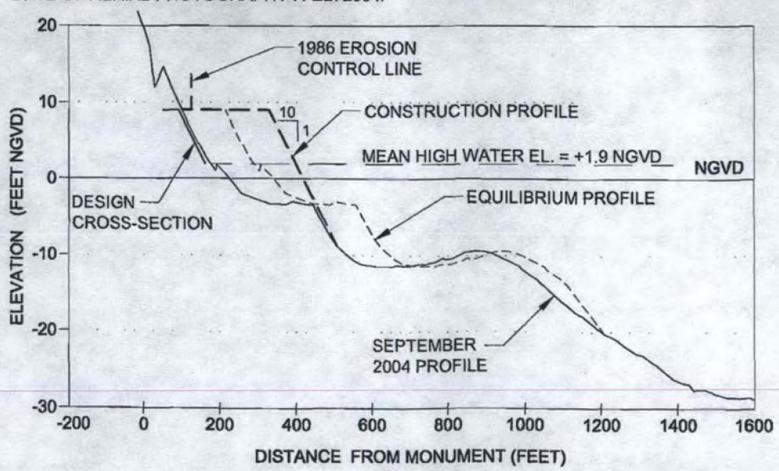
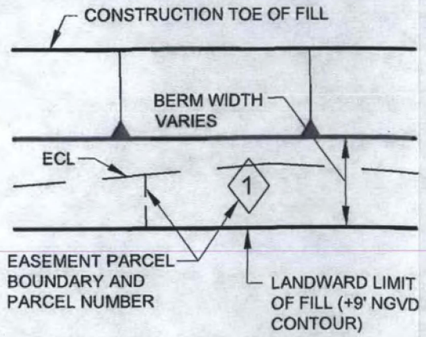
DATE OF AERIAL PHOTOGRAPHY : FEB. 2004.



R-209

LEGEND :

- (22) NUMBER OF PARKING SPACES FOR PUBLIC USE
- ▲ PROFILE LINE MONUMENT
- PUBLIC BEACH ACCESS
- CONSTRUCTION ACCESS
- (1) BEACH STORM DAMAGE REDUCTION EASEMENT PARCEL & BOUNDARY



PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

DEPARTMENT OF THE ARMY

JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

TO ACCOMPANY LIMITED REEVALUATION REPORT
DATED : OCT 2004
FILE NO.

PLATE 1-C

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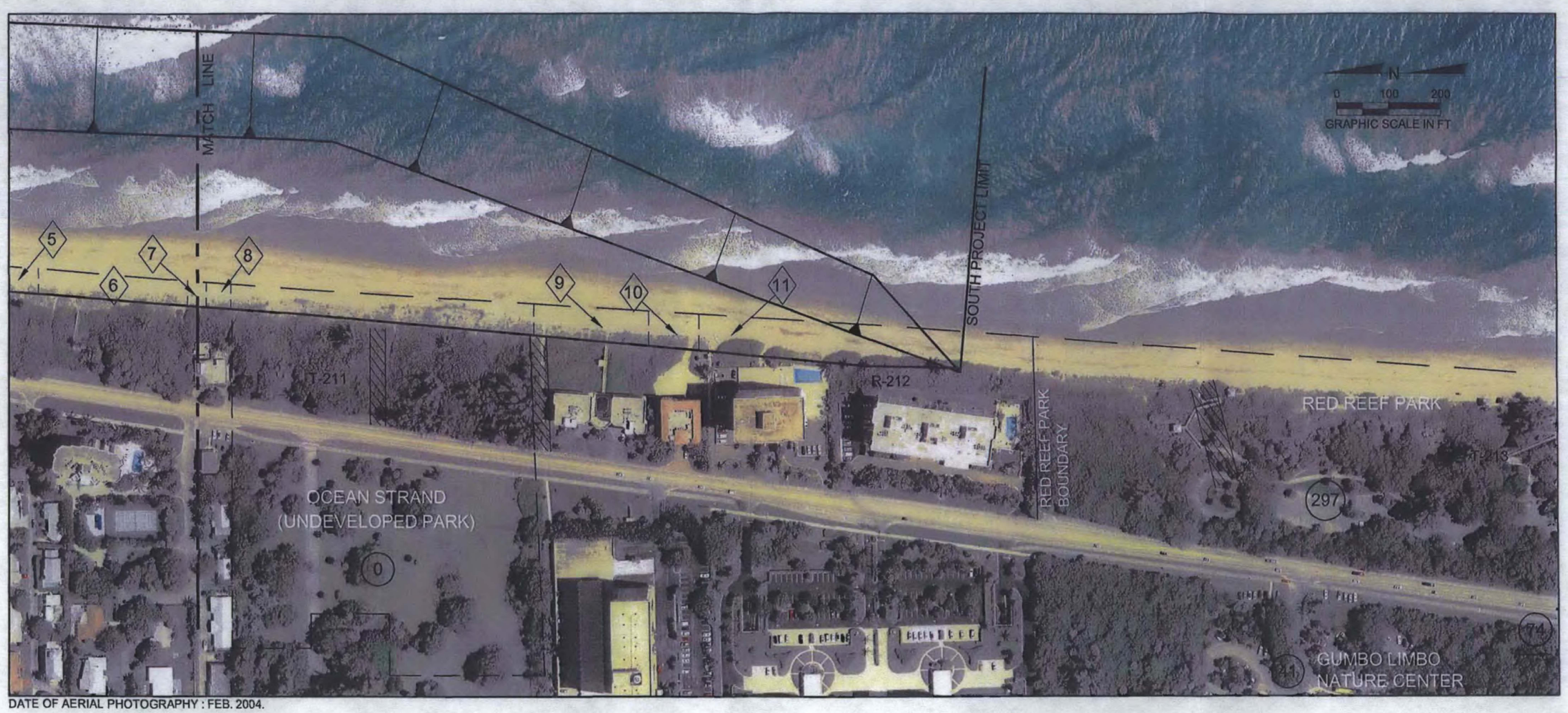

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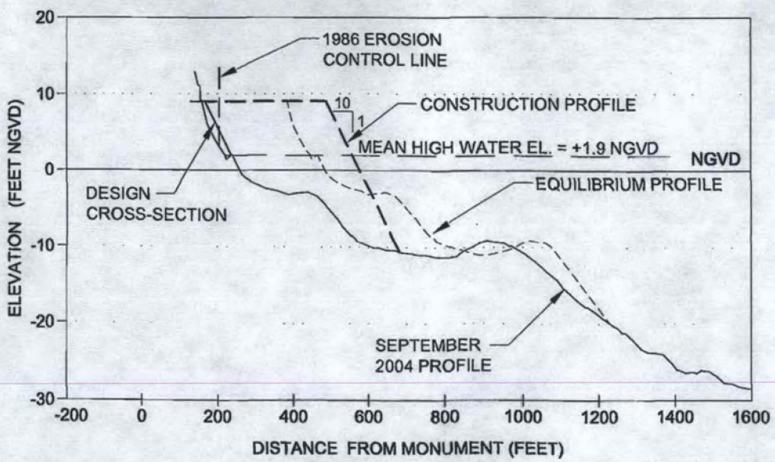

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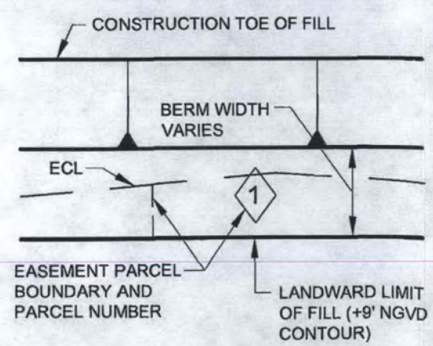
LEGEND :

- (22) NUMBER OF PARKING SPACES FOR PUBLIC USE
- ▲ PROFILE LINE MONUMENT
- PUBLIC BEACH ACCESS
- CONSTRUCTION ACCESS
- (1) BEACH STORM DAMAGE REDUCTION EASEMENT PARCEL & BOUNDARY



PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

DEPARTMENT OF THE ARMY

JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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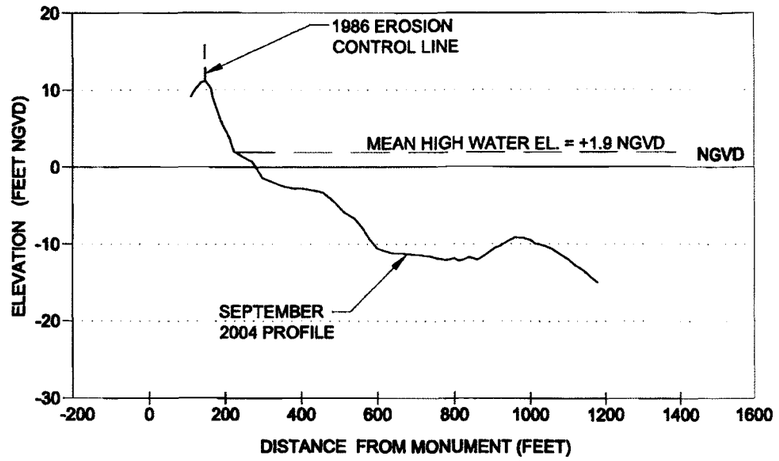

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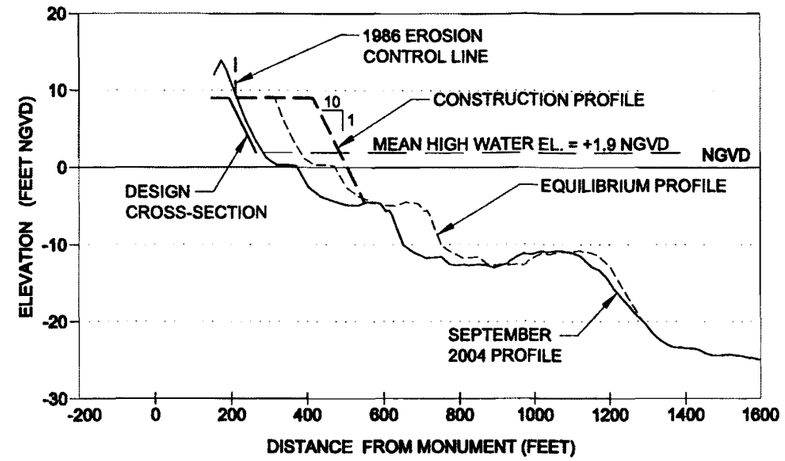

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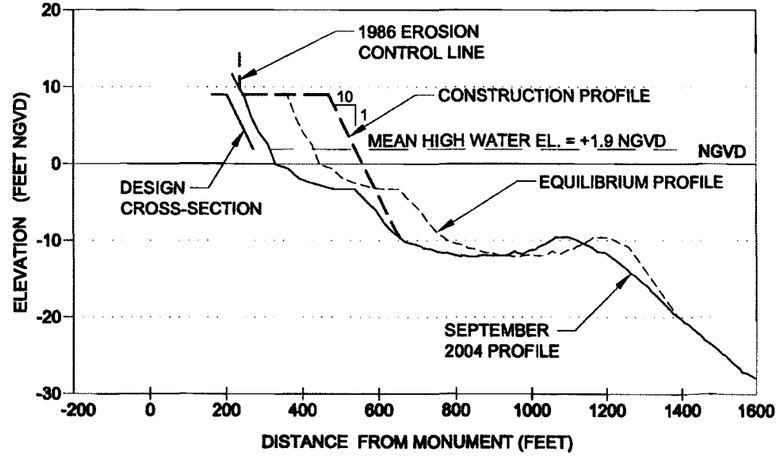

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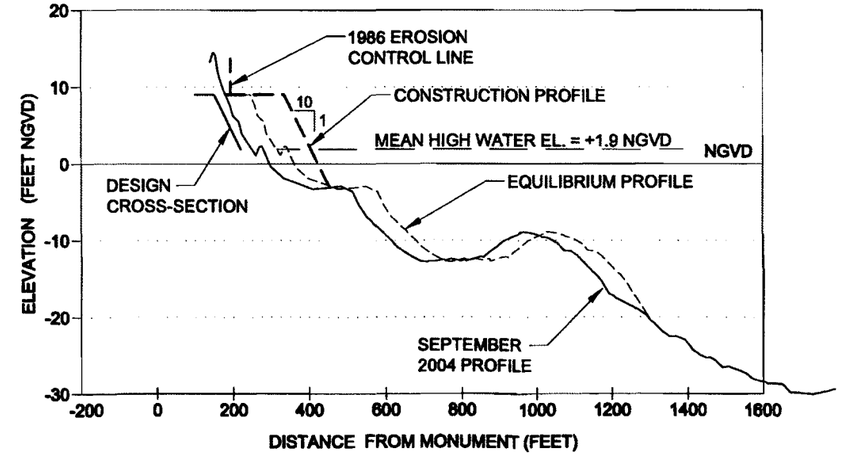

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PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

DEPARTMENT OF THE ARMY

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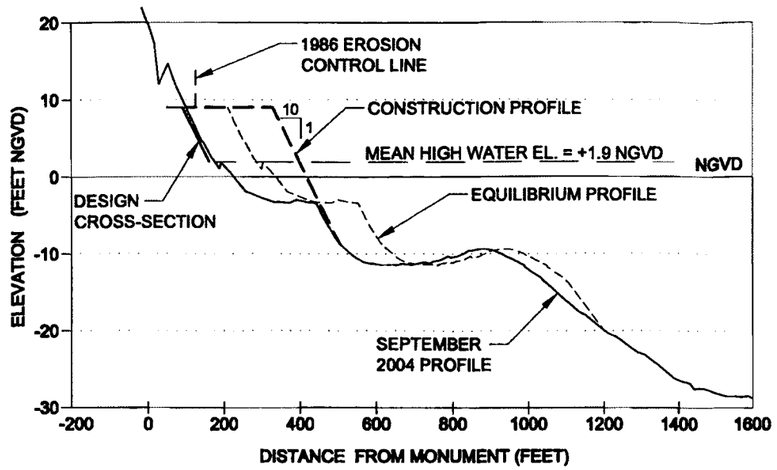

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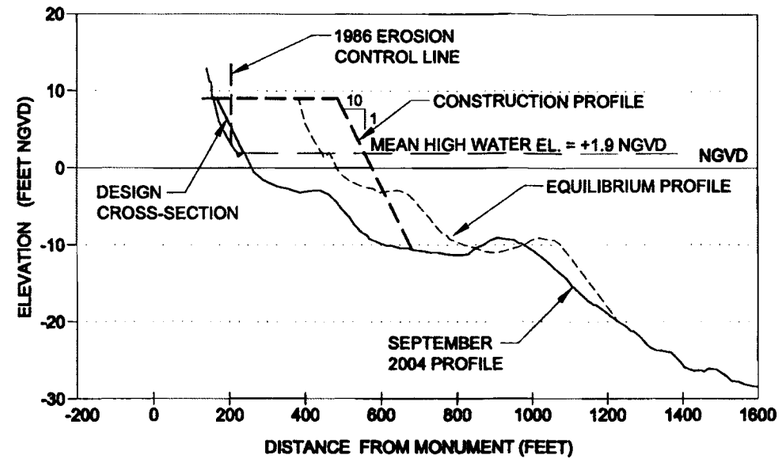

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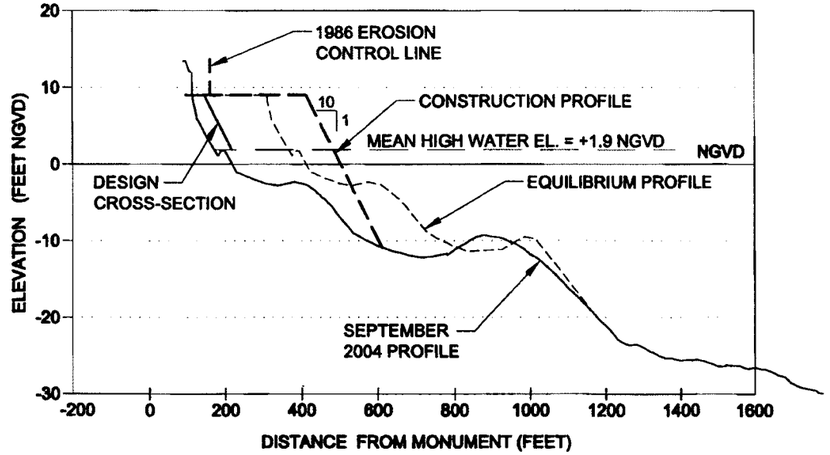

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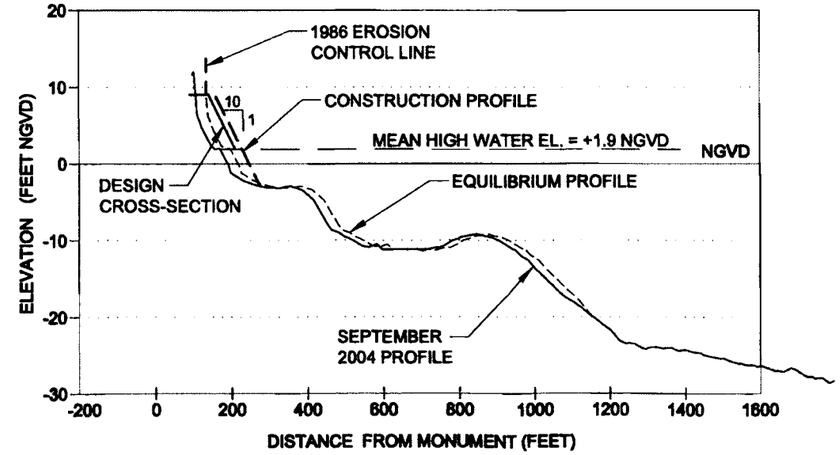

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NOTE:

ELEVATION SHOWN HEREON ARE IN FEET BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD).

PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

SCALES AS SHOWN

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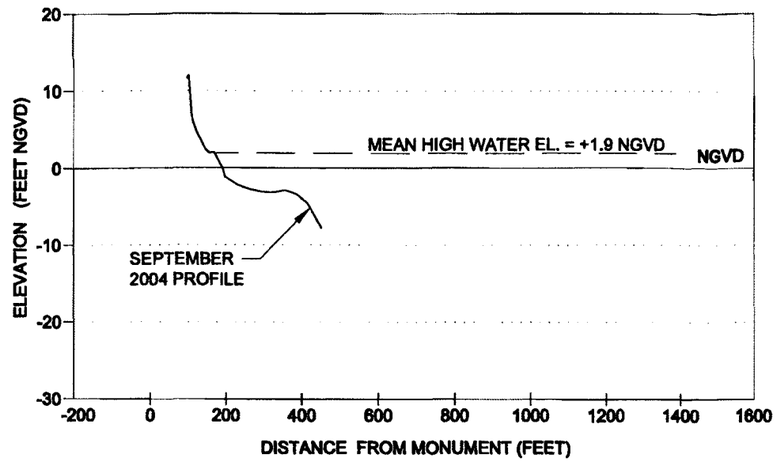

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NOTE:

ELEVATION SHOWN HEREON ARE IN FEET BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD).

PALM BEACH COUNTY FLORIDA

BEACH EROSION CONTROL PROJECT

SELECTED PLAN

BOCA RATON SEGMENT

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APPENDIX A

BOCA RATON SHORE PROTECTION PROJECT

ENGINEERING APPENDIX

APPENDIX A
BOCA RATON SHORE PROTECTION PROJECT
ENGINEERING APPENDIX

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APPENDIX A
ENGINEERING APPENDIX

INTRODUCTION

A-1. The Boca Raton renourishment project is located in southern Palm Beach County, along the southeastern coast of Florida (Figure A-1). The project is identified as the Boca Raton segment of the Palm Beach County Erosion Control Program, and as Reach 10 of the Palm Beach County Beach Erosion Control Projects General Design Memorandum (USACE, 1987). The initial nourishment project was completed in August 1988 with the placement of 1,070,800 cubic yards of beach material along 1.45 miles of beach. The first renourishment project was completed in April 1998 and placed 692,100 cubic yards of sand within the project area.

A-2. Available data and field studies suggest that the Atlantic shoreline in northern Boca Raton is actively eroding. The erosion history of the Boca Raton segment is documented in this appendix. This appendix also summarizes the natural forces and geomorphic changes that occur within the project area and uses them to analyze and quantify the erosion problem within the project area. The erosion and accretion patterns of the most recent nourishment project are updated to estimate the renourishment needs.

A-3. This appendix summarizes the engineering procedures used in the development of the second renourishment design and the project costs. The design cross-section, advanced nourishment volume, renourishment interval optimization, and equilibrium toe of fill are described in this appendix.

NATURAL FORCES

A-4. The natural forces that shape the southeast Florida coastline include wind, waves and tides. During storm conditions, these forces are amplified, posing a threat to the structures and properties that border the project area. Coastal currents and sea level rise further compound the erosion problem. The natural forces affecting the project area shoreline are described in the following paragraphs.

WINDS

A-5. Winds indirectly cause the littoral transport of sand by generating waves. Data related to the occurrences of wind speed and direction by month in the Boca Raton area are presented in Tables A-1 and A-2. Wind statistics for the project area are based on the Coastal and Hydraulics Laboratory (2004) hindcast for Wave Information Study (WIS) station 464. Winds affecting the project area are primarily from the northeast. These winds typically produce the largest waves due to a long, uninterrupted fetch and the duration of northeast winds. Winds from the east and southeast typically do not create large waves in the project area because of the limited fetch between southeast Florida and the Bahamas, and the limited duration of weather patterns from these directions.

A-6. Winds associated with tropical storms may also affect the shoreline. Due to the cyclonic nature of the winds associated with tropical storms and hurricanes, the winds can come from any direction. If the winds are in an onshore direction, a storm surge will be created and in conjunction with the higher waves will cause erosion of the beach.

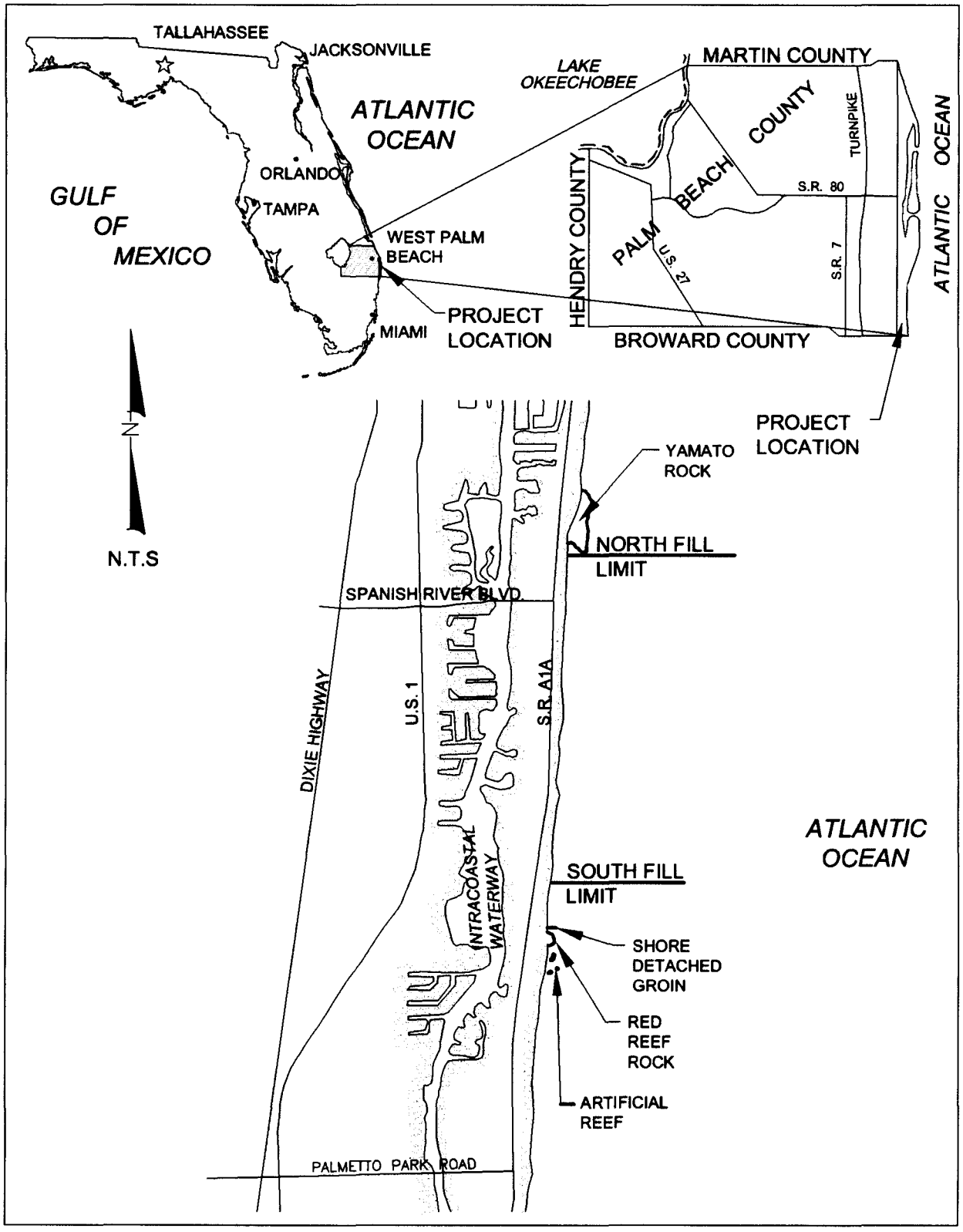

Figure A - 1. Location Map

Table A - 1
Hourly Occurrences of Wind Speed by Month from 1980 to 1999

Wind Speed (mph)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
0-5	189	159	241	426	524	852	608	1018	773	303	96	156	5345	3.05
5-10	2783	2621	2975	3845	5342	6864	7231	7607	6300	4267	1975	3003	54813	31.27
10-15	6051	5034	5631	5802	6453	5674	6522	5294	5628	5160	5951	5896	69096	39.41
15-20	3717	3628	3797	3501	2399	925	476	700	1238	3727	4234	3989	32331	18.44
20-25	1718	1697	1673	768	155	76	30	160	328	1198	1655	1546	11004	6.28
25-30	393	364	500	58	6	9	12	80	68	174	315	261	2240	1.28
30-35	28	57	44	0	0	0	0	14	35	23	123	20	344	0.20
35-40	0	0	10	0	0	0	0	6	19	9	41	4	89	0.05
40-45	0	0	8	0	0	0	0	0	11	7	10	0	36	0.02
45-50	0	0	0	0	0	0	0	0	0	6	0	0	6	0.00
> 50	0	0	0	0	0	0	0	0	0	5	0	0	5	0.00
Total	14879	13560	14879	14400	14879	14400	14879	14879	14400	14879	14400	14875	175309	100.00

Table A - 2
Hourly Occurrences of Wind Direction by Month from 1980 to 1999

Wind Direction (deg) Dir. Band and Center	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
337.5 - 22.5 (0)	2212	1688	1456	1102	618	227	179	322	602	1802	1987	2182	14377	8.20
22.5 - 67.5 (45)	2266	1961	2098	1896	1886	1152	445	863	2737	4869	4167	3105	27445	15.66
67.5 – 112.5 (90)	3117	2914	3189	3970	5631	4098	5337	5434	5676	4333	4061	4001	51761	29.53
112.5 – 157.5 (135)	2085	2078	2783	2892	3340	4014	4948	4237	2556	1573	1506	1575	33587	19.16
157.5 – 202.5 (180)	1261	1327	1736	1371	1454	2998	2185	2108	1310	623	641	844	17858	10.19
202.5 – 247.5 (225)	735	858	1098	929	880	1304	1190	1130	707	516	453	448	10248	5.85
247.5 – 292.5 (270)	974	1140	1070	1035	572	434	434	441	438	421	480	834	8273	4.72
292.5 – 337.5 (315)	2229	1594	1449	1205	498	173	161	344	374	742	1105	1886	11760	6.71
Total	14879	13560	14879	14400	14879	14400	14879	14879	14400	14879	14400	14875	175309	100.00

WAVES

A-7. One of the principal causes of beach erosion is waves breaking on the beach and washing sand into the ocean. Waves also cause littoral movement in the longshore direction, and the onshore-offshore direction. Due to the general north-south orientation of the project shoreline, waves from the east cause little longshore movement of sand. In contrast, waves from the north and northeast cause a net movement of sand to the south, whereas, waves from the south and southeast cause a net movement of sand to the north.

A-8. One important factor which contributes to the wave climate observed within the project area is the presence of the Bahama Banks. This geological formation limits the fetch for eastern, southeastern and some northeastern waves. Figure A-2 shows the effect the Bahama Banks has on the average wave height distribution patterns, and specifically waves arriving from the southeast. Since most waves affecting the project area are from the northeast, the annual net movement of sand is to the south, however a seasonal reversal in the direction of littoral transport does occur (south in the winter, north in the summer).

A-9. The distribution of wave heights and directions for the project area are provided in Figure A-2. This data is based on wave data from the USACE (2004) Wave Information Study station 464 located at 26.33°N, 79.92°W. This is approximately 10 miles east-southeast of the southern project limit or 9.5 miles due east of Boca Raton Inlet. The wave hindcast data covers a 20-year hindcast period from 1980 to 1999. In Boca Raton, the average onshore (005° to 185°) wave height is 3.1 feet, with a period of 4.8 seconds. These waves typically come from the east-northeast (068°). Monthly and annual wave statistics are provided in Tables A-3 through A-5. Figure A-2 gives a plot of these wave statistics. The highest wave hindcasted near the project area was approximately 24 feet.

A-10. Extreme wave statistics for the project area are based on data of tropical storm events prior to 1980 (Dean, 1992), and the 1980-1999 wave hindcast for WIS Station 464 (USACE, 2004), which includes the effects of tropical and extratropical storms. Table A-6 shows the expected return period frequency of the wave period and wave height. A Weibull distribution was used to estimate the return frequencies.

Table A - 3
Monthly Onshore Wave Height at WIS Station 464

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1980	3.6	4.6	3.6	2.6	2.6	2.3	1.6	2.0	2.3	2.6	4.3	4.6	3.1
1981	3.6	4.9	3.9	3.3	2.6	2.3	1.6	3.0	2.6	3.9	4.3	3.6	3.3
1982	3.6	3.6	3.3	3.0	3.3	2.3	2.0	1.6	2.3	3.9	4.6	4.9	3.2
1983	3.3	4.6	3.6	3.3	3.0	2.0	2.0	2.0	3.3	3.3	3.3	3.9	3.1
1984	5.2	3.6	3.3	2.6	3.3	2.6	2.3	1.6	3.9	4.9	4.9	3.6	3.5
1985	3.9	3.9	3.3	3.3	2.0	1.6	1.6	2.6	3.9	3.3	4.3	3.6	3.1
1986	3.9	3.0	4.3	3.0	3.3	2.0	1.6	2.3	2.3	3.3	3.3	3.9	3.0
1987	3.9	3.6	4.9	2.6	3.3	2.0	1.6	1.6	1.3	5.6	5.2	3.6	3.3
1988	4.9	3.9	3.6	2.6	2.6	2.3	2.0	2.0	2.6	3.9	3.9	3.6	3.2
1989	3.6	3.6	3.6	3.0	2.0	2.0	1.6	1.6	2.3	3.6	3.0	3.9	2.8
1990	3.0	3.9	3.6	3.0	2.3	1.6	1.6	1.0	2.0	3.3	3.3	3.6	2.7
1991	2.6	3.3	3.3	2.6	2.6	2.0	1.0	1.3	2.0	3.6	3.6	3.6	2.6
1992	3.0	3.3	3.3	3.9	3.0	1.6	2.0	2.0	2.6	3.9	4.6	3.9	3.1
1993	4.6	4.3	3.9	3.6	3.0	2.0	1.3	2.0	2.3	3.0	4.3	3.9	3.2
1994	4.9	3.9	3.3	3.3	2.6	1.6	2.0	2.0	2.6	3.3	5.2	4.3	3.3
1995	3.6	3.3	4.3	3.0	2.3	2.3	2.0	3.0	2.6	3.9	3.9	3.6	3.1
1996	3.9	3.0	5.6	3.3	2.6	2.3	2.6	2.0	2.6	4.3	6.2	3.9	3.5
1997	3.3	3.9	3.6	4.3	2.6	2.3	1.3	1.3	2.3	3.6	3.6	2.6	2.9
1998	3.9	4.3	4.6	3.6	2.3	1.6	1.6	2.3	3.3	3.6	3.0	3.3	3.1
1999	3.9	3.9	3.3	2.6	3.0	2.6	1.6	2.3	4.3	4.6	5.2	3.6	3.4
Monthly Average	3.8	3.8	3.8	3.1	2.7	2.1	1.8	2.0	2.7	3.8	4.2	3.8	3.1

Table A - 4
Monthly Onshore Wave Period at WIS Station 464

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1980	5.3	5.5	5.1	4.6	4.4	4.1	4.0	4.4	3.8	5.0	5.4	5.9	4.8
1981	5.2	5.4	5.2	4.9	4.5	4.1	3.6	4.3	5.8	5.2	6.0	4.5	4.9
1982	4.7	5.0	4.5	4.4	4.3	5.0	3.7	3.8	4.1	5.4	5.1	5.1	4.6
1983	5.2	5.9	5.6	4.6	4.1	3.8	3.6	3.8	4.3	5.2	4.2	5.3	4.6
1984	5.7	4.5	4.5	4.7	4.2	3.9	3.8	3.6	5.5	6.5	5.5	4.4	4.7
1985	5.0	4.7	4.9	4.5	4.2	4.2	4.1	4.2	5.3	4.8	5.3	4.4	4.6
1986	4.8	4.9	5.2	5.2	4.4	3.7	3.7	4.0	4.0	4.8	4.9	5.1	4.6
1987	5.2	5.3	5.2	5.0	4.7	3.5	3.9	3.9	5.2	6.1	5.3	4.7	4.8
1988	5.7	4.6	4.4	5.8	4.7	4.3	3.9	3.7	4.1	5.0	4.7	4.9	4.7
1989	5.0	4.8	5.2	4.6	3.8	3.9	3.9	4.0	4.4	5.1	4.3	6.3	4.6
1990	4.3	5.2	4.9	5.0	4.5	4.1	4.1	4.9	5.0	4.9	4.8	5.0	4.7
1991	4.2	5.1	5.0	5.0	3.9	6.3	3.7	4.3	4.6	5.4	6.3	5.1	4.9
1992	4.9	5.0	5.1	5.2	5.3	3.5	4.1	3.9	4.8	5.9	5.5	5.6	4.9
1993	5.6	5.3	5.8	5.2	4.7	4.2	3.9	4.5	4.2	6.1	5.5	5.0	5.0
1994	5.0	5.1	4.8	4.4	4.6	3.8	3.5	3.7	4.1	5.7	6.0	6.0	4.7
1995	4.4	4.5	5.3	4.2	6.3	4.6	4.6	6.0	4.8	5.0	4.5	4.7	4.9
1996	4.8	5.6	6.3	4.4	4.6	4.4	4.2	3.7	5.2	5.3	6.3	4.7	5.0
1997	4.7	5.0	5.2	5.0	4.7	4.4	3.7	3.6	4.1	5.1	5.1	5.1	4.6
1998	5.0	5.0	5.0	4.7	3.9	4.1	3.8	4.4	5.4	4.7	4.8	4.4	4.6
1999	4.8	4.9	4.5	4.3	4.7	4.0	3.6	4.6	6.7	5.2	5.1	5.1	4.8
Monthly Average	5.0	5.1	5.1	4.8	4.5	4.2	3.9	4.2	4.8	5.3	5.2	5.1	4.8

Table A - 5
Monthly Onshore Wave Direction at WIS Station 464

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1980	39.2	27.6	81.7	76.3	81.5	72.7	102.4	73.9	71.3	45.0	52.8	33.2	63.1
1981	19.9	50.6	41.0	77.7	83.3	99.3	116.1	101.0	52.3	41.9	40.0	46.9	64.2
1982	56.5	70.0	73.1	78.0	90.3	108.0	101.2	88.1	52.4	40.1	53.3	75.4	73.9
1983	36.4	71.0	97.2	85.2	95.8	74.9	89.7	93.5	80.1	51.7	57.2	59.4	74.3
1984	39.9	68.1	61.0	83.8	96.8	90.6	106.8	91.3	54.6	47.9	42.1	64.3	70.6
1985	32.5	63.4	59.0	79.4	75.1	100.3	98.3	96.6	54.4	70.9	75.6	41.6	70.6
1986	44.4	64.5	72.6	36.6	80.7	90.8	119.9	95.0	68.1	63.7	63.1	42.6	70.2
1987	63.0	45.5	80.2	36.1	69.1	104.0	87.5	78.1	63.2	31.2	70.1	66.3	66.2
1988	48.8	48.9	79.2	52.2	65.6	72.3	91.5	101.7	76.3	38.3	68.9	47.6	65.9
1989	62.4	63.4	70.5	60.7	86.8	109.0	91.5	69.3	56.9	31.1	51.9	36.2	65.8
1990	70.0	78.3	63.0	57.3	86.7	72.5	73.2	62.0	42.8	53.8	47.4	57.5	63.7
1991	47.6	50.8	75.0	79.7	98.9	62.6	96.4	84.0	49.2	42.9	47.3	45.2	65.0
1992	38.4	70.4	59.1	60.0	50.1	111.5	95.6	98.1	56.3	41.2	65.1	31.4	64.8
1993	73.6	42.6	59.5	55.4	78.0	89.9	87.5	67.2	73.0	39.2	41.6	31.3	61.6
1994	78.9	60.7	51.6	86.9	54.9	108.5	120.7	96.5	81.0	39.8	56.5	38.6	72.9
1995	43.1	40.8	56.7	76.2	59.6	94.8	74.0	70.1	45.8	77.9	44.6	49.6	61.1
1996	46.7	50.0	70.6	81.1	72.9	80.3	101.1	95.2	66.1	56.8	49.4	50.0	68.4
1997	67.1	71.8	70.9	79.1	70.0	76.6	101.8	87.6	87.5	57.2	49.5	53.9	72.8
1998	68.2	79.1	90.0	98.8	104.5	93.8	110.4	63.2	99.5	59.2	65.6	58.2	82.5
1999	71.5	41.2	38.4	69.9	61.5	70.1	91.7	89.8	52.7	57.8	44.9	48.7	61.5
Monthly Average	52.4	57.9	67.5	70.5	78.1	89.1	97.9	85.1	64.2	49.4	54.3	48.9	67.9

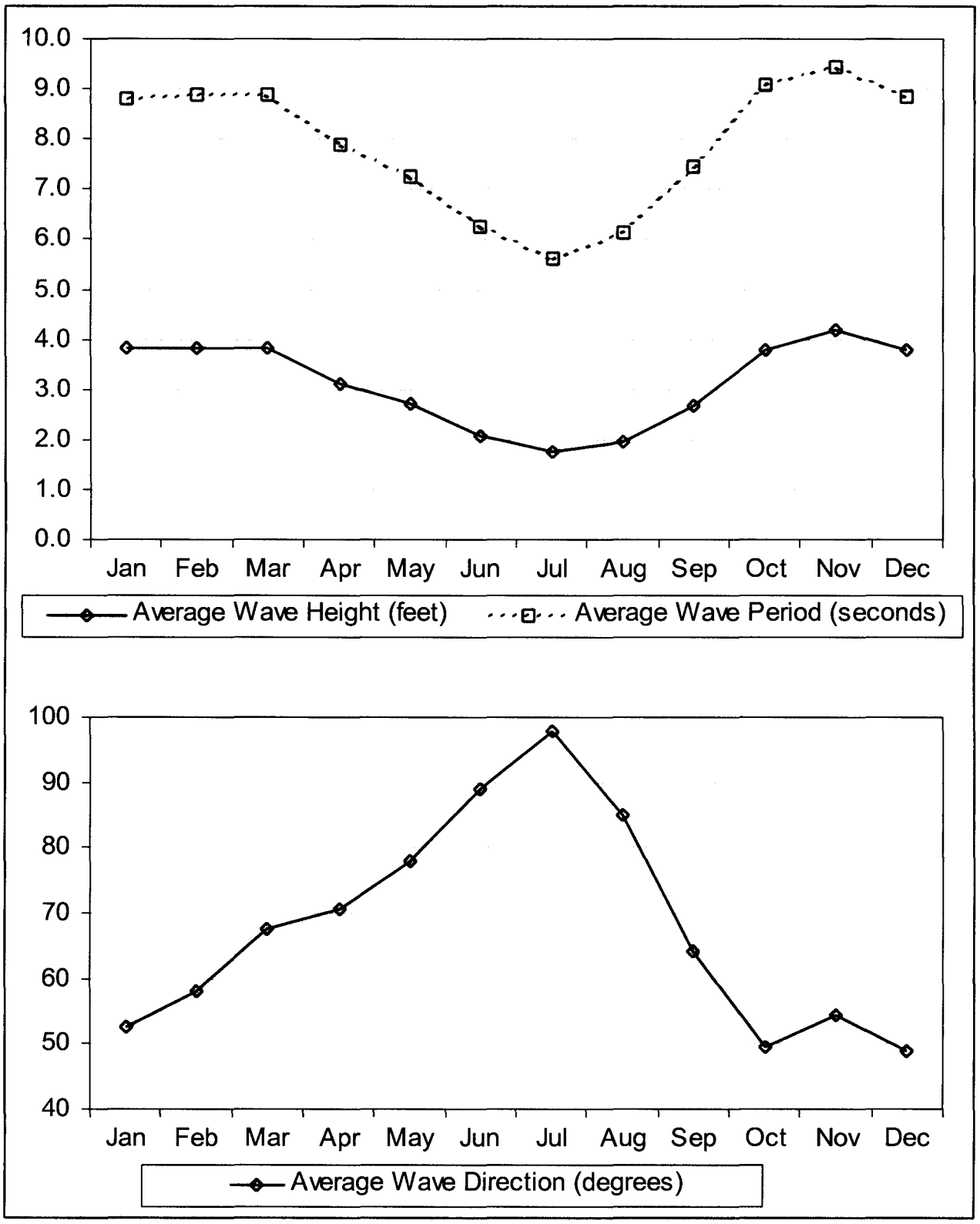

Figure A - 2. Seasonal Wave Statistics – WIS Station 464

Table A - 6
Extremal Wave Statistics and Water Levels

Return Period	Wave Height H_{mo} (feet)		Wave Period T_p (seconds)		FEMA (1984) Stage
(years)	Mean	+/- σ	Mean	+/- σ	(feet, NGVD)
2	10.6	1.1	8.3	0.3	2.7
5	19.9	1.4	10.1	0.4	3.8
10	25.2	2.0	11.4	0.6	4.6
20	29.8	2.6	12.7	0.9	5.4
25	31.1	2.8	13.2	1.0	5.7
50	35.0	3.3	14.5	1.3	6.5
100	38.6	3.8	15.8	1.6	7.3
200	41.9	4.3	17.2	1.9	8.1
500	46.0	4.8	19.0	2.3	8.7

TIDES

A-11. The mean high water line along Boca Raton's Atlantic coastline is at +1.93 feet, referenced to National Geodetic Vertical Datum (NGVD) (Thompson, 1994). The mean tidal range is 2.7 feet (Thompson, 1994). Mean Tide Level (MTL) is +0.65 feet, NGVD.

A-12. The highest water levels experienced within the project area occur in association with storms, as a combination of wind setup, barometric pressure setup and normal astronomical tidal peaks. Wave induced setup also increases the mean water level at the beach. The highest elevation of the sea surface ever measured in Palm Beach County (+11.2 feet) occurred during the hurricane of September 6 - 20, 1928 (USACE, 1987).

CURRENTS

A-13. Dominant currents within the study area include the Florida Current (Gulf Stream) and wave induced longshore currents. The Florida Current flows north approximately 1 mile offshore and is parallel to the Palm Beach County shoreline. The Florida Current has an average speed of 1 foot/second, and a maximum measured speed of 8.2 feet/second (USACE, 1987). The Florida current has no significant effect on the project area, due to the distance between the landward edge of the current and shore. The current may indirectly influence nearshore processes by its affect on wave refraction.

A-14. Longshore currents are caused by breaking waves impacting the shore at an angle. Longshore currents near the project area are generally less than 1 foot/second, with a maximum estimated speed of 7.5 feet/second at the Lake Worth Pier, 20 miles north of Boca Raton (USACE, 1987).

SEA LEVEL RISE

A-15. The global sea level has both risen and fallen throughout geological history. Recent trends in local sea level changes can be used as indicators of what will occur in the near future. Experience indicates that as the relative sea level rises, the shoreline will be subjected to increased flooding, shoreline recession, and profile erosion. The National Ocean Service (NOS) has published sea level trends for regions along the United States coasts based on measured yearly mean sea level records. Using this data, Hicks and Hickman (1988) calculated that the mean sea level along the southeastern coast of Florida rose at a rate of 0.0076 feet per year between 1932 and 1986. This was based on data collected at a tide gage at Miami Beach, Florida.

A-16. Bruun (1962) proposed a formula for estimating the rate of shoreline recession based on the local rate of relative sea level rise. This methodology also includes consideration of local topography and bathymetry. Bruun's approach assumes that with a rise in sea level, the beach profile will attempt to reestablish the same bottom depths relative to the previous sea level. As a result, the beach profile shape relative to the mean water level will re-establish itself. If the longshore littoral transport in and out of a given shoreline area is equal, the quantity of material required to re-establish the nearshore slope must be derived from shoreline recession. The effects of sea level rise on the shoreline recession can be approximated using Bruun's (1962) relationship:

$$R = LS / (h+b) \qquad \text{[Equation A-1]}$$

where R = shoreline recession,
S = sea level rise,
b = berm height,
h = depth of the limit of the active profile,
L = horizontal distance from the beach to the limit of the active profile.

A-17. The annual limit of the depth of the active profile, h, has been estimated by comparing cross-shore beach profiles collected since the last nourishment in 1998. The profiles closed at an average depth of –20 feet, NGVD. Review of the post-hurricane surveys (Frances and Jeanne) also suggested that -20 feet, NGVD is a good estimate of the depth of the active profile.

A-18. A second method of estimating the depth of closure is using Hallermeier's method (1978).

$$d_c = 2.28\ H_e - 68.5\ (H_e^2/gT_e^2) \qquad \text{[Equation A-2]}$$

where
d_c = depth of closure,
H_e = wave height exceeded 12 hours per year
T_e = wave period corresponding to H_e
g = acceleration of gravity constant (32.2 feet/sec^2)

The Wave Information Study (USACE, 2004) indicates that the wave height exceeded 12 hours per year is approximately 13.5 feet in height and has a period of 9.7 seconds. The depth of closure using equation A-2 suggests that the depth of active profile movement within the project area is -27 feet, NGVD.

A-19. The estimate of shoreline recession due to relative sea level rise used –20 feet, NGVD as the depth of closure. The distance, L, from the mean high water line to the depth of closure is estimated to be 1,000 feet (an average value was calculated from surveys collected along FDEP survey monuments R-204 through R-212). Using a berm height, B, of 9 feet and a sea level rise rate of 0.0076 feet/year, the shoreline recession is calculated to be only 0.25 feet/year using Bruun's rule.

A-20. Nevertheless, the National Research Council (1987) has estimated that sea level rise may accelerate in the future to a rate of approximately 0.04 feet/year. For this extreme rate of sea level rise, Equation A-1 yields a recession rate of 1.3 feet/year. If the sea level rise increases to this higher rate, an increase in the volume of advanced nourishment would be required. However, until a higher rate of sea level rise is documented, no change in the recommended plan is warranted.

TROPICAL STORMS

A-21. Surges and waves caused by extratropical and tropical storms (including hurricanes) are major threats to the shoreline of Palm Beach County. The hurricane season extends from June 1 through November 30. Palm Beach County has averaged 1.0 land-falling tropical storm per 10 nautical miles of shoreline from 1871 to 1973 (USACE, 1987). Table A-7 gives a summary of historical tropical storms affecting Boca Raton. Storm events prior to 1980 are based on data from Dean (1992). Storm events between 1980 and 1999 are based on WIS data (USACE, 2004). Storm events after 1999 were calculated from pressure, forward velocity, radius to maximum winds, and distance to project location.

Table A - 7
Summary of Largest Tropical Storms Affecting Boca Raton since 1903

Date	Name	Deep Water Wave Height (feet)	Wave Period (sec)	Storm Surge (feet)	Wind Speed (mph)
9/11/1903	Hurricane #3	31.3	11.9	5.4	98
6/14/1906	Hurricane #2	16.1	8.6	3.3	81
10/11/1906	Hurricane #8	19.9	9.5	3.7	121
10/6/1909	Hurricane #9	12.8	7.9	2.9	98
7/27/1926	Hurricane #1	23.3	10.2	4.1	109
9/18/1926	Hurricane #6	33.1	12.3	6.4	138
10/21/1926	Hurricane #10	16.5	8.9	3.4	109
8/7/1928	Hurricane #1	19.3	9.3	3.6	98
9/17/1928	Hurricane #4	39.7	13.4	7.3	150
9/28/1929	Hurricane #2	30.4	11.7	5.2	104
9/4/1933	Hurricane #12	25.1	10.6	4.6	132
11/4/1935	Hurricane #6	23.2	10.3	4.0	75
10/6/1941	Hurricane #5	26.7	11.1	4.8	121
9/16/1945	Hurricane #9	25.9	10.8	4.7	132
9/17/1947	Hurricane #4	32.1	12.0	6.0	161
10/6/1948	Hurricane #8	10.6	7.2	2.9	104
8/26/1949	Hurricane #2	31.8	12.0	5.6	150
10/18/1950	King	23.3	10.3	4.2	104
8/27/1964	Cleo	22.1	10.0	3.9	104
10/15/1964	Isbell	11.7	7.5	2.9	127
9/8/1965	Betsy	29.7	11.6	5.0	127
9/3/1979	David	22.3	10.1	3.9	92
09/27/84	Isidore	24.3	12.5	4.4	43
11/19/85	Kate	17.1	11.1	3.5	35
11/23/88	Keith	13.8	9.1	3.0	33
08/24/92	Andrew	18.0	10.0	3.5	39
11/14/94	Gordon	23.3	12.5	4.2	41
08/02/95	Erin	15.1	10.0	3.2	34
09/25/98	Georges	14.8	9.1	3.1	34
11/05/98	Mitch	15.4	10.0	3.2	41
09/15/99	Floyd	24.3	12.5	4.4	42
10/15/99	Irene	21.7	10.0	3.8	56
09/05/04	Frances	33.9	9.9	4.7	104
09/26/04	Jeanne	32.0	10.9	4.3	115

Notes:
1. Storm Surges were determined based on the return period of the wave height and the FEMA (1984) storm surge frequency curve.
2. Storm surges do not include wave setup.

NORTHEASTER STORMS

A-22. Extratropical storms that generate waves out of the northeast have a significant effect on the county's shoreline. These storms are characterized by strong winds of long duration (several days) that generate swell waves. Northeaster storms typically cause more beach erosion along the coast of Boca Raton than any other event. One example of this was the northeast storm of November 1996. This storm resulted in shoreline recession of up to 22 feet (CPE, 1998). Other severe northeasters which recently affected the project area are shown in Table A-8.

Table A - 8
Summary of Largest Extratropical Storms Affecting Boca Raton since 1980

Date	Deep Water Wave Height (feet)	Wave Period (sec)	Storm Surge (feet)	Wind Speed (mph)
10/25/1982	14.0	14.3	2.9	17
1/6/1987	19.0	12.5	4.5	28
10/13/1987	15.1	9.1	3.3	33
3/11/1989	14.1	12.5	3.2	29
3/13/1993	15.7	10.0	3.8	42
12/21/1994	15.7	12.5	3.8	38
3/12/1996	21.3	16.7	5.3	31
11/15/1996	17.1	11.1	4.1	35
2/3/1998	14.1	9.1	3.2	32
11/13/1999	13.5	9.1	2.8	36

Notes:
1. Storm Surges were determined based on the return period of the wave height and the FEMA (1984) storm surge frequency curve.
2. Storm surges do not include wave setup.

STORM SURGE

A-23. Storm surge is defined as the rise of the ocean surface above its astronomical tidal level due to storm forces. The increased water elevation is attributable to a variety of factors, which include waves, wind shear stress, and atmospheric pressure. An estimate of these water levels is essential to the design of the berm elevation of a beach fill area. High water levels increase the potential for recession, long-term erosion, and overwash due to severe waves. It is possible to classify and predict storm surge elevations for various storms through the use of historical information and theoretical models. The Federal Emergency Management Agency (FEMA) has performed investigations to determine 10 to 100 year return period storm surge elevations in Palm Beach County (FEMA, 1984). The surge elevations are shown in Table A-6. The methodology used in this study was developed by the National Academy of Sciences. Assumptions made in the analysis include: 1) breaking wave heights are limited to 78% of the local still water depth, 2) the wave crest constitutes 70% of the wave height, and 3) waves are dissipated by features such as sand dunes, dikes and seawalls, buildings, and vegetation.

Regeneration of wave heights over areas of large fetch was also considered. Storm surge elevations for the modeled wave cases are shown in Tables A-7 and A-8.

STORM RECESSION

A-24. Storm induced beach profile recession, or storm recession as it is commonly called, is a direct result of the storm surge and wave action. For the purpose of this report, storm recession is defined as the horizontal distance from the pre-storm mean high water shoreline to the furthest landward point where the storm has caused a lowering of the profile by 0.5 feet or more. This envelope is considered appropriate for evaluating the areas in which structural damage can be expected from the storm.

A-25. Storm recession was estimated using the Storm Induced Beach Change model (SBEACH, Larson and Kraus, 1989). SBEACH simulates beach profile changes which result from varying storm waves and water levels. These beach profile changes include the formation and movement of major morphological features such as longshore bars, troughs, and berms. SBEACH is a two-dimensional model that considers only cross shore sediment transport; that is, the model assumes that simulated profile changes are produced only by cross shore processes. Longshore wave, current, and sediment transport processes are not included. SBEACH is an empirically-based numerical model, which was formulated using both field data and the results of large-scale physical model tests. As input to the model, SBEACH requires the beach profile, the median sediment grain size on the beach, a number of calibration parameters, and the time histories of the wave height, wave period, and offshore water surface elevation. Optional inputs to the model include the wind speed, wind direction, and wave direction.

A-26. SBEACH calculates the cross shore variation in wave height and wave- and wind-induced setup at discrete points along the profile from the seaward boundary to the shoreline. To define the landward boundary of profile change, the model calculates the limit of wave runup. Profile changes are calculated at each model time step by solving for conservation of mass using an explicit finite-difference scheme.

A-27. The following basic assumptions underlie the SBEACH model:

(1) Breaking waves and variations in water level are the major causes of sand transport and profile change.
(2) Cross-shore sand transport takes place primarily in the surf zone.
(3) Conservation of mass dictates that the amount of material eroded must equal the amount deposited.
(4) Median sediment grain diameter on the profile is reasonably uniform across shore.
(5) Influence of structures blocking longshore transport is small, and the shoreline is straight (i.e., longshore effects are negligible during the term of simulation).
(6) Linear wave theory is applicable everywhere along the profile without shallow-water wave approximations.

A-28. SBEACH has significant capabilities that make it useful for quantitative studies of beach profile response to storms. The model allows for variable cross shore grid spacing, wave refraction by specifying wave direction, randomization of input waves to better represent forcing conditions in the field, and water level setup due to input wind parameters. Output data consists of a final profile at the end of the simulation, simulated profiles at intermediate time steps, intermediate and maximum wave heights, intermediate and maximum water elevations that include wind- and wave- setup, volume change, and a record of various coastal processes that may occur during the simulation such as accretion, erosion, overwash, boundary-limited runup, or inundation.

A-29. The storm recession analysis utilizes the June 1988 beach profile. Profile line R-208 is used as the input profile, as it is located in the center of the project area and is representative of other profiles. The average grain size within the North Boca project area has varied from 0.29 mm in 1997 (pre-renourishment project) to 0.25 mm in 1998 (post-renourishment project) (CPE, 2000). A mean grain size of 0.26 mm was observed in the 1999 monitoring study (CPE, 2000) and is used in the SBEACH modeling.

Wave Data

A-30. To estimate the storm recession expected to occur along the project area, simulations of 32 tropical storms and hurricanes impacting Palm Beach County between 1903 and 1999 were conducted using the SBEACH model. The characteristics of these storms appear in Table A-7. Model simulations of the 10 largest extratropical storms occurring between 1980 and 1999 (based on the WIS record) were also conducted. The characteristics of the extratropical events appear in Table A-8.

A-31. Hourly wave data for tropical and extratropical storm events after 1980 were extracted from the WIS database (USACE, 2004) for Station 464. Wave data for tropical storm events prior to 1980 were calculated using the Coastal Engineering Manual (USACE, 2001) method and data from Dean et al (1992). Wave data was calculated using the wind speed, radius to maximum winds, central pressure, system forward speed. The duration of all storms was taken as 36 hours, with the peak wave height occurring at hour 18.

Water Level Data

A-32. The 100-year frequency combined total storm tide hydrograph for Profile Four (Range 186 – 227) from the Palm Beach County Storm Surge Model Study (Dean et al, 1992) was used to develop a unit water level hydrograph. Tidal fluctuations were removed from the water level hydrograph to obtain the increase in water level due only to the passage of the storm event, by assuming that high tide coincided with the peak storm surge.

A-33. The peak storm stage for each storm event was determined by comparing the wave height return period to the FEMA (1984) storm stage frequency curve. To account for uncertainties in the water level hindcasts, four scenarios regarding the timing of the peak stage were considered:

Peak flood (phase = 0°)
High tide (phase = 90°)
Peak ebb (phase = 180°)
Low tide (phase = 270°)

The water level hydrograph without tidal fluctuation was scaled so that the peak storm stage corresponded to the return frequency storm stage at mean tide level.

Calibration and Verification of SBEACH Model

A-34. Calibration of the North Boca Raton SBEACH model was performed through simulations of the November 22-25, 1984 Thanksgiving Day Storm and was verified based on simulations of the December 22-25, 1971 storm. The Thanksgiving Day storm resulted in a 25-foot recession of the dry beach (CPE, 1985). The 1971 storm caused a 22-foot recession along the Boca Raton shoreline (DeWall, 1977) and volume losses from the dry beach were as high as 8 c.y./foot.

A-35. In addition to the beach sediment, beach profile, wave, and water level data discussed previously, the SBEACH model required a number of calibration parameters:

1. Surf zone depth (feet)
2. Avalanche slope (angle of repose)
3. Transport rate coefficient, K (m^4/N)
4. Slope dependent coefficient, ε (m^2/s)
5. Transport rate decay coefficient, λ (m^{-1}).

A-36. To calibrate the model, several simulations of the 1984 storm were conducted. Due to a lack of available survey data, the calibration and verification model runs were simulated using February 2004 survey data at R-208. The surf zone depth and avalanche slope were set to typical engineering values, 1 foot and 30 degrees, respectively (Larson and Kraus, 1989; Das, 1990). The transport coefficient, slope dependent coefficient and transport rate decay coefficient were varied to determine the values that would most accurately predict the observed shoreline recession. The most accurate prediction of the observed shoreline recession, 25 feet, was obtained by setting the transport coefficient to 5.0×10^{-7} m^4/N, the slope dependent coefficient to 0.002 m^2/s, and the transport rate decay coefficient to $0.5m^{-1}$ (Table A-9).

Table A - 9
SBEACH Calibration and Verification Summary

Storm	Trial	Transport Coefficient (m^4/N)	Slope Dependent Coefficient (m^2/s)	Transport Rate Decay Coefficient (m^{-1})	MHW Recession (feet)	Subaerial volume change (c.y./foot)
Nov. 22-25, 1984	1	1.75E-06	0.002	0.5	31	-2.9
Nov. 22-25, 1984	2	7.50E-07	0.002	0.5	29	-2.5
Nov. 22-25, 1984	3	1.75E-06	0.004	0.5	41	-4.6
Nov. 22-25, 1984	4	1.75E-06	0.002	0.25	32	-3.0
Nov. 22-25, 1984	5	2.50E-07	0.002	0.5	19	-1.2
Nov. 22-25, 1984	**6**	**5.00E-07**	**0.002**	**0.5**	**25**	**-2.0**
Nov. 22-25, 1984	**Observed**				**25**	
Storm	**Trial**	**Transport Coefficient (m^4/N)**	**Slope Dependent Coefficient (m^2/s)**	**Transport Rate Decay Coefficient (m^{-1})**	**MHW Recession (feet)**	**Subaerial volume change (c.y./foot)**
Dec. 22-25, 1971	1	5.00E-07	0.002	0.5	19	-7.3
Dec. 22-25, 1971	Observed				22	-8.0

Notes:
1. Data sources: CPE (1985), DeWall (1977)
2. Observations during the 1984 storm were made in Delray Beach.
3. Observations during the 1971 storm were made along the Boca Raton shoreline.
4. MHW = 1.9 feet NGVD; MTL = 0.64 feet NGVD.

A-37. To verify the model, the December 1971 storm was simulated. Table A-9 shows that the predicted values were close (within 13%) of the observed values so the calibration parameters were adopted to model the storm recession of the existing and improved conditions.

Storm Recession Results

A-38. The calibrated SBEACH model was used to calculate storm recession for the set of historical tropical and extratropical storms in Tables A-7 and A-8. A total of 128 SBEACH simulations were conducted (32 storms with 4 tide cycles per storm). Model output was then used to develop a recession/frequency relationship for the project area. To determine the expected storm recession as a function of return period, the Empirical Simulation Technique (EST) (Borgman et al., 1992) was utilized. The application of the EST involved the following steps:

(1) Constructing the EST input data files using the descriptive storm parameters and estimated recession values.
(2) Generating multiple repetitions of multi-year scenarios of storm events and their corresponding beach erosion responses using the EST.
(3) Analyzing the EST simulations to compute storm recession as a function of return period with associated confidence limits.
(4) Determining the combined storm recession:

$$1 / R(S)_{combined} = 1 / R(S)_{tropical} + 1 / R(S)_{extratropical}$$

where:

S = Storm recession in feet
$R(S)_{combined}$ = Combined return period corresponding to recession value S.
$R(S)_{tropical}$ = Tropical return period corresponding to recession value S.
$R(S)_{extratropical}$ = Extratropical return period corresponding to recession value S.

(5) Apply the resulting recession-frequency curves as input to the economics-based model for computation of damages, costs, and benefits.

Based on this procedure, a tropical, extratropical, and combined storm recession-frequency curve was generated for North Boca Raton. Storm recession as function of return period appears in Table A-10.

Table A - 10
Storm Recession, North Boca Raton, FL

Return Period (years)	Storm Recession (feet)			
	Tropical	Extra-tropical	Combined	Std. Dev.
1	0.0	0.0	13.1	15.0
2	0.0	18.3	74.3	3.7
5	81.1	83.4	103.0	4.0
10	105.2	101.7	116.0	3.0
20	118.0	114.9	124.0	3.0
50	128.3	124.8	136.0	8.0
100	154.3	131.3	153.0	16.0
200	176.8	138.8	178.0	24.0

COASTAL GEOMORPHIC CHANGES

A-39. There are three major elements that are needed to quantify the coastal geomorphic changes along the project shoreline. These elements are the historic shoreline change, the volumetric accretion or erosion, and the sediment budget. These elements, when taken together

with the potential for upland damage due to storms, quantify the need for erosion control along the Boca Raton segment.

HISTORIC SHORELINE CHANGES

A-40. A measure of the severity of an erosion problem can be determined by comparing the location of the mean high water line (MHW) over time. Table A-11 presents the MHW changes from 1929 to 1979, 1974 to 1985, 1985 to June 1988 (pre-construction), June 1988 (pre-construction) to January 1998 (pre-construction), and June 1988 to September 2004. MHW comparisons along USACE profile lines are referenced to the nearest FDEP monument.

A-41. Between 1929 and 1979, the average shoreline change within the project limits (T-205 to R-212) was -99.3 feet or -2.0 feet/year (USACE, 1987). The average shoreline change between R-203 and R-218 was -79.5 feet, or -1.6 feet/year (USACE, 1987).

A-42. Between 1974 and 1985, the average shoreline change within the project limits was -14.6 feet or -1.3 feet/year (CPE, 1987). The average shoreline change between R-204 and R-212 was -17.1 feet, or -1.6 feet/year (CPE, 1987).

A-43. Between 1985 and 1988 (pre-construction), the average shoreline change within the project limits was -2.5 feet or -0.8 feet/year. The average shoreline change between T-205 and R-214 was +1.8 feet, or +0.6 feet/year.

A-44. Between June 1988 (pre-construction) and January 1998 (pre-construction), the average shoreline change within the project area was +50.4 feet. The project had receded to the design section (1988 MHW plus 50 feet). It should be noted, however, that the shoreline locations at profile lines R-209, R-210, T-211 and R-212 were landward of the design beach width. Shoreline locations at the four remaining project area profile lines (T-205 to R-208) were an average of 27.7 feet seaward of the design shoreline location.

Table A - 11
Historic Mean High Water Changes along the Boca Raton Segment

DEP Profile Line	Mean High Water Change (feet) (1)				
	1929-1979 (2)	1974-1985 (3)	1985-1988 (4)	6/1988-1/1998 (5)	6/1988-9/2004 (6)
R-204		-37		87.7	143.2
North Project Limit					
T-205		-30	-4.6	109.1	107.7
R-206	-128	-35	10.1	87.5	92.1
T-207		-18	-3.7	58	68.1
R-208	-40	3	-24.1	56.2	108.8
R-209		9	-26.8	34.7	63.8
R-210		-19	27.7	7.8	3.9
T-211	-130	-16	-2.4	24.5	52.3
R-212		-11	3.8	25.7	8.6
South Project Limit					
T-213	-20		13.9	-40.2	-57.8
R-214			24.4	-26	-67.9
T-215				-16.9	-8.9
R-216				11.8	18.3
Avg Change in Project Area (T-205 to R-212)	-99.3	-14.6	-2.5	50.4	63.2
Avg Change in Study Area (R-204 to R-216)	-79.5	-17.1	1.8	32.3	40.9

Notes:
1. A negative number denotes shoreline recession. A positive number denotes shoreline advance.
2. From USACE, 1987 - Data are based on USACE profile lines and have been inserted in the table at the closest DEP Monument.
3. From CPE, 1987.
4. Denotes change between 1985 and June 1988 (pre-construction survey).
5. Denotes change between June 1988 (pre-construction) and January 1998 (pre-construction survey).
6. Denotes change between June 1988 (pre-construction survey) and September 2004.

A-45. The February 1998 beach renourishment project extended the shoreline an average of 136.7 feet (CPE, 2000). Table A-11 shows the September 2004 mean high water location with respect to the June 1988 mean high water. This shows that the 2004 shoreline is approximately 63 feet seaward of the 1988 mean high water and thus 13 feet seaward of the design shoreline. However, the September 2004 shoreline is only 4 and 9 feet seaward of the 1988 shoreline at R-210 and R-212, respectively (56 and 51 feet landward of the design shoreline location). The

September 2004 survey was performed following the passage of Hurricane Frances but prior to Hurricane Jeanne.

A-46. Table A-12 shows that the 1988 nourishment project resulted in an average shoreline extension of 201.8 feet within the project area. The shoreline receded 151 feet before the next nourishment project was constructed in January 1998, giving a recession rate of 16 feet/year. The shoreline recession rate between June 1998 and September 2004 was 19.6 feet/year.

Table A - 12
Mean High Water Changes Related to Nourishment Projects

DEP Profile Line	Mean High Water Change (feet) (1)			
	6/1988 - 8/1988	8/1988 - 1/1998	1/1998 - 5/1998	5/1998 - 9/2004
R-204	10.5	77.2	15.8	39.7
North Project Limit				
T-205	75.3	33.8	8.4	-9.8
R-206	250.3	-162.8	164.1	-159.5
T-207	225.8	-167.8	159.4	-149.3
R-208	224.3	-168.1	146.5	-93.9
R-209	260.1	-225.4	181.3	-152.1
R-210	221.1	-213.3	179.9	-183.8
T-211	247.7	-223.2	199.9	-172.1
R-212	109.6	-84	54.4	-71.5
South Project Limit				
T-213	-22.2	-18	-2.2	-15.4
R-214	-11.1	-14.9	-12.3	-29.6
T-215	-2.3	-14.7	7.4	0.6
R-216	1.4	10.4	32.4	-25.9
Avg Change in Project Area (T-205 to R-212)	201.8	-151.4	136.7	-124.0
Avg Change in Study Area (R-204 to R-216)	122.3	-90.1	87.3	-78.7

Notes:
1. A negative number denotes shoreline recession. A positive number denotes shoreline advance.

A-47. The observed shoreline changes suggest a spreading pattern common to many beach nourishment projects (Campbell, Dean, and Wang, 1989). The shorelines have advanced both north and south of the project area, while the project area itself has been characterized by shoreline recession.

VOLUMETRIC CHANGES

A-48. The volumetric changes which occurred in the project area between 1929 and 1979, 1974 and 1985, 1985 and 1988 (pre-construction), 1988 (pre-construction) and 1998 (pre-construction), and 1988 (pre-construction) and 2004 are presented in Table A-13. The September 2004 survey was taken after the passage of Hurricane Frances but prior to the passage of Hurricane Jeanne.

Table A - 13
Historic Volumetric Changes along the Boca Raton Segment

DEP Profile Line	Volumetric Change (cy) (1)				
	1929-1979 (2,3)	1974-1985 (4,5)	1985-1988 (6)	1988-1998 (7)	1988-2004 (8)
R-204	-270,000	-18,000		19,000	37,100
North Project Limit					
T-205			25,840	99,890	112,440
R-206			31,800	124,870	103,540
T-207	-190,000	-66,000	38,000	86,750	130,840
R-208			-1,390	138,600	178,790
R-209			42,250	69,640	107,570
R-210	-352,000	-298,000	44,160	43,390	84,050
T-211			20,590	68,490	80,840
R-212	-291,000		11,320	89,350	76,620
South Project Limit					
T-213		-98,000	54,970	16,900	35,250
R-214	-60,000		32,650	9,870	-4,970
T-215				11,300	67,790
R-216	-116,000			32,780	45,960
Total Change in Project Area (T205-R212)	-833,000	-364,000	212,570	720,980	874,690
Total Change in Study Area (R204-R216)	-1,279,000	-480,000	300,190	810,830	1,055,820

Notes:

1. A negative number denotes erosion. A positive number denotes accretion.
2. Volumetric changes are to the -18 ft, NGVD contour.
3. From USACE, 1987 - Data are based on USACE profile lines and have been inserted in the table at the closest DEP Monument.
4. Volumetric changes are to the -30 ft, NGVD contour.
5. From CPE, 1987.
6. Denotes change between 1985 and June 1988 (pre-construction survey) to the -24 ft, NGVD contour.
7. Denotes change between June 1988 (pre-construction) and January 1998 (pre-construction survey). Includes 1.1M cy beach nourishment. Volumetric changes are to the -20 ft, NGVD contour.
8. Denotes change between June 1988 (pre-construction) and September 2004. Includes 1.78M cy of fill placed during two beach nourishment projects. Volumetric changes are to the -20 ft, NGVD contour.

A-49. The 1929-1979 volumetric changes within the project area indicate erosion along the entire segment (USACE, 1987). During this time, an estimated 833,000 cubic yards of sand were lost from the project area (T-205 to R-212). This was equivalent to an annual loss of 16,660 cubic yards/year or 2.0 cubic yards/foot/year. The study area (R-204 to R-216) lost an estimated 1,279,000 cubic yards (also 2.0 cubic yards/foot/year).

A-50. A total of 364,000 cubic yards of sand eroded from the project area between 1974 and 1985 (CPE, 1987). This corresponds to an erosion rate of 33,100 cubic yards/year, or 4.3 cubic yards/foot/year. The average unit volumetric loss better reflects the pre-construction erosion than the shoreline changes. To estimate an effective pre-construction shoreline change, the unit volume (4.3 cubic yards/foot/year) is multiplied by 27 cubic feet/cubic yard and then divided by the height of the active profile (29 feet) to calculate an effective pre-construction shoreline change of -4.0 feet/year. This shoreline recession value is used in the storm damage model for without project conditions.

A-51. Between 1985 and June 1988 (pre-construction), a total of 212,600 cubic yards of sand accreted within the project area. This was equivalent to an average change of 70,900 cubic yards/year. At the same time, an estimated 300,200 cubic yards, or 100,100 cubic yards/year, accreted within the study area (R-204 to R-216). This accretion occurred primarily in the offshore area. During the same time period, storms were continuing to erode the dune in this area. The 1974 to 1985 erosion rate provides the best indication of the pre-construction erosion stress.

A-52. Comparison of the June 1988 and August 1988 surveys showed that approximately 1,070,800 cubic yards of sand were placed within the project area (Table A-14). However, 404,500 cubic yards of sand eroded from within the project area by January 1998. Approximately 98,100 cubic yards of this was retained within the study area while the remainder, 306,400 cubic yards, were transported out of the study area.

Table A - 14
Volumetric Changes Related to Nourishment Projects along the Boca Raton Segment

DEP Profile Line	Volumetric Change (cy)			
	6/1986 - 8/1988	8/1988 - 1/1998	1/1998 - 5/1998	5/1998 - 9/2004
R-204	3,800	17,200	1000	17,000
North Project Limit				
T-205	17,700	64,800	-7,700	25,200
R-206	154,300	-29,400	98,700	-100,700
T-207	181,500	-94,800	106,400	-60,400
R-208	219,900	-81,600	123,300	-73,900
R-209	157,300	-88,300	118,700	-80,600
R-210	128,200	-84,900	104,300	-61,500
T-211	146,200	-79,600	105,400	-89,900
R-212	65,600	-10,700	43,200	-55,600
South Project Limit				
T-213	-7,200	23,300	-19,200	36,500
R-214	-5,800	15,800	-2,700	-12,000
T-215	-3,600	14,400	-18,100	74,800
R-216	5,600	27,400	18,900	7,700
Total Change in Project Area (T205-R212)	1,070,700	-404,500	692,300	-497,400
Total Change in Study Area (R204-R216)	1,063,500	-306,400	672,200	-373,400

Notes:
1. A negative number denotes erosion. A positive number denotes accretion.
2. Volumetric changes are to the -20 ft, NGVD contour.

A-53. The second (1998) nourishment project placed approximately 692,300 cubic yards of sand within the project area. Since the 1998 nourishment project, approximately 497,400 cubic yards have eroded from within the project area (based on the September 2004 survey). As with the initial nourishment project, some of the beach fill (124,000 cubic yards) eroded from the project area but remained in the study area while the remainder (373,400 cubic yards) was transported out of the study area.

A-54. The project area lost 901,900 cubic yards between August 1988 and September 2004. The average erosion rate during this period is therefore 56,100 cubic yards/year. This is higher than the historic erosion rate of 33,100 cubic yards/year.

LITTORAL TRANSPORT

A-55. Littoral transport is the movement of sediment in the littoral zone by waves and currents. Most littoral transport occurs between the shoreline and the area just beyond the most seaward breaking waves. The rate at which sedimentary material is supplied or removed from the beach determines the rate of beach erosion or accretion. Littoral transport rates can be determined by various methods including the analysis of dredging records, volumetric surveys and pumping records at existing sand bypass plants.

A-56. The net littoral transport rate in the Boca Raton project area has frequently been estimated to be 120,000 cubic yards of material per year to the south (CPE, 1987; USACE, 1987). However, the USACE (1995) recalculated littoral transport rates in Palm Beach County using the 1974 and 1990 FDEP beach profiles. They concluded that the littoral transport rate within the project area increases from an estimated 131,000 cubic yards per year to the south in the northern portion of the project area, to approximately 156,000 cubic yards per year to the south in the southern portion of the project area.

LITTORAL BUDGET

A-57. A littoral budget has been developed to show the net movement of sand within the project area. The littoral budget is shown in Figure A-3 and is described in the following paragraphs.

A-58. The net littoral drifts into and out of the project area have been estimated at 131,000 and 156,000 cubic yards per year, respectively, to the south (USACE, 1995). These estimates are based on the 1974 to 1990 survey period, which does not completely reflect the higher erosion rate caused by the placement of the fill in 1988. Assuming that the transport of 131,000 cubic yards into the project area is correct, then the calculations developed during this LRR suggest that the sediment transport out of the project site is 184,800 cubic yards/year.

A-59. An average of 2,300 cubic yards/year of sand accumulated in the study area north of the project area. Accretion implies that the net movement of sand out of cell R-204 is less than the net movement of sand into cell R-204. Therefore the littoral transport rate decreases from 131,000 cubic yards/year to 128,700 cubic yards/year. The average erosion rate of the project area (R-205 to R-212) since August 1988 is estimated to be 56,100 cubic yards/year. This volume of fill increases the littoral transport rate to 184,800 cubic yards/year at R-212. An average of 13,800 cubic yards/year of sand accumulated in the study area south of the project beach resulting in a southerly littoral transport rate of 171,000 cubic yards at the southern end of the study area (Figure A-3).

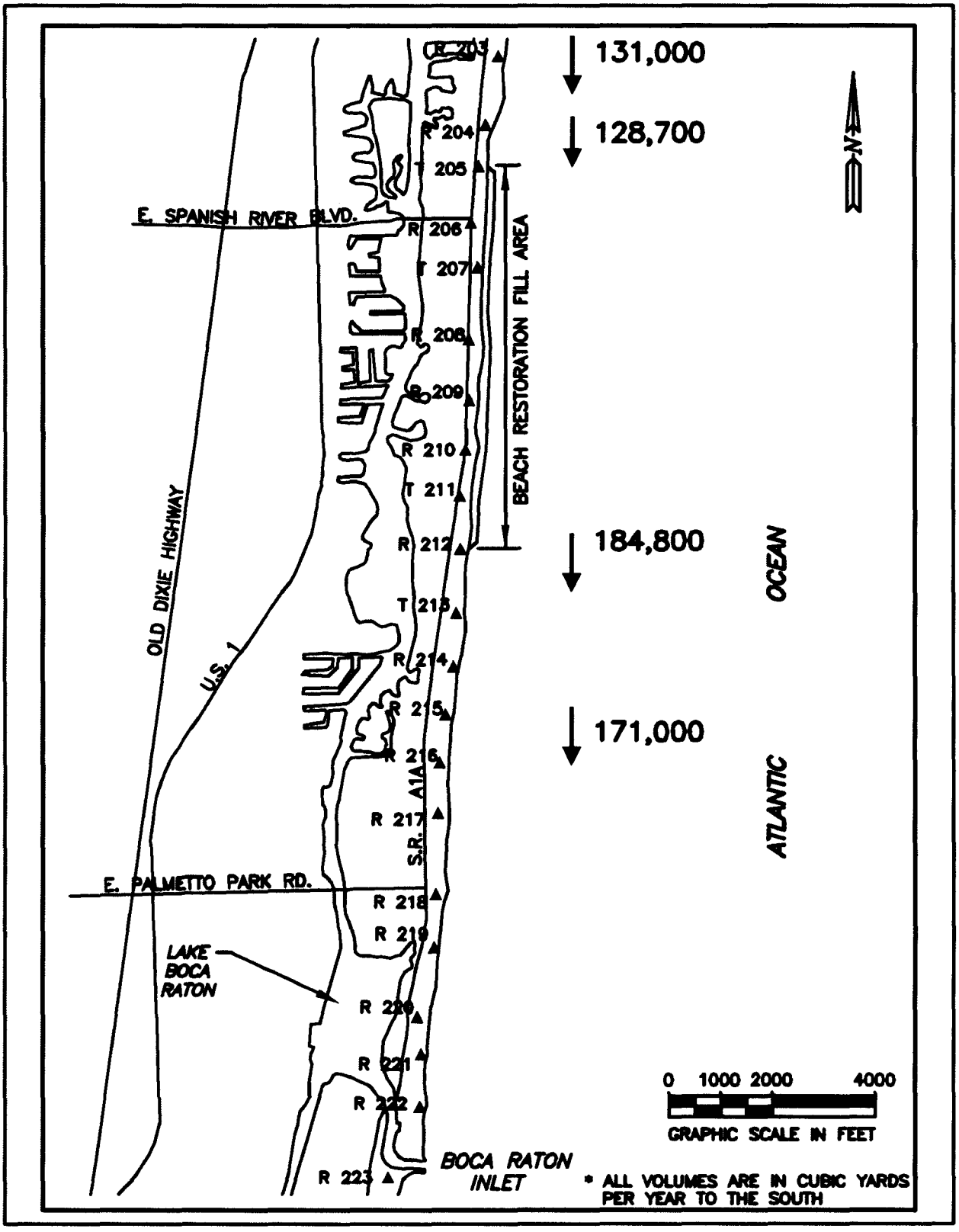

Figure A - 3. Net Littoral Budget for the Northern Boca Raton Segment, 1988-2004

INLET EFFECTS

South Lake Worth Inlet

A-60. Known locally as Boynton Inlet, South Lake Worth Inlet is located in Palm Beach County, about 15 miles south of Lake Worth Inlet and 14 miles north of Boca Raton Inlet. The inlet lies approximately 11 miles north of the North Boca Raton project area. The inlet is owned and operated by Palm Beach County, which is responsible for maintaining the inlet and its structures for navigation.

A-61. South Lake Worth Inlet was cut in 1927 to improve water quality in Lake Worth and is the southern of two man-made connections between Lake Worth and the Atlantic Ocean. The channel was constructed 130 feet wide to an original channel depth of –8 feet MLW. Due to the inlet's narrow width and the resulting scour, little maintenance is required within the main area of the channel. Shoaling of the interior flood shoal and sand trap is estimated to be 14,000 cubic yards/year (CPE, 2003). An area seaward of the ebb shoal was dredged in 1998 and approximately 793,000 cubic yards of sand (CPE, 1999) were removed and placed on the beach south of the inlet. The infilling rate of the borrow area has been estimated at 19,000 cubic yards/year (CPE, 2003).

A-62. Since 1937, a sand transfer plant has been operating on the north jetty, removing sand adjacent to the jetty to be deposited on the beach approximately 500 feet south of the inlet. The sand transfer plant was relocated seaward in 1967. The plant transfers approximately 60,000 cubic yards/year to the beach to the south of the inlet. Natural bypassing across the inlet has been estimated between 95,000 and 103,000 cubic yards/year (CPE, 2003).

A-63. Estimates of the longshore transport rate south of South Lake Worth Inlet vary between 121,000 cubic yards/year (USACE, 1995) and 218,000 cubic yards/year (CPE, 2003).

Boca Raton Inlet

A-64. The southernmost of four inlets in Palm Beach County, Boca Raton Inlet is an improved natural inlet located approximately 2.3 miles south of the project area. The inlet extends from Lake Boca Raton and the Intracoastal Waterway to the Atlantic Ocean, providing ocean access for boaters in southern Palm Beach and northern Broward Counties. The City of Boca Raton is the local sponsor for implementation of the Boca Raton Inlet and Adjacent Beaches Monitoring Program, authorized in 1972 when the inlet, jetties, and maintenance access easements were deeded to the City by private interests. The City has committed funding and personnel to maintain the inlet while protecting and maintaining adjacent beaches.

A-65. Boca Raton Inlet requires nearly continuous dredging to provide for navigation and to maintain the beach immediately south of the inlet. In the early 1940's, the U.S. Air Force provided funding for the dredging of the inlet due to shoaling in the channel. In 1957 the inlet was dredged for pleasure craft navigation, with the spoil placed on the south beach to combat

erosion. Since private interests deeded the inlet, its jetties, and maintenance access easements to the City of Boca Raton in 1972, a City-owned dredge has continuously removed sand from the interior of the inlet to improve navigation. The maintained channel has extended through the landward portion of the ebb shoal since 1981. Since 1979, an average of 36,800 and 14,500 cubic yards per year have been removed from the interior and exterior channel, respectively (USACE, 1995). In addition, three beach nourishment projects removed sand from the ebb shoal to restore the beach immediately south of the inlet. Approximately 221,000 cubic yards were dredged in 1985, while 220,000 cubic yards of sand were dredged in 1996. The last project in 2002 dredged 343,000 cubic yards of material. As the net longshore transport for the region is from north to south, the Boca Raton Inlet has no discernable impact on the project area.

EXISTING SHORE PROTECTION STRUCTURES

A-66. A 230-foot long, shore-parallel seawall fronts the Ocean Reef Towers Condominium in the southern portion of the project area. This is the only shore protection structure located in the project area.

A-67. Two shore protection structures exist outside of the project area. The first is a seawall which is located 270 feet north of the northern project limit. The second is a shore-detached groin which is in Red Reef Park, south of the project area. The groin, which was constructed in 1988 to protect a nearshore rock outcrop (south of the project area) from the longshore transport of sand, was not intended to protect the shoreline.

A-68. An artificial reef was constructed at Red Reef Park as mitigation for the unavoidable burial of some low relief nearshore rock outcrops during the 1988 beach project. The reef consists of a total of six discontinuous groupings of limestone boulders placed in 5 to 8 feet of water, approximately 100 to 150 feet from shore. The artificial reef was intended to provide habitat for nearshore marine organisms and was not intended to protect the shoreline.

DESIGN CROSS SECTION

A-69. The local cooperation agreement (LCA) describes the design (storm protection) cross section as a 50-foot wide extension at mean high water with a 9 foot NGVD berm elevation. The beach slope was assumed to be 1V:10H in the 1988 beach restoration. The design offshore profile utilized a profile translation of the August 1994 offshore profiles. Project performance has confirmed this design parameter. The design cross section was not re-optimized in this addendum.

A-70. Beach profile monitoring has been performed since 1988 in compliance with the Florida Department of Environmental Protection (FDEP) permits. Onshore and offshore profiles were surveyed along the FDEP profile lines and bearings. Profile comparisons were computed to determine volumetric erosion and accretions for each profile line within the study area. The results of these analyses are shown in Appendix A (Tables A-13 and A-14).

A-71. The design volume for each profile was determined by integrating the area between the design cross-section and the 1988 pre-construction profiles. The design volumes are shown in Table A-15. By comparing the design volume with the monitoring volume, the volume of design fill remaining, and the volume of advanced nourishment remaining were calculated for each profile (Table A-15).

A-72. Based on the project monitoring data, the erosion rate for each profile was calculated (Table A-15). Erosion rates were based on the volumetric loss between May 1998 (post-construction survey) and September 2004. The project area has eroded at an average rate of 79,500 cubic yards/year. This erosion rate includes background erosion and losses due to diffusion.

A-73. The erosion rates were used to estimate when the design section will become exposed and anticipate when the next renourishment project will be required. Table A-15 shows that R-210 has already eroded below the design volume. The shorelines from R-210 to R-212 are already behind the design shoreline. Therefore, the next renourishment project should be planned for as soon as practical, which is the winter of 2007.

Table A - 15
Project Performance Volume Summary

DEP Profile Line	Erosion Rate (cy/yr)	Design Volume (cy)	Total Volume Remaining (2004) (cy)	Remaining Advanced Fill (2004) (cy)	Years of Advanced Fill Remaining in 2004
T-205	0	0	56,200	56,200	-
R-206	15,900	36,700	103,500	66,800	4
T-207	9,500	81,500	130,800	49,300	5
R-208	11,700	110,100	178,800	68,700	5
R-209	12,700	46,100	107,600	61,500	4
R-210	9,700	90,300	84,000	-6,300	0
T-211	14,200	61,700	80,800	19,100	1
R-212	5,800	27,400	50,300	22,900	3
Total	79,500	453,800	792,000	338,200	-

A-74. Initial renourishment volume estimates for the winter of 2007 are presented in Table A-16. Future beach volumes were estimated by projecting the erosion of the beach, on a profile-by-profile basis, until winter 2007 (date of expected renourishment). The volume of design fill required to restore the LCA design and the volume of advanced nourishment remaining from the 1998 project were estimated. The initial renourishment volume is equal to the nourishment interval times the erosion rate plus the design fill required minus the advanced fill remaining. This was computed on a profile-by-profile basis. Initial renourishment volumes for 9, 10, 11, and 12-year intervals are shown in Table A-16.

Table A - 16
Winter 2007 Nourishment Volume Estimates

DEP Profile Line	Design Fill Required in 2007	Advanced Fill Available in 2007 (cy)	Following Project in 2016 (9 years of Adv Fill)	Following Project in 2017 (10 years of Adv Fill)	Following Project in 2018 (11 years of Adv Fill)	Following Project in 2019 (12 years of Adv Fill)
T-205	0	56,200	0	0	0	0
R-206	0	19,100	124,000	139,900	155,800	171,700
T-207	0	20,800	64,700	74,200	83,700	93,200
R-208	0	33,600	71,700	83,400	95,100	106,800
R-209	0	23,400	90,900	103,600	116,300	129,000
R-210	35,400	0	122,700	132,400	142,100	151,800
T-211	23,500	0	151,300	165,500	179,700	193,900
R-212	0	5,500	0	0	0	0
Subtotal	**58,900**	**158,600**	**625,300**	**699,000**	**772,700**	**846,400**

A-75. No adjustment needs to be made for the slight difference in grain size between the existing beach and the borrow area. The grain size on the existing beach is 0.26 mm while the combined borrow area has a grain size of 0.27 mm.

A-76. Future renourishment volume estimates are presented in Table A-17. Future beach renourishment volume estimates were developed by projecting the erosion of the beach due to background erosion and diffusion losses. Future nourishment volumes were estimated assuming the following:

a. The erosion rate measured between May 1998 and September 2004 will be constant for future nourishments.

b. No design fill is required at each nourishment.

c. No advanced nourishment will be remaining at the end of each nourishment interval.

Table A - 17
Future Nourishment Volume Estimates

DEP Profile Line	9-year Interval	10-year Interval	11-year Interval	12-year Interval
T-205	0	0	0	0
R-206	143,100	159,000	174,900	190,800
T-207	85,500	95,000	104,500	114,000
R-208	105,300	117,000	128,700	140,400
R-209	114,300	127,000	139,700	152,400
R-210	87,300	97,000	106,700	116,400
T-211	127,800	142,000	156,200	170,400
R-212	0	0	0	0
Renourishment Volume (cy)	**663,300**	**737,000**	**810,700**	**884,400**

A-77. The Generalized Model for Simulating Shoreline Change (GENESIS) (Gravens et al, 1991) was used to predict the performance of the 10-year interval beach nourishment project. The model suggests that the without-project shoreline will retreat an average of 13 feet throughout the project area and will be landward of the design shoreline from R-209 to R-212. At R-210, the shoreline will be 66 feet behind the design shoreline in 10 years. Under with-project conditions, the future shoreline will be seaward of the design shoreline at all monuments, except R-210, where the predicted 10-year shoreline will be 6 feet landward of the design shoreline. The modeled performance of the 10-year fill volume is presented in Figure A-4. A complete discussion of the shoreline modeling is included in Sub-Appendix A-1.

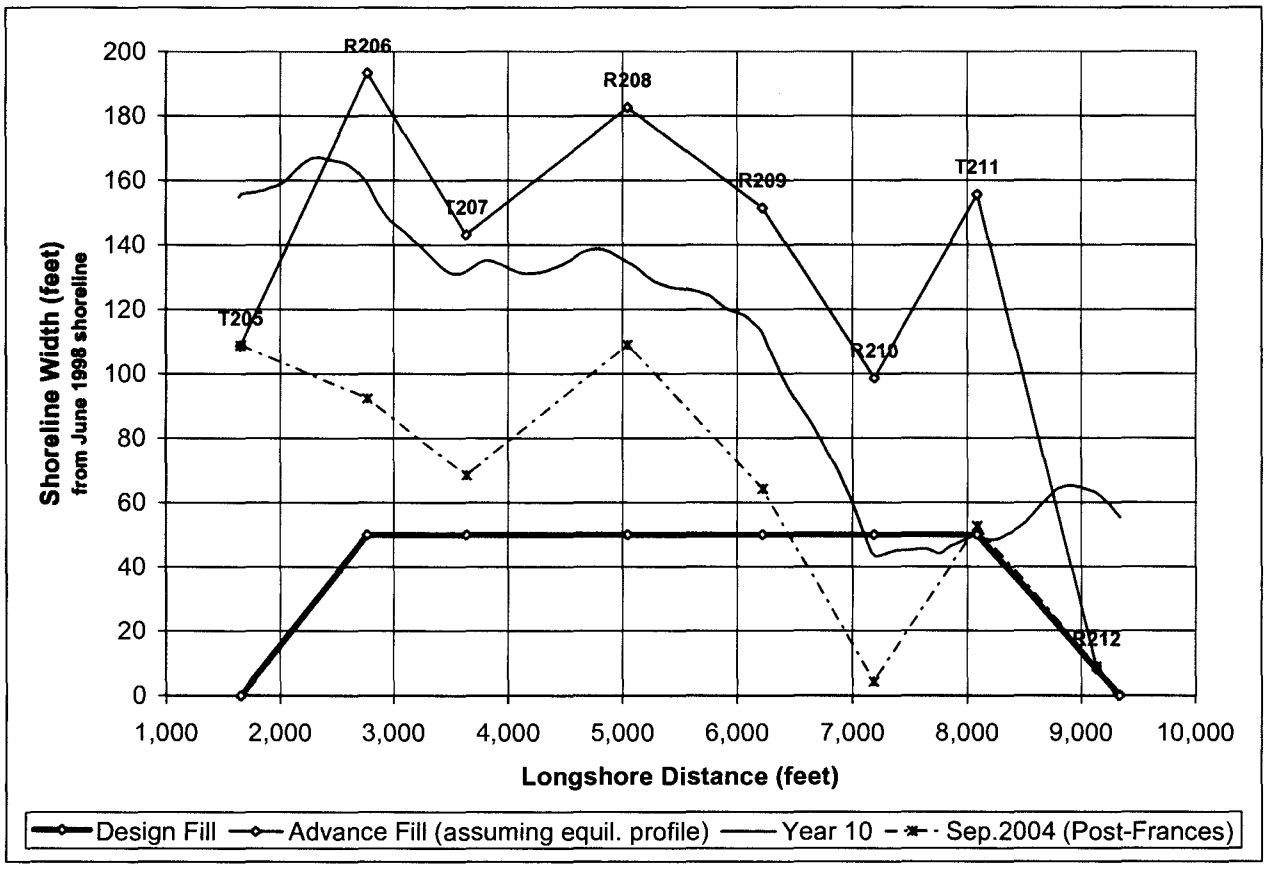

Figure A - 4. Performance of the 10-year Beach Fill Project

TOLERANCE VOLUME

A-78. The beach fill tolerance for the initial renourishment will be ±0.5 feet. The volume of fill within the tolerance section was not included in the economic analysis since the tolerance volume that is constructed can vary significantly and is small when compared to the nourishment volume.

PROJECT COSTS

A-79. Project costs for 8, 9, 10, 11, and 12-year nourishment intervals are detailed in Tables A-18 through A-22. These tables include all costs associated with each nourishment project including dredging, beach tilling, monitoring, contingencies, and engineering.

A-80. Dredge costs for the project were estimated based on the costs for similar projects in the area. In 2004, the unit cost for dredging was $3.59/ cubic yard for Central Boca Raton using a similar borrow area and construction fill density. In 2005, the unit cost for dredging the Ocean Ridge Segment (Palm Beach County) was $4.88/cubic yard. In 2005, the unit cost for dredging at Delray Beach was $6.51/ cubic yard. The Delray Beach nourishment had a higher unit cost

due to low fill densities in some areas of the project area and a dredge fleet that was busy due to high demand because of storm impacts. The cost analysis for the North Boca Raton Second Renourishment is included in an MCACES report (Sub-Appendix A-2).

A-81. The price levels for ocean dredging in the south Florida areas were reevaluated in August 2007. A mobilization/demobilization cost of $1,400,000 and a unit cost of $5.50 per cubic yard of sand in place on the renourished beach was used as an estimate when dredging sand from borrow area B. A unit cost of $4.75 per cubic yard was used for dredging from borrow area A. These cost estimates are conservative based on the present dredging market and will allow for the extra cost of wintertime dredging if necessary.

A-82. Borrow area B will be used for the next renourishment project. Subsequent renourishment projects will likely use borrow area A, as it is 1 mile closer to the beach and thus the unit cost for dredging is lower. When the 1,790,000 cubic yards are expended from borrow area A, sand will again be dredged from borrow area B. The cost of the fill has been weighted based on the volume of fill dredged from each borrow source when multiple borrow areas are used during one project. Long-term sediment resources are described in Appendix B.

A-83. The construction of the project will cause a small increase in the cost of operating and maintaining Spanish River Park and the other City owned beachfront properties. There will be a small increase in the cost of maintaining the beach in order to remove scarps for safety and environmental habitat preservation reasons. The operation and maintenance costs, as a result of the project, are estimated to be $30,000 annually.

A-84. Project monitoring costs are estimated based on the cost of physical and environmental monitoring of the original nourishment. Beach tilling following sand placement is required by the environmental permits. These costs are included in Tables A-18 through A-22.

A-85. A contingency of 15% is included for all cost estimates. Engineering and design costs are estimated at 5%, as are supervision and contract administration costs. Interest during construction of the 2007 project is estimated based on the duration of construction and an interest rate of 4.875%. Production is based on 300,000 cubic yards/month.

Table A - 18
Estimate of Contract and Construction Costs for 8-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)			
						2007	2015	2023	2031
Mobilization			Lump Sum	1	$1,400,000	$1,400	$1,400	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	551,600	$5.50	$3,034			
	2015	Offshore	C.Y.	589,600	$4.75		$2,801		
	2023	Offshore	C.Y.	589,600	$4.75			$2,801	
	2031	Offshore	C.Y.	515,900	$5.34				$2,755
Beach Tilling			Acre	39	$300	$12	$12	$12	$12
Project Monitoring			Lump Sum	1	$470,000	$470	$470	$470	$470
Subtotal						$4,916	$4,683	$4,683	$4,637
Contingency (15%)						$737	$702	$702	$696
Contract Cost						$5,653	$5,385	$5,385	$5,332
E&D + S&A (10%)						$565	$538	$538	$533
Total Construction Cost						**$6,218**	**$5,923**	**$5,923**	**$5,865**

Summary-Investment and Annual Costs for 8-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)					
	1988	1998	2007	2015	2023	2031
Construction Cost	$3,100	$2,420	$6,218	$5,923	$5,923	$5,865
Interest During Construction	-	-	$46	-	-	-
Operation and Maintenance Cost	$300	$240	$240	$240	$240	$240
Total Investment Cost	$3,400	$2,660	$6,505	$6,163	$6,163	$6,105
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	$6,505	$4,211	$2,878	$1,948
Total Present Worth (1988 through 2038)	$28,023					
Total Present Worth (2007 through 2038)	$15,542					

Average Annual Cost over 50-year project life ($1,000's) $1,505 (2007 $'s at 4.875% interest rate)
Average Annual Cost over 31-year project life ($1,000's) $982 (2007 $'s at 4.875% interest rate)

Table A - 19
Estimate of Contract and Construction Costs for 9-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)			
						2007	2016	2025	2034
Mobilization			Lump Sum	1	$1,400,000	$1,400	$1,400	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	625,300	$5.50	$3,439			
	2016	Offshore	C.Y.	663,300	$4.75		$3,151		
	2025	Offshore	C.Y.	663,300	$4.79			$3,177	
	2034	Offshore	C.Y.	294,800	$5.50				$1,621
Beach Tilling			Acre	41	$300	$12	$12	$12	$12
Project Monitoring			Lump Sum	1	$500,000	$500	$500	$500	$500
Subtotal						$5,351	$5,063	$5,089	$3,533
Contingency (15%)						$803	$759	$763	$530
Contract Cost						$6,154	$5,822	$5,853	$4,063
E&D + S&A (10%)						$615	$582	$585	$406
Total Construction Cost						**$6,769**	**$6,404**	**$6,438**	**$4,469**

Summary-Investment and Annual Costs for 9-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)					
	1988	1998	2007	2016	2025	2034
Construction Cost	$3,100	$2,420	$6,769	$6,404	$6,438	$4,469
Interest During Construction	-	-	$57	-	-	-
Operation and Maintenance Cost	$300	$240	$270	$270	$270	$270
Total Investment Cost	$3,400	$2,660	$7,096	$6,674	$6,708	$4,739
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	$7,096	$4,349	$2,848	$1,311
Total Present Worth (1988 through 2038)	$28,084					
Total Present Worth (2007 through 2038)	$15,603					

Average Annual Cost over 50-year project life ($1,000's)	$1,509	(2007 $'s at 4.875% interest rate)
Average Annual Cost over 31-year project life ($1,000's)	$986	(2007 $'s at 4.875% interest rate)

Table A - 20
Estimate of Contract and Construction Costs for 10-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)		
						2007	2017	2027
Mobilization			Lump Sum	1	$1,400,000	$1,400.0	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	699,000	$5.50	$3,844.5		
	2017	Offshore	C.Y.	737,000	$4.75		$3,501	
	2027	Offshore	C.Y.	810,700	$4.99			$4,045
Beach Tilling			Acre	43	$300	$13.0	$13	$13
Project Monitoring			Lump Sum	1	$530,000	$530.0	$530	$530
Subtotal						$5,787.5	$5,444	$5,988
Contingency (15%)						$868.1	$817	$898
Renourishment Contract Cost						$6,655.6	$6,260	$6,887
E&D + S&A (10%)						$665.6	$626	$689
Total Construction Cost						**$7,321.2**	**$6,886**	**$7,576**

Summary-Investment and Annual Costs for 10-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)				
	1988	1998	2007	2017	2027
Construction Cost	$3,100	$2,420	$7,321.2	$6,886	$7,576
Interest During Construction	-	-	$69.3	-	-
Operation and Maintenance Cost	$300	$240	$300.0	$300	$300
Total Investment Cost	**$3,400**	**$2,660**	**$7,690.5**	**$7,186**	**$7,876**
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	$7,690.5	$4,465	$3,040
Total Present Worth (1988 through 2038)	$27,676				
Total Present Worth (2007 through 2038)	$15,195				

Average Annual Cost over 50-year project life ($1,000's) $1,486.8 (2007 $'s at 4.875% interest rate)
Average Annual Cost over 31-year project life ($1,000's) $960.3 (2007 $'s at 4.875% interest rate)

Table A - 21
Estimate of Contract and Construction Costs for 11-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)		
						2007	2018	2029
Mobilization			Lump Sum	1	$1,400,000	$1,400	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	772,700	$5.50	$4,250		
	2018	Offshore	C.Y.	810,700	$4.75		$3,851	
	2029	Offshore	C.Y.	663,300	$4.96			$3,290
Beach Tilling			Acre	46	$300	$14	$14	$14
Project Monitoring			Lump Sum	1	$560,000	$560	$560	$560
Subtotal						$6,224	$5,825	$5,264
Contingency (15%)						$934	$874	$790
Contract Cost						$7,157	$6,699	$6,054
E&D + S&A (10%)						$716	$670	$605
Total Construction Cost						**$7,873**	**$7,369**	**$6,659**

Summary-Investment and Annual Costs for 11-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)				
	1988	1998	2007	2018	2029
Construction Cost	$3,100	$2,420	$7,873	$7,369	$6,659
Interest During Construction	-	-	$82	-	-
Operation and Maintenance Cost	$300	$240	$330	$330	$330
Total Investment Cost	$3,400	$2,660	$8,286	$7,699	$6,989
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	**$8,286**	**$4,561**	**$2,452**
Total Present Worth (1988 through 2038)	$27,780				
Total Present Worth (2007 through 2038)	$15,299				

Average Annual Cost over 50-year project life ($1,000's) $1,492 (2007 $'s at 4.875% interest rate)
Average Annual Cost over 32-year project life ($1,000's) $967 (2007 $'s at 4.875% interest rate)

Table A - 22
Estimate of Contract and Construction Costs for 12-Year Renourishment Cycle

Item	Year of Project	Borrow Area	Unit	Quantity	Unit cost	Year of Renourishment Project (amount in $1,000's)		
						2007	2019	2031
Mobilization			Lump Sum	1	$1,400,000	$1,400	$1,400	$1,400
Beach Fill	2007	Offshore	C.Y.	846,400	$5.50	$4,655		
	2019	Offshore	C.Y.	884,400	$4.75		$4,201	
	2031	Offshore	C.Y.	515,900	$4.91			$2,533
Beach Tilling			Acre	48	$300	$14	$14	$14
Project Monitoring			Lump Sum	1	$590,000	$590	$590	$590
Subtotal						$6,659	$6,205	$4,537
Contingency (15%)						$999	$931	$681
Contract Cost						$7,658	$7,136	$5,218
E&D + S&A (10%)						$766	$714	$522
Total Construction Cost						**$8,424**	**$7,850**	**$5,740**

Summary-Investment and Annual Costs for 12-year Renourishment Cycle

Item	Year of Renourishment Project (amount in $1,000's)				
	1988	1998	2007	2019	2031
Construction Cost	$3,100	$2,420	$8,424	$7,850	$5,740
Interest During Construction	-	-	$97	-	-
Operation and Maintenance Cost	$300	$240	$360	$360	$360
Total Investment Cost	$3,400	$2,660	$8,881	$8,210	$6,100
Present Worth of Each Construction (2007 $'s)	$8,398	$4,083	**$8,881**	**$4,637**	**$1,946**
Total Present Worth (1988 through 2038)	$27,945				
Total Present Worth (2007 through 2038)	$15,464				

Average Annual Cost over 50-year project life ($1,000's) $1,501 (2007 $'s at 4.875% interest rate)
Average Annual Cost over 31-year project life ($1,000's) $977 (2007 $'s at 4.875% interest rate)

A-86. The present worth (2007 dollars) of each construction cost was calculated and the sum of the present worth was amortized over a 50-year project life. The cost of the 1988 and 1998 nourishment projects were included in the present worth value over the entire project life. The average annual cost over the remaining project life (2007 to 2038) excluded the 1988 and 1998 project costs. Annual costs (in 2007 dollars) for each nourishment interval were calculated at the interest rate of 4.875% and are shown in Tables A-18 through A-22.

OPTIMIZATION OF RENOURISHMENT INTERVAL

A-87. Based on the annual costs in Tables A-18 through A-22, the 10-year renourishment interval was chosen as the renourishment interval with an annual cost of $1,486,800. If an interest rate of 10% was assumed, the annual cost for the 10-year renourishment interval would be $3,910,200. The annual cost of the project over the remaining life of the project (2007 to 2038) is $960,300. The 10-year nourishment interval also has the lowest annual cost over the remaining life of the project.

EQUILIBRIUM TOE OF FILL ESTIMATE

A-88. The beach profile is constructed in an artificially steep shape to minimize water turbidity and to simplify construction. Variable wave and water level conditions over an approximate time period of six months to one year will cause offshore sediment transport to occur until the profile reaches a quasi-equilibrium shape.

A-89. In order to estimate the potential for environmental impacts, the maximum seaward limit of offshore transport of the placed fill, the equilibrium toe of fill, is estimated. The equilibrium toe of fill can be estimated using naturally occurring onshore and offshore slopes or shapes, or empirical profile shape equations. The naturally occurring onshore beach slope is 1V:10H in the project area. The offshore profile was assumed to be similar to the September 2004 profile. The offshore profile was shifted seaward on each profile until the volume between the 2004 profile and the equilibrium profile was equal to the construction volume. The toe of fill was determined by the intersection of the two profiles. This approach results in a conservative estimate of the toe of fill for nearly similar sediments. The results are shown in Table A-23.

Table A - 23
Estimated Location of the Equilibrium Toe of Fill

Profile	Distance from Monument to Estimated Toe of Fill (ft)
T-205	N/A
R-206	1390
R-207	1288
R-208	1297
R-209	1206
R-210	1177
T-211	1230
R-212	1155

SUMMARY

A-90. Based on the continuing erosional history of the Boca Raton segment, the littoral budget, potential storm impacts, and the performance of the 1988 and 1998 beach nourishment projects, the original fill limits of the Boca Raton segment of the Palm Beach County Beach Erosion Control Project should be maintained (FDEP monument R-205 to a point 181 feet south of FDEP monument R-212)

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SUB-APPENDIX A-1

BOCA RATON SHORE PROTECTION PROJECT

GENESIS SEDIMENT TRANSPORT MODEL

BACKGROUND

A-1-1. Future sediment transport projections for northern Boca Raton, Florida utilize the Generalized Model for Simulating Shoreline Change (GENESIS) (Gravens, et al., 1991). This model can incorporate seawalls, groins, breakwaters, beach fills, artificial sand transport, and offshore bathymetry. Inputs to the model include shoreline locations, structure locations, a time series of offshore waves, and, if desired, a set of wave refraction coefficients and refracted wave angles. Outputs to the model consist of shoreline changes and sediment transport rates.

A-1-2. The GENESIS model determines shoreline changes relative to a fixed baseline based on the wave-driven, longshore sediment transport. Transport rates are calculated using the U.S. Army Corps of Engineers (1989) formula (CERC Equation), with an additional term to account for longshore variations in the breaking wave height. To calibrate the model, two longshore transport coefficients are determined. Coefficient K1 governs the transport resulting from changes in shoreline orientation. Coefficient K2 governs the transport resulting from longshore variations in the breaking wave height (Gravens, et al., 1991).

A-1-3. GENESIS assumes that the shoreline changes are directly proportional to the volume changes, the profile shape is constant with time, and the berm elevation and depth of closure are constant and uniform. However, the shoreline and volume change analysis (main text of Appendix A) shows that the beach profile varies with time and location. To address this problem, shoreline changes from the calibration and verification runs were converted into equivalent volume changes by assuming an active profile height of 33 feet (+9 feet, NGVD to –24 feet NGVD). The model was thus calibrated using volumetric changes rather than shoreline changes.

BASELINE

A-1-4. The North Boca Raton GENESIS model covers 15,840 feet (~3 miles) of shoreline from profile lines R-204 to R-218 (Figure A-1-1). The orientation of the model baseline is 4° / 184° clockwise from north.

WAVE DATA

A-1-5. The 1980-1999 Wave Information System (WIS) hindcast at WIS Station 464 (Figure A-1-1) provided the time series of offshore waves (USACE, 2004). The depth at WIS Station 464 is 837 feet. To determine the nearshore waves, the STWAVE model (Smith, 2001) was used. STWAVE is a spectral wave model that evaluates the refracted wave height and wave angle based on a spectrum of waves. The model utilizes linear wave theory, assuming negligible bottom friction and steady-state waves, winds, and currents. Inputs to the STWAVE model include the bathymetry, the wave spectra, and the water levels.

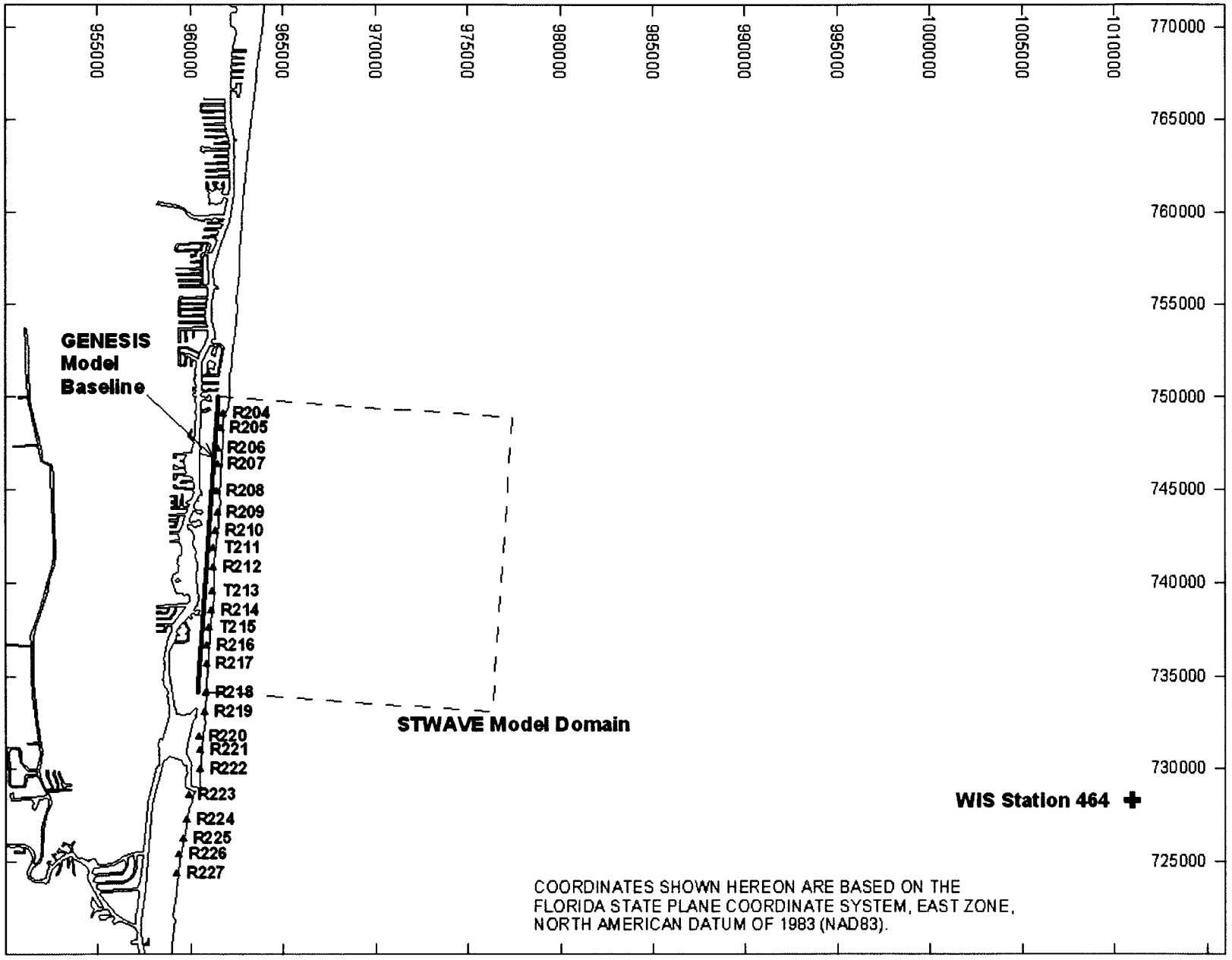

Figure A-1-1. North Boca Raton, FL Shoreline Model Location Map

BATHYMETRY

A-1-6. Bathymetric data for the STWAVE refraction model was compiled from the following sources:

a. The January 1998 survey of the study area's beach.

b. The 2002 LIDAR Altimetry Data System (LADS) survey of Palm Beach County (Tenix, 2003).

c. The 1979 offshore bathymetric survey by the National Oceanographic and Atmospheric Administration.

A-1-7. To apply the STWAVE model, 54 wave angle and period bands were identified from the 1980-1999 hindcast. Each band was assigned a wave height of 1 meter (3.3 feet) and given a corresponding wave spectrum using CEDAS-NEMOS 2.01 (Veri-Tech, 2002). The 1 meter (3.3 foot) waves were then refracted to -24 feet NGVD using STWAVE. Refraction coefficients were determined by dividing the nearshore wave heights by the offshore wave height. The refraction coefficients and refracted wave angles were then applied to the offshore waves to produce a time series of nearshore waves.

ROCK OUTCROPPING AND STRUCTURES

A-1-8. A natural rock outcropping known as Yamato Rock lies on the border between Boca Raton and Highland Beach (north of R-204). This rock outcropping has a groin-like effect. Model simulations treat Yamato Rock as a non-diffracting groin with a porosity of zero.

A-1-9. A small groin located adjacent to a natural, offshore rock outcropping lies within Red Reef Park, near R-214. The rock outcropping and groin's landward end are currently submerged. The effect of these features on the shoreline shape is discernable but minor. Model simulations treat these two features as a single non-diffracting groin with a porosity of 98%.

CALIBRATION

A-1-10. Calibration of the GENESIS model was based on the performance of the first beach nourishment along northern Boca Raton (T-205 to R-212). Wave data was available for the August 1988 to January 1998 calibration time period. The August 1988 (post-construction) shoreline was used as the initial condition.

A-1-11. To determine K1 and K2, several simulations of the August 1988 to January 1998 volume changes were conducted using GENESIS with the STWAVE results. The values of K1 and K2 were estimated to be 0.17 and 0.02, respectively.

A-1-12. Calibration results appear in Figure A-1-2. The model results reflect the general erosional patterns, which consist of erosion from R-206 to R-212, accretion to the immediate north and south of the project limits, and erosion near Palmetto Park Road (south of R-217). Discrepancies from the observations occur due to the overestimated erosion at R-206, R-210, and R-211, and the model's simplified representation of Yamato Rock. Despite these discrepancies, overall agreement between the observed and simulated volume changes is reasonable.

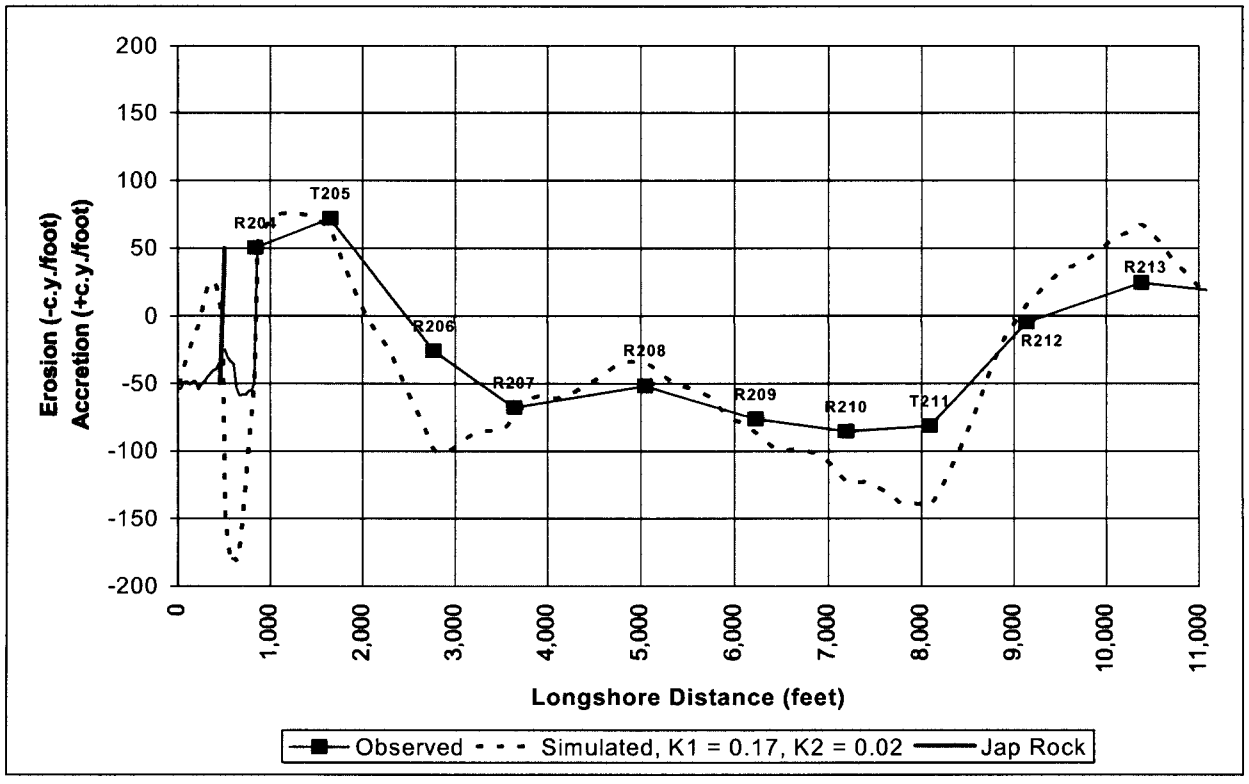

Figure A-1-2. GENESIS Model Calibration, August 1988 to January 1998

VERIFICATION

A-1-13. Verification of the GENESIS model was based on the performance of the second beach nourishment along northern Boca Raton (T-205 to R-212). The calibration was performed using the May 1998 (post-construction) survey and the April 2004 survey. The May 1998 post-construction shoreline was used as the initial condition. Wave data was available only through December 1999 so wave data between 1980 and 1984 was used to extend the time series of waves. Four hurricanes affected the study area in 1998 and 1999: Mitch (1998), Dennis (1999), Floyd (1999), and Irene (1999).

A-1-14. Verification results appear in Figure A-1-3. Similar to the calibration, the model results reflect the general erosional patterns. Despite differences between the observations and the model in a few locations, the total predicted amount of fill lost from T-205 to R-212 is similar to

the total observed loss. Given these considerations, the model is suitable for predicting future erosion rates.

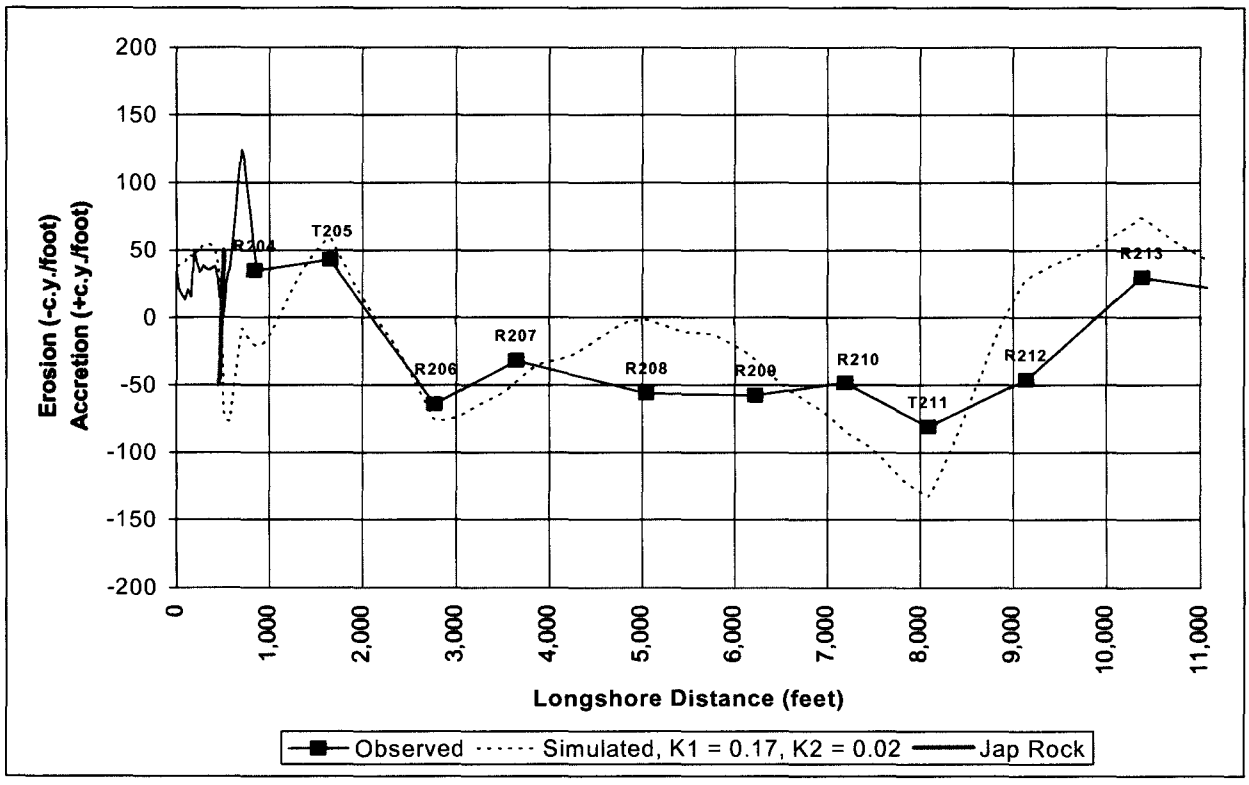

Figure A-1-3. GENESIS Model Verification, May 1998 to April 2004

WITHOUT-PROJECT FUTURE CONDITIONS

A-1-15. Projected shoreline changes over the next 10 years appear in Table A-1-1 and Figure A-1-4. These projections assume the September 2004 post-Frances survey to be representative of the existing conditions. A 10-year project life was modeled based upon the chosen renourishment interval. According to the 10-year without project prediction, the average shoreline change will be a 13-foot retreat. The shoreline is expected to advance between T-205 and R-207, and at R-212. Along the remainder of the project area, the shoreline will retreat. The maximum retreat, 50 feet, will occur at T-211. The shoreline is predicted to be landward of the design shoreline from R-209 to T-211. At R-210, the predicted shoreline will be 66 feet landward of the design shoreline.

Table A-1-1
Without-Project Future Conditions

Profile Line	Fill Length (feet)	Shoreline Width (feet)* without project			
		Year 5	Year 10	Sep.2004	Design
T-205	482	102	114	108.7	
R-206	993	111	106	92.3	50
R-207	1,141	78	72	68.5	50
R-208	1,295	78	68	108.9	50
R-209	1,073	57	**47**	64.2	50
R-210	932	**-6**	**-16**	**4.3**	50
T-211	975	**6**	**3**	52.6	50
R-212	754	14	35	8.9	
Average	7,644	55	52	65	50

Profile Line	Fill Length (feet)	Shoreline Change (feet) Year 0 through	
		Year 5	Year 10
T-205	482	-7	5
R-206	993	19	14
R-207	1,141	10	3
R-208	1,295	-31	-41
R-209	1,073	-7	-17
R-210	932	-10	-20
T-211	975	-46	-50
R-212	754	5	26
Average	7,644	-9	-13

Notes: * Shoreline elevation = +1.9' NGVD. Shoreline width measured from June 1988 shoreline.

Erosion into the design shoreline highlighted in ***bold***.

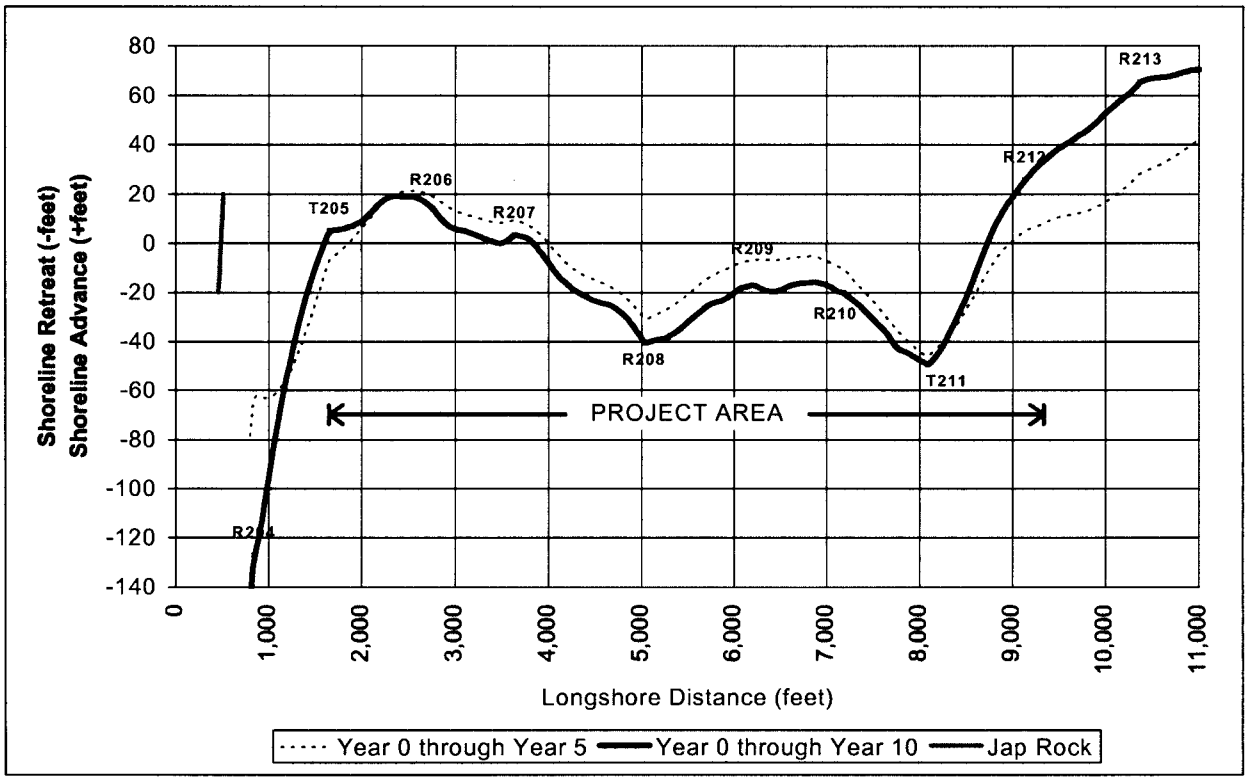

Figure A-1-4. Without-Project Future Conditions

WITH-PROJECT FUTURE CONDITIONS

A-1-16. The next nourishment of the project area will place 699,000 cubic yards of fill between T-205 and R-212. The total volume relative to the June 1988, pre-project, cross-section will be approximately 1,372,600 cubic yards. At most locations, this volume will be enough to prevent erosion into the design fill over the next 10 years. While minor recession into the design cross-section could occur at R-210, the GENESIS model tends to overestimate the erosion rate at this location (Figures A-1-2 and A-1-3). The GENESIS model supports the proposed beach nourishment design and renourishment interval. The future performance of the project is summarized in Table A-1-2 and Figure A-1-5.

Table A-1-2
Beach Fill Performance

Profile Line	Fill Length (feet)	Shoreline Width (feet)*				
		Design	Des.+Adv.	Sep. 2004	Year 5	Year 10
T-205	482		108.7	108.7	139	155
R-206	993	50	193.3	92.3	164	159
R-207	1,141	50	143.2	68.5	143	132
R-208	1,295	50	182.6	108.9	153	135
R-209	1,073	50	151.4	64.2	134	113
R-210	932	50	98.6	**4.3**	64	**44**
T-211	975	50	155.6	52.6	62	50
R-212	754		8.9	8.9	51	63
Average	7,644	50	138.3	64.6	117	107

Profile Line	Fill Length (feet)	Remaining Volume (cubic yards)**				
		Design	Advance	Sep. 2004	Year 5	Year 10
T-205	482	0	0	60,300	71,600	80,400
R-206	993	36,700	161,400	118,300	174,700	169,500
R-207	1,141	81,500	149,200	139,200	175,200	161,600
R-208	1,295	110,100	176,500	193,600	213,400	187,300
R-209	1,073	46,100	159,400	117,100	154,400	129,800
R-210	932	90,300	91,300	94,900	***64,100***	**43,700**
T-211	975	61,700	140,300	91,200	65,000	***52,100***
R-212	754	27,400	40,700	50,000	41,300	50,800
TOTAL	7,644	453,800	918,800	864,600	959,700	875,200

Notes: * Shoreline elevation = +1.9' NGVD. Shoreline width measured from June 1988 shoreline.
** Volumes evaluated assuming June 1988 conditions as pre-construction conditions.
Assumes a berm elevation +9' NGVD and a depth of closure of -20' NGVD.
Erosion into the design cross-section highlighted in **bold**.

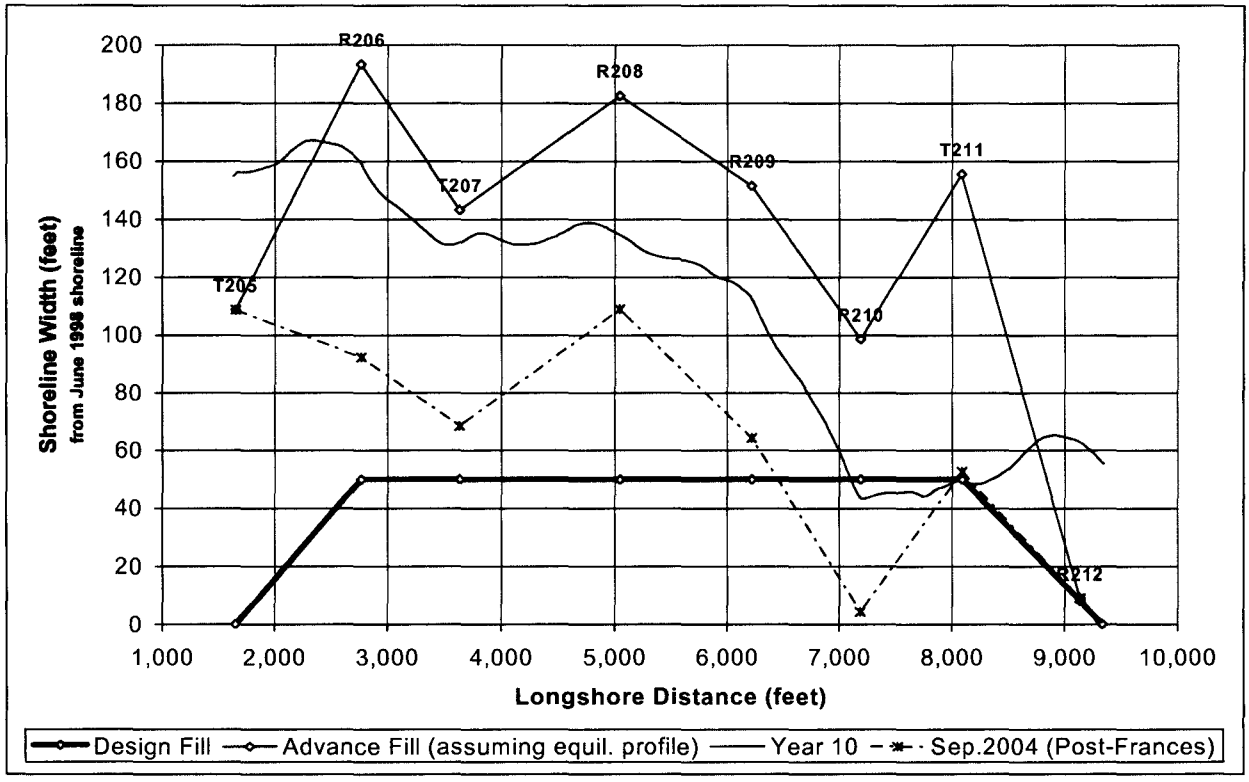

Figure A-1-5. Beach Fill Performance

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SUB-APPENDIX A-2

BOCA RATON SHORE PROTECTION PROJECT

MCACES ECONOMIC MODEL OUTPUT

Estimated by	Coastal Planning & Engineering, Inc.
Designed by	Coastal Planning & Engineering, Inc.
Prepared by	Coastal Planning & Engineering, Inc.
Preparation Date	8/13/2007
Effective Date of Pricing	8/13/2007
Estimated Construction Time	108 Days

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Designed by
Coastal Planning & Engineering, Inc.

Estimated by
Coastal Planning & Engineering, Inc.

Prepared by
Coastal Planning & Engineering, Inc.

Design Document	North Boca Raton LRR
Document Date	8/13/2007
District	Jacksonville District
Contact	Charlie Stevens
Budget Year	2007
UOM System	Original

Direct Costs
LaborCost
EQCost
SubBidCost

Timeline/Currency

Preparation Date	8/13/2007
Escalation Date	8/13/2007
Eff. Pricing Date	8/13/2007
Estimated Duration	108 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB06EB: MII English Cost Book 2006

Labor LB06NatFD: Labor National 2006
Note: http://www.wdol.gov/

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Date	Author	Note
8/13/2007	Gordon Thomson, PE	This cost estimate was developed following review of the plans and specifications for the project. SUBJECT: Palm Beach County, Florida, Shore Protection Project (From Martin County Line to Lake Worth Inlet and from South Lake Worth Inlet to South County Line) Limited Reevaluation Report for North Boca Raton, Second Periodic Renourishment with Environmental Assessment. Construction volumes are based on erosion rates between May 1998 and September 2004 to avoid effects of Hurricane Jeanne and Hurricane Wilma on the erosion rate. Project assumes 699,000 cubic yards in-place. All dredge material is to come from the northern section of Borrow Area B and will be dredged using a large (30") ocean certified pipeline dredge. Turbidity monitoring and beach tilling will be required. Project extends 1.45 miles along Palm Beach County's Atlantic shoreline, extending from T-205 to R-212+180 (south of Yamato Rock to north of Red Reef Park). Total volume to be placed = 699,000 cubic yards with fill to be placed in one continuous reach along 1.45 miles of shoreline. The total estimated quantity used in the cost estimate for the LRR is 699,000 cubic yards in-place. Construction berm varies, 1V:10H berm slope, berm elevation = +9.0 feet, NGVD. Volumes provided assume that there will be no pay for material placed above the design template, though a +0.5-foot tolerance is allowed. The borrow area is located approximately 1,500 feet offshore of the fill area. Estimate assumptions: 1. The beach work will be accomplished using a 30-inch cutterhead pipeline dredge. Since the work is in the exposed open ocean outside the Seagoing Barge Act and Colregs demarcation lines, the dredge and all other associated plants would have to be US Coast Guard Certified. 2. The dredging unit costs were developed based on a review of similar projects (Central Boca Raton, South Boca Raton, Delray Beach, Anna Maria Island, Juno Beach), internal PCE cost estimating methods, and a review of expected upcoming work. It does not appear that there will be an above average need for cutterhead dredges during the winter of 2007 (the expected construction period). 3. A 15% contingency was applied for this level of design. Estimated construction time based on offshore borrow area using one 30-inch cutterhead dredge: Mobilization/demobilization = 1 month or 30 days, Beach fill = 2.6 months or 78 days. Total estimated time = 3.6 months or 108 days. Mobilization/demobilization does not include dredge transit time to and from the site but is assumed to start when equipment arrives at the beach and concludes when the last piece of equipment is removed from the beach.

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Standard Report SelectionsStandard Report Selections						
17 Beach ReplenishmentBeach Replenishment						
1700 Beach ReplenishmentBeach Replenishment						
170099 Associated General ItemsAssociated General Items						
Project Monitoring	**1.0**	EA	530,000	0	79,500	**609,500**
170016 Pipeline DredgingPipeline Dredging						
Beach Fill (Estimated Quantity)	**699,000**	CY	3,844,500	0	576,675	**4,421,175**
170070 Beach FillBeach Fill						
Beach TillingBeach Tilling						
Beach Tilling	**43.3**	EA	13,000	0	1,950	**14,950**
170001 Mob, Demob & Preparatory WorkMob, Demob & Preparatory Work						
New Project Item	**1.0**	LS	1,400,000	0	210,000	**1,610,000**
30 Planning, Engineering and DesignPlanning, Engineering and Design						
3019 Limited Reevaluat'n Report (LRR)Limited Reevaluat'n Report (LRR)						
301901 Engineering Analysis/ReportEngineering Analysis/Report						
30190104 Engineering and Design AnalysisEngineering and Design Analysis						
USR Engineering & Design	**1.0**	EA	122,800	0	0	**122,800**
30190105 Geotechnical Studies ReportGeotechnical Studies Report						
Borrow Area Investigations	**1.0**	LS	150,000	0	0	**150,000**
301904 Environmental Studies DocumentsEnvironmental Studies Documents						
30190403 Environmental Assessment (EA) orEnvironmental Assessment (EA) or						
USR Environmental Assessment	**1.0**	EA	15,000	0	0	**15,000**
30190405 Coordinatn Documts w/Other AgencCoordinatn Documts w/Other Agenc						
USR FDEP Permitting	**1.0**	EA	10,000	0	0	**10,000**
301906 Culturl Resource Studies DocumtsCulturl Resource Studies Documts						
30190609 All Other Cultural ResourcesAll Other Cultural Resources						
Cultural Resources Survey & Report	**1.0**	EA	35,000	0	0	**35,000**
31 Construction ManagementConstruction Management						
3123 Construction ContractsConstruction Contracts						
312311 Supervision and AdministrationSupervision and Administration						
31231101 Prjt Office Supervn and AdminstnPrjt Office Supervn and Adminstn						
Construction Management (S&I)	**1.0**	LS	332,800	0	0	**332,800**
Real EstateReal Estate						
Real Estate Easement CostsReal Estate Easement Costs						
Real Estate Easement Cost	**1.0**	EA	12,500	0	0	**12,500**

Estimated by	Coastal Planning & Engineering, Inc.
Designed by	Coastal Planning & Engineering, Inc.
Prepared by	Coastal Planning & Engineering, Inc.
Preparation Date	8/13/2007
Effective Date of Pricing	8/13/2007
Estimated Construction Time	114 Days

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Designed by
Coastal Planning & Engineering, Inc.

Estimated by
Coastal Planning & Engineering, Inc.

Prepared by
Coastal Planning & Engineering, Inc.

Design Document	North Boca Raton LRR
Document Date	8/13/2007
District	Jacksonville District
Contact	Charlie Stevens
Budget Year	2007
UOM System	Original

Direct Costs
LaborCost
EQCost
SubBidCost

Timeline/Currency

Preparation Date	8/13/2007
Escalation Date	8/13/2007
Eff. Pricing Date	8/13/2007
Estimated Duration	114 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB06EB: MII English Cost Book 2006

Labor LB06NatFD: Labor National 2006
Note: http://www.wdol.gov/

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Date	Author	Note
8/30/2007	Gordon Thomson, PE	This is a pre-plans and specifications cost estimate developed for the 2017 nourishment project without a draft bid schedule. This estimate was developed as part of the LRR for the second periodic renourishment. SUBJECT: Palm Beach County, Florida, Shore Protection Project (From Martin County Line to Lake Worth Inlet and from South Lake Worth Inlet to South County Line) Limited Reevaluation Report for North Boca Raton, Second Periodic Renourishment with Environmental Assessment. Construction volumes are based on erosion rates between May 1998 and September 2004 to avoid effects of Hurricane Jeanne and Hurricane Wilma on the erosion rate. Project assumes 737,000 cubic yards in-place. All dredge material is to come from Borrow Area A and will be dredged using a large (30") ocean certified pipeline dredge. Turbidity monitoring and beach tilling will be required. Project extends 1.45 miles along Palm Beach County's Atlantic shoreline, extending from T-205 to R-212+180 (south of Yamato Rock to north of Red Reef Park). Total volume to be placed = 737,000 cubic yards with fill to be placed in one continuous reach along 1.45 miles of shoreline. The total estimated quantity used in the cost estimate for the LRR is 737,000 cubic yards in-place. Construction berm varies, 1V:10H berm slope, berm elevation = +9.0 feet, NGVD. Volumes provided assume that there will be no pay for material placed above the design template, though a +0.5-foot tolerance is allowed. The borrow area is located approximately 1,500 feet offshore of the fill area. Estimate assumptions: 1. The beach work will be accomplished using a 30-inch cutterhead pipeline dredge. Since the work is in the exposed open ocean outside the Seagoing Barge Act and Colregs demarcation lines, the dredge and all other associated plants would have to be US Coast Guard Certified. 2. The dredging unit costs were developed based on a review of similar projects (Central Boca Raton, South Boca Raton, Delray Beach, Anna Maria Island, Juno Beach), internal PCE cost estimating methods. 3. A 15% contingency was applied for this level of design. Estimated construction time based on offshore borrow area using one 30-inch cutterhead dredge: Mobilization/demobilization = 1 month or 30 days, Beach fill = 2.8 months or 84 days. Total estimated time = 3.8 months or 114 days. Mobilization/demobilization does not include dredge transit time to and from the site but is assumed to start when equipment arrives at the beach and concludes when the last piece of equipment is removed from the beach.

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Standard Report Selections						
17 Beach Replenishment						
1700 Beach Replenishment						
170099 Associated General Items						
Project Monitoring	1.0	EA	530,000	0	79,500	**609,500**
170016 Pipeline Dredging						
Beach Fill (Estimated Quantity)	737,000.0	CY	3,500,750	0	525,113	**4,025,863**
170070 Beach Fill						
Beach Tilling						
Beach Tilling	43.3	EA	13,000	0	1,950	**14,950**
170001 Mob, Demob & Preparatory Work						
New Project Item	1.0	LS	1,400,000	0	210,000	**1,610,000**
30 Planning, Engineering and Design						
3019 Limited Reevaluat'n Report (LRR)						
301901 Engineering Analysis/Report						
30190104 Engineering and Design Analysis						
USR Engineering & Design	1.0	EA	103,000	0	0	**103,000**
30190105 Geotechnical Studies Report						
Borrow Area Investigations	1.0	LS	150,000	0	0	**150,000**
301904 Environmental Studies Documents						
30190403 Environmental Assessment (EA) or						
USR Environmental Assessment	1.0	EA	15,000	0	0	**15,000**
30190405 Coordinatn Documts w/Other Agenc						
USR FDEP Permitting	1.0	EA	10,000	0	0	**10,000**
301906 Culturl Resource Studies Documts						
30190609 All Other Cultural Resources						
Cultural Resources Survey & Report	1.0	EA	35,000	0	0	**35,000**
31 Construction Management						
3123 Construction Contracts						
312311 Supervision and Administration						
31231101 Prjt Office Supervn and Adminstn						
Construction Management (S&I)	1.0	LS	313,000	0	0	**313,000**

Estimated by	Coastal Planning & Engineering, Inc.
Designed by	Coastal Planning & Engineering, Inc.
Prepared by	Coastal Planning & Engineering, Inc.
Preparation Date	8/30/2007
Effective Date of Pricing	8/30/2007
Estimated Construction Time	120 Days

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Designed by
Coastal Planning & Engineering, Inc.

Estimated by
Coastal Planning & Engineering, Inc.

Prepared by
Coastal Planning & Engineering, Inc.

Design Document	North Boca Raton LRR
Document Date	8/30/2007
District	Jacksonville District
Contact	Charlie Stevens
Budget Year	2007
UOM System	Original

Direct Costs
LaborCost
EQCost
SubBidCost

Timeline/Currency

Preparation Date	8/30/2007
Escalation Date	8/30/2007
Eff. Pricing Date	8/30/2007
Estimated Duration	120 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB06EB: MII English Cost Book 2006

Labor LB06NatFD: Labor National 2006
Note: http://www.wdol.gov/

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Date	Author	Note
8/30/2007	Gordon Thomson, PE	This is a pre-plans and specifications cost estimate developed for the 2027 nourishment project without a draft bid schedule. This estimate was developed as part of the LRR for the second periodic renourishment. SUBJECT: Palm Beach County, Florida, Shore Protection Project (From Martin County Line to Lake Worth Inlet and from South Lake Worth Inlet to South County Line) Limited Reevaluation Report for North Boca Raton, Second Periodic Renourishment with Environmental Assessment. Construction volumes are based on erosion rates between May 1998 and September 2004 to avoid effects of Hurricane Jeanne and Hurricane Wilma on the erosion rate. Project assumes 810,700 cubic yards in-place. Dredge material will likely be dredged from both Borrow Area A and Borrow Area B and will be dredged using a large (30") ocean certified pipeline dredge. Turbidity monitoring and beach tilling will be required. Project extends 1.45 miles along Palm Beach County's Atlantic shoreline, extending from T-205 to R-212+180 (south of Yamato Rock to north of Red Reef Park). Total volume to be placed = 810,700 cubic yards with fill to be placed in one continuous reach along 1.45 miles of shoreline. The total estimated quantity used in the cost estimate for the LRR is 810,700 cubic yards in-place. Construction berm varies, 1V:10H berm slope, berm elevation = +9.0 feet, NGVD. Volumes provided assume that there will be no pay for material placed above the design template, though a +0.5-foot tolerance is allowed. The borrow area is located approximately 1,500 feet offshore of the fill area. Estimate assumptions: 1. The beach work will be accomplished using a 30-inch cutterhead pipeline dredge. Since the work is in the exposed open ocean outside the Seagoing Barge Act and Colregs demarcation lines, the dredge and all other associated plants would have to be US Coast Guard Certified. 2. The dredging unit costs were developed based on a review of similar projects (Central Boca Raton, South Boca Raton, Delray Beach, Anna Maria Island, Juno Beach), internal PCE cost estimating methods. 3. A 15% contingency was applied for this level of design. Estimated construction time based on offshore borrow area using one 30-inch cutterhead dredge: Mobilization/demobilization = 1 month or 30 days, Beach fill = 3.0 months or 90 days. Total estimated time = 4.0 months or 120 days. Mobilization/demobilization does not include dredge transit time to and from the site but is assumed to start when equipment arrives at the beach and concludes when the last piece of equipment is removed from the beach.

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Standard Report SelectionsStandard Report Selections						
17 Beach ReplenishmentBeach Replenishment						
1700 Beach ReplenishmentBeach Replenishment						
170099 Associated General ItemsAssociated General Items						
Project Monitoring	**1.0**	EA	530,000	0	79,500	**609,500**
170016 Pipeline DredgingPipeline Dredging						
Beach Fill (Estimated Quantity)	**810,700.0**	CY	4,045,393	0	606,809	**4,652,202**
170070 Beach FillBeach Fill						
Beach TillingBeach Tilling						
Beach Tilling	**43.3**	EA	13,000	0	1,950	**14,950**
170001 Mob, Demob & Preparatory WorkMob, Demob & Preparatory Work						
New Project Item	**1.0**	LS	1,400,000	0	210,000	**1,610,000**
30 Planning, Engineering and DesignPlanning, Engineering and Design						
3019 Limited Reevaluat'n Report (LRR)Limited Reevaluat'n Report (LRR)						
301901 Engineering Analysis/ReportEngineering Analysis/Report						
30190104 Engineering and Design AnalysisEngineering and Design Analysis						
USR Engineering & Design	**1.0**	EA	134,300	0	0	**134,300**
30190105 Geotechnical Studies ReportGeotechnical Studies Report						
Borrow Area Investigations	**1.0**	LS	150,000	0	0	**150,000**
301904 Environmental Studies DocumentsEnvironmental Studies Documents						
30190403 Environmental Assessment (EA) orEnvironmental Assessment (EA) or						
USR Environmental Assessment	**1.0**	EA	15,000	0	0	**15,000**
30190405 Coordinatn Documts w/Other AgencCoordinatn Documts w/Other Agenc						
USR FDEP Permitting	**1.0**	EA	10,000	0	0	**10,000**
301906 Culturl Resource Studies DocumtsCulturl Resource Studies Documts						
30190609 All Other Cultural ResourcesAll Other Cultural Resources						
Cultural Resources Survey & Report	**1.0**	EA	35,000	0	0	**35,000**
31 Construction ManagementConstruction Management						
3123 Construction ContractsConstruction Contracts						
312311 Supervision and AdministrationSupervision and Administration						
31231101 Prjt Office Supervn and AdminstnPrjt Office Supervn and Adminstn						
Construction Management (S&I)	**1.0**	LS	344,300	0	0	**344,300**

APPENDIX B

BOCA RATON SHORE PROTECTION PROJECT

GEOTECHNICAL REPORT

BOCA RATON SHORE PROTECTION PROJECT
GEOTECHNICAL REPORT

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BOCA RATON SHORE PROTECTION PROJECT
GEOTECHNICAL REPORT

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B-14 2002 Beach Data-Individual Grain Size Distribution Curves/Histograms
B-15 2002 Beach Data-Composite Granularmetric Reports
B-16 2002 Beach Data-Composite Grain Size Distribution Curves/Histograms

BOCA RATON SHORE PROTECTION PROJECT
GEOTECHNICAL REPORT

INTRODUCTION

B-1. This report summarizes geotechnical investigations and geophysical surveys that identify marine sand resources offshore of Boca Raton in Palm Beach County, Florida. The survey area is located offshore of north Boca Raton, approximately 0.5 miles offshore in water depths that range from 40 to 60 feet. Sedimentary deposits targeted in this investigation include unconsolidated sediments that infill an inter-reefal trough between an inshore rock reef (Anastasia Formation) and an offshore coral reef, within Boca Raton borrow areas that were developed in 1984 and 1994. A 3,000-foot northern extension to these previous borrow areas is also included in this investigation (Figure 1). The extension area has not been dredged and likely contains sedimentary materials that are laterally contiguous with known deposits of beach-compatible sands.

PROJECT PURPOSE AND SCOPE

B-2. The purpose of this sand search was to explore sand flats (trough infills) in an effort to identify offshore sand deposits that are compositionally compatible with, and texturally suitable, for beach fill for the North Boca Raton Renourishment Project, which is to be constructed in 2006. The sand search was conducted in three phases. Phase I included initial field planning and coordination based on historical data that was compiled for the study area. This legacy data included 1984 and 1994 vibracore logs, and 2002 LADS bathymetry. Phase II focused on obtaining detailed seismic, side-scan sonar, and magnetometer data. The Phase III investigation involved a vibracore survey. The investigations were conducted according to protocols, guidelines, and standards that are acceptable to the Florida Department of Environmental Protection (DEP). The results of these investigations were used to define the best quality economic sediment source available for future renourishment projects.

GEOGRAPHIC AND GEOLOGICAL SETTING

B-3. Boca Raton is located on the southeast coast of Florida in the southernmost portion of Palm Beach County (Figure B-1). Boca Raton Beach is divided by Boca Raton Inlet. The City is bounded by the City of Deerfield Beach to the south and Highland Beach to the north.

B-4. The southeast Florida Lowlands physiographic province represents an area of emergent, low-relief carbonate platforms (Parkinson and White, 1994). Surface lithified rocks along most of the coast of Palm Beach County consist of coquinoid limestones of the Anastasia Formation (Cooke, 1945). Coastal outcrops of the coquinoid limestone occur at several locales along the intertidal zone along Boca Raton's shoreline.

B-5. The continental shelf along the southeast coast of Florida varies in width from a few miles to about one mile (Raymond, 1972). The shelf is narrowest between Palm Beach and Miami and

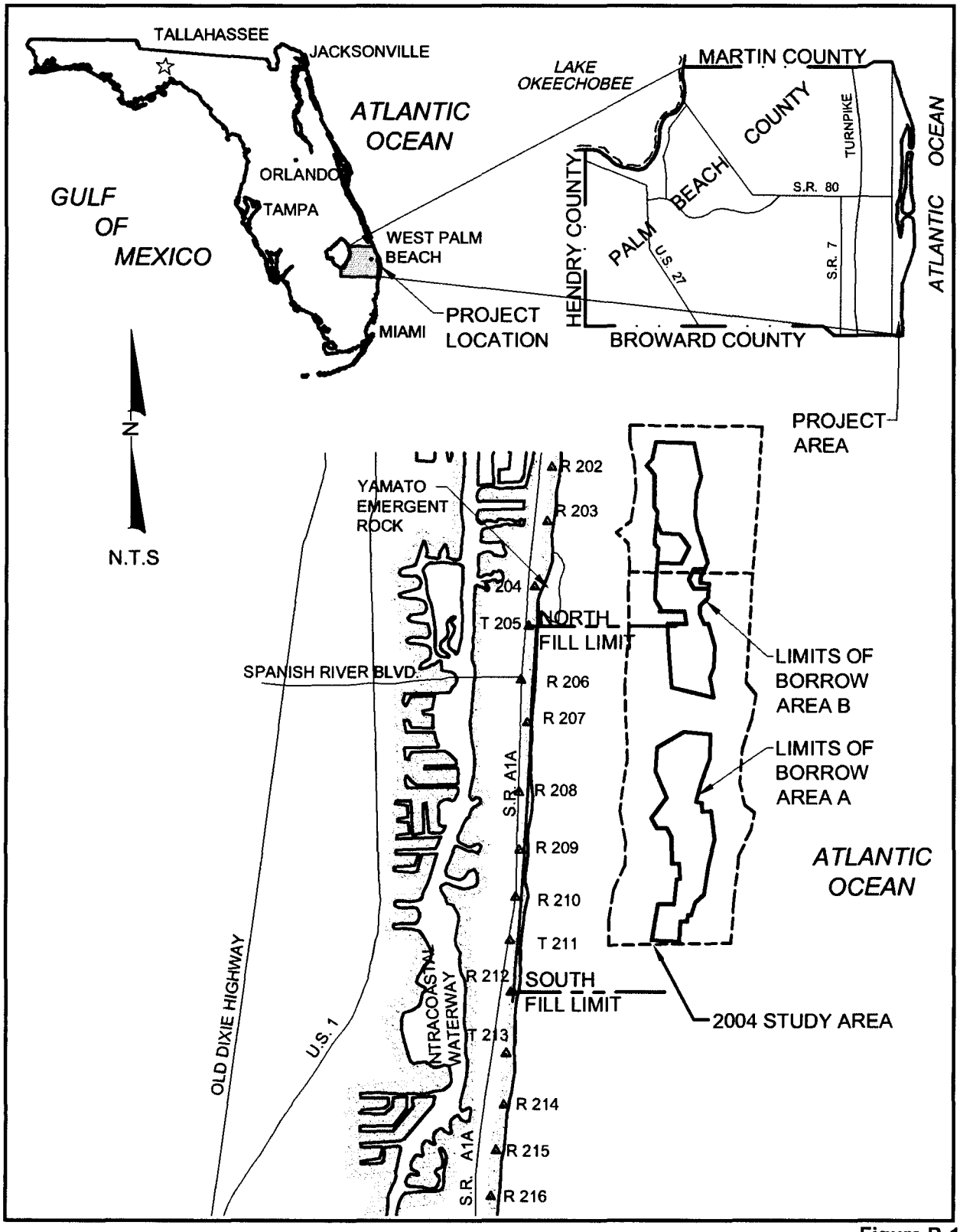


Figure B-1
Location Map of the Boca Raton Beach Renourishment Project and Offshore Study Area

consists of step-like terraces (Raymond, 1972). These terraces coincide with the reef systems outlined by Duane and Meisberger (1969). Relict barrier reefs form intermittent ridges at the seaward edges of each of these terraces (Raymond, 1972). The reefs trend parallel to the approximately north-south orientation of the shoreline.

B-6. Sediments on the shelf can be divided into two distinct types. South of Boca Raton the dominant sediments are white to gray, calcareous, skeletal sand and gravel. Over 80% of this sediment is composed of calcium carbonate (Duane and Meisberger, 1969). North of Boca Raton the dominant sediment type is a homogeneous, fine to medium-grained gray sand composed of approximately 60% calcium carbonate. The calcium carbonate is composed of brown, gray or black calcareous skeleton fragments (Duane and Meisberger, 1969).

GEOTECHNICAL INVESTIGATIONS

PREVIOUS STUDIES

B-7. The earliest study offshore south Palm Beach County was conducted as part of a regional investigation of the nearshore continental shelf by the U.S. Army Corps of Engineers in 1969. A reconnaissance level seismic survey along the entire South Florida coast included a single alongshore trackline which crossed the approximate location of the north Boca Raton study area. Three vibracores were collected within the vicinity of the study area during this investigation.

B-8. In 1979, the U.S. Army Corps of Engineers conducted an additional county wide vibracore study which included three additional vibracores within the vicinity of the north Boca Raton sand search area.

B-9. In 1984, the City of Boca Raton contracted Coastal Planning & Engineering, Inc. (CPE) to conduct a sand search to locate sand for a restoration project of the northern 1.45 miles of the Boca Raton shoreline. A sand source for the beach renourishment project was identified approximately 2,500 feet offshore from the project area. Geotechnical surveys included seismic, side-scan sonar, jet probes, vibracores, magnetometer and bathymetric investigations. The seismic survey was performed to determine the thickness of sediment which overlays the limestone. The isopach showed a layer of sand ranging from 20 to 50 feet in the borrow area (CPE, 1985a). The side-scan sonar survey showed no areas of relief or hardbottom within the borrow area. The magnetometer survey covered the borrow area and an additional 200-foot buffer around the borrow area.

B-10. During the survey, 23 magnetic anomalies were recorded. Fifteen anomalies were located outside and 8 were located inside the boundaries of the proposed borrow area (CPE, 1985b). In a letter dated March 14, 1986, the State Historic Preservation Officer (SHPO) reported that nine scattered anomalies within and immediately adjacent to the borrow area were unlikely to be culturally or historically significant (Percy, 1986). The remaining fourteen anomalies, however, fell into two clusters and were identified by the SHPO as potential cultural or historical resources. Prior to the 1988 project, the SHPO recommended the establishment of a 150-foot

buffer zone around each of the two anomaly clusters. As an added measure of safety, a 200-foot buffer zone was implemented instead of the recommended 150-foot buffer zone.

B-11. The Florida Department of Environmental Protection (FDEP) required that beach surveys consisting of onshore profiles and offshore bathymetric profiles be performed on an annual basis. The 1985 beach sediment analysis resulted in a composite mean grain size of 0.31 mm (1.68 phi). When sand samples were collected from the beach immediately preceding the 1988 restoration, the composite mean grain size was 0.42 mm (1.25 phi). The considerably coarser sand of the 1988 samples is typical of sediments on badly eroded beaches where the finer sediments have been winnowed from and transported off of the beach. The pre-construction sorting value of the native beach sand was 0.71 phi, which is considered well sorted (Table B-1).

B-12. Following the dredging project in 1988, annual post-construction surveys have been conducted by CPE. The surveys monitor infilling and side slope adjustment and are reported in the annual restoration monitoring reports completed as a permit requirement for the Department of Environmental Protection (CPE, 1991a, 1991b, 1992, 1993, 1995, 1996, 1997a, 1997b and 1998).

B-13. In 1993, the U.S. Army Corps of Engineers conducted a county-wide preliminary sand search of the offshore area out to 1 mile from shore. The USACE (1994) found an estimated 32,000,000 cubic yards of unconsolidated sediment offshore of Boca Raton. This was estimated to be sufficient to supply the project for the remainder of its authorized project life. A preliminary borrow area was identified for future use in conjunction with the project.

Table B-1
1988 Restoration Sediment Characteristics

Location	Date	Mean Grain Size (mm)	Mean Grain Size (phi)	Sorting (phi)	Silt %
Borrow Area (CPE, 1987)	1984	0.32	1.65	0.85	0.51
Beach (Native) (CPE, 1987)	1985	0.31	1.68	0.80	0.40
Beach (Pre) (CPE, 1991a)	6/88	0.42	1.25	0.71	1.22
Beach (Post) (CPE, 1991b)	8/88	0.35	1.51	0.63	1.00

Note: 2 point method used to determine mean grain size and sorting values.

B-14. A borrow area investigation was conducted by CPE in 1994. The 1994 borrow area investigation was performed in much the same manner as the 1984 investigation. The previously used borrow sites and adjacent areas were surveyed and vibracored to establish the characteristics and quantity of the sediment. The area of re-investigation was determined by review of the 1984 sand search seismic and side scan sonar data. Based on the 1984 seismic data, it was determined that the location in and around the previous borrow area contained the deepest deposits of sand that were free of rubble and reef talus. A sand source for the 1998 renourishment project, located approximately 2,500 ft directly offshore of the beach fill area was delimited based on the 1994 investigation. Approximately 2,471,000 cubic yards of beach compatible sand was found as a result of this investigation. During March and April of 1998, approximately 600,000 cubic yards of sand were hydraulically dredged from this borrow area and placed over the same 1.45 mile project area as the 1988 beach restoration.

RECENT INVESTIGATIONS

2004 Beach Area Sediment Characteristics

B-15. Beach sediment samples were obtained in October 2002. Surface samples were taken at the top of dune, toe of dune, mid-berm, mean high water, mean tide line, mean low water, trough, bar and elevation intervals of 3 feet from an elevation of -12 feet NAVD 88 to an elevation of -24 feet NAVD 88. Individual granularmetric reports and grain size distribution curves/histograms are presented in Sub-Appendices B-13 and B-14, respectively. The mean grain size for profile T-207 was 0.26 mm (1.93 phi). Similarly, the mean grain size for R-210 was 0.26 mm (1.93 phi). The composite mean grain size was 0.26 mm and the composite sorting was calculated to be 0.86 phi (Table B-2). Composite granularmetric reports and grain size distribution curves/histograms are presented in Sub-Appendices B-15 and B-16, respectively. Composite summary tables are presented in Sub-Appendix B-12.

Table B-2
Borrow Area Sediment Characteristics

LOCATION	SURFACE AREA (SQ. FT.)	VOLUME (C.Y.)	MEAN GRAIN SIZE (MM)	MEAN GRAIN SIZE (PHI)	MEAN SORTING (PHI)	MEAN SILT/CLAY (%)	Ra	Rj
2002 BEACH DATA	-	-	0.26	1.93	0.86	1.06	-	-
TOTAL BORROW AREA	7,060,000	3,005,000	0.27	1.90	0.85	1.43	1.00	0.98
BORROW AREA A	3,400,000	1,290,000	0.26	1.97	0.86	1.15	1.02	1.05
BORROW AREA B	3,660,000	1,715,000	0.28	1.85	0.84	1.61	1.00	0.93

2004 Borrow Area

Geophysical Investigation – Seismic, Side Scan Sonar and Magnetometer Surveys

B-16. The seismic, side scan sonar and magnetometer surveys were performed concurrently across the old borrow areas in the southern part of the study area and in the northern 3,000-foot extension. Track lines were spaced approximately 200 feet apart in areas that were previously dredged as these borrow areas have already undergone cultural resource investigations. In order to obtain the survey resolution necessary for cultural resource assessment, geophysical track line spacing was decreased to 100 feet in the 3,000-foot northern extension. Analysis of seismic data and detailed LADS bathymetry in conjunction with interpretation of legacy jet probe and vibracore logs indicated data gaps and locations where additional vibracores would be required to meet minimum industry standards of 1,000-foot spacing between vibracores.

B-17. Results of the side scan sonar investigation were used to delimit hardbottom locations (Figures B-2 and B-3). A 400-foot buffer was applied around the hardbottom areas during borrow area development. A small area east of Borrow Area A was interpreted as possible hardbottom from the side scan sonar. The area was diver verified as being discontinuous rubble. The position of the rubble was recorded and a 400-foot buffer was applied around the area (Figure B-2).

B-18. Coastal Planning & Engineering, Inc. subcontracted Tidewater Atlantic Research to assess the project area for submerged cultural resources. The magnetometer survey and side scan sonar survey were utilized to this end. Analysis of the data revealed a total of three targets (Figure B-3): two magnetic anomalies within the study area and one within 200 feet of its boundary (Tidewater Atlantic Research, 2004). Two of the targets exhibited characteristics consistent with modern debris and were not recommended for further investigation. The third anomaly, BR-02, has a complex signature of low intensity and high duration. Additional investigation to identify and assess the material generating the signature has been recommended. In order to avoid this area a 200-foot buffer was applied around this area during borrow area development.

Vibracore Investigation

B-19. Ten vibracores were taken in the study area in 2004. The vibracore locations were selected within the northern extension and to supplement historic data collected in the previous study areas (Figures B-2 and B-3). The vibracores were obtained in water depths ranging from 38 to 64 feet (NAVD).

B-20. The vibracore rig utilizes a 20-foot long steel barrel with a 3-inch liner which is vibrated into the sediments by a hydraulically operated motor. The 20-foot long core barrel is supported by a tripod assembly that holds the barrel erect on the sea floor.

B-21. Positioning for the vibracores was obtained by use of DGPS interfaced with Coastal Oceanographics data acquisition survey software, HYPACK®.

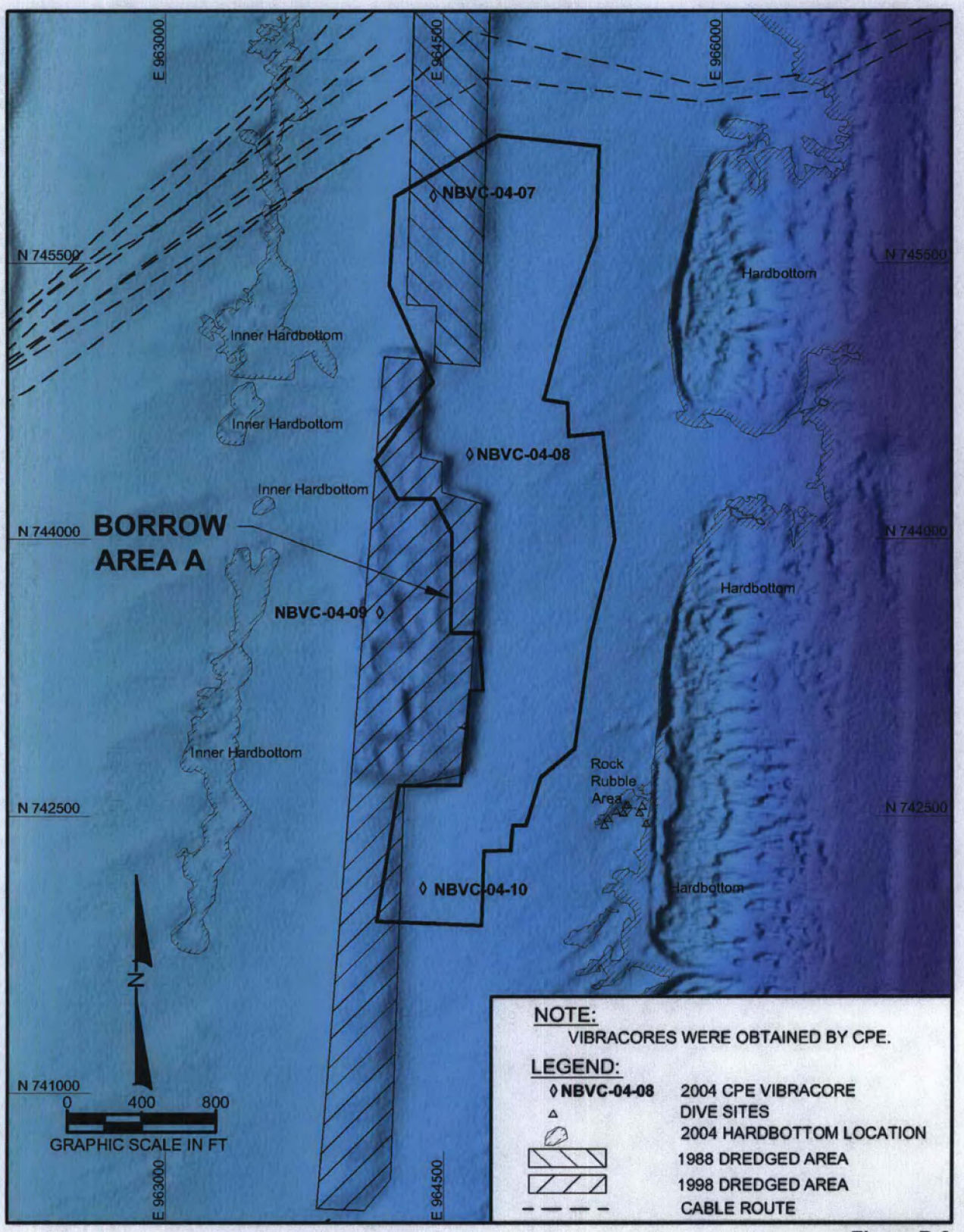


Figure B-2

Borrow Area A – Reef and Hardbottom Locations

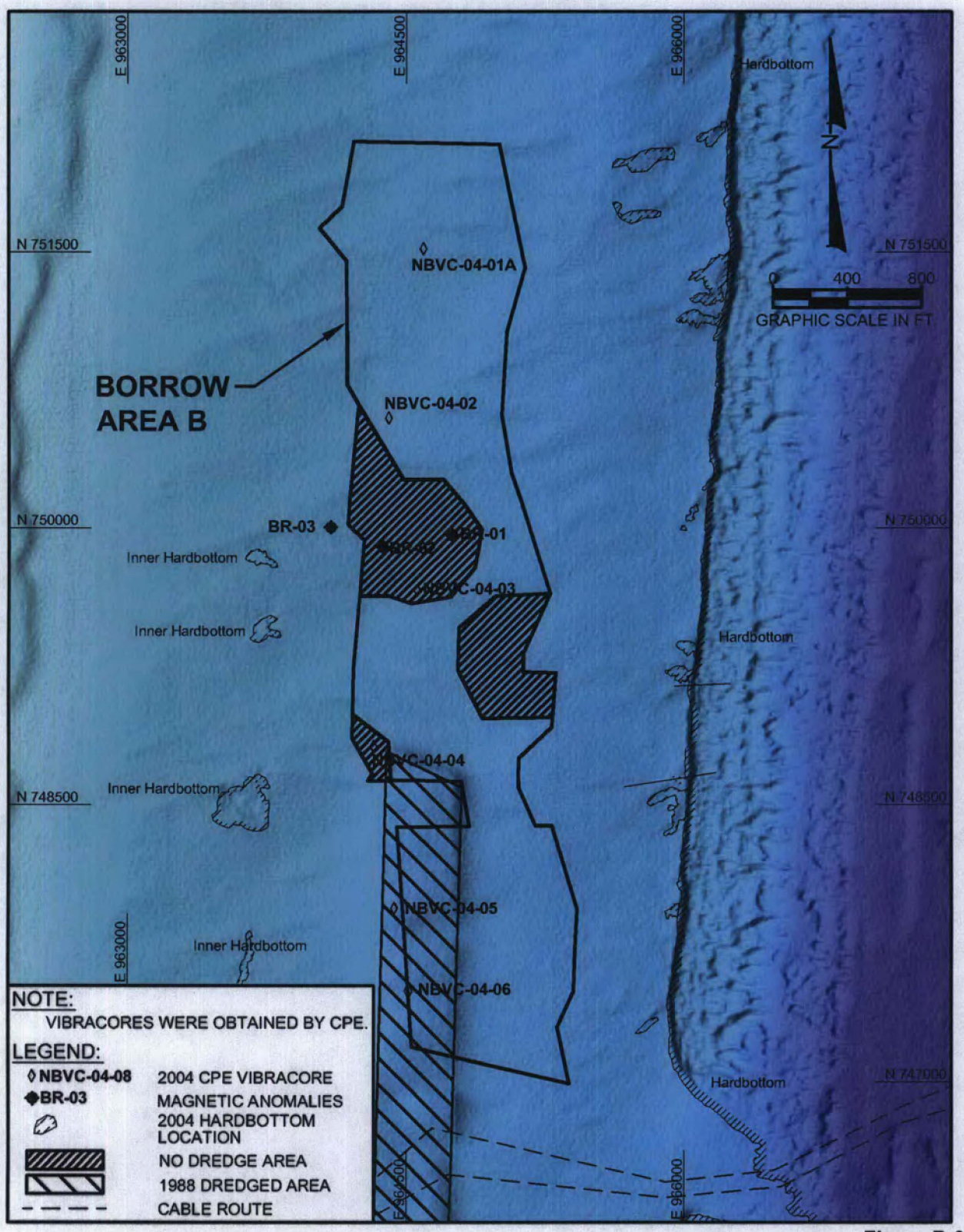


Figure B-3

Borrow Area B – Magnetic Anomaly, Reef and Hardbottom Locations

B-22. The cores were returned to the laboratory and divided lengthwise in preparation for analysis. The megascopic characteristics of each vibracore was described and logged (Sub-Appendix B-2). Visual descriptions included color and textural change such as grain size, silt content and shell content. Each core was photographed (Sub-Appendix B-10) and one half of the core was archived. Samples were taken from distinct layers within the non-archived half of the core for analysis. Mechanical sieve analysis was conducted for 32 sub-samples generated from the 10 vibracores. The resulting granularmetric reports and grain size distribution curves/histograms are in Sub-Appendices B-3 and B-4, respectively.

B-23. Ten of the archived 1994 vibracores (NBR-1 to NBR-10) were re-logged to include a higher level of detail for use in this project (Sub-Appendix B-5). Vibracore photographs are presented in Sub-Appendix B-11. Granularmetric reports and grain size distribution curves/histograms for the samples collected from these vibracores are presented in Sub-Appendices 6 and 7, respectively.

Isopach - Sediment Thickness

B-24. The depth to the first reflector (bottom of sand layer) (Figures B-4 and B-5) was developed from data collected during the 2003 geophysical and geotechnical investigations. Unconsolidated sediment depth was identified using seismic data, and subsequently verified by vibracore analysis. Unconsolidated sediment thicknesses up to 47 feet were found when comparing the 2002 LADS bathymetry (Figures B-6 and B-7) and the depth to the first reflector.

Sediment Analysis

B-25. Sieve analyses of samples were performed in accordance with the American Society for Testing and Materials (ASTM) Standard Methods Designation D 422-63 for particle-size analysis of soils (ASTM, 2004). This method covers the quantitative determination of the distribution of sand size particles. For sediment finer than the No. 230 sieve (4.0 phi) the ASTM Standard Test Method, Designation D 1140-54 was used (ASTM, 2004). The sediment statistics were computed using the moment method (Krumbein, 1936).

(a) Sediment composition. The 10 vibracores obtained in 2004 and the 10 vibracores taken in the 1994 were used to determine the sediment characteristics. The sand in the study area was found to be generally fine grained, composed of a mixture of quartz and carbonate with trace amounts of shell hash, shell fragments and occasional coral fragments. The color is almost uniformly gray (5Y 5/1). Material with silt content greater than 5% was found at the base of vibracore NBVC-04-09. A rock layer was found at the base of vibracores NBR-4 and NBR-7, and scattered coral and rubble was found at the base of vibracore NBVC-04-07. All material that is not defined as being beach quality per FDEP rule FAC 62B-41.007 was excluded from the borrow area design.

(b) Grain size statistics. Granularmetric reports and grain size distribution curves/histograms were generated for each 2004 (Sub-Appendices B-3 and B-4, respectively) and 1994 (Sub-Appendices B-6 and B-7, respectively) vibracore sample. All of the calculated individual grain

size statistics are presented on the granularmetric reports. The mean grain size of material within the study area ranged from 0.16 mm to 0.45 mm. Silt content ranges from 0.53% to 8.3%. The sediment was generally well to moderately sorted.

DELINEATION OF BORROW AREA

B-26. Two borrow areas were delineated based on the recent geotechnical/geophysical investigations and the 1994 vibracore data (Figures B-6 and B-7). Figures B-8 to B-11 show typical cross-sections of sand thickness within these borrow areas.

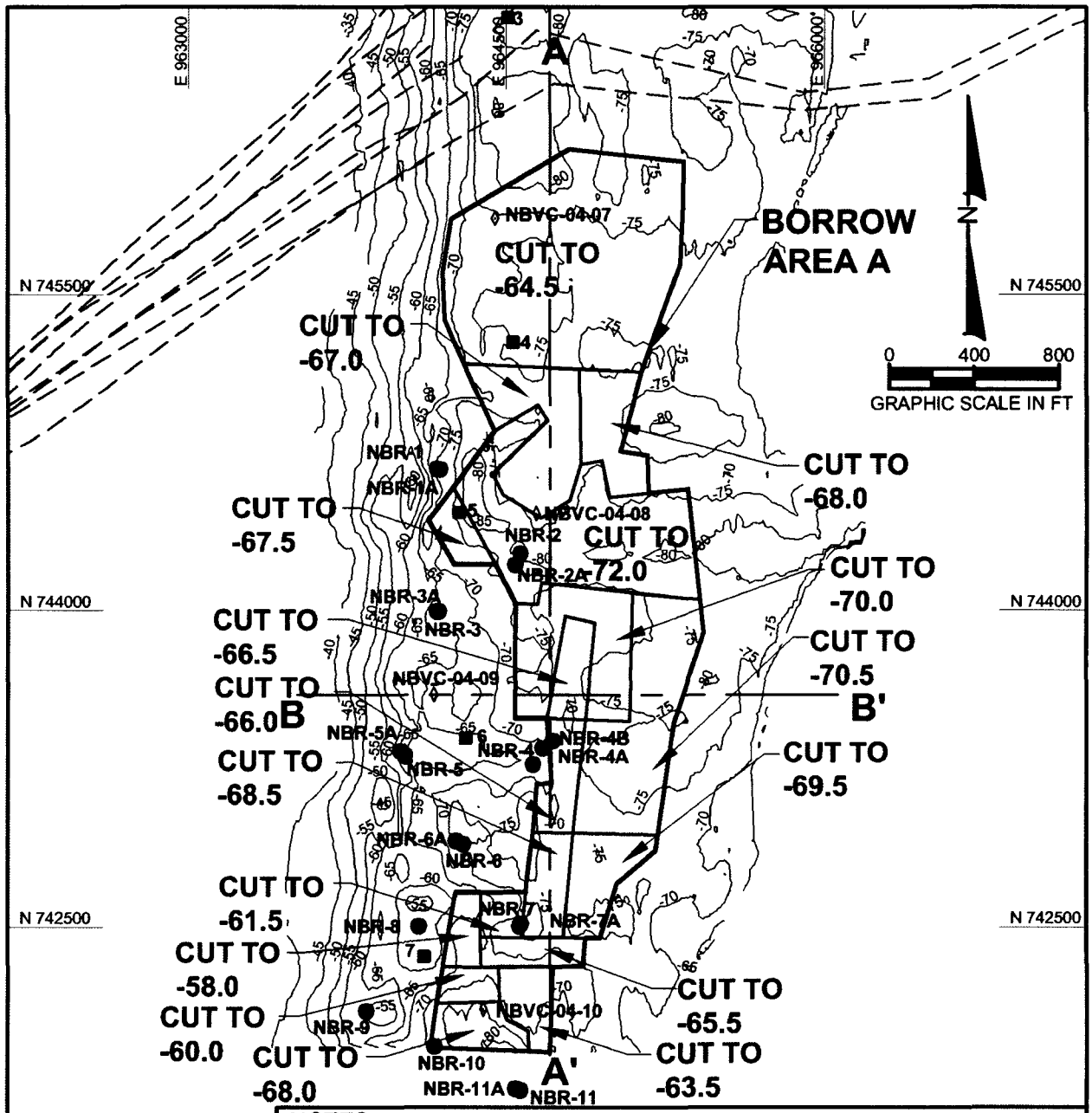
B-27. The study area was initially refined by the application of several buffers:

- The vibracore spacing recommended by the Army Corps of Engineers is 1,000 feet. The extent of the borrow area boundary was therefore limited to a maximum distance of 1,000 feet from any vibracore.
- A 400-foot buffer was applied around reef, hard-bottom and rubble areas identified during the 2003 side-scan sonar survey.
- A 200-foot buffer was applied around magnetic anomaly BR-02, which was identified for avoidance or further investigation during the cultural resource investigation.
- A 300-foot buffer was placed around the cable corridors, effectively bisecting the study area into two borrow areas, A and B (Figures B-6 and B-7).

B-28. The borrow areas were further refined based on the isopach and vibracore data. A minimum 3 foot thickness of beach quality material was maintained when creating cuts for Borrow Areas A and B. Cut depths were then developed for the borrow areas based on vibracore and seismic data.

B-29. Individual core composites were based on cut depths within the cores area of influence. Vibracore composites were determined by weighting sieve analysis results of individual sediment layers, within the cut depth, by their effective length (Sub-Appendix B-1). The weighted averaging method allows for each individual sample to represent the total layer from which it was obtained. Vibracore composite information was then used to compute the sediment characteristics for each borrow area. The resulting granularmetric reports and grain size distribution curves/histograms are in Sub-Appendices B-8 and B-9, respectively.

B-30. Table B-2 shows the total area and estimated quantity of sand of each borrow site as well as the sediment statistics. The total volume available for both borrow sites is 3,005,000 cubic yards of beach compatible sand.



NOTES:

1. CUT DEPTHS ARE IN FEET REFERENCED TO NAVD.
2. CONTOURS ARE ESTIMATED BASED ON SEISMIC DATA COLLECTED IN NOVEMBER 2003, AND REPRESENT DEPTH OF FIRST REFLECTOR.
3. VIBRACORES WERE OBTAINED BY CPE.
4. COORDINATES SHOWN HEREON ARE BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM NAD 83.
5. ELEVATIONS SHOWN HEREON ARE IN FEET BASED ON NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88).

LEGEND:

● NBR-14	1994 CPE VIBRACORE	■4	1984 CPE VIBRACORE
◊ NBVC-04-08	2004 CPE VIBRACORE	— — — —	CABLE ROUTE

Figure B-4

Borrow Area A – Depth to First Reflector

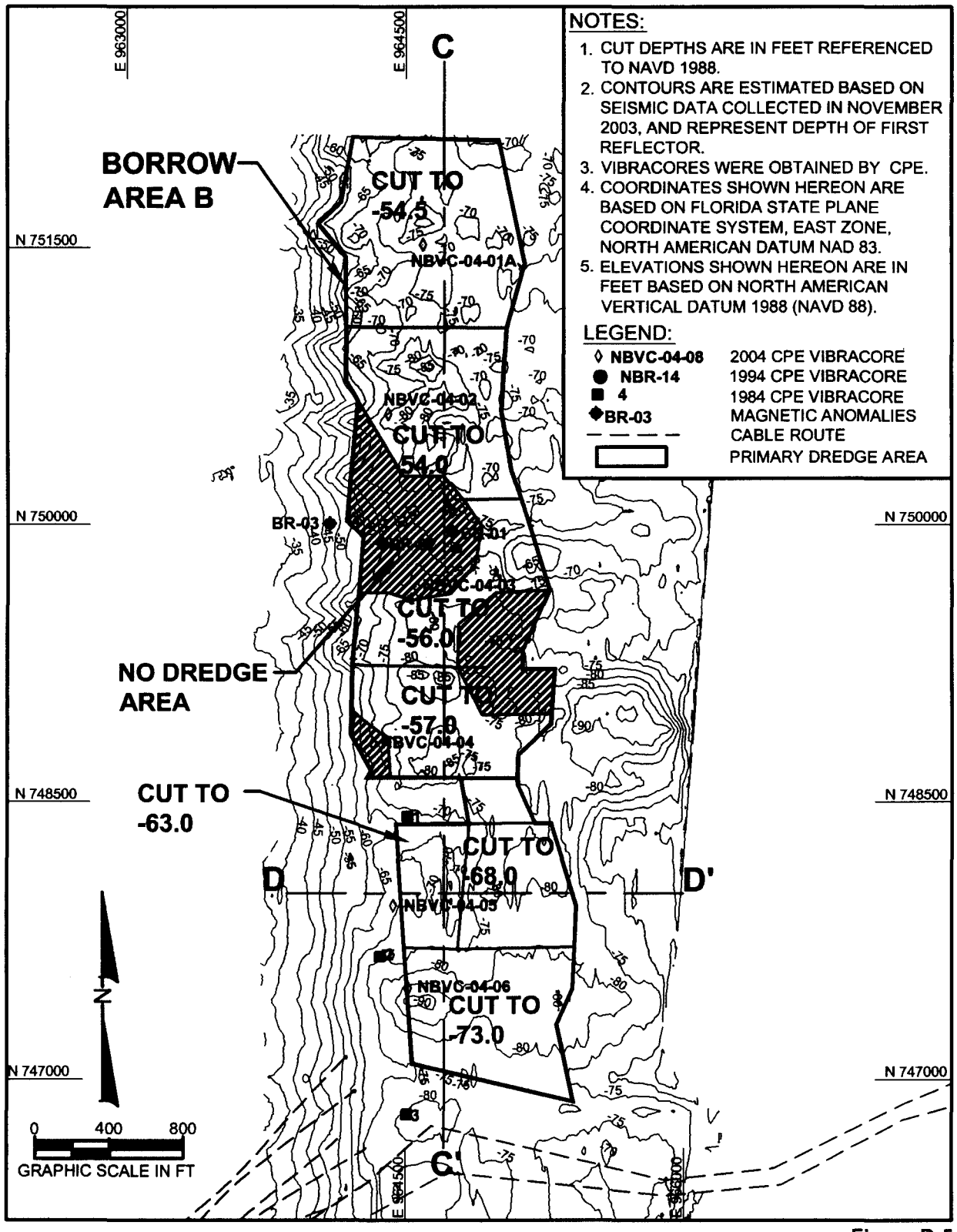
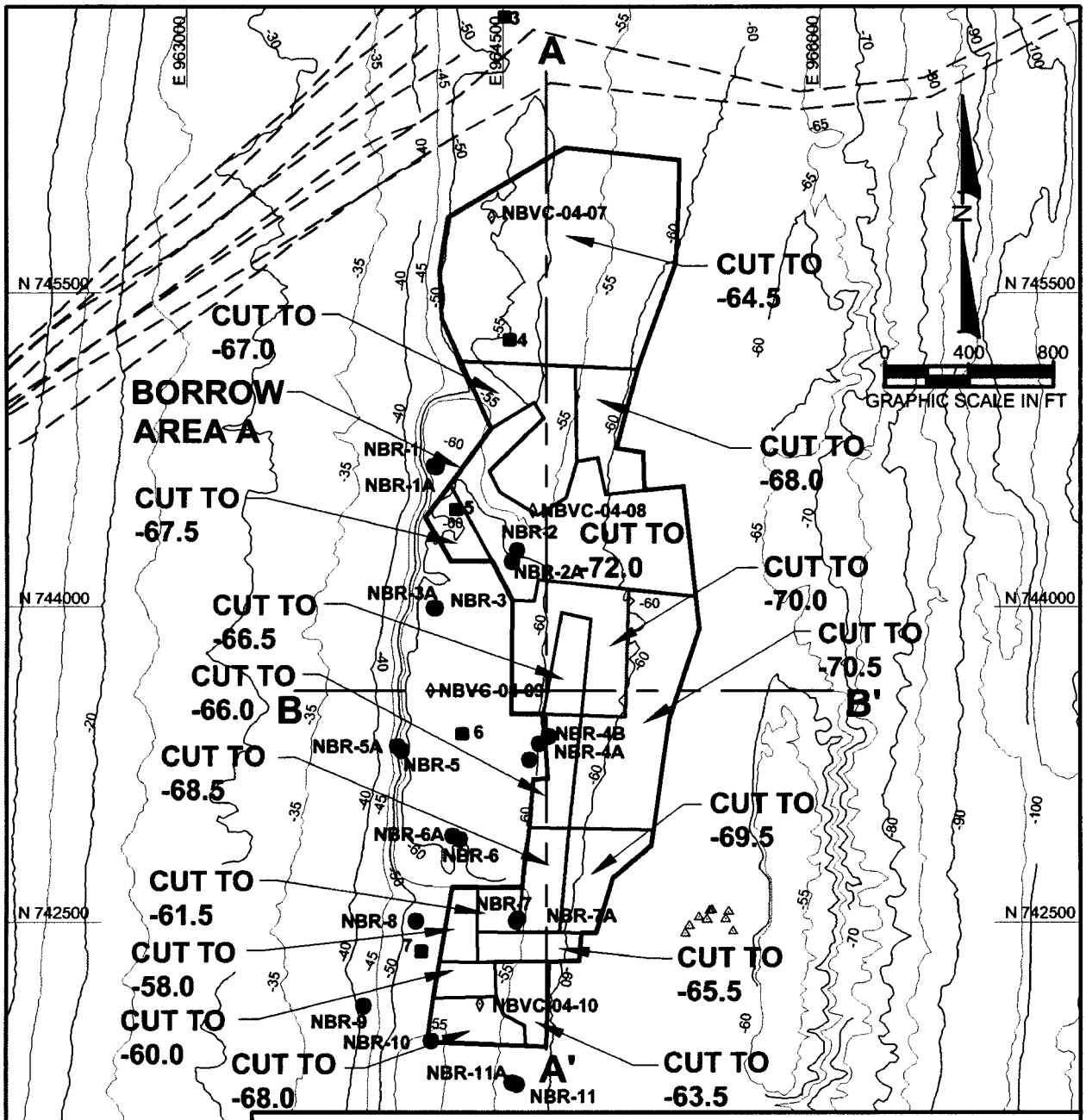


Figure B-5

Borrow Area B – Depth to First Reflector



NOTES

1. CUT DEPTHS ARE IN FEET REFERENCED TO NAVD.
2. BATHYMETRIC SURVEY CONDUCTED BY TENIX LADS CORP. IN OCTOBER 2002.
3. VIBRACORES WERE OBTAINED BY CPE.
4. COORDINATES SHOWN HEREON ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM 1983, (NAD 83).
5. ELEVATIONS SHOWN HEREON ARE IN FEET BASED ON NORTH AMERICAN VERTICAL DATUM 1988, (NAVD 88).

LEGEND:

● NBR-14	1994 CPE VIBRACORE	■4	1984 CPE VIBRACORE
◊ NBVC-04-08	2004 CPE VIBRACORE	— — — —	CABLE ROUTE

Figure B-6

Borrow Area A - Bathymetry

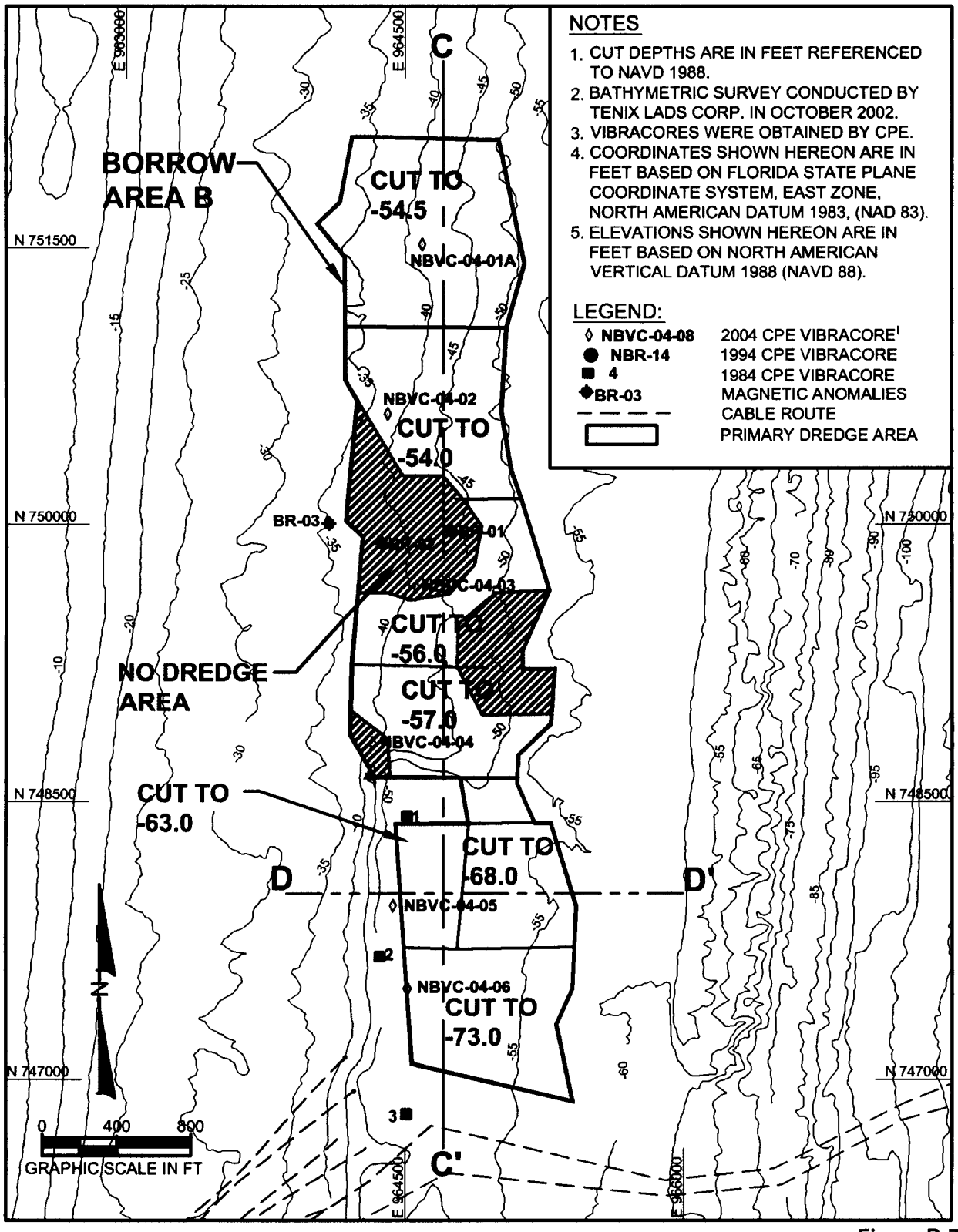
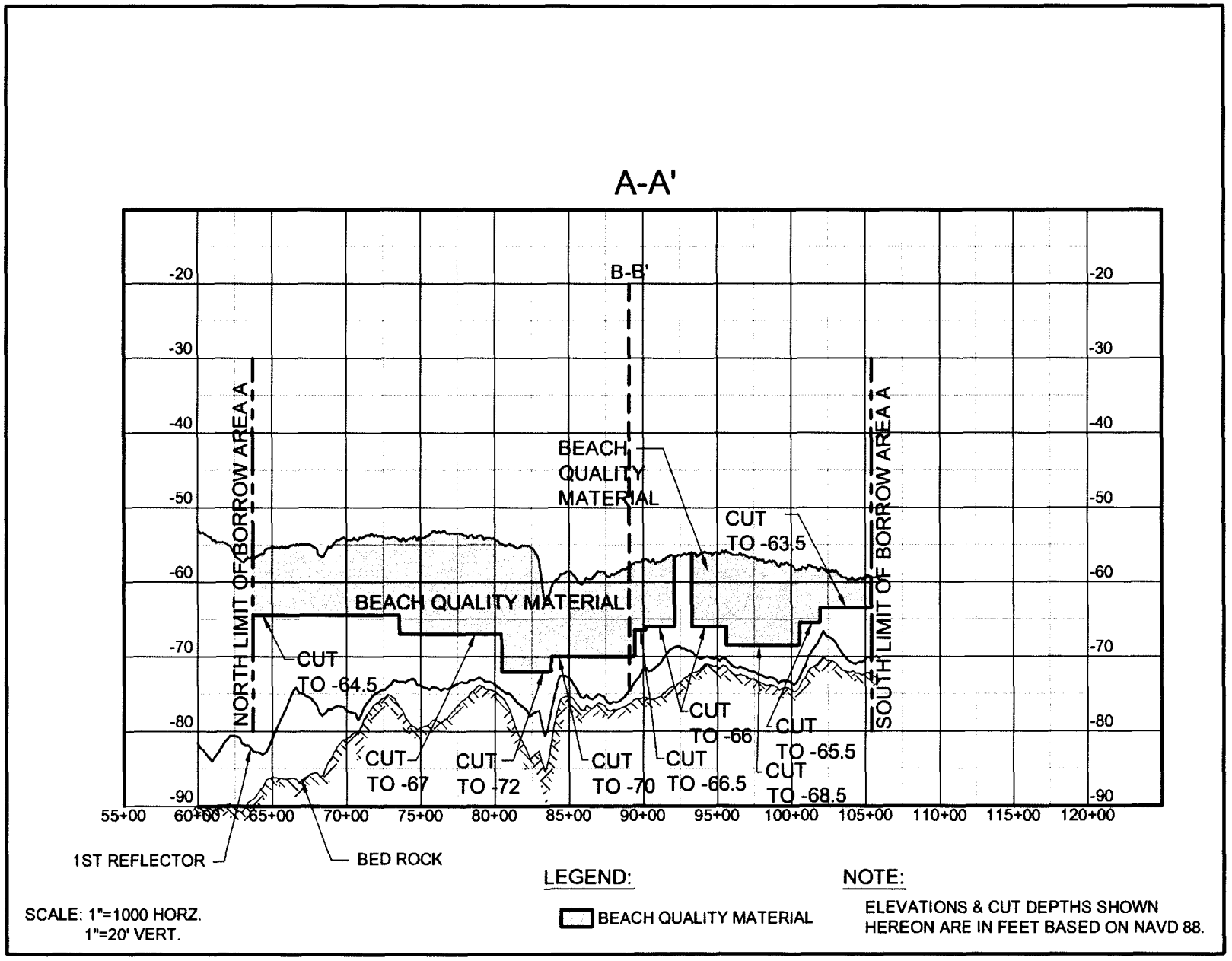


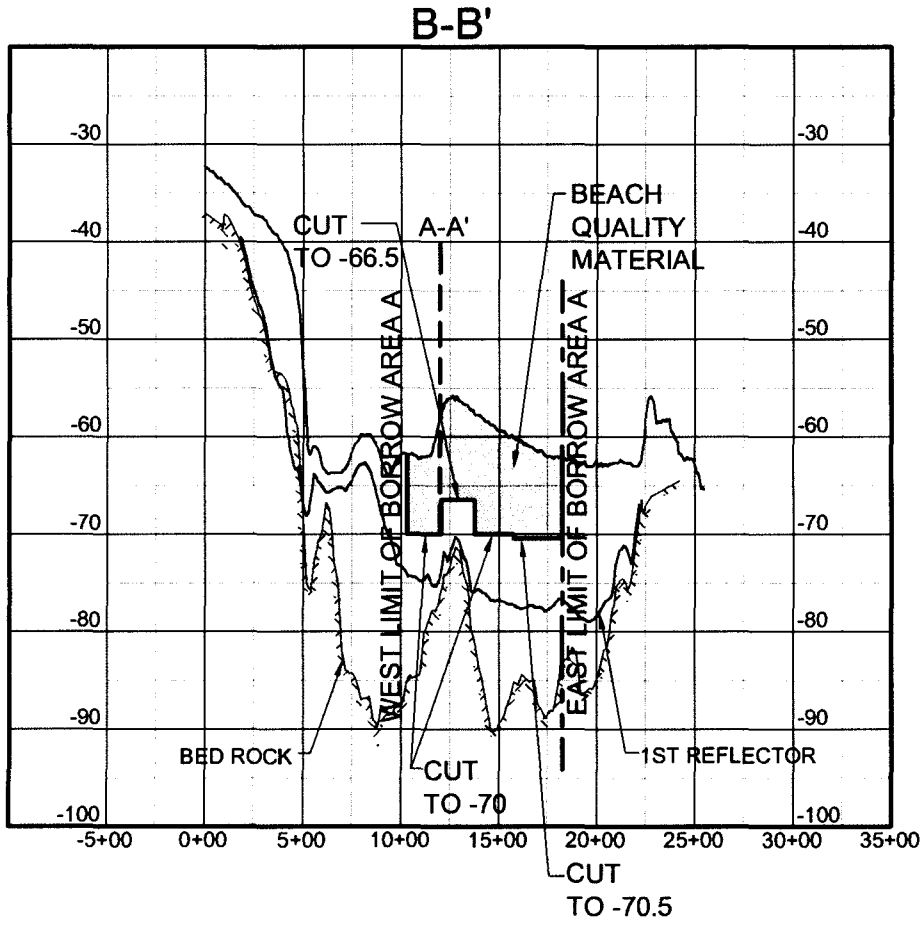
Figure B-7

Borrow Area B - Bathymetry



Geologic Cross Section A-A'

Figure B-8



LEGEND:

BEACH QUALITY MATERIAL

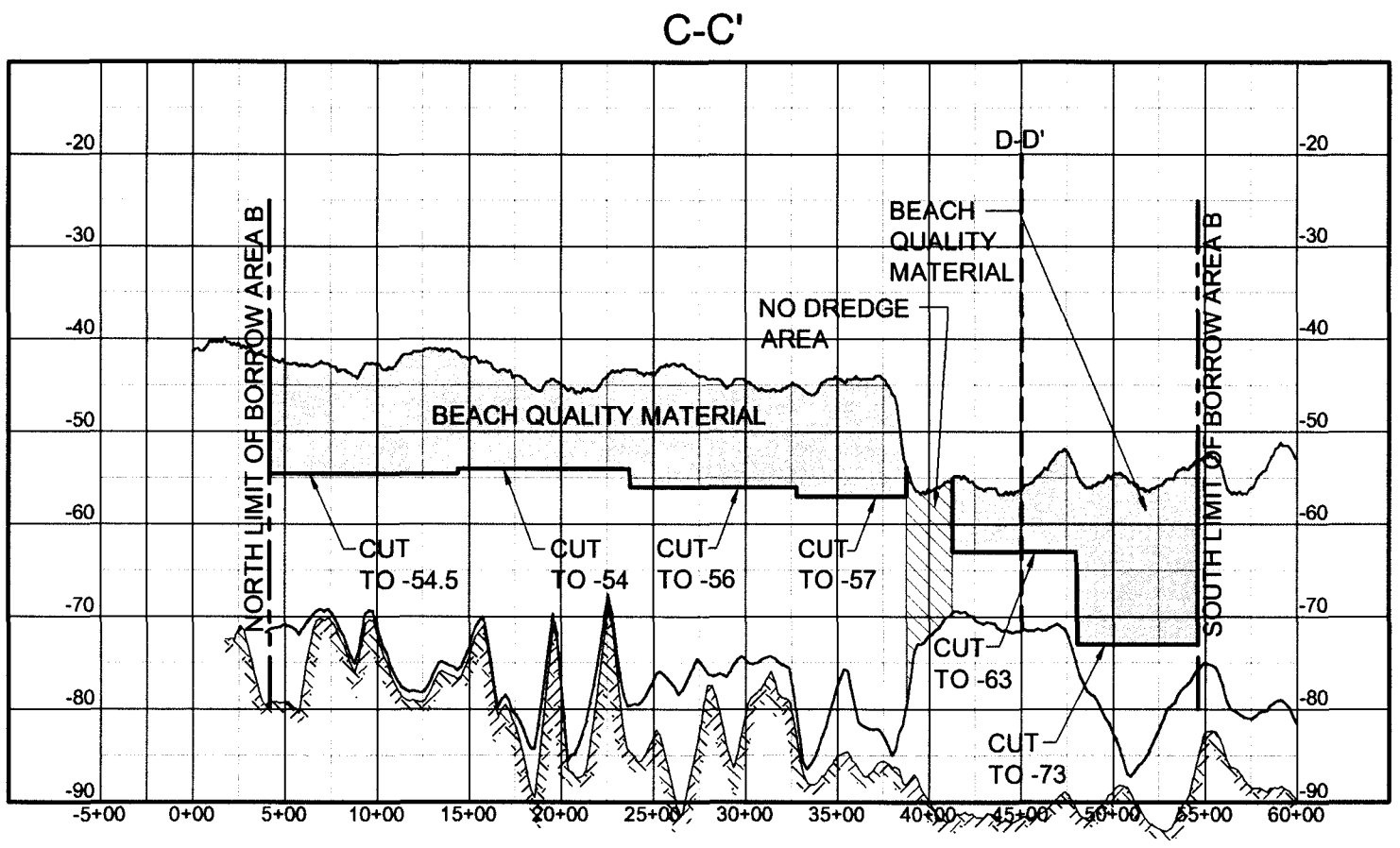
NOTE:

ELEVATIONS SHOWN HEREON ARE IN FEET BASED ON NAVD 88.

SCALE: 1"=1000 HORZ.
1"=20' VERT.

Figure B-9

Geologic Cross Section B-B'



LEGEND:

BEACH QUALITY MATERIAL

NO DREDGE AREA

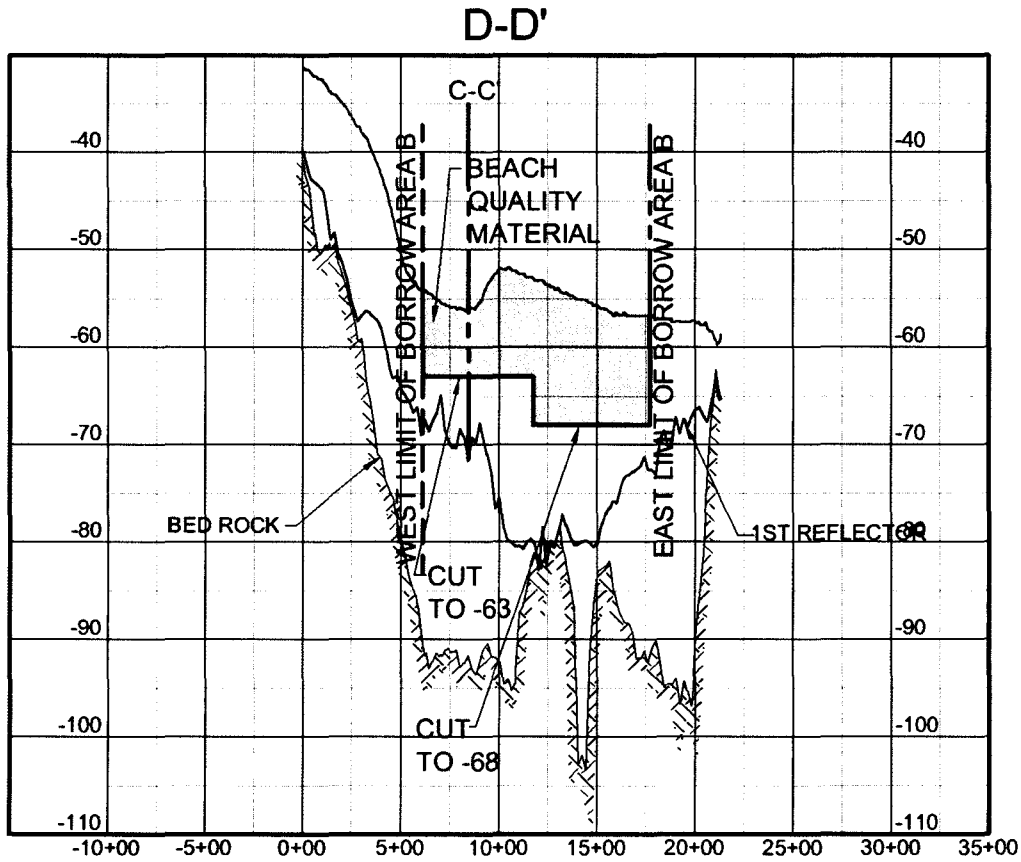
NOTE:

ELEVATIONS SHOWN HEREON ARE IN FEET BASED ON NAVD 88.

SCALE: 1"=1000 HORZ.
1"=20' VERT.

Figure B-10

Geologic Cross Section C-C'



LEGEND:

BEACH QUALITY MATERIAL

NOTE:

ELEVATIONS SHOWN HEREON ARE IN FEET BASED ON NAVD 88.

SCALE: 1"=1000 HORZ.
1"=20' VERT.

Figure B-11

Geologic Cross Section D-D'

MATERIAL SUITABILITY

B-31. The compatibility of the proposed borrow areas were evaluated to determine their suitability with the native beach sand. The Coastal Engineering Research Center (USACE, 1992) ACES program was used to calculate the overfill ratio, Ra and the renourishment factors, Rj. The overfill ratio, Ra, predicts the amount of fill material required to produce, after natural beach processes, a unit volume of stable beach material. The overfill ratio technique is based on the assumption that sorting processes will selectively remove material form the various size classes of the borrow fill until a stable grain size distribution results (James, 1975). Background erosion and end losses are not calculated by the overfill ratio.

B-32. The renourishment factor, Rj is a measure of the stability of the placed borrow material relative to the existing sand. The renourishment factor is based on the assumption that no borrow sand is completely stable and that a portion of borrow material will be eroded on an annual basis depending on the characteristics of its grain size distribution.

B-33. The overfill ratios and renourishment factors for borrow areas A and B were calculated. Table B-2 shows the results of the suitability analysis for the native beach and the potential borrow sources.

B-34. The sand sources considered in this investigation have overfill ratios ranging from 1.00 to 1.02 (Table B-2). The overfill quantity reflects the losses expected due to sorting of the placed material from the original textural character to a textural character more like that of the existing beach. The renourishment factors range from 1.05 to 0.93.

CONSTRUCTION DETAILS

B-35. The previous projects were constructed using a cutterhead dredge because the borrow area is less than one mile offshore of the project area. It is anticipated that a cutterhead dredge will be used to construct future renourishment projects. The borrow area has been designed based on the ability of cutterhead dredges to excavate sections of borrow areas that have various depths and irregular shapes. The dredge contractor will be required to excavate the borrow area to the maximum depth practical and excavate the borrow area in a uniform manner. The contractor will be required to dredge borrow area B during the 2007 renourishment project.

CONCLUSIONS

B-36. The study area has been divided into 2 borrow areas which are separated by a cable corridor. The combined borrow areas contain 3,005,000 cubic yards of beach compatible sand. The estimated volume of sand required for the next project is approximately 669,000 cubic yards. Based on the estimated volume, the borrow area provides for 450% of the required volume.

B-37. It is anticipated that a cutterhead dredge will be used to construct the project, which will allow the dredge contractor to access the various segments of the borrow area. Therefore, the borrow area depth limits will likely be left as is. The dredge contractor will not be limited

to a particular section of the borrow area but will be required to uniformly excavate the borrow area to the maximum depth allowable. The Contractor will be required to dredge borrow area B during the 2007 renourishment project. Consideration of limiting the dredge contractor to a portion of the borrow area will be considered in the development of plans and specifications.

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APPENDIX C

BOCA RATON SHORE PROTECTION PROJECT

ECONOMIC APPENDIX

APPENDIX C
BOCA RATON SHORE PROTECTION PROJECT
ECONOMIC APPENDIX

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ECONOMIC APPENDIX

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Sub Appendices

Sub Appendix C-1 Storm Damage Model Input Tables

ECONOMIC SUMMARY

C-1. An economic analysis was performed to confirm the economic benefits of renourishing the Boca Raton Shore Protection Project from Florida Department of Environmental Protection (FDEP) monument T-205 to a point 181 feet south of R-212 in Boca Raton. The optimized project is described in the PCA and was first constructed in 1988. The project has an annual net benefit of $2,932,200 over the entire project life (1988 to 2038) with a benefit to cost ratio of 3.0. Over the remaining life of the project, from 2007 to 2038, the project has an annual net benefit of $2,301,700 and a benefit to cost ratio of 3.4. These benefits include storm damage reduction benefits, based on the replacement values less depreciation for condominiums in the project area, and secondary benefits.

DESCRIPTION OF STUDY AREA

C-2. The economic study area for the Boca Raton segment is located in southern Palm Beach County. The Boca Raton Shore Protection Project begins at FDEP monument T-205 and ends 181 feet south of R-212 in Boca Raton. However, some of this length consists of taper sections that do not provide the full benefits associated with the project. The full design cross-section extends from FDEP monuments R-206 to T-211. The benefits described in the Appendix include only the area between FDEP monuments R-206 and T-211. The economic calculations presented in this study use an interest rate of 4.875%, 2007 price levels, and two economic analysis periods: a 50 year period from 1988-2038, and a 31 year period from 2007-2038.

OVERVIEW OF PROJECT BENEFITS

C-3. Shore protection projects generate both primary and incidental benefits. The primary benefit of a shore protection project is the reduction in future damage to the shoreline and upland development. An increase in recreational beach use, which can be attributed to a shore protection project, is considered an incidental benefit. Both primary and incidental benefits may be used to justify the construction of a shore protection project. Engineering Regulation 1105-2-100 (USACE, 2000) provides economic evaluation procedures to be used in all Federal water resources planning studies.

STORM DAMAGE REDUCTION BENEFITS

C-4. This study is a reevaluation of the existing Federal project in North Boca Raton. The Risk and Uncertainty Storm Damage Model (RUSDM) was used to determine storm damage and loss of land benefits caused by various shoreline extensions from the 1988 mean high water location. The cost to build and maintain the design shoreline used in the RUSDM is subtracted from the storm damage benefits to determine the annualized net benefits.

C-5. Storm induced damages to upland development, shore protection structures, upland property, and vegetation can be calculated using a probabilistic approach. Annual probabilities associated with various levels of storm induced beach and dune recession can be used to develop

a relationship between storm-induced damage and probability. The area damaged by storms versus annual storm probability yields the annual storm damage projection. The resulting storm damage prevention benefit is the difference between the projected storm damage with and without the proposed shore protection project.

C-6. Expected storm damage over the economic life of the project may vary greatly. As long-term shoreline recession moves the shoreline closer to the upland development, the expected storm damage will increase. This trend may also be accentuated by an acceleration in the rate of sea-level rise. Values of expected storm damage are calculated at one-year time intervals to perform the economic analysis. The economic analysis also provides an annual equivalent value of expected storm damage that is used to compute a storm damage reduction benefit for the with project condition.

Risk and Uncertainty Storm Damage Model

C-7. The Risk and Uncertainty Storm Damage Model (RUSDM) was used to simulate damages at existing and future years and determines average annual equivalent damages. The model uses structural data and shoreline recessions (both background and storm induced recession) to compute expected damages to each structure. For the purpose of analysis, storm damage is defined as the damage incurred by the loss of a given amount of shoreline as a direct result of erosion caused by a storm of a given magnitude and frequency. In addition to residential structures, storm damages were calculated for commercial and public buildings, roads, and public parks.

C-8. A risk-based analysis has been incorporated into the storm damage model adopted for the development of primary project benefits. Uncertainties inherent in each model input were used to generate a Monte Carlo simulation of multiple benefits/outcomes. A total of 4 model runs were conducted:

1. The with-project conditions from 1988 to 2038.
2. The without project conditions from 1988 to 2038.
3. The with-project conditions from 2007 to 2038.
4. The without project conditions from 2007 to 2038.

The results from each model run above represented an average of 500 simulations.

C-9. Annualized equivalent damages for each project condition were calculated by the RUSDM based upon long-term erosion rates, storm recession vs. return period curves, and the values, dimensions, and locations of the upland structures. Using this information, frequency-damage relationships were constructed for each year of the project life. The resulting estimates of expected damages were converted to an annual equivalent basis using an interest rate of 4.875% for the project life. As noted above two study periods were considered: 1988 to 2038 and 2007 to 2038. For each study period, the differences in annualized equivalent damages between the with- and without-project conditions were adopted as the storm damage prevention benefits.

Storm Damage Model Inputs

C-10. Input files for the RUSDM are based on a database of property values and structure dimensions. This section will qualitatively address the data that is necessary to create a RUSDM input file. Input files appear in Sub-Appendix C-1.

C-11. With and Without Project Shoreline Positions. The June 1988 preconstruction beach profile survey was used to establish the location of the reference shoreline. Structure locations and future shoreline positions were expressed in terms of feet landward of this shoreline.

C-12. Long-term beach erosion generally results in a retreat of the shoreline position. However, the cumulative effect of storm activity coupled with natural and man-made barriers to littoral drift may also result in a long-term change in the average shoreline position. This long-term movement of the shoreline position is known as shoreline recession and must be taken into account in developing storm damage economics. Based on the 364,000 cubic yard volumetric loss along the project area between 1974 and 1985 (Appendix A, Table A-13), the average erosion rate between FDEP monuments R-206 and T-211 was 4.3 cubic yards/foot/year (Appendix A, paragraph A-50). Given an active beach profile extending from +9 feet NGVD to -20 feet NGVD, the equivalent shoreline retreat rate would be 4.0 feet/year. This retreat rate was used to calculate the 1988 to 2038 without-project shoreline positions for the RUSDM.

C-13. Storm Frequency-Recession Relationship. Storm induced beach profile recession, or storm recession as it is commonly called, is a direct result of the storm surge and wave action. For the purpose of this report, storm recession is defined as the horizontal distance from the pre-storm mean high water shoreline to the furthest landward point where the storm has caused a lowering of the profile by 0.5 feet or more. This envelope is considered appropriate for evaluating the areas in which structural damage can be expected from a storm.

C-14. Appendix A discusses the storm induced beach recession within the project area. The SBEACH computer model (USACE, 1992) was used to determine storm recession for storms impacting the area while the Empirical Simulation Technique (EST) (Borgman et al., 1992) was utilized to develop a relationship between beach recession and frequency of occurrence. The results of the analysis for the project area are presented in Table C-1.

Table C-1
Summary of Storm Surge and Storm Recession Values

Return Period (years)	Frequency (1/year)	Surge Elevation (feet NGVD)	Storm Recession* (feet)
2	0.500	2.7	74.3
5	0.200	3.8	103.0
10	0.100	4.6	116.0
20	0.050	5.4	124.0
50	0.020	6.5	136.0
100	0.010	7.3	153.0
200	0.005	8.1	178.0

Note: * Distance is measured from mean high water to landward most 0.5-foot change contour.

C-15. Coastal Armor Protection. The RUSDM can account for various existing and future types of coastal armor. If coastal armor is present, the model presumes that the armor will halt background erosion indefinitely, but the armor only provides limited protection against storm recession.

C-16. There are currently no shore protection structures along the project area. However, State Highway A1A separates the major upland buildings from the dune and beach. During major hurricanes such as Frances, most shorefront roads are subject to either pavement damage or burial by overwash and debris. In either case, damages to landward structures are not substantially reduced by the presence of a paved road. Accordingly, the level of protection offered by the road was assumed to be negligible. However, if the road were in danger of being undermined, it was assumed that the state, county, or city would construct a revetment to protect it. In nearby Delray Beach, erosion prior to the first beach restoration project in the early 1970s led to the construction of a revetment to protect State Highway A1A. A 5-year level of protection and an $850 per lineal foot construction cost were assumed.

C-17. Structures that are unprotected and located close to the shoreline may sustain damage too frequently to justify repair. These structures are typically condemned. The distance between the shoreline and an unprotected structure used to initiate condemnation was assumed to be equal to the recession associated with a storm having an annual exceedance probability of 0.50 (2-year storm event) as indicated in Table C-1.

C-18. Backfill Costs. If a storm broaches coastal armor, the cost to replace the backfill is taken into account. The RUSDM assumes that the backfill is placed to a depth of 3 feet from the existing ground level. The cost of backfill is in terms of dollars per square foot. Backfill costs were assumed to be $25.00 ± 5.00 per cubic yard, based on 2005 trucked fill estimates for the South St. Lucie County Emergency Dune Restoration and Revegetation Project (CPE, 2005). The equivalent cost used by the model was $2.78 ± 0.56 per square foot.

C-19. Upland Building Values.

A. The values of the condominiums between R-206 and T-211 were based on an appraisal report by Strahan (2008). The buildings reviewed in this report were the San Remo condominiums (R-209), the Yacht & Racquet Club of Boca Raton (R-210), and the Ocean Club (T-211). These buildings represented 78% of the model's input by dollar value, and were given as "replacement cost new, less depreciation".

B. The six story Oceanview/Lakeview apartment complex was not reviewed by Strahan (2008). The property was purchased by NRW Development for $57 million in order to convert the apartments to condominiums (Palm Beach Post, 2007). Due to the conversion effort, the complex was removed from the Palm Beach County Property Appraiser's Office database after 2005. A foreclosure lawsuit was filed against NRW Development in June 2007, and the long term future of the complex is uncertain. For this assessment, an average cost per effective square foot of $162.22 from Strahan's report was applied to 26,750 square feet. A value of $8,680,000 was applied for Oceanview/Lakeview.

C. The Bluewater Townhomes were appraised by the Palm Beach County Property Appraiser's Office in 2006, with a combined structural improvement value of $3,411,000.

D. The remaining structures consisted of 2 small office buildings, 2 single-family homes, a decorative fountain, picnic shelters, dune overwalks, lifeguard towers, and guard houses. The values of these buildings were estimated based on the most recent structural improvement values from the Palm Beach County Property Appraiser's Office, which assigned a land value and an improvement value. The values of the various structures were assigned as follows:

1. The 6 Spanish River Park lifeguard towers between monuments R-206 and R-208 were given the values of similar structures near the project area. The city-owned beachfront tract just north of monument R-206 (06-43-47-09-00-001-0030) featured one lifeguard tower, no dune overwalks, and an improvement value of $7,665. Thus the structural improvement value was assumed to be due to the lifeguard tower and this value was adopted for the other 6 lifeguard towers.

2. The dune overwalks at the San Remo Condominium (R-209), the Yacht & Racquet Club of Boca Raton (R-209), Oceanview/Lakeview Apartments (R-210), and the Ocean Club Condominium (T-211) were based on the beachfront tract at R-206. This tract (06-43-47-09-00-004-0020) featured one dune overwalk, no lifeguard towers, and an improvement value of $4,453. Again the improvement value was assumed to be due to the dune overwalk and thus the other dune overwalks were given a comparable cost.

3. The fountains at the San Remo Condominium (R-209) and the guardhouse at the Yacht & Racquet Club of Boca Raton (R-209) were based on the guardhouse in the median of Coquina Way (06-43-47-20-29-002-0000), located 0.8 miles south of project area. This was given a structural improvement value of $60,170 by the Palm Beach County Property Appraiser's Office.

C-20. Based on items A-D above, the replacement costs used in the RUSDM appear in Table C-2.

Table C-2
Replacement Costs
North Boca Raton Shore Protection Project Area

Building	Replacement Value	Cost Basis
Spanish River Blvd. Dune Overwalk	$4,453	(3)
Spanish River Park Offices	$681,330	(3)
Spanish River Picnic Shelters	$236,750	(3)
San Remo - Capri	$12,109,788	(1)
San Remo - Diano	$13,795,961	(1)
Yacht & Racquet Club Of Boca Raton (A)	$6,287,260	(1)
Yacht & Racquet Club Of Boca Raton (I)	$7,183,437	(1)
Bluewater Townhomes	$3,411,000	(3)
Oceanview/Lakeview	$8,680,002	(1)
963 Lake Wyman Rd	$281,219	(3)
Ocean Club	$8,867,017	(1)
2330 N Ocean Blv	$157,239	(3)
2325 N Ocean Blv	$97,120	(3)
Tower R-206.5	$7,665	(4)
Tower R-207	$7,665	(4)
Tower R-207.3	$7,665	(4)
Tower R-207.6	$7,665	(4)
Tower R-208	$7,665	(4)
Tower R-208.5	$7,665	(4)
San Remo Overwalk	$4,453	(4)
Yacht Club Overwalk	$4,453	(4)
Oceanview/Lakeview Overwalk	$4,453	(4)
Ocean Club Overwalk	$4,453	(4)
San Remo Fountain	$60,170	(4)
Yacht Club Guard House	$60,170	(4)

COST BASIS:
(1) Replacement cost new, less depreciation.
(2) Structural improvement values from Palm Beach County (2005).
(3) Structural improvement values from Palm Beach County (2006).
(4) Value of similar structures based on structural improvement values from Palm Beach County (2005, 2006).

C-21. For multi-story structures, the RUSDM considered only the damages to the first two floors. The model assumed that in the event the lower two floors were damaged, the structural integrity of the building would not be compromised.

C-22. The 2006 improvement values of the structures considered and their locations relative to the 1988 shoreline appear in Sub-Appendix C-1.

C-23. Number of Floors. As noted above, The RUSDM limits damage estimates to the first two stories of multiple-story structures. Accordingly, the total number of stories was needed as a model input. The RUSDM linearly determined the value of the first two stories based upon the total structure value and the total number of floors. The number of floors in each building was confirmed during site visits.

C-24. Structure Locations. The location of each structure relative to the 1988 shoreline was determined by superimposing the 1988 shoreline on 2004-2006 aerial photographs provided by Palm Beach County and the City of Boca Raton. The following distances were measured to define the location of development relative to the reference shoreline (Sub-Appendix C-1):

a. The distance to State Highway A1A, which was used by the RUSDM as the distance between the 1988 shoreline and the revetment that would be needed to protect the road.

b. The distance to the seaward edge of buildings or other structural improvements (zero value distance).

c. The distance to the maximum value of storm damage (full value distance).

C-25. The distance to maximum storm damage is located at the mid-point or center of the structure. For pools and utilities, the distance to maximum storm damage is measured to the landward edge of the improvement. This variation in distance to maximum storm damage is based on the assumed mode of failure for each of the structural improvements.

C-26. Parcel Width. The "width" of the parcel was equal to length of the parcel along the shoreline, and was used to determine the land loss values in the model given the background erosion rate. Parcel widths were measured from parcel boundaries provided by the Palm Beach County Property Appraiser's Office. The RUSDM assumed that the parcels extended landward for an infinite distance.

C-27. Land Loss. Land loss values were given for each major building based on the 2006 land values for each parcel provided by the Palm Beach County Property Appraiser's Office. For the San Remo (R-209), the Yacht & Racquet Club of Boca Raton (R-209), and the Ocean Club (T-211) Condominiums, land values were absorbed into the value of each condominium unit and not available from the Property Appraiser's Office. To determine land loss values at these condominiums, the land value assumed to be equal to the area-weighted, average land value of the other private properties, $30 per square foot. For all buildings, a two letter land-loss classification was assigned for use in the RUSDM: PC, PN, VC, or VN. The first letter indicated whether the parcel was public (P) or private (V). The second letter indicated whether the land loss value was to be counted (C) or not counted (N).

C-28. Independent Land Value. The RUSDM is able to assign a land value ($/ft^2) other than the private or public land values that are assigned by the RUSDM parameters. This capability was exercised during this study.

C-29. Duplicate Lot. Land loss calculations for the lifeguard towers, the privately-owned dune overwalks, the San Remo fountain (R-209), and the Yacht & Racquet Club of Boca Raton guardhouse (R-209) were not counted (PN, VN). These smaller structures were located along the same sections of shoreline as the larger buildings considered in this analysis. To avoid the double-counting of land losses, the land values of the lifeguard towers, privately-owned dune overwalks, and other minor structures were set to zero and noted in the model as "duplicate lots". The office at 2325 N. Ocean Blvd (T-211), located directly landward of 2330 N. Ocean Blvd., was also noted as "duplicate lot" and excluded from land loss estimates.

Storm Damage Model Assumptions

C-30. The primary assumptions considered in calculating expected storm damage are as follows:

a. Long-term erosion or accretion will result in a shift of the natural beach profile but will not significantly change the shape of the profile.

b. Damage to development will not occur until storm induced recession exceeds the seaward edge of the development.

c. The cost of replacing a damaged portion of a building is twice the cost of constructing that portion during new construction. The increase is due to the cost of providing temporary structural supports, dismantling and removing storm damaged or destroyed construction materials, and reconstructing the damaged portion to fit together with the undamaged portion of the original structure.

d. The cost to repair buildings that are less than one-half undermined is prorated with the maximum value being reached at the center of the building.

e. Single family homes and other single floor buildings are considered a total loss when storm recession exceeds the center of the building.

f. Storm damage to multi-floor or high-rise buildings such as hotels and condominiums is limited to the bottom two floors. This assumes that structural support damage did not occur that would affect upper floors.

g. The cost to repair storm damaged pavement such as roads and parking areas is the same as the cost of new construction.

h. Seawalls, revetments and other coastal protective structures protect all upland development until they fail. The coastal protective structure is considered fully damaged when the volume of scour in front of the structure is sufficient to cause failure.

i. Repair costs to the coastal armor and the cost of backfill are determined by current engineering estimates of replacement and/or repair costs of such work.

j. Repair of storm damaged buildings, shorefront, roads, parking lots, etc., will result in full restoration to pre-storm conditions.

k. Although the shorefront may continue to develop over time, expected storm damage is limited to properties that are currently developed.

Storm Damage Reduction Benefit Analysis

C-31. The RUSDM was run under four scenarios.

a. Without-project conditions, 1988-2038.

b. Without-project conditions, 2007-2038.

c. With-project conditions (50-foot project), 1988-2038.

d. With-project conditions (50-foot project), 2007-2038.

The results of the storm damage estimates for the without project condition and maintaining the 50-foot project conditions are summarized in Tables C-3 and C-4. The analysis was performed using the values described above. Annual damages were calculated over the project life and an interest rate of 4.875%. By maintaining the 50-foot project, the annual storm damage reduction benefits would be $1,007,000 over the complete life of the project (1988 to 2038) and $693,000 over the remaining life of the project (2007-2038).

Table C-3
Storm Damage Prevention Benefits
FDEP Monuments R-206 to T-211 (Full Section Only)
1988-2038

Type of Damage	Annual Damage without Project Conditions	Annual Damage with 50-foot Project	Annual Damage Reduction Benefit
Upland Development	$129,000	$19,000	$110,000
Loss of Backfill & Vegetation	$382,000	$65,000	$317,000
Loss of Land	$323,000	$0	$323,000
Coastal Armor Repair and Construction	$257,000	$0	$257,000
TOTAL	$1,091,000	$84,000	$1,007,000

Table C-4
Storm Damage Prevention Benefits
FDEP Monuments R-206 to T-211 (Full Section Only)
2007-2038

Type of Damage	Annual Damage without Project Conditions	Annual Damage with 50-foot Project	Annual Damage Reduction Benefit
Upland Development	$248,000	$55,000	$193,000
Loss of Backfill & Vegetation	$410,000	$422,000	-$12,000
Loss of Land	$210,000	$0	$210,000
Coastal Armor Repair and Construction	$344,000	$42,000	$302,000
TOTAL	$1,212,000	$519,000	$693,000

SHORELINE STABILITY BENEFITS

C-32. Another primary benefit of a shore protection project is a reduction in loss of land. Long-term shoreline recession can be determined from beach profile surveys or other historical records. These trends are used to calculate the surface area of land that is expected to be lost over the economic period of analysis. A reduction or halt of long-term shoreline recession that is attributable to a shore protection project provides the basis for calculating this economic benefit.

C-33. Benefits derived from stabilizing the shoreline result from halting the amount of land being lost to long-term shoreline recession. To determine the value of the benefit, the value of the lands being lost must be determined. An economic evaluation of the value of private land

losses that occur during each year is used to develop an annual equivalent value. The annual equivalent value is compared for without project and with project conditions to determine the magnitude of any shoreline stability benefit.

C-34. The value of the lands used in the analysis was determined according to Engineering Regulation 1165-2-130, which requires that the fair market value of nearshore land be used in the analysis. Nearshore land is defined in the regulation as "land that is sufficiently removed from shore to lose its significant increment of value because of its proximity to the shore, when compared to adjacent parcels that are more distant from the shore".

C-35. Land loss values were given for each major building based on the 2006 land values for each parcel provided by the Palm Beach County Property Appraiser's Office, except for the condominiums. Land values for the condominiums along the study area were based on the average 2006 land value for the other private properties, as discussed previously. Land values used to calculate land loss appear in Sub-Appendix C-1.

C-36. The evaluation of shoreline stability benefits along public shores (non-Federal) must reflect the special use for which the land is dedicated. Normally, public shores are dedicated for parks or conservation areas. The benefit derived from stabilizing these shores is related to expected losses in recreational activity. Therefore, shoreline stability benefits along public shores must be claimed as incidental benefits. Along both the private and public lands, land loss estimates assume that if State Highway A1A were in danger of being undermined, the state, county, or city would construct a revetment to protect it. Accordingly, the location of State Highway A1A was adopted as the most landward shoreline position.

C-37. Loss of land benefits are based on the surface area of private land that is expected to be lost in the absence of a shore protection project. An average effective shoreline recession rate of 4.0 feet per year, as discussed previously, was used to determine the amount of private land loss between FDEP monuments R-206 and T-211. The location of State Highway A1A was assumed to be the limit land loss over the 50-year economic life of the project. The amount of land lost each year, within the above limit, was used to compute annual damages. The resulting losses in square feet were converted to dollars using the land values in Sub-Appendix C-1 and annualized using a 4.875% interest rate. The shoreline stability benefit for private lands is the difference between the value of land lost with and without the shore protection project. An economic evaluation of private land losses in the project area is shown in Tables C-5 and C-6. Table C-5 shows the annual loss of private land prevented by the project over the project life (1988 to 2038) is $209,000, while Table C-6 indicates that the annual loss of private land prevented by the project is $175,000 over the remaining life of the project (2007-2038).

Table C-5
Private Property Land Loss Benefit Analysis
FDEP Monuments R-206 to T-211 (Full Section Only)
1988-2038

Year	Year	Without Project Loss of Land	Present Worth Land Loss	With Project Loss of Land	Present Worth Land Loss
1	1989	$261,521	$249,365	$0	$0
2	1990	$261,521	$237,773	$0	$0
3	1991	$261,521	$226,721	$0	$0
4	1992	$261,521	$216,182	$0	$0
5	1993	$261,521	$206,133	$0	$0
6	1994	$222,653	$167,339	$0	$0
7	1995	$208,771	$149,612	$0	$0
8	1996	$208,771	$142,657	$0	$0
9	1997	$208,771	$136,026	$0	$0
10	1998	$208,771	$129,703	$0	$0
11	1999	$208,771	$123,674	$0	$0
12	2000	$208,771	$117,925	$0	$0
13	2001	$208,771	$112,444	$0	$0
14	2002	$208,771	$107,217	$0	$0
15	2003	$208,771	$102,233	$0	$0
16	2004	$208,771	$97,481	$0	$0
17	2005	$208,771	$92,949	$0	$0
18	2006	$208,771	$88,629	$0	$0
19	2007	$208,771	$84,509	$0	$0
20	2008	$208,771	$80,581	$0	$0
21	2009	$208,771	$76,835	$0	$0
22	2010	$208,771	$73,263	$0	$0
23	2011	$208,771	$69,858	$0	$0
24	2012	$200,166	$63,865	$0	$0
25	2013	$181,521	$55,224	$0	$0
26	2014	$181,521	$52,657	$0	$0
27	2015	$181,521	$50,209	$0	$0
28	2016	$181,521	$47,875	$0	$0
29	2017	$181,521	$45,650	$0	$0
30	2018	$181,521	$43,528	$0	$0
31	2019	$181,521	$41,504	$0	$0
32	2020	$181,521	$39,575	$0	$0
33	2021	$181,521	$37,736	$0	$0
34	2022	$181,521	$35,981	$0	$0
35	2023	$181,521	$34,309	$0	$0
36	2024	$181,521	$32,714	$0	$0
37	2025	$181,521	$31,193	$0	$0
38	2026	$181,521	$29,743	$0	$0
39	2027	$138,259	$21,602	$0	$0
40	2028	$130,147	$19,389	$0	$0
41	2029	$130,147	$18,488	$0	$0
42	2030	$130,147	$17,628	$0	$0
43	2031	$130,147	$16,809	$0	$0
44	2032	$130,147	$16,028	$0	$0
45	2033	$130,147	$15,283	$0	$0
46	2034	$130,147	$14,572	$0	$0
47	2035	$130,147	$13,895	$0	$0
48	2036	$83,022	$8,452	$0	$0
49	2037	$41,199	$3,999	$0	$0
50	2038	$10,146	$939	$0	$0
Total Present Worth			$3,897,953		$0
Interest Rate			4.875%		4.875%
Capital Recovery Factor			0.0537		0.0537
Annual Equivalent Land Loss			$209,407		$0
Annual Loss of Land Reduction Benefit (nearest $1,000)					$209,000

Table C-6
Private Property Land Loss Benefit Analysis
FDEP Monuments R-206 to T-211 (Full Section Only)
2007-2038

Year	Year	Without Project Loss of Land	Present Worth Land Loss	With Project Loss of Land	Present Worth Land Loss
1	2007	$208,771	$199,067	$0	$0
2	2008	$208,771	$189,813	$0	$0
3	2009	$208,771	$180,990	$0	$0
4	2010	$208,771	$172,577	$0	$0
5	2011	$208,771	$164,555	$0	$0
6	2012	$200,166	$150,438	$0	$0
7	2013	$181,521	$130,084	$0	$0
8	2014	$181,521	$124,037	$0	$0
9	2015	$181,521	$118,271	$0	$0
10	2016	$181,521	$112,773	$0	$0
11	2017	$181,521	$107,531	$0	$0
12	2018	$181,521	$102,533	$0	$0
13	2019	$181,521	$97,767	$0	$0
14	2020	$181,521	$93,222	$0	$0
15	2021	$181,521	$88,889	$0	$0
16	2022	$181,521	$84,757	$0	$0
17	2023	$181,521	$80,817	$0	$0
18	2024	$181,521	$77,060	$0	$0
19	2025	$181,521	$73,478	$0	$0
20	2026	$181,521	$70,063	$0	$0
21	2027	$138,259	$50,884	$0	$0
22	2028	$130,147	$45,672	$0	$0
23	2029	$130,147	$43,549	$0	$0
24	2030	$130,147	$41,525	$0	$0
25	2031	$130,147	$39,594	$0	$0
26	2032	$130,147	$37,754	$0	$0
27	2033	$130,147	$35,999	$0	$0
28	2034	$130,147	$34,326	$0	$0
29	2035	$130,147	$32,730	$0	$0
30	2036	$83,022	$19,908	$0	$0
31	2037	$41,199	$9,420	$0	$0
32	2038	$10,146	$2,212	$0	$0
Total Present Worth			$2,812,293		$0
Interest Rate			4.875%		4.875%
Capital Recovery Factor			0.0623		0.0623
Annual Equivalent Land Loss			$175,323		$0
Annual Loss of Land Reduction Benefit (nearest $1,000)					$175,000

PLAN OPTIMIZATION

C-38. The size of Federal shore protection projects must be economically optimized after establishing any construction or environmental constraints. Engineering Regulation 1105-2-100 contains specific guidance for this procedure. The optimization process is based on maximizing primary net benefits (primary benefits minus project costs). The project size was optimized in the original General Design Memorandum (CPE, 1987) as a 50-foot extension of mean high water. Reoptimization was not performed in this addendum.

INCIDENTAL BENEFIT ANALYSIS

Recreational Benefits

C-39. Recreational benefits are the most common incidental benefit produced by a shore protection project. These benefits result from an increased capacity for a recreational activity with an existing or expected surplus demand (which may be limited by public parking and access). The new beach surface produced by a beach nourishment project increases the capacity for recreational beach activity. All recreational benefits are considered incidental and do not influence optimization of the project design. Procedures for the evaluation of recreational benefits are described in Engineering Regulation 1105-2-100.

C-40. Engineering Regulation 1105-2-100 provides guidance and procedures for the evaluation of recreation benefits. Acceptable evaluation procedures described in this regulation have the following characteristics:

a. The evaluation is based on an empirical estimate of demand applied to the particular project.

b. Estimates of demand reflect the socio-economic characteristics of market area populations, recreation resources under study, and existing alternative recreation opportunities.

c. The evaluation must account for the value of losses or gains to existing sites in the study area and alternative recreation opportunities.

d. Willingness to pay is evaluated by either the travel cost method, contingent valuation method, or day value method.

Annual Beach Activity Demand

C-41. Annual beach activity demand must be determined over the economic life of the project to analyze recreational benefits. This is primarily accomplished by collecting existing beach use data and relating it to current populations. The Florida Department of Environmental Protection performs such studies to determine the recreational needs of residents and tourists. A report, entitled "State Comprehensive Outdoor Recreation Plan" or SCORP, is prepared as part of this effort (FDEP, 2002). Data from the State of Florida and SCORP was used in establishing reliable estimates of annual demand for recreational beach activity.

C-42. Annual per capita participation rates for beach activity in Palm Beach County were obtained from FDEP Division of recreation and Parks, Office of Park Planning. The 2000 rates for Palm Beach County residents and out-of-state tourists are 2.3547 and 2.3757, respectively. The FDEP Division of Recreation and Parks also provided the ratio of 1.8 for annual beach activity demand for Palm Beach County by other State of Florida residents to Palm Beach

County residents. The per capita participation rates and beach activity demand ratio are assumed to remain constant throughout the economic period of analysis.

C-43. Population projections for Palm Beach County were obtained from the 1999 "Florida Statistical Abstract" (BEBR, 2000) for the years 2000, 2010, 2020, and 2030 (Table C-7). The resident population data for 2040 was determined by linear extrapolation. The tourist population was linearly extrapolated for the years 2010, 2020, 2030, and 2040.

Table C-7
Expected Beach Activity Demand Analysis
(all numbers in thousands)

Item	2000 (1,2)	2010 (1,2)	2020 (1,2)	2030 (1,2)	2040 (1,2)
County Population	1,059.7	1,244.5	1,434.1	1,623.7	1,813.3
Tourist Population (3)	2,729.6	4,043.4	5,357.2	6,671.0	7,984.8
Demand (4)					
County (visits)	2,495.3	2,930.4	3,376.9	3,823.3	4,269.8
Tourist (visits)	6,484.7	9,605.9	12,727.1	15,848.3	18,969.5
Fl. Residents (visits) (5)	4,491.5	5,274.8	6,078.4	6,882.0	7,685.6
Total Demand (visits)	13,471.5	17,811.1	22,182.4	26,553.6	30,924.9
Private Shore Demand (6)	3,279.0	3,279.0	3,279.0	3,279.0	3,279.0
Public Shore Demand	10,192.5	14,532.1	18,903.4	23,274.6	27,645.9
Project Area Demand (7)	550.4	784.7	1,020.8	1,256.8	1,492.9

NOTES:
(1) Florida Statistical Abstract (1999)
(2) Population data extrapolated from published data, F.S.A (1999).
(3) Tourist Population data from FDEP Div. of Parks & Recreation Planning Office.
(4) Saltwater beach per capita participation rates planning area 10, from FDEP Div. of Parks & Recreation Planning Office.
Resident Per Capita Participation Rate = 2.3547
Tourist Per Capita Participation Rate = 2.3757
(5) Ratio of Florida resident demand to county demand is 1.8 (FDEP, Div. of Parks and Rec.)
(6) Private beach demand for Palm Beach County (CPE, 1994).
(7) Project area demand is assumed uniform along Palm Beach County Public Shorelines.
Public beaches along the full project cross-section represent 5.40% of the county's public shorelines.

C-44. The annual beach activity demand for Palm Beach County is a combination of the demand that is generated by Palm Beach County residents, other State of Florida residents, and tourists. The demand that is generated for Palm Beach County residents and tourists is determined by multiplying the annual per capita participation rates by their respective populations. The demand from other Florida residents is obtained by multiplying the Palm Beach County resident demand by the demand ratio (1.8). The total beach activity demand for Palm Beach County is a summation of these components (Table C-7).

C-45. An aerial survey of coastal Palm Beach County was performed on September 1, 1984 (Labor Day) to study recreational beach usage and to determine the recreational beach use of privately owned shores. A video tape recorder was used to create a permanent record of recreational beach usage during the peak period of the day. Analysis of the videotape revealed

that 1,534 people (27%) occupied private shores out of the 5,682 total people on the beach in the entire county at that point in time.

C-46. The demand for recreational beaches along private shores is proportional to the level of coastal development and local population. Public use of private shores in Palm Beach County is limited by the number of public access points and the amount of public parking. Although access points exist, the majority of private shores possess little or no public parking. With the exception of a few drop-offs and bicyclists, recreational beach use on private shores is limited to local residents that live near the ocean and walk to the beach. Therefore, the demand for private shores is directly related to the level of development along the coast and the local population near each access point to the coast.

C-47. The maximum demand attributable to private shores can be estimated by assuming that the annual demand for private and public shores in 1984 was distributed the same as was observed during the 1984 aerial survey. Therefore, 27% or 2,951,100 beach visits of the 10,930,000 total beach visits in 1984 can be attributed to private shores. The private shores of Palm Beach County were approximately 90% developed and the coastal neighborhoods fully populated at the time of the aerial survey. The maximum annual demand attributable to private shores is therefore assumed to be 3,279,000 beach visits (27% x 90% x 10,930,000) (CPE, 1994).

C-48. The annual demand for public shores is determined by subtracting the maximum demand attributable to private shores from the total annual beach activity demand for the County as shown in Table C-7.

C-49. The annual beach activity demand on the 0.61 mile, public beach along the full project cross-section (Spanish River Park, R-206 to R-209) is a percentage of the total beach activity demand for all of the public shores in Palm Beach County. The demand for public shores is assumed to be uniformly distributed over the accessible public shores in Palm Beach County (USACE, 1987). Similarly, visitors that are walk-ons, cyclists, and drop-offs from buses or cars are also assumed to be uniformly distributed along the publicly accessible shores.

C-50. The length of beach along the full project cross-section is 0.61 miles or 5.40% of the entire public shores (11.21 miles) in Palm Beach County. This percentage is assumed to remain constant throughout the economic life of the project. The expected annual beach activity demand for the project area is also shown in Table C-7.

Daily Beach Activity Demand

C-51. Daily beach activity demand varies considerably from day to day with the greatest demand occurring on weekends, holidays, or other special occasions. The variation in daily demand is also dependent on the time of year since tourist demand can be a major component. The distribution of pattern of daily beach activity demand is determined by performing a frequency analysis on actual beach activity in the project area whenever possible. Once this pattern is determined, annual beach activity demand can be distributed into daily demand.

C-52. A frequency analysis was performed to determine the distribution of daily beach activity demand. A daily log of observed beach activity was obtained from the City of Boca Raton Parks and Recreation Department and used as data for the analysis. The log consisted of five daily beach counts at lifeguard tower #20 of Spanish River Park from October 2000 to September 2004. Based on beach observations, it was approximated that there were twice as many beach users in Spanish River Park as were counted from tower #20. It was also estimated that there was a daily turnover rate of two in front of lifeguard tower #20. Therefore, multiplying the maximum count during the day by four provided an estimate of the total number of daily beach users. This is a conservative estimate, as on peak use days the total number of beach users will be more than double the maximum count at tower #20. Several analyses were performed to determine an appropriate number of class intervals for the final analysis and an interval of 100 visits was chosen. The frequency distribution of daily beach activity for Spanish River Park is shown in Figure C-1.

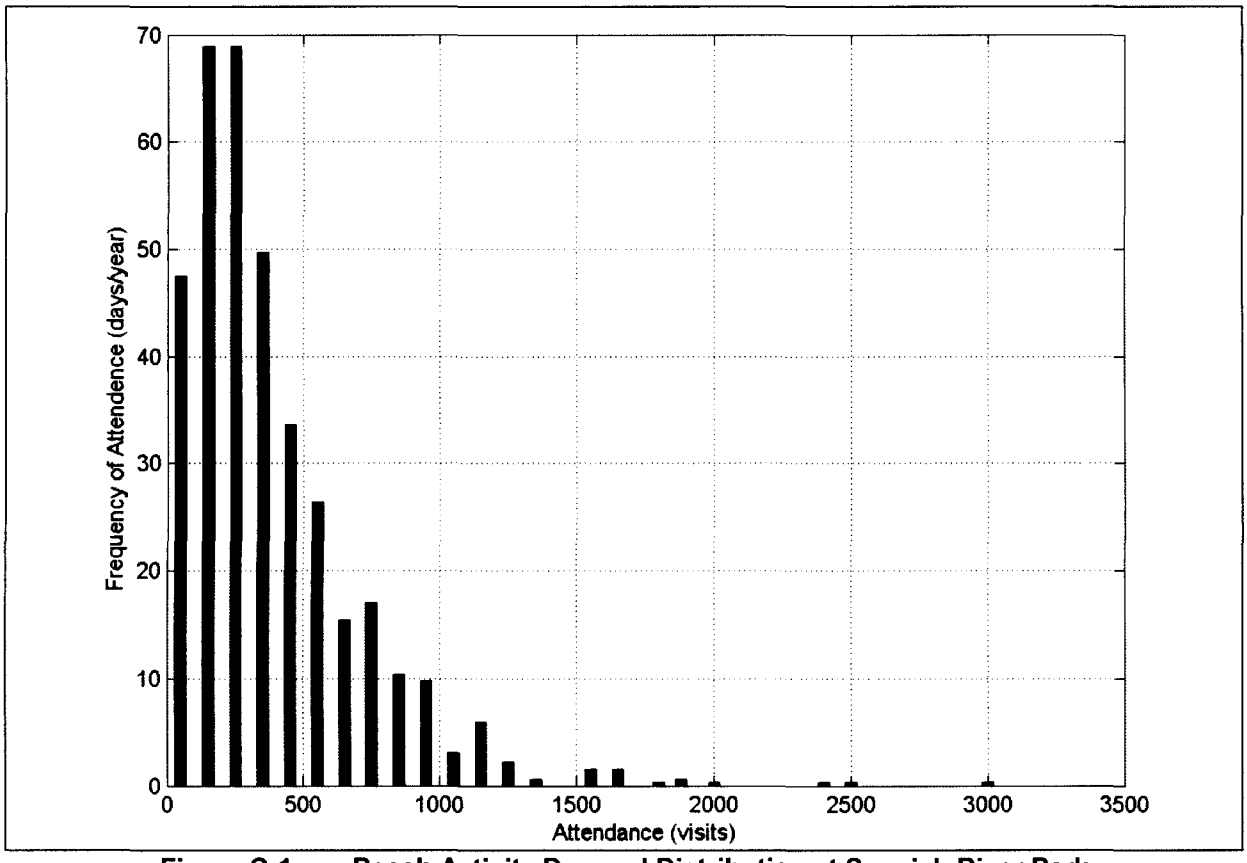

Figure C-1. Beach Activity Demand Distribution at Spanish River Park

C-53. Daily beach activity capacity is a measure of the maximum number of people that can possibly recreate on a beach in a single day. Beach capacity is primarily based on the amount of dry beach that is available to the recreational beach visitor. Limitations on beach capacity may be imposed by public access and parking. Also, visitors that are walk-ons, cyclists, and drop-offs

from either buses or cars must be considered. Daily beach activity capacity for the project area is shown in Table C-5 for without project conditions and 50-foot project conditions.

C-54. Dry beach surface area is the most important factor in determining daily beach capacity. Dry beach surface area is measured between mean high water and the base of the dune or vegetation line, whichever is more seaward. Studies by the U.S. Army Corps of Engineers and the Florida Department of Environmental Protection (2002) have determined that approximately 200 square feet of dry beach is required for normal beach activity by the average person. Given a daily turnover rate of 2, this corresponds to 100 square feet per person per day.

C-55. Controlled aerial photographs were used to determine the amount of dry beach in the project area in 1988. Average beach widths were calculated for beach segments with irregular dunes or shoreline configurations. The unrestricted daily beach activity capacity for all public properties in the project area was computed based on these measurements (Table C-8).

Table C-8
Daily Beach Capacity along North Boca Raton's Public Shorefront
FDEP Monuments R-206 to T-211 (Full Section Only)

	Without Project	With 50' Project
Public Shorefront (feet)	3197	3197
Public Parking Spaces	917	917
Passengers per car	3.5	3.5
Cars per space per day	2	2
Feet of shoreline per notional visitor	13	13
Parking & Notional Capacity (visits)	6665	6665
1988 Beach Width (feet)	60	110
1988 Daily Beach Capacity (visits)	1918	3517
1990 Beach Width (feet)	52	110
1990 Daily Beach Capacity (visits)	1675	3517
1995 Beach Width (feet)	33	110
1995 Daily Beach Capacity (visits)	1068	3517
2000 Beach width (feet)	14	110
2000 Daily Beach Capacity (visits)	460	3517
2005 to 2038 Beach width (feet)	0	110
2007 to 2038 Daily Beach Capacity (visits)	0	3517

C-56. Daily beach activity capacity may be limited by public access, parking, and "notional parking". Notional parking and notional visitors are terms commonly used to describe beach visitors such as walk-ons, cyclist, and drop-offs from either buses or cars that recreate on a beach

but do not require actual parking spaces. Assuming that the notional visitation observed in the 1984 aerial survey represents a maximum value and that it is linearly described along the shore, one notional visitor is present for every 13 feet of shoreline in the project area.

C-57. An estimate of parking limitations on daily beach capacity as determined by multiplying the number of public parking places within one quarter mile of public beach accesses by 7 and adding the number of notional visitors (USACE, 1984). This value is based on 3.5 people per car, with a daily turnover rate of 2.

C-58. Public access and parking for Federal shore protection projects must be reasonable and available to all persons on an equal basis. To meet these restrictions, only public parking spaces located within a quarter mile of a public beach access were considered for the purposes of calculating beach activity capacity. At Spanish River Park, there are currently 887 parking spaces. On Spanish River Blvd., there are 30 additional parking spaces between State Highway A1A and the Intracoastal Waterway (IWW): 7 on the north side of the street and 23 on the south side of the street. Parking spaces west of the IWW lie further than a quarter mile from the beach. Public access points and parking spaces for the entire study area are shown in Figure C-2.

C-59. The available public parking and beach accesses were determined by updating values presented in the 1996 GDM Addendum (CPE, 1996). Parking in Spanish River Park has been reduced from 930 to 887 parking spaces. However, with the 30 additional spaces on Spanish River Blvd., total number of available parking spaces is 917.

C-60. In early 1995, the City of Boca Raton, in cooperation with its Beach Tax District, purchased several properties near the south end of the project area known as the Ocean Strand (Figure C-2). These properties currently contain two single-family homes east of A1A and undeveloped land west of A1A. There are no immediate plans for development of these lands into a public park. However, the land was purchased for park development for the long term needs of the City. There is an access through the oceanfront lots, but no developed parking at this time.

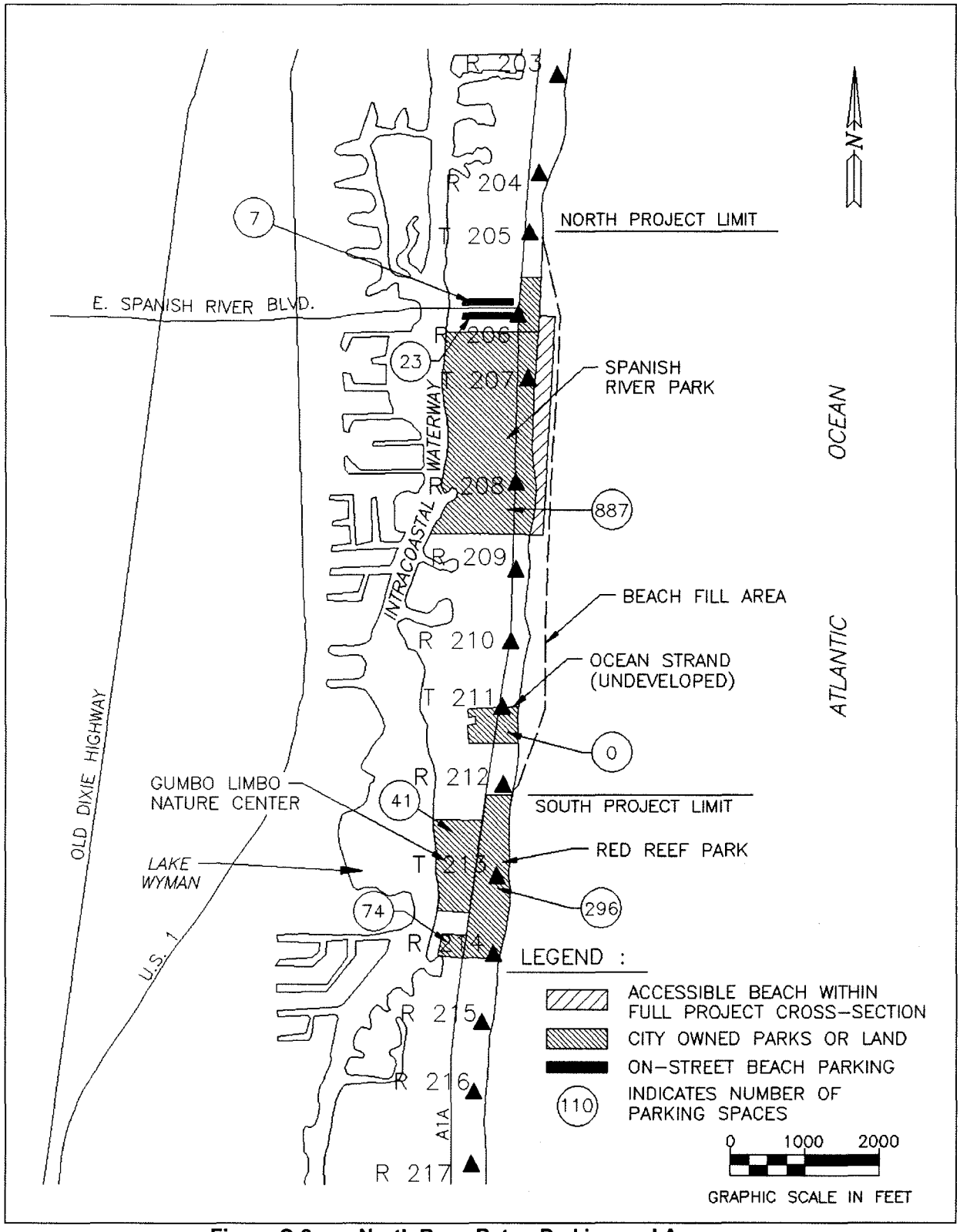

Figure C-2. North Boca Raton Parking and Access

Travel Cost Method

C-61. The demand for the project area has been developed such that it reflects the socio-economic characteristics and takes into account other available recreational resources within the project area. Nearby recreational resources may act as "sinks" that lessen the demand for the project. The recreation benefit evaluation procedure must determine a willingness to pay, or assign a value to the recreational usage generated by the proposed project. Engineering Regulation 1105-2-100 allows three acceptable methods for determining the value of a recreation visit: the travel cost method, contingent valuation method, and unit day value method. The travel cost method was used for this study.

C-62. The basic premise of the travel cost method is that per capita participation to a recreational site decreases as out-of-pocket expenses and travel time to the site increases, with other factors remaining constant. The travel cost method consists of deriving a demand curve by using the variable costs of travel and the value of time as proxies for price.

Estimating Use

C-63. The preferred method for estimating use is to relate recreational usage of the proposed site to distance traveled, socio-economic factors, site specific characteristics, and alternative recreation opportunities. The beach use data collected by FDEP for the 1980 SCORP was used since this data meets all of the prescribed criteria. The Florida State University Computing Center, under contract (DACW17-81-0854) to the U.S. Army Corps of Engineers Jacksonville District, performed a special analysis on the SCORP data. The result of the analysis is a table of per capita participation by zip code for beach activity in each of the coastal counties of the state. Using the zip code areas as population zones, a relationship can be developed between recreational beach usage and travel distance for Palm Beach County. The zip code areas are also used later in the derivation of the resource demand curve.

C-64. A least squares regression analysis was performed on the tabular data to determine a functional relationship between per capita participation and travel distance for beach activity in Palm Beach County (CPE, 1994). The per capita participation function is:

$$\text{Participation} = 7.87 \times e^{-(0.1 \times \text{distance})} \qquad (1)$$

C-65. The regression curve defined by equation (1) is shown in Figure C-3. This functional relationship is assumed to be valid throughout the economic life of the project. The acceptable range of this function is assumed to be from 0 to 50 miles. Participation for distances greater than 50 miles is considered to be zero.

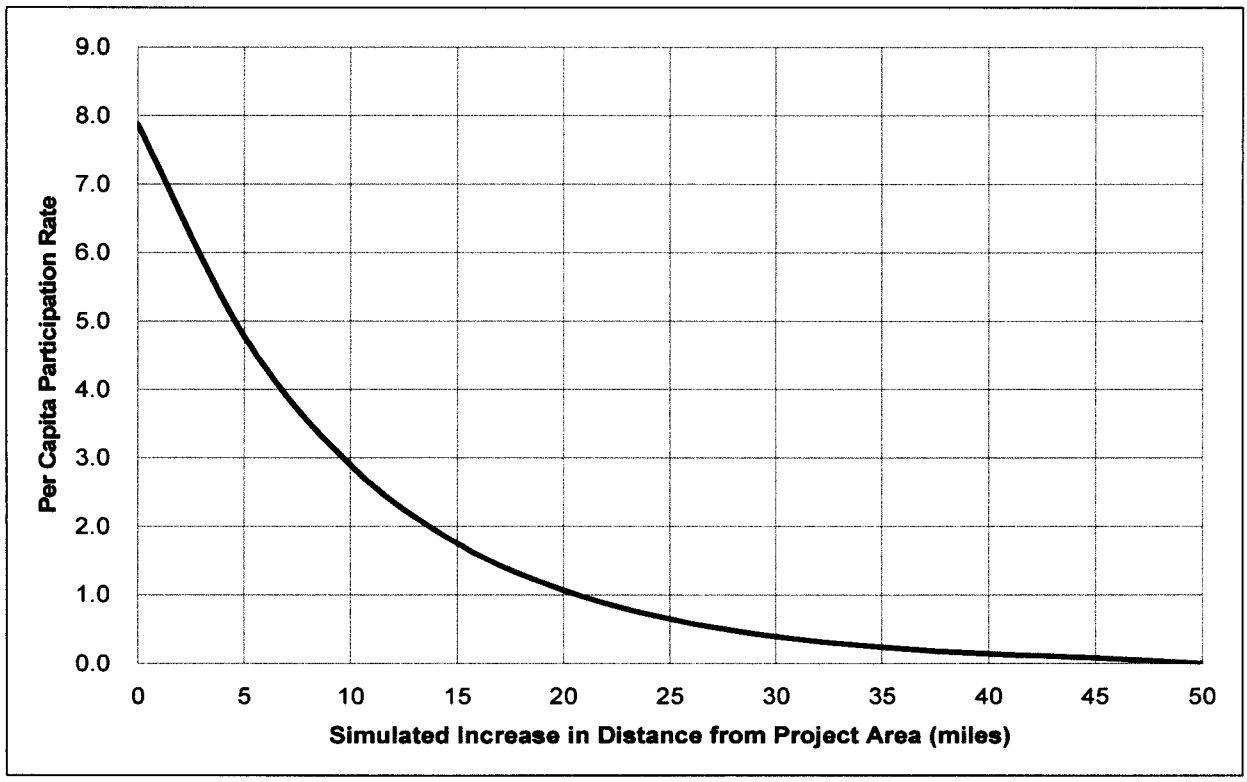

Figure C-3. Per Capita Participation Rate vs. Distance

Deriving Demand

C-66. The travel cost method is based on correlating increases in travel distance to the site with increases in the cost of travel or price of recreation for the site. The amount of recreational visits to the project site for different incremental distances is determined by using the per capita participation relationship. This process is used to develop a recreational resource demand curve.

C-67. A resource demand curve was constructed using the zip code areas as population zones. Based on the current distribution of population, recreational demand for the beach was determined by applying the per capita participation curve in Equation 1. This yields the quantity of recreational use, or visits, that would be demanded at a zero price and is the initial point on the resource demand curve. To define the remainder of the curve, other points are generated by making small incremental increases in travel distance and the associated increases in price of participation. This process is essentially equivalent to moving the project farther and farther from the potential users, requiring them to pay more and more in travel costs. As the simulated distance increases, use decreases for each increment in distance, and a new use estimate is computed using the per capita participation curve. For this study, 10 mile increments were used to define the remaining points on the resource demand curve until the anticipated visitation is zero, as shown in Figure C-4.

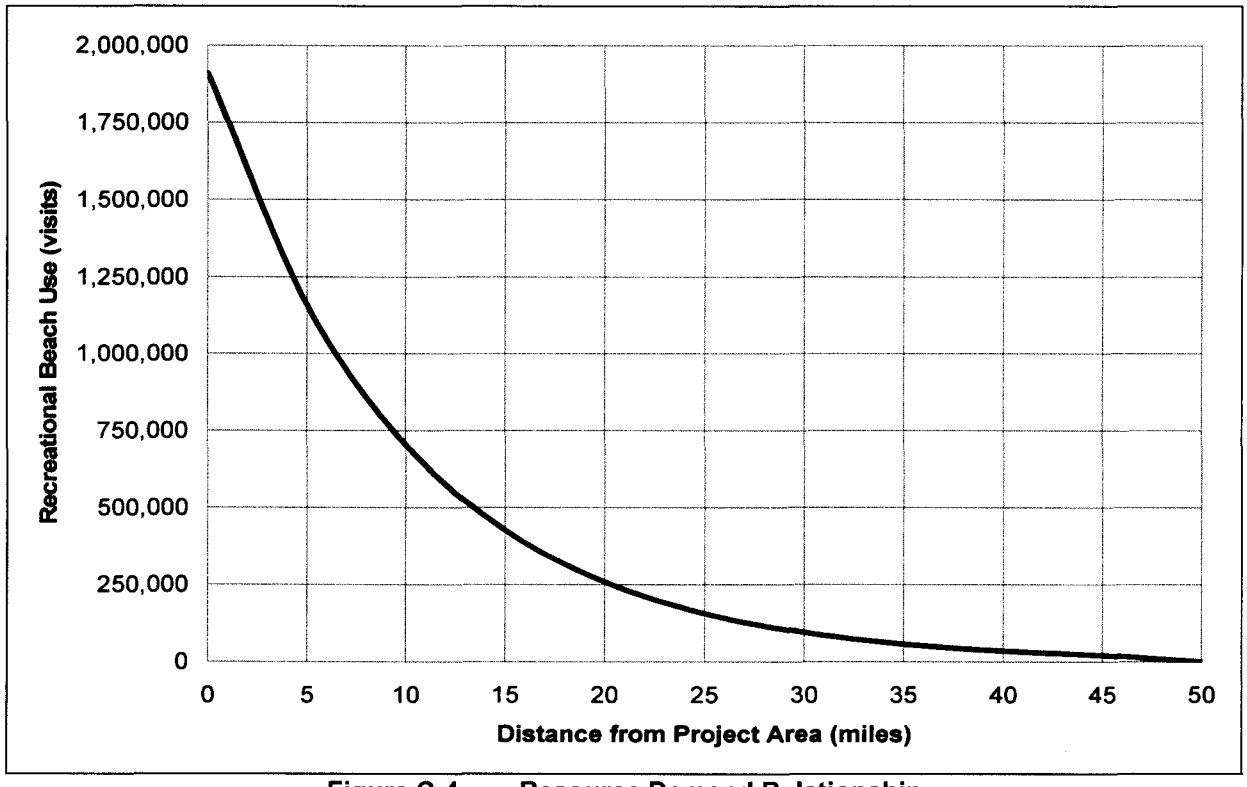

Figure C-4. Resource Demand Relationship

Cost of Travel

C-68. The price associated with various quantities of use is determined by calculating the cost of travel associated with the incremental increases in distance. These are the costs that would be incurred by the recreation users if they were required to travel the additional mileage. The out-of-pocket travel costs are the price that potential users would be most aware of when making a decision about whether to visit a particular recreation area.

C-69. The cost of travel consists of out-of-pocket travel costs and the opportunity cost of time. Out-of-pocket travel costs are determined as an average variable cost per mile. Based on data published by the U.S. Department of Transportation (USDOT), the variable cost to operate a car in 1984 would be 11.47 cents per mile (USDOT, 1985). No data on the cost of travel has been computed or published by the USDOT since 1985. However, each year the American Automobile Association estimates the cost of owning and operating automobiles. The 2007 out-of-pocket travel (variable) costs to operate an automobile are summarized in Table C-9. Maintenance and tire costs, along with gasoline and oil costs utilize 2007 price levels from AAA (2007). Given 3.5 passengers per vehicle, the variable cost is 4.15 cents per mile per person.

Table C-9
2007 Cost to Operate an Automobile
(cents per mile)

Vehicle Class	Variable Costs*			
	Maintenance	Gasoline and Oil	Tires	Total
Full Size	5.5	10.0	0.7	16.2
Intermediate	4.7	9.4	0.8	14.9
Compact	4.5	7.4	0.5	12.4
Average				14.5

NOTE: * Source: American Automobile Association, 2007.

C-70. The opportunity cost of time was determined using the guidance provided by EC-1105-2-100. Based on a median family income of $32,191, the opportunity cost of the time is $9.29 per car per hour. Based on the 2000 U. S. Census, the average family income in Palm Beach County is $45,062. Therefore, the opportunity cost of time is computed as shown below:

$$\$9.29 \times \$45{,}062 / \$32{,}191 = \$13.01$$

For an average of 3.5 people per car, this results in an opportunity cost of time of per hour per visitor.

Cost Per Visit

C-71. The cost or value of a beach visit is computed in Table C-10. The incremental distances of the resource demand curve are converted into a cost per individual using a cost per mile factor that reflects both time and out-of-pocket travel costs. The value of the visit is a weighted average of the average demand times the increment in total cost (Table C-10). This value is equal to the average amount users are willing to pay, but do not have to pay, for the opportunity to participate in recreation at the project site. The average cost per visit is $2.95.

Table C-10
Value of Average Visit to the Beach

One Way Travel Distance (miles)	Total travel Distance (miles)	Travel Time (hours)	Travel Costs (1)	Opportunity Cost of Time (2)	Total Cost	Beach Use Demand (visits)	Avg. Demand x Incremental Cost ($-visits)
0	0	0	$0.00	$0.00	$0.00	$1,910,364	$2,492,075
5	10	0.325	$0.42	$1.21	$1.62	$1,158,694	$1,251,844
10	20	0.575	$0.83	$2.14	$2.97	$702,784	$759,282
15	30	0.825	$1.25	$3.07	$4.31	$426,260	$460,528
20	40	1.075	$1.66	$4.00	$5.66	$258,540	$279,324
25	50	1.325	$2.08	$4.93	$7.00	$156,812	$169,419
30	60	1.575	$2.49	$5.86	$8.35	$95,111	$102,758
35	70	1.825	$2.91	$6.79	$9.69	$57,688	$62,326
40	80	2.075	$3.32	$7.72	$11.04	$34,990	$37,802
45	90	2.325	$3.74	$8.65	$12.38	$21,222	$14,272
50	100	2.575	$4.15	$9.58	$13.73	$0	$0
						Total	$5,629,629
						Value of Average Visit	$2.95

NOTES: (1) Unit Travel Cost = 4.15 cents/mile/visitor
(2) Unit Opportunity Cost of Time = $3.72 /hour/visitor

Benefit Analysis

C-72. Recreational benefits are realized when the number of beach visits that result from the construction of a shore protection project exceed the number of visits that occur without the project. The difference in visitation is the recreational benefit of the project. The value of the benefit is determined by multiplying the number of visits attributable to the project by the value of each visit. This analysis must be performed for each year or incremental years throughout the economic life of the project. For this analysis, the economic life is 50 years beginning in 1988, in order to justify continued participation in the project. The resulting benefits are then annualized to determine an annual equivalent recreational benefit.

C-73. The distribution of daily demand for the project area is used to determine the expected amount of visitation in each year. By applying the frequency distribution that was shown in Figure C-1 to the annual beach activity demand in Table C-7, the distribution of daily beach activity demand can be determined for the economic life of the project. This information is used along with the beach activity capacity data in Table C-8 (without project condition) to calculate the number of visits that are a direct result of the project (Figure C-5).

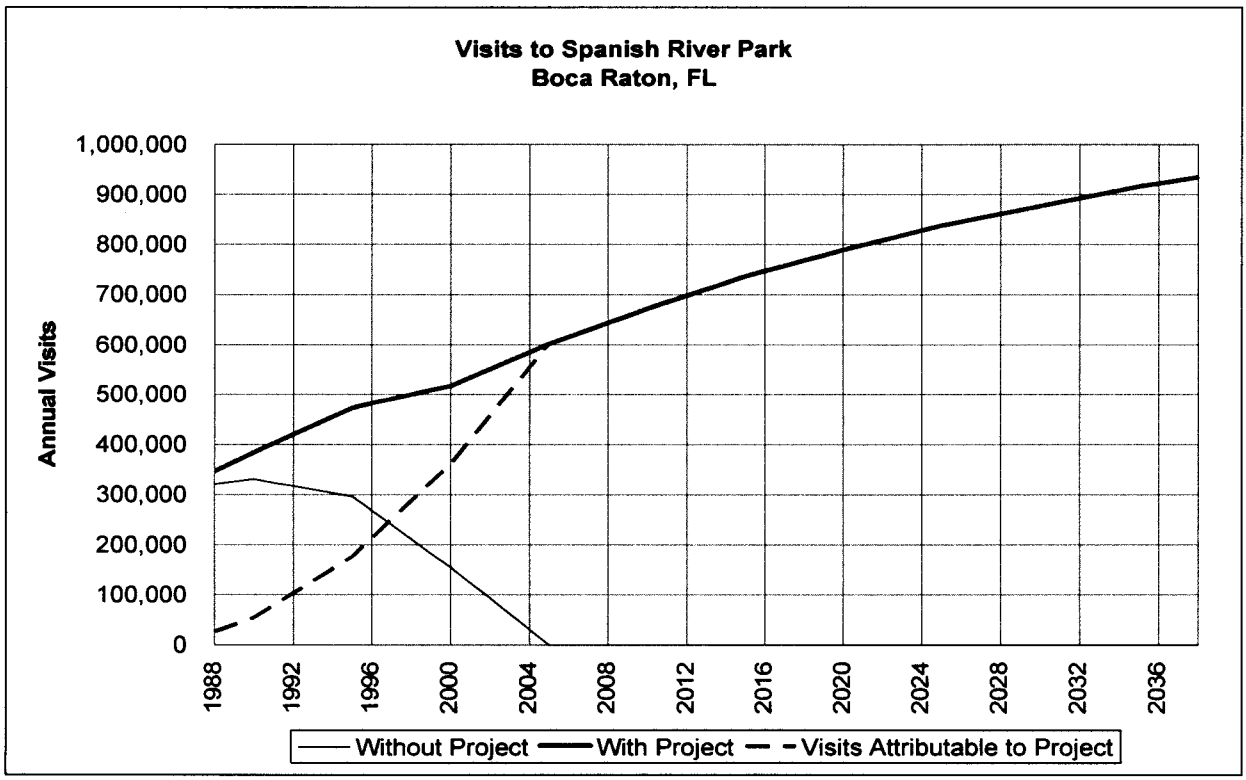

Figure C-5. Visits to Spanish River Park, Boca Raton, FL

C-74. The economic analysis of the recreational benefits for the project area is summarized in Tables C-11 and C-12. The analysis was performed using an interest rate of 4.875%. The results of the analysis indicate that the annual equivalent benefit for recreational beach activity over the project life (1988-2038) is $3,203,000 while the annual equivalent benefit is $2,394,000 over the remaining life of the project (2007-2038).

Benefit Summary

C-75. Although the optimum project is determined solely on primary project benefits, the total benefit of the project is a summation of both primary and incidental benefits. Summaries of the benefits, costs, and benefit to cost ratios for the project using 2007 price levels appear in Tables C-13 and C-14. The annual net benefit of maintaining this project is $2,301,700 over the remaining life of the project (2007-2038). The corresponding benefit to cost ratio is 3.4. The annual net benefit of maintaining this project is $2,932,200 over the entire, 50 year project life (1988-2038). The corresponding benefit to cost ratio is 3.0.

Table C-11
Annual Recreation Benefit Analysis Summary
FDEP Monuments R-206 to T-211 (Full Section Only) - 1988-2038

Year	Visits Attributable to Project	Recreational Benefits	Present Worth of Benefits
1988	26,664	$78,576	$194,113
1989	40,212	$118,500	$279,134
1990	53,760	$158,424	$355,831
1991	78,349	$230,884	$494,477
1992	102,937	$303,345	$619,464
1993	127,526	$375,805	$731,764
1994	152,115	$448,266	$832,284
1995	176,704	$520,727	$921,878
1996	213,801	$630,047	$1,063,567
1997	250,898	$739,368	$1,190,092
1998	287,995	$848,689	$1,302,555
1999	325,092	$958,009	$1,401,992
2000	362,189	$1,067,330	$1,489,370
2001	410,138	$1,208,631	$1,608,146
2002	458,087	$1,349,931	$1,712,662
2003	506,036	$1,491,232	$1,803,986
2004	553,985	$1,632,533	$1,883,119
2005	601,934	$1,773,833	$1,950,998
2006	616,078	$1,815,514	$1,904,021
2007	630,223	$1,857,195	$1,857,195
2008	644,367	$1,898,876	$1,810,609
2009	658,511	$1,940,557	$1,764,341
2010	672,655	$1,982,238	$1,718,462
2011	685,498	$2,020,087	$1,669,868
2012	698,342	$2,057,935	$1,622,079
2013	711,185	$2,095,784	$1,575,124
2014	724,029	$2,133,633	$1,529,029
2015	736,873	$2,171,481	$1,483,817
2016	747,344	$2,202,338	$1,434,948
2017	757,814	$2,233,195	$1,387,416
2018	768,285	$2,264,051	$1,341,203
2019	778,756	$2,294,908	$1,296,288
2020	789,227	$2,325,765	$1,252,651
2021	798,954	$2,354,428	$1,209,143
2022	808,680	$2,383,090	$1,166,973
2023	818,407	$2,411,753	$1,126,111
2024	828,133	$2,440,416	$1,086,527
2025	837,860	$2,469,079	$1,048,189
2026	845,753	$2,492,340	$1,008,881
2027	853,647	$2,515,601	$970,962
2028	861,540	$2,538,863	$934,389
2029	869,434	$2,562,124	$899,118
2030	877,327	$2,585,385	$865,107
2031	885,221	$2,608,646	$832,315
2032	893,114	$2,631,907	$800,703
2033	901,007	$2,655,168	$770,230
2034	908,901	$2,678,429	$740,861
2035	916,794	$2,701,690	$712,558
2036	922,959	$2,719,856	$684,004
2037	929,123	$2,738,022	$656,565
2038	935,288	$2,756,188	$630,199
		Total Present Worth of Benefits	$59,625,318
		Capital Recovery Factor	0.0537
		Annual Recreation Benefits (nearest $1,000)	$3,203,000

NOTES:
1. **Unit Benefit = $2.95**
2. **Interest Rate = 4.875%**
3. **Values given in 2007 dollars.**

Table C-12
Annual Recreation Benefit Analysis Summary
FDEP Monuments R-206 to T-211 (Full Section Only) - 2007-2038

Year	Visits Attributable to Project	Recreational Benefits	Present Worth of Benefits
2007	630,223	$1,857,195	$1,857,195
2008	644,367	$1,898,876	$1,810,609
2009	658,511	$1,940,557	$1,764,341
2010	672,655	$1,982,238	$1,718,462
2011	685,498	$2,020,087	$1,669,868
2012	698,342	$2,057,935	$1,622,079
2013	711,185	$2,095,784	$1,575,124
2014	724,029	$2,133,633	$1,529,029
2015	736,873	$2,171,481	$1,483,817
2016	747,344	$2,202,338	$1,434,948
2017	757,814	$2,233,195	$1,387,416
2018	768,285	$2,264,051	$1,341,203
2019	778,756	$2,294,908	$1,296,288
2020	789,227	$2,325,765	$1,252,651
2021	798,954	$2,354,428	$1,209,143
2022	808,680	$2,383,090	$1,166,973
2023	818,407	$2,411,753	$1,126,111
2024	828,133	$2,440,416	$1,086,527
2025	837,860	$2,469,079	$1,048,189
2026	845,753	$2,492,340	$1,008,881
2027	853,647	$2,515,601	$970,962
2028	861,540	$2,538,863	$934,389
2029	869,434	$2,562,124	$899,118
2030	877,327	$2,585,385	$865,107
2031	885,221	$2,608,646	$832,315
2032	893,114	$2,631,907	$800,703
2033	901,007	$2,655,168	$770,230
2034	908,901	$2,678,429	$740,861
2035	916,794	$2,701,690	$712,558
2036	922,959	$2,719,856	$684,004
2037	929,123	$2,738,022	$656,565
2038	935,288	$2,756,188	$630,199
		Total Present Worth of Benefits	$37,885,867
		Capital Recovery Factor	0.0632
		Annual Recreation Benefits (nearest $1,000)	$2,394,000

NOTES: **1. Unit Benefit = $2.95**
2. Interest Rate = 4.875%
3. Values given in 2007 dollars.

Table C-13
Benefit Summary over Project Life
1988 to 2038

	Annual Amount
Storm Damage Prevented*	$1,007,000
Loss of Land Prevented*	$209,000
Primary Benefits*	$1,216,000
Incidental (Recreational) Benefits*	$3,203,000
Total Project Benefits*	$4,419,000
Project Cost	$1,486,800
Net Benefit	$2,932,200
Benefit-to-Cost Ratio	3.0

NOTES:
a. All benefits and costs are annual equivalent expected values in 2007 $'s.
b. 50-Year economic life with a 4.875% interest rate.
c. Benefits are calculated along the full project cross-section between R-206 to T-211 only.

Table C-14
Benefit Summary over Project Life
2007 to 2038

	Annual Amount
Storm Damage Prevented*	$693,000
Loss of Land Prevented*	$175,000
Primary Benefits*	$868,000
Incidental (Recreational) Benefits*	$2,394,000
Total Project Benefits*	$3,262,000
Project Cost	$960,300
Net Benefit	$2,301,700
Benefit-to-Cost Ratio	3.4

NOTES:
a. All benefits and costs are annual equivalent expected values in 2007 $'s.
b. 31-Year economic life with a 4.875% interest rate.
c. Benefits are calculated along the full project cross-section between R-206 to T-211 only.

C-76. The AAEQ costs and benefits over the remaining project life (2007 to 2038) are insightful. The average annual equivalent cost of the project for future construction events (2007 price level) is $960,300 (assuming a 10-year renourishment interval). Over the remaining life of the project (2007-2038), the storm damage prevention benefits will be $693,000, the annual loss of land prevented benefit will be $175,000, and the annual incidental benefits will be $2,394,000. Accordingly, the total annual benefit of the project from 2007 to 2038, less the annual cost, will be $2,301,700.

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SUB-APPENDIX C-1

STORM DAMAGE MODEL
INPUT TABLES

INPUT FILE #1a FOR STORM DAMAGE MODEL, 1988-2038, RISK, V. 2 (RUSDM):
Shoreline, Storm Recession, Armoring, and Property Information with Explanation of Inputs

```
'Palm Beach County, North Boca Raton'
1988,50
 000.0
 003.8  007.6  011.4  015.2  019.0
 022.8  026.6  030.4  034.2  038.0
 041.8  045.6  049.4  053.2  057.0
 060.8  064.6  068.4  072.2  076.0
 079.8  083.6  087.4  091.2  095.0
 098.8  102.6  106.4  110.2  114.0
 117.8  121.6  125.4  129.2  133.0
 136.8  140.6  144.4  148.2  152.0
 155.8  159.6  163.4  167.2  171.0
 174.8  178.6  182.4  186.2  190.0
8
.005,178
.01,153
.02,136
.05,124
.10,116
.20,103
.50,74
1.0,60
2
'NO SHORE PROTECTION       ',   0 ,   0 ,   0 ,0.00        1
'REVETMENT                 ', 850 , 103 ,   0 ,0.50        2

2.78
```

Project Title
Starting Year, Project Life
Shoreline Position (feet) at Year 0 (1988)
Shoreline Position (feet) at Years 1-50 (1989-2038)
(Shoreline Positions measured landward of Year 0 position)

Number of Storm Recession Values
Annual Probability (1/year), Storm Recession (feet)

Number of Armor Types

Armor Type, Cost ($/l.f.), Level of Prot. (feet),
Halts Erosion (0=yes, 2=No), % of Cost to Replace, Type #
Backfill Cost ($ per square foot = $ per c.y. / 9)

The inputs in the block above are property values. Explanations of each column are as follows:

```
'Spanish River Blvd. Dune Overwalk',4453,217.0172,1,1,2,50,114,122,'PC',8.29,0,'R-206',0
'Spanish River Park Offices',681330,1126.4889,1,1,2,185,254,321.5,'PC',15.50,0,'R-207',0
'Spanish River Picnic Shelters',236750,1853.7031,1,1,2,40,326,641,'PC',15.11,0,'R-208',0
'San Remo - Capri',12109788,225.32355,5,1,2,145,236,412,'VC',30.00,0,'R-209',0
'San Remo - Diano',13795961,225.32355,5,1,2,145,235,420.5,'VC',30.00,0,'R-209',0
'Yacht & Racquet Club Of Boca Raton (A)',6287260,398.1194,6,1,2,185,277,329.5,'VC',30.00,0,'R-209',0
'Yacht & Racquet Club Of Boca Raton (I)',7183437,352.4775,6,1,2,180,335,519.5,'VC',30.00,0,'R-210',0
```

```
'Bluewater Townhomes',3411000,125.6871,3,1,2,90,278.2258,390.27025,'VC',20.72,0,'R-210',0
'Oceanview/Lakeview ',8680002,151.022,6,1,2,90,301,790,'VC',30.24,0,'R-210',0
'963 Lake Wyman Rd',281219,100.6799,2,1,2,200,404,438.5,'VC',26.52,0,'R-210',0
'Ocean Club',8867017,302.0419,8,1,2,180,297,343.5,'VC',30.00,0,'T-211',0
'2330 N Ocean Blv',157239,244.8252,2,1,2,20,93,134,'VC',56.70,0,'T-211',0
'2325 N Ocean Blv',97120,244.8252,2,1,2,210,294,317,'VC',19.56,1,'T-211',0
'Tower R-206.5',7665,15,2,1,1,30,30,37.5,'PN',0.00,1,'R-206.5',0
'Tower R-207',7665,15,2,1,1,43,43,50.5,'PN',0.00,1,'R-207',0
'Tower R-207.3',7665,15,2,1,1,48,48,56,'PN',0.00,1,'R-207.3',0
'Tower R-207.6',7665,15,2,1,1,46,46,55,'PN',0.00,1,'R-207.6',0
'Tower R-208',7665,15,2,1,1,31,31,39.5,'PN',0.00,1,'R-208',0
'Tower R-208.5',7665,15,2,1,1,38,38,47,'PN',0.00,1,'R-208.5',0
'San Remo Overwalk',4453,20,1,1,1,59,59,84.5,'VN',0.00,1,'R-209',0
'Yacht Club Overwalk',4453,21,1,1,1,80,80,110,'VN',0.00,1,'R-209',0
'Oceanview/Lakeview Overwalk',4453,8,1,1,1,77,77,118,'VN',0.00,1,'R-210',0
'Ocean Club Overwalk',4453,8,1,1,1,68,68,116.5,'VN',0.00,1,'T-211',0
'San Remo Fountain',60170,44,1,1,1,192,192,213.5,'VN',0.00,1,'R-209',0
'Yacht Club Guard House',60170,16,1,1,1,254,254,270.5,'VN',0.00,1,'R-209',0

 1,                          2, 3,4,5,6,  7,  8,    9,  10, 11, 12,    13,14
```

1. Structure Description
2. 2005 Structure Improvement Value.
3. Property parcel width (feet)
4. Number of Floors
5. Existing armor type and replacement armor types cannot be zero and but be within armor array.
6. Replacement Armor, if the armor fails what are you going to replace it with?
7. Distance to armor or distance to where armor would be if there is no armor.
8. Distance to the ocean face of the structure.
9. Distance to full value. This is usually the mid point of the structure.
10. Type of structure for loss of land computations:
    a. 'PC' = Public and count it.
    b. 'PN' = Public and do not count it.
    c. 'VC' = Private and count it.
    d. 'VN' = Private and do not count it.
11. Value to be used for loss of land in $/foot^2 (2005 land value seaward of the structure from Palm Beach County Property Appraiser's Office).
12. Duplicate lot indicator.
    a. 0 = Not duplicate and place holder if you wish to add monument location or condemnation flag.
    b. 1 = Duplicate record. This can be used if there is more than on structure for the lot, benefits for the structure are desired, and benefits for armor, backfill and loss of land are not desired.
13. FDEP monument location.

14. Condemnation flag.
    a. 0 = Condemn structure if structure is within the condemnation distance.
    b. 1 = Do not condemn structure even if structure is within the condemnation distance.

INPUT FILE #1b FOR STORM DAMAGE MODEL, 2007-2038, RISK, V. 2 (RUSDM):
Shoreline, Storm Recession, Armoring, and Property Information
(see Input File #1a for Explanation of Inputs)

```
'Palm Beach County, North Boca Raton'
2007,31
 072.2
 076.0  079.8  083.6  087.4
 091.2  095.0  098.8  102.6  106.4
 110.2  114.0  117.8  121.6  125.4
 129.2  133.0  136.8  140.6  144.4
 148.2  152.0  155.8  159.6  163.4
 167.2  171.0  174.8  178.6  182.4
 186.2  190.0
8
.005,178
.01,153
.02,136
.05,124
.10,116
.20,103
.50,74
1.0,60
2
'NO SHORE PROTECTION       ',   0 ,   0 ,   0 ,0.00        1
'REVETMENT                 ', 850 , 103 ,   0 ,0.50        2
2.78
'Spanish River Blvd. Dune Overwalk',4453,217.0172,1,1,2,50,114,122,'PC',8.29,0,'R-206',0
'Spanish River Park Offices',681330,1126.4889,1,1,2,185,254,321.5,'PC',15.50,0,'R-207',0
'Spanish River Picnic Shelters',236750,1853.7031,1,1,2,40,326,641,'PC',15.11,0,'R-208',0
'San Remo - Capri',12109788,225.32355,5,1,2,145,236,412,'VC',30.00,0,'R-209',0
'San Remo - Diano',13795961,225.32355,5,1,2,145,235,420.5,'VC',30.00,0,'R-209',0
'Yacht & Racquet Club Of Boca Raton (A)',6287260,398.1194,6,1,2,185,277,329.5,'VC',30.00,0,'R-209',0
'Yacht & Racquet Club Of Boca Raton (I)',7183437,352.4775,6,1,2,180,335,519.5,'VC',30.00,0,'R-210',0
'Bluewater Townhomes',3411000,125.6871,3,1,2,90,278.2258,390.27025,'VC',20.72,0,'R-210',0
'Oceanview/Lakeview ',8680002,151.022,6,1,2,90,301,790,'VC',30.24,0,'R-210',0
'963 Lake Wyman Rd',281219,100.6799,2,1,2,200,404,438.5,'VC',26.52,0,'R-210',0
'Ocean Club',8867017,302.0419,8,1,2,180,297,343.5,'VC',30.00,0,'T-211',0
'2330 N Ocean Blv',157239,244.8252,2,1,2,20,93,134,'VC',56.70,0,'T-211',0
'2325 N Ocean Blv',97120,244.8252,2,1,2,210,294,317,'VC',19.56,1,'T-211',0
'Tower R-206.5',7665,15,2,1,1,30,30,37.5,'PN',0.00,1,'R-206.5',0
```

```
'Tower R-207',7665,15,2,1,1,43,43,50.5,'PN',0.00,1,'R-207',0
'Tower R-207.3',7665,15,2,1,1,48,48,56,'PN',0.00,1,'R-207.3',0
'Tower R-207.6',7665,15,2,1,1,46,46,55,'PN',0.00,1,'R-207.6',0
'Tower R-208',7665,15,2,1,1,31,31,39.5,'PN',0.00,1,'R-208',0
'Tower R-208.5',7665,15,2,1,1,38,38,47,'PN',0.00,1,'R-208.5',0
'San Remo Overwalk',4453,20,1,1,1,59,59,84.5,'VN',0.00,1,'R-209',0
'Yacht Club Overwalk',4453,21,1,1,1,80,80,110,'VN',0.00,1,'R-209',0
'Oceanview/Lakeview Overwalk',4453,8,1,1,1,77,77,118,'VN',0.00,1,'R-210',0
'Ocean Club Overwalk',4453,8,1,1,1,68,68,116.5,'VN',0.00,1,'T-211',0
'San Remo Fountain',60170,44,1,1,1,192,192,213.5,'VN',0.00,1,'R-209',0
'Yacht Club Guard House',60170,16,1,1,1,254,254,270.5,'VN',0.00,1,'R-209',0
```

INPUT FILE #2 FOR STORM DAMAGE MODEL, RISK, V. 2 (RUSDM):
Shoreline, Storm Recession, Armoring Uncertainty Data

```
"Uncertainties Palm Beach County, North Boca Raton"
3.6,"shoreline position sd"
.100,"armor cost uncertainty at 95% confidence limit"
.100,"structure value cost uncertainty"
1.0,"sd of setback distance"
.56,"sd of backfill cost per ft^3"
8,"# of storm probabilities"
24
16
8
3                                Uncertainties of storm recession (feet)
3
4
4
15
1,0,0                            Armor #1 minimum level of protection (feet), maximum level of protection (feet)
2,85,110                         Armor #2 minimum level of protection (feet), maximum level of protection (feet)
9999,9999,9999                   End of file indicator
```

STORM DAMAGE MODEL, RISK, V. 2 (RUSDM),
Miscellaneous Inputs:

```
Interest Rate = 4.875%
Project Extension = 50 (with project condition only)
Condemnation Distance = 74 feet  = 2 year storm recession
```

APPENDIX D

PERTINENT CORRESPONDENCE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960
July 20, 2007

Colonel Paul L. Grosskruger
U.S. Army Corps of Engineers
701 San Marcos Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Federal Activity No:	41420-2007-FA-0477
Corps Application No.:	SAJ-1986-479 (IP-LAO)
Date Received:	January 23, 2007
Formal Consultation Initiation Date:	April 27, 2007
Project:	Northern Boca Raton Beach Nourishment
Applicant:	City of Boca Raton
County:	Palm Beach County

Dear Colonel Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed nourishment of the Atlantic Ocean shoreline along northern Boca Raton, Palm Beach County, Florida, and its effects on the threatened loggerhead sea turtle (*Caretta caretta*), the endangered leatherback sea turtle (*Dermochelys coriacea*), the endangered green sea turtle (*Chelonia mydas*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), the endangered Kemp's ridley sea turtle (*Lepidochelys kempii*), and the endangered West Indian manatee (*Trichechus manatus*). This biological opinion is provided in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*).

In your letter dated January 18, 2007, the U.S. Army Corps of Engineers (Corps) determined the proposed action "may affect, but is not likely to adversely affect," the West Indian manatee because no seagrass resources are to be impacted by the proposed project, and the *Standard Manatee Construction Conditions* will be implemented. Based upon implementation of the above stated conditions, the Service concurs with this determination.

This Biological Opinion is based on information provided in the Corps' letter dated January 18, 2007; the Corps' Public Notice; information supplied by Coastal Planning and Engineering (CPE); Environmental Protection Agency; Florida Fish and Wildlife Conservation Commission (FWC); the National Marine Fisheries Service (NOAA Fisheries); and telephone conversations and email correspondence with the Corps. A complete administrative record of this consultation is on file at the South Florida Ecological Services Office, Vero Beach, Florida.

CONSULTATION HISTORY

On January 23, 2007, the Service received a letter and Public Notice from the Corps requesting concurrence with the Corps' determination of "may affect, but is not likely to adversely affect"

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the West Indian manatee and to initiate formal consultation for nesting sea turtles with regard to conducting a second beach renourishment project on the beaches of northern Boca Raton. On March 22, 2007, the Service sent a request for additional information to the Corps.

On April 27, 2007, the Service received the necessary information required to initiate formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Applicant proposes to renourish and stabilize 1.45 miles of shoreline in northern Boca Raton, Palm Beach County, Florida, between Florida Department of Environmental Protection (DEP) monuments T-205 and 181 feet south of R-212 (Figure 1). The volume of sand in the proposed beachfill template is approximately 918,200 cubic yards (cy). Although past nourishment projects have utilized two borrow areas, the proposed renourishment project will only use the northern portion of borrow area A. Borrow area A and the southern portion of borrow area B have been eliminated because an updated cultural resource survey would have been required. Consequently, beach compatible sand will only be obtained from the northern portion of borrow area B which is located approximately 0.5 mile offshore of the project area between monuments R-201 and R-211. Borrow area B is approximately 5,200 feet long and 930 feet wide with depths ranging from -32 to -64 feet National Geodetic Vertical Datum (NGVD). The volume of beach compatible material in borrow area B is estimated at 2,080,000 cy.

Material will be hydraulically dredged from borrow area B using a cutterhead dredge and pumped onto the beach by a combination submerged, floating and onshore pipelines. Bulldozers will be used to construct seaward and shore parallel dikes to contain the sand on the beach, and to configure the beach to the appropriate cross-section template. The design cross section will provide an average berm width extension of 230 feet at an elevation of +9 feet NGVD and a seaward slope of 1:15 from the berm crest to the construction toe of fill in order to reduce potential escarpments. The pipeline may be stored on the back portion of the beach, landward of the onshore pipeline and seaward of the dune line. Construction will occur outside of sea turtle and shorebird nesting season. Construction is scheduled to commence in November 2007 and is expected to take approximately 60 to 75 days to complete. The proposed project will involve nighttime construction.

The proposed construction access and staging area for heavy equipment and supplies (*e.g.*, bulldozers, front-end loaders, pipe, etc.) will be similar to that used in the 1998 project. The access corridor is located immediately south of monument R-208 within the Spanish River Public Park. This corridor is maintained by the Applicant and used by beach maintenance vehicles. It is anticipated no dune vegetation will be impacted along this access corridor because it is currently used as an access road onto the beach, and there is currently no vegetation growing within the access road.

Based on field observations conducted by Coastal Planning & Engineering Incorporated on September 21, 2006, no direct impacts to nearshore hardbottom is expected from the proposed nourishment project, but approximately 0.10 acre of indirect impacts to the nearshore hardbottom south of the proposed project may occur. Hardbottom impacts in this area have already been

mitigated for through the construction and maintenance of an artificial reef provided as mitigation for the 1988 nourishment project. In turn, the Applicant was assured that no additional future mitigation would be required if any hardbottom habitat previously described should re-expose as the beach erodes. Consequently, mitigation is not proposed for the proposed nourishment project.

A proposed Water Quality Monitoring Plan has been developed and coordinated with the DEP which is similar to the 1998 monitoring program. Sedimentation monitoring will be conducted in conjunction with hardbottom monitoring of the offshore hardbottom resources. The sedimentation monitoring will be based on examination of the transects over the hardbottom area, as required by the DEP. The monitoring plans will assess the abundance and biodiversity of the benthic flora and fauna within the influence of the predicted equilibrium toe of fill (ETOF), turbidity mixing zone, and downdrift of the project fill area; evaluate the extent of the ETOF as compared to the predicted ETOF; assess the potential burial of hardbottom due to beach profile adjustment; assess secondary impacts to hardbottom communities due to sedimentation; assess secondary impacts to hardbottom communities due to the longshore spreading of beach fill material downdrift of the project area; and assess the potential direct impacts to nearshore hardbottom communities due to pipeline placement.

The Service identifies the action area to include shoreline in northern Boca Raton, Palm Beach County, Florida, between monuments T-205 and 181 feet south of R-212 (1.45 miles).

STATUS OF THE SPECIES/CRITICAL HABITAT

Species/critical habitat description

Loggerhead Sea Turtle

The loggerhead sea turtle, listed as a threatened species on July 28, 1978 (43 Federal Register [FR] 32800), inhabits the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea 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).

No critical habitat has been designated for the loggerhead sea turtle.

Green Sea Turtle

The green sea turtle was federally listed on July 28, 1978 (43 FR 32800). 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. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. 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 (NOAA Fisheries and Service 1991a). Nesting has also been documented along the Gulf coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (FWC statewide nesting database). Green turtles

have been known to nest in Georgia, but only on rare occasions (Georgia Department of Natural Resources statewide nesting database). The green turtle also nests sporadically in North Carolina and South Carolina (North Carolina Wildlife Resources Commission statewide nesting database; South Carolina Department of Natural Resources statewide nesting database). Unconfirmed nesting of green turtles in Alabama has also been reported (Bon Secour National Wildlife Refuge nesting reports).

Critical habitat for the green sea turtle has been designated for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys.

Leatherback Sea Turtle

The leatherback sea turtle, listed as an endangered species on June 2, 1970 (35 FR 8491), nests on shores of the Atlantic, Pacific and Indian Oceans. Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard 1992). Nesting grounds are distributed worldwide, 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 (NOAA Fisheries and Service 1992, National Research Council 1990).

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 (NOAA Fisheries and Service 1992). Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions (North Carolina Wildlife Resources Commission, South Carolina Department of Natural Resources, and Georgia Department of Natural Resources statewide nesting databases). Leatherback nesting has also been reported on the northwest coast of Florida (LeBuff 1990, FWC statewide nesting database); a false crawl (non-nesting emergence) has been observed on Sanibel Island (LeBuff 1990).

Marine and terrestrial critical habitat for the leatherback sea turtle has been designated at Sandy Point on the western end of the island of St. Croix, U.S. Virgin Islands.

Hawksbill Sea Turtle

The hawksbill sea turtle was listed as an endangered species on June 2, 1970 (35 FR 8491). The hawksbill 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 sea turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Dade Counties) and the Florida Keys (Monroe County) (Meylan 1992, Meylan et al. 1995). However, 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 (NOAA Fisheries and Service 1993).

Critical habitat for the hawksbill sea turtle has been designated for selected beaches and/or waters of Mona, Monito, Culebrita, and Culebra Islands, Puerto Rico.

Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970 (35 FR 18320). The range of the Kemp's ridley includes the Gulf coasts of Mexico and the U.S., and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland. Most Kemp's ridleys nest on the coastal beaches of the Mexican states of Tamaulipas and Veracruz, although a very small number of Kemp's ridleys nest consistently along the Texas coast (Turtle Expert Working Group 1998). In addition, rare nesting events have been reported in Florida, Alabama, South Carolina, and North Carolina. Hatchlings, after leaving the nesting beach, are believed to become entrained in eddies within the Gulf of Mexico, where they are dispersed within the Gulf and Atlantic by oceanic surface currents until they reach about 8 inches in length, at which size they enter coastal shallow water habitats (Ogren 1989). Outside of nesting, adult Kemp's ridleys are believed to spend most of their time in the Gulf of Mexico, while juveniles and subadults also regularly occur along the eastern seaboard of the United States (Service and NOAA Fisheries 1992).

No critical habitat has been designated for the Kemp's ridley sea turtle.

Life history

Loggerhead Sea Turtle

Loggerheads are known to nest from one to seven times within a nesting season (Talbert et al. 1980, Richardson and Richardson 1982, Lenarz et al. 1981); the mean is approximately 4.1 (Murphy and Hopkins 1984). The interval between nesting events within a season varies around a mean of about 14 days (Dodd 1988). Mean clutch size varies from about 100 to 126 eggs along the southeastern United States coast (NOAA Fisheries and Service 1991b). Nesting migration intervals of years are most common in loggerheads, but the number can vary from 1 to 7 years (Dodd 1988). Age at sexual maturity is believed to be about 20 to 30 years (Turtle Expert Working Group 1998).

Green Sea Turtle

Green turtles deposit from one to nine clutches within a nesting season, but the overall average is 3.3. The mean interval between nesting events within a season is 13 days (Hirth 1997). Mean clutch size varies widely among populations. Average clutch size reported for Florida was 136 eggs in 130 clutches (Witherington and Ehrhart 1989). Only occasionally do females produce clutches in successive years. Usually 2, 3, 4, or more years intervene between breeding seasons (NOAA Fisheries and Service 1991a). Age at sexual maturity is believed to be 20 to 50 years (Hirth 1997).

Leatherback Sea Turtle

Leatherbacks nest an average of five to seven times within a nesting season, with an observed maximum of 11 (NOAA Fisheries and Service 1992). The interval between nesting events within a season is about 10 days. Clutch size averages 80 to 85 yolked eggs, with the addition of

usually a few dozen smaller, yolkless eggs, mostly laid toward the end of the clutch (Pritchard 1992). Nesting migration intervals of 2 to 3 years were observed in leatherbacks nesting on Sandy Point National Wildlife Refuge, St. Croix, U.S. Virgin Islands (McDonald and Dutton 1996). Leatherbacks are believed to reach sexual maturity in 6 to 10 years (Zug and Parham 1996).

Hawksbill Sea Turtle

Hawksbills nest on average 4.5 times per season at intervals of approximately 14 days (Corliss et al. 1989). In Florida and the U.S. Caribbean, clutch size is approximately 140 eggs, although several records exist of over 200 eggs per nest (NOAA Fisheries and Service 1993). On the basis of limited information, nesting migration intervals of 2 to 3 years appear to predominate. Hawksbills are recruited into the reef environment at about 14 inches in length and are believed to begin breeding about 30 years later. However, the time required to reach 14 inches in length is unknown and growth rates vary geographically. As a result, actual age at sexual maturity is not known.

Kemp's Ridley Sea Turtle

Nesting occurs from April into July during which time the turtles appear off the Tamaulipas and Veracruz coasts of Mexico. Precipitated by strong winds, the females swarm to mass nesting emergences, known as *arribadas* or *arribazones*, to nest during daylight hours. Clutch size averages 100 eggs (Service and NOAA Fisheries 1992). Some females breed annually and nest an average of 1 to 4 times in a season at intervals of 10 to 28 days. Age at sexual maturity is believed to be between 7 to 15 years (Turtle Expert Working Group 1998).

Population dynamics

Loggerhead Sea Turtle

Total estimated nesting in the Southeast is approximately 50,000 to 90,000 nests per year (FWC statewide nesting database 2004, Georgia Department of Natural Resources statewide nesting database 2004, South Carolina Department of Natural Resources statewide nesting database 2004, North Carolina Wildlife Resources Commission statewide nesting database 2004). In 1998, 85,988 nests were documented in Florida alone. However, in 2001, 2002, 2003, and 2004, this number dropped to 69,657, 62,905, 56,852, and 47,173, respectively. An analysis of nesting data from the Florida Index Nesting Beach Survey (INBS) Program from 1989 to 2004, a period encompassing index surveys that are more consistent and more accurate than surveys in previous years, has shown no detectable trend but, more recently (1998 through 2004), has shown evidence of a declining trend (Blair Witherington, FWC, personal communication, 2005). Given inherent annual fluctuations in nesting and the short time period over which the decline has been noted, caution is warranted in interpreting the decrease in terms of nesting trends.

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, NOAA Fisheries and Service 1991b). The status of the Oman loggerhead nesting population, reported to be the largest in the world (Ross 1979), is uncertain because of the lack of long-term standardized nesting or foraging ground

surveys and its vulnerability to increasing development pressures near major nesting beaches and threats from fisheries interactions on foraging grounds and migration routes (Earl Possardt, Service, personal communication, 2005). The loggerhead nesting aggregations in Oman, the southeastern U.S., and Australia have been estimated to account for about 88 percent of nesting worldwide (NOAA Fisheries and Service 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 Counties) (NOAA Fisheries and Service 1991b).

Green Sea Turtle

About 150 to 2,750 females are estimated to nest on beaches in the continental U.S. annually (FWC 2006). In the U.S. Pacific, over 90 percent of nesting throughout the Hawaiian archipelago occurs at the French Frigate Shoals, where about 200 to 700 females nest each year (NOAA Fisheries and Service 1998a). Elsewhere in the U.S. Pacific, nesting takes place at scattered locations in the Commonwealth of the Northern Marianas, Guam, and American Samoa. In the western Pacific, the largest green turtle nesting group in the world occurs on Raine Island, Australia, where thousands of females nest nightly in an average nesting season (Limpus et al. 1993). In the Indian Ocean, major nesting beaches occur in Oman where 30,000 females are reported to nest annually (Ross and Barwani 1995).

Leatherback Sea Turtle

Recent estimates of global nesting populations indicate 26,000 to 43,000 nesting females annually (Spotila et al. 1996). The largest nesting populations at present occur in the western Atlantic in French Guiana (4,500 to 7,500 females nesting/year) and Colombia (estimated several thousand nests annually), and in the western Pacific in West Papua (formerly Irian Jaya) and Indonesia (about 600 to 650 females nesting/year). In the United States, small nesting populations occur on the Florida east coast (100 females/year) (FWC 2006), Sandy Point, U.S. Virgin Islands (50 to 190 females/year) (Alexander et al. 2002, and Puerto Rico (30 to 90 females/year).

Hawksbill Sea Turtle

About 15,000 females are estimated to nest each year throughout the world with the Caribbean accounting for 20 to 30 percent of the world's hawksbill population. Only five regional populations remain with more than 1,000 females nesting annually (Seychelles, Mexico, Indonesia, and two in Australia). Mexico is now the most important region for hawksbills in the Caribbean with 3,000 nests per year (Meylan 1999). Other significant, but smaller populations in the Caribbean still occur in Martinique, Jamaica, Guatemala, Nicaragua, Grenada, Dominican Republic, Turks and Caicos Islands, Cuba, Puerto Rico, and U.S. Virgin Islands. In the U.S. Caribbean, about 150 to 500 nests per year are laid on Mona Island, Puerto Rico, and 70 to 130 nests per year on Buck Island Reef National Monument, U.S. Virgin Islands. In the U.S. Pacific, hawksbills nest only on main island beaches in Hawaii, primarily along the east coast of the island of Hawaii. Hawksbill nesting has also been documented in American Samoa and Guam (NOAA Fisheries and Service 1998b).

Kemp's Ridley Sea Turtle

The 40,000 nesting females estimated from a single mass nesting emergence in 1947 reflected a much larger total number of nesting turtles in that year than exists today (Carr 1963, Hildebrand 1963). However, nesting in Mexico has been steadily increasing in recent years - from 702 nests in 1985 to over 10,000 nests in 2005 (U.S. Fish and Wildlife Service 2005). Despite protection for the nests, turtles have been and continue to be lost to incidental catch by shrimp trawls (Service and NOAA Fisheries 1992).

Status and distribution

Loggerhead Sea Turtle

Genetic research involving analysis of mitochondrial DNA has identified five different loggerhead subpopulations/nesting aggregations in the western North Atlantic: (1) the Northern Subpopulation occurring from North Carolina to around Cape Canaveral, Florida (about 29° N.); (2) South Florida Subpopulation occurring from about 29° N. on Florida's east coast to Sarasota on Florida's west coast; (3) Dry Tortugas, Florida, Subpopulation, (4) Northwest Florida Subpopulation occurring at Eglin Air Force Base and the beaches near Panama City; and (5) Yucatán Subpopulation occurring on the eastern Yucatán Peninsula, Mexico (Bowen 1994, 1995; Bowen et al. 1993; Encalada et al. 1998; Pearce 2001). These data indicate gene flow between these five 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 subpopulation.

The Northern Subpopulation has declined substantially since the early 1970s. Recent estimates of loggerhead nesting trends from standardized daily beach surveys showed significant declines ranging from 1.5 to 2.0 percent annually (Mark Dodd, Georgia Department of Natural Resources, personal communication, 2005). Nest totals from aerial surveys conducted by the South Carolina Department of Natural Resources showed a 3.3 percent annual decline in nesting since 1980. Overall, there is strong statistical evidence to suggest the Northern Subpopulation has sustained a long-term decline.

Data from all beaches where nesting activity has been recorded indicate the South Florida Subpopulation has shown significant increases over the last 25 years. However, an analysis of nesting data from the Florida INBS Program from 1989 to 2002, a period encompassing index surveys that are more consistent and more accurate than surveys in previous years, has shown no detectable trend and, more recently (1998 through 2002), has shown evidence of a declining trend (Blair Witherington, FWC, personal communication, 2003). Given inherent annual fluctuations in nesting and the short time period over which the decline has been noted, caution is warranted in interpreting the decrease in terms of nesting trends.

A near census of the Florida Panhandle Subpopulation undertaken from 1989 to 2002 reveals a mean of 1,028 nests per year, which equates to about 251 females nesting per year (FWC 2006). Evaluation of long-term nesting trends for the Florida Panhandle Subpopulation is difficult because of changed and expanded beach coverage. Although there are now 8 years (1997 to 2004) of INBS data for the Florida Panhandle Subpopulation, the time series is too short to detect a trend (Blair Witherington, FWC, personal communication, 2005).
A near census of the Dry Tortugas Subpopulation undertaken from 1995 to 2001 reveals a mean of 213 nests per year, which equates to about 50 females nesting per year (FWC 2006). The

trend data for the Dry Tortugas Subpopulation are from beaches that were not part of the State of Florida's INBS program prior to 2004, but have moderately good monitoring consistency. There are 7 continuous years (1995 to 2001) of data for this Subpopulation, but the time series is too short to detect a trend (Blair Witherington, FWC, personal communication, 2005).

Nesting surveys in the Yucatán Subpopulations have been too irregular to date to allow for a meaningful trend analysis (Turtle Expert Working Group 1998, 2000).

Threats include incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

Green Sea Turtle

Total population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. For instance, in Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, estimates range from 150 to 2,750 females nesting annually (FWC 2006). Populations in Surinam, and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and food. Fibropapillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously impacted green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

Leatherback Sea Turtle

Declines in leatherback nesting have occurred over the last two decades along the Pacific coasts of Mexico and Costa Rica. The Mexican leatherback nesting population, once considered to be the world's largest leatherback nesting population (historically estimated to be 65 percent of the worldwide population), is now less than 1 percent of its estimated size in 1980. Spotila et al. (1996) estimated the number of leatherback sea turtles nesting on 28 beaches throughout the world from the literature and from communications with investigators studying those beaches. The estimated worldwide population of leatherbacks in 1995 was about 34,500 females on these beaches with a lower limit of about 26,200 and an upper limit of about 42,900. This is less than one third the 1980 estimate of 115,000. Leatherbacks are rare in the Indian Ocean and in very

low numbers in the western Pacific Ocean. The largest population is in the western Atlantic. Using an age-based demographic model, Spotila et al. (1996) determined leatherback populations in the Indian Ocean and western Pacific Ocean cannot withstand even moderate levels of adult mortality and even the Atlantic populations are being exploited at a rate that cannot be sustained. They concluded leatherbacks are on the road to extinction and further population declines can be expected unless we take action to reduce adult mortality and increase survival of eggs and hatchlings.

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific. Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; and watercraft strikes.

Hawksbill Sea Turtle

The hawksbill sea turtle has experienced global population declines of 80 percent or more during the past century and continued declines are projected (Meylan and Donnelly 1999). Most populations are declining, depleted, or remnants of larger aggregations. Hawksbills were previously abundant, as evidenced by high-density nesting at a few remaining sites and by trade statistics. The decline of this species is primarily due to human exploitation for tortoiseshell. While the legal hawksbill shell trade ended when Japan agreed to stop importing shell in 1993, a significant illegal trade continues. It is believed individual hawksbill populations around the world will continue to disappear under the current regime of exploitation for eggs, meat, and tortoiseshell, loss of nesting and foraging habitat, incidental capture in fishing gear, ingestion of and entanglement in marine debris, oil pollution, and boat collisions. Hawksbills are closely associated with coral reefs, one of the most endangered of all marine ecosystem types.

Kemp's Ridley Sea Turtle

The decline of this species was primarily due to human activities, including the direct harvest of adults and eggs and incidental capture in commercial fishing operations. Today, under strict protection, the population appears to be in the early stages of recovery. The recent nesting increase can be attributed to full protection of nesting females and their nests in Mexico resulting from a bi-national effort between Mexico and the U.S. to prevent the extinction of the Kemp's ridley, and the requirement to use turtle excluder devices in shrimp trawls both in the United States and Mexico.

The Mexico government also prohibits harvesting and is working to increase the population through more intensive law enforcement, by fencing nest areas to diminish natural predation, and by relocating all nests into corrals to prevent poaching and predation. While relocation of nests into corrals is currently a necessary management measure, this relocation and concentration of eggs into a "safe" area is of concern since it makes the eggs more susceptible to reduced viability

due to movement-induced mortality, disease vectors, catastrophic events like hurricanes, and marine predators once the predators learn where to concentrate their efforts.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect nesting females, nests, and hatchlings within the proposed project area. The effects of the proposed action on sea turtles will be considered further in the remaining sections of this biological opinion. Potential effects include destruction of nests deposited within the boundaries of the proposed project, harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities, and behavior modification of nesting females due to escarpment formation within the project area during a nesting season resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs. The quality of the placed sand could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest.

Critical habitat has not been designated in the continental U.S.; therefore, the proposed action would not result in an adverse modification.

ENVIRONMENTAL BASELINE

The Boca Raton Shore Protection Project was authorized by the Corps on January 29, 1988. This initial project resulted in the placement of approximately 1,102,000 cy of sand along the 1.45 mile project area. The project design beach width was 50 feet and the project included the placement of 95 feet of advanced nourishment fill based on the expected equilibrium profile. The design berm elevation for this project was +9 feet NGVD. The project was constructed between July and August 1988. As mitigation for the unavoidable burial of exposed ephemeral nearshore hardbottom habitat, a limestone boulder artificial reef consisting of six reef modules was constructed in April 1988. The mitigation was a "one time only" requirement and the City of Boca Raton agreed to maintain the artificial reef. In turn, the City was assured that no additional future mitigation would be required if any rock in the area should be re-exposed as the beach eroded.

Between March and April 1998, the first renouishment project was performed. Based on pre- and post-construction surveys, an estimated 680,000 cy of material was placed along the 1.45 mile project area. Similarly, the beach was constructed to meet a design beach width of 50 feet and a design berm elevation of +9 feet of NGVD.

Palm Beach County is located within the most densely populated nesting range for three species of sea turtles: loggerhead, green, and leatherback sea turtles that regularly nest along the beaches of southeast Florida. Between 1998 and 2003, Palm Beach County beaches supported approximately 18 percent of the overall sea turtle nesting in Florida. Only one other Florida county, Brevard, supports a greater percentage of sea turtle nesting. In total, 11,893 and 13,327 sea turtle nests were recorded in 2004 and 2005, respectively, along the 42 miles of Palm Beach County beach included in the FWC's Florida Statewide Nesting Beach Survey (Table 1). The distribution of nests among species in 2004 included 10,759 loggerhead sea turtles, 968 green

sea turtles, and 166 leatherback sea turtles; and in 2005 the distribution included 10,791 loggerhead sea turtles, 2,252 green sea turtles, and 284 leatherback sea turtles (Table 1). Only false crawls have been recorded for Kemp's Ridley sea turtles in Palm Beach County (Meylan et al. 1995).

Status of the species/critical habitat within the action area

In Palm Beach County an average of 283 and 317 sea turtle nests were laid per mile in 2004 and 2005, respectively (Table 1). The nesting density along the 5 miles of the City of Boca Raton beach did not exceed the County average in 2004 or in 2005, with an average of 97 and 123 nests per mile in 2004 and 2005, respectively (Table 2).

Loggerhead Sea Turtle

The loggerhead sea turtle nesting and hatching season for Palm Beach County extends from March 15 through November 30. Incubation ranges from about 45 to 95 days.

Along the Florida east coast between 1995 and 2005, Palm Beach County had the second highest average nesting of loggerhead sea turtles, with approximately 13,000 nests laid (Palm Beach County 2006a). In 2004, a total of 10,759 loggerhead sea turtle nests, or 256 nests per mile, were laid in Palm Beach County (Table 1). In 2005, a total of 10,791 nests, or 257 nests per mile, were laid (Table 1). Loggerhead sea turtle nesting density along the City of Boca Raton beaches did not exceed the County average in 2004 or in 2005, with an average of 83 and 97 nests per mile in 2004 and 2005, respectively (Table 2).

Loggerhead sea turtles made 15,822 false crawls in 2004 and 14,345 in 2005, in Palm Beach County (Table 1). Along the City of Boca Raton beaches, loggerhead turtles made 628 false crawls in 2004, and 554 in 2005 (Table 2). In all cases, there were more false crawls than nests laid.

Green Sea Turtle

The green sea turtle nesting and hatching season for Palm Beach County extends from May 1 through November 30. Incubation ranges from about 45 to 75 days.

Between 1995 and 2005, Palm Beach County had the second highest average green sea turtle nesting along the Florida east coast; with a little more than 1,000 nests laid per year (Palm Beach County 2006b). In Palm Beach County, a total of 968 green sea turtle nests were laid in 2004, which is equivalent to 23 nests per mile (Table 1). A total of 2,252 green sea turtle nests were laid in 2005, for an average nesting density of 54 nests per mile (Table 1). Green sea turtle nesting density along the City of Boca Raton beaches did not exceed the County average in 2004 or in 2005, with an average of 13 and 23 nests per mile in 2004 and 2005, respectively (Table 2).

In Palm Beach County, 1,283 green sea turtle false crawls were made in 2004, and 3,142 in 2005. Along the City of Boca Raton beaches, green sea turtles made 58 false crawls in 2004, and 157 in 2005 (Table 2).

Leatherback Sea Turtle

The leatherback sea turtle nesting and hatching season for Palm Beach County extends from February 15 through November 30. Incubation ranges from about 55 to 75 days. Palm Beach County had the highest average leatherback sea turtle nesting along the Florida east coast from 1995 to 2005 (Palm Beach County 2006c). The total number of leatherback sea turtle nests laid in Palm Beach County was 166 in 2004, and 284 in 2005 (Table 1). The average nesting density was four nests per mile in 2004, and seven nests per mile in 2005. Along the City of Boca Raton beaches, 5 and 18 leatherback sea turtle nests were laid in 2004 and 2005, respectively (Table 2). Leatherback sea turtles made 25 false crawls 2004 and 52 in 2005, in Palm Beach County (Table 1). Along the City of Boca Raton beaches, one and zero false crawls were made by leatherback turtles in 2004 and 2005, respectively (Table 2).

Hawksbill Sea Turtle

The hawksbill sea turtle nesting and hatching season for Palm Beach County extends from June 1 through December 31. Incubation lasts about 60 days.

Although no nesting has been reported from the action area with regard to hawksbill sea turtles, nesting by this species has been documented five times in Palm Beach County since 1985 (Meylan et al. 1995, FWC 2006). The most recent record is from 2004.

Kemp's Ridley Sea Turtle

Although no nesting has been reported in Palm Beach County for Kemp's ridley turtles, four false crawls at Phipps Ocean Park were reported in 1989 (Meylan et al. 1995).

The majority of nesting surveys conducted in Florida occur during the morning hours and are based on interpretation of the tracks left by the turtles as they ascend and descend the beach; the turtles themselves are rarely observed. Because both hawksbill and Kemp's ridley turtle tracks are difficult to discern from loggerhead tracks, it is likely that nesting by both species is underreported (Meylan et al. 1995).

Factors affecting the species habitat within the action area

The project area includes 1.45 miles of shoreline which has an average beach width of 197 feet. Beaches of Boca Raton have been experiencing both short and long-term erosion for decades, resulting in serious exposure of infrastructure and development, the loss of recreational beach and sea turtle nesting habitat, and the erosion of dunes during storm events. As a result of storm-related erosion, 1,070,700 cy of sand was placed in the action area in 1988. Over a period of 9.6 years, 349,600 cy were lost resulting in a net beach volume of 721,100 cy prior to the 1998 nourishment project. In March and April 1998, 692,300 cy of sand was placed in the action area. Based on a survey conducted in September 2004, approximately 497,400 cy of sand has been lost since the 1998 nourishment project.

A primary threat to sea turtles along nesting shorelines includes sea turtle hatchling disorientation as a result of artificial lighting along the beach. Typically, sea turtle hatchlings will emerge from the nest and orient themselves towards the brighter, open horizon of the ocean

(Salmon et al. 1992). If artificial lights are visible from the beach, sea turtle hatchlings tend to travel toward the artificial lights instead of the ocean. Disorientation events often result in hatchling mortality as a result of dehydration, predation, and motor vehicle strikes. In addition, regular beach maintenance in the form of tractor tilling may disrupt or impact deposited nests and nesting females. Plastics, styrofoam, and fishing line are pollutants that may negatively impact nesting success and nearshore foraging.

As restored beaches equilibrate to a more natural profile, steep vertical escarpments often form along the seaward edge of the constructed beach berm and this presents a physical barrier to nesting turtles (Indian River County 2004). Additionally, as beach profiles equilibrate, losses of nests laid in the seaward portions of the renourished beach due to erosion may be high. Steinitz et al. (1998) following long-term studies at Jupiter Inlet indicated that at 2 years post-renourishment, nesting success was considerably higher than pre-renourishment levels and similar to densities found on nearby non-eroded beaches. However, the nesting success declined as the renourished beach eroded and narrowed until the next renourishment event.

EFFECTS OF THE ACTION

The analysis of the direct and indirect effects of the proposed action on sea turtles and the interrelated and interdependent activities of those effects was based on beneficial and detrimental factors.

Factors to be considered

The proposed action has the potential to adversely affect nesting females, nests, and hatchlings within the proposed project area through the placement of dredged material along 1.45 miles of beach in northern Boca Raton, Palm Beach County, Florida.

Analyses for effects of the action

Beneficial effects

The placement of sand on a beach with reduced dry fore-dune habitat may increase sea turtle nesting habitat if the placed sand is highly compatible (*e.g.*, grain size, shape, color, etc.) with naturally occurring beach sediments in the area, and compaction and escarpment remediation measures are incorporated into the project. In addition, a nourished beach that is designed and constructed to mimic a natural beach system may be more stable than the eroding one it replaces, thereby benefiting sea turtles.

Direct effects

Placement of 920,000 cy of sand along 1.45 miles of beach in and of itself may not provide suitable nesting habitat for sea turtles. Although beach nourishment may increase the potential nesting area, significant negative impacts to sea turtles may result if protective measures are not incorporated during project construction. Nourishment during the nesting season, particularly on or near high density nesting beaches, can cause increased loss of eggs and hatchlings and along with other mortality sources, may significantly impact the long-term survival of the species. For example, 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 impacts, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) 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 7 percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

1. Nest relocation

Besides the potential for missing nests during a nest relocation program, there is a potential for eggs to be damaged by their movement, particularly if eggs are not relocated within 12 hours of deposition (Limpus et al. 1979). Nest relocation can have adverse impacts on incubation temperature (and 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 sands 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). In a 1994 Florida study comparing loggerhead hatching and emergence success of relocated nests with *in situ* nests, Moody (1998) found hatching success was lower in relocated nests at 9 of 12 beaches evaluated and emergence success was lower in relocated nests at 10 of 12 beaches surveyed in 1993 and 1994.

2. Missed nests

Although a nesting survey and nest marking program would reduce the potential for nests to be impacted by construction activities, nests may be inadvertently missed (when crawls are obscured by rainfall, wind, and/or tides) or misidentified as false crawls during daily patrols. Even under the best of conditions, about 7 percent of the nests can be misidentified as false crawls by experienced sea turtle nest surveyors (Schroeder 1994).

3. 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.

4. Artificial lighting

Visual cues are the primary sea-finding mechanism for hatchling sea turtles (Mrosovsky and Carr 1967; Mrosovsky and Shettleworth 1968; Dickerson and Nelson 1989; Witherington and

Bjorndal 1991). When artificial lighting is present on or near the beach, it can misdirect hatchlings once they emerge from their nests and prevent them from reaching the ocean (Philibosian 1976; Mann 1977). In addition, a significant reduction in sea turtle nesting activity has been documented 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, misdirect females trying to return to the surf after a nesting event, and misdirect 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 impact could be reduced by using the minimum amount of light necessary (may require shielding) or low pressure sodium lighting during project construction.

Indirect effects

Many of the direct effects of beach nourishment may persist over time and become indirect impacts. These indirect effects include increased susceptibility of relocated nests to catastrophic events, the consequences of potential increased beachfront development, changes in the physical characteristics of the beach, the formation of escarpments, and future sand migration.

1. Increased susceptibility to catastrophic events

Nest relocation may concentrate eggs in an area making them more susceptible 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 (Glenn 1998; Wyneken et al. 1998).

2. Increased beachfront development

Pilkey and Dixon (1996) state that beach replenishment frequently leads to more development in greater density within shorefront communities that are then left with a future of further replenishment or more drastic stabilization measures. Dean (1999) also notes that the very existence of a beach nourishment project can encourage more development in coastal areas. Following completion of a beach nourishment project in Miami during 1982, investment in new and updated facilities substantially increased tourism in the area (National Research Council 1995). Increased building density immediately adjacent to the beach often resulted as older buildings were replaced by much larger ones that accommodated more beach users. Overall, shoreline management creates an upward spiral of initial protective measures resulting in more expensive development which leads to the need for more and larger protective measures. Increased shoreline development may adversely affect sea turtle nesting success. Greater development may support larger populations of mammalian predators, such as foxes and raccoons, than undeveloped areas (National Research Council 1990), and can also result in greater adverse effects due to artificial lighting, as discussed above.

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 impacts on nest site selection, digging behavior, clutch viability, and emergence by hatchlings (Nelson and Dickerson 1987; Nelson 1988).

Beach compaction and unnatural beach profiles that may result from beach nourishment activities could negatively impact sea turtles regardless of the timing of 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 (*e.g.*, false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Fletemeyer 1980; Raymond 1984; Nelson and Dickerson 1987; Nelson et al. 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may increase the length of time required for female sea turtles to excavate nests and also cause increased physiological stress to the animals (Nelson and Dickerson 1988c). 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.

These impacts can be minimized by using suitable sand and by tilling compacted sand after project completion. The level of compaction of a beach can be assessed by measuring sand compaction using a cone penetrometer (Nelson 1987). Tilling of a nourished beach with a root rake may reduce the sand compaction to levels comparable to unnourished beaches. However, a pilot study by Nelson and Dickerson (1988c) showed that a tilled nourished beach will remain uncompacted for up to 1 year. Therefore, the Service requires multi-year beach compaction monitoring and, if necessary, tilling to ensure project impacts on sea turtles are minimized.

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 timeframe for sediment mixing and bleaching to occur could be critical to a successful sea turtle nesting season.

During dredging and pumping activities on the beach, turbidity in the water column increases due to the suspension of silt in the borrow material. The maximum silt content recorded in Borrow Areas A and B is 4.59 percent. The mean silt content in Borrow Areas A and B and the native beach are 1.14 and 1.61 percent, respectively. Overall, the silt content documented in Borrow Areas A and B meet the State standard for beach nourishment projects (less than 5 percent silt). Grain size compatibility is quantified using the overfill factor, which indicates the proportion of sand required to compensate for differences between grain size distributions of the borrow area source and the native beach. An overfill factor of 1.00 indicates that no extra sand is required. An overfill factor of 1.28 indicates that the sand volume must be increased 28 percent to achieve the same performance as material identical to the native beach. The mean grain size

in Borrow Areas A and B, and the native beach are 0.26 mm, 0 .28 mm, and 0.29 mm, respectively. Overfill factors range from 1.13 to 1.28 in Borrow Area A and 1.04 to 1.09 in Borrow Area B. The grain size documented in Borrow Areas A and B meet the State standard for beach nourishment projects (0.062 mm to 4.76 mm)

4. Escarpment formation

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 (Nelson and Blihovde 1998). Researchers have shown that 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 prolonged tidal inundation). This impact can be minimized by leveling any escarpments prior to the nesting season.

Species' response to a proposed action

Ernest and Martin (1999) conducted a comprehensive study to assess the effects of beach nourishment on loggerhead sea turtle nesting and reproductive success. The following findings illustrate sea turtle responses to and recovery from a nourishment project. A significantly larger proportion of turtles emerging on nourished beaches abandoned their nesting attempts than turtles emerging on Control or pre-nourished beaches. This reduction in nesting success was most pronounced during the first year following project construction and is most likely the result of changes in physical beach characteristics associated with the nourishment project (*e.g.*, beach profile, sediment grain size, beach compaction, frequency and extent of escarpments). During the first post-construction year, the time required for turtles to excavate an egg chamber on the untilled, hard-packed sands of one treatment area increased significantly relative to Control and background conditions. However, in another treatment area, tilling was effective in reducing sediment compaction to levels that did not significantly prolong digging times. As natural processes reduced compaction levels on nourished beaches during the second post-construction year, digging times returned to background levels.

During the first post-construction year, nests on the nourished beaches were deposited significantly farther from both the toe of the dune and the tide line than nests on Control beaches. Furthermore, nests were distributed throughout all available habitat and were not clustered near the dune as they were in the Control. As the width of nourished beaches decreased during the second year, among-treatment differences in nest placement diminished. More nests were washed out on the wide, flat beaches of the nourished treatments than on the narrower steeply sloped beaches of the Control. This phenomenon persisted through the second post-construction year monitoring and resulted from the placement of nests near the seaward edge of the beach berm where dramatic profile changes, caused by erosion and scarping, occurred as the beach equilibrated to a more natural contour.

As with other beach nourishment projects, Ernest and Martin (1999) found the principal effect of nourishment on sea turtle reproduction was a reduction in nesting success during the first year following project construction. Although most studies have attributed this phenomenon to an

increase in beach compaction and escarpment formation, Ernest and Martin (1999) indicate changes in beach profile may be more important. Regardless, as a nourished beach is reworked by natural processes in subsequent years and adjusts from an unnatural construction profile to a more natural beach profile, beach compaction and the frequency of escarpment formation decline, and nesting and nesting success return to levels found on natural beaches.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, 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 Act. The Service has considered potential cumulative effects of this project on sea turtles and, in this instance, there are no cumulative effects.

CONCLUSION

After reviewing the current status of the loggerhead, green, leatherback, hawksbill and Kemp's ridley sea turtles, the environmental baseline for the action area, the effects of the proposed beach nourishment, and the cumulative effects, it is the Service's biological opinion that the beach nourishment project, as proposed, is not likely to jeopardize the continued existence of these sea turtles. No critical habitat has been designated for the loggerhead, green, leatherback, Kemp's Ridley, and hawksbill sea turtles in the continental United States; therefore, none will be affected.

The proposed project will affect 1.45 miles of the approximately 1,400 miles of available sea turtle nesting habitat in the southeastern United States. Research has shown that the principal effect of beach nourishment on sea turtle reproduction is a reduction in nesting success, and this reduction is most often limited to the first year following project construction. Research has also shown the impacts of a nourishment project on sea turtle nesting habitat are typically short-term because a nourished beach will be reworked by natural processes in subsequent years, and beach compaction and the frequency of escarpment formation will decline. Although a variety of factors, including some that cannot be controlled, can influence how a nourishment project will perform from an engineering perspective, measures can be implemented to minimize impacts to sea turtles.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent 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 defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. 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 to be prohibited under the Act 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 Corps so that they become binding conditions of any grant or permit issued to the Applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or, (2) 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, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates 1.45 miles of nesting beach habitat could be taken as a result of this proposed action. The take is expected to be in the form of: (1) destruction of all nests that may be constructed and eggs that may be deposited from March 1 through April 30 and from September 1 through September 30 and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited from October 1 through February 28 (or 29 as applicable) when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) misdirection of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service.

Incidental take is anticipated for only the 1.45 miles of beach that has been identified for sand placement. The Service anticipates incidental take of sea turtles will be difficult to detect for the following reasons: (1) the turtles nest primarily at night and all nests are not found because [a] natural factors, such as rainfall, wind, and tides may obscure crawls and [b] human-caused factors, such as pedestrian and vehicular traffic, may obscure crawls, and result in nests being destroyed because they were missed during a nesting survey and egg relocation program; (2) the total number of hatchlings per undiscovered nest is unknown; (3) the reduction in percent hatching and emerging success per relocated nest over the natural nest site is unknown; (4) an unknown number of females may avoid the project beach and be forced to nest in a less than optimal area; (5) lights may misdirect an unknown number of hatchlings and cause death; and (6) escarpments may form and cause an unknown number of females from accessing a suitable nesting site. However, the level of take of these species can be anticipated by the disturbance

and renourishment of suitable turtle nesting beach habitat because: (1) turtles nest within the project site; (2) beach renourishment will likely occur during a portion of the nesting season; (3) the renourishment project will modify the incubation substrate, beach slope, and sand compaction; and (4) artificial lighting will deter and/or misdirect nesting females and hatchlings.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the species. Critical habitat has not been designated in the project area; therefore, the project will not result in destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

1. Beach quality sand suitable for sea turtle nesting, successful incubation, and hatchling emergence must be used on the project site;

2. Beach nourishment and dune enhancement activities must 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, crushing of eggs, or nest excavation;

3. If the beach nourishment and dune enhancement activities will be conducted during the period from March 1 through April 30, surveys for early nesting sea turtles must be conducted. If nests are constructed in the area of beach nourishment and dune restoration, the eggs must be relocated;

4. If the project will be conducted during the period from November 1 through November 30, surveys for late nesting turtles must be conducted. If nests are constructed in the area of beach nourishment, the eggs must be relocated;

5. Immediately after completion of the project and prior to the next 3 nesting seasons, beach compaction must be monitored and tilling must be conducted as required by March 1 to reduce the likelihood of impacting sea turtle nesting and hatching activities. The March 1 deadline is required to reduce impacts to leatherbacks that nest in greater frequency along the South Atlantic coast of Florida than elsewhere in the continental United States;

6. Immediately after completion of the project and prior to the next 3 nesting seasons, monitoring must be conducted to determine if escarpments are present and escarpments must be leveled as required to reduce the likelihood of impacting sea turtle nesting and hatching activities;
7. The Applicant must ensure that contractors doing the beach nourishment and dune enhancement work fully understand the sea turtle protection measures detailed in this incidental take statement;

8. During the early (March 1 through April 30) and late (November 1 through November 30) portions of the nesting season, construction equipment and pipes must be stored in a manner that will minimize impacts to sea turtles to the maximum extent practicable; and

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

TERMS AND CONDITIONS

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

1. All fill material placed must be sand similar to a native beach in the vicinity of the site that has not been affected by prior renourishment activities. The fill material must be similar in both coloration and grain size distribution (sand grain frequency, mean and median grain size, and sorting coefficient) to the native beach and must not contain:

   1a. Greater than 5 percent, by weight, silt, clay, or colloids passing the #230 sieve;

   1b. Greater than 5 percent, by weight, fine gravel retained on the #4 sieve;

   1c. Coarse gravel, cobbles, or other material retained on the ¾-in sieve in a percentage or size greater than found on the native beach; and

   1d. Construction debris, toxic material, or other foreign matter; and not result in contamination or cementation of the beach.

2. Project construction must be started after October 31 and be completed before May 1. During the May 1 through October 31 period, no construction equipment or pipes will be stored on the beach;

3. If the project will be conducted during the period from March 1 through April 30, daily early morning surveys for sea turtle nests must be conducted. In the event a sea turtle nest is excavated during construction activities, all work shall cease in that area immediately and the permitted person responsible for egg relocation for the project should be notified so the eggs can be relocated per the following requirements:

   3a. Nesting surveys and egg relocations will only be conducted by personnel with prior experience and training in nesting survey and egg relocation procedures. Surveyors must perform under the supervision of a qualified professional with a valid FWC Marine Turtle Permit. Nesting surveys must be conducted daily between sunrise and 9 a.m. Surveys must 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; and

   3b. Only those nests that may be affected by construction activities will be relocated. Nests requiring relocation must 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 must cease when construction activities no longer threaten nests. Nests deposited within areas where construction activities have ceased or will not occur for 65 days must be marked and left in place unless other factors threaten the success of the nest. Any nests left in the active construction zone must be clearly marked, and all mechanical equipment must avoid nests by at least 10 ft.

4. If the project will be conducted during the period from November 1 through November 30, daily early morning sea turtle nesting surveys must be conducted 65 days prior to project initiation and continue through September 30. In the event a sea turtle nest is excavated during construction activities, all work shall cease in that area immediately and the permitted person responsible for egg relocation for the project should be notified so the eggs can be relocated per the receding requirements;

5. Immediately after completion of the project (April 30) and prior to March 1 for 3 subsequent years, sand compaction must be monitored in the area of restoration in accordance with a protocol agreed to by the Service, the FWC, and the Applicant. At a minimum, the protocol provided under 5a and 5b below must be followed. If required, the area must be tilled to a depth of 36 in. All tilling activity must be completed prior to March 1. An annual summary of compaction surveys and the actions taken must be submitted to the Service. (NOTE: The requirement for compaction monitoring can be eliminated if the decision is made to till regardless of post-construction compaction levels. Also, out-year compaction monitoring and remediation are not required if placed material no longer remains on the beach.)

   5a. Compaction sampling stations must be located at 500-foot intervals along the project area. One station must be at the seaward edge of the dune/bulkhead line (when material is placed in this area), and one station must be midway between the dune line and the high water line (normal wrack line).

   At each station, the cone penetrometer will be pushed to a depth of 6, 12, and 18 in. 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 lie over less compact layers. Replicates will 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 will be averaged to produce final values for each depth at each station. Reports will include all 18 values for each transect line, and the final 6 averaged compaction values.

   5b. If the average value for any depth exceeds 500 pounds per square inch (psi) for any two or more adjacent stations, then that area must 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 Service will be required to determine if tilling is required. If a few values exceeding 500 psi are present randomly within the project area, tilling will not be required.

6. Visual surveys for escarpments along the project area must be made immediately after completion of the project and prior to March 1 for 3 subsequent years if placed sand still

remains on the beach. All scarps shall be leveled, or the beach profile shall be reconfigured, to minimize scarp formation. In addition, weekly surveys of the project area shall be conducted during the 3 nesting seasons following completion of fill placement as follows:

6a. The number of escarpments and their location relative to DEP reference monuments shall be recorded during each weekly survey and reported relative to the length of the beach surveyed (*e.g.*, 50 percent scarps). Notations on the height of these escarpments shall be included (0 to 2 ft, 2 to 4 ft, and 4 ft or higher) as well as the maximum height of all escarpments; and

6b. Escarpments that interfere with sea turtle nesting or that exceed 18 in. in height for a distance of 100 ft must be leveled to the natural beach contour by April 30. Any escarpment removal shall be reported relative to R-monument locations. The Service must be contacted immediately if subsequent reformation of escarpments that interfere with sea turtle nesting or that exceed 18 in height for a distance of 100 ft occurs during the nesting and hatching season (May 1 to October 31) to determine the appropriate action to be taken. If it is determined escarpment leveling is required during the nesting or hatching season, the Service will provide a brief written authorization that describes methods to be used to reduce the likelihood of impacting existing nests. An annual summary of escarpment surveys and actions taken must be submitted to the Service. (NOTE: Out-year escarpment monitoring and remediation are not required if placed material no longer remains on the dry beach.)

7. The Applicant must arrange a meeting between representatives of the contractor, the Service, the FWC, 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 must 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 April 30 and November 1 through November 30, staging areas for construction equipment must be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use must be off the beach to minimize disturbance to sea turtle nesting and hatching activities during this period. In addition, all construction pipes placed on the beach must be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes must be off the beach to the maximum extent possible. Temporary storage of pipes on the beach must be in such a manner so as to impact the least amount of nesting habitat and must 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 1 through April 30 and November 1 through November 30, all on-beach lighting associated with the project must be limited to the immediate area of active construction only and must be the minimal lighting necessary to comply with all safety requirements. Lighting on offshore or onshore equipment must 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 Occupational Safety and Health Administration (OSHA) requirements. Shielded low pressure sodium vapor lights are recommended for lights on offshore equipment that cannot be eliminated, and for illumination of the nesting beach and nearshore waters. Light intensity of lighting plants must be reduced to the minimum standard required by OSHA for General Construction areas, in order not to misdirect sea turtles. Shields must be affixed to the light housing and be large enough to block light from all lamps from being transmitted outside the construction area (Figure 2).

10. A lighting survey shall be conducted prior to April 30 of the first nesting season following nourishment and action taken to ensure no lights or light sources are visible from the newly elevated beach. A report summarizing all lights visible, using standard survey techniques for such surveys, shall be submitted to the Service by May 15 and documenting all compliance and enforcement action. Additional lighting surveys shall be conducted monthly through August and results reported by the 15th of each month of the first nesting season after project completion;

11. A report describing the actions taken to implement the terms and conditions of this incidental take statement must be submitted to the FWC, Imperiled Species Management Section, Tequesta office and the Tallahassee office as well as the South Florida Ecological Services Office, Vero Beach, Florida 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 self-release beach sites, nest survey and relocation results, and hatching success of nests.

12. Upon locating a dead, injured, or sick endangered or threatened sea turtle specimen, initial notification must be made to the FWC at 1-888-404-3922, and the South Florida Ecological Services Office biologist listed at the end of this biological opinion. 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 evidence intrinsic to the specimen is not unnecessarily disturbed.

The Service believes incidental take will be limited to the 1.45 miles of beach that has been identified for sand placement. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service believes no more than the following types of incidental take will result from the proposed action: (1) destruction of all nests that may be constructed and eggs that may be deposited and missed by a nest survey and egg relocation program within the boundaries of the proposed project; (2) destruction of all nests deposited during the period when a nest survey and egg relocation program is not required to be in place within the boundaries of the proposed project; (3) reduced hatching success due to egg mortality during relocation and adverse conditions at the relocation site; (4) harassment in the form of

disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities; (5) disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting; (6) behavior modification of nesting females due to escarpment formation within the project area during a nesting season, resulting in false crawls or situations where they choose marginal or unsuitable nesting areas to deposit eggs; and (7) destruction of nests from escarpment leveling within a nesting season when such leveling has been approved by the Service.

The amount or extent of incidental take for sea turtles will be considered exceeded if the project results in more than a one-time placement of sand over a period of 10 years on the 1.45 miles of beach that has been identified for sand placement. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act 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.

1. Appropriate native salt-resistant dune vegetation should be established on the restored dunes. DEP, Bureau of Beaches and Wetland Resources, 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 3 years following beach nourishment to determine whether sea turtle nesting success has been adversely impacted.

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.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the 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.

Should you have additional questions or require clarification, please contact Jeff Howe at 772-562-3909, extension 283.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
Coastal Planning & Engineering Incorporated, Boca Raton, Florida (Richard Spadoni)
Corps, Palm Beach, Florida (Leah Oberlin)
DEP, Tallahassee, Florida (Stephanie Gudeman)
EPA, West Palm Beach, Florida
FWC, Office of Protected Species Management, Tallahassee, Florida (Robbin Trindell)
NOAA Fisheries, West Palm Beach, Florida (Jocelyn Karazsia)
Service, Ecological Services, Jacksonville, Florida (National Sea Turtle Coordinator)
Service, Atlanta, Georgia (Section 7 Coordinator) electronic copy
USGS, Florida Integrated Science Center, Gainesville, Florida (Susan Walls)

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Table 1. Summary of sea turtle nesting data for Palm Beach County, Florida from 2000 to 2005. Data accessed: http://research.myfwc.com/features/view_article.asp?id=7630 on March 23, 2007.

Year	Loggerhead Nests	Loggerhead False Crawls	Green Nests	Green False Crawls	Leatherback Nests	Leatherback False Crawls
2000	14187	16124	1942	1931	160	33
2001	13757	12957	175	103	334	36
2002	13032	12841	2339	2824	250	47
2003	12963	15050	767	846	306	50
2004	10759	15822	968	1283	166	25
2005	10791	14345	2252	3142	284	52
Mean	**12581.5**	**14523.2**	**1407.2**	**1688.2**	**250**	**40.5**

Table 2. Summary of sea turtle nesting data for the City of Boca Raton, Palm Beach County, Florida from 2000 to 2005. Data provided by the Palm Beach County Department of Environmental Resources Management.

Year	Loggerhead Nests	Loggerhead False Crawls	Green Nests	Green False Crawls	Leatherback Nests	Leatherback False Crawls
2000	723	826	124	74	9	0
2001	563	527	10	6	13	0
2002	550	500	120	144	15	2
2003	594	802	40	29	13	1
2004	416	628	66	58	5	1
2005	485	554	115	157	18	0
Mean	**555**	**640**	**79**	**78**	**12**	**1**

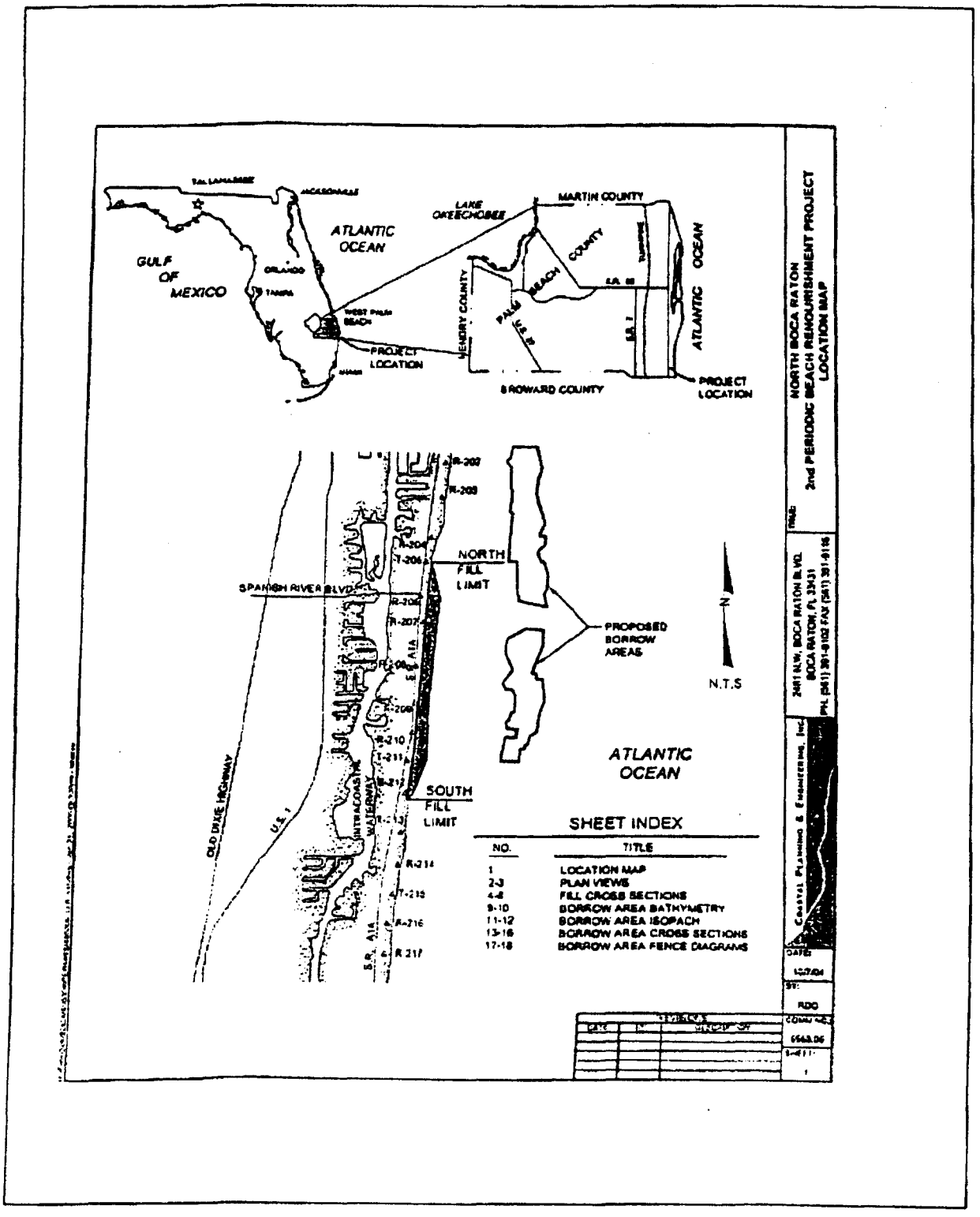

Figure 1. Location of the proposed beach renourishment project between DEP monuments T-205 and 181 feet south of R-212 in northern Boca Raton, Palm Beach County, Florida (CPE).

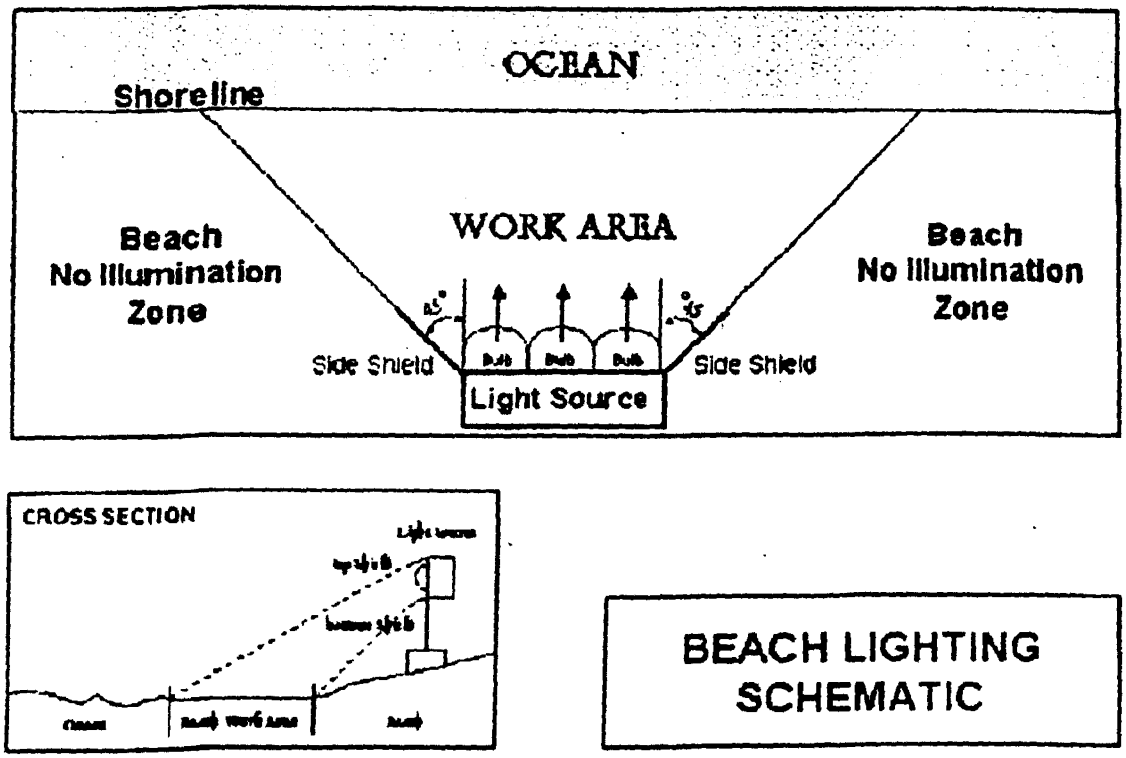

Figure 2. Beach lighting schematic.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

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February 22, 2007 F/SER4:JK/pw

Colonel Paul L. Grosskruger
District Engineer, Jacksonville District
Department of the Army Corps of Engineers
Jacksonville Regulatory Office, South Permits Branch
PO Box 4970
Jacksonville, Florida 32232

Dear Colonel Grosskruger:

NOAA's National Marine Fisheries Service (NMFS) reviewed public notice SAJ-1986-479 (IP-LAO) dated January 22, 2007. The applicant, City of Boca Raton, requests authorization from the Department of the Army to nourish 1.45 miles of beach between Florida Department of Environmental Protection (FDEP) monuments R-205 and R-212 + 181 feet. This work will require dredging 920,000 cubic yards of sand from two borrow areas. The excavated material would be transported from the borrow areas to the beach via floating and submerged pipelines. This stretch of beach was previously nourished during 1988 and 1998. According to the notice, the project would impact 0.10 acres of nearshore hard bottom and 53.63 acres of subtidal sandy bottom. No compensatory mitigation is proposed. The site of the proposed project is on and offshore of the North Boca Raton Beach, Palm Beach County. The Jacksonville District's initial determination is that this project would not have a substantial adverse impact on essential fish habitat (EFH) or federally managed fisheries. As the nation's federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the following comments and recommendations are provided pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Our comments and recommendations are based upon review of the public notice; the requests for additional information (RAI) made by the Florida Department of Environmental Protection (FDEP) on March 10, 2006, and October 25, 2006; and the applicant's response (dated September 22, 2006) to the March RAI. To our knowledge, the applicant has not responded yet to the RAI from October.

Borrow Areas and Nearby Hard Bottom Habitat
Two borrow areas are proposed as sand sources for the project. Borrow Area A is due east of the beach fill area and is approximately 4,300 feet long by 900 feet wide in 50 to 62 feet of water. Borrow Area B is located east and slightly to the north of the beach fill area and is approximately 5,200 feet long and 930 feet wide in water depths of 32 to 57 feet. Borrow Areas A and B are reported to have a mean grain size of 0.26 and 0.28 mm and an average silt content of 1.14 and 1.65 percent, respectively.

Hard bottom habitats are located 400 feet to the east and west of the borrow areas. To protect these valuable areas, the applicant proposes to establish a 400-foot buffer around the hard bottom locations.

These buffers should be sufficient to protect these habitats; however, this conclusion is tentative pending resolution of three issues. First, the drawings provided with the public notice identify "no dredge" areas within Borrow Area B. Presumably, these "no dredge" areas are present for archaeological reasons, but this is not clear from the information provided. On the other hand, if these "no dredge" areas result from hard bottom habitat occurring within this borrow site, further information is needed to demonstrate the buffer zones would be sufficient to protect these habitats. Second, we note that the borrow areas are irregular in shape, especially Borrow Area A, which may present significant challenges with respect to navigating the dredge and work boats. An accurate, real-time vessel-tracking system will be important to document the position of the dredge and its proximity to hard bottom habitats in order to verify that the 400-foot buffer has been maintained. Third, hard bottom areas around the borrow sites should be monitored before, during, and after construction to ensure the care taken to avoid impacts has in fact performed as intended. The biological monitoring plan should include sedimentation and turbidity monitoring at the nearest edge of the hard bottom habitat. In addition, coral health should be monitored, and provisions should be included in the plan for operating the dredge in a different manner should the monitoring during dredging show that hard bottom habitat is being stressed or buried.

Pipeline Corridors and Hard Bottom Habitat
NMFS agrees with the applicant and the Jacksonville District that great care must be taken to protect hard bottom habitats when establishing the pipeline that will transport sand from the borrow sites to the beach. This care begins with identifying appropriate corridors for the pipelines. We request that maps of pipeline corridors that show the proximity to hard bottom resources be provided to NMFS prior to permit award. The corridors should be designed to avoid and minimize hard bottom impacts to the maximum extent possible. Any impacts to hard bottom habitat that would occur through pipeline placement should be mitigated, including compensatory mitigation for the unavoidable impacts, and we ask that the mitigation plan be coordinated with our office.

Beach Fill Area and Hard Bottom Habitat
The amount of hard bottom habitat that will be directly or indirectly impacted at the beach fill area is not clear; the hard bottom in question is located between R-212 and R-213.5. The public notice states that placing sand on the beach will result in the loss of 0.10 acres of hard bottom habitat. However, the applicant's response to the first RAI from FDEP states that the hard bottom is 600 feet long and varies between 10 and 75 feet wide. These dimensions translate to an area between 0.13 acres and 1.03 acres in size, at least 30% more hard bottom impacts than what is stated in the public notice. Clarification is needed of both the area and nature of the hard bottoms present. Also, it is not clear if loss of these particular hard bottoms were previously mitigated under one or more authorizations for the previous nourishment events. The applicant claims that all hard bottom resources located between R-204 and R-216 were mitigated following the initial fill in 1988. However, the applicant's response to the first RAI from FDEP states the mitigation provided only met the needs for the initial nourishment.

We recommend the Jacksonville District and applicant take a long-term view. Hard bottom habitat in this area naturally undergoes burial and emergence as sands move along the shoreline. Beach nourishment disrupts this cycle reducing the ecological value of this particular section of shoreline to fishery resources. This temporal loss of ecological services requires compensation. We suggest the applicant and resource agencies estimate the acres of hard bottom that would need to be kept exposed and available to fishery resources to compensate for the recurring temporal loss of ecological services from the hard bottom habitat. This approach might allow all agencies to focus on maximizing the value returned to the ecosystem and provide the applicant with assurance that future nourishment events can proceed expeditiously provided the mitigation area is performing as anticipated.

Lastly, NMFS is aware of recent research that focuses on including mineralogical analyses when evaluating the compatibility of sand for beach nourishment. Some sand minerals are prone to fracture

from waves, which can elevate turbidity. We recommend that the applicant conduct sediment durability and settling analyses to examine this issue.

Essential Fish Habitat
The South Atlantic Fishery Management Council (SAFMC) has designated hard bottom habitat as EFH for corals, red and gag grouper, gray and mutton snapper, white grunt, and spiny lobster. Hard bottoms and corals are also designated by the SAFMC as a Habitat Area of Particular Concern (HAPC), which is a subset of EFH that is either rare, particularly susceptible to human-induced degradation, especially important ecologically, or located in an environmentally stressed area. Hard bottom habitats from Jupiter Inlet through the Dry Tortugas are specifically designated EFH-HAPC for spiny lobster. SAFMC provides detailed information on federally managed fisheries, EFH, and HAPC's in the 1998 comprehensive amendment to the fishery management plans for the South Atlantic region. The comprehensive amendment was prepared as required by the Magnuson-Stevens Act. As noted above, this project is expected to impact hard bottom habitat.

Information Needs:
NMFS does not feel that it has sufficient information to complete the EFH consultation at this time. We request that the Jacksonville District provide:

1. Clarification regarding the "no-dredge" areas identified in Borrow Area B and, if these represent hard bottom areas, an explanation of how this designation will protect hard bottom resources should be included.
2. A map of the pipeline corridors that shows their proximity to hard bottoms and a plan for how any unavoidable impacts to the hard bottoms from the pipeline will be compensated.
3. A vessel tracking plan (we recommend locating the dredge 1-minute intervals) and measures to make this information available to NMFS and other resource agencies.
4. A plan for monitoring the hard bottom habitats adjacent to the borrow sites before, during, and after dredging. This plan should outline alternative corrective actions the dredge may take should the monitoring show hard bottom areas are being impacted from the dredging.
5. Clarify the amount of hard bottom habitat expected to be impacted from the project. In addition, please provide a map and characterization of these resources in addition to documentation regarding whether this area was previously mitigated for under one of the earlier nourishment events.

EFH Conservation Recommendation
Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation recommendations when an activity is expected to adversely impact EFH. Based on this requirement, NMFS provides the following:

EFH Conservation Recommendation

Department of the Army shall hold any authorization for this project in abeyance pending the receipt of the above mentioned information needs.

Section 305(b)(4)(B) of the Magnuson-Stevens Act and its implementing regulation at 50 CFR Section 600.920(k) require your office to provide a written response to this letter within 30 days of its receipt. If it is not possible to provide a substantive response within 30 days, in accordance with our "findings" with your Regulatory Functions Branch, an interim response should be provided to NMFS. A detailed response then must be provided prior to final approval of the action. Your detailed response must include a description of measures proposed by your agency to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH Conservation Recommendation, you must provide a substantive discussion justifying the reasons for not following the recommendation.

Thank you for the opportunity to provide comments. Related correspondence should be directed to the attention of Ms. Jocelyn Karazsia at our West Palm Beach office, which is co-located with the US Environmental Protection Agency at USEPA, 400 North Congress Avenue, Suite 120, West Palm Beach, Florida, 33401. She may be reached by telephone at (561) 616-8880, extension 207, or by e-mail at Jocelyn.Karazsia@noaa.gov.

Sincerely,

Pam Willer

for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc: (via electronic mail)

EPA, WPB
FWS, Vero Beach
FWC, Tallahassee
FDEP OBCS, Tallahassee
SAFMC
NMFS, PRD
F/SER46, Ruebsamen
F/SER47, Karazsia

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
(727) 824-5312, FAX (727) 824-5309
http://sero.nmfs.noaa.gov

MAR 30 2007

F/SER31:MCB

Mr. John F. Studt
Jacksonville District, U.S. Army Corps of Engineers
4400 PGA Boulevard, Suite 500
Palm Beach Gardens, FL 33410

RECEIVED
APR 2007
JACKSONVILLE DISTRICT
USACE

Re: SAJ-1986-479 (IP-LAO)

Dear Mr. Studt:

This responds to your February 12, 2007, letter to the National Marine Fisheries Service (NMFS) regarding the Corps of Engineers' request for Endangered Species Act (ESA) section 7 consultation for the proposed hydraulic dredging and beach renourishment project at Boca Raton. You determined the proposed action may affect, but is not likely to adversely affect, green, loggerhead, Kemp's ridley, hawksbill, and leatherback sea turtles, smalltooth sawfish, and elkhorn and staghorn coral, and requested our concurrence with your findings.

The project is located in the Atlantic Ocean along the northern shoreline of Boca Raton between Florida Department of Environmental Protection monuments R-205 and R-212 + 181', Sections 9 and 16, Township 47, Range 43 East, Palm Beach County, Florida. The proposed project includes the hydraulic dredging of approximately 920,000 cubic yards of material from a borrow area located approximately 2,500 feet directly offshore of the beach fill area. The dredged material will be transported to the fill area via a submerged pipeline.

We have analyzed the routes of potential effects on listed species from the proposed action. Potential effects are limited to the direct effects from dredging and pipeline placement and indirect effects from water quality impacts associated with the dredging (i.e., turbidity). We conclude that the project's effects on listed species are discountable or insignificant based on the following: The probability of sea turtles and smalltooth sawfish impacts associated with non-hopper type dredging is very low; sea turtles and smalltooth sawfish potentially present in the project area are highly mobile and can avoid the slow-moving dredge; foraging habitat for sea turtles and smalltooth sawfish will not be lost; turbidity effects on water quality will be temporary and minimal; and dredged material will be placed on the beach with suspended particles settling out within a short time frame without measurable effects on water quality (or on listed species directly). Potential effects on elkhorn and staghorn coral are discountable as no coral exists in the identified borrow area, or in the predominantly sandy substrate along the pipeline corridor.

In summary, we concur with your determination that the proposed action will not adversely affect listed species under our purview. This concludes your consultation responsibilities under the ESA for species under NMFS' purview. Consultation must be reinitiated if a take occurs or new information reveals effects of the action not previously considered, or the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action. We have enclosed additional information on other statutory requirements that may apply to this action and on NMFS' Public Consultation Tracking System (PCTS) to allow you to track the status of ESA consultations. The COE's user identification and password for PCTS are "coepcts" and "coe22nmfs", respectively.

Thank you for your continued cooperation in the conservation of threatened and endangered species under NMFS' purview. If you have any questions on this consultation or PCTS use, please contact Michael Barnette at (727) 551-5794, or by e-mail at michael.barnette@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure

File: 1514-22 F.1.FL
Ref: I/SER/2007/00718

Additional Considerations for ESA Section 7 Consultations (Revised 12-6-2005)

Marine Mammal Protection Act (MMPA) Recommendations: The Endangered Species Act (ESA) section 7 process does not authorize incidental takes of listed or non-listed marine mammals. If such takes may occur an incidental take authorization under MMPA section 101 (a)(5) is necessary. Contact Ken Hollingshead of our NMFS Headquarters' Protected Resources staff at (301) 713-2323 for more information on MMPA permitting procedures.

Essential Fish Habitat (EFH) Recommendations: In addition to its protected species/critical habitat consultation requirements with NMFS' Protected Resources Division (PRD) pursuant to section 7 of the ESA, prior to proceeding with the proposed action the action agency must also consult with NMFS' Habitat Conservation Division (HCD) pursuant to the Magnuson-Stevens Fishery Conservation and Management Act's (MSA) requirements for essential fish habitat (EFH) consultation (16 U.S.C. 1855 (b)(2) and 50 CFR 600.905-.930, subpart K). The action agency should also ensure that the applicant understands the ESA and EFH processes; that ESA and EFH consultations are separate, distinct, and guided by different statutes, goals, and time lines for responding to the action agency; and that the action agency will (and the applicant may) receive separate consultation correspondence on NMFS letterhead from HCD regarding their concerns and/or finalizing EFH consultation.

Public Consultation Tracking System (PCTS) Guidance: PCTS is an online query system allowing federal agencies and U.S. Army Corps of Engineers' (COE) permit applicants to track the status of NMFS consultations under ESA section 7 and under MSA sections 305(b)2 and 305(b)(4): Essential Fish Habitat. Access PCTS via: www.nmfs.noaa.gov/pcts. Federal agencies are required to enter an agency-specific username and password to query the Federal Agency Site. The Corps Permit Site allows COE permit applicants the ability to check on the current status of Clean Water Act section 404 permit actions for which NMFS has conducted an ESA section 7 consultation with the COE since the beginning of the 2001 fiscal year (no password needed).

For COE-permitted projects, click on "Enter Corps Permit Site." From the "Choose Agency Subdivision (Required)" list, pick the appropriate COE district. At "Enter Agency Permit Number" type in the COE district identifier, hyphen, year, hyphen, number. The COE is in the processing of converting its permit application database to PCTS-compatible "ORM." An example permit number is: SAJ-2005-000001234-IPS-1. For the Jacksonville District, which has already converted to ORM, permit application numbers should be entered as SAJ (hyphen), followed by 4-digit year (hyphen), followed by permit application numeric identifier with no preceding zeros (e.g., SAJ-2005-123, SAJ-2005-1234, SAJ-2005-12345).

For inquiries regarding applications processed by Corps districts that have not yet made the conversion to ORM (e.g., Mobile District), enter the 9-digit numeric identifier, or convert the existing COE-assigned application number to 9 numeric digits by deleting all letters, hyphens, and commas; converting the year to 4-digit format (e.g., -04 to 2004); and adding additional zeros in front of the numeric identifier to make a total of 9 numeric digits (e.g., AL05-982-F converts to 200500982; MS05-04401-A converts to 200504401). PCTS questions should be directed to Eric Hawk at Eric.Hawk@noaa.gov. Requests for username and password should be directed to April Wolstencroft at PCTSUsersupport@noaa.gov.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5511
(727) 824-5317; FAX (727) 824-5300
http://sero.nmfs.noaa.gov/

August 14, 2007 F/SER4:JK/pw

Colonel Paul L. Grosskruger
District Engineer, Jacksonville District
Department of the Army Corps of Engineers
Jacksonville Regulatory Office, South Permits Branch
PO Box 4970
Jacksonville, Florida 32232

Dear Colonel Grosskruger:

NOAA's National Marine Fisheries Service (NMFS) reviewed the Jacksonville District's letter, dated August 1, 2007, regarding public notice SAJ-1986-479 (IP-LAO). The City of Boca Raton requests authorization from the Department of the Army to nourish 1.45 miles of beach between Florida Department of Environmental Protection (FDEP) monuments R-205 and R-212 + 181 feet. This work would require dredging 920,000 cubic yards of sand from two borrow areas. Your letter transmits the Jacksonville District's reply to the recommendations that NMFS made to conserve essential fish habitat (EFH); these conservation recommendations were provided to the District by letter dated February 22, 2007.

NMFS recommended that the Department of the Army not authorize the project until additional information was provided, including (1) clarification regarding the "no-dredge" areas identified in Borrow Area B; (2) a map of the pipeline corridors that show their proximity to hard bottoms and a plan for how any unavoidable impacts to the hard bottoms from the pipeline will be compensated; (3) a vessel tracking plan; (4) a plan for pre-, during-, and post-construction biological monitoring of the hard bottom habitats adjacent to the borrow sites; and (5) clarification on the amount of hard bottom habitat expected to be impacted from the project.

The information contained in your letter summarizes email correspondences that collectively address our information needs. Specifically, the "no dredge" areas were confirmed to be archaeological sites or debris and not hard bottom habitat; divers have verified that the pipeline corridors do not contain hard bottom or coral resources; a vessel tracking plan was provided; biological monitoring is being developed in concert with Florida Department of Environmental Protection (FDEP); and the impacts anticipated to nearshore hard bottom resources from the proposed project were previously mitigated for at Red Reef Rock under a permit issued during 1988 by FDEP and no additional hard bottom areas are expected to be impacted at this time.

We appreciate the efforts by the applicant and your staff to protect NOAA trust resources, and with inclusion of the aforementioned plans as special conditions of the permit issued by the Department of the Army for this project, the procedural goals of the Magnuson-Stevens Fishery Conservation and Management Act and the regulations for implementing the EFH requirements of the Act will be met.

Thank you for the opportunity to provide comments. Related correspondence should be directed to the attention of Ms. Jocelyn Karazsia at our West Palm Beach office, which is co-located with the US Environmental Protection Agency at USEPA, 400 North Congress Avenue, Suite 120, West Palm Beach, Florida, 33401. She may be reached by telephone at (561) 616-8880 x207 or by e-mail at Jocelyn.Karazsia@noaa.gov.

Sincerely,

Pam Willer

/ for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc: (via electronic mail)

EPA, WPB
FWS, Vero Beach
FWC, Tallahassee
FDEP OBCS, Tallahassee
SAFMC
NMFS, PRD
F/SER46, Ruebsamen
F/SER47, Karazsia

SHOREBIRD MONITORING PLAN

Submitted by CPE for the City of Boca Raton

Second Re-nourishment Project

North Boca Raton Beach Renourishment
Proposed Shorebird Monitoring Plan

In order to monitor shorebird activity during construction activities, the following requirements shall be implemented:

a. **Surveys.** Shorebird surveys should be conducted by trained, dedicated individuals using accepted, appropriate ecological survey procedures (for example, see "*Breeding Season Population Census Techniques for Seabirds and Colonial Waterbirds Throughout North America*" at URL: http://www.mp2-pwrc.usgs.gov/cwb/manual/). The shorebird nesting season generally is 1 April – 1 September, but some nesting may occur through September.

   i. Nesting season surveys shall begin on April 1 or 45 days prior to construction commencement, whichever is later, and be conducted daily throughout the construction period or through September if no shorebird nesting activity is observed.

   ii. Each shorebird species observed, a rough estimate of numbers of each species, the location of the birds, and their activity (e.g., foraging, resting, nesting, courtship behavior) should be logged and reported to the FWC Regional Wildlife Diversity Conservation Biologist monthly.

b. **Buffer Zones and Travel Corridors.** Within the project area, the permittee shall establish a 300 ft-wide buffer zone around any location where shorebirds have been engaged in courtship or nesting behavior, or around areas where piping plovers occur or winter migrants congregate in significant numbers. Any and all construction activities, including movement of vehicles, should be prohibited in the buffer zone.

   i. The width of the buffer zone shall be increased if birds appear agitated or disturbed by construction or other activities in adjacent areas.

   ii. Site-specific buffers may be implemented upon approval by FWC as needed.

   iii. Designated buffer zones must be posted with clearly marked signs around the perimeter. These markings shall be maintained until nesting is completed or terminated, the chicks fledge, or piping plovers or winter migrants depart.

   iv. No construction activities or storage of equipment shall be allowed within the buffer area.

   v. FWC-approved travel corridors should be designated and marked outside the buffer areas. Heavy equipment, other vehicles, or

pedestrians may transit past nesting areas in these corridors. However, other activities such as stopping or turning shall be prohibited within the designated travel corridors adjacent to the nesting site.

vi. Where such a travel corridor must be established within the project area it should avoid critical areas for shorebirds (known nesting sites, wintering grounds, FWC-designated Critical Wildlife Areas, and USFWS designated critical piping plover habitat) as much as possible, and be marked with signs clearly delineating the travel corridor from the shorebird buffer areas described above.

vii. To the degree possible, the permittee should maintain some activity within these corridors on a daily basis, without directly disturbing any shorebirds documented on site or interfering with sea turtle nesting, especially when those corridors are established prior to commencement of construction. Passive methods to modify nesting site suitability must be approved by the FWC Wildlife Diversity Conservation Biologist for that region.

c. **Notification.** If shorebird nesting occurs within the project area, a bulletin board will be placed and maintained in the construction area with the location map of the construction site showing the bird nesting areas and a warning, clearly visible, stating that "BIRD NESTING AREAS ARE PROTECTED BY THE FLORIDA THREATENED AND ENDANGERED SPECIES ACT AND THE FEDERAL MIGRATORY BIRD ACT".

d. **Beach Contours.** All tilling and scarp removal should be done outside the shorebird nesting season (April 1 through September 1). If necessary, contractors should contact the FWC Regional Wildlife Diversity Conservation Biologist to obtain data on known shorebird nesting areas. It is the responsibility of the contractors to avoid tilling or scarp removal in areas where nesting birds are present.

i. A relatively even surface, with no deep ruts or furrows, shall be created during tilling. To do this, chain-linked fencing or other material shall be dragged over those areas as necessary after tilling.

ii. The slope between the mean high water line and the mean low water line must be maintained in such a manner as to approximate natural slopes.

TC, RS, CK

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

June 28, 1995

Programs and Project Management Division
Project Management Branch

PUBLIC WORKS
DEPARTMENT
City of Boca Raton

Mr. Ronald G. Laccheo
Municipal Services Director
City of Boca Raton
201 West Palmetto Park Road
Boca Raton, Florida 33432-3795

Dear Mr. Laccheo:

This is in regard to your letter of March 17, 1994, requesting review of the plan of study and schedule for the Palm Beach County (62) Shore Protection Project, Boca Raton segment. Enclosed are comments for your consideration.

Since the authorized period of Federal participation in cost sharing for the Boca Raton segment will expire on December 31, 1998, the city has requested that the term of the Project Cooperation Agreement (PCA) be amended to extend Federal cost sharing for periodic nourishment from 10 to 50 years. There are several interrelated issues associated with this request.

As you may know, the Federal Government cannot participate in the operation and maintenance of a shore protection project. The Federal government has cost shared in periodic nourishment of projects past the initial authorized period of Federal participation based upon additional authorization. In order to seek extension of Federal cost sharing past the initial 10-year authorization for Boca Raton, the City would need to request an extension of Federal participation, specifically under the authority of Section 934 of the Water Resources Development Act (WRDA) of 1986. The City must also express a willingness to cost share in accordance with Public Law 99-662. It should be understood that extension of Federal participation in the costs of periodic nourishment to 50 years is not automatic. A Section 934 report would have to be prepared and the Assistant Secretary of the Army (Civil Works) would have to approve the report.

However, the Department of Army budget request for Fiscal Year 1996 reflects the President's commitment to focus the development of the nation's water resources on projects and purposes which have national significance and proposes the phase out of Federal participation in shore protection projects. The budget request does not contain any new starts for shore

protection projects or studies, which are best left to state and local governments. Our Fiscal Year 1996 Civil Works budget proposal reflects the start of a phase out of the U.S. Army Corps of Engineers' role in shore protection. Under this phase out plan, the current phase of each study, project, or separable element will be completed but new phases will not be initiated. As a part of this plan, Section 934 of the 1986 WRDA will not be used to extend Federal participation in nourishment. While this policy could change depending on the final decisions by the Administration and Congress, our office can not plan for initiation of preparation of a Section 934 Report at this time.

If you have any questions or require additional information, please contact the project manager, Mr. Charles Stevens, at 904-232-2113.

Sincerely,

Richard E. Bonner, P.E.
Deputy District Engineer
for Project Management

Enclosures

RALPH REGULA, OHIO
JERRY LEWIS, CALIFORNIA
HAROLD ROGERS, KENTUCKY
FRANK R. WOLF, VIRGINIA
JIM KOLBE, ARIZONA
JAMES T. WALSH, NEW YORK
CHARLES H. TAYLOR, NORTH CAROLINA
DAVID L. HOBSON, OHIO
ERNEST J. ISTOOK, JR., OKLAHOMA
HENRY BONILLA, TEXAS
JOE KNOLLENBERG, MICHIGAN
JACK KINGSTON, GEORGIA
RODNEY P. FRELINGHUYSEN, NEW JERSEY
ROGER F. WICKER, MISSISSIPPI
GEORGE R. NETHERCUTT, JR., WASHINGTON
RANDY "DUKE" CUNNINGHAM, CALIFORNIA
TODD TIAHRT, KANSAS
ZACH WAMP, TENNESSEE
TOM LATHAM, IOWA
ANNE M. NORTHUP, KENTUCKY
ROBERT B. ADERHOLT, ALABAMA
JO ANN EMERSON, MISSOURI
KAY GRANGER, TEXAS
JOHN E. PETERSON, PENNSYLVANIA
VIRGIL H. GOODE, JR., VIRGINIA
JERRY LEWIS, CALIFORNIA
RAY LAHOOD, ILLINOIS
JOHN E. SWEENEY, NEW YORK
DAVID VITTER, LOUISIANA
DON SHERWOOD, PENNSYLVANIA
DAVE WELDON, FLORIDA
MICHAEL K. SIMPSON, IDAHO
CONSTANCE A. MORELLA, MARYLAND
JOHN ABNEY CULBERSON, TEXAS
MARK STEVEN KIRK, ILLINOIS

Congress of the United States
House of Representatives
Committee on Appropriations
Washington, DC 20515-0015

SAD

JOHN P. MURTHA, PENNSYLVANIA
NORMAN D. DICKS, WASHINGTON
MARTIN OLAV SABO, MINNESOTA
STENY H. HOYER, MARYLAND
ALAN B. MOLLOHAN, WEST VIRGINIA
MARCY KAPTUR, OHIO
PETER J. VISCLOSKY, INDIANA
NITA M. LOWEY, NEW YORK
JOSE E. SERRANO, NEW YORK
ROSA L. DELAURO, CONNECTICUT
JAMES P. MORAN, VIRGINIA
JOHN W. OLVER, MASSACHUSETTS
ED PASTOR, ARIZONA
DAVID E. PRICE, NORTH CAROLINA
CHET EDWARDS, TEXAS
ROBERT E. "BUD" CRAMER, JR., ALABAMA
PATRICK J. KENNEDY, RHODE ISLAND
JAMES E. CLYBURN, SOUTH CAROLINA
MAURICE D. HINCHEY, NEW YORK
LUCILLE ROYBAL-ALLARD, CALIFORNIA
SAM FARR, CALIFORNIA
JESSE L. JACKSON, JR., ILLINOIS
CAROLYN C. KILPATRICK, MICHIGAN
ALLEN BOYD, FLORIDA
CHAKA FATTAH, PENNSYLVANIA
STEVEN R. ROTHMAN, NEW JERSEY
SANFORD D. BISHOP, JR., GEORGIA
MARION BERRY, ARKANSAS

CLERK AND STAFF DIRECTOR
JAMES W. DYER
TELEPHONE:
(202) 225-2771

Honorable Les Brownlee
Acting Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington, DC 20310-0108

April 8, 2003

Dear Mr. Secretary:

In response to your letter of January 2, 2003, this is to advise you that I have no objection to the Army Corps of Engineers proposal to enter into a reimbursement agreement with the city of Boca Raton, Florida, for construction of the Boca Raton North Beach segment of the Palm Beach County project subject to the availability of funds appropriated for this purpose.

Sincerely

David Hobson

David Hobson
Chairman
Subcommittee on Energy
and Water Development

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

30 SEP 1997

REPLY TO
ATTENTION OF

MEMORANDUM FOR THE DIRECTOR OF CIVIL WORKS

SUBJECT: Palm Beach County, Florida, Shore Protection Project - Boca Raton Segment

This responds to a Planning Division memorandum of July 29, 1997, requesting approval of the General Design Memorandum Addendum for the subject project.

I concur in your findings that a shore protection project for the Boca Raton segment of the Palm Beach County project is economically justified and environmentally acceptable. The report found that the national economic development plan for the Boca Raton segment involves the restoration of about 1.45 miles of Atlantic shoreline, and that periodic beach renourishment is necessary for the project to function.

In accordance with Section 506(b)(2) of the Water Resources Development Act of 1996, the time period for the periodic beach nourishment for the Boca Raton segment is authorized for a period of 50 years beginning on the date of initial construction. The report should serve as the decision document for the planned non-Federal nourishment and for Federal reimbursement should Congress provide funds for the project.

John H. Zirschky
Acting Assistant Secretary of the Army
(Civil Works)

F: CRC
CECW-AR
CECW-P
CECW-PE
CECW-B
SACW: Dola
SACW: Read, File, Sign
Prepared: Jim Smyth/OASA(CW)/Sep 26, 97
SA7073101

CECW-PE

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

CESAJ-PD-C (CESAJ-PD-C/18 July 1984) (1110-2-1150A) 4th End Mr. Schmidt/1697
SUBJECT: Palm Beach County Beach Erosion Control Projects-Post Authorization Study

Cdr, Jacksonville District Corps of Engineers, P.O. Box 4970, Jacksonville, Florida 32232-0019 16 September 1987

FOR: Commander, South Atlantic Division, Attn: CESAD-EN-G, Atlanta, GA 33035-6801

1. The subject report is revised as per direction provided in the third endorsement. Two copies of the report are provided (enclosure 1). Specific responses to the 3rd Endorsement comments also are provided (enclosure 2). Revised reports were provided to all interested parties, including Federal, State, and local agencies. Copies of all correspondence received concerning the revised report and our responses to those letters are provided (enclosure 3).

2. A copy of Supplemental Appendix B-1 for the subject report is enclosed (Enclosure 4).

3. In review of annual costs (table D-6) and benefits (table E-46) presented in the GDM for the subject study, it is apparent that the NED plan for Boca Raton (Reach 10) is the project that provides for a 50-foot extension of the MHW. A summary of the economic analysis supporting this conclusion is enclosed (table 1, enclosure 5). In addition, specific analysis indicates that a nine-year nourishment interval would provide for future nourishments with the least annual cost. Tables 2 and 3 (enclosure 5) provide details concerning specific quantities and costs for nourishment interval optimization. The NED plan would provide for placement of 875,000 cubic yards of material. A revision to table 9, page 65 of the main text, Federal and Non-Federal Participation-Initial Cost, is provided as (table 4, enclosure 5).

FOR THE COMMANDER:

A. J. Salem

5 Encls

A. J. SALEM
Chief, Planning Division

6

PLEASE ADD TO ATT C
END

CESAD-EN-G (SAJPD-C/18 Jul 84) (1110-2-1150a) 5th End Mr. Tarrant/lhk/242-4361
SUBJECT: Palm Beach County Beach Erosion Control Projects - Post Authorization Study

Cdr, South Atlantic Division, Corps of Engineers, 510 Title Building, 30 Pryor Street, S.W., Atlanta, Georgia 30335-6801 12 NOV 1987

FOR: COMMANDER, JACKSONVILLE DISTRICT, ATTN: CESAJ-PD-C

1. The information furnished in the previous endorsement is satisfactory.

2. As noted by paragraph 3 of the 4th endorsement, the NED plan for the Boca Raton (Reach 10) has been redefined to provide for a 50 foot rather than a 25 foot extension of the MHW. This change which is supported by enclosure 5 was necessary because an error was made in transferring data between Tables D-6 and E-46. The report has not been revised to correct this error. The following comments are provided to clearly document the reasons for the change.

a. Page E-64, table E-46. The annual costs shown for Boca Raton are for a 100-foot project not the 50-foot project as stated. This impacts net benefits and the 50-foot project, rather than the 25-foot project, becomes the NED plan.

b. Page E-65, table E-46. Costs for the 100-foot project for Boca Raton are in error as well as the net benefits.

c. Page 38, table 3, page 55, paragraph 143, page 58, table 5, page 61, table 7, page 65, table 9, page 67, table 10. The costs and benefits for the 25-foot project at Boca Raton should be the 50-foot NED project.

FOR THE COMMANDER:

Kenneth W. Quigg

K. R. AKERS, P.E.
Chief, Engineering Division

5 Encls
wd all encls

CF:
CEEC-EB w/4 cy encl

Florida Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

July 26, 2007

Ms. Catherine L. Brooks
Jacksonville District, Planning Division
U. S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, FL 32232-0019

RE: Department of the Army, Jacksonville District Corps of Engineers - Public Notice - North Boca Raton Second Beach Renourishment Project - Boca Raton, Palm Beach County, Florida.
SAI # FL200707263652C

Dear Ms. Brooks:

Florida State Clearinghouse staff, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has reviewed the referenced public notice.

Please be advised that the Department's Bureau of Beaches and Coastal Systems is currently reviewing a Joint Coastal Permit (JCP) application from the City of Boca Raton for the proposed project (JCP File No. 0261499-001-JC). Department staff recommends continued coordination with the Bureau of Beaches and Coastal Systems and Florida Fish and Wildlife Conservation Commission to facilitate resolution of any outstanding project design, turbidity control, sediment management, protected species monitoring, and resource mitigation issues. Please refer to the enclosed Department and applicant correspondence and contact Mr. Martin Seeling, Environmental Administrator, at (850) 414-7728 or Ms. Stephanie Gudeman, Environmental Specialist, at (850) 414-7798 for further information and assistance.

Based on the information contained in the federal notice and JCP application, the state has determined that, at this stage, the proposed federal action is consistent with the Florida Coastal Management Program (FCMP). The funding/permit applicant must, however, address the concerns identified by the Department and state reviewing agencies prior to project implementation. The state's continued concurrence with the project will be based, in part, on the adequate resolution of issues identified during the JCP application review. In accordance with Section 373.428, *Florida Statutes*, the state's final concurrence of the

project's consistency with the FCMP will be determined by final agency action on the permit application.

Thank you for the opportunity to review the proposed project. Should you have any questions regarding this letter, please contact Ms. Lauren P. Milligan at (850) 245-2170.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm
Enclosures

ATTACHMENT NO. 35

PROPOSED SHOREBIRD MONITORING PLAN

North Boca Raton Beach Renourishment
Proposed Shorebird Monitoring Plan

In order to monitor shorebird activity during construction activities, the following requirements shall be implemented:

a. **Surveys.** Shorebird surveys should be conducted by trained, dedicated individuals using accepted, appropriate ecological survey procedures (for example, see "*Breeding Season Population Census Techniques for Seabirds and Colonial Waterbirds Throughout North America*" at URL: http://www.mp2-pwrc.usgs.gov/cwb/manual/). The shorebird nesting season generally is 1 April – 1 September, but some nesting may occur through September.

   i. Nesting season surveys shall begin on April 1 or 45 days prior to construction commencement, whichever is later, and be conducted daily throughout the construction period or through September if no shorebird nesting activity is observed.

   ii. Each shorebird species observed, a rough estimate of numbers of each species, the location of the birds, and their activity (e.g., foraging, resting, nesting, courtship behavior) should be logged and reported to the FWC Regional Wildlife Diversity Conservation Biologist monthly.

b. **Buffer Zones and Travel Corridors.** Within the project area, the permittee shall establish a 300 ft-wide buffer zone around any location where shorebirds have been engaged in courtship or nesting behavior, or around areas where piping plovers occur or winter migrants congregate in significant numbers. Any and all construction activities, including movement of vehicles, should be prohibited in the buffer zone.

   i. The width of the buffer zone shall be increased if birds appear agitated or disturbed by construction or other activities in adjacent areas.

   ii. Site-specific buffers may be implemented upon approval by FWC as needed.

   iii. Designated buffer zones must be posted with clearly marked signs around the perimeter. These markings shall be maintained until nesting is completed or terminated, the chicks fledge, or piping plovers or winter migrants depart.

   iv. No construction activities or storage of equipment shall be allowed within the buffer area.

   v. FWC-approved travel corridors should be designated and marked outside the buffer areas. Heavy equipment, other vehicles, or

pedestrians may transit past nesting areas in these corridors. However, other activities such as stopping or turning shall be prohibited within the designated travel corridors adjacent to the nesting site.

vi. Where such a travel corridor must be established within the project area it should avoid critical areas for shorebirds (known nesting sites, wintering grounds, FWC-designated Critical Wildlife Areas, and USFWS designated critical piping plover habitat) as much as possible, and be marked with signs clearly delineating the travel corridor from the shorebird buffer areas described above.

vii. To the degree possible, the permittee should maintain some activity within these corridors on a daily basis, without directly disturbing any shorebirds documented on site or interfering with sea turtle nesting, especially when those corridors are established prior to commencement of construction. Passive methods to modify nesting site suitability must be approved by the FWC Wildlife Diversity Conservation Biologist for that region.

c. **Notification.** If shorebird nesting occurs within the project area, a bulletin board will be placed and maintained in the construction area with the location map of the construction site showing the bird nesting areas and a warning, clearly visible, stating that "BIRD NESTING AREAS ARE PROTECTED BY THE FLORIDA THREATENED AND ENDANGERED SPECIES ACT AND THE FEDERAL MIGRATORY BIRD ACT".

d. **Beach Contours.** All tilling and scarp removal should be done outside the shorebird nesting season (April 1 through September 1). If necessary, contractors should contact the FWC Regional Wildlife Diversity Conservation Biologist to obtain data on known shorebird nesting areas. It is the responsibility of the contractors to avoid tilling or scarp removal in areas where nesting birds are present.

i. A relatively even surface, with no deep ruts or furrows, shall be created during tilling. To do this, chain-linked fencing or other material shall be dragged over those areas as necessary after tilling.

ii. The slope between the mean high water line and the mean low water line must be maintained in such a manner as to approximate natural slopes.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5511
(727) 824-5317; FAX (727) 824-5300
http://sero.nmfs.noaa.gov/

August 14, 2007 F/SER4:JK/pw

Colonel Paul L. Grosskruger
District Engineer, Jacksonville District
Department of the Army Corps of Engineers
Jacksonville Regulatory Office, South Permits Branch
PO Box 4970
Jacksonville, Florida 32232

Dear Colonel Grosskruger:

NOAA's National Marine Fisheries Service (NMFS) reviewed the Jacksonville District's letter, dated August 1, 2007, regarding public notice SAJ-1986-479 (IP-LAO). The City of Boca Raton requests authorization from the Department of the Army to nourish 1.45 miles of beach between Florida Department of Environmental Protection (FDEP) monuments R-205 and R-212 + 181 feet. This work would require dredging 920,000 cubic yards of sand from two borrow areas. Your letter transmits the Jacksonville District's reply to the recommendations that NMFS made to conserve essential fish habitat (EFH); these conservation recommendations were provided to the District by letter dated February 22, 2007.

NMFS recommended that the Department of the Army not authorize the project until additional information was provided, including (1) clarification regarding the "no-dredge" areas identified in Borrow Area B; (2) a map of the pipeline corridors that show their proximity to hard bottoms and a plan for how any unavoidable impacts to the hard bottoms from the pipeline will be compensated; (3) a vessel tracking plan; (4) a plan for pre-, during-, and post-construction biological monitoring of the hard bottom habitats adjacent to the borrow sites; and (5) clarification on the amount of hard bottom habitat expected to be impacted from the project.

The information contained in your letter summarizes email correspondences that collectively address our information needs. Specifically, the "no dredge" areas were confirmed to be archaeological sites or debris and not hard bottom habitat; divers have verified that the pipeline corridors do not contain hard bottom or coral resources; a vessel tracking plan was provided; biological monitoring is being developed in concert with Florida Department of Environmental Protection (FDEP); and the impacts anticipated to nearshore hard bottom resources from the proposed project were previously mitigated for at Red Reef Rock under a permit issued during 1988 by FDEP and no additional hard bottom areas are expected to be impacted at this time.

We appreciate the efforts by the applicant and your staff to protect NOAA trust resources, and with inclusion of the aforementioned plans as special conditions of the permit issued by the Department of the Army for this project, the procedural goals of the Magnuson-Stevens Fishery Conservation and Management Act and the regulations for implementing the EFH requirements of the Act will be met.

Thank you for the opportunity to provide comments. Related correspondence should be directed to the attention of Ms. Jocelyn Karazsia at our West Palm Beach office, which is co-located with the US Environmental Protection Agency at USEPA, 400 North Congress Avenue, Suite 120, West Palm Beach, Florida, 33401. She may be reached by telephone at (561) 616-8880 x207 or by e-mail at Jocelyn.Karazsia@noaa.gov.

Sincerely,

Pam Willer

/ for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc: (via electronic mail)

EPA, WPB
FWS, Vero Beach
FWC, Tallahassee
FDEP OBCS, Tallahassee
SAFMC
NMFS, PRD
F/SER46, Ruebsamen
F/SER47, Karazsia

COASTAL PLANNING & ENGINEERING, INC.

COASTAL & OCEAN ENGINEERING
COASTAL SURVEYS
BIOLOGICAL STUDIES
GEOTECHNICAL SERVICES

^481 N.W. BOCA RATON BOULEVARD, BOCA RATON, FL 33431

(561) 391-8102 Fax: (561) 391-9116
Internet: http://www.coastalplanning.net
E-mail: mail@coastalplanning.net

6953.02

December 16, 2004

Laura Kammerer
Section Head
Florida Bureau of Historic Preservation
R.A. Gray Building, 4th Floor
500 South Bronough Street
Tallahassee, FL 32399-0250

Re: Cultural Resource Investigation and Magnetometer Survey Results for North Boca Raton, Palm Beach County, Florida Proposed dredge Borrow Area and Request for Borrow Area Approval (Archaeological Research Permit #0304.30)

Dear Ms. Kammerer:

This is to request approval of the offshore proposed borrow area for the North Boca Raton renourishment program. The report provided with this letter "Archaeological Remote Sensing North Boca Raton Beach Renourishment Project, Boca Raton, Palm Beach County, Florida" contains the following:

1. Research Methodology
2. Environmental Setting
3. Historical Background
4. Previous Investigations
5. Description of Findings
6. Known Shipwrecks
7. Florida Master site file, survey log sheet

Three magnetic anomalies were detected by the magnetometer survey. Two anomalies exhibited signature characteristics consistent with modern material. No additional investigation of those sites is recommended in conjunction with the proposed project. The third anomaly BR-2 has a signature of the type associated with both modern debris and historic shipwrecks. Additional investigation of the signature is recommended unless the anomaly is avoided. In order to avoid this anomaly, a 200 ft. buffer has been established around anomaly BR-2.

If you should have any questions, please call me.

Very truly yours,

COASTAL PLANNING & ENGINEERING, INC.

Jeffrey L. Andrews, PSM
Vice President

P:\Palm Beach\Boca Raton\North Boca Raton\6953.02 2003 SAND SEARCH\cultural resource letter.doc

cc: Bob DiChristopher, P.E., City of Boca Raton
Rick Spadoni, CPE

FLORIDA DEPARTMENT OF STATE
Glenda E. Hood
Secretary of State
DIVISION OF HISTORICAL RESOURCES

RECEIVED
FEB 07 2005
BY: 6953.0
JA, RS,

Mr. Jeffery L. Andrews
Coastal Planning & Engineering, Inc.
2481 N.W. Boca Raton Boulevard
Boca Raton, Fl 33431

January 27, 2005

Re: DHR Project File No. 2004-12836/ Additional Information Received by DHR: January 26, 2005
Archaeological Remote Sensing North Boca Raton Beach Renourishment Project, Boca Raton, Palm Beach County, Florida

Dear Mr. Andrews:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992; *36 C.F.R., Part 800: Protection of Historic Properties*; and Chapter 267, *Florida Statutes*, for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the *National Register of Historic Places (NRHP)*, or otherwise of historical, architectural or archaeological value.

In November 2003, Tidewater Atlantic Research, Inc. conducted an underwater remote sensing survey of areas of the North Boca Raton Beach Renourishment project area in Palm Beach County on behalf of Coastal Planning & Engineering, Inc. Three magnetic anomalies were identified within the project area during the investigation, one of which was determined likely to represent a significant historical resource.

The magnetic anomaly, BR-02 (30° 51' 12.79747" N, 73° 01' 13.57913" E), had a complex magnetic signature indicating that it could be either modern debris or a historic shipwreck. It is the recommendation of Tidewater Atlantic Research, Inc. that if the anomaly cannot be reliably avoided, then additional investigation of the anomaly is needed to determine the nature of anomaly BR-02.

Based on the information provided, our office concurs with these determinations and finds the submitted report complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code*.

If you have any questions concerning our comments, please contact Ron Grayson, Historic Sites Specialist, by phone at (850) 245-6333, or by electronic mail at rigrayson@dos.state.fl.us. Your continued interest in protecting Florida's historic properties is appreciated.

Sincerely,

Laura A. Kammerer, Deputy SHPO

Frederick Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ **Director's Office** (850) 245-6300 • FAX: 245-6436
☐ **Archaeological Research** (850) 245-6444 • FAX: 245-6436
■ **Historic Preservation** (850) 245-6333 • FAX: 245-6437
☐ **Historical Museum** (850) 245-6400 • FAX: 2

☐ **Southeast Regional Office** (954) 467-4990 • FAX: 467-4991
☐ **Northeast Regional Office** (904) 825-5045 • FAX: 825-5044
☐ **Central Florida Regional Office** (813) 272-3843 • FAX: 272-2340

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

Rec'd 10/10

REPLY TO
ATTENTION OF:

CECW-PE

03 OCT 1997

MEMORANDUM FOR COMMANDER, South Atlantic Division

SUBJECT: Palm Beach County, Florida, Shore Protection Project - Boca Raton Segment General Design Memorandum (GDM) Addendum

1. The Washington level policy review of the GDM Addendum has been completed and it is approved. The GDM Addendum will serve as the decision document in support of the first renourishment of the project in accordance with the terms of the existing local cooperation agreement. A copy of the approval memorandum from the Acting Assistant Secretary of the Army (Civil Works) is attached.

2. In accordance with Section 506 (b) of the Water Resources Development Act of 1996, the time period for periodic nourishment for the Boca Raton segment is authorized for 50 years beginning on the date of initial construction. The GDM Addendum should serve as the decision document for future renourishments by the non-Federal sponsor with Federal reimbursement should Congress provide funding for the project. In the event of future renourishments, the use of any estate for the placement of beach fill other than the Perpetual Beach Storm Damage Reduction Easement (copy attached) will require approval as a non-standard estate.

FOR THE COMMANDER:

Atch

G. EDWARD DICKEY
Chief, Planning Division
Directorate of Civil Works

DEPARTMENT OF THE ARMY
SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS
ROOM 313, 77 FORSYTH ST., S.W.
ATLANTA, GEORGIA 30335-6801

REPLY TO
ATTENTION OF:

CESAD-ET-RO (405-10k) 03 October 1996

MEMORANDUM FOR

COMMANDER, JACKSONVILLE DISTRICT, ATTN: CESAJ-RE
COMMANDER, MOBILE DISTRICT, ATTN: CESAM-RE
COMMANDER, SAVANNAH DISTRICT, ATTN: CESAS-RE

SUBJECT: Approval of Perpetual Beach Storm Damage Reduction Easement as a Standard Estate

1. Forwarded is a copy of the approved standard "Perpetual Beach Storm Damage Reduction Easement" for use in the South Atlantic Division. The enclosed estate represents considerable efforts by CERE-AP and this office to craft a comprehensive estate that assures the acquisition of the necessary interests in land and at the same time provides the flexibility to meet the requirements for each specific project. The estate draws heavily on past estates which were approved on a case by case basis. District input was also most helpful in this effort. We are particularly pleased as this estate would have met the requirements for all storm damage reduction projects we have reviewed in recent years.

2. Please note that approval to use the estate provided in CERE-AP memorandum, 4 Aug 95, subject: Standard Estates - Perpetual Beach Nourishment Easement and Perpetual Restrictive Dune Easement is hereby rescinded.

3. Any modifications other than those provided for in the enclosed estate must be treated as a non-standard estate and forwarded to this office with a request for approval by CERE-AP.

4. Point of contact is Bill Thompson at (404) 331-6759.

FOR THE DIRECTOR OF ENGINEERING AND TECHNICAL SERVICES:

Encl

E. A. SOUSA
Chief, Real Estate Division
Directorate of Engineering and
Technical Services

RECEIVED
OCT 07 1996
BY:

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CERE-AP (405-10k) 9 July 1996

MEMORANDUM FOR COMMANDER, SOUTH ATLANTIC DIVISION,
ATTN: CESAD-ETR

SUBJECT: Approval of Perpetual Beach Storm Damage Reduction Easement as a Standard Estate

1. Reference: CERE-AP Memo, 4 Aug 95, subject: Standard Estates - Perpetual Beach Nourishment Easement and Perpetual Restrictive Dune Easement.

2. The estate approved in the referenced memorandum is no longer approved for use within the South Atlantic Division.

3. Instead, the attached Perpetual Beach Storm Damage Reduction Easement is approved as a standard estate for use in the South Atlantic Division.

4. It should be noted that the standard estate is for a public beach. If an estate is required for an SAD project for non-public beach, that easement will be non-standard and will have to be approved by CERE-A.

5. The point of contact for this action is Tom Cooper, 202-761-1710.

FOR THE DIRECTOR:

Laura Ouverson Norman
LAURA OUVERSON NORMAN
Chief, Acquisition Division
Directorate of Real Estate

Encl
as

PERPETUAL BEACH STORM DAMAGE REDUCTION EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. __) for use by the (Project Sponsor), its representatives, agents, contractors, and assigns, to construct; preserve; patrol; operate; maintain; repair; rehabilitate; and replace; a public beach [a dune system] and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land; to construct berms [and dunes]; to nourish and renourish periodically; to move, store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the (Project Name), together with the right of public use and access; [to plant vegetation on said dunes and berms; to erect, maintain and remove silt screens and snow fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas;] to trim, cut, fell, and remove from said land all trees, underbrush, debris, obstructions, and any other vegetation, structures and obstacles within the limits of the easement (except _____); [reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns, the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the (designated representative of the Project Sponsor) and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project; and further] reserving to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

PD

United States Department of the Interior

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

May 20, 1997

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

Attn: Planning Division

Dear Colonel Rice:

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 draft Fish and Wildlife Coordination Act Report on the Boca Raton Beach Erosion Control Project. The COE requested an evaluation of the environmental effects of nourishing approximately 1.3 miles of beach along the Atlantic coastline of Palm Beach 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 1956, as amended (16 U.S.C. 661 *et seq.*).

Copies of this report have been sent to the U.S. National Marine Fisheries Service and the Florida Game and Fresh Water Fish Commission for their concurrence. A final Section 2(b) Fish and Wildlife Coordination Act Report will be provided to you as soon as that concurrence is received.

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

Sincerely yours,

Thomas E. Grahl

Thomas E. Grahl
Acting Field Supervisor
South Florida Ecosystem Office

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

DRAFT

FISH AND WILDLIFE COORDINATION ACT REPORT

BOCA RATON BEACH
PALM BEACH COUNTY, FLORIDA

Submitted to: U.S. Army Corps of Engineers, Jacksonville, Florida

Prepared by: Charles W. Sultzman, Project Biologist
Approved by: Thomas E. Grahl, Acting Supervisor

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

MAY 1997

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers has requested a Fish and Wildlife Coordination Act Report from the U.S. Fish and Wildlife Service (FWS) regarding the environmental effects of a proposed beach nourishment project in Palm Beach County, Florida. Material for the project would be obtained from a borrow area approximately one-half mile offshore of the 7,000-foot long renourishment site. The fill will be transported by submerged pipeline to the fill site.

Palm Beach County reefs were mapped with side scan sonar for the Coast of Florida Study, Region III. The reefs in the vicinity of the borrow area for this project were also mapped with side scan sonar in 1984 by Coastal Planning and Engineering (CPE), the consultant for the project. The location of the mapped reefs as a result of these efforts is very similar. Both maps show hardbottom habitat approximately one thousand feet offshore of the borrow area. Palm Beach County aerial photographs and the CPE side scan maps show patch reefs 300 to 900 feet inshore of the proposed borrow area.

Aerial photographs also show that reefs are absent from the nearshore fill area. Approximately four acres of reef were buried by construction of the same beach area in 1988. Mitigation for this loss of habitat consisted of six limestone boulder modules placed offshore and south of the fill area.

The FWS recommends: (1) that reefs near the borrow area are monitored for siltation and sedimentation effects and (2) that the Terms and Conditions of our October 24, 1996, Biological Opinion for the Coast of Florida Study, Region III, are implemented for this project.

I. INTRODUCTION

Beach erosion control projects for Palm Beach County, Florida, were authorized by Section 101 of the Rivers and Harbors Act of October 23, 1962. The authorized project provides for the placement of sand to form a protective and recreational beach from the Martin County line to Lake Worth Inlet and from South Lake Worth Inlet to the Broward County line.

II. PROJECT DESCRIPTION

The location and limits of the project are shown in Figure 1. The project area is located along the east coast of Florida on a barrier island separated from the mainland by the Atlantic Intracoastal Waterway. The project is located within the City of Boca Raton and extends from Florida Department of Environmental Protection (DEP) Marker R-205 southward to 181 feet south of Monument R-212. The width of the construction berm is 50 feet at an elevation of +9 feet National Geodetic Vertical Datum (NGVD).

Approximately 594,600 cubic yards of beach fill will be placed along 1.45 miles of shoreline. The fill material for the project will be excavated from a borrow area parallel to and one-half mile offshore of the renourishment area. The material is reported to contain three percent silt and clay. As currently designed, the construction limits of the borrow area are a minimum of 300 feet from adjacent hardbottom. This distance is more commonly referred to as the buffer zone. The fill would be transported by submerged pipeline to the renourishment sites.

III. DESCRIPTION OF STUDY AREA

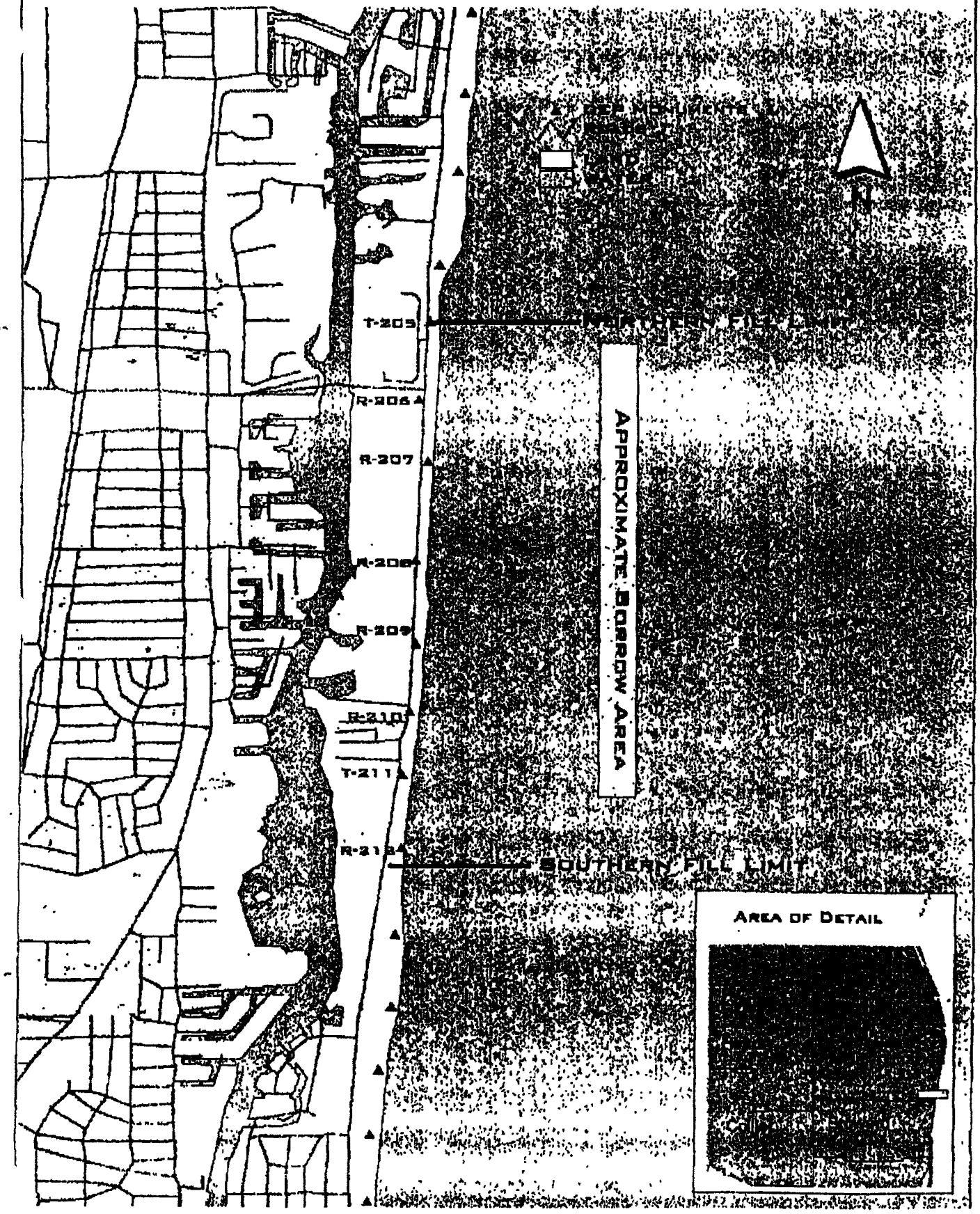
The city of Boca Raton is located on the Atlantic coastline of South Florida. The State of Florida occupies part of a larger geographic unit, the Floridian Plateau, which separates the deep waters of the Gulf of Mexico from the Atlantic Ocean. The east coast of Florida, from the Georgia state line to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

IV. FISH AND WILDLIFE RESOURCES

Fish and wildlife habitats in the project area which could be affected by the proposed action include the supralittoral beach which serves as nesting habitat for four species of sea turtles, the intertidal beach zone, and those patch reefs through which the pipeline is proposed to be laid as well as those reefs which may be affected by dredging at the borrow area.

FIGURE 1:

BOCA RATON BEACH RENOURISHMENT



A. Community Descriptions

Beach zone

The beaches of Palm Beach 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*), sand fleas (*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 Boca Raton, 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 (or south) side are deprived of this sand.

Florida's beaches are important as nesting habitat for four species of federally listed sea turtles: 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*). All four of these species nest on Palm Beach County beaches. Approximately 40 percent of all loggerhead nesting occurs in the southeastern United States, primarily in Florida. Our Biological Opinion for the Coast of Florida Study, Region III, dated October 23, 1996, details sea turtle nesting in Dade, Broward and Palm Beach Counties.

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.

Patch 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 continental United States in Florida. Much of the 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 coral (or gorgonians) in these higher latitudes. Still farther north, soft corals become fewer, and live bottom communities are more prevalent. Live bottom communities are also found within the project area and are populated by sponges, small (ahermatypic) hard corals, tunicates, bryozoans, algae, and sabellariid worms.

The reefs of the project area in Palm Beach County could be classified as live bottom communities with scattered hard and soft coral. The extent of such 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 nourished), 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.

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 area are a remnant of structures formed by the reef-building gastropod, *Petaloconchus* sp.

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 trap planktonic organisms for consumption. Reef-building corals are at the northern extent of their range in Palm Beach County and are very slow-growing. Dodge (1987) presents evidence that brain coral (*Diploria labryinthiformis*) and star coral (*Montastrea annularis*) grow only 0.5 cm per year in Broward County to the immediate south of the project area. Thus, while these organisms are termed hermatypic, or reef-building corals, the substrate is not overgrown with them.

More abundant on the patch reefs of Palm Beach County are the soft corals and sponges. Examples of soft corals are the sea fans (*Gorgonia* sp.) and sea whips (*Pterogorgia* sp.). The exposed rock provides stable substrate for these organisms which, through photosynthesis by symbiotic zooxanthellae, produce basic organic material on which much of the reef's food web is based. As with the hard corals, carbon fixed far offsite is also concentrated on the reefs by soft corals (which are facultative filter feeders) 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. Both sponges and gorgonians add structure to the reef, providing shelter from predation for the numerous fishes of the reef.

Fishes and motile invertebrates

The motile invertebrates include the sea urchins, conch, octopus, flatworms, and decapod crustaceans which include penaeid shrimp (*Penaeus* spp.), blue 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 may include other invertebrates such as the spiny lobster (Lellis pers. comm. 1992).

The spiny lobster makes up the most popular recreational 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 Palm Beach 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 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

Palm Beach County supports 18 percent of Florida's sea turtle nesting (Meylan *et al.* 1995). Three species are known to nest in Palm Beach County. The loggerhead constitutes by far the largest percentage of Palm Beach County's total nesting activity with an average of 12,133

loggerhead nests constructed each year. An average of 540 green sea turtle nests and 99 leatherback nests are also laid each year.

The FWS is concerned when offshore material proposed to be placed within sea turtle nesting areas contain high levels of silt and clay and become too compact to allow sea turtles to excavate nests.

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 three percent silt and clay, recovery of the beach fauna should occur in within one year. Similarly, adverse effects to sea turtles should be brief as described in our 1996 Biological Opinion.

Patch reefs

Reef-building corals and coral reefs of the continental United States are restricted to south Florida. Some of the corals are very slow-growing, and the larger of these are not replaceable in the 50-year life of this project. The best evidence available suggests that two long-lived species of brain and star coral grow at a rate of approximately 0.5 cm per year (Dodge 1987). Based on this information, we estimate it would take a coral head of either species approximately 180 years to reach one meter in diameter. We cannot estimate the length of time required to replace the many species of soft corals and other taxa located on Palm Beach County reefs. To protect these long-lived species, Florida State Law 370.114 prohibits the taking of sea fans or marine corals.

While direct destruction of patch reefs near the borrow area is not planned, such destruction has occurred on at least one occasion during implementation of this project in 1988. The towing cable between a tug boat and dredge was dragged over an offshore reef (Rick Spadoni, pers. comm.) resulting in the removal of epifaunal organisms, including reef-building corals, from the reef substrate. This potential for direct contact between construction equipment and the patch reefs adjacent to the borrow area should be reduced by establishing buffer zones between the borrow area and the nearby patch reefs.

We do not anticipate secondary effects caused by dispersion and settling of sediment suspended by dredging. 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 affects (Goldberg 1980, Goldberg 1984). Unfortunately, the diversity of

tropical reef epifauna and the variety of responses to sedimentation observed from different taxonomic groups have 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. It is difficult to separate the effects of naturally occurring turbidity from the effects of dredge-induced turbidity and sedimentation on these species. Thus, it is imperative that project activities are sufficiently monitored and remedial measures are taken (within 24 hours) as soon as effects are observed. On-site adjustments of work activity are critical to reduce reef damages. The FWS does not anticipate impacts from siltation and sedimentation because of the high quality of the borrow material.

Harmful effects can also occur when a pipeline from the dredge to the beach is laid on top of reef habitat. However, the spacing between patch reefs along the pipeline corridor is wide enough to allow the pipeline to be laid without incurring such effects.

VI. RECOMMENDATIONS

In developing the Fish and Wildlife Service 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 altogether 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 (or evaluation species) in the project area 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 only by 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 large star coral and brain coral, both greater than one meter in diameter. These species inhabit the reefs both surrounding the offshore borrow area and the proposed pipeline corridor. Because of the high value and irreplaceability of these organisms, the FWS considers this habitat to be in Resource Category 1. Resource Category 1 has, as its mitigation goal, no loss of these evaluation species.

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

1. In addition to buffer zones around the patch reefs near the borrow area, a sensitive monitoring system with response capability (within 24 hours) should be developed. The system should provide advanced warning to the City of Boca Raton and their contractors of an incident in which turbidity or sedimentation damage to reef organisms could occur. Should turbidity or sedimentation exceed acceptable levels for a specified duration in a particular location, the monitor would notify the City and dredge operator recommending immediate remedial action before the plume reaches the reefs (e.g., cease dredging and increase the buffer zone).

2. The contract should stipulate that no construction equipment, including towing cables, can come in direct contact with the reefs near the borrow area.

3. The project will be constructed outside the main portion of sea turtle nesting season.

4. Relocation of nests will be required during periods of lower sea turtle nesting activity, near the beginning and end of the overall turtle nesting season.

5. Substantial monitoring for compaction will be conducted and appropriate corrective actions taken to ensure that the constructed beach is suitable for sea turtle nesting.

6. Escarpments will be leveled, if they occur.

7. The COE shall ensure that the contractor fully understands the sea turtle protection measures.

8. Construction equipment will be placed in a manner which minimizes effects to sea turtles.

9. Lighting associated with the project shall be minimized to reduce the possibility of disrupting and disorienting nesting or hatchling sea turtles.

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City of Boca Raton

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September 27, 2006

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Mr. Charlie Stevens
U.S. Army Corps of Engineers
Jacksonville Dist.
PO Box 4970
Jacksonville, FL 32232-0019

RE: City of Boca Raton, North Boca Raton Second Beach Renourishment Project, Statement of Financial Capability

Dear Mr. Stevens:

Please accept this letter and enclosed information as the City of Boca Raton's statement of financial capability for the City of Boca Raton, North Boca Raton Second Beach Renourishment Project.

It is assumed the project will be funded with participation from the Federal Government at 57.53%. This percentage was calculated in the August 2006 Limited Reevaluation Report (LRR), the final version of which has been submitted to your office for review and forwarding to a higher authority. The State of Florida has agreed to fund 21.235% of the eligible costs. The City of Boca Raton as the local sponsor is therefore responsible for 21.235% of the project costs. The City of Boca Raton provides support through the use of ad valorem tax dollars in conjunction with the general fund of the City of Boca Raton.

Enclosed in Appendix A provides the City of Boca Raton Comprehensive Annual Financial Report (CAFR) for the Fiscal Year ending September 30, 2005. The state law requires that every general-purpose local government publish within six months of the close of each fiscal year a complete set of audited financial statements. The CAFR document was submitted to the Mayor on March 1, 2006. The Comprehensive Annual Financial Report assists the City in continuing to make economic, social and political decisions, assists in comparing actual financial results with the legally adopted budget, assesses financial conditions and results of operations, assists in determining compliance with finance related laws, rules and regulations and finally the CAFR assists in evaluated the efficiency and effectiveness of City operations.

The City of Boca Raton has provided for its share of the project costs since construction of the 1988 initial beach nourishment project. In the unlikely event that the City share is not available when construction begins, funds will be borrowed in order to continue the project. The City of Boca Raton has maintained its "AAA" rating from all three bond credit rating agencies for its general obligation debt.

Since the Federal share of the project costs is on a reimbursement basis, the City of Boca Raton will be required to "up front" the cash needed to construct the project. The City plans to use the general funds reserve on a short-term basis in order to bridge the gap between the expenditure of funds and the receipt of the Federal reimbursement. Tables 5, 6-A and 9-A (Appendix B), excerpted from the LRR, show the estimated costs of the North Boca Raton Second Beach Renourishment Project, respectively. A comparison of the tables provided in Appendix B with the Comprehensive Annual Financial Report demonstrates clearly that the City of Boca Raton is not only able and willing to fund our share of the Second Beach Renourishment Project, but has in fact the ability to fund the entire cost of the project until the Federal cost-share becomes available.

As is evident from perusal of the City's Comprehensive Annual Financial Report, the Federal contribution is an essential financial element in the funding of this project. Please feel free to contact me if we can assist with any additional information.

Sincerely,

Robert J. DiChristopher, P.E.
Municipal Services Director
City of Boca Raton

Cc: Judi Ahern, City of Boca Raton
Jennifer Bistyga, City of Boca Raton
Richard H. Spadoni, CPE
Tom Pierro, P.E., CPE

PD-E

RECEIVED
20 DEC 2007

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Ms. Marie G. Burns
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

December 15, 2007

Re: DHR No.: 2007-4129 / Received by DHR: May 30, 2007
Additional Information Received: August 1, 2007
Archaeological Remote Sensing North Boca Raton Beach Renourishment Project, Boca Raton, Palm Beach County, Florida

Dear Ms. Dugger:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992; *36 C.F.R., Part 800: Protection of Historic Properties*; and Chapter 267, *Florida Statutes*, for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In November 2003, Tidewater Atlantic Research, Inc. (TAR) conducted a remote sensing survey of the borrow area for the North Boca Raton Beach Renourishment project on behalf of Coastal Planning and Engineering, Inc. TAR identified 10 magnetic anomalies within the proposed borrow area during the investigation.

TAR determined that four magnetic anomalies (BR06-01, BR06-05, BR06-06, and BR06-08) generated signatures suggestive of historic shipwrecks. TAR recommends that anomalies BR06-01, BR06-06, and BR06-08 be avoided with a 400-foot diameter buffer zone and BR06-05 be avoided with a 600-foot diameter buffer zone. If the four buffered sites cannot be avoided, TAR recommends additional investigation to determine if the anomalies represent potentially significant cultural resources.

Contingent upon the avoidance of BR06-01, BR06-05, BR06-06, and BR06-08 and their associated buffer zones, it is the opinion of TAR that the borrow area will have no effect on cultural resources.

Based on the information provided, our office concurs with these determinations and finds the submitted report to be complete and sufficient under 1A-46, *Florida Administrative Code.*

The U.S. Army Corps of Engineers, Jacksonville District, recommends that the buffer zones be increased to a 100 meter diameter. Our office concurs that these buffer zones would also provide more than adequate protection for any cultural resources.

For any questions concerning our comments, please contact April Westerman, Historic Preservationist, by electronic mail at amwesterman@dos.state.fl.us, or by phone at (850) 245-6333. We appreciate your continued interest in protecting Florida's historic properties.

Sincerely,

Frederick P. Gaske, Director, and
State Historic Preservation Officer

Xc: Gordon Watts, Tidewater Atlantic Research, Inc.

APPENDIX E

PROJECT MONITORING

APPENDIX E

PROJECT MONITORING

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APPENDIX E

PROJECT MONITORING

INTRODUCTION

E-1. Permit applications for the proposed renourishment project have been filed with the Florida Department of Environmental Protection (FDEP). Although the exact monitoring requirements are not known at this time, the State of Florida typically requires the periodic physical monitoring of beach projects to assess the project performance and assist in the determination of the need for renourishment. The following description of expected monitoring requirements is based on the monitoring requirements from the non-federal Central Boca Raton Nourishment Project constructed in February 2004.

PHYSICAL MONITORING

E-2. The FDEP will likely require topographic and hydrographic surveys of the beach fill area be conducted immediately prior to the commencement of project construction and immediately after the completion of the beach project. Topographic and hydrographic surveys of the beach fill area shall be conducted annually thereafter. The annual surveys are likely to occur during the summer months. Surveys will be conducted along Florida Department of Environmental Protection's beach profile lines from R-204 to R-219. Profiles will extend from the monument such a distance seaward to ensure closure or to the 30-foot depth contour.

E-3. Specific survey control information including monument location coordinates in Florida State Plane Coordinates, profile azimuth/bearings and vertical datum will be provided for all monitoring data. All survey data will be submitted in ASCII format and will be formatted according to FDEP, Bureau of Beaches and Coastal Systems specifications. Each survey will be submitted to the Bureau of Beaches and Coastal Systems within 90 days of completion of the survey.

E-4. A monitoring report will be submitted with each set of survey data. Each report will include an assessment of the performance of the beach fill, volumetric changes, erosion rates, and erosional trends of the beach.

ENVIRONMENTAL MONITORING

E-5. The State will likely require the monitoring of the hardbottom adjacent to the borrow area before, during and after project construction, as well as the monitoring of water quality, sedimentation rates and marine turtle nesting activities during construction.

E-6. The expected hardbottom monitoring plan includes the establishment of patch and barrier reef hardbottom monitoring stations prior to construction, and the monitoring of these stations before, during, and after project construction. The monitoring will include the photography of the stations; identification and quantification of all sponges, corals and gorgonians within each station; and analysis of changes observed in the stations over time. Hardbottom monitorings are expected to be conducted twice prior to construction, once a month during project construction, and annually in post-construction years.

E-7. State permits will likely require the monitoring of water quality at the fill site and dredge site twice daily while the dredge is operating. Water quality monitorings will include the measurement of water quality in Nephelometric Turbidity Units (NTU's). At least one background location and three compliance stations will be monitored at both the dredge and fill sites. Water samples will be collected at the water's surface, mid-depth and one (1) meter above the ocean floor. These samples will be analyzed for turbidity within two (2) hours of collection. If the monitoring shows that the turbidity at any of the compliance stations exceeds the counterpart background station by more than 29 NTU's, construction activities will cease immediately and will not resume until corrective measures have been taken and turbidity has returned to acceptable levels. Based in previous monitoring programs, any such occurrence shall be immediately reported to the Department of Environmental Protection, Bureau of Beaches and Coastal Systems in Tallahassee and the Southeast District in West Palm Beach. Weekly summaries of the water quality analyses shall be submitted to the Bureau of Beaches and Coastal Systems and the Southeast District office. At a minimum, the water quality monitoring reports shall include the time of day the samples were taken, the depth of the water body at the station, depth of samples, antecedent weather conditions, tidal stage and direction of flow, wind direction and velocity, and a map indicating the sampling locations.

E-8. State permits may require the monitoring of sedimentation rates at the patch and barrier hardbottom formations near the borrow area. Monitorings will most likely be conducted once a month during project construction and once every three months for at least the first year following project construction. At a minimum, analyses of the collected sediments will include the calculation of the sedimentation rate for each monitoring period, and the determination of the mean grain size and silt/clay content of the collected sediments. The results of these analyses will be submitted to the Bureau of Beaches and Coastal Systems within 90 days of the completion of the sedimentation monitoring program.

E-9. In addition to the monitoring requirements, State permitting agencies will require that the perimeter of the borrow area be clearly marked using lighted buoys, placed a maximum of 1000 feet a part. These buoys will be continuously maintained throughout project construction.

MARINE TURTLE MONITORING

E-10. The City of Boca Raton currently has an ongoing marine turtle monitoring program, which includes the monitoring of marine turtle nesting activities along the entire City shoreline.

The program, which is conducted under FDEP guidelines, currently includes daily surveys of the beach to record all crawls and nests that occur between March 1 and October 31. The program also monitors the hatching success of a representative number of nests during the nesting season. This monitoring program will continue during project construction (assuming construction occurs during the nesting season) and for at least two years following construction. The City's marine turtle monitoring program will be adapted to meet State permitting requirements.

E-11. As with other recent beach projects, the State is expected to require the implementation of a marine turtle monitoring program during project construction (if construction occurs during the nesting season) and for one to two years following project construction. This monitoring program will follow existing FDEP marine turtle monitoring procedures and will monitor nesting activities, as well as nesting and hatching success. Nesting information obtained during project construction and for the first one to two years following project construction will be analyzed to determine any effects the project may have on marine turtle nesting activities. The results of required marine turtle monitoring activities will be submitted to the Bureau of Beaches and Coastal Systems within 90 days of the completion of each specified nesting season. At a minimum, each monitoring report will document the total number of crawls, the number of successful nests, the number of false crawls and the hatching success.

E-12. If project construction is to occur during the nesting season (identified by FDEP as March 1 to November 30), daily marine turtle monitoring/nest relocation surveys of the project area shall commence on March 1 or 70 days prior to the initiation of construction, whichever date is later. Any marine turtle nests deposited in areas where construction has not been completed will be relocated. These nests will be relocated prior to 9:00 am each day to a pre-approved, nearby self-release beach location where artificial lighting and/or other disturbances would not interfere with successful incubation, hatching or hatchling orientation. Effected nests will be relocated by specially trained personnel operating under a FDEP approved marine turtle permit.

E-13. If construction occurs during the night and during the marine turtle nesting season, night-time surveyors will survey the beach from the discharge point to 1,000 feet in either direction of the discharge. Surveyors will record all false crawls, successful nests, and any additional marine turtle activities that are observed. If a nesting female is observed in an area that is close to the discharge site or within an area that is likely to be affected by the discharge, the surveyor will notify the person in charge of project operations and appropriate measures will be taken to protect the marine turtle. Nests that are deposited in areas where construction activities have not been completed will be relocated as soon as possible if construction would threaten the successful incubation and hatching of the eggs.

E-14. If construction occurs during the marine turtle nesting season, any construction pipes, which shall be placed parallel to the shoreline, will be placed as far landward as possible when passing over completed sections of the beach. Temporary storage of pipes and other construction equipment will be off the beach as much as possible and as far landward as possible when temporary storage on the beach is necessary.

E-15. If construction occurs during the marine turtle nesting season, temporary lighting of the construction area will be required to meet the following standards. All lighting associated with project construction will be the minimal lighting necessary to comply with OSHA safety requirements. Direct illumination of the beach and nearshore waters will be restricted to the immediate area of construction. Low-pressure sodium vapor lights will be required on all temporary fixtures at the construction site. Lighting on offshore equipment will be shielded to avoid excessive illumination of the water, while meeting all Coast Guard and OSHA requirements.

E-16. FDEP will likely require that the City monitor the compaction of the beach and the presence of escarpments during the first season following project construction, at a minimum. Immediately following project construction, sand compaction will be measured using a cone penetrometer. If values exceed 500 cpu's are encountered along any two adjacent stations, the beach will be tilled. All tilling will be completed prior to May 15, or other date as specified by FDEP.

E-17. At a minimum, visual surveys for escarpments along the project area will be conducted prior to March 1 of the first nesting season following project completion. Additional escarpment surveys may be required prior to the second, and possibly the third, nesting season(s) following project construction. Any escarpments which interfere with marine turtle nesting or which exceed 12 inches in height for a distance of 100 feet shall be mechanically leveled to the natural beach contour prior to May 15, or other date as specified by FDEP.

PROJECT MONITORING COST SHARING

E-18. Federal participation in the cost of project monitoring is limited to those items that are required for construction of the project. These items typically include pre and post-construction beach profiles, pre-construction, construction, and immediate post-construction environmental monitoring of hardbottom, and water quality. The non-Federal project sponsor will be responsible for all monitoring costs associated with OMRR&R which typically include beach tilling, scarp removal, sea turtle monitoring, long-term post-construction environmental monitoring of hardbottom, and water quality, and annual beach profile surveys.

APPENDIX F

REAL ESTATE SUPPLEMENT

APPENDIX F

REAL ESTATE SUPPLEMENT

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APPENDIX F

REAL ESTATE SUPPLEMENT
PALM BEACH COUNTY
BOCA RATON SEGMENT

STATEMENT OF PURPOSE

F-1. This Real Estate Supplement has been developed for planning purposes only and both the final real property acquisition lines and the establishment of value are subject to change even after approval of the Limited Reevaluation Report.

PROJECT AUTHORIZATION

F-2. The Palm Beach County, Florida Shore Protection Project from the Martin County Line to Lake Worth Inlet and from South Lake Worth Inlet to the Broward County Line was authorized by Section 101 of the River and Harbor Act of October 23, 1962 (PL 87-874). The project was described in H.R.Doc. No. 164 (1987). The 1962 authorization included the nourishment of a 2.7 mile long segment of beach in southern Highland Beach and northern Boca Raton. In the 1987 GDM, the Boca Raton segment was modified to include a 1.45 mile long stretch of beach in northern Boca Raton. The modified project was to be constructed using sand from an offshore borrow area.

PROJECT LOCATION AND DESCRIPTION

F-3. The Boca Raton segment of the Palm Beach County Shore Protection Project is located entirely within the limits of the City of Boca Raton. The project limits include the beach area from FDEP monument T-205 to 181 feet south of R-212. The proposed project includes the dredging of an estimated 712,600 cubic yards of beach quality material from an offshore borrow area and the subsequent placement of the fill on the project beach. The project provides for a 50-foot wide design beach, plus an average of 95 feet of advanced nourishment, at equilibrium. The design berm elevation will be +9 feet NGVD.

GOVERNMENT OWNED LANDS IN PROJECT AREA

F-4. All lands within the project area and borrow area are owned by the State of Florida. Fill placement will primarily occur seaward of the ECL on lands owned by the State of Florida. It is anticipated that a small volume of fill (24,400 cubic yards) will be placed on publicly or privately owned property landward of the ECL. Perpetual beach storm damage reduction easements will be obtained by the non-Federal sponsor prior to construction. The borrow area is part of the Atlantic Ocean submerged bottoms owned by the State of Florida. No Federally owned lands exist within the project limits.

F-5. There are, however, two publicly owned properties which border the project beach. Spanish River Park, a City owned beach park, borders the northern portion of the project area. A second City owned property is located near the center of the project area, referred to as the Ocean Strand. A third City Park, Red Reef Park, is located immediately south of the south project limit.

APPRAISAL INFORMATION

F-6. The project borders the Atlantic Ocean and will provide shore protection for the properties landward of the project. Under the Federal Appraisal Standards, which allow the offset of benefits towards the purchase price of the beach storm damage reduction easements for the placement of material, the value of these beach storm damage reduction easements for crediting towards the project sponsor's share of project costs is zero.

RELOCATION ASSISTANCE (PUBLIC LAW 91-646, AS AMENDED, BY PUBLIC LAW 100-17)

F-7. There are no persons nor businesses that would be relocated as a result of this project.

ADMINISTRATIVE COST ESTIMATES OF EASEMENT ACQUISITION

F-8. Land easements from the State of Florida for dredging material from the borrow area and placing sand seaward of the ECL, and beach storm damage reduction easements from the private owners are the only easements required for the construction of the project. The non-Federal sponsor is anticipating an administrative cost of $3,000 to obtain the easements. The acquisition costs of the easements are the responsibility of the non-Federal sponsor and will not be cost-shared.

F-9. The project sponsor will also incur administrative costs in obtaining the necessary fill site and borrow area easements from the State of Florida. These costs are estimated at $3,000. The non-Federal sponsor will receive credit for its administrative costs incurred in providing the necessary fill site and borrow area easements.

F-10. The Federal review of the acquisition process is estimated to be $3,000.

RELOCATIONS

F-11. There are no facilities or utilities which would be relocated because of the project.

NON-FEDERAL OPERATION/MAINTENANCE RESPONSIBILITIES

F-12. The non-Federal sponsor will operate and maintain the project for the project life at 100% of the non-Federal cost.

NON-FEDERAL AUTHORITY TO PARTICIPATE IN THE PROJECT

F-13. In the authorizing documents, Federal participation in the cost of the Palm Beach County Erosion Control Project was subject to the condition that non-Federal interests would be responsible for certain items (USACE, 1987). The U.S. Army Corps of Engineers and Palm Beach County entered into a contract concerning these requirements on January 23, 1973 (DACW17-73-A-0007). In a letter dated October 28, 1985, Palm Beach County identified the City of Boca Raton as the non-Federal co-sponsor for the Boca Raton segment of the Federal erosion control project.

F-14. The City of Boca Raton was established by action of the Florida Legislature (Chapter 65-1264, Special Laws, laws of Florida, as amended). Under the provisions of the action, the City was granted authority to make contracts and enter into agreements; to acquire and hold lands and property by any lawful means; to exercise the power of eminent domain; to construct, acquire, operate and maintain public works projects and facilities; and to tax property or issue bonds to meet the cost of public works. The City has also been provided a companion Authority under Chapter 161 of the Florida Statutes to make contracts and enter into agreements; to acquire and hold lands and property by any lawful means; to exercise the power of eminent domain; and to tax property or issue bonds for the purpose of the City's beach erosion control program. Chapter 161 of the Florida Statutes also provides for the City to act as the local shore preservation authority.

HAZARDOUS AND TOXIC WASTES

F-15. No hazardous or toxic waste sites have been identified within or adjacent to either the fill site or the borrow area.

RECREATIONAL LANDS

F-16. No recreational features will be constructed as part of this project.

STRUCTURES AND FACILITIES

F-17. There are no known structures or facilities that come within the purview of Section 111 of the Act of Congress approved 3 July 1958 (Public Law 85-500).

OUTSTANDING RIGHTS

F-18. The majority of the fill will be placed on public lands seaward of the Erosion Control Line. There are no outstanding rights seaward of the ECL. Beach storm damage reduction easements will be obtained to place a small volume of material (24,400 cubic yards) seaward of the ECL.

MINERAL RIGHTS

F-19. No outstanding mineral rights exist within the project fill site or the borrow area.

TIMBER/VEGETATIVE COVER

F-20. There is no timber or vegetative cover that will be impacted as a result of the project.

TOWNS AND CEMETERIES

F-21. No towns or cemeteries will be relocated as a result of the project.

ESTIMATED COST OF LANDS, EASEMENTS, RIGHTS-OF-WAY AND RELOCATIONS (LERR) FOR THE PROJECT

F-22. The estimated cost of lands, easements, rights-of-way and relocations is summarized as follows:

Administrative Costs:	
Non-Federal	$6,000
Federal	$3,000
Project Related Administration:	
Federal Review of PCA	$1,000

These costs are further summarized in the Real Estate Chart of Accounts.

REAL ESTATE CHART OF ACCOUNTS

01B	ACQUISITIONS	$ 0
01B20	BY PROJECT SPONSOR (PS)	$ 6,000*
01B40	REVIEW OF PROJECT SPONSOR	$ 3,000
01M00	PROJECT RELATED ADMINISTRATION	
	REAL ESTATE PCA REVIEW	$ 1,000
TOTAL REAL ESTATE COSTS (excluding contingencies)		$10,000
REAL ESTATE CONTINGENCIES (25%)**		$ 2,500
TOTAL REAL ESTATE COSTS		$12,500

* Administrative costs for acquisition were provided by the project sponsor.
** A contingency of 25% is estimate to cover uncertainties associated with such elements as valuation, variance, negotiation latitude, condemnation awards and interest, and refinement of boundary line during ownership verification.

F-23. Beach storm damage reduction easements will be required from private owners bordering this project. All of the acquisition costs identified above are administrative in nature and relate to the acquisition of land easements from the State of Florida for dredging sand from the borrow area and placing sand seaward of the ECL, and for acquiring beach storm damage reduction easements for placing a small volume of sand landward of the ECL.

REAL ESTATE ACQUISITION SCHEDULE

F-24. The non-Federal sponsor will apply to the State of Florida for consent of use easements for the borrow area and fill site. Construction access easements will be provided by the City of Boca Raton by April 2007.

F-25. The ECL for the project area was established and approved by the State on 7 July 1987. The ECL was recorded in the Palm Beach County Records on 27 August 1987 (Book No. 6, pages 155 - 159).

ESTATES TO BE ACQUIRED

F-26. The project sponsor will provide perpetual beach storm damage reduction easements (described below) landward of the erosion control line for the placement of material on private shores (11).

> Perpetual Beach Storm Damage Reduction Easement: A perpetual and assignable easement and right-of-way, in on, over and across (the land described in Schedule A) (Tracts No.) for use by the Project Sponsor, its representatives, agents, contractors and assigns, to construct: preserve: patrol; operate; maintain: repair; rehabilitate; and replace; a public beach (a dune system) and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land: to construct berms (and dunes); to nourish and renourish periodically; to move store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the Project together with the right of public use and access; (to plant vegetation on said dunes and berms; to erect maintain and remove silt screens and snow fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas;) to trim, cut fell and remove from said land all trees underbrush, debris, obstructions, and any other vegetation structures and obstacles within the limits of the easement (except); (reserving, however, to the grantor(s), (his) (her) (Its) (their) (heirs), successors and assigns the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape dimension or function and that prior approval of the plans and specifications for such structures is obtained from the (designated representative or the Project Sponsor) and provided further that such structures are

subordinate to the construction operation, maintenance, repair rehabilitation and replacement of the project; and further) reserving to the grantor(s) (his) (her) (its) (their) (heirs) successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired: subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

The administrative cost associated with obtaining these easements is $3,000.

CONSENT TO USE

F-27. The non-Federal sponsor will not obtain any estate from the State as a result of the placement of fill. Instead, the State will issue a permit type document known as a "consent to use". The consent to use will grant the non-Federal sponsor the right to obtain sand from an offshore borrow area and place sand on State owned lands seaward of the ECL, in accordance with the State permit application. These consents will be issued when the initial Water Quality Certificate is approved by the State of Florida. The Consent of Use and Water Quality Certificate for the proposed project are expected to be approved by June 2006. These documents must be renewed prior to each subsequent renourishment, along with the renewal of the Water Quality Certificate. The costs associated with obtaining the consents of use are administrative in nature and are estimated to be $3,000.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P.O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

FINDING OF NO SIGNIFICANT IMPACT
NORTH BOCA RATON SECOND RENOURISHMENT
PALM BEACH COUNTY, FLORIDA

I have reviewed the Environmental Assessment (EA) for the proposed action. This Finding incorporates by reference all discussions and conclusions contained in the EA enclosed hereto. Based on information analyzed in the EA, reflecting pertinent information obtained from agencies having jurisdiction by law and/or special expertise, I conclude that the proposed action will not significantly impact the quality of the human environment and does not require an Environmental Impact Statement. Reasons for this conclusion are provided in summary as following:

a. The proposed renourishment would occur within the footprint of prior beach nourishment actions and propose no adverse environmental impacts.

b. The project will comply with the Biological Opinion issued by the Fish and Wildlife Service for this action and the Regional Biological Opinion from National Marine Fisheries Service pursuant to Section 7 of the Endangered Species Act. The work will not jeopardize the continued existence of any threatened or endangered species or adversely impact any designated "critical habitat" and protective measures will be in place to avoid harm or harassment to nesting sea turtles and emerging hatchlings.

c. Compliance with the state of Florida water quality standards would be met pursuant to the Section 401 and Section 404 (b)(1) of the Clean Water Act.

d. With respect to the Coastal Zone Management Act and the Regulatory permitting process, the State concurs that the proposed action is "consistent at this point." Final consistency would be with the certification of water quality.

e. The necessary buffer will be in place around identified cultural resources or historical resources.

f. Measures to avoid or minimize potential impacts to fish and wildlife resources would be implemented throughout project construction, in accordance with the general and mandatory protective requirements of Federal and State resource agencies.

12 OCT 07
Date

Paul L. Grosskruger
Colonel, U.S. Army
District Commander