DOWNTOWN MONTAUK

DOWNTOWN MONTAUK STABILIZATION PROJECT

HURRICANE SANDY LIMITED REEVALUATION REPORT

Evaluation of a Stabilization Plan for Coastal Storm Risk Management in Response to Hurricane Sandy
&
Public Law 113-2

MAIN REPORT

U.S. ARMY CORPS OF ENGINEERS

New York District

August 2014

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I. EXECUTIVE SUMMARY

The Downtown Montauk Stabilization project is designed to provide coastal storm risk management from coastal erosion through construction of 3,100 ft of reinforced dune within the hamlet of Montauk, New York. The proposed dune extends west to east from South Emery Street to Atlantic Terrace motel and tapers into high dunes at both ends of the project area, which will provide protection to the shorefront existing commercial buildings in downtown Montauk.

As a consequence of the severe coastal erosion during Hurricane Sandy in October 2012, the protective beach was largely eroded causing damage to the commercial buildings in downtown Montauk. The buildings were left vulnerable to additional damages from future storms.

The plan for the Downtown Montauk Stabilization was developed using background material and existing information and data from the Fire Island to Montauk Point (FIMP) Reformulation Study to expedite the Hurricane Sandy Limited Reevaluation Report (HSLRR) in accordance with approach approved by Headquarters, USACE in a memorandum dated 8 January 2014 and consistent with The Disaster Relief Appropriations Act of 2013 (Public Law. 113-2; herein P.L. 113-2).

This Stabilization Project is a one-time, stand-alone project with its own independent utility. As developed, this project does not limit the options available in the FIMP Reformulation Study or pre-suppose the outcome of the Reformulation Study.

The Stabilization Project has been evaluated over a 15 year period. As a stand-alone project, long term erosion will reduce the width of the beach and lead to a reduced level of risk management Continued maintenance by the Non-Federal sponsor over the effective project life is required to maintain the sand dune cover and increase the longevity of the GSCs.

The project's total annual benefits and annual costs were updated to April 2014 price levels and are $1,237,000 and $918,000 respectively. The updated Benefit to Cost Ratio is 1.4 (at 3.50% FY14 Discount Rate). The project is economically justified and the New York District, USACE recommends that the Stabilization Project be constructed at a project cost of $8,900,000.

The Draft HSLRR and Environmental Assessment (EA) will be released for public review. The reports will be revised to account for public comments received on the project, as well as agency input received through coordination and consultation that will occur concurrently with public review of the EA.

II. PERTINENT DATA

Pertinent project information is summarized below.

1. Project Design and Layout

The proposed dune design includes approximately 3,100 ft of reinforced dune extending from South Emery Street to Atlantic Terrace motel in downtown Montauk and tapering into existing high dunes at both ends of the project area. The core of the dune consists of 14,171 Geotextile Sand Containers (GSCs) with filled dimensions of about 5.5 ft long, 3.5 ft wide and 1.5 ft tall, each weighing 1.7 tons. The alignment closely follows the existing dune (+12 ft NGVD) contour. The Project will provide protection to the shorefront commercial buildings in downtown Montauk.

2. Sand Borrow Area Locations

A total of 71,000 cubic cards (CY) of sand are required to construct the reinforced dune. Approximately two-thirds of the sand fill will be used to fill the GSCs or placed in the dune. The remaining one-third will be used to construct the berm cap. About 20,000 CY will be obtained from excavation and re-grading of the existing dune, with the remaining 51,000 CY obtained from upland sand sources. The material excavated from the existing beach will be used as a top-cover to more closely match the pre-project and post-project sand appearance.

3. Real Estate Requirements

No property acquisitions or structural relocations are required for the project. Two types of easements are required for the Stabilization project:

Perpetual Easements - in locations where beachfill and reinforced dune will be placed to allow for construction, operation, maintenance, patrol, and repair and replacement of the beach berm and dune.

Temporary work area Easements – to allow right of way, in, over and across the land for the planned construction schedule.

4. Costs (100% Federal Funding)

Construction (Beach and Reinforced dune)	$7,054,000
Lands and Damages	$507,000
Planning, Engineering and Design	$749,000
Construction Management	$589,000
Total Project First Cost (Apr 2014 PL)	$8,770,000
Total Investment Cost	$8,900,000

5. Economics

	Discounted at 3.50% over a 15-year period – FY14
Annual Project Cost	$918,000
Total Average Annual Benefits	$1,237,000
Benefit to Cost Ratio	1.4

COST ALLOCATION (FIRST COST – HSLRR Plan)

Federal (100%)	$8,900,000
Non-Federal (0 %)	$0
TOTAL	$8,900,000

6. Construction is scheduled to extend from January 2015 (Notice to Proceed) to May 2015. The total construction duration is approximately 4 months.

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1.0 INTRODUCTION

The Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project (FIMP) was authorized by the River and Harbor Act of 14 July 1960. The project is being reformulated to identify a comprehensive long-term solution to reduce the risk of coastal storm damages along the south shore of Long Island in a manner which balances the risks to human life and property while maintaining, enhancing, and restoring ecosystem integrity and coastal biodiversity.

The ongoing FIMP reformulation study is evaluating alternatives to reduce the risk of storm damages, determine Federal interest in participating in one or more of these alternatives, and identify a mutually agreeable joint Federal/state/locally supported plan for addressing the storm damage reduction needs in the Study Area.

Prior to the Fall of 2012, the most recent effort in the FIMP Reformulation Study had been the refinement of the plan alternatives developed in 2009 and presented by the federal agencies to state and local officials in 2011, as a Tentative Federally Supported Plan (TFSP) in preparation for finalizing the overall study's recommendation in the form of a General Reevaluation Report (GRR).

However, on 29 October 2012, Hurricane Sandy made landfall approximately five miles south of Atlantic City, NJ, where it collided with a blast of arctic air from the north, creating conditions for an extraordinary and historic storm along the East Coast with the worst coastal impacts centered on the northern New Jersey, New York City, and the Long Island coastline. Hurricane Sandy's unusual track and extraordinary size generated record storm surges and offshore wave heights in the New York Bight. The maximum water level at The Battery, NY peaked at 12.4 feet NGVD, exceeding the previous record by over 4 feet. Further east, at Montauk Point, the maximum water level reached 6.6 feet NGVD, 1.4 feet less than the previous storm of record (Hurricane Carol in 1954). Coastal erosion and damages within the FIMP Study Area as a result of Hurricane Sandy were severe, substantial and devastating, particularly along Fire Island and in downtown Montauk. During Hurricane Sandy, the protective beach in downtown Montauk was eroded leaving many buildings vulnerable to additional damages from future storms. Figure 1 and Figure 2 show the eroded beach conditions at downtown Montauk the day after Hurricane Sandy. Emergency actions by local property owners have restored a portion of the dune that eroded during Hurricane Sandy; however, the area still remains vulnerable to future storms.

Consistent with the Disaster Relief Appropriations Act of 2013 (Public Law. 113-2; herein P.L. 113-2), the USACE has proposed an approach to expedite implementation of a one-time stabilization project at downtown Montauk in advance of the completion of the Reformulation study. It is recognized that the timeframe to complete the FIMP Reformulation Study would leave vulnerable portions of the hamlet of Montauk exposed to future damages. This approach is strongly supported by the State of New York, Suffolk County, N.Y., and the Town of East Hampton,. This approach is also consistent with USACE policy guidance (Memorandum dated 8 January 2014 approval from Steven L. Stockton, P.E., Director of Civil Works, Appendix G – Pertinent Correspondence).

The recommended plan utilizes information and data from the ongoing FIMP study to develop a one-time stabilization project that does not limit the options being considered or presuppose the outcome of the Reformulation study.

Figure 1: Post-Hurricane Sandy at Ocean Beach Resort

Figure 2: Post-Hurricane Sandy at Royal Atlantic Resort

1.1 Report Purpose

This report has been prepared to satisfy the requirements of Public Law 113-2 (P.L. 113-2). This report will serve as the USACE decision document to support the justification for the implementation of a project for the downtown Montauk area as a post-Sandy stabilization project that is compatible and consistent with the findings of the overall FIMP Reformulation study. The efforts described in this report are limited to a stabilization project with an estimated 15-year project life.

This report includes an Environmental Assessment, per the requirements of the National Environmental Policy Act (NEPA) and USACE implementing regulation as contained in ER-200-1 to provide environmental analyses and determination of whether a Finding of No Significant Impact (FONSI) is appropriate or if an Environmental Impact Statement (EIS) would be required for the stabilization effort.

This report also addresses necessary changes in the implementation of the authorized but unconstructed (ABU) FIMP project in accordance with the Disaster Relief Appropriations Act of 2013 (P.L. 113-2). Specifically, this report addresses:

1. The costs and cost-sharing to support a Project Partnership Agreement (PPA) for the Plan for Coastal Storm Risk Management.

2. Acknowledgement of the changes in the applicability of Section 902 of the Water Resources Development Act (WRDA) 1986, as amended.

3. The requirements of P.L. 113-2 to demonstrate that the project is economically justified, technically feasible, and environmentally acceptable.

4. The requirements of P.L. 113-2 to demonstrate resiliency, sustainability, and consistency with the North Atlantic Coast Comprehensive Study (NACCS).

This report is arranged to provide the following information:

Chapter 1 provides an introduction to the Downtown Montauk Project, the project authorization, an overview of the FIMP Study Area and history of construction, and an overview of the project partners.

Chapter 2 provides an overview of the existing conditions within the Downtown Montauk Project Area, socio-economic conditions, and environmental resources.

Chapter 3 outlines the problem identification, including a detailed description of the damages expected in the future without project conditions, and the methods used to develop these damages.

Chapter 4 introduces the planning considerations used in developing alternatives for the project, including the goals, objectives and constraints.

Chapter 5 provides an overview of the formulation of plans that was undertaken to arrive at the recommended plan, presents the economic justification for the selected Stabilization Project, and provides the specific details associated with the recommended plan.

Chapter 6 provides a brief overview of the physical, environmental and cultural effects associated with the project. Full discussion of these effects is contained in the accompanying Environmental Assessment.

Chapter 7 provides a detailed description of the selected stabilization plan.

Chapter 8 provides an overview of how the recommended plan meets the requirements of P.L. 113-2.

Chapter 9 provides the details of the implementation required for the Project.

Finally, Chapters 10 and 11 provide the conclusions and recommendations that are being made for this Stabilization Project.

1.2 Study Authority

The Fire Island Inlet to Montauk Point (FIMP), NY, Combined Beach Erosion Control and Hurricane Protection Project was originally authorized by the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960, which established the authorized overall FIMP project. The authorized project provides for beach erosion control and hurricane protection along five reaches of the Atlantic Coast of New York from Fire Island Inlet to Montauk Point by widening the beaches along the developed areas to a minimum width of 100 feet, with an elevation of 14 feet above mean sea level, and by raising dunes to an elevation of 20 feet above mean sea level, from Fire Island Inlet to Hither Hills State Park, at Montauk and opposite Lake Montauk Harbor. This construction would be supplemented by grass planting on the dunes, by interior drainage structures at Mecox Bay, Sagaponack Lake and Georgica Pond and the construction of up to 50 groins, and by providing for subsequent beach nourishment for a period of ten years, as amended.

This authorization has been modified by Section 31 of the Water Resources Development Act (WRDA) of 1974 (P.L. 93-251), and Sections 103, 502, and 934 of the WRDA of 1986 (P.L. 99-662), which principally impact cost-sharing percentages and the period of renourishment. The project presented in this is also report considering the cost-sharing provisions within Public Law (PL) 113-2 of January 29, 2013, Disaster Relief Appropriations. The initial construction cost in accordance with the provisions of P.L. 113-2 is 100% Federal. PL 113-2 states that "the completion of ongoing construction projects receiving funds provided by this division shall be at full Federal expense with respect to such funds."

The authorized project was developed along five reaches. These reaches are used in the description of the implementation of the project, and are as follows and as shown in Figure 3:

Reach 1 – Fire Island Inlet to Moriches Inlet (FIMI)
Reach 2 – Moriches Inlet to Shinnecock Inlet
Reach 3 – Shinnecock Inlet to Southampton (Quogue to Agawam Lake)
Reach 4 – Southampton to Beach Hampton (Agawam Lake to Hook Pond)

Reach 5 – Beach Hampton to Montauk Point (Hook Pond to Montauk Point)

1.3 Study Area

1.3.1 Overall FIMP Study Area

The FIMP Study Area extends from Fire Island Inlet east to Montauk Point along the Atlantic Coast of Suffolk County, Long Island, New York. The Study Area includes the barrier island chain from Fire Island Inlet to Southampton inclusive of the Atlantic Ocean shorelines, and adjacent back-bay areas along Great South, Moriches, and Shinnecock Bays. The FIMP Study Area also includes Atlantic Ocean shoreline of Long Island from Southampton to Montauk Point.

A total of 83 miles of Atlantic Ocean shoreline and over 200 miles of estuarine shorelines lie within the Study Area. The Study Area is shown in Figure 3.

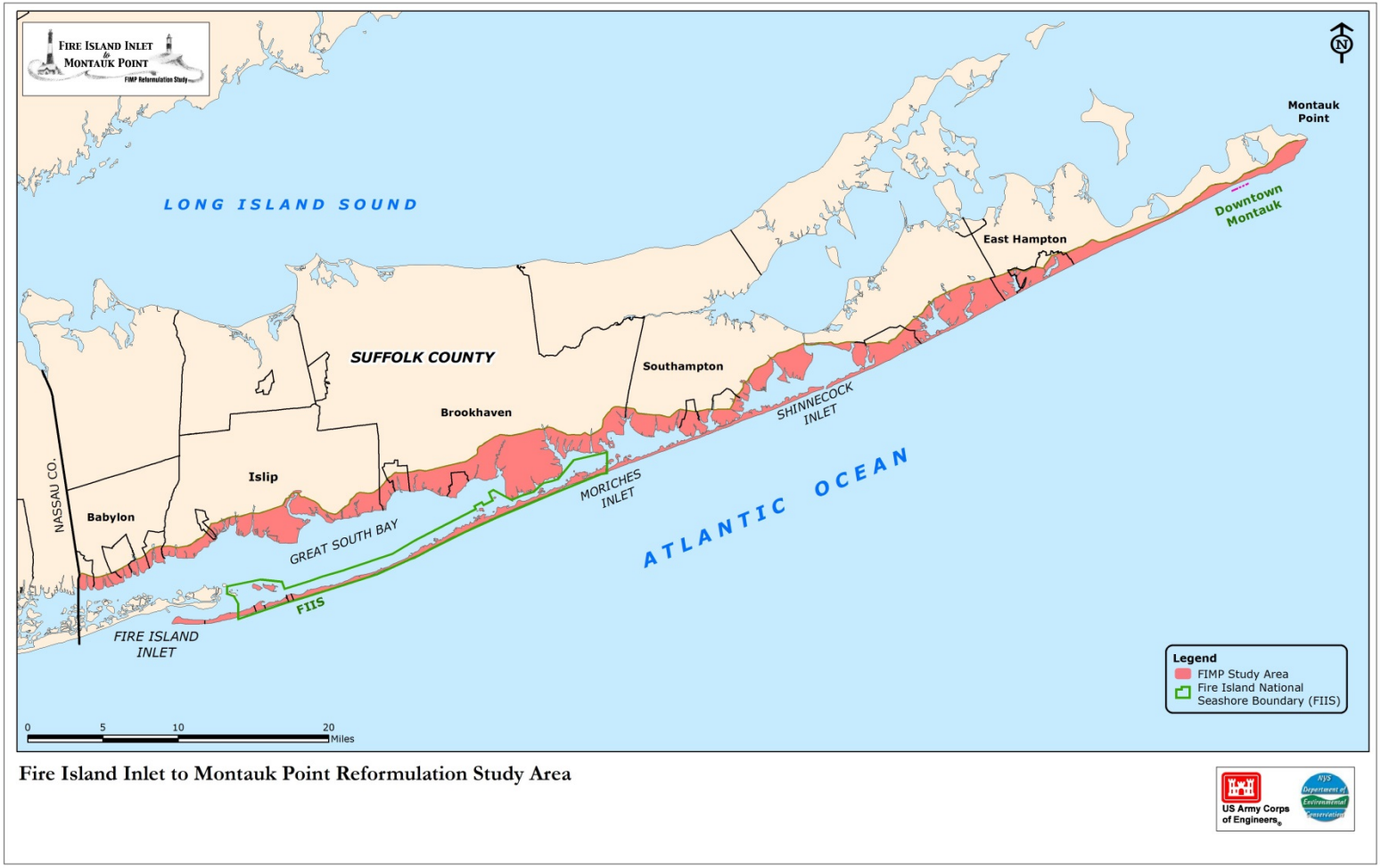
This overall FIMP Study Area consists of a complex mosaic of ocean fronting shorelines, barrier islands, tidal inlets, estuaries, and back-bay mainland area. It functions as an interconnected system driven by large scale coastal processes with respect to hydrodynamic and sediment exchange that support diverse biological and natural resources.

1.3.2 Montauk Reach and the Hamlet of Montauk

The Montauk Reach is the eastern most of the five designated Reaches within the overall FIMP Study Area (Figure 3). It extends from Hook Pond in East Hampton to Montauk Point, a distance of about 20 miles.

The unincorporated hamlet of Montauk is in the eastern portion of the Montauk Reach and is a major tourist destination with many hotels, restaurants and shops in the downtown area, many of which suffered significant damages as a result of Sandy. There are 43 buildings in downtown Montauk that fall within the modeled 100-yr floodplain (storm with a 1% probability of occurring in any given year). The Downtown Montauk Reach Project Area is shown in Figure 4.

This Stabilization Report addresses the immediate actions necessary for the Downtown Montauk portion of the overall FIMP Study Area.



Fire Island Inlet to Montauk Point Reformulation Study Area

Figure 3: FIMP Study Area

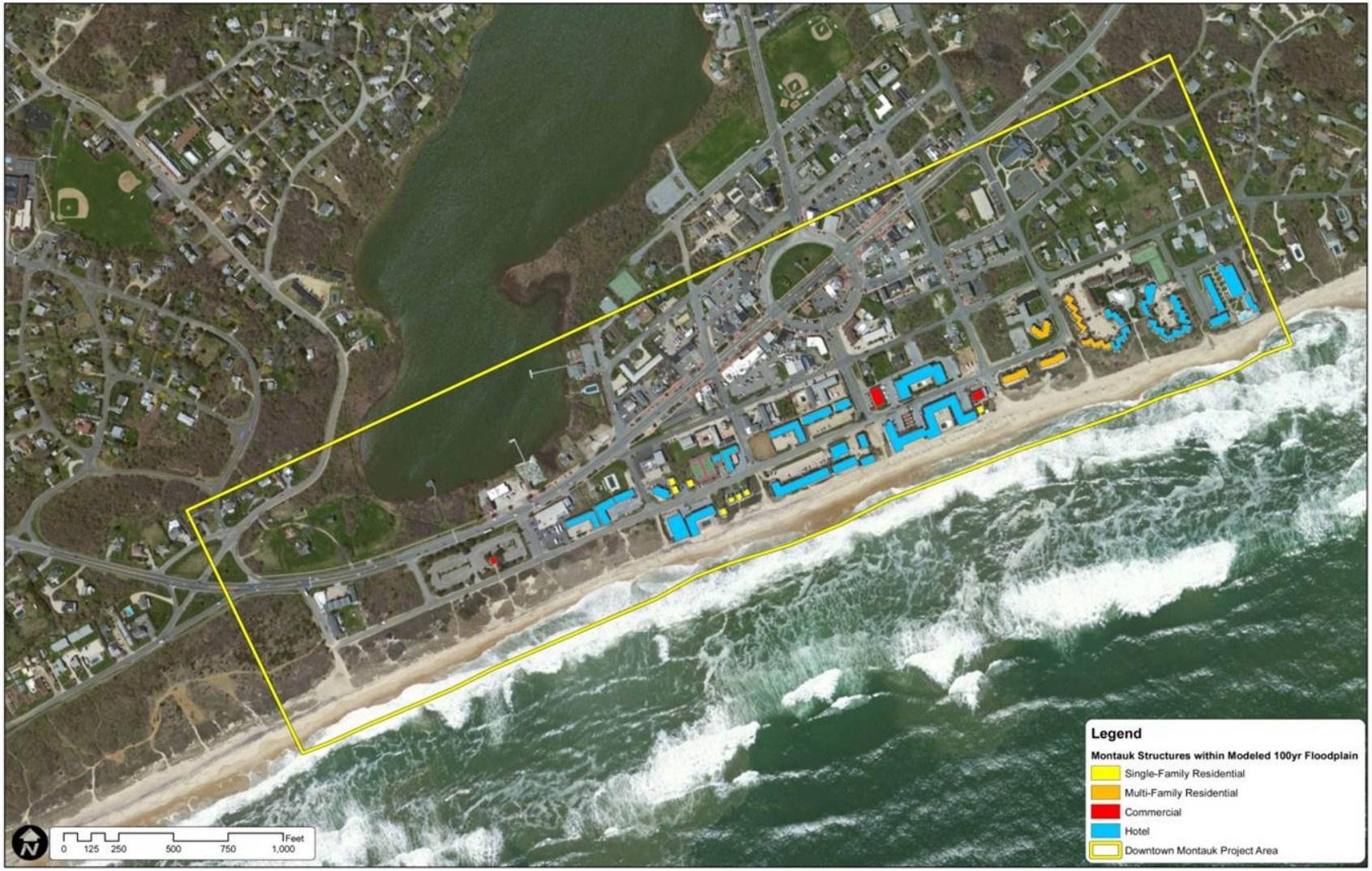


Figure 4: Downtown Montauk Project Area

1.4 Project History

1.4.1 1960's Project Implementation

Following the original FIMP project authorization in 1960, several design memoranda (reports) covering portions of the project were prepared. General Design Memorandum (GDM) No. 1, covering the portion of the project between Moriches and Shinnecock Inlets, was approved by the Chief of Engineers on 9 January 1964 and recommended construction of 13 groins and placement of dune and beachfill concurrent with groin construction. Due to objections by the project sponsor, the plan was modified to provide for construction of 11 groins in the Westhampton Beach area, and beach fill to be added as necessary but not sooner than 3 years after groin completion. The design for two groins at East Hampton, in the vicinity of Georgica Pond (Reach 4), was addressed in a special report of design memorandum scope dated July 1964. Construction of 11 groins in Reach 2 was completed in September 1966. Construction of two groins in Reach 4 was completed in September 1965.

In the years following construction of the eleven groins in Reach 2, erosion was evident in the area west of the eleven groins. In February 1969, Supplement No.1 to GDM No. 1 (Moriches to Shinnecock Reach) was prepared. That document recommended the construction of four more groins and placement of beach fill backed by a dune at an elevation of 16 ft above mean sea level (M.S.L.) in the 6,000 ft section of beach west of the 11 groin field. The four new groins were filled with 1.95 million cubic yards of sand to construct a beach and dune. This groin construction was completed in July 1970, bringing the total number of groins in Reach 2 to fifteen. Dune and beach fill was placed between October 1969 and October 1970.

1.4.2 Renewed Interest in 1978

Because of renewed interest by the New York State Department of Environmental Conservation (NYSDEC), an EIS was prepared in 1978 for the FIMP Study Area. The Council on Environmental Quality (CEQ) indicated that the plan formulation did not address all alternatives or adequately assess their impact. The CEQ further indicated that the entire Study Area should be treated as a system. The USACE concurred and directed a project reformulation. In 1980, a plan of study for project reformulation was approved by the Chief of Engineers and initiated shortly thereafter. The study was halted in 1984 due to an issue regarding the cost sharing requirements for periodic renourishment. NYSDEC withdrew its support for the project until a Congressional change was made to the authorization regarding periodic renourishment.

1.4.3 Reformulation Efforts in 1994

The cost sharing issue, including periodic renourishment, was resolved with WRDA of 1986, in which cost sharing provisions provided for 70 percent Federal funding for periodic nourishment of continuing construction at Westhampton Beach for a period of 20 years. With this resolution, the State was willing to participate in a plan for Reach 2 (Westhampton Beach). In light of the State of New York's willingness to participate in a plan for this reach, the most critically eroded of the overall Study Area; the USACE resumed the efforts of the Reformulation Study in 1994.

The USACE, as requested by Congressional and local interests, was charged to evaluate the feasibility of interim projects which could be implemented pending completion of the Reformulation Study. Several interim projects were considered for sections of the Study Area including a Breach Contingency Plan (BCP) designed to achieve breach closure within 3 months.

The Westhampton Interim Project, which was already under study prior to a breach in December 1992, culminated in a Technical Support Document for Westhampton which was finalized in July 1995. That report demonstrated the feasibility of this interim project by evaluating the project costs and benefits, and comparing it to the authorized plan to establish that the interim plan was within the envelope of a larger (potentially National Economic Development - NED) plan, which would provide greater net excess benefits than the proposed interim plan. The report identified a plan to provide interim protection to the Westhampton Beach area west of Groin 15 and affected mainland communities north of Moriches Bay. The project provides for a protective beach berm 90 feet wide and a dune of +15 ft NGVD[1], tapering off of the western two existing groins (groins 14 and 15) and construction of an intermediate groin (groin 14a) between these two. The project also includes periodic nourishment, as necessary to ensure the integrity of the project design, for up to 30 years (2027).

Beachfill for this interim project also includes placement within the existing groin field to fill the groin compartments and encourage sand transport to the areas west of groin 15. The interim plan was determined to be in the Federal interest to provide protection until the findings of the reformulation effort are available. Initial construction of the project was completed in December 1997. The interim project has been subsequently renourished in 2001, 2004 and 2008, and has required less sand at longer intervals than was estimated when designed.

In 1996, the USACE Headquarters (HQUSACE) approved a Breach Contingency Plan (BCP) which provides a rapid response to close breaches along the barrier islands within the authorized project area. The motivation for developing a BCP stems from the early 1990's after a series of powerful storms eroded the barrier islands in Westhampton on Long Island and the 1992 storm caused a breach that took 10 months to close. The BCP is only a response action to restore the barrier island to an elevation of +9 feet NGVD in order to provide a limited level of protection and to provide the basis for future efforts (a 5-year level of protection). Areas along the barrier island where the BCP has been implemented are characterized by low-lying areas likely to be overwashed and subsequently breached again during relatively minor events. The BCP was activated following Hurricane Sandy and used to close a 1,500 foot-wide breach at Cupsogue County Park and a 500-foot-wide breach to the west of Moriches Inlet at Smith Point Count Park. Breach closure operations were not activated at the third breach at Old Inlet, which is on National Park Service land. The USACE and the state of New York are coordinating with National Park Service personnel and monitoring the breach.

In parallel with these interim efforts, the Reformulation Study continued with a goal to identify a long-term (50-year) plan to reduce the risk of storm damages, while maintaining, enhancing or restoring the existing environment. In order to address the data collection and analysis challenges of the Study Area the Interagency Reformulation Group (IRG) was assembled, including representatives from the USACE, New York State, the Cooperating Agencies of National Park

[1] National Geodetic Vertical Datum of 1929 (NGVD29 or NGVD) is approximately 1.06 feet higher than North American Vertical Datum of 1988 (NAVD88 or NAVD) within the FIMP Study Area.

Service and U.S. Fish and Wildlife Service, as well as representatives from National Marine Fisheries, and the Environmental Protection Agency. A number of Technical Management Groups (TMG's) were also established, responsive to this IRG, who were responsible for the scoping, and reviewing of specific technical issues, and included members from the agencies, non-governmental organizations, and academics. As presented in this report, this interagency team developed a Project Visions Statement to provide a planning framework, and has advanced the study to identify a Tentative Federally Supported Plan, which has been modified, and with local support has been identified as the Tentatively Selected Plan.

1.5 Project Area Vulnerability

The downtown area of the hamlet of Montauk is vulnerable to nor'easters and hurricanes which produce storm surges and waves that historically have caused erosion to the beach and dunes in the Project Area. Although long-term erosion and storm events have posed a significant threat to the Project Area for many years, the extensive beach and dune erosion that occurred during Hurricane Sandy has left the foundations of several shorefront commercial buildings exposed and vulnerable to future storm events.

As a consequence of coastal erosion during Hurricane Sandy, the dune and berm system at downtown Montauk is depleted. In response to the increased vulnerability to future events, consistent with the Disaster Relief Appropriations Act of 2013 (Public Law. 113-2; herein P.L. 113-2), and recognizing the urgency to repair and implement immediate storm protection measures, USACE has proposed an approach to expedite implementation of construction of necessary stabilization efforts at Downtown Montauk independent of the FIMP Reformulation Study.

Stabilization efforts were focused on Fire Island to Moriches Inlet (FIMI) which is scheduled for construction start in 2014 and Downtown Montauk as there is a more urgent need to advance the stabilization reaches due to their vulnerability and potential for major damage and risk to life and property.

A detailed storm history is provided in Appendix A.

1.6 Non-Federal Partners and Stakeholders

The non-Federal partner for the overall FIMP project and also for this Stabilization Project is the New York State Department of Environmental Conservation (NYSDEC). There has been extensive coordination with study stakeholders in addition to the non-Federal partner including:

- Department of the Interior; U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- NOAA/National Marine Fisheries Service
- Federal Emergency Management Agency
- New York State Department of State; Emergency Management Office
- Suffolk County
- Town of East Hampton

2.0 EXISTING CONDITIONS

This section provides a summary of the natural and human environment within the Downtown Montauk Project Area and serves as a reference point to understand "future without project conditions" and impacts associated with project alternatives. Additional details are provided in Appendix B, Physical Conditions.

Geological Characteristics

Long Island is part of the Atlantic and Gulf Coastal physiographic province which lies along the eastern border of the United States at the southern boundary of the late Pleistocene glacial advance in the eastern part of North America (Taney, 1961). The Ronkonkoma and Roanoke Point moraine deposits (i.e., mounds of unstratified glacial drift chiefly consisting of boulders, gravel, sand, and clay) characterize the topography along the northern side of Long Island, while a gentler southward dipping gradient on the outwash plains makes up much of the southern side of the island (Schwab et al., 2000).

From Montauk Point west to Southampton (approximately 33 miles,) headlands formed by Ronkonkoma moraine and outwash deposits are eroded, forming a narrow beach and a series of small bays (i.e., ponds). Eroded sediments along this reach are transported westward by wave action. The headland section is subdivided into three units. Bluffs that rise to 60 ft or more above sea level and narrow beaches of coarse sand and gravel characterize the shoreline from Montauk Point westward for a distance of approximately 10 miles. The next unit, which includes Napeague Beach, is considered a connecting beach that provides a link between two areas of deposition of the Ronkonkoma moraine. This unit is characterized by a low sandy beach backed by dunes and stretches approximately 4 miles long. The third unit of the headland section is 19 miles long and extends to Southampton. Sandy beaches and long continuous dunes that rise to an elevation of 20 ft above sea level characterize this unit. Lying just north of the shoreline are several small ponds or bays that have been cut off from the ocean by bay mouth bars and narrow barrier beaches, which are periodically breached during and after storms. The larger of these bays include Agawam Lake, Mecox Bay, Sagaponack Lake, Georgica Pond and Hook Pond. To the north of the ponds the Ronkonkoma moraine ridge provides the dominant topographic relief of the area.

Beach Characteristics

Along the Project Area and across the beach profile the grain size distribution of the sediment varies. In general, the median grain size decreases from east to west, with median grain size of 0.44 mm at Montauk (USACE-NAN, DRAFT, 2000).

Astronomical Tides

Astronomical tides on the south shore of Long Island are semi-diurnal, rising and falling twice daily. The tidal range along the ocean shoreline increases from east to west. The average tidal range in the vicinity of Montauk Point is approximately 2 feet.

Storm Surge

Two types of storms are of primary significance along the south shore of Long Island: (1) tropical storms which typically impact the New York area from July to October, and (2) extratropical storms which are primarily winter storms occurring from October to March, often referred to as "nor'easters" due to the predominate direction from which the winds originate.

Storm surge is water that is pushed toward the shore by the force of the winds and the decrease in astronomical air pressure during major storms. Water levels rise at the shoreline when the motion of wind driven waters is arrested by the coastal landmass.

Hurricanes are the most powerful tropical storms to reach the Study Area with wind speeds in excess of 74 mph (by NOAA definition). Records indicate 26 hurricanes have impacted the Study Area in the past century. Nor'easters are less intense than hurricanes, with sustained wind speeds generally less than 57 mph. However, the durations of elevated water levels and waves during nor'easters are generally longer, enhancing the ability of nor'easters to cause coastal damage. Approximately 68 moderate to severe nor'easters have impacted the New York coastal region since 1865.

Sea Level Rise

By definition, sea level rise (SLR) is an increase in the mean water surface level of the ocean. Eustatic sea level rise is an increase in global average sea level brought about by an increase to the volume of the world's oceans (thermal expansion). Relative sea level rise takes into consideration the eustatic increases in sea level as well as local land movements of subsidence or lifting. Historic information and local mean sea level (MSL) trends used for the Study Area are provided by the NOAA/NOS Center for Operational Oceanographic Products and Services (CO-OPS) using the tidal gauge at Sandy Hook, New Jersey. The historic sea level rise rate (1935-2013) is approximately 0.0128 feet/year or about 1.3 feet/century.

Recent climate research has documented observed global warming for the 20th century and has predicted either continued or accelerated global warming for the 21st century and possibly beyond (IPCC 2013). One impact of continued or accelerated climate warming is continued or accelerated rise of eustatic sea level due to continued thermal expansion of ocean waters and increased volume due to the melting of the Greenland and Antarctic ice masses (IPCC 2013). A significant increase in relative sea level could result extensive shoreline erosion and dune erosion. Higher relative sea level elevates flood levels which may result in smaller, more frequent storms that could result in dune erosion and flooding equivalent to larger, less frequent storms.

The current guidance Engineering Regulation 1100-2-8162 (ER 1100-2-8162) from HQUSACE states that proposed alternatives should be formulated and evaluated for a range of possible future local relative sea level rise rates. The relative sea level rates shall consider as a minimum a low rate based on an extrapolation of the historic rate, and intermediate and high rates which include future acceleration of the eustatic sea level rise rate. These rates of rise correspond to 0.7 ft, 1.1 ft, and 2.4 ft over 50 years for the low, medium and high rates of relative sea level rise.

Waves

Waves are the dominant forcing mechanism for most coastal processes along the south shore of Long Island. During storm events, wave impact on beaches that cause erosion of the beach are combined with the increased water level from wave setup, which can lead to dune erosion and wave overtopping. In the Study Area, significant wave heights, exceeding 3.3 feet occur approximately 25 to 30 percent of the time (USACE-NAN, DRAFT, 2000). Significant wave heights during extreme storm events may exceed 18 feet.

Storm History

Historical storm records and the recent experience with Hurricane Sandy illustrate the potential for storm risk now and in the future, and illustrate the immediate need for action to address vulnerable areas in Montauk. Severe coastal storms in the last few decades have caused significant damage to the south shore of Long Island. Severe erosion is a consistent result of such storm events, particularly at Montauk.

The 1938 hurricane, with wind gusts up to 135 MPH, caused water to flood through Napeague and cut off the eastern end of the South Fork and turning the entire the Montauk Reach into an 11 mile long island. Water flooded downtown Montauk and ocean surf caused severe beach erosion. During Hurricane Carol in 1954, the ocean broke through the dunes near Fort Pond damaging the Montauk IGA (grocery store). Severe erosion of the beach and cliffs east of Montauk was reported in addition to damage to the seawall at Montauk Point. In addition to these major Hurricanes, several nor'easters have caused extensive beach and dune erosion, including Halloween Storm of 1991 and winter of 1992.

On October 29, 2012, Hurricane Sandy made landfall approximately five miles south of Atlantic City, NJ, where it collided with a blast of arctic air from the north, creating conditions for an extraordinary and historic storm along the East Coast with the worst coastal impacts centered on the northern New Jersey, New York City, and the Long Island coastline. Hurricane Sandy's unusual track and extraordinary size generated record storm surges and offshore wave heights in the New York Bight. The maximum water level at The Battery peaked at 12.4 feet NGVD, exceeding the previous record by over 4 feet. Further east, at Montauk Point, the maximum water level reached 6.6 feet NGVD, 1.4 feet less than the previous storm of record (Hurricane Carol in 1954). Beach and dune erosion occurred in the downtown Montauk area exposing the foundations of several structures along "motel row".

Historic Shoreline Changes

Historic shoreline change rates for the FIMP study are documented in Gravens et al. (1999), which examined three non-overlapping time intervals using available shoreline data sets. The third period, representative of modern times, is approximately 15 years long (1979 to 1995). Observed shoreline changes over this time frame indicate that shoreline from Montauk Point to Downtown Montauk is eroding. Observed erosion rates vary along the shoreline with an average erosion rate at downtown Montauk of approximately -3 feet/year. It is important to note that there is significant temporal and spatial variation in the shoreline change rates within the Study Area.

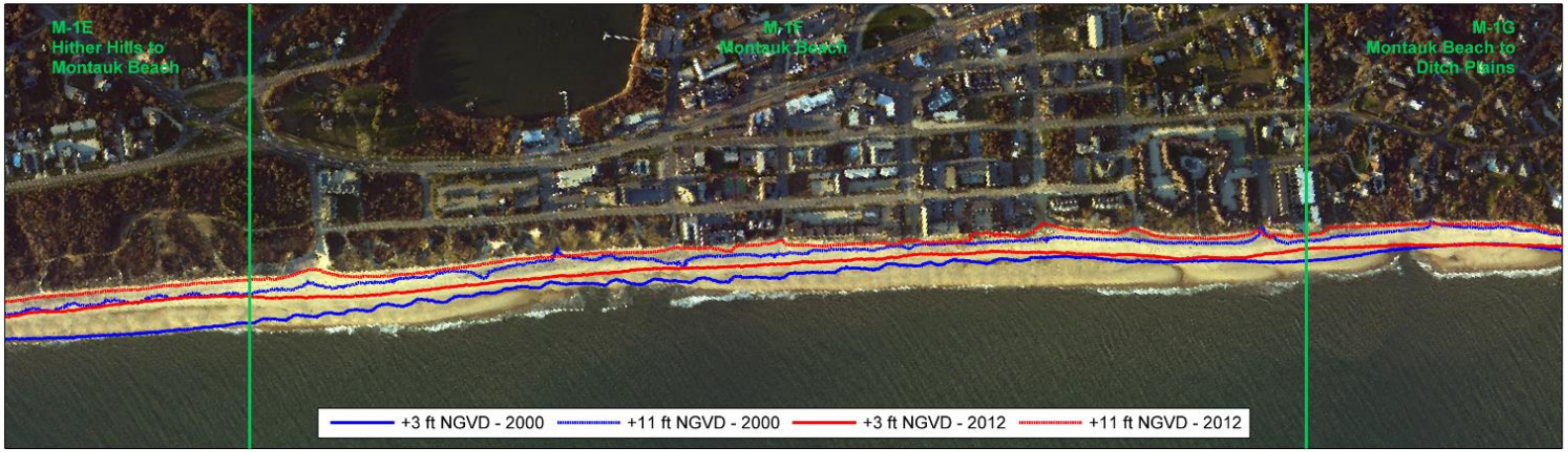
A separate study by Buonaiuto & Bokuniewicz (2005) evaluated bluff erosion east of downtown Montauk based on profile surveys collected between 1995 and 2001. The study found that the average rate of bluff recession rate was -1 feet/year over this time period.

Recent shoreline changes were evaluated based on LIDAR collected in 2000 and on November 16, 2012 (Post-Hurricane Sandy). A quantitative analysis of the shoreline and dune migration was performed by analyzing the change in the +3 feet NGVD and +11 feet NGVD contours. These contours were selected to characterize the recession of the shoreline and dune. Figure 5 shows the change in position in the +3 feet NGVD and +11 feet NVD contour over the 12 year period. The shoreline experienced an average landward migration of 44 feet or -3.7 feet/year.

Based on these observations a background erosion rate of -3 feet/year was selected to characterize the future without-project conditions and applied in the engineering and economic analysis.

Existing Shore Protection Activities

There is no history of federal beach nourishment activities at downtown Montauk. However, local governments and home owners have periodically trucked in sand to stabilize dunes in response to storm events. Available records indicated that in the years 2010 through 2013 beach and dune repairs of this nature were conducted costing more than $2,200,000.



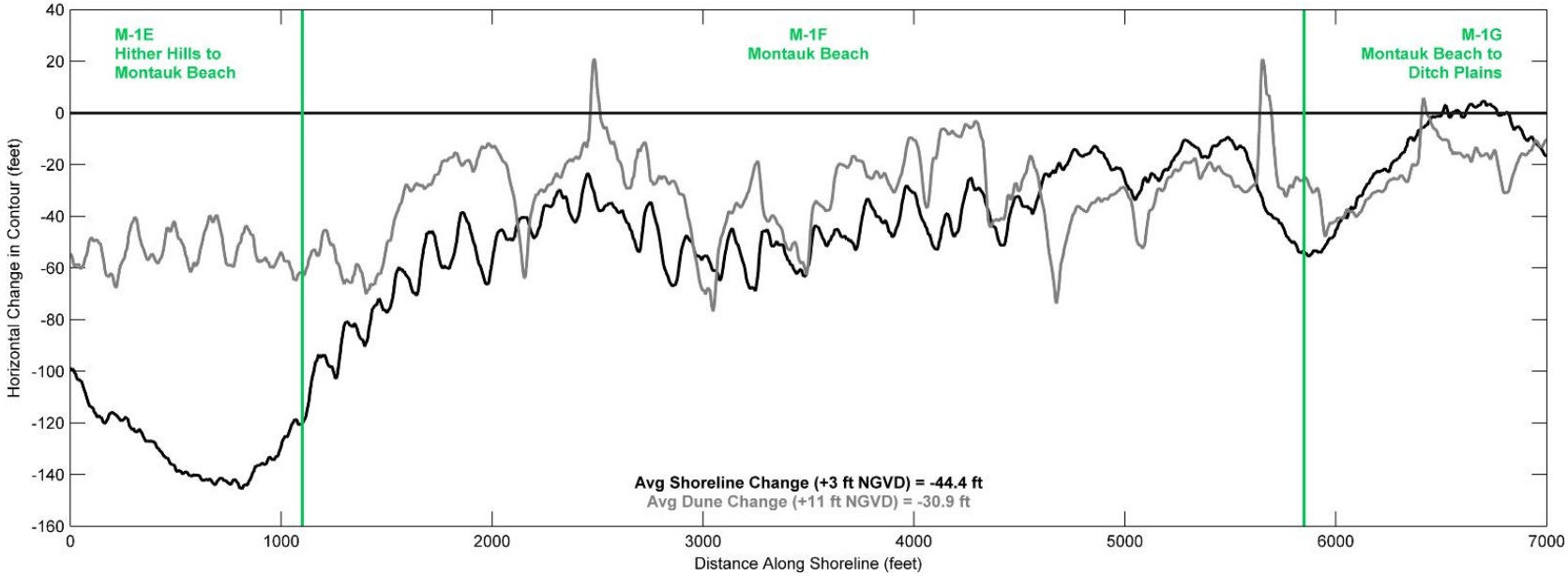


Figure 5: Observed Shoreline Changes at Downtown Montauk

2.2 Socio-Economic Conditions

Table 1 presents the U.S. Census Bureau Median Household, Family and Per Capita Income averages for 2008-2012, for East Hampton Town, its villages and hamlets, and also for Suffolk County. It is noted that while the median household and family income is more than $10,000 lower in East Hampton than in Suffolk County, the per capita income is higher. The higher per capita income is likely the result of the higher wages earned by a smaller segment the East Hampton population that skews the average per capita income as well as the fact that children under 18 make up a smaller percent of the population in East Hampton than in Suffolk County.

Table 1: Per Capita and Family Income

Place	Median Household Income ($)	Median Family Income ($)	Per Capita Income ($)	Percent of Households With Income $200,000 +	Percent of Families Below Poverty Level
East Hampton Town	74,894	90,990	50,377	12.5	6.7
Amagansett CDP	76,346	121,607	60,743	20.2	2.8
East Hampton Village	79,542	88,207	96,189	23.7	6.8
East Hampton North CDP	50,325	70,952	42,005	8.5	11.2
Montauk CDP	71,312	79,495	44,905	7.8	3.9
Napeague CDP	78,958	79,792	40,463	13.0	0.0
Northwest Harbor CDP	94,216	112,371	64,236	16.6	0.0
Sag Harbor Village	91,004	129,432	66,847	15.6	1.9
Springs CDP	72,557	88,667	39,348	15.1	6.3
Wainscott CDP	81,875	81,667	51,428	13.3	6.0
Suffolk County	87,778	100,179	36,819	10.5	4.1

In the hamlet of Montauk, the occupation category with the highest percentage of workers was management, professional and related occupations; 31.1 percent of the employed population, 24.0 percent of the Montauk workforce occupied sales and office positions, 26.5 percent worked in service occupations and 14.6 percent had natural resources, construction, and maintenance occupations. Production, transportation and material moving occupations accounted for 3.7 percent of the employed population. As in Montauk, Countywide the management, professional and related occupations (37.8%); sales and office occupations (26.4%), and service occupations (17.1%) had the highest percentage of workers. Montauk residents are generally well educated; 48.5 percent of the population 25 years old and older have an Associate's degree or higher and another 15.7 percent have some college education. Countywide, 41.7 percent of this segment of the population have an Associate's degree or higher.

Some people in Montauk have a very low income, a fact that is not necessarily obvious from looking only at median income figures. Approximately 3.9 percent of families in Montauk live below the poverty level, as compared to 4.1 percent Countywide. The poverty level is defined according to the number of people per household, the number of children per household and other factors; the weighted average poverty threshold for a 4-person family (including two under the age of 18) in 2013 was an income of $23,624. About 9 percent of the total population of Montauk have an income below poverty level, compared to 6 percent in Suffolk County. The percent of households with incomes over $200,000 is comparatively less in Montauk than Countywide, reflecting less affluence Montauk than in the County in general. Living on a low income in Montauk is particularly difficult as there is limited public transportation and the cost of housing is extremely high.

Downtown Montauk is the major business area in the Study Area. The town is divided by Montauk Highway and extends south to the Atlantic Ocean. There are wide variety of year-round commercial establishments in addition to the seasonal motels and resort units. The business district includes supermarkets, banks, clothing stores, gas stations, restaurants, bars, pharmacies, repair shops and other establishments traditionally found in business centers. Institutional facilities, including churches and a library, are located along Montauk Highway in the eastern portion of the business district. A municipal ball field complex borders the northern portion of the downtown area. The downtown area is laid out in a grid of 40 foot by 100 foot lots separated by wide public roads and alleyways.

2.3 Environmental Resources

The Downtown Montauk project area is surrounded by natural habitats but the project area itself predominantly consists of commercial development that includes hotels, restaurants and shops for transient visitors. Single-family and multi-family residential development is also present in the project area. Natural resources/habitats within the study area are found mainly along the shoreline, within the limits of sand placement for the proposed dune reinforcement, but also extend landward to Fort Pond. Habitats in the project area include the marine nearshore, marine intertidal, maritime beach and maritime dunes, as well as the inland waters of Fort Pond. The marine nearshore and marine intertidal habitats of the Atlantic shores ecosystem support a variety of marine invertebrates, finfish, marine mammals, reptiles and birds. Terrestrial mammals, birds, vegetation and invertebrates are also found in the marine beach habitat of the Atlantic shores ecosystem, as well as in the dunes and swales habitat of the barrier island ecosystem. Upland sand sources are proposed to be used for the dune reinforcement rather than offshore borrow areas. Therefore the project area does not include the marine offshore environment. As these upland sand sources are commercial sand quarries, these sand sources are not described as natural habitats.

The potential for threatened and endangered species or critical habitat for protected species to occur within the project area was assessed through written consultation with the applicable regulatory agencies and through database review. Based on the habitats present in the Downtown Montauk project area, the proximity of the project area to developed areas and agency responses stating the lack of known records of rare or federal or state-listed animals and plants, and significant natural communities the likelihood of protected species occurring in the Downtown Montauk project area is minimal. Additional information regarding environmental resources in the Downtown Montauk project area is provided in Section 3.3.3 of the accompanying EA.

2.4 Cultural and Archaeological Resources

This section provides an overview of known and potential cultural resources and historic properties, including archaeological and architectural resources, within the Area of Potential Effect (APE) as well as within the area surrounding the Downtown Montauk project area (36 CFR 800.16(d). The APE for this proposed project includes the Downtown Montauk project area which includes approximately one mile of the Atlantic shoreline in the downtown Montauk area, extending seaward from the existing dune line into the marine beach sand placement area and extending landward to include much of downtown Montauk. There are no properties listed on State or National Registers of historic places within the APE. Additional information regarding cultural resources in the Downtown Montauk project area is provided in Section 3.2.6 of the accompanying EA.

The history of development in East Hampton begins with the earliest settlements of Native Americans. The New York State archaeological site location map indicates numerous archaeological sites in East Hampton with many sites located in Montauk (NYSOPRHP, 2014). As is common at many early sites, areas adjacent to ponds, harbors or bays, particularly where fresh water meets salt, were often settled by earliest people. These sites generally contain archaeological material as evidence of the settlement characterized by subsistence hunting, fishing, and gathering. Several sites in East Hampton have undergone archaeological surveys, and these studies, serve as a basis for identification of archaeologically sensitive areas. Recent remains of native culture exist in Montauk, as this was the last area in the Town of East Hampton where the Montauk tribe had a reserve of land. When European settlers arrived in East Hampton in the 17th century a written record of the Native Americans was begun documenting the agreements and conflicts between the two groups (Town of East Hampton, 2008).

Montauk was one of the last outposts of the native tribes who were slowly displaced and disappeared as the European settlement moved eastward. Due to the dynamic nature of the shoreline environment, remnant archaeological resources are not expected within the dune reinforcement footprint. However, the project area is within an area mapped as archeologically sensitive (NYSOPRHP 2014). Although shipwrecks are common off the coast of Long Island, the APE does not extend offshore where wrecks would be located.

Montauk was used as common pasture from 1658 through the late nineteenth century. A few structures remain from the period in Montauk's history from the mid- 1600's through the 1800's when the land was used as common pasture. Second House, located within the Town's Kirk Park on the banks of Fort Pond, north of Montauk Highway, and Third House, located on County parkland, were both used to house the keepers of livestock and later by Theodore Roosevelt and the Rough Riders (Town of East Hampton LWRP, 1999). Second House, which was built in 1797, is the oldest building in downtown Montauk and currently serves as a museum. Second House is located in the northwest corner of the APE while Third House is located outside the APE.

Present development in Montauk is largely a result of influences and events from the late 1800's onward when wealthy New York residents discovered the potential for a vacation area away from the City. The Town of East Hampton began to change from a predominantly rural and agricultural region to a seaside recreational area (Liquori and Nagel, 2005).

The developer Carl Fisher, known for the creation of resorts in Miami Beach, saw potential for recreation facilities on the eastern end of Long Island. His development company designed a resort community, a residential community, the downtown Montauk area, a protected harbor in Lake Montauk and four major sporting facilities, the Surf Club, the Polo Club, the Tennis Club and the Yacht Clubs. None of these sporting clubs are within the APE. After Fisher's death in 1934, his projects went into a decline, leaving only Montauk Manor, the tennis auditorium, Montauk railroad station and several buildings in downtown Montauk. Six of these Tudor Revival style structures constructed by Carl Fisher in the 1920's are located in the downtown area (Town of East Hampton LWRP, 1999). Aside from the Second House and Third House, these are the oldest structures in the community. Four of these buildings retain sufficient integrity to be recognized as historic. Most of the buildings in downtown Montauk were constructed in the 1950's and later.

There are no known resources - terrestrial, underwater, or architectural - that are listed on State and National Registers of Historic Places within the APE; however, there is potential for terrestrial archeological resources.

3.0 PROBLEM IDENTIFICATION AND WITHOUT PROJECT FUTURE CONDITION

3.1 Problem Identification

The downtown area of the hamlet of Montauk is vulnerable to nor'easters and hurricanes which produce storm surges and waves that historically have caused erosion to the beach and dunes in the Project Area. Although long-term erosion and storm events have posed a significant threat to the Project Area for many years, the extensive beach and dune erosion that occurred during Hurricane Sandy has left the foundations of several shorefront commercial buildings exposed and vulnerable to future storm events.

3.2 Comparison of Pre-Sandy and Post-Sandy Conditions

Prior to Hurricane Sandy the beach at downtown Montauk was characterized by a relatively wide beach berm and sand dunes with heights between +16 and +25 feet NGVD.

During Hurricane Sandy the wide beach berm, present before the storm, was effectively removed and the dunes experienced severe erosion / scarping. The relatively high elevation of the dunes prevented significant overwash and overtopping from occurring during Hurricane Sandy except at the gaps in the dunes which provided public beach access. Figure 6 shows profile conditions at four profiles along downtown Montauk in 2000 and 2012 (post-Sandy). The post-Sandy conditions are characterized by a narrow beach berm and narrower dunes. Despite the dune erosion that occurred, the post-sandy dunes are still relatively high, between +16 and +25 feet NGVD, and provide protection against overwash and overtopping during future storm events. The primary near-term threat, and source of storm damages at Montauk, is to several shorefront commercial buildings located along the dunes that had their foundations exposed during Hurricane Sandy (Figure 1 and Figure 2). Emergency actions by local property owners have restored a portion of the dune that eroded during Hurricane Sandy; however, the area still remains vulnerable to future storms.

The beach conditions at downtown Montauk typically undergo a seasonal transformation from a narrower "winter" beach to a wide "summer" beach (Figure 7). During the fall and winter months, storm waves are more frequent and sand from the beach berm is transported offshore and deposited in a protective sand bar. During late spring and summer months, storm events are less frequent and smaller waves dominate, allowing sand to be transported landward restoring the wide summer berm. During particular severe storm events, such as Hurricane Sandy, sand may be transported offshore or downdrift and lost from the system. Beach surveys at Montauk were collected about once every two weeks in the year following Hurricane Sandy, capturing the seasonal variability in the beach conditions at Montauk. Figure 8 illustrates the temporal evolution of the beach conditions at Montauk and transition from a winter beach profile to a summer beach profile and then beginning of the transition back to a winter beach profile.

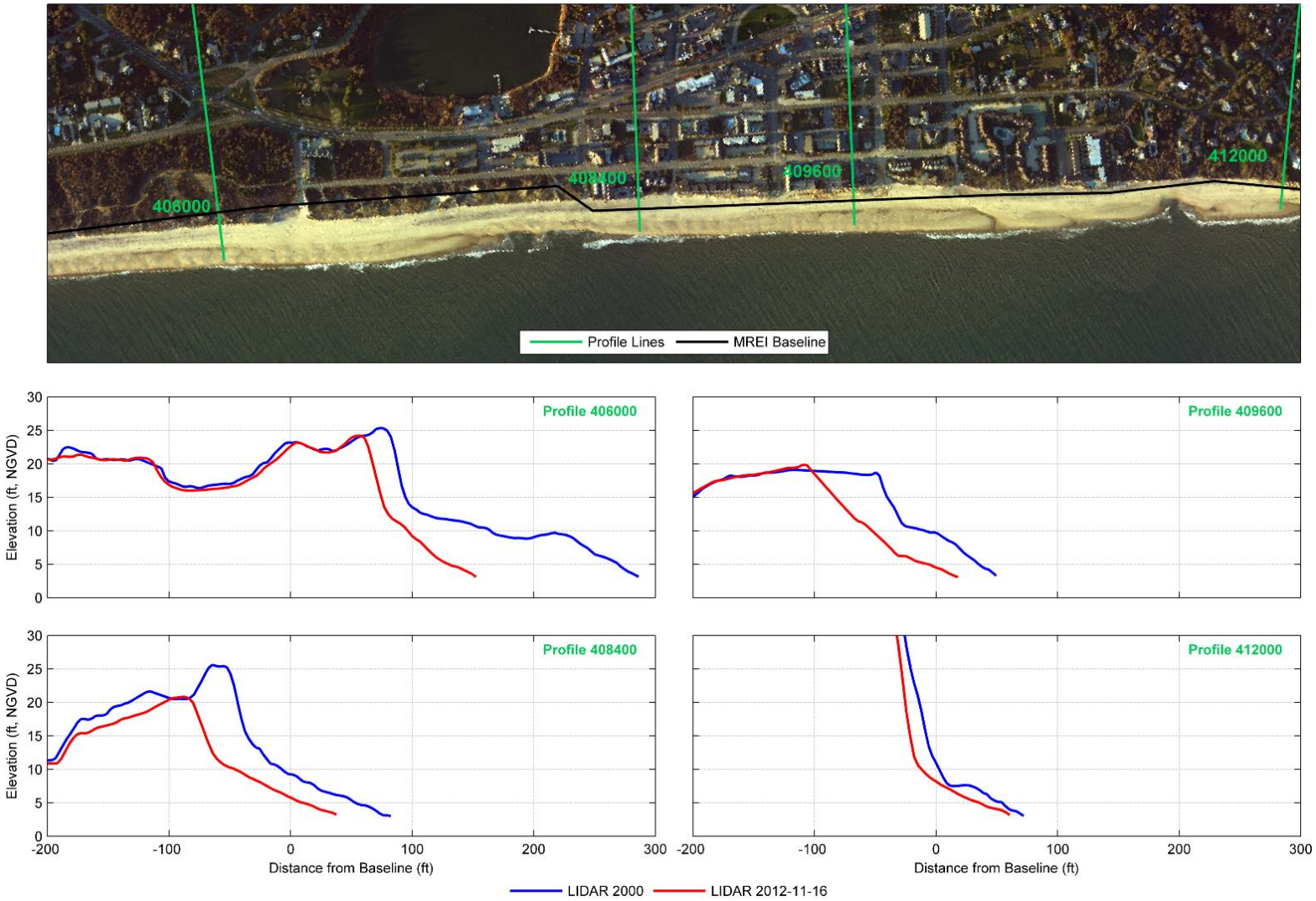


Figure 6: Observed Beach Profile Changes at Downtown Montauk

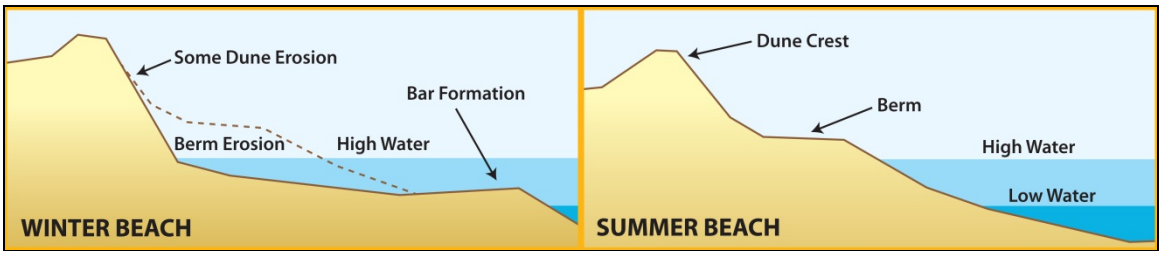


Figure 7: Schematic of Seasonal Changes in Beach Conditions (Maine Sea Grant)

Figure 8: Seasonal Changes in Beach Conditions at Montauk (Photos)

3.3 Storm Damage Analysis

3.3.1 Development of Damages

The Downtown Montauk Shorefront Emergency Stabilization model was developed to quantify the impact of storms on shorefront development and also to quantify the benefits arising from the construction of an emergency stabilization project to reduce the risk of storm damages in this area.

The immediate shorefront area is potentially subject to storm damage from waves, storm erosion/recession undermining of buildings, and inundation.

Prior analyses indicated that the primary damage mechanism affecting shorefront structures in downtown Montauk is undermining by storm erosion/shoreline recession and that wave and inundation damage represent a very small percentage of the potential damages with most wave and inundation damage occurring at very low frequency events. Hence it was decided to limit the model to the calculation of erosion damages only.

Most existing models (including the original FIMP shorefront damage model) were considered to be not appropriate for this task, either due to limitations in the models themselves, or due to the time and budget required to collate and process the required input data. One limitation of the FIMP shorefront damage model is that it was intended to evaluate with-project scenarios featuring regular beach renourishment as a key component, while renourishment will not be considered for any stabilization project implemented at Downtown Montauk under Public Law 113-2 as a one-time, stand-alone project.

The damage model was developed using @Risk for Excel to simulate the damages and losses of shorefront buildings to erosion over the 15-year period of analysis permitted within the bounds of Public Law 113-2, both with- and without project. The model randomly generates one storm event in each year of the analysis period, and returns a corresponding water surface elevation, scoured elevation at the toe of the structure, and storm erosion distance, taking into account the effects of sea level rise and shoreline change due to yearly erosion. These are used to determine whether the reinforced structure has failed due to wave attack or erosion at the toe of the structure, and to lookup damages due to subsequent erosion and undermining of shorefront structures.

In accordance with current HQUSACE guidelines the model incorporates risk and uncertainty in that key parameters are defined by probability distributions. These allow the input value to vary independently for the execution of each lifecycle as the @RISK model repetitively recalculates the model and collects the results to report the mean average annual damage value. The parameters currently subject to uncertainty in this model are the setback distances and depreciated replacement value of the shorefront structures in this area.

3.3.2 Without Project Damages

The calculation of without project damages was based on the assumption that the selected plan is not constructed and that the shorefront structures are vulnerable to damage from erosion in any year of the period of analysis. The set of vulnerable structures contributing to the damage analysis was taken from the structure inventory compiled for the original FIMP shorefront damage analyses, with their depreciated structure replacement values revised to a 2013 price level via an update factor of 1.26, which was derived from the historic building cost index published monthly by the *Engineering News-Record*. This update factor has been used for other components of the current FIMP study. The locations of the 43 structures in the damage dataset are presented in Figure 9. A summary of the characteristics of the structures is presented in Table 2. The structure inventory was verified post Hurricane Sandy to validate the without project damage analysis.

The model records damages due to erosion in any given year by means of a lookup table of aggregated structure damage versus erosion distance. The model currently assumes that as a building is undermined, the damage incurred increases linearly from zero at zero undermining to 100% when the mid-point of the structure has been passed. Content damages were incorporated by adding 50% to the value of each structure.

Table 2: Summary of Downtown Montauk Structure Inventory

Structure Usage	Number	Average Footprint (Sq. Ft)	Depreciated Structure Replacement Value	
			Total	Average
Hotel	**27**	**9,600**	**$79,698,400**	**$2,951,800**
Commercial	**3**	**5,900**	**$2,825,100**	**$941,700**
Single-Family Residential	**8**	**1,300**	**$1,959,900**	**$245,000**
Multi-Family Residential	**5**	**10,200**	**$19,350,500**	**$3,870,100**
Totals	***43***		***$103,833,900***	

Depreciated Structure Value: 2005 price level updated to 2013 via factor of 1.262 (ENR BCI Index)

The aggregate damage/erosion distance function resulting from this approach which has been incorporated in the model is presented in Figure 10. The model currently assumes that structures damaged to 100% of their value are not rebuilt within the same lifecycle.

The model has been executed using an interest rate of 3.5% and 25,000 lifecycle iterations to give without project equivalent annual damages of $1,378,000. It should be noted that if this analysis were to be conducted for the evaluation of a long-term solution for the downtown Montauk area, i.e. one using a period of analysis of 50 years, significantly higher without project equivalent annual damages would be expected, due to the increased vulnerability of structures to erosion in the latter part of the analysis period.

To illustrate this increasing vulnerability (and hence the increase in expected damages), the model outputs were post-processed to derive damage-frequency plots at various points in the analysis period. Figure 11 presents these curves for years 1, 5, 10, and 15. Figure 11 shows, for example, that in the without project base year a storm event of 10% annual chance exceedance ("10-year event") would be expected to cause approximately $1 million in damage, but by year 10 an event of equal probability would be expected to cause approximately $3.8 million in damage to structures and contents.

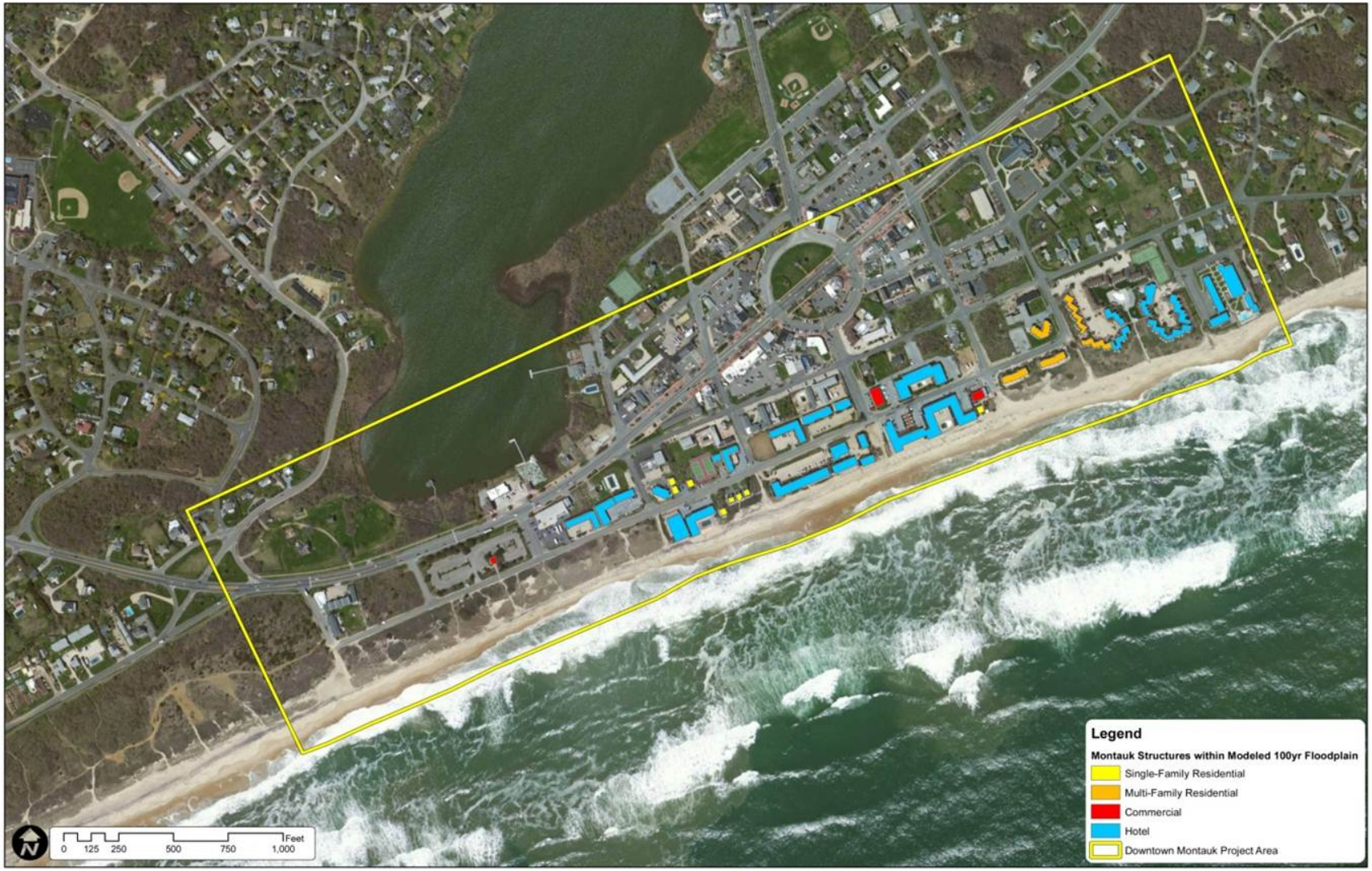


Figure 9: Downtown Montauk Shorefront Structures

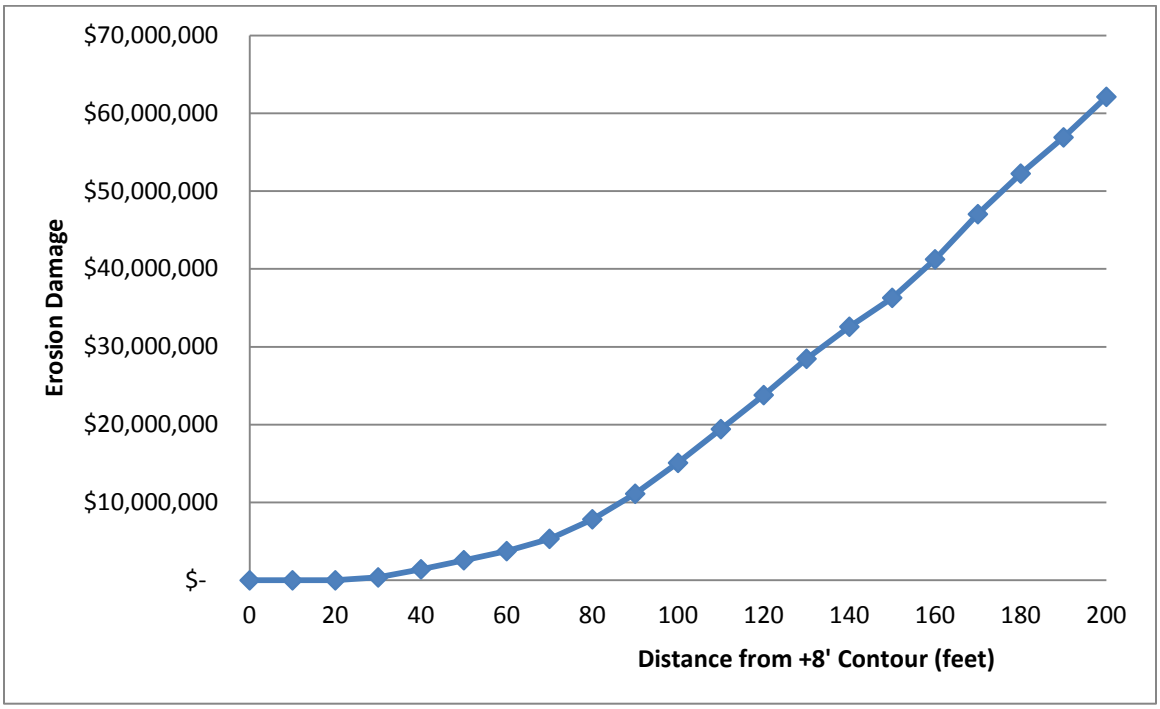


Figure 10: Erosion Distance-Damage Curve

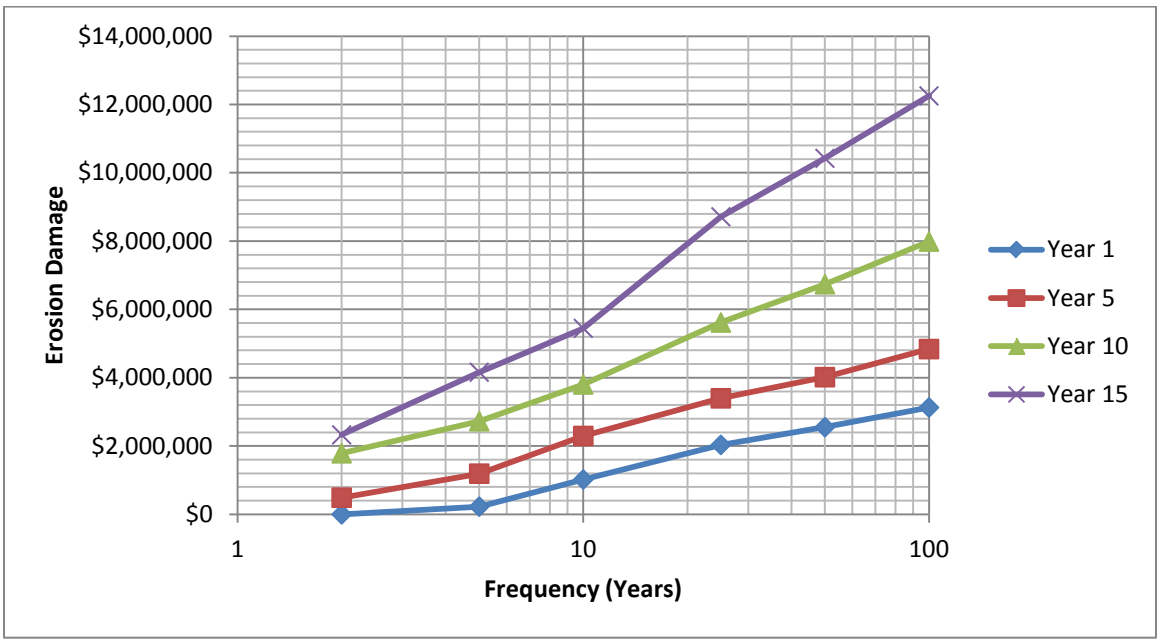


Figure 11: Without Project Damage-Frequency Curve

3.4 Without Project Future Conditions

The Without Project Future Conditions (WOPFC) is by definition the projection of the most-likely future conditions in the Study Area in the absence of a proposed project from the current study. The WOPFC serves as the base conditions for all the alternative analyses, including the engineering design, economic evaluation of alternatives, comparison of alternatives, as well as environmental, social and cultural impact assessment.

The WOPFC is a forecast based upon what has actually occurred, is currently occurring or is expected to occur in the Study Area if no actions are taken as a result of this study. As it is impossible to predict specifically what may occur, future activities that impact the without-project condition must be representative of what is most likely to occur, and as such must be based upon historic practice and trends, unless there is definitive evidence of new actions or policies scheduled for implementation that would influence past practices. The goal is to choose the most likely future scenario (not the only future scenario), based upon reasoned, documentable forecasting.

In defining the WOPFC, it is assumed that emergency dune construction projects will continue to be implemented by property owners to maintain a minimal dune condition. This condition is based on a review of recent activities including the extent of private activities. Recent records indicated that in the years 2010 through 2013 dune repairs of this nature costing more than $2,200,000 were locally implemented. An example of recent and ongoing dune repairs at downtown Montauk are captured in photos taken in July of 2014. It is likely that within their available resources, property owners will continue to maintain a minimum dune condition.

The minimum beach and dune condition that is currently maintained merely helps to provide continued access to the beach; it provides only limited protection against severe storms. A more robust dune and beach is required to provide adequate protection from severe storms and address the vulnerability of the project area.

Figure 12: Recent and Ongoing Dune Repairs (June 2014)

4.0 STUDY GOALS AND OBJECTIVES

4.1 Study/Project Goals

The goal of the overall FIMP Reformulation Study is to manage the risk of storm damages on the mainland and barrier island by reducing the potential for barrier island breaching and overwash, shorefront erosion, and by directly addressing residual flooding along the bayside shoreline. The short-term goal of this Downtown Montauk stabilization effort is to provide risk management through a one-time stabilization effort to the vulnerable shorefront within the hamlet of Montauk that suffered severe erosion during Hurricane Sandy. The stabilizing effort does not pre-suppose the outcome of the Reformulation or limit the range of options that could be implemented as part of the overall FIMP project.

4.2 Planning Objectives

ER 1105-2-100 states that the Federal objective of water and related land resources project planning is to contribute to National Economic Development (NED) consistent with protecting the nation's environment, pursuant to national environmental statues, applicable executive orders, and other federal planning requirements. A secondary objective of this project is to integrate opportunities for advancing National Ecosystem Restoration (NER) objectives consistent with the NED objectives that restore the coastal processes in a manner to advance the USACE Strategic Vision, Environmental Operating Principles, and Regional Sediment Management Principles. These objectives were established by the U.S Water Resources Council's Economic and Environmental Principles and Guidelines for Water and related Land Resources Implementation Studies (P&G's) on 10 March 1983.

The objective of this stabilization effort is to provide a separate, independent Coastal Storm Risk Management Plan that can address the extensive and immediate problems associated with the extremely vulnerable downtown Montauk conditions and that can proceed independently of the ongoing FIMP Study.

4.3 Project Constraints

Formulation and evaluation of alternative improvement plans are constrained by technical, environmental, economic, regional, social, and institutional considerations. These constraints must be considered in current and future project planning efforts, as summarized below.

<u>Technical Constraints</u>

- Plans must represent sound, safe, acceptable engineering solutions.
- Plans must be in compliance with sound engineering practice and satisfy HQUSACE regulations.
- Plans must be realistic and state-of-the-art. Reliance on future research and development of key components is unacceptable.
- Plans must provide storm risk management.

Economic Constraints

- Plans must be efficient. They must represent optimal use of resources overall. Accomplishment of one economic purpose cannot unreasonably impact another economic system.
- The economic justification of the proposed project must be determined by comparing the anticipated annual tangible economic benefits which should be realized over the project life with the average annual costs

Environmental Constraints

- Plans cannot unreasonably impact environmental resources.
- If a potential adverse impact is established, plans must consider replacement measures and should adopt such measures, if justified.
- Where opportunities exist to enhance significant environmental resources, the plan should incorporate all justified measures.

Regional and Social Constraints

- Reasonable opportunities for development within the study scope must be weighed relative to others, and views of State and local public interests must be solicited.
- The needs of other regions must be considered and one area cannot be favored to the unacceptable detriment of another.

Institutional Constraints

- The State must be willing to participate in a plan to provide storm risk management and be responsible for the operations and maintenance of the completed project.
- Federal and State participation must be contracted for the recommended period of time for implementation, although no assurances can be made that future Federal budgets will accommodate the capability funding against competing needs.
- Plans must be consistent with existing Federal, State, and local laws.
- Plans must be locally supported to the extent that local interests must, in the form of a signed Project Partnership Agreement (PPA), guarantee all items of local cooperation.
- Local interests must agree to provide public access to the beach in accordance with Federal guidelines and with requirements of State laws and regulations.
- The plan must be fair and find overall support in the region and State.
- Plans must be consistent with State Coastal Zone Management Policies to the maximum extent practicable and consider such policies in plan formulation.
- Each considered measure must identify environmental impacts and appropriate mitigation (mitigation measures for the Project Are not required).

Stabilization Constraints

- The Stabilization Plan must have independent utility.
- The Stabilization Plan cannot foreclose on alternatives under evaluation in the overall FIMP Reformulation Study.
- The Stabilization Plan must be within the current FIMP authorities as authorized in the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960, which established the authorized project. The FIMP authorization precedes authorization of P.L. 113-2 in 2013; thus providing the authority for the Stabilization Plan to be evaluated in a Hurricane Sandy Limited Reevaluation Report (HSLRR).

5.0 FORMULATION OF ALTERNATIVE PLANS

Prior to Hurricane Sandy, coastal storm risk management measures for the downtown Montauk area were considered as part of the ongoing FIMP Reformulation Study. This section details the development of plan alternatives under the Reformulation Study, and the inputs used from that analysis as input into the stabilization project.

Any stabilization project formulated for downtown Montauk in the aftermath of Hurricane Sandy is required to be:

a. Compatible with the likely outcome of the Reformulation process;
b. Economically justified as a separate, independent project;
c. Of limited duration to provide stabilization during the period prior to full implementation of the overall FIMP Reformulation.

5.1 Pre-Sandy Alternative Plan Comparison

The FIMP Reformulation Study undertook alternative analysis that included the downtown Montauk area. The initial screening considered non-structural measures, beachfill with structures, and beachfill. Each of these measures were analyzed considering general design requirements, costs, and local acceptability.

Non-structural measures (relocation and acquisition) were eliminated from further consideration based on high costs to relocate or acquire the large ocean front structures, and the lack of local support for an alternative that would largely eliminate a significant component of the local economy. Similarly, beachfill with structures was eliminated from further consideration based on cost considerations. Beachfill was the only measure considered for further evaluation.

The performance of the following three beachfill design templates was evaluated during the Reformulation Study: 1) +13 ft dune, 90 ft berm; 2) +15 ft dune, 90 ft berm; 3) +17 ft dune, 120 ft berm. The +15 ft (NGVD) dune and 90 ft berm was identified as the optimal design template for reducing storm damages and minimizing costs. However, an economic analysis of the beachfill alternative showed that it had a low Benefit-Cost Ratio (BCR). Consequently, the beachfill alternative was removed from further consideration in the Reformulation Study.

Downtown Montauk has one of the highest cost damages per foot of shoreline in the Study Area; however, unlike other reaches in the Study Area the Project Area is not susceptible to barrier island breaching, a major driver of economic benefits in the FIMP Study Area. The cost of beachfill at downtown Montauk is also significantly higher than at other locations because of the relatively high volume of sand required for initial construction and renourishment, and relatively high unit costs for sand.

The Reformulation study identified downtown Montauk as an area of high damage where sediment management measures should be evaluated as a possible alternative. Sediment management features are small-scale beach nourishment projects that are designed to offset long-term erosion trends in a location, which also act as a feeder beach for downdrift areas.

The sediment management measure for downtown Montauk recommended the placement of 120,000 cy of sediment every 4 years. The feeder beach would contribute an additional 30,000 cy/yr to the sediment budget. This supplemental sediment source would provide a constant supply of sediment to the beaches at downtown Montauk and farther west and, therefore, provide erosion control benefits to this region. The feeder beach would be constructed once every four years in concert with future renourishment operations at other locations in the Study Area.

An important distinction between the feeder beach and the beachfill alternatives is that a specific design section (i.e. 90 ft berm), and thus, a specific level of protection, is not being provided and maintained in the feeder beach. The primary objective of the feeder beach is to offset long-term erosion and ensure long-term continuity of longshore sediment transport. An economic analysis of the feeder beach indicated that the alternative had an acceptable BCR (greater than 1.0) and was incorporated in the TFSP plan.

5.2 Post-Sandy Alternative Plan Comparison

In the aftermath of Hurricane Sandy, it was recognized that there was a need to revisit the TFSP and determine if the eroded beach conditions and updated costs and benefits warranted selection of a larger alternative plan at downtown Montauk. This analysis is presently underway as part of the Reformulation Study to consider a wider array of alternatives, and to aid in identifying a stabilization plan. An evaluation of five alternatives is underway, taking into consideration the severely eroded beach conditions following Sandy. This includes reevaluation of the cost assumptions and other sources of potential economic benefits.

5.2.1 Alternative Development

Based on the prior screening of alternatives, and coordination with State and local officials five conceptual alternatives were considered for evaluation:

- Alternative 1: Beach Restoration,
- Alternative 2: Beach Restoration and Buried Seawall,
- Alternative 3: Feeder Beach,
- Alternative 4: Dune Reinforcement,
- Alternative 5: Dune Reinforcement and Feeder Beach.

These five alternatives represent a range of measures providing different levels of protection and design project lives. Alternatives 1, 2, and 3 are similar to the pre-Sandy alternatives, and are designed to provide a 44 year level of protection and have a design project life of 50 years. The post-Sandy analysis also considered two alternatives that provided a lower level of protection, and a shorter design life to stabilize the project area immediately and effectively. Alternative 4 is a geotextile reinforced dune alternative that could be constructed as a one-time action to offset the loss of dune function from Hurricane Sandy. Alternative 5 is an update to the plan previously recommended in the TFSP, which would repair the dune function at downtown Montauk and provide beach nourishment to maintain a consistent level of functioning.

Due to the large quantities of sand fill required for construction of Alternatives 1, 2, 3, and 5 dredging of an offshore borrow area would be required. Dune Reinforcement (Alternative 4) requires significantly less sand, approximately 51,000 cy, than other four alternatives. Therefore,

it is feasible and expected to be less costly to obtain the necessary sand fill material from upland sediment sources.

The final analysis and comparison of alternatives for the long-term Reformulation Study are still underway, but the above information has been used as the basis for developing the stabilization plan for downtown Montauk.

Stabilization Plan Selection

As presented previously, a stabilization project for downtown Montauk must meet the following requirements:

a. Compatible with the likely outcome of the Reformulation process;
b. Economically justified as a separate, independent project;
c. Limited in duration to provide stabilization prior to implementation of the FIMP Reformulation.

In reviewing the alternatives under consideration, Alternative 4 was identified as the only alternative that meets the criteria for a stabilization project. Alternatives 1, 2, 3, and 5 all have very high costs, and can only perform as designed if done in conjunction with a long-term plan for renourishment. Given that the stabilization project for downtown Montauk is intended as a 1 time project in advance of the implementation of the overall FIMP reformulation, these 4 alternatives were not considered further, and Alternative 4 was selected as a viable stabilization alternative.

Alternative 4 - Dune Reinforcement

Alternative 4, Dune Reinforcement, consists of stabilizing and reinforcing the existing dune along 3,100 ft of the shoreline in downtown Montauk. The core of the dune consists of hydraulically-filled Geotextile Sand Containers (GSCs). Geotextile Sand Containers (GSCs) have increasingly been used to provide low cost, soft, environmentally acceptable solution for shore protection structures (Pilarzyk, 2002, Dassanayake and Oumeraci, 2012). Coastal structures built with GSCs are obtained by substituting rocks with containers made of geotextile and hydraulically filled with locally available sand. An example of two coastal protection projects utilizing GSCs is provided in Figure 15. The photo on the left shows the project under construction and the photo on the right shows a project when covered with sand and vegetated.

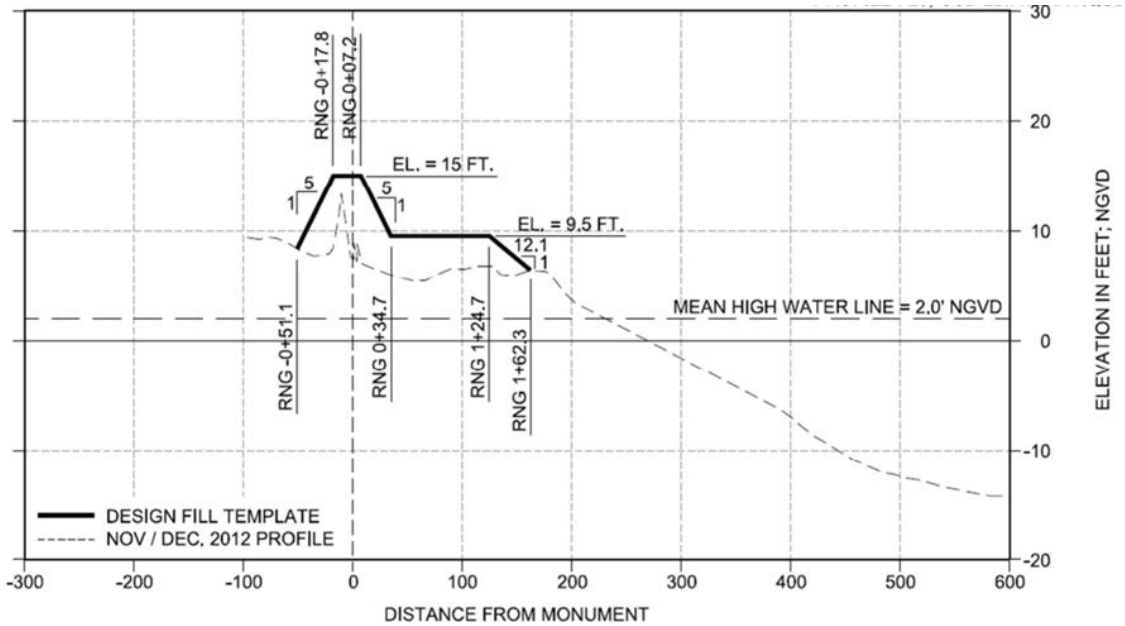


Figure 13: Typical Beachfill Section

Figure 14: Example Applications of Geotextile Sand Containers

A typical section of the proposed Reinforced Dune is shown in Figure 16. The core of dune consists of approximately 14,171 GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall, each weighing approximately 1.7 tons. For greater stability the GSCs are aligned with the long side perpendicular to the shoreline with an overlap of 50% of the filled width. The proposed design is to provide reinforcement by stacking the bags along the existing dune at a 1V:2H slope. The Dune Reinforcement extends from a toe elevation of +3 ft to a crest elevation of +13.5 ft NGVD. In order to increase the resiliency of the design and reduce the potential for undermining, the proposed design includes a 50 foot wide berm cap at +9.5 ft NGVD. The additional sediment, estimated at approximately 25,700 cubic yards, will provide additional protection to the toe of the structure from undermining and decrease the likelihood of exposure of the GSCs during small storm events.

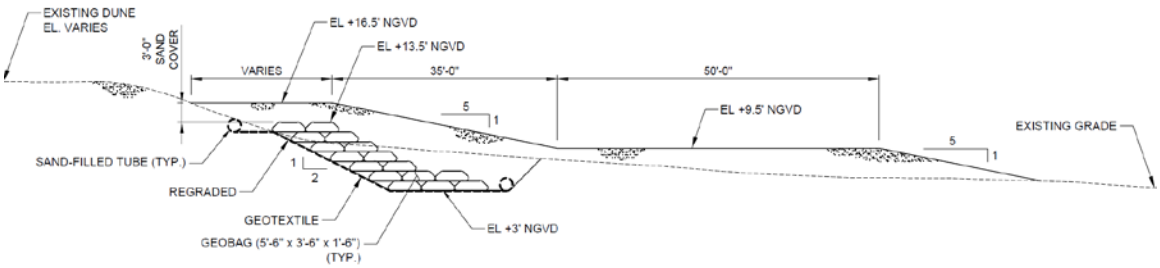


Figure 15: Reinforced Dune Typical Section

Dune reinforcement with GSCs may provide a relatively soft, flexible, easily installed, and easily removed solution. However, there are some disadvantages to using GSCs in the place of traditional armor stone units. The level of protection and longevity offered by the GSCs is considerably less than armor stone. GSCs have a lower specific gravity and are more susceptible to sliding and being pulled out when exposed to large waves. The longevity offered by GSCs is also limited by deterioration from UIV exposure, sand abrasion, vandalism, and debris. To maximize the longevity of the GSCs the proposed design calls for the GSCs to be covered by a layer of sand to decrease the likelihood of the geobags from being exposed for long periods of time.

It is estimated that the reinforced dune provides a level of protection of approximately 25 years (4% annual chance of design exceedance) and that the effective life of this type of structure would be approximately 15 years. A 15 year effective project life was determined based on two factors: 1) 15 years is the approximate point in the future in which the cumulative failure probability of the reinforced dune exceeded 50%; 2) the durability and longevity of the geotextile sand containers is limited and will eventually breakdown due to UV radiation, abrasion, and debris.

5.2.2 Quantities and Costs

Quantities

Initial construction beachfill quantities for Alternatives 1, 2, and 3 were estimated from profile surveys conducted during September, 2013. Average end area calculations were performed based on the design section and profile surveys. Advance fill is included in the initial beachfill quantities. Advance fill is a sacrificial quantity of sand that acts as an erosional buffer against long-term and storm-induced erosion as well as beachfill losses caused by “spreading out” or diffusion. The required advance berm width was computed based on representative erosion rates and expected renourishment interval (4 years). Table 3 provides a summary of the initial construction beachfill quantities, which include a 10% overfill factor and a 15% contingency/tolerance factor.

The beachfill quantities for the Dune Reinforcement (Alternative 4) were estimated from a profile survey conducted by First Coastal on November 24, 2013 at Ocean Beach as the November 2013 profile is more indicative of the winter profile that leaves the project area more vulnerable. The

flat (unfilled) GSCs are assumed to be placed in location by hand and hydraulically filled in place. Vegetation of the berm and the installation of sand fencing is also assumed to be included.

Renourishment quantities and costs are based on the estimated "effective" erosion rates under each alternative. The effective erosion rates were estimated based on sediment budgets of the Study Area, historical shoreline change rates, and a numerical beachfill diffusion analysis. Effective erosion rates for the alternatives range from 6 ft/yr to 18 ft/yr. The renourishment volumes reflect the required amount of beachfill volume to replace the sediment losses in between renourishments. Renourishment fill volumes for a single renourishment event (once every four years) and over the entire 50-yr project life are presented in Table 4. No renourishments are included in the Dune Reinforcement alternative (15-year project life).

Table 3: First Construction Beachfill Volumes

Item	Beach Restoration	Beach Restoration & Seawall	Feeder Beach	Dune Reinforcement	Feeder Beach & Dune Reinforcement
Length (ft)	6,600	6,000	3,100	3,100	3,100
Design fill (c.y.)	689,338	298,772	120,000	51,000	147,000
Advance Fill (c.y.)	591,514	140,873			
10% Overfill (c.y.)	128,085	43,865			
Subtotal (c.y.)	***1,408,937***	***482,510***	***120,000***	***51,000***	***147,000***
15% Tolerance (c.y.)	211,341	72,376			
Total Fill (c.y.)	**1,620,000**	**555,000**	**120,000**	**51,000**	**147,000**

Table 4: Renourishment Beachfill Volumes

Item	Beach Restoration	Beach Restoration & Seawall	Feeder Beach	Dune Reinforcement	Feeder Beach & Dune Reinforcement
Length (ft)	6,600	6,000	3,100	3,100	3,100
Erosion Rate (ft/yr)	18	6			
Advance Fill (c.y.)	641,520	194,400	120,000	n/a	120,000
10% Overfill (c.y.)	64,152	19,440			
Subtotal (c.y.)	***705,672***	***213,840***			
15% Tolerance (c.y.)	105,851	32,076			
Total Fill (c.y.)	**812,000**	**246,000**	**120,000**	**n/a**	**120,000**

Note: Fill quantities are provided for each 4-year renourishment cycle.

Offshore Dredging Alternatives

Due to the large quantities of sand fill required for construction of Alternatives 1, 2, 3, and 5 dredging of an offshore borrow areas is proposed. Dredging costs per cubic yard are estimated using CEDEP (USACE of Engineers Dredge Estimating Program). Mob/Demob estimates of $4 million are based on recent contracts. All future renourishment cost estimates are based on an intra-site Mob/Demob with the expectation that the alternative at downtown Montauk may be able to "piggy back" on other beachfill projects once the GRR is approved.

Buried seawall costs were developed based on the estimated quantities of armor stone, under layer stone, core fill, geotextile, and excavation with USACE cost estimating software MII.

Upland Trucking Alternatives

Dune Reinforcement (Alternative 4) requires significantly less sand, approximately 51,000 cy, than other four alternatives. Therefore, it is feasible and expected to be less costly to obtain the necessary sand fill material from upland sediment sources. There are two upland sand distributors in close proximity to Montauk that could provide the necessary sand fill quantities.

The fill material would be transported from the distributor to downtown Montauk in either dump trucks or tractor-trailers. The estimated travel distance from the upland distributors to downtown Montauk is less than 25 miles.

The total cost of placing sand from upland distributors on the beach includes three main components: raw material, transportation, and placement/shaping on the beach.

Plan Comparison

A summary of the annualized costs for the five conceptual alternatives are provided in Table 5. As previously discussed, the five alternatives represent a range of measures offering different levels of protection and different design project life. The annualized costs of alternatives 1, 2, 3, and 5 are based on a 50 year period of performance and assumed a periodic nourishment requirement every 4 years, while alternative 4 is based on a 15 year period of performance with no periodic nourishment. The 15 year period of performance is based on the expected life of the GSCs that are used to construct the reinforced dune. Due to the high annualized costs of alternatives 1, 2, 3, and 5 and also given that the stabilization project for Downtown Montauk is intended as a 1 time project in advance of the implementation of the overall FIMP reformulation, these 4 alternatives will not be considered further.

Table 5: Annualized Costs of Alternatives

Annual Costs	Beach Restoration[1]	Beach Restoration & Seawall[1]	Feeder Beach[1]	Dune Reinforcement[2]	Feeder Beach & Dune Reinforcement[1]
First Construction	$1,248,000	$1,390,000	$466,000	$761,000[3]	$680,000
Renourishment	$3,837,000	$2,417,000	$2,337,000	n/a	$2,422,000
O&M	$292,000	$326,000	$109,000	$157,000	$160,000
Total	$5,377,000	$4,133,000	$2,912,000	$918,000	$3,262,000

Notes: April 2014 price level, 3.5% Discount rate;
[1] Based on 50 yr. Period of Performance (POA) with periodic nourishment every 4 years;
[2] Based on 15 yr. POA with no renourishment.
[3] Includes Interest During Construction (IDC) based on a four-month construction schedule.

5.3 Economic Evaluation

5.3.1 With-Project Storm Damages and Benefits

In compliance with Public Law 113-2 and the project constraints described in previous sections, current efforts are limited to the implementation of a stabilization project with a 15 year life and no provision for periodic renourishment. Therefore at this stage in the study only Alternative 4, the reinforced dune structure has been subject to analyses for damages and benefits.

To model the damages with the Stabilization Project in place showing the benefits of the project, the model described in Section 3.3 was configured to allow erosion beyond the +5 foot NGVD contour only after the reinforced dune structure has failed due to either wave action or scour. In the first year of the project life, the dune provides approximately a 1 in 25 year level of protection (4% annual chance of failure immediately following construction) with the annual failure probability rising to approximately 8% (1 in 13 year) by the end of the project life. The increase in annual failure probability of the project over time is presented in Figure 17. The cumulative failure probability of the project is presented in Figure 18, which indicates that the probability that the project will have failed by the end of the period of analysis is almost 60%.

The model has been executed using a project life of 15 years, an interest rate of 3.5% and 12,500 iterations to compute with-project equivalent annual damages of $326,000. Hence the annual storm damage reduction benefits of the project are estimated to be $1,052,000.

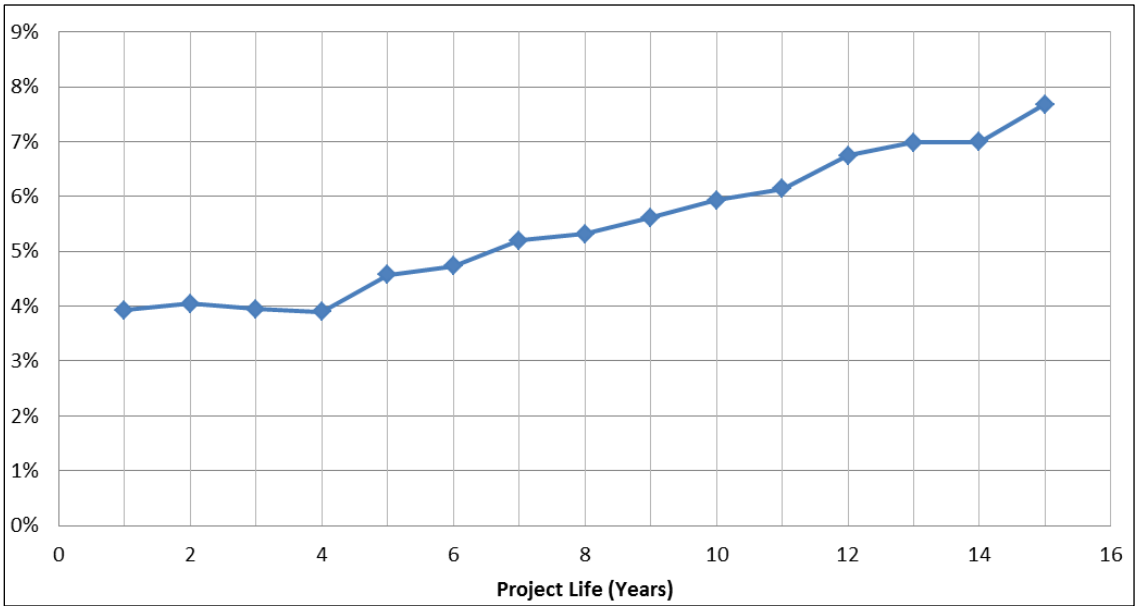


Figure 16: Annual Failure Probability of Reinforced Dune

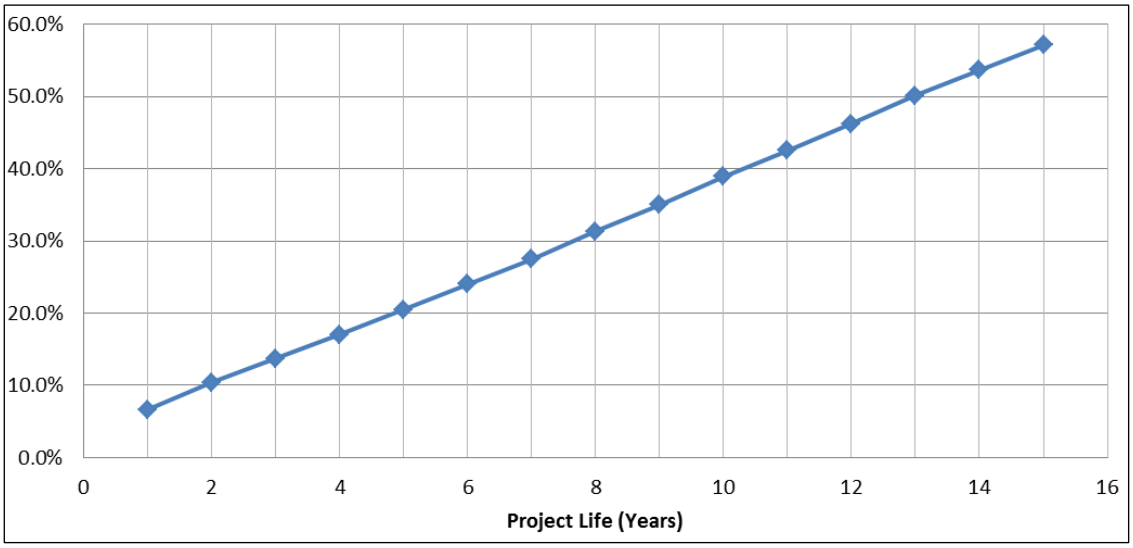


Figure 17: Cumulative Failure Probability of Reinforced Dune

The with-project model outputs were post-processed to derive damage frequency plots for years 1, 5, 10, and 15 in the analysis period, and these plots are presented in Figure 19 for comparison with Figure 11. It is evident that while the vulnerability to erosion still increases over time with the project in place, the expected damages are greatly reduced. For example; for the 10% annual chance exceedance event, expected damages in years 1 and 10 are expected to be reduced from $1 million and $3.8 million to zero and $1.3 million respectively.

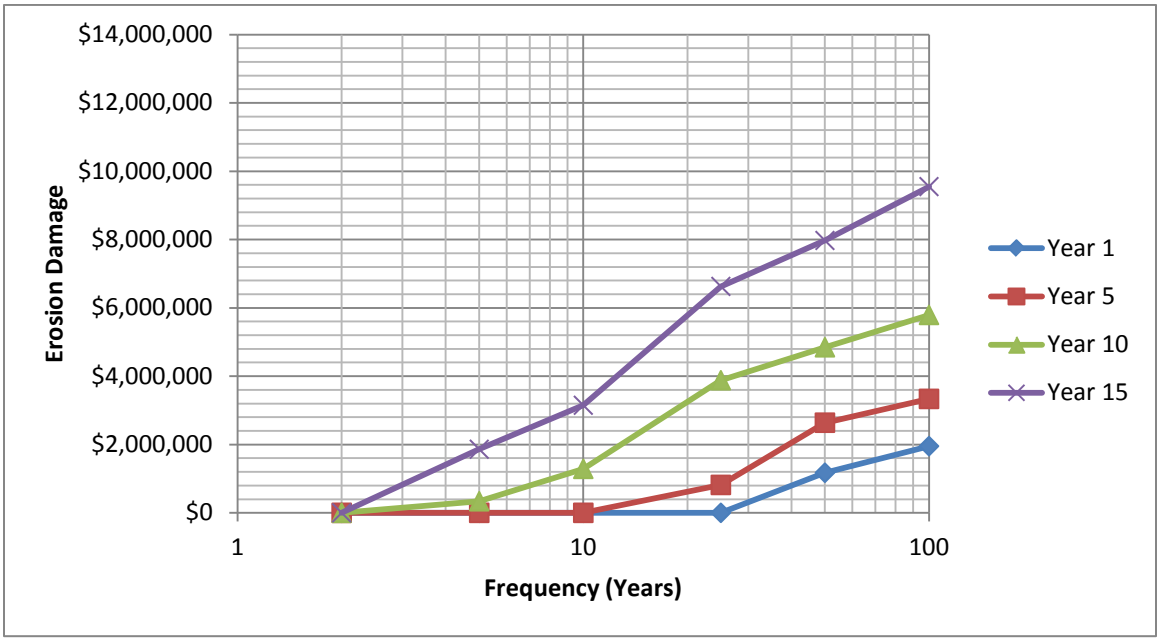


Figure 18: With-Project Damage-Frequency Curve

5.3.2 Additional Benefits

The cost of locally implemented beach and dune repairs mentioned in Section 3.2 would assumed to be avoided following the construction of the selected plan, and therefore can be considered a project benefit. The annual cost avoided has been derived by assigning frequencies of occurrence to the recorded local repair costs for the years 2011 – 2013, based on the return periods of the most significant storms in those years. A cost/frequency curve was subsequently constructed which was used to compute a probability-weighted annual average cost avoided of $185,000.

5.3.3 Summary of Economic Evaluation

The annual damages and benefits resulting from the model analyses for the reinforced dune are summarized in Appendix D, Back-up Calculations, and also in below, along with annualized project costs estimated separately (See Appendix G), and the resulting benefit-cost ratio of 1.4.

Table 6: Summary of Stabilization Project Damages, Costs, and Benefits

Without Project Annual Damages	**$1,378,000**
With Project Annual Damages	**$326,000**
Storm Damage Reduction Benefits	**$1,052,000**
Local Costs Avoided	**$185,000**
Total Annual Project Benefits	**$1,237,000**
Annual Cost	**$918,000**
Net Benefits	**$319,000**
Benefit-Cost Ratio	**1.4**

Interest rate 3.5%, Project Life 15 years

To illustrate the potential variance of the model results, 25th and 75th percentile storm damage reduction benefits have been extracted from the @Risk model results. The 25th percentile benefits are $1,118,000 and the 75th percentile damage reduction benefits are $1,108,000, giving a range of benefit-cost ratios of 1.21 to 1.12.

6.0 IDENTIFICATION OF MONTAUK STABILIZATION PLAN

As a consequence of coastal erosion during Hurricane Sandy, the dune and berm system at downtown Montauk is depleted. The foundations of several shorefront commercial buildings were exposed during Hurricane Sandy and are vulnerable to future storm events. In response to the increased vulnerability to future events, consistent with the Disaster Relief Appropriations Act of 2013 (Public Law. 113-2; herein P.L. 113-2), and recognizing the urgency to repair and implement immediate storm protection measures, the USACE has proposed an approach to expedite implementation of construction of necessary stabilization efforts at Downtown Montauk independent of the FIMP Reformulation Study. This approach has gained widespread approval from New York State, Suffolk County, N.Y. and the Town of East Hampton, who recognize the extreme vulnerability of the coast and the need to move quickly to address this need.

The post-Sandy Downtown Montauk Stabilization Project was developed based upon the Engineering, Economic, Environmental, and Planning efforts that have been undertaken through the ongoing FIMP Reformulation Study. The study compared several alternatives to identify the recommended scale and scope of a stabilization project. Stabilization efforts were focused on downtown Montauk as there is a more urgent need to advance the stabilization of this reach due to its vulnerability and potential for major damage and risk to life and property.

This stabilization effort has been developed as a one-time, stand-alone construction project to repair damages caused by Hurricane Sandy that entails stabilizing / reinforcing the dune. This Chapter demonstrates that the Downtown Montauk Stabilization Project has its own independent utility, and as developed does not limit the options available in the overall FIMP Reformulation Study or pre-suppose the outcome of the Reformulation Study.

The stabilization Project is estimated to have a 15 year project life, which represents the approximate timeframe when the cumulative failure probability of the reinforced dune exceeds 50%. This takes into account the longevity of the geotextile sand containers, which will eventually breakdown due to UV radiation, abrasion, debris, and vandalism. This also considers that in the absence of a sediment management solution as part of the overall FIMP Reformulation Study, long-term erosion will lead to a reduced level of protection increasing the likelihood of undermining and displacement of the reinforced dune core. Continued maintenance over the effective project life is required to maintain the sand dune cover and increase the longevity of the GSCs.

6.1 Stabilization Plan Details

6.1.1 Extent

The proposed design includes 3,100 feet of reinforced dune extending from west to east from South Emery Street to Atlantic Terrace Motel and tapering into high dunes at both ends of the Project Area. The extent of the proposed plan was selected to provide protection to all of the shorefront commercial buildings in downtown Montauk.

6.1.2 Alignment

The design alignment defines the cross-shore location of the design section. For the Stabilization Project the alignment closely follows the existing dune (+ 12 ft NGVD contour). In some locations the alignment was adjusted to ensure that the footprint of the GSCs is seaward of shorefront structures. Figure 20 shows an example of the alignment in the Project Area. The plan layout for the Stabilization Project is available in Appendix C.

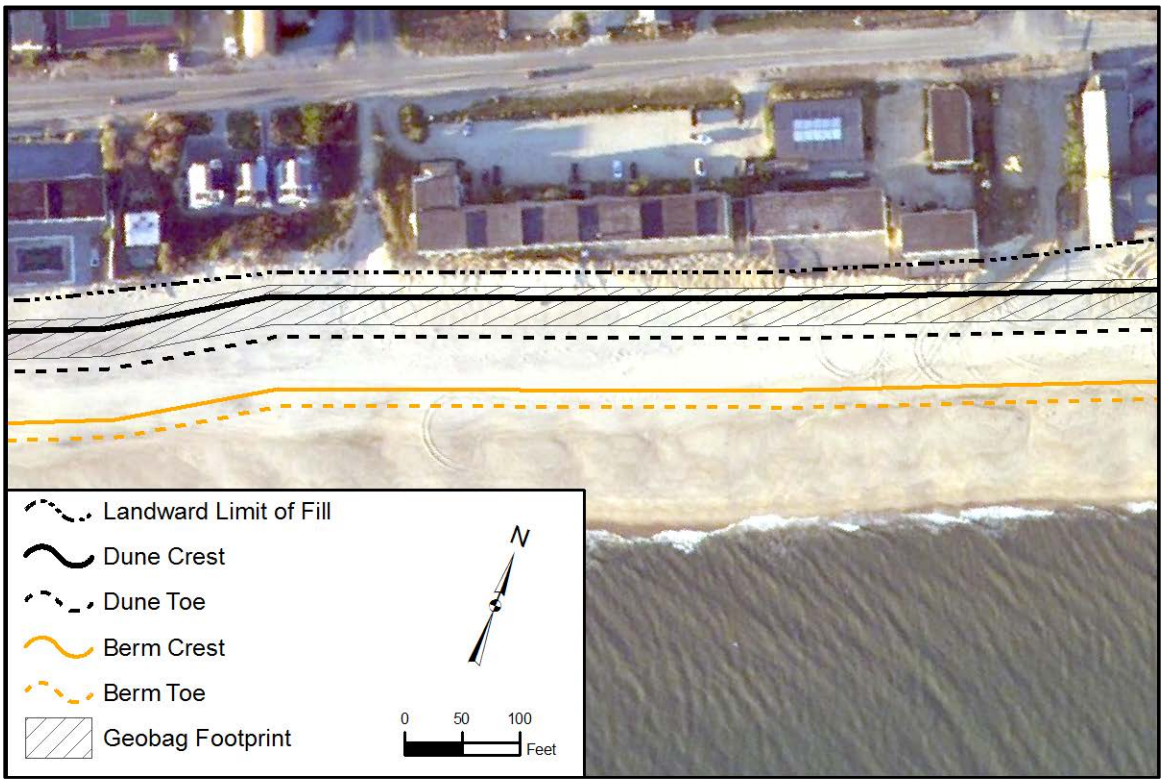


Figure 19: Downtown Montauk Alignment

6.1.3 Design Section

A typical section of the proposed Reinforced Dune is shown in Figure 21. The core of dune consists of approximately 14,171 GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall, each weighing approximately 1.7 tons. For greater stability the GSCs are aligned with the long side perpendicular to the shoreline with an overlap of 50% of the filled width. The GSCs are stacked along the existing dune at a 1V:2H slope. The GSCs extend from a toe elevation of +3 ft to a crest elevation of +13.5 ft NGVD. In order to increase the resiliency of the design and reduce the potential for undermining, the proposed design includes a 50 foot wide berm cap at +9.5 ft NGVD. The additional sand will provide protection to the toe of the structure and decrease the likelihood of exposure of the GSCs during small storm events.

The design of the GSC structure is based on beach conditions on November 24, 2013, which are more representative of a winter profile. It is possible that during winter months or during a severe storm event the beach conditions could become even narrower than depicted by the November

survey. The toe elevation of the reinforced dune was selected to minimize the risk of scour and undermining under storm events with annual exceedance probability of 4% (25 year return period).

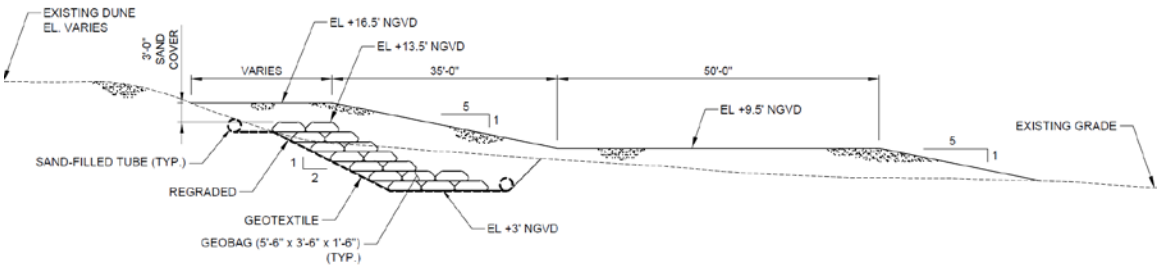


Figure 20: Reinforced Dune Typical Section

6.1.4 Geotextile Sand Containers

Geotextile Sand Containers (GSC) are an emerging technology and design guidance for the use of GSC in coastal protection structures is still evolving. Large scale model tests and field tests have shown that the dislodgment and pullout of the slope containers by wave action, including the sliding and the overturning of crest containers, are strongly affected by the deformation of the sand containers (Dassanayake and Oumeraci, 2012). Recent advances in understanding the hydraulic stability of the GSC under wave attack (Wouters, 1998; Pilarczyk, 2000; Oumeraci et al, 2003; and Dassanayake and Oumeraci, 2012) have led to several design formulae for GSC structures. Most of the design formulae relate the stability of the GSC to the surf similarity parameter and wave height. An increase in the wave height and wave period results in decreased stability of the GSCs and increases the required size and weight of the GSC.

The aforementioned design guidance led to selection of 1.7 ton GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall. In order to increase the stability of the GSCs the long side of GSCs is laid out perpendicular to the shoreline with an overlap of 50% of the filled width. A total of 14,171 GSC are required to construct the reinforced dune core.

A total of 71,000 cy of sand are required to construct the reinforced dune. Approximately 51,000 cubic yards of the sand fill will be used to fill the GSCs or placed in the dune. The remaining 20,000 will be used to construct the berm cap and will be obtained from excavation and re-grading of the existing dune. The remaining 51,000 cy will be obtained from upland sediment sources. In order to more closely match the appearance of the sand after the project is constructed, the construction will ensure that the upland sand is used for filling the GSC's and base fill. The sand excavated from on site will be used as a top cover for the project.

Filling of the GSCs will be hydraulic and conducted using Best Management Practices (BMPs) to minimize any discharge that could be in violation of the Water Quality Certificate (WQC). The contractor will submit a Sediment Control Plan for District approval prior to any construction activities.

6.1.5 Upland Sediment Sources

Due to the relatively small quantity of sand fill needed to construct the project it is recommended that the sand fill be obtained from upland sediment sources. The cost of mobilizing a dredge, approximately $4 million, would not be cost-effective considering the relatively small quantities of sand fill required.

Two upland sediment sources that could meet the sediment demands of the project were identified within 25 miles of the Project Area. The compatibility of the upland sediment and native sediment was evaluated based on the grain size distribution and color. The analysis indicated that the median grain size of the upland sediment sources (0.51 and 0.44 mm) is the same or slightly larger than the native sediment (0.42 mm). In addition, the grain size distribution of the upland sediment sources and native sediment are similar. The compatibility of the color of the sediment is illustrated by Figure 22 which compares sediment samples from the two upland sediment sources.

Figure 21: Upland Sediment Samples

6.1.6 Real Estate

The Real Estate requirements, for this project, include certain lands, easements, relocations and rights of way (LERR). The total LER required in support of the Project is approximately 13.36 acres; approximately 2.13 acres required in perpetual easements, and approximately 11.23 acres required in access agreements over public land. The Project impacts 19 parcels, impacting 13 private owners and 6 public owners. This project will not require relocation of property or utilities. Details of the real estate requirements and cost estimate are provided in Appendix F.

No property acquisitions or structural relocations are required for the project. The lands, easements, rights of ways, and relocations necessary for implementing the project are described

herein. The two types of easements required for the Stabilization Project include a perpetual easement, and a temporary work easement. A perpetual easement would be obtained along all areas where beachfill material is placed to allow continual access to construct, operate, maintain, patrol, repair, and replace the beach berm and dune. This easement precludes development, other than approved dune crossings and ensures that the design section would be held inviolate from future development. Temporary work area easement would be obtained to allow right of way in, over, and across the land for a period of three years for construction operations.

Within a few of the oceanfront properties, perpetual easements are required over a portion of the footprint of decks. In these locations construction work is limited to placing beachfill underneath the deck. This work is consistent with recent and ongoing engineering practices in downtown Montauk carried out by local property owners.

The responsibility for the acquisition of the necessary lands and easements is the responsibility of the Non-Federal Sponsor (NFS), the New York State Department of Environmental Conservation. The NFS may enter into sub-agreements with local municipalities to assist in carrying out its acquisition responsibilities. New York State Law (Title 4, Chapter 7, Sections 1531-1539 of the Unconsolidated Laws) require that lands upon which beachfill is placed must be municipally owned, while lands upon which dunes are erected may be privately owned with permanent easement granted to a municipality. In either case, the NFS must maintain the control it needs in order to certify the property interests required for the project.

6.1.7 Public Access

Suitable public access is required for any areas where Federal expenditure of funds will be utilized for beach restoration. Four pedestrian crossing crossings and one vehicular crossing have been identified and included in the project. Figure 23 shows the pedestrian and vehicular access points.

Analysis and acceptability of public access is documented in Appendix E. The analysis of public access indicates that the areas where sand is being placed is fully accessible and in compliance with ER 1165-2-130.

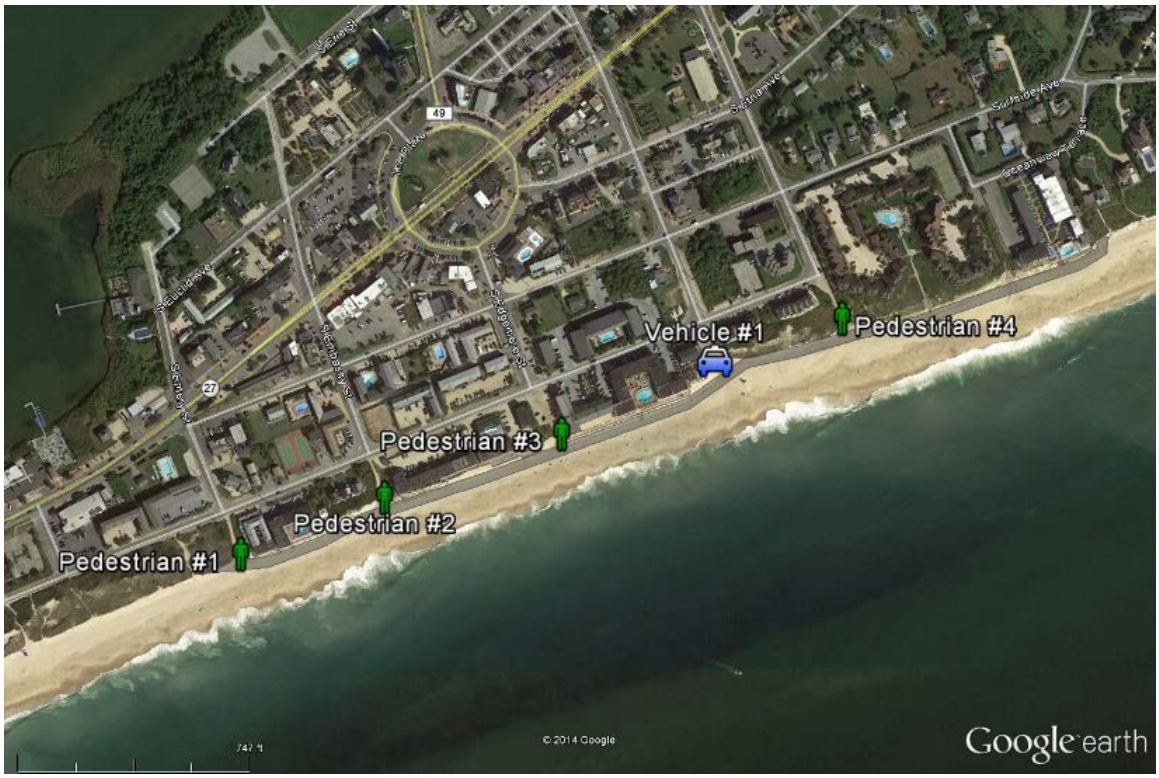


Figure 22: Public Access

7.0 PROJECT IMPACTS

Given its limited scope, implementation of the Downtown Montauk project is not expected to have any significant adverse impact on the environment. The following is a summary of potential impacts. Details of specific impacts are outlined in the accompanying EA.

7.1 Human Environment

The construction activities for the Dune Reinforcement Alternative are limited to the shoreline, waterward of existing shoreline structures in downtown Montauk. Therefore, the Dune Reinforcement Alternative would not have a negative impact on the land use in downtown Montauk project area. The proposed project would help prevent damage to and/or the loss of hotels and restaurants in the downtown Montauk project area. Therefore the proposed project would have a positive impact on the land use in the project area. Also, overall, the Downtown Montauk TSP is expected to yield annual storm damage reduction benefits estimated at $728,000. With the Dune Reinforcement Alternative, adverse effects to traffic, transportation, access, and circulation that are expected following a severe storm event under the No Action Alternative would be reduced. The existing road network would continue to function. During construction the Dune Reinforcement Alternative would prevent the use of the beaches in the project area including a small portion of Kirk Park Beach. There would be a temporary impact on recreational use of the area during the construction period. However, the construction activities would not occur during the summer tourist season. The proposed project would prevent the loss of beaches in the project area, and would have a positive impact on the recreational use in the project area.

7.2 Cultural Resources

There are no known resources - terrestrial, underwater, and architectural - that are listed on State or National Registers of Historic Places within the APE that could potentially be impacted by the project. The few older structures that remain in the downtown Montauk area include Second House which was built in 1797 and several Tudor Revival style structures constructed by Carl Fisher in the 1920's. The construction activities for the Dune Reinforcement Alternative are limited to the shoreline, waterward of existing shoreline structures and therefore would not directly impact any of these structures. The added shoreline protection from the Dune Reinforcement Alternative would protect these structures from potential future storm damage. The increased truck traffic necessary to transport sand to the project area could cause vibrations that could damage older structures in the area. To minimize the potential for this impact, truck routes will avoid roads with sensitive structures to the extent practicable.

Due to the dynamic nature of the shoreline environment, no remnant archaeological resources are expected within the dune reinforcement footprint that could potentially be impacted. However, the area is mapped as archeologically sensitive (NYSOPRHP 2014.) Dune Reinforcement Alternative would further bury any subsurface resources that may be present, protecting them from erosion forces and exposure to the elements. Any archaeological resources encountered during construction would be salvaged, with work halted as needed to allow consultation with the NY SHPO. All work will be done consistent with the Memorandum of Agreement between the USACE and NY SHPO for FIMP which will be modified to incorporate the Downtown Montauk Stabilization Project TSP.

7.3 Physical Environment

The Dune Reinforcement Alternative includes the placement of sand filled geobags below the sand fill along approximately 3,100 feet of shoreline. The dune reinforcement activities will take place waterward of existing shoreline structures to create a design beach and dune profile. There are three major ways that the proposed geobags and sand cover could physically impact the coastal beach environment: 1) the direct deposition of new material cover the existing beach sediments, 2) l modification of the beach (sand/water) interface following material placement; and 3) erosion/transport of the deposited material into tidal waters resulting in increased turbidity in the intertidal and near shore areas. Any impacts to water quality associated with the construction activities would be minor, localized and short term, limited to the construction phase of the project. The project would also alter the beach/dune profile substantially, reducing the potential for breaching and overwash during storm events and creating greater stability of this reach along the shoreline in the project area. The project would facilitate coastal processes, such as longshore sediment transport and dune development and evolution, yielding a benefit to the physical environment.

7.4 Natural Environment

The project would not directly affect the marine nearshore habitat, as all sand placement would be landward of MLW. Likewise, there would be no direct impact to the marine intertidal habitat, as the project footprint is primarily landward of MHW, and incidental sediment transport to the intertidal habitat would be expected to be within the natural variability typical of this dynamic environment. The selected alternative would result in direct sand placement on the marine beach and dunes and swales habitat. In the Project Area, this habitat is subject to heavy human use, particularly during the summer tourist season; impacts to the marine beach and dunes habitat would be short term, with return of affected species within a year. There are no listed species or critical habitats within the Project Area; no impacts to species or habitats is anticipated. Additional details on potential impacts are provided in the accompanying EA.

7.5 Cumulative Impacts

Repeated beach renourishment projects, as well as implementation of other emergency projects, such as the BCP, and the full Reformulation Plan, once finalized, will result in cumulative impacts to resources impacted by the overall FIMP Project, as well as the Downtown Montauk Stabilization Project area. The cumulative impact assessment of federal nourishment projects on the south shore of Long Island indicate that federal project actions would occur in a dynamic environment whose biotic inhabitants have adapted to these conditions. Studies indicate that borrow area and sand placement areas re-colonize shortly after construction activities are completed. Unlike several of the other projects proposed along the south shore of Long Island the Downtown Montauk project does not propose the use of an offshore borrow area and therefore would not add to the cumulative impacts to the offshore benthic environment. Relative to the categorization provided within Council on Environmental Quality guidance, the cumulative impacts of the Federal projects in the Study Area can be characterized as additive. The impacts are also interactive in that the stabilization of barrier beaches and mainland shoreline may alter/prevent early successional communities such as maritime beach from evolving in overwash areas. The area immediately adjacent to the beach and dunes in the Downtown Montauk project area is fully developed and consists of hotels, commercial and residential structures. Therefore,

there is no opportunity for early successional communities to evolve in overwash areas in the project area. The extent of these cumulative impacts will be fully vetted in the EIS prepared for the Reformulation Project.

Relative to the categorization provided within Council on Environmental Quality guidance, the cumulative impacts of the Federal projects in the Study Area are uncertain. The coastal barriers were originally created by natural processes without human intervention. These natural processes redistribute sand in the nearshore environment in response to gradual erosion and storm events. Once coastal barriers are manipulated by human interventions, which for example, Fire Island has undergone through maintenance of the inlets at either end of the island, they are no longer able to maintain their natural equilibrium. In combination with sea level rise, lower shoreface erosion, bayshore inundation and continuing natural sediment transport processes, the long-term effect of sand placement and prevention of breaches on the coastal barriers is uncertain. The impacts are also interactive in that the stabilization of barrier beaches and mainland shoreline may alter/prevent early successional communities such as maritime beach from evolving in overwash areas. The natural barrier beach environment exists in a continually changing state of "dynamic equilibrium" that depends on the size of the waves, changes in sea level relative to the land, the shape of the beach, and the beach sand supply. When any one of these factors changes, the others adjust accordingly. Development patterns that have built up over the years took place prior to coastal regulation and research on coastal barrier island behavior and sea level rise. Under the cumulative effect of natural processes acting on an environment altered by human intervention the proposed Downtown Montauk TSP mediates between managing risk to the community and natural processes. The additive damages to homes, businesses, the area's recreational resources, and its economy would be reduced by the Downtown Montauk TSP. The use of natural and nonrenewable resources in the salvage, repair, and reconstruction in the aftermath of storm damage would also be reduced. The Downtown Montauk TSP maintains the opportunity for long-term management plans in the project area to incorporate natural processes and sea level rise adaptation within risk reduction and community resilience strategies.

8.0 PUBLIC LAW 113-2 CONSIDERATIONS

This Hurricane Sandy Reevaluation Report has been prepared in response to and accounting for the Disaster Relief Appropriations Act of 2013 (P.L. 113-2). Specifically, this report addresses:

1. The costs and cost-sharing to support a Project Partnership Agreement (PPA).

2. The specific requirements necessary to demonstrate that the project is economically justified, technically feasible, and environmentally acceptable.

3. The specific requirements necessary to demonstrate resiliency, sustainability, and consistency with the Comprehensive Study.

8.1 Fully Funded and Costs Apportionment

The summary of Total Project Cost for the Downtown Montauk Stabilization is provided in Table 7. The initial construction element includes beach replenishment (i.e. dune reinforcement). In addition, the real estate costs associated with obtaining the required easements for construction as well as the planning, engineering, and design costs and construction management costs are shown in the Total Project Costs table. The estimated total project (First) cost is $8,900,000. The estimated costs for each contract are escalated to the midpoint of construction. A detailed Total Project Cost Summary table is provided in the Appendix G.

The cost-sharing of the initial construction cost in accordance with the provisions of P.L. 113-2 is shown in Table 8. P.L. 113-2 states that 'the completion of ongoing construction projects receiving funds provided by this division shall be at full Federal expense with respect to such funds. The Downtown Montauk Stabilization Project has 100% Federal funding (P.L. 113-2). Therefore, the Federal cost apportionment is $8,900,000. The non-Federal partner is responsible for 0% of the total project cost.

Table 7: Fully Funded Total Investment Project Cost

Feature & Sub-Feature Description	Cost	Contingency	Full
Beach Replenishment	**$5,528,000**	**$1,527,000**	**$7,054,000**
Construction Estimate Totals	***$5,528,000***	***$1,527,000***	***$7,054,000***
Lands and Damages	**$507,000**	**$0**	**$507,000**
Planning, Engineering & Design	**$664,000**	**$85,000**	**$749,000**
Construction Management	**$523,000**	**$67,000**	**$589,000**
Total	**$7,221,000**	**$1,679,000**	**$8,900,000**

Midpoint of construction is 2015Q3

Table 8: Cost Allocations

Federal (100%)	$8,900,000
Non-Federal (0%)	**$0**
Total	**$8,900,000**

8.2 Section 902 of WRDA 1986, as amended

P.L. 113-2 included language that changes the applicability of Section 902 of WRDA 1986, as amended, to projects funded by its appropriation. Specifically, it states in Title X, Chapter 4, "…Provided further, that for these projects, the provisions of section 902 of the Water Resources Development Act of 1986 shall not apply to these funds…" There are no Section 902 limits associated with the construction of the project since the project was authorized for construction prior to WRDA 1986.

8.3 Risks, Economics and Environmental Compliance

The prior sections of this report, notably Section 5.3, demonstrate how the recommended alternative reduces flood and coastal storm risks, and contributes to improved capacity to manage such risks. It also identifies that the recommended alternative is economically justified for the authorized period of federal participation.

The attached EA has been prepared to meet the requirements of NEPA and demonstrate that the recommended alternative is compliant with environmental laws, regulations, and policies and has effectively addressed any environmental concerns of resource and regulatory agencies.

8.4 Resiliency, Sustainability and Consistency with the Comprehensive Study

This section has been prepared to address how the recommended alternative contributes to the resiliency of downtown Montauk; how the recommended alternative affects the sustainability of environmental conditions in the affected area; and how the recommended alternative will be consistent with the findings and recommendations of the North Atlantic Coast Comprehensive Study (NACCS).

Resiliency is defined in the February 2013 USACE-NOAA Infrastructures Systems Rebuilding Principles white paper as the ability to adapt to changing conditions and withstand, and rapidly recover from disruption due to emergencies.

Sustainability is defined as the ability to continue (in existence or a certain state, or in force or intensity), without interruption or diminution.

The proposed features described in this report represent a resilient, sustainable solution, which when factoring the other elements included within the GRR reflect a model resilient, sustainable solution that integrates sand based features, improved systems management, integration of nature-based infrastructure, and integrated non-structural plans with improved land management. The beaches and dunes are resilient, in that they can adapt to changes, and can recover after a major disturbance, both through natural recovery of the beach, and through maintenance operations or major rehabilitation of the project.

In assessing consistency with the forthcoming North Atlantic Coast Comprehensive Study (NACCS), it is acknowledged that the results of the Comprehensive Study are not yet available, but that there are overriding principles which have been established for the NACCS that can be

addressed for consistency. These principles recognize that preferred plans are those that provide protection with the use of sand features, which are readily adaptable, and could be modified or terminated based upon findings of the NACCS. The NACCS also emphasizes the need for integrated land-use planning, recognizing the need for local adoption of Flood Plain Management Regulations, based upon current understanding of risks.

The proposed features of the Downtown Montauk Stabilization Report are consistent with these principles of the NACCS. The overall risk management is to be provided with a geotextile reinforced dune system that could be readily adapted, based upon future findings. With respect to integrated land management, there are FEMA floodplain regulations and also regulations pursuant to New York State's Coastal Erosion Hazard Act (CEHA), to address development within the primary dune. Recognizing the Federal government's commitment to ensure no inducement of development in the floodplain, pursuant to Executive Order 11988, this project will identify in the Project Partnership Agreement, the need for the local partner to develop a Floodplain Management Plan, and a requirement for the local partner to certify that measures are in place to ensure the project does not induce development within the floodplain.

9.0 PROJECT IMPLEMENTATION

The completion of this Hurricane Sandy Limited Reevaluation Report and recommendation by the District Engineer is the first step toward implementing construction of the Stabilization Project. Upon approval by USACE's North Atlantic Division, the project will be considered for construction with funding made available through P.L. 113-2.

9.1 Construction Schedule

The pre-construction and construction sequence, and time schedule of the Stabilization Project is dependent on the timeliness of this report's approval, the foregoing construction procedures, and the ability of local interests to implement items of local cooperation. These items of local cooperation are principally the furnishing of the required shoreline real estate easements by the State of New York.

The construction schedule is based on a Notice to Proceed (NTP) for construction on January 2, 2015. The total duration of construction is 122 days (4 months), with construction to be completed on May 4, 2015.

9.2 Local Cooperation

The initial project cost of the Stabilization Project will be funded 100% by the Federal Government. A fully coordinated Project Partnership Agreement (PPA) package has been prepared which will be coordinated and executed subsequent to the approval of this document and will serve as the agreement for the next phase of the project. The PPA reflects the recommendations of this Hurricane Sandy Limited Reevaluation Report. The non-Federal partner, NYSDEC, has indicated support for evaluating a stabilization project for downtown Montauk, and will provide a letter of support with the final report, stating their willingness to execute a PPA for the Montauk Stabilization Project.

As the non-Federal project partner, NYSDEC must comply with all applicable Federal laws and policies and other requirements, including but not limited to:

1. In coordination with the Federal Government, who shall provide 100% of the initial project cost,

    a. Provide all lands, easements, rights of way and relocations (LERR) determined by the Federal Government to be necessary for the initial construction and operation, and maintenance of this project.

    b. Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of excavated material associated with the construction, operation, and maintenance of the project.

    c. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law (PL) 96-510, as amended,

42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the construction, operation, and maintenance of the Project. However, for lands that the Federal Government determines to be subject to the navigational servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal project partner with prior specific written direction, in which case the non-Federal project partner shall perform such investigations in accordance with such written direction.

d. Coordinate all necessary cleanup and response costs of any CERCLA-regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the Project.

e. Coordinate mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project.

2. For so long as the project remains functioning, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, including mitigation features, at no cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and any specific directions prescribed by the Government in the Operations, Maintenance, Replacement, Repair and Rehabilitation (OMRR&R) manual and any subsequent amendments thereto.

3. Provide the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal project partner, now or hereafter, owns or controls for access to the Project for the purpose of inspection, and, if necessary after failure to perform by the non-Federal project partner, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall operate to relieve the non-Federal project partner of responsibility to meet the non-Federal project partner's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance.

4. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project and any Project-related betterments, except for damages due to the fault or negligence of the United States or its contractors.

5. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Codes of Federal regulations (CFR) Section 33.20.

6. As between the Federal Government and the non-Federal project partner, the non-Federal project partner shall be considered the operator of the project for the purpose of CERCLA

liability. To the maximum extent practicable, operate, maintain, repair, replace and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA.

7. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1790, Public Law 91-646, as amended by Title IV of the Surface Transportation and Unifom1 Relocation Assistance Act of 1987 (Public Law 100-17),and the Unifom1 Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the construction, operation, and maintenance of the Project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

8. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense directive 5500.11 issued pursuant thereto, as well as Army regulation 600- 7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

9. Participate in and comply with applicable Federal flood plain management and flood insurance programs and comply with the requirements in Section 402 of the Water Resources Development Act of 1986, as amended.

10. Not less than once each year inform affected interests of the extent of protection afforded by the Project.

11. Publicize flood plain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with the protection provided by the project.

12. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.

13. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms.

14. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal project partner has entered into a written agreement to furnish its required cooperation for the project or separable element.

15. At least twice annually and after storm events, perform surveillance of the beach to determine losses or nourishment material from the project design section and provide the results of such surveillance to the Federal Government.

9.3 Operations, Maintenance, Repair, Replacement and Rehabilitation Plan

New York State Department of Environmental Conservation (NYSDEC) as the local partner will be responsible for the Operations and Maintenance (O&M) of the Downtown Montauk Stabilization Project. The O&M Responsibilities will be provided in greater specificity in the OMRR&R Plan (Operations, Maintenance, Repair, Replacement and Rehabilitation Plan), which is provided to the partner after completion of initial construction and describes the specific requirements of the non-Federal partner. The OMRR&R costs are estimated to be $157,000 annually (Table 9).

Table 9: Estimated Annual Maintenance Costs

Item	Quantity	Unit Cost	Cost
Dune Fill	2,754 c.y.	$35	$96,396
Patch & Fill GSCs	78 each	$40	$3,118
Replace GSCs	39 each	$370	$14,419
Geotextile Roll	0.5 each	$1,350	$675
Subtotal			***$114,608***
Contingency	7%		$22,922
E&D	7%		$9,627
S&A	7%		$9,627
Total (Annual)			**$157,000**

Relatively high maintenance costs are associated with the Dune Reinforcement alternative at downtown Montauk for two reasons:

1. The GSCs should remain covered by a layer of sand to protect against UV degradation, vandalism, and debris.

2. Unlike typical beachfill projects, the dune is not protected by a wide design berm. As a result the dune is vulnerable to erosion during storm events.

Maintenance of the Dune Reinforcement alternative entails: a) trucking in sand in response to storm events which result in dune volume losses; and b) effort required to patch & fill or replace GSC damaged during a storm events. The required maintenance quantities were estimated based on Multivariate Empirical Simulation Technique (EST) results, recession of the 10 foot NGVD contour, for an eroded beach profile at downtown Montauk (Figure 24). The purpose of the reinforced dune core (GSC) is to prevent erosion landward the reinforced core during storm events. Therefore, the dune recession EST results were adjusted to capture the reduction dune recession and dune volume loss caused by the presence of the reinforced core (GSC).

An estimate of the number of bags that would be damaged during storm events is estimated based on the likelihood that the GSC would be uncovered (roughly 5 year event) as well as the

likelihood that the GSC would be subjected to large waves that have the potential to dislodge the GSC or carry debris up the GSC slope and puncture the containers.

One of the important variables applied in the estimate is the permanent loss factor. The permanent loss factor defines the percentage of sediment that is eroded from the beach and lost from the system. Typically a permanent loss factor between 10% and 30% is used in beachfill projects when estimating emergency rehabilitation volumes. However, a value of 50% was applied in this alternative because the eroded material is coming from the dune and not primarily from the berm. A value less than 100% was selected because the eroded dune material will not be completely lost from the system. A large percentage of the eroded dune material will likely be transported seaward and stored in a sand bar. During non-storm conditions the sediment in the sand bar will be gradually transported back to the berm. This process often takes days, weeks, or even a few months (i.e. summer/winter beach profiles). Longer time scales (e.g. months/years) are typically required for the dune to be naturally restored by aeolian transport. For this project it is assumed that a portion of the dune maintenance fill (50%) will be recovered from the system through naturally processes or beach scraping.

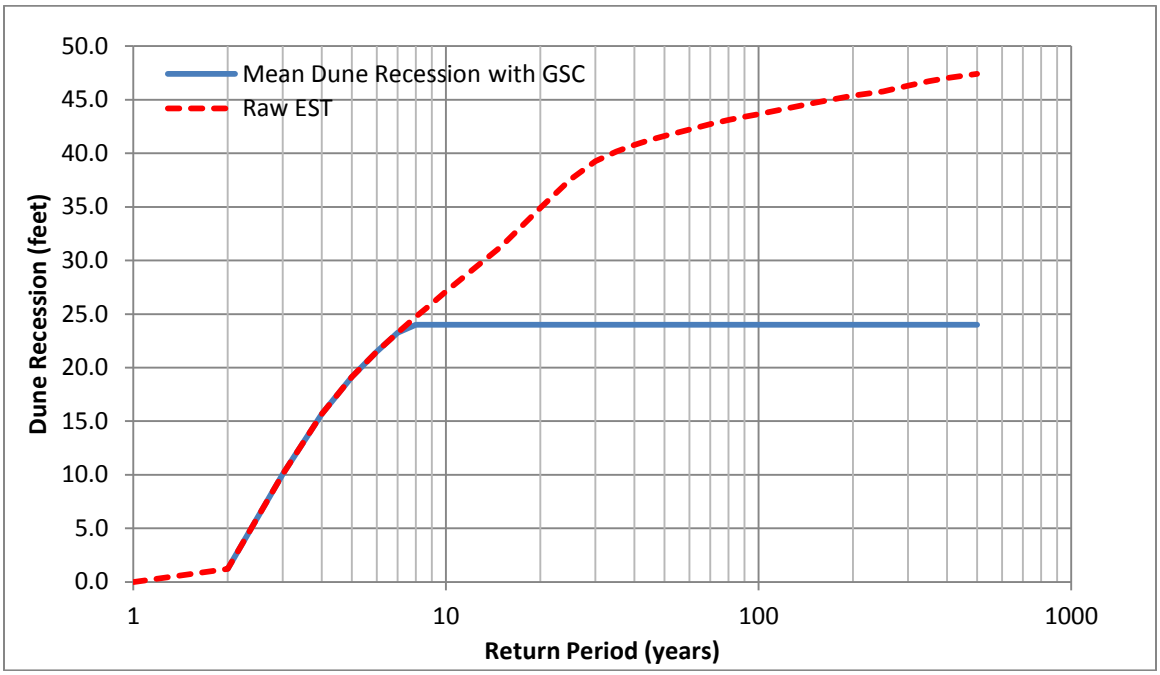


Figure 23: Storm Induced Dune Recession

9.3.1 NFS Administrative and Operational Responsibilities:

- Maintain public ownership and public use of the Project Area which are the basis of the Federal participation in the project. This includes preventing trespass or encroachment by private interests by the placement, onto these shores or within the seaward portion of the project, of any temporary or permanent structures, except as specifically permitted by the District Engineer or authorized representative.
- Prohibit any excavation of or construction on, over, under, or through the dune or beach berm, without prior written approval of the District Engineer or authorized representative

- Prohibit alterations in any feature of the beach fill that may affect its functional performance unless prior written approval has been obtained from the District Engineer
- Prohibit unauthorized vehicular traffic on the beach and restrict authorized vehicle access to authorized access ways.
- Assure that no drains discharge onto the beach.
- Remove all trash and debris from beach (day to day operations of the facilities).
- Permit the District Engineer or authorized representative access to the project at all times.
- Maintain organized records of activities and costs covering maintenance, operation, inspection, repair and replacement of protective works
- Participate in a yearly joint inspection of the project with personnel from the New York District.
- Ensure that safe operation of recreational activities continues during construction and maintenance operations.

9.3.2 Maintenance Responsibilities:

- Repair (patch and fill) or replace any damaged Geotextile Sand Containers.
- Take measures to prevent sand from blowing off the dune and berm onto nearby streets and into adjacent properties, including deploying and keeping sand fences in an upright position and in serviceable condition.
- Undertake semi-annual Inspections of the dunes as well as before and after each tropical and extratropical storm.

9.3.3 Reporting Responsibilities:

- Provide semi-annual Inspection Reports
- Provide organized records of activities and costs covering maintenance, operation, inspection, repair and replacement of protective works.
- Contact the District Engineer if at any time storm or other erosion reduces the berm to below the minimum beach fill cross-section width and maintenance measures to move sand from accreted areas to eroded areas prove inadequate to restore the design section.

10.0 FINDINGS AND CONCLUSIONS

The effects of Hurricane Sandy on downtown Montauk have made project implementation imperative to restore and reinforce the dune system to provide storm damage protection to vulnerable oceanfront commercial structures. In light of the changes provided in P.L. 113-2 with regard to the urgency, and cost-sharing of project implementation, the District recommends that the above project be implemented in accordance with this Hurricane Sandy Limited Reevaluation Report and the provisions of PL113-2 as a stabilization project.

The District has given consideration to all significant aspects in the overall public interest, including environmental, social and economic effects, engineering feasibility and compatibility of the project with the policies, desires and capabilities of the State of New York and other Federal and non-Federal interests. The project's annual benefits and annual costs were updated to April 2014 price levels and are $1,237,000 and $918,000 respectively. The updated Benefit to Cost Ratio is 1.4 (at 3.50% FY14 Discount Rate). The project is economically justified and the District recommends that the Stabilization Project be constructed at first cost of $8,770,000 that has a fully funded project cost (April 2014 PL) is $8,900,000 (based on an estimated March 2015 midpoint of construction),

11.0 RECOMMENDATIONS

Prefatory Statement

In making the following recommendations, I have given consideration to all significant aspects of this study as well as the overall public interest in eliminating or reducing storm damage within the Fire Island to Montauk Point Study Area and the Downtown Montauk Project Area in particular. The aspects considered include engineering feasibility, economic effects, environmental impacts, social concerns, and compatibility of the project with the policies, desires, and capabilities of the local government, State, Federal government, and other interested parties.

Recommendations

A number of alternatives have been examined as part of the ongoing FIMP study and a Tentative Federally Selected Plan has been identified. That plan may be further refined during completion of the overall FIMP Reformulation Study, the Hurricane Sandy General Reevaluation Report (HSGRR). However, in accordance with the current analysis and the guidance outlined in P.L. 113-2, the Downtown Montauk Stabilization Tentatively Selected Plan described in this report is acceptable to the non-Federal partner, agencies, and stakeholders as a one-time action, stand-alone stabilization project for immediate implementation.

Due to the currently degraded condition of the dunes at downtown Montauk as a result of Hurricane Sandy, it is recommended that this stabilization project be constructed as authorized by P.L. 113-2. I make this recommendation based on findings that the Stabilization Plan constitutes engineering feasibility, economic justification, and environmental acceptability. These recommendations are made with such further modifications thereof, as in the discretion of the MSC may be advisable, at fully funded cost of $8,900,000 (based on an estimated March 2015 midpoint of construction), provided that non-Federal interests comply with all the requirements substantially in accordance with the Project Partnership Agreement which will be executed upon approval of this report.

Disclaimer

The recommendations contained herein reflect the information available at this time and current Department policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and/or implementation funding.

Paul E. Owen
Colonel, U.S. Army USACE of Engineers
District Engineer

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APPENDIX A

PROJECT AREA STORM HISTORY

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APPENDIX I

NYSDEC LETTER OF APPROVAL

1930's – 1980's

The 1930s had a number of significant storms, including the March 1931 nor'easter, and the "Long Island Express" hurricane in 1938. The March 1931 nor'easter occurred during a full moon, and is the storm that created Moriches Inlet. Prior to 1931 nor'easter, the only sustained inlet in the study area was Fire Island Inlet.

The 1938 hurricane had wind gusts up to 135 miles per hour (mph), and made landfall in the vicinity of Moriches Inlet, at a time nearly coinciding with a high tide. The results of this hurricane were devastating. Wave heights between 15 to 30 feet swept the beaches along the entire south shore of Long Island. The ocean broke through the barrier island in hundreds of places inundating the normally dry land. The storm resulted in 11 new openings of the barrier islands in the study area. One opening at Napeague cut off the eastern end of the South Fork turning Montauk into an 11 mile long island. The storm left 50 people dead and over 1,000 homes destroyed. Damages to property on Long Island were estimated at $87 million.

Despite the impact, in the years following the 1938 hurricane, there was increased human investment along the shoreline. Suffolk County and New York State stabilized Moriches Inlet with stone jetties and dredged the inlet for improved navigation access. Building after World War II resulted in extensive development along the western bay shorelines. The NPS indicates that the number of houses and business on Fire Island increased from 1,260 to 2,400 from 1955 to 1962.

During Hurricane Carol in 1954, the ocean broke through the dunes near Fort Pond damaging the Montauk IGA (grocery store). Severe erosion of the beach and cliffs east of Montauk was reported in addition to damage to the seawall at Montauk Point.

The next period of intense storm activity was in the period of the mid 50's and early 60's. Notable storms impacting the area during this period include the November 1950 Nor'easter, the November 1953 nor'easter, Hurricane Carol in 1954, Hurricane Donna in 1960, and the Ash Wednesday Nor'easter of 1962, also known as the "5-High Storm". These storms had a considerable effect on the area and resulted in a continued human response to the problem.

The 1962 Ash Wednesday storm was particularly damaging to the study area because it lasted through five consecutive high tides causing severe beach and dune erosion. Each successive high tide was able to reach further inland or into back-bay areas as the beaches and sand dunes eroded and washed away. The storm destroyed 96 barrier beach homes. Many houses not destroyed during the storm were left hanging on the edge of the eroded dunes.

A new 300 foot wide inlet was formed through the barrier beach. Additional smaller inlets in the barrier island were also formed. The local authorities worked quickly to repair the breaches, using two dredges provided by the county; it took approximately one week to close the major breach working 24 hours each day.

The storm activity in the mid-1950s was also the impetus for the original FIMP Study. The study concluded with the 1958 Survey Report that was authorized for construction by Congress. This time period also saw continued development along the shoreline and additional man-made shore protection and inlet stabilization structures built. Groins were constructed by State and local interests in the areas of Ocean Beach on Fire Island. Numerous local and homeowner projects were also constructed, as

evidenced by the small groins, bulkheads, and dunes sometimes reinforced with stone, concrete and cars, which are intermittently exposed today.

The 1970's and 80's were a period of relative calm. Although a Nor'easter in January1980 resulted in a breach of the barrier island, just to the east of Moriches Inlet, which remained open for 13 months, until closed in February 1981 at a cost of $12 Million. It should be noted that the breach that occurred just to the east of Moriches Inlet in 1980 was in approximately the same location as the breach that occurred during the 2012 Hurricane Sandy.

Hurricane Gloria impacted the study area in 1985, but made landfall at low-tide, sparing Long Island from severe flooding, and resulting in mostly wind damage. Still, 48 houses were reported as destroyed in the Study Area with peak wind gusts of 100 mph.

1990's – 2000's

The next series of events impacting the project area included Hurricane Bob in 1991, the Halloween Nor'easter of 1991 (dubbed the "Perfect Storm"), the December 1992 Nor'easter, and the March 1993 "Storm of the Century". Hurricane Bob (1991) and the Halloween Nor'easter (1991) caused widespread coastal flooding in low lying areas and dune washovers along the project area.

The December 1992 Nor'easter resulted in significant damages along barrier islands and back-bays. Overwashes of the island were also observed along western Fire Island, at Smith Point County Park, Old Inlet. On the mainland at Mastic Beach the water reached 2 to 4 feet deep in the streets as a result of back-bay flooding from the breaches.

The March 1993 ("Storm of the Century") resulted in severe wave action that scoured the beaches along the entire barrier island. The dunes were overtopped, lowering the height of the dunes 15 to 20 feet. It was reported that homes were destroyed or severely damaged in several communities on Fire Island and in the back-bay. In 1996, a Breach Contingency Plan (BCP) was developed to allow for the rapid closure of barrier island breaches by quickly mobilizing federal, state, and municipal resources. The BCP was recommended based on the experiences at Westhampton where severe back-bay flooding was linked to the breach in the barrier island, in which it took 11 months to obtain the necessary approvals to close the breach. The BCP aims to reduce the time and cost to close future breaches. BCP was approved in 1996 and implemented under Advanced Measures (PL 84-99).

In the 2000s the following storms created significant threat to life and property as follows:

- August 10, 2002 — Tropical Storm Cristobal generates rip currents which drown three people on the coast of Long Island.
- September 21, 2003 — Hurricane Isabel affects the state with high winds and flooding. Damage in New York totals to $90 million
- September 6, 2008 — Hurricane Hanna strikes Long Island as a tropical storm with wind gusts of 52 mph (84 km/h) at Shinnecock Inlet.
- August 22, 2009 — Offshore Hurricane Bill causes severe beach erosion and coastal damage on the southern shore of Long Island.

2010's

The most recent major storm events to impact the project area are Hurricane Irene (2011) and Hurricane Sandy (2012). Hurricane Irene caused minor coastal flooding along Fire Island as water levels reached

7.0 feet NAVD 88 at Sandy Hook, NJ. Measured wave heights 15 nautical miles offshore exceeded 25 feet during the peak of the storm.

Hurricane Sandy made landfall near Atlantic City, NJ on October 29th with wind speeds equivalent to a Category 1 hurricane. The orientation of Hurricane Sandy's wind field prior to landfall caused strong winds to blow across the continental shelf towards New York. Because the peak storm surge was in phase with the peak high tide, storm-induced flooding was exacerbated. Hurricane Sandy's unusually large diameter resulted in long fetch lengths generating extreme wave heights at the study area. These three factors (track, timing, and extraordinary size) resulted in record water levels and wave heights in the New York Bight. The maximum water level at Sandy Hook, NJ is estimated to have reached elevation 11.6 feet NAVD88 exceeding the previous record by over 4 feet (USACE, 2013). Further east, at Montauk Point, the maximum water level reached 5.5 feet NAVD88, 1.4 feet less than the previous storm of record (Hurricane Carol in 1954).

A team from the USGS went to Fire Island before and after Hurricane Sandy to survey the beach and assess morphological changes. The following excerpt from their field report provides a summary of the impacts along Fire Island immediately after the storm (USGS, 2012):

"The impacts to the island were extensive. The majority of oceanfront homes in the communities within Fire Island National Seashore were damaged or destroyed. Enormous volumes of sand were carried from the beach and dunes to the central portion of the island, forming large overwash deposits, and the island was breached in multiple locations. With few exceptions, lower-relief dunes were overwashed and flattened. High dunes, which are more commonly found within undeveloped portions of the island, experienced severe erosion and overwash. The elevation of the beach was lowered and the dunes form vertical scarps where they survived."

Similarly, at downtown Montauk severe beach and dune erosion occurred, undermining the structures along "motel row" and exposing the foundations of the Royal Atlantic, Ocean Surf, and Ocean End. Figure 1 and 2 capture the post-Sandy beach conditions at two locations along downtown Montauk, Ocean Beach and Royal Atlantic.

Figure 1: Post-Hurricane Sandy at Ocean Beach Resort

Figure 2: Post-Hurricane Sandy at Royal Atlantic Resort

APPENDIX B
PHYSICAL CONDITONS

Physical Conditions

A general description of the coastal processes that characterize the study area and provide the basis for design and evaluation of storm protection measures are provided in this section.

Winds

Predominant wind directions in the Study Area are from the southwest, west and northwest. Although winds from the southeast are not predominate (less than 25% of all wind occurrences), due to the study area shoreline orientation (159 degrees from north) and the almost unlimited fetch distances to generate waves, they do have a marked influence on the study area coastal processes. Wind speeds are typically less than 27 knots, accounting for approximately 95 percent of all observations. The dominant wind speed range is from 7 to 16 knots, which occurs nearly 49 percent of the time. Wind speeds exceeding 27 knots (strong breeze) are less frequent with a total occurrence of approximately 5 percent (USACE-NAN, DRAFT, 2000).

Astronomical Tides

Astronomical tides on the south shore of Long Island are semi-diurnal, rising and falling twice daily. The tidal range along the ocean shoreline increases from east to west. For example, the average range in the vicinity of Montauk Point is approximately 2 feet (most easterly); while near Fire Island Inlet the range is over 4 feet (most westerly).

Storm Surge

Storm surge is water that is pushed toward the shore by the force of the winds and the decrease in astronomical area pressure during major storms. Water levels rise at the shoreline when the motion of wind driven waters is arrested by the coastal landmass. Two types of storms are of primary significance along the south shore of Long Island: (1) tropical storms which typically impact the New York area from July to October, and (2) extratropical storms which are primarily winter storms occurring from October to March. These storms are often referred to as "nor'easters" due to the predominate direction from which the winds originate.

Hurricanes are the most powerful tropical storms to reach the study area with wind speeds in excess of 74 mph (by NOAA definition). Records indicate 26 hurricanes have impacted the study area in the past century. Nor'easters are less intense than hurricanes, with sustained wind speeds generally less than 57 mph. However, the durations of elevated water levels and waves during nor'easters are generally longer, enhancing the ability of nor'easters to cause coastal damage. Approximately 68 moderate to severe nor'easters have impacted the New York coastal region since 1865.

As a part of the Reformulation Study, the USACE has undertaken a comprehensive evaluation of storm-induced water levels for FIMP. Estimates of storm surge were made using a combination of models including the finite element hydrodynamic model ADCIRC (Advanced CIRCulation model) (Scheffner et al., 1994), the beach, berm, and dune erosion model SBEACH (Larson and Kraus ,1989), and the waves, currents, sediment transport, and morphological evolution modeling system Delft3D (WL | Delft Hydraulics, 2004). The models allow for the simulation of dune erosion, barrier island inundation, and breaching in order to identify the water surface elevations for different storm events and barrier island configurations. The output of these models led to the development of storm surge stage-frequency curves that identify the probability of these storm-

induced water elevations occurring throughout the study area. The impact of open breaches on storm stages was quantified with the hydrodynamic model described above. Modeling results indicate that open breaches result in measurable changes in storm water levels and cause relative increase in the stage frequency curves of 6 to 18 inches.

Sea Level Rise

By definition, sea level rise (SLR) is an increase in the mean level of the ocean. Eustatic sea level rise is a change in global average sea level brought about by an alteration to the volume of the world's oceans. Relative sea level rise takes into consideration the eustatic increases in sea level as well as local land movements of subsidence or lifting. The historic sea level rise rate at NOAA Tidal Station at Sandy Hook, NJ is approximately 0.0126 feet/year or about 1.3 feet/century.

Recent climate research has documented observed global warming for the 20th century and has predicted either continued or accelerated global warming for the 21st century and possibly beyond (IPCC 2013). One impact of continued or accelerated climate warming is continued or accelerated rise of eustatic sea level due to continued thermal expansion of ocean waters and increased volume due to the melting of the Greenland and Antarctic ice masses (IPCC 2013). There are various projections of accelerated sea level rise, from 2.6 feet/century up to almost 5.4 feet/century. A significant increase in relative sea level could result in extensive shoreline erosion and inundation. Higher relative sea level elevates flood levels, and as a result, smaller, more frequent storms could result in flooding equivalent to larger less frequent storms. The more frequent flood events on top of higher sea level may affect more property, resulting in greater damages as sea level increases.

The current guidance (ER 1100-2-8162) from the USACE states that proposed alternatives should be formulated and evaluated for a range of possible future eustatic rates of SLR. Three possible eustatic SLR rates, low, intermediate, and high, are provided in the guidance. These rates of rise correspond to 0.7 ft, 1.3 ft, and 2.7 ft over the 50 year period of analysis for the low, medium and high rates of relative sea level rise.

Currents

The rise and fall of tides is accompanied by the horizontal movement of the water called tidal current. When these waters are channeled through narrow passages such as inlets, the currents can become quite strong, first in one direction as the tide comes in (the flood) and then reversing as the tide falls (the ebb). For the inlets in the study area, the flood and ebb tidal currents generate ebb and flood shoals, which impact sediment bypassing across an inlet (see Inlets, below).

Waves

Waves are the dominant forcing mechanism for most coastal processes along the south shore of Long Island. During storm events, wave impact on beaches that cause erosion of the beach are combined with the increased water level from wave setup, which can lead to overwashing or breach formation. In the study area, significant wave heights, exceeding 3.3 feet occur approximately 25 to 30 percent of the time (USACE-NAN, DRAFT, 2000). Significant wave heights during extreme storm events may exceed 18 feet. The predominant wave period (time between successive wave crests) is between 5 and 9 seconds, which accounts for more than 60 percent of all waves.

Beach Characteristics

Along the study area the grain size distribution of the beach material varies. Typically, grain size increases from west to east, with mean grain size ranging from 0.39 mm to 0.52 mm.

Offshore Sediment Characteristics

The inner continental shelf south and offshore of the study area is characterized by ridge and swale morphology. Surficial sediments are predominantly fine to medium grained sands. Fine-grained sediment outcrops exist in isolated areas of the inner shelf and shoreface. The geology of this area is complex and is characterized by Holocene sediments of variable thickness. These sediments generally consist of either organic-rich muds (backbarrier deposits typically found in the sheltered waters leeward of a barrier island) or modern marine and inlet-filling sands. The area west of Moriches Inlet is typified by a seaward-sloping wedge-shaped deposit of backbarrier sediments underlying marine sand. The maximum thickness of these Holocene sediments is 10 feet along the western portion of Fire Island thinning towards Moriches Inlet.

Since the 1960's, efforts have been undertaken in the study area to identify locations offshore which contain sediment (sand) that would be a suitable source for beach nourishment. This includes considerations for compatibility to native beach grain size, the amount of volume available, environmental considerations, and distance to the project site. Twelve potential offshore sites and seven potential upland source sites were identified as possible sources for the beach nourishment measures.

Shoreline Changes

Historic Shoreline Rate-of-Change (SRC) values in the FIMP study are documented in Gravens et al. (1999), which examined three non-overlapping time intervals using available shoreline data sets. The first period, representative of the epoch prior to significant human influence on the barriers, is 63 years long (1870 to 1933). The second period, representative of initial development on the barriers and the initiation of human intervention with natural processes including inlet stabilization and significant beach fill placements, is approximately 46 years long (1933 to 1979). The third period, representative of modern times and reflecting the most recent beach nourishment practices, is approximately 15 years long (1979 to 1995).

Downtown Montauk is eroding. Observed shoreline changes from 1979 to 1995 (Figure 1) indicate that within the Downtown Montauk Project Area the shoreline is eroding on average by approximately 3 ft/yr (0.9 m/yr).
A separate study by Buonaiuto & Bokuniewicz (2005) evaluated bluff erosion east of Downtown Montauk based on profile surveys collected between 1995 and 2001. The study found that the average rate of bluff recession rate was -1 feet/year over this time period

Recent shoreline changes were evaluated based on LIDAR collected in 2000 and on November 16, 2012 (Post-Hurricane Sandy). A quantitative analysis of the shoreline and dune migration was performed by analyzing the change in the +3 feet NGVD and +11 feet NGVD contours. These contours were selected to characterize the recession of the shoreline and dune. Figure 2 shows the change in position in the +3 feet NGVD and +11 feet NVD contour over the 12 year period. The shoreline experienced an average landward migration of 44 feet or -3.7 feet/year.

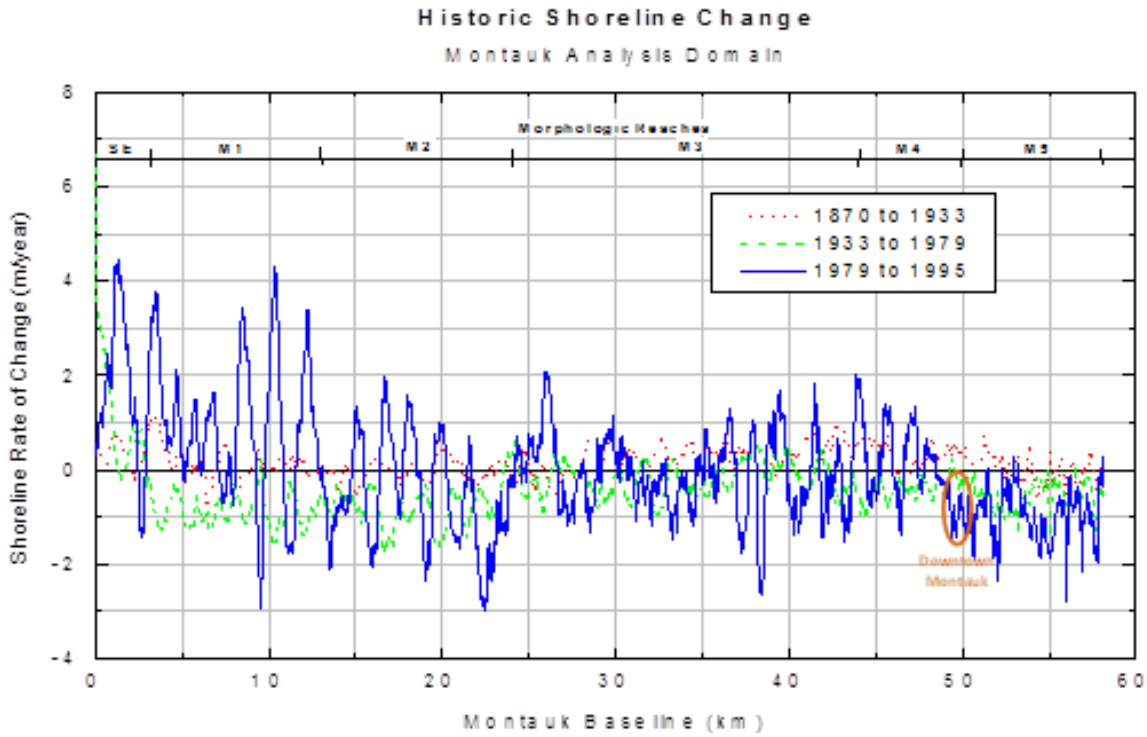

Figure 1: Historic Shoreline Change in Montauk (Gravens et al. 1999)

Based on these observations a background erosion rate of -3 feet/year was selected to characterize the future without-project conditions and applied in the economic analysis.

Existing Shore Protection Activities

There is no history of federal beach nourishment activities at Downtown Montauk. However, local governments and home owners have periodically trucked in sand to stabilized dunes in response to storm events. Available records indicated that in the years 2010 through 2013 beach and dune repairs of this nature were conducted totaling more than $2,200,000.

Sediment Budget

A sediment budget refers to the balance between sediment added to or removed from the coastal system, and is used to reflect the trends in alongshore sediment transport. Coastal erosion is a physical expression of a deficit in the sediment budget where nearshore processes remove more material from the shore than is added.

An existing (c. 2001) conditions sediment budget presenting estimates of volume changes and alongshore sediment transport rates within the FIMP study area were developed. The budget incorporates, to the extent possible, relevant long-term trends identified in previous studies as well as recent changes, including relatively new inlet and shoreline management practices at Shinnecock Inlet and the Westhampton Interim Project.

Overall, this budget shows that there is a gradient in the alongshore sediment transport rates from Montauk Point to Fire Island Inlet. In the Montauk Cell, sediment transport rates increase from 0

to 205,000 cy/yr from Montauk Point to Shinnecock Inlet. This alongshore sediment transport gradient causes a deficit in the sediment budget that is offset by coastal erosion since there is no other source of sediment to the cell.

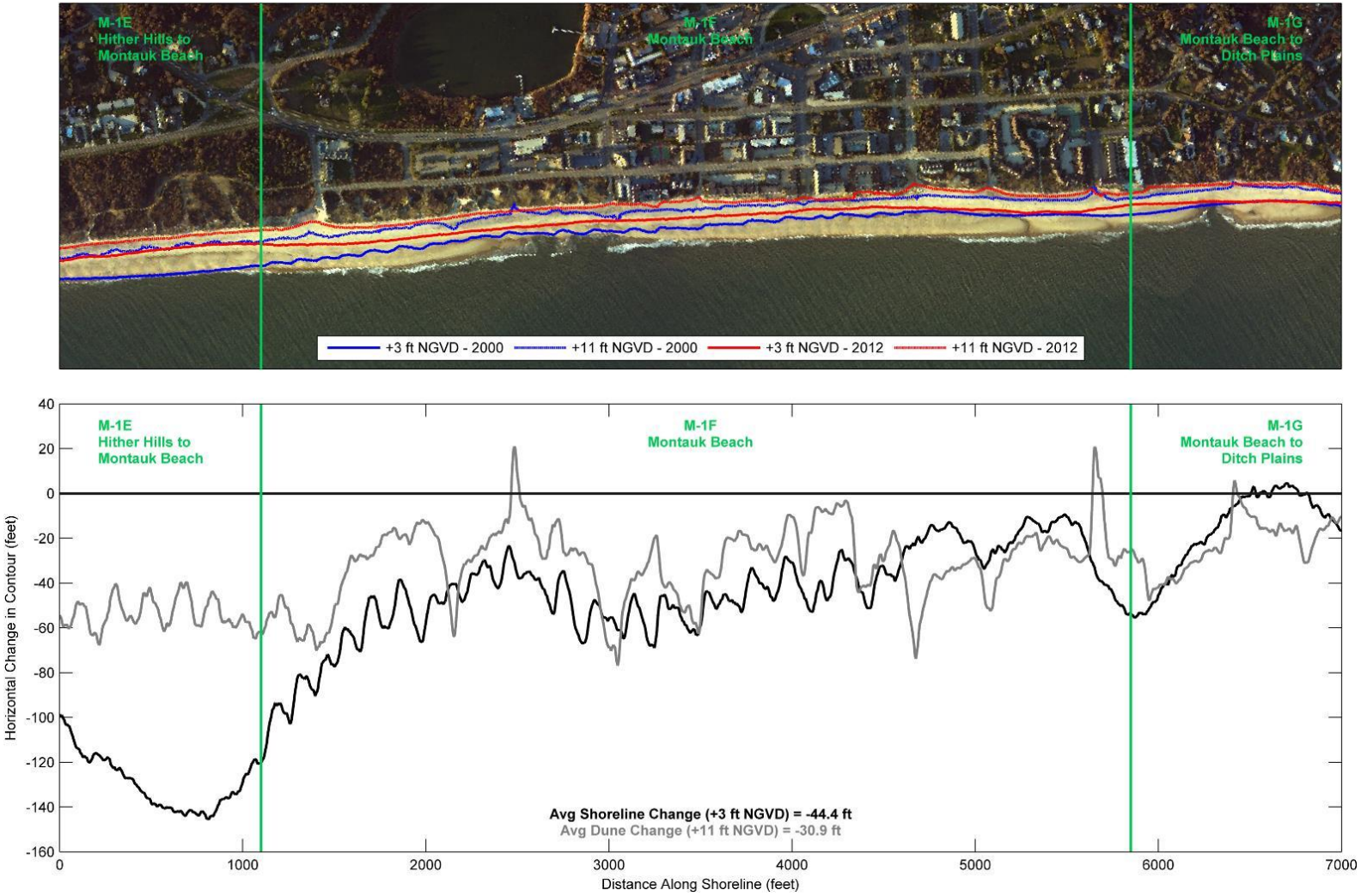

Figure 2: Observed Shoreline Changes at downtown Montauk

Socio-Economic Conditions

According to the U.S. Census Bureau, average for 2008-2012, median household income for the Town of East Hampton was $74,894 compared with $87,778 in Suffolk County. This was not evenly distributed across the Town; median income was $71,312 in Montauk and $112,371 in Northwest Harbor. The census distinguishes for all households and income for various types of family households, and income for non-family households. It is noted that while the median household and family income is more than $10,000 lower in East Hampton than in Suffolk County, the per capita income is higher. The higher per capita income is likely the result of the higher wages earned by a smaller segment the East Hampton population that skews the average per capita income as well as the fact that children under 18 make up a smaller percent of the population in East Hampton than in Suffolk County.

In Montauk Village, the occupation category with the highest percentage of workers was management, professional and related occupations; 31.1 percent of the employed population, 24.0 percent of the Montauk workforce occupied sales and office positions, 26.5 percent worked in service occupations and 14.6 percent had natural resources, construction, and maintenance occupations. Production, transportation and material moving occupations accounted for 3.7 percent of the employed population. As in Montauk, Countywide the management, professional and related occupations (37.8%); sales and office occupations (26.4%), and service occupations (17.1%) had the highest percentage of workers.

Table 1: Per Capita and Family Income

Place	Median Household Income ($)	Median Family Income ($)	Per Capita Income ($)	Percent of Households With Income $200,000 +	Percent of Families Below Poverty Level
East Hampton Town	74,894	90,990	50,377	12.5	4.7
Amagansett CDP	76,346	121,607	60,743	20.2	2.8
East Hampton Village	79,542	88,207	96,189	23.7	6.8
East Hampton North CDP	50,325	70,952	42,005	8.5	11.2
Montauk CDP	71,312	79,495	44,905	7.8	3.9
Napeague CDP	78,958	79,792	40,463	13.0	0.0
Northwest Harbor CDP	94,216	112,371	64,236	16.6	0.0
Sag Harbor Village	91,004	129,432	66,847	15.6	1.9
Springs CDP	72,557	88,667	39,348	15.1	6.3
Wainscott CDP	81,875	81,667	51,428	13.3	6.0
Suffolk County	87,778	100,179	36,819	10.5	4.1

Montauk residents are generally well educated; 48.5 percent of the population 25 years old and older have an Associate's degree or higher and another 15.7 percent have some college education. Countywide, 41.7 percent of this segment of the population have an Associate's degree or higher.

Some people in Montauk have a very low income, a fact that is not necessarily obvious from looking only at median income figures. Approximately 3.9 percent of families in Montauk live below the poverty level, as compared to 4.1 percent Countywide. The poverty level is defined according to the number of people per household, the number of children per household and other factors; the weighted average poverty threshold for a 4-person family (including two infer the age of 18) in 2013 was an income of $23,624. About 9 percent of the total population of Montauk have an income below poverty level, compared to 6 percent in Suffolk County. The percent of households with incomes over $200,000 is comparatively less in Montauk than Countywide, reflecting less affluence Montauk than in the County in general. Living on a low income in Montauk is particularly difficult as there is limited public transportation and the cost of housing is extremely high.

Downtown Montauk is the major business area in the Study Area. The town is divided by Montauk Highway and extends south to the Atlantic Ocean. There are wide variety of year-round commercial establishments in addition to the seasonal motels and resort units. The business district includes supermarkets, banks, clothing stores, gas stations, restaurants, bars, pharmacies, repair shops and other establishments traditionally found in business centers. Institutional facilities, including churches and a library, are located along Montauk Highway in the eastern portion of the business district. A municipal ball field complex borders the northern portion of the downtown area. The downtown area is laid out in a grid of 40 foot by 100 foot lots separated by wide public roads and alleyways.

Problem Identification

This section describes the shorefront and back bay conditions in greater detail to more effectively characterize the relative risk to storm damages that have been accounted for in the project modeling. It is noted here that the back bay conditions were not considered in the Downtown Montauk Stabilization Project since the Project Area does not include any of the three major bays (Great South Bay, Moriches Bay, and Shinnecock Bay). However, the overall FIMP study does consider back bay conditions.

1. Topography. Extensive information is available to characterize the existing topography along the Atlantic Ocean shoreline and along the back bay area. The topography of the shorefront can be characterized by the dune conditions (dune height, width, and volume), and the beach conditions (beach berm height, width, and slope), The back bay environment is more characterized by the overall elevation within the floodplain.

The shorefront conditions along the study area are quite variable. Changes in the beach and dune are reflected in seasonal changes, storm induced changes, human induced changes, and changes that can occur due to shoreline undulations linked to very site specific variations in the nearshore conditions.

To account for this variability over time, the study considers a range of conditions, from a baseline condition to a future vulnerable condition. A September 2000 topographic survey was used to establish a baseline condition. This topography served as the basis for the various modeling efforts undertaken to characterize the response to storm events. This September 2000 condition, however, only represents one condition that could exist within the project area. In fact, the September 2000 conditions represent a beach which is relatively wide and a dune condition which is relatively high and wide. In order to characterize the storm response under a range of future conditions, another topographic condition was established, which is called a “future vulnerable condition”. The future vulnerable condition is a condition derived from past survey information and a projection of future trends. It is intended to represent a more vulnerable condition. The future vulnerable condition was developed to be similar in nature to conditions that existed in the mid-90’s, except that ongoing fill actions which are identified as

likely to occur in the future, such as the Westhampton Interim Project. The post-Sandy condition in many instances is now equal to this future vulnerable condition.

Along the backbay shoreline, the topography is more stable. Since the area is gently sloping, it is difficult to characterize the area relative to its topography. Instead, the relative heights of the backbay area are described in the next section which provides a description of the floodplain.

2. Existing Coastal Structures and Expected Future Response. As discussed in the existing conditions and w/o project conditions section, there are a number of beachfill projects and coastal structures in the study area. There is also a history of local beachfill efforts, which is expected to continue in the future. These existing projects and expected future activities significantly affect conditions that are likely to occur in the future. In areas where fill projects have occurred and are likely to occur in the future, it is expected that there is a limit to how degraded the shoreline conditions will become. It is also necessary to consider the long-term erosional trends that would likely occur with these projects in place and whether or not there is an existing coastal structure, or beachfill project that would likely occur in the future.

3. Long-Term Erosional Trends. Long-term erosional trends are those conditions which are due to differences in long-shore transport rates, physical conditions, or constructed features which impact long-shore transport. The long-term erosional trends are essential when assessing the long-term changes that are likely to occur in a given area, and whether the area is erosional, stable, or accreting.

4. Shoreline Undulations. Shoreline undulations, in contrast to long-term erosion trends, are an erosional signature apparent to different degrees along the study area that are short-term in nature and somewhat ephemeral. Shoreline undulations are also referred to as “circulation cells”, and “erosional hot spots”. The exact cause of these shoreline undulations is unknown, but it is assumed that there is a correlation between the condition of the nearshore bar, and the localized erosion. Analysis has been undertaken to evaluate historic shorelines to identify locations where these undulations are likely to occur, and the likely magnitude of these shoreline undulations.

These analyses show that the undulations tend to form and migrate alongshore for a distance before disappearing. Although it appears that some areas are more prone to these undulations, analysis of the undulations indicates that they could occur anywhere along the shoreline. For purposes of analyses, it has been assumed that the undulations can occur anywhere, and are likely to range in size between 1 and 2 km in length (0.6 miles to 1.2 miles). The landward and seaward amplitude of the undulations were quantified as 16 meters (52 feet). It is important to note that in the analyses, it is assumed that locations which are experiencing accelerated erosion due to the presence of existing coastal structures are not subject to erosional undulations.

5. Sea Level Rise. Sea level rise is a critical factor when evaluating future impacts. For purposes of this analysis, an estimate for future sea level rise based upon the historical rate of change for the gage at Sandy Hook has been used. To reflect the fact that a significant degree of uncertainty surrounds the selection of a rate of sea level rise for use in this analysis, all modeling exercises allow variation of the rate of sea level rise from simulation to simulation, with the final results incorporating the average affects of sea level rise over many simulations. Based on the Sandy Hook gage, the most likely rate of sea level rise in the study area is estimated to be 0.127 feet per year, and that the sea level rise follows a log-normal probability distribution with a standard deviation of 0.0006 feet per year. It is acknowledged that the assumed most likely rate is a conservative estimate for purposes of alternative analysis, and may understate without-project damages and with-project benefits.

Overview of the Modeling Approach

This section provides an overview of the specific hydrodynamics of the study area. To orient the reader, the following paragraphs summarize the modeling efforts undertaken for this study, including an overview of the hydrodynamic modeling and the estimation of frequency relationships.

Storm-surge numerical modeling

Storm-surge numerical modeling was performed to produce peak storm water levels at 49 locations across the entire FIMP study area. These 49 locations were selected to capture the variability in storm water levels along the open coast and within the three bays. The storm-surge numerical modeling strategy for FIMP addressed a comprehensive list of physical processes (wind conditions, barometric pressure, astronomic tide, wave conditions, morphologic response, [namely barrier island overwash and breaching], and localized wind and wave setup) by merging hydrodynamic, wave, and sediment transport models. The integration of these modeling efforts is shown below. Each component shown is described below in Figure 3.

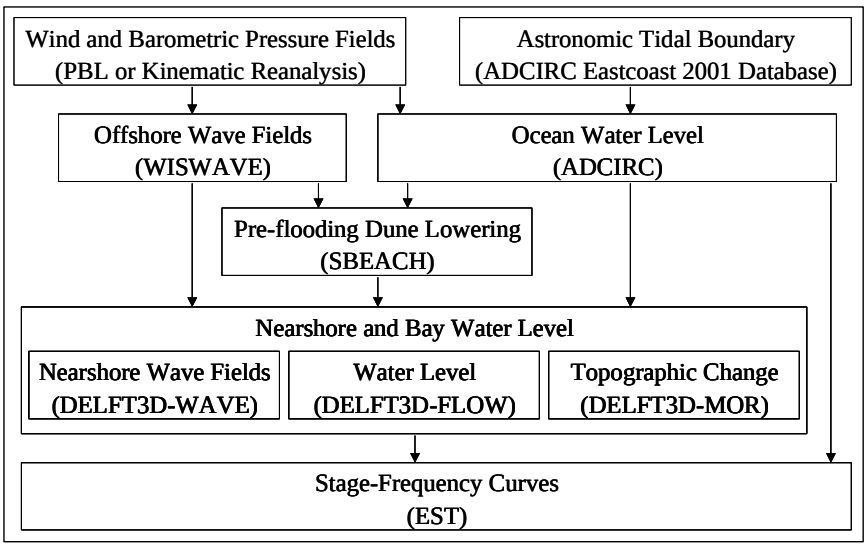

Figure 3. FIMP storm water level modeling and stage-frequency methodology

The six numerical models were applied to accomplish specific requirements for the study, as described below:

1. A Planetary Boundary Layer (PBL) model for wind field simulation was used to develop wind and pressure fields for tropical storms. (Thompson and Cardone, 1996).

2. An Interactive Kinematic Objective Analysis (IKOA) for wind field simulation was used to develop extratropical wind fields through data assimilation, based upon the National Center for Environmental Prediction (NCEP) database.

3. The offshore extreme storm wave conditions were generated using WISWAVE (also WAVAD) (Resio, 1981) a second generation, directional spectral wave model. WISWAVE output was used as input for the DELFT3D modeling and for SBEACH.

4. ADCIRC was used to simulate the ocean and nearshore (outside the surf zone) storm water levels (Luettich et al., 1992). ADCIRC is a long-wave hydrodynamic finite-element model that simulates water surface elevations and currents from astronomic tides, wind, and barometric pressure by solving the two-dimensional, depth-integrated momentum and continuity equations. The grid resolution varies from very coarse at the open ocean boundaries to 50-m in some nearshore locations. ADCIRC was forced with the winds and barometric pressure fields from 1 and 2 above, to capture meteorological effects on water levels, in conjunction with astronomic tidal constituents from the ADCIRC East Coast 2001 Tidal Constituent Database.

5. SBEACH was used for the hydrodynamic modeling, and separately to evaluate the shorefront response for the design and evaluation of beachfill alternatives. In the context of the hydrodynamic modeling, SBEACH was applied to estimate dune lowering that occurred prior to a dune being overtopped. SBEACH (Larson and Kraus 1989a; Larson, Kraus, and Byrnes 1990) is a numerical model for predicting beach, berm, and dune erosion due to storm waves and water levels. SBEACH is an empirically-based model of beach profile change developed to replicate dynamics of dune and berm erosion using standard data (topography, beach profiles, etc.) available in most engineering applications. In model simulations, the beach profile progresses to an equilibrium state as a function of the initial profile condition (including median grain size and shoreward boundary conditions) and storm conditions (wave height, period, and direction; wind speed and direction; and water level). The model predicts profile response to storms including wave overtopping and dune lowering (Kraus and Wise 1993, Wise and Kraus 1993). For storm surge modeling, SBEACH storm simulations were performed for more than 200 beach profiles cut from the 2000 lidar topography. Dune crest elevation change just prior to inundation was extracted from the SBEACH simulation results and put into the DELFT3D topography grid to improve estimates of potential breaching and overwash processes.

6. The DELFT3D Modeling Suite (FLOW, WAVE, MOR) was used to compute the bay water levels under storm conditions, taking into account the contribution of storm surge, waves, winds and the contribution of overwash and/or breaching.

a. The DELFT3D-FLOW applied for this study simulates water level and currents from tidal, meteorological, and wave forcing by solving a two-dimensional depth-integrated flow and transport phenomena. The grid for this study extended from East Rockaway Inlet eastward to the east side of Shinnecock Bay. The model grid includes Great South, Moriches, and Shinnecock Bays, and their inlets, and extends up to 5 km from across the nearshore, with variable resolution. DELFT3D-FLOW was forced along its offshore boundary with water level time series from ADCIRC, throughout its domain with the storm wind and pressure fields, and with wave radiation stress fields.

b. The stationary wave model HISWA (DELFT3D-WAVE) was used to compute nearshore wave climate and resulting surf-zone radiation stresses (Holthuijsen et al., 1989). HISWA is a second generation wave model that computes wave propagation; wave generation by wind; non-linear wave-wave interactions and dissipation for a given bottom topography; and stationary wind, water level, and current field in waters of deep, intermediate and finite depth.

HISWA wave computations are carried out on a rectangular grid. A nested grid approach was also used for nearshore wave modeling and spans from East Rockaway Inlet to Montauk Point. The offshore grid was forced on its offshore boundary with significant wave height, peak period, and mean wave direction, input from the WISWAVE simulations, for each hourly input condition. The HISWA model has a dynamic interaction with DELFT3D-FLOW (i.e. two way wave-current interaction), which accounts for the effect of waves on currents and the effect of flow on waves, including wave setup, which allows for direct simulation of the impacts of wave setup on hydrodynamics, specifically water level at the coastline and in the estuarial bays.

c. The morphological changes, namely barrier island overwash and breaching, were simulated using DELFT3D-MOR. Three-dimensional transport of suspended sediment is calculated in DELFT3D by solving the three-dimensional advection-diffusion (mass-balance) equation for the suspended sediment. The local flow velocities and eddy diffusivities are based on the results of the hydrodynamic computations. Computationally, the three-dimensional transport of sediment is computed in exactly the same way as the transport of any other conservative constituent, such as salinity and heat. For the transport of non-cohesive sediment the Van Rijn (1993) formulation is used, which accounts for the effect of waves. Based on these sediment transport calculations, the elevation of the bed is dynamically updated at each computational time-step.

Collectively, these models simulate the impact that each modeled storm has on ocean and bay water elevations, lowering of the dune during the storm, and the morphological response due to a storm. The outputs from these models were input into a statistical modeling tool to estimate the likelihood of storm occurrence. The output from this analysis is presented in this report to represent the likelihood of various storm effects.

Stage Frequency Methodology

The Empirical Simulation Techniques (EST) was applied to generate stage frequency curves. EST are a group of nonparametric methods for proceeding directly from hydrometeorological storm data to simulations of future storm activity and coastal impact, without introducing parametric assumptions concerning the probability law formulas and related parameters of the data (Scheffner *et al.*, 1999).

Two EST procedures, one univariate (1-D) and the other multivariate, were used in the FIMP studies. The 1-D EST methodology, using water level as the one dimension, was employed for stage-frequency development for the FIMP study. The multivariate EST was used in conjunction with SBEACH for modeling of beach profile response and estimation of storm-induced coastal changes, which is used to evaluate the beach and dune impacts for purpose of design and evaluation. (see Gravens *et al*., 1999).

For the FIMP study, the 1-D EST methodology was applied in a manner to account for the likelihood that historic storms could impact the areas at any tide condition. In order to apply this approach, 21 additional alternate tide events were run, to provide an improved estimate of the storm effects under different tide conditions. Along the open coast, the total surge generally can be added to the various tide conditions to develop the total surge effect, however, due to the complicated hydrodynamics of flows through the inlets and over the barrier island ,this approach does not work well within the bays,. With the inclusion of these alternate tide scenarios, final stage-frequency curves were generated to represent stage frequency relationships for the study area, at the 49 locations output from the model.

Storms and Ocean Storm Induced Water Level

Storms are the major drivers for storm damage within the study area. The modeling efforts have been undertaken to characterize likely storm activity in the future, and the storm response that can be expected in the future, under different topographic conditions. The basis for our modeling effort in this study assumes that storms will occur in a manner similar to what has occurred in the past. Historic storms (as shown in Table 2) were used to develop statistics on storm recurrence, and the corresponding estimates of storm frequency, and the estimates of stage frequency. Table 3 shows stage-frequency relationships along the Atlantic Ocean illustrative of downtown Montauk project area. Two sets of elevations are shown on the table: the storm water level alone, and the water elevation including the storm water level plus wave setup. The storm water level value is an elevation which is determined based upon procedures described

above. This storm water level value is not representative of what an observer would see if standing on the beach.

In addition to the storm water level, there is an additional increase in water elevation due to wave setup, where the breaking of waves results in a localized increase in the water surface elevation along the coast. This value of storm water level, plus setup is what is shown as the higher elevation on this curve. Wave setup is a component of the water elevation which is difficult to quantify, and which can be variable depending upon the specific site conditions. As shown in the figure, wave setup adds an additional 2 to 3 feet of water to the storm water height under the conditions evaluated.

It is important to note that the combination of surge plus setup is intended to be representative of the still water elevation along the shoreline. To replicate conditions that would be representative of what an observer would see during a storm, one would also have to include the amount of wave runup which occurs. The amount of wave runup that occurs can be characterized as the average amount of runup, or the extreme amount of runup that occurs. These runup values are not directly used in the design and evaluation of alternatives, and are not presented here.

Table 2: Historic Storms Modeled for FIMP

Tropical Events (1930 – 2001)			**Extratropical Events (1950 – 1998)**	
Name	**Start Date**	**Duration (hrs)**	**Start Date**	**Duration (hrs)**
not named	10-Sep-1938	15	22-Nov-1950	34
not named	9-Sep-1944	10	04-Nov-1953	26
Carol	25-Aug-1954	5	11-Oct-1955	43
Edna	2-Sep-1954	7	25-Sep-1956	34
Hazel	5-Oct-1954	6	03-Mar-1962	56
Connie	3-Aug-1955	0	05-Nov-1977	28
Donna	29-Aug-1960	13	17-Jan-1978	16
Esther	10-Sep-1961	14	04-Feb-1978	27
Doria	20-Aug-1971	2	22-Jan-1979	19
Agnes	14-Jun-1972	18	22-Oct-1980	17
Belle	6-Aug-1976	7	26-Mar-1984	31
Gloria	16-Sep-1985	5	09-Feb-1985	17
Bob	16-Aug-1991	4	28-Oct-1991	50
Floyd	7-Sep-1999	3	01-Jan-1992	18
			08-Dec-1992	78
			02-Mar-1993	12
			10-Mar-1993	25
			28-Feb-1994	22
			21-Dec-1994	23
			05-Jan-1996	25
			6-Oct-1996	12
			02-Feb-1998	24

Table 3: Stage-frequency relationships with and without wave setup for downtown Montauk

Return Period (years)	Without Wave Setup[1] Feet (NGVD)	With Wave Setup[2] Feet (NGVD)
2	3.8	4.5
10	5.4	7.5
25	6.6	9.4
50	7.8	11.4
100	9.4	14.2
500	12.1	19.1

Notes: [1]Stage frequency relationships derived from ADCIRC Modeling Results and 1-D EST (Station 39, Ditch Plains)
[2]Includes wave setup from Multivariate EST

Erosion Response

The storm parameters were used as input in a variety of coastal engineering models to characterize the erosion response for various topographic conditions. The Corps model SBEACH was applied to characterize the erosional response along the ocean shoreline. Characterization of the erosional response of a dune and beach and the impacts to existing development requires consideration of several important factors. These factors include These factors include:

- Erosion Distance – distance from the shoreline (+) NGVD) on the in initial beach profile to the landward-most point of 1 foot of vertical accretion or erosion that occurs during a storm.
- Vertical Erosion of Dune Crest - amount of dune lowering that occurs during a storm.
- Recession of 0 ft NGVD - landward translation of the 0 ft NGVD contour that occurs during a storm.
- Recession of 10 ft NGVD - landward translation of the 10 ft contour that occurs during a storm.

Figures 4 to 7 illustrate the erosional response for a typical location along the project area in downtown Montauk.

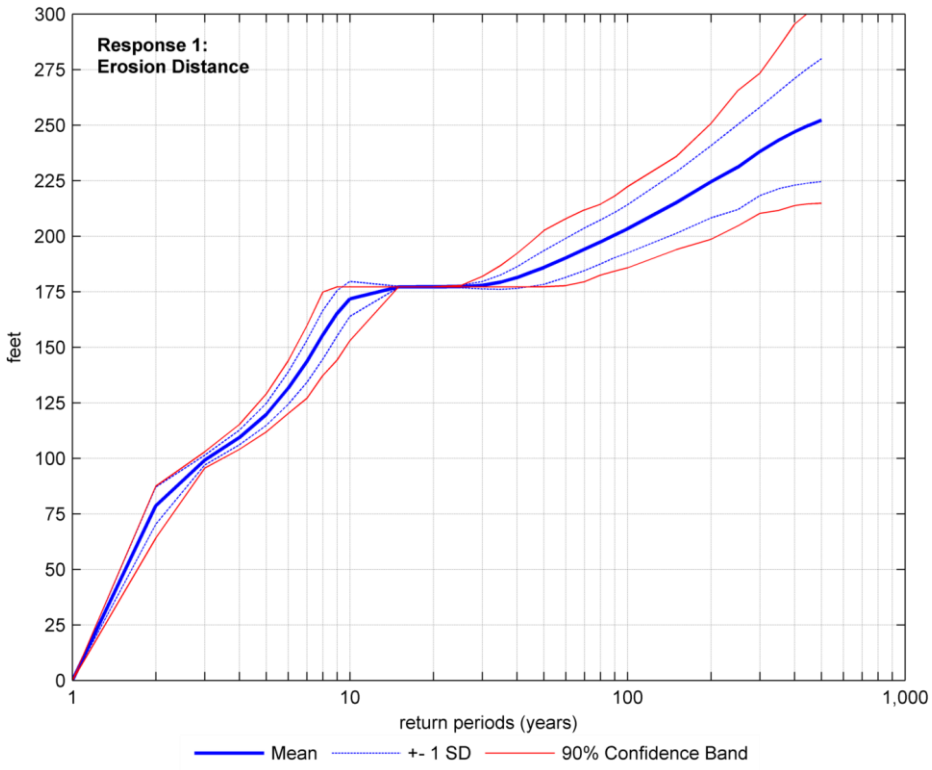

Figure 4: Erosion distance vs. frequency for downtown Montauk

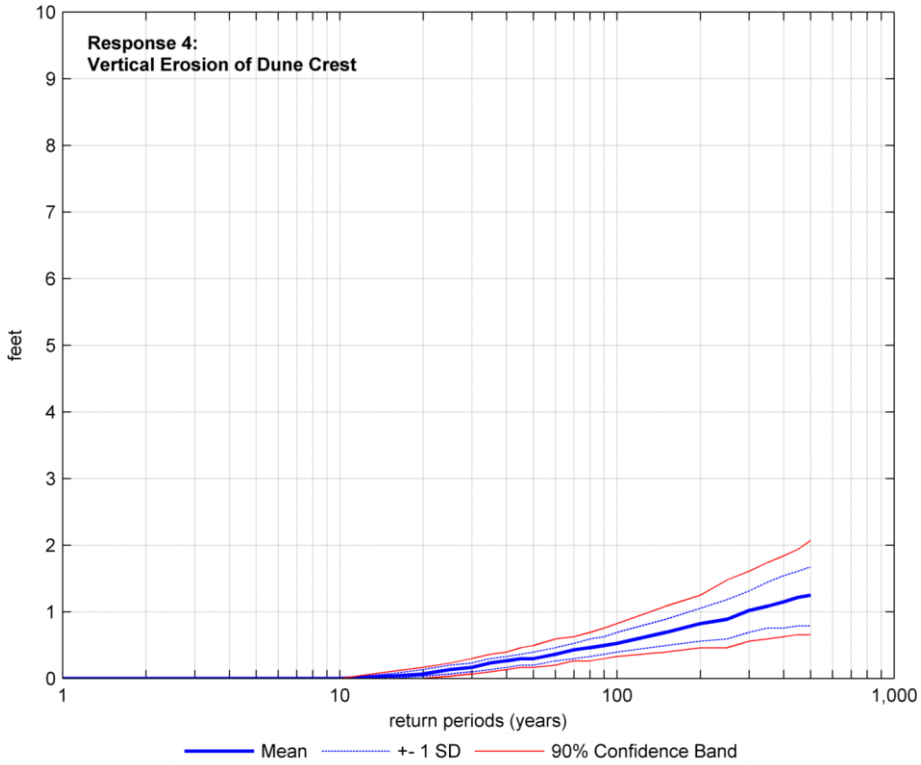

Figure 5: Vertical erosion of dune crest vs. frequency for downtown Montauk

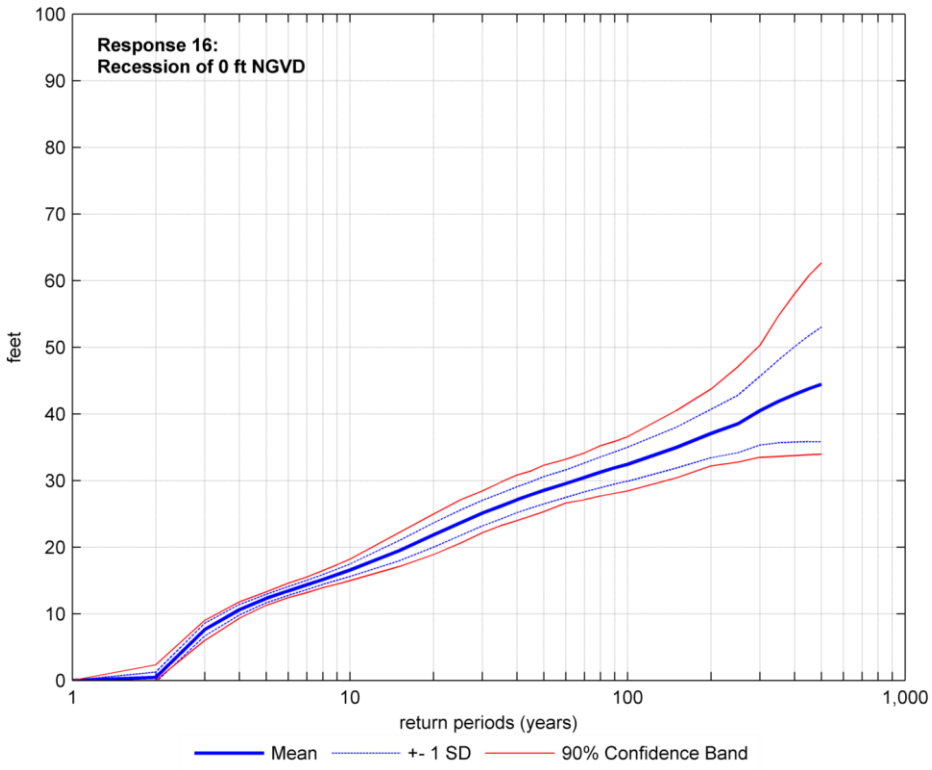

Figure 6: Recession of 0-ft NGVD29 elevation vs. frequency for downtown Montauk

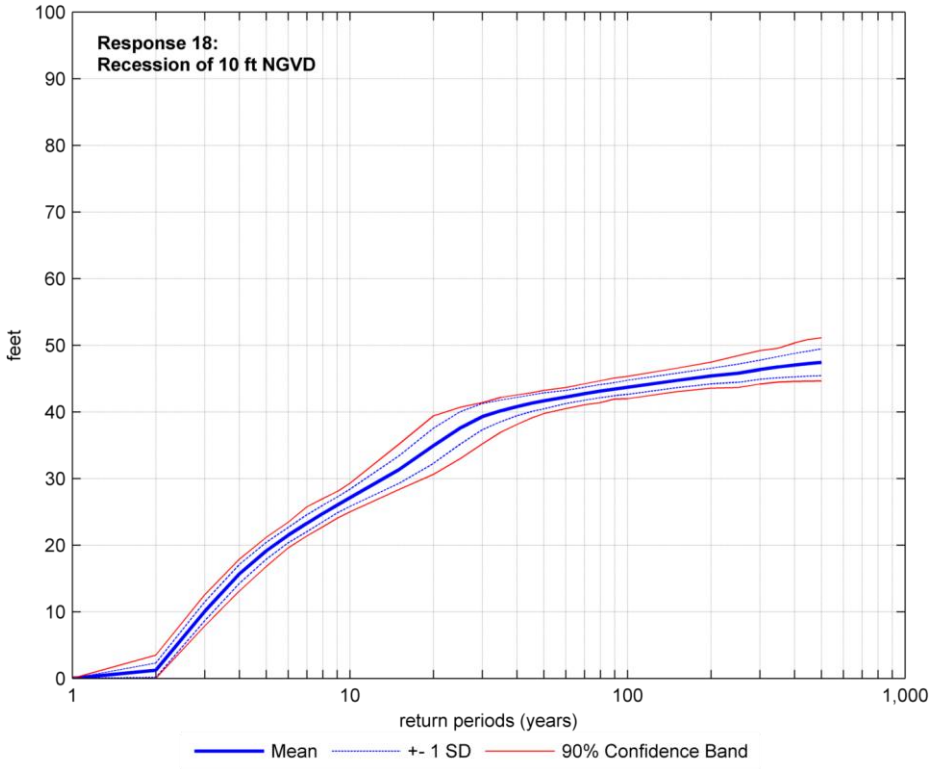

Figure 7: Recession of 10-ft NGVD29 elevation vs. frequency for downtown Montauk

Post-Storm Recovery

It is important to note that the SBEACH modeling, described above captures the erosion which occurs during a storm event. What has been observed to occur is, immediately after a storm event, beaches tend to begin to recover when long-period waves move the sand from the nearshore back onto the beach. When determining how the study area evolves over time, it is important to estimate the amount of recovery expected in an area. The amount of recovery, expressed as a percentage of the volume lost, depends upon a number of factors, including the sediment budget.

The estimated amount of beach recovery has been established for various shoreline locations. These recovery amounts have been developed in order to match the long-term erosional trends for each location, and establish whether the area is erosional, stable or accreting in the long-term.

Lifecycle Considerations

The information summarized above has been used as key inputs into a lifecycle model, which has been developed specifically to estimate the shorefront storm damages that are likely to occur in downtown Montauk in the future. Because the damage may change over time in response to shoreline change, sea level rise, and storm impacts, the analysis of damage considers various sequences of storms over the period of analysis.

The lifecycle model uses the stage-frequency relationship (with setup) presented in Table 3 and the recession-frequency relationship in Figure 7 to simulate the increasing vulnerability of the shorefront structures during a series of lifecycles. Key variables are subject to uncertainty, in compliance with current USACE guidelines. In addition to the stage- and erosion-frequency relationships above, the baseline model also incorporates the historic sea level rise rate of 0.0126 feet/year and a background (non-storm) shoreline change rate of -3 feet/year.

The results of this model indicate that the risk of storm damages to structures in the shorefront area of downtown Montauk will increase in the future due to the combined impacts of sea level rise, storms, and shoreline erosion.

APPENDIX C

PLAN SHEETS

DRAFT

- 10 foot Buffer
- Landward Limit of Fill
- Dune Crest
- Dune Toe
- Berm Crest
- Berm Toe
- Geobag Footprint
- MHW
- OSI Survey Monuments
- OSI Survey
- CEHA

N

0 50 100 200 Feet

Notes

1) Aerial Imagery collected by NOAA on November 14, 2012, as part of "Hurricane Sandy: Rapid Response Imagery of the Surrounding Regions".
2) Landward Limit of Fill is based on profile surveys collected by OSI on October 17, 2013.

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NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

DRAWING TITLE:

Montauk
Dune Reinforcement

PLATE NO.
001

DATE:

FILE NAME:
Montauk Alternative 4.mxd

DRAFT

- 10 foot Buffer
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N

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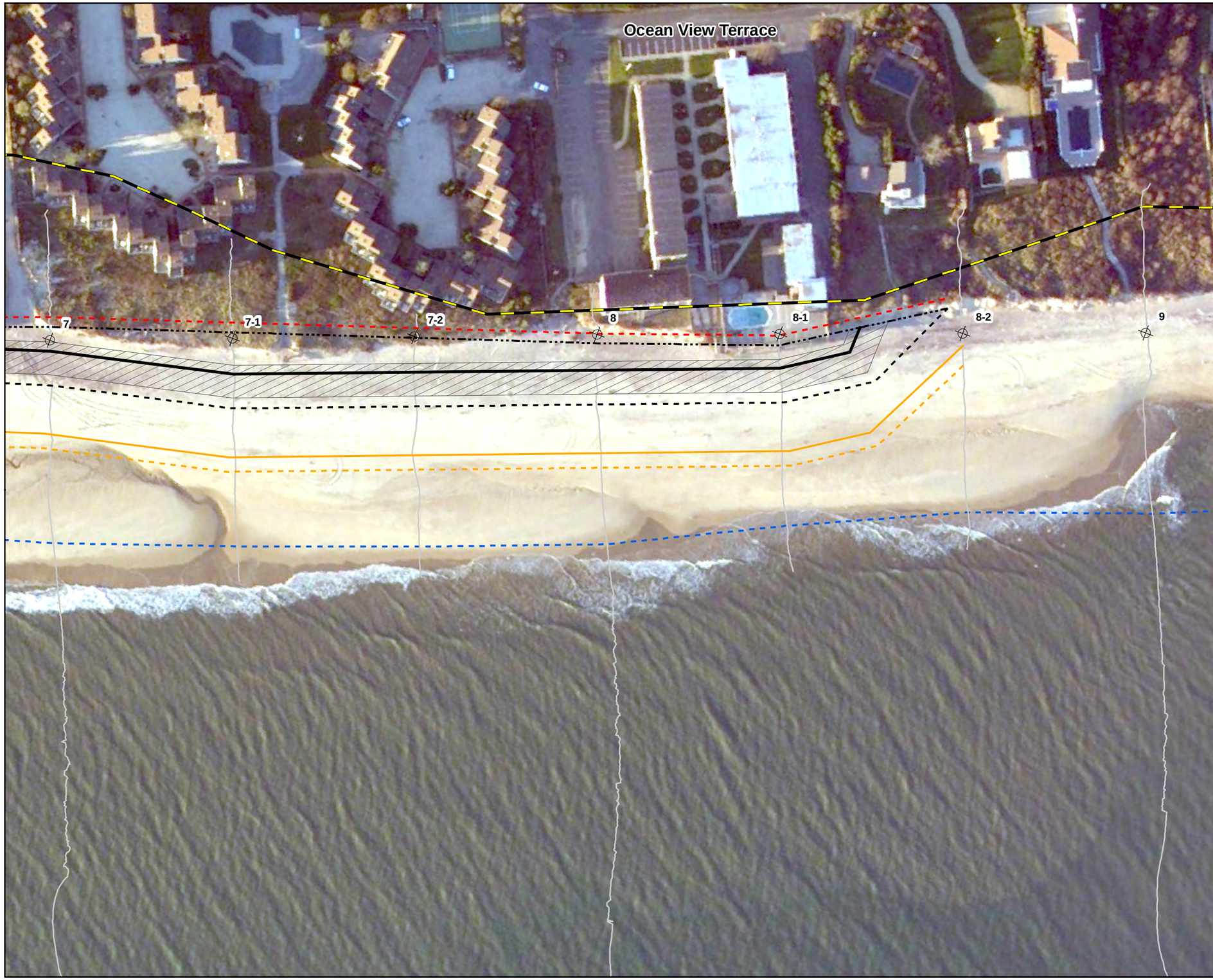
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

DRAWING TITLE:

Montauk
Dune Reinforcement

DATE:	FILE NAME:	PLATE NO.
	Montauk Alternative 4.mxd	002



DRAFT

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- Landward Limit of Fill
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N

0 50 100 200 Feet

Notes

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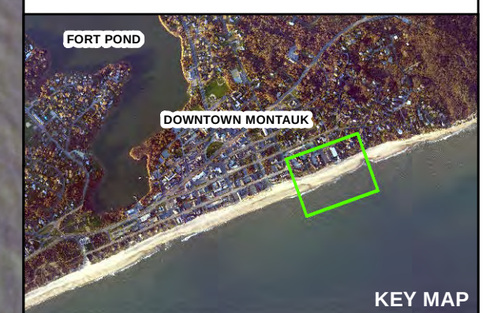

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NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

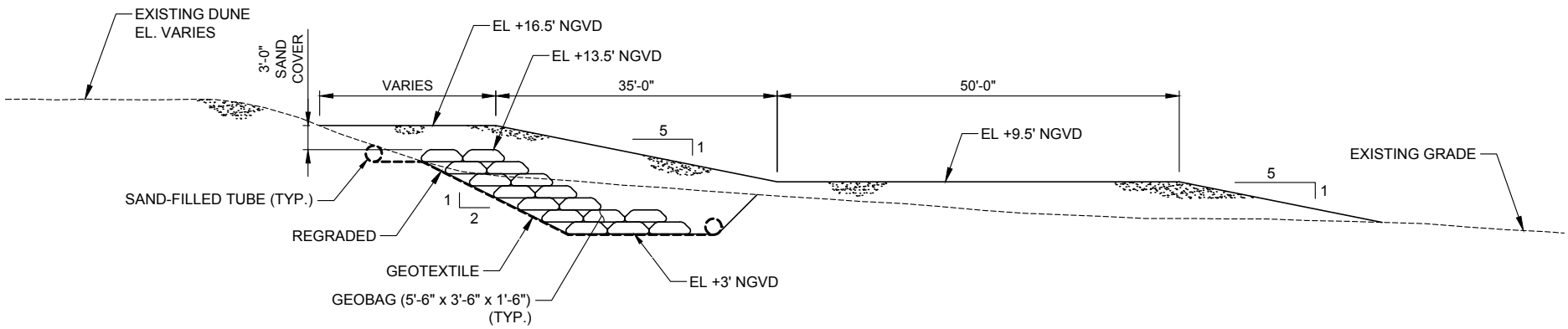
DRAWING TITLE:

Montauk
Dune Reinforcement

PLATE NO. **003**

DATE:

FILE NAME: Montauk Alternative 4.mxd



TYPICAL REINFORCED DUNE SECTION

SCALE: 1" = 20'-0"

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NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

TYPICAL REINFORCED DUNE SECTION

DRAWING TITLE:

SHEET 1

10' 0' 10' 20'

SCALE: 1"=20'

JUNE/10/2014	TYPICAL SECTION - REINFORCED DUNE.dwg	PLATE NO.

DOWNTOWN MONTAUK

DOWNTOWN MONTAUK STABILIZATION PROJECT

HURRICANE SANDY LIMITED REEVALUATION REPORT

Evaluation of a Stabilization Plan for Coastal Storm Risk Management in Response to Hurricane Sandy
&
Public Law 113-2

BACK-UP CALCULATIONS APPENDIX

U.S. ARMY CORPS OF ENGINEERS

New York District

August 2014

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1.0 INTRODUCTION

This appendix provides additional "back-up" documentation regarding the historical beach evolution at downtown Montauk, with-project erosion rates and beach replenishment volumes, feasibility level cost estimates for the five alternatives, details of the operations and maintenance cost estimate and construction schedule for the selected alternative.

2.0 BEACH EVOLUTION

2.1 Historical Sediment Budget at downtown Montauk

An Existing Conditions (c. 2001) sediment budget was developed for the entire FIMP study area (USACE-NAN 2007). Downtown Montauk is located at the eastern end of sediment budget cell M4, which includes Hither Hills State Park as well. The existing conditions sediment budget indicates that this cell is relatively stable from 1995 to 2001. However, the observed shoreline changes from 1979 to 1995 (Figure 1) indicate that within the Downtown Montauk Project Area the shoreline eroded on average by approximately 3 ft/yr (0.9 m/yr). In addition, subaerial morphological changes derived from LIDAR measurements collected in 2000 and Nov. 16 2012 indicate that downtown Beach experienced significant beach (-3.7 ft/yr) and dune erosion over this time period.

In light of these observations a background erosion rate of -3 ft/yr is selected for the Project Area.

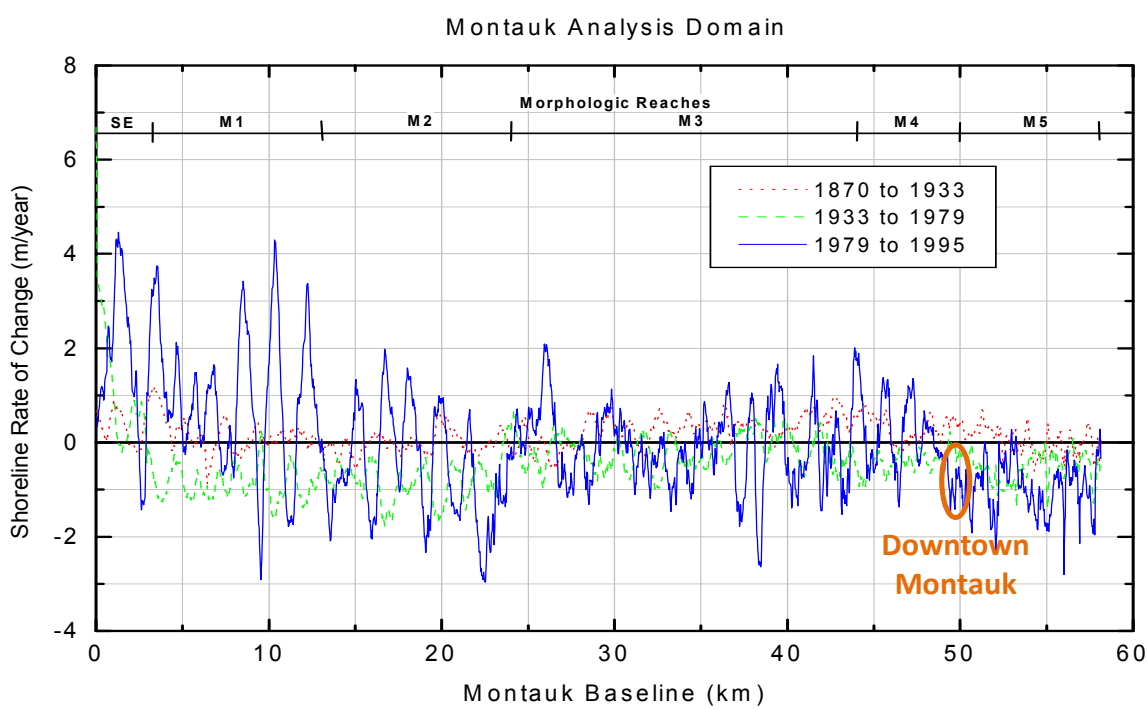


Figure 1: Historic Shoreline Change in Montauk (Gravens et al. 1999)

2.2 Profile Observations at downtown Montauk (1995-2012)

Initiated in 1995, the Atlantic Coast of New York Monitoring Program (ACNYMP), a cooperative effort of the New York State Department of State, U.S. Army Corps of Engineers' New York District and New York Sea Grant, has been collecting information and data on beach changes and coastal processes for the 135-mile stretch of shoreline between Coney Island and Montauk Point. One ACNYMP station, M-34, is located in downtown Montauk and captures the general profile evolution from 1995 to 2002 (Figure 2). Two additional profile lines were added to Figure 2 based extracted from LIDAR data (2012-11-14) and a beach profile survey conducted by Ocean Survey Inc. in August 2013 at the same profile origin (M-34).

The profile surveys show that significant dune erosion has occurred at M-34 since 1995. From 1995 to 2002 the crest elevation and location of the dune crest was relatively stable. Some dune scarping is captured by the 2002-03-09 ACNYMP profile survey (dark red). The two post-Sandy profile surveys (2012-11-14 and 2013-09-17) indicate that the crest elevation of the dune has been lowered and shifted landward. It is unclear from the available profile observations how much dune erosion occurred during Hurricane Sandy and much dune erosion occurred to more typical storm events between 2002 and 2012. The dune recovery observed in the OSI survey (2013-09-17) is attributed to dune repairs by local interest in response to Hurricane Sandy.

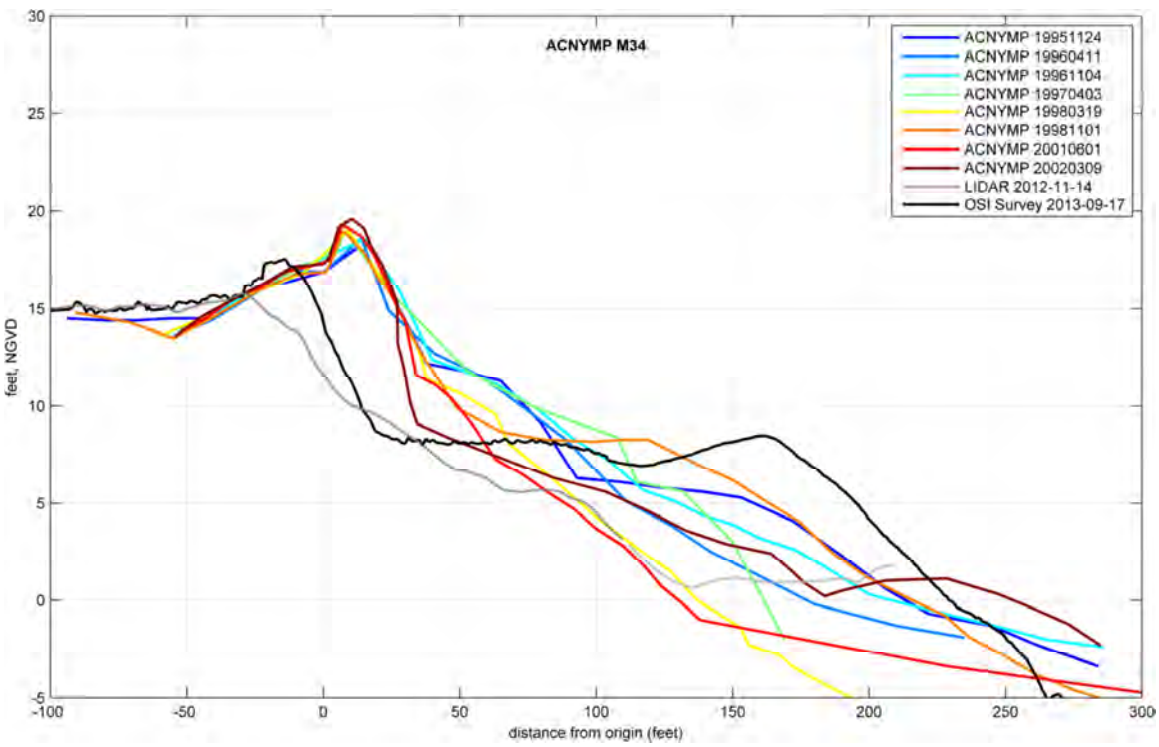


Figure 2: 18-Year Evolution of ACNYMP Profile M34

2.3 Hurricane Sandy

2.3.1 Water Levels & Waves

On 29 October 2012, Hurricane Sandy made landfall approximately five miles south of Atlantic City, NJ, where it collided with a blast of arctic air from the north, creating conditions for an extraordinary and historic storm along the East Coast with the worst coastal impacts centered on the northern New Jersey, New York City, and the Long Island coastline. Hurricane Sandy's unusual track and extraordinary size generated record storm surges and offshore wave heights in the New York Bight. The maximum water level at The Battery peaked at 12.4 feet NGVD29, exceeding the previous record by over 4 feet. Further east, at Montauk Point, the maximum water level reached 6.6 feet NGVD29, 1.4 feet less than the previous storm of record (Hurricane Carol in 1954). Coastal erosion and damages within the FIMP Study Area as a result of Hurricane Sandy were severe, substantial and devastating, particularly along Fire Island and in downtown Montauk. Following Hurricane Sandy, the protective beach in downtown Montauk has been largely eroded leaving many buildings vulnerable to additional damages from future storms.

2.3.2 Observed Subaerial Changes

Prior to Hurricane Sandy the beach at downtown Montauk was characterized by a relatively wide beach berm and sand dunes with heights between +16 and +25 feet NGVD. During Hurricane Sandy the wide beach berm was effectively removed and the dunes experienced severe erosion. The relatively high elevation of the dunes prevented significant overwash and overtopping from occurring in downtown Montauk during Hurricane Sandy except at the gaps in the dunes which provided public beach access. Figure 3 shows profile conditions at four profiles along downtown Montauk in 2000 and 2012 (post-sandy). The post-sandy conditions are characterized by a narrow beach berm and narrower dunes. Despite the dune erosion that occurred, the post-sandy dunes are still relatively high, between +16 and +25 feet NGVD, and provide protection against overwash and overtopping during future storm events. As previously discussed, it is unclear how much of the observed profile changes can be directly attributed to Hurricane Sandy versus other storm events and long-term coastal processes occurring between 2000 and 2012.

A quantitative analysis of the shoreline and dune migration was performed by analyzing the change in the +3 ft NGVD and +11 ft NGVD contours. These contours were selected to characterize the change in the beach and dune widths from 2000 to Nov. 2012. The top panel of Figure 4 shows the position of the contours in 2000 (blue) and Nov. 2012 (red). The bottom panel of Figure 4 shows the change in the horizontal position of the contours over this 12 year period (negative value represents erosion). It is clear that the entire project area experienced significant subaerial beach erosion, as both the shoreline and dune migrated 20 to 60 feet landward. In general the magnitude of shoreline recession is greater than dune recession. Within downtown Montauk (Reach M-1F) the shoreline and dune experience an average landward migration of 44 feet and 31 feet respectively

The beach conditions at downtown Montauk typically undergo a seasonal transformation from a narrower "winter" beach to a wide "summer" beach (Figure 3). During the fall and winter months, storm waves a more frequent and sand from the beach berm is transported offshore and deposited in a protective sand bar. During late spring and summer months, storm events are less frequent and smaller waves dominate, allowing sand to be transported landward restoring the

wide summer berm. During particular sever storm events, such as Hurricane Sandy, sand may be transported offshore or downdrift and lost from the system. Beach surveys at Montauk were collected about once every two weeks in the year following Hurricane Sandy, capturing the seasonal variability in the beach conditions at Montauk Figure 6 illustrates the temporal evolution of the beach conditions at Montauk and transition from a winter beach profile to a summer beach profile and then beginning of the transition back to a winter beach profile. Profile measurements collected semi-monthly following Hurricane Sandy provide additional evidence of the seasonal transformation of the beach conditions (Figure 7 and Figure 8).

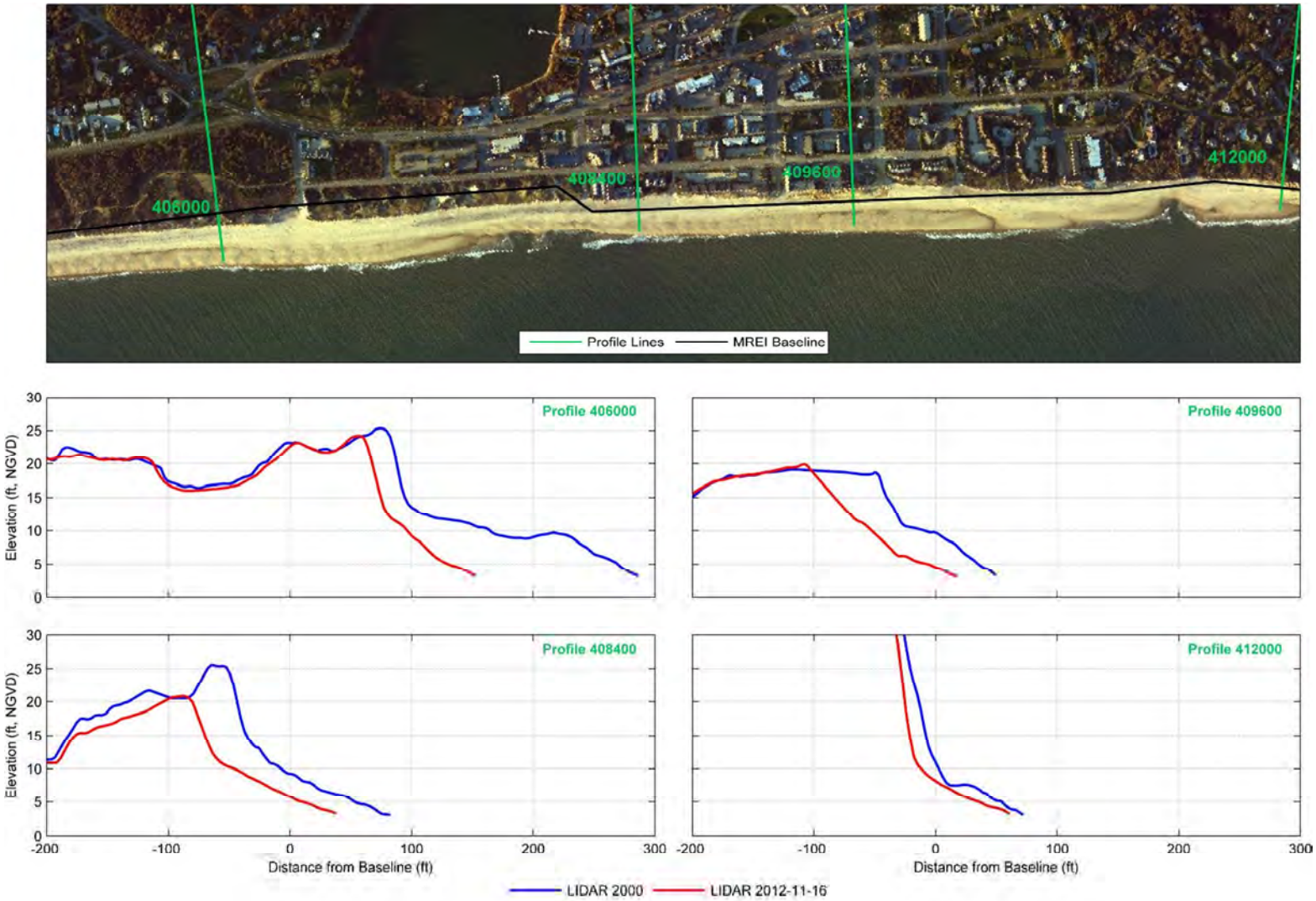


Figure 3: Observed Beach Profile Changes at downtown Montauk

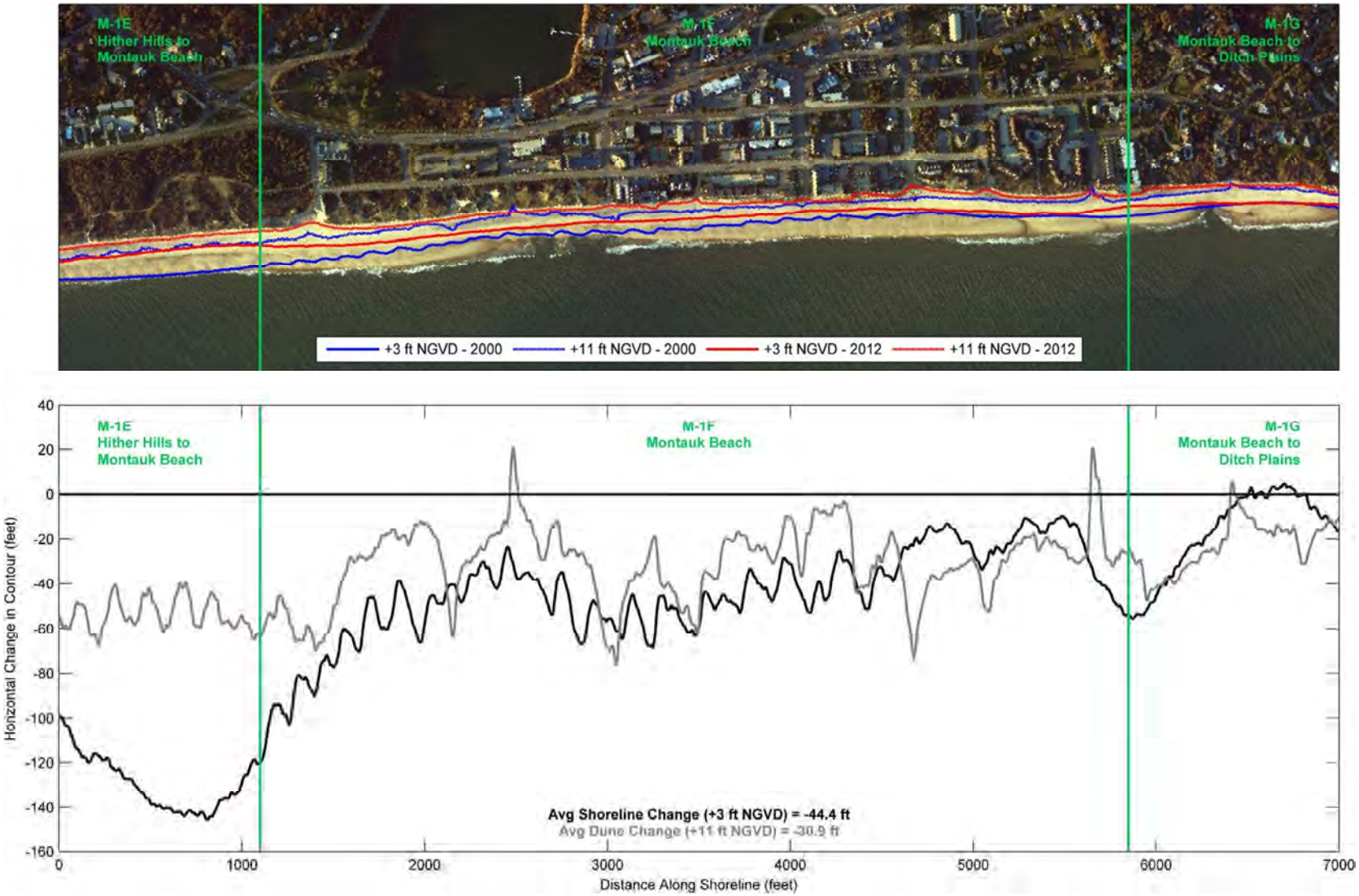


Figure 4: Observed Shoreline Changes at downtown Montauk

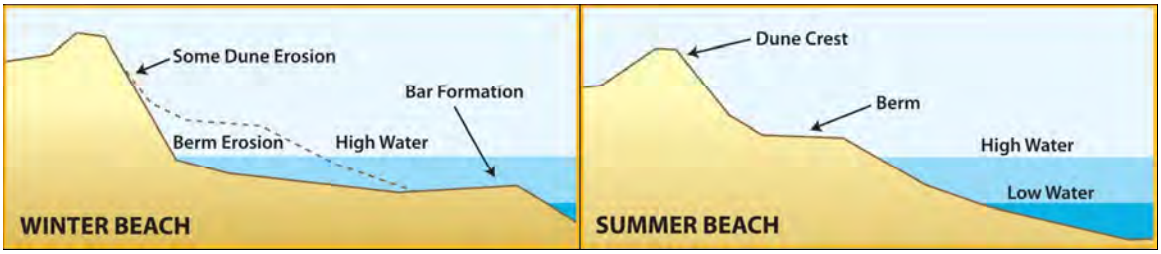


Figure 5: Schematic of Seasonal Changes in Beach Conditions (Maine Sea Grant)

Figure 6: Seasonal Changes in Beach Conditions at Montauk (Photos)

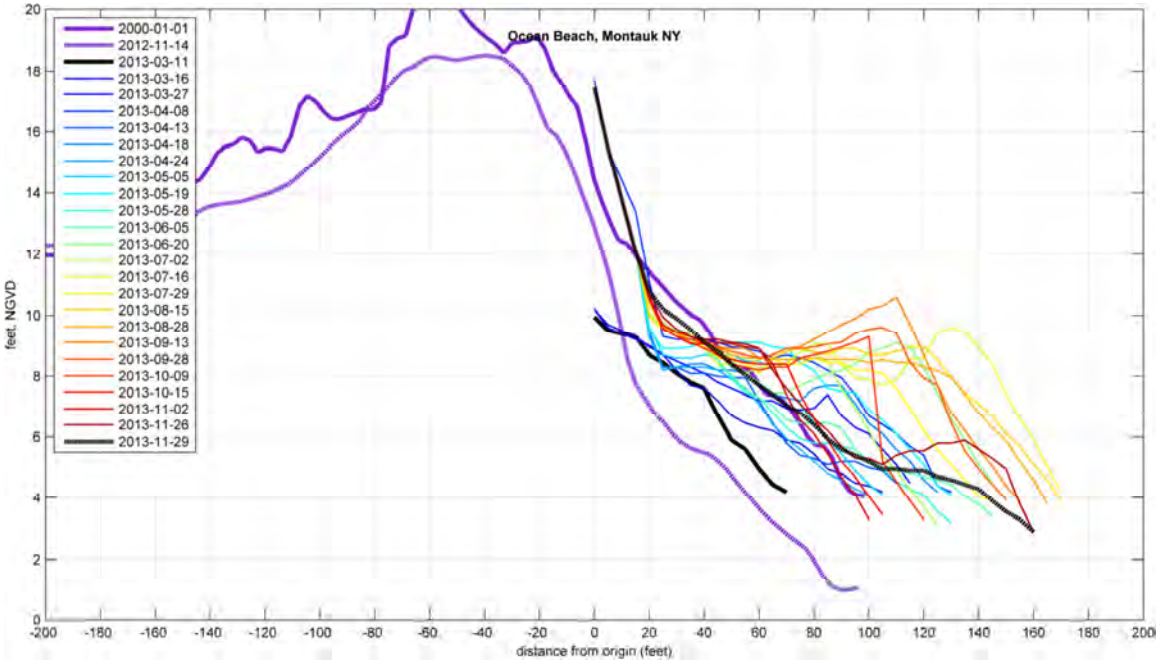


Figure 7: Post-Sandy Beach Evolution at Ocean Beach

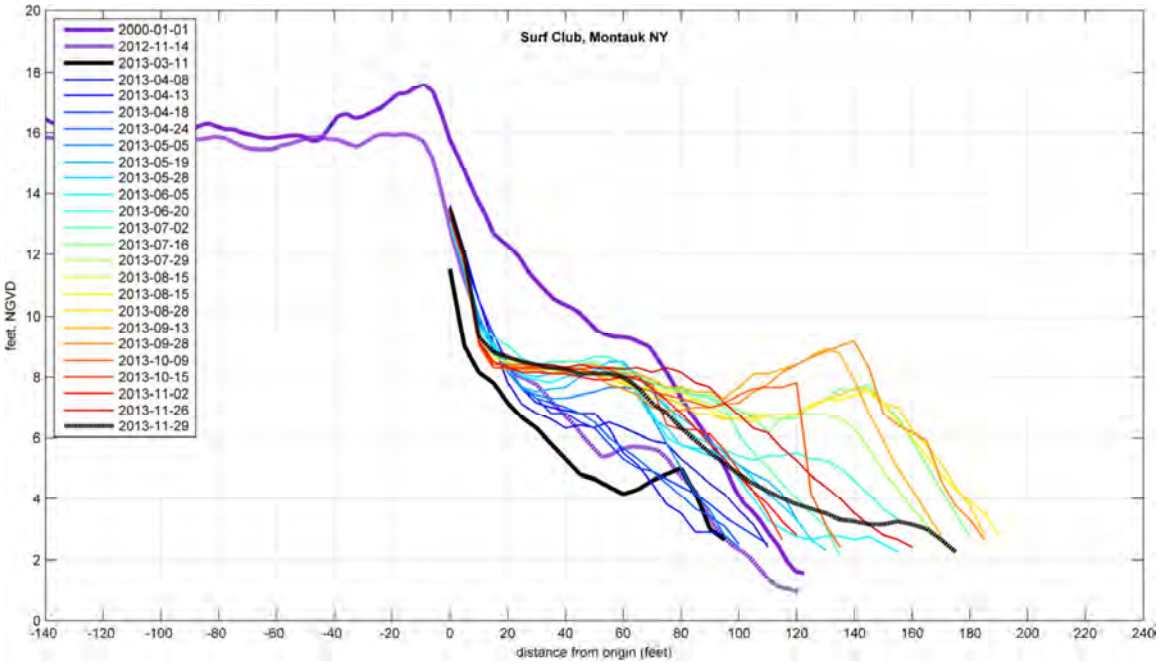


Figure 8: Post-Sandy Beach Evolution at Surf Club

3.0 ALTERNATIVE OVERVIEW

In the aftermath of Hurricane Sandy, it was recognized that there was a need to revisit the Tentatively Federally Selected Plan (TFSP) and determine if the eroded beach conditions and updated costs and benefits warranted selection of an alternative plan at downtown Montauk. A new evaluation of six conceptual alternatives was performed at downtown Montauk taking into consideration the eroded beach conditions following Sandy.

The six conceptual alternatives were narrowed down to five alternatives based on preliminary cost estimates and input from stakeholders:

- Alternative 1: Beach Restoration,
- Alternative 2: Beach Restoration and Buried Seawall,
- Alternative 3: Feeder Beach,
- Alternative 4: Dune Reinforcement,
- Alternative 5: Dune Reinforcement and Feeder Beach.

The five alternatives represent a range of measures providing different levels of protection and design project lives. Alternatives 1, 2, and 3 are designed to provide a 44 year level of protection and have a design project life of 50 years. The post-Sandy analysis also considered two lower cost alternatives that provided a lower level of protection, 25 years, and a shorter design life. A detailed description of the five alternatives is provided in the Main Report (Section 5.2.1).

4.0 WITH PROJECT EROSION RATES & RENOURISHMENT QUANTITIES

The advance fill berm width and renourishment volumes are determined based on the representative erosion rates for each design reach. The representative erosion rate accounts for:

1. "Spreading out" or diffusion of sand resulting from the shoreline anomaly or "bump" created by the beachfill;

2. Background shoreline erosion due to ongoing processes before the project was constructed.

Beachfill diffusion is a function of the longshore length of the beachfill, cross-shore width of the beachfill, and longshore diffusivity. The rate of beachfill diffusion is particularly sensitive to longshore length of the beachfill project. downtown Montauk is susceptible to relatively high rates of diffusion due to its short length. Analytical solutions to the diffusion equation (i.e. Pelnard Considere, 1956) are applied in Section 4.1.3 to determine the rate of beachfill diffusion at downtown Montauk.

Generally it is assumed that the background shoreline erosion will continue at the same rate as before the project. Background erosion rates were determined based on the sediment budget and recent measurements of shoreline change.

4.1 Beachfill Diffusion

A beach nourishment project constructed on a long beach represents a perturbation, which under wave action will spread out along the shoreline (Dean, 2005). If the wave action is small, than the rate at which the anomaly resulting from the beach nourishment is spread out from the placement area will likewise be small. It important to remember that beachfill diffusion is a separate process from background shoreline erosion, which is generally caused by gradients in the net longshore sediment transport.

4.1.1 Theoretical Background

The one-dimensional diffusion equation or Pelnard-Considere equation for planform evolution may be derived from combining the conservation of sediment equation with the total longshore sediment transport equation.

The conservation of sediment equation:

$$\frac{\partial Q}{\partial x} + (h_* + B)\frac{\partial y}{\partial t} = 0$$

Where Q is the total longshore sediment transport, y is the shoreline, and h_* and B are the depth of closure and berm height respectively.

The total longshore sediment transport, Q, equation or CERC formula is given by:

$$Q = C' H_b^{5/2} \sin 2\theta_b$$

$$C' = \frac{K\sqrt{g/\delta_b}}{8(S-1)(1-p)}$$

Where H_b is the breaking wave height, θ_b is breaking wave angle relative to shore normal, K sediment transport coefficient, g is acceleration of gravity, δ_b breaking wave index, S specific gravity of sand, and p is the porosity of sand.

For an undulating shoreline, with small values of $\partial y / \partial x$ the sediment transport equation may be re-written as follows

$$Q = C' H_b^{5/2} \sin 2\theta_b - G(h_* + B)\frac{\partial y}{\partial x}$$

The first term above represents the background sediment transport rate for shoreline parallel to the x-axis, and the second term represents the transport induced by the shoreline undulations ($\partial y / \partial x$). Parameter G is the longshore diffusivity and is equal to

$$G = \frac{2C' H_b^{5/2} \cos 2\theta_b}{(h_* + B)}$$

Taking the derivative of the sediment transport equation (assuming $\partial y / \partial x << 1$) and combing with the conservation of sediment equation yields the final form of the Pelnard-Considere equation

$$\frac{\partial y}{\partial t} \cong G \frac{\partial^2 y}{\partial x^2}$$

There are many solutions to the equation, of interest here are the solutions for a rectangular and trapezoidal beachfill (e.g. with tapers) on a long straight beach. Consideration was given to solutions to the Pelnard-Considere equation for a barrier island with inlets; however, the distance between the inlets and limits of beachfill are sufficiently large to result in very small differences.

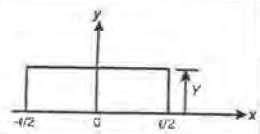
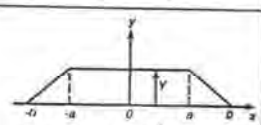
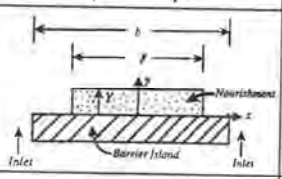
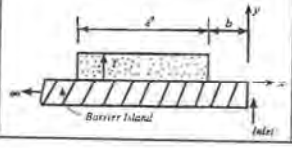
Rectangular Beachfill

The solution to the Pelnard-Considere equation for a rectangular beachfill project on a long straight beach is shown in panel "a" of Figure 9. The non-dimensional results for a rectangular beachfill project with alongshore length *l*, cross-shore width *Y*, and time *t* are shown in Figure 10 illustrating that the planform location after some time "*t*" is proportional to $1/l^2$. As a result, the performance of the beachfill is very sensitive to the alongshore length.

Figure 11 further demonstrates the sensitivity of the performance of a beachfill project to the alongshore length by plotting the fraction of volume remaining, M(t), versus non-dimensional time, $\sqrt{Gt}/l$. The solid black line shows the solution to the Pelnard-Considere equation, the dashed black line presents the results for exponential decay, and the four markers present the volume remaining after 4 years for beachfill projects at Western Fire Island (41,800 feet), Fire Island Pines (6,400 feet), Davis Park (4,200 feet), SPCP (19,400 feet), and downtown Montauk (6,600 feet). It is important to note, that the results in Figure 11 are in the absence of background erosion. The implications of Figure 11 are clear, shorter beachfill projects will experience a much higher rate of diffusion. Therefore, it is expected that the representative erosion rates at downtown Montauk will be much higher than at Western and Eastern Fire Island because the alongshore length of the beachfill project is significantly smaller.

Trapezoidal Beachfill

The solution to the Pelnard-Considere equation for a trapezoidal beachfill project on a long straight beach is shown in panel "b" of Figure 9. The results for a trapezoidal beachfill project a similar to the results for a rectangular beachfill project except that end losses are slightly lower due to the tapers. The trapezoidal beach solution is applied to Montauk Study since six (6) degree tapers are applied in this study.

Description	Illustration	Solution
(a) Initially rectangular planform on a long straight beach		$y(x,t)=\frac{Y}{2}\left\{\begin{array}{l}\mathrm{erf}\left[\frac{\ell}{4\sqrt{Gt}}\left(\frac{2x}{\ell}+1\right)\right]\\ -\mathrm{erf}\left[\frac{\ell}{4\sqrt{Gt}}\left(\frac{2x}{\ell}-1\right)\right]\end{array}\right\}$
(b) Initially trapezoidal planform on a long straight beach	 $A=\frac{a}{2\sqrt{Gt}},\ B=\frac{b}{2\sqrt{Gt}},\ X=\frac{x}{a}$	* $y(x,t)=\frac{Y}{2(B-A)}\left\{\begin{array}{l}(A-AX)\,\mathrm{erf}(AX-A)-(A+AX)\,\mathrm{erf}(AX+A)\\ +(B+AX)\,\mathrm{erf}(AX+B)-(B-AX)\,\mathrm{erf}(AX-B)\\ +\frac{2}{\sqrt{\pi}}[e^{-(A^2X^2+B^2)}\cosh(2AXB)-e^{-(A^2X^2-A^2)}\cosh(2A^2X)]\end{array}\right\}$
(d) Initially rectangular planform centered on a barrier island		$y(x,t)=4Y\left(\frac{\ell}{b}\right)\sum_{n=1}^{\infty}\frac{1}{\mu_n}\sin\left(\frac{\mu_n}{2}\right)\cos\left(\mu_n\frac{x}{\ell}\right)e^{-\mu_n^2Gt/\ell^2}$ $\mu_n=(2n-1)\frac{\ell}{b}\pi$
(d) Initially rectangular planform near inlet on a long barrier island		$y(x,t)=\frac{Y}{2}\left\{\begin{array}{l}\mathrm{erf}\left(\frac{x+b+\ell}{\sqrt{4Gt}}\right)-\mathrm{erf}\left(\frac{x+b}{\sqrt{4Gt}}\right)\\ +\mathrm{erf}\left(\frac{x-b-\ell}{\sqrt{4Gt}}\right)-\mathrm{erf}\left(\frac{x-b}{\sqrt{4Gt}}\right)\end{array}\right\}$

*Walton, 1997

Figure 9: Solutions to Pelnard-Considere Equation (Dean, 2005)

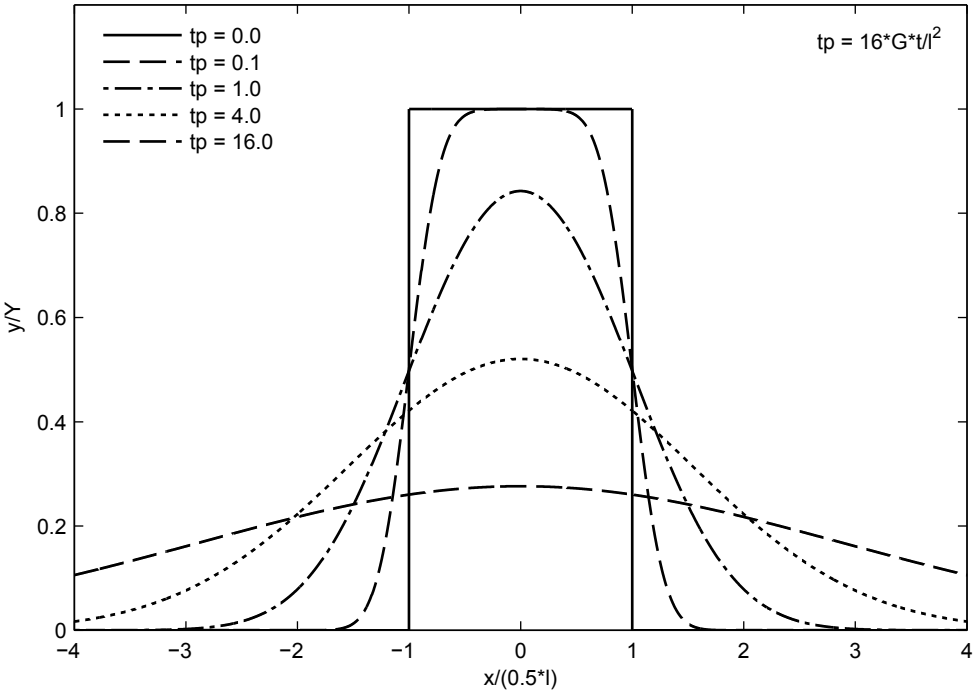


Figure 10: Non-dimensional Beachfill Evolution Based on Diffusion Equation

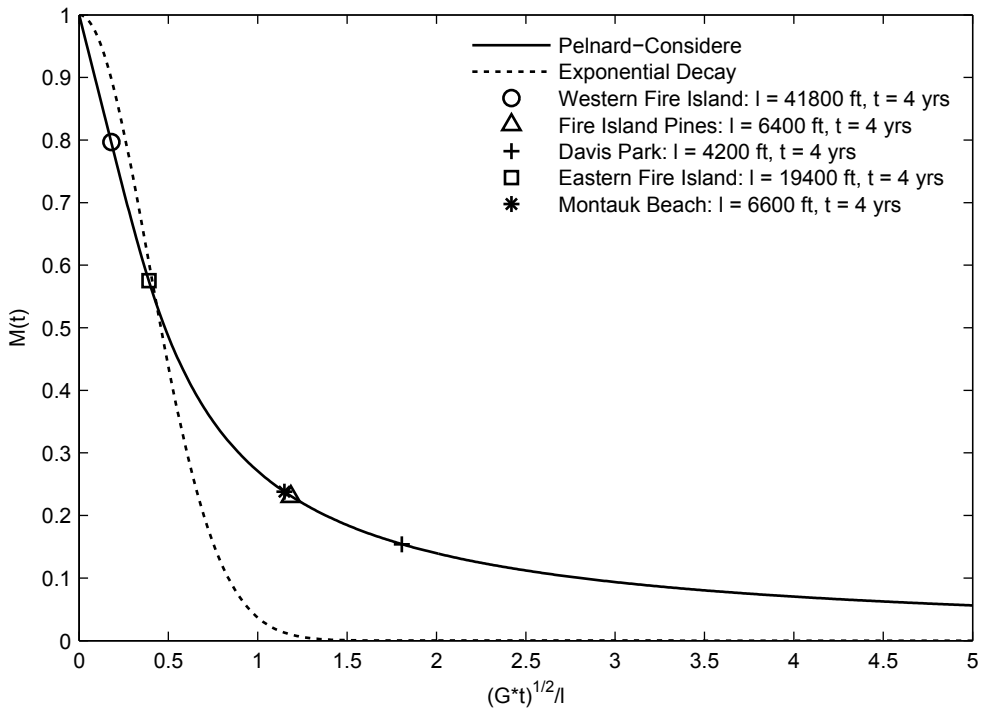


Figure 11: Theoretical Longevity of Beachfill (Excluding Background Erosion)

Incorporating Background Erosion

The combined effect of diffusion and background erosion, $\partial E / \partial t$, can be accounted for by adding an additional term to solutions for a rectangular or trapezoidal beachfill:

$$y(x,t) = \ldots - \frac{\partial E}{\partial t}$$

4.1.2 Alongshore Diffusivity

The alongshore diffusivity, *G*, controls the rate at which "spreading" or diffusion of the beachfill project occurs. The alongshore diffusivity is proportional to the breaking wave height raised to the 5/2 power. Since the wave conditions at a site vary over time, so too does the alongshore diffusivity. Therefore, the alongshore diffusivity can be determined by integrating *G* over time or by determining an effective wave breaking height.

If the gross sediment transport rate at a site is known, than it is possible to back-calculate the effective breaking wave height, H_b, from the CERC sediment transport formula and use H_b to determine the alongshore diffusivity, *G*. It is important to use the gross sediment transport rates because it reflects the true diffusivity of project site. For example, if a study area had a very high gross sediment transport potential but virtually zero net sediment transport, one would still expect the alongshore diffusivity to be high.

Based on a gross sediment transport rate 2.25 million m^3/yr (2.94 MCY), at Montauk Point (Gravens et al, 1999), an effective breaking wave height of 3.65 feet (1.10 m), and alongshore diffusivity of 0.15 ft^2/s. The alongshore diffusivity was reduced by 60% to account for stabilizing effect of wave refraction around the beachfill project (Dean, 2005). Backup calculations for the alongshore diffusivity are provided in Appendix E.

4.1.3 Application to downtown Montauk

As previously discussed downtown Montauk is particularly vulnerable to losses from beachfill diffusion since the project length is relatively short (6,600 feet) and because the proposed design shorelines stick out from the existing shoreline. A simple analytical approach is applied here to determine the beachfill diffusion losses for the alternatives. The Beachfill and Beachfill & Buried Seawall were evaluated. The Dune Reinforcement Feeder Beach alternatives were not evaluated since these alternatives either don't have renourishment (Dune Reinforcement) or provide a fixed volume of sand for renourishment (Feeder Beach).

In order to apply the beachfill diffusion analysis the cross-shore width, *Y*, of the beachfill project must be known. In this application, the cross-shore width represents the distance that the design berm (plus advance nourishment) protrudes from the adjacent shoreline where no beachfill placement is planned. It is not a straightforward task to determine this cross-shore width. The cross-shore width, Y, can be further broken down into three components:

$$Y = Y_o + Y_a$$

Where Y_o is the initial cross-shore distance that the design shoreline protrudes from the adjacent shoreline and Y_a is the advance nourishment width. The alongshore diffusivity, and alongshore length of beachfill are the same for all three alternatives. A summary of the initial cross-shore widths for the three alternatives is provided in Table 1. The cross-shore widths were determined by comparing design MHW line to the existing MHW line. The required advance fill width was determined iteratively by calculating the solution to the diffusion analysis for different advance fill widths. As the advance fill width increases so does the beachfill losses.

The results of the diffusion analysis for the three alternatives are presented in Table 1. The theoretical evolution of the three alternatives at downtown Montauk is shown in Figure 12 and Figure 13.

The results from the beachfill diffusion analysis have been rounded off and adjusted based on engineering judgment to determine the final representative erosion rates to be used in the renourishment volume estimates (Table 2).

Table 1: Diffusion Results

Location	Length (ft)	Y_o (ft)	Y_a (ft)	Background Erosion (ft/yr)	Diffusive Erosion (ft/yr)	Representative Erosion (ft/yr)
Beachfill	6,600	60	91.2	3	19.8	22.8
Beachfill & Buried Seawall	6,600	5	28.9	3	4.2	7.2

Table 2: Representative Erosion Rates for Downtown Montauk Alternatives

Location	Representative Erosion (ft/yr)
MREI Beachfill	20
Beachfill & Buried Seawall	7

4.2 Renourishment Volumes

Future renourishment volumes over the project life (50 years) are calculated based on the representative erosion rates determined in Section 4.1.3. Similarly to the advance berm width, the renourishment volumes is equal to the representative erosion rate multiplied by the renourishment interval (e.g. 5 feet/year x 4 years = 20 feet). The relatively large representative erosion rate predicted for the Beachfill Alternative may warrant consideration of shorter renourishment interval. The renourishment extents are the same as the initial construction extents. Renourishment volumes for a single renourishment operation are presented in Table 3.

Table 3: Renourishment Beachfill Volumes

Item	Beach Restoration	Beach Restoration & Seawall	Feeder Beach	Dune Reinforcement	Feeder Beach & Dune Reinforcement
Length (ft)	6,600	6,000	3,100	3,100	3,100
Erosion Rate (ft/yr)	18	6			
Advance Fill (c.y.)	641,520	194,400	120,000	n/a	120,000
10% Overfill (c.y.)	64,152	19,440			
Subtotal (c.y.)	***705,672***	***213,840***			
15% Tolerance (c.y.)	105,851	32,076			
Total Fill (c.y.)	**812,000**	**246,000**	**120,000**	**n/a**	**120,000**

Note: Fill quantities are provided for each 4-year renourishment cycle.

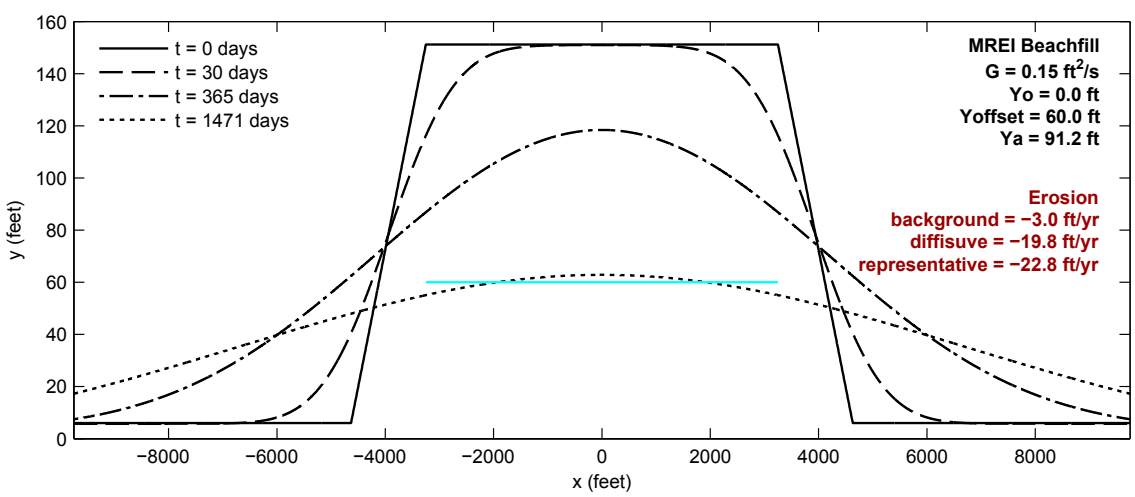


Figure 12: Beachfill Evolution at Downtown Montauk – Beachfill

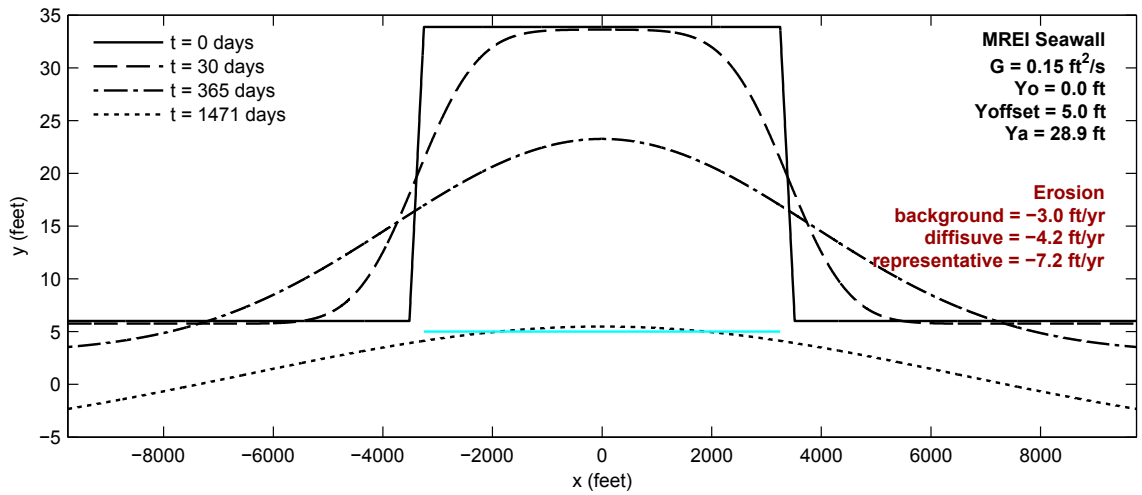


Figure 13: Beachfill Evolution at Downtown Montauk – Beachfill and Buried Seawall

5.0 INITIAL CONSTRUCTION QUANTITIES

5.1 Beachfill Quantities (Alternatives 1, 2, and 3)

5.1.1 Methodology

Initial construction beachfill quantities for Alternatives 1 and 2 were estimated from profile surveys conducted by OSI in September, 2013. Average end area calculations were performed based on the design section (Figure 14) and profile surveys. The fill volume at each survey location was calculated using an USACE product called RMAP (Regional Morphology Analysis Package). The Feeder Beach alternatives are not defined by a specific design profile and the alternative is not intended to provide and maintain a specific berm/dune width. Instead the alternative provides a source of sediment to the system that is intended to help alleviate background erosion. Therefore, a fixed quantity of sand, 120,000 cy, would be placed once every 4 years.

Advance fill is included in the initial beachfill quantities for Alternatives 1 and 2. Advance fill is a sacrificial quantity of sand that acts as an erosional buffer against long-term and storm-induced erosion as well as beachfill losses caused by "spreading out" or diffusion. The required advance berm width was computed based on representative erosion rates and expected renourishment interval (4 years). Since the Feeder Beach alternatives are not designed to maintain a specific berm width over time no advanced fill is added to these design quantities.

Below +3 ft NGVD, both the beach profile and design profile are set to the representative morphological profile. As a result, the berm fill volumes below +3 feet are equal to the offset in the +3 feet contour multiplied by 30 feet (depth of closure +3 feet). In general, the berm fill volumes are dominated by the subaqueous fill, which is directly related to the difference between the +3 feet contour in the design profile and survey data. Therefore, the beach fill volumes are very sensitive to the location of +3 feet NGVD.

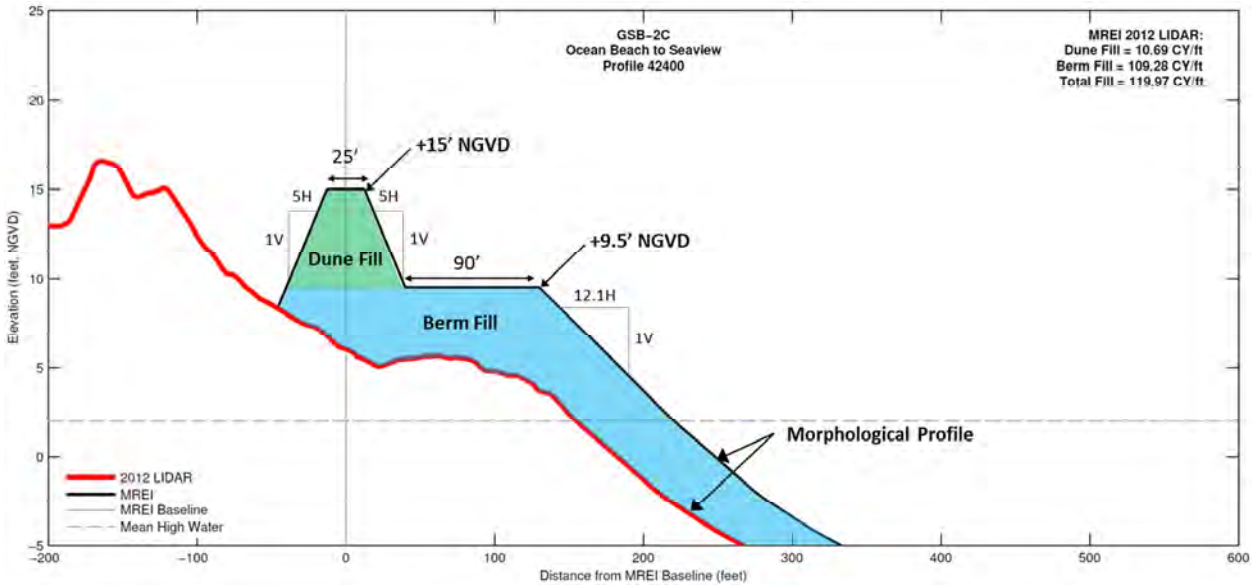


Figure 14: Beach Fill Design Section

5.1.2 Results

Table 4 presents the lengths in which dune and berm fill was considered for the five alternatives, the design volumes, advance fill volumes, and total initial fill volumes. The total initial fill volumes include a 15% contingency and 10% overfill.

Table 4: First Construction Beachfill Volumes (Alternatives 1, 2, and 3)

Item	Beach Restoration	Beach Restoration & Seawall	Feeder Beach
Length (ft)	6,600	6,000	3,100
Design fill (c.y.)	689,338	298,772	120,000
Advance Fill (c.y.)	591,514	140,873	
10% Overfill (c.y.)	128,085	43,865	
Subtotal (c.y.)	***1,408,937***	***482,510***	***120,000***
15% Tolerance (c.y.)	211,341	72,376	
Total Fill (c.y.)	**1,620,000**	**555,000**	**120,000**

5.2 Buried Seawall Stone Quantities

5.2.1 Methodology

In the FIMP Basis of Design Report (USACE-NAN, 2000) various combinations of beachfill berm width, seawall crest height, side slope, and toe elevation were evaluated for Montauk. The Storm-induced Beach Change (SBEACH) model was used to determine the required structure toe elevations (i.e. scour depth) for a range of berm widths. The procedure for determining the design seawall configuration is as follows:

1) Input Structural Constants, Design Water Level, Wave Height, and Wave Period

2) Estimate depth-limited wave conditions at site
   a) breaking wave condition
   b) maximum breaker height
   c) wave length at site

3) Compute maximum wave and significant wave heights based on random wave transformation by GODA

4) Perform runup calculations to determine seawall crest elevation
   a) based on Pilarcyzk (1990)
   b) based on van der Meer (1992)
   c) estimate mean runup assuming Rayleigh distribution
   d) estimate significant runup based on Pilarcyzk (1990)

5) Estimate overtopping
   a) based on van der Meer
   b) based on Pilarcyzk
   c) determine structure crest elevation based on tolerable overtopping limit

6) Seawall design
   a) determine armor size with Hudson formula and checked with van der Meer formulae
   b) determine armor and underlayer sizes and thicknesses
   c) determine scour toe berm width

7) Quantity Estimates

   a) determine quantity for 1 foot cross-section, include 1 foot of tolerance, and multiply by total structure length
   b) excavation volume is equal to the total stone volume plus 20%

5.2.2 Results

The optimum seawall configuration was identified for the 44 year level of protection is adopted for downtown Montauk. A typical section of the rubble mound seawall is provided in Figure 15. The proposed rubble-mound seawall has a crest elevation of +11 ft NGVD, toe elevation of +4.3 ft NGVD, a crest width of 7.7 ft, slope of 1V:1.5H, scour toe berm width of 13.1 ft, and armor stone size of 1.4 ton (USACE-NAN, 2000). Backup calculations are provided in Appendix C.

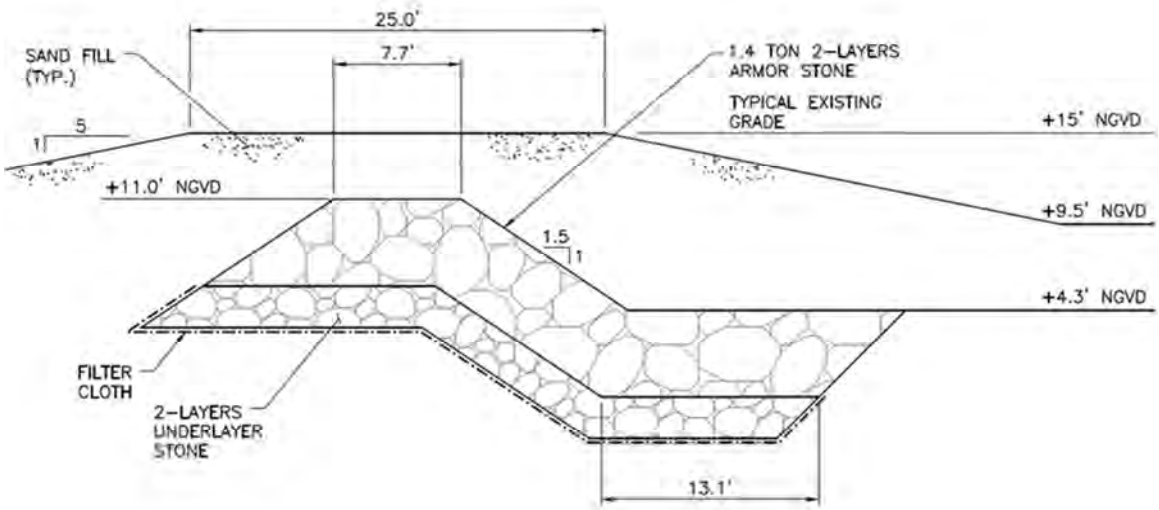


Figure 15: Typical Buried Seawall Section

Table 5 presents the total quantity of armor stone, underlayer stone, geotextile filter fabric, and excavation for the buried seawall alternative (3,150 feet).

Table 5: Buried Seawall Stone Quantities

Item	Quantity
Armor Stone (ton)	33,145
Underlayer / Core Stone (ton)	16,487
Geotextile (sq.yd.)	17,520
Excavation (c.y.)	41,193

5.3 Dune Reinforcement

5.3.1 Methodology

The beachfill quantities for the Dune Reinforcement (Alternative 4) were estimated from a profile survey conducted by First Coastal on November 24, 2013 at Ocean Beach. The quantities of excavation and sand fill were determined from a cut/fill calculation in CADD based on the typical section (Figure 16). The quantity of sand is required to fill the GSC, cover and build the dune, and build the berm cap were identified. The estimated quantities at the Ocean Beach profile were applied to the entire 3,100 feet length of the project to determine the total sand fill quantities.

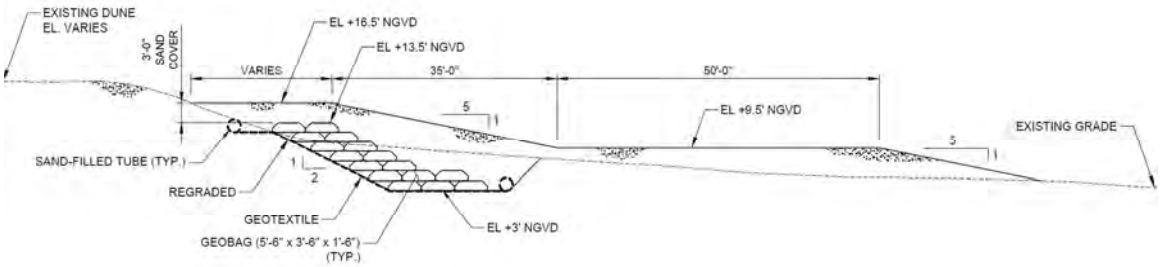


Figure 16: Reinforced Dune Typical Section

5.3.2 Results

The estimated quantities of excavation, sand fill, and GSC are shown in Table 6. Note that the excavated sand will be reused to construct the dune. A total of 51,000 cy of sand fill is required to construct the reinforced dune. Sixteen GSCs are required for each section with a total of 14,171 GSCs over the entire length of the project. The Feeder Beach and Dune Reinforcement Alternative includes the sand fill required to construct the dune as well as the 120,000 cy of sand fill to construct the feeder beach. A summary of the first construction beachfill volumes for Alternatives 4 and 5 is provided in Table 7.

Table 6: Dune Reinforcement Quantities

Item	Number	Unit
Excavation	20,283	cu.yd.
Sand Fill (Geobags)	15,146	cu.yd.
Sand Fill (Dune)	30,437[1]	cu.yd.
Sand Fill (Berm)	25,700	cu.yd.
Furnish Geobags	14,171	each
Fill & Place Geobags	14,171	each
Geotextile Filter Layer	24,357	sq.yd.

Notes: [1]20,283 cy of the required sand fill will be obtained from excavation.

Table 7: First Construction Beachfill Volumes (Alternatives 4 and 5)

Item	Dune Reinforcement	Feeder Beach & Dune Reinforcement
Length (ft)	3,100	3,100
Design fill (c.y.)	51,000	147,000
Advance Fill (c.y.)		
10% Overfill (c.y.)		
Subtotal (c.y.)	***51,000***	***147,000***
15% Tolerance (c.y.)		
Total Fill (c.y.)	**51,000**	**147,000**

6.0 GEOTEXTILE SAND CONTAINERS

Geotextile Sand Containers (GSCs) have been used in hydraulic and coastal applications in many parts of the world for the past 50 years. Over the past 20 years, advancements in container technology, as well as engineering design criteria, have established GSCs as a cost-effective, reversible, and versatile "soft" solution to a wide variety of projects. Successful projects using GSCs include those used in erosion control, bottom scour protection and scour fill, artificial reefs, groins, dams, seawalls, revetments and dune reinforcement (Saathoff, et al., 2007). Many coastal structures normally constructed using stone, concrete, or wood may alternatively be constructed with properly designed and maintained GSCs. GSC structures offer some advantages over traditional hard structures: GSCs may be constructed with in-situ sand/gravel, environmental friendly, user friendly, and easily reversible. However, there are also disadvantages to using GSCs in coastal applications that are primarily associated with the decreased stability, durability, and longevity of GSCs when compared to armor stone.

Early geotextile containers consisted predominately of relatively long "geotubes" manufactured predominately from woven geotextiles (Hornsey, et al., 2011). Although geotubes have proven to be cost effective as short term solutions, experience has shown that they do not often provide long-term engineering solutions as localized damage (e.g. differential settlement) or vandalism can cause large sections of the structure to fail (Saathoff, et al., 2007). Over the past 20 years, the use of geotubes has decreased in favor of structures consisting of smaller individually stacked GSCs constructed from woven and non-woven geotextiles (Hornsey, et al., 2011).

GSCs are a relatively new technology and consequently the geotextile materials and design guidance are still evolving. Nonetheless, there are already numerous case studies in the United States and rest of the world that highlight positive experiences and performance of structures constructed with GSCs. This memorandum outlines some of the important engineering (design and construction) and maintenance considerations and reviews several case studies.

Figure 17: Example Applications of Geotextile Sand Containers

6.1 Engineering Considerations

The engineering considerations of GSC coastal protection structures can be divided into three categories: wave stability, durability, and constructability. Other design considerations such as

scour toe protection and required crest elevation are not unique to GSC structures and are not discussed herein.

6.1.1 Wave Stability

Similarly to stone structures the individual GSCs must be designed to be stable under the design wave conditions. GSCs have a lower specific gravity and are more susceptible to sliding and being pulled out than traditional stone. Studies have shown that the dislodgment and pullout of the slope containers by wave action, including the sliding and the overturning of crest containers, are strongly affected by the deformation of the sand containers (Dassanayake, et al., 2012). Established design formulae do not exist for GSC-structures; however, recent advances in understanding the hydraulic stability of the GSC under wave attack (Wouters, 1998; Pilarczyk, 2000; Oumeraci et al, 2003; and Dassanayake and Oumeraci, 2012) have led to several design formulae for GSC structures. Most of the design formulae relate the stability of the GSC to the surf similarity parameter and wave height. An increase in the wave height and wave period results in decreased stability of the GSCs and increases the required size / weight of the GSCs. Studies have shown that stability of GSCs is also affected by the amount of overlap between the GSCs, friction of geotextile material, sand fill ratio, and properties of fill material (Dassanayake, et al., 2012) (Saathoff, et al., 2007).

Generally, GSCs sizes range from 1 to 4 cubic yards. The selection of a bag size should assess: how large it needs to be to stable under design wave conditions; how small it should be such that one or multiple broken containers will not result in structure failure; and which bag size is appropriate for the preferred placement method given available equipment.

The aforementioned design guidance led to selection of GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall and a weight of 1.7 ton. In order to increase the stability of the GSCs the long side of GSCs is laid out perpendicular to the shoreline with an overlap of 50% of the filled width. The selected GSCs are hydraulically stable under 25-year design conditions, and unstable under 50-year design considerations. The GSCs are expected to provide a 25-year level of protection. Hydraulic stability calculations for the GSCs under design conditions are available in Attachment B.

6.1.2 Durability

The longevity of GSC structure is often limited by the durability of the individual GSCs. The following characteristics of the GSCs affect its durability: UV resistance, seam strength, abrasion resistance, puncture resistance, fines retention, permeability, and elongation (Saathoff, et al., 2007).

Degradation due to UV radiation is a significant factor in long-term serviceability of the GSC (Saathoff, et al., 2007). The containers may also be exposed to abrasion due to water born sands, gravel, and shells carried by the currents and waves. Over time the abrasion may weaken the geotextile and lead to tearing. Puncture from vandalism or driftwood is often unavoidable.

The longevity and required durability of the GSCs may be reduced by limiting their exposure to UV, abrasion, and debris/vandalism. This may be accomplished by maintaining a protective cover of sand. Alternatively, stronger and thicker and more costly geotextile materials may be used for

greater durability and increased longevity. Recent advances in geotextile materials have led to materials that have greater UV resistance and case studies that have withstood extreme UV exposure and abrasion for over 10 years (Saathoff, et al., 2007). Recent improvements have led to geotextile materials that are more resistant to puncture (Hornsey, et al., 2011).

GSCs are primarily made of two different types of fabrics: a woven polypropylene fabric, and a non-woven polyester fabric. The woven material typically has higher tensile strength than the non-woven material. However, non-woven may have better filtration, higher abrasive resistance. Within both classes of geotextile materials there are options available to select thicker, stronger, and more durable materials for increased longevity. The aforementioned design guidance led to selection of 1.7 ton GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall. In order to increase the stability of the GSCs the long side of GSCs is laid out perpendicular to the shoreline with an overlap of 50% of the filled width. The selected GSC are hydraulically stable under 25-year design conditions, and unstable under 50-year design considerations. The GSC are expected to provide a 25-year level of protection. Hydraulic stability calculations for the GSC under design conditions are available in Attachment B.

Other design considerations that are not explicitly accounted for in the currently available design formulas are the sand fill ratio, friction between the GSCs, and incline angle of the GSCs (Dassanayake and Oumeraci, 2012). Most existing studies recommend a sand fill ratio of 80% for GSC which is believed to balance the advantages (higher stability) and disadvantages (elongation) of the sand fill ratio.

6.1.3 Constructability

Construction stages of GSC structures include preparation of the site, filling of the containers, and placement of the containers. Conventional heavy equipment may be used to prepare a smooth slope surface clear of all debris. A layer of geotextile fabric placed on the slope then must be either sewn at the ends, or provided with sufficient overlap. The GSCs may be mechanically or hydraulically filled with the available sediment (often locally available onshore or offshore). Care must be taken during construction to prevent damage and additional stresses (e.g. elongation) of the GSCs during placement. One advantage of hydraulically filling the GSCs is that the containers may be easily filled in place reducing the labor required to place the GSCs.

7.0 OPERATIONS & MAINTENANCE

Relatively high maintenance costs are associated with the Dune Reinforcement alternative at downtown Montauk for two reasons:

1. The GSCs should remain covered by a layer of sand to protect against UV degradation, vandalism, and debris.

2. Unlike typical beachfill projects, the dune is not protected by a wide design berm. As a result the dune is vulnerable to erosion during storm events.

Maintenance of the Dune Reinforcement alternative entails: a) trucking in sand in response to storm events which result in dune volume losses; and b) effort required to patch & fill or replace GSC damaged during a storm events. The required maintenance quantities were estimated based

on Multivariate EST results, recession of the 3.0 m contour, for an eroded beach profile at downtown Montauk (Figure 18). The purpose of the reinforced dune core (GSC) is to prevent erosion landward the reinforced core during storm events. Therefore, the dune recession EST results were adjusted to capture the reduction dune recession and dune volume loss caused by the presence of the reinforced core (GSC).

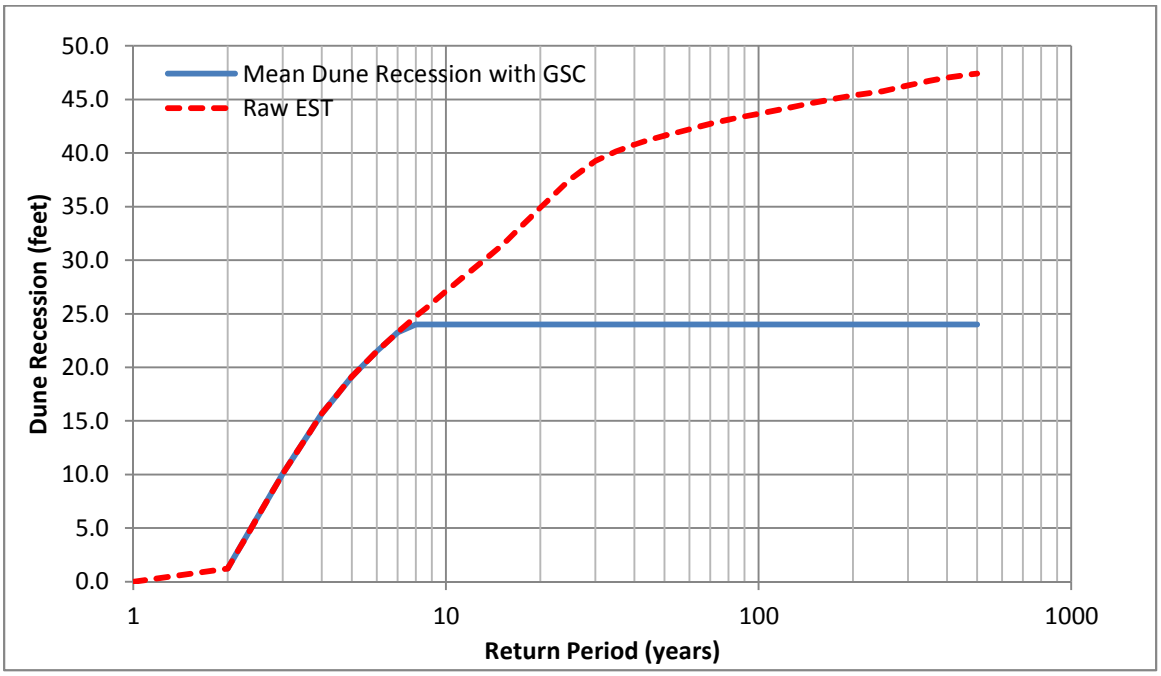


Figure 18: Storm Induced Dune Recession – EST Results

An estimate of the number of bags that would be damaged during storm events is estimated based on the likelihood that the GSC would be uncovered (roughly 5 year event) as well as the likelihood that the GSC would be subjected to large waves that have the potential to dislodge the GSC or carry debris up the GSC slope and puncture the containers.

One of the important variables applied in the estimate is the permanent loss factor. The permanent loss factor defines the percentage of sediment that is eroded from the beach and lost from the system. Typically a permanent loss factor between 10% and 30% is used in beachfill projects when estimating emergency rehabilitation volumes. However, a value of 50% was applied in this alternative because the eroded material is coming from the dune and not primarily from the berm. A value less than 100% was selected because the eroded dune material will not be completely lost from the system. A large percentage of the eroded dune material will likely be transported seaward and stored in a sand bar. During non-storm conditions the sediment in the sand bar will be gradually transported back to the berm. This process often takes days, weeks, or even a few months (e.g. summer/winter beach profiles). Longer time scales (e.g. months/years) are typically required for the dune to be naturally restored by aeolian transport. For this project it is assumed that a portion of the dune maintenance fill (50%) will be recovered from the system through naturally processes or beach scraping.

Table 8: Maintenance Costs (Dune Reinforcement)

Geobag Maintenance Costs				
Project Length	3,100	ft		
Project Life	15	Years		
Discount Rate	3.50%			
PVF (Maintenance)	11.517			
Annualized Maintenance Quantities & Costs				
Item	**Quantity**		**Parametric Estimate**	
	Number	**Unit**	**Unit Cost**	**Total Cost**
Rehab Dune Fill	2,754	cu.yd.	$35	$96,396
Patch & Fill Bags	78	each	$40	$3,118
Furnish Geobags	39	each	$70	$2,728
Mechanical Fill & Place Geobags	39	each	$300	$11,691
Patch Geotextile Roll (500 sq.yd.)	0.5	each	$1,350	$675
Subtotal				**$114,608**
Contingency	20%			$22,922
Total Construction				**$137,529**
E&D	7%			$9,627.06
S&A	7%			$9,627.06
Total Estimated Annualized Maintenance Cost				**$156,784**

8.0 REFERENCES

Dassanayake D., Oumeraci, H., 2012. "Hydraulic Stability of Coastal Structures Made of Geotextile Sand Containers (GSCS): Effect of Engineering Properties of GSCS", Coastal Engineering.

Dean, R. G., 2005. "Beach Nourishment Theory and Practice," World Scientific Publishing Co., Hackensak, NJ.

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Oumeraci, H., Hinz, M., Bleck, M., Kortenhaus, A, 2003. "Sand Filled geotextile containers for shore protection". COPEDEC VI, Colombo, Sri Lanka.

Pilarzyk K. W., 2000. "Geosynthetics and geosystems in hydraulic and coastal engineering." A.A. Balkema, Rotterdam, the Netherlands

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Wouters, J. 1998. Open Taludbekledinger; Stabiliteit van Geosystems, Delft Hydraulics Report H1930, Delft, The Netherlands.

ATTACHMENT A

ALTERNATIVE PLAN LAYOUTS

PLAN DIMENSIONS:
BERM WIDTH = 90'
BERM ELEV = 9.5' NGVD
DUNE CREST WIDTH = 25'
DUNE CREST ELEV = 15' NGVD

CONCEPTUAL
SUB□ECT TO C□ANGE

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

DRAWING TITLE:
DOWNTOWN MONTAUK
BEACH FILL PLAN

SCALE:
250' 0' 250' 500'
SCALE: 1"=250' (34"x22" Sheet)
SCALE: 1"=500' (11"x17" Sheet)

DATE:	FILE NAME:	PLATE NO.
APRIL/08/2014	PLATE 1 – BEACH FILL 15-90.dwg	1

PLAN DIMENSIONS:
BERM WIDTH = 35'
BERM ELEV = 9.5' NGVD
DUNE CREST WIDTH = 25'
DUNE CREST ELEV = 15' NGVD
SEAWALL CREST ELEV=11' NGVD

CONCEPTUAL
SUBJECT TO CHANGE

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

DRAWING TITLE:

DOWNTOWN MONTAUK BURIED SEAWALL PLAN

SCALE: 250' 0' 250' 500'

SCALE: 1"=250' (34"x22" Sheet)
SCALE: 1"=500' (11"x17" Sheet)

DATE:	FILE NAME:	PLATE NO.
APRIL/08/2014	PLATE 2 – BURIED SEAWALL 15-90.dwg	2

PLAN DIMENSIONS:
FEEDER BEACH = 120,000 CY

CONCEPTUAL
SUB□ECT TO C□ANGE

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

DRAWING TITLE:

DOWNTOWN MONTAUK
FEEDER BEACH

SCALE:

250' 0' 250' 500'

SCALE: 1"=250' (34"x22" Sheet)
SCALE: 1"=500' (11"x17" Sheet)

DATE:	FILE NAME:	PLATE NO.
APRIL/08/2014	PLATE 3 – FEEDER BEACH.dwg	3

FORT POND

MONTAUK

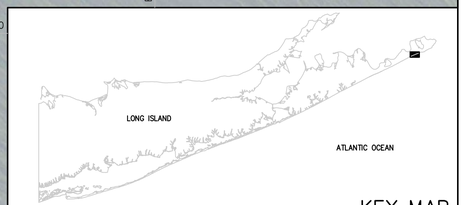
LIDAR NOV/2012
(FEET, NGVD)

REINFORCED DUNE

MREI
BASELINE

FINAL LOCATION OF REINFORCED DUNE TO BE DETERMINED BASED ON PRECONSTRUCTION SURVEY

CONCEPTUAL
SUB□ECT TO C□ANGE



KEY MAP

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

DRAWING TITLE:

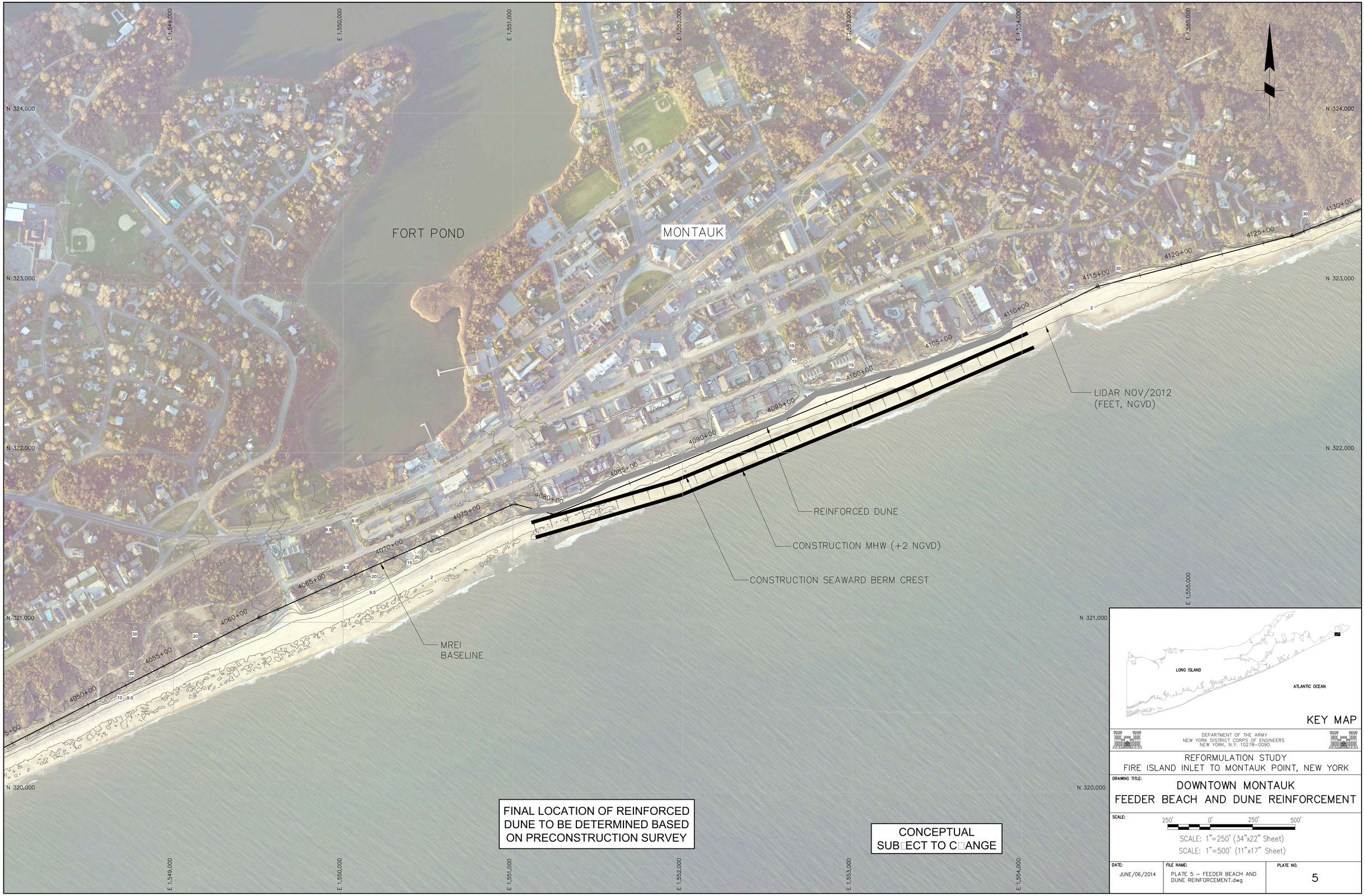
DOWNTOWN MONTAUK
DUNE REINFORCEMENT

SCALE:

250' 0' 250' 500'

SCALE: 1"=250' (34"x22" Sheet)
SCALE: 1"=500' (11"x17" Sheet)

DATE:	FILE NAME:	PLATE NO.
JUNE/06/2014	PLATE 4 – DUNE REINFORCEMENT.dwg	4


FORT POND
MONTAUK
LIDAR NOV/2012
(FEET, NGVD)
REINFORCED DUNE
CONSTRUCTION MHW (+2 NGVD)
CONSTRUCTION SEAWARD BERM CREST
MREI
BASELINE
4050+00
4055+00
4060+00
4065+00
4070+00
4075+00
4080+00
4085+00
4090+00
4095+00
4100+00
4105+00
4110+00
4115+00
4120+00
4125+00
4130+00
N 324,000
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FINAL LOCATION OF REINFORCED DUNE TO BE DETERMINED BASED ON PRECONSTRUCTION SURVEY
CONCEPTUAL
SUB□ECT TO C□ANGE
LONG ISLAND
ATLANTIC OCEAN
KEY MAP
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
DRAWING TITLE:
DOWNTOWN MONTAUK
FEEDER BEACH AND DUNE REINFORCEMENT
SCALE:
250' 0' 250' 500'
SCALE: 1"=250' (34"x22" Sheet)
SCALE: 1"=500' (11"x17" Sheet)
DATE:
JUNE/06/2014
FILE NAME:
PLATE 5 – FEEDER BEACH AND DUNE REINFORCEMENT.dwg
PLATE NO.
5

ATTACHMENT B

GEOTEXTILE SAND CONTAINER DESIGN CALCULATIONS

Date: March 21, 2014
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Montauk Beach - FIMP
Analysis: Geobag Stability - 25 year Return Period

Calculate stability of geobag revetment based on modified Hudso's formula

References: Krystian W. Pilarczyk, 1998. "Dikes and Revetments," A.A. Balkema, Rotterdam, Netherlands.
H. Oumeraci, M. Hinz, M. Bleck, and A. Kortenhaus, 2003. "Sand-filled Geotextile Containers for Shore Protection." Proceedings Coastal Structures 2003, Portland, Oregon.

Definitions

$\rho s := 165 \cdot \frac{lb}{ft^3}$ density of sand fill in geobags

$\rho w := 62.4 \cdot \frac{lb}{ft^3}$ density of water

$n := 0.45$ porosity of sand fill in geobags

$S := 0.5$ slope of geobags

$\theta := atan(S) = 0.464$ angle of incline (radians)

$Ho := 20 \cdot ft$ deep water significant wave height

$Tp := 14 \cdot s$ peak wave period

$SWL := 6.6 \cdot ft$ still water level (NGVD)

$\eta s := 3.3 \cdot ft$ wave setup

$belev := 6.5 \cdot ft$ bed elevation during storm event (NGVD)

$L := 5.5 \cdot ft$ Length of geobags

$D := L \cdot sin(\theta) = 2.46 \cdot ft$ Thickness of Cover Layer

Sediment Parameters

$\rho t := (1 - n) \cdot \rho s + n \cdot \rho w = 118.83 \cdot \frac{lb}{ft^3}$ density of top layer

$\Delta t := \frac{\rho t - \rho w}{\rho w} = 0.904$ relative mass under water of the top layer

Wave Parameters

$Lo := 1.56 \cdot Tp^2 \cdot \left(\frac{m}{s^2}\right) = 1.003 \times 10^3 \cdot ft$ deep water wave length

$\zeta op := \frac{S}{\left(\frac{Ho}{Lo}\right)^{0.5}} = 3.541$ surf similiarity parameter (Iribarren parameter)

$htoe := SWL + \eta s - belev = 3.4 \cdot ft$

$Htoe := 0.78 \cdot htoe = 2.652 \cdot ft$

Geobag Stability Criteria (derived from Hudson's Formula)

$$Dcr := \frac{Htoe \cdot (\zeta op)^{0.5}}{2.75 \Delta t} = 2.007 \cdot ft$$

D (2.46 ft) is > Dcr

GSC stable.

Date: March 21, 2014
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Montauk Beach - FIMP
Analysis: Geobag Stability - 50 year Return Period

Calculate stability of geobag revetment based on modified Hudso's formula

References: Krystian W. Pilarczyk, 1998. "Dikes and Revetments," A.A. Balkema, Rotterdam, Netherlands.
H. Oumeraci, M. Hinz, M. Bleck, and A. Kortenhaus, 2003. "Sand-filled Geotextile Containers for Shore Protection." Proceedings Coastal Structures 2003, Portland, Oregon.

Definitions

$\rho s := 165 \cdot \frac{lb}{ft^3}$ density of sand fill in geobags

$\rho w := 62.4 \cdot \frac{lb}{ft^3}$ density of water

$n := 0.45$ porosity of sand fill in geobags

$S := 0.5$ slope of geobags

$\theta := atan(S) = 0.464$ angle of incline (radians)

$Ho := 20 \cdot ft$ deep water significant wave height

$Tp := 17 \cdot s$ peak wave period

$SWL := 7.8 \cdot ft$ still water level (NGVD)

$\eta s := 3.6 \cdot ft$ wave setup

$belev := 6.5 \cdot ft$ bed elevation during storm event (NGVD)

$L := 5.5 \cdot ft$ Length of geobags

$D := L \cdot sin(\theta) = 2.46 \cdot ft$ Thickness of Cover Layer

Sediment Parameters

$\rho t := (1 - n) \cdot \rho s + n \cdot \rho w = 118.83 \cdot \frac{lb}{ft^3}$ density of top layer

$\Delta t := \frac{\rho t - \rho w}{\rho w} = 0.904$ relative mass under water of the top layer

Wave Parameters

$Lo := 1.56 \cdot Tp^2 \cdot \left(\frac{m}{s^2}\right) = 1.479 \times 10^3 \cdot ft$ deep water wave length

$\zeta op := \frac{S}{\left(\frac{Ho}{Lo}\right)^{0.5}} = 4.3$ surf similiarity parameter (Iribarren parameter)

$htoe := SWL + \eta s - belev = 4.9 \cdot ft$

$Htoe := 0.78 \cdot htoe = 3.822 \cdot ft$

Geobag Stability Criteria (derived from Hudson's Formula)

$$Dcr := \frac{Htoe \cdot (\zeta op)^{0.5}}{2.75 \Delta t} = 3.187 \cdot ft$$

D (2.46 ft) is < Dcr

GSCUnstable

ATTACHMENT C

BURIED SEAWALL DESIGN BACKUP

Date: October 8, 2013
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Downtown Montauk Stabilization
Analysis: Buried Seawall Design

Note: This analysis was originally performed by Moffatt & Nichol in 2000 for the FIMP Basis of Design Report.

PROCEDURE:

1. Input Structural Constants, Design Water Level, Wave Height, and Wave Period

2. Estimate depth-limited wave conditions at site
    a. breaking wave condition
    b. maximum breaker height
    c. wave length at site

3. Compute maximum wave and significant wave heights based on random wave transformation by GODA

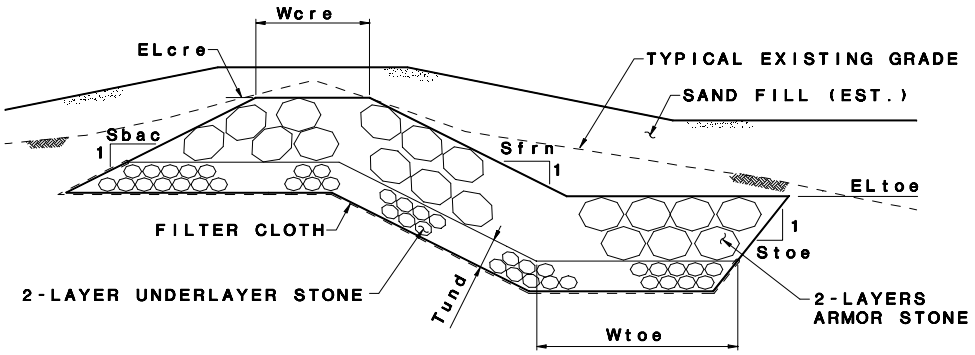
4. Perform runup calculations to determine seawall crest elevation
    a. based on Pilarcyzk (1990)
    b. based on van der Meer (1992)
    c. estimate mean runup assuming Rayleigh distribution
    d. estimate significant runup based on Pilarcyzk (1990)

5. Estimate overtopping
    a. based on van der Meer
    b. based on Pilarcyzk
    c. determine structure crest elevation based on tolerable overtopping limit

6. Seawall design
    a. determine armor size with Hudson formula and checked with van der Meer formulae
    b. determine armor and underlayer sizes and thicknesses
    c. determine berm width

7. Quantity Estimates

TYPICAL SECTION:



Structure Constants:
Elevation=11' NGVD
Slope=1(v):1.5(h)
Structure Variables:
Return Period=44, 73 and 150 years
Scour Design Toe Elevation= 5.6, 5.0, 4.3, 2.4 ft NGVD for typical profile MR1
Corresponding to Berm Widths=30, 20, 10, 0 meter

$\mathbf{ecrest} := 11.0 \cdot \mathbf{ft}$

$\mathbf{Sslope} := \frac{1}{1.5}$ structure slope

CALCULATION

Water level, wave heights & wave periods for Eastern domain as obtained from hindcasts & CHL data:

$$\mathbf{RP} := \begin{pmatrix} 44 \\ 73 \\ 150 \end{pmatrix} \cdot \mathbf{yr} \quad \mathbf{wl} := \begin{pmatrix} 10.2 \\ 10.9 \\ 12.3 \end{pmatrix} \cdot \mathbf{ft} \quad \mathbf{Hs} := \begin{pmatrix} 17.2 \\ 17.4 \\ 18.0 \end{pmatrix} \cdot \mathbf{ft} \quad \mathbf{Tp} := \begin{pmatrix} 17.1 \\ 18.1 \\ 19.4 \end{pmatrix} \cdot \mathbf{sec}$$

$\mathbf{j} := 0 .. 2$

DEPTH LIMITED WAVE CONDITIONS:

$\mathbf{k} := 0 .. 3$

$$\mathbf{etoe} := \begin{pmatrix} 5.6 \\ 5.0 \\ 4.3 \\ 2.4 \end{pmatrix} \cdot \mathbf{ft}$$

Estimated scour elevation for berm widths =

$$\mathbf{bermw} := \begin{pmatrix} 30 \\ 20 \\ 10 \\ 0 \end{pmatrix} \cdot \mathbf{m}$$

$\mathbf{d}_{\mathbf{j},\mathbf{k}} := \mathbf{wl}_{\mathbf{j}} - \mathbf{etoe}_{\mathbf{k}}$ Compute limiting depth

$\mathbf{depth}_{\mathbf{j},\mathbf{k}} := \mathbf{if}\left(\mathbf{d}_{\mathbf{j},\mathbf{k}} \le 0 \cdot \mathbf{ft}, 0.1 \cdot \mathbf{ft}, \mathbf{d}_{\mathbf{j},\mathbf{k}}\right)$ Set minimum depth to 0.1 ft.

$$\mathbf{depth} = \begin{pmatrix} 4.6 & 5.2 & 5.9 & 7.8 \\ 5.3 & 5.9 & 6.6 & 8.5 \\ 6.7 & 7.3 & 8 & 9.9 \end{pmatrix} \cdot \mathbf{ft}$$

Depth-limited breaking wave conditions:

$\mathbf{slope} := \frac{1}{20}$ Breaker zone slope:

$\mathbf{Aw} := 43.8 \cdot (1 - \mathbf{exp}(-19 \cdot \mathbf{slope}))$ $\mathbf{Aw} = 26.9$

$\mathbf{Bw} := \frac{1.56}{(1 + \mathbf{exp}(-19.5 \cdot \mathbf{slope}))}$ $\mathbf{Bw} = 1.1$

$\mathbf{Tm}_{\mathbf{j}} := 0.9 \cdot \mathbf{Tp}_{\mathbf{j}}$ From EM 1110-2-1614

Initial guess at the max breaker height: $\mathbf{Hb} := 5 \cdot \mathbf{ft}$

Given

$$\mathbf{depth} = \frac{\mathbf{Hb}}{\mathbf{Bw} - \mathbf{Aw} \cdot \frac{\mathbf{Hb}}{\mathbf{g} \cdot \left(\mathbf{Tp}^2\right)}}$$

$$\mathbf{HBF}(\mathbf{depth}, \mathbf{Aw}, \mathbf{Bw}, \mathbf{Tp}) := \mathbf{Find}(\mathbf{Hb})$$

$$\mathbf{Hb}_{j,k} := \mathbf{HBF}\left(\mathbf{depth}_{j,k}, \mathbf{Aw}, \mathbf{Bw}, \mathbf{Tp}_j\right)$$

$$\kappa_{j,k} := \frac{\mathbf{Hb}_{j,k}}{\mathbf{depth}_{j,k}}$$ Wave breaking coefficient

$$\mathbf{RP} = \begin{pmatrix} 44 \\ 73 \\ 150 \end{pmatrix} \cdot \mathbf{yr} \qquad \mathbf{Hb} = \begin{pmatrix} 5.1 & 5.8 & 6.6 & 8.6 \\ 5.9 & 6.6 & 7.4 & 9.4 \\ 7.5 & 8.1 & 8.9 & 11 \end{pmatrix} \cdot \mathbf{ft} \qquad \kappa = \begin{pmatrix} 1.12 & 1.12 & 1.11 & 1.11 \\ 1.12 & 1.12 & 1.11 & 1.11 \\ 1.12 & 1.11 & 1.11 & 1.11 \end{pmatrix}$$

Wave length at structure toe used to estimate deepwater conditions

$\mathbf{L} := 100 \cdot \mathbf{ft}$ Initial Guess for Wavelength Calculation

Given

$$\mathbf{L} = \frac{\mathbf{g}}{2 \cdot \pi} \cdot \mathbf{T}^2 \cdot \tanh\left(2 \cdot \pi \cdot \frac{\mathbf{depth}}{\mathbf{L}}\right)$$

$$\mathbf{Wavel}(\mathbf{T}, \mathbf{depth}) := \mathbf{Find}(\mathbf{L})$$

$$\mathbf{L}_{j,k} := \mathbf{Wavel}\left(\mathbf{Tp}_j, \mathbf{depth}_{j,k}\right)$$

$$\mathbf{L} = \begin{pmatrix} 207.4 & 220.4 & 234.6 & 269.4 \\ 235.6 & 248.5 & 262.7 & 297.7 \\ 283.8 & 296.1 & 309.9 & 344.4 \end{pmatrix} \cdot \mathbf{ft}$$ Wavelength at structure toe

GODA Wave Calculation Method: random wave transformation to structure toe

$$Ks_{j,k} := \sqrt{\frac{1}{\tanh\left(2\cdot\pi\cdot\frac{depth_{j,k}}{L_{j,k}}\right)}\cdot\frac{1}{\left(1+4\cdot\pi\cdot\frac{\frac{depth_{j,k}}{L_{j,k}}}{\sinh\left(4\cdot\pi\cdot\frac{depth_{j,k}}{L_{j,k}}\right)}\right)}}$$

$$Ks = \begin{pmatrix} 1.91 & 1.85 & 1.79 & 1.68 \\ 1.89 & 1.84 & 1.79 & 1.69 \\ 1.85 & 1.81 & 1.77 & 1.68 \end{pmatrix}$$

Shoaling coefficient estimate

$$Hop_{j,k} := \frac{Hb_{j,k}}{1.8\cdot Ks_{j,k}}$$

Deepwater significant wave height from Goda

$$Hop = \begin{pmatrix} 1.5 & 1.7 & 2 & 2.9 \\ 1.7 & 2 & 2.3 & 3.1 \\ 2.2 & 2.5 & 2.8 & 3.6 \end{pmatrix}\cdot ft$$

Equivalent Deepwater Wave Height:

$$slopoff := \frac{1}{20} \qquad \theta b := atan(slopoff)$$

Bottom angle based on slope

$$Lp_j := \frac{g}{2\cdot\pi}\cdot\left(Tp_j\right)^2 \qquad Lp = \begin{pmatrix} 1497.3 \\ 1677.6 \\ 1927.2 \end{pmatrix}\cdot ft$$

Deep water wave length

Compute the Hmax=H1/250 wave height from Goda's Theory

First re-compute the maximum breaker height according to Goda

$$Hbg_{j,k} := Lp_j \cdot .18 \cdot \left[1 - e^{\left[-1.5 \cdot \pi \cdot \frac{depth_{j,k}}{Lp_j} \cdot \left(1+15 \cdot \tan(\theta b)^{\frac{4}{3}}\right)\right]}\right]$$

Goda Formula for Upper Limit Irregular Waves

Goda upper limit of irregular waves
vs. depth-limited estimate

$$Hbg = \begin{pmatrix} 4.9 & 5.6 & 6.3 & 8.3 \\ 5.7 & 6.3 & 7.1 & 9.1 \\ 7.2 & 7.8 & 8.6 & 10.6 \end{pmatrix} \cdot ft \qquad Hb = \begin{pmatrix} 5.1 & 5.8 & 6.6 & 8.6 \\ 5.9 & 6.6 & 7.4 & 9.4 \\ 7.5 & 8.1 & 8.9 & 11 \end{pmatrix} \cdot ft$$

GODA'S COEFFS FOR MAX WAVES

$$\beta os_{j,k} := 0.052 \cdot \left(\frac{Hop_{j,k}}{Lp_j}\right)^{-.38} \cdot e^{\left(20 \cdot \tan(\theta b)^{1.5}\right)}$$

$$\beta 1s_j := 0.63 \cdot e^{(3.8 \cdot \tan(\theta b))}$$

$$\beta maxs_{j,k} := 0.53 \cdot \left(\frac{Hop_{j,k}}{Lp_j}\right)^{-.29} \cdot e^{(2.4 \cdot \tan(\theta b))}$$

$$\beta maxs_{j,k} := if\left(\beta maxs_{j,k} > 1.65, \beta maxs_{j,k}, 1.65\right)$$

$$Hmax1_{j,k} := \beta os_{j,k} \cdot Hop_{j,k} + \beta 1s_j \cdot depth_{j,k}$$

$$Hmax2_{j,k} := \beta maxs_{j,k} \cdot Hop_{j,k}$$

$$Hmax3_{j,k} := 1.8 \cdot Ks_{j,k} \cdot Hop_{j,k}$$

$$H2_{j,k} := if\left(Hmax1_{j,k} < Hmax2_{j,k}, Hmax1_{j,k}, Hmax2_{j,k}\right)$$

$$H2_{j,k} := if\left(H2_{j,k} < Hmax3_{j,k}, H2_{j,k}, Hmax3_{j,k}\right)$$

$$H2_{j,k} := if\left(H2_{j,k} > Hbg_{j,k}, Hbg_{j,k}, H2_{j,k}\right)$$

Set max value to upper limit

GODA'S COEFFS FOR SIG WAVES

$$\beta o_{j,k} := 0.028 \cdot \left(\frac{Hop_{j,k}}{Lp_j}\right)^{-.38} \cdot e^{\left(20 \cdot \tan(\theta b)^{1.5}\right)}$$

$$\beta 1_j := 0.52 \cdot e^{(4.2 \cdot \tan(\theta b))}$$

$$\beta max_{j,k} := 0.32 \cdot \left(\frac{Hop_{j,k}}{Lp_j}\right)^{-.29} \cdot e^{(2.4 \cdot \tan(\theta b))}$$

$$\beta max_{j,k} := if\left(\beta max_{j,k} > .92, \beta max_{j,k}, .92\right)$$

$$Hs1_{j,k} := \beta o_{j,k} \cdot Hop_{j,k} + \beta 1_j \cdot depth_{j,k}$$

$$Hs2_{j,k} := \beta max_{j,k} \cdot Hop_{j,k}$$

$$Hs3_{j,k} := Ks_{j,k} \cdot Hop_{j,k}$$

$$Hsa_{j,k} := if\left(Hs1_{j,k} < Hs2_{j,k}, Hs1_{j,k}, Hs2_{j,k}\right)$$

$$Hsa_{j,k} := if\left(Hsa_{j,k} < Hs3_{j,k}, Hsa_{j,k}, Hs3_{j,k}\right)$$

Depth

$$\mathbf{depth} = \begin{pmatrix} 4.6 & 5.2 & 5.9 & 7.8 \\ 5.3 & 5.9 & 6.6 & 8.5 \\ 6.7 & 7.3 & 8 & 9.9 \end{pmatrix} \cdot \mathbf{ft}$$

GODA
Hb

$$\mathbf{Hbg} = \begin{pmatrix} 4.9 & 5.6 & 6.3 & 8.3 \\ 5.7 & 6.3 & 7.1 & 9.1 \\ 7.2 & 7.8 & 8.6 & 10.6 \end{pmatrix} \cdot \mathbf{ft}$$

GODA
H2% approx. =
H1/250

$$\mathbf{H2} = \begin{pmatrix} 4.8 & 5.4 & 6.1 & 8 \\ 5.6 & 6.2 & 6.8 & 8.7 \\ 7 & 7.6 & 8.3 & 10.1 \end{pmatrix} \cdot \mathbf{ft}$$

GODA
Hsa (significant)

$$\mathbf{Hsa} = \begin{pmatrix} 2.9 & 3.2 & 3.7 & 4.8 \\ 3.3 & 3.7 & 4.1 & 5.2 \\ 4.2 & 4.5 & 4.9 & 6.1 \end{pmatrix} \cdot \mathbf{ft}$$

$$\mathbf{K}_{j,k} := \frac{\mathbf{H2}_{j,k}}{\mathbf{Hsa}_{j,k}}$$

$$\mathbf{K} = \begin{pmatrix} 1.7 & 1.69 & 1.68 & 1.66 \\ 1.69 & 1.69 & 1.68 & 1.66 \\ 1.69 & 1.68 & 1.67 & 1.66 \end{pmatrix}$$

Preliminary Revetment Design, RUNUP CALCULATIONS:

from Pilarcyzk (1990)

Equivalent surf similarity parameter

$$\xi\mathbf{p}_{j,k} := \frac{\mathbf{Sslope}}{\sqrt{\frac{\mathbf{Hsa}_{j,k}}{\mathbf{Lp}_j}}}$$

$\gamma\mathbf{r} := 0.55$ Runup roughness reduction coefficient

$$\mathbf{Fact}_{j,k} := 1.75 \cdot \xi\mathbf{p}_{j,k} \qquad \mathbf{Fact}_{j,k} := \mathbf{if}\left(\xi\mathbf{p}_{j,k} > 2.5, 3.5, \xi\mathbf{p}_{j,k}\right) \qquad \mathbf{Fact} = \begin{pmatrix} 3.5 & 3.5 & 3.5 & 3.5 \\ 3.5 & 3.5 & 3.5 & 3.5 \\ 3.5 & 3.5 & 3.5 & 3.5 \end{pmatrix}$$

Runup from Pilarczyk

$$\mathbf{R2p}_{j,k} := \mathbf{Fact}_{j,k} \cdot \mathbf{Hsa}_{j,k} \cdot \gamma\mathbf{r} \qquad \mathbf{R2p} = \begin{pmatrix} 5.5 & 6.2 & 7 & 9.2 \\ 6.3 & 7 & 7.9 & 10.1 \\ 8 & 8.7 & 9.5 & 11.7 \end{pmatrix} \cdot \mathbf{ft}$$

de Waal and Van der Meer (1992)

Depth reduction factor

$$\gamma h_{j,k} := 1 - 0.03 \cdot \left(4 - \frac{depth_{j,k}}{Hsa_{j,k}}\right)^2 \qquad \gamma h = \begin{pmatrix} 0.83 & 0.83 & 0.83 & 0.83 \\ 0.83 & 0.83 & 0.83 & 0.83 \\ 0.83 & 0.83 & 0.83 & 0.83 \end{pmatrix}$$

$$\gamma h_{j,k} := \text{if}\left(\frac{depth_{j,k}}{Hsa_{j,k}} > 4, 1, \gamma h_{j,k}\right) \qquad Fact_{j,k} := 1.5 \cdot \xi p_{j,k}$$

Upper runup limit:

$$Fact_{j,k} := \text{if}\left(Fact_{j,k} > 3, 3, Fact_{j,k}\right)$$

$$R2v_{j,k} := Fact_{j,k} \cdot \gamma r \cdot \gamma h_{j,k} \cdot Hsa_{j,k}$$

$$R2p = \begin{pmatrix} 5.5 & 6.2 & 7 & 9.2 \\ 6.3 & 7 & 7.9 & 10.1 \\ 8 & 8.7 & 9.5 & 11.7 \end{pmatrix} \cdot ft \qquad R2v = \begin{pmatrix} 3.9 & 4.4 & 5 & 6.6 \\ 4.5 & 5 & 5.6 & 7.2 \\ 5.7 & 6.2 & 6.8 & 8.4 \end{pmatrix} \cdot ft$$

$$trup_{j,k} := wl_j + R2p_{j,k}$$

$$truv_{j,k} := wl_j + R2v_{j,k}$$

Runup elevations from van der Meer and Pilarczyk (ft, NGVD)

$$truv = \begin{pmatrix} 14.1 & 14.6 & 15.2 & 16.8 \\ 15.4 & 15.9 & 16.5 & 18.1 \\ 18 & 18.5 & 19.1 & 20.7 \end{pmatrix} \cdot ft \qquad trup = \begin{pmatrix} 15.7 & 16.4 & 17.2 & 19.4 \\ 17.2 & 17.9 & 18.8 & 21 \\ 20.3 & 21 & 21.8 & 24 \end{pmatrix} \cdot ft$$

Overtopping Calculations:

$$Hm_{j,k} := \frac{Hsa_{j,k}}{1.6} \qquad Tm_j := 0.9 \cdot Tp_j$$

$$Lo_j := \frac{g \cdot (Tm_j)^2}{2 \cdot \pi}$$

$$Hm = \begin{pmatrix} 1.8 & 2 & 2.3 & 3 \\ 2.1 & 2.3 & 2.6 & 3.3 \\ 2.6 & 2.8 & 3.1 & 3.8 \end{pmatrix} \cdot ft \qquad Tm = \begin{pmatrix} 15.4 \\ 16.3 \\ 17.5 \end{pmatrix} s \qquad wl = \begin{pmatrix} 10.2 \\ 10.9 \\ 12.3 \end{pmatrix} \cdot ft$$

$$Fc_j := ecrest - wl_j \qquad Fc = \begin{pmatrix} 0.8 \\ 0.1 \\ -1.3 \end{pmatrix} \cdot ft$$

Structure freeboard calculations

$$FB_{j,k} := \frac{R2v_{j,k} - Fc_j}{Hsa_{j,k}} \qquad FB = \begin{pmatrix} 1.1 & 1.1 & 1.1 & 1.2 \\ 1.3 & 1.3 & 1.3 & 1.4 \\ 1.7 & 1.7 & 1.6 & 1.6 \end{pmatrix}$$

Wave Overtopping By Van der Meer:

$$qv_{j,k} := \sqrt{g \cdot (Hsa_{j,k})^3} \cdot (8 \cdot 10^{-5}) \cdot e^{\left(3.1 \cdot \frac{R2v_{j,k} - Fc_j}{Hsa_{j,k}}\right)} \qquad qv_{j,k} := if\left(qv_{j,k} < 0.01 \cdot \frac{ft^3}{ft \cdot sec}, 0.01 \cdot \frac{ft^3}{ft \cdot sec}, qv_{j,k}\right)$$

$$qv = \begin{pmatrix} 0.06 & 0.08 & 0.11 & 0.2 \\ 0.17 & 0.2 & 0.24 & 0.36 \\ 0.7 & 0.74 & 0.79 & 0.93 \end{pmatrix} \cdot \frac{ft^3}{ft \cdot sec}$$

Estimate overtopping confidence bands

$$x_{j,k} := \log\left[\frac{qv_{j,k}}{\sqrt{g\cdot\left(Hsa_{j,k}\right)^3}}\right] \qquad xu_{j,k} := x_{j,k} - 1.645\cdot\left(\frac{0.11\cdot x_{j,k}}{\sqrt{1}}\right) \qquad qvmax_{j,k} := 10^{xu_{j,k}}\cdot\sqrt{g\cdot\left(Hsa_{j,k}\right)^3}$$

$$xl_{j,k} := x_{j,k} + 1.645\cdot\left(\frac{0.11\cdot x_{j,k}}{\sqrt{1}}\right) \qquad qvmin_{j,k} := 10^{xl_{j,k}}\cdot\sqrt{g\cdot\left(Hsa_{j,k}\right)^3}$$

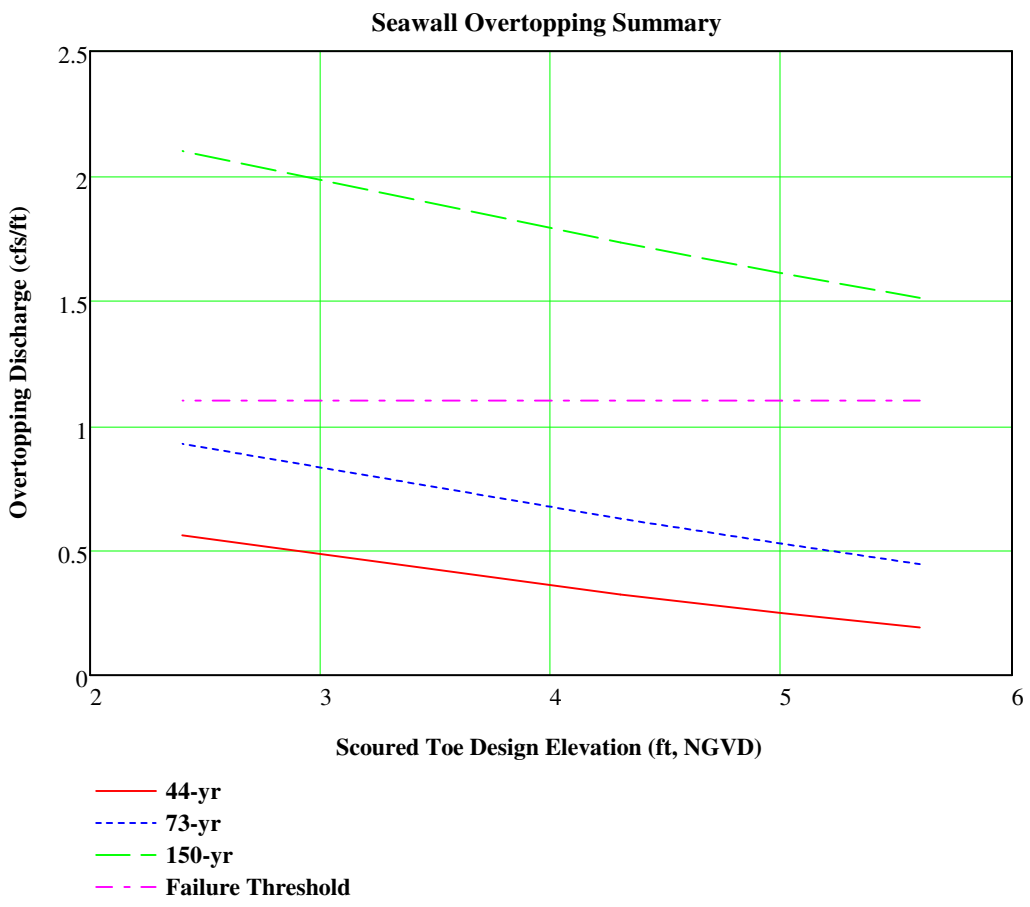
Overtopping calculation summary:

$$ecrest = 11\cdot ft$$

$$qv = \begin{pmatrix} 0.1 & 0.1 & 0.1 & 0.2 \\ 0.2 & 0.2 & 0.2 & 0.4 \\ 0.7 & 0.7 & 0.8 & 0.9 \end{pmatrix}\cdot\frac{ft^3}{ft\cdot sec} \qquad qvmax = \begin{pmatrix} 0.2 & 0.2 & 0.3 & 0.6 \\ 0.4 & 0.5 & 0.6 & 0.9 \\ 1.5 & 1.6 & 1.7 & 2.1 \end{pmatrix}\cdot\frac{ft^3}{ft\cdot sec}$$

Tolerable overtopping limit

$$tol := 1.1\cdot\frac{ft^3}{ft\cdot sec} \qquad RP = \begin{pmatrix} 44 \\ 73 \\ 150 \end{pmatrix}\cdot yr \qquad etoe = \begin{pmatrix} 5.6 \\ 5 \\ 4.3 \\ 2.4 \end{pmatrix}\cdot ft \qquad bermw = \begin{pmatrix} 30 \\ 20 \\ 10 \\ 0 \end{pmatrix} m$$


Seawall Overtopping Summary
Overtopping Discharge (cfs/ft)
2.5
2
1.5
1
0.5
0
2
3
4
5
6
Scoured Toe Design Elevation (ft, NGVD)
44-yr
73-yr
150-yr
Failure Threshold

Revetment Armor Calculations:

$$\mathbf{wl} = \begin{pmatrix} 10.2 \\ 10.9 \\ 12.3 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Hb} = \begin{pmatrix} 5.1 & 5.8 & 6.6 & 8.6 \\ 5.9 & 6.6 & 7.4 & 9.4 \\ 7.5 & 8.1 & 8.9 & 11 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Hs} = \begin{pmatrix} 17.2 \\ 17.4 \\ 18 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{etoe} = \begin{pmatrix} 5.6 \\ 5 \\ 4.3 \\ 2.4 \end{pmatrix} \cdot \mathbf{ft}$$

$$\mathbf{depth} = \begin{pmatrix} 4.6 & 5.2 & 5.9 & 7.8 \\ 5.3 & 5.9 & 6.6 & 8.5 \\ 6.7 & 7.3 & 8 & 9.9 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Tp} = \begin{pmatrix} 17.1 \\ 18.1 \\ 19.4 \end{pmatrix} \mathbf{s}$$

$$\mathbf{L} = \begin{pmatrix} 207.4 & 220.4 & 234.6 & 269.4 \\ 235.6 & 248.5 & 262.7 & 297.7 \\ 283.8 & 296.1 & 309.9 & 344.4 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Lo} = \begin{pmatrix} 1.2 \times 10^3 \\ 1.4 \times 10^3 \\ 1.6 \times 10^3 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Lp} = \begin{pmatrix} 1497.3 \\ 1677.6 \\ 1927.2 \end{pmatrix} \cdot \mathbf{ft}$$

$$\mathbf{Kd} := 2.0$$

$$\mathbf{cot\theta} := \frac{1}{\mathbf{Sslope}} \qquad \gamma\mathbf{r} := \frac{170 \cdot \mathbf{lb}}{\mathbf{ft}^3} \qquad \gamma\mathbf{w} := \frac{64 \cdot \mathbf{lb}}{\mathbf{ft}^3}$$

Structure characteristics

$$\mathbf{ton} := 2000 \cdot \mathbf{lb}$$

Hudson formula:

$$\mathbf{W}_{\mathbf{j},\mathbf{k}} := \frac{\gamma\mathbf{r} \cdot \left(\mathbf{H2}_{\mathbf{j},\mathbf{k}}\right)^3}{\mathbf{Kd} \cdot \left(\frac{\gamma\mathbf{r}}{\gamma\mathbf{w}} - 1\right)^3 \cdot \mathbf{cot\theta}} \qquad \mathbf{W} = \begin{pmatrix} 0.7 & 1 & 1.4 & 3.1 \\ 1.1 & 1.5 & 2 & 4.1 \\ 2.1 & 2.7 & 3.5 & 6.4 \end{pmatrix} \cdot \mathbf{ton}$$

van der Meer:

$$\theta := \operatorname{atan}\left(\frac{1}{Sslope}\right)$$

Check required rock sizes using Van der Meer's Formulae

$P := .4$ Structure Permeability factor

$N := 7000$ Number of Waves

$Sd := 2$ Damage Level, about 0 to 5 %

$$\Delta := \left(\frac{\gamma r}{\gamma w} - 1\right) \quad \Delta = 1.7$$

$$\xi mc := \left[6.2 \cdot P^{.31} \cdot \sqrt{\left(\frac{1}{\cot\theta}\right)}\right]^{\frac{1}{(P+.5)}} \qquad \xi mc = 4.4 \qquad \xi m_{j,k} := \frac{\frac{1}{\cot\theta}}{\sqrt{\frac{Hsa_{j,k}}{Lo_j}}} \qquad Sm_{j,k} := \frac{Hsa_{j,k}}{Lo_j}$$

$\xi mc = 4.4$

$\alpha 1_{j,k} := \xi m_{j,k} < \xi mc$ Factors to determine if plunging or surging waves

$\alpha 2_{j,k} := \xi m_{j,k} > \xi mc$

$$\xi m = \begin{pmatrix} 13.7 & 12.9 & 12.2 & 10.6 \\ 13.5 & 12.8 & 12.2 & 10.7 \\ 12.9 & 12.4 & 11.8 & 10.7 \end{pmatrix} \qquad \alpha 1 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \qquad \alpha 2 = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{pmatrix}$$

Plunging Waves:

$$Dn50p_{j,k} := \frac{Hsa_{j,k}}{\left[6.2 \cdot P^{0.18} \cdot \left(\frac{Sd}{\sqrt{N}}\right)^{0.2} \cdot \left(\xi m_{j,k}\right)^{-0.5}\right] \cdot \Delta} \cdot \alpha 1_{j,k} \qquad W50p_{j,k} := \left(Dn50p_{j,k}\right)^3 \cdot \gamma r$$

$$Dn50p = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \cdot ft \qquad W50p = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \cdot ton$$

Surging Waves:

$$Dn50s_{j,k} := \frac{Hsa_{j,k}}{\left[1.0 \cdot P^{-0.13} \cdot \left(\frac{Sd}{\sqrt{N}}\right)^{.2} \cdot \sqrt{\cot\theta} \cdot \left(\xi m_{j,k}\right)^{P}\right] \cdot \Delta} \cdot \alpha 2_{j,k} \qquad W50s_{j,k} := \left(Dn50s_{j,k}\right)^3 \cdot \gamma r$$

$$Dn50s = \begin{pmatrix} 0.9 & 1.1 & 1.2 & 1.7 \\ 1.1 & 1.2 & 1.4 & 1.9 \\ 1.4 & 1.5 & 1.7 & 2.2 \end{pmatrix} \cdot ft \qquad W50s = \begin{pmatrix} 0.1 & 0.1 & 0.2 & 0.4 \\ 0.1 & 0.2 & 0.2 & 0.6 \\ 0.2 & 0.3 & 0.4 & 0.9 \end{pmatrix} \cdot ton$$

$$W50 := W50p + W50s \qquad Dn50 := Dn50p + Dn50s$$

Compare van der Meer
and Hudson

$$W50 = \begin{pmatrix} 0.1 & 0.1 & 0.2 & 0.4 \\ 0.1 & 0.2 & 0.2 & 0.6 \\ 0.2 & 0.3 & 0.4 & 0.9 \end{pmatrix} \cdot ton \qquad Dn50 = \begin{pmatrix} 0.9 & 1.1 & 1.2 & 1.7 \\ 1.1 & 1.2 & 1.4 & 1.9 \\ 1.4 & 1.5 & 1.7 & 2.2 \end{pmatrix} \cdot ft$$

$$W = \begin{pmatrix} 0.7 & 1 & 1.4 & 3.1 \\ 1.1 & 1.5 & 2 & 4.1 \\ 2.1 & 2.7 & 3.5 & 6.4 \end{pmatrix} \cdot ton$$

Armor Layer Thickness:

Crest Width:

$$\mathbf{r}_{j,k} := \mathbf{nl}\cdot\left(\frac{\mathbf{W}_{j,k}}{\gamma\mathbf{r}}\right)^{\frac{1}{3}} \qquad \mathbf{r} = \begin{pmatrix} 4.1 & 4.6 & 5.1 & 6.7 \\ 4.7 & 5.2 & 5.7 & 7.3 \\ 5.9 & 6.4 & 6.9 & 8.5 \end{pmatrix}\cdot\mathbf{ft}$$

$$\mathbf{rc}_{j,k} := \frac{3}{2}\cdot\mathbf{r}_{j,k}$$

$$\mathbf{rc} = \begin{pmatrix} 6.1 & 6.8 & 7.7 & 10 \\ 7 & 7.7 & 8.6 & 10.9 \\ 8.8 & 9.5 & 10.4 & 12.7 \end{pmatrix}\cdot\mathbf{ft}$$

Burial depth at bottom of primary toe (a=Hs)
Width of primary toe (b=2a)

$$\mathbf{a}_{j,k} := \mathbf{Hb}_{j,k} \qquad \mathbf{b}_{j,k} := 2\cdot\mathbf{a}_{j,k}$$

$$\mathbf{a} = \begin{pmatrix} 5.1 & 5.8 & 6.6 & 8.6 \\ 5.9 & 6.6 & 7.4 & 9.4 \\ 7.5 & 8.1 & 8.9 & 11 \end{pmatrix}\cdot\mathbf{ft} \qquad \mathbf{b} = \begin{pmatrix} 10.3 & 11.6 & 13.1 & 17.3 \\ 11.8 & 13.2 & 14.7 & 18.8 \\ 15 & 16.3 & 17.8 & 21.9 \end{pmatrix}\cdot\mathbf{ft}$$

Underlayer:

$$\mathbf{Wu} := \frac{\mathbf{W}}{10}$$

$$\mathbf{ru}_{j,k} := 2\cdot\left(\frac{\mathbf{Wu}_{j,k}}{\gamma\mathbf{r}}\right)^{\frac{1}{3}} \qquad \mathbf{Wu} = \begin{pmatrix} 142.2 & 200.6 & 286 & 627.1 \\ 216.4 & 292.3 & 400.5 & 815.8 \\ 429 & 545.8 & 706 & 1285.6 \end{pmatrix}\cdot\mathbf{lb}$$

$$\mathbf{Wu} = \begin{pmatrix} 0.1 & 0.1 & 0.1 & 0.3 \\ 0.1 & 0.1 & 0.2 & 0.4 \\ 0.2 & 0.3 & 0.4 & 0.6 \end{pmatrix}\cdot\mathbf{ton} \qquad \mathbf{ru} = \begin{pmatrix} 1.9 & 2.1 & 2.4 & 3.1 \\ 2.2 & 2.4 & 2.7 & 3.4 \\ 2.7 & 3 & 3.2 & 3.9 \end{pmatrix}\cdot\mathbf{ft}$$

$$\mathbf{W} = \begin{pmatrix} 0.7 & 1 & 1.4 & 3.1 \\ 1.1 & 1.5 & 2 & 4.1 \\ 2.1 & 2.7 & 3.5 & 6.4 \end{pmatrix}\cdot\mathbf{ton}$$

QUANTITY ESTIMATES:

Design Feature for 1.0 ft shore parallel section:

$\mathbf{j} := 0 .. 2$

$\mathbf{Tarm} := \mathbf{r}$ $\quad \mathbf{Tund} := \mathbf{ru}$ $\quad \mathbf{Wcre} := \frac{3}{2} \cdot \mathbf{r}$ $\quad \mathbf{Wtoe} := \mathbf{b}$ $\quad \mathbf{ELcre} := \mathbf{ecrest}$

$$\mathbf{RP} := \begin{pmatrix} 44 \\ 73 \\ 150 \end{pmatrix} \cdot \mathbf{yr} \quad \mathbf{Tarm} = \begin{pmatrix} 4.1 & 4.6 & 5.1 & 6.7 \\ 4.7 & 5.2 & 5.7 & 7.3 \\ 5.9 & 6.4 & 6.9 & 8.5 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Tund} = \begin{pmatrix} 1.9 & 2.1 & 2.4 & 3.1 \\ 2.2 & 2.4 & 2.7 & 3.4 \\ 2.7 & 3 & 3.2 & 3.9 \end{pmatrix} \cdot \mathbf{ft}$$

$$\mathbf{ELcre} = 11 \cdot \mathbf{ft}$$

$$\mathbf{Wcre} = \begin{pmatrix} 6.1 & 6.8 & 7.7 & 10 \\ 7 & 7.7 & 8.6 & 10.9 \\ 8.8 & 9.5 & 10.4 & 12.7 \end{pmatrix} \cdot \mathbf{ft} \qquad \mathbf{Wtoe} = \begin{pmatrix} 10.3 & 11.6 & 13.1 & 17.3 \\ 11.8 & 13.2 & 14.7 & 18.8 \\ 15 & 16.3 & 17.8 & 21.9 \end{pmatrix} \cdot \mathbf{ft}$$

$$\mathbf{ELtoe}_{\mathbf{j},\mathbf{k}} := \mathbf{etoe}_{\mathbf{k}} + \frac{\mathbf{r}_{\mathbf{j},\mathbf{k}}}{2}$$

$$\mathbf{Sfrn} := \frac{1}{\mathbf{Sslope}}$$

$$\mathbf{Sbac} := \mathbf{Sfrn}$$

$$\mathbf{Stoe} := 1.0$$

$$\theta\mathbf{1} := \mathrm{atan}\left(\frac{1}{\mathbf{Sfrn}}\right) \qquad \theta\mathbf{1} = 0.6 \qquad \sin(\theta\mathbf{1}) = 0.55$$

$$\theta\mathbf{2} := \mathrm{atan}\left(\frac{1}{\mathbf{Sbac}}\right) \qquad \theta\mathbf{2} = 0.6$$

$$\theta\mathbf{3} := \mathrm{atan}\left(\frac{1}{\mathbf{Stoe}}\right) \qquad \theta\mathbf{3} = 0.8$$

Area of Armor: A1+A2+A3+Atolerance

$$\mathbf{A1}_{\mathbf{j},\mathbf{k}} := 0.5 \cdot \mathbf{Tarm}_{\mathbf{j},\mathbf{k}} \cdot \left[2 \cdot \mathbf{Wcre}_{\mathbf{j},\mathbf{k}} + \mathbf{Tarm}_{\mathbf{j},\mathbf{k}} \cdot (\mathbf{Sbac} + \mathbf{Sfrn})\right]$$

$$\mathbf{A2}_{\mathbf{j},\mathbf{k}} := 2 \cdot \frac{\mathbf{Tarm}_{\mathbf{j},\mathbf{k}}}{\sin(\theta\mathbf{1})} \cdot \left(\mathbf{ELcre} - \mathbf{ELtoe}_{\mathbf{j},\mathbf{k}} - \mathbf{Tarm}_{\mathbf{j},\mathbf{k}}\right)$$

$$A3_{j,k} := 0.5 \cdot Tarm_{j,k} \cdot \left[2.0 \cdot Wtoe_{j,k} + Tarm_{j,k} \cdot (Sfrn + Stoe)\right]$$

$$Atol_{j,k} := \left[Wcre_{j,k} + Wtoe_{j,k} + \left(ELcre - ELtoe_{j,k}\right) \cdot \left(\sin(\theta 1)^{-1} + \sin(\theta 2)^{-1}\right)\right] \cdot 1 \cdot ft$$

$$Aarmor := A1 + A2 + A3 + Atol$$

Cross-sectional feature:

$$Wcre1_{j,k} := Wcre_{j,k} + Tarm_{j,k} \cdot \left(Sbac + Sfrn - \frac{1}{\sin(\theta 1)}\right)$$

$$Wtoe1_{j,k} := Wtoe_{j,k} + Tund_{j,k} \cdot \left(\frac{1}{\sin(\theta 1)} - Sfrn - Stoe\right)$$

Area of Underlayer: C1+C2+C3

$$C1_{j,k} := 0.5 \cdot Tund_{j,k} \cdot \left[2 \cdot Wcre1_{j,k} + Tund_{j,k} \cdot (Sbac + Sfrn)\right]$$

$$C2_{j,k} := \frac{Tarm_{j,k}}{\sin(\theta 1)} \cdot Tund_{j,k}$$

$$C3_{j,k} := 0.5 \cdot Tund_{j,k} \cdot \left[2.0 \cdot Wtoe1_{j,k} + Tund_{j,k} \cdot (Sfrn + Stoe)\right]$$

$$Aund := C1 + C2 + C3$$

Filter Cloth Area:

$$Lfilter := \frac{Tund}{\sin(\theta 3)} + Wtoe1 + \frac{Tarm + Tund}{\sin(\theta 1)} + Wcre1 + Tund \cdot Sbac + \frac{Tund}{\sin(\theta 2)}$$

$$Lfilter = \begin{pmatrix} 39.5 & 44.4 & 50.1 & 65.2 \\ 45.5 & 50.3 & 56 & 71.2 \\ 57.2 & 62.1 & 67.7 & 82.9 \end{pmatrix} \cdot ft$$

Armor Quantity:

$\gamma w := 170 \cdot \frac{lb}{ft^3}$ $\quad$ $Porosity := 0.37$ $\quad$ $cy := 27 \cdot ft^3$ $\quad$ $sy := 9 \cdot ft^2$ $\quad$ $ton := 2000 \cdot lb$

$Conv := \gamma w \cdot (1 - Porosity)$ $\quad$ $Conv = 1.446 \cdot \frac{ton}{cy}$

Total Length:

$L1 := 1.0 \cdot ft$

$Varmor := Aarmor \cdot L1$ $\quad$ $Varmor = \begin{pmatrix} 4.8 & 5.9 & 7.3 & 11.7 \\ 5.6 & 6.7 & 8.2 & 12.9 \\ 7.2 & 8.5 & 10.2 & 15.4 \end{pmatrix} \cdot cy$

$Warmor := Varmor \cdot Conv$

$Warmor = \begin{pmatrix} 7 & 8.5 & 10.5 & 16.9 \\ 8.1 & 9.7 & 11.9 & 18.7 \\ 10.4 & 12.3 & 14.7 & 22.2 \end{pmatrix} \cdot ton$

Underlayer Quantity

$Vund := Aund \cdot L1$ $\quad$ $Vund = \begin{pmatrix} 2.3 & 2.9 & 3.6 & 6.1 \\ 3 & 3.7 & 4.5 & 7.3 \\ 4.7 & 5.6 & 6.6 & 9.9 \end{pmatrix} \cdot cy$

$Wund := Vund \cdot Conv$

$Wund = \begin{pmatrix} 3.3 & 4.1 & 5.2 & 8.9 \\ 4.3 & 5.3 & 6.6 & 10.6 \\ 6.8 & 8 & 9.6 & 14.3 \end{pmatrix} \cdot ton$

Filter Cloth Quantity:

$Afilter := Lfilter \cdot L1$ $\quad$ $Afilter = \begin{pmatrix} 4.4 & 4.9 & 5.6 & 7.2 \\ 5.1 & 5.6 & 6.2 & 7.9 \\ 6.4 & 6.9 & 7.5 & 9.2 \end{pmatrix} \cdot sy$

Excavation for Revetment:

Assume that excavation volume is approximately the total stone volume plus 20%

$a := 0.2$

$Vexca := (Varmor + Vund) \cdot (1 + a)$ $\quad$ $Vexca = \begin{pmatrix} 8.5 & 10.5 & 13.1 & 21.4 \\ 10.3 & 12.5 & 15.3 & 24.3 \\ 14.3 & 16.9 & 20.2 & 30.3 \end{pmatrix} \cdot cy$

Summary of Design Configuration

Use Index (0,2) or 44 year return period & 4.3 foot toe elevation which corresponds to a 10 m berm width to calculate quantities

$\mathbf{ELcre} = 11 \cdot \mathbf{ft}$ crest elevation

$\mathbf{etoe}_2 = 4.3 \cdot \mathbf{ft}$ toe elevation

$\frac{\mathbf{1}}{\mathbf{Sslope}} = 1.5$ structure slope

$\mathbf{qv}_{0,2} = 0.1 \cdot \frac{\mathbf{ft}^3}{\mathbf{ft} \cdot \mathbf{sec}}$ mean overtopping rate

$\mathbf{tol} = 1.1 \cdot \frac{\mathbf{ft}^3}{\mathbf{ft} \cdot \mathbf{sec}}$ mean overtopping rate threshold

$\mathbf{W}_{0,2} = 1.4 \cdot \mathbf{ton}$ armor stone size

$\mathbf{Tarm}_{0,2} = 5.1 \cdot \mathbf{ft}$ armor stone layer thickness

$\mathbf{Wcre}_{0,2} = 7.7 \cdot \mathbf{ft}$ armor stone crest width

$\mathbf{Wu}_{0,2} = 0.1 \cdot \mathbf{ton}$ under layer stone size

$\mathbf{Tund}_{0,2} = 2.4 \cdot \mathbf{ft}$ under layer stone layer thickness

$\mathbf{Wtoe}_{0,2} = 13.1 \cdot \mathbf{ft}$ scour toe berm width

Total Quantities

Use Index (0,2) or 44 year return period & 4.3 foot toe elevation which corresponds to a 10 m berm width to calculate quantities

$\mathbf{PL} := 3150 \cdot \mathbf{ft}$ Project Length

$\mathbf{Warmor_PL} := \mathbf{Warmor}_{0,2} \cdot \frac{\mathbf{PL}}{\mathbf{ft}} = 33145 \cdot \mathbf{ton}$ Total Armor Stone Quantity

$\mathbf{Wund_PL} := \mathbf{Wund}_{0,2} \cdot \frac{\mathbf{PL}}{\mathbf{ft}} = 16487 \cdot \mathbf{ton}$ Total Underlayer Stone Quantity

$\mathbf{Afilter_PL} := \mathbf{Afilter}_{0,2} \cdot \frac{\mathbf{PL}}{\mathbf{ft}} = 17520 \cdot \mathbf{sy}$ Total Area of Filter

$\mathbf{Vexca_PL} := \mathbf{Vexca}_{0,2} \cdot \frac{\mathbf{PL}}{\mathbf{ft}} = 41193 \cdot \mathbf{cy}$ Total volume of excavation

ATTACHMENT D

UPLAND SEDIMENT ANALYSIS

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Upland Sediment Sources - Montauk

By: Dornhelm, Esther

Date: 03/18/2014

Abstract: Summary of potential upland sand distributors, their prices, sand properties, and overfill required.

There are five principal upland source of sand on Long Island, with two located in Montauk with the capability to supply the entire volume of sand required (45,000 CY). There is also potential for the sand distributor to deliver and place the sand. A list of the two sand distributors being considered, their information, sand properties, and transportation capacity is shown in Table 1. Figure 1 shows the location of the sand stockpiles. The upland suppliers were contacted to provide price quotes for the cost of the raw material as well as the cost including transportation to downtown Montauk

A comparison of grain size distribution was completed to determine overfill required for each option. Overfill (placing over 1 cubic yard a fill for every 1 cubic yard of beach sand required at the site) is required to compensate for the finer sands in the placed sand that is lost when subjected to the native beach's sediment transport environment. For this reason, it is preferred to place sand with similar or larger grain size to the native beach. The overfill factor (R_A) was determined following the methodology presented in *Shore Protection Manual (1984)* . Grain size distributions and calculations are shown in Table 2. The graph that was used to determine R_A is shown in Figure 2.

The compatibility of the color of the sediment is illustrated by Figure 4 which compares sediment samples from the two upland sediment sources. The "white" sand on the left of Figure 4 is the East Coast Coarse Washed and the "yellow" sample on right is from Bistrian.

Table 1: Summary of Sand Distributors

Potential Upland Source	Phone Number	Location	Miles to	Sand Type	Median Grain Size	Overfill Factor	Color	Cost per CY*		Availability	Transportation
								Material	Material & Transport		
Bistrian	631-324-1123	225 Spring Fireplace Road	14.2	N/A	0.5 mm	1.12	More yellow than native beach sand.	$14.00	$21.00	Sufficient. 55-60,000 CY in stock pile currently.	Fleet available to transport 1000 CY per day using a combination of 20 CY dump trucks and 35 CY trailers.
East Coast	631-653-5445	585 Middle Line Hwy	24.6	Coarse Washed Sand	0.91 mm	1.0	More white than native beach sand.	$13.23	$18.98	Sufficient.	Fleet of six-40 ton trailers and three-25 ton tri-axles.
				Fine Dry Sand	0.34 mm	1.75	More white than native beach sand.	$12.08	$17.83		
				Fine Washed Sand	0.44 mm	1.25%	More white than native beach sand.	$13.23	$18.98		

* Assuming 1.15 tons per CY.

Table 2: Determining Overfill Factor using Grain Size Distribution

	D50* (mm)	D16* (mm)	D84* (mm)	D50* (phi)	D16* (phi)	D84* (phi)	Std Dev (phi)	Mean (phi)	σφb/σφn	(Mφb-Mφn)/σφn	RA from Chart
Native Sand	0.42	0.30	0.77	1.25	1.72	0.38	0.67	1.05	1.00	0.00	
Bistrian	0.51	0.81	0.27	0.97	0.30	1.89	0.79	1.10	1.18	0.07	1.12
East Coast Coarse (Washed)	0.905	1.7	0.43	0.14	-0.77	1.22	0.99	0.23	1.48	-1.23	1
East Coast Fine (Dry)	0.34	0.64	0.202	1.56	0.64	2.31	0.83	1.48	1.24	0.64	1.75
East Coast Fine (Washed)	0.44	1.15	0.22	1.18	-0.20	2.18	1.19	0.99	1.78	-0.09	1.25

*Percentiles represent "percent coarser"

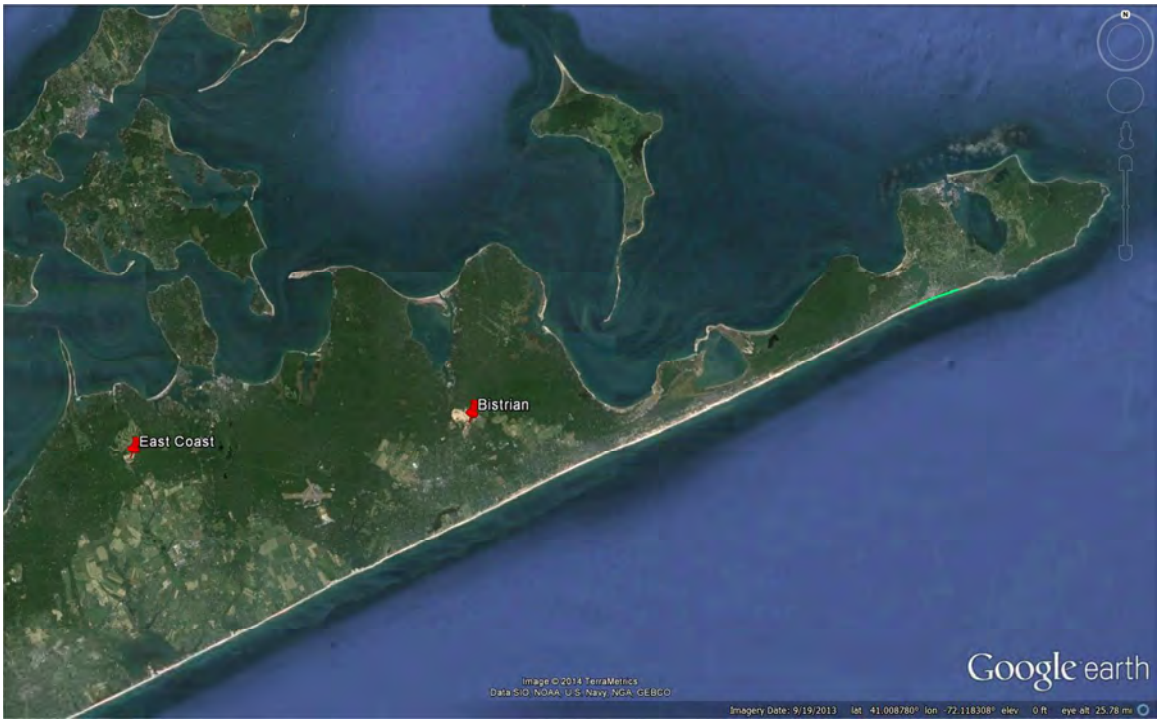

Figure 1: Sand Distributor Locations

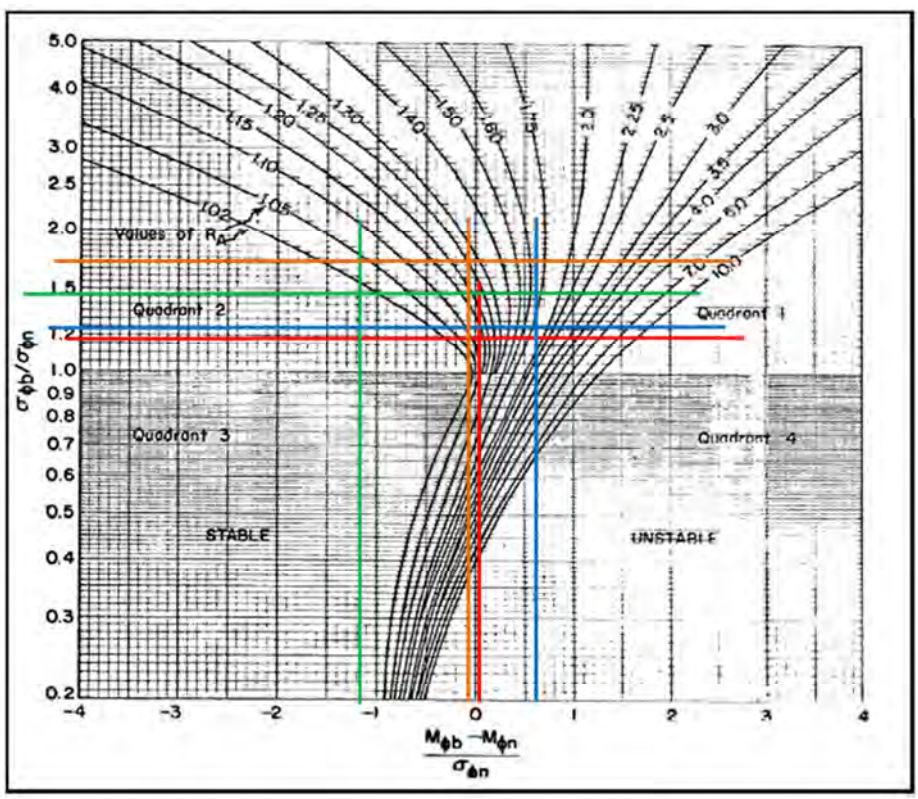

Figure 2: Overfill Factor Isolines

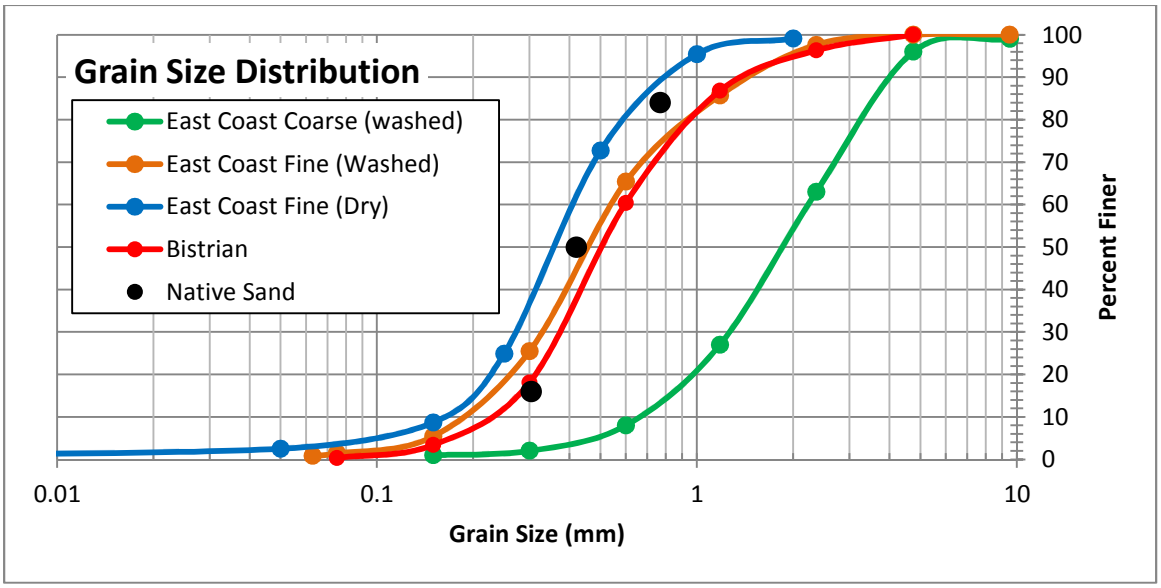

Figure 3: Grain Size Distribution of Upland Sediment Sources

Figure 4: Upland Sediment Samples

ATTACHMENT E

BEACHFILL DIFUSSION ANALYSIS

Date: July 18, 2013
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Fire Island Interim
Analysis: Alongshore Diffusivity

Solving for the Alongshore Diffusivity along Fire Island based on predicted Gross Sediment Transport Rate

Reference: Dean R. G., Dalyrmple R. A., 2002. "Coastal Processes with Engineering Applications," Cambridge University Press, New York, NY.)

Definitions

$GST := 2250000 \cdot \frac{m^3}{yr}$ gross sediment transport at Montauk (Gravens et al., 1999)

$S := 2.65$ specific gravity of sand

$p := 0.35$ porosity of sand

$\gamma b := 0.78$ breaking wave index

$K := 0.77$ sediment transport coefficient for medium sand (e.g. 0.3 mm) (Komar & Inman 1970)

$\theta b := 10 \cdot deg$ effective breaking wave angle

$hc := 27 \cdot ft$ depth of closure (NGVD)

$B := 9.5 \cdot ft$ berm elevation (NGVD)

$Tp := 8 \cdot s$ assumed effective wave period

CERC Sediment Transport Equation

$$GST = \blacksquare \cdot Cp \cdot Hb^{\frac{5}{2}} \cdot \sin(2 \cdot \theta b)$$ CERC Equation

$$Cp := K \cdot \frac{\sqrt{\frac{g}{\gamma b}}}{16 \cdot (S - 1) \cdot (1 - p)} = 0.159\, m^{0.5} \cdot s^{-1}$$

$$Hb := \left(\frac{GST}{Cp \cdot \sin(2 \cdot \theta b)} \right)^{\frac{2}{5}} = 1.114\, m$$ effective breaking wave height

Alongshore Diffusivity, G

$$G := 2 \cdot Cp \cdot Hb^{\frac{5}{2}} \cdot \frac{\cos(2 \cdot \theta b)}{hc + B} = 0.035\, m^2 \cdot s^{-1}$$

Effect of Wave Refraction on Alongshore Diffusivity, G

Reference: Dean R. G., 2005. "Advanced Series on Ocean Engineering - Volume 18: Beach Nourishment Theory and Practice," World Scientific Publishing Co., Hackensack, NJ.)

Dean showed that wave refaction at a beachfill project can reduce the alongshore diffusivity by the ratio Cb/Cc where Cb and Cc are the wave celerity at breaking and depth of closure respectively

Wave Length and Celerity at depth of closure

$L := 150 \cdot m$ Initial value

Given

$$L = \frac{g}{2 \cdot \pi} \cdot T^2 \cdot \tanh\left(2 \cdot \pi \cdot \frac{depth}{L}\right)$$

$Wavel(T, depth) := Find(L)$

$Lc := Wavel(Tp, hc) = 65.641\,m$

$Cc := \frac{Lc}{Tp} = 8.205\,m \cdot s^{-1}$

Wave Length and Celerity at break point

$L := 150 \cdot m$ Initial value

Given

$$L = \frac{g}{2 \cdot \pi} \cdot T^2 \cdot \tanh\left(2 \cdot \pi \cdot \frac{depth}{L}\right)$$

$Wavel(T, depth) := Find(L)$

$Lb := Wavel\left(Tp, \frac{Hb}{\gamma b}\right)$ $\qquad Lb = 29.492\,m$

$Cb := \frac{Lb}{Tp} = 3.687\,m \cdot s^{-1}$

$\frac{Cb}{Cc} = 0.449$

$ref := 0.4$ set reduction factor to 0.4

Adjusted Alongshore Diffusivity, G

$G := G \cdot ref = 0.0141\,m^2 \cdot s^{-1}$

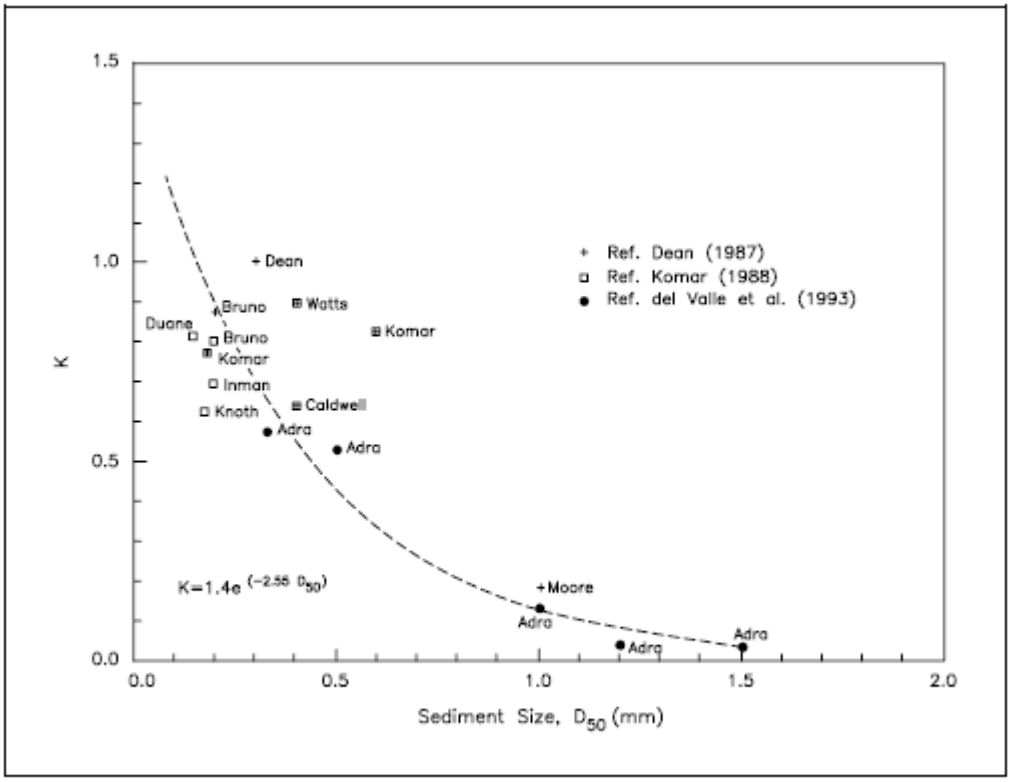

Figure III-2-6. Coefficient *K* versus median grain size D_{50} (del Valle, Medina, and Losada 1993)

Reproduced from CEM, Page III-2-15

Date: October 8, 2013
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Montauk Beach - FIMP
Analysis: Beachfill Diffusion - MREI Beachfill

Calculate fraction of beachfill volume remaining with Pelnard-Considere Equation for Rectangular Beachfill

Reference: Dean R. G., Dalyrmple R. A., 2002. "Coastal Processes with Engineering Applications," Cambridge University Press, New York, NY.)

Note: This analysis does not include beachfill tapers, the final analysis for the Montauk Beach applied 6 degree berm tapers, which requires the trapazoidal beachfill solution to the Pelnard-Considere Equation. The trapzoidal beachfill solution was solved numerically in Matlab.

Definitions

$hc := 27 \cdot ft$	depth of closure (NGVD)
$B := 9.5 \cdot ft$	berm elevation (NGVD)
$G := 0.014 \cdot \frac{m^2}{s}$	alongshore diffusivity
$Yo := 60 \cdot ft$	initial cross-shore distance between design shoreline and natural shoreline
$Ya := 91.2 \cdot ft$	advance nourishment width
$l := 6600 \cdot ft$	alongshore length of beachfill
$t := 4yr$	time after initial placement
$be := 3 \cdot \frac{ft}{yr}$	background erosion rate
$Yb := 6 \cdot ft$	addditional distance natural shoreline sticks out relative to baseline

Analytical Solution to Pelnard-Considere for Rectangular Beachfill Project

$$M := \left[\frac{\sqrt{4 \cdot G \cdot t}}{l \cdot \sqrt{\pi}} \cdot \left[e^{-\left(\frac{l}{\sqrt{4 \cdot G \cdot t}}\right)^2} - 1 \right] + \mathrm{erf}\left(\frac{l}{\sqrt{4G \cdot t}}\right) \right] - \frac{be \cdot t}{(Yo + Ya - Yb)}$$

fraction of initial fill remaining after time t

$M = 0.308$

$$re := (1 - M) \cdot \frac{(Yo + Ya - Yb)}{t} = 25.129 \cdot \frac{ft}{yr}$$

representative erosion rate

$$de := re - be = 22.129 \cdot \frac{ft}{yr}$$

diffusive erosion rate

Date: October 8, 2013
Analyst: Rob Hampson, Moffatt & Nichol
Client: U.S. Army Corps of Engineers
Project: Montauk Beach - FIMP
Analysis: Beachfill Diffusion - MREI Beachfill and Buried Seawall

Calculate fraction of beachfill volume remaining with Pelnard-Considere Equation for Rectangular Beachfill

Reference: Dean R. G., Dalyrmple R. A., 2002. "Coastal Processes with Engineering Applications," Cambridge University Press, New York, NY.)

Note: This analysis does not include beachfill tapers, the final analysis for the Montauk Beach applied 6 degree berm tapers, which requires the trapazoidal beachfill solution to the Pelnard-Considere Equation. The trapzoidal beachfill solution was solved numerically in Matlab.

Definitions

$hc := 27 \cdot ft$ depth of closure (NGVD)

$B := 9.5 \cdot ft$ berm elevation (NGVD)

$G := 0.014 \cdot \frac{m^2}{s}$ alongshore diffusivity

$Yo := 5 \cdot ft$ initial cross-shore distance between design shoreline and natural shoreline

$Ya := 28.9 \cdot ft$ advance nourishment width

$l := 6600 \cdot ft$ alongshore length of beachfill

$t := 4yr$ time after initial placement

$be := 3 \cdot \frac{ft}{yr}$ background erosion rate

$Yb := 6 \cdot ft$ addditional distance natural shoreline sticks out relative to baseline

Analytical Solution to Pelnard-Considere for Rectangular Beachfill Project

$$M := \left[\frac{\sqrt{4 \cdot G \cdot t}}{l \cdot \sqrt{\pi}} \cdot \left[e^{-\left(\frac{l}{\sqrt{4 \cdot G \cdot t}}\right)^2} - 1 \right] + \mathrm{erf}\left(\frac{l}{\sqrt{4G \cdot t}}\right) \right] - \frac{be \cdot t}{(Yo + Ya - Yb)}$$

fraction of initial fill remaining after time t

$M = -0.04$

$re := (1 - M) \cdot \frac{(Yo + Ya - Yb)}{t} = 7.252 \cdot \frac{ft}{yr}$ representative erosion rate

$de := re - be = 4.252 \cdot \frac{ft}{yr}$ diffusive erosion rate

ATTACHMENT F

CONSTRUCTION SCHEDULE

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MEMORANDUM

To: Santiago Alfageme, Rob Hampson

From: Adam Isaacson

Date: May 23, 2014

Subject: Downtown Montauk Stabilization Project – Construction Feasibility Schedule

M&N Job No.: 7190-14

Copy: Jack Fink

This memorandum summarizes the assumptions applied in developing a feasibility level construction schedule for the Downtown Montauk Stabilization Project. The project is expected to be given a Notice to Proceed (NTP) on January 2, 2014 and it is the local stakeholders desire to have construction completed in time for the Memorial Day holiday weekend May 22, 2015. The schedule is based on a ten hour work day, seven days a week with the exception of the upland sediment supplier, which is only open for a half day on Saturday and closed on Sundays.

Pumps

Based on discussions with a representative from Maccaferri, each pump and crew is assumed to have a production rate of 8 bags per hour. As stated previously, it is assumed that the construction crew and pumps would be operated 10 hours a day, 7 days a week. Each pump and crew is expected to be able to fill and place 80 geobags per day and 560 geobags per week.

Truck Trips

The stabilization project will require approximately 2,762 truck round trips to deliver the 45,000 cubic yards of sand needed to complete the project. This trip quantity is based on an average sand load per truck of 22 tons or 16.3 cubic yards. The required frequency of truck trips depends on the duration of the job, which is controlled by the number of pumps used. The number of truck trips per ten hour work day needed to complete the job in the three-pump scenario is 5 trucks per hour. The number of truck needed to complete the job in the two-pump scenario is 3.4 trucks per hour.

Upland Sediment Supplier

Based on discussions with two local upland suppliers, it is assumed that the upland sediment supplier has the ability to fulfill the needs of this project. It is also assumed that the business hours of the supplier are 7 AM – 4:30 PM Monday-Friday and 7 AM – 12 PM Saturday.

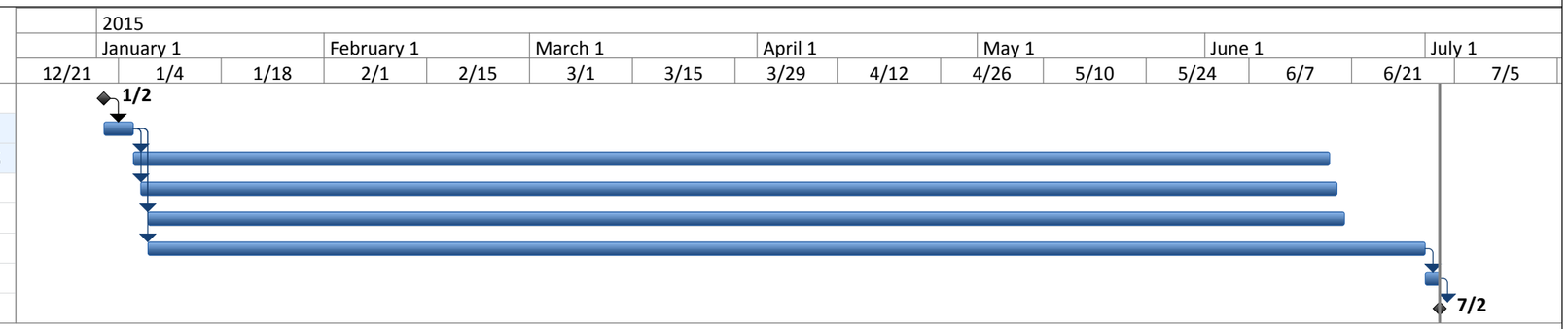
Excavation and Grading

The necessary sequence for the excavators and bulldozers assumed for this schedule are as follows. Excavation will begin two days after sand delivery begins and one day prior to the start of filling and placing geobags. This sequencing will allow a sufficient stockpile to build up and ensure a sufficient trench is ready once geobags begin to be filled and placed. It is assumed that excavated materials will be placed over top of geobags shortly after the placement of the geobags to limit their exposure. Final

grading of the dunes will take place intermittently following the replacement of excavated materials. It will also extend one week after the placement of the final geobags to finish the final beach segment and to touch up other areas of the project if necessary.

Montauk Beach Rehabilitation
Construction Feasibility Schedule - 2 Pumps
May 29, 2014

ID	Task Mode	Task Name	Duration	Start	Finish
1		Notice to Proceed (NTP)	0 days	Fri 1/2/15	Fri 1/2/15
2		Mobilization	2 days	Fri 1/2/15	Mon 1/5/15
3		Sand Delivery	117 days	Tue 1/6/15	Wed 6/17/15
4		Trench Excavation	117 days	Wed 1/7/15	Thu 6/18/15
5		Fill and Place Geobags	117 days	Thu 1/8/15	Fri 6/19/15
6		Grading of Sand Over Bags	124 days	Thu 1/8/15	Tue 6/30/15
7		Demobilization	2 days	Wed 7/1/15	Thu 7/2/15
8		Completion	0 days	Thu 7/2/15	Thu 7/2/15

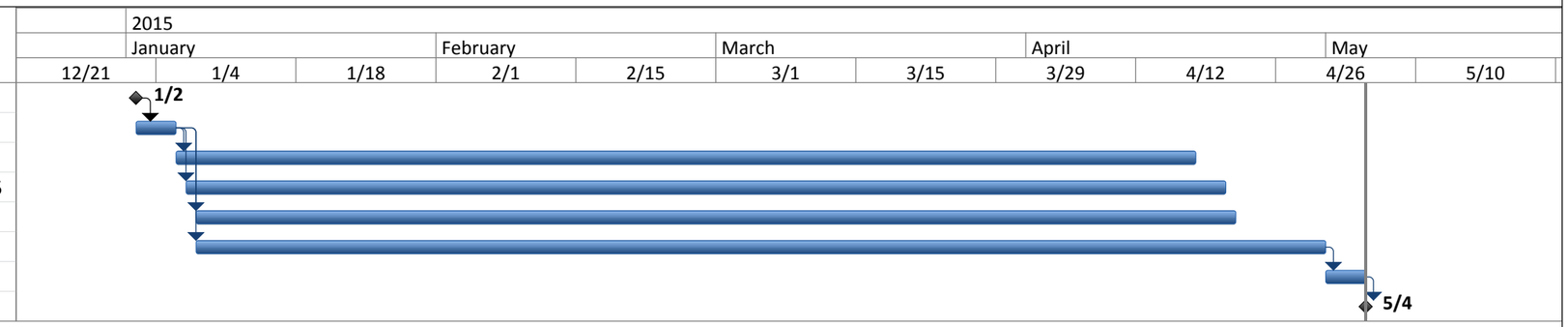


Project: Montauk Feasibility Sche
Date: Thu 5/29/14

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

Montauk Beach Rehabilitation
Construction Feasibility Schedule - 3 Pumps
May 29, 2014

ID	Task Mode	Task Name	Duration	Start	Finish
1		Notice to Proceed (NTP)	0 days	Fri 1/2/15	Fri 1/2/15
2		Mobilization	2 days	Fri 1/2/15	Mon 1/5/15
3		Sand Delivery	74 days	Tue 1/6/15	Fri 4/17/15
4		Trench Excavation	74 days	Wed 1/7/15	Mon 4/20/15
5		Fill and Place Geobags	74 days	Thu 1/8/15	Tue 4/21/15
6		Grading of Sand Over Bags	81 days	Thu 1/8/15	Thu 4/30/15
7		Demobilization	2 days	Fri 5/1/15	Mon 5/4/15
8		Completion	0 days	Mon 5/4/15	Mon 5/4/15



Project: Montauk Feasibility Sche
Date: Thu 5/29/14

Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

Fire Island Inlet to Montauk Point

Coastal Storm Risk Management Simulation Model
Downtown Montauk Shorefront Emergency Stabilization

Economic Reference Documentation

1.0 INTRODUCTION

The Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project (FIMP) was authorized by the River and Harbor Act of 14 July 1960. The project is being reformulated to identify a comprehensive long-term solution to reduce the risk of coastal storm damages along the south shore of Long Island in a manner which balances the risks to human life and property while maintaining, enhancing, and restoring ecosystem integrity and coastal biodiversity.

The ongoing FIMP reformulation study is evaluating alternatives to reduce the risk of storm damages, determine Federal interest in participating in one or more of these alternatives, and identify a mutually agreeable joint Federal/state/locally supported plan for addressing the storm damage reduction needs in the Study Area. Prior to Hurricane Sandy, the study had identified but not finalized a Tentative Federally Supported Plan.

Following landfall of Hurricane Sandy on 29 October 2012, the protective beach in downtown Montauk has been largely eroded leaving many buildings vulnerable to additional damages from future storms. Figures 1 and 2 in the main report show the eroded beach conditions at downtown Montauk the day after Hurricane Sandy.

Consistent with the Disaster Relief Appropriations Act of 2013 (Public Law. 113-2; herein P.L. 113-2), the USACE has proposed an approach to expedite implementation of a one-time stabilization project within the hamlet of Montauk in advance of the completion of the Reformulation study. It is recognized that the timeframe to complete the FIMP Reformulation Study would leave vulnerable portions of the Village exposed to future damages. This approach is strongly supported by the State of New York, Suffolk County, N.Y., the Town of Easthampton, and the hamlet of Montauk. This approach is also consistent with USACE policy guidance (Memorandum dated 8 January 2014 approval from Steven L. Stockton, P.E., Director of Civil Works, Appendix H – Pertinent Correspondence).

This Stabilization effort is being undertaken in response to the highly vulnerable condition following Hurricane Sandy's erosive forces, where expedited action is needed to stabilize this area. This Downtown Montauk stabilization effort (Reach 5) has been developed as a one-time, initial construction project to repair damages caused by Hurricane Sandy and to stabilize the area. This report utilizes information and data from the ongoing FIMP study to develop a one-time stabilization project and demonstrate that the Stabilization Project has its own independent utility, and as developed, does not limit the options available in the Reformulation Study or pre-suppose the outcome of the Reformulation Study.

1.1 Downtown Montauk Relationship to FIMP

The Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project (FIMP) was first authorized by the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960, which established the authorized project. The project is being reformulated by the U.S. Army Corps of Engineers, New York District (USACE) as the lead Federal agency to identify a comprehensive long-term solution to manage the risk of coastal storm damages along the south shore of Long Island in a

manner which balances the risks to human life and property while maintaining, enhancing, and restoring ecosystem integrity and coastal biodiversity.

The overall FIMP reformulation study was undertaken to evaluate alternatives to determine Federal interest in participating in one or more of these alternatives, and identify a mutually agreeable joint Federal/state/locally supported plan for addressing the storm risk management needs in the study area. In addition to addressing the USACE's national objectives of storm risk management and environmental sustainability, this collaborative effort identified alternatives for implementation by other Federal, state and local agencies to achieve broader study objectives.

The FIMP Reformulation Study is in the final stages of documenting the process for development of the TFSP. The Reformulation study evaluated several combinations of features to identify the plan that meets the USACE goals and missions and is mutually agreeable to the Department of the Interior, as required by law in the Fire Island National Seashore authorizing act.

The TFSP from the FIMP plan was advanced following economic evaluation consistent with Corps guidelines and will be detailed in the subsequent GRR. The TFSP includes multiple features to achieve CSDR in the study area, including beachfill and renourishment.

1.2 Summary of FIMP Plan Formulation

Evaluation of design and placement of proposed CSDR features in the Study Area identified that a wide range of the individual alternatives are cost effective options for Storm Risk management. The analysis also indicated that no one alternative addresses all the storm risk management problems. Rather, addressing multiple problems requires multiple solutions. In this respect, many of the alternatives considered complement each other, and Alternative Plans benefit from combinations of alternatives. This reformulation process recommended the following features be integrated into overall Plans of improvement:

- Inlet bypassing Plans
- Breach Response Plans (Responsive Plan at +9.5 ft NGVD, Responsive or Proactive Plans at +13 ft NGVD)
- Non-Structural Plans (6-year and 10-year levels of risk management) - defined as those activities to minimize potential damages through elevation, relocation, flood proofing, buyout, etc
- Beachfill (13 ft Dune and 15 ft Dune) - soft structural measures, generally are those constructed of sand and are designed to "augment and/or" mimic the existing natural protective features

Based on the evaluation of the individual alternatives, combined plans were developed. First, Second and Third added plans were developed by incrementally adding Management Alternatives (Plan 1), Non-Structural Alternatives (Plan 2), and Structural Alternatives (Plan 3). The scale of the alternatives selected for inclusion was based on the results of the optimization of individual alternatives and the potential for the combined alternatives to more fully satisfy the project objectives and evaluation criteria.

The authorized project addresses CSDR along five reaches as follows:

Reach 1 – Fire Island Inlet to Moriches Inlet (FIMI)
Reach 2 – Moriches Inlet to Shinnecock Inlet
Reach 3 – Shinnecock Inlet to Southampton (Quogue to Agawam Lake)
Reach 4 – Southampton to Beach Hampton (Agawam Lake to Hook Pond)
Reach 5 – Beach Hampton to Montauk Point (Hook Pond to Montauk Point)

1.3 Montauk Reach and the Hamlet of Montauk

The Montauk Reach is the eastern most of the five designated Reaches within the overall FIMP Study Area. It extends from Hook Pond in East Hampton to Montauk Point, a distance of about 20 miles.

The incorporated hamlet of Montauk is in the eastern portion of the Montauk Reach and is a major tourist destination with many hotels, restaurants and shops in the downtown area, many of which suffered significant damages as a result of Sandy. There are 43 buildings in downtown Montauk that fall within the modeled 100-yr floodplain (storm with a 1% probability of occurring in any given year).

This Stabilization Report addresses the immediate actions necessary for the Downtown Montauk portion of the overall FIMP Study Area.

1.4 Stabilization Project Details

The proposed design includes 3,100 feet of reinforced dune extending from South Emery Street to Atlantic Terrace Motel and tapers into high dunes at both ends of the Project Area. The extent of the proposed plan was selected to provide protection to all of the shorefront commercial buildings in Downtown Montauk.

1.5 Effective Project Life

The Stabilization Project has been evaluated over a 15 year period since that is the period of time over which there is a measurable difference between the without project future condition and with-project condition. Erosive conditions on the beach are anticipated to expose the geotextile filled containers (GFCs) to sunlight and waves, and without renourishment, the anticipated duration of CSDR provided by the reinforced dune is 5 years.

1.6 Relevant Benefit Streams

Two benefit streams have been assessed to demonstrate that the Stabilization effort is economically justified. Damage avoided to structure and contents is the largest component of the project benefit for this effort. The structures and contents are largely subjected to undermining from coastal storms. Avoided costs of beach sediment placement by local entities is the second benefit stream captured in this analysis.

1.7 Problem Identification

1.7.1 Without Project Future Conditions

The Without Project Future Conditions (WOPFC) is by definition the projection of the most-likely future conditions in the Study Area in the absence of a proposed project from the current study. The WOPFC serves as the base conditions for all the alternative analyses, including the engineering design, economic evaluation of alternatives, comparison of alternatives, as well as environmental, social and cultural impact assessment.

The WOPFC is a forecast based upon what has actually occurred, is currently occurring or is expected to occur in the Study Area if no actions are taken as a result of this study. As it is impossible to predict specifically what may occur, future activities that impact the without-project condition must be representative of what is most likely to occur, and as such must be based upon historic practice and trends, unless there is definitive evidence of new actions or policies scheduled for implementation that would influence past practices. The goal is to choose the most likely future scenario (not the only future scenario), based upon reasoned, documentable forecasting

In defining the WOPFC, it is assumed that periodic beach fills and beach scraping will continue to be implemented by local governments and home owner associations to maintain some threshold beach condition. This condition is based on a review of historic activities including the extent of local and private activities. Available records indicated that in the years 2010 through 2013 beach and dune repairs of this nature totaling more than $2,200,000 were locally implemented. It is likely that future regulatory requirements may limit the size, scope, and timing of future local projects; but even with these conditions, it is expected that within their available resources, local groups will continue to maintain a minimum beach and dune condition. Since local agencies discourage hard structures to protect shoreline properties, it is not assumed that individual hardening of the shoreline will be allowed.

1.7.2 Structures at Risk

The structure inventory for the Downtown Montauk study area was isolated from the larger FIMP reformulation inventory, and reviewed and updated in cooperation with local officials and property owners. It is summarized and presented in Table 1 and illustrated in Figure 1.

Table 1: Structure Valuation in Downtown Montauk

Structure Usage	**Number**	**Average Footprint (Sq. Ft)**	**Depreciated Structure Replacement Value**	
			Total	**Average**
Hotel	27	9,600	$79,698,400	$2,951,800
Commercial	3	5,900	$2,825,100	$941,700
Single-Family Residential	8	1,300	$1,959,900	$245,000
Multi-Family Residential	5	10,200	$19,350,500	$3,870,100
Totals	*43*		*$103,833,900*	

Depreciated Structure Value: 2005 price level updated to October 2013 via factor of 1.262 (ENR BCI Index)

Figure 1. Downtown Montauk Structures at Risk

2.0 STORM DAMAGE ANALYSIS

2.1 Development of Damages

While BeachFx is the model endorsed for use in Coastal storm damage reduction studies, Beach Fx is not capable of analyzing a reinforced structure as proposed in this scenario. Therefore, the Downtown Montauk Shorefront Emergency Stabilization model was developed to quantify the impact of storms on shorefront development and also to quantify the benefits arising from the construction of an emergency stabilization project to reduce the risk of storm damages in this area.

The immediate shorefront area is potentially subject to storm damage from waves, storm erosion/recession undermining of buildings, and inundation. Prior analyses indicated that the primary damage mechanism affecting shorefront structures in downtown Montauk is undermining by storm erosion/shoreline recession and that most existing models (including the original FIMP shorefront damage model) were not appropriate for this task, either due to limitations in the models themselves, or due to the time and budget required to collate and process the required input data. One limitation of the FIMP shorefront damage model is that it was intended to evaluate with-project scenarios featuring regular beach renourishment as a key component, while renourishment may not be considered for any stabilization project implemented at Downtown Montauk under Public Law 113-2.

The damage model was developed using @Risk for Excel to simulate the damages and losses of shorefront structures to erosion over the 15-year period of analysis permitted within the bounds of Public Law 113-2, both with- and without project. The model randomly generates one storm event in each year of the analysis period, and returns a corresponding water surface elevation, scoured elevation at the toe of the structure, and storm erosion distance, taking into account the effects of sea level rise and shoreline change due to yearly erosion. These are used to determine whether the reinforced structure has failed, and to lookup damages due to subsequent erosion and undermining of shorefront structures.

In accordance with current USACE guidelines the model incorporates risk and uncertainty in that key parameters are defined by probability distributions. These allow the input value to vary independently for the execution of each lifecycle as the @RISK model repetitively recalculates the model and collects the results to report the mean average annual damage value. The parameters currently subject to uncertainty in this model are the setback distances and depreciated replacement value of the shorefront structures in this area.

2.1.1 Model Description

The purpose of this model is to quantify the impact of storms on development along East Hampton, NY, in the study area. The immediate shorefront area is subject to storm damage from waves, storm erosion and inundation.

The study area is also vulnerable to wave and inundation damages. Analysis of these impacts was conducted under the larger FIMP effort with a different model. These damages were found to be a small percentage of the overall damages and were primarily incurred only at very low frequency events. For this stabilization effort, the PDT limited the analysis to erosion damage only, quantified by the spreadsheet model described below.

This is a spreadsheet model using @Risk (Palisade Corporation) add in to Microsoft Excel to simulate the damages and losses to shorefront structures over a fifteen year period of analysis, with and without project. The model randomly generates one storm event in each year of the analysis period and returns a corresponding water surface elevation, scoured elevation at the toe of the structure, and storm erosion distance, taking into account the effects of sea level rise and shoreline change due to yearly erosion. These are used to determine whether the reinforced structure has failed, and to lookup damages due to subsequent erosion and undermining of shorefront structures.

The model currently assumes that the reinforced dune alternative will fail when impacted by a wave height of three feet or more, or id the toe elevation is reduced to scour to +1 foot NGVD. In accordance with current USACE guidelines, the model incorporates risk and uncertainty in that key parameters are defined by probability distributions. These allow the input value to vary independently for the execution of each lifecycle as the @RISK model repetitively recalculates the model and collects the results to report the mean average annual damage value. The parameters currently subject to uncertainty in this model are the setback distances and depreciated replacement value of the shorefront structures in this area.

@Risk is a Monte Carlo simulation risk analysis tool available from the Palisade Corporation. It is used as an add-on to Excel to generate a range of outcomes from which probabilities can be derived. @Risk was developed by Palisade Corp. in 1987 and continues to be updated and supported. It supports decision-making throughout a wide range of industry sectors. More information on @Risk is available through the company's website at: http://www.palisade.com/risk/. The Planning and Policy Division of Headquarters, USACE has approved @Risk for use in Corps studies.

2.1.2 Without Project Damages

The calculation of without project damages was based on the assumption that the selected plan is not constructed and that the shorefront structures are vulnerable to damage from erosion in any year of the period of analysis. The set of vulnerable structures contributing to the damage analysis was taken from the structure inventory compiled for the original FIMP shorefront damage analyses, with their depreciated structure replacement values revised to a 2013 price level via an update factor of 1.26, which was derived from the historic building cost index published monthly by the *Engineering News-Record*. This update factor has been used for other components of the current FIMP study.

The model records damages due to erosion in any given year by means of a lookup table of aggregated structure damage versus erosion distance. The model currently assumes that as a building is undermined, the damage incurred increases linearly from zero at zero undermining to 100% when the mid-point of the structure has been passed. Content damages were incorporated by adding 50% to the value of each structure. The aggregate damage/erosion distance function resulting from this approach which has been incorporated in the model is presented. The model currently assumes that structures damaged to 100% of their value are not rebuilt within the same lifecycle.

The model has been executed using an interest rate of 3.5% and 25,000 iterations to give without project equivalent annual damages of $1,378,000. It should be noted that if this analysis were to be conducted for the evaluation of a long-term solution for the Downtown Montauk area, i.e. one using a period of analysis of 50 years, significantly higher without project equivalent annual damages would be expected, due to the increased vulnerability of structures to erosion in the latter part of the analysis period.

It should be noted that additional damages to reflect land loss and cost of demolition of structures could be included in the without project analysis. For the purposes of the Stabilization effort, these values were not quantified.

Without Project conditions are presented in Figure 2.

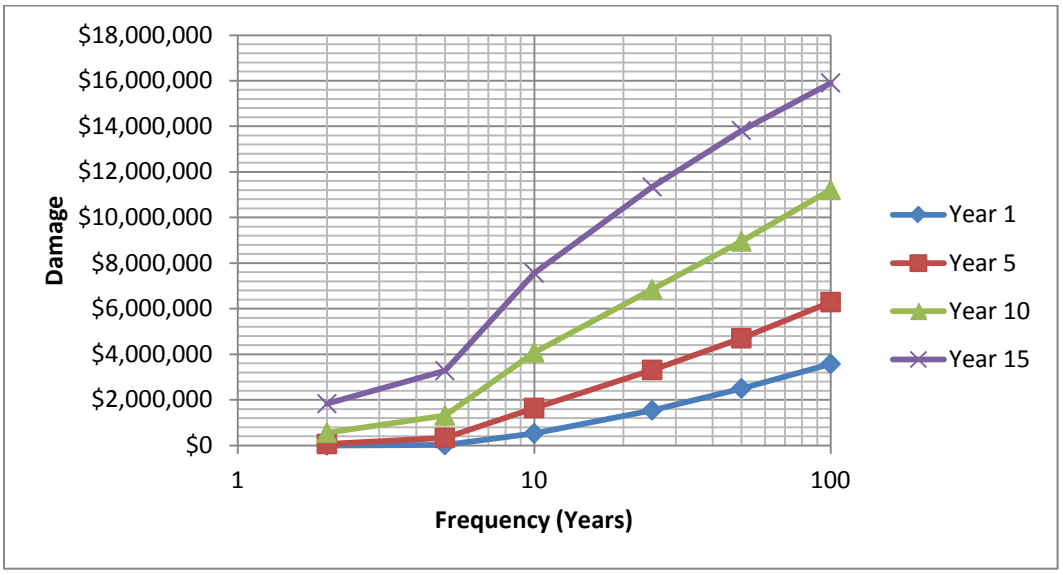


Figure 2: Without-Project Damage-Frequency Curve

2.1.3 Damage Sensitivity and Uncertainty

As described above, annual damages represent the expected average or mean results. The actual amount of future damages is highly sensitive to the timing and sequence of storms, future events that cannot be predicted. The life cycle simulation has incorporated the uncertainty of these parameters by allowing the values to vary in each simulation. In order to account for uncertainties in the timing and impacts of various storms, calculations are performed for a large number of lifecycles and mean or average value is reported.

The model has been developed to evaluate the non-shorefront erosion conditions unique to the project site, and is not intended for direct application to evaluate shorefront damages at other locations.

Table 2: Description of Simulation Model Spreadsheet Component Tabs

Tab	Tab name	Contents and Description
1	Simulation	Input of key data and the lifecycle simulation mechanism by which storm events are generated and erosion damages to structures are realized, depending on the existence and integrity of the reinforced dune structure on the shorefront. A storm event probability is randomly generated for each lifecycle year, for which erosion distances and ocean water levels are retrieved from Tab 2, enabling total erosion distances and wave heights to be calculated. If the without-project condition is specified, erosion beyond the 5 foot contour and subsequent building damage is possible from the first year in the lifecycle. If the with-project condition is specified, erosion beyond the 5 foot contour is only possible following failure of the structure due to toe scour or wave action. Once it has failed by either mechanism, the structure is assumed to be not repaired or replaced. Erosion damages associated with the total erosion distance (storm erosion plus long term shoreline change) are looked up in Tab 4, and are refined by linear interpolation between low/high damages when the erosion distance falls between the 10 foot increments in the erosion-damage curve. Erosion damages are adjusted to reflect the user-defined probability that destroyed structures will be rebuilt. The adjusted damages in each lifecycle year are converted to present values, and their total is amortized to produce the EAD for each lifecycle.
2	Lookup	Interpolated stage- and erosion-frequency data from Tab 3 formatted into a lookup table to be referenced by Tab 1.
3	Interpolation	Input of local Stage-Frequency and Erosion-Frequency curves, plus interpolation of stage and erosion values for all intermediate frequencies for which data has not been provided.
4	Damages Lookup	Provides lookup tables of the aggregated erosion-distance relationships generated by Tabs 5 and 6, to be referenced by Tab 1.
5	Building Inventory	Calculates the damage experienced by each structure due to erosion as the structure is undermined in increments of 10 feet, based on the depreciated replacement value and setback distance of each structure. Erosion damage is assumed to increase linearly from zero at the point immediately before undermining occurs to 100% when 50% of the structure footprint has been undermined. Uncertainty has been incorporated by allowing the setback distance and total value of the structures to vary via normal distributions with standard deviation input by the user.

Tab	Tab name	Contents and Description
6	No Rebuild Adjustment	Calculates the damage experienced by each structure due to erosion as the structure is undermined as per Tab 5, except that in this case only the erosion distance at which 100% damage is realized is captured for each structure. This data is used to adjust erosion damages generated in Tab 1 to reflect the probability that previously destroyed structures are rebuilt to their original condition before subsequent storms.
7, 8	Results	Example results output generated by executing the model for without- and with-project conditions.

Upon a successful execution, results are written to a new spreadsheet tab which is automatically appended to the existing tabs in the spreadsheet, provided the user has chosen the appropriate settings in the Utilities\Reports menus in the @RISK application.

2.2 Model overview in Planning Effort

The model is critical to the planning effort in that it is considered to be the only appropriate tool currently available to evaluate the benefits of the proposed reinforced dune structure and hence is vital to facilitating the selection of the NED plan for the emergency stabilization of the downtown Montauk shorefront area.

2.3 Description of Input Data

The model requires several types of input data as described above in the "Model Description" Section and in Table 1. All data in the current version of the model

The key inputs to the model are the externally-generated ocean stage-frequency and erosion frequency relationships unique to this location, and the physical characteristics of the vulnerable shorefront structures, notably their depreciated replacement value and shorefront setback distances. Other inputs to be entered by the user are the base year, project life in years, Federal interest rate, rate of sea level rise, long-term shoreline change rate, shorefront profile geometry (structure elevation, berm elevation/width, profile slope), structure failure thresholds, standard deviations of uncertain variables, and the probability that structures destroyed by erosion will be rebuilt.

2.4 Description of Output Data

The model has flexible output capabilities and the principal output generated by each execution of the model is the EAD. In the version provided for certification, the model also includes outputs which enable annual and cumulative reinforced dune failure probabilities to be plotted. In addition, any cell in the model may be included as an output of the simulation model in order to track other variables such as patterns of damage or shoreline change over time.

2.5 Assumptions

The model makes numerous assumptions described in the sections above regarding the relationship between ocean water levels, shorefront conditions and the exposure to erosion of the shorefront structures. Among the key assumptions are the following:

- Wave action and toe scour are the only potential mechanisms by which the reinforced dune may fail and leave the shorefront structures exposed to erosion.
- Erosion damage is assumed to increase linearly from zero at the point immediately before undermining occurs to 100% when 50% of the structure footprint has been undermined.

Other assumptions such as the probability of rebuilding and the actual failure thresholds for the reinforced dune due to wave and scour are not fixed and may be chosen by the user.

2.6 Conformance with Corps policies and procedures

The model complies with policies and procedures regarding treatment of economic parameters, including considerations of base year and present worth analysis, and the application of sea level rise. The model incorporates Risk and Uncertainty concepts through the application of a lifecycle approach and the application of uncertainty distributions to key input variables such as structure value and setback distance.

2.7 Identification of formulas used in the model and proof that the computations are appropriate and done correctly

The formulas used in the model are simple mathematical functions, which were verified as part of the standard checking and QC process. The most complex formulas are the interpolation of water levels and the calculation of building damage based on erosion distances. The generation of the random storm events has been tracked and verified to produce sampled stage probability distributions that reproduce closely the input stage frequency curves. In addition, the modeled failure of the reinforced dune structure has been examined to demonstrate that it does initially provide the intended level of protection against erosion.

2.8 Process used to test and validate model

The model drew on previous simulation models originally initially developed for other US Army Corps of Engineers coastal storm damage reduction projects in 2003 and 2006 and shared several concepts and techniques. Alpha or Beta testing was not undertaken since the model components are not intended for use outside the development team.

However, results and spreadsheet computations were checked at multiple stages in the development, and reproduction of the stage frequency data by the storm simulation approach was verified by comparing input stage frequency data to @RISK output statistics.

2.9 Availability of input data necessary to support the model

The hydrologic/geomorphic model input data may be developed using standard coastal engineering tools, while the building inventory data necessary to evaluate erosion damages must be sourced either from field surveys or local tax assessment data.

2.10 Formatting of output in an understandable manner

The primary output from the model is the single value of EAD resulting from the @RISK simulation which is written to a simple table in a new spreadsheet tab generated by every execution of the model. This table also includes all other secondary outputs as selected by the user.

The model results provide the necessary information to determine storm damage reduction benefits. The detailed statistics can be reviewed to identify associated uncertainty and confidence bands**.**

3.0 FORMULATION OF ALTERNATIVE PLANS

Prior to Hurricane Sandy, storm damage reduction measures for the downtown Montauk area were considered as part of the ongoing FIMP Reformulation Study. Consistent with both P.L. 113-2 and the Reformulation Study itself, requirements in formulating any stabilization project formulated for downtown Montauk in the aftermath of Hurricane Sandy is required to include:

a. Compatible with the likely outcome of the Reformulation process;

b. Economically justified with no adverse environmental impacts

c. Reversible should the stabilization project be subsequently determined to be NOT compatible with the finding and recommendations of the overall Reformulation study.

3.1 Pre-Sandy Alternative Plan Comparison

The FIMP Reformulation Study considered the downtown Montauk area in the alternative analysis. The initial screening considered non-structural measures, beachfill with structures, and beachfill. Each of these measures were analyzed considering general design requirements, costs, and local acceptability.

Non-structural measures (relocation and acquisition) were eliminated from further consideration based on high costs to relocate or acquire the large ocean front structures, and the lack of local support for an alternative that would largely eliminate a significant component of the local economy. Similarly, beachfill with structures was eliminated from further consideration based on cost considerations. Beachfill was the only measure considered for further evaluation.

The performance of the following three beachfill design templates was evaluated during the Reformulation Study: 1) +13 ft dune, 90 ft berm; 2) +15 ft dune, 90 ft berm; 3) +17 ft dune, 120 ft berm. The +15 ft (NGVD) dune and 90 ft berm was identified as the optimal design template for reducing storm damages and minimizing costs. However, an economic analysis of the beachfill alternative showed that it had a low Benefit-Cost Ratio (BCR). Consequently, the beachfill alternative was removed from further consideration in the Reformulation Study.

Downtown Montauk has one of the highest cost damages per foot of shoreline in the Study Area; however, unlike other reaches in the Study Area, the Project Area is not susceptible to barrier island breaching, which is a major driver of economic benefits in the FIMP Study Area. The cost of beachfill at downtown Montauk is also significantly higher than at other locations because of the relatively high volume of sand required for initial construction and renourishment, and relatively high unit costs for sand.

The Reformulation study identified downtown Montauk as an area of high damage where sediment management measures should be evaluated as a possible alternative. Sediment management features are small-scale beach nourishment projects that are designed to offset long-term erosion trends in a location, which also act as a feeder beach for downdrift areas.

The sediment management measure for downtown Montauk recommended the placement of 120,000 cy of sediment every 4 years. The feeder beach would contribute an additional 30,000 cy/yr to the sediment budget. This supplemental sediment source would provide a constant supply of sediment to the beaches at downtown Montauk and farther west and, therefore, provide erosion control benefits to this region. The feeder beach would be constructed once every four years in concert with future renourishment operations at other locations in the Study Area.

An important distinction between the feeder beach and the beachfill alternatives is that a specific design section (i.e. 90 ft berm), and thus, a specific level of protection, is not being provided and maintained in the feeder beach. The primary objective of the feeder beach is to offset long-term erosion and ensure long-term continuity of longshore sediment transport. An economic analysis of the feeder beach indicated that the alternative had an acceptable BCR (greater than 1.0) and it was incorporated in the TFSP plan.

3.1 Post-Sandy Alternative Plan Comparison

In the aftermath of Hurricane Sandy, it was recognized that there was a need to revisit the TFSP and determine if the eroded beach conditions and updated costs and benefits warranted selection of a larger alternative plan at downtown Montauk. This analysis is presently underway as part of the Reformulation Study to consider a wider array of alternatives, and to aid in identifying a stabilization plan. An evaluation of five alternatives is underway, taking into consideration the severely eroded beach conditions following Sandy. This includes reevaluation of the cost assumptions and other sources of potential economic benefits.

3.1.1 Alternative Development

Based on the prior screening of alternatives, and coordination with State and local officials, five conceptual alternatives were considered for evaluation:

- Alternative 1: Beach Restoration,
- Alternative 2: Beach Restoration and Buried Seawall,
- Alternative 3: Feeder Beach,
- Alternative 4: Dune Reinforcement,
- Alternative 5: Dune Reinforcement and Feeder Beach.

These five alternatives represent a range of measures providing different levels of protection and design project lives. Alternatives 1, 2, and 3 are similar to the pre-Sandy alternatives, and are designed to provide a 44 year level of protection and have a design project life of 50 years. The post-Sandy analysis also considered two alternatives that provided a lower level of protection, and a shorter design life to stabilize the project area immediately and effectively. Alternative 4 is a geotextile reinforced dune alternative that could be constructed as a one-time action to offset the loss of dune function from Hurricane Sandy. Alternative 5 is an update to the plan previously recommended in the TFSP, which would repair the dune function at downtown Montauk and provide beach nourishment to maintain a consistent level of functioning.

Due to the large quantities of sand fill required for construction of Alternatives 1, 2, 3, and 5, dredging of an offshore borrow area would be required. Dune Reinforcement (Alternative 4) requires significantly less sand, approximately 51,000 cy, than other four alternatives. Therefore, it is feasible and expected to be less costly to obtain the necessary sand fill material from upland sediment sources.

The final analysis and comparison of alternatives for the long-term Reformulation Study are still underway, but the above information has been used as the basis for developing the stabilization plan for downtown Montauk.

Stabilization Plan Selection

As presented previously, a stabilization project for downtown Montauk is required to be each of the following:

a. Compatible with the likely outcome of the Reformulation process;
b. Economically justified as a separate, independent project;
c. Limited in duration to provide stabilization prior to implementation of the FIMP Reformulation.

In reviewing the alternatives under consideration, Alternative 4 was identified as the only alternative that meets the criteria for a stabilization project. Alternatives 1, 2, 3, and 5 all have very high costs, and can only perform as designed if done in conjunction with a long-term plan for renourishment. Given that the stabilization project for downtown Montauk is intended as a 1 time project in advance of the implementation of the overall FIMP reformulation, these 4 alternatives were not considered further, and Alternative 4 was selected as a viable stabilization alternative.

Alternative 4 - Dune Reinforcement

Alternative 4, Dune Reinforcement, consists of stabilizing and reinforcing the existing dune along 3,100 ft of the shoreline in downtown Montauk. The core of the dune consists of hydraulically-filled Geotextile Sand Containers (GSCs). GSCs have increasingly been used to provide low cost, soft, environmentally acceptable solution for shore protection structures (Pilarzyk, 2002, Dassanayake and Oumeraci, 2012). Coastal structures built with GSCs are obtained by substituting rocks with containers made of geotextile and filled with locally available sand.

The core of a typical proposed Reinforced Dune consists of approximately 14,171 GSCs with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall, each weighing approximately 1.7 tons. For greater stability, the GSCs are aligned with the long side perpendicular to the shoreline with an overlap of 50% of the filled width. The proposed design is

to provide reinforcement by stacking the bags along the existing dune at a 1V:2H slope. The Dune Reinforcement extends from a toe elevation of +3 ft to a crest elevation of +13.5 ft NGVD. In order to increase the resiliency of the design and reduce the potential for undermining, the proposed design includes a 45 foot wide berm cap at +9.5 ft NGVD. The additional sediment, estimated at approximately 20,000 cubic yards (6 cy/ft), will provide additional protection to the toe of the structure from undermining and decrease the likelihood of exposure of the GSCs during small storm events.

Dune reinforcement with GSCs may provide a relatively soft, flexible, easily installed, and easily removed solution. However, there are some disadvantages to using GSCs in the place of traditional armor stone units. The level of protection and longevity offered by the GSCs is considerably less than armor stone. GSCs have a lower specific gravity and are more susceptible to sliding and being pulled out when exposed to large waves. The longevity offered by GSCs is also limited by deterioration from UIV exposure, vandalism, and contact with debris. To maximize the longevity of the GSCs the proposed design calls for the GSCs to be covered by a layer of sand to decrease the likelihood of the geobags being exposed for long periods of time.

It is estimated that the reinforced dune provides a level of protection of approximately 25 years (4% annual chance of design exceedance). The effective life of this type of structure would be approximately 15 years (50% probability of failure). A fifteen year effective project life was determined as a result of two factors: 1) 5 years is the approximate point in the future in which the cumulative failure probability of the reinforced dune exceeded 50%; and 2) the durability and longevity of the GSCsis limited and will eventually break down due to UV radiation, abrasion, and contact with debris.

3.2.2 Stabilization Constraints

- The Stabilization Plan must have independent utility.
- The Stabilization Plan cannot foreclose on alternatives under evaluation in the overall FIMP Reformulation Study.
- The Stabilization Plan must be within the current FIMP authorities as authorized in the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960, which established the authorized project. The FIMP authorization precedes authorization of P.L. 113-2 in 2013; thus providing the authority for the Stabilization Plan as an HSLRR.

The Main Report summarizes the alternatives which were investigated for inclusion in the GRR. Due to the requirements of PL 113-2, only one alternative was appropriate for recommendation within the Stabilization plan.

Dune reinforcement with GSCs may provide a relatively soft, flexible, easily installed, and easily removed solution. However, there are some disadvantages to using GSCs in the place of traditional armor stone units. The level of protection and longevity offered by the GSCs is considerably less than armor stone. GSCs have a lower specific gravity and are more susceptible to sliding and being pulled out when exposed to large waves. The longevity offered by GSCs is also limited by deterioration from UIV exposure, vandalism, and debris. To maximize the

longevity of the GSCs the proposed design calls for the GSCs to be covered by a layer of sand to decrease the likelihood of the geobags from being exposed.

Not only are the GSCs less resilient than an armor stone, but the absence of a wide maintained berm width increases the potential for undermining and exposure to larger wave heights. It is estimated that the reinforced dune provides a level of protection of approximately 25 years (4% annual chance of design exceedance). The effective life of this type of structure would be approximately 15 years (50% probability of failure).

3.2.3 Plan Comparison

A summary of the annualized costs for the five conceptual alternatives are provided in Table 3. As described in the Main report, the five alternatives represent a range of measures offering different levels of protection and different design project life. The annualized costs of alternatives 1, 2, 3, and 5 are based on a 50 year period of performance and assumed a periodic nourishment requirement every 4 years, while alternative 4 are based on a 15 year period of performance with no periodic nourishment. The 15 year period of performance is based on the expected life of the GSCs that are used to construct the reinforced dune. Due to the high annualized costs of alternatives 1, 2, 3, and 5 and also given that the stabilization project for downtown Montauk is intended as a 1 time project in advance of the implementation of the overall FIMP reformulation, these 4 alternatives will not be considered further.

Table 3: Annualized Costs of Alternatives

Annual Costs	Beach Restoration[1]	Beach Restoration & Seawall[1]	Feeder Beach[1]	Dune Reinforcement[2]	Feeder Beach & Dune Reinforcement[1]
First Construction	**$1,248,000**	**$1,390,000**	**$466,000**	**$761,000[3]**	**$680,000**
Renourishment	**$3,837,000**	**$2,417,000**	**$2,337,000**	**n/a**	**$2,422,000**
O&M	**$292,000**	**$326,000**	**$109,000**	**$157,000**	**$160,000**
Total	**$5,377,000**	**$4,133,000**	**$2,912,000**	**$918,000**	**$3,262,000**

Notes: April 2014 price level, 3.5% Discount rate;
[1] Based on 50 yr. Period of Performance (POA) with periodic nourishment every 4 years;
[2] Based on 15 yr. POA with no renourishment.
[3] Includes Interest During Construction (IDC) based on a four-month construction schedule.

3.2 Economic Evaluation

3.2.1 With-Project Storm Damages and Benefits

In compliance with Public Law 113-2 and the associated constraints described in previous sections, current efforts are limited to the implementation of a stabilization project with a 15 year life and no requirement for periodic renourishment. Therefore at this stage in the study only

Alternative 4, the reinforced dune structure has been subject to analyses for damages and benefits.

To model the damages with the Stabilization Project in place showing the benefits of the project, the model described in Section 3.3 was configured to allow erosion beyond the +5 foot NGVD contour only after the reinforced dune structure has failed due to either wave action or scour. In the first year of the project life, the dune provides approximately a 1 in 25 year level of protection (4% annual chance of failure immediately following construction) with the annual failure probability rising to approximately 8% (1 in 13 year) by the end of the project life. The increase in annual failure probability of the project over time is presented in Figure 3. The cumulative failure probability of the project is presented in Figure 3, which indicates that the probability that the project will have failed by the end of the period of analysis is almost 60%.

The model has been executed using a project life of 15 years, an interest rate of 3.5% and 12,500 iterations to compute with-project equivalent annual damages of $326,000. Hence the annual storm damage reduction benefits of the project are estimated to be $1,052,000.

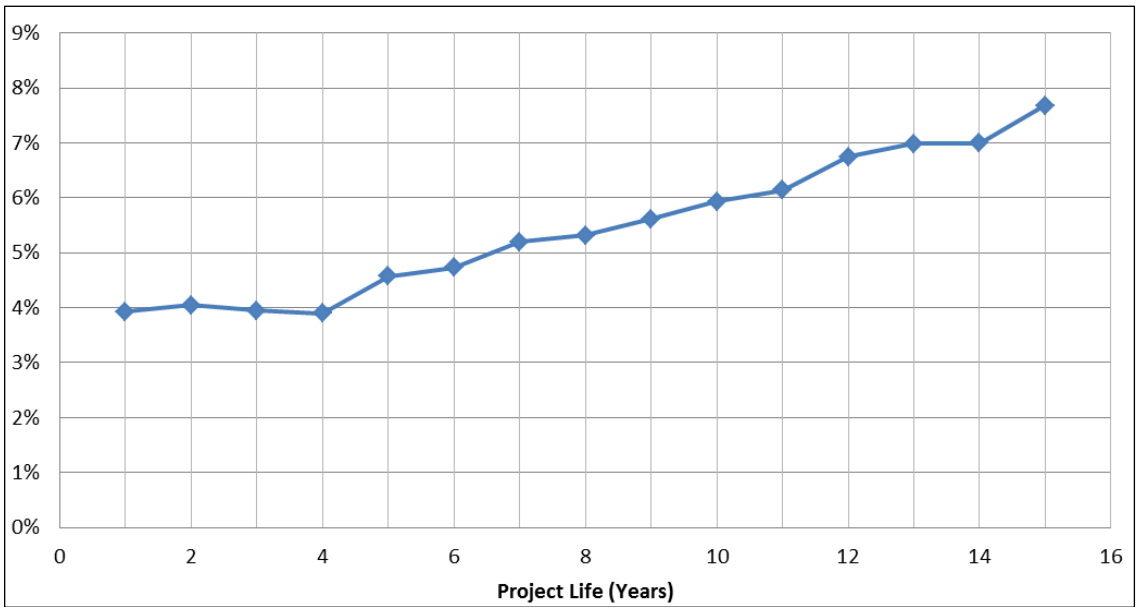


Figure 3a: Annual Failure Probability of Reinforced Dune

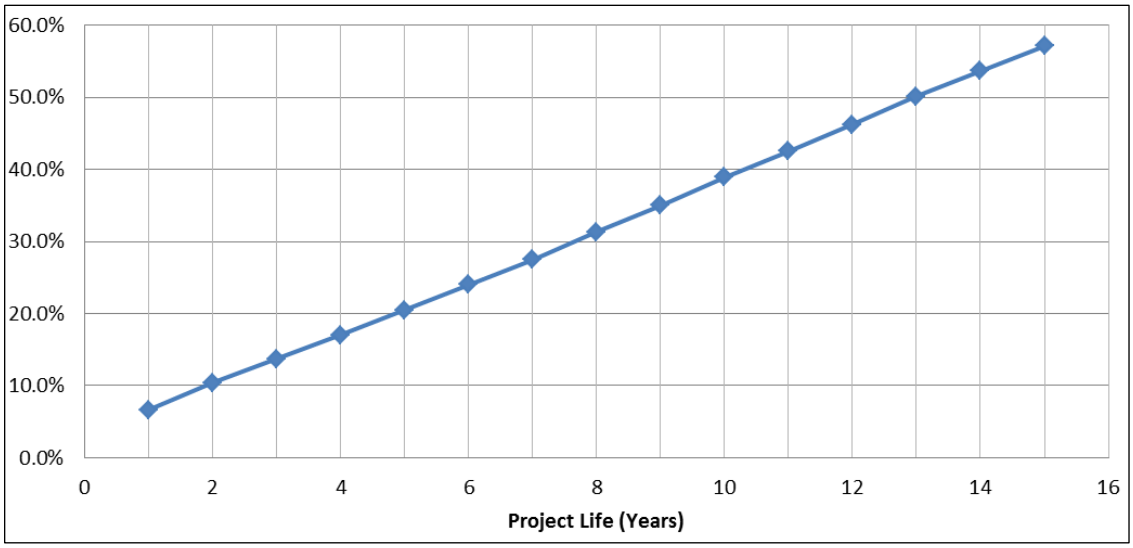


Figure 3b: Cumulative Failure Probability of Reinforced Dune

The with-project model outputs were post-processed to derive damage frequency plots for years 1, 5, 10, and 15 in the analysis period, and these plots are presented in Figure 4 for comparison with Figure 2. It is evident that while the vulnerability to erosion still increases over time with the project in place, the expected damages are greatly reduced. For example; for the 10% annual chance exceedance event, expected damages in years 1 and 10 are expected to be reduced from $1 million and $3.8 million to zero and $1.3 million, respectively.

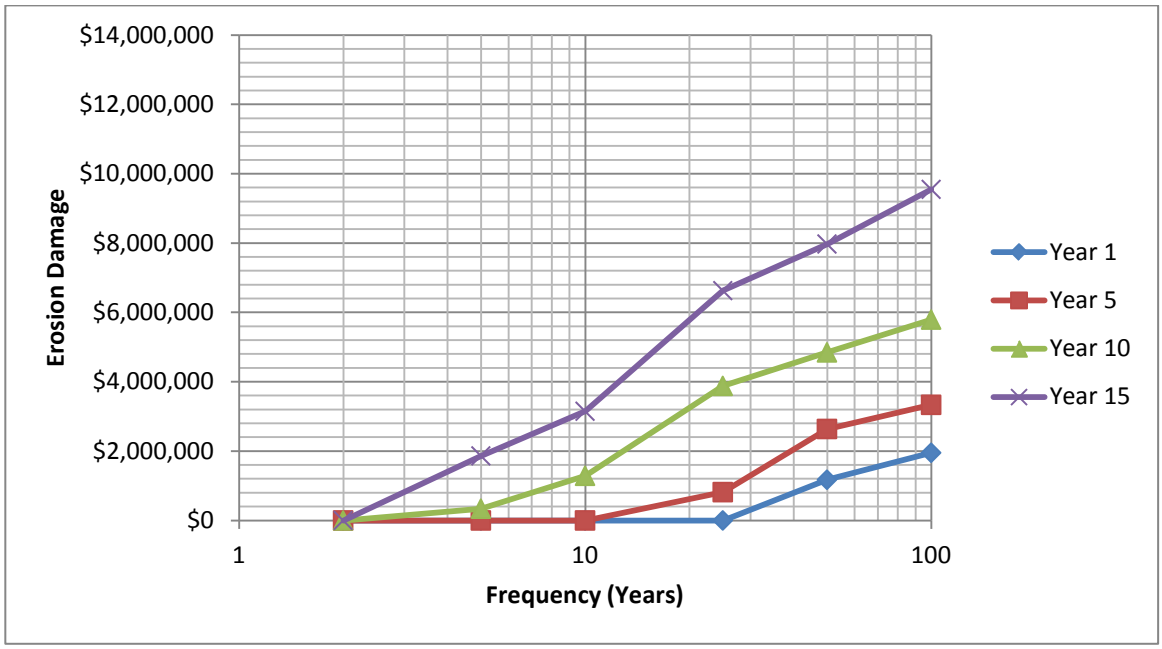


Figure 4: With-Project Damage-Frequency Curve

3.2.2 Additional Benefits

The cost of locally implemented beach and dune repairs mentioned in Section 3.2 would assumed to be avoided following the construction of the selected plan, and therefore can be considered a project benefit. The annual cost avoided has been derived by assigning frequencies of occurrence to the recorded local repair costs for the years 2011 – 2013, based on the return periods of the most significant storms in those years. A cost/frequency curve was subsequently constructed which was used to compute a probability-weighted annual average cost avoided of $185,000.

Table 4: Summary of Cost Avoided Frequency Generation

Date of Actions[1]	Estimated Frequency[2]	Cost[3]
August 2011	20% (5-year)	$555,600
October 2012	5% (20-year)	$1,340,000
March 2013	33% (3-year)	$136,800
December 2013	25% (4-year)	$182,300
Annual Average Cost		*$185,340*

1. Approximate date of storm event that triggered actions.
2. Estimated from comparison of measured storm tide levels and the local stage vs frequency relationship.
3. Derived from data collated by First Coastal Corporation, Westhampton Beach, NY

3.2.3 Summary of Economic Evaluation

The annual damages and benefits resulting from the model analyses for the reinforced dune are summarized in Table 5, along with annualized project costs estimated separately (See Appendix G), and the resulting benefit-cost ratio.

Table 5: Summary of Stabilization Project Damages, Costs, and Benefits

Without Project Annual Damages	**$1,378,000**
With Project Annual Damages	$326,000
Storm Damage Reduction Benefits	$1,052,000
Local Costs Avoided	$185,000
Total Annual Project Benefits	$1,237,000
Annual Cost	$918,000
Net Benefits	$319,000
Benefit-Cost Ratio	1.35

Interest rate 3.5%, Project Life 15 years, Benefits in 2014 Price Level, Model reflects base year of 2016

To illustrate the potential variance of the model results, 25th and 75th percentile storm damage reduction benefits have been extracted from the @Risk model results. The 25th percentile

benefits are $1,118,000 and the 75th percentile damage reduction benefits are $1,108,000, giving a range of benefit-cost ratios of 1.21 to 1.12.

As demonstrated in the analysis, the recommended Stabilization Plan is economically justified as a one time, stand alone action.

DOWNTOWN MONTAUK

DOWNTOWN MONTAUK STABILIZATION PROJECT

TECHNICAL SUPPORT DOCUMENT

EVALUATION OF A STABILIZATION PLAN FOR COASTAL STORM RISK MANAGEMENT

PUBLIC ACCESS PLAN

U.S. Army Corps of Engineers

June 2014

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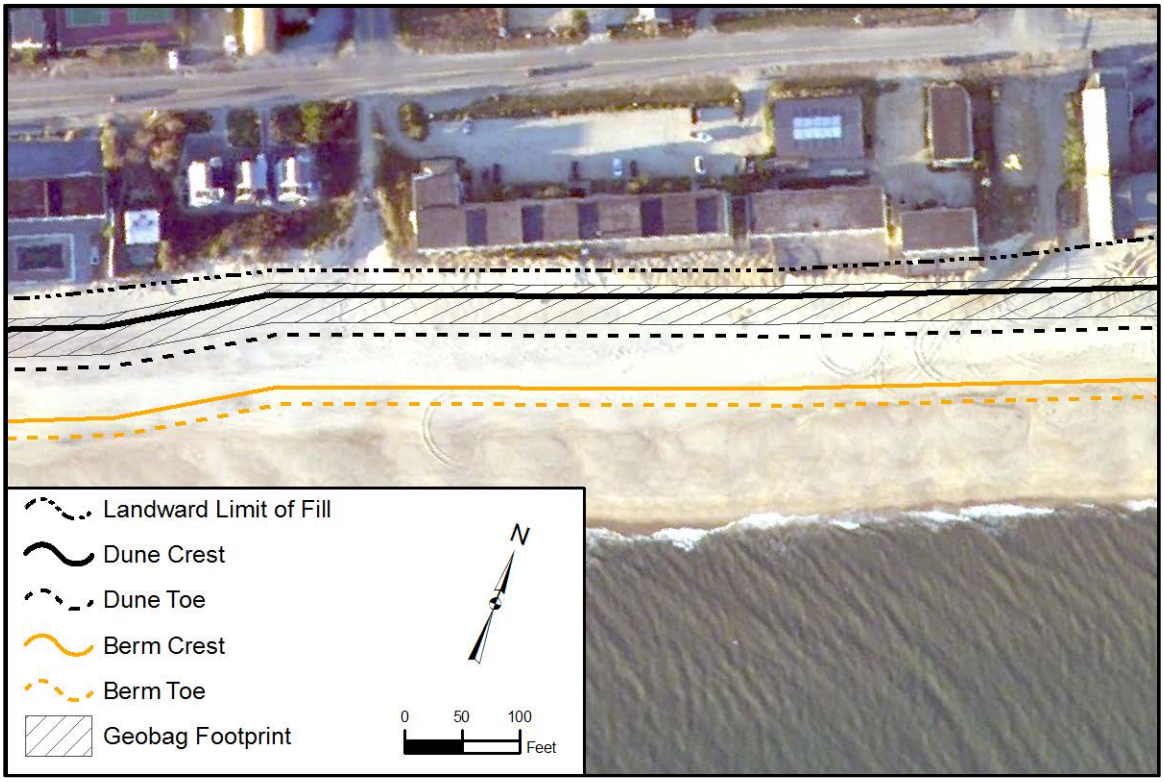
1.0 SCOPE

The Atlantic Coast of Long Island, Downtown Montauk Reach - Stabilization Project - Technical Support Document (Downtown Montauk Stabilization) project proposes constructing 3,100 feet of reinforced dune extending from South Emery Street to Atlantic Terrace Motel and tapers into high dunes at both ends of the Project Area. The extent of the proposed plan was selected to provide protection to all of the shorefront commercial buildings in Downtown Montauk.



The core of dune consists of 14,171 bags each weighing 1.7 tons of Geotextile Sand Containers (GSC) with filled dimensions of approximately 5.5 ft long, 3.5 ft wide, and 1.5 ft tall. For greater stability the GSCs are aligned with the long side perpendicular to the shoreline with an overlap of 50% of the filled width. The GSCs are stacked along the existing dune at a 1V:2H slope. The GSCs extend from a toe elevation of +3 ft to a crest elevation of +13.5 ft NGVD. In order to increase the resiliency of the design and reduce the potential for undermining, the proposed design includes a 45 foot wide berm cap at +9.5 ft NGVD. The additional sand will provide protection to the toe of the structure and decrease the likelihood of exposure of the GSCs during small storm events.

2.0 PURPOSE

A public access evaluation requires a two-step process. The first step is to describe and tabulate the existing degree of public access. The second step is to assess whether the existing public access is adequate or if additional facilities are needed with the proposed project in place. Relevant guidelines specifying the criteria under which the adequacy or inadequacy of public access is assessed are described below.

3.0 SUMMARY OF FEDERAL POLICY

[Department of the Army, ER 1165-2-130, dated 15 June 1989, Federal Participation in Shore Protection, paragraph 6h.] It is Corps policy to participate in the additional costs for placing beach-quality sand or other suitable material onto adjacent beaches or near shore providing that the beaches involved must be open to the public. Project beaches will not be limited for use by only a segment of the public; they must be open to all visitors regardless of origin or home area. Reasonable public access must be provided in accordance with the recreational use objectives of the particular area. However, public use is construed to be effectively limited to within one-quarter mile from available points of public access to any particular shore.

Additionally, nearby parking facilities, on free or reasonable terms, should be within a reasonable walking distance to the beach. Lack of sufficient public parking with reasonable public access to the beach will preclude federal participation. Items of local cooperation require the sponsor to provide necessary access roads, parking areas, and other public use facilities open and available to all on equal terms. However, even though the lack of such facilities may constrain beach use, it is not the intent to require that facilities be provided to meet all demand situations, but only that public use and access not be precluded by the lack of existing facilities due to local practices and/or unique situations.

Nonetheless, a visitor to an area should be reasonably assured of parking near the access point on an average day. Any evaluation should discuss the availability of access points and public parking along the entire length of shore in which Federal participation is proposed. If reasonable access and parking for non-residential users is not available within reasonable walking distance to the beach, they must be provided by the sponsor, or Federal participation limited to those areas where access and parking area reasonable available.

Further, in the event public access points are not within one-half mile of each other, either an item of local cooperation specifying such a requirement and public use throughout the project life must be included in project recommendations or the cost sharing must be based on private use.

4.0 SUMMARY OF NEW YORK STATE POLICY

[State of New York Coastal Management Program: Policy 19 – Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities; and Policy 20 – Access to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly-owned shall be provided and it shall be provided in a manner compatible with adjoining uses.]

> Policy 19: This policy calls for achieving balance among the following factors: (l) the level of access to a resource or facility, (2) the capacity of a resource or facility, and (3) the protection of natural resources. Imbalance among these factors tends to be in the urban areas of the state, and can generally be attributed to limited access. Access to water-related recreational resources, such as public beaches, will be given priority for improvement.
>
> Policy 20: This policy states that access should be provided to coastal areas where there are limited or no recreational facilities that provide specific water-related recreational activities. Access should be provided for numerous activities and pursuits that require only minimal facilities, such as walking, biking, bird watching, photography, and fishing. Furthermore, the State will not undertake or fund any project which increases access to a water-related resource or facility that is no open to all members of the public.

5.0 TRAFFIC AND TRANSPORTATION

Downtown Montauk is the major business area in the Study Area. The town is divided by Montauk Highway and extends south to the Atlantic Ocean. There are wide variety of year-round commercial establishments in addition to the seasonal motels and resort units. The business district includes supermarkets, banks, clothing stores, gas stations, restaurants, bars, pharmacies, repair shops and other establishments traditionally found in business centers. Institutional facilities, including churches and a library, are located along Montauk Highway in the eastern portion of the business district. A municipal ball field complex borders the northern portion of the downtown area. The downtown area is laid out in a grid of 40 foot by 100 foot lots separated by wide public roads and alleyways. There is limited public transportation and the cost of housing is extremely high.

6.1 Public Transportation

The Long Island Rail Road provides train service to Penn Station, and Hampton Jitney provides bus service to Manhattan. Suffolk Transit's 10C and seasonally-operated S94 bus routes serve the village. The 10C connects the village with East Hampton, and the Amagansett, East Hampton and Montauk Long Island Rail Road stations on the Montauk Branch, and the seasonally-operated S94 connects the village with the Montauk Point Light. Small planes can fly into the Montauk Airport.

6.2 Private Transportation

Due to time constraints, many visitors use private taxi services to reach the ferry terminals from train stations. For New York City residents who want alternative private transportation to Downtown Montauk, several companies provide bus service between Manhattan and the ferry terminals. Approximately 5 percent of the total traffic is provided by taxi.

6.3 Parking

About 70 percent of all traffic arrives by private automobile.

The beaches in Montauk are

1.Kirk Beach,

2. Hithers Hill state Park,

3.Gin beach,

4.Ditch Plains Beach, and

5.Nicks Beach.

Parking at the beaches is restricted, with town permits required at all beaches except Kirk Park Beach in the Village and Hither Hills State Park. Kirk Park Beach in Montauk offers nonpermit parking for $5 a day. The beach at Hither Hills State Park in Montauk offers daily parking for $4.

A beach permit is free for town residents and a non-resident permit costs $375 per year. Many hotels and motels provide permits for their guests.

Permits to drive four-wheel drive vehicles on the town beaches can be obtained free to East Hampton Town property owners who have proof of residency, they cost $275 per year for non-residents. By law, vehicles must stay off the beaches between 10am-6pm from May-September.

6.0 LAND AND WATER USES

This description of land and water uses characterizes the existing conditions in the vicinity of the project site. To determine existing conditions and assess the potential for impacts, the study area has been defined as the Town of Easthampton.

6.1 Land and Water Uses

Montauk is a major tourist destination and has six state parks. It is particularly famous for its fishing, claiming to have more world saltwater fishing records than any other port in the world.[2] Located 20 miles (32 km) off the Connecticut coast, it is home to the largest commercial and recreational fishing fleet in New York State.

Six state parks are in Montauk. They are, from west to east:

- Hither Hills State Park
- Shadmoor State Park
- Montauk Downs State Park
- Amsterdam Beach State Park
- Camp Hero State Park
- Montauk Point State Park

In addition, there is Montauk County Park and several East Hampton parks and Nature Conservancy areas.

6.1.1 Recreation

Visitors appreciate Montauk for its abundance of recreational land and water activities. Generally, the bayside beaches are roped off swimming areas near the town's marina or dock; therefore, these areas tend to attract families with children. Other than swimming, popular water sports include surfing, sea kayaking, windsurfing, water skiing, canoeing, and sailing. Area businesses rent windsurfing boards hourly, and stores on the mainland sell and rent other equipment, such as sea kayaks and jet skis.

The project area features a wide array of fish species plus shellfish and crabs, each of which has a designated prime season. Consequently, local sport fishing is an activity for which the area is well known. In addition, several local charter companies offer deep sea fishing excursions in the Atlantic.

Amsterdam Beach Preserve
This 200-acre park was a joint purchase by NY State, Suffolk County, and the Town of East Hamp
passive use park, the land stretches from Ranch Road at Indian Field on the east to the M
Association houses to the west. It is bordered on the north by Montauk Highway and extends southv
the Atlantic Ocean and the ocean beach. It is situated near other protected lands, such as Sha

Montauk Point, and Camp Hero State Parks. Fifty-four acres of tidal and freshwater wetlar interspersed throughout maritime shrublands. This natural topography is called "Montauk Moorlanc provides critical habitat to several rare and endangered species such as the northern harrier, the turtle and the Cooper's hawk, and hosts several species of spring migrating birds and other shore bir

Camp Hero State Park
This 755-acre State Park formerly housed U.S. Army and U.S. Airforce bases. Several buildings, b batteries, and an old radar building (a National Historic Site) remain, although they remain off limit public. Roads cross the park, along with an extensive system of trails for hiking, bicycling, and hor riding, a beach used by surfers and surfcasters, and an old maritime forest. Located a half mile wes Montauk Point Lighthouse, the park includes two small parking fields; fee is $8. Open daily yea from sunrise to sunset.

Hither Hills State Park
Located four miles west of the Village of Montauk on the Old Montauk Highway, with a two anc mile beach along the Atlantic Ocean and 1,755 acres of parkland. Hither Hills has 168 campsite with hiking and nature trails. Open year round from sunrise to sunset. Charges for NY State reside $28/day weekdays, $32/day weekends; nonresidents $56 weekday and $64 a day for weekends.

Hither Woods Preserve & Lee Koppelman Nature Preserve Kirk Park
These two preserves and adjacent Hither Hills State Park are Montauk's prime mountain biking located north of the Montauk Highway between Napeague and the Village of Montauk with 40 r trails

Kirk Park
A beautiful three-acre park maintained by the Montauk Village Association, located just west Village, includes Fort Pond, the second largest freshwater lake on Long Island. Freshwater permitted.

Montauk Downs State Park
A 160-acre park

Montauk Mountain
A six-acre preserve area maintained by the Nature Conservancy.

Montauk Point State Park
This 724-acre park, at the site of the Montauk Point Lighthouse, is great for bird watching year rou seal watching in the winter months. Daily parking costs $8. The Montauk Point Lighthouse, a muse by the Montauk Historical Society, is open to the public daily in season.

Shadmoor State Park
Located two miles east of the Village on Montauk Highway, this 99-acre tract of land has a half ocean frontage where tall clay cliffs plunge down to a pebble strewn beach. If you are coming by ca in the parking lot at the entrance to the park. About 30 percent of Shadmoor is freshwater wetlan

several small ponds hidden in the thickets. Trails and dirt roads lead to the bluffs from the entra Montauk Highway.

Montauk County Park
Two entrances: one at the end of East Lake Drive just north of the airport, where the park office is l and the other at Third House, three miles east of the Village on Montauk Highway. A total of 1,12 features three and a half miles of nature trails suitable for hiking, five miles of bridle paths, fres fishing and canoeing at Big Reed Pond, surfcasting on the outer beach, and hunting in the wi season.

Walking Dunes
Part of Hither Hills State Park on the east side of Napeague Harbor, the Walking Dunes can reach a of 80 feet and are slowly moving southeast.

6.1.2 Community Services

The National Park Service is responsible for policing conservation laws on federal property, and the U.S. Coast Guard enforces boat safety regulations in surrounding waters.

6.1.3 Marinas

As shown in Table 1, Downtown Montauk has 11 marinas that accommodate a total of over 900 boats. About half of the slips are leased on a transient basis, and the remainder is leased by the season. Only two facilities, those at Robert Moses State Park and at Seaview, operate year round. Half of the marinas, include amenities such as grocery or supply stores. East Lake Marina is only a short walk to Montauk Airport.

Table 1: Downtown Montauk Marinas

Name	Location	Seasonal or Round	Transient Berths	Total B	Amenities[1]
Montauk Marine Basin	426 West Lake D	YR		150	G, M, F
Sportsmans Dock	414 West Lake D	S		NA	
Uihleins Marina & Boat Re	444 West Lake D	S		40	
Rick's Crabby Cowboy C Marina	435 East Lake D	S		22	
Gone Fishing Marina	467 East Lake D	S		180	G, M, F
Snug Harbor Resort & Mar	3 Star Island Rd	S		90	
East Lake Marina	507 East Lake D	S		20	
Star Island Yacht Club	Star Island Rd	YR		130	G, M, F
Montauk Yacht Club Res Marina	32 Star Island Rd	YR		232	
Diamond Cove Marina	364 West Lake D	S		NA	
Offshore Sports Marina	408 Westlake Dr	S		43	
Total				907	

Note: [1] Groceries, Marine supplies, Fuel

6.1.4 Access

Access to Montauk is provided by Montauk Highway (Route 27A) and the Sunrise Highway (Route 27), which are two major connectors through the south shore. North of Route 27A is two major east west highways: the Northern State Parkway and the Long Island Expressway (Interstate 495).

Hampton Jitney

The motor coach line service operates 365 days a year between Montauk and Metro New York (including the airports). In addition, Hampton Jitney limousines, charters and tour coaches operate regularly throughout the northeastern US and Canada. Location: 395 County Road 39A - Southampton, NY

Suffolk Transit Bus

The Suffolk Transit 10C Bus provides public transportation with pick-ups at the Bus Shelter near the corner of S. Euclid Ave. & Embassy St. near the Public Restrooms and the Police Station. The 10C provides connecting service with S92 (East Hampton), S94 (Montauk - Summer Only) and 10B (East Hampton). Location: S. Euclid Ave. - Montauk, NY.

Montauk Airport is a privately owned, public use airport located three nautical miles northeast of the central business district of Montauk, in Suffolk County, New York, United States

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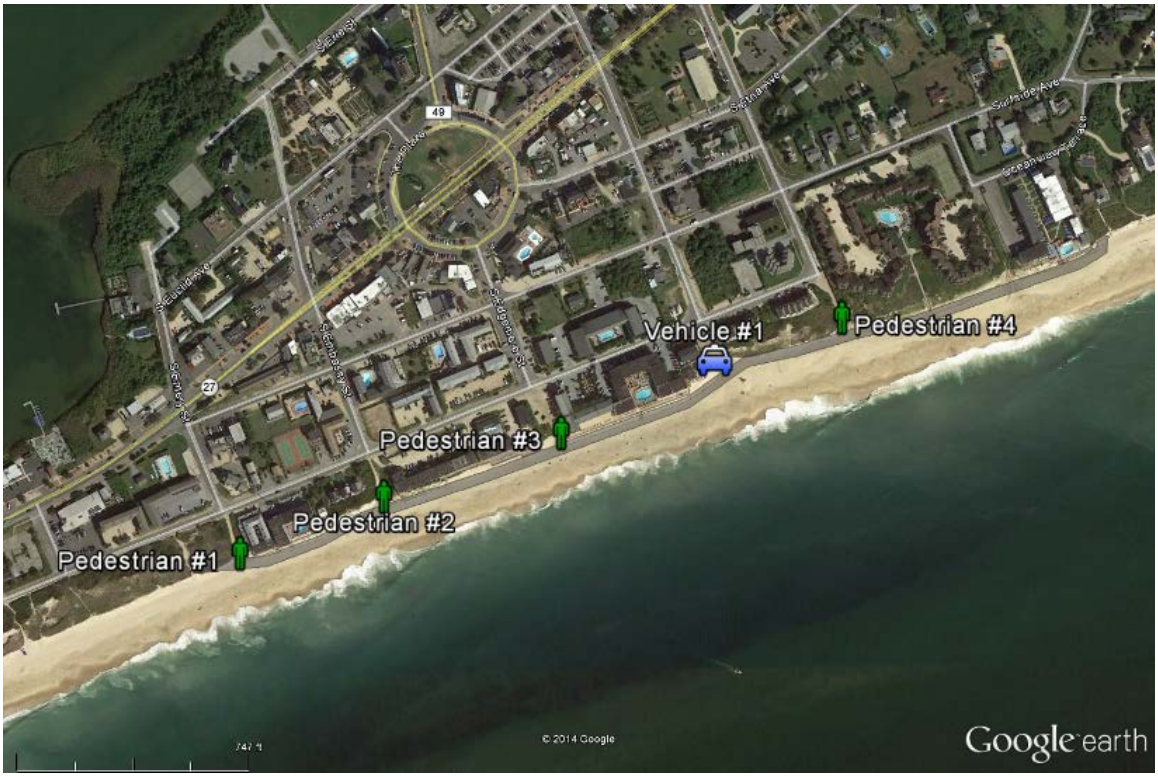
7.0 PUBLIC ACCESS EVALUATION & CONCLUSION

An evaluation of sufficient public access must completed with the knowledge that complications may arise because of numerous criteria which that could contradict each other.

7.1.1 Existing Public Access meets Federal Standards

Since there is adequate parking facilities for the general public, the requirements for parking as specified in ER 1165-2-130, paragraph 6h.(2) meet the federal guidelines and the Planning Guidance Notebook, ER 1105-2-100. Suitable public access is required for any areas where Federal expenditure of funds will be utilized for beach restoration. Four pedestrian crossing crossings and one vehicular crossing have been identified and included in the project. The following figure shows the pedestrian and vehicular access points. The analysis of public access indicates that the areas where sand is being placed is fully accessible and in compliance with ER 1165-2-130.

The provisions for access as required in ER 1165-2-130, paragraph 6h.(3) generally specify that public access points be no further than one-half mile from each other in order to justify federal participation. However, paragraph 6h.(3) specifically states that "Reasonable public access must be provided in accordance with the recreational use objectives of the particular area. Since the recreational use objectives of the study area are unique, it is therefore concluded that no additional public access is needed with the proposed Downtown Montauk, 3,100 linear foot Stabilization project in place.



Downtown Montauk Stabilization Project

Real Estate Plan Appendix

August 2014

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Figure 1 – FIMP Study Area

Figure 2 – Downtown Montauk Project Area

Figure 3 – Lands, Easements and Rights-of-Entries

Figure 4 – Proposed Acquisition Schedule

Exhibit A – Estates to be Acquired

Exhibit B – Real Estate Map

Exhibit C – NFS Capability Assessment Checklist

1. GENERAL:

This Real Estate Plan (REP) is in support of the Fire Island Inlet to Montauk Point, Coastal Storm Risk Management Project (FIMP), of which the Downtown Montauk Stabilization Project is a part. The purpose of this REP is to provide an overview of the real estate requirements for this Project. This document is intended for planning purposes and is not dispositive as to real estate costs and requirements. Actual project real estate costs and requirements may change based upon the final plans and specifications of the project.

Authority. The Fire Island Inlet to Montauk Point, NY, Combined Beach Erosion Control and Hurricane Protection Project was authorized by the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960. The authorized project provides for beach erosion control and hurricane protection along five reaches of the Atlantic Coast of New York from Fire Island Inlet to Montauk Point by widening the beaches along the developed areas to a minimum width of 100 feet, with an elevation of 14 feet above mean sea level, and by raising dunes to an elevation of 20 feet above mean sea level. The authorized project also provides for construction of up to 50 groins, grass planting on the dunes, interior drainage structures at Mecox Bay, Sagaponack Lake and Georgica Pond and for subsequent beach re-nourishment

This authorization has been modified by Section 31 of the Water Resources Development Act (WRDA) of 1974, and Sections 103, 502, and 934 of the WRDA of 1986 (P.L. 99-662), which principally impact cost-sharing percentages and the period of renourishment. In addition, the Disaster Relief Appropriations Act of 2013 Public Law (PL) 113-2) of January 29, 2013 provides for 100% federal funding for the initial construction costs for ongoing construction projects such for Downtown Montauk Authorized But Unconstructed Project.

The authorized project was developed and implemented along five reaches as shown in Figure 3 as follows:

Reach 1 – Fire Island Inlet to Moriches Inlet (FIMI)
Reach 2 – Moriches Inlet to Shinnecock Inlet
Reach 3 – Shinnecock Inlet to Southampton (Quogue to Agawam Lake)
Reach 4 – Southampton to Beach Hampton (Agawam Lake to Hook Pond)
Reach 5 – Beach Hampton to Montauk Point (Hook Pond to Montauk Point)

Location. The overall FIMP Study Area extends from Fire Island Inlet east to Montauk Point along the Atlantic Coast of Suffolk County, Long Island, New York. The Montauk Reach is the eastern most of the five designated Reaches within the overall FIMP Study Area; Figure 1. It extends from Hook Pond in Easthampton to Montauk Point, a distance of about 20 miles.

The incorporated Hamlet of Montauk (Montauk) is located on the eastern end of the south shore of Long Island in the town of East Hampton, in Suffolk County, New York. Montauk occupies 17.5 square miles of land and is bounded to the west by the Hamlet of Napeauge, to the north by Block Island Sound, and to the south by the New York New Jersey Bight. Montauk is located within the eastern portion of the Beach Hampton to Montauk Point reach of FIMP. The downtown area is a tourist destination with a number of hotels, restaurants and shops. Forty-three buildings in downtown Montauk are located within the modeled 100-yr floodplain (storm with a 1% probability of occurring in any given year). The Downtown Montauk Project Area is identified in Figure 2.

Figure 1 –FIMP Study Area

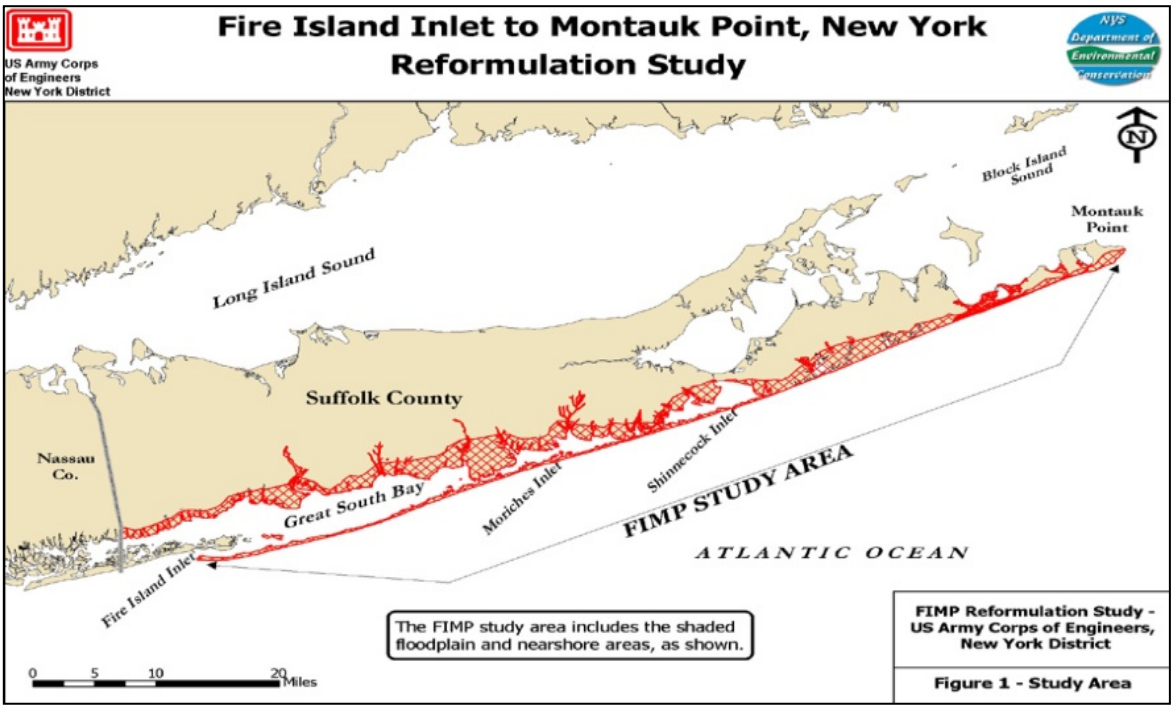


Figure 2 – Downtown Montauk Project Area

Purpose and Need. T Continued erosion and damages to coastal structures within the hamlet of Montauk is considered likely given the eroded state of the shorefront as a result of the impacts of Hurricane Sandy. Therefore, the goal of this stabilization effort is to provide a one-time stabilization and protection to the vulnerable shorefront within the hamlet of Montauk. This stabilization project is assumed to have a project life of 15 years and would only address the impacts from Hurricane Sandy. It does not pre-suppose the outcome of the FIMP Reformulation or limit the range of options that would be implemented as part of the overall FIMP project.

2. REAL ESTATE REQUIREMENTS:

   a. Description of Land, Easements, Rights-of-Way, and Relocations and Disposal Area Project Requirements:

The Real Estate requirements, for this project, include certain lands, easements, relocations and rights of way (LERR). The total LER required in support of the Project is approximately 13.36 acres; approximately 2.13 acres required in perpetual easements, and approximately 11.23 acres required in access agreements over public land. The Project impacts 19 parcels, impacting 13 private owners and 6 public owners. This project will not require relocation of property or utilities.

Figure 3 – Real Estate Requirements: Lands, Easements, and Right-of-Entries

Real Estate Requirements/Impacted Parcels							
Location	District	Section	Block	Lot	Estate Type	Total Est. Easement Area (SF)	Property Ownership
Montauk Beach	300	50	1.00	30.000	Perpetual Beach Easement	31411.8	Private
Montauk Beach	300	50	1.00	29.000	Perpetual Beach Easement	4187.1	Private
Montauk Beach	300	51	4.00	1.000	Perpetual Beach Easement	6768.5	Private
Montauk Beach	300	50	2.00	27.000	Access Agreement	160857.0	Public
Montauk Beach	300	50	1.00	25.001	Perpetual Beach Easement	284.5	Private
Montauk Beach	300	50	2.00	28.000	Access Agreement	33796.4	Public
Montauk Beach	300	50	2.00	22.000	Perpetual Beach Easement	263.1	Private
Montauk Beach	300	50	1.00	23.005	Perpetual Beach Easement	2079.7	Private
Montauk Beach	300	50	1.00	28.000	Perpetual Beach Easement	1248.9	Private
Montauk Beach	300	50	2.00	24.001	Perpetual Beach Easement	2517.7	Private
Montauk Beach	300	50	2.00	26.001	Perpetual Beach Easement	1079.6	Private
Montauk Beach	300	50	1.00	27.001	Perpetual Beach Easement	735.4	Private
Montauk Beach	300	49	6.00	26.000	Perpetual Beach Easement	9721.0	Private
Montauk Beach	300	49	6.00	21.000	Perpetual Beach Easement	29421.4	Private
Montauk Beach	300	49	6.00	20.013	Perpetual Beach Easement	3259.2	Private
Montauk Beach	300	205	1.00	1.000	Access Agreement	268732.3	Public
Montauk Beach	300	47	3.00	12.000	Access Agreement (Staging)	4,672.2	Public
Montauk Beach	300	47	3.00	8.000	Access Agreement (Staging)	11,465.9	Public
Montauk Beach	300	47	3.00	1.000	Access Agreement (Staging)	9,671.0	Public
					Total Easements: 19		
					Location of Temporary Work Area Easements (TBD)		

Contract 1: Downtown Montauk

Relocations:	0	Easement Costs (13 Private Easements)	$457,000.00
Lands & Damages:	$498,800.00	Labor for Easement Acquisition	41,800.00
			$498,800.00

The responsibility for the acquisition of the necessary lands and easements is the responsibility of the Non-Federal Sponsor (NFS), the New York State Department of Environmental Conservation. The NFS may enter into sub-agreements with local municipalities to assist in carrying out its acquisition responsibilities. New York State Law (Title 4, Chapter 7, Sections 1531-1539 of the Unconsolidated Laws) require that lands upon which beachfill is placed must be municipally owned, while lands upon which dunes are erected may be privately owned with permanent easement granted to a municipality. In either case, the NFS must maintain the control it needs in order to certify the property interests required for the project.

The project will require two estates: The Perpetual Beach Storm Reduction Easement and The Temporary Work Area Easement. Right of Entries, Special Use Permits, Licenses, or Access Agreements may be used for parcels owned by municipalities or local government.

A Standard Perpetual Beach Storm Damage Reduction Easement (Standard Estate No. 26) is required for property along all areas where beachfill material is placed, or could potentially be placed, during construction and renourishment operations, to allow continual access to construct, operate, maintain patrol, repair, renourish, and replace the beach berm and dune. This Easement precludes development, other than approved dune crossings and ensures that the design section, including 25 feet landward of the landward toe of the dune, would be held inviolate from future development. Temporary Work Area Easements are necessary to allow access in, over and across the land for a period of three

years for construction operations. Lands in Fee will also be required for beachfill placement where the project footprint impacts an existing dwelling. The text of the interests is as follows:

PERPETUAL BEACH STORM DAMAGE REDUCTION EASEMENT
(Standard Estate No. 26)

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

TEMPORARY WORK AREA EASEMENT
(Standard Estate No. 15)

A Temporary Easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____), for a period not to exceed _____, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the _____ Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby

acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

b. Non-Standard Estates

There are no non-standard estates required for this project.

c. Current Ownership

A list of all parcels for which real estate is required for the construction and operation and maintenance of the proposed project, may be found in Figure 3 above: Real Estate Requirements/ Impacted Parcels.

d. Real Estate Mapping

Real Estate Mapping for this project is attached to this document as Exhibit B. The map delineates the parcels impacted and easements required by this project.

3. EXISTING FEDERAL PROJECT.

Fire Island Inlet to Montauk Point, NY project (FIMP) was originally authorized in the River and Harbor Act of 1960. For this larger project that extends another 53 miles to the east and includes Fire Island, a General Design Memorandum (GDM) was prepared in 1963. The GDM recommended building groins and placing beach fill along the south shore of Long Island. Construction began in 1965, and 11 groins were built. Later in the 1960's 4 more groins were constructed bringing the number of groins constructed to 15. In the 1970s, the final two groins were built, for a total of 17. All of the constructed groins were located east of Fire Island. The FIMP project was halted in 1972 when New York State withdrew its support of the project. In 1978, an Environmental Impact Statement (EIS) was prepared by the USACE, New York District for the FIMP project. After consultation with the DOIU, the EIS was referred to the Council on Environmental Quality (CEQ), which found the document to be inadequate because of the lack of consideration of alternatives. In addition, CEQ indicated that the impact analysis needed to treat the complete length of the barrier island as a system. Work began on a Reformulation Study, but was halted in 1984 because of a disagreement about cost sharing. This disagreement was resolved following the adoption of the Water Resources Development Act of 1986.

Study efforts were resumed in 1994. However, the Reformulation Study is an effort that is currently ongoing. The barrier islands are subject to storms that could damage structures, open breaches, and cause flooding on the bayshore. With support from state and local interests, three Interim Plans have been developed while the Reformulation Study proceeds. The first Interim Plan entailed beachfill, dune construction, and support of the existing groin field in Westhampton Beach; a design by New York State was modified by the New York District to meet their policy and was approved by local and federal agencies. The Westhampton Interim Project was constructed in 1997 and 1998. The second interim project was the development of a Breach Contingency Plan (BCP). The BCP authorized the closing of a barrier island breach and rebuilding the beach and dunes to provide protection consisting of a berm at elevation 9 feet above NGVD. The BCP was developed and is in place. Another Interim Plan is protection of the commercial fishing facilities at the West of Shinnecock Inlet. The beach west of Shinnecock Inlet is subject to over wash with high breach potential, and also subject to severe erosion.

In response to P.L. 113-2 implemented in the aftermath of Hurricane Sandy, the Fire Island to Moriches Inlet (FIMI) Stabilization Hurricane Sandy Limited Reevaluation Report (HSLRR) has been approved (July 2014) as noted for reach 1. This Authorized but Unconstructed project at FIMI was approved as a Stabilization Project.

This Downtown Montauk Hurricane Sandy Limited Reevaluation Report (HSLRR) study and project is also developed as an Authorized but Unconstructed in accordance with P.L. 113-2 as a one-time stand-alone project that does not pre-supposed the outcome of the overall Fire Island to Montauk Point Reevaluation Report (FIMP GRR) that is an on-going study..

4. EXISTING FEDERALLY-OWNED/PUBLICLY OWNED LANDS.

The Project area contains lands owned by The State of New York and The Town of East Hampton. Refer to Exhibit A – Estates to be acquired for identification of these properties. Part of the publicly owned land identified as required for the Project is identified as Kirk Park Beach, owned by the Town of East Hampton. The parcels associated with Kirk Park Beach are labeled as parcels 17, 18, and 19 on Exhibits A and B.

5. LANDS OWNED BY THE NON-FEDERAL SPONSOR.

The Non-Federal Sponsor owns the submerged lands below Mean High Water.

6. NAVIGATIONAL SERVITUDE.

Navigational Servitude is the right of the Government (under the Commerce Clause of the U.S. Constitution) to use, control, and regulate the navigable waters of the United States and the submerged lands thereunder for various commerce-related purposes including navigation and flood control. In tidal areas, the servitude extends to all lands below the mean high water mark. In non-tidal areas, the servitude extends to all within the bed and banks of a navigable stream that lie below the ordinary high water. However, since the purpose of the Downtown Montauk Stabilization Project is coastal storm risk management, the Government will not exercise its rights under the doctrine of Navigational Servitude for this project.

7. INDUCED FLOODING

No induced flooding is anticipated due to the proposed project features.

8. BASELINE COST ESTIMATE FOR REAL ESTATE

The detailed Real Estate Cost Estimates are listed below. Private land holdings subject to shore erosion and required for project purposes have been appraised considering the benefits in accordance with the relevant statutes. The Uniform Appraisal Standards for Federal Land Acquisition guidelines regarding the use of special benefits when appraising partial acquisitions taking special benefits into account was used to develop the appraisal estimate. The consideration of special benefits when appraising partial acquisitions, taking special benefits is required by Federal policy and process.

The Baseline Cost Estimate for Real Estate contained below includes Perpetual Beach Storm Damage Reduction Easements costs for the project LERR.

The Total Baseline Cost for Real Estate for the project is **$498,800** summarized as follows:

Administrative and Acquisition Costs:

Administrative Costs:
Administration of Perpetual Beach Storm Risk Management Easements (13),
Access Agreements on Public Property (6),
Temporary Construction Easements (tbd), and
Staging Rights-of-Entry (tbd): **(*Total 19 Properties)*** ..... $ 38,000
Contingency 10%..... $ 3,800
Subtotal..... $ 41,800

Fee Acquisition Costs:
Perpetual Beach Easement Costs (13)..... $ 457,000*
*(cost value includes contingency)

TOTAL LANDS AND DAMAGES..... **. $ 498,800**

9. PUBLIC LAW 91-646 RELOCATIONS

No properties have been identified for relocation in this Stabilization Project. Should it be determined that there are private property owners so impacted by this project as to require relocation, benefits under P.L. 91-646 will be appropriately applied.

10. MINERAL ACTIVITY

There is no present or anticipated mineral activity in the vicinity of the project that may affect this planned project.

11. TIMBER RIGHTS

There is no present or anticipated timber harvesting activity in the vicinity of the project that may affect this planned project.

12. ASSESSMENT OF NON-FEDERAL SPONSOR ACQUISITION CAPABILITY

The Non-Federal Sponsor, NYSDEC, maintains the legal and professional capability and experience to acquire the LER in support of the Project. The Non-Federal Sponsor has indicated real estate acquisition would be accomplished by their Office, with the assistance of Suffolk County. The Sponsor has condemnation authority and other applicable authorities that may apply if necessary to support acquisition. NYSDEC will assume responsibility to maintain the Project after construction and has been supplied a copy of the Non-Federal Sponsor Manual outlining its responsibilities for this project.

The Non-Federal Sponsor Capability Assessment Checklist is attached as Exhibit "C" herein.

13. ZONING

The enactment of zoning ordinances is not proposed to facilitate acquisition.

14. ACQUISITION SCHEDULE

The Non-Federal Sponsor will officially initiate real estate acquisition activities after final execution of the Project Partnership Agreement (PPA). Based upon the estimated PPA signing date of October 14, 2014, the following is a generic real estate timeline for initiation:

Figure 4 – Proposed Acquisition Schedule

A	PPA EXECUTION	START DATE: October 14, 2014
B	FORWARD MAPS TO NFS	WITH 1 WEEK OF START DATE
C	PLATS AND OWNER VERIFICATION	WITHIN 12 WEEKS OF SPONSOR MAP RECEIPT
D	INFORMAL VALUE ESTIMATES RECEIPT	WITHIN 8 WEEKS OF PLATS/OWNERS
E	REVIEW VALUE ESTIMATES	WITHIN 4 WEEKS OF ESTIMATE RECEIPT
F	INITIATE NEGOTIATIONS	WITHIN 12 WEEKS AFTER VALUE ESTIMATES
G	INITIATE CONDEMNATION	WITHIN 4 WEEKS OF COMPLETED NEGOTIATIONS
H	CLOSINGS	WITHIN 6 WEEKS OF COMPLETED NEGOTIATIONS
I	POSSESSION	WITHIN 1 DAY OF CLOSING
J	CERTIFICATION OF REAL ESTATE	WITHIN 1 WEEK OF POSSESSION: Requires transmittal of the NFS Authorization for Entry for Construction and Certificate of Authority.
	APPROXIMATE TOTAL	1 YEAR

The acquisition of Project real estate may or may not be complete prior to the date USACE advertises the contract for Project construction. In the event USACE decides to advertise the contract for construction prior to certification of real estate, the New York District shall obtain a waiver from USACE Headquarters prior to advertisement.

15. UTILITY AND FACILITY RELOCATIONS

This project will not require the relocation of Utilities or Facilities.

16. ENVIRONMENTAL CONCERNS

There are no known or suspected on-site Hazardous, Toxic and Radioactive Waste (HTRW) associated with this Project, and the real estate cost estimates contained do not reflect the presence of contamination.

17. LANDOWNER AND LOCAL PROJECT SUPPORT

The Project Delivery Team (PDT) members have held Project pre-planning and coordination meetings with the NYSDEC (the Non-Federal Sponsor), the officials of Suffolk County, and the Town of East Hampton. These officials, representing the residents, have expressed initial support of this project. Local officials have offered their assistance to the Non-Federal Sponsor in its efforts to accomplish project needs.

18. NOTIFICATION TO THE NON-FEDERAL SPONSOR

The USACE, New York District, Real Estate Division provided formal written notification of the risks associated with acquiring the LER for this project prior to the full execution of the Project Partnership Agreement (PPA) (as outlined in paragraph 12-31, Chapter 12, ER 405-1-12, Real Estate Handbook, 20 Nov 85) through letter dated 7 August 2014.

19. RISK ANALYSIS

The risks identified with this project are considered minimal. The project real estate requires Perpetual Easements and Temporary Easements. There will be no fee acquisitions of homes or other properties. With the support of local officials, there does not appear to be opposition to the project at this time.

20. POINTS OF CONTACT

The points of contact for this real estate plan is the undersigned at (917)790-8448 (email: Noreen.D.Dresser@usace.army.mil) or the Real Estate Project Delivery Team member Realty Specialist Esther M. Tinort at (917)790-8067 (email: Esther.M.Tinort@usace.army.mil).

Downtown Montauk Stabilization Project
Exhibit A – Estates to be Acquired

No.	DISTRICT	SECTION	BLOCK	LOT	G/P* Govt/Pvt	OWNERSHIP	Easement Area (sq.ft>)	TYPE(S) ESTATES TO BE ACQUIRED	Reach
1	300	50.00	1.00	30.000	P	GIBBONS LOIS	31411.8	Perpetual Beach Easement	Montauk Beach
2	300	50.00	1.00	29.000	P	GIBBONS LOIS	4187.1	Perpetual Beach Easement	Montauk Beach
3	300	51.00	4.00	1.000	P	MARY CASH	6768.5	Perpetual Beach Easement	Montauk Beach
4	300	50.00	2.00	27.000	G	TOWN OF EAST HAMPTON	160857.0	Access Agreement	Montauk Beach
5	REMOVED								
6	REMOVED								
7	300	50.00	1.00	25.001	P	ROY TUCCILLO	284.5	Perpetual Beach Easement	Montauk Beach
8	300	50.00	2.00	28.000	G	TOWN OF EAST HAMPTON	33796.4	Access Agreement	Montauk Beach
9	300	50.00	2.00	22.000	P	DALAL PREIDEL	263.1	Perpetual Beach Easement	Montauk Beach
10	300	50.00	1.00	23.005	P	HOUSES ON THE OCEAN CORP	2079.7	Perpetual Beach Easement	Montauk Beach
11	300	50.00	1.00	28.000	P	OCEAN END APARTMENTS LTD	1248.9	Perpetual Beach Easement	Montauk Beach
12	300	50.00	2.00	24.001	P	ROYAL ATLANTIC CORP	2517.7	Perpetual Beach Easement	Montauk Beach
13	300	50.00	2.00	26.001	P	OCEAN BEACH RESORT LTD	1079.6	Perpetual Beach Easement	Montauk Beach
14	300	50.00	1.00	27.001	P	ANKIT & AVANI ENTERPRISES INC	735.4	Perpetual Beach Easement	Montauk Beach
15	REMOVED								
16	300	49.00	6.00	26.000	P	CITM LLC	9721.0	Perpetual Beach Easement	Montauk Beach
17	300	49.00	6.00	21.000	P	SURF CLUB AT MONTAUK CORP	29421.4	Perpetual Beach Easement	Montauk Beach
18	300	49.00	6.00	20.013	P	UNIT OWNERS	3259.2	Perpetual Beach Easement	Montauk Beach
19	300	205.00	1.00	1.000	G	STATE OF NEW YORK	268732.3	Access Agreement	Montauk Beach
20	300	47.00	3.00	12.000	G	TOWN OF EAST HAMPTON	4672.2	Access Agreement (Staging)	Montauk Beach
21	300	47.00	3.00	8.000	G	TOWN OF EAST HAMPTON	11465.9	Access Agreement (Staging)	Montauk Beach
22	300	47.00	3.00	1.000	G	TOWN OF EAST HAMPTON	9671.0	Access Agreement (Staging)	Montauk Beach

Downtown Montauk Stabilization Project
Exhibit B – Real Estate Map

ID #	SECTION	BLOCK	LOT	ADDRESS	Parcel Area (ft^2)	Easement Area (ft^2)
1	50	1	30.000	159 PANTIGO RD	78,625.8	31,411.8
2	50	1	29.000	159 PANTIGO RD	69,913.8	4,187.1
3	51	4	1.000	PO BOX 905	46,652.8	6,768.5
4	50	2	27.000	159 PANTIGO RD	160,518.6	160,857.0
5	REMOVED					
6	REMOVED					
7	50	1	25.001	88 S EMERSON AVE	5,583.5	284.5
8	50	2	28.000	159 PANTIGO RD	33,541.2	33,796.4
9	50	2	22.000	12 W 17TH ST	5,867.5	263.1
10	50	1	23.005	92 S EMERSON AVE	21,514.7	2,079.7
11	50	1	28.000	PO BOX730	11,775.1	1,248.9
12	50	2	24.001	POBOX 936	57,222.6	2,517.7
13	50	2	26.001	108 S EMERSON AVE	70,697.9	1,079.6
14	50	1	27.001	84 S EMERSON AVE	23,381.3	735.4
15	REMOVED					
16	49	6	26.000	21 OCEANVIEW TER	89,907.8	9,721.0
17	49	6	21.000	55 NEWTOWN LN	281,833.2	29,421.4
18	49	6	20.013		39,813.8	3,259.2
19	205	1	1.000		6,526,217,570.4	239,183.5
20	47	3	12.000		9,670.3	4,672.2
21	47	3	8.000	159 PANTIGO RD	33,497.6	11,465.9
22	47	3	1.000	159 PANTIGO RD	32,365.1	9,671.0

Notes:

1. Coordinates are in feet based on the New York State Plane Coordinate System, Long Island Zone, North American Datum of 1983 (NAD 83).
2. Aerial Imagery collected by NOAA on November 4, 2012, as part of "Hurricane Sandy: Rapid Response Imagery of the Surrounding Regions".
3. Landward Limit of Fill is based on profile surveys collected by OSI on October 17, 2013.
4. Parcel Data obtained from Suffolk County.

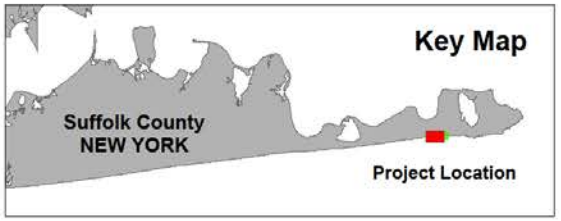
Dune Reinforcements
Easement Requirements
Montauk, Suffolk County, New York

Scale 1:1600

0 162.5 325 650 975 1,300 Feet

Legend:

- Landward Limit of Fill
- Suffolk County Parcels
- Easements



August 26 2014

US Army Corps of Engineers
New York District

Downtown Montauk Stabilization Project
Exhibit C – NFS Capability Assessment Checklist

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

DOWNTOWN MONTAUK
DOWNTOWN MONTAUK STABILIZATION PROJECT,
SUFFOLK COUNTY, NEW YORK

I. Legal Authority.

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? Yes

b. Does the sponsor have the power of eminent domain for this project? Yes

c. Does the sponsor have "quick-take" authority for this project? Yes

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? No

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? No

II. Human Resource Requirements.

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? No

b. If the answer to II.a is "yes," has a reasonable plan been developed to provide such training?

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? Yes

d. Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule? Yes

e. Can the sponsor obtain contractor support, if required in a timely fashion? Yes

f. Will the sponsor likely request USACE assistance in acquiring real estate? No

III. Other Project Variables.

a. Will the sponsor's staff be located within reasonable proximity to the project site? Yes

b. Has the sponsor approved the project/real estate schedule/milestones? Yes

IV. Overall Assessment.

a. Has the sponsor performed satisfactorily on other USACE projects? Yes

b. With regard to this project, the sponsor is anticipated to be: highly capable/fully capable/moderately capable/marginally capable/insufficiently capable. If sponsor is believed to be "insufficiently capable," provide explanation. Highly Capable.

V. Coordination.

a. Has this assessment been coordinated with the sponsor? Yes

b. Does the sponsor concur with this assessment? Yes

Concur:

Susan D. McCormick 8/11/14

Sue McCormick, P.E.
Chief, Coast Erosion Management Program
New York State Department of Environmental Conservation

Reviewed and approved by:

Noreen Dean Dresser

Noreen Dean Dresser
Chief of Real Estate Division
Real Estate Contracting Officer
New York District Corps of Engineers

DOWNTOWN MONTAUK

DOWNTOWN MONTAUK STABILIZATION PROJECT

HURRICANE SANDY LIMITED REEVALUATION REPORT

Evaluation of a Stabilization Plan for Coastal Storm Risk Management in Response to Hurricane Sandy
&
Public Law 113-2

COST APPENDIX

U.S. ARMY CORPS OF ENGINEERS

New York District

August 2014

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1.0 INTRODUCTION

This appendix provides a detailed cost estimate for the Downtown Montauk Stabilization Project. The selected plan stabilizes and reinforces the existing dune along 3,100 ft of shoreline in Downtown Montauk. Construction includes excavation and re-grading of the existing dune, fill and placement of Geotextile Sand Containers (GSC), and beach fill placement. The construction work is expected to be completed in a single contract.

The following sections provide a summary of the construction costs by code of account, abbreviated risk analysis, construction schedule, and fully funded and cost apportionment. Additional cost-backup is provided in Attachment A and B, which include the abbreviated risk analysis and M2 summary.

Details of the cost estimates prepared for the four other conceptual alternatives at Downtown Montauk are not presented in this appendix. Due to the relatively high annualized costs of these alternatives selection as one-time stabilization project was not possible. The annualized costs of these four alternatives over a 50 year period of performance are as follows: Beach Restoration ($5,377,000), Beach Restoration & Buried Seawall ($4,133,000), Feeder Beach ($2,912,000), and Feeder Beach & Dune Reinforcement ($3,262,000).

2.0 ACCOUNT SUMMARY

2.1 Basis for Estimates

Cost estimates were developed at an April 2014 price level for labor, material, and equipment. The material quantities for the project have been developed from the detailed plans shown in the Main Report.

2.2 Work Breakdown Structure

The detailed estimate was compiled using MCACES MII ver. 4.1, and patterned after the Civil Works Template as a model. The estimate makes use of five reporting levels available in the following format:

- Level 1 – Construction Element: One of two major account codes used to estimate the total project cost.
- Level 2 – Sub Element / Segment: An individual segment of construction activity comprising one or more categories of work or features (cost account).
- Level 3 – Feature: A subcomponent of a major type of work (cost account).
- Levels 4 through 5 – Sub Feature, Bid Item, Assembly: Increasingly detailed levels of descriptions, assembly, and estimating dependent on the information and design level developed for the Feasibility Report.

2.3 Project Component Details and Associated Basis of Costs

Labor costs reflect Davis Bacon labor rates for heavy dredging work in New York (General Decision No. NY130001). Equipment costs are derived from the MII 2011 Equipment Library, Region 01. Other costs such as sales tax, labor adjustment factor, freight and other local area factors are derived from the USACE publication EP 1110-1-8, Vol. 1.

Code of Account 01 – Lands and Damages

The Federal Government is required to acquire all Lands, Easements, Rights-of-way, and Relocations (LERR) that are necessary for construction of the Stabilization Project. Additional detail is provided in the Real Estate Plan, attached as Appendix F of the Downtown Montauk HSLRR.

The Real Estate requirements, for this project, include certain lands, easements, relocations and rights of way (LERR). The total LER required in support of the Project is approximately 13.46 acres; approximately 2.33 acres required in perpetual easements, and approximately 12.37 acres required in access agreements over public land. The Project impacts 22 parcels, impacting 16 private owners and 6 public owners. This project will not require relocation of property or utilities. The combined easement costs are estimated at $498,800 (including contingency). Since the cost estimate for this account already includes contingency it was not included in the Abbreviated Risk Analysis (ARA).

Code of Account 17 – Beach Replenishment

Beach Replenishment includes the work required to construct the reinforced dune: mobilization/demobilization; excavation; sand fill; geotextile filter layer; and furnish, fill, and place GSCs.

The beachfill quantities are estimated from a profile survey conducted on November 24, 2013 at Ocean Beach Motel. The cost of obtaining and transporting the sand fill to project location is based on several quotes from local upland sand suppliers. Labor rates and overhead costs are adjusted to reflect the Davis Bacon labor rates for heavy dredging work in New York (General Decision No. NY130001). The cost of furnishing, filling, and placing the GSC are based on quotes from a potential manufacturer of the GSCs.

Mobilization includes assembling and transfer all the necessary crew and equipment at the project site. Sand fill will be obtained from one of the local upland suppliers and transported to from the upland supplier to a stockpile on site with dump trucks or tractor-trailers. The flat (unfilled) GSC will be placed in location by hand and hydraulically filled in place. A sand slurry will be mixed and pumped from the stock pile to each individual GSC using a mini-hopper, high pressure pump, and hydraulic power pack. Dozers will be used to shape the sand fill to the required design profile.

The estimated cost for beach replenishment is $5,416,341.

Code of Account 30 – Engineering & Design

An estimated cost was developed for all activities related with the engineering and design effort. The engineering and design cost includes project planning, environmental compliance, preparation of Plans and Specifications, as well as pre-construction monitoring and engineering support through project construction. The monitoring costs include beach physical monitoring conducted over a 15 year period.

Engineering and design fees were calculated to be 12% of total construction cost. The operation maintenance, repair, and replacement costs over a 15 year period are the responsibility of the local stakeholder and not included in the First Costs.

The estimated cost for engineering and design is $650,000.

Code of Account 31 – Construction Management

A cost was developed for all construction management (supervision and administration) activities from pre-award requirements through final contract closeout. Construction management fees were calculated to be 9.40% based on the standard S&A calculator for civil works.

The estimated cost for construction management is $509,000.

2.4 First Costs

First costs include charges arising from the acquisition or construction of each individual component, as well as the cost of easements, planning and environmental compliance, engineering and design, monitoring, engineering during construction, construction management (supervision & administration), and contingencies.

Unit Costs

Unit costs for material and equipment were developed and based on the MII English Cost Book 2012 related with MCACES; actual costs and productions on projects and construction of a similar nature; current Davis Bacon labor rates for heavy dredging work; quotes from local upland sand suppliers and potential GCS manufacturer; and cost estimating judgment based on experience.

Labor Rates

The labor rates including fringe benefits for the CEDEP and MCACES estimates were taken from the Davis Bacon labor rates for heavy dredging work in New York (General Decision No. NY130001).

Lands and Damages

In order to construct the beach fill project, the Federal Government will be required to provide lands, easements and rights-of-way. The extent and value of the lands required for project implementation are provided in the Real Estate Plan Appendix.

Contingencies

A risk based contingency was developed for the Stabilization Project with an Abbreviated Risk Analysis (ARA). The ARA was performed with the involvement of the PDT and cost engineer. The contingency factor is used to identify the uncertainty associated with the work or task, forecast the risk/cost relationship, and assign a value that would limit the cost risk to an acceptable level. Contingency factors were assigned to the various project/construction elements, real estate, engineering and design, and construction management based on the level of detail in the degree of confidence. Based on the abbreviated risk analysis (Attachment A) performed by the project development team, the following contingencies were assigned to the various project construction elements:

- 01 Land & Damages – 0% (Already built in to cost estimate)
- 17 Beach Replenishment – 27.62%
- 30 Engineering & Design – 12.82%
- 31 Construction Management – 12.82%

Summary

Detail project first costs for the selected plan are presented in Table 1.

Table 1: Project First Costs

Account Code	Description	Quantity	UOM	Amount	Contingency %	Contingency Amount	Total
17	TOTAL BEACH REPLENISHMENT	1	EA	$5,416,341	27.62%	$1,496,105	$6,912,446
01	TOTAL LANDS & DAMAMGES	1	EA	$498,800	0%	$0	$498,800
30	TOTAL PLANNING, ENGINEERING, & DESIGN	1	EA	$650,000	12.82%	$83,301	$733,301
31	TOTAL CONSTRUCTION MANAGEMENT	1	EA	$509,000	12.82%	$65,231	$574,231
	TOTAL PROJECT FIRST COST			**$7,074,141**		**$1,644,637**	**$8,718,778**

Notes: 2015Q1 Price Level

3.0 CONSTRUCTION SCHEDULE

The pre-construction and construction sequence and time schedule of the Stabilization Project is dependent on the timeliness of this report's approval, the foregoing construction procedures, and the ability of local interests to implement items of local cooperation. These items of local cooperation are principally the furnishing of the required shoreline real estate easements by the State of New York.

The construction schedule is based on a Notice To Proceed (NTP) for construction on January 2, 2015. The total duration of construction is 122 days (4 months), with construction completed on May 4, 2015.

4.0 FULLY FUNDED & COST SHARING

The Total Project Cost Summary is provided in Table 2. The estimated total project cost is $8,900,000. The costs are escalated to the midpoint of construction (described above).

The Downtown Montauk Stabilization Project has 100% Federal funding. Therefore, the Federal cost apportionment is $8,900,000. The non-Federal partner is responsible for 0% of the total project cost. Operation and maintenance costs and administrative costs for real estate acquisition will be 100% non-Federal.

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Downtown Montauk Stabilization Project
PROJECT NO: 0
LOCATION: Montauk, NY

DISTRICT: NAN New York
PREPARED: 8/25/2014
POC: CHIEF, COST ENGINEERING, Mukesh Kum

This Estimate reflects the scope and schedule in report; Evaluation of a Stabilization Plan for Coastal Storm Risk Management in Response to Hurricane Sandy & Public Law 113-2

Program Year (Budget EC): 2015
Effective Price Level Date: 1 OCT 14

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: **6/3/2014** ($K)	**FIRST COST** ($K)	ESC (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*				*M*	*N*	*O*
17	BEACH REPLENISHMENT	$5,416	$1,496	28%	$6,912	1.6%	$5,501	$1,519	$7,020	$0	$7,020	0.5%	$5,528	$1,527	$7,054
	CONSTRUCTION ESTIMATE TOTALS:	$5,416	$1,496		$6,912	1.6%	$5,501	$1,519	$7,020	$0	$7,020	0.5%	$5,528	$1,527	$7,054
01	LANDS AND DAMAGES	$499	$0	0%	$499	1.6%	$507	$0	$507	$0	$507	0.0%	$507	$0	$507
30	PLANNING, ENGINEERING & DESIGN	$650	$83	13%	$733	2.2%	$664	$85	$749	$0	$749	0.0%	$664	$85	$749
31	CONSTRUCTION MANAGEMENT	$509	$65	13%	$574	2.2%	$520	$67	$587	$0	$587	0.5%	$523	$67	$589
	PROJECT COST TOTALS:	$7,074	$1,645	23%	$8,719		$7,191	$1,671	**$8,862**	$0	**$8,862**	0.4%	$7,221	$1,679	$8,900

Mandatory by Regulation	CHIEF, COST ENGINEERING, Mukesh Kumar
Mandatory by Regulation	PROJECT MANAGER, Frank Verga
Mandatory by Regulation	CHIEF, REAL ESTATE, Noreen Dresser
	CHIEF, PLANNING, Frank Santomauro
	CHIEF, ENGINEERING, Arthur Connolly
	CHIEF, OPERATIONS, Thomas Creamer
	CHIEF, CONSTRUCTION, Timothy Yarger
	CHIEF, CONTRACTING, Francis Cashman
	CHIEF, PM-PB, xxxx
	CHIEF, DPM, Joseph Seebode

ESTIMATED FEDERAL COST:	**100%**	**$8,900**
ESTIMATED NON-FEDERAL COST:	**0%**	**$0**
ESTIMATED TOTAL PROJECT COST:		**$8,900**

ATTACHMENT A

ABBREVIATED RISK ANALYSIS

ATTACHMENT A

ABBREVIATED RISK ANALYSIS

Abbreviated Risk Analysis

FIMP- Alt #4 Downtown Montauk
Feasibility (Alternatives)

Meeting Date: 28-May-14

PDT Members

Note: PDT involvement is commensurate with project size and involvement.

Project Management:	Frank Verga
Hydraulic Engineer:	
Engineering Manager:	Andrew Zuzulock
Coastal Engineer:	
AE PM:	
Coastal Engineer:	
Chief Environmental:	
Engineering & Design:	
Technical Lead:	
Geotech:	
Section Chief Hydraulics:	
Civil:	
Structural:	
Mechanical:	
Electrical:	
Cost Engineering:	Anthony Schiano
Construction Management:	
Operations:	
Economist:	
Biologist:	
Chief Cost Engineering:	
Cost Engineering:	
Real Estate:	
Planner:	
Supervisor Archeologist:	
Assistant PM	Robert Hampson

Terminology

Term	Definition
Risk Analysis ER 1110-2-1302, 15 Sep 08, page 19	a. Cost risk analysis is the process of identifying and measuring the cost impact of project uncertainties on the estimated TPC. It shall be accomplished as a joint analysis between the cost engineer and the designers or appropriate PDT members that have specific knowledge and expertise on all possible project risks. (1) PDTs are required to prepare a formal cost risk analysis for all decision documents requiring Congressional authorization for projects exceeding $40 million (TPC)(see appendix B). Where cost risk analysis is required, it is anticipated that the cost risk analysis will be performed once the recommended plan is identified prior to the alternative formulation briefing milestone.
Typical Risk Elements	Factors that can introduce risk to items listed in the Selected Work Breakdown Structure Items. The ones listed are the most typical for Civil Works Projects. These Risk Elements should be reviewed and established for each project.
Potential Risk Areas	These are items from the estimate's Work Breakdown Structure, either broad or detailed, that are believed to contain some risk. The cost estimator defines the Work Breakdown Structure. It is recommended that the PDT select the appropriate Selected Work Breakdown Structure Items and considers all Features. Focus should be placed on the items with the significant risks. Appropriately identifying the Selected Work Breakdown Structure Items will lead to a more confident development of contingency.

Typical Risk Elements

Risk Element	Typical Concerns
Project Scope Growth	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Investigations sufficient to support design assumptions? • Design confidence? • Water care and diversion fully understood, planned?
Acquisition Strategy	• Contracting plan firmly established? • 8a or small business likely? • Requirement for subcontracting? • Accelerated schedule or harsh weather schedule? • High-risk acquisition limits competition, design/build? • Limited bid competition anticipated? • Bid schedule developed to reduce quantity risks?
Construction Elements	• Accelerated schedule or harsh weather schedule? • High risk or complex construction elements, site access, in-water? • Water care and diversion plan? • Unique construction methods? • Special mobilization? • Special equipment or subcontractors needed? • Potential for construction modification and claims?
Quantities for Current Scope	• Level of confidence based on design and assumptions? • Possibility for increased quantities due to loss, waste, or subsidence? • Appropriate methods applied to calculate quantities? • Sufficient investigations to develop quantities? • Quality control check applied?
Specialty Fabrication or Equipment	• Unusual parts, material or equipment manufactured or installed? • Confidence in suppliers' ability? • Confidence in contractor's ability to install? • Ability to reasonably transport? • Risk of specialty equipment functioning first time? Test?
Cost Estimate Assumptions	• Reliability and number of key quotes? • Assumptions related to prime and subcontractor markups/assignments? • Assumptions regarding crew, productivity, overtime? • Site accessibility, transport delays, congestion? • Overuse of Cost Book, lump sum, allowances? • Lack confidence on critical cost items?
External Project Risks	• Potential for severe adverse weather? • Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing?

Abbreviated Risk Analysis

Project (less than $40M): **FIMP- Alt #4 Downtown Montauk**
Project Development Stage: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **$ 5,416,341**

	CWWBS	Feature of Work		Contract Cost		% Contingency		$ Contingency		Total
	01 LANDS AND DAMAGES	Real Estate	**$**	**498,800**		**0.00%**	$	-	$	498,800.00
1	**17 BEACH REPLENISHMENT**	**mob/demob**	**$**	**250,000**		10.62%	$	26,560	$	276,559.75
2	**17 BEACH REPLENISHMENT**	**Geobags**	**$**	**5,096,290**		28.58%	$	1,456,746	$	6,553,035.55
3	**17 BEACH REPLENISHMENT**	**excavation**	**$**	**70,051**		18.27%	$	12,800	$	82,850.79
4						0.00%	$	-	$	-
5						0.00%	$	-	$	-
6						0.00%	$	-	$	-
7						0.00%	$	-	$	-
8						0.00%	$	-	$	-
9						0.00%	$	-	$	-
10						0.00%	$	-	$	-
11						0.00%	$	-	$	-
12		**Remaining Construction Items**	**$**	**-**	*0.0%*	0.00%	$	-	$	-
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	**$**	**650,000.00**		12.82%	$	83,301	$	733,300.73
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	**$**	**509,000**		12.82%	$	65,231	$	574,230.88

Totals							
Real Estate	$	498,800	0.00%	$	-	$	498,800.00
Total Construction Estimate	$	5,416,341	27.62%	$	1,496,105	$	6,912,446
Total Planning, Engineering & Design	$	650,000	12.82%	$	83,301	$	733,301
Total Construction Management	$	509,000	12.82%	$	65,231	$	574,231
Total	$	7,074,141		$	1,644,637	$	8,718,778

FIMP- Alt #4 Downtown Montauk
Feasibility (Alternatives)
Abbreviated Risk Analysis

Meeting Date: 28-May-14

Risk Level

	Negligible	Marginal	Significant	Critical	Crisis
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3

Risk Element	Feature of Work	Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply)	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Likelihood	Impact	Risk Level
Project Scope Growth							
						Max Potential Cost Growth	**75%**
PS-1	mob/demob	• Project accomplish intent?	• Project accomplish intent?	Based on recent bids within this area, the team does not foresee any concern with this feature of work.	Unlikely	Negligible	**0**
PS-2	Geobags	• Potential for scope growth, added features and quantities?	• Project accomplish intent? • Investigations sufficient to support design assumptions?	Intent is well understood, however the application of the geobags is not a typical application for the NYD. We are confident in the design, however there may be a slight risk overall with the use of the geobags.	Possible	Marginal	**1**
PS-3	excavation	• Investigations sufficient to support design assumptions?	• Potential for scope growth, added features and quantities? • Project accomplish intent? • Design confidence?	Quantities may change, however this will be discussed later in the ARA along with the technique to excavate the sand to place the geobags in the trench.	Unlikely	Negligible	**0**
PS-4	0				Unlikely	Negligible	**0**
PS-5	0				Unlikely	Negligible	**0**
PS-6	0				Unlikely	Negligible	**0**
PS-7	0				Unlikely	Negligible	**0**
PS-8	0				Unlikely	Negligible	**0**
PS-9	0				Unlikely	Negligible	**0**
PS-10	0				Unlikely	Negligible	**0**
PS-11	0				Unlikely	Negligible	**0**
PS-12	Remaining Construction Items				Unlikely	Negligible	**0**
PS-13	Planning, Engineering, & Design	• Potential for scope growth, added features and quantities?	• Potential for scope growth, added features and quantities?	No issues that will affect this account	Unlikely	Negligible	**0**
PS-14	Construction Management	• Potential for scope growth, added features and quantities?	• Potential for scope growth, added features and quantities?	No issues that will affect this account	Unlikely	Negligible	**0**

Acquisition Strategy

						Max Potential Cost Growth	30%
AS-1	mob/demob	• Limited bid competition anticipated?	• Limited bid competition anticipated?	Recent bids for dredging suggests that contractors are in the area and the pricing has been competitive.	Possible	Negligible	0
AS-2	Geobags	• Limited bid competition anticipated?	• Limited bid competition anticipated? • Requirement for subcontracting?	Limited competition due to the nature of the work being completed (installing geobags). However a few contractors have done this type of work in the area. Therefore the costs reflects this concern.	Likely	Negligible	1
AS-3	excavation	• Requirement for subcontracting?	• Contracting plan firmly established? • Limited bid competition anticipated?	Beach work contractors are experienced with this type of work and the team does not see this as an issue.	Unlikely	Negligible	0
AS-4	0				Unlikely	Negligible	0
AS-5	0				Unlikely	Negligible	0
AS-6	0				Unlikely	Negligible	0
AS-7	0				Unlikely	Negligible	0
AS-8	0				Unlikely	Negligible	0
AS-9	0				Unlikely	Negligible	0
AS-10	0				Unlikely	Negligible	0
AS-11	0				Unlikely	Negligible	0
AS-12	Remaining Construction Items				Unlikely	Negligible	0
AS-13	Planning, Engineering, & Design	• Bid schedule developed to reduce quantity risks?	• Bid schedule developed to reduce quantity risks?	No issues that will affect this account	Unlikely	Marginal	0
AS-14	Construction Management	• Bid schedule developed to reduce quantity risks?	• Bid schedule developed to reduce quantity risks?	No issues that will affect this account	Unlikely	Marginal	0

Construction Elements

						Max Potential Cost Growth	25%
CE-1	mob/demob	• Special mobilization?	• High risk or complex construction elements, site access, in-water? • Special mobilization?	Accelerated schedule becomes an issue and therefore extra pumping stations and dump trucks are needed to fill the geobags in a timely fashion to meet this schedule.	Likely	Marginal	2
CE-2	Geobags	• Accelerated schedule or harsh weather schedule?	• Unique construction methods? • Accelerated schedule or harsh weather schedule?	Slurry mix is needed to fill the geobags, and the technique to place and fill bags may cause a slight risk to the contractor in the beginning of the construction process. However the risk should drop off by the end of the construction process.	Likely	Significant	3
CE-3	excavation	• Special equipment or subcontractors needed?	• Unique construction methods?	Complex construction due to filling the geobags along with dewatering the trench in order to place the geobags within the project area. The team does not necessarily see this as a unique construction method, but a small risk involved with completing the work.	Likely	Significant	3
CE-4	0				Unlikely	Negligible	0
CE-5	0				Unlikely	Negligible	0
CE-6	0				Unlikely	Negligible	0
CE-7	0				Unlikely	Negligible	0
CE-8	0				Unlikely	Negligible	0
CE-9	0				Unlikely	Negligible	0
CE-10	0				Unlikely	Negligible	0
CE-11	0				Unlikely	Negligible	0
CE-12	Remaining Construction Items				Unlikely	Negligible	0
CE-13	Planning, Engineering, & Design	• Potential for construction modification and claims?	• Potential for construction modification and claims?	Quantities change in field after geobags settle and attempting to reach the dune height.	Possible	Marginal	1
CE-14	Construction Management	• Potential for construction modification and claims?	• Potential for construction modification and claims?	Quantities change in field after geobags settle and attempting to reach the dune height. Therefore S&A support would be neccassary.	Possible	Marginal	1

Quantities for Current Scope

						Max Potential Cost Growth	20%
Q-1	mob/demob	• Appropriate methods applied to calculate quantities?	• Level of confidence based on design and assumptions? • Appropriate methods applied to calculate quantities?	N/A	Unlikely	Marginal	0
Q-2	Geobags	• Possibility for increased quantities due to loss, waste, or subsidence?	• Appropriate methods applied to calculate quantities? • Sufficient investigations to develop quantities?	Based on discussions with the manufacture the teams feels there may be a slight chnace of an increase in the number of geobags necessary to complete the project.	Possible	Marginal	1
Q-3	excavation	• Sufficient investigations to develop quantities?	• Sufficient investigations to develop quantities? • Appropriate methods applied to calculate quantities?	Quantities may increase once the latest survey is completed, however the quantity increase will decrease the quantity necessary to be transported to fill the geobags. Therefore this risk becomes a wash.	Possible	Negligible	0
Q-4	0				Possible	Negligible	0
Q-5	0				Possible	Negligible	0
Q-6	0				Unlikely	Negligible	0
Q-7	0				Unlikely	Negligible	0
Q-8	0				Unlikely	Negligible	0
Q-9	0				Unlikely	Negligible	0
Q-10	0				Unlikely	Negligible	0
Q-11	0				Unlikely	Negligible	0
Q-12	Remaining Construction Items				Unlikely	Negligible	0
Q-13	Planning, Engineering, & Design	• Sufficient investigations to develop quantities?	• Appropriate methods applied to calculate quantities? • Sufficient investigations to develop quantities?	Due to the outdated surveys, additional design may be needed.	Likely	Negligible	1
Q-14	Construction Management	• Sufficient investigations to develop quantities?	• Sufficient investigations to develop quantities?	If quantities increase on the features above, then there may be a an increase in S&A time.	Likely	Negligible	1

Specialty Fabrication or Equipment

						Max Potential Cost Growth	75%
FE-1	mob/demob				Unlikely	Negligible	0
FE-2	Geobags				Unlikely	Negligible	0
FE-3	excavation				Unlikely	Negligible	0
FE-4	0				Unlikely	Negligible	0
FE-5	0				Unlikely	Negligible	0
FE-6	0				Unlikely	Negligible	0
FE-7	0				Unlikely	Negligible	0
FE-8	0				Unlikely	Negligible	0
FE-9	0				Unlikely	Negligible	0
FE-10	0				Unlikely	Negligible	0
FE-11	0				Unlikely	Negligible	0
FE-12	Remaining Construction Items				Unlikely	Negligible	0
FE-13	Planning, Engineering, & Design			N/A	Unlikely	Negligible	0
FE-14	Construction Management			N/A	Unlikely	Negligible	0

Cost Estimate Assumptions

						Max Potential Cost Growth	35%
CT-1	mob/demob	• Lack confidence on critical cost items?	• Reliability and number of key quotes? • Lack confidence on critical cost items?	Based on recent bids within this area.	Unlikely	Negligible	0
CT-2	Geobags	• Reliability and number of key quotes?	• Reliability and number of key quotes?	Possible limited competition, which may increase the key quote received by the manufacture. Therefore we see this as a slight risk to the cost estimate.	Possible	Significant	2
CT-3	excavation	• Reliability and number of key quotes?	• Reliability and number of key quotes? • Lack confidence on critical cost items?	Based on recent bids within this area.	Unlikely	Negligible	0
CT-4	0				Unlikely	Negligible	0
CT-5	0				Unlikely	Negligible	0
CT-6	0				Unlikely	Negligible	0
CT-7	0				Unlikely	Negligible	0
CT-8	0				Unlikely	Negligible	0
CT-9	0				Unlikely	Negligible	0
CT-10	0				Unlikely	Negligible	0
CT-11	0				Unlikely	Negligible	0
CT-12	Remaining Construction Items	• Reliability and number of key quotes?			Unlikely	Negligible	0
CT-13	Planning, Engineering, & Design	• Reliability and number of key quotes?		N/A	Unlikely	Negligible	0
CT-14	Construction Management	• Reliability and number of key quotes?		N/A	Unlikely	Negligible	0

External Project Risks

						Max Potential Cost Growth	40%
EX-1	mob/demob	• Unanticipated inflations in fuel, key materials?	• Political influences, lack of support, obstacles? • Unanticipated inflations in fuel, key materials?	N/A	Unlikely	Negligible	0
EX-2	Geobags	• Potential for severe adverse weather?	• Unanticipated inflations in fuel, key materials? • Potential for market volatility impacting competition, pricing? • Political influences, lack of support, obstacles? • Potential for severe adverse weather?	Some possible political issues with the use of geobags, however the team does not foresee this as a huge risk.	Likely	Marginal	2
EX-3	excavation	• Political influences, lack of support, obstacles?	• Unanticipated inflations in fuel, key materials?	Gas is always fluctuating and therefore since this is a heavily gas driven job there is a chance the price could increase significantly above the assumed inflation rate.	Possible	Significant	2
EX-4	0				Unlikely	Negligible	0
EX-5	0				Unlikely	Negligible	0
EX-6	0				Unlikely	Negligible	0
EX-7	0				Unlikely	Negligible	0
EX-8	0				Unlikely	Negligible	0
EX-9	0				Unlikely	Negligible	0
EX-10	0				Unlikely	Negligible	0
EX-11	0				Unlikely	Negligible	0
EX-12	Remaining Construction Items	• Potential for severe adverse weather?			Unlikely	Negligible	0
EX-13	Planning, Engineering, & Design	• Political influences, lack of support, obstacles?	• Political influences, lack of support, obstacles?	The concern may cause a requirement to redesign.	Possible	Marginal	1
EX-14	Construction Management	• Potential for severe adverse weather?			Possible	Marginal	1

FIMP- Alt #4 Downtown Montauk
Feasibility (Alternatives)
Abbreviated Risk Analysis

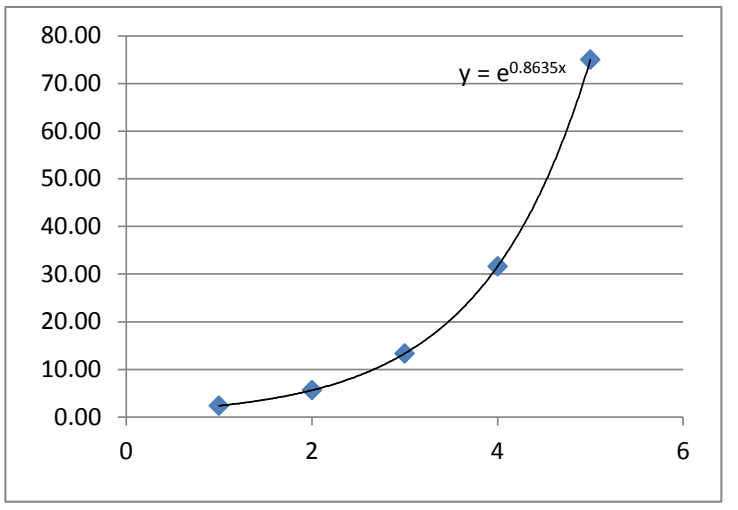
Typical Risk Elements	Potential Risk Areas													
	mob/demob	Geobags	excavation	0	0	0	0	0	0	0	0	Remaining Construction Item	Planning, Engineering, & Design	Construction Management
Project Scope Growth	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Acquisition Strategy	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Construction Elements	2	3	3	-	-	-	-	-	-	-	-	-	1	1
Quantities for Current Scope	-	1	-	-	-	-	-	-	-	-	-	-	1	1
Specialty Fabrication or Equipment	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cost Estimate Assumptions	-	2	-	-	-	-	-	-	-	-	-	-	-	-
External Project Risks	-	2	2	-	-	-	-	-	-	-	-	-	1	1

Project Scope Growth

Max Potenital Cost Growth 75 %

x	y	
0	0	0.00%
1	2.37	2.37%
2	5.62	5.62%
3	13.34	13.34%
4	31.63	31.63%
5	75.00	75.00%

y = a^x
a = y^(1/x)
a = 2.371441

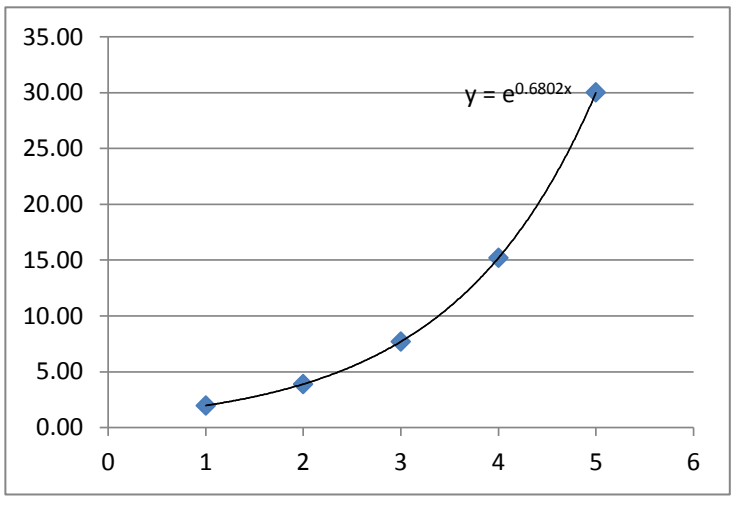


Acquisition Strategy

Max Potenital Cost Growth 30 %

x	y	
0	0	0.00%
1	1.97	1.97%
2	3.90	3.90%
3	7.70	7.70%
4	15.19	15.19%
5	30.00	30.00%

y = a^x
a = y^(1/x)
a = 1.97435

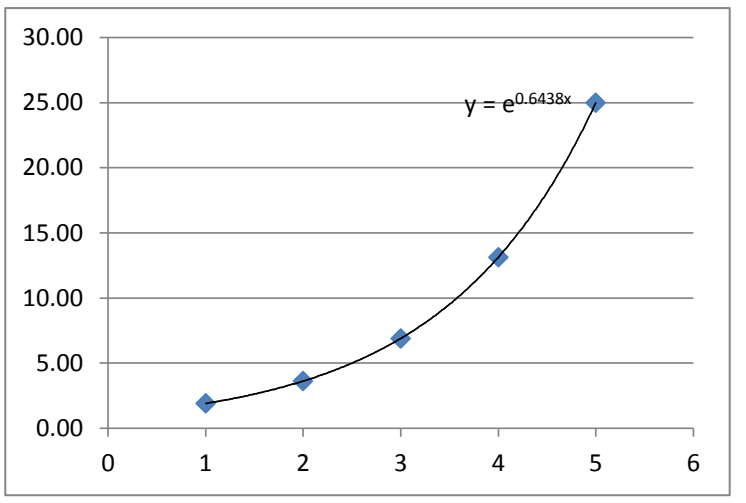


Construction Elements

Max Potenital Cost Growth 25 %

x	y	
0	7	7.00%
1	1.90	8.90%
2	3.62	10.62%
3	6.90	13.90%
4	13.13	20.13%
5	25.00	32.00%

y = a^x
a = y^(1/x)
a = 1.903654

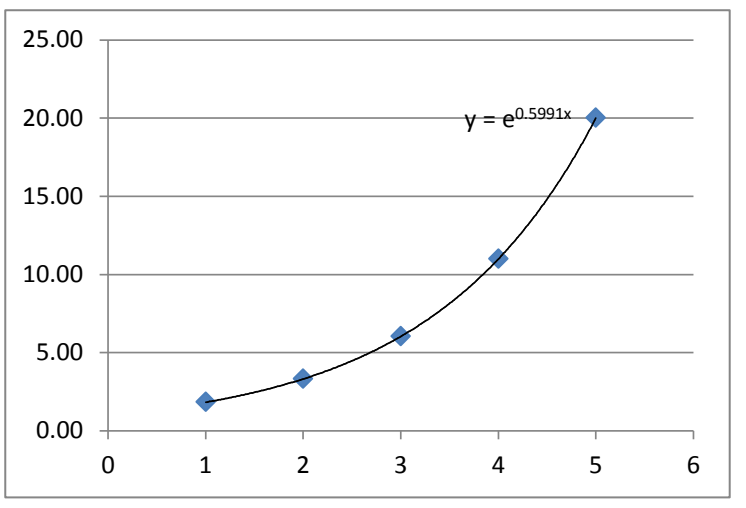


Quantities

Max Potenital Cost Growth 20 %

x	y	
0	0	0.00%
1	1.82	1.82%
2	3.31	3.31%
3	6.03	6.03%
4	10.99	10.99%
5	20.00	20.00%

y = a^x
a = y^(1/x)
a = 1.820564

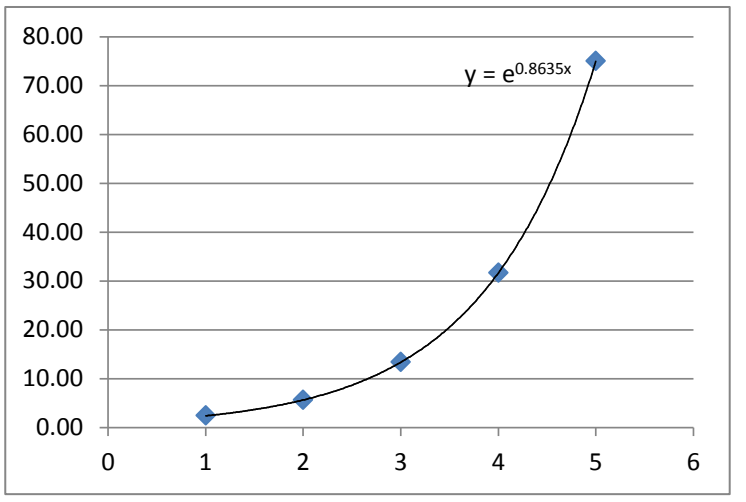


Fab or Equip

Max Potenital Cost Growth 75 %

x	y	
0	0	0.00%
1	2.37	2.37%
2	5.62	5.62%
3	13.34	13.34%
4	31.63	31.63%
5	75.00	75.00%

y	=	a^x
a	=	y^(1/x)
a	=	2.371441



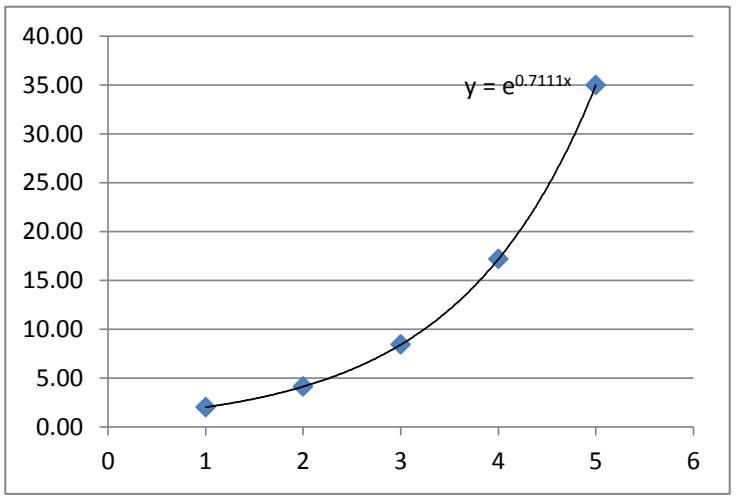
Cost Est Assumptions

Max Potenital Cost Growth 35 %

x	y	
0	0	0.00%
1	2.04	2.04%
2	4.15	4.15%
3	8.44	8.44%
4	17.19	17.19%
5	35.00	35.00%

y	=	a^x
a	=	y^(1/x)
a	=	2.036168

95

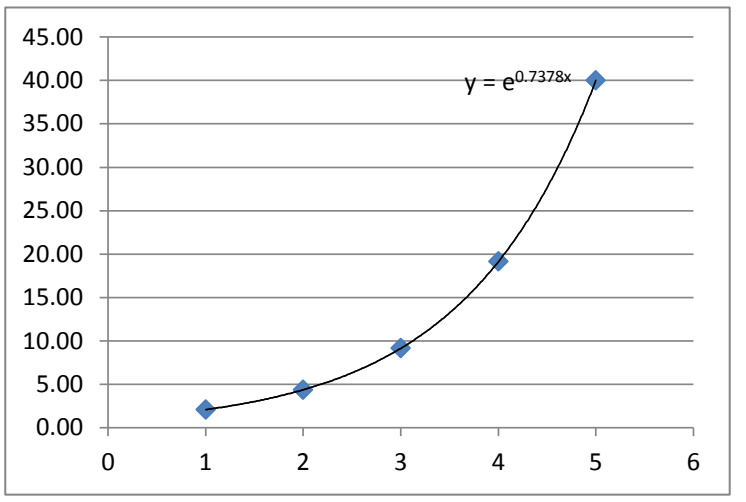


External Risks

Max Potenital Cost Growth 40 %

x	y	
0	0	0.00%
1	2.09	2.09%
2	4.37	4.37%
3	9.15	9.15%
4	19.13	19.13%
5	40.00	40.00%

y	=	a^x
a	=	y^(1/x)
a	=	2.091279



FIMP- Alt #4 Downtown Montauk
Feasibility (Alternatives)
Abbreviated Risk Analysis

	Project Scope Growth		Acquisition Strategy		Construction Elements		Quantities for Current Scope		Specialty Fabrication or Equipment		Cost Estimate Assumptions		External Project Risks		Σ	Σ of $
	75%		30%		25%		20%		75%		35%		40%		300%	
mob/demob	0.00%	$ -	0.00%	$ -	10.62%	$ 26,560	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ 26,560
Geobags	2.37%	$ 120,855	1.97%	$ 100,619	13.90%	$ 708,315	1.82%	$ 92,781	0.00%	$ -	4.15%	$ 211,291	4.37%	$ 222,884		$ 1,456,746
excavation	0.00%	$ -	0.00%	$ -	13.90%	$ 9,736	0.00%	$ -	0.00%	$ -	0.00%	$ -	4.37%	$ 3,064		$ 12,800
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
0	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
Remaining Construction Items	0.00%	$ -	0.00%	$ -	7.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -	0.00%	$ -		$ -
		$ 120,855.49		$ 100,618.63		$ 744,611.31		$ 92,781.23		$ -		$ 211,291.17		$ 225,947.25	$ 1,496,105.08	$ 1,496,105
		$ 5,416,341.00		$ 5,416,341.00		$ 5,416,341.00		$ 5,416,341.00		$ 5,416,341.00		$ 5,416,341.00		$ 5,416,341.00	$ 5,416,341.00	$ 5,416,341.00
		2.23%		1.86%		13.75%		1.71%		0.00%		3.90%		4.17%	27.62%	27.62%

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, D.C. 20314-1000

JAN 8 2014

CECW-NAD-RIT

MEMORANDUM FOR CHIEF, SANDY COASTAL MANAGEMENT DIVISION

SUBJECT: Fire Island to Montauk Point, Completion Strategy

1. The North Atlantic Division's attached completion strategy for the Fire Island to Montauk Point (FIMP) project outlines the proposed approach for expediting completion of the FIMP reformulation study while concurrently moving forward with stabilization projects consisting of the beach fill (dune/berm) elements authorized pre-Sandy. HQUSACE concurs with this approach to expedite construction of the FIMP project.

2. The stabilization projects will be documented in Hurricane Sandy Limited Reevaluation Reports for Fire Island Inlet to Moriches Inlet and Downtown Montauk. The strategy for the stabilization projects is intended to expedite implementation of previously authorized elements of the FIMP project to reduce the heightened risk post-Sandy. The stabilization projects should be developed so that they do not foreclose the consideration of alternatives in the reformulation study. The FIMP reformulation study will be documented in a General Reevaluation Report and will consider non-structural alternatives (to include structure elevation/flood-proofing) and nature-based solutions.

3. Questions or concerns regarding this matter should be directed to Mr. Michael Voich, North Atlantic Division, Regional Integration Team, at (202) 761-4655.

Encl

STEVEN L. STOCKTON, P.E.
Director of Civil Works

Fire Island to Montauk Point Completion Strategy

Executive Summary

1. There is increased urgency to complete the Fire Island Inlet to Montauk Point (FIMP) Reformulation Study and to implement the recommendations, in the wake of Hurricane Sandy within the Project Area. The following outlines the Corps' approach for expediting completion of the FIMP Reformulation Study, and a concurrent approach for stabilizing vulnerable and susceptible areas.

2. FIMP falls into several programs within PL 113-2 including Constructed Projects, eligible for repair and restoration (Westhampton, WOSI) and Authorized but Unconstructed (ABU) Projects. The identified efforts for FIMP are itemized below. This approach focuses on the effort necessary for the last 2 tasks, completion of the Reformulation Study Effort (d), and Stabilization Efforts (e).
    a. PL 84-99 Repair, and Enhanced Repair of the Westhampton Interim Project
    b. PL 84-99 Enhanced Repair of the WOSI Project (84-99 repair already accomplished)
    c. Execution of Breach Contingency Plan (BCP) in the Wilderness Area (two other breaches already closed)
    d. Completion of the Reformulation Study, and construction of Recommendations
    e. Stabilization Efforts to address Sandy impacts including:
        i. Fire Island Inlet to Moriches Inlet Reach (Fire Island)
        ii. Downtown Montauk

3. Stabilization Efforts are intended to reduce the heightened risk post-Sandy while the FIMP reformulation study is being completed. The solutions will not foreclose on alternatives under consideration for FIMP.

Reformulation Study Effort Approach

4. Prior to Hurricane Sandy, there had been significant advances in identifying a recommended plan acceptable to all partners. A Recommended Plan for FIMP must have agreement between USACE, DOI, and NYS (who represents the local governments). In March 2011, USACE and DOI identified a Tentative Federally Supported Plan (TFSP) that was coordinated at the Secretary-level of both USACE and DOI. This plan was provided to NYS for their concurrence. NYS provided comments on TFSP, and asked for additional information to come to a decision on a Tentatively Selected Plan (TSP) in a letter dated December 29, 2011. The Corps provided a response to NYS by letter dated May 16, 2013 which addressed the State's comments, and identified the changes that are being proposed to

address post-Sandy impacts. In response, NYSDEC provided a letter dated June 14, 2013 supporting the TFSP, and the Stabilization Efforts.

1. Post-Sandy Refinements. Following Sandy, it was recognized by USACE, DOI, and NYS that the TFSP must be re-evaluated and incorporate changes due to Sandy. The primary changes that have been incorporated are revisions to the dune alignment and updates to the quantities, costs, and benefits reflecting the current island condition. Additionally, changes in project features have been incorporated at several locations (feeder beach in Smith Point County Park, a dune in the Lighthouse Tract, a plan for downtown Montauk, updates to nature-based features, and updated breach response protocols).

2. The most significant change in the TFSP is an updated beachfill alignment. The team has identified a beachfill alignment located further north than the prior agreed-upon alignment. The revised alignment requires the acquisition and relocation of approximately 48 houses. The comparison of costs indicates that this new plan has a lower life-cycle cost as compared to the prior, more seaward alignment. NYSDEC has indicated support for this alternative and asked that USACE minimize the scope to the extent possible for unwilling sellers.

3. Based upon the letter of support from NYS, the District is proceeding with the following efforts. This information will ultimately feed into the recommended plan section of the HSGRR. The HSGRR will be based upon the Draft Reformulation Report previously reviewed by NAD and HQ, which was the subject of the prior IPR held in August 2010.
   - Updating quantities, costs and economics of the alternatives
   - Updating and comparing plans specific for Fire Island and Downtown Montauk
   - Incorporating Sea Level Rise into the analysis (as per USACE guidance and requested by NYS)

4. The District has undertaken additional coordination as part of completing the Reformulation Study. The District has followed a three-pronged approach to coordinating the plan:
   - Ensuring vertical team buy-in within the Corps;
   - Reaffirming vertical team support with the Federal partners (DOI);
   - Reaffirming Local sponsor support of the plan.

5. The partner coordination to date has been extensive, at the Federal, State, and Local-levels. Based upon the recent meetings, it is recognized that there is both USACE and DOI agreement on the overall approach for FIMP, and for the stabilization efforts. Local sponsor support for the plan has also been confirmed. It is recognized that there are still several details of the plan that need to be finalized.

Stabilization Project: Approach

1. The current schedule to complete the Reformulation Study will leave the identified vulnerable and susceptible portions of the Study Area (as a result of Hurricane Sandy) exposed to future damages until the recommendations from the FIMP Reformulation Study can be implemented. A proposed solution to address this concern is the advanced implementation of Stabilization Projects. The assumption for these Stabilization Projects is that these projects are necessary to address the effects of Hurricane Sandy as quickly as possible before another major storm event occurs, and will be independent of the FIMP Reformulation recommendations.

2. Based upon the existing vulnerability in the Study Area, it is expected that there should be two stabilization efforts: 1) Fire Island Inlet to Moriches Inlet (Fire Island) and 2) Downtown Montauk.

3. It is expected that a "Hurricane Sandy Limited Reevaluation Report (HSLRR)" will be prepared for each area (Fire Island and Downtown Montauk) to obtain approval for construction of the recommended plan, and will serve as the basis of a PPA for construction of each stabilization project.

4. These HSLRR's will contain independent plans that are economically justified. These plans will be evaluated in an appropriate NEPA document, and a PPA will be prepared for the plan described in the HSLRR and NEPA document. There may be differences in the exact plan development for each stabilization effort since site conditions may warrant different life-cycle considerations. The following approach describes the plan for the Fire Island Inlet to Moriches Inlet Stabilization Project with similar approach for Downtown Montauk

5. The Fire Island HSLRR will include a plan that includes a one-time action, beachfill recommendation that would not negate consideration of any of the alternatives under consideration for FIMP. The No Action FIMP alternative would be achieved post-stabilization, because renourishment is not contemplated after the Stabilization Project is complete. The overall FIMP HSGRR/EIS will assess the entire Project Area and all elements of its implementation. Due to the need to implement the stabilization efforts at Fire Island and Downtown Montauk prior to the completion of the overall HSGRR/EIS , the District will prepare respective Environmental Assessments (EA) that will evaluate appropriate project alternatives including the one-time action, as described above and associated environmental impacts. As required by NEPA, the EA must conclude with a finding that a selected alternative either will or will not significantly affect the quality of the human environment. If a significant impact is found, an EIS will be prepared.

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

June 14, 2013

Colonel Paul E. Owen
District Commander
United States Army Corps of Engineers
New York District
26 Federal Plaza
Room 2109
New York, NY 10278

Dear Colonel Owen:

I am pleased to inform you that New York State supports implementation of the fully federally funded Fire Island to Montauk Point (FIMP) project, including the United States Army Corps of Engineers' (Corps) proposal to expedite the implementation of elements of FIMP, such as the immediate restoration of dunes and beaches damaged by Hurricane Sandy on Fire Island and downtown Montauk. This support is based on the overall concepts of the FIMP project subject to the items further described in this letter.

On March 11, 2011, representatives of the Corps and the United States Department of Interior sent a letter to me outlining the potential plan of improvement for the Fire Island to Montauk Point ("FIMP") Reformulation Study. This "Tentative Federal Supported Plan" ("TFSP") was proposed as the basis to move forward with Reformulation Study efforts for the entire FIMP study area – encompassing approximately 83 miles of Atlantic Ocean coastal and bay areas of Suffolk County, New York. As noted in the federal letter, New York State must find the general plan of improvement acceptable before its attributes can be finalized through a collaborative process. New York's approval at this stage, I understand, would allow the Corps and State to move forward with a final analysis of the TFSP, including such matters as plan formulation, engineering, economics, environmental assessment, model certifications and formal agency policy-level approvals.

After a series of discussions, on December 29, 2011, DEC sent a letter to the Army Corps presenting information requests aimed at better understanding some of the basic elements of the TFSP so that DEC would be in a position to accurately explain project elements, costs, maintenance obligations and impacts of the TFSP to the required local community sponsor(s). While further discussions were taking place, Hurricane Sandy arrived – altering the physical and fiscal landscape in a variety of ways. On May 16, 2013 the Corps responded to the Department's letter which addressed a number of the concerns raised by the Department, but deferred a response on a few issues that are currently under review based on the impacts from Sandy.

I understand that alternative components of the TFSP are now being further refined, including: breach response measures along the barrier island, including "advanced" breach response methods or protocols; inlet management, beach and dune fill components and alignments with on-going beach nourishment; structural groin modifications; resiliency measures, including a significant number of coastal community building elevations; road elevations; land and development management to limit new development in certain flood hazard areas; protective natural infrastructure features (including wetland complexes, living shorelines, shellfish reefs, dunes, ecologically friendly in-bay breakwaters, and marsh islands) and environmental restoration, particularly in south shore bay areas.

All of the above elements would be sharpened in a process that fully involves local stakeholders. As you have emphasized, this massive project would need to be finalized in a manner that takes into account increased storm surge intensity associated with climate change and sea level rise. It is understood that the Corps will be performing an environmental impact review process under the National Environmental Policy Act (NEPA) for the entire FIMP project and that the National Park Service is evaluating the need for a NEPA review with respect to the existing breach in the Wilderness Area of the Fire Island National Seashore. It is through these processes that the elements of the project will be fully analyzed and a final FIMP project will be fully defined.

The State also supports the Corps' review of the post Sandy dune re-alignment along Fire Island that may be necessary based on the Corps' cost to benefit analysis that is still underway. If the cost to benefit analysis indicates that the alignment should be moved north in order to make the project more economical, resilient, and sustainable over the 50-year period of the project, then the State would support this realignment. If the realignment requires the purchase of properties, then the State would request that the Corps minimize the scope of this activity to the extent possible for unwilling sellers and to perform the procurement of these properties for the State at full federal expense. The State awaits the Corps' submittal of the elements of the project that you are currently working on, as delineated in your May 16, 2013 response. Thank you for all of your good and continuing efforts to help New York rebuild smarter and stronger in the face of the challenges presented by Hurricane Sandy.

Sincerely,

Joseph J. Martens

c: Mr. Joseph Vietri

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF
Project Management Division

16 MAY 2013

Mr. Alan A. Fuchs, P.E.
Director, Bureau of Flood Protection and Dam Safety
New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection and Dam Safety, 4th Floor
625 Broadway
Albany, New York, 12233-3504

Dear Mr. Fuchs:

Thank you for your letter dated December 29, 2011 regarding the Fire Island Inlet to Montauk Point (FIMP) Reformulation Study, which requested additional information on the Tentative Federal Supported Plan (TFSP). This was in response to the March 11, 2011 jointly signed letter from both the U.S. Army Corps of Engineers and the U.S. Department of Interior (DOI) which requested New York State's review and verification of acceptability of the TFSP.

We recognize there have been significant changes since the exchange of this correspondence, most notably Hurricane Sandy, the passage of PL 113-2 (The Disaster Relief Appropriations Act; 2013) which includes provisions that establish a framework for proceeding with Sandy affected authorized and unconstructed projects, and the increased support to bring the FIMP Reformulation Study to a conclusion.

Prior to Hurricane Sandy, the Corps was coordinating proposed responses with both your office and the DOI, as well as in the process of developing the requested information. As we are currently in the process of updating this information to account for necessary changes due to Hurricane Sandy, we have attached preliminary responses to your comments for your immediate review.

Since Hurricane Sandy, our offices have also been engaged in a number of discussions regarding appropriate revisions to the TFSP, and the evaluation of alternatives which properly reflect the post-Sandy condition. The revisions to the TFSP that are currently under consideration include the following:

- Beach fill alignment adjustments along Fire Island to account for post-Sandy changes
- Incorporation of a dune and beach feature in the Fire Island Lighthouse Tract
- Incorporation of a feeder beach in Smith Point County Park
- Updating of Breach Response protocols
- Updating of potential plan features in Downtown Montauk

The details requested by the State are necessary for identifying a FIMP mutually acceptable plan between the Corps, DOI and State of New York. Local sponsor concurrence with the features and scale set forth in the TFSP is an essential first step to formalizing the specific features of a recommendable plan. The Corps will continue to coordinate development of the updated TSFP implementation details with affected agencies to ensure the priorities communicated by NYS are incorporated.

We look forward to your timely review and continued discussion and coordination with your office. Please contact Mr. Frank Verga, Project Manager, at (917) 790-8212 if you have any questions.

Sincerely,

Paul E. Owen
Colonel, U.S. Army
Commander

CF w/Attachments:
NYSDEC, (P. Scully; S. McCormick)
NYSDOS, (F. Anders; B. Pendergrass)
NPS, (C. Soller)
USFWS, (D. Stilwell)

Joint Signed TFSP, dated March 11, 2011

NYS comments, dated December 29, 2011

NYS comments, dated June 28, 2012

US Army Corps of Engineers®

March 11, 2011

Honorable Joe Martens, Commissioner
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Dear Mr. Martens:

We write together to ask for your consideration of a newly developed potential plan of improvement for the Fire Island Inlet to Montauk Point, New York, Reformulation Study.

Any plan developed for this area that involves erosion control and beach nourishment must be mutually acceptable to the United States Secretary of the Army and Secretary of the Interior. Through a series of meetings spanning nearly 18 months, the U.S. Army Corps of Engineers and the U.S. Department of Interior now stand ready to move forward with Reformulation Study efforts by utilizing this potential plan of improvement for the entire project study area. This plan of improvement is the Tentative Federal Supported Plan (TFSP) and outlines a plan that appears to meet the Federal agency objectives and requirements necessary for mutual acceptability.

We have enclosed for your review a summary of the TFSP components. While this is a brief overview, supporting information for this plan is included in the May 2008 Draft Formulation Report, similar to Alternative 3G. The State of New York, the non-Federal sponsor, must find the general plan of improvement acceptable before any finalization can occur, including completion of the Reformulation Study Draft General Reevaluation Report and Draft Environmental Impact Statement.

If the State finds the components of the TFSP acceptable, we would immediately move forward with final analysis of the TFSP plan (plan formulation, engineering, economics, environmental assessment, model certifications, internal/external reviews), including higher authority approvals by each Federal agency.

If the State finds any components of the TFSP not acceptable, we request the State provide a locally preferred alternative (LPA). The LPA should include specific components that could be supported, in order to move forward with the required additional analysis. Both Federal agencies would still need to assess their ability to support the LPA.

We look forward to your timely review and are willing to arrange a meeting with your office in the March/April timeframe in order to further discuss the elements of the TFSP as necessary. Please do not hesitate to contact Mr. Anthony Ciorra, Chief of Civil Works at (917) 790-8208, or Mr. Frank Verga, Project Manager at (917) 790-8212, if you have any questions.

Sincerely,

John R. Boulé II
Colonel, Corps of Engineers
District Commander

K. Christopher Soller
Superintendent, Fire Island National Seashore
National Park Service

David Stilwell
Field Supervisor, New York Field Office
U.S. Fish and Wildlife Service

Enclosure

CF:
Al Fuchs, NYS Department of Environmental Conservation
Fred Anders, NYS Department of State, Coastal Resources

FIRE ISLAND INLET TO MONTAUK POINT, NY
Tentative Federally-Supported Plan
Summary of Components

INLETS: FIRE ISLAND, MORICHES, SHINNECOCK

- Continuation of authorized projects, with increased sediment bypassing at each inlet

MAINLAND

- 10-year floodplain non-structural building retrofits, including road raisings
- Over 4,400 structures, and 4 road raising locations

BARRIER ISLANDS:

FIRE ISLAND @ DEVELOPED LOCATIONS (communities, minor Federal Tracts)

- Beachfill (+15 ft dune, with berm)
- minimum real estate impact alignment
- No tapers into Federal tracts; with overfill in communities

FIRE ISLAND @ UNDEVELOPED LOCATIONS (major Federal Tracts & Smith Point Park)

- Conditional Breach Response (+9.5 ft berm only), guidelines to be developed, anticipated closure to be initiated within 45-60 days
- @ Lighthouse - Reactive Breach Response (+9.5 ft berm only), closure initiated w/in 45 days
- @ Smith Point County Park - short term beachfill in western, developed section to allow relocation of infrastructure, then Conditional Breach Response
- Science Response Team to advise the decision makers for conditional closure
- No maintenance fill for breach closure, action taken only when a breach occurs

WESTHAMPTON BARRIER ISLAND:

- Beachfill (+15ft dune with berm) fronting Moriches Bay
- Breach Response (+13 ft dune, with berm), fronting Shinnecock Bay
- Breach Response to include action to be taken when vulnerable to breaching (specifics still to be defined)

DOWNTOWN MONTAUK AND POTATO ROAD

- Sediment management measures at both sites (feeder beach)
- Potato Road contingent upon a local pond opening management plan for Georgica Pond

GROIN MODIFICATION

- Taper existing Westhampton Groins (13) and existing Ocean Beach Groins (2)

RESTORATION

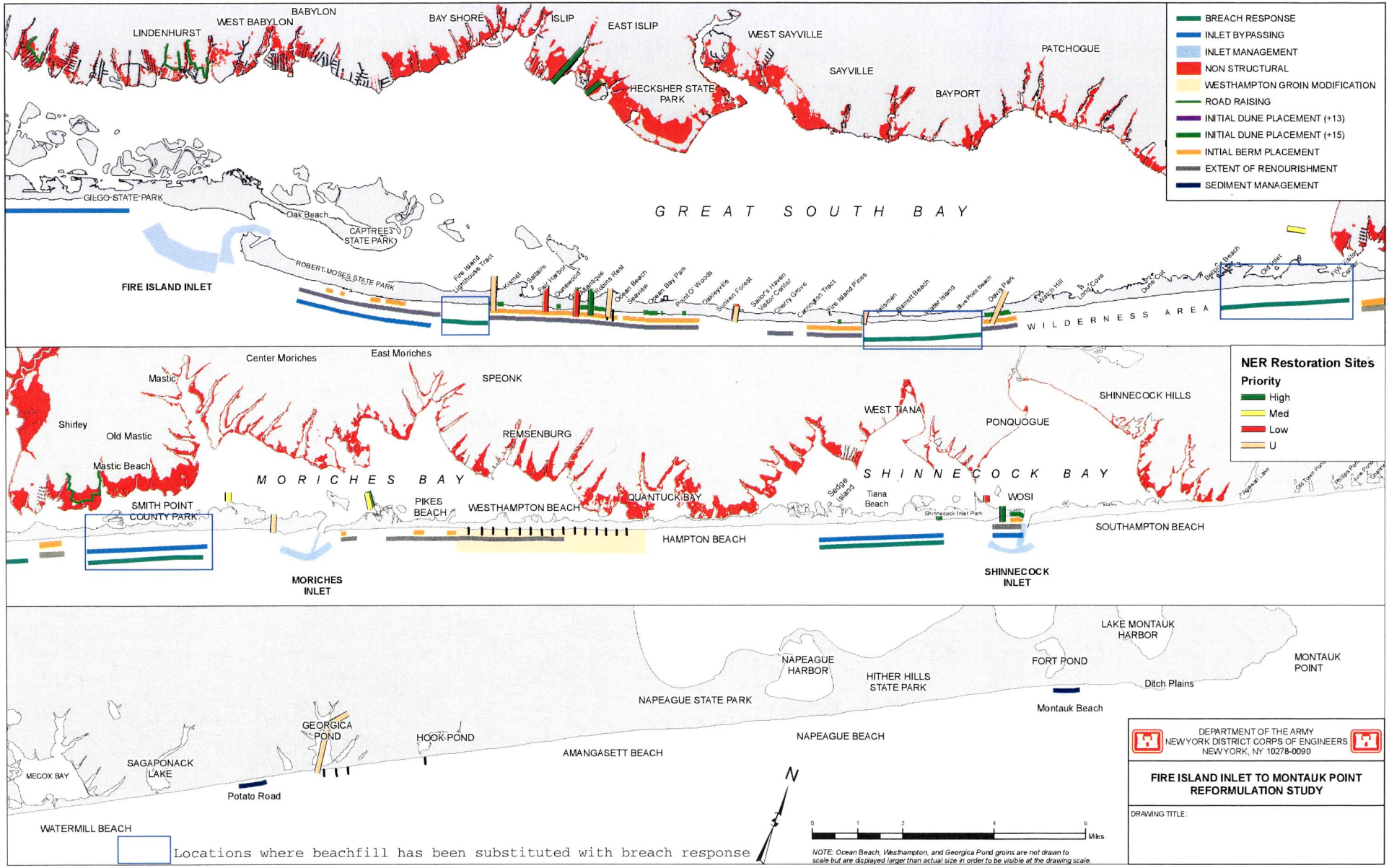
- Various alternatives at locations throughout study area

INTEGRATION OF ADAPTIVE MANAGEMENT

- Period of renourishment subject to adaptive management considerations and local land use regulations, or 50 year period of renourishment
- Provisions to continually adjust components of the project to improve effectiveness
- Applies to all plan features, developed to address climate change concerns (e.g., Sea Level Rise)

INTEGRATION OF LOCAL LAND USE REGULATIONS AND MANAGEMENT

- Local Land Management planning to include enforcement of federal and state zoning requirements, land acquisition or other measures is a necessary component for long-term risk reduction
- Improved land management can allow for adaptation to reduce costs for renourishment
- Important to ensure that the project does not induce development.


BREACH RESPONSE
INLET BYPASSING
INLET MANAGEMENT
NON STRUCTURAL
WESTHAMPTON GROIN MODIFICATION
ROAD RAISING
INITIAL DUNE PLACEMENT (+13)
INITIAL DUNE PLACEMENT (+15)
INTIAL BERM PLACEMENT
EXTENT OF RENOURISHMENT
SEDIMENT MANAGEMENT
LINDENHURST
WEST BABYLON
BABYLON
BAY SHORE
ISLIP
EAST ISLIP
WEST SAYVILLE
SAYVILLE
BAYPORT
PATCHOGUE
HECKSHER STATE PARK
GILGO STATE PARK
Oak Beach
CAPTREE STATE PARK
ROBERT MOSES STATE PARK
FIRE ISLAND INLET
GREAT SOUTH BAY
WILDERNESS AREA
Fire Island Lighthouse Tract
Kismet
Saltaire
Fair Harbor
Dunewood
Atlantique
Robins Rest
Ocean Beach
Seaview
Ocean Bay Park
Point O' Woods
Oakleyville
Sunken Forest
Sailor's Haven Visitor Center
Cherry Grove
Carrington Tract
Fire Island Pines
Felixman
Talmot Beach
Water Island
Blue Point Beach
Davis Park
Watch Hill
Long Cove
Dune Cut
Old Inlet
Center
Mastic
Center Moriches
East Moriches
SPEONK
Shirley
Old Mastic
Mastic Beach
REMSENBURG
MORICHES BAY
SMITH POINT COUNTY PARK
PIKES BEACH
WESTHAMPTON BEACH
QUANTUCK BAY
HAMPTON BEACH
MORICHES INLET
WEST TIANA
PONQUOGUE
SHINNECOCK HILLS
SHINNECOCK BAY
Sedge Island
Tiana Beach
WOSI
Shinnecock Inlet Park
SOUTHAMPTON BEACH
SHINNECOCK INLET
NER Restoration Sites
Priority
High
Med
Low
U
LAKE MONTAUK HARBOR
MONTAUK POINT
FORT POND
Ditch Plains
Montauk Beach
NAPEAGUE HARBOR
HITHER HILLS STATE PARK
NAPEAGUE STATE PARK
NAPEAGUE BEACH
AMANGASETT BEACH
HOOK POND
GEORGICA POND
SAGAPONACK LAKE
MECOX BAY
Potato Road
WATERMILL BEACH
Locations where beachfill has been substituted with breach response
N
0 1 2 4 6 Miles
NOTE: Ocean Beach, Westhampton, and Georgica Pond groins are not drawn to scale but are displayed larger than actual size in order to be visible at the drawing scale.
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090
FIRE ISLAND INLET TO MONTAUK POINT
REFORMULATION STUDY
DRAWING TITLE:

New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection and Dam Safety, 4th Floor
625 Broadway, Albany, New York 12233-3504
Phone: (518) 402-8185 • **FAX:** (518) 402-9029
Website: www.dec.ny.gov

Joe Martens
Commissioner

December 29, 2011

Colonel John R. Boulé II
United States Army Corps of Engineers
New York District
26 Federal Plaza
Jacob K. Javits Federal Building
New York, New York 10278

Re: Fire Island Inlet to Montauk Point (FIMP) Reformulation Study

Dear Colonel Boulé:

Thank you for the March 11, 2011, letter regarding the Federal Government's (New York District of the Army Corps of Engineers, National Park Service Fire Island National Seashore Office, and U.S. Fish and Wildlife Service New York Field Office) request for New York State to consider a potential plan of improvement for the Fire Island Inlet to Montauk Point area which is identified in the March 11th letter as the "Tentatively Federally Supported Plan" ("TFSP"). As the March 11th letter notes, the TFSP "appears to meet the Federal agency objectives and requirements," yet will need further approvals in the respective federal agencies before it would be fully approved.

The State has reviewed the TFSP and has had discussions with potential local sponsors. Unfortunately, we find that additional information is needed for the State and the potential local sponsors to respond to your request. As you understand, a positive response, or an adequately formulated request for a locally preferred alternative, will require the State to have support from its potential local partners. It is highly difficult for the State to fully understand, and to present the TFSP to potential local sponsors to seek their response or participation, when the TFSP is general in nature and does not contain the supporting information needed to justify its attributes. Therefore, the State respectfully requests the following information:

1. The March 11th letter provides a one page summary of the components of the TFSP. In May 2009 the Corps issued a Draft FIMP Reformulation Study ("Study"). Within this Study the Corps identified a number of options, including "Alternative 3G." The March 11th letter stated that Alternative 3G is "similar" to the TFSP. In the Study, we understand that alternative 3G was identified as being the National Economic Development/National Ecosystem Restoration ("NED/NER") plan, which was identified as the plan that best accomplishes the storm damage reduction objectives, based upon the integration of the alternatives. The NED/NER plan previously was discussed at a FIMP Executive Steering Committee meeting on November 10, 2009, and was presented by the Corps as the plan recommended for further development. Alternative 3G was also recommended for inclusion in the Draft General Re-evaluation Report and the

Environmental Impact Statement for evaluation as a part of the public review process. Unfortunately, it is impossible to identify the significant differences between the newly developed TFSP and alternative 3G and we would appreciate receiving a detailed comparison of the two plans. We request that this comparison include a detailed description of the increased or decreased risks and impacts to the communities within in the study, as well as the level of storm damage reduction that would be provided by the TFSP.

2. For the State and potential local sponsors to determine the feasibility of agreeing to all or some of the TFSP, it is necessary to understand the costs involved with each phase. The State requests that the Corps provide the detailed cost-estimate/cost-breakdown for various elements of the TFSP and compare TFSP costs to those for Alternative 3G and the NED/NER plan. The Department is currently not clear on which plan is the NED/NER plan.

3. The March 11th letter indicates that the "plan *appears* to meet the Federal Agency objectives" (emphasis supplied). The State respectfully requests confirmation that the TFSP does, in fact, meet Federal Agency objectives and is the Corps "Recommended Plan". It is an extensive process for the State, in conjunction with potential local sponsors, to determine if the TFSP is fully acceptable or if a locally preferred alternative needs to be proposed for all or some of the project area. The State would strongly prefer to undertake this more extensive consultation with the knowledge that the TFSP will be acceptable to the Federal Government (subject to NEPA review and modifications, as well as appropriations) if endorsed by the State.

4. The TFSP calls for significant non-structural measures, such as elevation or relocation of structures. The State would appreciate detailed information on the Corps' proposed options for implementation of this portion of the TFSP. As one might expect, this is of great interest to potential local sponsors. The State would also be interested in the results of any consultations the Corps has undertaken with the Federal Emergency Management Agency on these proposed measures and their implementation. This non-structural effort has a direct relationship to FEMA's flood plain management and flood insurance programs, and they may be of great assistance in this implementation. Also, we request that the Corps provide a comparison of the levels of flood protection provided by the TFSP, Alternate 3G and the NED/NER plan versus the residual flood risks associated with maintaining the existing inlets.

5. Please provide more detailed information on the various barrier island breach and breach closure plans (current and proposed via the TFSP) including their locations, impacts, timeframes for closure, benefits, future estimated costs and how they relate to flood risk. It would be very useful to know how the level of storm damage reduction increases or decreases with the proposed breach plans in the TFSP in comparison to Alternative 3G and the NED/NER plan.

6. The State has discussed with the Federal Agencies its interest in evaluating the option of reducing or phasing out the re-nourishment portion of this project over the project's 50-year life span. This option might allow the beach configuration to eventually return to a more naturalized status or to possibly have beach

configuration addressed by property owners, local municipalities or local zoning entities. The State requests information on the manner in which this option would be addressed within the proposed TFSP. If these concepts are not addressed in the TFSP, the State requests that they be addressed.

7. The State has also previously raised concerns regarding the total cost of implementing any adopted plan for FIMP. One option in which there is strong potential interest is breaking the TFSP, or any plan, into a number of smaller geographical areas which could then be implemented in phases based on the availability of resources and the particular interest of non-federal sponsors. Please provide the Federal Agencies' views on whether such a phased approach would be acceptable and if there is any preferred or priority order recommended by the Federal Agencies for the implementation of a phased approach.

8. Please explain how sea level rise and climate change considerations and concerns were integrated in the TFSP, and how they will be integrated as we learn more in the future. Similarly, the summary of components associated with the TFSP also makes brief reference to beach re-nourishment being the subject of adaptive management measures; please provide information on the monitoring and assessment program associated with an adaptive management approach, as well as the entities potentially responsible for undertaking such an adaptive management approach. It is essential to understand the method by which elements of the TFSP could be adapted and modified to accommodate sea level rise and climate change.

The State very much appreciates the extensive efforts of the Federal Agencies and looks forward to working through the process with the local sponsor(s) to achieve a plan that best meets our mutual objectives. We look forward to your response to the above requests. If there are any questions pertaining to these requests, please contact me at the above number.

Sincerely,

Alan A. Fuchs, P.E.
Director
Bureau of Flood Protection and Dam Safety

cc.: K. Christopher Soller, U.S. National Park Service
D. Stilwell, U.S. Fish and Wildlife Service
F. Santamora, Corps of Engineers
A. Ciorra, Corps of Engineers
F. Anders, NYSDOS
B. Culhane, Suffolk County
Commissioner Joe Martens
P. Scully, NYSDEC, Region 1
J. Tierney, NYSDEC
M. Klotz, NYSDEC
S. McCormick, NYSDEC

FIRE ISLAND INLET TO MONTAUK POINT (FIMP) REFORMULATION STUDY

Below are New York State comments to the “MODIFIED 2B” plan which the Corps has proposed as an alternative to be prepared to other alternatives in order to respond to the State letter dated December 29, 2011. The Corps has recommended that a comparison be made of alternatives 3A, TFSP, and MODIFIED 2B, and no action. These alternatives will be prepared in order to address the questions raised in the State’s letter.

June 28, 2012

1. In “MODIFIED 2B” plan the non-structural measures need to stand alone and the benefits cost ratio of the overall plan cannot depend on them.

2. "MODIFIED 2B" proposes 13 ft dune under Proactive Breach Response at Fire Island Developed Locations. Why is the dune 2 ft lower than under Plans 3A and TFSP? How is the berm width affected?

3. What is the cross-section for 25-year plan Proactive Breach Response for “MODIFIED 2B” and what does subject to evaluation mean for all the project locations?

4. What will the real estate impact alignment be under "MODIFIED 2B"?

5. Under Integration of Adaptive Management in “MODIFIED 2B” nourishment is not included. Does that mean that it is not planned?

6. Will there be any maintenance fill for any of the breach closures under “MODIFIED 2B” and other remaining plans?

7. Is there an ability to taper off the State's involvement over time under any of the remaining plans?

8. Will FIMP prevent non-federal entities from constructing non-project activities within the project footprint such as building higher dunes, planting additional vegetation, installing snow fences, or privately funding beach replenishment?

9. Will FIMP allow non-federal entities (state, county, communities) take advantage of dredge mobilization to build a larger locally preferred alternative? Should they choose to provide additional funding to do so? Can they mobilize their own dredge in the event FIMP is providing less protection than they desire?

10. Will FIMP prevent non-federal entities from securing FEMA damage assistance or FEMA mitigation grant monies within the project footprint? (FEMA funded replenishment of non-federal engineered beaches, or FEMA funded home elevations through programs such as "project impact")?

11. If the FIMP plan becomes so big that it is unaffordable, will the lesser plan exist or there will be only no action plan left?

12. Natural processes value: The relative benefit/cost to natural processes of each alternative should be estimated, particularly with respect to flood protection and coastal barrier migration. For example, preventing breaches eliminates the primary method of barrier adjustment and retreat in response to sea level rise. See for example the recently prepared Ecosystem-based Management Plan for Great South Bay prepared by TNC. It would benefit all participants to know the environmental costs of such actions. A conceptual description of the effects of each alternative should be developed as a precursor to providing this information for the alternatives that will advanced for study in the EIS.

13. Environmental Restoration Alternatives and beach fill: The descriptions of alternatives provided by the Army Corps do not identify an opportunity to reduce the volume of fill along the ocean front in the event that bay side fill reduces the likelihood of a breach. This factor should be incorporated into the Breach Contingency and beachfill options.

14. Road raising/levees: We previously understood that this measure was not likely to be used because of state concerns over maintenance and long term effectiveness. If it is still under consideration, include evaluation of the potential costs if the levee is compromised, the maintenance work that can be anticipated over the project life, and cost shares among federal, state and local partners for both construction and long term maintenance.

15. Groins at Ocean Beach: The alternatives in the Army Corps spreadsheet cite "Taper Ocean Beach Groins" as a project measure. What exactly does "taper" mean with respect to two groins? Are they going to be shortened or rebuilt so the seaward end declines in elevation until it matches the bottom surface, or both?

16. Potato Road: The alternatives in the Army Corps spreadsheet all recommend "feeder beaches" contingent upon a management plan for opening Georgica Pond. What is being protected by these actions? Are the feeder beaches cost effective?

17. "MODIFIED 2B", beach/dune construction for all reaches: The Corps spreadsheet heading for this alternative says "Initial Beach Placement Will First Be Provided for All Reaches" Clarification is needed regarding which reaches are involved.

18. "MODIFIED 2B", Land Use Management: The clause that appears on the spreadsheet for TFSP "Improve land management can allow for adaptation to reduce nourishment cost" is missing from the description in "MODIFIED 2B". It should be included for all nourishment alternatives in any selected plan.

Responses to NYS Comments

Detailed NAN Responses to
NYSDEC Comments, as dated December 29, 2011, and dated 28 June 2012

NYS Comment #1

The March 11th letter provides a one page summary of the components of the TFSP. In May 2009 the Corps issued a Draft FIMP Reformulation Study ("Study"). Within this Study the Corps identified a number of options, including "Alternative 3G". The March 11th letter stated that Alternative 3G is "similar" to the TFSP. In the Study, we understand that alternative 3G was identified as being the National Economic Development/National Ecosystem Restoration ("NED/NER") plan, which was identified as the plan that best accomplishes the storm damage reduction objectives, based upon the integration of the alternatives. The NED/NER plan previously was discussed at a FIMP Executive Steering Committee meeting on November 10, 2009, and was presented by the Corps as the plan recommended for further development. Alternative 3G was also recommended for inclusion in the Draft General Re-Evaluation Report and the Environmental Impact Statement for evaluation as a part of the public review process. Unfortunately, it is impossible to identify the significant differences between the newly developed TFSP and alternative 3G and we would appreciate receiving a detailed comparison of the two plans. We request that this comparison include a detailed description of the increased or decreased risks and impacts to the communities within in the study, as well as the level of storm damage reduction that would be provided by the TFSP.

- NAN Response #1

The May 2009 Draft Formulation Report (May 2009 Report) recommended two alternative plans for further consideration. The plans were described in Chapter 11 of the Report. Alternative 3A, which was identified as the plan that appears to maximize storm damage reduction benefits, and Alternative 3G, which was identified as the plan that appears to best balance the objectives of storm damage reduction, and achieving the objectives of the FIMP Vision Statement.

Following coordination with involved agencies, the TFSP evolved from 3G and was proposed in the March 2011 letter. The TFSP differs from 3G in two ways:
1) The TFSP includes beach fill in the portion of Smith Point County Park fronting the pavilion, where Plan 3G recommended only a breach response in this area, and:
2) The specific breach closure procedures in the TFSP acknowledges a delay of up to 60 days in closing a breach and possibility of natural closure. Plan 3G estimated 45 days to close breach.

As indicated in the cover letter, we are incorporating changes in the plan due to Sandy, in an Updated TFSP, which are not reflected in the following information. That information will be provided at a later date. The changes that are being incorporated include the following:

- Adjustments to beach fill alignment along Fire Island to account for post-Sandy changes
- Incorporation of a dune and beach feature in the Fire Island Lighthouse Tract
- Incorporation of a feeder beach in Smith Point County Park
- Updating of Breach Response Protocols
- Updating of potential plan features in Downtown Montauk

The comparisons of the alternative plans are documented in the May 2009 Report (Chapter 10). This information has also been summarized in the following sub-attachments:

- Attachment #1 – Table that provides a comparison of the remaining potential plans
- Attachment #2 – Text description of the TFSP
- Attachment #3 – A series of figures that compares the effectiveness of the TFSP

Please note: in coordinating the proposed responses to comments, the Corps suggested that the analysis consider the effectiveness of an additional alternative, identified as Plan 2B. Plan 2B is included in the table that compares alternatives. This table reflects the comments that were provided by NYS and DOI by email on 28 June 2012. Plan 2B is presently under evaluation.

NYS Comment #2

For the State and potential local sponsors to determine the feasibility of agreeing to all or some of the TFSP, it is necessary to understand the costs involved with each phase. The State requests that the Corps provide the detailed cost estimate/cost-breakdown for various elements of the TFSP and compare TFSP costs to those for Alternative 3G and the NED/NER plan. The Department is currently not clear on which plan is the NED/NER plan.

- NAN Response #2

  Updated project costs are being developed to show costs associated with each remaining plan. Please note, all costs will change as the plan is updated to account for post-Sandy changes.

  In general, costs include the upfront costs associated with construction, and recurring costs associated with renourishment, breach response, and sand bypassing.

- Attachment #4 shows costs associated with the following plans, based upon information contained in the May 2009 Report.
  - 1) Plan 3A, which appears to be the plan that maximizes net benefits
  - 2) TFSP, the plan supported by the Federal Agencies

NYS Comment #3

The March 11th letter indicates that the "plan appears to meet the Federal Agency objectives" (emphasis supplied). The State respectfully requests confirmation that the TFSP does, in fact, meet Federal Agency objectives and is the Corps "Recommended Plan". It is an extensive process for the State, in conjunction with potential local sponsors, to determine if the TFSP is fully acceptable or if a locally preferred alternative needs to be proposed for all or some of the project area. The State would strongly prefer to undertake this more extensive consultation with the knowledge that the TFSP will be acceptable to the Federal Government (subject to NEPA review and modifications, as well as appropriations) if endorsed by the State.

- NAN Response #3

  The Corps anticipates further confirmation that the TFSP is acceptable to the Federal agencies, but can only document its understanding of agency priorities communicated in the most recent coordination. These plans were briefed at the Secretary-level and general

support was expressed for them. It is expected that Secretary-level support will be reaffirmed to account for changes that are incorporated as a result of Hurricane Sandy. Even with this re-affirmation, until the necessary NEPA reviews are completed, it is appropriate to indicate that this support is tentative.

Vertical support is also conditional upon local sponsor concurrence. While confirming support from the State's sponsors can be challenging, it is necessary before the District seeks higher authority confirmation of the acceptability of these plans. Therefore, we request some indication from NYS that all components of the TFSP are found to be acceptable to the State. This would be a pre-requisite to engaging our HQ on the acceptability of any of these 3 remaining potential plans.

NYS Comment #4.
The TFSP calls for significant non-structural measures, such as elevation or relocation of structures. The State would appreciate detailed information on the Corps' proposed options for implementation of this portion of the TFSP. As one might expect, this is of great interest to potential local sponsors. The State would also be interested in the results of any consultations the Corps has undertaken with the Federal Emergency Management Agency on these proposed measures and their implementation. This non-structural effort has a direct relationship to FEMA's flood plain management and flood insurance programs, and they may be of great assistance in this implementation. Also, we request that the Corps provide a comparison of the levels of flood protection provided by the TFSP, Alternate 3G and the NED/NER plan versus the residual flood risks associated with maintaining the existing inlets.

- NAN Response #4:
  The implementation of non-structural measures affords flexibility to accommodate local sponsor interests and leverage FEMA expertise. For evaluation of alternatives, the relative cost and anticipated benefits is sufficient for inclusion of measures in the TSFP.

  The Corps has consulted FEMA and our USACE Center of Expertise for non-structural planning in the "National Flood Proofing Committee (NFPC)."

  - Attachment #5 is a paper that was assembled for the Reformulation Study and communicates the options available for implementing non-structural solutions and some of the challenges that need to be addressed. At this point, our preference is to follow the model of implementation through the "homeowner-led approach". The Corps is willing to work with representatives of the State and local governments to further this discussion, and take advantage of State initiatives that are underway following Hurricane Sandy, as a model for how to proceed.

  The Corps will coordinate a meeting to evaluate implementation options, and clarify preferred implementation approaches.

  The Corps has been in contact with FEMA regarding the intersection of the non-Structural plan contained within FIMP, and how that relates to FEMA initiatives. As it relates to flood insurance, there is recent legislation that requires homeowners to pay

actuarial rates, based upon the elevation of their house. As such, it is expected that the decision whether or not to participate in the non-structural program could have a bearing on the individual's financial responsibility for their individual flood insurance. In our discussions with FEMA, it also appears that the inclusion of the non-structural program will have a bearing on a homeowner's eligibility for participation in various FEMA programs. Similar to the funding of repair of engineered beaches, FEMA and the Corps need to consider the need to avoid augmentation. We are working to obtain a legal opinion on this, but at this point, it would be best to assume that the Corps program could limit the availability of FEMA funds, through certain programs.

NYS Comment #5.
Please provide more detailed information on the various barrier island breach and breach closure plans (current and proposed via the TFSP) including their locations, impacts, timeframes for closure, benefits, future estimated costs and how they relate to flood risk. It would be very useful to know how the level of storm damage reduction increases or decreases with the proposed breach plans in the TFSP in comparison to Alternative 3G and the NED/NER plan.

- NAN Response #5:

  Chapters 8 and 9 of the draft formulation report summarize the breach response plans to the extent they were developed at the time. The report identified the expected number of breaches for each plan alternative. Refinements to the breach closure measures which have been made since the compilation of the formulation report draft, as well as additional changes that have been requested will require that the team assess changes which may result if we allow for "natural closure" at a lower elevation than the breach closure design level. Further evaluation of the impacts will be sensitive to the assumptions in the trigger for action to be taken.

  The information provided in Attachment #2, in response to NYS Comment #1, provides a comparison as it presently exists of the comparison between the two plans.

NYS Comment #6.
The State has discussed with the Federal Agencies its interest in evaluating the option of reducing or phasing out the re-nourishment portion of this project over the project's 50-year life span. This option might allow the beach configuration to eventually return to a more naturalized status or to possibly have beach configuration addressed by property owners, local municipalities or local zoning entities. The State requests information on the manner in which this option would be addressed within the proposed TFSP. If these concepts are not addressed in the TFSP, the State requests that they be addressed.

- NAN Response #6:
  Presently the May 2009 draft Formulation Report includes text on three different alternatives for lifecycle management of these alternatives. These three scenarios are the ones jointly developed by the involved agencies, and are described in Chapter 11, Consideration of Lifecycle Management.

Presently, the report includes a brief summary of the options, without extensive quantitative analysis. The report presently concludes that of the three available options, the preferred approach is to address this through an adaptive management program.

An excerpt of the possible approaches and recommended approach is attached to this response (Attachment #6).

NYS Comment #7.
The State has also previously raised concerns regarding the total cost of implementing any adopted plan for FIMP. One option in which there is strong potential interest is breaking the TFSP, or any plan, into a number of smaller geographical areas which could then be implemented in phases based on the availability of resources and the particular interest of non-federal sponsors. Please provide the Federal Agencies' views on whether such a phased approach would be acceptable and if there is any preferred or priority order recommended by the Federal Agencies for the implementation of a phased approach.

- NAN Response #7:

  Implementation of a Recommended Plan for the Reformulation Study would be a large effort which would be undertaken under multiple contracts. Incremental constructible elements may be achieved in several ways. The Corps considers identification of constructible elements to be a critical step undertaken in the final design phases of the project, following local sponsor concurrence with the elements and features within the recommended plan. At this point, the project is being formulated to prepare a Reformulation Report to address the entire Study Area with a project formulated on Separable Elements, which would allow for separate PPA's for one or more separable elements and multiple construction contracts for each PPA, as necessary.

  The specifics of this are still subject to the final plan refinements and the updated final economic analyses.

NYS Comment #8.

Please explain how sea level rise and climate change considerations and concerns were integrated in the TFSP, and how they will be integrated as we learn more in the future. Similarly, the summary of components associated with the TFSP also makes brief reference to beach re-nourishment being the subject of adaptive management measures; please provide information on the monitoring and assessment program associated with an adaptive management approach, as well as the entities potentially responsible for undertaking such an adaptive management approach. It is essential to understand the method by which elements of the TFSP could be adapted and modified to accommodate sea level rise and climate change.

- NAN Response #8:

The Corps' Sea Level Change (SLC) guidance has been superseded twice since the May 2009 Draft Formulation Report. The current Corps Guidance is EC 1165-2-212 Sea-Level Change Considerations for Civil Works Programs, dated 1 October 2011.
A 9 June 2010 workshop with the FIMP stakeholders considered the implementation and inclusion of prior guidance, EC 1165-2-211, dated July 2009, into the analysis of the alternatives and the selected plan and a scope of work for SLC analysis resulted from the meeting. Subsequent coordination with the Corps' leadership on the Corps guidance, which requires analysis of a three scenarios: "low" (historic), "intermediate" and "high" rates of sea level change further refined this scope of work. An AE is under contract to complete this analysis and to reflect the impact of SLC on the costs and benefits of the various alternatives.

In general, adaptive management of beach renourishment for sea level change considerations can be determined by sea level change and physical project features monitoring. Beach renourishment is highly adaptable due to its "soft" nature, and project features can be revised throughout the life of the projects. Monitoring will be specifically recommended as a feature of the plan, and as a cost-shared project requirement.

Similarly, based upon our discussions with HQUSACE, a similar course of action is recommended for non-structural solutions so that proposed plans can be adapted in the future based upon actual or realized SLC.

ATTACHMENT #1

FIMP - COMPARISON OF REMAINING PLANS OF IMPROVEMENT ---- AS OF MAY 2, 2013

*** Final comparison will also include the *NO ACTION PLAN* ***

Plan 3A *NOTE; THIS PLAN IS NOT ACCEPTABLE TO ALL PARTNERS	Updated TFSP Tentative Federally Supported Plan (dated March 11, 2011) *This contains updates to reflect post-Sandy considerations	Plan 2B * Full Analysis of this plan still to be undertaken *This contains updates to reflect post-Sandy considerations
INLETS: FIRE ISLAND + MORICHES + SHINNECOCK Continuation of authorized projects, with increased sediment bypassing	**INLETS: FIRE ISLAND + MORICHES + SHINNECOCK** Continuation of authorized projects, with increased sediment bypassing	**INLETS: FIRE ISLAND + MORICHES + SHINNECOCK** Continuation of authorized projects, with increased sediment bypassing
MAINLAND **6-year floodplain** Non-structural building retrofits, including road raisings Over 3,200 structures	**MAINLAND** **10-year floodplain** Non-structural building retrofits, including road raisings Over 4,400 structures + 4 road raising locations	**MAINLAND** **10-year floodplain** Non-structural building retrofits, including road raisings Over 4,400 structures + 4 road raising locations
BARRIER ISLANDS: **FIRE ISLAND @ DEVELOPED LOCATIONS** **Communities + minor Federal Tracts** Beachfill (+15 ft dune, with berm) Minimum real estate impact alignment Groin Modifications; Taper existing Ocean Beach Groins (2)	**BARRIER ISLANDS:** **FIRE ISLAND @ DEVELOPED LOCATIONS** **Communities + minor Federal Tracts** Beachfill (+15 ft dune, with berm) Post-Sandy Adjusted Beachfill Alignment Tapers into Federal tracts; alternately overfill in communities @ Lighthouse; Beachfill (+15 ft dune, with berm) Groin Modifications; Taper existing Ocean Beach Groins (2)	**BARRIER ISLANDS:** **FIRE ISLAND @ DEVELOPED LOCATIONS** **Communities + minor Federal Tracts** Beachfill (+13 ft dune, with berm) Post-Sandy Adjusted Beachfill Alignment Tapers into Federal tracts; alternately overfill in communities @ Lighthouse; Beachfill (+13 ft dune, with berm) No set renourishments; renourish when cross-section falls below design level (25-year) Groin Modifications; Taper existing Ocean Beach Groins (2)
FIRE ISLAND @ UNDEVELOPED LOCATIONS **Major Federal Tracts + Smith Point County Park** Beachfill (+13 ft dune, with berm) Minimum real estate impact alignment	**FIRE ISLAND @ UNDEVELOPED LOCATIONS** **Major Federal Tracts + Smith Point County Park** Conditional Breach Response (details TBD) - guidelines TBD; anticipated closure to be initiated within 45-60 days @ Smith Point County Park (East + West) Feeder Beach - beachfill to offset inlet effects, details TBD Long-term relocation of park facilities to minimize renourishment Science Response Team to advise decision makers for conditional closure No maintenance fill for breach closure; action taken only when breach occurs	**FIRE ISLAND @ UNDEVELOPED LOCATIONS** **Major Federal Tracts + Smith Point County Park** Conditional Breach Response (details TBD) - guidelines TBD; anticipated closure to be initiated within 45-60 days @ Smith Point County Park (East + West) Feeder Beach - beachfill to offset inlet effects, details TBD Long-term relocation of park facilities to minimize renourishment Science Response Team to advise decision makers for conditional closure No set renourishments; renourish when cross-section falls below design level (25-year)
WESTHAMPTON (fronting Moriches Bay) Beachfill (+15 ft dune, with berm) Groin Modifications; Taper existing Westhampton Groins (13)	**WESTHAMPTON (fronting Moriches Bay)** Beachfill (+15 ft dune, with berm) Groin Modifications; Taper existing Westhampton Groins (13)	**WESTHAMPTON (fronting Moriches Bay)** Beachfill (+13 ft dune, with berm) No set renourishments; renourish when cross-section falls below design level (25-year) Groin Modifications; Taper existing Westhampton Groins (13)
SHINNECOCK (fronting Shinnecock Bay) Proactive Breach Response (+13 ft dune, with berm)	**SHINNECOCK (fronting Shinnecock Bay)** Beachfill / Proactive Breach Response (+13 ft dune, with berm) No set renourishments; renourish when cross-section falls below design level (25-year)	**SHINNECOCK (fronting Shinnecock Bay)** Beachfill (+13 ft dune, with berm) No set renourishments; renourish when cross-section falls below design level (25-year)

FIMP - COMPARISON OF REMAINING PLANS OF IMPROVEMENT ---- AS OF MAY 2, 2013

* Final comparison will also include the *NO ACTION PLAN* *

Plan 3A *NOTE; THIS PLAN IS NOT ACCEPTABLE TO ALL PARTNERS	Updated TFSP Tentative Federally Supported Plan (dated March 11, 2011) *This contains updates to reflect post-Sandy considerations	Plan 2B * Full Analysis of this plan still to be undertaken *This contains updates to reflect post-Sandy considerations
DOWNTOWN MONTAUK + POTATO ROAD Sediment management measures at both sites (feeder beaches) Potato Road contingent upon pond opening mgt plan for Georgica Pond Structural Solution at Downtown Montauk under consideration *	**DOWNTOWN MONTAUK + POTATO ROAD** Sediment management measures at both sites (feeder beaches) Potato Road contingent upon pond opening mgt plan for Georgica Pond Structural Solution at Downtown Montauk under consideration *	**DOWNTOWN MONTAUK + POTATO ROAD** Sediment management measures at both sites (feeder beaches) Potato Road contingent upon pond opening mgt plan for Georgica Pond Structural Solution at Downtown Montauk under consideration *
ENV RESTORATION Various alternatives throughout the study area (TBD)	**ENV RESTORATION** Various alternatives throughout the study area (TBD)	**ENV RESTORATION** Various alternatives throughout the study area (TBD)
INTEGRATION OF ADAPTIVE MANAGEMENT N/A	**INTEGRATION OF ADAPTIVE MANAGEMENT** Period of nourishment subject to adaptive management considerations and local land use regulations or; 50-year period of nourishment Provisions to continually adjust components of project to improve effectiveness Applies to all plan features, developed to address climate change concerns (Sea level rise)	**INTEGRATION OF ADAPTIVE MANAGEMENT** No structured renourishment; renourish upon breach vulnerability planned for 50 years, or, can be adapted Provisions to continually adjust components of project to improve effectiveness Applies to all plan features, developed to address climate change concerns (Sea level rise)
INTEGRATION OF LAND USE REGULATIONS AND MANAGEMENT N/A	**INTEGRATION OF LAND USE REGULATIONS AND MANAGEMENT** Local land management planning to include enforcement of Federal and State zoning requirements, land acquisition or other measures as necessary component for long-term risk reduction Improved land management can allow for adaptation to reduce nourishment costs Important to ensure project does not induce development	**INTEGRATION OF LAND USE REGULATIONS AND MANAGEMENT** Local land management planning to include enforcement of Federal and State zoning requirements, land acquisition or other measures as necessary component for long-term risk reduction Improved land management can allow for adaptation to allow for less frequent nourishment Important to ensure project does not induce development

ATTACHMENT #2

SUMMARY OF TENTATIVE FEDERAL SELECTED PLAN (TFSP)

The Tentative Federal Selected Plan (TFSP) has been identified as the plan that reasonably balances the policies of the US Army Corps of Engineers and the Department of the Interior.

The full analysis of how this plan was identified is included in the Draft GRR. This paper provides a summary of the TFSP. The following alternative has been developed and considered as a comprehensive plan, but each component is described separately below. In simplified terms, the TFSP is:

- Continuation of authorized projects at the inlets, with sand bypassing
- +15 ft dune, 90 ft berm beachfill plan at the post Sandy adjusted alignment along developed locations spanning Great South Bay and Moriches Bay, maintained for 50 years
- +13 ft dune, Proactive Breach Response Plan along Shinnecock Bay
- Conditional Breach Response in Fire Island undeveloped areas
- Restoration measures in conjunction with breach response
- Sediment management measures for Downtown Montauk, and Potato Road (contingent upon an improved management plan for Georgica Pond)
- Modification of the Westhampton and Ocean Beach groinfields
- Non-structural building retrofit plan for structures in the 10-year floodplain, in conjunction with road raising where cost-effective
- Approximately 38 restoration alternatives at various locations throughout the study area

A. Beach and Dune Fill Component.

Based upon the engineering and economic evaluation of the beach fill alternatives, and coordination with the Federal Partners, the TFSP includes beach fill with the following characteristics:

- Continuous beach and dune fill along the developed shorefront areas fronting Great South Bay and Moriches Bay, where necessary, to meet this design threshold; and
- Alignment: Beachfill configured along a post Sandy alignment;
- +15 ft NGVD dune, 90 ft berm at +9.5 ft NGVD in developed areas & minor federal tracts
- +15 ft NGVD dune, berm at Lighthouse Tract
- Renourishment: 50 years, approximate 4-year cycle, along same length of shoreline

B. Non-Structural Plan

Based upon the engineering and economic evaluation of the non-structural plans, the non-structural plan that optimizes the net excess benefits is a combined building retrofit plan and road-raising plan along the mainland floodplain, which is generally described as follows:

- 100-year level of protection for structures inside 10-year flood plain
- Building retrofit measures are proposed, include limited relocation or buyouts, based upon structure type and condition
- 4 locations of road raising, totaling 5.91 miles in length, directly protects 1,020 houses
- Over 4,400 structures are included for non-structural treatment
- Estimated construction period is 20 years

C. Inlet Modification Plan

Based upon the engineering and economic evaluation of the inlet modification and management measures, including the multiple criteria screening matrix, the recommended plan for inlet management is continuation of the authorized project at each inlet with increased sediment bypassing from the ebb shoal to offset the downdrift deficit. A long-term, monitoring and adaptive management plan is included to allow for future changes or improvements in the inlet management, over time. The inlet management measures are generally described as follows:

Shinnecock Inlet: Continuation of authorized project + Ebb shoal dredging; -16' deposition basin

- 2 year cycle; additional 100,000 CY/yr

Moriches Inlet: Continuation of authorized project + Ebb shoal dredging

- 1 year cycle; additional 100,000 CY/yr;

Fire Island Inlet: Continuation of authorized project + Ebb shoal dredging; deposition basin expansion, with additional updrift disposal

- 2 year interval; additional 100,000 CY/yr; and

D. Groin Modification Plan

Based upon engineering and economic analysis of groin modifications, recommendation is shortening (or tapering) of Westhampton groin field (15 existing), which will increase the amount of sediment transported to the west, and will reduce renourishment requirements for the shoreline downdrift of the groins. This plan includes:

- Shortening of groins, varying between 70 – 100 ft;
- Releases 0.5M to 2M CY of sand to west

E. Breach Response Plan (BRP)

Based upon engineering and economic analysis of the alternatives, recommendation is:

- Conditional Breach Response Plan in Fire Island undeveloped areas, with threshold details currently under development
- Proactive Breach Response Plan for areas along Shinnecock Bay, where a beachfill plan is not recommended:
    - Breach Closure Template: +13' NGVD dune, berm height +9.5 ft NGVD, berm width generally 90 ft wide, but vary depending on conditions prior to the breach and within adjacent areas
    - Proactive Response Plans include restoring the template to the design condition when the shoreline is degraded to an effective width of 50 ft.

F. Sediment Management Plans

The engineering and economic analyses identified two areas of high damages where a conventional beach nourishment project was not economically viable (Downtown Montauk, and Potato Road). In these areas, Sediment Management Alternatives were evaluated to offset the long-term erosion trend, to maintain the current protection, and prevent conditions from getting worse; these features would also serve as feeder beaches. In the area of Potato Road, the implementation of this plan

would be contingent upon the development of a local management plan for Georgica Pond to address the effects of the pond opening and measures to minimize the consequences of this. The plans generally include:

- Sediment placement to offset long-term erosion trend; 120,000 CY at each location; includes placement every 4 years with material to be placed as advance fill on front face of existing berm

G. Restoration Measures

Collaborative planning with an interagency team drawn from the Study's Environmental Technical Management Group and supported by the Interagency Reformulation Group established specific objectives through the development of a Restoration Framework.

This framework called for the restoration of five coastal processes that are critical to the development and sustainability of the various coastal features (such as beaches, dunes, barrier islands and bluffs), which together form the natural system. In a natural ecosystem, features such as barrier islands and dunes protect coastal lands and property, and reduce danger to human life, stemming from flooding and erosion, while establishing habitats important to coastal species. The five Coastal Processes identified by the Restoration Framework (reference as *"Processes Targeted"* within the attached Table titled "Summary of Restoration Ranks and Scores") as vital to maintain the natural coastal features are: Longshore Sediment Transport; Cross Island Sediment Transport; Dune Development and Evolution; Estuarine Circulation; and Bayside Shoreline Processes.

The Design of restoration alternatives focused on measures that contribute to the restoration of these coastal processes that are consistent with the Reformulation objectives. Such alternatives have been developed into specific and sustainable National Ecosystem Restoration (NER) alternatives.

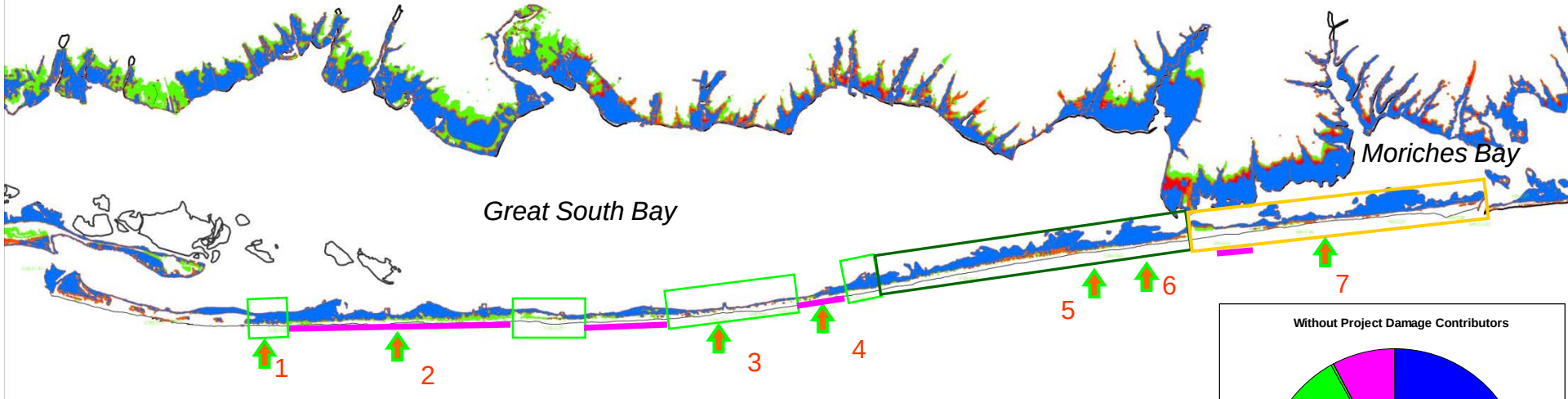
H. Adaptive Management

Adaptive Management has been identified as a component of TFSP. There is significant uncertainty associated with this plan, therefore the implementation requires an incremental adaptive management approach. This approach will be defined in the next phase of planning and will include 1) data collection to improve the understanding of the physical, social and environmental setting, 2) modeling efforts (engineering and formulation) to analyze the data, and 3) an adaptive management framework that would establish the overall objectives, decision rules, and identify the adaptations to the plan that could be accomplished with the project. This adaptation strategy will require a periodic review of the project execution (10-yr basis) and recommendations for the adaptation of the project, based upon the findings.

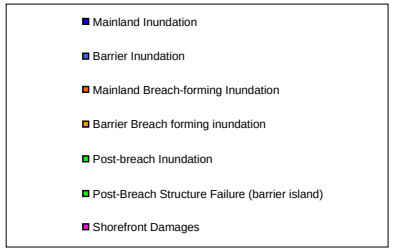
The adaptive management plan will formalize mechanisms for reviewing and revising the lifecycle management of elements of the project, relating to the following elements: Inlet Management, Breach Response, Beach fill, Borrow Area, Non-Structural, Restoration, Land Management Policies and Climate Change. Climate change will be accounted for with the monitoring of climate change parameters, identification of the effect of climate change on the project design, and identification of adaptation measures that are necessary to accommodate climate changes, as it relates to all the project elements.

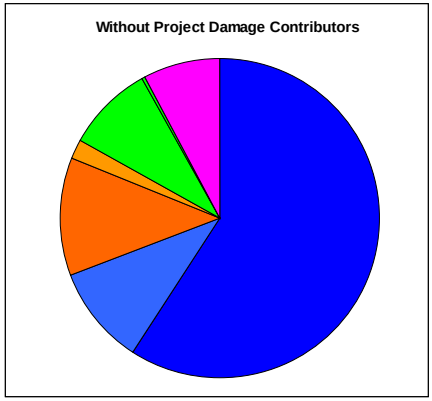
ATTACHMENT #3

FIMP - Problem Summary (Based upon May 2009 Report, being updated)



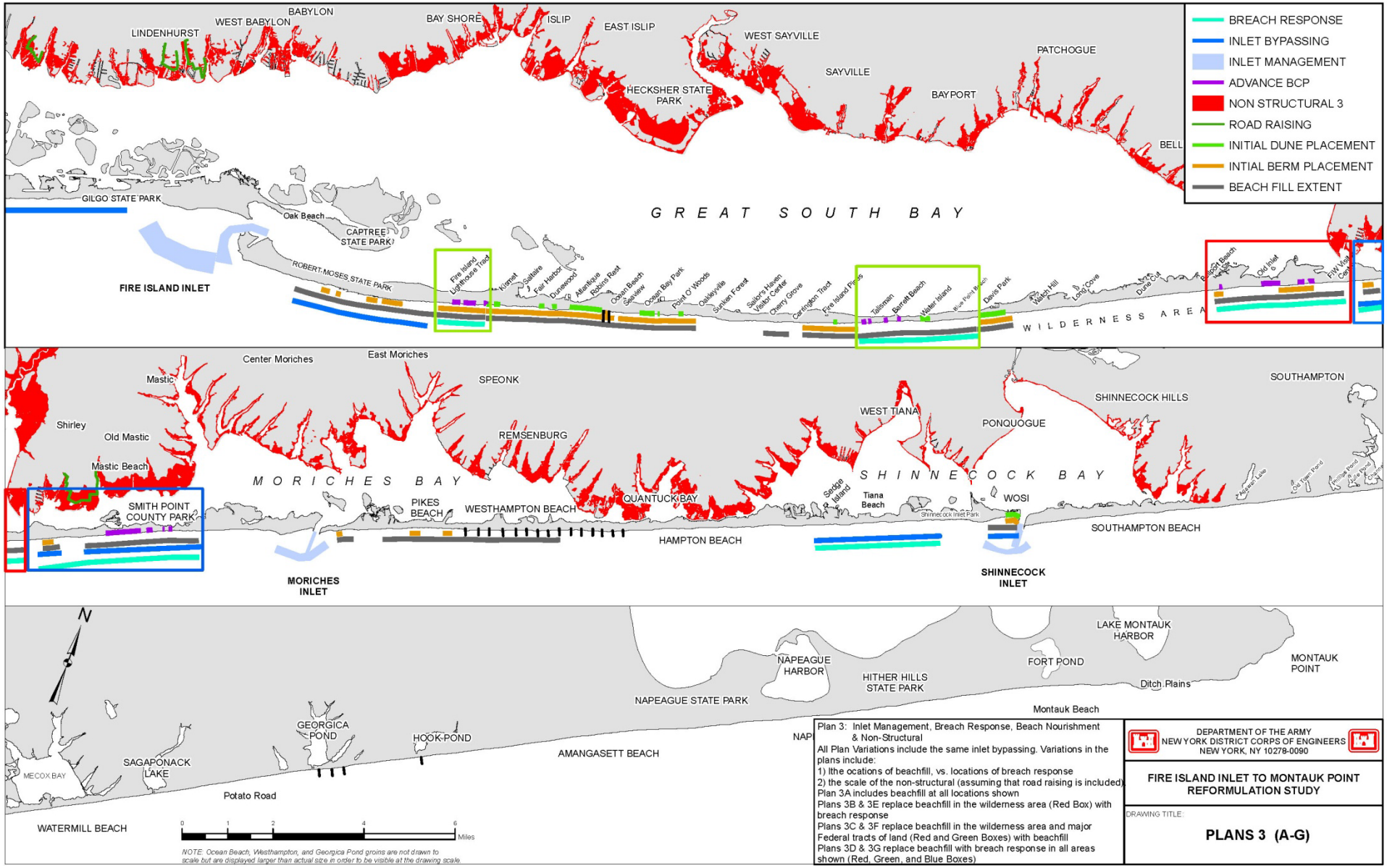
- Breach Vulnerable Areas
- Major Federal Tracts of Land
- Wilderness Area
- County Park Land



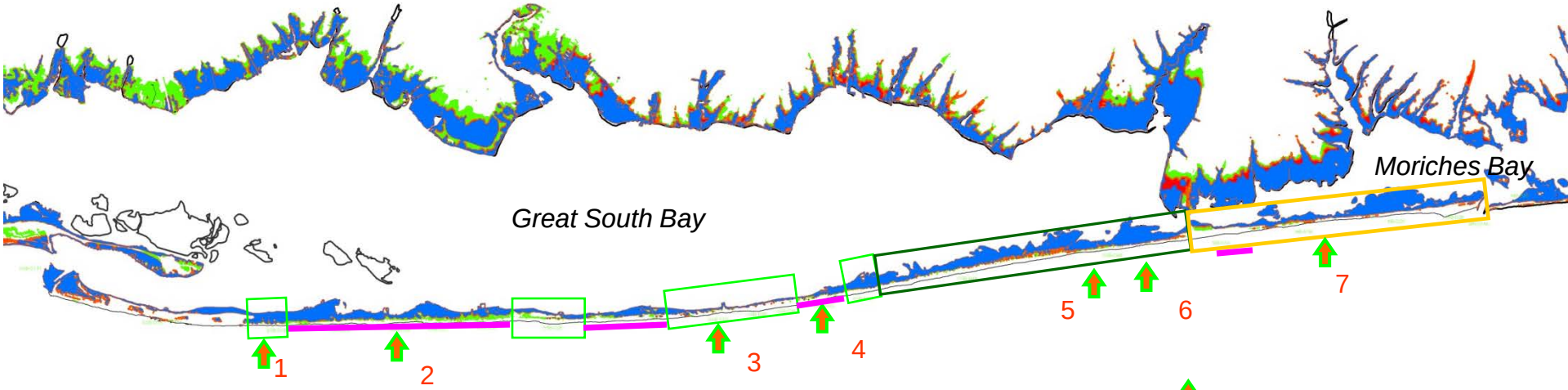


Damage Category	Without Project Annual Damages	Great South Bay	Moriches Bay	Shinnecock Bay	Alternatives
Total Project					
Tidal Inundation occurring due to inlet conditions, and wave setup in back bay					
Mainland	**55,834,500**	**32,403,700**	**14,379,500**	**9,051,300**	**Non-Structural & Road Raising**
Barrier	**9,423,300**	**9,414,300**	**2,400**	**6,600**	
Tidal Inundation occurring due to the event resulting in breaching, and overwash					
Mainland	**$11,035,500**	**6,483,500**	**3,618,700**	**933,300**	**Beachfill**
Barrier	**$1,946,900**	**1,939,600**	**1,600**	**5,700**	
Total Inundation	**$78,240,200**	**50,241,100**	**18,002,200**	**9,996,900**	
Damages (Inundation and Structure Failure) due to a breach remaining open					
Inundation	**$8,292,700**	**6,660,500**	**1,469,600**	**162,600**	**Beachfill Breach Response**
Structure Failure (barrier island)	**$358,900**	**304,600**	**-**	**54,300**	
Total Breach-Open	**$8,651,600**				
Shorefront Damages	**$7,305,200**	**3,900,000**	**355,000**	**1,150,000**	**Beachfill**
Total Storm Damage	**$94,197,000**	**61,106,200**	**19,826,800**	**11,363,800**	

FIMP – Alternative 3 Summary



FIMP – Impact of Alternatives



- Breach Vulnerable Areas
- Major Federal Tracts of Land
- Wilderness Area
- County Park Land

Effect of eliminating fill along the island – Most observable: (Over the 50-year life of the project)

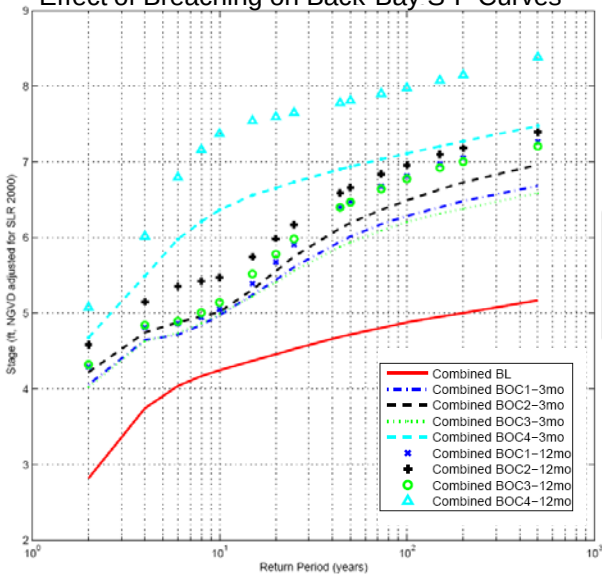
1. <u>Increase in number of expected breaches</u>
2. Increase in back-bay stage frequency curves
3. Increase in number of houses flooded
4. Increase in Residual Risk

Average likelihood of beaching

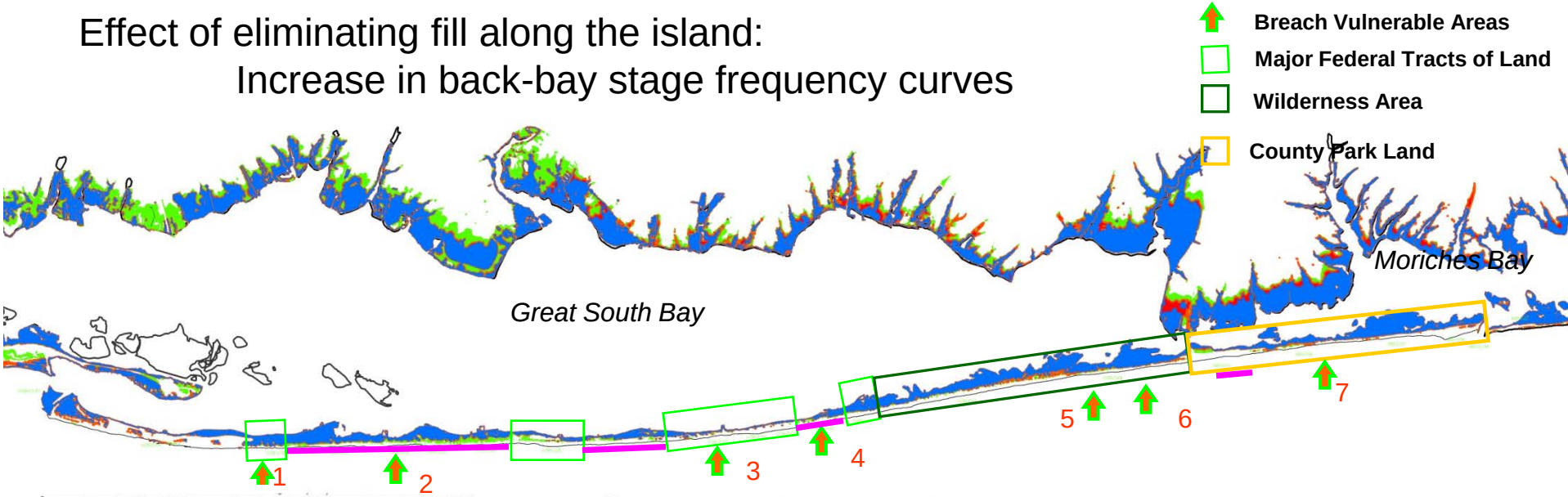
Location		Without	3A	3B/E	3C/F	3D/G	Location
1	WGSB	1	0	0	1	1	MFTL
2	WGSB	2.1	0	0	0	0	
3	CGSB	1.8	0	0	1.7	1.7	MFTL
4	CGSB	0.1	0	0	0	0	
5	EGSB	1.7	0	1.7	1.7	1.7	Wilderness
6	EGSB	1.5	0	1.5	1.5	1.5	Wilderness
7	MOR	1.8	0	0	0	1.8	County Park
8	WSHN	0.2	0.1	0.1	0.1	0.1	
9	WSHN	0.5	0.4	0.4	0.4	0.4	
10	SHN	0.3	0.2	0.2	0.2	0.2	
Total		11	0.7	3.9	6.6	8.4	

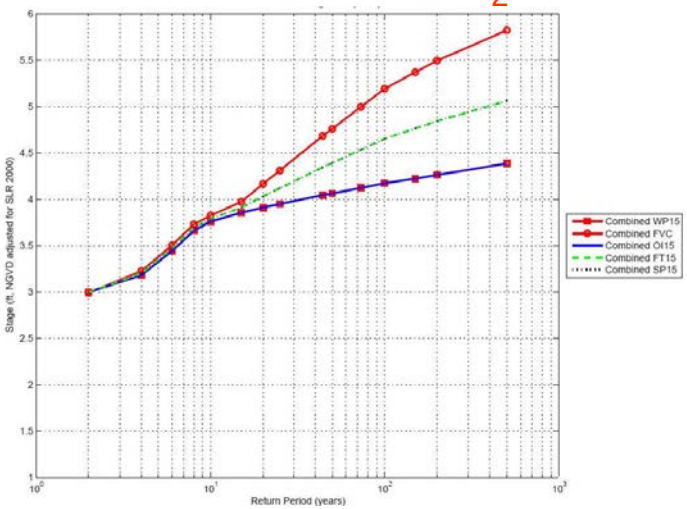
Mean Values based upon 50 years of analysis

Effect of Breaching on Back-Bay S-F Curves

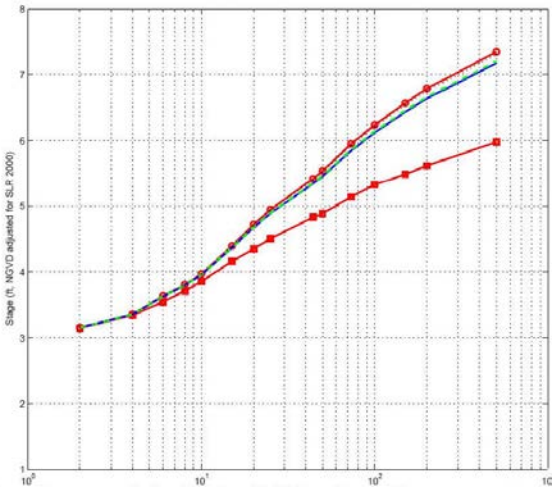


Effect of eliminating fill along the island:
Increase in back-bay stage frequency curves

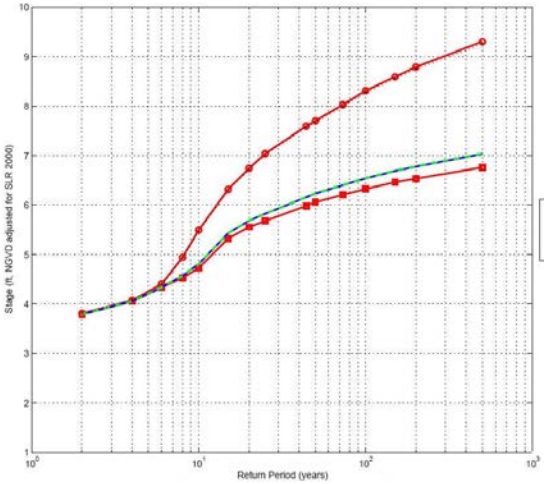




Station 3 Western Great South Bay



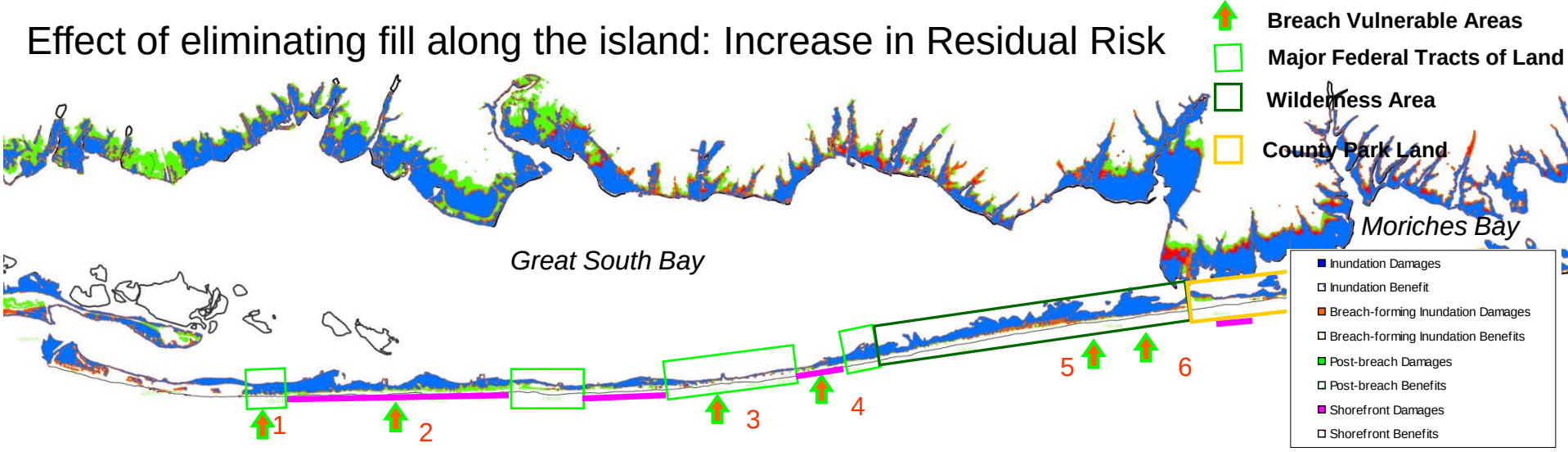
Station 8 Eastern Great South Bay

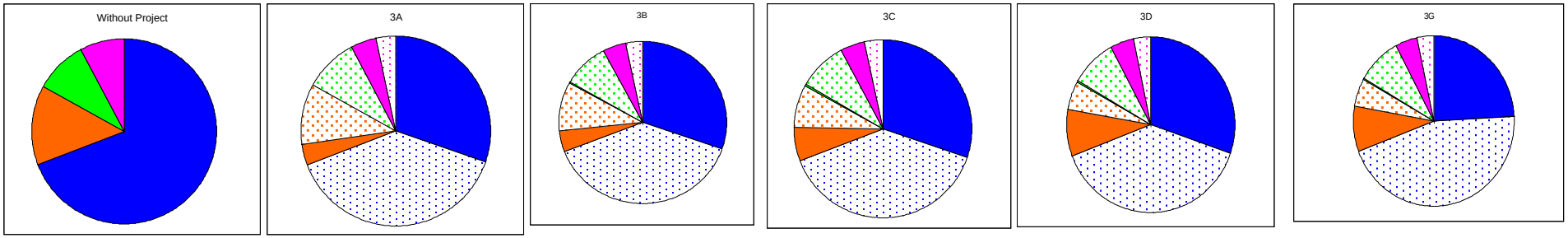


Station 10 Moriches Bay

The figures above show the engineering modeling used as input into the lifecycle damages model. The upper and Lower (red) curves represent the variability in the back-bay stages that are likely in the future without project condition based upon projected changes in the barrier Island condition, considering storm activity, and local actions that may be implemented. Plan 3A is represented by the lower red curve, which is comparable to the baseline condition. The intermediate curves show the effect of eliminating beachfill in various locations. Western GSB is most influenced by eliminating fill in the MFTL. Eastern GSB is most influenced by eliminating fill In the wilderness area. Moriches Bay is relatively insensitive to the effects of fill removal.

Effect of eliminating fill along the island: Increase in Residual Risk





Damage Category	Without
Total Project	
Tidal Inundation occurring due to inlet conditions, and wave setup in back bay	
Mainland	**55,834,500**
Barrier	**9,423,300**
Tidal Inundation occurring due to the event resulting in breaching, and overwash	
Mainland	**$11,035,500**
Barrier	**$1,946,900**
Total Inundation	**$78,240,200**
Damages (Inundation and Structure Failure) due to a breach remaining open	
Inundation	**$8,292,700**
Structure Failure (barrier island)	**$358,900**
Total Breach-Open	**$8,651,600**
Shorefront Damages	**$7,305,200**
Total Storm Damage	**$94,197,000**

Alternative Damages	3A	3B	3C	3D	3G*
Non-Structural & Road Raising	**19,081,400**	**19,081,400**	**19,081,400**	**19,081,400**	**13,270,200**
	9,423,300	**9,423,300**	**9,423,300**	**9,423,300**	**9,423,300**
Beachfill	**3,298,500**	**3,890,000**	**5,618,800**	**7,929,300**	**7,929,300**
	10,000	**20,000**	**60,000**	**70,000**	**70,000**
	31,790,800	**32,430,500**	**34,611,900**	**36,980,000**	**30,692,800**
Beachfill Breach Response	**0**	**200,000**	**300,000**	**380,000**	**380,000**
	0	**0**	**0**	**0**	**0**
Beachfill	**4,045,200**	**4,045,200**	**4,045,200**	**4,045,200**	**4,045,200**
	35,836,000	**36,675,700**	**38,957,100**	**41,405,200**	**35,118,000**
Storm Damage Reduction Benefits	**58,361,000**	**57,521,300**	**55,239,900**	**52,791,800**	**59,079,000**
Total Benefits**	**61,970,000**	**60,751,000**	**58,396,000**	**55,189,000**	**60,877,000**
Alternative First Cost	**328,850,000**	**322,686,000**	**320,911,000**	**320,911,000**	**386,285,000**
Alternative Annual Cost	**39,656,000**	**39,562,000**	**38,909,000**	**38,962,000**	**45,598,000**
Net Benefits	**22,314,000**	**21,189,000**	**19,487,000**	**16,227,000**	**15,279,000**

* Plan 3g includes the same barrier island features as Plan 3D, but includes a larger non-structural plan along the mainland.

** Total benefits are larger than the sum of the storm damage reduction benefits. These benefits include the costs avoided benefits associated with breach closure and local beachfill operations.

Differences Between Plans 3A and 3G/TFSP:

Plan 3A Reduces Breaching in all locations in Great South and Moriches Bay

Plan 3G/TFSP Allows Breaching in Multiple Locations, but includes a larger N-S Plan

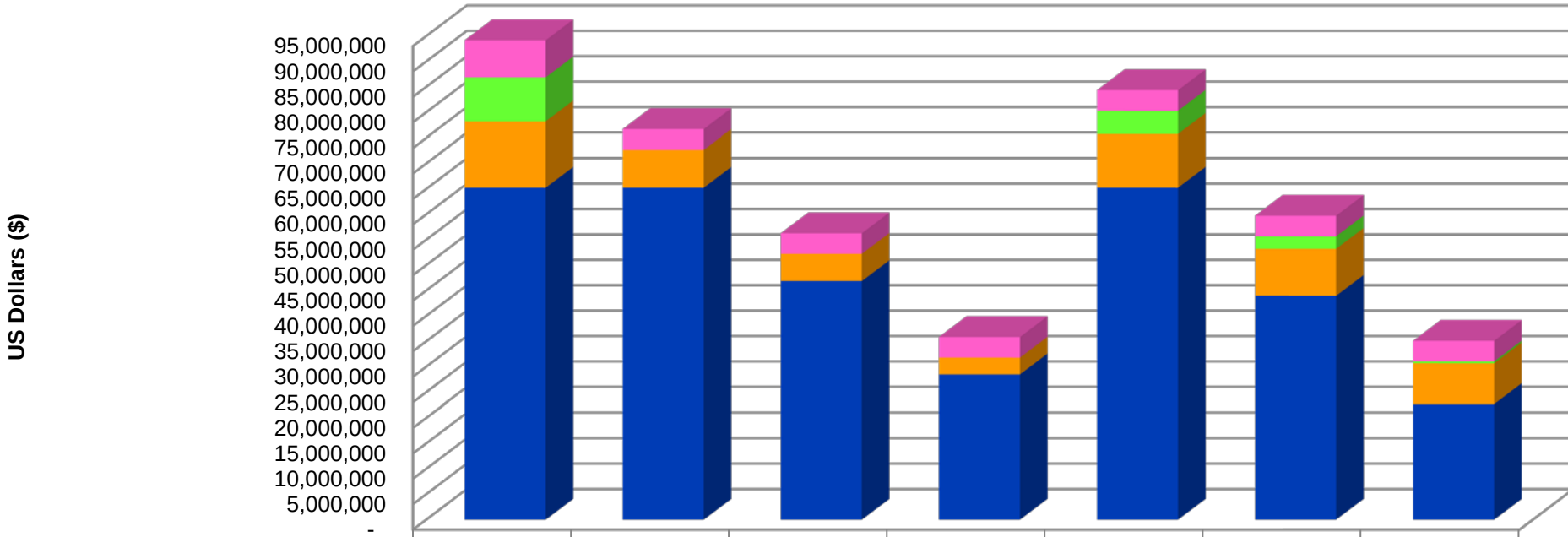
Success of Both Plans (but greater for 3G/TFSP) depends upon participation in N-S Plan

Reduction in "breach reduction benefits" between 3A and 3G/TFSP is: $140M

Increase in "non-structural benefits" between 3A and 3G/TFSP is: $110M

3G/TFSP relies more upon N-S, and is also significantly more expensive than 3A, $105M more

FIMP Damage Contributions by Alternatives



	Without Project	3A - 0% NS	3A - 50% NS	3A - 100% NS	3G - 0% NS	3G - 50% NS	3G - 100% NS
Shorefront Damages	7,305,200	4,045,200	4,045,200	4,045,200	4,045,200	4,045,200	4,045,200
Post-breach Damages	8,651,600	0	0	0	4,547,100	2,463,600	380,000
Breach-forming Inundation Damages	12,982,400	7,419,000	5,372,400	3,308,500	10,509,700	9,254,500	7,999,300
Inundation Damages	65,257,800	65,257,800	46,881,250	28,504,700	65,257,800	43,975,600	22,693,500

ATTACHMENT #4

FIMP Cost Overview by Plan Feature

**** Please note costs are presently being updated to account for changed conditions, and current price levels***

**** Costs below reflect those contained in the May 2009 Draft Report***

- **Plan 3A**

Beach fill = $160,000,000
Building Retrofits = $407,000,000
Road Raising = $14,900,000
Groin Modification = $10,000,000
Inlet Management (additional cost of bypassing)
    Shinnecock Inlet = $756,000 per cycle
    Moriches Inlet = $600,000 per cycle
    Fire Island Inlet = $4,100,000 per cycle
Breach Response ($6-$12M per closure)
Restoration Alternatives = up to $60,000,000

- **Plan TFSP**

Beach fill = $140,000,000
Building Retrofits = $550,000,000
Road Raising = $14,900,000
Groin Modification = $10,000,000
Inlet Management (additional cost of bypassing)
    Shinnecock Inlet = $756,000 per cycle
    Moriches Inlet = $600,000 per cycle
    Fire Island Inlet = $4,100,000 per cycle
Breach Response ($6-$12M per closure)
Restoration Alternatives = up to $60,000,000

Table 10.10 – Annual Cost

Plan 3 – Management, Non-Structural and Beach Nourishment Plans

	Plan 3.a	**Plan 3.g / (TFSP)**
Cost Category	Inlet Mgmt, BCP 13 @SB, NS2R, 15ft Dune @ GSB & MB	Inlet Mgmt, BCP 13 @ SB, BCP 9.5 @ OPWA, MFT, & SPCP, NS3R, 15 ft Dune @ GSB & MB
Beach Fill	$160,200,000	$139,200,000
Nonstructural	$407,200,000	$550,800,000
Road Raising	$14,900,000	$14,900,000
Total First Cost	*$582,400,000*	*$705,000,000*
Total IDC	$26,600,000	$29,400,000
Total Investment Cost	*$609,000,000*	*$734,400,000*
Interest and Amortization	$34,000,000	$41,000,000
Operation & Maintenance	*$9,300,000*	*$8,900,000*
Renourishment	*$12,900,000*	*$11,000,000*
Subtotal	*$56,200,000*	*$60,900,000*
Annual Breach Closure Cost	*$0*	*$1,000,,000*
Major Rehabilitation	*$0*	*$0*
Total Annual Cost	*$56,200,000*	*$61,900,000*

Interest Rate 5.125%, Project Life 50 years

ATTACHMENT #5

Implementation of Non-Structural Measures

Fire Island Inlet to Montauk Point

As a member of your local municipal government, you may know that you must play a key role in the implementation of non-structural measures that are recommended for your community as a result of the FIMP study. However, what does this really mean? To what degree would you be involved? At what phase of the process would your involvement begin? How would your role in a project with US Army Corps participation differ from what you may be used to through your community's participation in other Federal programs? This fact sheet provides answers to questions you may have regarding the implementation of building retrofit measures, such as elevating and/or floodproofing.

THREE BASIC OPTIONS

There are three basic options available for the implementation of non-structural measures. The options differ in their level of municipal, homeowner, and federal involvement. Let's call these options 1) municipally-managed 2) Federal government-managed 3) homeowner and Federal-government managed.

Under option 1, a participating municipality would enter into an agreement that outlines the local responsibilities for issuing requests-for-proposal (RFPs), selecting a contractor to perform the work, providing oversight during the construction phase of the project, distributing Federal funds to the contractor upon successful completion, and post-project monitoring to ensure that the effectiveness of the project is not compromised; e.g., to prevent residents from converting areas below the base flood elevation to living space.

This approach would likely require the dedication of municipal resources, such as a full-time staff person(s) for the project duration. The Village of Freeport in Nassau County provides an example of a Long Island community using a similar approach. (see sidebar)

Under option 2, the Corps would handle the design specifications, RFP, contracting, construction monitoring and inspection tasks. This options reduces the work required by both the municipality and the homeowner; however, since the Corps would conduct contract arrangements, detailed plans and specifications would need to be developed for each building to be retrofit. This requirement increases the project cost per building.

FREEPORT'S STORY

Since 1997, Freeport's Superintendent of Buildings, Joseph Madigan, has worked to achieve the elevation of 24 flood-prone residential structures through participation in FEMA's Hazard Mitigation Grant Program and Flood Mitigation Assistance Program.

After their project applications were approved by FEMA, the Village issued RFPs and hired contractors on a case-by-case basis. FEMA paid 75% of the project costs, and the individual homeowners paid the remaining 25%. The average cost to raise each flood-prone structure in Freeport was roughly $75,000.

In general, there was significant public support of the elevation projects. The most prominent concerns identified by homeowners were the 25% matching share, and the need to vacate their homes for the roughly 3-week construction phase.

Option 3, in which participating homeowners take a lead role, is a technique that the Corps has used successfully on a number of large non-structural projects. The homeowner enters into a real estate agreement with the Corps under which the homeowner, using Corps-prepared guide specifications, contracts directly with area contractors. Project funds are provided at an agreed-upon level of funding to the homeowner. Experience within the agency has shown that this method can achieve significant cost savings, and also gives the homeowner a greater degree of control over the work and the flexibility to incorporate additional home improvements (at their cost) as part of the retrofit project. The use of real estate agreements establishes a legal requirement that the homeowner maintain the structure in a manner to minimize future flood damages.

For these reasons, this third option would appear to be the optimal approach for implementing non-structural protection for typical structures in Long Island. (The Corps may choose to develop plans and specifications for more complex retrofit designs.) This proposed approach is broken down into the following four phases:

REFORMULATION/PLANNING PHASE:

This first phase is now being undertaken by the FIMP Study Team, and will identify building retrofit plans for alternative levels of protection, using input from the municipalities. Next, the benefits, costs, and impacts of the different plans will be evaluated to determine which measures are best suited for the different portions of the study area. Based upon these results, the Reformulation Study will recommend plans for Congressional authorization and funding.

DESIGN PHASE

If Congress authorizes a plan that includes non-structural measures, the Corps then coordinates with participating homeowners to discuss and select retrofit options. After considering homeowner preferences, the Corps prepares design alternatives and evaluates the cost-effectiveness of each option. The Corps would then meet with homeowners to refine the details of the plan. After the final alternative is selected, final cost estimates are developed. Please note that all retrofit work will be done in compliance with FEMA/National Flood Insurance Program (NFIP) regulations, and may provide some reduction in flood insurance premiums.

IMPLEMENTATION PHASE

At the start of this phase, individual municipalities enter into Project Cooperation Agreements with New York State and the Corps, and sponsor funding is obtained. Real Estate Agreements are then executed with participating homeowners. (Participation in the program is strictly voluntary, and at the discretion of the individual homeowner.) Next, each homeowner issues a Corps-provided RFP and guide specifications to contractors, and evaluates submitted bids (designs, cost estimates, and qualifications). Based upon this evaluation, the homeowner decides which firm they would like to hire to retrofit their home.

Nationally, non-structural projects typically have a 65/35 federal/non-federal cost-sharing arrangement. The State of New York as non-federal sponsor would pay between 50% and 70% of the non-federal share, while the remainder would be borne by local municipalities, who can in turn pass the cost onto participating homeowners. A homeowner would be responsible for up to 50% of the 25% non-federal share, or 12.5% of the total project cost. Temporary relocation during construction would be included in the cost-sharing arrangement as a project component.

Each participating homeowner is then required to submit a proposal to the Corps, stating their selection. Upon approval, the Corps meets with the homeowner and their selected contractor to sign a Contractor/Homeowner Agreement (CHA).

Construction activities then begin. The Corps will periodically provide construction inspectors as necessary to review the work. The homeowner is responsible for ensuring that their selected contractor complies with the CHA, and adheres to the approved scope of work and required safety measures.

In the event of unforeseen conditions requiring changes to selected project plans, an appeals process would be established whereby homeowners can submit requests for change orders. The Corps deems the construction phase complete upon a Final Inspection of the building.

MONITORING PHASE

Upon completion of the construction phase, the homeowner is responsible for adhering to the requirements set forth in the Real Estate Agreement regarding acceptable uses. Periodic inspections to ensure continued compliance are conducted by State, County, or local officials.

Above: Residential structure elevation project underway in the Village of Freeport

Some **key points** to keep in mind during project implementation:

- Local height restrictions may be exceeded by elevated buildings, requiring the issuance of variances.
- Legislation in your municipality may require that homes be reassessed after elevation *(in Freeport, this requirement was waived for participating homeowners)*.
- Traffic slowdowns during construction due to driver curiosity are common.
- Your local utility company likely has height restrictions for electrical panels, meters, etc. This equipment may need to placed at acceptable heights after the building is elevated.
- During the winter months, ensure that contractors insulate pipes to prevent freezing.
- For small lots with limited workspace, helical piles are a space-saving alternative for building elevation, if substantial wave action is not anticipated.

ATTACHMENT #6

D. <u>Consideration of the life cycle management of these plans.</u>

Alternative Plans 3A and 3G, were developed with a 50-year project life, and 50 years of renourishment. These plans do not meet the Vision objectives that "the plan addresses long-term demands for public resources". These plans do not include provisions that would change the need for continued renourishment within the project life, or alter the conditions so that a different solution could be expected following the 50-year project life.

In order to achieve a reduction in the long-term commitment for renourishment, alternatives would need to be implemented that would reduce the infrastructure that is at risk, or remove infrastructure to allow for a more efficient use of resources. The integration of land and development management regulations identifies improvements in the application of land use regulations, acquisition planning, and post-storm response planning that could help to reduce the infrastructure at risk along the shorefront.

With this as a component of the overall plan, there are several approaches which could be undertaken in the life-cycle management of the project to achieve this. The options that have been identified include:

1 – A scheduled reduction in the scale of protection for the beachfill in a timeframe that coincides with the acquisition planning. Under this scenario a beachfill plan would be maintained for a shorter period of time, over which purchase of property would be offered to shorefront structures at risk. After this period of time, the scale of protection would be reduced, thus reducing the commitment of resources for continued renourishment. The benefit of this approach is that the reduction in protection is not dependent upon the acquisition occurring.

2 – A scheduled relocation of the proposed line of protection that coincides with the acquisition planning. Under this scenario, the beachfill plan would be linked with the proposed acquisition plan. After a period of time, the footprint of the project would be maintained in a more landward location on a scheduled timeframe. The difficulty with this initiative is that the movement of the dune on a prescribed timeframe would require guaranteed acquisition, and could not be guaranteed with a willing-seller program.

3 – Adaptive Management. Under this scenario, the beachfill plan and the acquisition plan could proceed independently. On a periodic basis, coinciding with the scheduled renourishment, the constructed project would be revisited to identify if opportunities exist for adjustment of the maintained profile based upon the relative success in implementing the acquisition plan.

Under any of these scenarios, it is important to 1) identify the time scale that would be necessary for the implementation of alternatives, and 2) identifying the effect that these changes would have on project economics.

It is recognized that the acquisition of shorefront property through a willing-seller program is not an instantaneous action, particularly with consideration for acquisition strategies that could allow for a homeowner to sell their property but be allowed to continuously use the property.

The timeframes necessary for implementation of these measures suggests a timeframe measured in decades, not in years. Along the shorefront, consideration must be given for: the funding availability for acquisition, the timing of interest in selling, and the staffing to process these acquisitions.

When consideration was given for the time necessary to implement the non-structural alternatives along the mainland, accounting for staffing this effort, and funding these programs, it is expected that implementation of the mainland non-structural program would require 25 to 30 years. Discussions have also been held with agencies responsible for the relocation of public infrastructure along the shorefront. Input from these agencies indicates that major public works improvements, whether relocation or otherwise typically require 10 to 20 years, from conception to execution.

These timeframes suggest that if there is interest in reducing the long-term commitment for public investment in renourishment, a beachfill with a duration of 20 to 30 years could be considered in conjunction with an acquisition plan. As the project duration is shortened, it impacts the project economics. A sensitivity analysis was conducted which established that Alternative 3, built and maintained for 30 years, and subsequently replaced with a breach response plan, would have little effect on the project economics, and the economic viability. Achieving this objective, however, would require a larger investment in Real Estate to provide an alternative form of risk reduction for houses along the shorefront.

The challenge with developing a plan that integrates the land management, acquisition, and scheduled renourishment of the project is the uncertainty that exists. These elements introduce uncertainty to a situation that is already uncertain due to the complexities of projecting renourishment, projecting the functioning of the inlets, and the unknowns regarding future climate change. With all these uncertainties it is suggested that the implementation of the project adopt an incremental adaptive management approach. This approach would establish 1) data collection that would be implemented, 2) modeling efforts to analyze the data, and 3) an adaptive management framework that would establish the overall objectives, and the adaptations to the plan that could be accomplished with the project. This adaptation strategy is based upon the concept that with the passage of time the trends become established and more appropriate strategies can be executed. It is expected that this adaptation strategy would require a periodic review of the project execution (10-yr basis) and recommendations for the adaptation of the project, based upon the findings.

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

June 14, 2013

Colonel Paul E. Owen
District Commander
United States Army Corps of Engineers
New York District
26 Federal Plaza
Room 2109
New York, NY 10278

Dear Colonel Owen:

I am pleased to inform you that New York State supports implementation of the fully federally funded Fire Island to Montauk Point (FIMP) project, including the United States Army Corps of Engineers' (Corps) proposal to expedite the implementation of elements of FIMP, such as the immediate restoration of dunes and beaches damaged by Hurricane Sandy on Fire Island and downtown Montauk. This support is based on the overall concepts of the FIMP project subject to the items further described in this letter.

On March 11, 2011, representatives of the Corps and the United States Department of Interior sent a letter to me outlining the potential plan of improvement for the Fire Island to Montauk Point ("FIMP") Reformulation Study. This "Tentative Federal Supported Plan" ("TFSP") was proposed as the basis to move forward with Reformulation Study efforts for the entire FIMP study area – encompassing approximately 83 miles of Atlantic Ocean coastal and bay areas of Suffolk County, New York. As noted in the federal letter, New York State must find the general plan of improvement acceptable before its attributes can be finalized through a collaborative process. New York's approval at this stage, I understand, would allow the Corps and State to move forward with a final analysis of the TFSP, including such matters as plan formulation, engineering, economics, environmental assessment, model certifications and formal agency policy-level approvals.

After a series of discussions, on December 29, 2011, DEC sent a letter to the Army Corps presenting information requests aimed at better understanding some of the basic elements of the TFSP so that DEC would be in a position to accurately explain project elements, costs, maintenance obligations and impacts of the TFSP to the required local community sponsor(s). While further discussions were taking place, Hurricane Sandy arrived – altering the physical and fiscal landscape in a variety of ways. On May 16, 2013 the Corps responded to the Department's letter which addressed a number of the concerns raised by the Department, but deferred a response on a few issues that are currently under review based on the impacts from Sandy.

I understand that alternative components of the TFSP are now being further refined, including: breach response measures along the barrier island, including "advanced" breach response methods or protocols; inlet management, beach and dune fill components and alignments with on-going beach nourishment; structural groin modifications; resiliency measures, including a significant number of coastal community building elevations; road elevations; land and development management to limit new development in certain flood hazard areas; protective natural infrastructure features (including wetland complexes, living shorelines, shellfish reefs, dunes, ecologically friendly in-bay breakwaters, and marsh islands) and environmental restoration, particularly in south shore bay areas.

All of the above elements would be sharpened in a process that fully involves local stakeholders. As you have emphasized, this massive project would need to be finalized in a manner that takes into account increased storm surge intensity associated with climate change and sea level rise. It is understood that the Corps will be performing an environmental impact review process under the National Environmental Policy Act (NEPA) for the entire FIMP project and that the National Park Service is evaluating the need for a NEPA review with respect to the existing breach in the Wilderness Area of the Fire Island National Seashore. It is through these processes that the elements of the project will be fully analyzed and a final FIMP project will be fully defined.

The State also supports the Corps' review of the post Sandy dune re-alignment along Fire Island that may be necessary based on the Corps' cost to benefit analysis that is still underway. If the cost to benefit analysis indicates that the alignment should be moved north in order to make the project more economical, resilient, and sustainable over the 50-year period of the project, then the State would support this realignment. If the realignment requires the purchase of properties, then the State would request that the Corps minimize the scope of this activity to the extent possible for unwilling sellers and to perform the procurement of these properties for the State at full federal expense. The State awaits the Corps' submittal of the elements of the project that you are currently working on, as delineated in your May 16, 2013 response. Thank you for all of your good and continuing efforts to help New York rebuild smarter and stronger in the face of the challenges presented by Hurricane Sandy.

Sincerely,

Joseph J. Martens

c: Mr. Joseph Vietri

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

In Reply Refer To
PMS/EC

MAR 07 1978

Honorable Charles H. Warren, Chairman
Council on Environmental Quality
Executive Office of the President
722 Jackson Place, N.W.
Washington, D.C. 20006

Dear Mr. Warren:

This Department has reviewed the final Environmental Impact Statement for the U.S. Army Corps of Engineers Fire Island Inlet to Montauk Point, New York Beach Erosion Control and Hurricane Protection Project. Severe long term adverse environmental effects will result if this project is implemented as proposed in the EIS and authorized by the River and Harbor Act of 1960. We are, therefore, referring it to you in accordance with the interim guidance of your August 11, 1977 memorandum. This project is the largest barrier beach modification proposal to date. It will result in serious and irreverable adverse impacts on the natural resource values of this barrier island and beach with National precedent setting potential to other barrier beach ecosystems. Further, this proposal is in conflict with the Congressional authorization establishing Fire Island National Seashore.

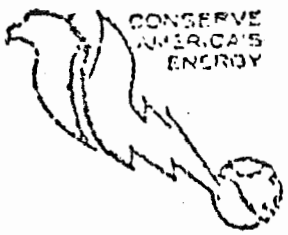
We met with representatives of the Office of the Chief of Engineers and New York Division Engineer on March 1, 1978, and are continuing our efforts to seek a resolution to major issues. There have been numerous meetings during the years on this project since a public meeting in 1964. Since filing of the final EIS signifies an intent to proceed with the action as proposed, we believe action by the Council is appropriate. We have advised the Corps of our intent to refer this matter to you.

The attached statement supports our conclusions. We are prepared to discuss the issues with you at your earliest convenience.

Sincerely,

Luis H. Kimmelman

Acting SECRETARY



ATTACHMENT A1

Save Energy and You Serve America!

Statement of the U.S. Department of Interior
concerning the

Fire Island Inlet to Montauk Point, New York Beach Erosion Control and Hurricane Protection Project. - U.S. Army Corps of Engineers

The Department of Interior as well as other Federal agencies in reviews of the draft EIS for this project pointed out many deficiencies. Our letters of June 4 and 14, 1977, were reproduced in the final EIS. However, no attempt was made by the Corps to answer the concerns in our June 4 letter and most of the major points in the June 14 letter went unanswered. On most other points, the answers were not satisfactory or stated that the concern would be addressed in future studies, as needed, when preparing detailed plans for a particular reach. One of the most serious difficiencies is the failure to assess the impacts on off-shore marine resources of the initial dredging of 64 million cubic yards of sand with the periodic (every 2 to 3 years) dredging of additonal sand for maintenance.

The final EIS itself does not present adequate information to assess the full potential effects of this project. However, from the information available we provide the following statement.

A. Completion of the project as proposed by the U.S. Army Corps of Engineers, according to an authorization in the River and Harbor Act of 1960, will permanently and adversely alter the barrier islands and beach along 83 miles (70 percent of the total ocean frontage) of Long Island from 50 miles east of New York City to the eastern tip of the Island. The project will result in;:

1. Raising the sand dunes to an elevation of 20 feet above mean sea level to form a nearly continuous dune line, except for existing inlets, along the whole reach,

2. Establishing a minimum 100 ft. wide berm at an elevation of 14 feet above mean sea level seaward of the dune with the beach sloping from the berm at a 30.1 slope,

3. The utilization of approximately 64,500,000 cubic yards of sand for inital construction to be dredged largely from undesignated areas off shore,

4. The construction of not more than 50 groins perpendicular to the beach to control natural sand movement,

5. Provide for the maintenance of the works of improvement through;
   a. periodic nourishment (replacement of sand eroded away) every 2 to 3 years as a Federal cost for 10 years
   b. requiring the nourishment needs be continued at a local cost "...unless Federal participation in providing periodic nourishment is renewed." and
   c. Federal reconstruction as needed after major storms, should a disaster be declared in the region, under the "emergency repair and rescue" category of Public Law 84-99 or under Section 206 of the Flood Control Act of 1962 that provides for emergency protection of threatened works at 100 percent Federal cost.

The Corps in their final environmental impact statement of September 1977, filed with EPA February 3, 1978, recognized most of the adverse impacts but, in our opinion, underestimates their severity and long term nature. They concluded that the environmental losses are offset by the economic gains to be derived by local residents as a result of the project. We do not believe this to be the case.

B. The project as proposed appears to be inconsistent with the following law and policy directive.

1. The spirit and intent of Presidents Carter's Executive Order 11988 - Floodplain Management. The project can not help but lead to increased development in flood prone areas in addition to the loss of the natural and beneficial values of coastal flood plains. The President emphasized his specific concern for barrier islands in his May 23, 1977, Environmental Message.

2. As we stated in our June 4, 1976 letter, "Public Law 88-587 authorized and established the Fire Island National Seashore, "...for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features

within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population..." It is this Department's policy, as reflected in the Seashore's Master Plan, that these goals are achievable through a thorough understanding of the natural processes at work in a barrier island setting and by informed accommodation with them." Our policy is based on the belief that to interdict natural processes for the purposes of stablizing barrier island resources to achieve short term goals is ultimately a futile effort.

Further, P.L. 88-587 (78 Stat. 928), Sec. 8(a) requires that shore erosion control and beach protection projects on the Fire Island National Seashore be a part of a plan mutually acceptable to the Secretary of Interior and the Secretary of Army. The Corps plan, as presented in the EIS, is not acceptable to the Department of Interior.

3. The project conflicts with the main purposes, to protect and preserve the flora and fauna of the dune ecosystem, for which the Amagansett National Wildlife Refuge is a part of.

C. The Department of Interior believes the project, as proposed, is environmentally unsatisfactory as:

1. It would permanently alter the naturally functioning dune ecosystem along 83 miles (70 percent) of Long Island's ocean frontage. The fragile plant and animal communities associated with these ecosystems would no longer exist in their present form in most of the area.

2. The elimination of oceanic overwash will result in the gradual loss of the wetlands associated with bays behind the barrier islands. The highly valued fish and wildlife resources of the inshore bays will gradually decrease in quality and quantity without the periodic overwash.

FACSIMILE HEADER SHEET
(ER 105-1-51)

- Fax 3/14 Called

(Name)	Office Symbol	Telephone No.	Releaser's Signature
MAKINEN	DAEN-CWR-P	693-6795	R. Makinen

(Name)	Office Symbol	Telephone No.	# Pages	Precedence	DTG
STONE	(NAD) NADPL-R	212-264-7031	7		

(CT)

3. Construction activities and especially the continual maintenance requiring the disturbance of oceanic benthic communitites will jeopordize their existence and that of the fish that depend on them. Maintenance operations will be especially damaging following, as they must, major storms when the benthic communities are under severe natural stress.

4. Project activities as proposed conflict directly with the objectives of the Fire Island National Sea Shore and the Amagansett National Wildlife Refuge. (See previous discussion in Section B. of this statement)

5. Secondary impacts resulting from more intensive use of land now used for residential and commercial development will result in the loss of additional fish and wildlife habitat resources. Unless proposed zoning in the areas to be protected by the proposed works are more effective than they have been in any other similar area, development is likely to occur that will nearly eliminate the existing terrestrial wildlife habitat on all but public lands. Secondary effects of such development would also degrade the fishery resources associated with the inshore bays.

6. Potential offshore borrow sites described to complete this project have been identified as supporting populations of surf clams that serve as the source of recruitment of this fishery stock off Long Island. Sandy substrate, which is also the most desireable material for beach nourishment, is the preferred habitat of this species. Further, extensive study of borrow sites in Connecticut and New Jersey waters have shown that there is a strong potential that this area will be removed, or have entensively lowered value, as habitiat for renewable marine resources.

D. The impacts of this project as proposed will result in degradation of a Nationally significant environmental resource. The project also represents the most ambitious attempt ever undertaken to modify barrier islands in order to eliminate the effects of severe storms and hurricanes.

E. The Department of Interior has attempted to work with the Corps on this project since it was first proposed. Because of our efforts the Corps no longer proposes to take the fill material from the inshore bays. Other minor changes have been incorporated as a result of our efforts, however, the portions of the proposal that will cause the major long term adverse impacts have not been modified.

The following are the major steps taken since 1968 by the Department to resolve the issues:

1. Department of the Interior reports dated December 17, 1968, and April 16, 1969, were submitted to the Corps of Engineers to assist in their planning.

2. Department of the Interior responded on November 15, 1974, to Public Notice No. 7871 dated October 21, 1974, and recommended:

   a. Permit denial

   b. A public hearing be held

   c. An EIS be prepared prior to initiation of work, and

   d. In view of the adverse environmental impacts resulting from the existing groins, that the groins be removed and the shoreline be allowed to restore itself through natural processes.

3. Department of the Interior offered to meet with the Corps, both at the District and Division level, to resol differences and attempt to resolve deficiencies via letter dated December 31, 1974. Also the letter noted that DOI had not received any response from letters to the Corps dated November 15, 1974 and November 19, 1974.

4. Department of the Interior reviewed and made extensive comments on the DEIS on June 4 and 14, 1976, stating that it exhibited deficiencies regarding on-site data collection, comparison of alternative actions, assessment of long- and short-term impacts resulting from the project, and the need for more specific determinations as to the unavoidable adverse impacts and to the extent of existing marine resources in the borrow sites and the impact of the project on them. Our review of the final environmental statement found it to still be deficient in that no new significant information was provided.

5. In addition there have been numerous field level contacts and meetings between Corps of Engineers, Fish and Wildlife Service, and Park Service personnel. Attached is a listing of contacts between the Corps and Park Service personnel since 1973.

6. On March 1, 1978, Assistant Directors of the Fish and Wildlife Service and the Park Service met with the Corps Deputy Director of Civil Works, members of his staff and represenatives from the New York District of the Corps of Engineers. They stated that, "The final project could potentially differ substantially from that described in the Chief of Engineers Report and the final EIS." If this is the case the EIS, as now written, should be withdrawn and one prepared on what will actually be done. It was concluded that Interior and Corps personnel will work together to see if a mutually acceptable plan can be developed. It was also agreed that the Department of Interior would proceed with its referral to the Council of Environmental Quality.

F. The Department of Interior recommends that CEQ become involved in discussions with us and the Corps with the objective of mediating the differences so the proposed project will be environmentally sound and conform to existing laws and the spirit and intent of current Executive policies.

The goals should be to;

1. have the Corps withdraw their EIS on this project and have the Corps and the Department of Interior, with other agencies as appropriate, work together in developing a protection plan that promotes to the greatest degree possible the long term perpetuation of barrier island, estuarine and marine resources,

2. have the project revised to work with the natural barrier island evolution process in providing protection to existing property. Such a solution could be developed by combining components of alternatives #2, #4 and #5, as shown in the final EIS, already studied by the Corps with limited structural work on the barrier island and beaches and "flood-proofing", of mainland facilities, and

3. have the President recommend ammending the project authorization as needed to accomplish the above goals.

Attachments (2)

COUNTY OF SUFFOLK

COUNTY LEGISLATURE

JOHN T. DONOHUE
LEGISLATOR, 2ND DISTRICT

CHAIRMAN:
COMMERCE & TRANSPORTATION COMMITTEE
ENERGY COMMITTEE

163 MONTAUK HIGHWAY
HAMPTON BAYS, NEW YORK 11946
(516) 728-1434

April 5, 1978

Colonel Clark H. Benn, District Engineer
U. S. Army Corps of Engineers
26 Federal Plaza
New York, N. Y. 10007

Dear Colonel Benn:

As requested, I am forwarding a copy of Suffolk County Resolution 204-1978 (Intro. 1249-78) concerning local support of the proposed work on Reach #2 of the Fire Island Inlet to Montauk Point Hurricane Protection and Erosion Control project.

It was my pleasure to see that the resolution passed unanimously among the members present, and was signed shortly afterward.

I hope I will be able to help further this work along, and look forward to hearing from you in that regard shortly.

Cordially,

John T. Donohue
County Legislator, 2nd L. D.

encl: Certified Copies of 202-78, 204-78

Intro. Res. No. 1249-78 Laid on Table 3/14/78
Requested by Legislators Donohue, Wehrenberg, Feldman, Noto and Foley

RESOLUTION NO. 204 - 1978, SUFFOLK COUNTY IS IN SUPPORT OF THE CONTINUANCE OF THE REACH #2 BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT IN THE TOWNS OF BROOKHAVEN AND SOUTHAMPTON.

WHEREAS, the erosion of the beaches on the South Shore of Suffolk County was felt most severely in the Reach #2 area; Moriches Inlet to Shinnecock Inlet; and

WHEREAS, all preliminary work on this Reach #2 Project has been completed; and

WHEREAS, New York State and the Federal Government are willing and able to support this project by the amount of 21% and 70% respectively of an approximate $20 million total cost; and

WHEREAS, it is necessary to show local interest in the amount of 9% in order that this Reach #2 Project continue; now, therefore, be it

RESOLVED, that Suffolk County is willing and able to fulfill its requirement of local participation of 9% of approximately $20 million, or $1.8 million for Beach Erosion Control and Hurricane Protection Project, Reach #2 in the Towns of Brookhaven and Southampton; and be it further

RESOLVED, that Suffolk County request that the U. S. Army Corps of Engineers prepare plans and surveys for the Reach #2 Project, and place this project into the President of the U. S. Capital Budget for Fiscal Year 1979.

DATED: March 28, 1978

APPROVED BY:

County Executive of Suffolk County

Date of Approval: 3-30-78

SUFFOLK COUNTY
County Legislature
RIVERHEAD, N. Y.

This is to Certify That I, William H. Rogers, Clerk of the County Legislature of the County of Suffolk, have compared the foregoing copy of resolution with the original resolution now on file in this office, and which was duly adopted by the County Legislature of said County on March 28, 1978
and that the same is a true and correct transcript of said resolution and of the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of the County Legislature of the County of Suffolk.

April 3, 1978 William H. Rogers

Clerk of the County Legislature

3-108

/CM

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Peter A. A. Berle,
Commissioner

April 10, 1978

Dear Colonel Benn:

Please refer to your letter of December 23, 1977, requesting an endorsement of the plans of improvement for Reach 2, Sections 1A, 1B and 2A of the Fire Island Inlet to Montauk Point Hurricane Protection Project.

The plans have been reviewed by this Department and by Suffolk County. Suffolk County, by resolution of the Board of Legislators, has expressed approval of the proposed increment of work and further expressed willingness and ability to fulfill its participation in the project.

The project is hereby endorsed and this Department is willing and able to provide the necessary local cooperation required for construction subject to review of final plans and specifications necessary for construction.

Sincerely,

Langdon Marsh
First Deputy Commissioner

Colonel Clark H. Benn
District Engineer
Department of the Army
New York District, Corps of Engineers
26 Federal Plaza
New York, New York 10007

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

JUN 6 1978

Lt. Gen. John W. Morris
Chief of Engineers
U.S. Army Corps of Engineers
Washington, D.C. 20314

Dear General Morris:

The Council has reviewed the U.S. Army Corps of Engineers' proposal for a beach erosion control and hurricane protection project from Fire Island to Montauk Point, N.Y., in response to the referral from the Secretary of the Department of the Interior. The Commerce Department and the Environmental Protection Agency also expressed major concerns about your proposed course of action.

The Council agrees with the objectives of the proposal, which are to preserve the natural shoreline and barrier beaches of Long Island and to reduce the risk of human and other losses as a result of flooding. As you know, the Council has maintained a long-standing interest and involvement in these two aspects of the human environment.

We have carefully reviewed the final environmental impact statement; we also appreciate the briefings your staff has provided on the proposal. As we understand the proposal, the Corps of Engineers would rebuild the southern edge of Long Island by creating a 25 x 16 foot dune along 83 miles of barrier beach in order to slow the pace of erosion and shield developed and undeveloped areas from storm flooding. Initial construction of the overall project would involve more than $100 million of federal funds, between 48 and 80 million cubic yards of sand taken mainly from the ocean, and the potential for dredging operations at existing inlets and for substantial construction of groins and other works. These estimates do not include the resources required for frequent maintenance of the system for an unspecified period of time after initial construction. We realize the Corps does not intend to construct the entire proposal immediately, but would study each part in detail before proceeding.

Incl. 1

This is a proposal for a radical, artificial facelift for Long Island's southern shoreline. The major policy questions are whether the proposal presented and analyzed in the environmental impact statement will resolve the problems it seeks to address and whether it is the best available alternative.

By way of background, we fully agree with your statement on the first page of the final environmental impact statement that the whole project area "must be considered as a system." We also agree, therefore, that the evaluation of alternative courses of action and their environmental impacts and acceptability is required for the entire system and must be presented in a single statement, prior to proceeding with any part of the proposal.

The dynamics of barrier beaches and islands underscores this point, as does your own analysis. The impact statement repeatedly reveals the system-wide effects that actions on one part of the Long Island shore have had on other parts. Indeed, Long Island has had a history of subsequently confronting and constantly compensating for human manipulations of the barrier island system for several decades since the inlets at Moriches and Shinnecock Bays were first artificially kept open. The impact statement illustrates the westward erosion that can result from the construction of groins. The actions taken on one part of Long Island's barrier beach and ocean shore have repeatedly been shown to affect other parts that are often many miles away.

The Fire Island National Seashore, for example, which comprises nearly a third of the project area and is located on the western end of the system, is likely to be affected by any major shoreline changes to its east. This relationship gives us special cause for concern in light of the intention of the Congress and the National Park Service to allow the National Seashore to revert to as natural a state as possible. In addition, the Congress wisely instructed the Corps to exercise its authority within the Fire Island National Seashore in accordance with a plan which is acceptable to the Secretary of the Interior (16 U.S.C. 459e-7).

Although the Corps recognizes the impact on the National Seashore of actions taken to its east, the Corps would proceed first with the reach immediately to the east of the Seashore without any plan to which the Secretaries of the Army and the Interior have agreed. This lack of coordination at the planning stage can only cause subsequent delays and referrals to the Council which should be avoided.

We believe that the proposed course of action has not been planned with adequate attention to the significant, potentially adverse impacts of the project. We have appended an indication of several specific concerns and have noted areas requiring your attention.

In conclusion, we believe that the proposed course of action, as described in the environmental impact statement, is environmentally unacceptable and that the Corps has not demonstrated that there are no practicable alternatives available. Rather, a number of reasonable alternatives and combinations of alternatives, which we believe warrant serious consideration by the Corps, have been given short shrift or been omitted from the programmatic statement. Because the entire project area is a system, it would be disingenuous to treat these issues solely in connection with a particular segment of the shore.

We would have strong objections to the Corps proceeding with the project as planned and would seek full Executive branch resolution prior to any Administration request for appropriations of funds for the project. However, we recognize that the project, initially conceived about two decades ago, and its impact statement, begun more than a year ago, may not accurately reflect the Corps' currently stated intention to include other alternative approaches in its plans before proceeding with any actual construction. We also recognize the vast improvement in the knowledge of barrier beach dynamics that has occurred since the project was authorized in 1960.

Because each facet of the proposal is likely to affect other parts, as well as the whole highly dynamic barrier beach system, we recommend that the Corps revise its overall project plan to create an adequate framework within which subsequent detailed planning for specific parts--or reaches--might occur. We would expect, of course, that your existing final EIS would be revised accordingly (by draft and final supplement if you believe that to be most appropriate). We would also expect your revised analysis to explain the rationale and criteria for dividing the overall project into its constituent parts for detailed review and future actions.

We appreciate the Corps' current plan to prepare "fully coordinated EIS supplements in draft and final format for each reach" which would discuss the full range of alternatives, as General Wilson noted in his April 28, 1978 letter to the Council. We believe that this approach would, however, cause unnecessary duplication and delay. We agree with your view that further site-specific analysis for actions on a particular reach (and their impacts on neighboring reaches) is appropriate at the design stage, prior to funding and construction. But the Corps' intention to prepare detailed analyses of all reasonable alternatives and their environmental impacts for each individual reach--including broad alternatives and impacts which apply to the entire system--would result in repetitive analysis of questionable scope conducted at different times in the absence of an overall framework. This approach is likely to delay planning and decisionmaking processes unnecessarily, and would undercut the Corps' laudable effort to produce an adequate overview or "umbrella" statement for the proposal that fully recognizes the dynamic and fragile character of the entire shoreline.

In addition to treating the deficiencies mentioned above, we recommend that you work more closely with the Interior and Commerce Departments and the Environmental Protection Agency in revising your programmatic proposals and analysis of their impacts.

Sincerely,

Gus Speth
Member

Attachment

Appendix

We believe that the proposed course of action has not been planned with adequate attention to the significant, potentially adverse impacts of the project and recommend that you pay particular attention to the following in any subsequent work:

1. The physical capability of the proposed construction techniques may not achieve the project's stated purposes over the long run, particularly in light of the anticipated storms. (The impact statement indicates a minimum 10-year federal commitment; the costs and benefits were computed on a 50-year basis.) Recent scientific evidence has shown that the radical modification of barrier beach floodplains, such as is proposed here, can accelerate--not reduce--erosion. This, in turn, increases the need for and commitment of persistent federal efforts to rebuild these environments, accompanied by new and usually more disruptive environmental effects. This approach would be contrary to sections 101 and 102 of the National Environmental Policy Act, which require careful attention to long term environmental consequences in order to fulfill the Federal Government's responsibility to each generation as trustee of the environment for succeeding generations.

2. By their very nature, barrier beaches are constantly changing and reforming, but the proposal neither incorporates actions to eliminate the existing structures which impede natural processes, nor employs wider use of natural processes to achieve the purposes of the proposal, such as greater reliance on sand bypasses or a combination of alternative approaches. More serious consideration of the system-wide impact of groins on beach erosion and of the advisability of removing existing groins is warranted, as well as the definition of circumstances or limitations for using long term, heavy structural devices.

3. The impact statement recognizes that the project will spur development of the barrier beach and mainland coast, much of which is adjacent to the National Seashore, but it does not identify or analyze non-structural alternatives to the project. Corps officials should know whether, or to what extent, or under what circumstances the Corps could or would condition its assistance on local efforts to control floodplain development, including the use of appropriate enforcement tools. We would call your attention to Executive Order 11988 on floodplain management, which requires the Corps to avoid conducting or supporting floodplain development unless there is no practicable alternative, and, equally important, to provide leadership and take action to restore and preserve the natural and beneficial values served by floodplains.

4. We have several other concerns about the proposal, which do not require detailed discussion in this letter. Among these are the impacts of the planned pond drainage structures on wetlands and the contradictory assumptions regarding the impacts of the proposal and its alternatives on the bay wetlands, bay ecology, and shellfish population.

NADDE (29 Jun 78) 1st Ind
SUBJECT: South Shore of Long Island, Fire Island Inlet to Montauk Point, New York

DA, North Atlantic Division, Corps of Engineers, 90 Church Street, New York, New York 10007

JUL 14 1978

TO: District Engineer, New York

1. Subject project was authorized by the Rivers and Harbors Act of 1960. Since that time, we have had many additional requirements imposed upon our water resources planning program by legislation and by executive action. Among these are the National Environmental Policy Act, the Water Resources Council's Principles and Standards and specifically in this case, the Fire Island National Seashore Act. There are many others as well. Therefore, it is clear that time has overtaken the Fire Island Inlet to Montauk Point project.

2. At this point, we are unable to demonstrate for the record that we have complied with and are in conformance with the new criteria and procedures. Therefore, the District will have to re-evaluate the subject project based on current procedures and, if necessary, reformulate it. This reformulation process should not be a reinvented wheel but should take into account all of the work that has occurred up to this time.

3. Special attention should be given to coordination with the Department of Interior. In view of the sensitive nature of the coastal zone, this coordination is particularly important. It is also mandatory because of the DOI's special interest in the reach from Fire Island Inlet to Moriches Inlet due to the Fire Island National Seashore Act and their position as a major land owner in this reach.

4. Your schedule should be submitted as promptly as possible.

1 Incl
n/c

JAMES A. JOHNSON
Major General, USA
Division Engineer

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

REPLY TO
ATTENTION OF:

DAEN-CWP-E

29 JUN 1978

SUBJECT: South Shore of Long Island, Fire Island Inlet to Montauk Point, New York

Division Engineer, North Atlantic

1. A copy of CEQ's letter to the Chief of Engineers on DOI's referral of the subject project is inclosed. CEQ is concerned whether the project analyzed in the EIS will resolve the problems it seeks to address and whether it is the best available alternative. They believe that the proposed course of action has not been planned with adequate attention to the significant, potentially adverse impacts of the project, and conclude that the proposed course of action as described in the environmental statement is environmentally unacceptable. They also believe that the Corps has not demonstrated that there are no practicable alternatives available. CEQ indicates that the evaluation of alternative courses of action and their environmental impacts and acceptability is required for the entire system and must be presented in a single statement prior to proceeding with any part of the proposal. They recommend that we work more closely with the Interior and Commerce Departments and the Environmental Protection Agency in revising programmatic proposals and analyses of their impacts.

2. You are requested to reformulate the project for Fire Island Inlet to Montauk Point in accordance with WRC's Principles and Standards and Corps guidance thereon. You should revise the EIS, as necessary, by draft and final supplement. You should comply with the most recent guidance on pertinent Executive Orders, particularly those on barrier beaches and flood plains. We would expect reformulation to address a broad range of alternatives, including non-structural measures, and to present conclusive support for dividing the project into constituent parts. The EIS supplement will present an evaluation of alternative courses of action and their environmental impacts for the entire project area. In recognition of DOI's specific interest in this project, we suggest special coordination efforts during reformulation and preparation of the EIS supplement.

DAEN-CWP-E

29 JUN 1978

SUBJECT: South Shore of Long Island, Fire Island Inlet to Montauk Point, New York

3. After you have had an opportunity to review the inclosed, please submit a schedule.

FOR THE CHIEF OF ENGINEERS:

Charles I. McGinnis

CHARLES I. McGINNIS
Major General, USA
Director of Civil Works

1 Incl
as

CF: District Engineer, New York

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

REPLY TO
ATTENTION OF:
DAEN-CWP-E

22 NOV 1978

Honorable Robert L. Herbst
Assistant Secretary, Fish and Wildlife Parks
Department of the Interior
Washington, D. C. 20240

Dear Mr. Herbst:

On 7 March 1978, the Department of Interior made a referral to the Council on Environmental Quality (CEQ) on the authorized Federal beach erosion control and hurricane protection project for the area from Fire Island Inlet to Montauk Point, Long Island, New York. By letter, dated 6 June 1978, to Lieutenant General J. W. Morris, Chief of Engineers, the CEQ recommended that the U. S. Army Corps of Engineers reformulate the authorized Federal project. The Corps of Engineers has initiated reformulation of the project plan in coordination with the Departments of Interior and Commerce and the Environmental Protection Agency (EPA).

Following the action taken by CEQ, several meetings have been held by representatives of the Departments of Interior and Commerce, the EPA, and the Corps of Engineers to develop an acceptable solution to mitigate immediate threats to property and human welfare at Westhampton Beach where serious erosion is occurring. During these discussions, your agency has underscored its concern that the objective of any action taken at Westhampton Beach will be to provide hurricane protection and beach erosion control benefits during the reformulation period for the overall project. The Corps affirms this objective and assures that any pending decision on the Westhampton Beach portion of the authorized project will not preempt future decisions on the design and nourishment of the reformulated overall project for hurricane protection and erosion control from Fire Island Inlet to Montauk Point. The Corps further considers that the nourishment requirements of any plan constructed for the Westhampton Beach portion of the project will be superseded by the nourishment commitments of the overall reformulated project, assuming the Congress funds the construction of the Westhampton Beach element and authorizes and funds the reformulated project.

DAEN-CWP-E
Honorable Robert L. Herbst

In order to assure that the concerns of the various agencies and CEQ are fully considered, the Corps proposes to plan the Westhampton Beach portion of the project in the manner described in the inclosure hereto. A decision to construct this element will await completion of the environmental review responsibilities which are set forth in the inclosure.

The Corps intends to prepare an analysis of the Westhampton Beach portion of the overall authorized project which will be used to reach a decision on construction. The Corps will work closely with you to develop a plan of study for reformulating the overall project over its full 83-mile reach. Both the analysis and the plan of study could be completed within Fiscal Year 1979, if sufficient funds are made available.

The Corps recognizes the interrelationship of the contemplated construction at Westhampton Beach with the reformulation activities for the overall project, and therefore, any construction and nourishment activities at Westhampton Beach will be performed in a manner that will be consistent with study results that may be available from the reformulation activities. Since Congressional appropriation of funds will be required before construction of the Westhampton Beach portion can be initiated or before the reformulation studies can be continued, the Corps will, consistent with guidelines and policies established by the Office of Management and Budget, recommend and support simultaneous funding for the reformulation studies and any construction or nourishment proposals at Westhampton Beach.

If the proposals set forth above, and detailed in the inclosure, are acceptable to you, it is anticipated that CEQ will agree to the Corps proceeding with the analysis of the Westhampton Beach portion of the project in order to reach a decision on construction in that seriously eroding area. As previously stated, the Corps will continue to reformulate the overall project plan concurrently with the analyis of Westhampton Beach

Sincerely,

SIGNED

1 Incl
As stated

CHARLES I. McGINNIS,
Major General, USA
Director of Civil Works

Identical letter sent to: Hon. Peter L. Cook, EPA; Hon Terry Leitzel, NOAA.

PROPOSAL FOR ANALYSIS
OF
WESTHAMPTON BEACH

1. Analysis and Demonstration of No Adverse Effect on Fire Island National Seashore

The Corps will prepare an analysis of the Westhampton Beach portion of the authorized project to assess the direct and indirect environmental impacts of alternative implementation strategies, including the alternative of allowing existing conditions and trends to continue (i.e., no action). In preparing the analysis, the Corps will rely primarily on existing data and other readily available information. The Corps will gather any additional information that is needed, provided that such data gathering will not cause delay in preparation of the analysis.

The Corps will work in close cooperation with the National Park Service, the U. S. Fish and Wildlife Service, the National Marine Fisheries Service and the Environmental Protection Agency in identifying alternatives to be assessed and in preparing the analysis of environmental impacts. The cooperating agencies are expected to provide timely review of materials submitted to them by the Corps, and to furnish available technical information that may be required to facilitate objective analysis.

Each cooperating agency should identify personnel responsible for carrying out these cooperative activities.

The analysis will be used in reaching a decision on whether to proceed to construction and, if construction proceeds, on the specific design and nourishment program for the project. If construction proceeds, the analysis will be used to ensure that, to the maximum extent practicable:

(1) the project is designed and nourished in a manner that minimizes short-term disturbance of coastal ecosystems and, in particular, the hard clam beds and fisheries of the offshore region, and

(2) there will not be significant long-term impacts on these resources.

The analysis will contain evidence that any Corps action in the Westhampton Beach area will not adversely affect, either directly or indirectly, the environment of Fire Island National Seashore.

2. Nourishment

Federal participation in nourishment of the Westhampton Beach portion of the authorized project will be limited to the period of nourishment authorized by Congress, and will be superseded by the requirements of the

overall reformulated project plan, if authorized and funded by Congress. The Corps will consult with and consider the views of the National Park Service, the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Environmental Protection Agency prior to taking any action to nourish the project. The Corps will consult and cooperate with said agencies to the greatest extent practicable if it becomes necessary to act pursuant to the Corps' emergency authorities. Any required nourishment will be accomplished in a manner that minimizes and mitigates, to the greatest extent practicable, short-term adverse impacts on coastal ecosystems as well as on any research/monitoring activities that may be planned or in progress in support of the overall project reformulation. A separate analysis will be prepared for any nourishment program assessed in the original analysis of the Westhampton Beach portion of the overall project (i.e., an average of 500,000 cu. yds every 2 years). The analysis will contain evidence that any revised nourishment action will not adversely affect, either directly or indirectly, the environment of Fire Island National Seashore.

3. Selection and Operation of Borrow Sites

Should a decision to construct the Westhampton Beach segment be made, the Corps will withdraw all nourishment material from locations seaward of the offshore bar in areas of minimum benthic habitat value.

The Corps of Engineers will consult with the U. S. Fish and Wildlife Service, the National Marine Fisheries Service, and the Environmental Protection Agency and will fully consider the views of these agencies in the selection and operation of borrow sites for suitable sand to be used as nourishment material. The objective of this consultation will be to control the location, timing and volume of sand withdrawal so as to reduce adverse impacts on coastal ecosystems, and, in particular, the hard clam and fisheries resources of the area, to the greatest extent practicable.

4. The Westhampton Groin Field

Modification or removal of the Westhampton groin field will be considered within the context of overall project reformulation, and will not be undertaken as part of the Westhampton Beach project. The Corps will initiate a monitor and analysis program to assess the effects of the existing groins on the distribution of sand in the littoral drift system. This monitoring program will be continued to assess the effects and effectiveness of the interim measure during the construction and post-construction phases of project implementation.

5. Interagency Agreement on Overall Project Reformulation

The Corps will prepare a plan of study for the reformulation of the overall project. The plan of study will be made available for review by the Departments of Interior and Commerce, and the Environmental Protection Agency, and their concurrence will be obtained prior to approving the plan of study. The plan of study will identify: (1) research and monitoring to be undertaken by the Corps in support of reformulation; (2) responsibilities of Interior and NOAA in providing technical assistance; (3) content and purpose of interim and final documents to be prepared by the Corps within the guidelines of the Water Resource Council's Principals and Standards; (4) estimated schedule for completion of identified work elements; and (5) funding to be made available for identified work elements. The Corps will seek from the Congress, through the budgetary process, funds for reformulating the overall project. Should a decision be made to seek funds for the construction of the Westhampton Beach portion of the project, a simultaneous appropriation of funds will be sought for pursuing both the reformulation study and the construction of the Westhampton Beach portion.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C. 20235

DEC 2 1978

Major General Charles I. McGinnis
Director of Civil Works
Office of the Chief of Engineers
Department of the Army
Washington, D.C. 20314

Dear General McGinnis:

We have reviewed your letter of November 22, 1978, concerning the Federal beach erosion control and hurricane protection project for the area from Fire Island Inlet to Montauk Point, Long Island, New York, and the Proposal for Analysis of Westhampton Beach.

We are pleased to note that paragraph two of the letter affirms our concern that any action at the Westhampton Beach portion of the authorized project will not preempt future decisions on the reformulated overall project. The National Marine Fisheries Service is interested in a short-term project with minimal volumes of sand taken from a jointly agreed upon location. This sand should be placed only along the most critically impacted sections of the beach.

We remain concerned that not all of Reach II (Moriches Inlet to Shinnecock Inlet) is in need of an interim measure. We believe the critical impacted areas are: (1) down current from the 13th groin and (2) just east of Moriches Inlet. While the Corps has estimated that this area encompasses about 9600 feet of shore line, we believe the critical areas are actually much less.

We are particularly interested in the proposed analysis of the Westhampton Beach portion of the authorized project. The data in the Final Environmental Impact Statement were insufficient to adequately assess the overall project. We are apprehensive about the use of either existing data or any which may be generated without delaying the assessment document. However, in the interest of cooperation with you, the Department of the Interior, and the Environmental Protection Agency, we will await the results of the proposed analysis.

We appreciate the opportunity to review the proposal for analysis of the Westhampton beach area.

Sincerely,

Terry L. Leitzell
Assistant Administrator
for Fisheries

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

DEC 22 1978

Maj. General Charles I. McGinnis, USA
Director of Civil Works
Office of the Chief of Engineers
Washington, D.C. 20314

Dear General McGinnis:

The Department of the Interior has reviewed your proposed process for analysis of hurricane protection and erosion control measures at Westhampton Beach. Your process provides the necessary assurances that the resources of Fire Island National Seashore will not be adversely affected by any future action in this area, that impacts on coastal ecosystems of the project area will be reduced to the greatest extent practicable, and that any decision to proceed with the Westhampton Beach portion of Reach II would be planned and implemented in a manner compatible with the reformulation of the overall Fire Island Inlet to Montauk Point project. I appreciate your commitment to fully coordinate planning and operational activities with this Department and other interested agencies, and assure you that our personnel will be working closely with you in these efforts.

In analyzing alternatives at Westhampton Beach, and in carrying out the planned research and monitoring program for the overall project reformulation, we would anticipate continuing involvement of the technical staff of your Coastal Engineering Research Center, with whom we would expect to have close professional collaboration.

Your commitment to recommend and support simultaneous funding for the reformulation studies and any construction or nourishment that may be needed at Westhampton Beach is the cornerstone of your proposal and an essential prerequisite for this Department's decision to withdraw its objection to the Corps' decision to proceed with the environmental assessment of the Westhampton segment. In order to ensure that we are kept informed of the status of funding or reauthorization, I would appreciate your providing me a reasonable advance notice of any Corps of Engineers' request to the Office of Management and Budget for congressional appropriations or legislation, as well as any congressionally initiated action on these projects.

By copy of this correspondence, I am informing the Council on Environmental Quality of this Department's decision and our above-outlined additional suggestions for carrying out future cooperative activities. I am looking

forward to their favorable review and official endorsement of these commitments and understandings. I assume the Council will provide you with their recommendations for proceeding under these constraints and understandings.

Let me reemphasize my sincere appreciation of your responsiveness to our concerns for protection of coastal ecosystems and Fire Island National Seashore. I can assure you of our prompt participation in your environmental assessment review and in your future planning efforts.

Sincerely,

Assistant SECRETARY

cc: K. Weiner

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

January 18, 1979

Maj. Gen. Charles I. McGinnis
Director of Civil Works
U.S. Army Corps of Engineers
Washington, D.C. 20314

Dear General McGinnis:

The Council has reviewed your letter of 22 November 1978 to Assistant Secretary of the Interior Robert L. Herbst and his response to you of 22 December 1978, concerning the Federal project for beach erosion and hurricane protection from Fire Island to Montauk Point, N.Y.

We are pleased that your agencies, together with the Commerce Department and the Environmental Protection Agency, have reached agreement for taking interim remedial action on portions of Reach II of the project area in a way which will not prejudice the overall project revision begun by the Corps last year on our recommendation.

Your letters reflect the results of negotiations encouraged by the Council after the resolution of the formal referral on this project from the Interior Department. The letters clarify the relationship between the overall project plan, which is being reformulated by the Corps, and the need for specific measures to mitigate immediate problems caused by severe erosion at Westhampton Beach. Equally important, they indicate a new spirit of cooperation between your agencies.

Your exchange of letters adequately addresses the Council's concern that interim remedial action should be taken as quickly as possible in cooperation with interested agencies

that is (1) limited to these areas for which it is essential; (2) designed and implemented in an environmentally responsible fashion; and (3) does not involve actions that are inconsistent with the reformulated project planning.

On behalf of the Council I would like to express our appreciation for the constructive efforts of the Corps, the Interior Department and other concerned Federal agencies in resolving the controversy. We trust that this momentum will be maintained in the coming months as you proceed with planning and implementation.

Sincerely,

Edward L. Strohbehn, Jr.
Executive Director

cc: Robert L. Herbst
Michael Blumenfeld

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Federal Building, 14 Elm Street
Gloucester, Massachusetts 01930

July 17, 1979

Col. Clark H. Benn
District Engineer
Department of the Army
Corps of Engineers
26 Federal Plaza
New York, New York 10007

Dear Colonel Benn:

The National Marine Fisheries Service has quantified the fishery landings and the related extent of marine resources along the southern shore of Long Island with special emphasis on the area from Moriches Inlet to Shinnecock Inlet. This information is being field checked with local fishermen but, as it represents a compilation of their landings, we doubt it will be altered significantly.

From the information collected it appears that several of the areas identified in the Offshore Borrow Investigation and Evaluation and Side Scan Survey along Reach 2, Fire Island Inlet to Montauk Point, New York, could be usable without significant impact to existing benthic resources of commercial interest. In particular it would appear, pending additional refinement and review of the specific distances offshore, that core sampling Areas 7, 9, and 16 are good sites for borrow. Site 8 also may be in that category, although there does seem to be a clay-silt problem in several horizons. Back-up sites might include core sample sites 12, 13, 14, 24, 35, 37, 42, and 43 provided that their distance offshore is less than 1.5 nautical miles. Any sites mined will be adversely impacted, but surf clam populations seem to be lower in these areas. The major issue now remaining appears to be the dimensions of the borrow area, which must be coordinated with all concerned parties.

We look forward to coordination of these matters. Should your staff require further explanation of the data provided please contact Mr. Michael Ludwig at Milford, Connecticut facility. His telephone number is 203/878-2459.

Sincerely,

Ruth Pelfus
for Allen E. Peterson, Jr.
Regional Director

Commercial Finfish Activity Offshore of Eastern Reach I and Reach II.

Commercial fishing occurs in this area from the surf zone outward. However, fishing effort varies from moderate in the zero to three-mile zone, to very low three to six miles offshore; becoming moderate again in the six to twelve-mile zone, and increasing noticably beyond the twelve-mile mark.

Fishing activity within three miles of shore appears to drop off during July and August. Most vessels working this area use Shinnecock Inlet for access to the fishing grounds. Fishing pressure, therefore, builds close to that point, but the effort extends from the Shinnecock Jetty westerly toward the Moriches Inlet Jetty with a possible net hauling effort occurring at Moriches. There is also an easterly effort, again beginning at Shinnecock.

During spring and early fall, after the inshore depression of finfish stocks in July and August, there are inshore and/or offshore movements of squid (Loligo sp), scup (Stenotomus chrysops), fluke (Paralichthys dentatus), bluefish (Pomatomus saltatrix), weakfish (Cynoscion regalis), striped bass (Morone saxatilis) and butterfish (Peprilus triacanthus). The period of April through June appears to be the period in which commercial fishermen direct their effort primarily toward catching fluke. This effort is generally within three miles of shore but more offshore than the concurrent striped bass and bluefish efforts which take the boats as inshore as they can get. April also represents the beginning of the inshore movement of lobsters (Homarus americanus), toward which a fair amount of effort is directed. Since the lobster catch remains relatively stable during July and August, some of the Shinnecock-based fishermen shift their primary effort from finfish to the high valued lobster during this period. Other fishermen shift their efforts into Long Island Sound,

further offshore or into Block Island Sound as the species composition alters with increasing water temperature. During September finfish populations again begin to increase offshore off of the Hamptons and efforts are redirected back toward these more local stocks.

In the late fall, silver hake (whiting) (Merluccius bilinearis) is taken, typically in waters from 12 to 35 meters. The 1978 catch of silver hake was rather good and continued until falling water temperatures drove the fish out of the inshore area.

During winter the effort is directed primarily toward yellowtail flounder (Limanda ferruginea), but Atlantic cod (Gadus morhua) and winter flounder (Pseudopleuronectes americanus) are also valuable portions of the catch. The effort, at least for yellowtail flounder, is generally in 22 to 30 meters of water.

Since it has been stated that the sand mining effort will be performed outside the ten meter depth, the borrow effort should have little impact on the haul seine and surf fisheries. However, the placement activity may impact these fisheries. A dichotomy of impacts may result from the discharge of material on the beach and the resulting outwash of fine grained material and its associated benthic infauna. While the suspended sediment will induce avoidance by some species, the presence of increased and readily available food sources may lure species that are less sensitive to turbid conditions into the outwash plume.

Fishery catches for 1978 are tabulated below by month and are identified by gear type. Unless otherwise noted all fish catches are by fish trawl. They represent only those catches which were made within three miles of the shore in the east Fire Island and Hamptons area. Typical habitat of the captured species is also indicated. A note of caution: the following data show catches, not effort. Catches appear to vary primarily with season, number of participants, and extent of effort, rather than with fish availability.

1. Anglerfish (Lophius americanus): benthic inhabitant usually found over sand, pebbles or gravel.

January 1,500	July 1,440 pounds
February 360 pounds	August 1,000 pounds
March 400	September 1,200 pounds
April 3,410 pounds	October 1,100 pounds
May 12,030 pounds	November 4,650 pounds
June 8,300 pounds	December 1,110 pounds

2. Bluefish (Pomatomus saltatrix): a midwater fish found from the bottom to the surface, inshore to the open sea.

January No recorded catches	July 11,970 pounds 1,150 pounds by hand held lines 2,830 pounds by gill nets 14,120 pounds by haul seine
February No recorded catches	

March
No recorded catches

April
No recorded catches

May
458 pounds
6,000 pounds by gill net
2,320 pounds by haul seine

June
4,000 pounds
1,000 pounds by hand held lines
6,540 pounds by gill net
19,590 pounds by haul seine

August
10,470 pounds
1,300 pounds by hand held lines
3,790 pounds by gill net
5,350 pounds by haul seine

September
8,600 pounds
2,000 pounds by hand held lines
29,080 pounds by gill nets
18,660 pounds by haul seine

October
34,150 pounds
2,150 pounds by hand held lines
31,780 pounds by gill net
59,710 pounds by haul seine

November
64,960 pounds
2,500 pounds by hand held lines
12,000 pounds by gill net
33,000 pounds by haul seine

December
3,780 pounds
920 pounds by hand held lines

3. Butterfish (Peprilus triacanthus): generally occur inshore near the surface but may overwinter in deep water.

January
5,000 pounds

February
No recorded catches

March
No recorded catches

April
1.180 pounds

July
7,720 pounds

August
2,250 pounds

September
4,800 pounds

October
2,350 pounds

May
1,600 pounds

June
11,734 pounds

November
1,980 pounds

December
4,680 pounds

4. Cod (Gadus morhua): Found from the surface to the bottom. Larger individuals lay close to the bottom and best catches are made on rocky, pebbly or sandy bottoms.

January
20,000 pounds
5,930 pounds by set lines

February
12,350 pounds
6,110 pounds by set lines

March
8,350 pounds
4,450 pounds by set lines

April
11,930 pounds

May
9,320 pounds

June
1,100 pounds

July
480 pounds

August
No recorded catches

September
180 pounds

October
1,160 pounds

November
7,680 pounds

December
48,770 pounds

5. Blackback or winter flounder (Pseudopleuronectes americanus): Generally found inshore as benthic inhabitants on silty-sand to sandy bottoms.

January
2,000 pounds

February
18,990

July
1,850 pounds

August
970 pounds
1,200 pounds by hand held lines

March 15,100 pounds	September 4,380 pounds
April 26,500 pounds	October 3,090 pounds
May 71,970 pounds	November 8,910 pounds
June 39,820 pounds 610 pounds by hand held lines	December 29,870 pounds

6. Fluke or summer flounder (Paralichthys dentatus): Benthic inhabitants which prefer sandy or muddy bottoms then tend to move shoreward as water temperatures increase.

January No recorded catches	July 40,440 pounds
February No recorded catches	August 35,220 pounds
March No recorded catches	September 94,290 pounds 1,200 by hand held lines
April 1,480 pounds	October 36,400 pounds
May 102,490 pounds	November 31,240 pounds
June 112,560 pounds	December No recorded catches

7. Yellowtail flounder (Limanada ferruginea): This benthic inhabitant prefers sandy to silty-sandy bottoms typically staying somewhat more offshore in deeper water.

January
690 pounds

February
2,540 pounds

March
10,750 pounds

April
10,160 pounds

May
4,220 pounds

June
No recorded landings

July
No recorded landings

August
No recorded landings

September
No recorded landings

October
No recorded landings

November
9,970 pounds

December
23,990 pounds

8. Red hake (squirrel hake or ling) (Urophycis chuss): Commonly confused with white hake (Urophycis tenuis). This benthic species tends to inhabit progressively deeper water as it matures, although it does move inshore as an adult, preferring soft bottoms to rocky ones.

January
2,000 pounds

February
2,370 pounds

March
No recorded catches

April
6,350 pounds

May
76,950 pounds

June
470 pounds

July
280 pounds

August
No recorded catches

September
380 pounds

October
1,880 pounds

November
4,200 pounds

December
6,530 pounds

9. Atlantic mackerel (Scomber scombrus): A midwater species which feeds at all depths. It moves inshore as water temperatures rise.

January
No recorded catches

February
No recorded catches

March
No recorded catches

April
5,280 pounds
4,750 pounds by gill net
14,430 pounds by haul seine

May
19,360 pounds
3,700 pounds by gill net
5,020 pounds by haul seine

June
520 pounds
3,200 pounds by gill net

July
1,150 pounds

August
No recorded catches

September
No recorded catches

October
200 pounds

November
No recorded catches

December
2,880 pounds
3,110 pounds by hand held lines

10. Scup or porgy (Stenotomus chrysops): Inshore migrants as waters warm, they prefer smooth bottoms, although they are a midwater species.

January
830 pounds

February
No recorded catches

March
No recorded catches

April
1,260 pounds

May
53,750 pounds
2,180 pounds by inshore traps

June
39,770 pounds
1,000 pounds by inshore traps

July
17,690 pounds
1,820 pounds by inshore traps

August
5,180 pounds
180 pounds by inshore pots
2,000 pounds by hand held lines

September
10,160 pounds
2,250 pounds by hand held lines

October
6,740 pounds
2,100 pounds by hand held lines

November
1,340 pounds
2,000 pounds by hand held lines

December
630 pounds

11. Weakfish (grey sea trout) (Cynoscion regalis): A migrant midwater species that prefers inshore waters during the warmer months.

January
No recorded landings

February
No recorded landings

March
No recorded landings

April
680 pounds
260 pounds by gill net

May
11,700 pounds
16,220 pounds by gill net
10,040 pounds by haul seine

June
10,700 pounds
1,000 pounds by hand held lines
12,300 pounds by gill net
11,460 pounds by haul seine

July
10,220 pounds
1,500 pounds by hand held lines
2,020 pounds by gill net
6,440 pounds by haul seine

August
120 pounds
1,600 pounds by hand held lines
3,550 pounds by gill net
2,130 pounds by haul seine

September
5,480 pounds
1,500 pounds by hand held lines
9,590 pounds by gill net
8,330 pounds by haul seine

October
19,640 pounds
2,000 pounds by hand held lines
6,430 pounds by gill net
41,850 pounds by haul seine

November
940 pounds
1,880 pounds by hand held lines
4,800 pounds by gill net
74,548 pounds by haul seine

December
3,410 pounds

12. Striped bass (Morone saxatilis). A seasonal midwater migrant to the area, it feeds from the surface to the bottom.

January
No recorded catches

February
No recorded catches

March
No recorded catches

April
170 pounds
260 pounds by gill net

May
200 pounds
870 pounds by gill net
2,030 pounds by haul seine

June
1,570 pounds
1,420 pounds by gill net
4,460 pounds by haul seine

July
3,560 pounds
4,410 pounds by haul seine

August
400 pounds by gill net
1,100 pounds by haul seine

September
1,230 pounds
7,040 pounds by gill net
1,650 pounds by haul seine

October
15,430 pounds
2,050 pounds by gill net
63,330 pounds by haul seine

November
37,400 pounds
4,900 pounds by gill net
43,960 pounds by haul seine

December
4,110 pounds
5,000 pounds by hand held lines

13. Silver hake (whiting) (Merluccius bilinearis): This midwater fish is found both inshore and offshore as a resident to the area.

January
6,900 pounds

February
5,290 pounds

March
4,000 pounds

April
36,790 pounds

May
219,870 pounds

June
1,510 pounds

July
1,150 pounds

August
750 pounds

September
1,200 pounds

October
3,850 pounds

November
58,130 pounds

December
230,790 pounds

14. American lobster (*Homarus americanus*): Of the various life patterns of lobsters, it appears that fishermen in this area harvest the onshore-offshore migrants.

January No recorded catches	July 4,000 pounds by traps
February No recorded catches	August 12,000 pounds by traps
March No recorded catches	September 7,200 pounds by traps
April No recorded catches	October 6,400 pounds in traps 580 pounds by divers
May 500 pounds by traps	November 800 pounds in traps
4,000 pounds by traps	December No recorded catches

15. Long finned and short finned squid (*Loligo peale* and *Ilex illacebrosus*): Although two separate species are caught, the long finned species comprises more than 90 percent of the catch. The two species are combined in the catch data presented below.

January 5,000 pounds	April 2,000 pounds
February 70 pounds	May 16,490 pounds
March 1,510 pounds	June 34,790 pounds

July
36,560 pounds

August
55,880 pounds

September
14,440 pounds

October
7,170 pounds

November
11,610 pounds

December
500 pounds

Offshore Shellfish Resources Along Southern Long Island

The following assessment discusses only the commercially sought surf clam (Spisula solidisima) and ocean quahog (Arctica islandica). To facilitate an understanding of the resource, a brief historical overview of the commercial fishery for these resources and the impact of fishing on local populations is discussed below.

The surf clam has been harvested off New York since the early 1900's. The effort, however, was relatively insignificant until the mid 1940's. During the war years the modern fishery developed and known stocks were heavily fished. This rapidly depleted the available resource, forcing the fishery to range further afield in the search for fishable concentrations. Most surf clam populations are found in depths of 12 to 43 meters but have been recovered at depths up to 128 meters. The ocean quahog has slowly joined the surf clam in commercial importance. The quahog fishery has, to a large extent, resulted from depletion of the surf clam resource. Quahogs inhabit the same general area as surf clams, but occur also in deeper water.

The surf clam resource has been slow in recovering from the overfishing that occurred in the 1950's and 1960's. Judging from observations made in 1974-1975, it appears that reproductive success has been limited in recent years and that there is a general failure of juveniles to survive their first two years, resulting in significant gaps in year classes entering the adult population and marketable size range.

Regarding the presence of both clam species in the proposed borrow area, the most extensive sampling efforts to date were carried out during 1974 and 1975. However, the character of the species involved and their life expectancy allow reasonable belief that the resource has not significantly altered its

population structure or established major colonies in areas previous uninhabitated by them. The sampling was carried out by David R. Franz.[1] Using 47 transect lines placed every two nautical miles, sampling occurred at 0.5, 1.5 and 2.5 nautical miles offshore.

Adult Spisula and Arctica were collected with a 48 inch (1.2 meter) commercial hydraulic clam dredge operated for five minutes at each station. Associated with each dredging effort replicate sediment samples were collected using a 1/4 meter Shipek grab sampler. The sample was sieved through a 1mm mesh screen and that portion not passing the grid was preserved for later analysis.

In the eastern portion of the sampling area (transects 1 thru 30; Figure 1), adult Spisula per bushel ranged in number from 40 to 57 with a mean of 49. West of transect 30, clams per bushel ranged from 78 to 125 with a mean of 86. This indicates that the population east of transect 30 is significantly older (larger clams taking fewer to fill the bushel measure), or has had better growth rates than their counterparts to the west. Additionally, this apparent age discrepancy was accompanied by a gradual decline in abundance west of Shinnecock Inlet. This decline was reversed near the Rockaways.

It was found that approximately 56% of the estimated standing stock of about 3.5 million bushels of clams is located east of Fire Island Inlet. This fac is hypothesized as being related to the fact that the resource east of Fire Island Inlet has not experienced the same level of fishing as has the resource further west. This is felt to be related to the lack of suitable harbors

[1] Franz, David R. 4/26/76. A Management Study of Surf Clam Resources Along the Long Island Coast - Final Report, Contract #03-4-043-355, State/Federal Surf Clam Fishery Management Program. June 1974-Sept. 1975.

for basing commercial fishing activities. The specific location of the resource within the sampling grid revealed the presence of a distribution pattern which only breaks down in the 0.5 nautical mile stations west of Moriches Inlet. Thus, the inshore-offshore distribution might be used to indicate preferred mining locations along the shoreline east of Moriches Inlet. That pattern indicates that the populations are depressed in the 1.5 to shore zone along most of the Westhampton Beach Reach. It was also noted that populations west of Jones Inlet exhibit major differences in shell ring development over those east of the inlet.

Distribution of juvenile clams show lowest densities near Montauk, increasing as one moves westward, attaining a maximum of 2.5 animals per Shipek grab sample just short of Moriches Inlet. In addition to the east-west pattern, there appears to be an onshore-offshore pattern. Inshore (stations at 0.5 miles), peak abundance was found along the eastern half of Fire Island. Abundance decreases rapidly with increasing distance offshore. Within the 1.5 mile grid the longshore pattern is visible; however, in the 2.5 grid only populations outside the Westhampton Beach study area reflect the inshore pattern.

Visual evidence on both surface sediment character and concentrations of Spisula suggests that juvenile populations concentrate in finer grained sediments. It may be hypothesized that these concentrations are caused by disruption of long-shore transport processes that result in the deposition of both finer bay sediments and recently metamorphosed Spisula. This would explain why populations of juvenile Spisula are elevated near inlets. However, there are too few data to adequately test the above hypothesis. By contrast it should be noted that in approximately 80 percent of samples taken in the 1974-1975 study, adult Spisula were found to occupy habitats having a mixture of medium to fine sand instead of finer grained sediments.

Extensive populations of adult Arctica were noted off eastern Long Island from Fire Island Inlet almost to Montauk and typically in fine to medium sized sand. Although it has been shown that Arctica normally are found in somewhat siltier sands and deeper waters, the sampling revealed them in waters of 10 to 12 meters depth and in the less stable inshore sites.

Figure #I and Location of Sampling Stations Along South Shore of Long Island, New York

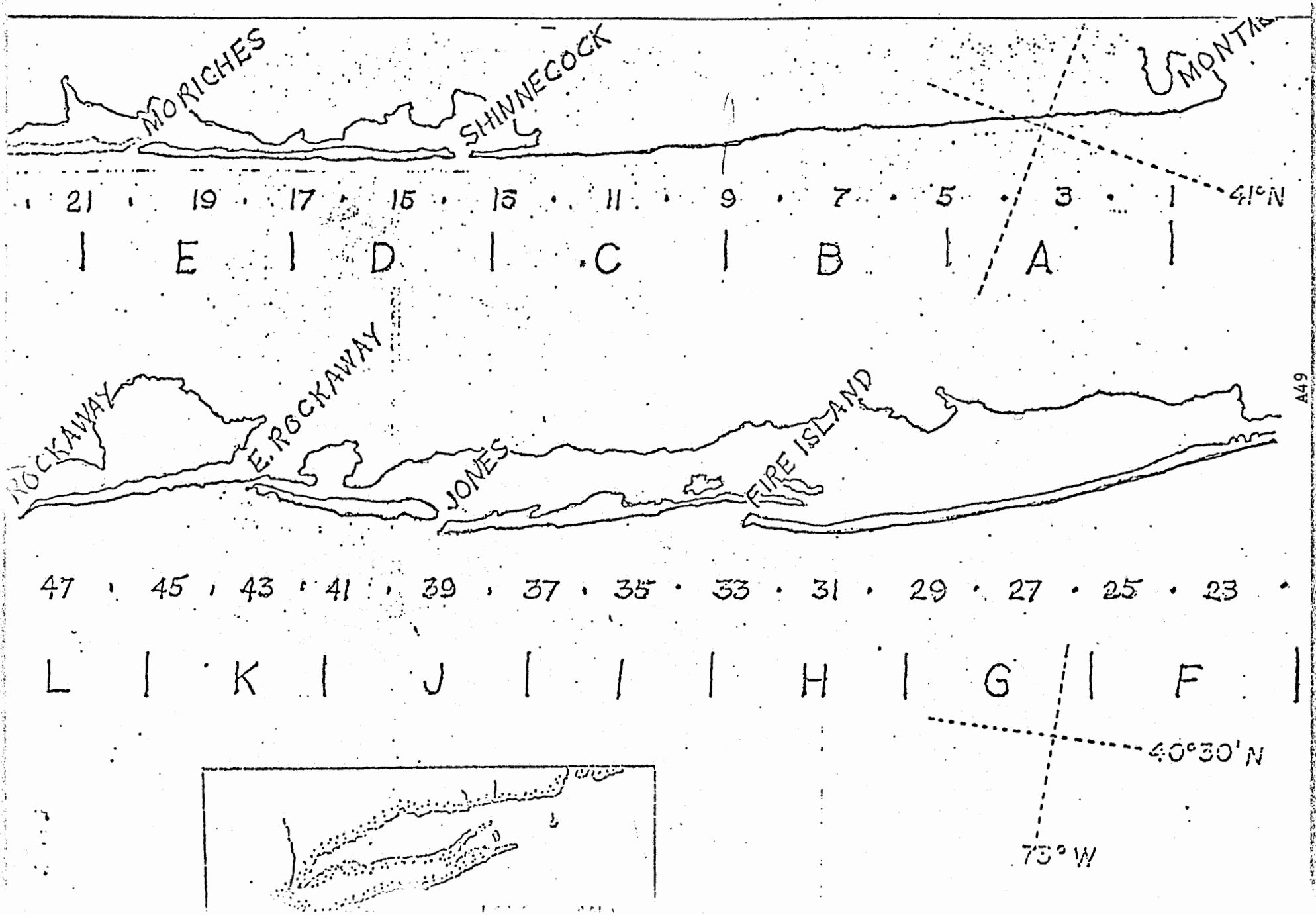


Figure 2.

Abundance of *Spisula solidissima* and *Arctica islandica*[1]

Station No.	Spisula in Bushels Per Haul	Arctica Presence at each Station[2]
130	2.5	-
131	1.5	-
132	-	-
140	1.0	+
141	3.0	-
142	2.0	-
150	0.3	+
151	1.0	-
152	1.0	-
160	0.5	-
161	0.5	-
162	2.0	-
170	0.4	+
171	1.0	-
172	0.5	-
180	0.1	+
181	1.5	-
182	0.9	-
190	0.1	+
191	0.2	-
192	0.2	-
200	1.0	+
201	0.5	+
202	0.3	-

1. The stations are numbered so that the final digit represents station location. Station numbers ending with (0) are 2.5 nautical miles offshore, (1) is 1.5 nautical miles offshore and (2) is 0.5 nautical miles offshore.

2. Plus (+) indicates presence of adults while minus (-) indicates lack of species in sample.

AGREEMENT BETWEEN
THE UNITED STATES OF AMERICA
AND
THE STATE OF NEW YORK

FOR LOCAL COOPERATION AT
FIRE ISLAND INLET TO MONTAUK POINT, N.Y.
BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT

INCREMENT OF WORK
SECTIONS 1B, 1A and 2A
MORICHES TO SHINNECOCK REACH

This AGREEMENT entered into this _____ day of _____ 1980, by and between the UNITED STATES OF AMERICA (hereinafter called the "Government"), represented by the Contracting Officer executing this agreement, and the STATE OF NEW YORK (hereinafter called the "State"), WITNESSETH THAT:

WHEREAS, construction of the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Project (hereinafter called the "Entire Project") was authorized by the River and Harbor Act of Congress, approved 14 July 1960 (Public Law 86-645), substantially in accordance with House Document No. 425, 86th Congress, 2nd Section, and heretofore modified by Section 31 of the Water Resources Development Act of 1974, approved 7 March 1974; and

WHEREAS, the State has requested the continuation of the Entire Project by the placement of beach and dune fill in the Sections 1B, 1A and 2A of the Moriches Inlet to Shinnecock Inlet Reach (hereinafter called the "Project"), the said area consisting of the previously constructed 15 groin field and a 9500ft section to the west of the groin field.

WHEREAS, the State hereby represents that it has the authority and capability to furnish the Non-Federal cooperation required by the Federal legislation authorizing the Entire Project and by other applicable laws;

NOW, THEREFORE, the parties agree as follows:

1. The State agrees that if, within two years of the date of this contract, the Government shall commence construction of the Project in accordance with existing Federal legislation authorizing such construction, the State shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of Non-Federal cooperation specified in such legislation, to wit:

a. The State for its share, will bear 30 percent of the first cost, including the value of lands easements, and rights-or-way, of the Entire Project, with the local cash contribution to be paid either in a lump sum prior to commencement of the Entire Project, or in installments prior to commencement of pertinent items including those of the Project, in accordance with the construction schedules as required by the Chief of Engineers. Final apportionment of costs will be made after actual costs and values have been determined;

b. The State will maintain and operate all the improvements and undertake periodic beach nourishment for the Entire Project after completion in accordance with regulations prescribed by the Secretary of the Army, which are attached hereto as Schedule "A", except that for a period of ten years after completion of a useful nourishment unit, the Government will contribute an amount now estimated at annually towards the said periodic beach nourishment in accordance with the authorizing House Document for the Entire Project dependent on conditions of public use and ownership and other changes at the time of construction;

c. The State willhold and save the United States free from damages due to the construction works of the Entire Project and periodic beach nourishment, except for for damages due to the fault or negligence of the United States or its contractors;

d. The State will maintain, during the economic life of the Entire Project, continued public ownership of the Non-Federal publicly-owned shores;

e. The State will adopt appropriate ordinances for the Entire Project to provide for the preservation of the dunes and their protective vegetation;

f. The State will control water pollution for the Entire Project to the extent necessary to safeguard the health of bathers;

g. With respect to the Project, the State, as cooperating agency, agrees to:

(1) The placement of beach and dune fill utilizing an offshore borrow site within the existing 15 groinfield area and an area 9500ft. to the west (Sections 1B, 1A and 2A). The dune will be constructed to an elevation of 16ft. above m.s.l. with a crest width of 40ft. Within the groinfield area, the top of the beach berm will be 14ft. above m.s.l. with a 100ft. width at that elevation. In the 9500ft. section west of the groinfield, the top of the beach berm will be 12ft. above m.s.l. with a 100-foot width at that elevation.

(2) The installation of sand fences and the planting of beach grass on the dune areas. Such work to constitute an increment of the Entire Project which extends from Fire Island Inlet to Montauk Point;

h. The State will bear 30 percent of the first cost, including lands, easements, and rights-of-way for its share of the beach and dune fill work of the Project to be initiated in FY 1981, with the local cash contribution to be paid either in a lump sum prior to commencement of the Project, or in installments prior to commencement of pertinent items, in accordance with the construction schedules as required by the Chief of Engineers. The State, upon request by the Government, will program its share of funds in succeeding fiscal years to continue this project (as an increment of the Entire Project) to completion. In addition, the State will program funds in the amount to be mutually determined for other work until the Entire Project is completed;

i. The Commissioner of the Department of Environmental Conservation agrees for the State of New York to contribute the full amount of any increase in Federal costs, if any, resulting from the separate construction of the beach and dune fill, sand fences, and the planting of beach grass;

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090
August 20, 2014

Reply to
Environmental Analysis Branch

Caroline D. Hall
Assistant Director
Federal Property Management Section
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, D.C. 20001-2637

Dear Ms. Hall:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

The Area of Potential Effect (APE) is identified as the area to be excavated for the placement o of the geotextile sand containers and the access areas for the trucks to fill the containers. Existing roads will be used to transport the sand to the site. There are no know historic properties within the Area of Potential Effect, although there are several properties that are potentially eligible within the APE, although none are located on the shoreline in the area for excavation. A review of information at the New York State Historic Preservation Office (NYSHPO) indicates the entire APE has been identified as archaeologically sensitive.

The District has determined that the proposed undertaking will not have an adverse effect on known potentially eligible, eligible or listed historic properties. The District has determined that the installation of the geotextile sand containers may have an adverse effect on archaeological resources that may be located within the placement area. To address this, the District has prepared a draft Programmatic Agreement outlining the process for monitoring the excavation to determine if any sites are present and to evaluate those sites, if identified, in coordination with the NYSHPO and the interested parties (Attachment 3).

As part of this undertaking, the District is initiating coordination and consultation with the Shinnecock Indian Nation, the Montauk Historical Society, the Suffolk County Historical Society and the Suffolk County Archaeological Association.

In accordance with 36 CFR 800.6.a.i, the District is notifying your office of its intent to execute a Programmatic Agreement and invites you to participate. Please review the attached information and draft Programmatic Agreement and provide your decision not later 20 September 2014. If you have any questions or need additional information, please contact Nancy J. Brighton, at (917) 790-8703 or Nancy.J.Brighton@usace.army.mil. Thank you for your assistance on this project.

Sincerely,

Nancy J. Brighton

Peter Weppler
Chief, Environmental Analysis Branch

Attachments

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090
August 20, 2014

Reply to
Environmental Analysis Branch

Ruth Pierpont
New York State Division for Historic Preservation
New York State Office of Parks, Recreation and Historic Preservation
Peebles Island State Park
PO Box 189
Waterford, New York 12188-0189

Dear Ms. Pierpont:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

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As part of this undertaking, the District is initiating coordination and consultation with the Shinnecock Indian Nation, the Montauk Historical Society, the Suffolk County Historical Society and the Suffolk County Archaeological Association.

Please review the attached information and draft Programmatic Agreement and provide comments in accordance with Section 106 of the National Historic Preservation Act, as amended (Attachment 3). If you have any questions or need additional information, please contact Nancy J. Brighton, at (917) 790-8703 or Nancy.J.Brighton@usace.army.mil. Thank you for your assistance on this project.

Sincerely,

Nancy J. Brighton
for Peter Weppler
Chief, Environmental Analysis Branch

Attachments

Cc: Eric Kuchar, Technical Assistance and Compliance Unit, Historic Sites Bureau, New York State Office of Parks, Recreation, and Historic Preservation
Brian Yates, Archaeology Unit, Historic Sites Bureau, New York State Office of Parks, Recreation, and Historic Preservation

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NEW YORK DISTRICT, CORPS OF ENGINEERS
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Reply to
Environmental Analysis Branch

Brian Yates
New York State Division for Historic Preservation
New York State Office of Parks, Recreation and Historic Preservation
Peebles Island State Park
PO Box 189
Waterford, New York 12188-0189

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Sincerely,

Nancy J. Brighton

Peter Weppler
Chief, Environmental Analysis Branch

Attachments

Cc: Eric Kuchar, Technical Assistance and Compliance Unit, Historic Sites Bureau, New York State Office of Parks, Recreation, and Historic Preservation

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Eric Kuchar
New York State Division for Historic Preservation
New York State Office of Parks, Recreation and Historic Preservation
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Waterford, New York 12188-0189

Dear Mr. Kuchar:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

The Area of Potential Effect (APE) is identified as the area to be excavated for the placement o of the geotextile sand containers and the access areas for the trucks to fill the containers. Existing roads will be used to transport the sand to the site. There are no know historic properties within the Area of Potential Effect, although there are several properties that are potentially eligible within the APE, although none are located on the shoreline in the area for excavation. A review of information at the New York State Historic Preservation Office (NYSHPO) indicates the entire APE has been identified as archaeologically sensitive.

The District has determined that the proposed undertaking will not have an adverse effect on known potentially eligible, eligible or listed historic properties. The District has determined that the installation of the geotextile sand containers may have an adverse effect on archaeological resources that may be located within the placement area. To address this, the District has prepared a draft Programmatic Agreement outlining the process for monitoring the excavation to determine if any sites are present and to evaluate those sites, if identified, in coordination with the NYSHPO and the interested parties (Attachment 3).

As part of this undertaking, the District is initiating coordination and consultation with the Shinnecock Indian Nation, the Montauk Historical Society, the Suffolk County Historical Society and the Suffolk County Archaeological Association.

Please review the attached information and draft Programmatic Agreement and provide comments in accordance with Section 106 of the National Historic Preservation Act, as amended (Attachment 3). If you have any questions or need additional information, please contact Nancy J. Brighton, at (917) 790-8703 or Nancy.J.Brighton@usace.army.mil. Thank you for your assistance on this project.

Sincerely,

Nancy J. Brighton for

Peter Weppler
Chief, Environmental Analysis Branch

Attachments

Cc: Brian Yates, Archaeology Unit, Historic Sites Bureau, New York State Office of Parks, Recreation, and Historic Preservation

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090
August 20, 2014

Reply to
Environmental Analysis Branch

Kathryn Nadeau
President
Montauk Historical Society
PO Box 943
Montauk, New York 11954

Dear Ms. Nadeau:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

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Please review the attached information and please respond if you want to be a concurring pary to this agreement. If you have any questions or need additional information, please contact Nancy J. Brighton, at (917) 790-8703 or Nancy.J.Brighton@usace.army.mil. Thank you for your assistance on this project.

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Chief, Environmental Analysis Branch

Attachments

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090
August 20, 2014

Reply to
Environmental Analysis Branch

Dr. Gaynell Stone
Suffolk County Archaeological Association
PO Box 1542
Stony Brook, New York 11790

Dear Dr. Stone:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

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Sincerely,

Nancy J. Brighton

Peter Weppler
Chief, Environmental Analysis Branch

Attachments

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090
August 20, 2014

Reply to
Environmental Analysis Branch

Kathryn M. Curran
Executive Director
Suffolk County Historical Society
300 West Main Street
Riverhead, New York 11901

Dear Ms. Curran:

The U.S. Army Corps of Engineers, New York District (District) has been conducting studies to develop coastal storm risk management alternatives along the southern coast of Long Island from Fire Island Inlet to Montauk Point (FIMP) for a number of years. As the result of damage caused by Hurricane Sandy in October 2012, the District is evaluating interim coastal storm risk management measures immediately along one segment of this overall study area within the Downtown Montauk area (Attachment 1). The proposed undertaking includes the construction of dune reinforcement consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Attachment 2). Sand used to fill the geotextile sand containers would be trucked to the site from upland sources and the containers would be filled prior to installation. The filled containers will be covered with a minimum of three feet of sand to reduce exposure, requiring the excavation of the beach along the extent of the placement area.

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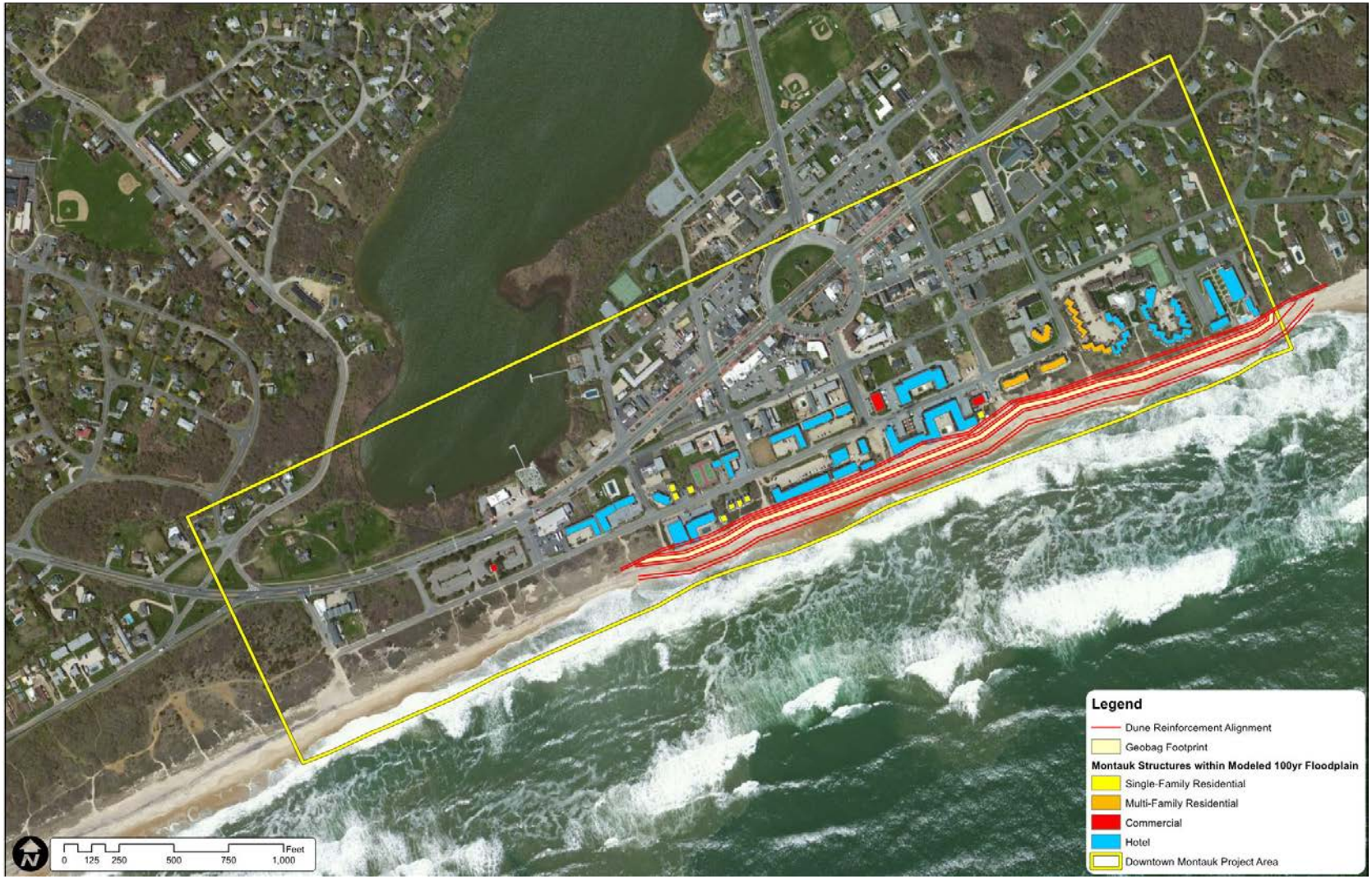
Sincerely,

Nancy J. Brighton
for Peter Weppler
Chief, Environmental Analysis Branch

Attachments



Attachment 1: Downtown Montauk Stabilization Project Area and Area of Potential Effect

DRAFT

- 10 foot Buffer
- Landward Limit of Fill
- Dune Crest
- Dune Toe
- Berm Crest
- Berm Toe
- Geobag Footprint
- MHW
- OSI Survey Monuments
- OSI Survey
- CEHA

N

0 50 100 200 Feet

Notes

1) Aerial Imagery collected by NOAA on November 14, 2012, as part of "Hurricane Sandy: Rapid Response Imagery of the Surrounding Regions".
2) Landward Limit of Fill is based on profile surveys collected by OSI on October 17, 2013.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

DRAWING TITLE:

Montauk
Dune Reinforcement

PLATE NO.
001

DATE:

FILE NAME:
Montauk Alternative 4.mxd

DRAFT

- 10 foot Buffer
- Landward Limit of Fill
- Dune Crest
- Dune Toe
- Berm Crest
- Berm Toe
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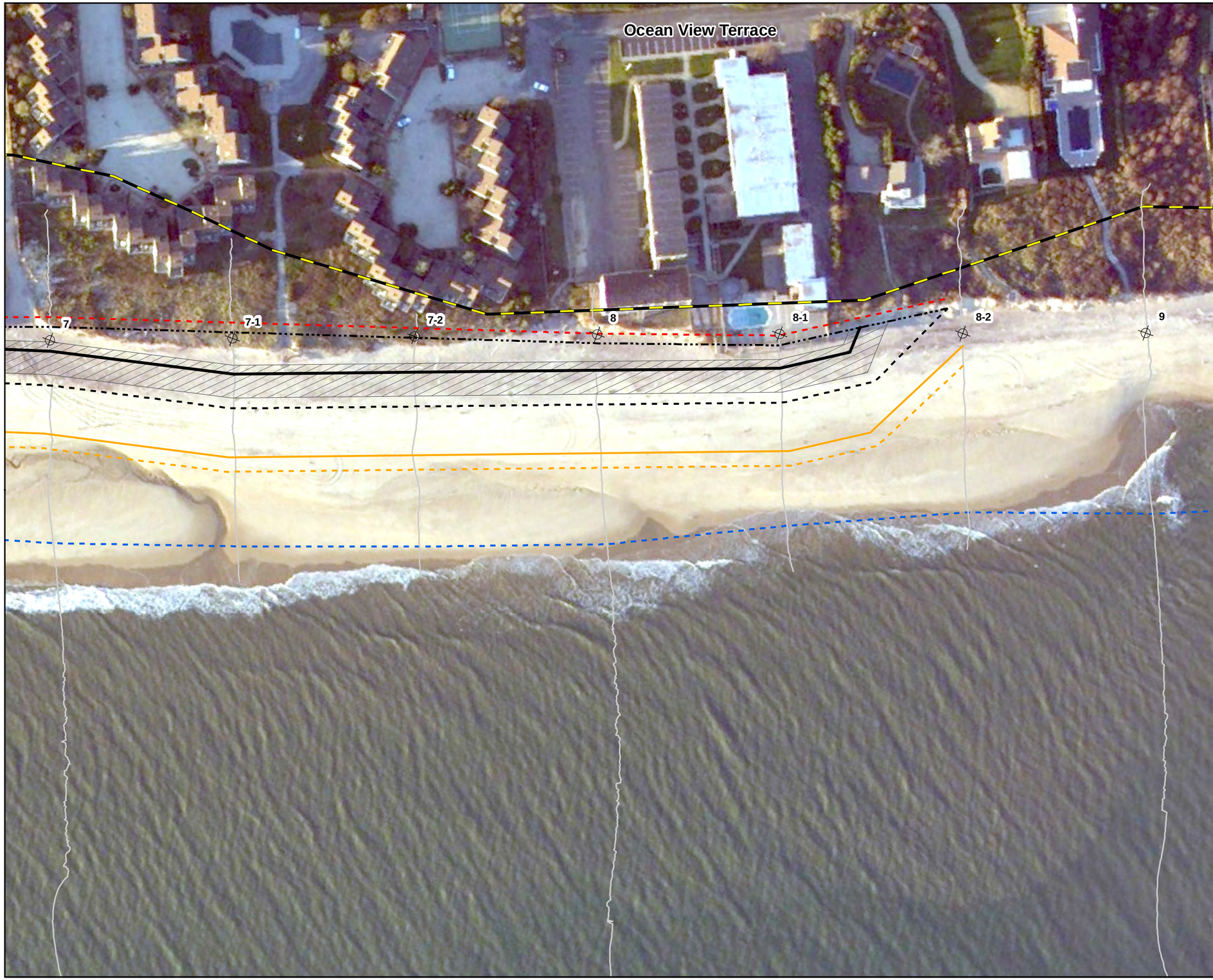
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

DRAWING TITLE:

Montauk
Dune Reinforcement

DATE:	FILE NAME:	PLATE NO.
	Montauk Alternative 4.mxd	002



DRAFT

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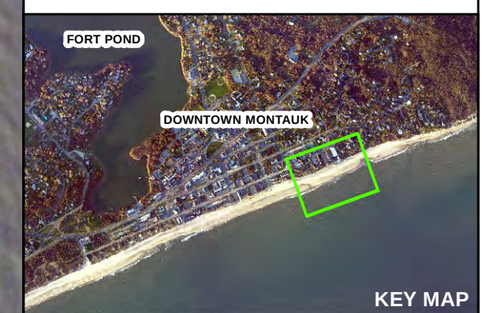


DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, NY 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT

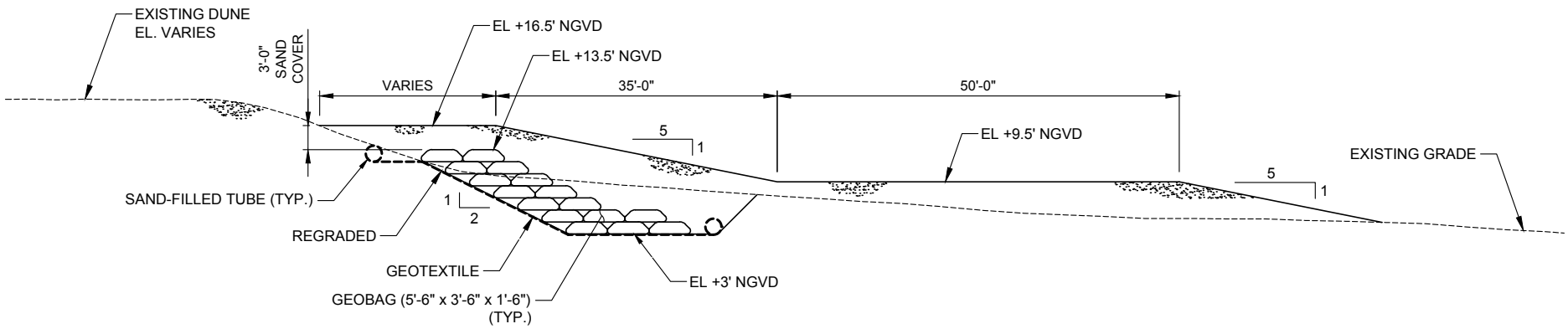
DRAWING TITLE:

Montauk
Dune Reinforcement

PLATE NO. **003**

DATE:

FILE NAME: Montauk Alternative 4.mxd



TYPICAL REINFORCED DUNE SECTION

SCALE: 1" = 20'-0"

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK

TYPICAL REINFORCED DUNE SECTION

DRAWING TITLE:

SHEET 1

10' 0' 10' 20'

SCALE: 1"=20'

JUNE/10/2014	TYPICAL SECTION - REINFORCED DUNE.dwg	PLATE NO.

DRAFT PROGRAMMATIC AGREEMENT
AMONG
THE U. S. ARMY CORPS OF ENGINEERS, NEWYORK DISTRICT,
THE NEW YORK STATE OFFICE OF PARKS, RECREATION,
AND HISTORIC PRESERVATION,
REGARDING
DOWNTOWN MONTAUK STABILIZATION PROJECT
MONTAUK, SUFFOLK COUNTY, NEW YORK

WHEREAS, the U. S. Army Corps of Engineers, New York District (District), is undertaking a storm damage reduction project that would address erosion that occurred during Hurricane Sandy and provide protection to Downtown Montauk, (Undertaking), Suffolk County, New York (Appendix A, Figure 1); and

WHEREAS, the District is proposing the construction of dune reinforcement, consisting of the installation of geotextile sand containers along 3,100 feet of shoreline (Appendix A, Figure 2). The filled geotextile sand containers will be covered with a minimum of three feet of sand to reduce the likelihood of exposure. The Undertaking requires approximately 45,083 cubic yards (cy) of sand that will be obtained from upland sources and transported to the site via trucks; and

WHEREAS, the Area of Potential Effect (APE) for the Undertaking is defined as Downtown Montauk, including the shoreline as indicated on Figure 1 (Appendix A); and

WHEREAS, there are no historic properties listed on the National Register of Historic Places within the APE, although there are several properties, including the Second House, that are potentially eligible for the National Register located within the APE; and

WHEREAS, a review of the information at the New York State Historic Preservation Office (NYSHPO) indicates the entire APE is mapped as an archaeologically sensitive area; and

WHEREAS the sand used in the geotextile sand containers will be obtained from a source that operates in compliance with the relevant State and Federal historic preservation regulations and guidelines; and

WHEREAS, the District has determined that the Undertaking will not have an adverse effect on potentially eligible historic structures within APE; and

WHEREAS, the District has determined that the installation of the geotextile sand containers may have an adverse effect on archaeological resources that may be located in the project area, if identified; and

WHEREAS, the District has consulted with the New York State Historic Preservation Office (NYSHPO) pursuant to 36 CFR Part 800, regulations implementing Section 106

of the National Historic Preservation Act (16 U.S.C. 470f); and

WHEREAS, the District has invited the Advisory Council on Historic Preservation, the Montauk Historical Society and the Shinnecock Indian Nation to be consulting parties;

NOW, THEREFORE, the New York District, and the NYSHPO agree that the undertaking shall be administered in accordance with the following stipulations to satisfy the District's Section 106 responsibility for this undertaking. The adverse effect caused as a result of this project will be mitigated through the following stipulations:

STIPULATIONS

The New York District shall ensure that the following measures are carried out:

A. The District shall monitor the excavation of the placement area for the geotextile sand containers. The monitoring will be conducted by a qualified archaeologist, meeting the *Secretary of the Interior Professional Qualifications Standards* (36 CFR 61), to document features, artifacts, etc., that may be located in the bluff below the Lighthouse and other contributing elements to NHL.

B. If any features are identified during the monitoring, work will stop in the area of the find to allow for its assessment and determination of significance. If the feature is determined to be eligible for the National Register of Historic Places, a treatment plan will be developed. The results of the assessment, determination of significance and treatment plan, if developed, will be coordinated with the NYSHPO and the consulting parties. The work stoppage will only occur in the area of the find; work activities not associated with the area of the find may continue.

C. As part of the assessment and, treatment plan, a determination regarding the retention and curation of any recovered artifacts will be made in consultation with the NYSHPO and any consulting parties.

D. Upon completion of all archaeological monitoring, a report detailing the activities conducted and the results of the archaeological monitoring will be prepared. The draft report will be provided to the NYSHPO and the consulting parties for their review. The NYSHPO and consulting parties shall have 30 calendar days to review and submit comments in writing to the District. If comments are not received in 30 calendar days, the District will assume concurrence with the report. The final report will be made available to the public and provided to the NYSHPO, Montauk Point Historical Society, and others.

E. All work will be conducted in accordance with the New York Archaeological Council *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* (1994) and *Monitoring Guidelines* (2002) and the *US Army Corps of Engineers Safety and Health Requirements* (EM 385-1-1 2008).

II. ADMINISTRATIVE TERMS

A. UNANTICIPATED DISCOVERY

During the construction of this project, the District will treat unanticipated discoveries in a manner that is in accordance with 36 CFR Part 800.13 "Post Review Discoveries" and in the case of the discovery of human remains, treatment shall follow the "Human Remains Discovery Protocol" of the New York State Office of Parks, Recreation and Historic Preservation. The District shall cease work in the vicinity of the discovery until it can be evaluated and if determined to be eligible the District shall consult with the NYSHPO, and others as necessary, to develop a treatment plan. The District shall implement the treatment plan once approved by the NYSHPO, and others as necessary.

B. HUMAN REMAINS

If any human remains and/or grave-associated artifacts are encountered during construction, the District will follow the NYSHPO Human Remains Discovery Protocol (2008; Appendix B) and, as appropriate, develop a treatment plan for human remains that is responsive to the Advisory Council's "Policy Statement on Human Remains" (September 27, 1988), the Native American Graves Protection and Repatriation Act (PL 101-601) and, US Army Corps of Engineers, Policy Guidance Letter No. 57 (1998) Indian Sovereignty and Government-to-Government Relations with Indian Tribes. Any identification of human remains during monitoring and/or construction will be coordinated with the NYSHPO and Shinnecock Indian Nation.

B. TERMINATION

Any signatory to this PA may terminate it by providing 30 days written notice to the other parties, provided that the parties will consult during the period prior to termination by certified mail to seek agreement on amendments or other actions that would avoid termination.

C. SUNSET CLAUSE

This PA will continue in full force and effect until the construction of the Undertaking is complete and all terms of this PA are met, unless the Undertaking is terminated or authorization is rescinded or a period of five years from the execution of this PA has passed, at which time the agreement may be extended as written provided all signatories concur.

D. AMENDMENT

This PA may be amended upon agreement in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the Advisory Council on Historic Preservation.

E. ANTI-DEFICIENCY ACT

All requirements set forth in this PA requiring expenditure of funds by the District are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 U.S.C. 1341). No obligation undertaken by the District under the terms of this PA shall require or be interpreted to require a commitment to extend funds not appropriated for a particular purpose. If the District cannot perform any obligation set forth in this PA because of unavailability of funds, that obligation must be renegotiated among the District, the NYSHPO, and the consulting parties, as necessary.

F. DISPUTE RESOLUTION

Should the signatories to this agreement object at any time to any actions proposed or the manner in which the terms of this PA are implemented, the District shall consult with the signatories to resolve the objection. If the District determines that such objection cannot be resolved, the District will:

1. Forward all documentation relevant to the dispute, including the District's proposed resolution, to the Council. The Council shall provide the District with its advice on the resolution of the objection within 30 calendar days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the District shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the Council, signatories and concurring parties, and provide them with a copy of this written response. The District will then proceed according to its final decision.

2. If the Council does not provide its advice regarding the dispute within the 30 calendar day time period, the District may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the District shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the PA, and provide them and the Council with a copy of such written response.

3. The District's responsibilities to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

Execution and implementation of this PA evidences that the District has satisfied its Section 106 responsibilities for all individual undertakings of the Project, and that the New York District has afforded the NYSHPO an opportunity to comment on the undertaking and its effects on historic properties.

PROGRAMMATIC AGREEMENT
AMONG
THE U. S. ARMY CORPS OF ENGINEERS, NEWYORK DISTRICT,
THE NEW YORK STATE OFFICE OF PARKS, RECREATION,
AND HISTORIC PRESERVATION,
REGARDING
DOWNTOWN MONTAUK STABILIZATION PROJECT
MONTAUK, SUFFOLK COUNTY, NEW YORK

By: _____ Date: _____
U.S. ARMY CORPS OF ENGINEERS

PROGRAMMATIC AGREEMENT
AMONG
THE U. S. ARMY CORPS OF ENGINEERS, NEWYORK DISTRICT,
THE NEW YORK STATE OFFICE OF PARKS, RECREATION,
AND HISTORIC PRESERVATION,
REGARDING
DOWNTOWN MONTAUK STABILIZATION PROJECT
MONTAUK, SUFFOLK COUNTY, NEW YORK

By: _____ Date: _____
NEW YORK STATE OFFICE OF PARKS, RECREATION AND HISTORIC PRESERVATION

APPENDIX A – FIGURES

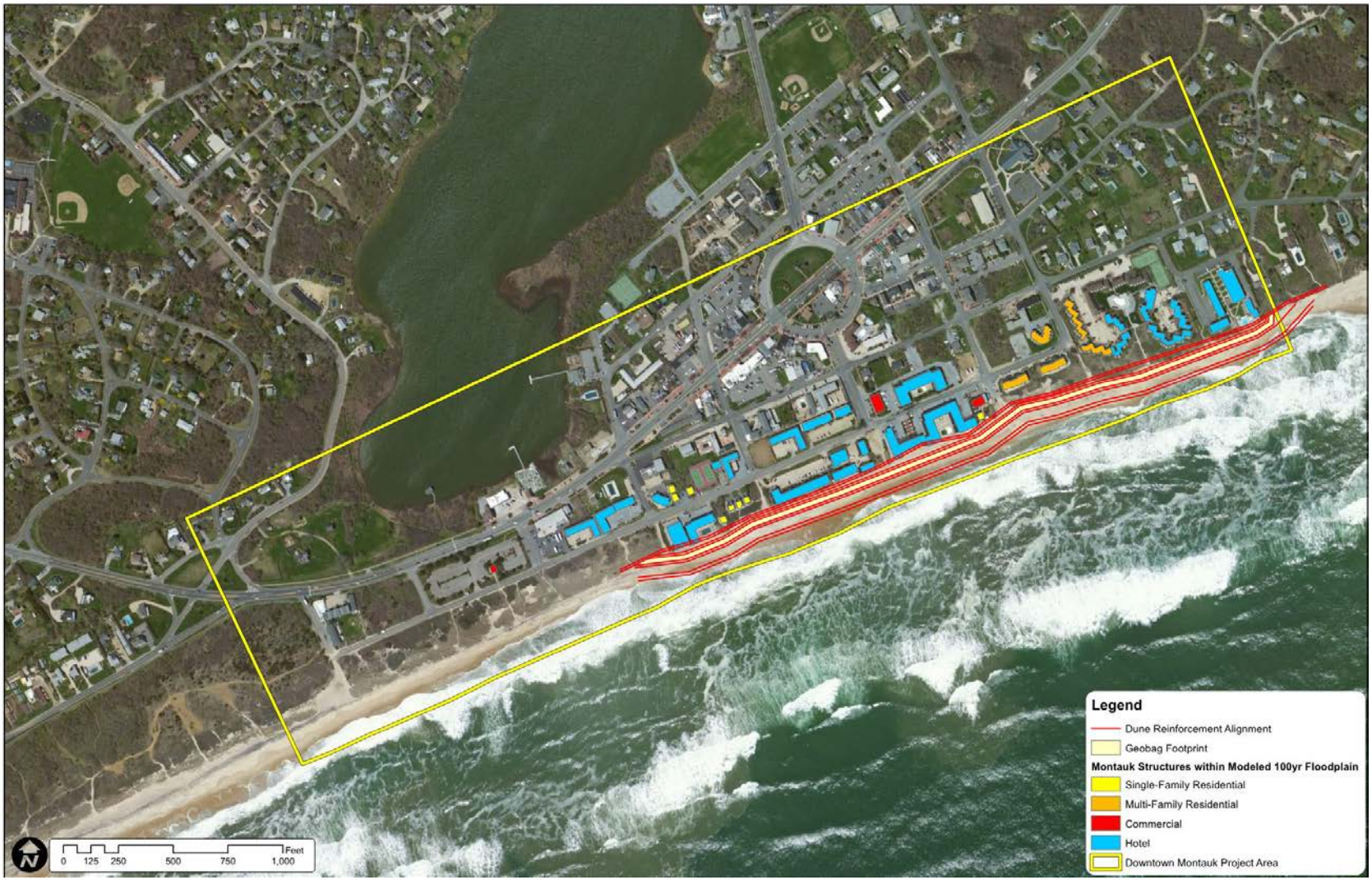


Figure 1: Downtown Montauk Stabilization Project Area and Area of Potential Effect

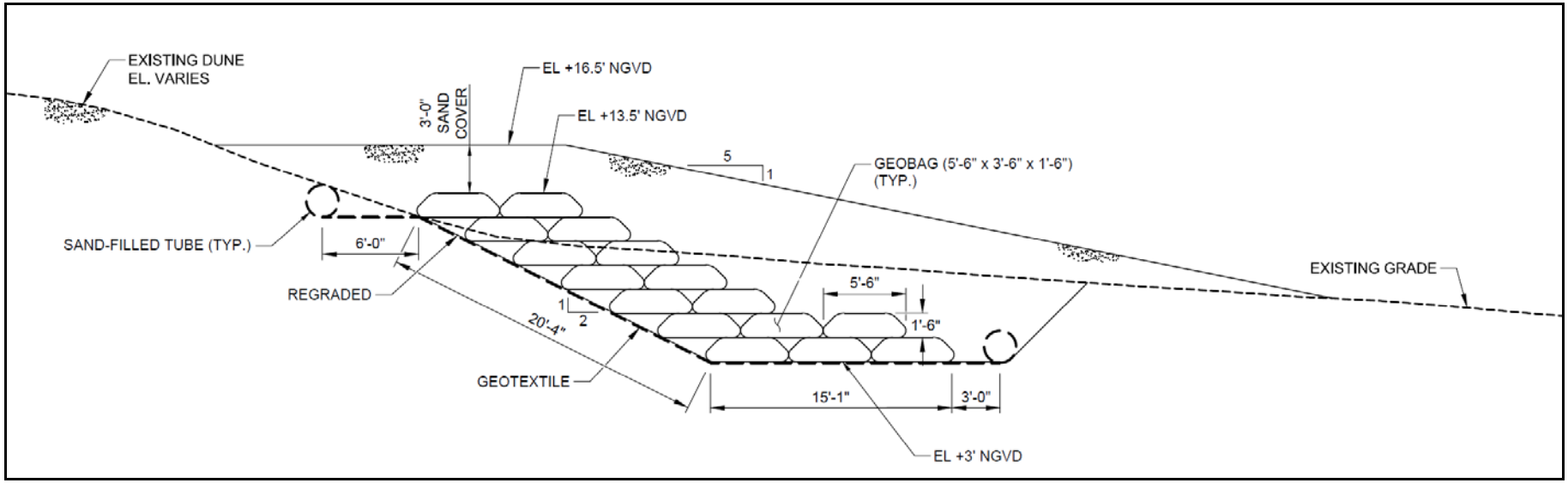


Figure 2: Reinforced Dune Typical Section, Downtown Montauk Stabilization Project

Figure 3: Area o f Potential Effect, Montauk Point Storm Damage Reduction Project

Figure 4: Photograph of the Montauk Point Lighthouse National Historic Landmark showing the Lighthouse, WWII Fire Control Tower, Keeper's House, Garage/Former Keeper's House, Oil House, and Bluff as well as the existing stone revetment

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

June 14, 2013

Colonel Paul E. Owen
District Commander
United States Army Corps of Engineers
New York District
26 Federal Plaza
Room 2109
New York, NY 10278

Dear Colonel Owen:

I am pleased to inform you that New York State supports implementation of the fully federally funded Fire Island to Montauk Point (FIMP) project, including the United States Army Corps of Engineers' (Corps) proposal to expedite the implementation of elements of FIMP, such as the immediate restoration of dunes and beaches damaged by Hurricane Sandy on Fire Island and downtown Montauk. This support is based on the overall concepts of the FIMP project subject to the items further described in this letter.

On March 11, 2011, representatives of the Corps and the United States Department of Interior sent a letter to me outlining the potential plan of improvement for the Fire Island to Montauk Point ("FIMP") Reformulation Study. This "Tentative Federal Supported Plan" ("TFSP") was proposed as the basis to move forward with Reformulation Study efforts for the entire FIMP study area – encompassing approximately 83 miles of Atlantic Ocean coastal and bay areas of Suffolk County, New York. As noted in the federal letter, New York State must find the general plan of improvement acceptable before its attributes can be finalized through a collaborative process. New York's approval at this stage, I understand, would allow the Corps and State to move forward with a final analysis of the TFSP, including such matters as plan formulation, engineering, economics, environmental assessment, model certifications and formal agency policy-level approvals.

After a series of discussions, on December 29, 2011, DEC sent a letter to the Army Corps presenting information requests aimed at better understanding some of the basic elements of the TFSP so that DEC would be in a position to accurately explain project elements, costs, maintenance obligations and impacts of the TFSP to the required local community sponsor(s). While further discussions were taking place, Hurricane Sandy arrived – altering the physical and fiscal landscape in a variety of ways. On May 16, 2013 the Corps responded to the Department's letter which addressed a number of the concerns raised by the Department, but deferred a response on a few issues that are currently under review based on the impacts from Sandy.

I understand that alternative components of the TFSP are now being further refined, including: breach response measures along the barrier island, including "advanced" breach response methods or protocols; inlet management, beach and dune fill components and alignments with on-going beach nourishment; structural groin modifications; resiliency measures, including a significant number of coastal community building elevations; road elevations; land and development management to limit new development in certain flood hazard areas; protective natural infrastructure features (including wetland complexes, living shorelines, shellfish reefs, dunes, ecologically friendly in-bay breakwaters, and marsh islands) and environmental restoration, particularly in south shore bay areas.

All of the above elements would be sharpened in a process that fully involves local stakeholders. As you have emphasized, this massive project would need to be finalized in a manner that takes into account increased storm surge intensity associated with climate change and sea level rise. It is understood that the Corps will be performing an environmental impact review process under the National Environmental Policy Act (NEPA) for the entire FIMP project and that the National Park Service is evaluating the need for a NEPA review with respect to the existing breach in the Wilderness Area of the Fire Island National Seashore. It is through these processes that the elements of the project will be fully analyzed and a final FIMP project will be fully defined.

The State also supports the Corps' review of the post Sandy dune re-alignment along Fire Island that may be necessary based on the Corps' cost to benefit analysis that is still underway. If the cost to benefit analysis indicates that the alignment should be moved north in order to make the project more economical, resilient, and sustainable over the 50-year period of the project, then the State would support this realignment. If the realignment requires the purchase of properties, then the State would request that the Corps minimize the scope of this activity to the extent possible for unwilling sellers and to perform the procurement of these properties for the State at full federal expense. The State awaits the Corps' submittal of the elements of the project that you are currently working on, as delineated in your May 16, 2013 response. Thank you for all of your good and continuing efforts to help New York rebuild smarter and stronger in the face of the challenges presented by Hurricane Sandy.

Sincerely,

Joseph J. Martens

c: Mr. Joseph Vietri