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The Distribution of Shore Protection Benefits: A Preliminary Examination

Prepared by

Dennis P. Robinson and Laura Zepp
Policy and Special Studies Division
U.S. Army Engineer Institute for Water Resources
Alexandria, VA

And

Harry M. Shoudy
Planning and Policy Division
Headquarters, U.S. Army Corps of Engineers
Washington, DC

For the

Office of Management and Budget

November 2001

Preface

This report presents analyses and findings undertaken to respond to a request by the U.S. Office of Management and Budget. The report responds to concerns about the shoreline protection program, particularly concerning the distribution of economic benefits and environmental effects related to shoreline development. The study addresses three basic questions:

(1) Who benefits from shore protection projects?
(2) What is the distribution of project benefits?
(3) Do increases in tax revenues that stem from shore protection projects affect the capacity of non-Federal sponsors to pay for projects?

This report presents and demonstrates a method of comprehensively evaluating the benefits of beach nourishment projects that can be consistently applied across all shore protection projects. The methodology addresses the question of how the economic benefits of beach nourishment projects are distributed among local, state, and national interests.

Acknowledgements

This report was the product of collaboration of many individuals both within the Corps of Engineers and a number of academic researchers and professional analysts. We would like to thank them for their assistance and to recognize their contributions here.

A number of Corps staff members assisted by providing information and insights regarding specific shore protection projects.

Terrance L. Breyman	Headquarters, USACE
Gerald R. Melton	South Atlantic Division
Robert A. Finch	Wilmington District
Christine M. Brayman	Buffalo District
Kenneth G. Claseman	Mobile District
Mark T. Mansfield	Norfolk District
Susan S. Lucas	Philadelphia District
Joseph Jones	Charleston District
Kenneth Dugger	Jacksonville District
Danny D. Peck	Jacksonville District
Thomas D. Smith	Jacksonville District
Eric P. Raasch	Jacksonville District

Several academic and professional researchers graciously provided advise, data, and studies that facilitated the timely completion of the study.

Dr. William Stronge	Florida Atlantic University
Dr. Phillip King	San Francisco State University
Dr. Linda Lent	Economic Consultant, Bethesda, MD
Dr. Allan Mills	Virginia Commonwealth University

Many beach community officials and representatives contributed data and information concerning beach related characteristics, visitation data, contact information, and reports.

Mr. Howard Marlowe	American Coastal Coalition
Mr. Anthony Pratt	Delaware Department of Natural Resources and Environmental Control
Dr. David Chapman	National Oceanic and Atmospheric Administration
Ms. Pat Evans	Florida Parks and Planning
Dr. Steve Holland	Florida Center for Tourism Research and Development
Mr. Dan Quandt	South Padre Island Convention and Visitors Bureau
Mr. Jim Robertson	North Carolina Department of Commerce

Ms. Noreen Bodman	Office of Travel & Tourism, New Jersey Commerce & Economic Growth Commission
Ms. Kim Sterrent	California Department of Boating and Waterways
Mr. Steve Higgins	Broward County, FL.
Mr. Bernie Moore	State of New Jersey
Mr. John Morris	State of North Carolina
Ms. Dee Lindsay	State of Texas

Mr. Charlie Chesnutt, Headquarters of the U.S. Army Corps of Engineers, reviewed all drafts of the report and contributed important comments. Mr. James J. Smyth, Assistant for Water Resource Development, Office of Assistant Secretary of the Army (Civil Works), is commended for reviewing the report and for providing important guidance for the study.

The U.S. Army Engineer Institute for Water Resources provided technical and management support for this report. Dr. Eugene Stakhiv directed the effort as Chief of the Policy and Special Studies Division. The Director of the Institute for Water Resources is Mr. Robert Pietrowsky. Ms. Anne Sudar provided technical assistance and data collection. Ms. Lynn Martin, Mr. Ted Hillyer and Dr. David Moser reviewed several draft versions of the report and provided comments and suggestions that improved the structure and content of the study.

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Executive Summary

The President's fiscal year (FY) 2002 budget proposed to increase the non-Federal cost share for the beach re-nourishment component of shore protection projects. Presently, the existing cost-sharing formula for the nourishment portion of beach nourishment projects is generally 65 percent Federal and 35 percent non-Federal for projects authorized in the Water Resources Development Act of 1999 or prior to that. For projects authorized after the 1999 Act, cost sharing is generally 50 percent Federal and 50 percent non-Federal for practical purposes although there is a "phase-in" period.

The President's proposed FY 2003 formula called for reversing the percentages to require 35 percent of the re-nourishment project costs to be funded by the Federal government and 65 percent from the non-Federal sponsor. The new formula would not only be applied to recommendations for authorizations of future re-nourishment projects, but it would also be applied to those projects that have been authorized but not completed and existing projects with continuing re-nourishment requirements. This change was made to more appropriately reflect the distribution of economic benefits that shore protection projects provide to State and local sponsors. In addition, the Administration wants to ensure that the Federal government's long-term nourishment obligations do not "crowd-out" other important Federal expenditure needs.

In order to ensure that the Administration's proposal to increase the local share of the costs for the beach re-nourishment component of shore protection projects is based on sound reasoning and empirical observation, the U.S. Office of Management and Budget (OMB) is interested in determining,

- Who benefits from shore protection projects?
- What is the distribution of project benefits?
- Do increases in tax revenues that stem from Federal shore protection projects affect the capacity of non-Federal sponsors to pay for the projects?

An internal review within OMB found insufficient information to address these questions. As a result, the U.S. Army Corps of Engineers Institute for Water Resources (IWR) was asked to address the questions above. In its investigation, IWR reviewed available

- Shore protection project reports from the Corps and other agencies,
- Academic and professional studies of beach economies,
- Literature on environmental effects of shore protection projects,
- Information concerning fiscal effects (tax revenues and transfers) of shore protection projects, and
- Information on the extent and nature of State and local participation in cost sharing for shore protection.

ES.1 Results of the Literature Review

Summary of Shore Protection Environmental Effects: Although Corps beach projects do not extend beyond historical beach limits, the introduction of a large volume of sand into a beach area can result in significant physical changes, including subaerial changes in sand composition and attributes and subtidal changes in sedimentation, turbidity and water quality. However, studies monitoring the effects of beach nourishment projects have shown no significant long-term impacts on the environment.

In the short-term, beach nourishment activities may detrimentally affect organisms that inhabit the beach area; however, the plant and animal species in beach environments are adapted to survive environmental changes created by the natural cycle of sand erosion and accretion. These changes are experienced on a daily basis with the tides. The natural changes also occur on a seasonal basis as the beaches experience rapid, extensive retreat during the winter storm events and as beaches gradually and progressively rebuild during lower and longer waves between storm events. The results of biological monitoring programs indicate that the effects of beach nourishment projects on littoral organisms are short-lived.

The adverse environmental effects of the beach nourishment projects are minimized or avoided altogether through the use of sound management practices, such as using fill material that is well suited to the existing beach, installing silt screens where necessary, timing nourishment activities to avoid interfering with the nesting season for various species, and dredging borrow material in thin layers and/or strips rather than deep holes.

Many beach nourishment projects have also had beneficial environmental effects. For example, nourished beaches can create new nesting areas for endangered sea turtles, spawning grounds for horseshoe crabs and habitat for piping plover and least terns.

Summary of State and Local Cost-sharing Participation: Five states were surveyed as to their participation in the non-Federal share of Corps beach nourishment projects, with the following results: California—85% to 100%; Florida—50%; Delaware—100%; New Jersey—75%; and North Carolina—75%. The sources of state funding for beach nourishment varies from state legislature appropriations (California, Florida, and North Carolina), a real estate transfer tax (New Jersey), and to an accommodation tax (Delaware). The remaining non-Federal share of the project costs is usually paid by the local community.

Summary of Tourism Data: This study reports the most current data available on beach tourism for the states of Florida, California, Texas, New Jersey, and North Carolina. Data reported include the origin and destination, activities, and demographic attributes of beach visitors in each state. Beach tourism data was generally available through either a state economic development agency, a state department of tourism, or through academic research conducted by one of the state universities. In some cases, beach related tourism data was not reported independent of other types of tourism. In

other cases, detailed recreation data was available for one or two beaches in a state, but not for all beaches statewide.

Summary of the Distribution of Shore Protection Benefits: Regional economic development (RED) benefits are generally not examined in Corps shore protection project reports. However, Section 220 of WRDA 2000 and subsequent implementation guidance directs that all Corps studies consider, and evaluate and display (if appropriate), all potential project benefits for shore protection; including hurricane and storm damage reduction benefits, environmental protection and restoration benefits, and recreation benefits. In addition, Corps Districts are encouraged to be receptive to requests from non-Federal sponsors to include in feasibility studies the evaluation of benefits not normally considered, including those that are regional and local in nature. The distribution of national economic development (NED) benefits amongst beneficiaries is not found in Corps shore protection project reports. Academic and professional studies of the economic effects of beaches

- Examine the distribution of beneficial effects from a regional perspective
- Assume that impacts (income, tax revenues, employment, etc.) attributed to the rest of the nation would not otherwise occur in the absence of beaches
- Do not identify all elements of RED benefits of beach economies
- Are inconsistent with one another in terms of impacts that are measured and the methods used to measure them

Consequently, the present literature does not adequately address the issues of the distribution of shore protection benefits.

ES.2 Analysis of the Distribution of Shore Protection Benefits

IWR undertook this study to evaluate the distribution of both the national and regional economic development benefits of a shore protection project. The NED benefits considered included storm damage reduction benefits, recreation benefits, and other NED benefits (i.e., reductions in maintenance and emergency costs). RED benefits of shore protection are defined as the change in "net value added" resulting from subsequent recreational activities associated with alternative project plans. Net value added is the sum of employee compensation, proprietors' income, property income, and indirect business taxes (value added) adjusted for the transfers of commuters' income and tax revenues and for the local costs of managing and maintaining the beaches.

Distributing NED Benefits of Shore Protection Projects: NED benefits are distributed as follows in this study: storm damage reduction benefits are distributed according to the residence patterns of the affected property owners, recreation benefits are distributed by the residence patterns of the beach users, and other NED benefits are assigned to the area outside the beach region (i.e., the rest of the nation).

The distribution of shore protection benefits was analyzed using a hypothetical beach new nourishment project that has a "dry sand" (dry beach area above the mean

high water level) component that is one mile long by 100 feet wide. Quantities of sand were estimated that would not only create the "dry sand" component but also would extend out beyond the shoreline for storm damage protection and recreation. It was determined that the amount of sand needed to provide the appropriate level of shore protection varies according to the intensity of wave action on the beach. A "low" energy beach with our hypothetical configuration requires 500,000 cubic yards of sand and a "high" energy beach requires 700,000 cubic yards of sand. A middle quantity of sand (600,000 cubic yards) was used for the hypothetical beach nourishment project. Average annual benefits per cubic yard of sand for each of the NED benefit categories (i.e., for storm damage reduction, recreation, and other NED benefits) were estimated based on sand quantities and benefits for a sample of completed and authorized Corps beach nourishment projects. Storm damage reduction benefits and other NED benefits were based on the total amount of sand used for the hypothetical new nourishment project. Recreation benefits were based on the quantity of sand used for the "dry sand" portion of the nourishment project. The NED benefits for each benefit category of the hypothetical nourishment project were estimated by multiplying the estimated quantities of sand by the average annual benefits per cubic yard of sand for completed and authorized Corps shore protection projects. Total estimated average annual NED benefits for the hypothetical project are estimated to be $1.65 million ($920,000 for storm damage reduction benefits, $609,000 for recreation benefits, and $123,000 for "other" NED benefits). Not having access to empirical data for a real beach nourishment project, the parameters concerning the proportion of property owner and beach users residing in the beach region were estimated based on data for a coastal county reflecting a "typical" regional setting. The residential patterns were either estimated with data from the 2000 Census of Population or borrowed from selected past studies of beach economies. Based on the NED benefit estimates above and the derived beach parameters, it is estimated that approximately one-third of the NED benefits accrue to the beach region and two-thirds to the "rest of the nation" region.

Two other coastal regions were chosen to provide the residential patterns for property owners and beach users for simulation purposes. These regions were selected to provide a range of parameter values that reflect a much more "rural" beach region and a much more "urban" beach region. When the type of region in which the beach is located is considered (i.e., the residential patterns of property owners and beach users are different for the "typical", rural, and urban beach regions), the distribution of NED benefits differs to some extent. The findings indicate that approximately half of the NED benefits accrue locally for the rural beach region and about 40 percent of the NED benefits would accrue locally to the urban beach region.

The NED benefits of shore protection accruing locally not only varied between one-third and one half, they also failed to be consistent for the beach regions considered; the local proportion of NED benefits was greater for both the rural and urban regions than for the "typical" beach region. Given the variability found here, it is extremely important to understand that the distributional patterns of the NED benefits for shore protection projects depend on the residential patterns of the property owners and the beach users. These patterns are specific to each community and, as a consequence, the distribution of

NED benefits is also site-specific for each project. It should be noted that the NED benefit estimates for the "low" energy beach were smaller than for the hypothetical nourishment project and larger for the "high" energy beach, as would be expected, because the NED benefit estimates were related to the quantity of sand. However, the distribution of benefits between the beach region and the rest of the nation did not change much.

The effect of increased beach visitation due to the nourishment project on the distribution of NED benefits was evaluated; increases in visitation considered were 0, 5, 10, 15, 20, and 25 percent. Increases in visitation are partially based on the capacity of the hypothetical beach nourishment project. In addition, only real increases in visitation on peak visitation days are attributed to NED benefits. Corps District staff reported a variety of "unit-day" and "travel cost" method values that have been used when visitation is expected to increase due a beach nourishment project; "beach experience" values have typically varied between $2 and $5 under the "with project" conditions. However, another Federal agency indicated that their unit-day values for beach experiences are in the $15 to $20 range. Increases in visitation raised the level of NED benefits but had little effect on the distribution of NED benefits, regardless of the unit-day value.

Distributing RED Benefits of Shore Protection Projects: RED benefits are distributed to the beach region and to the rest of the nation according to the net value added impacts that occur in each of the respective regions due to spending of tourists at the beach. However, the net value added impacts that occur in each region are measured from each region's point of view. Consequently, the RED benefits for the beach region are the net value added impacts within the beach region due to spending by all beach visitors residing outside the beach region. The RED benefits for the "rest of nation" region are those net value added impacts occurring in the rest of the nation due to beach spending by foreign beach visitors only.

The RED analysis was carried out under several assumptions. First, it is assumed (for RED only) that the unemployment rate is not zero. This has the effect of permitting resources to flow between regions without negative impacts to occur in locations where the resources originated. Second, it is assumed that people's propensity to consume out of their incomes does not change due to the existence of a beach or because of a nourishment project. This means that the money spent at the beach will be spent whether a beach exists or not. If the beach is not available, then the users will spend their money on something else. The assumption also implies that any impacts (jobs, income, etc.) that might occur due to beach spending will occur in any event. At the local level, an exception to this assumption occurs when local beach users substitute going to a local beach for visits to beaches located outside the beach region. On a national level, foreign visitors may change the length of stay within the country or not come the U.S. at all (i.e., spend less money within the U.S.) if beaches are not available.

The net value added impacts (or RED benefits) for both the beach region and the rest of the nation were computed using a regional input-output analysis of recreational spending by visitors to the beach. To simulate the net value added effects of the existing

beach on the economies of the beach region and the "rest of the nation" region, the net value added effects of one million beach visits per year by outside tourists during the year were evaluated. The decision to use "one million" beach visits by outside tourists was made to simulate the importance of the existing beach on the economy of the respective region and to demonstrate the procedures that were used to compute the net value added impacts and their distribution between the beach region and the rest of the nation.

On average for the "typical" region, it is estimated that one million outside beach visitors annually spend $88.1 million within the beach region. Of that total, $49.9 million is a direct economic stimulus to the beach region economy. The cumulative economic "ripples" created by the direct stimulus result in an estimated total economic impact on local businesses of $71.5 million per year. In addition to other economic resources required for these economic "ripples" to occur, a total of almost 2,000 full-time jobs are created annually who are paid an estimated $25.5 million in wages and salaries. Total value added (or gross regional product) created per year by these economic changes is $48.3 million. It is estimated that the local workers who commute from places outside the beach region take $5.8 million of the value added with them. Also, it is estimated that $12.3 million in State and Federal taxes accrue each year outside the beach region. The beach community is estimated to incur just under $2.0 million in beach management and maintenance costs annually to support the beach activity. All together, the net value added effect on the beach region is $28.2 million. Computed in a similar fashion, the net value added effect on the rest of the nation due to beach spending by foreign tourists is estimated to be $31.9 million annually. Taken together, approximately 47 percent of the RED benefits or net value added effects are expected to accrue to the "typical" beach region and 53 percent to the rest of the nation. However, if the beach had been located in the rural region then approximately 40 percent of the RED benefits would accrue locally, while half of the RED benefits would accrue locally if the beach were in the urban region.

The effects on the distribution of RED benefits due to increases in visitation stemming from the hypothetical new beach nourishment project were analyzed; specifically resulting from incremental increases in beach visitation of 0, 5, 10, 15, 20, and 25 percent. It is assumed that increases in visitation are based on the capacity of the hypothetical beach nourishment project. However, instead of only considering increases in visitation during peak visitation days (for NED benefits), increases in visitation for the entire year are evaluated for RED benefits. Because input-output is mathematically "linear", all impacts resulting from increases in visitation are proportional to the change in visitation relative to existing visitation levels (i.e., one million outside beach visits). Consequently, the magnitude of the net value added effects increases in proportion to the increase in beach visitation, however, the distribution of RED benefits does not change.

A number of beach officials have indicated that beach visitation may not initially change as beaches are not nourished and allowed to erode. However, it appears that the mix of beach visitors and activities do change. It has been casually observed that the new visitors use the beaches differently; they use the beach more during low tide and less during high tide, they camp more and stay in "expensive" hotels and motels less; they

dine in restaurants less frequently, etc. These changes mean that "fewer" dollars flow into the beach economy and the RED effects are smaller as a consequence. These effects were simulated by determining what would happen if the outside beach visitors to the "typical" beach region behaved like the outside beach visitors to the rural beach region. That is, rather than the million outside beach tourists now spending $88.1 million per year, they will spend $66.7 million per year. It is also assumed that the pattern of expenditures will change accordingly. Relative to the "typical" situation, the drop in spending by outside tourists will mean a drop in RED benefits by $8 million both for the beach region and for the rest of the nation.

Local Fiscal Effects of Beach Nourishment Projects: Local tax revenues generated by recreation-related activities at existing beaches may be larger than required to fund related beach management and maintenance costs. The implication is that beaches have more than enough money to fund the additional non-Federal cost-share for the beach re-nourishment component of the shore protection program. However, even if local tax revenue collected are greater than needed to cover beach management and maintenance costs, the "excess" revenues are probably being currently used to help fund other important local public services and, therefore, they may not readily available to fund an increase in the non-Federal cost-share.

However, the local tax revenues that are collected as a result of "new" beach visitation due to the hypothetical beach nourishment project could be used to fund the increased non-Federal cost share. The non-Federal cost share of 65 percent of the project costs as recommended in the President's FY'02 budget was calculated by applying an assumed "cost-benefit" ratio of 2.0 to the estimated total NED benefits that result from increases in visitation due to the hypothetical beach nourishment project; increases in visitation considered are 0, 5, 10, 15, 20, and 25 percent. There are various methods that non-Federal sponsors use to fund their share of the project costs. One method of funding the non-Federal cost share is to "float" a municipal bond to be paid for in annual increments over a period of time (for example, 20 years). The total cost of the bond includes not only the principle (i.e., the non-Federal cost share) but also the interest that would accrue for the period of the bond. The bond is assumed to have a 5 percent annual interest rate compounded annually (the September 2001 rate of interest for 20-year State and local general obligation bonds is 5.09 percent). If no "new" visitation is induced by the hypothetical beach nourishment project or if the quality of the beach experience is not improved, then there will be no additional local tax revenues available to fund any of the non-Federal cost-share (even to cover the existing 35 percent cost share requirement). Under the increased visitation scenarios for the "typical" beach region, annual excess local tax revenues collected would be less than the annual cost of a bond to fund the increased non-Federal share of the hypothetical project costs for all increases of visitation considered. Even if the "typical" beach region's project benefit/cost ratio was as large as 3.0, the annual excess local tax revenues are still less than the annual cost of the bond for the "typical" beach region. If the State in which the beach and the "typical" region are located paid 75 percent of non-Federal cost-share (as some States do), the annual excess local tax revenues would still be less than the annual bond cost for 25 percent of the non-Federal cost-share. Even if a 50 percent non-Federal cost-share were instituted and the

State paid 75 percent, the annual excess local tax revenues would be less than the annual cost of the bond for any increase in visitation considered (0, 5, 10, 15, 20, and 25 percent).

Note that annual local tax revenues in the rural region are estimated to be less than annual beach management costs for all increases in beach visitation. Therefore, there are no expected excess local tax revenues collected to help fund the non-Federal share of project costs in these areas. In addition, urban regions would also be unable to pay for the entire non-Federal cost-share based on the annual excess local tax revenues collected due to any of the increases in visitation considered. However, if the State participated in the hypothetical beach nourishment project and pays 75 percent of the non-Federal cost-share. then visitation will need to increase in the range of 15 to 20 percent in order for the annual excess local tax revenues to be greater than the annual bond cost (if the non-Federal cost-share is 65 percent for the urban region). If the non-Federal cost-share is 50 percent and the State pays 75 percent, then beach visitation would need to increase in the range of 10 to 15 percent before annual excess local tax revenues are greater than the annual bond cost for the urban region.

Finally, if the hypothetical beach nourishment project were not implemented and the beach were allowed to erode initially, there appears to be concern that the fiscal conditions within the beach region might degrade; not so much because visitation will decline but because spending by tourists will decline. If, for example, outside beach visitors to the "typical" beach region were to spend and behave similar to those in a rural region, then the amount of local tax revenues collected will drop. In this case, they are estimated to drop to a level just above that needed to cover the beach management and maintenance costs. It is not asserted that these changes reflect any actual events. However, they might reflect the possible concerns of public officials responsible for managing and maintaining beaches.

ES.3 Conclusions

- **Due to the sensitivity of the estimated shares of NED and RED benefits that accrue locally, it is important not to "generalize" the results provided here.** The findings here depend on the specific parameter values that are used in the analysis. These parameters have been chosen from selected studies of beach economies. Also, the regions used in the analysis, although real coastal counties that contain beaches, are chosen based their representative characteristics of average, rural, and urban coastal counties. Specific results and conclusions of the present study may change substantially with better information. The shares of NED and RED benefits that accrue locally could be computed on a "case-by-case" basis when projects are evaluated. A more comprehensive study of the distribution of the benefits of shore protection projects could be undertaken with one of its purposes to produce more general results than provided here.

- **National cost sharing decision should not be made based on the subjective findings and hypothetical situations portrayed in this study.** The analysis

included many assumptions and hypothetical scenarios in order to demonstrate a methodology that could be used to analyze individual beach project situations, if pertinent data could be developed and collected. The methodology appears to warrant further development and application in establishing a reasonable distribution of shore protection benefits in regard to where beneficiaries live and the origin of visitors to the beaches.

- **For the "typical beach area" considered and the geographic distributions of the primary residence of beach property owners and beach users, approximately 35 percent of the national economic development benefits (storm damage reduction benefits, recreation benefits, and other NED benefits) from a beach nourishment project accrue to people within the beach region and 65 percent accrue to people who reside elsewhere.** The "typical" beach region was used because it reflected an average regional setting for which the great majority of Corps shore protection projects are located. However, considering more rural or more urban beach settings (regions), higher percentages of NED benefits (as high as 50 percent for a rural beach region) were found to accrue to people locally. Examining the business opportunities related to associated recreational activities, about 47 percent of the regional economic development benefits accrued to people residing in the "typical" beach region and 53 percent elsewhere. The local percentage of RED benefits varied between 40 and 50 percent for the rural and urban regions considered.

- **Periodic beach re-nourishment often has beneficial environmental effects.** Many Corps beach nourishment projects have produced environmental benefits, such as providing new nesting area for sea turtles, spawning grounds for horseshoe crabs, and habitat for piping plover, least terns and sea-beach amaranth

- **The most current and comprehensive monitoring of the environmental effects of beach nourishment projects indicate that nourishment projects have no significant impacts in the long-run, when appropriate management practices are exercised, as established by Corps regulations and guidelines.** The plant and animal species existing in littoral areas are adapted to survive in the dynamic environment created by the natural cycle of sand erosion and accretion.

  Properly engineered and constructed beach nourishment projects avoid potential adverse environmental impacts. In doing the literature search for this study of the potential environmental consequences of nourishment projects, it became apparent that the Corps has developed extensive expertise and general procedures for avoiding potential adverse environmental consequences due to the many years of experience in designing and constructing these types of projects.

  While beach nourishment does accelerate certain dynamic processes that can tax the capacity of species to adapt, Corps engineering guidelines specify the use of engineering and monitoring practices to avoid detrimental impacts. Practices employed by Corps engineers include planting beach plants to replace

damaged plants and create pedestrian barriers, conducting construction activities in the fall and winter season to avoid interfering with nesting and spawning season for near shore and beach animals, using sand that is closely matched to sand on the existing beach, establishing buffer zones around reefs and other sensitive habitats near the borrow site to prevent damage from turbidity or physical contact during dredging, monitoring turbidity levels and implementing dredging operations designed to minimize turbidity

- **With no increase in recreation visitation induced by a project and when there is no improvement in the quality of the beach experience, the increase in regional benefits is zero.** Many Corps feasibility studies anticipate no increase in tourism that satisfies unmet recreational demand with a Federal shore protection project. The regional economic benefits are tied to the related expenditures that beach visitors bring to the beach community. Without new infusions of money, there will be no regional economic impacts induced by a shore protection project.

- **The impact of a hypothetical one million recreation visitors from outside the beach region was shown in order to provide a perspective of the existing value of tourism to beach communities with approximately 2-3 million in total annual visitations.** The analysis of the hypothetical million outside recreation visitors was also to demonstrate and test the methodology used to evaluate the regional economic development benefits of shore protection projects.

- **Increases in recreation visitation induced by a beach nourishment project generate corresponding increases in potential regional economic benefits.** Increases in visitation in the of 0 to 25% were found to result in potential regional economic gains in the range of 0 to 10.7%

- **All 5 states surveyed participate in cost sharing the non-Federal share of Federal and even local projects.** However, the extent to which States participate in cost sharing with the non-Federal sponsors of shore protection projects varies. There are also a wide variety of funding mechanisms used by States and local communities to fund the non-Federal share of shore protection projects.

  Given the variability of NED benefits for shore protection that accrue locally, it is extremely important to understand that the distributional patterns of the NED benefits for shore protection projects depend on the residential patterns of the property owners and the beach users.

- **The fiscal capacity of State and local sponsors to fund the President's proposed 65 percent non-Federal share of re-nourishment costs will not improve if beach nourishment projects do not increase beach visitation or if the quality of the beach experience is not improved.** Beaches that do not experience increases in visitation as a result of nourishment projects will not experience any regional economic impact because lack of new visitation will not

generate any new spending for recreation. Local tax revenues, one of the impact elements affected beach visitor spending, will also not change. As a result, no additional funds would be available to help fund any increases in the non-Federal cost-share.

- **Although increases in visitation at beaches located within "typical" beach regions due to beach nourishment will likely increase annual local tax revenues above the needs for beach management and maintenance, the increases in annual "excess" local tax revenues are unlikely to be large enough to fund an increased non-Federal cost-share from the current 35 to 50 percent to 50 or 65 percent of the project re-nourishment costs, even if the State participates by paying as much as 75 percent of the non-Federal cost-share.**

- **Additional and creative funding mechanisms, other than existing local taxes and fees systems, may be needed to help beach communities fund their portion of any proposed increases in non-Federal cost-shares, even if the State would pay a significant portion of the increased share of project costs.** The large majority of the Corps' beach nourishment projects are located in regions that most like the "typical" beach region in this report and very few of the beach region would be categorized as either "rural" or "urban" when defined as in this report.

- **Urban regions may be capable of funding the proposed increased non-Federal cost-share with beach visitation increases in the range of 10 to 20 percent if the State participates in paying a significant portion of the non-Federal cost-share.** However, few of the past, current, or authorized Corps beach nourishment projects are located in regions that might be classified as "urban": for example, urban beach regions would include Miami Beach, Fl, Virginia Beach, VA, northern New Jersey shore and Long Island, NY in the vicinity of New York City, and a few others.

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Chapter 1
Introduction

General non-Federal sponsor cost sharing is 35 percent of the costs associated with the re-nourishment component of the Corps Shore Protection Program. The President's fiscal year 2002 budget proposed to raise the general local cost share for beach re-nourishment to 65 percent. The new formula would not only be applied to recommendations for authorizations of future re-nourishment projects, but it would also be applied to those projects that have been authorized but not completed and existing projects with continuing re-nourishment requirements. This change was made to more appropriately reflect the distribution of economic benefits that shore protection projects provide to State and local sponsors. In addition, the Administration wants to ensure that the Federal government's long-term nourishment obligations do no "crowd-out" other important Federal expenditure needs.

The purpose of this report is to review pertinent literature on the distribution of shore protection benefits and to attempt an analysis of the potential value of beach projects to local and national economies. These findings may be used to support the Administration's proposal to increase non-Federal cost sharing for the re-nourishment component. The report addresses the following three questions:

1. Who benefits from shore protection projects?
2. How are project benefits distributed?
3. Do increases in tax revenues that stem form Federal shore protection projects affect the capacity of non-Federal sponsors to pay for the projects?

During the process of completing this report a literature review was conducted covering five issues of interest.

1. Academic and professional studies of beach economies,
2. Environmental effects of shore protection projects,
3. Fiscal effects (tax revenues and transfers) of shore protection projects,
4. Measures of beach tourism and recreation activities, and

5 The extent and nature of State and local participation in cost sharing for shore protection.

Summaries of the beach tourism and recreation data found are described in appendix C of this study. Information pertaining to state and local cost-share participation are provided in Appendix E. The remaining issue reviews are discussed in the text of the report

Chapter 2 briefly reviews the history of shore protection in the United States from its inception to the present time. The philosophical shift from the use of structures for managing beach erosion and storm damage problems to the use of more functionally successful techniques that replicate the protective characteristics of natural beaches and dune systems is reviewed. Also, a historical review of the Corps' shore protection authorizations and construction activities is presented, including the expansion and consolidation of Federal responsibilities for shore protection activities following W.W.II. Finally, an explanation is provided of shore protection project purposes and periodic nourishment is introduced as a component of shore protection continuing construction and non-Federal requirements are discussed.

Chapter 3 addresses the question of how to evaluate the distribution of the economic benefits created by beach nourishment projects between the local and national interests. This chapter describes two different types of economic effects a beach nourishment project can have: net regional economic impacts and project-induced increases in the value of beach related services. Measures for both types of effects are described and a review is provided of the methods used in current studies to evaluate the economic benefits of beach nourishment projects. After providing an evaluation of the approaches taken in these studies, Chapter 3 introduces and demonstrates a method that can be applied consistently across all shore protection projects to comprehensively evaluate the economic benefits of beach nourishment and to address the question of how benefits are distributed among the local and national interests. The method is applied to three case studies, representing three beach regions surrounded by varying degrees of economic activity. The approach introduced measures both the regional economic

development (RED) effects, as well as changes in the value of beach related services, measured as "national economic development" or NED effects. The results of the case studies are reported and discussed.

Finally, Chapter 4 provides a review of the current literature addressing the environmental effects of beach nourishment projects. From the information provided in the literature, as well as from interviews and information obtained from Corps district offices, this chapter describes the changes that occur in the three regions affected by beach nourishment activities, the subaerial zone, the subtidal zone and the borrow site. The beneficial effects of beach nourishment are described. Also, a discussion is provided of the deleterious effects nourishment activities can have on littoral biota if appropriate management practices are not utilized during the course of a project. The management practices and procedures followed by the Corps to avoid negative environmental impacts are described.

Chapter 2
Shore Protection in the United States

Interest in shore protection began in New Jersey in the latter part of the 19th century and the early decades of the 20th century due to intense development of beach resorts near the burgeoning populations of New York City and Philadelphia. These beaches were the first to recognize the problems arising from erosion and other storm effects. Millions of dollars were spent in New Jersey on early erosion projects that were uncoordinated and often inappropriate, minimally effective, or even counterproductive. It was soon realized that the efforts of individual property owners were not capable of coping with the problems of coastal erosion and that a broader-based approach was necessary.

In response to the increasing problems of coastal erosion, the New Jersey legislature appropriated money in 1922 for a formal investigation of the changes taking place along the state's coastline. In Washington, DC, at about the same time, a Committee on Shoreline Studies was formed to examine shore erosion matters under the Division of Geology and Geography of the National Research Council. The American Shore and Beach Preservation Association was created as an outcome of the Committee's activities. An early objective of the association was to get the affected states to accept responsibilities for their beaches. However, within a year of its formation (1926), the association was lobbying to have the Federal government assume the function of unifying and coordinating the efforts of states with regard to shoreline problems. As a result, Congress enacted PL 71-520 in 1930 that authorized the U.S. Army Corps of Engineers to engage in shore protection studies in cooperation with state agencies and to establish a Beach Erosion Board. Throughout the 1930's the Federal in shore protection was essentially limited to cooperative analysis, planning studies, and technical advisory services. The costs of these planning efforts were shared on an equal basis between the Federal government and non-Federal interests. However, the Corps' involvement in shore protection studies virtually ended with the onset of World War II.

The *1971 National Shoreline Study* (House Document No. 93-121, 93rd Congress, 1st Session, Volumes 1-5, June 29, 1973) documents a national shoreline inventory that was completed in 1971. The study indicates that there are a little more than 84,000 miles of ocean, estuarine, and Great Lakes shorelines (including Alaska, Hawaii, Puerto Rico, and the Virgin Islands). Of this total shoreline distance, 20,500 miles were identified as experiencing a significant degree of shore erosion.[1] Of the 20,500 miles of shoreline that had significant erosion, 2,700 miles have been identified as having critical erosion problems (Table 2.1). Critical erosion is "where erosion presents a serious problem because the rate of erosion is considered in conjunction with economic, industrial, recreational, agricultural, navigational, demographic, ecological, and other relevant factors, indicates that action to halt such erosion may be justified."

Table 2.1: Assessment of Coastal Shorelines by Region (miles)

Region	Total Shoreline	Significant Erosion	Critical Erosion
North Atlantic	8,620	7,260	1,090
South Atlantic-Gulf	14,620	2,820	980
Lower Mississippi	1,940	1,580	30
Texas Gulf	2,500	360	100
Great Lakes	3,680	1,260	220
Alaska	47,300	5,100	100
North Pacific	2,840	260	70
California	1,810	1,550	80
Hawaii	930	110	30
U.S. Total	84,240	20,500	2,700

Source: 1971 National Shoreline Study. Shoreline mileage does not include small shore protection projects in the Continuing Authorities Program

During the period covered by the shoreline inventory, the Corps had completed 82 specifically authorized projects covering 226 miles of shorelines. Another 41 projects and studies protecting an additional 337 miles of coastline had been authorized but not constructed. However, these projects do not include the numerous state, county, city, and

[1] If Alaska is excluded, the Nation's shoreline is about 37,000 miles, of which 15,400 miles experience significant erosion.

private shoreline projects for which the Corps participates in its Continuing Authorities program. The relatively few major Federal projects in the face of the number of miles of shoreline experiencing critical erosion problems is due, in part, to the stringent Federal project feasibility criteria. These criteria, including benefit/cost analysis, virtually limit shore protection projects to densely developed areas with high economic value and public access.

2.1 Shift from Structures to Beach Nourishment

The main approach to beach erosion and storm damage problems in the United States and elsewhere prior to World War II was to use fixed structures, usually groins, seawalls, and jetties. These structures met with varying degrees of success. By the 1920's and 1930's, the use of fixed structures had proliferated along certain resort sections of the Nation's coastline to such an extent that these structures impeded the recreational use of the beaches.

By the late 1940's and early 1950's, it was increasingly realized that, in many situations, techniques that replicated the protective characteristics of natural beach and dune systems were more cost-effective and functionally successful than solely relying on the traditional coastal defense structures of the past. This concept, pioneered by the Corps, emphasized the use of artificial beaches and dunes as economically efficient and highly effective method of dissipating wave energy. The aesthetic and recreational values of artificially created beaches were other important considerations.

Federal legislation related to beach nourishment (i.e., the recurrent need to replenish sand along restored beaches) has contributed to the broad acceptance that now exists for the use of artificial beaches as the primary means of shore protection. Until 1956, periodic nourishment was considered a form of maintenance that was totally a non-Federal responsibility. Legislation enacted in 1956 classified beach nourishment as a continuing construction activity that is eligible for Federal cost sharing, when beach nourishment is used as a substitute for protective measures. The 1956 Act recommended

a nourishment period of 10 years. Subsequent authorizations have extended the period of Federal participation in beach nourishment to 15 years in 1976 and to 50 years in 1986.

Presently, the features of shore protection projects usually consist of one or a combination of the following functional elements: beach and dune fills, groins, seawalls, revetments, breakwaters, bulkheads, and sand transfer plants. There is no specific or singular functional feature that can be applied universally to solve all shore protection problems. Most project sites have some unique characteristics and must be evaluated on the basis of their particular attributes in order to develop a project plan that affords the best balance between functional performance, cost-efficiency, return of economic benefits, and environmental acceptability. The protection of relatively lone reaches of shoreline, more often than not, involves the placement of beach fill and the provision of subsequent periodic nourishment. However, even in these cases, many project sites require detailed assessments to determine, for example, whether or not groins are needed for all or part of the fill or how much fill to place, how long the fill will last before needing to be re-nourished, and whether a dune fill or seawall should be used to account for storm tide effects.

2.2 Historical Shore Protection Authorizations and Construction

Between 1930 and 1994 there have been 137 shore protection projects authorized by Congress with some degree of Federal participation. Prior to 1950, only five projects were authorized. In the most active year, 1954, eighteen shore protection projects were authorized. The large number of projects authorized during the 1950's and 1960's was a direct result of the numerous major coastal storms that occurred during those years.

It should be noted that there are fewer projects built than authorized. In response to the large number of authorizations during the 50's and 60's, both the number of beach restoration projects completed and the volumes of sand placed increased during the 1960's and peaked in the 1970's. However, due to the lack of water resource authorizations in the 1970's, construction declined in the 1980's. In response to WRDA

'86, the decade of the 90's has seen a resurgence of construction. There have been as many projects completed in the 1990-93 period as there was during the entire decade of the 80's.

Six legislative acts, called the Continuing Authorities Program as a group, authorize the Secretary of the Army, through the Chief of Engineers, to plan, design, and construct certain types of water resource improvements without specific Congressional authorization. Three of these authorities pertain partly or entirely to shoreline protection and beach erosion control projects

- Section 14, Flood Control Act of 1946 (PL 79-526), as amended (Emergency stream bank and shoreline erosion protection of public facilities and services). The program applies only partly to the shoreline and beach erosion control projects. The limit for Federal funding per project is currently $500,000 with a program limit of $12,500,000 per year.

- Section 103, River and Harbor Act of 1962 (PL 87-874), as amended originally Section 3, an Act authorizing Federal participation in the cost of protecting the shores of publicly owned property, approved August 13, 1946 (Beach erosion control). The limit for Federal funding per project is currently $2,000,000 with a program limit of $30,000,000 per year.

  Section 111, River and Harbor Act of 1968 (PL 90-483), as amended (Mitigation of shoreline erosion damage caused by Federal navigation projects). The limit for Federal funding per project is currently $2,000,000 with no yearly program limit.

Prior to the enactment of Section 103 of the 1962 River and Harbor Act and Section 111 of the 1968 river and Harbor Act, several shore protection projects were authorized that were small in size and cost. All of these projects were located either in the New England Division (21 projects) or in the Los Angles District (5 projects). Had the Continuing Authority Program been in effect at the time, these projects would have been constructed under those authorities.

2.3 Evolution of Federal Interest and Cost Sharing

Federal responsibilities for shore protection significantly expanded and consolidated after World War II.[2] The body of law enacted during this time has established an overall program in which Congress has authorized Federal involvement to prevent or control shore erosion caused by wind, tidal generated waves, and currents along the nation's coasts and shores and to prevent property damage and loss of life from hurricanes and storm flooding. Federal participation in shore protection includes research and development, planning, design, construction management, and Federal cost sharing. Responsibility for executing the shore protection program has been vested in the Secretary of the Army acting through the Chief of Engineers, U.S. Army Corps of Engineers.

Shore protection projects in the recent past have been traditionally developed for the purpose of beach erosion control and/or hurricane protection. Beach erosion control projects provided for the restoration of publicly owned shores that are open to the general public. Private properties could be included if such protection and restoration was incidental to the protection of publicly owned shores or if such protection would result in public use and benefits. Public use meant access by all on equal terms. For beach erosion control project. study costs were 100 percent Federal; costs of construction were 50 percent Federal for non-Federal public shores; and 70 percent Federal for non-Federal public shore parks and conservation areas. Hurricane protection features costs were shared on the basis of 70 percent Federal and 30 percent non-Federal.

With the enactment of the Water Resources Development Act of 1986 (WRDA '86), Congress established hurricane and storm damage reduction as a project purpose to which costs should be assigned. Section 103 indicates that beach erosion control is no longer recognized as a project purpose. However, costs of constructing beach erosion control measures will be assigned to "appropriate" project purposes, with cost sharing

[2] See Appendix A for a chronological summary of 15 legislative acts that have been established since World War II.

percentages determined by the purposes to which costs are assigned. The appropriate project purposes are hurricane and storm damage reduction (65/35 Federal/non-Federal) and recreation (50/50 Federal/non-Federal). Costs are shared on these two purposes while taking land ownership and public use into consideration. Feasibility study costs are shared on a 50/50 basis.

In Section 933 of WRDA '86, dredged materials from navigation projects is recognized as a desirable potential source of material for beach nourishment. When placement of dredged material on a beach or beaches is the least costly acceptable means for disposal, the placement shall be considered integral to the navigation project and shall be cost shared accordingly. When placement of dredged material on a beach or beaches is more costly than the least costly alternative, the Federal government is authorized to provide 50 percent of the costs greater than the least costly alternative providing all local cooperation requirements are met. When the additional cost for placement of dredged material is not justified, the Corps may still perform the work if the State requests it and non-Federal interests contribute 100 percent of the added cost of disposal.

Under Section 934 of WRDA '86, Federal aid for periodic beach nourishment at existing projects may be extended as necessary without further Congressional authorization for a period not to exceed 50 years from the date of start of project construction, although the extension to 50 years of not automatic. After notification by the Corps that the nourishment period is about to expire, the project sponsor must request an extension and express a willingness to share the costs. Evaluation of such projects will be made using current evaluation guidelines and policies.

2.4 Project Purposes

Prior to the enactment of WRDA '86, shore protection projects were traditionally developed for the purpose of beach erosion control and/or hurricane protection. Beach erosion control projects provided for restoration of publicly owned shores available for use by the general public. Private properties could be included if such protection and

restoration was incidental to the protection of publicly owned shores or if such protection would result in public use benefits. Public use was not a condition for Federal participation in hurricane protection because it is considered analogous to flood control. When both purposes were served by a project, costs were allocated between purposes. WRDA '86 discontinued shore (beach) erosion control as a project purpose. However, four other project purposes are recognized; hurricane and storm damage reduction, recreation, navigation, and mitigation.

Hurricane and Storm Damage Reduction: Section 103(d) of WRDA '86 established hurricane and storm damage reduction as a project purpose, where cost sharing is 65 percent Federal and 35 percent non-Federal.

Recreation: Department of the Army policy precludes the use of Civil Works funds for implementing recreation-oriented projects due to current budget constraints. Section 103 of WRDA '86 provides for a 50/50 cost sharing of the separable cost of this feature.

Navigation: In certain instances, material dredged from such activities can be used for beach fill purposes when it is incidental to the Corps mission of maintaining the Nation's rivers and harbors. Authority for such operations was contained in Public Law 94-587 (Water Resources Development Act of 1976), as amended by Section 933 of WRDA '86. Currently this authority and related regulations allow Federal participation if 50 percent of the added costs of dredged material placement for beach nourishment purposes (in relation to the least cost navigation disposal alternative). This condition holds providing the placement is economically justified and other conditions common to Civil Works storm damage reduction projects are met. Where all of these conditions cannot be met, placement can still be made if non-Federal interests provide all of the added costs and the placement is environmentally acceptable and in the public interest.

Mitigation: Beach fill measures (structural and non-structural) may be used as corrective measures under the authority of Section 11 of the Rivers and Harbor Act of 1968 (PL 90-483), as amended, if these measures are demonstrated to be economically justified and if an existing Federal navigation project is identified (to a quantifiable degree) as contributing factor in erosion and attendant damage along an adjacent shore. This authority is one of the Corps' "Continuing Authorities" programs that do not require specific project authorization by Congress unless the total costs of corrective measures under Section 111 exceed $2,000,000.

Ecosystem Restoration and Protection: The Corps can pursue ecosystem restoration and protection needs and opportunities in coastal areas through specific authorizations and programmatic authorities such as Section 204, 206, and Section 1135. Cost sharing is 65 percent Federal and 35 percent non-Federal, except under Section 1135 where it is 75 percent Federal and 25 percent non-Federal. In addition, suitable dredged material can be used beneficially to restore or protect valuable ecological resources.

2.5 Operations and Maintenance

Under the provisions of WRDA '86, the non-Federal sponsor must operate, maintain, repair, replace, and rehabilitate (O&M) a completed shore protection project. A unique aspect of beach fill projects is the provision for continuing Federal participation in the periodic nourishment of such projects where sand is placed on the beach, berm, or dune to replenish eroded material. Periodic nourishment is considered a continuing construction feature for funding and cost sharing purposes. It is undertaken when necessary to replace storm induced sand losses and to prevent excessive interim erosion of the authorized beach design profile.

Operation activities of a beach fill project include assuring public access and safety, providing basic amenities, protection of dunes, prevention of encroachments, and monitoring of beach design section conditions. Operation of the project should also

assure that no acts of man erode or damage the integrity of the beach fill, berm and/or dune, or any structure that may be part of the project.

Maintenance of a shore protection project includes maintaining, replacement, repair, or rehabilitation of the measures/structures comprising the project. For a beach fill project, the primary maintenance responsibility is to maintain the beach, berm, and dune design section by sand relocation (moving sand laterally along the beach) and profile reshaping (moving sand perpendicular to the shore). It does not include beach nourishment that is incorporated in the project as deferred construction. Maintenance also includes the maintenance, replacement, and repair of dune walk-overs, dune vegetation or sand fencing and to make all necessary repairs that assure the integrity and working order of any fixed structures.

Chapter 3
The Economic Development Effects of Beach Nourishment Projects and Their Geographic Distribution: A Case Study Analysis

The President's fiscal year (FY) 2002 budget proposes to increase the local share of the costs for the re-nourishment component of shore protection projects in order to more appropriately reflect the distribution of economic benefits that these projects provide to State and local sponsors. The Administration wants to ensure that the Federal Government's long-term nourishment obligations do not "crowd-out" other important funding priorities. Obviously, such a proposal is a major concern for the affected non-Federal cost-sharing partners, who will now have to pay a higher share of the shore protection costs. In order to ensure that the Administration's proposal to increase the local share of the costs for the re-nourishment component of shore protection projects is a sound change in policy, this chapter addresses the following issues:

1. What are the economic benefits of shore protection projects?
2. Who are the beneficiaries of shore protection projects' benefits?
3. What is the relative distribution of the benefits among the beneficiaries?
4. Do increases in tax revenues that stem from Federal shore protection projects affect the capacity of Federal and non-Federal interests' to pay for shore protection projects?

This chapter presents and demonstrates a method of comprehensively evaluating the benefits of beach nourishment that can be consistently applied across all shore protection projects to address the question of how the economic benefits of beach nourishment projects are distributed among the local, state and national interests. The purpose of this study is to describe and demonstrate such a method.

In this study, benefits of shore protection are defined to be both the tradition national economic development (NED) benefits of shore protection and the related regional economic development (RED) benefits. NED benefits measure the increased

value of services provided by beaches, including storm damage reduction benefits, other NED benefits (reduction in emergency and facility maintenance costs), and recreational benefits. RED benefits are changes in regional economic activity associated with a beach nourishment project, measured as the income changes that stem from changes in recreational activities due to the initial construction and periodic nourishment of beaches.[3] Income is broadly defined as "net value added" to include not only wages and salaries but other components also.[4] The "net" means that reductions in value added income are made for transfers of income from the beach region to other places within the nation due to commuting patterns, for transfers of State and national tax revenues from the beach area, and for beach management and maintenance costs.

The Federal Shore Protection program currently costs the nation's taxpayers about $100 million a year.[5] Compared to the entire Federal budget, the money spent on shore protection appears rather modest. However, these expenditures must still be weighed against the benefits that these projects provide. The U.S. Army Corps of Engineers does a benefit-cost analysis of every shore protection project. The Corps' benefit-cost procedures view these projects from a National perspective. The procedures ensure that the value of a project's beneficial effects is greater than the cost of the project. In addition, the project option that will provide the greatest increase in the net value of the national output of goods and services is called the national economic development or NED plan.

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[3] There are other types of RED benefits not included in this report. For example, if the storm protection measures decrease the risks of storm damages property owners may decide to undertake enhancement activities on their properties (such as constructing new out-buildings or new roofs for their houses). These activities would generate RED effects. However, if the shore protection measures are not undertaken then construction activities will occur due to the period storms. These, too, generate RED effects. The differences in these two RED effects would have to be calculated. Without the data to perform a detailed analysis it was assumed that the without project RED effects would be equal to or greater than the with project RED effects of construction activities. However, if a more in-depth and comprehensive study of the RED effects of shore protection activities were undertaken, then the RED effects due to storm damage reduction should be evaluated and reported.

[4] In addition to wages and salaries (employee compensation), value added includes all payments to other factors of production; such as proprietors' income (approximately means small business owners), profits, rents, indirect business taxes (taxes on business activities), and other miscellaneous income-type items.

[5] Over the past 45 years, the average annual Federal shore protection outlay is actually less than $50 million. It is only in the recent fiscal years that it has reached $80 to $100 million.

The NED procedures place the greatest emphasis on the private property that is immediately adjacent to the coastline and accounts for the majority of the storm damages prevented with the implementation of a storm damage reduction project. However, it may not be reasonable to assume that a healthy beach with natural dunes and vegetation will benefit only that first row of homes and businesses. All of the homeowners spend money in the region. Hotels attract tourists, who also spend money. Local residents who live inland come to the beach to recreate. They, too, spend money. There are a variety of service businesses, from t-shirt vendors to banks, whose existence depends on these expenditures. In addition, there is an environmental benefit derived from nourishing our beaches. Property owners do not retreat from an eroding shorefront. They build seawalls and other hard structures to protect their property. These hard structures, which often exacerbate beach erosion, provide an unfriendly home to the birds and turtles that nest in the sand. In addition, other beneficial aspects of coastal regions are not accounted for in the NED evaluation process. For example, the U.S. commercial fishing industry produced and marketed products valued at $10.8 billion in 1993. Saltwater recreational anglers generated $15 billion from 64 million fishing trips. In 1990, 2.15 billion tons of cargo valued at over $500 billion moved through the nation's seaports.[6] While all of these coastal effects are recognized, it is difficult to identify the differences in these effects with and without a storm damage reduction project.

3.1 A Review of Recent Studies of the Economic Benefits of Shore Protection Projects

Beach communities have responded to the administration's proposed increase in the local share of beach nourishment costs by pointing to a variety of economic benefits that beaches contribute to the state and national economies, as well as to local beach communities. For example, from a study of the economic benefits generated by beaches in Broward County, FL (Stronge and Schultz, 1997), out-of-state visitors to Broward

[6] The H. John Heinz Center for Science, the Economy, and the Environment found that, in 1996, saltwater recreational fishermen spent $8.7 billion on a variety of items to participate in their fishing. These dollars are reported to have a "ripple" effect of $25.1 billion, supported the equivalent of 288,000 full-time jobs, and generated $1.24 billion in State and Federal taxes, according to a 1998 study by the American Sportfishing Association.

County beaches are reported to have generated $350 million in annual economic benefits to the county. Furthermore, Broward's beaches produced over $28 million per year in county property taxes and nearly 18,000 jobs. Similarly, drawing on a 1997 study by PRI of the economic value of California beaches, "Beach tourism spending contributes over $10 billion in direct benefits to the state and another $17 million in indirect benefits...." and that "Beach tourism creates a half million California jobs and $1 billion in state sales, income and gas tax revenues". Results of a 1998 study of the economic consequences of a 5-year beach nourishment project on Delaware beaches indicate that, "Beach tourism (in Delaware) generates $173.2 million in expenditures each year." The Delaware study finds that as beach erosion occurs over the 5 year period examined, consumer expenditures will decline by $30.2 million, 625 beach jobs will be lost, wages and salaries will fall by $11.5 million, local and state tax revenues will fall by $2.3 million, and beach area property values will decline by nearly $43 million dollars over the five year period

In general, the literature search determined that studies of the economic effects of beach nourishment projects are actually describing two different types of economic effects. One type of effect is the net regional economic impacts of a beach nourishment project. The second type of effect examined is the increase in value of beach related services resulting from a beach nourishment project. These two types of economic effects require two different measures.

3.1.1 Changes in the Value of Beach Related Services

Beach nourishment projects can provide a variety of services that are enjoyed by people. These include storm damage protection for waterfront properties as well as improved beach access and aesthetic conditions for recreationists. These services have value because they improve the well being of the people who benefit from them. The Principles and Guidelines (P&G) refer to these improvements as "National Economic Development (NED) benefits". The NED benefits of a beach nourishment project include any increases in the value of services provided by the beach, relative to what the

value of those services would have been, had the beach nourishment project not been undertaken. NED benefits are expressed as monetary measures of the improved well being of individuals that benefit from those services. In order to evaluate the improved well being of individuals in monetary terms, a proxy is used—the amount that people would be willing to pay for the improvement (referred to as "willingness-to-pay" or WTP). There are a variety of analytical techniques for approximating individuals' willingness-to-pay for the advantages offered by beach nourishment.

For example, in the 1997 examination of Broward County beaches, William Stronge assumed that the direct benefits of beach areas are capitalized into the value of beach properties. Stronge points out that if a beach is vulnerable to storm damages, its property value will be discounted according to the expected property loss that it might incur. With beach nourishment, the property value loss would diminish as the risk of storm damage is lessened. Also, Stronge argues that the protection afforded to surrounding public infrastructure, such as bridges and roads should show up in property values, as well as improved recreation opportunities and enhanced aesthetics. Therefore, as a measure of the direct economic benefits of Broward County beaches, Stronge compared property values on barrier islands to property values on mainland as the basis for estimating the effects of the presence of beaches to property values. After making a small adjustment to subtract out the contribution of beach recreation opportunities available to mainland residents, Stronge found that "The beaches in Broward County contribute $1.4 billion in property values in the county. This amounts to about 2.2 percent of the property value in the county. About $1 billion of the contribution of beaches to property values occurs on the barrier islands, and $302.4 million occurs on the mainland." (Stronge and Schultz, 1997)

As another example, in a 1999 Delaware study researcher Linda Lent measures the economic benefits of a beach nourishment project as "...dollars that would be lost to the economy in the absence of nourishment". These lost dollars take the form of losses in consumer surplus as fewer people visit the beaches to recreate as well as losses in property values as the narrowing beach results in increase risks of storm damage,

diminished aesthetic attributes, and other undesirable effects that are capitalized into land prices.

Finally, the estimates of the value of service provided by California's beaches are measured by beach user's stated willingness-to-pay to prevent erosion of the existing beaches. The benefits of reduced storm damages due to beach nourishment are calculated using Corps guidelines established for measuring NED benefits.

Changes in Regional Economic Activity

The second type of economic benefit is the extent to which a beach nourishment project stimulates the local economy in a region by generating new tourist spending in the

If a beach nourishment project results in attracting new tourists, new economic activity will be generated in the local economy as tourists spend their money on restaurants, lodging, equipment, souvenirs, etc. However, the extent to which the local economy is stimulated is not limited to the amount of money directly spent by the tourists. Instead, the economic impacts of the new tourist spending continue to ripple through the economy as the initial spending generates new rounds of expenditures.

For example, in the 1999 study of Delaware beaches, Linda Lent measures the diminished economic activity associated with allowing a beach to erode over a 5-year period, as fewer tourists visit the beach area and spend money there. In his study of Broward County, FL beaches, Stronge argues that the presence of the beach has regional economic impacts. Stronge reasons that, because beaches contribute to higher property values, it follows that households occupying these properties would tend to have higher incomes than households occupying properties not fronted by a beach. According to Stronge, this means that the higher income households would tend to spend more money in the regional economy than would lower income households. Therefore, declined property values resulting from beach erosion, could also have regional economic impacts as lower income families begin to occupy beach area residential properties and less money is spent in the local economy. Stronge traces out the "ripple effects" of spending

the local economy as the recipients of money spent by beach visitors, in turn spend the money elsewhere in the local economy. Stronge calculates the regional economic impacts of beaches on spending by barrier island residents, mainland residents, and non-residents visiting Broward County beaches. In making these calculations, Stronge accounts for the fact that not all occupants of residential properties on the barrier islands are actually residents of Broward County. Stronge also adjusts his calculations of spending by mainland residents to account for the fact that not all beach related spending would be lost in the absence of a beach. Stronge argues that, while the spending of frequent beach users on beach equipment and visits might be lost, the spending done by occasional beach users would probably still occur in the county in the form of spending on some other recreational activity.[7] Similarly, in his estimates of spending by non-residents, Stronge accounts for the fact that tourist spending in Broward county would only decline in the absence of a beach if the tourists declined to spend there money on any other activity in the county.[8] Stronge accounts for the fact that not all spending by beach users will be lost in the absence of a beach.

Using surveys data collected from 600 California residents, King and Potepan (1997) provide two different measures of the economic impacts of California beaches. They estimate the spending impacts of California beaches on the state economy. Unlike Stronge, King and Potepan do not account for the possibility that current beach related expenditures in the local economy might occur even in the absence of a beach. Instead, they estimated the regional economic impacts of beach related expenditures as though all of the spending would be lost in the absence of a beach.

[7] Stronge accomplishes this by taking the average of a "maximum" and "minimum" spending value. The maximum value is equal to total residential spending. The minimum value equals only the spending of frequent residential beach users, i.e., those users who visit the beach at least once a week in the summer or winter. This minimum value assumes that only the spending of the frequent beach users would be lost in the absence of a beach, because the occasional beach users would continue to spend their money on some other recreation activity or product. (Stronge and Schultz, 1997)

[8] Again, Stronge takes the average of the "maximum" and "minimum" estimates of beach related non-residential spending. The maximum value equals the total expenditures by non-residents visiting the beaches in Broward County. The minimum value equals expenditures of only those out-of-county tourists who say that they would not have come to Broward County if there were no beaches to visit. (Stronge and Schultz, 1997)

3.1.3 A Critique of the Recent Studies of the Benefits of Shore Protection Projects

While the study findings reported by Marlowe (1999) and others in the literature do suggest that beach nourishment projects offer economic benefits at the local, state and national levels, the results cannot be easily compared across studies (see Table 3.1). While at the most general level, Lent, Stronge, and King are all examining the same two types of economic effects, (i.e., the net regional economic impacts and the increase in value of beach related services), the specific effects they measure differ. For example, while Stronge and King estimate the economic value of storm damage protection provided by beaches, storm damage reduction are not considered in Lent's study.

Table 3.1 A Comparison of Beach Nourishment Economic Effects

Study	*Economic Value of Beach Services*	*Regional Economic Activity*
Lent (1998)—measures loss of economic benefits associated with shoreline erosion of Delaware beaches over a five year period.	1. Recreation—measured as loss in consumer surplus as fewer people visit the beaches to recreate. 2. Recreation – measured as diminished WTP for rental property as capitalized into property values.	1. Losses in economic activity in the state of Delaware due to reduced beach tourism expenditures.
Stronge (1997) – measures the economic impacts of beaches on Broward County, Florida.	1. Storm damage reduction to private properties and public infrastructure – measured as a property value premium. 2. Improved aesthetics – also measured as a property value premium	1. Increases in economic activity generated as higher income households occupy the area and produce higher levels of spending.
King (1997) – measures the economic effects of beaches on California's economy.	1. Value of beaches to tourists – includes a variety of beach related services. Economic value measured by beach user's stated willingness-to-pay to prevent erosion of the existing beaches. 2. Storm damage reduction to structures- as calculated by the Corps of Engineers for a case study in Oceanside, California using procedures established in the P&G.	1. They estimate the spending impacts of California beaches on the state economy.

In addition, the researchers have used different methods of analysis from one study to the next. For example, Stronge uses property value premiums as a measure of both the value of storm damage protection afforded to private structures and public infrastructure, as well as the aesthetic improvements associated with beach nourishment. The storm damage reduction benefits reported by King are calculated using the methods established by the Corps for calculating storm damage reduction NED benefits.

As another example, Lent measures the effects of beach tourism on the Delaware economy in terms of reductions in the number of tourists associated with beach erosion. Alternatively, Stronge assumes that the impacts of beach nourishment take the form of increased spending by beach residents, rather than by changes in the number of individuals visiting the beaches. Stronge reasons that nourishing Broward County beaches will result in higher valued properties occupied by higher income households that will spend more money than lower income residents.

Importantly, analysts that have estimated economic effects on the rest of the nation due to beach activities (such as income, employment, and tax revenue transfers) have used the perspective of the beach, county, region, or State in determining these effects. This is assumes implicitly that the impacts on the rest of the nation would not have otherwise occurred had the beach not existed. For example, people from Minnesota that go to a beach in Florida will not spend the money they would have spent at the beach, if the beach had to close (because of sharks, pollution, etc.). It is possible that they might go to the Bahamas instead, however, for a single beach the number of these beach visitors is probably small. It seems more appropriate to us, to count only those impacts occurring in the rest of the nation that are due to spending by foreign beach visitors. Similarly, we consider it appropriate to count only those economic effects occurring in a beach region that are due to spending by beach visitors who reside outside the beach region.

3.2 The Relationship Between National Economic Development and Regional Economic Development Benefits

The Federal objective in water project planning is defined in the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (Watt, 1983, p. iv) as monetary contributions to national economic development (NED). Contributions to NED are increases in the net value of the national output of goods and services. The project option with the largest net NED contribution is called the NED plan. The NED principle is first and foremost a Federal investment criterion. Its essential purpose is to determine whether construction of a water resource project by the Federal government is feasible. The NED principle articulates a framework to assist in making this decision. Inputs are required to produce these projects and inputs have value because we have the opportunity to use them for other purposes. Analyses are undertaken to assure that the value of the outputs (benefits) of Corps projects (for example, for storm damage reduction projects) is greater than the value of the inputs (costs) that are used to implement the projects. Therefore, the challenge is to decide how to use these inputs to achieve the greatest socially valued outputs after the costs have been accounted for.

One of the primary assumptions underlying the NED principle is that all resources (labor and non-labor) are fully employed. If all resources are fully employed, this means that all resources have alternative uses (i.e., they have opportunity costs). The significance of this assumption is that it provides a rationale for using market prices. To an economist, "full employment" of labor does not mean the absence of unemployment. It is generally recognized that there is some "normal" level of unemployment in the economy. Even when the economy is strong, with plentiful jobs, there are people who are unemployed because they are changing jobs or careers, moving to another part of the country, graduating from school, entering the work force for the first time, or reentering the workforce after some absence.

A practical consequence of assuming that all resources area fully employed is that national and regional economic impacts of projects that result from transferring resources from existing uses to the project (possibly from one part of the country to the project site) are also assumed to be zero on a national basis. Perhaps the most frustrating experience for any non-Federal partner is to hear that something that they know will benefit their community is not counted by the Corps because it is "regional economic" development, not "national economic" development.

Recreation is a major activity of many regions of the U.S. Shore front recreation and tourism activities (e.g., bathing, boating, fishing, and sightseeing) are vital economic components for many beach communities and States. Consider an example of a hypothetical beach community that has recently experienced a beach nourishment project. Further, assume that the expanded beach area will attract an estimated 150 thousand out-of-state visitors annually (many similar projects result in no increased visitation). However, for discussion purposes it is further assumed that people will spend an estimated $50 each, adding 7.5 million dollars to the local economy. The money will be spent on licenses, food, supplies, gasoline, lodging, etc. Part of this spending by visitors will become the income of local residents. The local residents will, in turn, spend this money in local barbershops, taverns, furniture and clothing stores, etc. creating income for these shop owners. And so it goes until the money initially introduced to the local economy leaks out through taxes, savings, and purchases outside the region. The $7.5 million brought into the region by the hypothetical new visitors would represent an increase in local sales that would eventually exceed the initial $7.5 million before these multiplier effects diminish.

It is because the multiplier effects can be so large relative to the size of the local economy that maintaining or increasing recreation visitation is so important to local people, businesses, and public officials. These are major economic effects that represent the very livelihoods of many local residents. It is not difficult to understand why they are often stunned and disappointed to learn that these very real and important effects are not

considered as project benefits. On the other hand, regional economic development (RED) effects are the changes in regional economic activity (often measured in terms of income and employment) that result from the NED options. Because RED effects are assumed to be the result of transfers of resources from one or more regions of the country to the project region, they cannot possibly contribute to the net value of the nation's output of goods and services (i.e., NED). Therefore, RED effects are not included in NED computations.[9]

3.3 Analyzing the National Economic Development Benefits Of Shore Protection Projects

3.3.1 National Economic Development Benefits of Shore Protection

Benefits from shore protection projects arise by reducing damages to coastal property and improvements. These are causes by erosion, water, and waves. Nourishment moves the shoreline seaward from property creating a sacrificial buffer for property reducing the frequency of erosion. This buffer dissipates wave energy before the waves reach structures. There are three major categories of national economic development (NED) benefits of shore protection projects: storm damage reduction benefits, other NED benefits, and recreation benefits. Since a project may protect against both storm damages from flooding and wave attack as well as erosion, it is necessary to evaluate the benefits of each type of protection to avoid double counting of benefits. Other NED benefits include reduced maintenance of existing coastal protection structures. Also, recreation benefits capture the value of enhanced recreational experiences by users of affected beaches as well as the value of the recreation experience for new visitors if there is an identified unmet demand for recreation in that area.

[9] Current NED procedures do allow for the use of the income of otherwise unemployed or underemployed workers to be included as a project benefit. However, not all income generated by a project is allowed to be counted as a project benefit. Because of identification and measurement problems and because unemployment is regarded as a temporary phenomenon, only the income of those onsite labor resources employed in the construction or installation of a project can be counted. This category of project benefit applies only to geographic areas that have annual rates of unemployment substantially above the nation average over an extended period of time.

Alternative project plans are formulated in a systematic manner to ensure that all reasonable solutions are evaluated. Usually, a number of alternative plans are identified early in the planning process and are refined in subsequent study iterations. Policy implementation guidance issued as a result of the Water Resources Development Act of 1986 (WRDA'86) specified that shore protection must be formulated for one purpose: i.e., to provide for hurricane/storm damage reduction. Any increase or enhancement of recreational opportunities that may also result is considered incidental. Such recreational benefits are considered NED benefits, and they should be included in the economic analysis. However, additional beach fill, beyond that needed to achieve the NED plan storm damage reduction purpose, or to better satisfy recreation demand is a separable recreational feature that is not an Administration budgetary priority.

3.3.1.1 Storm Damage Reduction Benefits

In many areas, damages caused by wave action causing the force of tons of water against beachfront structures can be the most significant coastal effect. Many benefits from storm damage reduction come from the reduction of inundation damages from coastal flooding. These benefits include the saving of structures and contents from flood and salt water damage and the reduction of clean-up costs, production losses, and flood fighting expenses.

Measures for reduction of beach erosion may also include tangible primary benefits. Damages due to shore erosion include physical losses of land and beach and associated damages to improvements such as roads, buildings, and other facilities. The loss of protective structures or an increasing threat of storm damage may cause owners to defer maintenance of existing structures or construction of new (replacement) facilities with resulting depression of economic values. Projects for the primary purpose of beach erosion control often result in incidental benefits for other purposes. These benefits, such as increased fish and wildlife habitat, reduction in shoaling at navigation projects, reduction in tidal flood damages, and incidental benefits to private property downdrift of

a shore protection project, could be evaluated and credited to the beach erosion control project.

3.3.1.2 Other NED Benefits

Other NED benefits of shore protection projects include reductions in emergency costs and reductions in the maintenance of existing structures. Emergency costs include both those expenses that result form the risk of a storm and those expenses that result form the storm itself. These include expenses for monitoring and forecasting storm problems, emergency evacuation, temporary relocation, administrative costs of disaster relief (but not the relief itself, that is a transfer), public clean-up costs, and increased costs of police, fire, and military patrol. Structures in the immediate vicinity of the shore may require more frequent maintenance because of recurring incidents of erosion. Benefits can be claimed to the extent that a project would reduce the extra maintenance.

3.3.1.3 Recreation Benefits

Recreational benefits are those benefits derived from the availability of beach recreational areas and the demand for use of those areas by residents and tourists. Recreational benefits are currently evaluated using the "unit day value" method, the similar projects method. the travel cost method, or the contingent value method.

The unit day value is intended to represent the users' average "willingness-to-pay" for a day of recreational activity at the site. When properly formulated unit day values are applied to the estimated beach use, under the with and without project conditions. The method inherently relies on professional judgment to arrive at a project-specific unit day value for both conditions. Consistent application of the procedure for each alternative being evaluated will produce meaningful estimates of value. When using the unit day value method, departure from the published range of values is not permissible.

This method applies a simulated market value to estimated annual beach use benefits. The simulated value is "judgmentally" derived from a range of values agreed to by Federal water resource agencies. Project specific values are estimated by applying a point system for various criteria. Under the point system, planners evaluate and assign points for each of the 5 criteria to determine the total points under with and without project conditions. Dollar values are identified for various recreation activities and total for each activity.

The travel cost method uses the variable costs of travel as a proxy for determining the net "willingness-to-pay" for consumption of recreation activities. According to this method, people have the option of enjoying a recreation day at many possible sites. Though the sites are similar (and can be considered substitutes) they each provide slightly different recreation opportunities. Individuals' recreation decisions reflect by the costs incurred and the benefits obtained from a site visit. These costs include travel expenditures and the value of time spent traveling. These costs decrease with proximity to the site. The travel cost method equates the implicit price of each site characteristic with the additional benefits its usage provides. By observing the pattern of site usage by individuals located different distances from the site, analysts can estimate a demand curve for the site.

The contingent value method differs from the travel cost method in that it does not rely on observed behavior to estimate benefits. Instead, surveys are used to elicit information about either an individuals' "willingness-to-pay" (WTP) or "willingness-to-accept" (WTA) payment for a change in some environmental characteristic of a project. Careful survey design is crucial to the validity of results by this method. While either the WTP or the WTA can be used to measure benefits, there is subtle but important difference between them. WTP answers the question, "Given the initial quality/quantity of an environmental attribute, how much would you be willing to pay to see a specific improvement?" WTA answers the question, "An improvement in environmental quality is going to take place. How much would you be willing to accept in lieu of the improvement?" Though estimated benefits are associated with the same environmental

change, the answers can diverge significantly depending on which measure is used. The accuracy of the contingent value method relies heavily on survey respondents being well informed. They must understand and be familiar with the commodity being valued. Also, when the survey is administered, the environmental change being evaluated must be explicitly stated. If the respondent's level of uncertainty is limited, the contingent value method can generate accurate estimates.

3.3.2 A Method for Distributing the NED Benefits of Shore Protection Projects: A Case Study

NED benefits were distributed between the beach region (defined to be the area encompassing the beach, its community, and the surrounding environs—usually the county or counties where the beach is located)[10] and the rest of the nation according to the residence patterns of those persons for whom the benefits accrue. For example, it is assumed that storm damage reduction benefits accrue to owners of those properties directly affected by the protection measures. Therefore, storm damage reduction benefits are distributed according to the residence patterns of the affected property owners. Similarly, it is assumed that project related recreation benefits accrue to the beach users. Accordingly, recreation benefits are distributed by the residence patterns of the beach users. The other NED benefits were assigned as "national". This is somewhat arbitrary, however, these benefits typically represent a small percentage of the total NED benefits.

3.3.2.1 Distributing the NED Benefits of a Shore Protection Project: A Case Study

Ideally, we would have preferred to analyze an existing or proposed shore protection project. However, we required a "case" study project that had information for both a NED analysis and a RED analysis. Project evaluation procedures used by the Corps would have allowed an analysis of the distribution of NED benefits for virtually any completed or current shore protection project. Because RED analysis does not contribute to the NED analysis of a project, RED analysis is not normally implemented as

[10] Some economic impact analysts use a convenient "commuting distance" concept for defining the beach region; e.g., a 30 or 50-mile radius.

part of the evaluation of a shore protection project. Consequently, information necessary to carry out a RED analysis (such as the spending patterns of beach visitors) is not normally available for Corps shore protection projects. Therefore, we chose to analyze a "hypothetical" shore protection project that provides storm damage reduction benefits, recreation benefits, and other NED benefits (i.e., emergency and maintenance cost reductions).

The beach area, its community, and the project evaluated here, although hypothetical, are configured to approximate "average" conditions and have project specific characteristics for projects usually evaluated by the Corps. The hypothetical project is located in a "Beach Community" (see Figure 3.1). The beach community has usual array of merchants, activities, and services found at many beach communities. The "hypothetical" beach nourishment project proposed for the beach will mitigate the expected erosion over the next several decades. The nourishment profile of the project beach is shown in Figure 3.2. The nourishment project is one mile long and will extend the existing beach by 100 feet. It is estimated that 600,000 cubic yards (CY) of sand will be required for the beach nourishment project.[11]

[11] Staff of the Wilmington District of the U.S. Army Corps of Engineers estimated that a typical mile long and 100 feet wide beach nourishment project would require 500,000 CY of sand for a "low" energy beach and 700,000 CY of sand for a "high" energy beach. We chose the middle value of 600,000 CY of sand for our "proposed" project to reflect a "medium" energy beach.

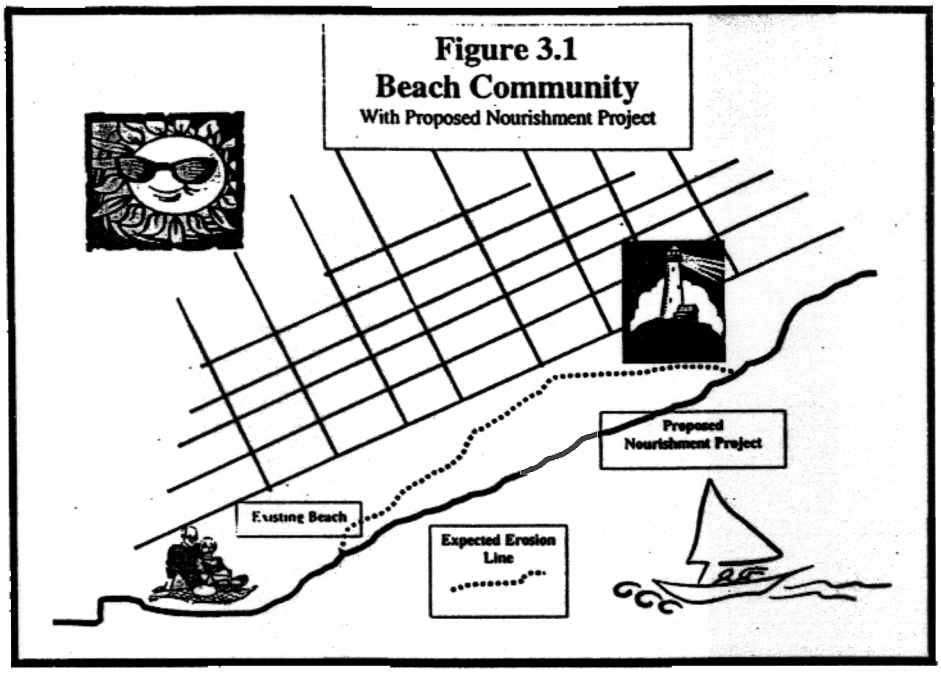


Figure 3.1
Beach Community
With Proposed Nourishment Project
Proposed
Nourishment Project
Existing Beach
Expected Erosion
Line

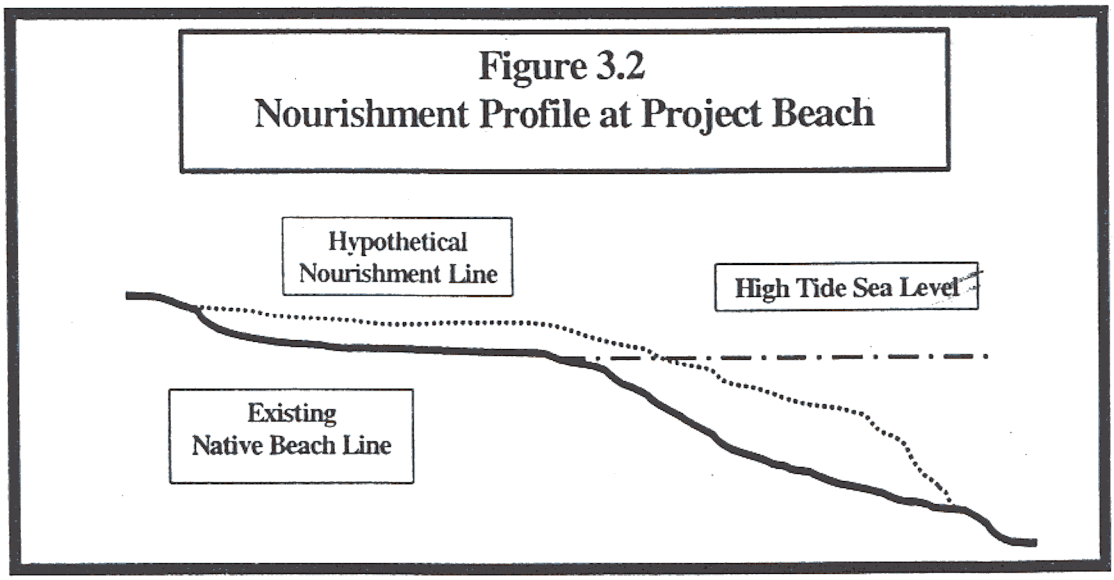


Figure 3.2
Nourishment Profile at Project Beach
Hypothetical
Nourishment Line
High Tide Sea Level
Existing
Native Beach Line

Table 3.2: Average Annual Benefits by Project ($/cubic yard in 2000 price levels)

Project Name	Project Price Year	Cubic Yards of Sand (000)	Average Annual Benefits per Cubic Yard of Sand			
			Storm Damage Reduction	Recreation	Other NED Benfits	Total Benefits
Harrison CO, MS	1948	5,700	$0.0000	$0.0000	$0.5691	$0.5691
Presque Isle, PA	1948	4,426	$0.0484	$0.4036	$0.0807	$0.5327
Channel Islands Habor, CA	1957	6,225	$0.2717	$0.0492	$0.0669	$0.3879
Long Island, Fire Is. To Montauk Pnt, Southampton to Beach Hampton , NY	1958	1,800	$4.0935	$0.4605	$0.0000	$4.5539
Carolina Beach & Vicinity, NC	1960	3,597	$0.3453	$0.2166	$0.0458	$0.6076
Oceanside, CA	1960	2,400	$0.1336	$0.0870	$0.0000	$0.2206
Wrightsville Beach, NC	1960	2,993	$0.2605	$0.0892	$0.0323	$0.3819
Fort Macon, NC	1961	93	$17.5563	$5.3691	$0.0000	$22.9253
Ventura-Pierpont, CA	1962	883	$0.8091	$0.3875	$0.0000	$1.1966
Surfside/Sunset, CA	1962	14,303	$0.7559	$0.1116	$0.0179	$0.8854
Fort Pierce Beach, FL	1962	718	$0.4535	$0.4979	$0.0000	$0.9514
Coast of CA, Point Mugu to San Pedro	1966	1,405	$0.0757	$1.6682	$0.0000	$1.7439
Hamlin Beach State Park, NY	1969	317	$0.0000	$3.2697	$0.0000	$3.2697
Long Lsland, Fire Island to Jones Inlet, NY	1970	4,123	$2.4134	$0.0000	$2.0980	$4.5113
Tybee Island, GA	1970	2,267	$0.0000	$0.6320	$0.0437	$0.6756
Brevard CO Cape Canaveral, FL	1972	1,250	$0.0000	$0.6789	$0.0330	$0.7119
Palm Beach CO Delray Beach, FL	1973	1,340	$0.3247	$1.3956	$0.0000	$1.7204
Rockaway, NYC	1974	6,364	$0.0384	$2.5311	$0.1860	$2.7555
Duval CO, FL	1974	2,486	$0.4940	$2.7370	$0.1293	$3.3608
Dade CO, FL	1974	14,601	$0.3464	$3.4388	$0.0682	$3.8534
Pinellas CO Treasure Island, FL	1974	600	$0.8790	$0.0000	$1.1410	$2.0201
Lakeview Park Coop, OH	1975	125	$0.0000	$10.3960	$0.0000	$10.3960
Broward CO, FL Segment 3	1976	3,070	$0.1439	$2.0495	$0.0084	$2.2018
Brevard CO, Indialantic/Melbourne, FL	1976	540	$0.0562	$5.6441	$0.0000	$5.7004
Grand Isle & Vicinity, LA	1976	2,870	$1.0012	$0.5567	$0.1794	$1.7374
Corpus Christi Beach, TX	1975	742	$0.0086	$4.3223	$0.0000	$4.3309
Broward CO, FL Segment 2	1980	1,030	$3.1083	$1.1463	$0.1359	$4.3906
Sherwood Island State Park, CT	1981	113	$0.3621	$11.9564	$0.0000	$12.3186
Pinellas CO, Long Key, FL	1984	253	$1.8211	$1.0088	$0.3406	$3.1706
Pinellas CO, Sand Key, FL	1984	2,707	$3.0074	$2.7435	$0.1727	$5.9235
Palm Beach CO, Lake Worth Inlet to South Lake Worth Inlet, FL	1986	875	$9.4901	$0.0000	$0.0000	$2.5605
Cape May Inlet to Lower Twp, NJ	1987	1,365	$3.3060	$0.9506	$0.1777	$4.4343
Maumee Bay, OH	1988	143	$0.0682	$25.8612	$0.0000	$25.9294
Great Egg Harbor & Peck Beach, NJ	1988	6,070	$6.2118	$1.3667	$0.0556	$7.6341
Revere Beach, MA	1988	670	$0.0000	$0.1412	$2.8430	$2.9842
Lee CO, Captiva Island, FL	1988	1,418	$0.9004	$0.5543	$0.0000	$1.4547
Ocean City, MD	1989	4,941	$3.7811	$0.1501	$0.0000	$3.9312
Folly Beach, SC	1990	3,100	$0.7926	$0.5963	$0.0000	$1.3889
Manatee CO, FL	1991	2,200	$2.2168	$0.1845	$0.0000	$2.4012
Cape Henlopen to Fenwick Island, DE	1995	1,437	$2.0468	$0.6636	$0.0228	$2.7332
Brevard County (North Reach), FL	1996	2,500	$1.3925	$0.4320	$0.0000	$1.8069
Brevard County (South Reach), FL	1996	1,645	$2.1210	$0.0814	$0.0000	$2.2024
Jones Inlet to East Rockaway Inlet, NY	1995	8,600	$1.9653	$0.2016	$0.0000	$2.2064
Cape Henlopen to Fenwick Island-Bethany Beach, DE	1998	1,458	$2.0106	$0.2844	$0.1509	$2.4532
Cape Henlopen to Fenwick Island-South Bethany, DE	1998	1,996	$0.9051	$0.1635	$0.1080	$1.1766
Broadkill Beach, DE	1996	1,305	$1.4776	$0.0000	$0.0000	$1.4776
Brigantine Inlet to Great Egg Harbor Inlet, NJ	1998	648	$1.3580	$0.2119	$0.0994	$1.6694
Oakwood Beach, NJ	1998	332	$1.6865	$0.0000	$0.4137	$2.1002
Reeds Beach and Pierces Beach-Reeds Beach, NJ	1998	78	$6.5445	$0.0000	$0.0000	$6.5486
Reeds Beach and Pierces Beach-Pierces Beach, NJ	1998	171	$0.8248	$0.0000	$0.0000	$0.8248
Townsends Inlet to Cape May Inlet, NJ	1997	4,447	$1.8097	$0.5276	$0.2970	$2.6344
Villas and Vicinity, NJ	1998	950	$0.3080	$0.0000	$0.0000	$0.3080
Raritan Bay and Sandy Hook Bay Hurricane, NJ	1999	379	$8.0114	$0.5344	$0.4935	$9.0393
Dare County Beaches North, NC	1999	4,300	$1.7611	$0.4432	$0.0336	$2.2378
Dare County Beaches South, NC	1999	8,040	$3.0581	$0.2499	$0.0465	$3.3544
Barnegat Inlet to Little Egg Inlet, NJ	1999	7,400	$1.1135	$0.2749	$0.1465	$1.5349

Source: Theodore M. Hillyer. 1996. Final Report: An Analysis of the U.S. Army Corps of Engineers Shore Protection Program, IWR Report 96-PS-1. Alexandria, VA: U.S. Army Engineer Institute for Water Resources (June). Project information listed in bold has been taken from project summary reports that have been submitted to the U.S. Army Chief of Engineers. These projects have been authorized thorugh legislation and may not have been completed.

To estimate NED benefits for the "proposed" project, we need estimates of the average annual benefits per CY of sand for each type of NED benefits. Table 3.2 provides estimates of annual average benefits per CY of sand by type of NED benefit estimate for both completed and currently authorized shore protection projects. Both storm damage reduction and other NED benefits are related to the total quantity of sand used for the nourishment project. Ideally, recreation benefits should be related to the area of the created beach (i.e., one mile long by 100 feet wide). However, Table 3.2 only provides CY of sand. Therefore, recreation benefits are related to the quantity of sand on the beach area (i.e., 137,000 CY of sand).[12] Based on the estimates provide in Table 3.2, the weighted average annual NED benefits per CY of sand, quantities of sand, and annual average benefits for each NED benefit category are:

Benefit Category	Benefit/CY	Sand (000CY)	Average Annual Benefits ($000)
Storm damage reduction	$1.5329	600	$920
Recreation	$4.4431	137	$609
Other NED	$0.2045	600	$123
Total benefits			$1,651*

*Total shown does not equal sum of benefits due to rounding.

The region in which the beach and its community is important for the RED analysis because much of the goods and services needed for the beach merchants to operate are provided by the firms located in the region and because many of the employees working at the beach find their residences there also. A beach region was chosen to reflect the "typical" attributes and conditions of regions where a majority of Corps shore protection projects are located.

[12] Corps District staff at Wilmington, NC indicated that a typical depth of sand on the beach area (one mile long and 100 feet wide) varies between 4 feet deep and 10 feet deep.

A "typical" beach region was chosen based on an existing coastal county that contains an actual beach. Demographic data for this county were collected from the 2000 Census of Population. Economic data for the county was provided by the most recent (1999) release of the Regional Economic Information System at the U.S. Bureau of Economic Analysis. Data shown in Table 3.3 paint an interesting picture of our "typical" beach area. For example, it has a moderate population of almost 60 thousand inhabitants with an average density a little less than 115 people per square mile. There are about 41 thousand housing units, a lot compared to the number of inhabitants. However, almost one-third of the housing units are normally vacant for seasonal, recreational, or occasional use. This is consistent with a region that is significantly dependent on beaches. Economically, workers in this county currently earn, on average, about $20,000 in wages and salaries per year. Retail trade and services establishments are the major employers in this county, employing almost half of all jobs found in the county. About 12 percent of the workers employed in local jobs commute from residences located outside the county. It is estimated that 35.1 percent of the county's property owners also live in the county. Approximately 41 percent of the beach users live within the county and 14.1 percent are from places outside U.S.

Two other coastal counties were chosen to provide contrasting attributes and characteristics. The purpose of the contrasting coastal counties is to provide the bases for comparing the results for our "typical" beach region with those if the beach were located in a very rural region of if the beach were found in a highly urban beach region. In other words, they were chosen to test the sensitivity results to conditions much different than for the "typical" beach region. Rural regions are different than the "typical" region because they tend to be more agriculturally oriented, less sparsely populated, and the firms would be expected to provide fewer goods and services required at the beach. Urban regions, on the other hand, would be more economically diverse, more densely populated, and the firms would be expected to supply more of the goods and services needed at the beach as compared with the "typical" beach region. It is expected that the "multiplier" effects of beach activities to be smaller for the rural beach regions and larger for the urban beach regions than for the "typical" beach region.

Table 3.3: Regional Profiles of Three Beach Regions

Characteristic	Regions by Level of Economic Development		
	Typical	Rural	Urban
2000 Census of Population			
Total population (number)	59,400	29,900	160,300
Median age (years)	42.3	40.4	36.3
65 years and over (percent)	17.2%	13.8%	12.8%
Total households (number)	25,200	12,700	68,200
Average household personal income (dollars)	$59,408	$59,258	$63,419
Total housing units (number)	40,900	26,700	79,600
Occupied (percent)	61.6%	47.6%	85.6%
Vacant for seasonal, recreational, or occasional use (percent)	32.6%	50.1%	5.5%
Land area (square miles)	520	384	200
Density (people per square mile)	114.2	78.0	801.5
BEA profile (1999)			
Personal income (thousands of dollars)	$1,448,400	$728,100	$4,184,500
Average earnings per job (dollars)	$19,900	$20,500	$28,300
Total full-time and part-time employment (number)	31,700	24,500	109,400
Employment by sector (all percent)			
Wage and salary employment	75.2%	75.0%	84.9%
Proprietors' employment	24.8%	25.0%	15.1%
Farm proprietors' employment	0.4%	0.0%	0.1%
Nonfarm proprietors' employment	24.5%	25.0%	15.0%
Private employment	84.5%	89.1%	85.8%
Ag. services, forestry, fishing, & mining	4.8%	4.7%	1.4%
Construction	8.6%	11.2%	8.6%
Manufacturing	6.4%	2.8%	8.4%
Transportation and public utilities	3.4%	2.2%	4.0%
Wholesale trade	3.0%	2.1%	3.9%
Retail trade	24.6%	28.2%	22.0%
Finance, insurance, and real estate	9.1%	14.6%	7.7%
Services	24.5%	23.4%	29.7%
Government and government enterprises	15.5%	10.9%	14.2%
Workers that live locally (percent)	88.0%	82.0%	80.0%
Beach parameters			
Property owners that reside locally (percent)*	35.1%	46.1%	53.6%
Beach users: Local (percent)	41.0%	60.8%	29.0%
Rest of state (percent)	13.0%	9.9%	16.0%
Rest of U.S. (percent)	31.9%	8.9%	38.2%
Foreign (percent)	14.1%	8.9%	16.8%

* Computed as the percent of housing units that are owner-occupied adjusted for homeowner vacancy rate

It is interesting to note several of the common and contrasting demographic and economic characteristics that the rural and urban regions have with our "typical" beach region (Table 3.3). For example, compared with the "typical" beach region, the rural region has a much higher share of its housing stock that is vacant for seasonal use while the urban region has a much lower share of its housing stock that is vacant for seasonal

use. Both the rural and urban regions have larger percentages of workers commuting from residences outside their respective counties than does the "typical" beach region. Similarly, the percentages of the property owners that reside locally (within the county) are greater for both of the contrasting coastal counties than for the "typical" beach region. In comparison with the "typical" region, the percentage of beach users that reside locally is much larger for the rural region and much smaller for the urban region. The percentage of beach users that are foreign residents is lower for the rural region and higher for the urban region as compared with the "typical" beach region.

Table 3.4: Distribution of National Economic Development Benefits of Shore Protection Project (Medium Energy Protection) With No Additional Recreation Demand (000 dollars in 2000 prices)

	Beach Area Benefits	Rest of Nation Benefits	Total NED Benefits	Benefits ($/CY) of Sand	Sand (000 CY)
Typical Beach Region					
Storm damage reduction	$323	$597	$920	$1.5329	600
Recreation for existing demand	$250	$359	$609	$4.4431	137
Other	$0	$123	$123	$0.2045	600
Total	$572	$1,079	$1,651		
Regional distribution	34.7%	65.3%			
Rural Beach Region					
Storm damage reduction	$424	$496	$920	$1.5329	600
Recreation for existing demand	$370	$239	$609	$4.4431	137
Other	$0	$123	$123	$0.2045	600
Total	$794	$857	$1,651		
Regional distribution	48.1%	51.9%			
Urban Beach Region					
Storm damage reduction	$493	$427	$920	$1.5329	600
Recreation for existing demand	$177	$432	$609	$4.4431	137
Other	$0	$123	$123	$0.2045	600
Total	$670	$982	$1,651		
Regional distribution	40.5%	59.5%			

The distribution of NED benefits was computed using the beach parameters for the "typical" beach region found in Table 3.3. As previously explained, storm damage reduction benefits are distributed according to the residence patterns of property owners and recreation benefits are distributed by the residence patterns of the beach users. Other NED benefits are assigned to the "rest of the nation" region. These computations are

shown in Table 3.4. The results for the "typical" beach region indicate that approximately one third the NED benefits accrue to persons residing within the beach region and two thirds accrue to persons in the "rest of the nation" region. If the beach had been located in a rural region, then just under a half of the NED benefits would accrue to local residents. However, if the beach had been located within an urban region, then a little more than 40 percent of the NED would have accrued to local residents.[13]

It should be noted here that these results should be considered and used with a great deal of care because the distributional results are highly sensitive to the specific beach parameters used to distribute the NED benefits. One critical factor in determining the distribution of storm damage reduction NED benefits is the proportion of property owners that reside locally. The estimated value of this parameter for the three regions is an average for the entire region, not just for the immediate beach area. The residence pattern of the property owners at the beach could be quite different than for the region as a whole. For example, in a study of Delaware's beaches the researchers found that 27.6 percent of the beach property owners resided locally (within the region surrounding the beach).[14] If we use this value for the proportion of property owners residing locally, rather than the 35.1 percent value found in Table 3.3 for the typical region, then the 30.5 percent of NED benefits would accrue to residents of the "typical" beach region. All of this means that if accurate evaluations of the distributions of NED benefits for shore protection projects is desirable, then it is necessary to acquire "good" estimates of critical parameters like the proportion of property owners that reside locally based on site-specific values (probably those that are based on survey results).

[13] Interestingly, a similar distributional pattern of NED benefits is found for "low" and "high" energy beach protection. Tables F.1 and F.2 report the distributional patterns for the "low" and "high" energy beach protection simulations.

[14] Linda Lent and Christopher Jones in *The Economic Effects of a Five Year Nourishment Program of the Ocean Beaches of Delaware*. A Final Report for the Delaware Department of Natural Resources and Environmental Control. Bethesda, MD: Jack Faucett Associates (March 1998).

3.3.2.2 Extending the Case Study to Consider Induced Recreation Visitation

So far the case study has not identified whether the proposed beach nourishment project will affect recreation uses of the nourished beach. A telephone survey of the staff of Corps of Engineers Districts that have shore protection projects indicates a mix of professional opinions and experiences concerning whether nourishment projects induce increased visitation for the beaches beyond expected recreational visitation growth without the project. Some staff members indicated that they did not observe any increase in beach usage after beaches were nourished and others said that they did find that beach use increased moderately after a nourishment project (for one project it was indicated that there was a rather large increases in beach use—as large as 25 percent).

We extended the case study to consider the effects of incremental increases in beach use on the distribution of NED benefits. The increments considered are 0, 5, 10, 15, 20, and 25 percentage increases in beach use due to the proposed beach nourishment project. We estimate these increases in beach use based on the capacity of the proposed nourished beach (i.e., one mile long and 100 feet wide). The usual way to determine the capacity of a beach is to assume that each person optimally requires 100 square feet of beach space in order to feel comfortable. In addition, it is assumed that each 100 square foot space has a "turn-over" rate of 2, meaning that it is expected that people spend half a day actually on the sand. If the space of the proposed nourished beach is fully occupied, then it can handle 10,560 beach visitors each day it is used. A 5 percent increase in beach use in relation to the beach capacity means that 5 percent of the beach capacity is used by new visitors, an increase of 528 visitors. We assume that the capacity of the beach is only critical during peak days of the "beach season" (between Memorial Day and Labor Day). It is assumed that increases in beach use are easily accommodated during the non-peak days of the year by the existing beach capacity. That is, NED benefits are only claimed for the peak days. Data from the Corps of Engineers District Office at Wilmington, NC indicate that there are 30 peak days during the beach season (these

include weekends and holidays). This means that 5 percent increases in beach use during the 30 peak days is an increase of 15,840 beach visits.

Table 3.5: Distribution of National Economic Development Benefits of Shore Protection Project (Medium Energy Protection) With Varying Recreation Demand, Unit-Day Value is $2.00 (000 dollars in 2000 prices)

	Beach Area		Rest of the Nation		Total NED	
	Benefits	%	Benefits	%	Benefits	New Visits
Typical Beach Region						
No increase in beach use	$572	34.6%	$1,079	65.4%	$1,651	0
5% increase in beach use	$585	34.8%	$1,097	65.2%	$1,682	15,840
10% increse in beach use	$598	34.9%	$1,116	65.1%	$1,714	31,680
15% increase in beach use	$611	35.0%	$1,135	65.0%	$1,746	47,520
20% increase in beach use	$624	35.1%	$1,154	64.9%	$1,778	63,360
25% increase in beach use	$637	35.2%	$1,172	64.8%	$1,809	79,200
Rural Beach Region						
No increase in beach use	$794	48.1%	$857	51.9%	$1,651	0
5% increase in beach use	$813	48.3%	$869	51.7%	$1,682	15,840
10% increse in beach use	$833	48.6%	$882	51.4%	$1,715	31,680
15% increase in beach use	$852	48.8%	$894	51.2%	$1,746	47,520
20% increase in beach use	$871	49.0%	$907	51.0%	$1,778	63,360
25% increase in beach use	$890	49.2%	$919	50.8%	$1,809	79,200
Urban Beach Region						
No increase in beach use	$670	40.6%	$982	59.4%	$1,652	0
5% increase in beach use	$679	40.3%	$1,004	59.7%	$1,683	15,840
10% increse in beach use	$688	40.1%	$1,027	59.9%	$1,715	31,680
15% increase in beach use	$697	39.9%	$1,049	60.1%	$1,746	47,520
20% increase in beach use	$706	39.7%	$1,072	60.3%	$1,778	63,360
25% increase in beach use	$715	39.5%	$1,094	60.5%	$1,809	79,200

The next step in considering the effects of induced beach visitation on the distribution of NED benefits of shore projects is to determine an average monetary value for each of the new beach visits. The results of the telephone survey of Corps District staff that have evaluated shore protection projects indicated that they have used both the "unit day" value and the "travel cost" methods for evaluating the value of recreational experiences at beaches. The "with-project" user values used by Corps staff ranges from $2.00 per day to $5.17 per day (2000 price levels). Other State and Federal agencies use unit-day values that would indicate that the Corps of Engineers might be undervaluing the experience-value of beaches. One agency, the National Oceanic and Atmospheric Administration (NOAA) has used a unit-day value as high as $17.38 (2000 price levels) in their 1993 American Trader Law Suite due to a Southern California oil spill.[15]

[15] The unit-day value that NOAA used was provided by David Chapman of NOAA.

Using a with-project daily unit-day value of $2.00 per person distributions of NED benefits were compute for each increment of increased recreational beach use (i.e., 0, 5, 10, 15, 20, and 25 percentage increases). These computations for the typical beach region are shown in Table 3.5. The basic notion is that NED benefits get larger as the beach use increases, however, the distribution of NED benefits between the beach region and the rest of the nation does not change much. Also the relationships between distribution of NED benefits for our typical beach region and the distributions for the rural and urban regions also do not change (results also found in Table 3.5). Similar tables (Tables F.3 though F.10) provide results for variations in the selection of recreation values and for differences in the wave intensity at the beach.

3.4 A Framework for Evaluating the Regional Economic Development Benefits of Shore Protection Projects

Regional economic effects of recreational activities are interesting and their magnitudes can be quite startling at times. Recent studies of the regional economic effects due to beach related activities in the literature provide a variety of measures that could be interpreted as regional benefits, such as income, employment, sales, or tax revenues. For example on the West Coast, California's beaches experienced more days of visitor attendance in 1996 than all of the State's other tourist attractions combined—including Disneyland. Beach tourists' spending contributed more than $10 billion directly to the State and almost another $17 billion indirectly. This amounted to almost 3 percent of the State's total economic activity. Beach tourism is responsible for a half million of California's jobs and $1 billion in State sales, income, and gasoline tax revenues.[16] On the East Coast. Delaware receives 5.1 million "person trips" each year where just 21,000 people reside in beach communities. Another 373,000 people live within easy access to the State's beaches. Beach tourism generates $173.2 million in spending within the State each year. With a significant erosion problem, it is estimated that Delaware's beaches will lose over 471,000 visitor-days a year if the erosion continues. The loss in the State's tourism is expected to climb to over 516,000 visitor-

[16] Data are from a study by the University of San Francisco's Public Research Institute (King and Potepan, 1997).

days per year after 5 years of erosion. During this five-year period, beach erosion will cost an estimated $30.2 million in consumer expenditures, the loss of 625 beach area jobs, and the reduction of wages and salaries by $11.5 million. Business profits will drop by $1.6 million and State and local tax revenues will decrease by $2.3 million.[17]

3.4.1 Defining Regional Economic Development Benefits

The problem is that there is no generally accepted definition and measure of "regional benefit". The "Principles and Guidelines" (1983, p. 11) defines regional economic development benefits as the regional income and employment that result from each alternative project plan. Unfortunately, the term "income" is not further refined to aid analysts as to its meaning or intent. Income could mean "wages and salaries". In addition to wages and salaries, it might also include "proprietors' income" or may even be more broadly defined. The same lack of definition for income also plagues many of the academic and professional economic impact studies of beaches. For the present analysis, we define "regional income" as broadly as possible and we use changes in regional income as measures for changes in regional benefit.[18]

The gross domestic product (GDP) is one of the broadest and most widely used measures of the overall health of an economy and the well being of its citizens.[19] The GDP is the sum of the value of all goods and services that are produced to meet the demands of the economy's citizens, investors, governments, and foreign buyers. Against this production, the GDP also measures the nation's income payments and other factor costs. GDP and its components are compiled and presented as a set of national income and product accounts (NIPA). The basic purpose of the NIPA is to provide a coherent and comprehensive picture of the Nation's economy. The account shows the composition of production and the distribution of the incomes that are earned in the

[17] March 1998 study by Jack Faucett Associates (Bethseda, MD) in cooperation with independent consultants Linda Lent and Christopher Jones for the Delaware Department of Natural Resources and Environmental Control.

[18] We report employment and output effects, however, we use income as defined above as the basic measure of regional benefit.

[19] Much of the discussion presented here is based on that given by Seskin and Parker (1998).

process of production. In the NIPA, production consists of goods, services, and structures that are produced during the current period.[20] The NIPA is a double-entry account that provides a comprehensive and unduplicated measure of economic activity within a consistently defined framework. Together with a set of similarly configured regional accounts, the NIPA can be used to trace the principal economic flows among the major sectors and regions of the economy.

Figure 3.3
Summary National Income and Product Accounts

Gross Domestic Product	Gross Domestic Product
Equals	Equals
Wages and salaries	Personal consumption expenditures
Plus profits	Plus gross private investment
Profits tax	Fixed private investment
Dividends paid (net)	Change in business inventories
Undistributed profits	Plus net exports of goods and services
Plus proprietors' and rental income	Exports
Plus net interest	Imports
Plus indirect business taxes	Plus government purchases
Plus other charges against production	

The basic configuration of the NIPA (Figure 3.3) is a double-entry account that shows, on the right side, gross domestic product is measured by the sum of goods and services produced in the United States and sold to final users and, on the left side, GDP is

[20] Gains and losses from the sale of non-produced assets, such as land, from the sale financial assets (e.g., stocks and bonds), or from holding goods in inventory are not included because they were not produced during the current period.

measured by the incomes earned in production (including a "statistical discrepancy" between the two measures.[21] Intermediate purchases by business that are used to produce other goods and services are excluded from the NIPA and GDP. On the left side, the entries represent payments to factors of production; i.e., wages and salaries, profits, proprietors' and rental income, net interest, indirect business taxes, and other charges.[22] On the right side, the entries measure the value of production that is sold to final users; i.e., purchases by persons, by business for investment, by governments (Federal, State, and local), by foreign citizens (exports) for U.S.-made goods and services, and by U.S. residents for foreign-made goods and services (imports). It is important to note that GDP can be measured using by either the income or product sides of the NIPA. This provides a method evaluating the "beneficial" effects of project impacts. It is often difficult, because of data limitations, to determine whether the subsequent direct and indirect sales generated due to recreational projects represent sales to final users or to intermediate producers (i.e., from the product side).

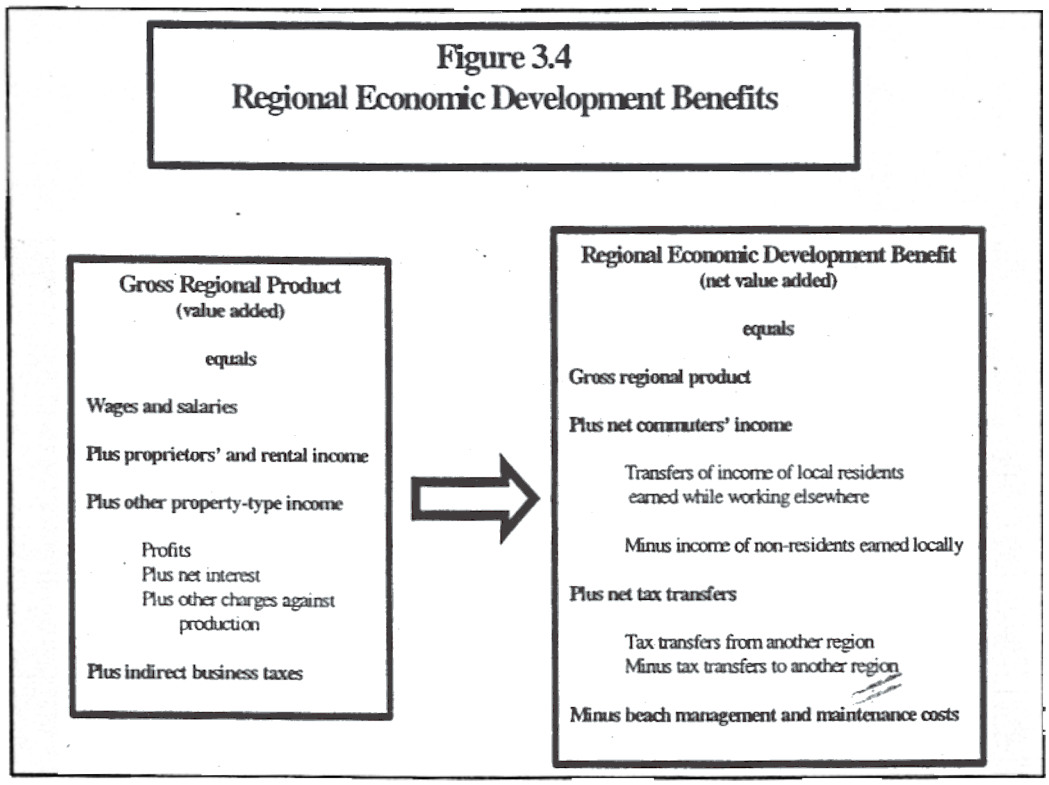
On a regional level, gross regional product (GRP) is analogous to gross domestic product. For states, this is called "gross state product" or GSP (Friedenberg and Beemiller, 1997). In concept, the GRP for an industry is equivalent to its gross output (sales or receipts and other operating income, commodity taxes, and inventory change) minus its intermediate inputs (consumption of goods and services purchased from other U.S. industries or imported). As a result, GRP is the regional counterpart for the Nation's gross domestic product. In practice, GRP measures the sum of costs incurred (such as compensation of employees, net interest, and indirect business taxes) and the profits earned in production—see the left-hand side of Figure 3.4.[23] Often, these items are called

[21] The National Income and Product Account is one of several accounts that comprise the full set of National Accounts. Other accounts that are compiled are the Personal Income and Outlay Account, the Government Receipts and Expenditures Account, the Foreign Transactions Account, and the Gross Saving and Investment Account. Efforts are also made to compile several related ancillary accounts; for example, the National Input-Output Accounts and the Gross State Product Accounts.

[22] Other charges include business transfer payments, consumption of fixed assets, and net income from the rest of the world. See Appendix B for a complete listing and detailed definition of the components of GDP from the income side of the accounts.

[23] GRP includes, in concept, all income items found in gross domestic product except for the statistical discrepancy. The statistically discrepancy is not often allocated to regions because of insufficient information.

"value added". Data on the income side of the income and product account are readily available from both public and commercial sources at many levels of geography (i.e., GSP for states and GRP for local areas).[24] Most available regional input-output models are configured to generate impact estimates based on the GRP concept. As a result, if appropriately implemented regional economic impact estimates can be provided to address changes in GRP due to project-related beach recreation activities.



[24] The U.S. Bureau of Economic Analysis compiles and publishes Gross State Product data. The Minnesota IMPLAN Group makes these data commercially available for counties.

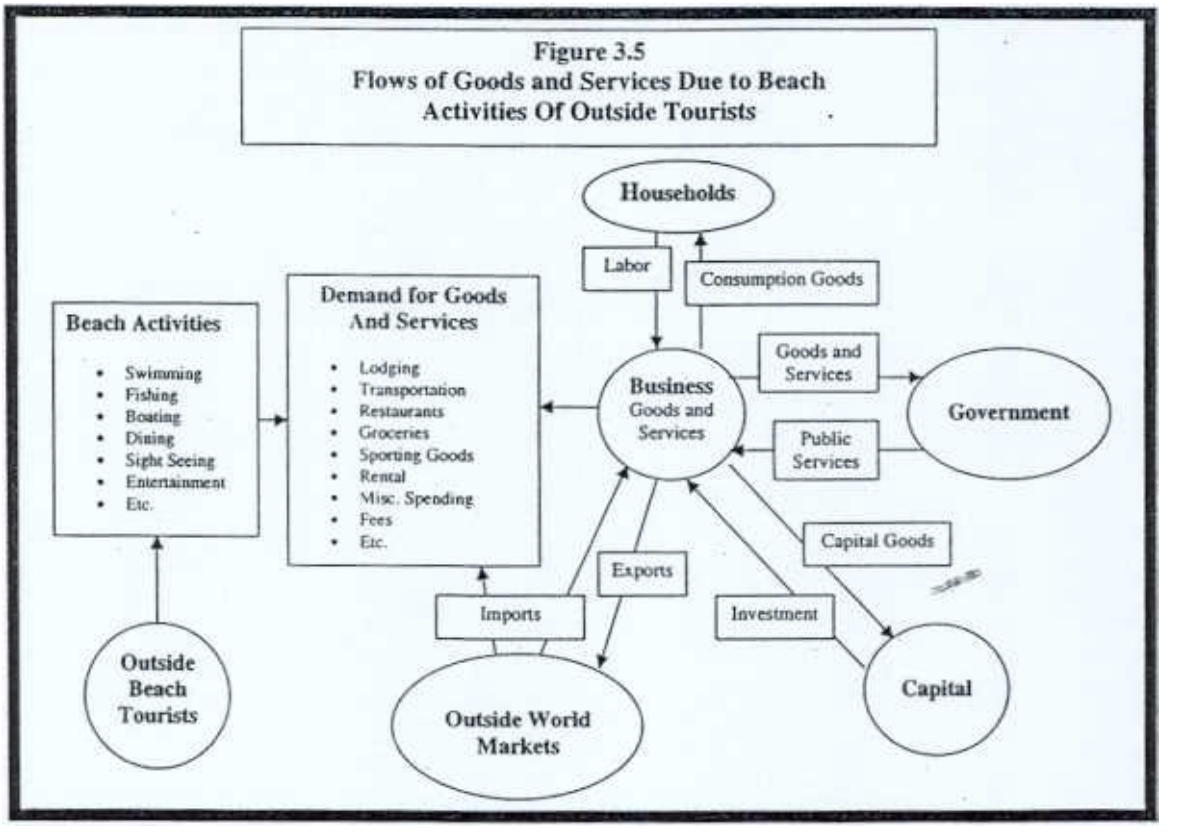
Changes in gross regional product measure the changes in the overall level of economic activity within a region. However, regions are more "open" than their national counterpart. This means that workers good and services flow through and between geographic areas almost without notice or measurement in the United States. Employees can work in one region and commute from residences in other areas. When this happen the income they earn commutes with them. Also, the wages and salaries earn are taxes by Federal and most State governments. Excise and sales taxes are collected by State agencies. In addition, beach communities are responsible for managing and maintaining beach areas for the tourists to enjoy The management and maintenance activities include, among other things, cleaning beach areas, employing lifeguards and safety personnel, providing parking facilities and other beach infrastructures, and floating bonds for required for future beach related investments. These commuting and tax revenue transfers from beach regions to other areas of the nation and maintenance requirements need to be accounted for our regional economic development framework. These adjustments to gross regional product are shown in the right-hand side of Figure 3.4. Our measure of regional economic development (RED) benefits is the change in "net value added" or GRP plus net commuters' income, plus net tax transfers, and minus beach management and maintenance costs.

3.4.2 Estimating Regional Economic Development Benefits

Most analysts estimate the regional economic effects of recreational activities—including beach recreation activities—using a variation of a simple methodological approach described by Propst, Stynes, Chang, and Jackson (1998). Four factors must be estimated and multiplied together to determine the economic impacts of visitor spending on a region; (1) the number of visits per year, (2) the spending per visitor; (3) the capture rate, and (4) the regional economic multiplier.

Economic Impact = # of visits x spending per visit x capture rate x regional economic multiplier

Each of the components of the economic impact will be discussed in greater detail below. However, to introduce the reader to the basic concepts behind economic impact analysis, the meaning of the components and a simple example will be presented here. See Appendix D for a more detailed discussion of several important issues related to estimating regional economic impacts.[25]



[25] Appendix D includes discussions of input-output analysis, estimating capture rates, defining regions for economic impact analysis, and regional economic impact modeling frameworks other than input-output sis.

Beach economies are complex systems of relationships between tourists, local merchants, other nearby businesses, workers, public and private institutions (e.g., governmental agencies), and related business entities outside the region surrounding the beach area. Figure 3.5 attempts to capture the essence of these relationships in graphical form. Suppose, for example, that 250,000 people visit the beach during a year (the first component of the impact formula). In a simplified manner, the way in which the beach economy works is that tourist come to the beach to participate in one or more recreational and related activities such as swimming, sun bathing, fishing, boating, and sight seeing. They may also dine in one of the fine restaurants or buy groceries and have a picnic. Camping facilities and local hotels and motels are often used for overnight visits.

While participating in these activities, tourists will frequently shop in local stores in order to purchase needed goods and services that will enhance their activities. These purchases may include a wide variety of commodities such as sporting goods (rods, reels, bait, etc.), groceries (for example, bread, milk, seafood, and snack foods), clothes (e.g., tee shirts and swim suits), or film and film development. In addition, the visitors may need to rent a car or a boat. They will usually need to purchase gas with these rental items. Based on a Texas study of a "typical" beach area, each tourist spends an average of $88 for goods and services at the beach and within the surrounding region (the second component of the economic impact); Fesenmaier, etal (1987). Together, the product of the first two impact components is the total amount of spending that beach visitors bring into the beach area. For our example, the beach visitors spent $22,000,000 (250,000×$88) during the year for goods and services within the beach area in conjunction with their beach activities.

The third component of the economic impact (the capture rate) is the rate at which the beach area is able to capture the money being spent by beach visitors. It is not hard to understand that everything purchased at the beach may not be made in the beach region. This is shown as imports of goods and services from sources outside the region that are, in turn, sold directly to the beach tourists. For example, a beach tourist might purchase a

t-shirt from a local vendor. The shirt may be made in a factory someplace other than the beach (e.g., in Mississippi). However, the service provided by the local merchant while selling the shirt to the tourist was provided within the beach area. So, the capture rate can be any number between zero and one. A capture rate such as 0.3 means that 30 percent of the money spent by visitors at the beach is captured by the area's businesses. Higher capture rates indicate that the respective region is able to supply more of what beach tourists want during their visits. In many economic impact studies, the "direct effect" of visitor spending is equal to the capture rate times the total visitor spending; i.e., the direct spending effect for our example is $6,600,000 (0.3 × $22,000,000).

Finally, the fourth component of the economic impact is the regional economic multiplier. The regional economic multiplier provides an estimate of economic circulation—or ripple effect—within the local economy (e.g., see the "spider web" formation in Figure 3.5). For example, a regional economic multiplier of 2.5 means that an original stimulus of $1— or the direct spending effect—will continue to circulate as an indirect effect throughout the local economy 1.5 times beyond the original stimulus (2.5 – 1.0). This means that the total spending effect of beach activities on the local economy for our example is $16,500,000 (2.5 × $6,600,000) while the indirect beach spending effect is $9,900,000 (1.5 × $6,600,000).

3.4.3 A Method of Distributing RED Benefits of Beach Recreation Activities

Distributing the RED benefits of shore protection projects is somewhat more complicated than distributing the NED benefits. The economic impacts that have their source within a beach region not only affects economic activity within the region but also places quite distant from the beach. For example, a rod and reel purchased from a "bait and tackle" shop at the beach not only provides income for the employees and owners of the shop, the purchase also affects the incomes of the employees and owners of the manufacturing plant that made the rod and reel as well as the trucking company the hauled the rod and reel from the plant to the merchant's shop. However, if the tourist that bought the rod and reel and the bait shop would have gone to a lake to fish and purchased

a rod and reel there, then the economic effects at the manufacturing plant would occur anyway. For the nation as a whole the two scenarios are very much the same. However, in this case, the income generated at the beach bait shop would not take place. Consequently, it is not appropriate to count the effects at the rod and reel manufacturing plant as part of a "rest of the nation" regional economic development benefit. More generally this kind of "double counting" is precisely what is attributed as a national effect in many regional economic impact studies of beach activities.

There are several assumptions made here that can affect the distribution of RED benefits. First, for RED benefits only, it is assumed that the unemployment rate is not zero.[26] This assumption permits the positive regional economic effects of beach activities within the beach region without having to also estimate the corresponding negative regional economic effects in the rest of the nation region.[27] To some extent, this is not that critical because so many of the beach workers are students and spouses. These workers are often only in the workforce for the summer season.

Second, we assume that the proportion of income that people spend will not change if a beach is not available for their use. That is, money spent at the beach would otherwise be spent on some other activity or for some goods and services. This assumption has some basis on the national level. Table 3.6 presents personal income data published recently by the U.S. Bureau of Economic Analysis.
The personal income and expenditure data indicates that people in the U.S. spend approximately 80 percent of their annual personal income with little variation over the period 1960 to 2000. The practical consequence of this assumption is that only the impacts of beach visitors from outside the region under consideration can be counted as its regional economic development benefits.[28]

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[26] A zero unemployment rate assumption is commonly used for computing NED benefits.
[27] That is, the resources necessary for the positive effects in the beach region are available without requiring reductions due to their leaving one productive activity for another.
[28] One exception to this assumption comes from the situation in which the local beach user substitutes the local beach for a beach outside the beach region. Another exception is the case where the domestic beach user would travel outside the nation if the beach were not available.

Table 3.6: Disposition of U.S. Personal Income (billions of dollars in current prices)

Year	Personal Income	Personal Taxes & Nontax Payments	Personal Outlays	Personal Savings	Percent of Personal Income	
					Outlays	Savinngs
1930	$76.5	$1.9	$71.3	$3.2	93.2%	4.2%
1935	$60.5	$1.3	$56.6	$2.6	93.6%	4.3%
1940	$78.6	$1.9	$72.2	$4.5	91.9%	5.7%
1945	$171.9	$19.8	$120.8	$31.4	70.3%	18.3%
1950	$229.9	$19.3	$195.4	$15.2	85.0%	6.6%
1955	$316.8	$33.4	$263.8	$19.5	83.3%	6.2%
1960	$412.7	$46.6	$339.8	$26.4	82.3%	6.4%
1965	$557.4	$58.4	$456.2	$42.7	81.8%	7.7%
1970	$841.1	$104.6	$667.0	$69.5	79.3%	8.3%
1975	$1,331.7	$150.3	$1,056.2	$125.2	79.3%	9.4%
1980	$2,323.9	$304.2	$1,814.1	$205.6	78.1%	8.8%
1985	$3,515.0	$428.5	$2,803.9	$282.6	79.8%	8.0%
1990	$4,903.2	$609.6	$3,959.3	$334.3	80.7%	6.8%
1995	$6,200.9	$778.3	$5,120.2	$302.4	82.6%	4.9%
2000	$8,319.2	$1,288.2	$6,963.3	$67.7	83.7%	0.8%

Source: U.S. Bureau of Economic Analysis. 2001. Table 4--National Income and Disposition of Personal Income. *Survey of Current Business* (August) page 137.

The personal income and expenditure data indicates that people in the U.S. spend approximately 80 percent of their annual personal income with little variation over the period 1960 to 2000. The practical consequence of this assumption is that only the impacts of beach visitors from outside the region under consideration can be counted as its regional economic development benefits.[29] For example, the net value added impacts that occur within the beach region due to visitors from places outside the beach region are counted as the RED benefits for the beach region. Similarly, the net value added impacts that occur within the "rest of the nation" region due to only the foreign beach visitors are counted as the RED benefits for the "rest of the nation" region.

[29] One exception to this assumption comes from the situation in which the local beach user substitutes the local beach for a beach outside the beach region. Another exception is the case where the domestic beach user would travel outside the nation if the beach were not available.

Another reason for considering only net value added impacts due to beach users from places outside the region being considered is that the regional economic impact models used here to compute the value added impacts treat the income generation and consumption process as "endogenous" to the model.[30] The importance of this distinction type of beach user rests on the fact that purchases by beach users from outside the region are considered exports for local businesses while purchases by local beach users are considered as part of their normal consumption expenditures This means that, for the case of the beach region, the local consumption of beach related activities is a personal consumption activity and is already accounted for by the beach region model. For the "rest of the nation" region the use of the beach by domestic residents is also a consumption activity and is also accounted for by the "rest of the nation" region model

3.4.4 Distributing RED Benefits: The Case Study Reconsidered

Like the case study used above to analyzed the distribution of NED benefits of shore protection, we would have preferred to examine the RED benefits of an actual or proposed shore protection project. Because we did not have access to spending for such a project, we chose to continue the analysis of our case study approach. In this study we examine the distribution of the RED benefits of the existing beach activities and the distribution of RED benefits of increases in the use of the beach due to the proposed hypothetical shore protection project. In addition, we are interested in what might happen if the project were not implemented and the shore line were allowed to naturally erode. Again, we also use the "typical" beach region as a "frame of reference" and compare its results with those for both rural and urban beach regions (see Table 3.3 for the basic set of demographic and economic characteristics of the three regions considered).[31]

[30] The technical term in input-output analysis is that we are using Type-II multipliers.
[31] Again, the data and the analysis of the RED benefits that follows are for three actual coastal counties that contain beach areas.

3.4.4.1 The RED Benefits of an Existing Beach

What is the RED value of an existing beach prior to consideration for a Federal shore protection project? The purpose of this analysis of the RED benefits of an existing beach is three-fold; (1) to explain the basic economic relationships that existing beaches have with their regions, (2) to provide an "order of magnitude" estimate of the value of an existing beach to the region in which it is located, and (3) to demonstrate the efficacy of the methodology for distributing RED benefits that has been developed here. While hypothetical, it does provide an indication of the magnitude of the regional importance of an existing beach with a visitation of one million recreation users a year from outside the region. Many existing beaches have outside visitations about this magnitude. The decisio9n to use "one million" beach visits by outside tourists was made to simulate the importance of the existing beach on the economy of the respective region and to demonstrate the procedures that are used to compute the net value added impacts and their distribution between the beach region and the rest of the nation.

The basic relationships of the beach economy were explained earlier and are shown schematically in Figure 3.5. Ideally, we would have liked to have access to spending patterns based on surveys of the beach users who actually visit an existing beach area. However, such survey results are unavailable. Therefore, we chose to use spending patterns based on survey results that we assume are representative of the beach users at our "typical" beach area. In addition, we also use "representative" spending patterns for the rural and urban beach areas. Table 3.7 provide these spending data on a daily "per visitor" basis and for a million visits from outside the region.[32] RED benefit results for annual visitation levels either lower or higher than a million annual visits can

[32] Our daily "per visitor" beach spending levels appear to be consistent with those found in other studies. For example, in a recent survey of travel and tourism expenditures at New Jersey beaches the average daily "per person" expenditures were $70 for people making only day trips, were $134 for people making overnight trips, and were $111 for the average visitor (all in 2000 price levels): prepared by Longwoods International for the 2000 New Jersey Travel Research Program, New Jersey Commerce and Economic Growth Commission (May 2001).

be derived from the results we present here by making appropriate simple proportional adjustments.

The "net value added" effects (RED benefits) within the "typical" beach region due to a million outside beach visitors were estimated using a "Type-II" regional input-output model for the "typical" beach region compiled from the IMPLAN Input-Output System.[33] Because the input-output model is configured for approximately 500 industrial sectors, the expenditures shown in Table 3.7 had to be further decomposed in much finer spending categories. This was accomplished using "bridge" tables for recreational spending developed by Propst, Stynes, Lee, and Jackson (1992).

Table 3.7: Recreational Spending in Beach Region Due Outside Tourists (2000 prices)

	Daily Spending per Visitor (dollars)			Spending Due to a Million Daily Visits ($000)		
Category	Typical	Rural	Urban	Typical	Rural	Urban
Lodging	$11.53	$7.93	$28.49	$11,532	$7,934	$28,485
Transportation	$11.00	$19.03	$17.08	$10,998	$19,027	$17,079
Restaurant	$13.29	$9.98	$42.88	$13,292	$9,977	$42,877
Grocery & Misc	$35.37	$18.71	$28.05	$35,367	$18,713	$28,045
Fishing	$12.00	$4.84	$6.96	$12,004	$4,839	$6,960
Rental	$2.33	$2.36	$2.47	$2,325	$2,357	$2,467
Fees	$2.59	$3.90	$2.86	$2,592	$3,896	$2,860
Total	$88.11	$66.74	$128.77	$88,111	$66,743	$128,773

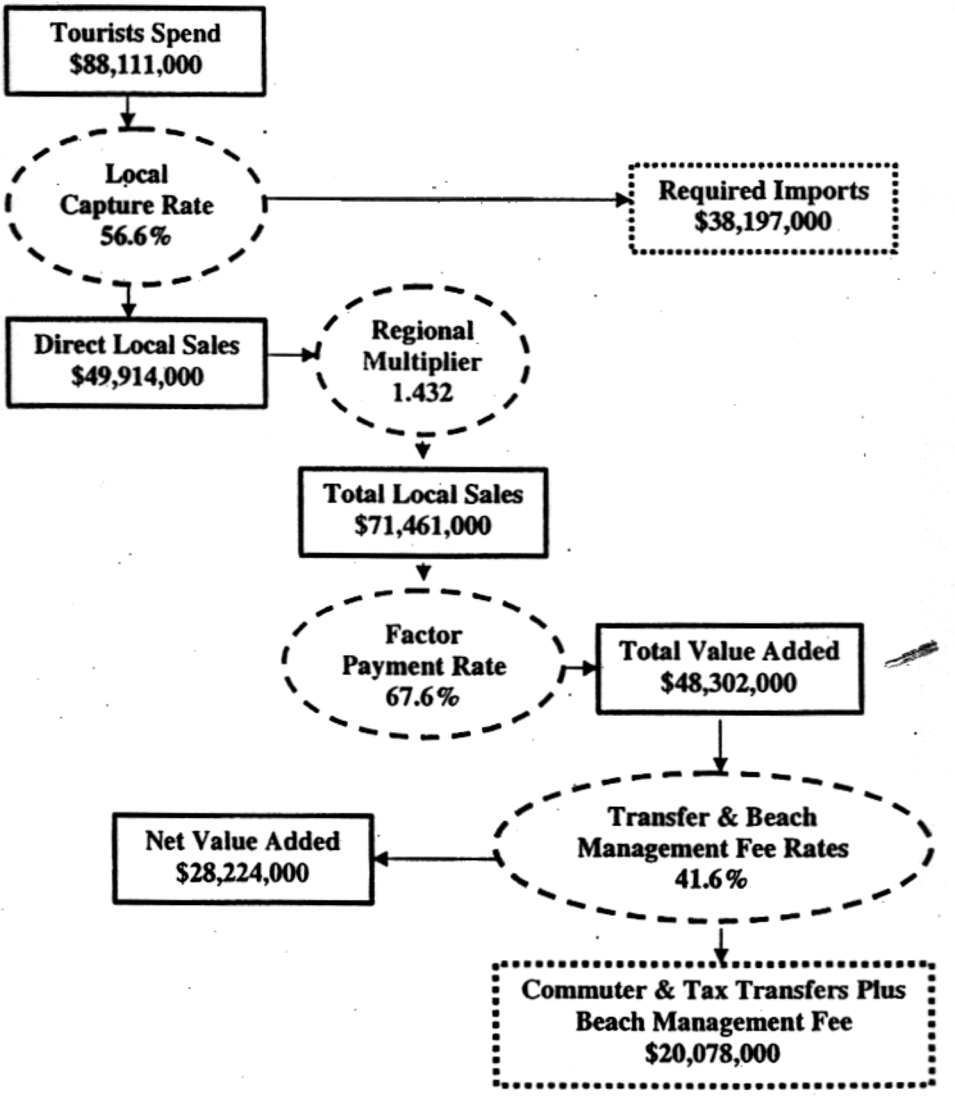
Note: Monetary values in the original study are updated to reflect 2000 price levels.
Source: Daniel R. Resenmaier, etal. 1987, *Regional and Statewide Economic Impacts of Sport Fishing, Other Recreational Activities, and Commercial Fishing Associated with Major Bays and Estuaries of the Texas Gulf Coast.* Report perpared for the Texas Department of Recreation and Parks (August).

The analysis of the RED benefits of a hypothetical million outside visitors to the "typical" beach region is pictured in Figure 3.6. The analysis shown in Figure 3.6 is highly aggregated. The rates and multipliers shown are weighted averages of the corresponding values in the IMPLAN input-output model and are only shown for

[33] Scott A. Lindall and Douglas C. Olson. 2000. *The IMPLAN Input-Output System*. Stillwater, MN: Minnesota IMPLAN Group.

illustrative purposes. They only represent the specific impact scenario that is analyzed for the "typical" beach region. They cannot be interpreted as representative for any other scenario in this region or any other region.

Figure 3.6
Local Economic Flows Generated by a Hypothetical Million Tourists in the Typical Beach Region
(monetary values in 2000 price levels)



Following the flow diagram in Figure 3.6, a hypothetical million visitors from outside the "typical" beach region come to enjoy the beach and, in turn, spend a little more than $88.1 million on goods and services purchased from local merchants. Given the availability of these goods and services from local businesses, the region economy is able to capture 56.6% of the beach visitor spending, or $49.9 million ($38.2 million of the goods and services have to directly imported from outside the region). On average, there is a 1.432 total multiplier effect on the regional economy.

This means that due to the direct effect of $49.9 million due to beach visitation by non-residents, total sales in local businesses will increase by approximately $71.5 million. It is estimated that factors of production (labor, proprietors, landlords, capitalists, and governments, or value added) will get $48.3 million of the increased local sales (67.6 percent). Commuter and tax revenue transfers and beach management and maintenance costs require about $20.1 million of the increased value added, leaving $28.2 million in the hands of the residents of the "typical" beach region.[34]

The "net value added" effects within "rest of the nation" due to the foreign beach visitors were computed in a similar fashion. First, we computed the economic impacts of foreign beach visitation (23.9 percent of the outside beach visitors, computed from information in Table 3.3) on the "typical" beach region and on the entire nation. A national "Type-II" input-output model was also compiled with the IMPLAN Input-Output System. We assumed that foreign beach visitors spend their money at the beach just like all outside visitors to the beach. Then, we subtracted the impacts due to foreign beach visitors in the beach area from the impacts due to foreign beach visitors in the entire nation. The RED benefits for both the "typical" and "rest of the nation" regions are presented in Table 3.8. All together, about 47 percent of the combined RED benefits

[34] A more "traditional" presentation of the economic impacts in the "typical" beach region is given in Table F.11. In addition, to the impact results provided in Figure 3.6, we estimate that the beach spending by a million outside visitors generates almost 2,000 full-time jobs in the region. It is also important to note that the "trade and services" sectors are the most heavily impacted by the beach visitation (these sectors account for more than 80 percent of the total output and employment impacts). Similar results are provided for the rural and urban beach regions in Tables F.12 and F.13

accrue to the "typical" beach region. Contrast this with the results for the rural and urban beach regions that get 40 percent and 50 percent of the RED benefits, respectively.

Table 3.8: Distribution of Regional Economic Development Benefits of Recreation Due to One Million Hypothetical Outside Visitors ($000 in 2000 prices)

	Beach Area Due to All Outside Visitors	Rest of the Nation Due to Foreign Visitors Only
Typical Beach Region		
Employee Compensation	$25,466	$13,220
Proprietors' Income	$6,098	$1,761
Other Property Income	$9,430	$7,083
Indirect Business Taxes	$7,308	$2,146
Gross Regional Product	$48,302	$24,209
Net commuters' income	-$5,796	$1,385
Net tax transfers	-$12,298	$6,312
Beach management costs	-$1,984	$0
Regional economic development benefits	$28,224	$31,907
Regional distribution	46.9%	53.1%
Local tax revenues collected	$3,239	
Rural Beach Region		
Employee Compensation	$17,637	$9,566
Proprietors' Income	$3,576	$1,429
Other Property Income	$6,587	$5,082
Indirect Business Taxes	$4,347	$1,829
Gross Regional Product	$32,147	$17,905
Net commuters' income	-$5,786	$1,314
Net tax transfers	-$8,479	$4,458
Beach management costs	-$1,984	$0
Regional economic development benefits	$15,898	$23,677
Regional distribution	40.2%	59.8%
Local tax revenues collected	$1,906	
Urban Beach Region		
Employee Compensation	$52,823	$18,004
Proprietors' Income	$8,414	$2,604
Other Property Income	$18,123	$9,503
Indirect Business Taxes	$12,499	$2,905
Gross Regional Product	$91,859	$33,016
Net commuters' income	-$18,372	$4,354
Net tax transfers	-$24,048	$9,691
Beach management costs	-$1,984	$0
Regional economic development benefits	$47,455	$47,061
Regional distribution	50.2%	49.8%
Local tax revenues collected	$5,355	

3.4.4.2 The RED Benefits of Increased Beach Use Due to the Proposed Project

The effects on the distribution of RED benefits due increases in visitation stemming from the hypothetical beach nourishment project were analyzed; specifically resulting from incrementally increasing beach visitation by 0, 5, 10, 15, 20, and 25 percent. It is assumed that increases in visitation are based on the capacity of the hypothetical beach nourishment project (as defined by the "hypothetical beach nourishment project). However, instead of only considering real increases in visitation during peak visitation days (for NED benefits), increases in visitation for the entire year are evaluated for RED benefits. Because input-output is mathematically "linear", all impacts resulting from increases in visitation are proportional to the change in visitation relative to existing visitation levels (i.e., one million outside beach visits). Consequently, the magnitude of the net value added effects increases in proportion to the increase in beach visitation, however, the distribution of RED benefits does not change; see Table 3.9.

Table 3.9: Distribution of Regional Economic Development Benefits of Shore Protection Project With Varying Recreation Demand (000 dollars in 2000 prices)

	Beach Area		Rest of the Nation		Total RED	New Outside
	Benefits	%	Benefits	%	Benefits	Visitors
Typical Beach Region						
No increase in beach use	$0		$0		$0	0
5% increase in beach use	$605	43.8%	$776	56.2%	$1,381	23,882
10% increse in beach use	$1,210	43.8%	$1,552	56.2%	$2,762	47,764
15% increase in beach use	$1,814	43.8%	$2,328	56.2%	$4,142	71,646
20% increase in beach use	$2,419	43.8%	$3,104	56.2%	$5,523	95,527
25% increase in beach use	$3,024	43.8%	$3,880	56.2%	$6,904	119,409
Rural Beach Region						
No increase in beach use	$0		$0		$0	0
5% increase in beach use	$571	40.2%	$851	59.8%	$1,422	35,945
10% increse in beach use	$1,143	40.2%	$1,702	59.8%	$2,845	71,889
15% increase in beach use	$1,714	40.2%	$2,553	59.8%	$4,267	107,834
20% increase in beach use	$2,286	40.2%	$3,404	59.8%	$5,690	143,778
25% increase in beach use	$2,857	40.2%	$4,255	59.8%	$7,112	179,723
Urban Beach Region						
No increase in beach use	$0		$0		$0	0
5% increase in beach use	$2,132	51.5%	$2,010	48.5%	$4,142	43,255
10% increse in beach use	$4,264	51.5%	$4,019	48.5%	$8,283	86,511
15% increase in beach use	$6,396	51.5%	$6,029	48.5%	$12,425	129,766
20% increase in beach use	$8,529	51.5%	$8,039	48.5%	$16,568	173,022
25% increase in beach use	$10,661	51.5%	$10,048	48.5%	$20,709	216,277

Using the net value added impacts within the "typical" beach region as a basis for determining importance of increases in visitation on the local economy, a 5 percent increase in visitation induced by the hypothetical beach nourishment project will increase the region's net value added from beach related activities by 2.1 percent (i.e., by comparing the net value added impacts in Table 3.9 with those in Table 3.8).[35] A 10 percent increase in visitation will improve the region's net value added by 4.3 percent, and so on. An increase in visitation of 25 percent will raise the region's net value added by 10.7 percent. Interestingly, the increases in regional net value added are large for both the rural and urban beach regions than for the "typical" region. For the rural beach region, increases in visitation of 0, 5, 10, 15, 20, and 25 percent will increase net value added, respectively, by 0, 3.6, 7.2, 10.8, 14.4, and 18 percent. The corresponding percentage increases in net value added for the urban region are 0, 4.5, 9, 13.5, 18, and 22.5 percent. Several reasons account for these differences. For example, both the level of spending per visitor and percentage of beach visitors residing outside the rural beach region are lower than for the "typical" beach region. Consequently, the net value added impact of the existing beach is smaller for the rural region than for the "typical" beach region (56 percent smaller) and, as a result, the rural region's net value added impacts due to increases in visitation are larger percentages of the existing beach's net value added impacts than for the "typical" region. On the other hand, the larger economic multiplier effects and level of spending by outside visitors within the urban region explain the larger percentage increases in net value added due to increases in visitation than in either the "typical" or rural beach regions.

3.4.4.3 The RED Benefits of Allowing the Beach to Erode

A number of beach officials have indicated that beach visitation may not change as beaches are not nourished and allowed to erode and accrete naturally. However, it appears that the mix of beach visitors and activities do change. It has been casually observed that the new visitors use the beaches differently; they use the beach more during

[35] Of course, no increase in visitation will have no affect the region's net value added.

low tide and less during high tide, they camp more and stay in "expensive" hotels and motels less; they dine in restaurants less frequently, etc. These changes mean that "fewer" dollars flow into the beach economy and the RED effects are smaller as a consequence. These effects were simulated by determining what would happen if the outside beach visitors to the typical beach region behaved like the outside beach visitors to the rural beach region. That is, rather than the hypothetical million outside beach tourists now spending $88.1 million per year, they will spend $66.7 million per year. It is also assumed that the pattern of expenditures will change accordingly. Relative to the typical situation, the drop in spending by outside tourists will mean a drop in RED benefits by $8 million both for the beach region and for the rest of the nation (Table 3.10)

Table 3.10: Distribution of Regional Economic Development Benefits of Recreation in Typical Region Due to a Reduction in Visitor Spending ($000 in 2000 prices)

	Beach Area Due to All Outside Visitors	Rest of Nation Due to Foreign Visitors Only
RED Benefits from Typical Propensity to Spend		
Employee Compensation	$25,466	$13,220
Proprietors' Income	$6,098	$1,761
Other Property Income	$9,430	$7,083
Indirect Business Taxes	$7,308	$2,146
Gross Regional Product	$48,302	$24,209
Net commuters' income	-$5,796	$1,385
Net tax transfers	-$12,298	$6,312
Beach management costs	-$1,984	$0
Regional economic development benefits	$28,224	$31,907
Region distribution	46.9%	53.1%
Local tax revenues collected	$3,239	
RED Benfits from Rural Propensity to Spend		
Employee Compensation	$18,559	$9,851
Proprietors' Income	$4,483	$1,287
Other Property Income	$7,011	$5,249
Indirect Business Taxes	$5,208	$1,720
Gross Regional Product	$35,261	$18,107
Net commuters' income	-$4,231	$1,011
Net tax transfers	-$8,899	$4,458
Beach management costs	-$1,984	$0
Regional economic development benefits	$20,147	$23,577
Region distribution	46.1%	53.9%
Local tax revenues collected	$2,322	
Net Regionas Economic Development Benefits		
Employee Compensation	-$6,907	-$3,368
Proprietors' Income	-$1,615	-$474
Other Property Income	-$2,419	-$1,834
Indirect Business Taxes	-$2,100	-$426
Gross Regional Product	-$13,041	-$6,102
Net commuters' income	$1,565	-$374
Net tax transfers	$3,399	-$1,854
Beach management costs	$0	$0
Regional economic development benefits	-$8,077	-$8,330
Region distribution	49.2%	50.8%
Local tax revenues collected	-$917	

3.5 The Fiscal Impacts of Beaches

Local tax revenues generated by recreation activities at existing beaches may be larger than required to fund related beach management and maintenance costs. The implication is that beaches have more than enough money to fund the additional non-Federal cost-share for the beach re-nourishment component of the shore protection program. However, even if it can be shown that local tax revenues collected are greater than needed to cover beach management and maintenance costs,[36] the "excess" revenues are probably being currently used to help fund other important local public services and, therefore, they may not be readily available to fund an increase in the non-Federal cost-share for an existing project. In-depth analysis of beach economies using appropriate survey data and relevant fiscal budget information would be required, before definite conclusions could be drawn concerning the fiscal conditions of beach communities.

Even though local tax revenues collected at existing beaches may not be appropriately considered available to fund the increases in the non-Federal cost-share of an exiting beach nourishment project, the local tax revenues that are collected as a result of "new" visitation due to beach nourishment due to a new Federal nourishment project could be used to fund the increased non-Federal cost-share. By applying the 65 percent non-Federal cost-share, as recommended by the President's FY'03 budget, is applied to the estimated project costs for the hypothetical beach nourishment project. The estimated annual NED benefits for the beach project is $1,651,000. Suppose that the benefit/cost ratio for this project is 2.0. Then the estimated non-Federal cost-share for the hypothetical beach nourishment project is $26,829,000 (0.65×50×$1,651,000÷2). There are a number of ways in which non-Federal sponsors can use to fund their share of

[36] For example, local tax revenues collected in the "typical" beach region are a little more than 60 percent greater than the beach management costs (Table 3.10). And for the urban beach region, the local tax revenues collected are more than 2.5 times the beach management costs. However, local tax revenues collected are slightly less than the beach management costs in the rural beach region.

the project costs. One method is to "float" a municipal bond and pay the annual cost of the bond out of local tax revenues or other sources of local revenue (e.g., parking fees, "bed" taxes, beach tolls, etc.). Using a 20-year municipal bond that has an annual 5 percent rate of interest,[37] the annual cost of the bond to cover the principal (non-Federal cost-share) and accumulated interest is $1,847,000. Some states pay the entire non-Federal cost-share, other states pay for a portion of the cost-share, and others do not participate in cost sharing with the local sponsor. If the State provides 100 percent of the non-Federal cost-share, then the increase in non-Federal cost-share to 65 percent will place no additional burden on the local project sponsor.[38] If the State does not participate in project cost sharing, then the local project sponsor is burdened with the entire non-Federal cost-share (i.e., the annual payment of $1,847,000). However, if the State participates in project cost sharing, then the local sponsor's obligation is reduced accordingly. Suppose the State provides 75 percent of the non-Federal cost-share, then the annual cost of the bond will be $462,000.

Table 3.11: Cost Sharing Requirements ($000 in 2000 prices) Sensitivity Analysis

	Total NED Benefits	Project Cost-Share for Selected Benefit/Cost Ratios			Annual Payment Required for a 20 Year Bond Accrued at A 5% Interest Rate for Selected Benefit/Cost Ratios			25 % of Annual Payment for Selected Benefit/Cost Ratios		
		1.0	2.0	3.0	1.0	2.0	3.0	1.0	2.0	3.0
65 % Cost Sharing	$1,651	$53,658	$26,829	$17,886	$3,694	$1,847	$1,231	$924	$462	$308
50 % Cost Sharing	$1,651	$41,275	$20,638	$13,758	$2,842	$1,421	$947	$710	$355	$237
35 % Cost Sharing	$1,651	$28,893	$14,446	$9,631	$1,989	$995	$663	$497	$249	$166

Assumes daily "unit-day" value is $2.00 per person and medium energy protection

Table 3.11 provides a sensitivity analysis for varying estimates of the local cost sharing requirements under several assumptions. For example, what is the local cost sharing obligation if the project had been marginal (i.e., cost/benefit ratio of 1.0) of if the project had a better cost-benefit ratio than assumed (i.e., 3.0). In addition, Table 3.24

[37] The September 2001 rate of interest for 20-year State and local general obligation bonds is 5.09 percent.
[38] However, the State may object.

shows the effect on the local cost sharing requirements if the non-Federal cost-share were raised to 50 percent (instead of the proposed 65 percent). Also, what are the cost-share obligations if the non-Federal cost-share requirement remains at 35 percent.

Table 3.12 shows the local tax revenues in excess of beach management and maintenance costs that will be available to fund the non-Federal cost-share of the hypothetical beach nourishment project in "typical", rural, and urban region for increases in beach visitation of 0, 5, 10, 15, 20, and 25 percent. Obviously, if the hypothetical beach nourishment project does not attract any additional visitation, then there will be no local tax revenues available to fund the nourishment project. Therefore, the local sponsor will have to find the additional revenues in some manner if they want the hypothetical beach nourishment project.

Table 3.12: Beach Costs and Local Tax Revenues for Varying Increases in Recreation Visitation ($000 in 2000 prices)

	Tax Revenues Net of Beach Costs	Beach Costs	Local Tax Revenues
Typical Beach Region			
No increase in beach use	$0	$0	$0
5% increase in beach use	$30	$47	$77
10% increase in beach use	$60	$95	$155
15% increase in beach use	$90	$142	$232
20% increase in beach use	$119	$190	$309
25% increase in beach use	$150	$237	$387
Rural Beach Region			
No increase in beach use	$0	$0	$0
5% increase in beach use	-$2	$71	$69
10% increase in beach use	-$6	$143	$137
15% increase in beach use	-$8	$214	$206
20% increase in beach use	-$11	$285	$274
25% increase in beach use	-$14	$357	$343
Urban Beach Region			
No increase in beach use	$0	$0	$0
5% increase in beach use	$146	$86	$232
10% increase in beach use	$291	$172	$463
15% increase in beach use	$438	$257	$695
20% increase in beach use	$584	$343	$927
25% increase in beach use	$729	$429	$1,158

They could "economize" by "belt-tightening" on other local public services. Or, they could develop an additional revenue source; for example, charge an additional "sales" tax on top of the existing sales tax. For the proposed 65 percent non-Federal cost-share, the local sponsor will need to charge an additional "sales" tax of 2.1 percent (i.e., based on an annual bond cost of $1,848,000 and annual sales of $88,111,000) if they have to pay for the entire non-Federal cost-share with no assistance from the State. If the State pays for 75 percent of the non-Federal cost-share, then the additional local "sales" tax will be 0.52 percent (i.e., based on annual bond cost of $462,000 and annual sales of $88,111,000).

For the typical beach region, local tax revenues in excess of the estimated beach management and maintenance costs increase as beach visitation increases, however, even with a 25 percent increase in annual visitation local tax revenues in excess of beach costs are estimated to be $150.000 annually. This amount is not enough to cover the annual cost of the 20-year municipal bond, $462,000 (assuming the non-Federal cost-share is 65 percent, a 5 percent annual interest rate, a benefit/cost ratio equal to 2.0, and the State provides 75 percent of the local cost-share). If the local sponsor raises these extra funds via an additional "sales" tax, then the additional tax rate will be 0.35 percent (based on an annual bond costs of $312,000 and annual sales of $88,111,000).

For the rural beach region, the annual local tax revenues collected are less than the annual beach management and maintenance costs. As a result, the local sponsor will not only have to find additional revenues to fund their share of the non-Federal cost-share, they will need extra funds to help pay for the beach costs that are not covered by local tax revenues. For the urban beach region that has no assistance for the non-Federal cost-share from the State, local annual tax revenues in excess of annual beach costs are less than what the annual cost of a bond, regardless of the visitation increases considered.

As a result, they will have to raise additional revenues in some manner. However, if the State pays for 75 percent of the non-Federal cost-share, the excess local tax revenues generated by approximately a 15 percent increase in visitation (i.e., $438,000) will be enough for the urban region to fund the annual cost of the municipal bond ($462,000) without having to raise additional revenues from other sources.

Finally, if the hypothetical beach nourishment project were not implemented and the beach were allowed to erode, there is a concern that the fiscal conditions within the beach region might degrade: not so much because visitation will decline but because spending by tourists will decline. If, for example, outside beach visitors to the "typical" beach region were to spend and behave similar to those in a rural region, then the amount of local tax revenues collected will drop. In this case, they are estimated to drop to a level just above that needed to cover the beach management and maintenance costs. It is not asserted that these changes reflect any actual events. They do reflect the possible concerns of public officials responsible for managing and maintaining beaches.