Environmental Assessment
for
Cyclic Beach Replenishment
at
Sandy Hook Unit
Gateway National Recreation Area
New York - New Jersey

United States Department of the Interior
National Park Service

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EXECUTIVE SUMMARY

Sandy Hook, the northernmost 18km (11 miles) of barrier beach along New Jersey's coast, has a long history of persistent shoreline erosion and change. An 11-km. (7-mile) seawall constructed in the early 1900's immediately adjacent to the National Recreation Area has effectively prevented the natural transport of sediment into Sandy Hook. This long-standing artificial structure has resulted in steepened nearshore slopes and the significant retreat of shorelines at its northern terminal--the southern beaches (Critical Zone) of Sandy Hook.

Since its inception as a National Recreation Area (NRA) Unit in 1976, the National Park Service (NPS) has attempted to maintain Sandy Hook's shoreline in order to provide continued recreational opportunities and protect its significant natural and cultural resources. The accelerated erosion and subsequent shoreline retreat threaten Sandy Hook's resources as well as the NPS' present level of use and operations. Continued erosion will likely result in a breach to the peninsula, damage NPS physical and historical facilities and beaches, and severely restrict access by the public and tenants.

Since 1976, the NPS has been pursuing and evaluating practical alternatives to address this problem and provide for continued operations and access to NPS resources. This document seeks to address each of the identified alternatives as well as the impacts of each alternative on the affected environments.

The NPS proposes a sustainable sand recycling system (Sand Slurry Pipeline) as its preferred alternative. This Sand Slurry Pipeline system would maintain shoreline equilibrium with minimal impact on the beach communities. The project objective is to simulate the natural sand transport and equilibrium along Sandy Hook in the context of the adjacent stabilization perturbation. This would require a pipeline which borrows sand from the northern, accreting portion of the Hook (Gunnison Beach) and deposits it on the eroding southern beach (Critical Zone). This system would provide NPS the flexibility of recycling up to 100,000 cubic yards (cy) annually (as needed) to maintain a shoreline equilibrium. This system would utilize the sand moving through the Sandy Hook nearshore in the form of sand bars and intertidal slurry.

In the preferred alternative, the slurry pipeline would be aligned with the existing road corridor in a previously disturbed area and utilize a series of pumps to transport the sand slurry with minimal heavy equipment at each end. Sand would be withdrawn (through an eductor system) from accreting shoals, pumped through the pipeline, and deposited in the intertidal zone. The annual sand transfer and placement (a maximum of 100,000cy) is anticipated to be restricted to a small area (about 3 acres) and depends upon the annual shoreline dynamics and bar formations for removal and redistribution of sediment. Adverse impacts to cultural and natural resources along the project area are minimized, and mitigation and monitoring measures are established to insure compliance with the appropriate legislation and Park mission.

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PURPOSE AND NEED

Sandy Hook, a unit of Gateway National Recreation Area, is a 10-mile, recurved spit along the northern New Jersey coastline that provides recreational opportunities for 2.5 million visitors annually. It remains one of New Jersey's most heavily-used beaches and best examples of a "natural" beach community and shoreline. Erosion from high seas and natural forces has been accelerated by adjacent shoreline stabilization, resulting in markedly steepened slopes and narrowed beach in an area known as the "Critical Zone" (Figure 1) which threatens vehicle access, recreational beach use, and NPS and tenant operations on Sandy Hook.

The New Jersey coastline including Sandy Hook has a long history of shoreline stabilization (Gorman 1988, Gares 1981). Shoreline stabilization efforts since 1900 immediately to the south of Sandy Hook have significantly impacted the NPS shoreline and created a sand deficit along its southern Critical Zone (Allen 1981, Phillips *et al.* 1984, Slezak *et al.* 1984). Groins, built over the decades in Monmouth Beach and Sea Bright, and the sea wall near the southern boundary of the Park have prevented sand from reaching Sandy Hook's southern beaches (Psuty and Namikas 1991). These beach stabilization structures, designed to prevent erosion, have actually interfered with the northern littoral drift of sand along the New Jersey shoreline. Although some sand is still deposited at the Critical Zone, the amount is insufficient to counter losses due to erosion. As a result, the sand deficit at the southern end of Sandy Hook continues to grow.

Continued erosion on this southern portion of Sandy Hook has reduced recreational bathing beaches and jeopardizes newly constructed beach facilities and public access. Furthermore, without an adequate sand barrier in place, access beyond the Critical Zone would eventually be denied due to inevitable breaching of the spit. Such consequences would adversely impact the millions of visitors who use the Park annually as well as the numerous federal and state agencies, schools, private organizations and approximately 1,000 employees working on Sandy Hook. The US Coast Guard station at Sandy Hook would also be rendered inaccessible by land, severely hampering their ability to conduct homeland security activities in New York Harbor.

This environmental assessment, prepared in accordance with the National Environmental Policy Act of 1969 and regulations of the Council on Environmental Quality (40 CFR 1508.9), evaluates a range of practical alternatives for replenishing sand at the Critical Zone to meet NPS management objectives of maintaining natural and cultural resource protection, as well as public access and recreational opportunities on Sandy Hook. Analysis of the alternatives focuses on the impact that beach replenishment would have on the cultural (Figure 2) and natural resources (Figure 3) of Sandy Hook, as well as its effect on the visitor experience and Park operations. Issues of major concern include the impact that beach replenishment would have on the coastal geomorphology of Sandy Hook as well as on the habitat and populations of several federal and state Threatened and Endangered (T & E) plant and animal species found along Sandy Hook's beaches.

Figure 1. Project Area

View GRAPHIC 1 File

BACKGROUND

Like most barrier islands and spits, Sandy Hook has experienced dynamic geomorphologic changes. Within the last two centuries, it has been an island; it has been connected to the mainland at two different sites; and it has had as many as four inlets joining the ocean and the Navesink-Shrewsbury River system (Gorman 1988, Gares 1981, Moss 1964). Beginning in 1900, however, significant effort and commitments were made to stabilize most of the New Jersey coast, including the construction of the Seawall at Sea Bright. These shoreline stabilization efforts have significantly altered the geomorphologic shoreline dynamics of Sandy Hook, creating an unnatural near-shore sand transport system. Presently, the continued effects of these established man-made structures along adjoining townships pose a challenge to Park Service management and operations on the NRA.

The NPS has made a long-term commitment to provide recreational opportunities and protect the natural and cultural resources of Sandy Hook. This commitment has been reaffirmed in numerous NPS planning and public review documents since the Park's establishment in 1974. The NPS has spent approximately $32 million on beach replenishment to maintain the shoreline and vehicle access to Sandy Hook.

Between late 1996 and early 1997, a combination of fierce storms and unusually high tides resulted in breaches of the Park's main access road at the Critical Zone, causing temporary road closures, damage to newly constructed beach facilities and parking lots, and severe erosion of recreational bathing beaches. As a result, the NPS undertook an emergency sand replenishment project in January 1997 to provide immediate protection to the road and beach facilities against future storms. Approximately 60,000 cy of sand were transported by truck from the Gunnison Beach area, at the northern end of Sandy Hook, to the Critical Zone, located one mile north of the Park entrance between January and March. Nearly 90% of the sand that was placed during the winter months was eroded by additional storms and high tides between April and June 1997, leaving the Critical Zone and Parking lots at Area D subject to overwash during periods of high tide. On six different occasions during 1997, mainland access to Sandy Hook was severed due to inundation of Hartshorne Drive, the only access route to and from the peninsula. The most recent incident occurred on October 19-20, 1997.

The first phase of the project conducted in December 1997 through March 1998 involved the placement of approximately 287,500 cy of sand to provide immediate protection of the Park road and beach facilities. Sand for this phase of the project was obtained from the State of New Jersey/U.S. Army Corps of Engineers (ACOE) offshore borrow site (ACOE 1989). A subsequent phase of this replenishment project was carried out in November 2002 when approximately 253,000cy of sand was placed at the Critical Zone.

Based on past performance models, approximately 1.5 million cy of sand is needed for replenishment at the Critical Zone every 5-7 years, or 250,000 cy/year, to counter beach erosion (Psuty 2001). Previous replenishment projects occurred in 1977, 1982-83, 1989-90, and more recently, during the winters of 1996-97, 1997-98, and 2002. However, the recent large-scale beach replenishment projects immediately south of Sandy Hook at Sea Bright by the ACOE have increased sediment availability in the Critical Zone. The amount of sand needed to maintain a stable system and prevent sand deficit is now estimated to be less than half of original

projections (100,000 cy) (Psuty, 2002, 2003). These recent long-term (50 yr) ACOE NJ coastline fill projects (ACOE 1989, 1993) have significantly altered the nearshore sand budget, providing more sand for transport around and past the Seawall into the Sandy Hook system. An estimated 200,000 cy now move through the Sandy Hook system on an annual basis and an estimate of 55,000 cy is now considered necessary to maintain an equilibrium state as well as the existing character of the Critical Zone (Psuty 2001, 2002).

RELATIONSHIP TO OTHER PROJECTS

The Park currently is managed under a 1979 General Management Plan (GMP) that was amended in 1990. In accordance with that plan, the NPS is undertaking or planning to undertake several projects in the Park. These projects are (or would be) separate undertakings and are not interrelated or interdependent with the actions considered in this Environmental Assessment (EA). The recent 2002 beach replenishment project, however, increases the effectiveness of this project, as it provided additional sand available for sediment transport and reduced the sand deficit at the Critical Zone.

Projects currently under construction at the Park include the rehabilitation of several historic structures, including the Sandy Hook Lighthouse keeper's quarters and former officers' residences #18 and #20, construction of a multi-use path from the Park entrance to the Fort Hancock Ferry terminal, and rehabilitation of a former barracks building to serve as the Park Visitor Center and for curatorial storage and display. These projects were initiated in 1999 and should be completed by 2004. A damaged section of the Park's main road was repaired in September 2000. The roadway in flood prone areas south of the Ranger Station was raised to improve drainage and reduce road closures following storm surges and overwash. Projects currently under consideration at the Park include: (1) redevelopment and historic leasing of 38 Fort Hancock buildings, and (2) construction of a permanent ferry terminal;.

ISSUES AND IMPACT TOPICS

This environmental assessment is prepared in accordance with the National Environmental Policy Act of 1969 and regulations of the Council on Environmental Quality (40 CFR 1508.9). The assessment evaluates two alternatives: the no action alternative and the action alternative, to meet Park management objectives of maintaining natural and cultural resource protection, and providing public access and recreational opportunities on Sandy Hook. The action alternative contains two options, differing on the method of sand extraction. Analysis of the alternatives focuses on the impact that beach replenishment may have on the natural and cultural resources of Sandy Hook, as well as its effect on the visitor experience and Park operations. Impact topics that will be discussed include coastal processes, National Historic Landmark structures, archeological resources (Figure 2), sensitive natural resources (Figure 3), beach users, residents, and employees.

Additional topics listed below were considered and dismissed from further analysis for the reasons stated in each topic area:

Wetlands and Floodplains

Executive Orders (EO's) 11988 (Floodplain Management) and 11990 (Protection of Wetlands) require the NPS and other federal agencies to evaluate likely impacts of actions on floodplains and wetlands. Both the borrow and fill sites, and adjacent lands are located within the 100 year floodplain, which includes all Parkland up to an elevation of 10.8 feet above mean sea level (MSL) (NPS 1994). None of the alternatives would elevate the areas above the floodplain or reduce the capacity and function of the floodplain. The action alternatives evaluated in this EA, which protect beach centers and provide recreational bathing beaches, are dependent upon the facilities being located in a floodplain. NPS Floodplain Management Guidelines V(B) exempt from further consideration impacts to "Picnic facilities, scenic overlooks, foot trails, and small associated daytime parking facilities in non-high hazard areas" that are located near water for the enjoyment of visitors. Wetland areas are located adjacent to the Critical Zone, however, and any effects to the wetlands would be the result of natural coastal processes which could result in overwash to bayside salt marshes. Any protective measures afforded by these alternatives would allow the salt marshes to remain as they currently exist.

Figure 2. Cultural Resources of Concern

View GRAPHIC 2 File

Figure 3. Natural Resource of Concern

View GRAPHIC 3 File

Dune, Upper Beach, Nearshore and Offshore Habitats

These habitats are important as they relate to threatened and endangered species and impacts to these areas are addressed in the sections dealing with impacts to piping plovers (*Charadrius melodus*), least tern (*Sterna antillarum*), Eastern beach tiger beetles (*Cicindella dorsalis dorsalis*), seabeach amaranth (*Amaranthus pumilus*), and marine mammals. Therefore, there will be no further discussion of these topics as concerns in and of themselves.

Visual and Scenic Values

Since the alternatives mimic natural conditions with dynamic coastal changes neither the no action alternative nor the beach fill alternatives will significantly alter or create a lasting change to the visual or scenic values of the area. Project activities are restricted to a winter window when visitation is at its lowest.

Air Quality

Air quality at Sandy Hook is highly influenced by the combined industrial, commercial, residential, and vehicle emissions of the New York/New Jersey metropolitan area. Under the no action alternative, vehicle access would be greatly diminished. However, overall air quality would not be affected by any of the alternatives, since regional air quality conditions and traffic adjacent to the Park would presumably remain unchanged.

Submerged Cultural Resources

The NPS Submerged Cultural Resources Unit conducted a magnetometer survey of areas offshore of Sandy Hook in September 1997. As part of the survey, various historical maps were examined along with other sources during the compilation of a Geographic Information System (GIS) database. The potential locations of eight documented shipwrecks were identified and plotted based on the historic maps (Figure 2). As a result of shoreline accretion on the north and northeast ends of Sandy Hook, these shipwrecks may now be buried onshore, although no testing has been conducted to confirm the existence of these potential archeological resources. The alternatives considered in this EA will not cause the erosion or removal of sand, or the covering by sand, of known submerged cultural resource sites.

ALTERNATIVES

BACKGROUND

Since the 1970's, a wide range of alternatives has been considered for maintaining public access and recreational opportunities at Sandy Hook. These alternatives have been analyzed by interdisciplinary teams of experts and have resulted in a variety of decision documents. A summary of these documents, the alternatives considered, and the solutions proposed are outlined below.

Assessment of Long Range Alternatives for the Reestablishment and Maintenance of the South Beach Area, Sandy Hook Unit, Gateway National Recreation Area, New York - New Jersey (1978)

This document evaluated a wide variety of methods for dealing with the erosion problem at the Critical Zone, ranging from short-term, stop-gap measures, such as the use of sand bags for road protection and trucking of sand to replenish eroded beaches, to more permanent actions that offered long-range solutions. Permanent actions that were assessed included the use of structures (e.g., seawalls, groins, armored causeway, and bridge over controlled inlet), as well as beach nourishment without structures.

Each of the above actions was evaluated based on the following criteria: (1) resource impacts (physical, biological, and cultural), (2) mitigating measures, (3) unavoidable adverse effects, (4) relationship of short-term liabilities and long-term gains, (5) irreversible and irretrievable commitment of resources, and (6) costs. The assessment was distributed for review and comment to all known interested parties, including regulatory agencies such as the ACOE, U.S. Coast Guard, and EPA. A preferred option was not identified in the document; this action was to be performed later by the NPS following analysis of all the alternatives and comments received during the public review process.

Applied Science Discussion of Management Alternatives (Nordstrom, et. al. 1982)

This document represents the culmination of an applied geomorphology study conducted at Sandy Hook. The goal of the study was to identify the physical processes affecting the Sandy Hook shoreline in order to assist the NPS with future management decisions regarding beach resources. The report identified management strategies and beach stabilization measures that are compatible with both the goals of the Park and the dynamic nature of the beach system. Beach nourishment was proposed as the best strategy for averting inlet formation at the Critical Zone given current management objectives of maximizing beach usage while protecting public access to the Park.

Assessment of Alternatives for Long Term Management of Critical Zone Erosion, Sandy Hook Unit, Gateway National Recreation Area (1988)

The continual need for beach nourishment coupled with the cumulative cost and an indeterminate dredging schedule prompted the NPS to reappraise the management options available for dealing with the Critical Zone over the long term. The following long-term erosion management strategies were explored: (1) take no future action beyond an interim measure, (2) continue beach nourishment, (3) stabilize the shoreline with protective structures, (4) construct a bridge to provide access, and (5) employ a ferry system to transport visitors and employees.

The preferred option, to continue beach nourishment, would allow the presently high visitor use levels to continue on Sandy Hook until about 1993-94. Taking no future action beyond an interim measure would result in restricted access to Sandy Hook in the short term, and the loss of overland access soon after. Stabilizing the shoreline with protective structures would not only displace the erosion locus northwards into the principal bathing beach, but would eliminate recreational opportunities. Although construction of a bridge might enable high-volume access to Sandy Hook to continue indefinitely, its construction would involve a lengthy span ranging

from 3,000 feet to 1.25 miles and costing between $50-$100 million, depending on the alignment chosen. Due to the highly dynamic and erosive nature of the shoreline and water currents, maintenance and life expectancy of such a structure is uncertain. Development of a ferry system would permit visitation to continue at moderate levels. However, at least one ferry terminal would have to be constructed on Sandy Hook and the shallow bay would likely need to be dredged to accommodate a reasonably-sized ferryboat. Construction, maintenance, and dredging costs of these new facilities would be significant.

The report also indicated that if dedicated appropriations for maintaining access can be obtained and if suitable sand is available, beach stabilization via recycling would be pursued. In the meantime, since these assumptions could not be guaranteed, the NPS would continue to examine the ferry-based alternative for possible adoption as the preferred solution by the mid-1990s.

Assessment of Alternatives for Long-term Management of Critical Zone Erosion, Sandy Hook Unit, Gateway National Recreation Area (1994)

The purpose of this document was to convey the urgency of the beach erosion problem at Sandy Hook, propose a viable solution, and identify associated costs. In addition to re-evaluating the alternatives considered in the 1988 assessment (i.e., no action, continue beach replenishment, use of structural stabilization, bridge construction, ferry system), modification of the existing groins was also examined.

The proposed solution was two-fold: First, in 1995, continue to preserve the beach at the Critical Zone through the placement of riprap and construction of sand dunes along Hartshorne Drive. Then in 1996, continue sand replenishment in addition to notching existing groins at the southern end of the Park to increase the amount of sand transported northward to the Critical Zone. This action would not only maintain visitor access, but would provide the NPS with time to adequately assess whether beach nourishment costs should continue or whether ferry service should be implemented. However, since these groins are covered with sand, and are expected to continue to be submerged by the sand from the ACOE Sea Bright fill for 50 years, notching of the groins now would serve no function. If, however, these groins become uncovered and begin to function, the NPS will again consider notching them.

The long-term availability of sand was also identified as a concern. Since beach nourishment using recycled sand at Sandy Hook was determined to be most compatible with NPS policies on fulfilling the recreational purpose of the Park, restoring damaged coastal systems, and not attempting to overcome natural coastal processes, the document recommended that this potential sand source be more fully explored.

Value Analysis Study for Providing Access and Beach Improvements at the "Critical Zone", Sandy Hook Unit, Gateway National Recreation Area (1995)

In June 1995, a value analysis study was conducted to assess options for providing access and beach improvements at the Critical Zone at Sandy Hook. The value analysis process documented

the discussions, technical data, and recommendations of a multidisciplinary team of design professionals based on the evaluation of a wide-range of concepts against a set of weighted criteria. The following rating criteria were used to evaluate the range of alternatives: (1) life-cycle costs, (2) level of service, (3) consistency with NPS and Park policies, (4) external impacts, (5) resource protection, (6) quality of visitor experience, (7) technical feasibility, and (8) sustainability.

The value analysis team concentrated their work in two functional areas: providing access, and providing recreational opportunities. A total of 18 major concepts and multiple sub-set alternatives were explored with each concept subjected to a "pass-fail" feasibility analysis. The six options which passed were then assessed in detail: (1) bridge construction, (2) pedestrian ferry with shuttle, (3) causeway without nourishment, (4) causeway with nourishment, (5) full beach nourishment, and (6) additional road protection with full beach nourishment.

The recommended solution for providing access was to construct a causeway with paved entrance road, approximately 1.0 mile long and across the Critical Zone area. The advantage of the causeway over the other concepts considered is that it offers a long-term solution for two functional problems: maintaining access to Sandy Hook, and preventing erosion and breaching through the Critical Zone. Maintaining a recreational beach at the Critical Zone by replenishing sand, as necessary, and notching the existing groins to maximize sand migration from the south was again chosen as the alternative that best satisfied the goal of providing recreational opportunities. However, the stability and longevity of such a structure, given the dynamic shoreline and erosion at that site, remain unpredictable and the potential need for additional significant structural reinforcements and maintenance were noted.

Value Analysis Study for Sandy Hook Beach Replenishment, Gateway National Recreation Area (1997a)

In February 1997, the NPS conducted another value analysis study to provide and document the best management strategy and most cost-effective solution to solving the problems at the Critical Zone while meeting the legislative mandates of the Park. This study builds on the results of the 1995 value analysis study and explores a range of alternatives for beach sand replenishment. Recommendations were made in three areas: (1) options and methods for beach sand replenishment, (2) methods to slow the loss of beach sand, and (3) strategies to ensure long-term maintenance of the Critical Zone.

The recommended solution proposed by the interdisciplinary study team was to provide full beach re-nourishment, coupled with construction of a slurry pipeline that would provide the infrastructure necessary for cyclic sand replenishment. It was believed that this combination would guarantee long-term access to the Sandy Hook peninsula without requiring construction of a causeway as was recommended in the 1995 study. No structural methods were recommended due to the known failure of many of these methods, as well as the unproven history of others.

Value Analysis Study for Sandy Hook Beach Replenishment, Gateway National Recreation Area (2003)

In August 2003, NPS conducted a value analysis study to determine the most cost effective alternatives for supplying sand to a chronically erosive section of beach at Sandy Hook. This included six alternatives that were considered, but dropped from further consideration due to cost, environmental, or logistical constraints and two action alternatives that are presented in more detail, as the two plans to be considered for choosing a selected final plan for recommendation. These alternatives were all developed to provide 100,000 cy/yr of sand to the Critical Zone from a 3 month/year operation, predominantly during the winter months, and with no more than 2,000cy transported daily for an 8 hour work shift.

Previous assessments completed over the past 20 years (outlined above) analyzed a variety of alternatives for dealing with ongoing erosion at the Critical Zone. These assessments build from the findings of previous studies as well as decades of coastal geomorphologic research conducted on the Sandy Hook peninsula. Each confirms that beach replenishment offers the best, most cost-effective solution for providing public access and maintaining recreational opportunities at Sandy Hook.

Under each of the action alternative options considered below, the beach at the Critical Zone would be restored to the shoreline profile that was previously constructed in 1998. This template was chosen since it closely resembles the natural shoreline configuration, while providing considerable protection for the roadway. The protective buffer would be approximately 600 feet wide, at the broadest point, and would include construction of a feeder beach just to the south to continue the protective dune along the road and Parking Area that ties into the existing dune on the south end. The new fill would utilize the existing dune ridge that has been built seaward of the Parking Lots as well as between Lots C and D. The newly created beach would offer protection against storm surges and serve as a sand reservoir if the beach experiences extensive erosion before sand replenishment could occur in the future.

The following discussion describes the range of alternatives considered for replenishing sand at the Critical Zone and, where applicable, the reasons for rejecting an alternative from further consideration. A preferred alternative has been identified based upon natural and cultural resource concerns, budgetary constraints, and associated impacts on visitor use and Park operations, as well as the ability to satisfy Park management objectives. The primary difference among the action alternative options is in the type of equipment use at the removal site. The method of transport and fill, and frequency and volumes of beach replenishment are identical.

ALTERNATIVE A: NO ACTION

Under the no-action alternative, the NPS would make no attempt to control ongoing beach erosion. As the sand deficit in the Critical Zone continues to build, public access would be gradually lost to much of Sandy Hook due to irreparable damage to Hartshorne Drive. Within a few years the spit would be breached and an inlet could form, causing Sandy Hook to become an island for an undeterminable duration. Tidal flow through the uncontrolled inlet would cause accelerated erosion on both ocean and bayside beaches resulting in a loss of recreational bathing beaches and millions of dollars of beach facilities. Bayshore communities could be affected by changes of tidal height and duration and possibly increased wave energy. Without an adequate sand barrier, Park closures would occur, adversely impacting the millions of annual visitors as

well as the numerous federal and state agencies, schools, private organizations and approximately 1,000 employees working on Sandy Hook. Public access to the cultural and historical resources on Ft. Hancock would be significantly curtailed, limiting financial options for their physical maintenance. Other forms of access to the island would need to be pursued, as a ferry service or causeway. Both these options were considered multiple times over the last few decades, but were not considered further as the best alternatives.

If an inlet were to form, the ephemeral nature of shoreline dynamics makes it difficult to predict its longevity and morphology. Construction of any new road or ferry terminal would need to consider the highly dynamic shoreline changes, including the probabilities of inlet migration and closure, and attachment to the mainland at some future time. Inlet formation would create an island effect for all inhabitants and restrict flow of public access and services as well as sand transport to the rest of Sandy Hook.

Creation of a new inlet should provide additional beaches suitable for federally-threatened piping plovers and other beach dependent species, but it is unclear whether the total shoreline of Sandy Hook would gain or lose suitable habitat due to the changes in sand transport caused by the new inlet. It is predicted that new inlet beaches with potential for overwash and back flat foraging habitat would be inhabited by piping plovers as in Westhampton (Houghton *et al.* 1995-2000). It is also predicted, however, that erosion and accretion rates along all of Sandy Hook would be affected by the resulting sand deficit. Prime northern nesting beach habitat could be affected by altered sand transport conditions along Sandy Hook due to inlet formation.

ACTION ALTERNATIVE

Obtain sand on a cyclic maintenance schedule from Gunnison Beach (accreting northern end of Sandy Hook) and Transport to Critical Zone via a Sand Slurry Pipeline.

The NPS proposes a sustainable solution of cyclic beach replenishment to best simulate and maintain shoreline equilibrium conditions, minimize beach impacts, and provide protection for NPS access roads, beach facilities and public bathing beaches. This action builds on previous studies that support sand recycling along the Sandy Hook peninsula (NPS 1988, 1994, 1997a, 2003). A permanent underground pipeline, approximately three miles (15,000 feet) in length, would be installed along the peninsula to provide the infrastructure necessary to periodically replenish sand to the Critical Zone with sand from accreting portions of Gunnison Beach at the northern portion of Sandy Hook. Only that amount of sand that accretes in the nearshore bars in a year's time (up to 100,000 cy) would be recycled back to the southern beaches of the Critical Zone.

The Sandy Hook project proposes to extract the slurry during the winter months to take advantage of the larger amounts of sand available in migrating shoals as well as transport rates. The sand by-pass system involves these basic steps. First the water is suctioned from the ocean and pumped through the pumping facility to the (sand removal end) eductor at the water's edge (Figures 5a and b). The eductor excavates sand, creating a slurry, while suspended and deployed by a crane at the borrow site (Figures 6a and b). The slurry is then pumped back through the pumping facility and out into the pipeline to the deposition area (Figures 7a and b). The Sandy

Hook system would be similar to the Indian River bypassing system except that it would require the use of three (3) booster pumps along the pipeline due to the length of sand transport.

Since the full (1998) beach profile was reestablished at the Critical Zone (2002 interim fill project), the most efficient and cost-effective maintenance schedule for beach replenishment would involve placement of up to 100,000 cy of sand to be pumped on an annual basis, as needed (NPS 2001, US Fish and Wildlife Service (FWS) 2002). This pumping schedule is based on a rough, preliminary cost estimate that modeled a three-year cycle (NPS 1997a). The preferred pumping schedule of up to 100,000 cy on a yearly basis would allow for complete restoration of the full beach profile and would not destroy the character of the eroding or accreting beaches, including the protective dunes, or cause damage to existing facilities. Replenishment of the beach with smaller quantities of sand on a more regular basis would also more closely mimic the amount of sand transported through natural littoral drift.

ALTERNATIVE B: SLURRY PIPELINE

Sand Transport System.

The sand transport system from Gunnison Beach to the Critical Zone includes 15,100 lf of 10" inner diameter HDPE pipe buried with an estimated 2 ft of earth cover for the sand slurry pipeline previously developed for the NPS. The alignment basically begins near the landward side of the dune at Gunnison Beach, proceeds to and advances along an area adjacent to Atlantic Drive and then runs adjacent to Hartshorne Drive to the beach at a point at the northern end of the Critical Zone. Three discharge ports with valves from the main pipeline will be included to minimize the need for grading the sand arriving at the Critical Zone, one at the terminus, one 1100 feet and one 3000 feet from the terminus.

The three booster pumps are located near Hartshorne Drive or Atlantic Ave. and are diesel-powered, 420 horsepower pumps spaced at locations 2,850 ft 7,350 ft and 11,910 ft from the end of the slurry pipeline at the Critical Zone. Diesel power is more cost effective than electric power for the booster pumps due to the high cost of electricity for a relatively high electrical power requirement over a short duration. In addition, electric power outages would pose a problem. Even though the initial cost of the diesel powered pump is higher than the electrically-driven pump, the life cycle cost of the booster pump powered by electricity would far exceed the cost of the diesel powered pump. The spacing of the booster pumps can be varied up to 1,000 ft in either direction, for better location, without effecting performance. The booster pumps would be portable and mounted on trailers or skids that would be placed on concrete pads measuring approximately 15' X 20'. The booster pumps would be removed when not in use. The sealwater for the operation of the booster pumps will come from water lines servicing NPS facilities, however, this will require approximately 30,000 gallons of water per day including a fourth booster pump at the collection tank of the sand retrieval system. Sealwater could also be obtained from the ocean if necessary. Sealwater piping would run in the same trench as the slurry pipe. Water would be bled from the system after each transport operation to preclude pipe damage (NPS 2003).

Sand Retrieval Excavation System.

Option 1: Sand removal with crane and clamshell bucket. The sand retrieval excavation system that ties into the sand transport system, as described above, is completely mobile. All of the features of this system are sled or crawler mounted and are intended to be mobilized at the start of the sand transport operation of roughly 3 months duration and demobilized at the end of the 3 months of operation. The sand excavator consists of a crawler mounted crane with an approximate 200 ft long boom equipped with a 10 cy clamshell bucket that will excavate the sand in the surf zone, swing the boom and deposit the sand in a 100 cy hopper.

The bottom of the hopper is equipped with a tank feed jet pump that facilitates hydration of the sand, producing the slurry that is drawn through an adjacent mobile booster pump. The source of the water for the slurry is the ocean that is drawn into the system through a 420 HP jetwater pump. The intake hose for this pump is intended to be floating just offshore, covered with a 4-6 inch metal mesh screen and attached to a buoy. This will eliminate unintended sand in the system as well as intake of marine life. It is noted that the sealwater for this booster pump can come from a vertical well pump or fed from the ocean intake.

From the mobile booster pump, the slurry is transported through up to approximately 3,000 ft of temporary above ground 10" diameter HDPE pipe to the mobile collection tank that is roughly 10 ft in diameter and 10 ft high. The collection tank is needed to prevent clogging of the system from the hopper over the 3,000 ft of pipe. Air can be sucked into the line from the hopper or surges in sand supply can clog the pipe and over the long, 3,000-foot transport distance, can cause cavitation of the booster pumps. A mobile control house of corrugated metal is located near the tank. From this control house the slurry flow is monitored and booster pump speeds are controlled. The slurry is drawn from the collection tank by a mobile 420 HP booster pump which discharges through a 10" diameter HDPE pipe above ground to the concrete pad anchoring the beginning of the 10" diameter buried HDPE pipeline and transport system, as described above.

Option 2: Eductor sand removal--Preferred. The sand retrieval excavation system that ties into the sand transport system, as described above, is completely mobile. All of the features of this system are sled or crawler mounted and are intended to be mobilized at the start of the sand transport operation of roughly 3 months duration and demobilized at the end of the 3 months of operation. The sand excavator consists of a crawler mounted crane with an approximate 200 ft long boom equipped with an eductor nozzle that is lowered into the surf zone for sand retrieval. This is the main difference between this option and Option 1.

The eductor hydrates the sand into a slurry and sucks the slurry into a 10" diameter slurry hose, drawn by a 420 HP mobile booster pump. This intake hose is surrounded by a metal, large-mesh screen framework to minimize the likelihood of intake of marine life (including sea turtles). The source of the water for the slurry is the ocean that is drawn into the system through a 420 HP jetwater pump, as in option 1. The intake hose for this pump is intended to be floating just offshore, screened with metal mesh, and attached to a buoy. This will eliminate unintended sand or intake of marine life in the system. It is noted that the sealwater for this booster pump can come from a vertical well pump or fed from the ocean intake. From the mobile booster pump, the slurry is transported by the same system as described for Option 1.

Proposed Project Description

This Sand Slurry Pipeline system would maintain shoreline equilibrium by placing small volumes of sand on an annual basis. The project objective is to simulate the most natural possible sand transport and equilibrium along Sandy Hook in the context of the adjacent stabilization perturbation. This would require a pipeline that borrows sand from the northern, accreting portion of the Hook (Gunnison Beach) and deposits it on the eroding southern beach (Critical Zone). This system would provide NPS the flexibility of recycling from 0- to 100,000 cy annually (as needed) to maintain shoreline equilibrium. This system would utilize the sand moving through the Sandy Hook nearshore sediment transport in the form of longshore, swash bars, and migratory shoals.

The project entails the construction of a pipeline for the periodic transport of sand from Gunnison Beach to the Critical Zone at South Beach. It would pump a maximum of 100,000 cy during suitable weather conditions during the months of October through February. The quantity depends on accretion at Gunnison Beach and sand extraction is anticipated to occur primarily from the swash bar and migratory shoals that weld onto the beach face and extend the intertidal zone seaward.

Infrastructure to be constructed is described above, and is designed to be mobile and low impact with minimal footprint. It includes a slurry pipeline, concrete pads with a corrugated metal structure along the pipeline to support booster pumps, and connection points at each end of the pipeline to accommodate temporary pipe that would extend to the source and discharge beaches. Life expectancy of the pipeline infrastructure is estimated at 30 years.

The back-passing method proposed here is modeled after the facility specifications developed for the Indian River sand bypassing system in Delaware which is described in (Clausner *et al.* 1992, Rambo *et al.* 1991, Watson *et al.* 1993). That system, designed to move 100,000 cy/yr, has averaged 1500 cy/day on a 4 day/week, 6.5 days/month schedule within the Labor Day to Memorial Day window.

The dimensions of the excavated area produced by a stationary dredge are expected to be approximately 150'l x 60'w x 6'd. The excavation, however, would be conducted in the intertidal zone and on the attached migratory shoal where the slurry mixing is more efficient. Therefore, the excavation area begins to fill as quickly as it is created. A crane, situated near the berm above the high tide line, suspends the pipe and dredge (eductor assembly) out into the intertidal zone where it is able to excavate a trench about 150'l x 60'w x 6'd without moving its location. This is the largest area of excavation used at the Delaware site and anticipated at Sandy Hook. Typically, the dredge will remain in one stationary location all day as it dredges most efficiently in the intertidal zone. Depending upon the amount of sand in the migrating bars, the crane would stay in its location as new sand became available, or would move up to 3 times that distance to acquire more sand in the bar. At most the dredge area would cover up to 450 feet in length. Each time it moves, the depression left behind is expected to fill within two tide cycles from the natural current and sediments.

Once a shoal welds onto the beach face, the crane would be transported to the area immediately landward of the berm crest. The crane boom would then extend out to 150 feet or until the sand extraction was complete. The crane would be moved along the beach to follow the welded shoal along the Gunnison Public Beach. This process would continue as these bars would be targeted and sand extracted throughout the October through February window, the time when the shoals are most active and sand transport is maximized. Minimal beach disturbance is anticipated by the crane that would move only short distances and infrequently to tap these shoals. Disturbance to the intertidal zone is expected to be minimal, as longshore currents will continue to transport sand into the borrow sites. The crane would transverse the beach in one corridor and then move along the edge of the beach face to harvest the sand from the shoal as indicated in Figure 7.

With maximum borrow material (100,000 cy) removed, it would take 50 pumping days of 2000 cy/day. Recovery time for the deposition slurry is expected within two days after pumping, and with intertidal deposition it is expected that the depression would not be visible after two high tides. The NPS proposes to pump for 50 days from October through February at an average rate of 2000 cy per day. Because the passage of the migratory shoals occurs as a series of sediment pulses, the borrow period would attempt to capitalize on the pulse peaks, as detected by shoreline monitoring. At Gunnison Beach, the very high rates of alongshore sediment transfer would fill the dredge sites continuously during excavation, and largely eliminate the creation of sizeable craters in the beach face.

Figure 4 (a and b). Sand Slurry Removal-Crane with Eductor-Alternative B, Option 2.

View GRAPHIC 4 File

Figure 5(a and b). Eductor Assembly Unit - Alternative B, Option 2(DE).

View GRAPHIC 5 File

Figure 6a. Sand Slurry Pipeline Deposition for Alternative B.

View GRAPHIC 6 File

Figure 6b. Sand Slurry Pipeline Deposition for Alternative B.

View GRAPHIC 7 File

Figure 7. Slurry Extraction Schematic

View GRAPHIC 8 File

Pipeline Alignments Considered

In conjunction with the action alternative, a preliminary analysis was conducted of various alternative pipeline alignments. The preferred alignment chosen was the one that best minimized impacts to cultural and natural resources as well as the visitor experience, and that would result in a system that was easy to operate and maintain (see Table 2). Each of the alternative alignments considered is described below; the preferred alignment is depicted in Figures 1, 2, and 3 and the alignment options in Appendix A.

Follow Existing Road Alignment:
Option 1. Pipeline follows road alignment with direct line to sand source (3,000 feet of new disturbance).
Option 2. Pipeline follows road alignment (pipeline is located on East Side of Hartshorne Drive and Atlantic Drive) with bend following railroad bed and temporary pipe to sand source (minimal new disturbance). (Preferred)
Option 3. Pipeline follows road alignment with short segment of new disturbance to sand source (1,000 feet of new disturbance).

Follow Shoreline:
Option 1. Pipeline follows shoreline and runs through Parking lots at areas D and E (16,000 feet of new disturbance).
Option 2. Pipeline follows shoreline and runs along beach (18,000 feet of new disturbance).

Pipeline Alignment Following Abandoned Rail Line:
Option 1. Pipeline follows road alignment and then runs parallel to railroad bed through radar site.

Preferred Alignment:
To aid in determining the best pipeline alignment, each of the proposed routes was assessed according to the following criteria: natural resource protection, cultural resource protection, visitor experience, and ease of operation and maintenance (Appendix A). The following alignment was selected by Park staff and NPS design professionals as the preferred option:

Pipeline follows road alignment Option 2: the pipeline is located on the East Side of Hartshorne Drive and Atlantic Drive with a bend following the old railroad bed and a temporary pipe to the sand source (minimal new disturbance). The following information supports this determination:

Protection of Park resources is a high priority in the selection of a preferred pipeline alignment. Placement of the pipeline along the roadway presents the least amount of disturbance to natural resources; placement along the beach or dunes would create an unacceptably high level of disturbance.

A roadway alignment would avoid wetlands and beach heather plant communities, and would minimize potential impacts on the sensitive beach flora and fauna. Routing the pipeline on the

East Side of Hartshorne Drive would avoid impacts to the holly forest located on the west side of the roadway. Revegetation could be more easily accomplished and maintained along a roadway. An alignment placed along the roadway would probably have the lowest potential for encountering unexploded ordinance (UXO).

Construction of the pipeline is likely to be easier, less costly and more easily maintained along the roadway, eliminating the need for oversand vehicles to transport materials along the beach or dunes. Excavated soil could be placed on the paved road surface to minimize disturbance of existing vegetation. Placing the pipeline on the East Side of the roadway would allow for possible future connections of above-ground feeder pipelines without the need to cross existing roads.

The pipeline alignment along the East Side of Hartshorne Drive is comparable with the alignment that would be compatible with the bicycle trail. However, that alignment was not preferred because it would fragment a large area of undisturbed habitat north and west of Atlantic Drive.

ALTERNATIVES CONSIDERED BUT REJECTED

All of the following actions were initially considered as potential solutions for dealing with the erosion problem at the Critical Zone. However, each was later dismissed from further analysis due to economic considerations, lack of a dependable sand source, or unacceptable impacts on Park resources, visitor use, and NPS operations. A summary of all alternatives, both considered and rejected can be found in Table 1.

Truck Transport-Obtain Sand from Gunnison Beach and Transport to Critical Zone via Truck

During the winter of 1997, approximately 60,000 cy of sand was trucked from Gunnison Beach to the Critical Zone over a 45-day period. To move this quantity of sand required trucks and heavy machinery to operate for two shifts a day, six to seven days per week. During that time, two lanes of Hartshorne Drive were closed from Area C to Atlantic Drive, and Atlantic Drive was closed from Hartshorne Drive to Gunnison Road. Based on this experience, the NPS believes that excavating sand from Gunnison bathing Beach (between the restricted piping plover protection areas) and then trucking it to the Critical Zone would be costly, inefficient, and would adversely affect visitor use and Park operations. Impacts to the beach from 45 days of intensive heavy equipment use are considered to be least desirable in terms of potential disruption of cultural and natural resources.

Develop New Off-Shore Sand Source

This option was dismissed from further consideration due to the uncertainty associated with locating a suitable off-shore borrow source, not to mention the cost involved, testing required, and permit considerations associated with developing such a site. Recent discussions with the ACOE indicate that there is a high demand for alternate sand sources and that these sources, including the Sandy Hook Channel Dredge, would not be available to NPS in view of the many ongoing replenishment projects in need of additional sand. Nonetheless, NPS will continue to inquire of ACOE regarding future availability of offshore sand resources, but recent inquiries

have been denied. Instead, the ACOE has recommended that NPS use its own sand that is accreting on northern Sandy Hook.

Use Approved Off-Shore Borrow Site-Take Advantage of State Dredging Program and Long Term ACOE Adjacent Replenishment Projects

To eliminate mobilization and demobilization costs associated with dredging operations (which run approximately $1,000,000 per operation), the NPS considered joining the state of New Jersey's offshore dredging program. However, this idea was also dismissed from further consideration since the state had already denied earlier requests made by the NPS and because there is no guarantee that the State's dredging schedule could always accommodate the Park's needs.

Additionally, NPS considered joining the ACOE's Beach Replenishment Project at the adjacent town of Sea Bright. Since the ACOE Sea Bright beach replenishment project has been approved for 50 years, and is scheduled for replenishment at Sea Bright every 5-7 years, it was thought that NPS could coordinate with ACOE which would increase the sand volume at Sea Bright by the amount needed at Sandy Hook. It was also hoped that the deposition area might also be extended around the Northern terminus of the seawall to the Critical Zone and Parking lot areas to address Sandy Hook's sand deficit. However, the EIS project scope and approved project did not include this option, and NPS has approached the ACOE for such a coordinated project with no success. Additionally, NPS would then be subject to the schedule of this project without the flexibility of addressing erosion needs on a timelier basis.

Construct Groins, Seawalls, and Breakwaters to Disrupt Wave Energy and Sand Loss at the Critical Zone

Previous studies examined the potential for beach stabilization measures such as groins, seawalls, onshore and offshore breakwaters, and other built structures to slow the loss of sand at the Critical Zone. Because structural solutions would merely displace the locus of erosion by shifting the Critical Zone northward, the NPS does not believe that such measures offer viable options for dealing with ongoing erosion. The construction of additional man-made structures would only complicate the sand transport system and take it even further from its natural state. NPS policy and desire is to maintain as natural a state of shoreline equilibrium and sand transport as possible in view of historic and current artificial perturbations.

Modify Groins at the Southern End of Sandy Hook to Increase Sand Deposition at the Critical Zone

Notching or shortening the existing groin field at the southern end of Sandy Hook may encourage more sand to migrate north, increasing the likelihood that some of the 17 million cy of sand being emplaced by the ACOE as part of the Sea Bright project reaches the Critical Zone. However, without accompanying beach nourishment, this action would only delay breaching of the spit since natural deposition rates would not overcome the sand deficit. Groin compartments are now full of sand, and have been rendered dysfunctional. This is allowing sand to pass the existing groin structures without being impeded, as they are submerged under the sand. Since

these groins are covered with sand, and are expected to continue to be submerged by the sand from the ACOE Sea Bright fill for 50 years, notching of the groins now would serve no function. If, however, these groins become exposed in the future, due to an increased sand deficit, NPS will reevaluate the effectiveness of this action.

Nevertheless, if and when the groins are removed or notched, the beach width will retreat as sand migrates north and will continue to retreat until it reaches the notch in the groin or the seawall. Once this occurs, sand will no longer be transported into the Critical Zone. Therefore, this would only be a temporary remedy to the problem. Additionally, existing recreational beaches and beach habitat used by piping plover, least tern, and seabeach amaranth will be greatly reduced or lost. Therefore, this alternative is considered ineffective as a stand alone action.

The ACOE is currently involved in an experimental project to the south of Sandy Hook where existing groins will be notched and/or shortened. Sand migration northward along the shore will then be monitored for any effect. Sand migration into the Sandy Hook area at the Critical Zone will require several years of research and modeling before the effects of the ACOE work will be known. Only then should a decision be made to modify the existing groin field just outside the Park to ensure that such actions would have the desired results.

Obtain Sand for Beach Replenishment from Non-T & E Species Beaches at Sandy Hook

In the past, piping plovers have nested at 6 different locations along the Sandy Hook peninsula including portions of the Critical Zone, Gunnison Beach, North and Coast Guard Beaches, and Fee and Hidden Beaches (Figure 3). Seabeach amaranth has recently colonized the Critical Zone and South Gunnison beach and northeastern beach tiger beetles remain on North Beach. Obtaining sand for beach replenishment from non-T & E species beaches at Sandy Hook is not feasible because there are no other accreting beaches that do not have T & E species protected areas. The accreting beaches at the north end of the Hook (North and Coast Guard Beaches) are large and potentially suitable as sand sources, but are not being considered due to the fact that they support T & E species and are therefore restricted protection areas. The only unrestricted accreting beach is the Gunnison Bathing beach where the borrow site is proposed for the slurry pipeline.

Permit Breach and Provide Ferry Transport

Under this alternative, the NPS would have permitted a breach of the Critical Zone. Subsequent to the breach, visitors, employees, and residents would have been transported by ferry to northern areas of the Park from remote Parking areas south of the breach. This alternative was rejected from further consideration due to high costs; severe access restrictions to visitors, employees, and residents; safety considerations; low sustainability, and exposure of the Highlands waterfront to new inlet coastal processes.

The costs/benefits of a breach and new inlet to natural resources are uncertain from both a short and long-term perspective. This is described in more detail under the No Action Alternative. Recent, beneficial events experienced at Westhampton demonstrated immediate colonization of

such a breach area by piping plovers (Houghton *et al.*, 1995-2000) and an increase in the amount of suitable nesting and foraging area in otherwise highly stabilized surroundings. A new inlet would likely create new suitable nesting and foraging habitat for the piping plover and other beach nesters. However, the new inlet would also greatly modify the sand transport system and affect the erosion and accretion rates along currently suitable northern beach habitats. Positive effects of a new inlet breach at Sandy Hook may be similar to those at Westhampton, but most of the suitable, unstabilized beach on Sandy Hook is presently utilized by and protected for these rare species. Inlet formation and subsequent shoreline changes and accretion rates at these productive sites would likely result in the redistribution of habitat and species, as suitable habitat shifts with the shoreline morphology and dynamics. However, the unpredictability of the changes, rates and longevity of any inlet formation, migration or closure makes it difficult to determine whether there would be a short or long-term net loss or gain in rare beach flora and fauna as well as the habitat to support them.

Construct Causeway

Under this alternative, the NPS would have constructed an elevated causeway through the Critical Zone within the existing alignment of Hartshorne Drive. The road would have been approximately one mile long and would have been elevated approximately 10 feet on fill material; the sides of the causeway would have been armored with rip-rap. This alternative was rejected from further consideration due to high costs, extensive loss of wetlands and disruption of natural communities, and low sustainability. Also, due to the highly dynamic nature of the Critical Zone, it is difficult to predict the stability, longevity and movements of the shoreline, or any potential inlet movement. Construction design and maintenance of such an infrastructure would be costly (an estimated $50-100 million for initial construction) in order to compensate for such a highly dynamic shoreline.

Lagoon Construction

This alternative includes the use of a small portable cutterhead dredge; with a 400 HP dredge pump and a 12 inch diameter discharge pipeline, operating from within a lagoon, built into Gunnison Beach that would hydraulically pump sand through a discharge pipeline from Gunnison Beach to the Critical Zone. The dredge measures approximately 40 ft long by 15 ft wide.

This alternative includes the following steps: (1) transport the dredge, in basically two pieces, on a flatbed truck to the site where it would be quickly assembled for operation, (2) with earth excavation equipment, dig out a lagoon area from which the dredge would operate, approximately 100 ft long by 50 ft wide with a bottom depth of approximately 4 ft below mean low water, set back from the beach's high water line, (3) continue the excavation with a channel from the lagoon to the ocean including a sand weir across the channel that would allow a controlled water supply to feed the lagoon for proper, continuous dredge operating depths, (4) with the dredge operating from the lagoon, earth moving equipment would move sand from the nearby accreted beach area and dump the sand into the end of the lagoon where the dredge intake is located, in order to provide a continuous source of sand supply, (5) the dredge would pump

the sand to the Critical Zone, and (6) the lagoon would be backfilled after the pumping is completed.

It is noted that since the dredge can operate from within the lagoon, away from the surf zone and in calm lagoon water, dredging during the harsh winter months would not be a problem except during heavy wind or storm conditions.

There are two options for this alternative, as listed below:

Alternative a) Pay for the manufacture of the portable hydraulic dredge to be stored at an existing or new storage building at Sandy Hook; train a Park employee or hire a dredge operator to operate the dredge; construct a permanent discharge pipeline from Gunnison Beach to the Critical Zone to be used to transport sand from the dredge with pipe alignment alternative routes as indicated in Table 1; and contract an earth moving equipment company to: (1) construct the lagoon, (2) move accreted Gunnison Beach sand to the lagoon, (3) grade transported sand at the Critical Zone, and (4) backfill the lagoon after the pumping is completed.

Alternative b) Contract a portable hydraulic dredge company to perform the entire operation, i.e. constructing the lagoon, moving sand to the lagoon and pumping sand from the dredge through a removable discharge pipeline w/booster pumps, along the beach and to the Critical Zone where it would be graded and the lagoon subsequently backfilled after the pumping is completed.

The total first cost for Plans 4a and 4b are $2,500,000 and $1,700,000, respectively with the annual O & M costs at $800,000 and $1,700,000, respectively. These plans were deleted mainly due to high O & M costs and the cumbersome nature of sand retrieval with bulldozers and sand transport with trucks. There were also some significant potential environmental concerns with building a lagoon into the beach, therefore it was rejected.

Permanent Pumphouse on Gunnison

This alternative includes the construction of a sand slurry pump station and discharge sand slurry pipeline to the Critical Zone. The pump station would be equipped with a 400 HP submersible pump and a jet water pump to draw water from the ocean through a flexible, removable pipeline (10”diamter). This pump would divert the ocean water to two ports at the opposite sides of the slurry mixing chamber and utilize a baffle at each port to enhance circulation in the slurry mixing chamber and avoid turbulence. This water line would also supply water needed for the operation of the booster pumps via a 2”diameter pipeline paralleling the 10” diameter slurry pipeline.

Sand would be delivered to the pump station by truck where the sand would be dumped into a hopper adjacent to the mixing chamber. Slide gates built into the wall adjoining the hopper and mixing chamber can be raised or lowered, from the control panel in the pump station, to vary the slurry mix for more efficient sand transport.

The pump station can be located on Gunnison Beach. This will require a permanent discharge slurry pipeline from the pump station to the Critical Zone, for cost effectiveness, versus the mobilization and demobilization of a temporary discharge pipeline, every year. Earth moving equipment such as 2 loaders would load sand from the dry beach at Gunnison Beach, onto 2-20 cy dump trailers, or equivalent, which would then be transported to the hopper at the pump station.

It is noted that to reduce grading costs at the Critical Zone, three short spur pipe segments with valves feeding off the main pipeline and discharging to the beach at approximately 500 to 1,500 ft intervals would be included. This would supply sand along the Critical Zone to minimize the sand grading effort.

The first cost of this alternative is approximately $2,200,000 with annual O & M costs of $800,000.

This plan was rejected mainly due to high annual O & M costs and the cumbersome and environmentally intrusive nature of the sand transport operation with trucks and sand retrieval with bulldozers.

Stop-Gap

Respond to Critical Situations as they Arise Using Short-term, Stop-Gap Measures; Rebuild Full Beach Profile on 5-7 Year Interval (Continuation of Existing Conditions).

Existing management practices are two-fold and involve responding to critical situations as they arise, along with rebuilding the shoreline to the full beach profile on a regular interval. This approach to erosion control at the Critical Zone represents crisis management and would be a continuation of existing conditions. Park management would continue to respond to critical situations as they arise with a series of short-term, stop-gap measures such as the use of sand bags to protect the road and trucking of sand to replenish eroded beaches. In the past, the sand source for such measures has been Gunnison Beach at the northern end of Sandy Hook (NPS 1998, 2003).

In addition to implementing emergency stop-gap measures when needed, the NPS would continue to replenish the Critical Zone with approximately 1.5 million cy of sand every 5-7 years to restore the beach to the 1998 shoreline profile and counter beach erosion. Currently the NPS has approval to remove this amount of sand from the State of New Jersey/ACOE Sea Bright 89 borrow site, located approximately 1.8 miles offshore from Sandy Hook. This is the same borrow site currently being used by the ACOE for the Barnegat to Sea Bright beach nourishment project. Sand would be extracted from the borrow site using a hopper dredge, pumped out via a mooring platform, and transported directly to the beach by a temporary, floating pipeline. Once deposited on the beach, the sand would be graded by onshore earth-moving equipment. To date, the NPS has removed approximately 300,000 cy of sand from the Sea Bright borrow site. Since the NPS is only authorized to remove 2.5 million cy from this site, the NPS would either need to renegotiate with the ACOE to remove additional quantities of sand from the Sea Bright borrow site, or other sand sources would have to be identified to meet future needs.

Continuing discussions with ACOE confirm collective concerns about future sand availability and source sustainability for all replenishment projects in the area.

According to the ACOE, mobilization/ demobilization costs for dredging operations run approximately $1,000,000, and the cost of pumping sand is currently about $4.00 per cubic yard. The total estimated cost of pumping sand from this offshore source is approximately $2,500,000 per pumping operation. This plan was rejected mainly due to high O & M costs, reactive nature and greater environmental impacts.

Stop-Gap with Pipeline

Obtain Sand on an As-Needed Basis from an Approved Off-Shore Borrow Site and Transport to Critical Zone via an Underwater Marine Pipeline.

This alternative would use the same sand source as described for the previous alternative discussed above as well as a similar method of transport; the major difference between the two alternatives is in the location of the pipeline and degree of permanency. In this alternative, an underwater pipeline would be constructed to transport sand from the State of New Jersey/ACOE Sea Bright 89 borrow site to the Critical Zone. Sand would be extracted from the borrow site using a hopper dredge, pumped out via a mooring platform, and transported directly to the beach by an underwater pipeline anchored to the ocean floor. Once deposited on the beach, the sand would be graded by onshore earth-moving equipment.

In addition to the estimated costs presented in the previous alternative description ($2,500,000 to cover equipment mobilization and cost of sand), costs associated with actual pipeline construction would be approximately $300,000. This plan was deleted mainly due to high operations and maintenance (O & M) costs.

Table 1. Summary of ALL Alternatives and Pipeline Options.

ALTERNATIVE	CONSIDERED OR REJECTED	REASON FOR REJECTION
Truck Transport-Obtain Sand from Gunnison Beach and Transport to Critical Zone via Truck	REJECTED	Costly, inefficient, and would adversely affect visitor use and Park operations.
Develop New Off-Shore Sand Source	REJECTED	Difficult to find suitable borrow source, too costly.
Use Approved Off-Shore Borrow Site-Take Advantage of State Dredging Program and Long Term ACOE Adjacent Replenishment Projects	REJECTED	Earlier requests denied, potential problems coordinating schedules.
Construct Groins, Seawalls, and Breakwaters to Slow the Loss of Sand at the Critical Zone	REJECTED	Would further complicate sand transport systems, making it even more unnatural.
Modify Groins at the Southern End of Sandy Hook to Increase Sand Deposition at the Critical Zone	REJECTED	Resulting increase in deposition would not be enough to overcome deficit.

Obtain Sand for Beach Replenishment from Non-T & E Species Beaches at Sandy Hook	REJECTED	No accreting beaches without T&E species protection areas.
Permit Breach and Provide Ferry Transport	REJECTED	High costs; severe access restrictions to visitors, employees, and residents; safety considerations; low sustainability, and exposure of the Highlands waterfront to new inlet coastal processes.
Construct Causeway	REJECTED	High costs, extensive loss of wetlands and disruption of natural communities, and low sustainability.
Lagoon Construction	REJECTED	Too costly and potential negative environmental effects.
Permanent Pumphouse on Gunnison	REJECTED	Too costly and environmentally intrusive.
Stop-Gap	REJECTED	Too costly and negative environmental impacts.
Stop-Gap with Pipeline	REJECTED	Too costly.
Alternative A: No Action	CONSIDERED	N/A
Alternative B: Slurry Pipeline with Crane and Clamshell Bucket for Sand Removal or Eductor Sand Removal	CONSIDERED	N/A
ALIGNMENT OPTIONS FOR ACTION ALTERNATIVES		
Follow Existing Road Alignment:	Option 1. Pipeline follows road alignment with direct line to sand source (3,000 feet of new disturbance).	
	Option 2. Pipeline follows road alignment (pipeline is located on East Side of Hartshorne Drive and Atlantic Drive) with bend following railroad bed and temporary pipe to sand source (no new disturbance). (PREFERRED)	
	Option 3. Pipeline follows road alignment with short segment of new disturbance to sand source (1,000 feet of new disturbance).	
Follow Shoreline:	Option 1. Pipeline follows shoreline and runs through Parking lots at areas D and E (16,000 feet of new disturbance).	
	Option 2. Pipeline follows shoreline and runs along beach (18,000 feet of new disturbance).	
Pipeline Alignment Following Abandoned Rail Line:	Option 1. Pipeline follows road alignment and then runs parallel to railroad bed through radar site.	

MITIGATION MEASURES

Mitigation measures and development constraints are specific actions that when implemented, minimize, avoid, or eliminate impacts on resources that would be affected by alternative actions. The NPS would fully comply with all applicable laws, regulations, and policies governing resource protection including the Endangered Species Act, Clean Water Act, National Historic Preservation Act, and agency specific guidelines.

The following resource protection strategies would be implemented under each action alternative to provide an effective monitoring and management program for each:

Natural Resources

Threatened and Endangered Species

Five terrestrial species of concern are currently or have historically been found in the Sandy Hook project area (Figure 3). They include the federally threatened piping plover, federally endangered seabeach amaranth, federally threatened northeastern beach tiger beetle, least tern listed by the state of New Jersey as threatened, and NJ state endangered seabeach knotweed (*Polygonum glaucum*). NPS will monitor (including Global Positioning System (GPS) and annual surveys) and protect these rare beach flora and fauna. It is unlikely for protected aquatic sea turtle and marine mammal species to be affected, however they are included in this analysis for consistency and compliance. A more detailed discussion of each species and the impacts on them from each alternative can be found in the Biological Assessment (BA) (Appendix B).

Piping Plover (Status: Federal – Threatened, State – Endangered)

The following actions would ensure continued protection of piping plovers and their habitat:

Sand for recycling would come from Gunnison bathing beach where plovers have not recently nested, though limited historic use of neighboring areas has been recorded. Past experience with removing sand from Gunnison indicated that sand was replaced by longshore transport within a few months of when it was removed.

- Sand removal and fill will occur outside the sensitive seasons for the T & E species (March-September) to avoid disturbing these species and their habitat. The project is scheduled to begin after October 1 and be completed by March 1. This schedule is outside of the breeding season and will avoid direct impacts and minimize indirect impacts to this species.

- An intensive plover monitoring program will be implemented. All potential activities that may harm or harass breeding piping plovers will also be recorded, abated and monitored. Corrective action will be immediately taken and adaptive management to prevent further occurrences will be incorporated into the management scheme by NPS biological personnel at Sandy Hook and Gateway's Division of Natural Resources. Adequate staffing and trained personnel will monitor, prevent and enforce human and other disturbances at each of the nesting sites during critical nesting stages as stated in the U.S. Fish and Wildlife Service

(FWS) consultation letter of 5/21/92 and the Plover Management Plan (FWS 1996). The additional cost of extra staff has been figured into the annual operating costs of the pipeline.

- Off-road-vehicles will be prohibited year round, and dogs will be prohibited on ocean beaches from March to September to protect piping plovers.

- An intensive predator monitoring and management program will be implemented in order to determine any effect of the project on predator populations or their impacts on plovers.

- Invertebrate populations, vegetation and other beach characteristics deemed important to plovers will be monitored and management will be considered if necessary to maintain optimum nesting and foraging conditions.

- If piping plovers nest on beach fill material all protection measures will be implemented to protect nesting areas from predators and public use, including closing the beach for a distance of 100 meters from any nest site. Protection measures and monitoring efforts are those outlined in the FWS recovery plan for Piping Plover (FWS 1992 consultation letter) and the Sandy Hook Unit Piping Plover Management Plan (NPS 1992) as well as the more recent Biological Opinion recommendations (FWS 2002a, 2002b). Nests in the Critical Zone will continue to be protected with signs, ropes, and intertidal closures during the critical nesting stages. Snow fencing will be placed around the road access areas where plover chicks might attempt to cross the road to forage in the back bay flat habitats. Intensive monitoring of nests and chicks will be conducted through fledging, and trained personnel will be stationed at the ends of the protected zones for enforcement and education purposes. Due to the proximity of the Critical Zone fill area and Gunnison beach borrow area to recreational bathing beaches, additional protection staff will be assigned as necessary to enforce shorebird area closures.

- Only the intertidal zone and nearshore bar portion of Gunnison bathing beach (that approx. 1500 ft area between the restricted protection areas) that is accreting on an annual basis would be removed so as not to result in a net loss of habitat. The elevation of the beach berm around potential nest site locations would be maintained, and sand would only be removed from the nearshore bars and intertidal zone to minimize the potential for habitat disturbance and nest flooding. Only that amount of sand accreting each year will be removed as a slurry at or below the water line. Similarly, the fill area at the Critical Zone will be seaward of any potential beach use in the breeding season, and fill will be placed along the intertidal zone and beach face so as to minimize impact to the beach profile and integrity.

- Nesting status and reproductive success would be monitored throughout the nesting season along all Park beaches, including both Gunnison and the Critical Zone to ensure that the project was not having an adverse affect on nesting plovers. Surveys will include data collected from qualified, trained biologists. Field data will be available for FWS inspection daily and record the number of eggs when nest found, status of nest, eggs, chicks, and adults, as well as exact cause of nest loss or mortality. This monitoring protocol will provide for quick response to any disturbance factors.

- Several transects located at the Critical Zone, Gunnison Beach, North and Coast Guard Beaches will be established and surveyed and beach characteristics recorded, including vegetation, profile, substrate, etc. in order to determine changes related to the project

- Outreach and educational efforts will be increased on Sandy Hook regarding piping plovers to increase compliance with measures to reduce take due to recreational use.

Seabeach Amaranth (Status: Federal – Threatened, State – Endangered)

The scheduled time period for the project (October 1 – March 1) is mostly outside the growing season, which has recently been determined to extend into December for seabeach amaranth. Since seabeach amaranth is an annual, most plants existing in the Critical Zone area on the August/September survey will reach mortality by the project start date.

- Most of the plants discovered during the Critical Zone survey are located high on the beach and are outside of the fill template. The location of these plants will be marked and protected with string lines to prevent any disturbance of the immediate area by construction personnel or vehicles involved in the fill project.

- To insure the seeds produced by these plants are not covered and lost by the fill project, seeds, if present, will be harvested and stored. The collected seeds will be distributed the following season in the same location on the beach. Established plants will be transplanted to the renourished portion of the beach.

- The public awareness program will include the status, life history, and threats to seabeach amaranth and facilitate its protection.

- Monitoring data will be supplied annually to agencies engaged in protecting and restoring the species to enhance interagency data sharing.

- When implementation of the proposed transplanting strategy is anticipated, activities to be conducted under this strategy will be coordinated with FWS and other agencies/organizations prior to implementation.

- Surveys will be conducted involving the collection of data on plant size and reproductive stage, GPS coordinates or location relative to permanent landmarks, the plants' location on the beach profile (position relative to the dune toe or apparent high water line), plant associates, a description of the occurrence (dispersed or concentrated), evidence and extent of predation, and documentation of any other threats.

- Populations will be monitored for evidence of herbivory, both insect and mammalian, herbivores will be identified if possible, and the results will be reported to FWS.

- A program of long-term storage of amaranth seeds collected from various parts of Sandy Hook will be implemented as insurance against catastrophic population declines, as coordinated with FWS.

Least tern (Status: State - Endangered)

The same conservation measures used for piping plover will be employed for any least tern nests or colonies located on the new fill including public use closures through symbolic fencing.

Seabeach Knotweed (Status: State - Endangered)

The seabeach knotweed plants located in the Critical Zone were found high on the beach and are not within the proposed fill template. The location of these plants will be marked and protected with string lines to prevent any disturbance of the immediate area by construction personnel or vehicles involved in the fill project. Since they occur in the same areas as amaranth, their protection will be coordinated and the species can be protected simultaneously.

Northeastern Beach Tiger Beetles (Status: Federal – Threatened, State - Endangered)

No tiger beetles have been located in the borrow or fill areas, but continued surveys will provide for detection of larvae and adults. Beetles had been reintroduced onto North beach at the northern portion of Sandy Hook as part of the Atlantic Coast recovery effort but none have been recorded near either the borrow or fill areas. Protection measures will be implemented for any individuals located in either site. NPS will consult FWS staff if additional locations are found and will follow the specific guidance from the FWS consultation letter of 9/23/94.

Sea Turtles and Marine Mammals

A database mapping system will record the use of the geographic areas affected and endangered/threatened species presence/interactions on which to base future management decisions.

Coastal Geomorphology

A detailed topographic survey of the Critical Zone beach will be performed prior to pumping, to collect data on beach morphology and calculate the volume pumped. These data would provide a baseline against which to measure future changes. A digital terrain model would be developed to portray profiles and spatial association of slopes and forms.

Surveys will continue to be conducted on a monthly basis to establish rates of shoreline change and sediment accumulation or transfer. Progress reports based on survey results would identify the sequence of changes to the topography and the volumes of sand involved. This information would be provided to regulatory agencies including the FWS and NJDEP to ensure that the project is not having an adverse effect on rare beach flora and fauna or coastal geomorphology.

Annual surveys of the full ocean shoreline of Sandy Hook would be conducted via a vehicle-mounted GPS receiver and entered into the digital atlas of shorelines to continue to assess conditions of sand transport and beach response all along the spit.

Gunnison Beach Sand Replenishment:

A monitoring program would be established to ensure that sand is not removed from Gunnison Beach faster than it can accrete on an annual basis. The program would involve topographic surveys of the beach to determine the net removal of sand as well as the rate of accumulation and its spatial pattern during recovery. Specific actions to be performed as part of the monitoring program include:

A detailed topographic survey of Gunnison Beach would be performed prior to initial pumping, to collect data on beach morphology and sand volume. These data would provide a baseline against which to measure future changes. A digital terrain model would be developed to portray profiles and spatial association of slopes and forms.

Sediment samples would be collected from all habitats that occur along the beach profile.

Survey and sediment sampling would extend 300 feet updrift and 600 feet downdrift of the borrow area to determine the extent of effects beyond the borrow zone boundaries.

Monitoring data would describe the position, number, and sequential movement of the spit extensions that are characteristic of sediment transport at this location.

Coastline surveys would be conducted on a monthly basis to establish rates of shoreline change and sediment accumulation. During pipeline operation, surveys would be performed weekly or at an interval appropriate to the degree of change occurring. Surveys would be repeated at monthly intervals after pumping ceases.

Progress reports based on survey results would identify the sequence of changes to the topography, the sediment grain sizes, and the volume of sand involved. This information would be provided to regulatory agencies including the FWS and NJDEP to ensure that the project is not having an adverse effect on piping plovers or coastal geomorphology.

Topographic and bathymetric survey data collected from Gunnison Beach would be compared with data from similar surveys performed at the Critical Zone to help balance sediment budgets.

Quarterly surveys of the full ocean shoreline of Sandy Hook would be conducted via a vehicle-mounted GPS receiver and entered into the digital atlas of shorelines as part of a continued assessment of sand transport and beach response conditions all along the spit. This would provide confirmation that sand removal from Gunnison Beach is not disturbing beaches downdrift.

- Monitoring of North and Coast Guard Beaches would be conducted on a much less intensive basis, but would be added to this monitoring protocol and would focus on detecting any potential beach changes due to the replenishment project. These accreting beaches have shown a net annual accretion and support most of the T & E species habitat. Therefore, NPS would begin monitoring of these important sites by establishing transects along each beach,

as well as continuing the intensive monitoring along Gunnison and the Critical Zone. Vegetation and T & E species monitoring would be coordinated with these activities so that changes or impacts can be appropriately detected.

Vegetation and Ground Disturbance:

To minimize unnecessary ground disturbance and vegetation impacts resulting from construction, equipment and materials would be stockpiled on previously disturbed sites or within beach construction footprints.

Construction limits would be identified in construction documents and specifications, and fenced or signed in the field to further protect native vegetation and environmentally sensitive areas from disturbance.

A construction supervisor would monitor ground and vegetation disturbance to ensure that it is restricted to the minimum area necessary.

Vegetated areas impacted by construction would be restored to natural conditions wherever possible. Native beach grasses would be used to stabilize dune areas; vegetation matching that which existed in an area prior to disturbance would be utilized elsewhere. Unsightly areas would be screened by native plantings where necessary. In areas where fast green-up was desirable, mature native plantings would be used.

Site Excavation and Grading:

To minimize unnecessary ground disturbance and vegetation impacts resulting from construction, equipment and materials would be stockpiled on previously disturbed sites or within construction footprints. Construction limits would be identified in construction documents and specifications, and fenced or signed in the field to further protect native vegetation and environmentally sensitive areas from disturbance. A construction supervisor would monitor ground and vegetation disturbance to ensure that it is restricted to the minimum area necessary.

The pipeline and related equipment would be designed to minimize cuts and fills as well as removal of existing native vegetation. Required fills would be sloped to provide positive drainage without erosive effects. Control measures would be implemented to keep effects such as sediment or erosion within construction limits.

Actions would be taken to ensure that runoff and sediments from the project area do not enter open bodies of water. Runoff would be controlled in compliance with federal and state regulations.

Barricades would be installed at the outset of the project and used where necessary to prohibit unauthorized access to sensitive areas.

Pipeline/pump operation Personnel Requirements:

Weekly meetings covering natural resource issues and protection measures would be conducted as determined by the Park Superintendent.

Personnel tasked with the O & M of the pipeline/pump would be required to attend natural resource-related training sessions conducted by Park staff to raise awareness of the reasons why the Park was established and how effects on the natural environment can be minimized during construction.

The operation protocol documents would clearly indicate which work activities could occur only when an appropriate resource staff is present to monitor such activities.

Damage costs would be established in any potential contract or tasks order that would discourage any pump/ pipeline personnel from causing adverse effects in adjacent areas.

An incentive clause would be established to encourage the pump/pipeline personnel to disturb even less area than that shown on the construction documents.

Work documents would indicate areas where hand work is required to minimize disturbance around existing utilities, mature vegetation, or other sensitive areas.

Any non-endangered animals that might enter construction areas would be protected from harm by the pump/ pipeline personnel and the NPS project supervisor. The Park staff would be notified of any animals found in construction areas and would be allowed to relocate animals as permitted.

Cultural Resources

All known cultural resources are plotted on Figure 2 (source NPS 2001) and are not anticipated to be impacted by these activities. This project has been reviewed by the Office of the Deputy of State Historic Preservation and has been determined to have "No Adverse Effect" (Guzzo letter dated 4/5/99). Should, however, presently unidentified archeological resources be discovered during the course of the project, work in that location would stop until the resources were properly recorded by an NPS archeologist and evaluated under the eligibility criteria of the National Register of Historic Places. If (in consultation with the New Jersey State Historic Preservation Office) the resources are determined eligible, appropriate measures would be implemented either to avoid further resource impacts or to mitigate their loss or disturbance in accordance with an approved data recovery plan. The NPS archeologist would also provide input on the treatment of UXO should this be discovered either as a result of preconstruction sweeps of the pipeline corridor or during construction excavations.

Placement of sand on the Critical Zone will cover any possible archeological artifacts or cultural resources on the fill site and will, therefore, not cause any disturbance impacts or loss. A NPS archeologist will conduct site visits during the fill to determine if archeological resources are being transported from the borrow site to the fill site. The NPS archeologist would also provide input on the treatment of UXO should this be discovered.

Visitor Use and Experience/NPS Operations

Whenever possible, the NPS would adjust its work schedules, particularly the timing of construction activities and pumping operations, to minimize impacts on Park visitors and NPS operations. The borrow and fill sites will be marked with signs and/or fences to insure visitor safety.

No impact is expected to surfing or fishing conditions, as the fill template will be adjusted to provide the maximum wave break possible for surfing while insuring the roadway and beach

facilities are adequately protected. Discussions with and input from the surfing community were incorporated into this project as for the 2002 Critical Zone fill project (NPS 2001, 2002)

PARK ENVIRONMENT

The following sections describe that portion of the natural and human environment of the Sandy Hook unit that may be affected by, or that could affect proposals under consideration. A more detailed discussion of the natural resource topics can be found in the BA and EFH Assessments (Appendices B and C).

Affected Environment

Sandy Hook, a unit of Gateway National Recreation Area, is a recurved spit along the northern New Jersey coastline that provides recreational opportunities for 2.5 million visitors annually, most of whom are from the New York-New Jersey metropolitan area. An ecologically diverse area comprising 686 hectares (1,674 acres), it includes over 18 km of ocean beaches as well as several hundred acres of barrier-beach vegetation. Of primary significance are the tidal areas, beach dunes, and holly forests, and the historic facilities and fortifications associated with Fort Hancock, a national historic district located in the northern end of the Park.

Geomorphic and Coastal Processes of Sandy Hook

Background

Sandy Hook is part of the Atlantic Coast barrier island system. The area ranges in width from several hundred feet at the southern end to approximately a mile in the north and is a dynamic environment, directly influenced by the natural processes which continually alter its configuration and natural systems.

Like most barrier island and spit systems, Sandy Hook has experienced dynamic geomorphologic changes. Within the last two centuries alone, it has been an island; it has been connected to the mainland at two different sites; and it has had as many as four inlets joining the ocean and the Navesink- Shrewsbury River system (Gorman 1988, Gares 1981). Beginning in 1900, however, significant effort and commitment has been made to stabilize the New Jersey coast. These shoreline stabilization efforts have significantly affected the geomorphologic dynamics of Sandy Hook, creating an unnatural near-shore sand transport system. These established man-made structures along adjoining townships pose a challenge to NPS management and operations on the NRA.

Shoreline stabilization efforts since 1900 immediately to the south of Sandy Hook have significantly altered the NPS shoreline and created a sand deficit along its southern Critical Zone (Allen 1981, Phillips *et al.* 1984, Slezak *et al.* 1984). The "Critical Zone," located one mile north of the Park entrance and four miles south of Fort Hancock, is the narrowest section along the Sandy Hook peninsula and is an area of instability due to ongoing, severe beach erosion. Although major storms are responsible for some of the shoreline erosion that occurs, they are not the primary source of the problem. Groins built over the decades in Monmouth Beach and Sea Bright, and the sea wall near the southern boundary of the Park have prevented sand from reaching Sandy Hook's southern beaches (Psuty 1991, 2001). These beach stabilization structures, designed to prevent erosion, have actually interfered with the northern littoral drift of sand along the New Jersey shoreline. Although some sand is still deposited at the Critical Zone,

the amount is insufficient to counter losses due to erosion. As a result, the sand deficit at the southern end of Sandy Hook continues to grow.

In contrast to the severe beach erosion experienced at the Park's southern beaches, beaches at the northern end of the hook are experiencing active sand accretion. Gunnison, North, and Coast Guard Beaches have all enlarged due to accretion. As Sandy Hook continues to expand to the north, periodic dredging is required to prevent the continued drift of the hook into shipping channels of lower New York Bay.

Sediment Budgets

Monitoring data collected since the Park's establishment have documented that the sand deficit at the Critical Zone is closely balanced with a net accumulation of sand at Gunnison and North Beaches. The sand deficit at the Critical Zone can be viewed as a sediment budget problem, in which more material is being transported from and around the site than is being introduced. A key requirement for managing the resources of the area under such a condition involves establishing the modern-day sand deficit and rates of transport at the site. Although several studies of the magnitudes of longshore transport and erosion at Sandy Hook have been published, these are generally regional in scope, and have limited applicability at the Critical Zone.

Data collected since the 1970s have documented sand transport rates and deficits around Sandy Hook and an increasing rate of erosion in the Critical Zone due to human interference with the natural sediment supply to the spit. Since the spring of 1997, however, the erosion rate has decreased due to an increase in the amount of sand coming northward to Sandy Hook from erosion of beach fill in the communities of Sea Bright and Monmouth Beach, New Jersey. The total input of sand to the Critical Zone during 1997 was slightly greater than the volumetric losses. Subsequent analysis on the performance of beach fill projects conducted from 1997 through 2002 and conditions in the Critical Zone revealed the annual loss of sand has been approximately 55,000 cy per year.

This means that although there is now a substantial amount of sediment moving around the end of the seawall at the southern end of the Park, it is insufficient to balance the losses. The overall Park deficit is expected to return to its more recent typical value of 220,000 cy per year deficit in the Critical Zone (Psuty 2001, Psuty and Allen unpubl. data). A more detailed discussion of sediments budgets and accretion rates can be found in the Biological Assessment (Appendix B).

Gunnison Beach Accretion Rates - Present and Near-Future

Gunnison Beach has been a site of nearly continuous accretion since the early 1980s. Between 1984 and 1994, the average sand accumulation at this site has been approximately 210,000 cy per year. Higher deposition rates on the order of 290,000 cy per year have been recorded in the several years immediately following past beach nourishment projects.

The compatibility of the volumetric changes in the Critical Zone with those at Gunnison Beach, through time, indicates that losses at the Critical Zone are correlated with gains at Gunnison Beach with a lag time of one to two years (Psuty 1991, 1997, 2001, 2002). In addition, approximately 300,000 cy of sand has passed through Gunnison Beach annually to accumulate either at North Beach, at the end of the Sandy Hook spit, or in the navigation channel just beyond the end of the hook. Thus, on the basis of the quantity of sediment available, both in the

amount of storage now at Gunnison Beach or in transit through the system, there is an ample supply to permit removal of 220,000 cy of sand per year and transport it back to the Critical Zone to balance the erosion losses there (Psuty and Allen unpubl. data, Psuty annual reports to NPS). The pipeline however, will be designed to pump a maximum of 100,000 cy/yr.

Natural Resources of Concern

Threatened and Endangered Species

Sandy Hook provides excellent nesting habitat for beach-nesting birds, including the federally threatened piping plover and the New Jersey state endangered least tern. In 2000, the federally endangered plant, seabeach amaranth was rediscovered on Sandy Hook beaches. NJ state endangered seabeach knotweed is also present. The threatened tiger beetle occurs at the northern portion of Sandy Hook at North Beach (Figure 3).

Piping Plover (Status: Federal – Threatened, State – Endangered)

The FWS listed the Atlantic Coast population of piping plover as a threatened species in 1986 (FWS 1985, 1988b, 1996). The State of New Jersey additionally lists the piping plover as an endangered species.

The piping plover is a small, sand-colored shorebird approximately 18 centimeters (cm) (7 inches) long with a wingspan of about 38 cm (15 inches). Breeding birds have white underparts, light-beige back and crown, white rump, and a black upper tail with a white edge. Breeding plumage includes a single, often-incomplete, black breastband and a black bar across the forehead (FWS 1988a, 1996).

Piping plovers typically arrive at the Park in mid-March, when they begin to excavate shallow nest depressions. At the Park, nests have been documented on sparsely vegetated, coastal beaches above the high-tide line and on gently sloping fore-dunes. In other areas, however, piping plovers have been observed nesting in overwash areas behind fore-dunes and in moderately dense stands of beach grass. Nesting substrates typically comprise fine sand or mixtures of sand, shells, pebbles, and cobbles. Plover eggs and young are cryptically colored and blend well with surrounding sands. Upon hatching, juvenile plovers feed alongside adults on marine invertebrates, which they forage from intertidal areas, mudflats, and tidal wrack. Most feeding occurs during low or falling tides. Piping plovers begin leaving the Park for southern winter grounds in mid-August, with most birds having left by early September.

Piping plovers have successfully fledged numerous offspring in the Park (McArthur 2003, FWS 2002a 2002b). Piping plovers were observed nesting at the Critical Zone during 2001 and fledged one (1) chick. Four (4) pairs nested there in 2003 and again, only 1 chick fledged. Plovers also nested on fill material at the Critical Zone in the years previous to 1996.

The Park contains one of the few relatively undisturbed sections of beach/dune habitat on the New Jersey coastline and supports one of the largest populations of breeding piping plovers in the state. Since monitoring began in the 1980's, abundance and productivity has been highly variable, but generally improving. The low rate of nesting success can be attributed primarily to predation by foxes, raccoons, and crows, human disturbance and weather events. NPS maintains

a plover management plan and has identified and protects six (6) beaches along Sandy Hook (NPS 1992, 1998, McArthur 2003) depicted in Figure 3.

Seabeach Amaranth (Status: Federal – Threatened, State – Endangered)

Seabeach amaranth is a rare plant at Sandy Hook. The plant has been absent in New Jersey for nearly 100 years and made a reappearance in 2000, primarily in areas which have received beach fill. Seabeach amaranth, a brittle annual plant growing on fragile beaches, may have been decimated over much of its former range by the increasing impacts of beach usage in recent decades (FWS 1993). At Gateway NRA, fencing that protected piping plover and other shorebird nesting areas has favored Seabeach amaranth by reducing access by off-road vehicles and pedestrians (Stalter *et al.* 1995).

The amaranth plants flower from mid-summer to late fall and produce seeds from July or August until the plants die. It has been found to grow in concentrated areas in and around the wrack line of material deposited by the highest spring tides. The plants can produce hundreds of seeds that are distributed by wind and water to new locations (NPS 1998, FWS 1993, 2002a and b). In 2000, 120 plants were located during an August survey. Seven (7) of the plants were in the Critical Zone. A September, 2001 survey revealed 561 plants on Sandy Hook extending from the Park entrance for 6 ½ miles to the Coast Guard Beach. Fifty three 53 of these plants were in the Critical Zone and approximately 28 are located in the proposed fill zone, but occur higher on the beach than the deposition area planned for the beach berm and beach face.

Least Tern (Status: State - Endangered)

This shorebird is listed as endangered by the NJ Division of Fish, Game and Wildlife, Endangered Non-game Species Unit. This small white and black seabird breeds in colonies, usually on the supratidal beach habitat. Least terns have similar nesting requirements to piping plovers, but tend to require wider beaches and use larger areas of sparsely vegetated dunes. Least tern chicks can leave the nest soon after hatching; however, they continue to be fed and cared for by the adults. The colonies can be quite large, including over 1,000 individuals. Least terns nested on the dredge fill placed at the Critical Zone following large fill projects. Colonies were observed there in 1990–1996 and 1998. Sandy Hook reported increasing populations through 2002, with a marked decline in 2003 (McArthur 2003).

Seabeach Knotweed (Status: State Endangered)

This is a rare plant which has only been documented only recently (since 2000) on Sandy Hook. While conducting surveys for seabeach amaranth, seabeach knotweed plants were found in the Critical Zone. Management for amaranth is intended to incorporate the presence and needs of this species.

Northeastern Beach Tiger Beetle (Status: Federal – Threatened, State – Endangered)

This federally protected species (FWS 1990) was reintroduced to a northern section of Sandy Hook as part of the recovery efforts for this species (Knisley and Hill 1996, 1997). No tiger beetle adults or larvae have been reported from either the deposition or borrow areas. Adult

populations are estimated to be around 500 individuals according to annual surveys (Knisley 2000).

Intertidal Zone Habitat

The effects of beach restoration or nourishment projects in the United States have been studied for many years. A literature search revealed many studies and reports documenting recovery rates of macrofaunal benthic organisms where sands have been deposited.

The ACOE recently presented findings on data collected for the restoration project to the south of Sandy Hook between Asbury Park and the Manasquan River. The intertidal benthos, prior to placement of fill, was dominated by three taxa: *Rhynchocoela,* the spionid polychaete *Scolelepis squamata*, and *Oligochaeta. Rhynchocoelas* are the most abundant organism (66%), *Scolelepis* (16%), and *Oligochaeta* (14%) of total abundance (ACOE 1998, 1999, 2001). Macroinvertebrate populations are subject to significant seasonal variations and are important prey for nesting and migrant shore and waterbirds. However, the ACOE study identified high densities at specific sites and times rather than a consistent difference between areas, stations, or seasons. In the swash zone, there was no statistical difference in abundance, diversity, composition, or total biomass between samples collected before and after nourishment (ACOE 2001).

Finfish

The range of ocean habitat, embayments and estuaries allows the coastal waters of New Jersey to have a productive fishery. Many species utilize the estuaries behind Sandy Hook Spit for forage and nursery grounds. The finfish found along the Atlantic Coast of New Jersey are principally seasonal migrants. Winter is a time of low abundance and diversity as most species leave the area for warmer waters offshore and southward. During the spring, increasing numbers of fish are attracted to the New Jersey Coast, because of its proximity to several estuaries, which are utilized by these fish for spawning and nurseries.

Species known to utilize estuaries along the Atlantic Coast of New Jersey include summer flounder (*Paralichtys dentatus*), sea bass (*Centropristis striata*), striped bass (*Morone saxatilis*), bluefish (*Pomatomus saltatrix*), witch flounder (*Glyptocephalus cynoglossus*), winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitiss*), weakfish (*Cynoscion regalis*), scup (*Stenotomus chrysops*), white perch (*Morone americana*), and Atlantic menhaden (*Brevoortia tyrannus*). In a study conducted at Peck Beach, 178 species of saltwater fishes were recorded, 156 of which were from the nearshore waters (ACOE 2000, 2001). Many species inhabit estuaries year-round; however, a large number of species only use estuaries for specific parts of their life history. Most species, however, occur during the warm seasons and are not present during the colder winter months.

The estuarine marsh complex is an important nursery area for coastal New Jersey fisheries. The protection afforded by the relatively calm waters, added protection from offshore predators and abundant food sources enhance this habitat for early life stages.

Man-made structures within the study area such as groins and jetties add more habitat diversity within the study area for finfish. Juvenile and larval finfish such as black sea bass, summer

flounder, winter flounder, and striped bass utilize these areas for feeding, protection from predators, and nursery habitat.

Recreational fishes in New Jersey include scup, black sea bass, several flounder species, weakfish, bluefish, hake and mackerel species, Atlantic cod (*Gadus morhua*), northern kingfish, and tautog, and others. Commercially important species include menhaden, winter flounder, weakfish, bluefish, scup, mackerel, silver hake, red hake, yellow flounder, black sea bass, butterfish (*Perpilus triacanthus*), and shad (*Alosa mediocris*). Harvesting is accomplished by use of purse seines, otter trawls, pots, and gill nets (ACOE 2001).

Shellfish

Shellfish beds, ranging in quality and productivity, are found in the back bays and shallow ocean waters of the study area. Atlantic surfclams *(Spisula solidissima*), hard clams (*Mercenaria mercenaria*), blue mussels (*Mytilus edulis*) and blue crabs (*Callinectes sapidus*) are common commercial and recreational shellfish within the coastal waters of the study area. Surfclams are the largest bivalve community found off the Atlantic coast from the Gulf of Saint Lawrence, Canada to North Carolina. The blue crab and the hard clam are two of the most important invertebrates of recreational and commercial value along the New Jersey Coast, and are common in backbays and inlets.

The surfclam has a wide distribution and abundance within the mid-Atlantic Region. Surfclams most commonly inhabit substrates composed of medium to coarse sand and gravel in turbulent marine waters just beyond the breaker zone (ACOE 2001). The abundance of adults varies from loose, evenly distributed aggregations to patchy, dense aggregations in the substrate.

The hard clam is an economically important shellfish of NJ back bays, supporting both commercial and recreational fisheries. In addition to hard clam resources, the bays in the project area also support other species of shellfish. American oysters (*Crassostrea virginica*) are not usually present in commercially harvestable densities, but can be found throughout the project area. Soft clams (*Mya arenaria*) and blue mussels are primarily harvested for recreation, but occasionally commercial densities are present. Blue crabs are an important species in the backbay estuaries. Of all New Jersey's marine fish and shellfish, more effort is expended in catching the blue crab than any other single species. Surveys indicate that three-quarters of the state's saltwater fishermen go crabbing and that crabbing accounts for roughly 30 percent of all marine fishing activity (ACOE 2000).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act protects the marine habitat and marine species utilizing it during their different life stages. Essential fish habitat comprises "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Table 9 lists the 25 species of fish that potentially occur with in the project area and their associated habitats.

Waters immediately adjacent to and offshore of Sandy Hook have been designated as EFH under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for many species of fish and these could also potentially occur in the waters off of Sandy Hook. These species include Atlantic salmon (adults), pollock (juveniles), whiting (eggs, larvae, juveniles), red hake

(eggs, larvae, juveniles), winter flounder (all life stages), yellowtail flounder (eggs), windowpane (all life stages), ocean pout (eggs, larvae, adults), Atlantic sea herring (adults), monkfish (eggs and larvae), bluefish (juveniles and adults), long finned squid (juveniles),Atlantic butterfish (all life stages), Atlantic mackerel (all life stages), summer flounder (juveniles, adults), scup (juveniles, adults), black sea bass (larvae, juveniles, adults), surf clam (juveniles, adults), ocean quahog (juveniles, adults), king mackerel (all life stages), Spanish mackerel (all life stages), cobia (all life stages), sand tiger shark (larvae), common thresher shark (larvae, juveniles, adults), blue shark (larvae, juveniles, adults), white shark (juveniles), tiger shark (larvae, juveniles), dusky shark (larvae, juveniles), sandbar shark (larvae, juveniles, adults), shortfin mako shark (larvae, juveniles, adults), and bluefin tuna (juveniles, adults and skipjack tuna (adults). Site conditions at both the borrow and placement areas determine the species and life stages which must be considered (NMFS 2003).

Sea Turtles and Marine Mammals

Sea turtles and marine mammals potentially occur within the project area during the warmer months, but due to the project timing, they are not expected to be present or impacted by the project during the October 1-February 1 window. In addition, the size of the eductor equipment along with its protective encasement and 4-6 inch mesh screen would avoid and minimize any reasonable possibility for impact or mortality to even the smallest of these species or individuals. Equipment will be operating in the surf zone, where it is unlikely to impact these large species.

Three species of endangered whales—the finback (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), and the right whale (*Balaena glacialis*)—have the potential to pass through the waters above the borrow area. All three species are state and federally listed endangered species. They are found significantly farther offshore, but have the (limited) potential to enter the area during spring and fall migration periods. No records, present or past, indicate that the New York Bight is a high use foraging area for large cetaceans. The finback whale is the most abundant species and occurs year round in the New York Area, although it peaks in the spring and summer months. Finbacks occur in both deep and shallow water (Blaylock *et al.* 1995, NMFS 1995).

Five species of sea turtles have been documented in the New York Bight, although none nest in the area. The loggerhead sea turtle is federally threatened and the Kemp's ridley (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricate*), and green sea turtles (*Chelonia mydas*) are federally endangered. Sea turtles occurring in nearshore waters are typically small juveniles; the most abundant is the loggerhead turtles, followed by the Kemp's ridley (Ruben and Morreale 1999). The waters off Long Island are also warm enough to support green sea turtles from June through October. The leatherback turtle, which is a commonly observed turtle from May through October, utilizes offshore areas and is not found in the estuaries or backbay areas. The hawksbill sea turtle rarely occurs in the area and is probably an anomalous visitor. Sea turtles begin arriving in New York waters in June and July and remain for several weeks, using the shallow coastal waters to forage. Kemp's ridley and loggerheads feed primarily on benthic crustaceans, and green sea turtles feed primarily on eelgrass (*Zostera* spp.) and algae. The leatherback sea turtle remains offshore of the barrier islands and commonly feeds on jellyfish and ctenophores. Abundant prey resources of these

nearshore productive environments result in high juvenile growth rates before their activity slows in the fall. Sea turtles leave the area by late fall as water temperatures decrease.

Since European settlement, however, there appears to have been a drastic decline in habitat quality for sea turtles which is reflected in the decreased number of sightings reported since the early 1900's (FWS 2001). Until the 1930's Raritan Bay with its extensive eelgrass beds provided very suitable habitat for sea turtle species and DeSola (1931) reported seeing great numbers of turtles there. Shortly thereafter, however, the eelgrass beds were wiped out by wasting disease and to this day have not fully recovered (FWS 2001). This pattern of degradation may be reflected in the usage of the bay by sea turtles, which were once apparently abundant, but have since been rarely recorded.

Cultural Resources

It is likely that Native Americans frequented Sandy Hook throughout prehistoric and early historic periods. The abundance of resources (e.g. shellfish, wild plums, game, etc.) would have made the peninsula a desirable destination for food procurement and other seasonal activities. Early maps from 1778 and 1782 identify the point of land projecting southwestward from the north end of Horseshoe Bay as "Wigwam Point," suggesting prior Native American use in that area.

However, with the possible exception of a few undisturbed inland locations where the land mass is comparatively more stable, the dynamics of Sandy Hook's coastal environment make it unlikely that intact archeological sites reflecting Native American use exist in-situ. Furthermore, subsequent development of Sandy Hook for military, recreational and other purposes would undoubtedly have contributed to the disturbance of possible sites. Although the archeological evidence has so far been scant, excavation at one historic site uncovered chert flakes and ceramic shards in a disturbed context. A couple of isolated projectile points have also been recovered with limited diagnostic potential, one of which appeared to have been introduced in imported fill from the mainland (NPS 1997b).

For over two hundred years, Sandy Hook's strategic location served a vital role in guarding the approach to New York Harbor. During the Revolutionary War, British forces occupied the peninsula and constructed a redoubt with gun emplacements at the northern end. They fortified the existing lighthouse (constructed in 1764) as a base of operations. To prevent a reoccurrence of this during the War of 1812, the United States military constructed a temporary log fort ("Fort Gates") at the northern tip, and two blockhouses at the north and south ends of the Hook. These were abandoned following the withdrawal of U.S. forces and subsequently disintegrated. In the latter 1850s, work began on a granite five-bastion Fort. Construction continued through the Civil War, but as a consequence of armament improvements that rendered the Fort obsolete, work was suspended in 1868 before it was completed.

The U.S. Army established a proving ground at Sandy Hook in 1874 to test armaments and ordnance. All of the nation's experimental guns and mortars used for seacoast defenses were tested here before being emplaced, as were the heavy and field artillery used by the Army during the Spanish-American War and World War I. Proving ground operations were relocated to

Aberdeen, Maryland in 1918-19, where the testing of longer-range guns could be accommodated.

In 1886, a military review board headed by Secretary of War, William C. Endicott, issued a report recommending improvements to bolster the nation's outdated system of seacoast defenses. As a consequence, extensive concrete gun batteries were constructed at Sandy Hook between 1890 and 1908 to house the most modern defensive weapons of the period. The gun batteries were designed to blend into the seashore landscape to provide protection and camouflage. Battery Potter (completed in 1893) contained two 12-inch rifles that were lowered after firing by hydraulic lifts, enabling them to disappear from enemy view. Several subsequent batteries constructed during this period (notably the mortar battery, Battery Granger with its counterbalanced gun carriages, and Battery Gunnison with its rapid-fire guns) reflected the ongoing technological evolution of armament design.

In 1895, the Army designated the fortifications and installations at Sandy Hook as Fort Hancock, in honor of Major General Winfield Scott Hancock. The Fort was never a walled compound in the traditional sense, but in addition to the batteries, consisted of many brick buildings used to house the garrison and support operations. The long row of Georgian Revival-style officers' quarters remains one the Fort's outstanding features. Additional batteries were constructed and modernized during World Wars I and II. Fort Hancock was designated the headquarters for the New York Harbor defenses during World War II, and served as the base of operations for the 113th Regimental Combat Team. The regiment was reassigned in 1944 prior to deployment in Europe.

The Sandy Hook batteries were phased out and disarmed between 1943 and 1948 as new weapons technology (e.g. surface-to-air missiles, and new methods of amphibious warfare) made them obsolete. In the 1950s, Sandy Hook became the location of a Nike-Ajax missile site; the air defense system was upgraded in the early 1960s with the deployment of the Nike-Hercules system and more sophisticated tracking radar. Later in the decade, the long-range Intercontinental Ballistic Missile (IBM) system supplanted the Nike-Hercules system, and the latter was deactivated nationwide in August 1974. Fort Hancock itself was closed in December 1974, although facilities and operations of the U.S. Coast Guard and the U.S. Army were retained.

The Fort Hancock and Sandy Hook Proving Ground Historic District was designated a National Historic Landmark (NHL) in 1982 in recognition of its exceptional national significance. The boundaries of the NHL district encompass the entire peninsula of Sandy Hook. Additional historic properties listed individually on the National Register of Historic Places are the Sandy Hook Lighthouse (the oldest operating lighthouse in the United States owned by the U.S. Coast Guard and designated a NHL in 1964), and the Spermaceti Cove Lifesaving Station (a shingle-style building with distinctive four-story tower constructed by the U.S. Life-Saving Service in 1894 currently used as an NPS visitor center and museum and listed on the National Register in 1981) (Figure 2).

During a November 1997 reconnaissance of the preliminary pipeline corridor near the intersection of Hartshorne Drive and Atlantic Drive in the central portion of Sandy Hook, the project team identified remnants of the 1892 railroad bed that was used by the Army to transport heavy weaponry, ordnance and other supplies. Segments of steel rail, wood ties and switch

mechanisms were identified. The proposed pipeline corridor was rerouted in this area to avoid these and other railroad-related resources.

Because of Sandy Hook's long history of use as a proving ground, there is also a possibility that UXO may be encountered during ground-disturbing activities for the current project. As determined by archeological assessment of ordnance recovered from previous projects, much of this (often experimental at the time) may possess valuable archeological potential in documenting technological advances or modifications in ordnance design.

The NPS Submerged Cultural Resources Unit conducted a magnetometer survey of areas offshore of Sandy Hook in September 1997. As part of the survey, various historical maps were examined along with other sources in compiling a Geographic Information System (GIS) database. The potential locations of eight (8) documented shipwrecks were identified and plotted based on the historic maps (Figure 2). As a result of shoreline accretion on the north and northeast ends of Sandy Hook, these shipwrecks may now be buried onshore, although no testing has been conducted to confirm the existence of these potential archeological resources. There is also a possibility that rechanneling off the northern end of the Hook would have removed these wrecks prior to the establishment of the current shoreline.

VISITOR USE AND PARK OPERATIONS

Over two and a half million people visit the Park each year. Almost 60 percent of visitors use the Park during the summer, when almost 50,000 people at a time congregate on Park beaches during hot weekends. Less than ten percent of visitors use the Park during winter months, and approximately 30 percent of visitors use the Park during the spring and fall months. Dominant visitor activities at the Park are beach-related and include swimming, sunbathing, beach-combing, and picnicking.

In addition to swimmers, surfers are an active user group within the Critical Zone area. Surfing is popular in this area due to the restricted public access and loss of other popular surfing sites along the northern New Jersey coast. Surfers often refer to the Critical Zone as "Big Cove". A large wave break is created when east and southeast swells contact the extension of the seawall terminus as it curves into the surf zone. Use of the Critical Zone by surfers is dependent on the surf conditions; however, when the conditions are favorable, 50 to 100 surfers may be using the site. Surfers have expressed concerns that placing fill in the Critical Zone will straighten the shoreline, changing the wave break and reducing the length of the ride. Through considerable discussions with and input from the surfing community coupled with scientific shoreline monitoring studies a mutually acceptable design for the Critical Zone was developed (NPS 2001, 2003).

Fishermen find this area productive and fish along the shoreline and on the seawall when the rocks are exposed. The Parking lot is open to fisherman with a permit during hours of darkness when the Park is otherwise closed.

Sandy Hook is home to numerous private and non-profit organizations, a high school, a day care center, college field stations, state and federal agencies, a U.S. Coast Guard Station, and NPS facilities. These agencies and organizations employ or serve over 1000 people, many of whom reside on Sandy Hook with their families. These employees and residents would be directly affected by any action that restricts access to their facilities.

Hartshorne Drive extends north from Route 36 to a U.S. Coast Guard Station at the northern end of the peninsula and is the main roadway through the Park. For most of its length, Hartshorne Drive provides two (2) northbound traffic lanes and two (2) southbound traffic lanes, with north and southbound vehicles separated by an unpaved median. The road also serves six (6) recreational beach centers that include concessions, rest rooms and lifeguard/ first aid services. Utilities, such as telephone lines, sewer lines, water supply, electrical power lines and a proposed natural gas line, follow the existing road corridor.

A $65 million historic leasing program involving the adaptive reuse of 38 historic buildings in Fort Hancock is planned for the next few years. The success of this program is dependent on the ability to continue to provide current levels of vehicular access to Sandy Hook.

ENVIRONMENTAL CONSEQUENCES

The National Environmental Policy Act (NEPA) requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. This section analyzes the environmental impacts of the three (3) project alternatives on natural resources, cultural resources, and visitor use/traffic flow. These analyses provide the basis for comparing the effects of the alternatives. NEPA requires consideration of both the intensity and duration of impacts, cumulative impacts, and measures to mitigate for impacts. A more detailed analysis of the impacts to natural resources can be found in the BA and EFH Assessment (Appendices B and C).

General Methodology For Establishing Impact Thresholds And Measuring Effects

General Definitions

The following definitions were used to evaluate the context, intensity, duration, and cumulative nature of impacts associated with project alternatives:

Context is the setting within which an impact is analyzed, such as society as a whole, the affected region, the affected interests, and/or a locality. In this EA, the intensity of impacts generally are evaluated within a local (i.e., project area) context, while the contribution of impacts to cumulative effects are analyzed in a regional context or, in the case of special status species, within the context of a species distribution.

Intensity is a measure of the severity of an impact. The intensity of an impact may be *negligible*, when the impact is localized and at the lower levels of detection. (For cultural resources when the impact is barely perceptible and not measurable; confined to small areas or a single contributing element of a larger National Register district or archeological site(s) with low data potential.)

minor, when the impact is localized and slight but detectable. (For cultural resources, impact is perceptible and measurable; remains localized and confined to a single contributing element of a larger National Register district or archeological site(s) with low to moderate data potential.)

moderate, when the impact is readily apparent and appreciable. (For cultural resources, impact is sufficient to cause a change in character-defining feature; generally involves a single or small group of contributing elements or archeological site(s) with moderate to high data potential.); or

major, when the impact is severely adverse and highly noticeable. (For cultural resources, impact results in substantial and highly noticeable change in character-defining features; involves a large groups of contributing elements and/or individually significant property or archeological site(s) with high to exceptional data potential.)

Duration is a measure of the time period over which the effects of an impact persist. The duration of impacts analyzed in this EA may be: *short term*, when impacts occur during construction or last one year or less; or *long term,* when impacts last one year or longer.

Cumulative Impacts are impacts on the environment that results from the incremental (i.e., additive) impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of who undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Special Status Species Analyses

In accordance with language used to determine effects on threatened and endangered species under the federal Endangered Species Act (FWS 1998), potential effects on special status species were categorized as follows:

- ***no effect*****,** when the proposed actions would not affect special status species or critical habitat;

- ***not likely to adversely affect*****,** when effects on special status species are discountable (*i.e.*, extremely unlikely to occur and not able to be meaningfully measured, detected, or evaluated) or completely beneficial; or

- ***likely to adversely affect*****,** when any adverse effect to listed species may occur as a direct or indirect result of proposed actions and the effect is not discountable or completely beneficial.

Remaining considerations concerning special status species, including conclusions and evaluation of cumulative impacts, are presented in accordance with the general definitions described above under "General Definitions". As described in impact sections, a determination of "likely to adversely affect" does not necessarily constitute a "major" or "moderate" adverse impact to a species.

ALTERNATIVE A: NO ACTION

Impacts on Natural Resources

If no attempt would be made to reduce or modify the ongoing rates of erosion, the sand deficit in the Critical Zone would continue to occur. Within a few years the spit would be breached at this narrow section and an inlet would form, causing Sandy Hook to become an island.

Once the breach develops, it is expected to be a highly dynamic inlet. Strong tidal flow through the uncontrolled inlet would cause accelerated erosion on both ocean and bayside beaches. Significant changes in bay and ocean circulation patterns, water quality, and biota could be expected (Psuty and Allen pers. comm.). The already existent sand deficit would increase due to the entrapment of sand in the formation of the flood tide delta. This condition would exacerbate the erosion along the southern portions of Sandy Hook and reduce the amount of available beach for wildlife and recreation. It is believed that the inlet would be highly dynamic, and due to the sand deficit in the area, widen significantly. This wider inlet would rob some of the sand that would be transported north to Sandy Hook to form a flood tide delta.

The size, duration and general conditions of such an inlet are difficult to predict but are unlikely to remain stable. There is the possibility for the inlet tip to become attached to the mainland, or to migrate significantly as in the past (Moss 1964). The most certain prediction is that, due to the sand deficit there, it would be a highly dynamic area and would clearly reduce the amount of sand available for transport north along the Sandy Hook shoreline.

This accelerated beach erosion would have an impact on the existing distribution and success of the flora and fauna of Sandy Hook. The intertidal zone provides habitat for several species of crabs, mollusks, and marine worms. The beaches at Sandy Hook are also used as a feeding and resting area for numerous shorebirds, as well as a nesting area for the piping plover. Nesting by piping plovers in the Critical Zone and along southern beaches would likely be affected. The sand deficit would increase, impacting the rate of accretion along the northern beaches that presently support the rare beach flora and fauna. Continued loss of existing suitable nesting habitat could jeopardize the recovery of this threatened shorebird.

On the other hand, a breach and new inlet formation might provide new nesting and foraging habitats on the north and south beaches of this new inlet. New east-west oriented beaches with the potential for wide sand flats and pool development would provide improved foraging habitat for plovers as well as a more sheltered beach condition. Numerous Atlantic coast studies have documented the importance of beaches with ephemeral pools and tidal bay flats on piping plover distribution and reproductive success (Cape Lookout NS 1998, Coutu *et al.* 1990, Ellias *et al.* 2000, Goldin, 1990, Goldin and Regosin 1998, Hoopes 1993, Houghton *et al.* 1995-2000, Jones 1997, Loegering 1992, NPS and MD DNR 1993-1997). The state of sand starvation at the site of the new inlet due to the presence of the seawall, however, would severely limit flat and bar formation (Psuty and Allen pers.com.).

Another aspect to consider in habitat suitability is human disturbance. Numerous studies have documented the direct and indirect adverse effects of human disturbance on piping plovers (Burger 1987, Melvin *et al.* 1992, Howard *et al.* 1993, Ellias-Gerken and Fraser 1994, Strauss

1990). If these areas were protected from the high public use pressure at this highly visible and accessible site at the entrance to the NPS, new natural beach communities may develop. These newly formed beaches might support nesting Piping plovers, as has occurred on Westhampton Beaches in similar barrier breach conditions (Houghton *et al.* 1995-2000).

The location and accessibility of this new inlet, however, may perpetuate the existing "attractive nuisance" condition and require intensive enforcement for public safety and resource protection concerns which already exist at this site. The high visibility of the area and accessibility by land and water makes this site very prone to random disturbance events. Also, the dynamic nature of this inlet might create suitable habitat for T & E species, but is predicted (Psuty and Allen pers. comm.) to be highly dynamic due to strong current into the Ruritan Bay system, and be subject to higher tides and flooding due to increased water volumes into the Bay.

It is therefore uncertain whether the new inlet formation would be a net short or long-term gain or loss of quality beach habitat to support T & E species, as the existing Sandy Hook beaches might be reduced by this exacerbated sand deficit of an inlet formation. A series of protective dunes once extended all along Sandy Hook, from the seawall at the southern end of the Park to nearly the northern tip of the hook. Due to ongoing erosion, however, many dunes have been washed away, especially within the Critical Zone. As shoreline erosion continues, more beach and dunes would be lost. Existing beaches might narrow and become less suitable for beach flora and fauna with increased sand deficit in the longshore transport due to inlet formation.

A breach of the spit would also cause the loss or overwash of portions of the area's holly forest, maritime forest, and intertidal wetlands. Perhaps the most significant impact, however, would be the resultant habitat fragmentation and geographic isolation of Sandy Hook's biotic community. The maritime holly forest is a resource of national significance. Alteration or loss of the forest would be the direct result of the sand deficit caused by the seawall and hard structures south of the Park. Failure to offset the sand deficit or provide protection to the forest would result in a long-term major impact.

No cumulative effects are anticipated under the no action alternative, as no action will be taken, and only existing natural and human-induced impacts will continue without the influence of any project actions.

Conclusion

Potential moderate to major positive or negative effects are anticipated, depending upon the time frame and coastal and habitat formation processes.

Since no attempt would be made to control ongoing erosion, the sand deficit in the Critical Zone would continue to increase. Within a few years the spit would be breached and an inlet would form, causing Sandy Hook to become an island for an unpredictable amount of time. Breaching of the spit and continued beach erosion could have a detrimental impact on the Park's existing shoreline and biotic community and could result in habitat fragmentation and geographic isolation of Sandy Hook's flora and fauna. The uncertainty of the highly dynamic, sand-starved

area remaining an inlet or shifting makes it difficult to assess the potential effects of such an unstable system.

The uncertainty of frequency or duration of inlet formation, spit attachment or other possible barrier dynamics makes it difficult to predict the effects of a "return to natural" barrier system within the context of the adjacent artificial shoreline and highly compromised longshore transport system. Resulting effects of man-induced accelerated erosion and reduced accretion on existing beaches are expected to have adverse impacts on existing natural resources, while inlet formation might provide additional quality habitats with positive impacts. The complex spatial and temporal morphological changes to the shoreline remain uncertain, but would occur within the framework and context of NJ's highly manipulated coastal system delivering a negative sand budget into the Sandy Hook System.

Impacts on Cultural Resources

The decision to forego beach replenishment at the Critical Zone would be expected to adversely affect Sandy Hook's cultural resources. This could occur both as a direct result of ongoing and accelerated beach erosion, which in time may threaten historic properties in the vicinity of the Critical Zone (e.g. the Spermaceti Cove lifesaving station) and as an anticipated consequence of inadequate preservation maintenance for historic properties resulting from the difficulties and uncertainties of public access. A diminished NPS presence on the Hook (as would be expected to accompany the loss of recreational beaches and a corresponding reduction in visitation), would also likely entail further NPS inability to adequately occupy and use historic buildings, such as those at Fort Hancock. This could similarly lead to the deterioration of these buildings and an eventual loss of historic integrity.

Conclusion

Potential moderate adverse impacts are expected as cultural resources and infrastructure are threatened.

Sandy Hook's cultural resources would be adversely affected if no action were taken to control beach erosion at the Critical Zone. The preservation and maintenance of historic properties would be problematic as a consequence of public access difficulties and a reduced NPS presence on Sandy Hook. Other properties may be threatened by shoreline erosion.

Impacts on Visitor Use and Park Operations

Impacts to visitors, residents, employees and other Park users would occur incrementally over time. At first, beaches would become reduced in size, resulting in diminished quality for recreation. Some users, however, such as fisherman and surfers, would be unaffected in the short term, but would have to respond to an inlet formation and new coastal processes and shoreline configuration. The effect on the Big Cove surf area is uncertain.

Once overwash begins to occur, the Park will begin to institute closings, depending on the severity of the flooding. This will cause loss of work days for employees on Sandy Hook, school closings, and significant inconvenience to residents. These closings will increase in frequency until the road is washed out. Without a system in place to protect the road, it would not be repaired as a paved roadway. Once the road is lost, employees and residents would travel on temporary gravel-filled roads. Gravel roads would not be able to handle the volume of visitation the Park currently receives, and ferry service would not be able to make up for the lack of vehicle access.

At this point, the Park's function as a National Recreation Area would be severely compromised. As the gravel road is lost and an inlet forms, the existing tenants, including the National Oceanographic and Atmospheric Administration, Marine Academy of Science and Technology, and many others would have to close or use boats to access the Park. The US Coast Guard station at Sandy Hook would also be rendered inaccessible by land, severely hampering their ability to conduct homeland security activities in New York Harbor. Inlet formation would likely cause difficulties in the local coastal communities because of increased tidal range and duration and possibly increased wave energy. Water quality could also be affected.

The difficulties in access would also result in the abandonment of the Fort Hancock Historic Leasing program. Alternate methods of public access would need to be developed. This effort would require significant NPS resources and result in both short and long-term losses to public access to the Park. New access options, already reviewed and rejected by several studies and analyses (NPS 1995, 1997a) would require time to establish as well as additional fees and arrangements for a net loss in public access to the Park.

With a large reduction in visitation, there would be a socioeconomic impact on the local businesses along Rt. 36 and the immediate Sandy Hook vicinity. Concessions operations in the Park would close or be greatly reduced, eliminating many summer jobs in the area. Local gas stations, restaurants and other tourist-related businesses would be affected as visitors relocate to other area beaches for recreation.

Conclusion

Moderate to major, long-term negative impact through reduction in the width of beach, threat of damage or loss to infrastructure and access, and decrease in visitor use.

Such consequences would have a long-term, major negative impact on the Park's 2.5 million annual visitors, the numerous federal and state agencies, schools, private organizations, approximately 1,000 employees working on Sandy Hook, and the current residents of the NPS and U.S. Coast Guard. The no-action alternative would essentially eliminate the Park's ability to serve the New York/New Jersey Metropolitan area as a National Recreation Area. Loss of visitation to the Park would have a long-term, severe, negative socioeconomic effect on the neighboring communities.

ALTERNATIVE B: SLURRY PIPELINE

Impacts on Natural Resources

Continual replenishment of the beach with smaller quantities of sand on a regular basis would more closely mimic the amount of sand transported through natural littoral drift. Sediment will be removed in transit through the beach face and nearshore. The area inland of the berm crest at Gunnison would not be excavated. The sand would be secured from the mobile pulses of sand passing through the beach face at Gunnison. The dredge hose would essentially work the beach face below the high tide line out to the sand bar formations (see Appendix A).

The length of shoreline to be affected is difficult to assess because of the assumptions required, such as the wave energy and direction components driving beach response, and sediment transport. But it should be less than 500 feet (near the present fenceline excluding pedestrians from southward incursion into protected beach habitat). During the period of sand removal, sand would be transported back into the excavated area by natural processes and decrease the size and duration of impact area.

Beach steepness should not change as a result of the bulk removal of sand, since steepness is dependent upon sediment grain size and wave parameters. The area of bare sand habitat on the beach also would remain unchanged, but would be displaced landward, because this feature is dependent upon wave overtopping of the beach berm and its envelope of annual excursion. Beach elevation is largely dependent on tidal range and wave runup heights; however, underlying geology and MSL also play roles. Since these parameters would remain unchanged, beach elevation (and flooding frequency) would remain constant.

There would be no change in all known attributes other than surface area and localized sediment budget, which is ample, because there is no arresting of the natural processes taking place. Small deviations from the norm could be expected for up to one or two tidal cycles (24 hours) after sand mining, but this effect would be minor.

Construction activities would affect up to three acres of vegetation in an area of previous disturbance. As mentioned under the heading “Mitigation Measures,” vegetation losses would be mitigated by the revegetation of disturbed sites with native species matching those which existed in the area prior to construction. Following facility removal with an active and ongoing revegetation program using native plants and seeds will help to prevent the invasion of non-native plants and noxious weeds that flourish in disturbed sites such as road corridors.

Noise and human presence associated with construction activities would disturb wildlife in the immediate vicinity of the project area. Potential impacts on wildlife would depend on such variables as the location, nearness of the construction site, time of year and species affected. Individual mammals and birds could be expected to avoid the project area during construction; however, effects are not anticipated to be significant since noise and human disturbance would not be noticeably increased over existing conditions. Timing of construction during the year would help mitigate noise impacts, particularly to nesting birds.

Removal of sand from Gunnison Beach is not likely to adversely affect the piping plover since this beach is not currently used by nesting plovers. Furthermore, past experience with removing sand from Gunnison beach has indicated that sand was replaced by longshore transport almost as quickly as it was removed. Any increase in turbidity and decreased water quality would be localized and short term. In addition, no net loss of plover habitat is expected, since only that portion of the beach that is accreting on an annual basis would be removed.

Further, to avoid potential disturbance to nesting birds, sand would only be removed from Gunnison Beach between October 1 and March 1 (outside the plover nesting season). Reproductive success would continue to be monitored throughout the nesting season to ensure that the project was not having an adverse affect on nesting plovers.

Sea turtles and marine mammals are not expected to be present due to the time of year. Additional timing and placement restrictions on the proposed plan and equipment design are intended to avoid any possible impacts to these protected aquatic species.

Finfish are not likely to be adversely affected because borrow activities will be localized so only a small area will be impacted at any given time. The method of removal and fill (~2000 cy/day) is small enough to avoid burial of fisheries resources, and any displacement will be highly localized and temporary. It is also unlikely that there will be any long-term turbidity impacts since sediment will be taken from the surf zone at Gunnison and moved to the surf zone at the Critical Zone, so there will not be any introduction of fine sediments that aren't already in that habitat and surf zone water column. See Appendix B for a full discussion of this.

When using an eductor as opposed to the clamshell bucket for sand removal there is less likelihood of coming in contact with marine life other than small buried benthic organisms utilizing the area because the eductor mines sand by creating a sand slurry within a depression in the intertidal zone and sucking it up onto the equipment on the beach for transport to the fill site, thus it remains in the sand without being raised frequently, like the clamshell bucket. In addition, the eductor is fitted with a 4-6 inch metal mesh screen that would filter out any large organisms in the unlikely event that they became siphoned into the slurry mixing chamber. Since the eductor is lowered into the surf zone and remains in the sand depression it creates, it is predicted that this equipment will have the least impact on water quality and sediment transport.

Benthic invertebrates in the intertidal zone are not expected to be adversely affected. Studies have shown such benthic macroinvertebrates to be mobile and have a high recolonization rate, with populations expected to be restored by mid March. Because activity is restricted to the highly dynamic intertidal surf zones, disturbance to marine life is expected to be minimal.

Machinery emissions and increased airborne dust resulting from construction activities would decrease air quality in the vicinity of the project site. However, since pollution sources would be temporary, localized, and of small magnitude, there would be no adverse effect on air quality or related values. Overall, it is expected that diminished air quality would have no effect on human health and would result in only minor and temporary impairment of visibility. Normal air quality conditions could be expected to return once construction is completed.

Cumulative impacts are expected to be negligible to minor due to the long term nature of a renourishment project such as this that attempts to simulate natural sand transport. Cumulative impacts of renourishment include the prevention of overwash or breach formation, which is a natural maintenance feature, thus preventing widening of the beach.

Conclusion

Negligible to minor, short term impacts could occur as sediment in water column causes increase in turbidity immediately downdrift of the project beach. Sand removal would be very localized and restricted to the highly dynamic surf zone. There is the potential for adverse and beneficial impacts on T&E species. Negligible to minor long-term impacts and cumulative impacts are expected. No impairment of park resources is expected.

Beach replenishment may have a beneficial effect on rare flora and fauna such as the piping plover by creating additional nesting habitat for this threatened shorebird in the Critical Zone. In addition, the project would have negligible effect on Park vegetation, and only short-term disturbance effects on wildlife. There would be minor and temporary impairment of air quality in the immediate project vicinity. This alternative would not interfere with the northern littoral drift of sand along the Sandy Hook peninsula. To avoid potentially adverse impacts on any rare species or EFH in the area, project operations would have to be scheduled during the months of October through February, and mitigation measures will be taken.

Impacts on Cultural Resources

Construction of the sand slurry pipeline is expected to have negligible to minor adverse effect on cultural resources because moderate, short-term noise and visual effects would accompany construction activities as well as periodic pumping operations, however, these effects would not substantially diminish the character-defining features contributing to the significance of Sandy Hook's National Historic Landmark district. Project designs have successfully incorporated the avoidance of identified historic properties, and the location of the pipeline route adjacent to the road corridors of Atlantic and Hartshorne Drives was selected in part with this objective in mind. An official review of the project by the N J Historic Preservation Office determined no adverse effect (Guzzo 1999). Once final locations for the pump stations have been chosen, an NPS archeologist and NJSHPO will review the project for a final determination.

Implementation of the preferred alternative would permit the NPS to more reliably carry out its preservation responsibilities with regard to the ongoing maintenance and occupation/ use of historic buildings and structures. Beach replenishment at the Critical Zone would also help provide historic properties in that vicinity with protection from shoreline erosion.

While it is likely that prior road construction would have disturbed potential archeological resources along the corridors, this cannot be completely confirmed because of the limited scope of previous surveys. Therefore, archeological monitoring will accompany ground-disturbing construction activities in potentially sensitive or less-disturbed areas.

Under Section 110(f) of the National Historic Preservation Act, the NPS is required to undertake such planning and actions as may be necessary to minimize harm to any National Historic Landmark that may be directly and adversely affected by an undertaking. In keeping with this legislative mandate, selection of the preferred alternative would provide greater assurances that the NPS would be able to fulfill its historic preservation responsibilities for the Sandy Hook NHL district.

Conclusion

Negligible to minor impacts are expected on cultural resources of the area due to the noise and visual disturbances that would accompany construction and the periodic pumping activities.

There would be negligible to minor adverse effects to identified historic properties or qualities/attributes contributing to the significance of the Sandy Hook NHL district under the preferred alternative. Archeological monitoring would accompany ground-disturbing construction activities to provide for the proper treatment of archeological resources should these be uncovered. The NPS would be able to perpetuate its role in providing for the long-term protection and preservation of Sandy Hook's diverse cultural resources.

The determination of effect under Section 106 is no adverse effect after a project review conducted by the NJSHPO in 1999 (Guzzo).

Impacts on Visitor Use and Park Operations

Implementation of this alternative would assure visitor and employee access to the Sandy Hook peninsula. Without such action, public access to all but a small portion of the Park would be by ferry boat or helicopter only. The beach that would be restored would serve 150,000 to 200,000 visitors each summer. The project also creates a unique opportunity to educate the public about the concept of wave dynamics, erosion, and littoral drift as well as the impact that beach stabilization structures have had on natural processes. Over the last year, surfing community input, along with shoreline study results, assisted in designing a mutually beneficial Critical Zone Fill design that would maintain the important surfing area.

Fishing should not be disrupted by the replenishment, as sand will not be placed over (nor will it drift over or onto) seawalls or groins. Access for fishing will also be maintained, except for when pumping is in progress. The majority of sand will be placed on the existing shoreline and will not change the bathymetry near the end of the seawall. This will allow the existing swells to continue to develop and provide a good wave break. Surfers may experience a short-term, moderate change in the length of the current wave break at the Critical Zone, but long-duration waves should continue, and will improve as the fill material migrates northward. Also, because the equipment will only occupy a small area of on the beach there will not be a significant displacement for any surf zone fishermen and this would only be for 50 days/year and not permanent location.

Because beach replenishment would occur well after the summer season, interference with visitor enjoyment of the area would be minimized. Nor would the project result in a disruption in normal traffic flow since sand would be transported to the project area from offshore and not via Park roads.

Beach replenishment would also protect a $12 million investment in recently completed beach facilities. Past storms have eroded away protective dunes safeguarding these structures. Without the placement of additional sand, with follow-up maintenance replenishment, these newly constructed facilities would be rendered useless and eventually destroyed.

Relationships with Park partners would be strengthened by this project. The Department of Commerce, U.S. Coast Guard, State of New Jersey, and Monmouth County School District and Community College all have facilities at Fort Hancock. Providing reliable vehicle access to staff and students is critical to maintaining effective partnerships with these organizations.

Conclusion

Short and long-term minor to moderate positive impacts on recreation and pubic use are expected. Similar cumulative impacts are expected as the Park is enabled to fulfill its NRA mission.

The actions proposed in this alternative would meet Park management objectives of maintaining public access and recreational opportunities on Sandy Hook in addition to protecting newly constructed beach facilities. Full implementation of this alternative can be accomplished within the Park's existing budget, using Parking fee receipts as a funding source. This alternative most closely mimics the natural sand transport system and minimizes impacts to all resources by providing more frequent sand replenishment (as needed) at smaller volumes during the safe window for sensitive resources. This allows NPS the certainty and flexibility of recycling its own resources in the most efficient and effective manner to provide for the Park's mission of resource conservation.

Table 2. Summary of Alternative Impacts

SUMMARY OF ALTERNATIVE IMPACTS

IMPACT TOPIC	Alternative A: No Action	**Alternative B, Option 1:** Slurry Pipeline with crane and clamshell bucket for sand removal	**Alternative B, Option 2:** Slurry Pipeline with eductor for sand removal--Preferred
NATURAL RESOURCE	The sand deficit in the Critical Zone and all beaches to the north would continue to build, affecting rare species habitat. New inlet beaches would form which could provide significant additional habitat for these rare species. However, uncertain longevity, movements, and morphology make it difficult to predict a net loss or gain in short and long-term habitat. Breaching of the spit and continued beach erosion would alter sand transport and accretion rates along existing productive and suitable northern beach habitats.	The proposed action would not result in significant impacts to natural resources. Continual replenishment of the beach with smaller quantities of sand on a regular basis would more closely mimic the amount of sand transported through natural littoral drift. Mitigation measures would be employed to ensure that Park resources are protected, including the development of monitoring programs to evaluate the effects of the project on rare species. **Negligible to minor, short term impacts could occur as sediment in water column causes increase in turbidity immediately downdrift of the project beach. Sand removal would be very localized and**	Same as Option 1, except for a difference in the equipment used for sand removal. Like the clamshell bucket, the eductor is swung from a crane, but the eductor has been fitted with a 4-6 inch mesh screen that would filter out any large organisms. This equipment minimizes turbidity and impacts to water quality. **Negligible to minor short term impacts could occur as sediment in water column causes increase in turbidity immediately downdrift of the project beach. Sand removal would be very localized and restricted to the highly dynamic surf zone. Potential adverse and beneficial impacts on T & E species. Negligible**

S	**Potential moderate to major positive or negative effects are anticipated, depending upon the time frame and coastal and habitat formation processes.**	**restricted to the highly dynamic surf zone. Potential adverse and beneficial impacts on T & E species. Negligible long-term impacts and cumulative impacts are expected due to the long-term nature of a renourishment that attempts to simulate natural sand transport.**	**long-term impacts and cumulative impacts are expected due to the long-term nature of renourishment that attempts to simulate natural sand transport.**
CULTURAL RESOURCES	Sandy Hook's cultural resources would be adversely affected if no action is taken to control beach erosion at the Critical Zone. The preservation and maintenance of historic properties would be problematic as a consequence of public access difficulties and a reduced NPS presence on Sandy Hook. Additional facilities and artifacts may be threatened by shoreline erosion. Potential major negative impacts are expected as cultural resources are threatened	There would be no adverse effects to identified historic properties or qualities/attributes contributing to the significance of the Sandy Hook NHL district. Archeological surveys indicate no resources in the area. Monitoring would accompany ground-disturbing construction activities to provide for the proper treatment of archeological resources should these be uncovered. The NPS would be able to perpetuate its role in providing for the long-term protection and preservation of Sandy Hook's diverse historical and archeological resources. **No negative impacts are expected on cultural resources of the area. Instead this will provide for protection of important cultural resources.**	Same as Option 1. **No negative impacts are expected on cultural resources of the area. Instead this will provide for protection of important cultural resources.**
VISITO	Operations at Sandy Hook would be adversely affected due to a loss of mainland access as well as a loss of recreational beaches and newly constructed beach facilities. Consequences would have an adverse	The actions proposed in this alternative would meet Park management objectives of maintaining public access and recreational opportunities on Sandy Hook in addition to protecting newly constructed beach facilities. It is anticipated that	Same as Option 1. Short and long-term minor to moderate positive impacts on recreation and public use. Similar cumulative effects anticipated

R U S E A N D P A R K O P E R A T I O N S	impact on the Park's 2.5 million annual visitors and the numerous federal and state agencies, schools, private organizations and approximately 1,000 employees working on Sandy Hook. Moderate to major, long-term negative impact through reduction in the width of beach and decrease in visitor use	implementation of this alternative can be accomplished with the Park's existing budget, using Parking fee receipts as a funding source. **Short and long-term minor to moderate positive impacts on recreation and public use. Similar cumulative effects anticipated as Park is enabled to fulfill its NRA function.**	as Park is enabled to fulfill its NRA function.

Table 3. Potential Effects of Alternative Pipeline Alignments

	Alternative A - Pipeline Follows Existing Road Alignments	Alternative B - Pipeline Follows Shoreline	Alternative C - Pipeline Alignment

						Follows Abandoned Rail Line
	Option 1. Follows West Side of Hartshorne Drive with Direct Line to Sand Source (3,000 Feet of New Disturbance)	Option 2. Follows East Side of Hartshorne Drive with Temporary Pipe to Sand Source (No New Disturbance)	Option 3. Follows West Side of Hartshorne Drive with Direct Line to Sand Source (1,000 Feet of New Disturbance)	Option 1. Follows Shoreline and Runs Through Parking Lots at Areas D and E (16,000 Feet of New Disturbance)	Option 2. Follows Shoreline and Runs Along Beach (18,000 Feet of New Disturbance)	Follows East Side of Hartshorne Drive and Then Runs Parallel to Railroad Bed Through Radar Site
Criteria # 1 Natural Resource Protection:						
Linear Feet of New Disturbance	moderate	minor	moderate	major	major	major
Vegetation Communities: Beach Grasses Shrublands	minor moderate	minor moderate	minor moderate	major moderate	major minor	minor major
Maritime Forest Holly Forest	minor major	minor minor	minor major	minor minor	minor minor	major minor
Dunes: Primary Dune Secondary Dune	minor moderate	minor minor	minor moderate	moderate major	major moderate	minor minor

Freshwater Ponds	minor	minor	minor	minor	minor	minor
Existing Drainage Patterns	minor	minor	minor	minor	minor	minor
Wetlands	minor	minor	minor	minor	minor	moderate
General Wildlife	moderate	minor	minor	minor	minor	minor
Threatened & Endangered Species Piping Plovers and Seabeach Amaranth and knotweed: Beach Habitat Reproductive Chronology	 moderate minor	 minor minor	 moderate minor	 moderate moderate	 major major	 minor minor
Tiger Beetles: Beach Habitat Other sensitive beach flora and fauna (i.e., least tern, common tern, osprey, red knot)	 minor moderate	 minor minor	 minor minor	 minor minor	 major minor	 minor major
Criteria #2- Cultural Resource Protection						
Historic Resources: Spermacetti Cove Visitor Center	 minor	 minor	 minor	 major	 major	 moderate

Radar Site	minor	minor	minor	minor	minor	major
Nike Site	minor	minor	minor	moderate	minor	minor
Railroad Corridor(s)	minor	moderate	minor	minor	minor	major
Archeological Resources:	moderate	minor	moderate	minor	minor	minor
Known Sites	minor	minor	minor	minor	minor	minor
Unknown Sites	minor	minor	minor	minor	minor	minor
Amount of survey work needed						
Unexploded Ordinance:						
Amount of Ground Clearance Needed (Probability or Finding UXO)	major	minor	moderate	moderate-major	moderate-major	moderate

Criteria #3- Visitor Experience						
Inconvenience to visitors:						
Beach Walking	minor	minor	minor	minor	major	minor
Surf Fishing	minor	minor	minor	minor	major	minor
Road Cminorosures	moderate	moderate	moderate	minor	minor	minor
Area Closures	minor	minor	minor	moderate	moderate	minor
Noise	minor	minor	minor	moderate	moderate	minor

Visual Disturbance	major	moderate	major	moderate	moderate	moderate
Criteria #4- Operations and Maintenance						
System's Compatibility with Existing Infrastructure	moderate	moderate	moderate	major	minor	moderate
Maintenance of System	minor	minor	minor	major	major	moderate
Daily Park Operations: Traffic Control Public Safety	minor minor	minor minor	minor minor	minor minor	minor minor	minor minor

ENVIRONMENTALLY PREFERRED ALTERNATIVE

Of the alternatives, Option 2 of Alternative B appears to have the least impact, while Option 1 is anticipated to have slightly more minor effects. Both options have long-term effects (some negative and others positive) by the nature of the design of this long-term renourishment project. It is well documented that the effects of sand nourishment are temporary, and that the benefits derived from such activities are also short term, since the geomorphologic dynamic balance of the barrier island system is not being overcome. The long term viability of this beach nourishment project relies on its simulation of natural sand transport and deposition along Sandy Hook. For this reason, Option 2 of Alternative B is believed to provide the best balance to the Park in protecting the natural and cultural environment and resources, and providing for public access and visitation.

Impairment Analysis

The NPS Management Policies of 2001 require an analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, as established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within a park system unit, that discretion is limited by the statutory requirement that the agency must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

• necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;

• key to the natural or cultural integrity of the park; or

• identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. The following

process was used to determine whether the various alternatives had the potential to impair park resources and values:
1. The park's enabling legislation, the General Management Plan, the Strategic Plan, and other relevant background were reviewed to ascertain the park's purpose and significance, resource values, and resource management goals or desired future conditions.

2. Beach and shoreline management objectives specific to resource protection goals at the park were identified.

3. Baselines have been established for each resource of concern to determine the context, intensity and duration of impacts, as defined above.

4. An analysis was conducted to determine if the magnitude of impact reached the level of "impairment," as defined by the NPS Management Policies.

The impact analysis includes any findings of impairment to park resources and values for each of the management alternatives.

IMPAIRMENT STATEMENT
Since the purpose of this impact analysis is to look at a proactive, longer- term project which best simulates natural shoreline dynamics, NPS Management Policies impairment determinations are based on this time frame and in this context. As stated earlier from NPS Management Policies - 4.8.1 Protection of Geologic Processes: "The Service will allow natural geologic processes to proceed unimpeded whenever possible." In this instance where the natural geological processes have been drastically altered by man-made conditions to the south, the system is no longer natural and impaired by outside adjacent conditions. This project attempts to simulate and restore a near-natural sand transport shy of allowing inlet formation and threatening property.

Geologic processes are the natural physical and chemical forces that act within natural systems, as well as upon human developments, across a broad spectrum of space and time. Such processes include, but are not limited to, exfoliation, erosion and sedimentation, glaciation, karst processes, shoreline processes, and seismic and volcanic activity. Geologic processes will be addressed during planning and other management activities in an effort to reduce hazards that can threaten the safety of park visitors and staff and the long-term viability of the park infrastructure. Intervention in natural geologic processes will be permitted only when: " Necessary in emergencies that threaten human life and property;"

From 4.8.1.1: Shorelines and Barrier Islands

Natural shoreline processes (such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration) will be allowed to continue without interference. Where human activities or structures have altered the nature or rate of natural shoreline processes, the Service will, in consultation with appropriate state and federal agencies, investigate alternatives for mitigating the effects of such activities or structures and for restoring natural conditions. The Service will comply with the provisions of Executive Order 11988 (Floodplain Management) and state coastal zone management plans prepared under the Coastal Zone Management Act of 1972. Any shoreline manipulation measures proposed to protect cultural resources may be

approved only after an analysis of the degree to which such measures would impact natural resources and processes, so that an informed decision can be made through an assessment of alternatives. Where erosion control is required by law, or where present developments must be protected in the short run to achieve park management objectives, including high-density visitor use, the Service will use the most effective and natural appearing method feasible, while minimizing impacts outside the target area.

Management Policies have been interpreted in this case, to take steps to minimize safety hazards and harm to cultural and natural resources. The Park will attempt to restore the most natural sand transport and deposition processes through this renourishment project and extend long term protection of natural, cultural and public access and visitation. For each alternative the following Impairment Analyses has been accomplished:

Alternative A. - No Action Alternative – No impairment of park resources is expected.

Alternative B. – Slurry Pipeline

Option 1: Slurry Pipeline with Crane and Clam Shell Bucket for Sand Removal – No Impairment of Park Resources is expected.

Option 2: Slurry Pipeline with Eductor - No Impairment of Park Resources is expected.

CONSULTATION AND COORDINATION

The following agencies were contacted and/or consulted during preparation of this EA:

U.S. Army Corps of Engineers, New York District. In 1997, the NPS conducted a similar fill project and contacted the ACOE to assist with design, contracting, and permitting of the project. The ACOE authorized the placement of up to 2.6 million cy of fill in the Critical Zone over a 10-year period. The NPS contacted the Regulatory Branch of the ACOE (James Haggerty) to insure the Department of the Army permit (#97-11830) is still valid for this project. Anthony Ciorra and Lynn Bocomazzo of the ACOE have worked with the NPS on the engineering and design of the fill and contracting. Mark Burlas, an ACOE biologist, was contacted regarding biological impacts associated with other ACOE fill projects in New Jersey. The NPS has submitted a copy of this EA to the ACOE for review. ACOE staff, Zarife Koko Cronin and Chris Rasmussen attended the planning/scoping meeting in July 2001 and provided valuable input. In 2002-2003 both the Philadelphia district and the New York district provided valuable design input resulting in the New York's proposed design described in this document.

U.S. Fish and Wildlife Service, New Jersey Field Office. The NPS consulted the Endangered Species Division (Annette Scherer) on endangered and threatened species including the Piping plover, Northeastern beach tiger beetle and Seabeach amaranth. Annette attended the July 2001 scoping meeting for this project and corresponded and met with staff to discuss various aspects

of this project. A September 21, 2000 letter, received from FWS specified that the project was likely to affect piping plover and seabeach amaranth and requested a BA. The NPS has responded to the request and has outlined conservation measures aimed at minimizing or avoiding impacts to species of concern. A draft copy of the BA and EA were provided to the FWS with a request for review in 2001 and correspondences assisted in refining the project.

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). The NPS requested technical assistance and support from the Cape May Plant Materials Center. Staff from the center is collecting seed from the Seabeach amaranth plants on site. Some plants have been removed and are being grown at the center in a greenhouse to improve success in collecting seeds and to grow individual plants for replanting at the fill site.

New Jersey Department of Environmental Protection (NJDEP). The NPS contacted the NJDEP to coordinate compliance with the New Jersey Coastal Zone Management Act, as well as other state laws and regulations in preparation of the slurry pipeline project. Dave Jenkins attended the July 2001 scoping meeting and presented input into shorebird and waterbird conservation issues.

NJ Coastal Program
Mark Mauriello, from NJ Coastal Program also attended the scoping meeting and provided valuable permit information.

National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries. The NPS consulted the NMFS Protected Species review staff (Karen Green and Diane Rusanowsky)for endangered and threatened species including the sea turtles and marine mammals and EFH assessment. Karen Greene attended the July 2001 scoping meeting and has corresponded on NOAA concerns. She has met and corresponded with project staff on various aspects of this project. A draft copy of the EFH, BA and EA were provided to the NMFS with a request for review in 2002 and correspondences assisted in refining the project.

In addition, the following agencies and organizations will be provided a copy of this assessment for their review and comment:

<u>Federal Agencies</u>

US Environmental Protection Agency
Department of Commerce, National Oceanic and Atmospheric Administration
Department of Transportation, US Coast Guard
US Congress – Senate
US Congress – House of Representatives

<u>State Agencies</u>

New Jersey Historic Preservation Office
New Jersey Department of Transportation

Local Agencies

Monmouth County Board of Chosen Freeholders
Monmouth County Planning Board
Monmouth County Vocational Schools, M.A.S.T.
Middletown Township Environmental Commission
Middletown Township Planning Board

Citizens Groups

American Littoral Society
Sandy Hook Foundation
Clean Ocean Action
Rutgers University, Center for Coastal Studies
Brookdale Community College
New Jersey Marine Science Consortium
Monmouth County Audubon
Surfers Environmental Alliance
Asbury Park Fishing Club
Friends of Gunnison

COMPLIANCE FRAMEWORK

Relevant Laws and Regulations

The following laws and associated regulations provided direction for the design of project alternatives, the analysis of impacts and the formulation of mitigation/ avoidance measures:

National Environmental Policy Act of 1969 (NEPA) (Title 42 U.S. Code Sections 4321 to 4370 [42 USC 4321-4370]).
The purposes of NEPA include encouraging "harmony between [humans] and their environment and promote efforts which will prevent or eliminate damage to the environment. . .and stimulate the health and welfare of [humanity]". The purposes of NEPA are accomplished by evaluating the effects of federal actions. The results of these evaluations are presented to the public, federal agencies, and public officials in document format (e.g., environmental assessments and environmental impact statements) for consideration prior to taking official action or making official decisions. Implementing regulations for the NEPA are contained in Part 1500 to 1515 of Title 40 of the U.S. Code of Federal Regulations (40 CFR 1500-1515).

Clean Water Act of 1972, as amended (CWA) (33 USC 1251-1387).
The purposes of the CWA are to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters". To enact this goal, the ACOE has been charged with evaluating federal actions that result in potential degradation of waters of the U.S. and issuing permits for actions consistent with the CWA. The U.S. Environmental Protection Agency (EPA) also has responsibility for oversight and review of permits and actions, which affect waters of the U.S. Implementing regulations describing the ACOE CWA program are contained in 33 CFR 320-330.

Coastal Zone Management Act of 1972 (CZMA) (16 USC 1451-1464).
The CZMA presents a congressional declaration to "preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations". The CZMA also encourages "states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone". In accordance with the CZMA, the State of New Jersey has adopted state laws and regulations, including a Coastal Zone Management Plan, which is administered by the NJDEP. All actions proposed by federal, state, and local agencies must be consistent or compatible with the Coastal Zone Management Plan, as determined by the NJDEP.

Endangered Species Act of 1973, as amended (ESA) (16 USC 1531-1544). The purposes of the ESA include providing "a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved". According to the ESA, "all Federal departments and agencies shall seek to conserve endangered species and threatened species" and "[e]ach Federal agency shall. . .insure that any action authorized, funded, or carried out by such agency. . .is not likely to jeopardize the continued existence of any endangered species or threatened

species". FWS (non-marine species) and NMFS (marine species, including anadromous fish and marine mammals) administer the ESA. The effects of any agency action that may affect endangered, threatened, or proposed species must be evaluated in consultation with either the FWS or NMFS, as appropriate. Implementing regulations which describe procedures for interagency cooperation to determine the effects of actions on endangered, threatened, or proposed species are contained in 50 CFR 402.

National Historic Preservation Act of 1966, as amended (NHPA) (16 USC 470 et sequentia). Congressional policy set forth in the NHPA includes preserving "the historical and cultural foundations of the Nation" and preserving irreplaceable examples important to our national heritage to maintain "cultural, educational, aesthetic, inspirational, economic, and energy benefits". The NHPA also established the National Register of Historic Places composed of "districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture". The NHPA requires that federal agencies take into account the effects of their actions on properties eligible for or included in the National Register of Historic Places and coordinate such actions with State Historic Preservation Offices (SHPO). NHPA also requires federal agencies, in consultation with the SHPO, to locate, inventory, and nominate all properties that appear to qualify for the National Register of Historic Places, including National Historic Landmarks. Further, it requires federal agencies to document those properties in the case of an adverse effect and propose alternatives to those actions, in accordance with the NEPA.

Environmental Justice
Executive Order 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. Consistent with this mandate, the population in the vicinity of Sandy Hook is evaluated to determine the potential for the project to adversely affect minority and/or low-income populations. The demographic study area comprises all census tracts adjacent to Sandy Hook. The analysis shows no significant concentrations of low-income households or minority populations within the census area that would be impacted by the action alternatives.

Local and regional businesses, residents, and tourists determine the socioeconomic climate at and near the park, which is located in the most densely populated region of the United States. Although park visitation is high, particularly during summer when several million visitors may visit the park (NPS 1990), the alternatives evaluated in this EA would have a negligible affect on local and regional tourism and would not affect socioeconomic conditions or socially or economically disadvantaged populations.

1972 Coastal Zone Management Act
In recognition of the increasing pressures of over-development on the nation's coastal resources, Congress enacted the Coastal Zone Management Act in 1972. The act encourages states to preserve, protect, develop, and where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife using those habitats. A unique feature of the coastal zone management program is that participation by states is voluntary. To encourage states to

participate, the act makes federal financial assistance available to any coastal state or territory that is willing to develop and implement a comprehensive coastal management program. In addition, once a state adopts a plan consistent with the Coastal Zone Management Act, that state's coastal 21 plan agency can make consistency determinations on federal actions subject to the plan.

State coastal zones include the coastal waters and adjacent shorelands that extend inland to the extent necessary to control activities that have a direct, significant impact on coastal waters. For federal approval, a coastal zone management plan must (1) identify the coastal zone boundaries; (2) define the permissible land and water uses within the coastal zone that have a direct and significant impact on the coastal zone and identify the state's legal authority to manage these uses; (3) inventory and designate areas of particular concern; (4) provide a planning process for energy facilities siting; (5) establish a planning process to assess the effects of, and decrease the impacts from, shoreline erosion; and (6) facilitate effective coordination and consultation between regional, state, and local agencies. The NOAA approves coastal zone management plans and oversees subsequent implementation of the programs.

1982 Coastal Barriers Resources Act

Congress passed the Coastal Barriers Resources Act in 1982 to address problems caused by coastal barrier development. The act restricts federal expenditures and financial assistance, including federal flood insurance, in the Coastal Barrier Resource System. This system is made up of a defined list of undeveloped coastal lands and associated aquatic environments that serve as barriers protecting the Atlantic, Gulf, and Great Lakes coasts. The system currently includes 585 units, which add up to almost 1.3 million acres and about 1,200 shoreline miles. There are also 274 "otherwise protected areas," a category added by the 1990 Coastal Barrier Improvement Act for coastal barriers within lands reserved for conservation purposes. Fire Island is included in this system as an otherwise protected area.

Three important goals of this act are to:

• minimize loss of human life by discouraging development in high risk areas,

• reduce wasteful expenditure of federal resources, and

• protect the natural resources associated with coastal barriers

Federal monies can be spent within the system for certain exempted activities, after consultation with FWS. Examples of such activities include emergency assistance, military activities for national defense, and maintenance of existing federal navigational channels.

Endangered Species Act

Section 7 if the Endangered Species Act (ESA,16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may adversely affect a federally listed species, consultation with the FWS is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction of adverse modification of critical habitat. If it is

determined that a proposed federal action is likely to result in the "take" of a listed species, then the FWS may describe those conditions which must be met in order for an activity to proceed. "Take" includes harming or harassing or species in ways which interfere with its normal breeding, feeding, or sheltering behaviors.

Informal consultation was initiated with the FWS and the National Marine Fisheries Service (NMFS) as well as the designated State regulatory agency, NYSDEC, throughout the internal scoping period for this project. Formal consultation under Section 7 of the ESA has also been initiated and a response from the FWS and NMFS will be incorporated into this EA or its errata sheet. Comments and information on species that potentially occur within or adjacent to the project area within the boundaries of Fire Island National Seashore was requested. An analysis of the potential impacts to each species listed is included in this document.

This draft environmental assessment will be submitted to the FWS, NMFS, and NYSDEC for review of ESA compliance along with an associated BA which covers the species impacts more thoroughly and which is required for formal consultation with these agencies.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.

Marine Mammal Protection Act of 1972

The Marine Mammal Protection Act establishes a federal responsibility to conserve marine mammals, with management vested in the Department of Commerce for cetaceans and pinnipeds other than walrus. The Department of the Interior is responsible for all other marine mammals, including sea otter, walrus, polar bear, dugong and manatee. The Act generally assigns identical responsibilities to the Secretaries of the two departments.

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ACRONYMS

ACOE	U.S. Army Corps of Engineers
cm	centimeters
cy	cubic yard
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Orders
FWS	U S Fish and Wildlife Service
GMP	General Management Plan
IBM	International Ballistic Missile
MHW	mean high water
MSL	mean sea level
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRA	National Recreation Area
T&E	Threatened and Endangered
UXO	Unexploded ordnance
yr	year

APPENDIX A: Biological Assessment

APPENDIX B: Essential Fish Habitat