

Draft Environmental Impact Report

SCONSET BEACH NOURISHMENT PROJECT
Nantucket, MA
EOEA #13468

Submitted to:

Executive Office of Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Submitted by:

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June 15, 2006

June 15, 2006

**Subject: Draft Environmental Impact Report
Sconset Beach Nourishment Project, Nantucket
EOEA #13468**

Dear Reviewer,

On behalf of the Siasconset Beach Preservation Fund (SBPF), Epsilon Associates, Inc. is providing the enclosed Draft Environmental Impact Report (DEIR). This DEIR was developed in accordance with the Secretary's May 9, 2005 Certificate on the Environmental Notification Form (ENF).

The DEIR will be noticed for public review in the Environmental Monitor on June 21, 2006 and the public comment period will extend through July 11, 2006.

Written comments on the DEIR should reference the project name and Massachusetts Environmental Policy Act (MEPA) project #13468, and should be sent to the Executive Office of Environmental Affairs at the following address:

Secretary Stephen R. Pritchard
Executive Office of Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114
Attn: MEPA Unit, Analyst Anne Canaday, EOEA #13468

If you should submit written comments on the DEIR, please include a return address to facilitate future correspondence.

Sincerely,
EPSILON ASSOCIATES, INC.

Holly Carlson
Project Scientist

Enclosure

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Executive Summary

EXECUTIVE SUMMARY

The Sconset Beach Nourishment Project (the “Project”) is a large-scale nourishment project proposed to protect almost three miles of shoreline along the eastern coast of Nantucket Island. Resources that will be directly preserved and protected by the Project include the Sankaty Head Lighthouse, portions of the Town of Nantucket’s wastewater facilities, Town roads, private properties, and historic structures. These resources are currently threatened by landward retreat of the shoreline resulting from coastal storms and beach erosion, which have caused undercutting at the toe of the Coastal Bank and resulted in bank collapse along much of the Project area. Siasconset Beach Preservation Fund (SBPF), the Applicant and Proponent, is proposing this critically and urgently needed Project to protect and restore the Sconset shoreline as well as benefit adjacent beaches north and south of the Project area by supplementing the regionally-deficient sediment supply.

The primary elements of the Project are 2.6 million cubic yards of beach and dune nourishment coupled with the dredging of beach-compatible nourishment material from an offshore borrow site. The Applicant proposes to supplement the nourishment activities with the following primary Project components: (1) bank terracing and vegetation planting to enhance bank stability; (2) up to 13 groins to retain beach nourishment sand and potentially enhance Project longevity; and (3) in certain limited areas, up to 6,100 linear feet of geotextile tubes installed along the toe of Coastal Bank to provide protection from extreme storms or a series of smaller storms occurring in rapid succession.

Acknowledging the Project’s significance for Sconset property owners, Nantucket residents and the Island’s visitors alike, the Proponent has engaged in significant community outreach and has sought to promote public education and involvement regarding the Project. The proposed activities will provide many benefits to the Project area, including but not limited to a wider beach, increased protection from storms and erosion for landward resources, enhanced recreational opportunities, preservation of remaining sections of the bluff walk and public access, and expanded habitat for listed shorebirds.

The proposed Project is the direct result of an extensive analysis of alternatives performed by the Proponent. This alternatives analysis is provided as Section 2.0 of this DEIR. Section 3.0 presents the preliminary Project design, which will be further refined and presented in final form in the FEIR. The Project’s environmental setting and direct Project-related impacts to environmental resources are discussed in Section 4.0. Monitoring of the various Project components and mitigation efforts related to Project impacts are identified in Section 5.0. An analysis of the Project within the framework of the regulatory environment is provided in Section 6.0. Section 7.0 contains Project responses to comments submitted to the Secretary of Environmental Affairs on the Project’s Environmental Notification Form. Section 8.0 comprehensively cites resources and materials which have been used in preparation of this document.

Section 1
Introduction

1.0 INTRODUCTION

1.1 Project Name, EOEA Number

The Sconset Beach Nourishment Project (the “Project”) is a large-scale nourishment project proposed to protect Sankaty Head Lighthouse, portions of the Town of Nantucket’s wastewater facilities, Town roads, private properties, and historic structures along the eastern shoreline of Nantucket Island (see Figure 1-1). The Applicant, Siasconset Beach Preservation Fund (SBPF), is a 501(c3) not-for-profit group that has been dedicated to protecting this portion of the Nantucket coastline for more than a decade. The SBPF’s primary mission is to protect and preserve the Sconset shoreline. SBPF’s mission also includes funding research and engineering studies for the purpose of erosion control and prevention along Nantucket’s eastern shoreline, investigating ways to conserve natural resources for scenic and recreational enjoyment in this area, demonstrating the effectiveness of innovative shoreline management strategies for coastal areas exposed to severe environmental conditions, and supporting efforts to inform the public about the importance of protecting valuable coastlines. The Project currently proposed by the SBPF is critically and urgently needed to protect and restore the Sconset shoreline; a secondary objective is to benefit adjacent beaches north and south of the Project area by supplementing the regionally-deficient sediment supply. The Project’s design has been and continues to be refined to prevent sediment losses from adjacent beaches.

The Project’s Executive Office of Environmental Affairs (EOEA) number is 13468. An Environmental Notification Form (ENF) for the Project was filed with the Massachusetts Environmental Policy Act (MEPA) Office on February 28, 2005, and the EOEA Secretary’s Certificate and Scope for the Draft Environmental Impact Report (DEIR) were issued on May 9, 2005.

Due to the infeasibility of performing proposed Project activities during the winter season when meteorological and oceanographic conditions are harsh and dangerous, construction is proposed between the end of May and November. At the same time, the Proponent recognizes the importance of protecting biological resources and understands that these resources are often seasonal. Essential Fish Habitat for winter flounder has been designated within the Primary Study Area where borrow site investigations have been focused, including the Northern Borrow Site which is the preferred offshore sand source. Results from an ichthyoplankton program being conducted as part of the Proponent’s Fisheries Sampling Plan will document whether or not the Primary Study Area provides spawning habitat for winter flounder; however, at this time the Proponent assumes that the designation is accurate and plans to avoid construction between February and the end of May at the borrow site. Sections 4.5.1.1 and 5.1.2 provide more detailed discussions of time-of-year (TOY) restrictions. This construction schedule and proposed TOY restriction will allow the Proponent to implement a feasible Project that satisfies Project objectives and provides safe and reasonable working conditions while still respecting and protecting

environmental resources. To this end, the Proponent has invested extensive effort in refining the Project's design and methodological approach with regard to construction, monitoring, and mitigation activities. Results of these efforts are included herein.

1.2 Project Overview

The purpose of this large-scale nourishment Project is to protect up to three miles of eroding coast along the eastern shoreline of Nantucket Island and provide close to a mile of dune restoration. This stretch of shoreline has undergone extensive landward retreat as a result of coastal storms and beach erosion, which have caused undercutting at the toe of the Coastal Bank and resulted in bank collapse along much of the Project area. As a result, the Project is urgently needed to prevent further destruction of private property at the top of the bank as well as existing public infrastructure and historic structures such as the Sankaty Head Lighthouse, Town Sewer Beds, and roads; in addition, the Project will enhance beach and dune habitat available to species such as listed shorebirds. The primary elements of the Project are beach and dune nourishment coupled with the dredging of beach-compatible nourishment material from an offshore borrow site. The Applicant proposes to supplement the nourishment activities with the following major Project components: (1) 6,100 feet of geotextile tubes installed along the toe of bank to provide protection from extreme (i.e., 50-year) storms, (2) up to 13 groins to retain beach nourishment sand and potentially enhance Project longevity, and (3) bank terracing and vegetation planting to enhance bank stability (see Figure 1-2).

1.2.1 *Sconset Beach Activities*

The Project will provide nourishment for up to three miles of shoreline extending from Sesachacha Pond south past the Sankaty Head Lighthouse and village of Siasconset, plus dune restoration south of Codfish Park to protect the Town Sewer Beds (see Figures 1-1 and 1-2). The Project involves placing a substantial volume of beach-compatible sand along the shoreline to build a wide, high beach and dune to protect the eroding Coastal Bank and threatened upland property and structures.

The conceptual design includes construction of a nourishment template designed to provide protection to upland resources and buffer the effects of severe coastal storms. Specifically, the beach berm width will be increased by approximately 200 feet, while the berm height is expected to be approximately 12 feet above Mean Low Water (MLW). Based on site-specific beach and bathymetric survey data, the volume of sand required to construct the Project according to the conceptual design is approximately 2.6 million cubic yards. Exact volumes will depend on the final design template, groin characteristics, and results from pre-construction surveys; the Project's preliminary design is presented in Section 3.0.

A series of geotextile tubes are proposed to be buried within the nourished portion of beach at the toe of the Coastal Bank. These structures are not intended to become exposed except in the case of a severe storm or a rapid series of smaller storms occurring after significant

depletion of the design berm has already occurred; in such an extreme case, the geotextile tubes will provide the toe of bank with some protection from wave-induced scour. Up to 13 groins may be constructed to manage longshore transport of sand from nodal points where sediment transport occurs in both directions along the Project shoreline, creating erosion hotspots. Terraces coupled with vegetation plantings are proposed to stabilize two over-steepened sections of the Coastal Bank; such over-steepened sections of bank pose particularly immediate risks to landward resources. Due to the time-critical component of the erosion threat, the Proponent is submitting a Notice of Project Change (NPC)/Phase One Waiver request to MEPA to allow construction of the proposed terraces and associated vegetation plantings to proceed immediately (see Sections 3.2.5 and 6.1).

1.2.2 Offshore Sediment Source Locations

Sediment required to construct the nourishment template will be obtained from an offshore borrow site. The Project Proponent has conducted extensive research and engaged in outreach with area fishermen to identify feasible and appropriate borrow sites. Preliminary efforts to identify a borrow site included investigations off the east coast of Nantucket and in Nantucket Sound (see Figure 1-3).

The search for an offshore sediment source has been refined; results from preliminary investigations were used to identify a 2,500-acre "Primary Study Area" located just west of shoals known as Bass Rip and entirely within Massachusetts' state waters (see Figure 1-4). Geotechnical investigations which included high-resolution side-scan sonar and vibrocore sampling were conducted in spring 2006 in two zones of the Primary Study Area: one 1,500 acres in size and one 1,000 acres in size (see Figure 1-4). Survey results have been used to identify a preferred borrow site (the Northern Borrow Site) in the northeastern portion of the Primary Study Area (see Figure 1-5). This site is discussed further in Sections 2.6.2 and 3.3. Additional surveys and modeling efforts will be used to further refine the offshore sand source; the site ultimately selected for the Project will be mined for the initial nourishment as well as a subsequent renourishment event.

Section 2.6 contains a thorough analysis of alternative sediment source locations and potential borrow sites.

1.2.3 Existing Project Components

The SBPF maintains a number of approved bank stabilization and shore protection measures in the Project area including coconut fiber terraces, beach dewatering systems, perched aquifer drainage wells, and snow fencing known as Duneguard (see Figure 1-2). The following discussion is included to provide general information about how the existing, permitted shore protection and bank stabilization measures will relate to the comprehensive Project.

1.2.3.1 Terracing

The SBPF plans to continue to install and maintain the approved biodegradable coconut fiber terraces on the bank face and at the toe of the Coastal Bank to complement the proposed nourishment efforts. Terraces are intended to provide temporary protection from erosion, particularly along over-steepened portions of the bank, until the larger nourishment effort can be completed. Upon completion of the nourishment Project, the terraces will be planted with native vegetation to further enhance the stability of the existing bank slope. The vegetated terraces are intended to complement the geotextile tubes to provide protection to the bank in the event of severe storms.

Detailed information regarding the terraces and related vegetation proposed by the Project is provided in Section 3.2.5; the Proponent is submitting an NPC/Phase One Waiver request to MEPA as a facet of this DEIR so this Project component may proceed immediately pending local approval while the comprehensive Project proceeds through the permitting process (see Section 6.1).

1.2.3.2 Beach Dewatering

Of the four existing dewatering systems at Codfish Park, Lighthouse South-South (LHS-S), Lighthouse South (LHS) and Lighthouse North (LHN), the LHS and LHN systems will be removed due to significant operational limitations. These two systems at LHS and LHN are being removed as weather permits, and any remaining components will be removed in conjunction with Project construction. The existing dewatering systems at Codfish Park and LHS-S are potentially viable systems.

1.2.3.3 Drainage Wells

Passive drainage wells have been installed within the 100-foot Buffer Zone to the top of Coastal Bank along a portion of the Project area. These wells were installed to facilitate drainage of a perched aquifer from which water flow was breaking out on the bank face and facilitating slumping and erosion. These wells will continue to be monitored and maintained.

1.2.3.4 Duneguard

The necessity of maintaining Duneguard fencing will be evaluated upon completion of nourishment. No Duneguard is proposed for the new bank terraces.

1.2.4 Changes Since the ENF

The primary changes in the Project since the filing of the ENF are: (1) refinement of borrow site investigations to a Primary Study Area in Massachusetts' state waters, (2) evaluation of additional shoreline management strategies as part of a comprehensive alternatives analysis,

and (3) inclusion of additional bank terracing and vegetation as a Project component for which an NPC/Phase One Waiver request is being submitted to MEPA.

As detailed in Section 2.0, the alternatives analysis evaluates a broad spectrum of shoreline management and beach nourishment alternatives, including: various beach nourishment designs, beach nourishment as a stand-alone measure, beach nourishment with the creation of a vegetated dune, beach nourishment combined with bank stabilization measures, and beach nourishment with geotextile tubes and groins. Additionally, a No Action alternative, retreat alternative, various structural alternatives, and stand-alone bank stabilization are evaluated.

1.3 Public Benefits and Outreach

By protecting and enhancing the various natural and cultural resources along the Sconset shoreline, the Project will provide numerous public benefits, including:

- ◆ Preservation and maintenance of the natural beauty of Sconset beach, which is a popular beach on the eastern shoreline of Nantucket and is available for use by the residents of Sconset Village, the Town of Nantucket and the general public;
- ◆ Enhancement of the sand supply in the littoral system, which can be expected to benefit adjacent shorelines outside of the immediate Project area (NRC, 1995);
- ◆ Preservation of the historic Sankaty Head Lighthouse, a National Historic Monument and treasured landmark of Nantucket;
- ◆ Preservation of the remaining southern portion of the historic bluff walk, a major tourist attraction, for public recreational enjoyment;
- ◆ Preservation of historic homes and properties, including several built in the 19th century and some built in the 17th and 18th centuries;
- ◆ Protection for public infrastructure, including:
 - Sewer/water services;
 - Baxter Road: Town road which provides access for the public, residents and emergency vehicles to the Sankaty Head Lighthouse and more than 100 homes;
 - Codfish Park Road: emergency vehicle access to approximately 50 homes;
 - Town Sewer Beds (which would cost more than \$5 million to relocate);
- ◆ Creation and restoration of natural habitat for endangered shorebirds;
- ◆ Improvement to public access and recreational opportunities, including:
 - More access for pedestrians;
 - More access for fishermen;

- ◆ Protection of valuable tax assets (at least \$450 million) for the Town of Nantucket, which constitute approximately 4% of the annual property tax base; and
- ◆ Demonstrate a cost-effective and innovative erosion control initiative with the use of private funds to protect shorelines where resources are exposed to the open ocean, strong tidal currents, and/or severe weather conditions; this Project may serve as a model for addressing similar needs elsewhere on the Massachusetts coastline and beyond.

Acknowledging the Project's significance for Sconset property owners, Nantucket residents, and the Island's visitors alike, the Proponent has engaged in significant community outreach and has sought to promote public education and involvement regarding the Project. Various meetings have been held to provide forums through which community and local government members have been able to comment on or learn more about the Project. The Proponent has also utilized local media outlets to promote public awareness of the Project. These community and public outreach efforts have included meetings with the following groups and individuals:

- ◆ Nantucket Planning and Economic Development Commission;
- ◆ Nantucket Island Chamber of Commerce;
- ◆ Major property owners;
- ◆ Commercial Fishing Industry representatives;
- ◆ Recreational Fishing representatives;
- ◆ Community Forum;
- ◆ Sconset Civic Association Members;
- ◆ Nantucket Rotary Club;
- ◆ Nantucket Association of Real Estate Brokers;
- ◆ Nantucket Land Council;
- ◆ Nantucket Town Administrator;
- ◆ Nantucket Board of Selectmen;
- ◆ Nantucket Marine Department;
- ◆ Nantucket Fire Department;
- ◆ Plum TV (interview and mini-documentary);
- ◆ N Magazine;
- ◆ Local newspaper coverage; and

- ◆ Massachusetts Environmental Policy Act site visit (attended by the public as well as federal, state and local government representatives including the Nantucket Conservation Commission and Wampanoag Tribe of Aquinnah).

The Project team has also conducted extensive outreach with state and federal regulatory agencies; one significant facet of this outreach was a meeting held at the U.S. Army Corps of Engineers (USACE) and attended by state and federal resource agencies at which the Proponent and resource agencies were able to review and discuss the Project's alternatives analysis prepared in accordance with the USACE's Highway Methodology. The USACE was also engaged in a meeting held in 2005 to discuss initial Project concepts. Separate meetings were held on April 3 and April 26, 2006 at the Massachusetts Division of Marine Fisheries (DMF) and the USACE, respectively, to review and obtain input on the Fisheries Sampling Plan (see Section 4.4).

1.4 Project Objective and Need

The immediate Project objective is to construct a nourishment profile that will provide lasting protection to upland resources and withstand the rigors of day-to-day coastal erosion and severe coastal storms. A wider and higher beach profile will provide storm damage protection for the historic Sankaty Head Lighthouse (a National Historic Monument), public infrastructure (such as roads, water and wastewater pipelines), and approximately 80 residential homes constructed prior to the adoption of the Wetlands Protection Act in 1978. Geotextile tubes and groins proposed as potential components of the Project are intended to provide storm damage protection primarily to pre-1978 buildings, while the nourishment is designed to protect the entire community along the Project shoreline. However, pre-1978 and post-1978 buildings are interspersed along the Project shoreline. Due to this layout, the proposed geotextile tubes will provide more adequate long-term protection for the pre-1978 buildings if they also extend across the seaward end of the occasional property containing a post-1978 building or empty lot (see Section 3.2.3). The groins, if included in the final design, will be proposed in locations where monitoring and modeling efforts identify erosion hotspots and where they will be most likely to enhance Project longevity. Depending on the locations of these hotspots, groins may be proposed seaward of properties absent pre-1978 buildings to adequately moderate the rate of sand loss and subsequently provide adequate protection for landward resources (including adjacent pre-1978 buildings).

The Project will also protect public infrastructure and remaining portions of the historic Scosset Bluff Walk, a major tourist attraction that is endangered by the erosion and has already partially collapsed. Finally, the Project will preserve and maintain the natural beauty of Scosset Beach so it will continue to be available for the enjoyment of the general public and residents of Scosset Village and the Town of Nantucket.

Long-term Project objectives are to preserve the infrastructure and beaches along the entire Scosset shoreline and to preserve the distinct community character that Scosset has

exhibited and developed over generations. The Nantucket Planning and Economic Development Commission (NPEDC) credits Sconset's history, character, and distinctiveness for making it one of Nantucket's chief tourist attractions (NPEDC, 2004). In its long-term plan for the village, the NPEDC describes Sconset as a "living community that continues to have a strong sense of itself" and declares that the layered history of homes along Baxter Road "and their open stance on the bluff is a marvelous aspect of the town". Further, the commission states that one of its goals is to preserve and enhance the sense of place and community that Sconset encompasses and portrays. This is a goal with which the proposed Project is wholly compatible. By implementing strategies to provide shoreline protection and prevent harm from erosion, the Project is also compatible with Nantucket's Park and Recreation plan and the community plan for Sconset.

The proposed Project will ultimately preserve hundreds of homes in Sconset, including many over 100 years old and some in excess of 300 years old. The fabric of the historic Sconset community will be preserved against the specter of long-term continuous erosion and loss. By stabilizing the eroding shoreline, the Project will protect the unique character and history of Sconset, preserving this distinct community and its contributions to Nantucket's sense of place. Without this Project, a vital and historic part of Sconset will eventually be lost, to the detriment of Nantucket as a whole. Furthermore, the Project will demonstrate the effectiveness of large-scale nourishment as a viable shore protection solution in New England, which is consistent with the mission of the SBPF.

The Project is critically needed, as demonstrated by an analysis of shoreline change data in the Project area. The shoreline has retreated 100-200 feet in many locations during the past decade (from November 1994 to October 2005) (see Figure 1-6). Documentation of this considerable and sustained erosion highlights the urgent need for timely shore projection measures. Additionally, individual major winter storms in the Project area have eroded 10 feet or more of Coastal Bank, and more than 30 feet of Coastal Dune lost over the past 50 years have not been rebuilt. Deep notches into the Coastal Bank have developed in several areas.

Over the last fifteen years, several houses very close to the edge of the bank have been moved to prevent them from being lost. These houses were either moved landward on their existing lots or moved to other more landward lots. Most of the landward lots nearby are now occupied, so the feasibility of moving additional homes away from the top of bank is becoming increasingly limited (see Figure 1-2 and Section 2.2). Additionally, if erosion is left unchecked, it will clearly not be feasible to move hundreds of homes away from an ever-receding bank. The threat to Sankaty Head Lighthouse is similarly immediate, and moving the structure would be complex, extremely costly and potentially compromising to its historical integrity. Continued erosion would also threaten public roads, the Town Sewer Beds and other public infrastructure. It is projected that relocating the Town Sewer Beds would cost the public \$5-7 million and relocating the beds would be logistically

challenging. The proposed Project is designed to provide the critical protection needed along the Sconset shoreline.

1.5 List of Permits Required

The Project will require the permits, reviews and approvals listed in Table 1-1. The Project's consistency with applicable performance standards or policies of each regulatory program is set forth in Section 6.0.

Table 1-1 Permits, reviews and approvals required for the Project.

Federal Agency/Permit	
U.S. Army Corps of Engineers (USACE)	<ul style="list-style-type: none"> ◆ Section 10/404 Permit ◆ Review by the Massachusetts Historical Commission and the Massachusetts Board of Underwater Archaeological Resources
Minerals Management Service (MMS)	<ul style="list-style-type: none"> ◆ Potential review by and negotiated agreement with MMS for use of borrow site (only if located in federal waters)
National Oceanic and Atmospheric Administration (NOAA)/U.S. Fish & Wildlife Service (FWS)	<ul style="list-style-type: none"> ◆ Endangered species review
National Marine Fisheries Service (NMFS)	<ul style="list-style-type: none"> ◆ Essential Fish Habitat Assessment review
State Agency/Permit	
Department of Environmental Protection (DEP)	<ul style="list-style-type: none"> ◆ 401 Water Quality Certificate ◆ Chapter 91 Waterways License ◆ Wetlands Protection Act (WPA) Order of Conditions (issued by the Nantucket Conservation Commission)
Executive Office of Environmental Affairs (EOEA)	<ul style="list-style-type: none"> ◆ Massachusetts Environmental Policy Act (MEPA) Review
Coastal Zone Management (CZM)	<ul style="list-style-type: none"> ◆ Federal Consistency Certification
Natural Heritage and Endangered Species Program (NHESP)	<ul style="list-style-type: none"> ◆ Endangered/Threatened species review
Local Agency/Permit	
Town of Nantucket (TON)	<ul style="list-style-type: none"> ◆ Approval to use Town-owned beach area ◆ Wetlands Bylaw Order of Conditions (typically issued concurrently with WPA Order of Conditions) ◆ Review of beach access relative to shorebird protection

1.6 Beach Nourishment Background

Beach nourishment projects and discussions revolving around the management strategy’s environmental, social, and economic factors have occurred along the Atlantic, Gulf, and Pacific coasts of the United States, during which time familiarity with the strategy and experience with various methodologies has grown. Scientific data and case studies can be used to advise and refine future beach nourishment efforts, and experience gained from past projects has been compiled in resources such as the National Oceanic and Atmospheric Administration’s (NOAA) *Beach Nourishment Guide for Local Government Officials* (NOAA¹, 2005). This guide acts as a comprehensive source where scientific, social, and

economic factors are debated within the realm of beach nourishment and coastal engineering.

The NOAA Guide also provides a forum for dialogue between advocates and opponents of beach nourishment. On one side of the beach nourishment debate, advocates argue that in addition to protecting upland infrastructure and property from erosion and storm damage, beach nourishment enhances recreational value and can support local economies dependent upon tourism and recreation. Nourishment also provides a means to maintain beaches for public enjoyment, and this strategy is a management option available in cases where retreat from an eroding coastline is not feasible (Marlowe¹, 2005). On the other hand, opponents of this management strategy contend that beach nourishment artificially manages a dynamic environment, encouraging development in high-hazard areas and often resulting in an inequitable distribution of costs and benefits (Goss, 2002; Pilkey and Coburn, 2005).

One objection to beach nourishment centers on evaluating the appropriate use of public funds; however, the majority of publicly-funded projects undergo rigorous cost-benefit analyses to ensure responsible use of public resources. Since the initial Sconset Project is privately funded and provides benefits to both public and private entities, this typical objection related to the cost of nourishment is not relevant. In addition, regardless of the funding source, nourishment projects can provide extensive public benefits by protecting public infrastructure, maintaining recreation along the shore, protecting properties important to the local tax base, and supporting economies that have grown dependent on tourism dollars (Marlowe², 2005).

The Sconset Project is intended to benefit existing public and private interests by protecting vulnerable infrastructure, private homes, and historic structures. In the case of this Project, affording protection to the upland area will not result in additional development; rather, it will prevent the destruction of existing public and private resources. This Project is proposed in an area where retreat from the eroding bank is no longer a feasible option. Furthermore, since the Project is being funded through private contributions, not only will existing infrastructure be protected but any public benefits accrued as a result of the Project will be provided at no public financial cost.

1.6.1 Nationwide Experience

Beach nourishment is a shoreline management strategy implemented in coastal zones throughout the U.S. and worldwide to restore and maintain coastal systems and to protect valuable upland property. U.S. projects involving large-scale beach nourishment supplied with material from offshore borrow sites were constructed as early as 1922 (e.g., Coney Island, New York); today there are over 200 sites across the country where significant nourishment programs have been constructed (Campbell and Benedet, 2004). This illustrates the growing popularity of beach nourishment as a management strategy along developed and recreationally-valued coastal areas. Documented benefits associated with

beach nourishment include storm damage reduction and protection of property, restoration of environmental habitat, enhanced recreation, and wide-ranging economic benefits. Although quantification of post-construction economic impacts has not been widespread in the past (NRC, 1995), there is a substantial and growing body of research and scientific literature indicating that economic benefits from upland protection provided by beach nourishment often outweigh the costs of the strategy (NOAA¹, 2005; Wakefield and Parsons, 2002; Rogers, 2000; USACE, 2000). In terms of the Project proposed herein, the economic benefits are tangible because they predominantly stem from preventing property losses and not from creating new or expanded markets or investments.

A compilation of data from various sources indicates that the total volume of sediment placed on U.S. beaches since the early 1930s is on the order of half a billion cubic meters (Campbell and Benedet, 2004). This estimate is based on nourishment volumes compiled on a state-by-state basis for large-scale projects implemented by federal, state, and municipal agencies (see Table 1-2). These data do not reflect the hundreds of smaller nourishment projects designed and constructed by private companies for local stakeholders.

Table 1-2: Estimated total nourishment volumes in the United States from 1930-2004 (in order from greatest to least volume) (Campbell and Benedet, 2004).

State	Total Volume (cubic meters)
California	180,000,000
Florida	103,000,000
<i>Atlantic Coast</i>	<i>65,000,000</i>
<i>Gulf Coast</i>	<i>38,000,000</i>
New York	80,000,000
New Jersey	60,000,000
North Carolina	40,000,000
South Carolina	20,000,000
Louisiana	12,000,000
Virginia	11,000,000
Texas	9,100,000
Mississippi	8,000,000
Maryland	7,000,000
Georgia	5,500,000
Delaware	5,000,000
Alabama	1,600,000
<i>Total</i>	<i>642,200,000</i>

The American Shore and Beach Preservation Association (ASBPA) recently published a summary of nourished beaches which found that every coastal state in the United States has a nourishment project (see Table 1-3). Information from these two studies alone indicates that since the 1920s more than 370 sites across the country have received nourishment.

Studying the distribution of projects shows that many of the most famous beaches in the United States depend on beach nourishment. These include:

- ◆ Miami Beach, Palm Beach, Jupiter Beach, Delray Beach and Fort Lauderdale (southeast Florida);
- ◆ St. Petersburg, Lido Key, and Siesta Key (southwest Florida);
- ◆ Panama City and Destin (Florida panhandle);
- ◆ Hampton Beach, Coney Island, and Fire Island (New York);
- ◆ Atlantic City and Sandy Hook (New Jersey);
- ◆ Virginia Beach (Virginia);
- ◆ Ocean City (Maryland);
- ◆ Wrightsville Beach and Cape Hatteras (North Carolina);
- ◆ Waikiki Beach (Hawaii); and
- ◆ Huntington Beach (Port of Long Beach), Venice Beach and Santa Monica Beach (California).

Table 1-3: Estimated total nourishment sites in the United States from the 1920-2004 (in order from greatest to least).

State	Number of Beach Nourishment Sites
Florida	91
<i>Atlantic Coast</i>	52
<i>Gulf Coast</i>	39
New Jersey	53
New York	33
Connecticut	27
Massachusetts	26
Delaware	24
North Carolina	23
South Carolina	22
California	16
Louisiana	12
Texas	11
Rhode Island	8
Hawaii	6
Alabama	5
Maine	4
Mississippi	4
Washington	4
Virginia	3
Georgia	2
Maryland	2
New Hampshire	2
Oregon	2
Total	375

Many of the country's large-scale beach nourishment projects have been built and maintained by local governments or the USACE using both offshore sites and navigational dredging projects as sediment sources. Funding for federally-sponsored projects is congressionally approved. In addition, a few coastal states (including Rhode Island, New Jersey, Delaware, Florida and Texas) have recognized the positive economic benefits of healthy beaches and have established dedicated funding sources to assist state and local governments in implementing beach nourishment projects. Funds dedicated to shore protection projects in these states have been raised through real estate transfer fees, occupancy taxes, document taxes, tourist (bed) taxes, and coastal protection trust funds. Many of the nourishment projects listed in Table 1-3 have also been funded through private fundraising efforts.

Nearly 70 years of nationwide experience with beach nourishment have highlighted three primary benefits associated with this shore protection strategy: storm damage reduction, recreational enhancement, and economic benefits; the first of these three benefits is the primary purpose of most nourishment projects. Documented examples of these benefits are growing annually as monitoring programs track the performance and impacts of specific beach nourishment projects. Monitoring efforts are primarily conducted to identify when renourishment triggers have been reached and to monitor project effectiveness relative to observed environmental conditions (i.e., actual wave, current and storm data). By monitoring projects during the post-storm recovery period, it has been possible to document storm damage reduction benefits. A study of damage on the Florida panhandle following Hurricane Eloise in 1975 indicated a dramatic positive correlation between increasing beach width (through beach nourishment) and reduced storm damage (Dean, Davis and Erickson, 2005). Similarly, damage surveys following Hurricanes Bertha and Fran in 1996, Dennis and Floyd in 1999, and Ivan in 2004 showed that developments landward of nourishment projects sustained little or no damage while adjacent areas suffered substantial adverse effects from the storms (Rogers, 2000; USACE, 2000).

Nationwide, the economic benefits of beach nourishment are far-reaching. For example, Bogue Banks, a high non-overwashed barrier island just south of Cape Lookout on the North Carolina coast, was impacted by a number of hurricanes in the 1990s which significantly damaged 26 miles of developed shoreline. Properties along this shoreline generate over 42 percent of Carteret County's tax revenue while requiring only five percent of the county's expenditures for services on the barrier islands (Forman, 2005). Recognizing the value of these properties to the local tax base and reflecting the local economy's dependence on tourism, three municipalities worked together to establish a Beach Preservation Task Force. This group evaluated three beach management alternatives: (1) no action, (2) retreat/relocate, and (3) beach nourishment. Through an extensive Environmental Impact Statement process, the task force concluded that beach nourishment was the only feasible alternative to protect the shoreline and associated benefits in this area. Although representing less than 1 percent of the land area in Carteret County, in 1997 Bogue Banks accounted for approximately 43 percent of the county's property tax base

(Forman, 2005). In addition, 1997-1998 taxes paid by Bogue Banks property owners accounted for approximately half of the funding for county schools while only representing 10 percent of the school population. Destruction of property along the threatened shoreline, therefore, would have been disastrous for the county's economic base. Aside from other considerations, this relationship vaulted beach nourishment into position as the economically advantageous strategy for shoreline protection. In addition, nourishment of Bogue Banks beaches ensured that coastal visitors would continue to be drawn away from the adjacent Cape Lookout National Seashore, thereby reducing potential adverse impacts to that pristine environment. As a result, several locally-funded beach nourishment projects have been completed in Carteret County, with nourishment efforts totaling 5.6 million cubic yards between 2002 and 2005. This community-led case study of beach nourishment illustrates how such efforts can benefit the public through both economic and environmental avenues.

Other coastal communities such as Miami Beach, Florida and Ocean City, Maryland are highly dependent upon recreational opportunities and economic support provided by wide beaches and coastal zones, and have therefore also selected beach nourishment as the preferred approach for beach management (Hedrick, 2000). These decisions were supported by the recreational and economic benefits that come with beach nourishment. The coastal zone is often responsible for a large portion of the travel and tourism industry and can host very high property values, both of which hold implications for tax base and revenue (Dean, Davis and Erickson, 2005). Where this dependence is particularly marked, the economic and social benefits of beach nourishment have proven to be vital to the health of the local community. For example, a \$64 million nourishment project constructed between 1976 and 1981 over Miami Beach's 10-mile length has been largely credited with revitalizing the local economy and attracting approximately 20 million tourists each year (Dean, Davis and Erickson, 2005).

Beach nourishment has become one of the preferred methods of coastal management primarily because it preserves and enhances the aesthetic and recreational values of the coastline by replicating protective characteristics of natural beach and dune systems. The growing number of beach nourishment projects, development of long-term funding strategies, and documented storm damage reduction benefits each indicate that beach nourishment is a viable means of shore protection.

1.6.2 New England Experience

Beach nourishment has been widely implemented in smaller New England projects. Data from the Duke University website identifies more than 150 individual beach nourishment projects in Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine with cumulative sand volumes exceeding 10 million cubic yards (<http://www.env.duke.edu/psds/nourishment.htm>). More than 80 beach nourishment projects have already occurred in Massachusetts, and the state is experiencing further erosion along the north and south shores of Boston as well as Cape Cod and the Islands. A

depleted nearshore sediment supply, very high costs associated with using upland sand sources, and a lack of adequate beach-compatible sand from navigation projects means that offshore sand mining will be a vital component of future beach nourishment projects in the region.

Beach nourishment has exhibited success in Massachusetts over the past 15 years, including projects at Craigville/Long Beach, Dead Neck Island, and Revere Beach. The Craigville/Long Beach project, which utilized an offshore borrow site, achieved its design life of 7-10 years and was successfully renourished on-schedule. Sand mining for the project actually produced environmental benefits at the borrow site by resulting in colonization by eel grass. Beach nourishment at Dead Neck Island was similarly successful, with the project achieving its 10-year design life. Both the Craigville/Long Beach and Dead Neck projects were privately funded and constructed to reduce storm damage. Ancillary benefits of improved recreational resources and enhanced economic value were also realized. The larger project at Revere Beach, constructed by the USACE, utilized an upland sand source to restore 13,000 feet of beach through dune construction and beach nourishment. The project was meant to protect existing seawalls during frequent storms and support recreational use of the beach. A cost-benefit analysis performed by the USACE documented that the project's economic benefits exceeded its costs.

In another local project, the Massachusetts Department of Conservation and Recreation (DCR) is proposing to nourish two sections (together spanning approximately 0.6 miles) of Winthrop Beach to provide storm damage protection and prevent erosion. The northern portion of the project consists of 2,200 feet of nourishment with a berm width of 100 feet, while the southern portion consists of 1,000 feet of additional nourishment. This state-funded \$11 million nourishment project, which is proposed to cover approximately 37 acres with 500,000 cubic yards of sand and gravel, recently received a Certificate from the Secretary of Environmental Affairs on its Final Environmental Impact Report (FEIR). DCR proposes to obtain the nourishment material from NOMES I, a 50-acre offshore borrow site located in Massachusetts Bay.

The Sconset Project is consistent with previous beach nourishment projects worldwide, along the U.S. Atlantic Coast, and in Massachusetts. Review and analysis of the research, design and performance underlying previous projects provides valuable background information on which future projects can be based. The Sconset Project, while unique in its setting, has incorporated this information into project planning and design to develop a stable foundation meant to maximize project performance.

Through conscientious design, careful planning and appropriate mitigation techniques, the Project Proponent is confident that adverse environmental impacts can be minimized to the maximum extent practicable. Although there will be short-term impacts to benthos, the sand mining is proposed in a highly dynamic location where there is no significant aquatic vegetation and benthic organisms present are highly adaptable and hence are expected to

recover quickly. In addition, although primary funding for the Project will be through private investment, tremendous public benefits will result from its implementation. As such, the Sconset Project provides a unique opportunity to demonstrate the effectiveness of large-scale beach nourishment in Massachusetts as a viable solution in instances of dramatic and persistent shoreline retreat.