APPENDIX B

ENDANGERED SPECIES ACT COMPLIANCE

APPENDIX B1

USFWS Biological Assessment (April 2018)

Final Biological Assessment
Fire Island Inlet to Montauk Point Coastal Storm Risk Management
Suffolk County, New York

Prepared and submitted by: U.S. Fish and Wildlife Service, Chesapeake Bay Field Office and
U.S. Army Corps of Engineers, New York District

April 1, 2018

April 2018

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1. Executive Summary

Introduction

The U.S. Army Corps of Engineers, New York District (Corps) is proposing approximately 83 miles of coastal storm risk management for the south shore of Long Island, New York from Fire Island Inlet to Montauk Point. The proposed project includes a combination of: (1) inlet modifications (continuation and expansion of authorized navigation projects at Fire Island, Moriches, and Shinnecock Inlets; including dredging, downdrift placement or dredged material, placement of berm, and monitoring); 2) non-structural measures (primarily building retrofits, with limited relocations and buy-outs); (3) breach response for barrier islands; (4) beach and dune fill with renourishment: up to 30 years, approximately every 4 years; (5) sediment management; (6) groin modifications; (7) coastal process features; and (8) monitoring and adaptive management. This project will utilize approximately 6.44 million cubic yards of beach fill for construction of dunes, berms and sand bypassing and will occur over the next 30 years. After 30 years, the Federal and non-Federal commitment would transition to Inlet Management and Breach Response Plan for the remainder of the 50 years.

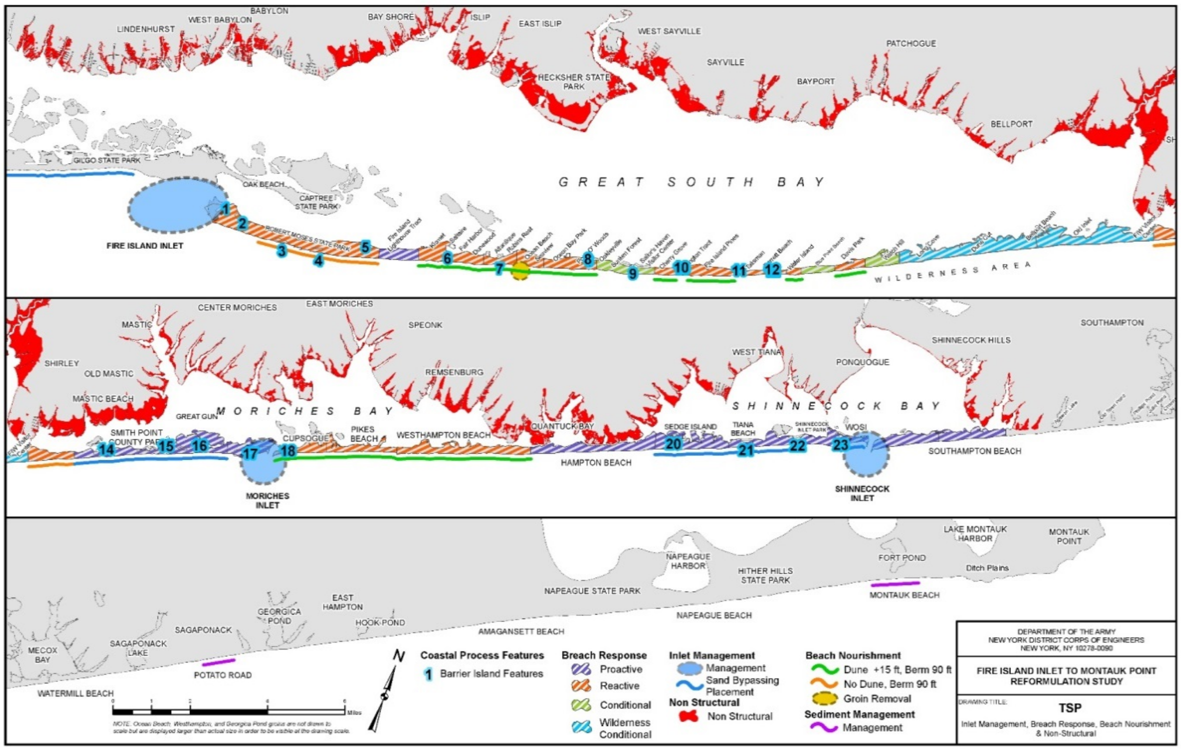
The Corps in consultation with the U.S. Fish and Wildlife Service (Service) evaluated effects of the project on four federally-listed species for this Biological Assessment (BA) which is summarized in the effects determination table below. The project as "proposed" "may effect, and is likely to adversely affect (LAA)" the federally-listed piping plover (*Charadrius melodius;* threatened) and seabeach amaranth (*Amaranth pumilis*; threatened). The project is "not likely to adversely affect (NLAA)" red knot (*Calidrus canutus rufa;* threatened). Although small numbers of red knot forage in the project area during spring and fall migration, and beach nourishment may diminish or reduce the diversity of prey items on the beach, there is sufficient foraging area in the entire project area. If construction occurs during the time of year that red knot are migrating through the area (September-November), birds could be flushed out of the construction area but there is enough shoreline where construction will not be occurring that the birds can utilize, since construction will not occur in more than three miles of shoreline at one time. The roseate tern (*Sterna dougallii dougallii*) has occasionally been historically observed roosting and breeding on Fire Island and breeding on the islands within the back bays (Great South, Moriches and Shinnecock Bays). However, no nesting activity of roseate terns has been documented in the action area. Based on the project description and conservation measures, adverse impacts to the roseate tern are not anticipated from the proposed project, therefore, there is no effect to roseate tern.

Species Table and Effect Determination

SPECIES	LISTING STATUS	DETERMINATION
Piping plover (*Charadrius melodius*)	Threatened	LAA
Roseate tern (*Sterna dougallii dougallii*)	Endangered	No effect
Seabeach amaranth (*Amaranthus pumilus*)	Threatened	LAA
Red knot (*Calidrus canutus rufa*)	Threatened	NLAA

2. Project Description

Location:



Action Area: The "action area" is defined as all areas to be affected directly or indirectly by the proposed Federal action. The action area includes all the areas identified on the above map (the Atlantic Ocean and bay shorelines from Fire Island to Montauk Point, including ocean beaches, intertidal areas, interdunal areas, and bay side habitats). The action area includes sand placement sites and adjacent areas where sand deposition is not proposed. These additional areas are included in the action area because of the potential for indirect effects (those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur) from littoral drift of sediments from the renourished reaches and thus, changes to the downdrift beaches in unnourished reaches. Since there are locations in the action area where sand is not being placed that will also be considered in the effects analysis.

Proposed Action:

The proposed action includes dredging of offshore borrow areas, navigation/dredging/sand bypassing activities at Fire Island, Moriches, and Shinnecock Inlets; non-structural building retrofits, flood proofing, relocation, acquisition,; beach and dune fill, berms, and breach response (see tables 1 and 2).

A beach and dune fill area would occur along the developed portions of the Atlantic Ocean shoreline from Fire Island Inlet through Moriches Inlet, and National Park Service's Lighthouse Tract. There will also be fill placed West of Shinnecock Inlet (WOSI) and at Westhampton. The total initial fill for the proposed action is approximately 6.44 million cubic yards. A 30-year commitment of Federal and non-Federal renourishment is proposed. After 30 years, the Federal and non-Federal commitment would transition to a Breach Response Plan (BRP) for the remainder of the 50 years. After 30 years and up to 50 years a Breach Response Plan (BRP) will be implemented.

Inlet Management: involves the continuation of authorized navigation projects, and scheduled Operations and Maintenance (O&M) dredging with beneficial reuse of sediment at Fire Island, Moriches and Shinnecock Inlets. There will be additional dredging of 73,000 to 379,000 cubic yards from the ebb shoals of each inlet, outside of the navigation channel, with downdrift placement undertaken in conjunction with scheduled O&M dredging of the inlets. There will be placement of sand in a berm template, as needed in identified placement areas. There will be monitoring to facilitate adaptive management changes in the future to determine if changes in the volume, changes in the frequency, changes in the dredging or disposal location are required to effectively reestablish the alongshore transport.

The mainland non-structural component: addresses approximately 4,134 structures within the 10 year flood plain using nonstructural measures, primarily through building retrofits, with limited relocations and buy-outs, based upon structure type and condition. It also includes localized acquisition in areas subject to high frequency flooding, and reestablishment of flood plain function.

Barrier Islands Beach and Dune Fill: provides for a continuous 90 ft. width berm and +15 ft. dune along the developed shorefront areas fronting Great South Bay and Moriches Bay on Fire Island and Westhampton barrier islands. On Fire Island the alignment follows the post-Sandy optimized alignment (middle alignment) that includes overfill in the developed locations and minimizes tapers into Federal tracts. Renourishment is scheduled for 30 years, as needed, generally every 4 years. In areas of beachfill, proactive breach response will be undertaken from years 31 to 50.

Barrier Islands Breach Response: Proactive Breach Response which is a response plan which is triggered when the beach and dune are lowered below a 25 year design level of risk management and provides for restoration to the design condition (+13 ft. NGVD dune and 90 ft. berm). This plan will be utilized on Fire Island in the Lighthouse Tract, Smith Point County Park East (to supplement the sand bypassing when needed), and Smith Point County Park West and also on the Westhampton barrier island fronting Shinnecock Bay.

Reactive Breach Response is a response plan which is triggered when a breach has occurred (e.g., the condition where there is an exchange of ocean and bay water during normal tidal conditions). It will be utilized as needed when a breach occurs, in locations that receive beach and dune placement. Reactive breach response is also recommended in additional locations where there is agreement that a breach should be closed quickly, including locations within Robert Moses State Park, and the Talisman Federal tract, with a closure template consisting of a berm at elevation +9.5 ft. NGVD.

Conditional Breach Response which is a response plan that applies to the large, Federally-owned tracts within Fire Island National Seashore, where the breach closure team determines whether or not the breach is closing naturally, and if it is not found to be closing, closure begins on day 60. Conditional Breach closure provides for a 90 ft. wide berm at elevation +9.5 ft. NGVD only.

Wilderness Conditional Breach Response which is a response plan that applies to the Wilderness area within Fire Island National Seashore, where the breach closure team determines whether a breach should be closed, based upon whether or not the breach is closing naturally and whether the breach is likely to cause significant damage. Conditional Breach closure provides for a 90 ft. wide berm at elevation +9.5 ft. NGVD only.

Sediment Management at Downtown Montauk (Montauk Beach) and Potato Road: In Downtown Montauk, the plan includes the placement of approximately 600,000 CY of sand during initial construction, and the placement of approximately 400,000 CY of sand on the front face of the existing berm approximately every 4 years as advance fill to offset erosion at Downtown Montauk. The plan in Downtown Montauk is to maintain the existing berm width of 40 ft.

At Potato Road, the plan includes the placement of approximately 120,000 CY of sand on the front face of the existing berm on average, every 4 years as advance fill to offset erosion at Potato Road. The Potato Road feeder beach is contingent upon implementation of a local pond opening management plan for Georgica Pond to ensure these efforts are not negatively impacting the feeder beach design. These features will be adaptively managed to ensure the volume of sediment placed, and placement configuration is accomplishing the design objectives of offsetting the long-term erosion.

Groin Modifications: Involves monitoring existing Westhampton groins (1-13) to reaffirm the functioning of the groins; removal of the existing Ocean Beach groins (relocation of Ocean Beach Water Supply presently underway, which reduces the need for these structures); and continued monitoring of the Georgica groins to reaffirm the functioning of the groins.

Coastal Process Features: Twenty one (21) locations for coastal process features (CPF's) along the bayside shoreline are proposed with the goal of reestablishing the coastal processes that are reduced by the placement of sediment along the Atlantic Coast to provide Coastal Storm Risk Management (CSRM)(see Table 3).

CPFs currently include: Features which compensate for impacts to Alongshore Transport (Groin modification or shortening, sand bypassing, sediment management.); features which compensate for reductions in Cross-Island Transport (Overwash fan and bay beach creation or reinforcement.); features which compensate for sediment loss to the bay or Bay Shoreline Processes by establishing resilient and sustainable uplands.

The purpose of the CPFs is to bolster the CSRM functions provided by natural coastal landforms and complement the FIMP risk management features. Damages in the FIMP study area are calculated by projecting the degree of flooding that will occur on the mainland of Long Island due to breaching and overwash of the barrier island. Risk management measures, such as berms and dunes constructed on the ocean coastline, are proposed to reduce breaching and overwash. The intent of the CPFs are to complement these measures, by adding volume to the bay side of the barrier system. Judicious siting of CPFs will help address inhibition of 'barrier island rollover resulting from the project.' Rollover is the gradual movement in geologic time of a barrier island as sediment is eroded from the ocean coast and transported by overwash and breaching to the bay shore. The rollover process contributes to barrier island integrity and robustness and supports the natural CSRM functions provided by healthy barrier island systems. Without CPFs, the FIMP risk management features would reduce the amount of sediment that enters the back bay environment, interrupting the rollover process and resulting in the degradation of the barrier island's natural CSRM functions. Therefore, CPFs are recommended along the back bay coast to help maintain the long-term sustainability of the barrier island system and reduce vulnerability of the barrier island to breaching, which will reduce water levels within the bay, and the resulting flooding.

Placement of approximately 4.7M CY of sediment in the backbay environment, and the resulting habitat is necessary to satisfy the mutually acceptable requirement of "no net loss" of sediment transport into the back bay. The CSRM features proposed to reduce risk along the shoreline will reduce the frequency of overwash and breaching, which naturally transports sediment into the back bay.

All CPF's will be constructed in conjunction with the construction of the project, and associated renourishment when the beachfill features are renourished, currently proposed as a 4 year cycle.

The restoration framework identified 5 key physical processes to be targeted for restoration, including 1) alongshore transport, 2) cross-island transport, 3) dune growth and evolution, 4) bay shoreline processes, and 5) estuarine circulation and water quality. A summary of the candidate projects, their status, and whether they are intended to address endangered species, coastal process features, or both are described in Table 3. A more detailed description of each project is included in Appendix A.

Monitoring and Adaptive Management: Will provide for physical, environmental, biological, and performance monitoring and the ability to adjust specific project features including CPFs to improve effectiveness and respond to changed conditions. 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. The monitoring plan guides applicable metrics and modeling tools to assess project feature performance in comparison to specific project feature goals.

Table 1. FIMP TSP Shorefront Reach Features, Fire Island Inlet to Moriches Inlet.

FIMP TENTATIVELY SELECTED PLAN - SHORELINE REACH FEATURES									
Reach Designations					**TFSP Description**				
Project Reach	**Design Reach**	**Design Subreach**	**Reach Name**	**Reach Length (ft)**	**Proposed Plan**	**Cross Section**	**CPF**	**ESA**	**Lifecycle Response**
			Fire Island Inlet and Gilgo Beach		Inlet Dredging and bypassing (FI)	+9.5 ft berm section			bypassing, 2 yr cycle, 50 yrs
GSB	GSB-1	1A	Robert Moses State Park - West	6,700	Reactive Breach Response	+9.5 ft closure section		Y	Reactive Closure, 50 yrs
		1A	Robert Moses State Park - East	19,000	Beach, no Dune, Renourishment	90 ft wide beach		Y	renourishment for 30 years, Proactive BR 30 -50
		1B	FI Lighthouse Tract	6,700	Proactive Breach Response	+13 ft dune, 90 ft wide berm			Proactive and Reactive BR, 50 yrs
	GSB-2	2A	Kismet to Lonelyville	8,900	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm	Y		renourishment for 30 years, Proactive BR 30 -50
		2B	Town Beach to Corneille Estates	5,100	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm	Y		renourishment for 30 years, Proactive BR 30 -50
		2C	Ocean Beach & Seaview	3,800	Beach, Dune, Renourish, Groin Removal	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		2D	OBP to Point O' Woods	7,400	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm	Y		renourishment for 30 years, Proactive BR 30 -50
		2E	Sailors Haven	8,100	Conditional Breach Response	+9.5 ft closure section	Y		Conditional Closure, 50 yrs
	GSB-3	3A	Cherry Grove	3,000	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		3B	Carrington Tract	1,500	Conditional Breach Response	+9.5 ft closure section			Conditional Closure, 50 yrs
		3C	Fire Island Pines	6,600	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		3D	Talisman to Water Island	7,300	Reactive Breach Response	+9.5 ft closure section	Y		Reactive Closure, 50 yrs
		3E	Water Island	2,000	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		3F	Water Island to Davis Park	4,700	Conditional Breach Response	+9.5 ft closure section	Y		Conditional Closure, 50 yrs
		3G	Davis Park	4,100	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		3H	Watch Hill	5,000	Conditional Breach Response	+9.5 ft closure section			Conditional Closure, 50 yrs
	GSB-4	4A	Wilderness Area - West	19,000	Conditional Breach Response	+9.5 ft closure section			Wilderness Conditional Closure, 50 yrs
		4B	Old Inlet	16,000	Conditional Breach Response	+9.5 ft closure section			Wilderness Conditional Closure, 50 yrs
MB	MB-1	1A	Smith Point CP- West	6,300	Beach, and Renourishment	90 ft wide beach			renourishment for 30 years, Proactive BR 30 -50
		1B	Smith Point CP - East	13,500	Proactive Breach Response, sand bypassing	+13 ft dune, 90 ft wide berm	Y	Y	sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
	MB-2	2A	Great Gun	7,600	Proactive Breach Response, sand bypassing	+13 ft dune, 90 ft wide berm	Y	Y	sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
		2B	Moriches Inlet - West	6,200	Proactive Breach Response	+13 ft dune, 90 ft wide berm	Y	Y	proactive and reactive BR, 50 yrs
			Moriches Inlet		Inlet Bypassing				bypassing, 2 yr cycle, 50 yrs
		2C	Cupsogue Co Park	7,500	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm	Y	Y	renourishment for 30 years, Proactive BR 30 -50
		2D	Pikes	9,700	Beach, Dune and Renourishment	+15 ft dune, 90 ft wide berm		Y	renourishment for 30 years, Proactive BR 30 -50
		2E	Westhampton	18,300	Beach, Dune, Renourishment	+15 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
SB	SB-1	1A	Hampton Beach	16,800	Proactive Breach Response	+13 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		1B	Sedge Island	10,200	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
		1C	Tiana Beach	3,400	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
		1D	Shinnecock Inlet Park West	6,300	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
	SB-2	2A	Ponquogue	5,300	Proactive Breach Response	+13 ft dune, 90 ft wide berm			proactive and reactive BR, 50 yrs
		2B	WOSI	3,900	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs

Table 2. FIMP TSP Shorefront Features-Hampton Beach to Montauk Point.

FIMP TENTATIVELY SELECTED PLAN - SHORELINE REACH FEATURES									
Reach Designations					TFSP Description				
Project Reach	Design Reach	Design Subreach	Reach Name	Reach Length (ft)	Proposed Plan	Cross Section	CPF	ESA	Lifecycle Response
SB	SB-1	1A	Hampton Beach	16,800	Proactive Breach Response	+13 ft dune, 90 ft wide berm			renourishment for 30 years, Proactive BR 30 -50
		1B	Sedge Island	10,200	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
		1C	Tiana Beach	3,400	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
		1D	Shinnecock Inlet Park West	6,300	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
	SB-2	2A	Ponquogue	5,300	Proactive Breach Response	+13 ft dune, 90 ft wide berm			proactive and reactive BR, 50 yrs
		2B	WOSI	3,900	Proactive Breach Response, bypassing	+13 ft dune, 90 ft wide berm	Y		sand bypassing placement, 2 yr cycle, 50 yrs; proactive and reactive BR, 50 yrs
Shinnecock Inlet					Inlet Dredging and bypassing				bypassing, 2 yr cycle, 50 yrs
	SB-3	2C	Shinnecock Inlet - East	9,800	Proactive Breach Response	+13 ft dune, 90 ft wide berm			proactive and reactive BR, 50 yrs
		3A	Southampton Beach	9,200	Proactive Breach Response	+13 ft dune, 90 ft wide berm			proactive and reactive BR, 50 yrs
		3B	Southampton	5,300	No Federal Action				
		3C	Agawam	3,800	No Federal Action				
P	P-1	1A	Wickapogue	7,700	No Federal Action				
		1B	Watermill	8,800	No Federal Action				
		1C	Mecox Bay	1,400	No Federal Action				
		1D	Mecox to Sagaponack	10,400	No Federal Action				
		1E	Sagaponack Lake	1,100	No Federal Action				
		1F	Sagaponack to Potato Rd	9,300	No Federal Action				
		1G	Potato Rd	4,300	Sediment Management, Pond Management Plan	+9.5 ft beach			Sediment Management features, 4 yr cycle 30 yrs
		1H	Wainscott	4,600	No Federal Action				
		1I	Georgica Pond	1,200	No Federal Action				
		1J	Georgica to Hook Pond	11,200	No Federal Action				
		1K	Hook Pond	1,100	No Federal Action				
		1L	Hook Pond to Amagansett	19,200	No Federal Action				
M	M-1	1A	Amagansett	10,400	No Federal Action				
		1B	Napeague State Park	9,100	No Federal Action				
		1C	Napeague Beach	9,900	No Federal Action				
		1D	Hither Hills SP	7,000	No Federal Action				
		1E	Hither Hills to Montauk B	15,800	No Federal Action				
		1F	Montauk Beach	4,700	Sediment Management	+9.5 ft beach			Continuation and refinement of Stabilization Project (Major Rehab); Sediment Management features, 4 yr cycle 30 yrs
		1G	Montauk B to Ditch Plains	4,700	No Federal Action				
		1H	Ditch Plains	3,400	No Federal Action				
		1I	Ditch Plains to Montauk Pt	19,300	No Federal Action				

Note: Each reach has been identified with the proposed actions. In locations where Federal action is recommended, the lifecycle management has been identified.

Site #	Type	Status	source	Coastal Process Features	Location	Measure	Action	Status
	Summary of Candidate Environmental Sites							
1	ESA	Landowner support	New	Democrat Point - west of Jetty	Robert Moses State Park	veg management / pond opening	design	RMSP supports plan features, concerned about: 1) attracting more boaters (channel opening), destabilizing the area, maintenance requirements for the park.
2	ESA	Landowner support	New	Democrat Point - bayside, east of jetty	Robert Moses State Park	maintain plover habitat	design	RMSP supports a plan for this area
3	ESA	Landowner support	New	Dunefield east of Field 2, between 2/3	Robert Moses State Park	maintain plover habitat	design	RMSP believes no action required now, would support future deveg. Concerned about maintenance requirements
4	ESA	No landowner support	New	Dunefield west of field 4	Robert Moses State Park	maintain plover habitat	stop	RMSP does not believe this location provides viable habitat
5	Mitigation	Not Supported in FIMP	New	Wetland North of Field 5	Robert Moses State Park	Reestablish wetland function	stop	RMSP supports, but believes effort would be large
6	CPF	Support	New	Clam Pond	Saltaire	reestablish spit	design	understanding is that Saltaire supports. Is confirmation necessary?
7	CPF	Support	Existing	T25 Atlantique to Corneille	Atlantique	bayside beach, overwash	design	understanding is that NPS supports, based upon Dec meeting
8	CPF	Needs landowner support	New	Point O' Woods	Point O' Woods	bayside beach		
9	CPF	Support	Existing	T2 Sunken Forest / Sailor's Haven	Sunken Forest	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
10	CPF	Support	New	Carrington Tract	Carrinngton Tract	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
11	CPF	Support	Existing	T3 Regan Property / Talisman	Talisman, FI Pines	bay beach, overwash, possible sill	design	understanding is that NPS supports, based upon Dec meeting
12	CPF	Support	New	Talisman	Talisman	Overwash fan / spit / feeder beach	design	understanding is that NPS supports, based upon Dec meeting
14	CPF / ESA	Needs landowner support	New	Smith Point County Park Pattersquash	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports feature, concerned about 1) allowing use of berma road, 2) long-term maintenance requirements
15	CPF / ESA	Needs landowner support	New	Smith Point County Park Breach / New	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports, same concerns as above
16	CPF	Needs landowner support	New	Smith Point County Park Marsh	Smith Point County Park	reestablish degraded wetland height	design	SPCP supports marsh efforts
17	ESA	Needs landowner support	New	Great Gunn Shorefront	Smith Point County Park	Maintain the FIMI ephemeral pool	design	SPCP supports, with concerns regarding the maintenacne requirements
18	ESA	Needs landowner support	New	Cupsogue	Cupsogue County Park	bayside beach, relocate recreation use	stop	SPCP does not support
19	ESA	Unlikely, Landowner Issues	New	Westhampton Spit	Westhampton	veg management / regrading	stop	property is currently in litigation over ownership
20	CPF	Needs landowner support	New	Sedge Island	Southampton	reestablish wetlands		
21	CPF	Needs landowner support	New	Tiana - mermaid lane	Southampton	establish bayside sandspit / wetland		
22	CPF	Needs landowner support	Existing	T7 Tiana - Rd K	Southampton	establish bayside sandspit / wetland		
23	CPF	Needs landowner support	Existing	T8 WOSI	Southampton	establish bayside beach		
	CPF / ESA	Needs to be developed	New	Tiana - WOSI	Southampton	setback dune, shorefront natural process		County Parks would like to discuss further, believes there is quality habitat.
24	CPF	Needs to be developed	New	Pepperidge Hall Wetland	Islip	reestablish degraded wetland, add height		
25	CPF	Needs to be developed	New	Fireplace Neck / Bellport Wetlands	Brookhaven	reestablish degraded wetland, add height		
26	CPF	Needs to be developed	New	Mastic Beach Wetlands	Brookhaven	reestablish degraded wetland, add height		
27	CPF	Needs to be developed	New	Forge River Wetlands	Brookhaven	reestablish degraded wetland, add height		

Table 3. Proposed Coastal Process Feature sites.

CONSERVATION MEASURES PROPOSED TO MINIMIZE IMPACTS TO FEDERALLY LISTED SPECIES

As part of the proposed Project, the Corps will carry out the following measures to avoid and minimize adverse effects to piping plovers and seabeach amaranth.

1. Continuing Consultation with the Service

The Corps will initiate informal consultation with the Service at least 6 months prior to the start of initial nourishment and each renourishment cycle to reevaluate any potentially changed conditions. If a changed condition occurs that was not covered by the existing Biological Opinion (including reactive and conditional breach response), if incidental take of piping plovers is likely, or if relevant new information regarding federally listed species has become available, the Corps will reinitiate formal consultation at that time.

2. Construction Activities (General)

a. Materials and Material Placement

All fill shall consist of "clean" sand material (i.e., 90 percent or greater sand) obtained from approved off-shore borrow areas. Grain size of fill material will be suitable for beach nourishment and will be similar in composition to the existing beach substrate on the targeted deposition site. Excavated sediments shall be placed directly onto the placement site to the greatest extent possible.

b. Materials Stockpiling and Equipment Storage

Any materials or equipment stored adjacent to known plover nesting areas will be removed prior to the nesting season (April 1). If construction occurs into the nesting season (April) (see conditions for working in nesting season below section 3aiii, 3av, 3avi), equipment and materials should be moved at least 1,000 m from a nesting area; (see buffer distance below).

c. Access Into Construction Areas

The Service and the qualified species monitor(s) (see below), will be given access to Program construction areas, subject to site safety plans, for the purpose of surveying; monitoring; posting; symbolically fencing of piping plover courtship, nesting, and brood areas; and erecting predator exclosures around nests. Access will be given on any day(s) at the frequency required to accomplish the purposes stated above.

3. Conservation Measures to Protect Piping Plovers During Construction

For the purposes of this Biological Opinion a piping plover “nesting area” is defined by the Service as the entire site currently occupied by courting, territorial, incubating, or brood rearing piping plovers, nests with eggs, unfledged chicks, or fledged chicks that have not yet left their natal area, or any site so occupied during any of the three most recent nesting seasons (including the current season if territories have already established for the year). “Potentially suitable” piping plover nesting habitat is habitat that contains natural features associated with known plover habitat and that could be reasonably expected to be occupied by piping plovers either in the upcoming nesting season or in the reasonably foreseeable future. For the purposes of this Biological Opinion a “fledged chick” will be defined as one that has been observed in flight for more than 15 meters.

During individual streamlined consultations the Service will provide the Corps with information and maps defining the nesting areas in proximity to the target construction area and the boundaries of the associated buffer areas.

a. Project Scheduling, Timing Restrictions, and Buffers for Construction

i. During the informal consultation process (see CM #1 above), the Corps will meet with the Service to discuss development of individual project plans and specifications, piping plover nesting areas of concern within and adjacent to the Planned Program activity**1**. Nourishment will be scheduled and sequenced to avoid or minimize construction activities during the nesting season within known piping plover nesting areas or areas likely to be occupied during the affected nesting season.

ii. The USFWS (Service) shall be notified via e-mail at least two weeks before the start and completion date, of the dredging and nourishment activities (see Communication Plan).

iii. A Time of Year restriction will be implemented during the piping plover breeding season (April 1 to September 1).

iv. Fire Island Communities-In the Fire Island communities, there is no time of year restriction, however, if there are nesting areas identified by the Service or breeding piping plovers are observed at the time construction activities are taking place, construction activities will not occur within 1,000 m of the nesting area or where there is brood activity (brood rearing, and the entire area used by unfledged chicks), and no activities within 200 meters of fledged chick foraging areas within their nesting area (not transient, fledged juveniles). If breeding piping plovers are not observed in a proposed project area, or are not within 1000 m of the project area by July 15, then project activities may commence, following consultation with the Service.

v. In all other project areas with nesting areas, the time of year restriction will be followed unless an unplanned or unforeseen delay occurs (i.e., weather-related work stoppages or equipment failures). The Corps should provide sufficient time to remove all pipeline material, machinery, equipment, and construction crews, and grading to fill to the construction template before the nesting season occurs (April 1).

vi. To provide for flexibility in Project implementation, the Project as proposed includes a maximum of three (3) episodes of nourishment or renourishment work in nesting areas during the nesting season (i.e., three episodes total over the entire Project area, with the exception of the Fire Island Communities, for the life of the Project) ending by May 1.

1 For projects that do not comply with the protective conservation measures and terms and conditions of this programmatic Biological Opinion, the Corps must initiate individual formal consultation and allow sufficient time for the full formal consultation process (at least 135 days from the Service's receipt of a complete initiation package).

If work in a nesting area becomes necessary, the Corps will implement all of the following protective measures:

a) The Service must be contacted via a formal letter (See Communication Plan) at least two weeks before the construction field meeting (see below).

b) A construction field meeting (different from the semi-annual meetings scheduled for overall piping plover coordination) will be held on or before continuation of work that is to occur after the start of the piping plover breeding season (April 1) and should include the local cost sharing sponsors, landowners, a representative from the Corps, Service, the qualified monitors, and the construction crew to provide all information on conservation measures that must be implemented. The Service will provide a checklist (see Appendix) to ensure that all conservation measures are followed.

c) All on site construction personnel will be required to participate in a mandatory piping plover and seabeach amaranth training session prior to construction occurring past April 1 (provided and conducted by the Service or an approved Service representative). Any individuals without this training will not be permitted on site.

d) The Corps will arrange for a qualified species monitor to be on-site at all times until construction is completed, equipment is removed and the area restored to pre-project conditions. If there are multiple activities occurring, more than one monitor may be required. A Qualified Monitor is a person who has the skills, knowledge, and ability regarding piping plover biology and behavior, monitoring procedures, and data collection. Skills of a qualified monitor include, but are not limited to: identifying potential nesting habitat, detecting and recording locations of territorial and courting adults, interpreting plover behaviors, identifying distinct nesting pairs or territories, confirming incubation through hatch data, locating broods, confirming fledging of chicks, and documenting observations in legible, complete field notes. Aptitude for monitoring includes ability to observe shorebirds, experience observing birds or other wildlife for sustained periods, patience, and familiarity with avian biology (see Appendix for minimum qualifications).

e) The qualified monitor will coordinate with the landowner 1 week before the start of the survey work, and then each day the surveys continue, to obtain current information on the locations of plover territories, nests and/or chicks. The qualified monitor will observe piping plover adults for signs of disturbance from the construction activities; direct work away from sensitive territorial/nesting/chick habitats; and ensure that contractors do not approach any nest sites or unfledged broods (see construction buffer distance below). The qualifications of the species monitor must be reviewed and approved by the Corps and shared with the Service.

f) Buffer areas will extend from the water's edge landward to the furthest seaward extent of the natural or man-made feature. Known piping plover nesting areas will be afforded a 1,000-meter buffer so as to not interfere with courtship activities and nest site selection. However, if due to eroded beach conditions or other beach features, no potentially suitable piping plover habitat is likely to be present within the buffer during the affected nesting season, the buffer area may be reduced on a case-by-case basis by the Service. Reduced buffers will be developed through close coordination with the Corps and will be sufficient in size to prevent disturbance to birds establishing or incubating nests. If an area where nesting occurs is not already pre-fenced, symbolic fencing will be installed by the qualified monitor or under supervision of the qualified monitor and should be placed in at least a 50m radius around nests above the high tide line.

g) Piping plovers may establish new nesting territories in previously unoccupied areas with suitable habitat. No construction activities will take place in April (outside the Fire Island communities) unless the qualified monitor has determined that the vicinity of the active construction site is unoccupied. Work in non-nesting portions of the project area may commence only if the construction monitor has detected no piping plovers in the area after 4 days of surveying, throughout the full tidal cycle, in the proceeding week. The qualified monitor will be kept apprised of the construction schedule to ensure that surveys have been completed within any areas where work will commence within the next week. If a piping plover is observed at any time in a previous unoccupied area, the qualified monitor will ensure that a 1,000m nesting area buffer is established immediately until the monitor can determine whether the plovers are migrants or are engaged in breeding activity. If nesting activity is confirmed, the buffer will remain in effect. If birds are no longer sighted during 8 consecutive days of observation, throughout the full tidal cycle, the nesting buffer will be removed.

g) Beach profile surveys which do not include motorized equipment and are considered a low impact construction activity will be conducted outside of the nesting season to the greatest extent possible. If work must be conducted within 100m of a nesting area after nesting has begun, a qualified monitor must be present. The qualified monitor will accompany the Corps or its contractors (not exceeding 2 individuals in addition to the qualified monitor) into fenced piping plover areas or buffers. Use of the survey sled will be limited to the lower portion of the beach to avoid impacting nesting birds. If work cannot be completed prior to nest establishment, it may be necessary for the Corps to omit of relocate certain survey lines to avoid disturbance to nests or chicks.

h) The qualified monitor will be on site if there is any need to move pipeline during the April timeframe to ensure it is aligned in a practicable manner conducive to minimal adverse impact to plovers and amaranths, as determined by the New York District after consultation with the local, state, and Federal agencies involved with project review.

i) If for any reason, at any time over the life of the Project, additional work in April becomes necessary (i.e., more than three times over the Project duration), the Corps will reinitiate consultation with the Service to reevaluate project impacts. If the Service determines that piping plovers are likely to be adversely affected, a new Biological Opinion will be required before further nesting-season work may proceed within a nesting area.

4. Non-Construction Related Surveying, Monitoring, and Management during the Breeding Season for Piping Plover

a) The Corps will fund a comprehensive program to monitor piping plovers on a yearly basis within the FIMP project area, beginning with the first nesting season after initial project construction and continuing for the life of the project or until assumed by the State or local project sponsor. The Corps will also fund the monitoring of CPF's or other proposed projects to inform adaptive management and to offset take of piping plovers. The Corps will also fund the development of beach management plans to address recreational impacts occurring on lands in which project activities are taking place. If, at any time during the life of the Project, sufficient Corps funding is no longer available to continue funding a comprehensive monitoring program or to fully develop beach management plans for each of the landowners in the Project area, the Corps will reinitiate informal[2] consultation with the Service to reevaluate project impacts with the loss of beneficial effects provided by monitoring and management.

b) Surveying and monitoring of the project area will occur for piping plover during the spring and summer nesting seasons. The monitoring will be completed in coordination with the land manager(s) and the Service. Monitoring will include identification of suitable habitats, nesting areas, symbolic fencing, and signage.

c) Monitors should be able to: quickly and accurately detect territorial males and courting pairs; detect nests (or incubating pairs, where thick vegetation precludes locating the nest) using appropriate cues (e.g., tracks, scrapes, vocalizations, foraging adults) to detect breeding activity without causing undue disturbance to the birds; ensure symbolic fencing (or other protection) is sufficient to encompass habitat where adult plovers are conducting breeding activities which include territorial, courtship displays, egg laying and brood rearing. Refer to "Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the Endangered Species Act" (USFWS 1994); ensure symbolic fencing (or other protection) provides sufficient buffer to prevent flushing of incubating adults; all areas where unfledged chicks are present are detected and receiving protections in accordance with Guidelines cited above.

d) Species monitors shall also work on the threatened and endangered species management activities (*e.g.*, coordinating with local communities and agencies, as well as organizing

2 As the Program was key to the Service's analysis of indirect effects to listed species from recreational impacts, beach management, and predation, and is critical to accurate delineation of piping plover nesting areas, reinitiation of formal consultation will be required if diminishment or elimination of the Program causes an effect on the species not considered in this Opinion.

the pre-season planning) within the FIMP project areas. The species monitor will also recommend and implement changes in coordination with the Corps, Service, and relevant landowners regarding the location and configuration of symbolic fencing and warning signs and gauge the effectiveness of management actions.

e) Protection of breeding piping plovers on all suitable habitats in the action area from human disturbance (*e.g.*, Off-road vehicles, hereafter ORVs, and recreational activities).

f) Suitable habitats within the project area(s) shall be protected through the placement of symbolic fencing and warning signs.

g) Symbolic fencing is intended to avoid or minimize accidental crushing of nests and repeated flushing of incubating adults, as well as provide an area where chicks can rest and seek shelter when people are on the beach. Therefore, prior to the piping plover breeding (April 1) or seabeach amaranth growing seasons (May 1), the Corps will coordinate with the land manager(s) and the Service biologists to design a "symbolic fencing plan" for areas identified by the Service (identified on GIS maps) and the Corps as suitable habitat for piping plovers and areas where there are seabeach amaranth plants. Coordination on the placement of symbolic fencing for piping plover will incorporate field population and habitat data for the project area.

h) Breeding and growing areas shall be protected with symbolic fencing using steel or fiberglass posts or other acceptable materials connected with string or twine. Fluorescent flagging material will be tied to the string to increase visibility and piping plover or seabeach amaranth habitat warning signs shall be placed on every second or third post. Posts should encompass areas of at least a 50m-radius around nests above the high tide line. Posts will be adjusted seaward as the beach widens. As sand accretes through the season, posts and fences may need to be moved further seaward to maintain symbolic fencing at this distance.

i) All pedestrian and ORV access into, or through symbolically fenced areas. Only persons engaged in monitoring, management, or research activities shall enter the protected areas. These areas shall remain symbolically fenced for piping plovers until at least July 1, and as long thereafter as viable eggs or unfledged chicks are present. If no breeding piping plovers, nests, or chicks are observed in the symbolically fenced areas, the fencing may be removed. Symbolic fencing erected to protect seabeach amaranth shall be in place until the plant dies, or until November 1, whichever comes first.

j) Population survey information shall include the total number of breeding pairs; the total number of piping plovers, paired and unpaired, within the action area; and detailed mapping of breeding (courtship, territorial, scrapes, egg-laying, incubating, and brood-rearing) and foraging use habitats in the action area. Productivity information shall include the total number of nests, the total number of fledged chicks per pair, and quantification of take, if observed, including causes of nest loss, death of chicks or adults that occurred, and reasons for take and actions that were taken to avoid take.

k) Surveys will be recorded and summarized, and plover locations will be recorded on maps, indicating areas surveyed and habitat types. Information collected will include the following:

- l) date;
- m) time begin/end;
- n) weather conditions;
- o) tidal stage;
- p) site name (location)number of adults observed;
- q) number of pairs observed;
- r) courtship locations
- s) brood locations
- t) nest locations;
- u) number of chicks fledged/adult pair;
- v) habitat type;
- w) banded plovers; and
- x) predator trail indices

l) Surveys shall be conducted three times weekly with observations evenly distributed over a minimum time period (to be determined). Survey time periods shall be conducted during daylight hours from 30 minutes after sunrise to 30 minutes before sunset and should include a full range of tidal conditions and habitat types. Areas should be surveyed slowly and thoroughly and should not be conducted during poor weather (*e.g.*, heavy winds greater than 25 miles-per-hour (mph), heavy rains, and severe cold), since birds may seek protected areas during these times.

m) Predator Management: Based on the meeting that will to be held semi-annually, the NYD will provide to the Service, a predator plan for a pre-season (if needed) and in-season predator monitoring and control program for all project areas. (Refer to Communications Plan).

n) ORV Management:

i. ORV management will be implemented by the landowner. Issues with implementation will be reported to the Corps, and the Corps will contact the landowner via phone followed up with a letter requesting adherence to the conditions provided below (or measures identified in a beach management plan once completed) which the Service will be copied on (see Communication Plan).

ii. Sections of beaches where unfledged piping plover chicks are present shall be temporarily closed to all ORVs. Areas where ORVs are prohibited shall include all dune, beach, and intertidal habitat within the chicks' foraging range, to be determined by either of the following methods: The vehicle-free area should extend 1000 meters on each side of a line drawn through the nest site and perpendicular to the long axis of the beach. The resulting 7,560-ft wide area of protected habitat for plover chicks should extend from the oceanside, low-water line to the farthest extent of dune habitat.

OR

If nests and chicks are monitored at least daily, vehicle-free areas may be reduced to not less than 656 ft on each side of the brood location. The size and location of the protected area should be adjusted in response to the observed mobility of the brood, and in some cases, highly mobile broods may require protected areas up to 3,280 ft, even where they are intensively monitored. Protected areas should extend from the oceanside, low-water line to the farthest extent of dune habitat.

iii. Restrictions on the use of ORVs in areas where unfledged plover chicks are present should begin on, or before, the date that hatching begins and continue until the chicks have fledged. For purposes of ORV management, plover chicks are considered fledged when observed in sustained flight for at least 15 meters, irrespective of age. In most cases, piping plovers attain flight capability by 35 days of age, but longer pre-fledge periods may occur. When piping plover nests are found before the last egg is laid, restrictions on ORVs should begin on the 26th day after the last egg is laid. This assumes an average incubation period of 27 days and provides one day margin of error. When piping plover nests are found after the last egg has been laid, making it impossible to predict the hatch date, ORV restrictions shall begin on a date determined by one of the following scenarios: When plover nests are found after the last egg has been laid, making it impossible to predict hatch date, restrictions on vehicles should begin on a date determined by <u>one of the following scenarios:</u>

iv. With intensive monitoring: If the nest is monitored at least twice per day, at dawn and dusk (before 0600 hrs and after 1900 hrs) by a qualified biologist, vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with spotting scope or binoculars to minimize disturbance to incubating plovers.

OR

Without intensive monitoring: Restrictions should begin on May 10 (the earliest probable hatch date). If the nest is discovered after May 10, then restrictions should start immediately. If ruts are present that are deep enough, as determined by the Service,to restrict the movements of plover chicks, then restrictions on ORVs should begin at least five days prior to the anticipated hatching date of the plover nests. If a plover nest is found with a complete clutch, precluding estimation of hatching date, and deep ruts have been created that could reasonably be expected to impede chick movements, then restrictions on ORVs should begin immediately. A corridor that is 25-ft wide shall be permitted along the water's edge, above the MHW line, and will be kept free of symbolic fencing as an maintenance and emergency response corridor.

o) Habitat Creation and Enhancement
Design features have been incorporated into several Coastal Process Features to create nesting and foraging habitat for piping plover (see Project Description and Appendix A).

These features, developed in conjunction with the Service, will provide piping plover with alternate nesting and feeding habitat in the project areas. These areas will be monitored to assess whether design criteria are being met and whether adaptive management is needed. Number of pairs nesting, nesting success, productivity, and issues with disturbance will also be monitored.

5. Conservation Measures to Protect Seabeach Amaranth

a. Biologist/botanist or designated representative will survey the area immediately prior to any construction activity within the seabeach amaranth growing season (May 1 to November 1). Approximately twice a week the construction area will be surveyed. Records shall include species locations, numbers of individuals, and size of plants. If there is any seabeach amaranth present, seabeach amaranth locations will be recorded. If construction personnel or vehicles are at the site or might transit the site, symbolic fencing will be placed in a 10 foot-diameter ring.

b. All construction activities shall avoid all delineated locations of seabeach amaranth where feasible. The New York District will undertake all practicable measures to avoid crushing or smothering plants. In the unlikely event that the species appears at the placement area, and there is a very good possibility that the surrounding placed sand will encroach upon and smother the plant, the New York District proposes to transplant the individual plant to a similar habitat near or within the project area to lessen the impact of placement. Transportation will include removal of a sufficiently large enough and intact volume of sand to include the full extent of the roots. This action, when necessary, will occur as soon as possible after the plant is identified, and every attempt will be made to include the entire (undamaged) root system.

c) It is understood that this action, when feasible, will be undertaken for individual plants whose destruction could not be avoided. Seed collection or transplants will be attempted as a means of mitigating potential loss; Seeds from plants to be translocated may be harvested prior to plants being moved. With input from the Service, and species experts, all or a portion of the seeds may be: (a) immediately transferred to an area of suitable habitat elsewhere within the project area; (b) stored under controlled conditions to be later replanted in the project area; (c) sent to a qualified greenhouse for germination and eventual replanting of germinated plants or propogated seeds in suitable habitats elsewhere in the project area. If no seed is collected on-site, a portion of the transplanted plants may be sent to a qualified greenhouse and propogated to produce seeds or plants for the purposes listed above.

d) If translocation/seed collection are not viable options, or have proven ineffective, construction that would destroy live plants will be postponed, if possible, until individual plants in the construction footprint naturally die. Whether or not construction can be postponed until the death of plants in the construction footprint, the Corps will endeavor to salvage and transfer the seedbank of such plants to the extent practicable. Within a 10-foot radius of each plant or group of plants (alive or recently alive), the top layer of sand substrate will be “scraped” and then re-spread on a suitable habitat in the project area.

3. Description of the Species and their habitat

Piping Plover

Species/Critical Habitat Description:

On January 10, 1986, the piping plover was listed as threatened and endangered under provisions of the ESA. Three distinct populations were identified by the Service during the listing process: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). No critical habitat has been designated or proposed in the Atlantic Coast breeding area which is the focus of this BA.

The Atlantic Coast population breeds on coastal beaches from Newfoundland to North Carolina (NC) (and, occasionally, in South Carolina) and winters along the Atlantic Coast from NC southward, along the Gulf Coast, and in the Caribbean.

Life History:

Piping plovers are small, sand-colored shorebirds approximately 7 inches long, with a wingspread of about 15 inches (Palmer 1967).

Breeding-Piping plovers begin returning to their Atlantic Coast nesting beaches in mid-March (Coutu et al. 1990; Cross 1990; Goldin 1990; MacIvor 1990; Hake 1993). Males establish and defend territories and court females by early April (Cairns 1982). Piping plovers are monogamous, but usually shift mates between years (Wilcox 1959; Haig and Oring 1988; MacIvor 1990; Strauss 1990) and, less frequently, between nesting attempts in a given year (Haig and Oring 1988, MacIvor 1990, Strauss 1990). Plovers are known to breed at one year of age (MacIvor 1990; Haig 1992), but the rate at which this occurs is unknown. Egg-laying and incubation can start as early as mid-April (USFWS 1996a).

Piping plovers nest on coastal beaches (NC to Newfoundland), sand spits at the end of barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and in overwash-created bare sand areas cut into or between dunes. In the central portions of their Atlantic Coast range (including NY-NJ), they may also nest on areas where suitable dredged material has been deposited.

Nest sites are shallow-scraped depressions in substrates ranging from fine-grained sand mixtures to sand and pebbles, shells, or cobble (Bent 1929; Cairns 1982; Burger 1987; Patterson 1988; Flemming et al. 1990; MacIvor 1990; Strauss 1990). Nests may be difficult to detect, especially during the six-to seven-day egg-laying phase when the birds generally do not incubate (Goldin 1994). Eggs may be present on the beach from mid-April through late July and clutch size for an initial nest attempt is usually four eggs, with one egg laid every other day.

Full-time incubation usually begins with the completion of the clutch and is shared equally by both sexes for a period lasting from 27 to 28 days (Wilcox 1959; Cairns 1977; MacIvor 1990).

Eggs in a clutch usually hatch within four to eight hours of each other, but the hatching period may extend to 48 hours.

Piping plovers generally fledge only a single brood (one or more chicks from a nest) per season, but may re nest several times if previous nests are lost or, infrequently, if a brood is lost within several days of hatching. A few rare instances of adults renesting following fledging of an early brood have also been observed . Chicks are precocial and are capable of foraging for themselves within several hours of hatching (Wilcox 1959; Cairns 1982) and may move hundreds of feet from the nest site during their first week of life (USFWS 1996a). Chicks may increase their foraging range up to 3,280 ft (Loegering 1992) or more based on observations from Fire Island to Moriches Inlet monitoring in 2016 (Carey et al. 2017), and will remain with both parents until they fledge at 25 to 35 days of age. Depending on the date of hatching, flightless chicks may be present from mid-May until late August, although most fledge by the end of July (Patterson 1988; Goldin 1990; MacIvor 1990; Howard et al. 1993). Nest success depends heavily on camouflage (Hull 1981). Cryptic coloration is a primary defense mechanism for this species; nests, adults, and chicks all blend in with their beach surroundings. Chicks sometimes respond to off-road vehicles (ORVs) and/or pedestrians by crouching and remaining motionless (Cairns 1977). Adult piping plovers respond to avian and mammalian predators by displaying a variety of distraction behaviors including squatting, false brooding, running, and injury feigning. Distraction displays may occur at any time during the breeding season, but are most frequent and intense during the time of hatching (Cairns 1977).

Migration-Fall migration to southern wintering grounds begins in mid-to late summer. Juvenile plover may remain on breeding grounds later but are generally gone mid-to late August (Cuthbert and Wiens 1982). A study of migration routes, duration, stopovers, and other behaviors of radio-tagged plovers is in progress (Loring et al. 2017). But the pattern of both spring and fall counts at migration suites along the southeastern Atlantic Coast demonstrates that many piping plovers make intermediate stopovers lasting from a few days up to one month during their migrations (Noel et al. 2006; Stucker and Cuthbert 2006).

Feeding-Piping plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989). Important feeding areas may include intertidal portions of ocean beaches, overwash areas, mudflats, sandflats, wracklines, sparse vegetation, and shorelines of coastal ponds, lagoons, or salt marshes (Gibbs 1986; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Cohen 2005; Houghton 2005). Studies by Cuthbert and Weins (1982) indicate that open shoreline areas are preferred and vegetated beaches are avoided. In Massachusetts, plover preferred mudflat, intertidal and wrack habitats for foraging (Hoopes et al. 1992). The relative importance of various feeding habitats may vary by site (Gibbs 1986; Coutu et al. 1990; McConnaughey et al. 1990; Loegering 1992; Goldin 1993; Hoopes 1993; Elias-Gerken 1994) and by stage in the breeding cycle (Cross 1990). Adults and chicks on a given site may use different feeding habitats in varying proportion (Goldin 1990). Most time-budget studies reveal that chicks spend a very high proportion of their time feeding. Cairns (1977) found that chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight-gain by day 12 were unlikely to survive. Feeding territories are generally contiguous to nesting territories (Cairns 1977). Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1994) and at all stages during the tidal cycle (Goldin 1993; Hoopes 1993).

Habitat in Atlantic Coast Recovery Unit:

Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass or other vegetation (Patterson 1988; Flemming et al. 1990; MacIvor 1990). Cohen et al. (2008) reported that mean vegetation cover around piping plover nests on a re-nourished Long Island beach was 7.5%, and all plovers nested in <47 percent cover. Although almost 60 percent of the nests were on bare ground, nests occurred in sparse vegetation more often than expected based on availability of this habitat type. Plovers also appeared to favor nest sites with coarse substrate over pure sand.

Piping plovers often select nest sites near moist substrate habitats. Patterson (1991) noted that most plover nesting on Asssateague Island, Maryland and Virginia occurred on beaches adjacent to one of the several types of moist substrate habitats available there. Elias et al. (2000) reported the pattern of nesting on three New York barrier islands. All 1-km beach segments that were adjacent to either ephemeral pools or bay intertidal zone were used for nesting, whereas fewer than half the beach segments without these habitats were used by nesting Piping plovers. Beach segments adjacent to these habitats supported 48% of nesting pairs in that study, despite comprising only 12% of the habitat.

At Westhhampton Dunes, New York, piping plover breeding pairs increased rapidly in nesting and foraging habitat created by a series of storms, as well as nesting habitat furnished by an artificial breach fill. The peak population density was lower at an adjacent reference site that was nourished, but was not adjacent to intertidal flats (Cohen et al. 2009). The breeding plover population then declined as nesting habitat created by the storm and breach fill diminished and became isolated from foraging habitat by development and vegetation growth. Cohen et al. (2009) concluded that local population growth can be very rapid where storms create both nesting and foraging habitat in close juxtaposition. An increase in local nesting habitat via artificial beach nourishment, however, is not necessarily followed by an increase in the local population if nearby intertidal flats are absent.

Plover typically return to the same general nesting area in consecutive years. First-time Atlantic Coast breeders are more likely to disperse from their natal sites, but their fidelity to their natal region is very high. Although long-distance movements between natal and breeding sites (and even between breeding years) have been documented, they are rare. On the Atlantic Coast, almost all observations of inter-year movements of birds have been within the same or adjacent states. Extensive efforts to re-sight >1,400 Atlantic Coast Piping Plovers color-banded in

Virginia, Maryland, Massachusetts and five Eastern Canadian provinces between 1985 and 2003 resulted in only four records of plovers breeding outside the recovery unit in which they were banded (USFWS files; Amirault et al. 2005, updated by D. Amirault-Langlais and F. Shaffer, Canadian Wildlife Service, pers. comm. 2009). Two ongoing studies have each detected one movement outside the recovery unit where the bird was banded (A. DeRose-Wilson, Virginia Tech, pers. comm. 2016; M. Stantial, SUNY, pers. comm. 2016). In New York, Wilcox (1959) recaptured 39 percent of the 744 adult plovers that he banded in prior years (many were recaptured during several successive seasons and all but three of them were retrapped in the same nesting area), but recaptured only 4.7 percent of 979 plovers that he banded as chicks. He also observed that males exhibited greater fidelity to previous nest sites than females. In Massachusetts, 13 of 16 birds banded on one site were resighted the following season, with 11 nesting on the same beach (MacIvor et al. 1987). Nine of the ten adults that changed sites from1985-1987 were females (MacIvor et al. 1987). Strauss (1990) observed individuals that returned to nest in his Massachusetts study area for up to six successive years. Of 92 adults banded on Assateague Island, Maryland, and resighted the following year, 91 were seen on the same site, as were 8 of 12 first-year birds (Loegering 1992). Cross (1996) reports that 10 of 12 juveniles banded on Assateague Island, Virginia and resighted one and/or two years later were on the Virginia or Maryland portions of Assateague Island, while the other two were observed on other Virginia barrier islands. Site fidelity of banded adults on Long Island in 2002-2004 was 83 percent (Cohen et al. 2006).

Genetic evidence is consistent with observed dispersal patterns described above. Miller et al. (2010) found strong genetic structure, supported by significant correlations between genetic and geographic distances in both mitochondrial and microsatellite data sets for Atlantic Coast piping plovers. Atlantic birds showed evidence of isolation-by-distance patterns, indicating that dispersal, when it occurs, is generally associated with movement to relatively proximal breeding territories. Furthermore, weaker genetic structure among Interior birds may reflect lower natal- and breeding-site fidelity (Miller et al. 2010), indicating that dispersal distances observed on the Missouri River may be larger than those occurring in the Atlantic Coast population. Population growth and stability are heavily dependent on survival and productivity of local populations.

Status of the Species:

Status and Abundance in the Atlantic Coast Recovery Unit (excerpted from USFWS 2016): Abundance of Atlantic Coast piping plovers is reported as numbers of breeding pairs (adult pairs that exhibit sustained (> 2 weeks) territorial or courtship behavior at a site or are observed with nests or unfledged chicks) (USFWS 1996a). Annual estimates of breeding pairs of Atlantic Coast piping plovers are based on multiple surveys of almost all breeding habitat, including many currently unoccupied sites. Sites that cannot be monitored repeatedly in May and June (primarily sites with few pairs or inconsistent occupancy) are surveyed at least once during a standard 9-day count period (Hecht and Melvin 2009).

The Atlantic Coast piping plover population estimate reached a post-listing high of 1,941 pairs in 2016, almost two and half times the 1986 estimate of 790 pairs (Table 4). New England and Massachusetts had the highest numbers of breeding pairs in 2016. Discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (USFWS 1996), the population doubled between 1989 and 2016 (USFWS 2017).

State/Recovery Unit	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Maine	15	12	20	16	17	18	24	32	35	40	60	47	60	56	50
New Hampshire											5	5	6	6	7
Massachusetts	139	126	134	137	140	160	213	289	252	441	454	483	495	501	496
Rhode Island	10	17	19	19	28	26	20	31	32	40	50	51	46	93	49
Connecticut	20	24	27	34	43	36	40	24	30	31	26	26	21	22	22
New England	184	179	200	206	228	240	297	376	449	552	590	612	627	624	623
New York	106	135	172	191	197	191	187	193	209	249	256	256	245	243	289
New Jersey	102	93	105	128	126	126	134	127	124	132	127	115	93	107	112
NY-NJ	208	228	277	319	323	317	321	320	333	381	383	371	338	350	401
Delaware	8	7	3	3	6	5	2	2	4	5	6	4	6	4	3
Maryland	17	23	25	20	14	17	24	19	32	44	61	60	56	58	60
Virginia	100	100	103	121	125	131	97	106	96	118	87	88	95	89	96
North Carolina	30	30	40	55	55	40	49	53	54	50	35	52	46	31	24
South Carolina	3		0		1	1		1			0				
Southern	158	160	171	199	201	194	172	181	186	217	189	204	203	182	183
USTotal	550	567	648	724	752	751	790	877	968	1150	1162	1187	1168	1156	1207
Eastern Canada **	240	223	238	233	230	252	223	223	194	200	202	199	211	236	230
Atlantic Coast Total	790	790	886	957	982	1003	1013	1100	1162	1350	1364	1386	1379	1392	1437

State/Recovery Unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maine	55	66	61	55	49	40	35	24	27	30	33	42	44	50	62	66
New Hampshire	7	7	7	4	3	3	3	3	5	4	4	6	7	6	8	7
Massachusetts	495	538	511	488	467	482	558	566	593	591	656	676	666	663	687	649
Rhode Island	52	58	71	70	69	72	73	77	84	85	86	90	92	91	99	98
Connecticut	32	31	37	40	34	37	36	41	44	43	52	51	45	51	62	63
New England	641	700	687	657	622	634	705	711	753	753	831	865	854	861	918	883
New York	309	369	386	384	374	422	457	443	437	390	318	342	289	286	308	381
New Jersey	122	138	144	135	111	116	129	111	105	108	111	121	108	92	108	115
NY-NJ	431	507	530	519	485	538	586	554	542	498	429	463	397	378	416	496
Delaware	6	6	6	7	8	9	9	10	10	9	8	7	6	6	6	8
Maryland	60	60	59	66	63	64	64	49	45	44	36	41	45	38	36	34
Virginia	119	120	114	152	192	202	199	208	193	192	188	259	251	245	256	291
North Carolina	23	23	24	20	37	46	61	64	54	61	62	70	56	65	64	53
South Carolina	0						0									
Southern	208	209	203	245	300	321	333	331	302	306	294	377	358	354	362	386
USTotal	1280	1416	1420	1421	1407	1493	1624	1596	1597	1557	1554	1705	1609	1593	1696	1765
Eastern Canada **	250	274	256	237	217	256	266	253	252	225	209	179	184	186	179	176
Atlantic Coast Total	1530	1690	1676	1658	1624	1749	1890	1849	1849	1782	1763	1884	1793	1779	1875	1941

** includes 1-5 pairs on the French Islands of St. Pierre and Miquelon, reported by Candaian Wildlife Service

Table 4. Number of census pairs from 1986-2016 in each state in the Atlantic Coast Recovery Unit (USFWS 2017).

Overall, population growth is tempered by geographic and temporal variability. By far, the largest net population increase between 1989 and 2016 occurred in New England (329 percent). Net growth in the Southern recovery unit population was over 94 percent between 1989 and 2016. Most of the Southern recovery unit breeding population increase occurred in 2003 to 2005 and 2011 to 2012. Abundance in the New York-New Jersey recovery unit experienced a net increase of 55 percent between 1989 and 2016, but the population declined sharply from a peak of 586 pairs in 2007 to 397 pairs in 2014, before rebounding to 496 pairs in 2016. In Eastern Canada, where increases have often been quickly eroded in subsequent years, the population posted a 24-percent decline between 1989 and 2016 (USFWS 2017).

In addition to the declines between 2007 to 2014 in the New York-New Jersey recovery unit and 2007 to 2016 in Eastern Canada, other periodic regional declines illustrate the continuing risk of rapid reversals in abundance trends. Examples include decreases of 21 percent in the Eastern Canada population in just 3 years (2002 to 2005) and 68 percent in the southern half of the Southern recovery unit during the 7-year period from 1995 to 2001. The 64-percent decline in the Maine population between 2002 and 2008, from 66 pairs to 24 pairs, followed only a few years of decreased productivity (USFWS 2017).

Atlantic Coast piping plover productivity is reported as number of chicks fledged per breeding pair. For purposes of measuring productivity, chicks are counted as fledged if they survive to 25 days of age or are seen flying, whichever occurs first. Productivity for each state and recovery unit is calculated by dividing the number of fledged chicks by the number of pairs that were monitored and for which number of fledglings could be determined. This includes both successful pairs and pairs that fledged no chicks either because they failed to nest or because no eggs hatched or no chicks survived to fledging. Accurate assessment of productivity is facilitated by repeated visits to nesting beaches to monitor individual nests and broods during May, June, July, and, if necessary, August (USFWS 2017).

Annual productivity estimates for the 1987-2016 period are summarized by recovery unit and state in Table 5. Hecht and Melvin (2009) evaluated latitudinal trends in Atlantic Coast piping plover productivity and relationships between productivity and population growth. Rangewide productivity for the Atlantic Coast population from 1989 through 2006 was 1.35 chicks fledged per pair (annual range = 1.16 to 1.54), and overall productivity within recovery units decreased with decreasing latitude: Eastern Canada = 1.61, New England = 1.44, New York-New Jersey = 1.18, and Southern = 1.19 (Hecht and Melvin 2009). Within recovery units, productivity was variable from year to year and showed no sustained trends. There were significant, positive relationships between productivity and population growth in the subsequent year for each of the three U.S. recovery units, but not for Eastern Canada. Regression analysis indicated a latitudinal trend in predictions of annual productivity needed to support stationary populations within recovery units, increasing from 0.93 chicks fledged per pair in the Southern unit to 1.44 in Eastern Canada. Relatively small coefficients of determination ($r^2 = 0.09$ to 0.59) for the relationships between annual productivity and population increases in the subsequent year indicate that other factors, most likely annual survival rates of both adults and fledged chicks, also had important influences on population growth rates. In some parts of the range, habitat availability may also be constraining recruitment into the breeding population (USFWS 2017).

State/Recovery Unit	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maine	1.75	0.75	2.38	1.53	2.5	2	2.38	2	2.38	1.63	1.98	1.47	1.63	1.6	1.98	1.39	1.28	1.45	0.55	1.35	1.06	1.75	1.7	1.63	2.12	1.52	1.93	1.94	1.95	1.53
New Hampshire											0.6	2.4	2.67	2.33	2.14	0.14	1	1	0	0.67	0.33	2	0.4	1.5	2	0.67	1.71	0.33	1.5	2.14
Massachusetts	1.1	1.29	1.59	1.38	1.72	2.03	1.92	1.81	1.62	1.35	1.33	1.5	1.6	1.09	1.49	1.14	1.26	1.38	1.14	1.33	1.25	1.41	0.91	1.5	1.18	0.85	0.87	1.18	1.29	1.44
Rhode Island	1.12	1.58	1.47	0.88	0.77	1.55	1.80	2.00	1.68	1.56	1.34	1.13	1.79	1.20	1.50	1.95	1.03	1.50	1.43	1.03	1.48	1.68	1.46	1.76	1.49	1.06	0.98	1.63	1.58	1.48
Connecticut	1.29	1.70	1.79	1.63	1.39	1.45	0.38	1.47	1.35	1.31	1.69	1.05	1.45	1.86	1.22	1.87	1.30	1.35	1.62	2.14	1.92	2.49	1.68	1.91	1.37	1.18	1.82	2.27	1.81	1.38
New England	1.19	1.32	1.68	1.38	1.62	1.91	1.85	1.81	1.67	1.40	1.39	1.46	1.62	1.18	1.53	1.26	1.24	1.40	1.15	1.34	1.30	1.51	1.04	1.56	1.27	0.93	1.00	1.33	1.40	1.45
New York	0.90	1.24	1.02	0.80	1.09	0.98	1.24	1.34	0.97	1.14	1.36	1.09	1.35	1.11	1.27	1.62	1.15	1.46	1.44	1.55	1.15	1.21	0.93	0.79	1.07	0.72	0.71	1.30	1.52	1.72
New Jersey	0.85	0.94	1.12	0.93	0.98	1.07	0.93	1.16	0.98	1.00	0.39	1.09	1.34	1.40	1.29	1.17	0.92	0.61	0.77	0.84	0.67	0.64	1.05	1.39	1.18	0.72	0.85	1.36	1.29	1.35
NY-NJ	0.86	1.03	1.08	0.88	1.04	1.02	1.08	1.25	0.97	1.07	1.02	1.09	1.35	1.19	1.28	1.49	1.07	1.23	1.28	1.36	1.03	1.10	0.96	0.92	1.09	0.72	0.74	1.32	1.46	1.62
Delaware		0.00	2.33	2.00	1.60	1.00	0.50	2.50	2.00	0.50	1.00	0.83	1.50	1.67	1.50	1.17	2.33	1.14	1.50	1.44	1.33	0.30	1.30	1.56	1.00	1.00	1.17	1.33	1.17	1.63
Maryland	1.17	0.52	0.90	0.79	0.41	1.00	1.79	2.41	1.73	1.49	1.02	1.30	1.09	0.80	0.92	1.85	1.56	1.86	1.25	1.06	0.78	0.41	1.42	1.09	1.25	1.02	0.76	1.55	1.31	1.47
Virginia		1.02	1.16	0.65	0.88	0.59	1.45	1.66	1.00	1.54	0.71	1.01	1.21	1.42	1.52	1.19	1.90	2.23	1.52	1.19	1.16	0.87	1.19	1.35	1.36	0.95	1.15	1.34	1.26	0.92
North Carolina			0.59	0.43	0.07	0.41	0.74	0.36	0.45	0.86	0.23	0.61	0.48	0.54	0.50	0.17	0.46	0.65	0.92	0.87	0.26	0.30	0.70	0.77	0.77	0.59	0.96	0.22	0.64	0.15
Southern	1.17	0.85	0.88	0.72	0.68	0.62	1.18	1.37	1.05	1.34	0.68	0.99	1.04	1.09	1.22	1.27	1.63	1.95	1.38	1.12	0.92	0.67	1.14	1.20	1.21	0.89	1.07	1.15	1.35	0.88
US Average	1.04	1.11	1.28	1.06	1.22	1.35	1.47	1.56	1.35	1.30	1.16	1.27	1.45	1.17	1.40	1.34	1.24	1.43	1.24	1.30	1.13	1.19	1.03	1.27	1.21	0.86	0.94	1.29	1.37	1.37
Eastern Canada **		1.65	1.58	1.62	1.07	1.55	0.69	1.25	1.69	1.72	2.10	1.84	1.74	1.47	1.77	1.18	1.62	1.93	1.82	1.82	1.14	1.47	1.22	1.59	1.19	1.38	1.36	1.37	1.60	1.39

** includes 1-5 pairs on the French Islands of St. Pierre and Miquelon, reported by Candaian Wildlife Service

Table 5. Estimated productivity from 1987-2016 for states in the Atlantic Coast Recovery Unit (USFWS 2017).

Although population growth, from approximately 790 pairs in 1986 to an estimated 1,941 pairs in 2016, has reduced the Atlantic Coast piping plover's vulnerability to extinction since listing under the Endangered Species Act (ESA), the distribution of population growth remains very uneven.

Abundance in the New York-New Jersey recovery unit attained a post-listing peak of 586 pairs in 2007, then declined 35 percent to 378 pairs in 2014 following 7 years of low productivity (including 4 years when it was less than 1.0 chicks per pair). Improved productivity in 2014 and 2015 fueled a partial rebound to 496 pairs in 2016, and there was high productivity in 2016 (1.62 chicks per pair). The New Jersey piping plover population has fluctuated at low numbers (1989–2016 range = 92 to 144 pairs), and totaled 115 pairs in 2016, when 85 percent of the New Jersey nesting pairs were concentrated along less than 14 percent of the State's ocean shoreline (Rice 2017, Pover and Davis 2016). Changes in the Long Island population account for most of the increases and decreases in the recovery unit population.

Concerns regarding increasingly uneven distribution of Atlantic Coast piping plovers as articulated in the 2009 5-Year Review have partially shifted with respect to their geographic focus, with improving status of the Southern recovery unit and an overall decline in the New York-New Jersey recovery unit. Although abundance has remained high in New England, no substantial dispersal from New England to either Eastern Canada or New York-New Jersey has occurred, and any future inter-recovery unit "rescue" will be very slow. The survival and recovery of Atlantic Coast piping plovers remain highly dependent on rangewide conservation of remaining habitats and habitat-formation processes, as well as annual implementation of labor-intensive management to minimize the effects of pervasive and persistent threats from predation and disturbance by humans and pets (USFWS 2009, 2017).

Recovery Plan/Criteria:

Recovery criteria established in the Piping Plover Recovery Plan set population and productivity goals for each recovery unit, as well as for the entire population. The population goals for the Atlantic Canada, New England, NY-NJ, and Southern Recovery Units are 400, 625, 575, and 400 pairs, respectively. The productivity goal for each of the recovery units is to achieve a five-year average productivity of 1.5 chicks fledged per pair. Attainment of these goals for each recovery unit is an integral part of the recovery strategy that seeks to reduce the probability of extinction for the entire population by: contributing to the population total; reducing vulnerability to environmental variation, including effects of hurricanes, oil spills, or disease; increasing the likelihood of genetic interchange among recovery units; and promoting re-colonization of any sites that experience declines or local extirpations due to low productivity or temporary habitat succession.

The Piping Plover Recovery Plan identifies a recovery objective to ensure the long-term viability of the Atlantic Coast plover population in the wild, thereby allowing for the de-listing of this species, along with five criteria for meeting the objective, which are listed below: the population goal of 2,000 breeding pairs, distributed among four recovery units, and maintained at that level for five years; the adequacy of a 2,000-pair population of piping plovers has been verified to maintain heterozygosity and allelic diversity over the long-term; a five-year average productivity of 1.5 chicks fledged per pair has been achieved in each of the recovery units; long-term agreements have been instituted to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit; and long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution has been ensured to maintain survival rates for a 2,000-pair population. The Piping Plover Recovery Plan further states, “A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population.”

Threats:

Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline. Disturbance by humans and pets often reduces the functional suitability of habitat and causes direct and indirect mortality of eggs and chicks. Predation has also been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites, and substantial evidence shows that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation (U.S. Fish and Wildlife Service 1996a).

Much of the plover's historic habitat along the Atlantic Coast has already been destroyed or permanently degraded by inlet stabilization activities, development and human use. The construction of houses and commercial buildings on and adjacent to barrier beaches directly removes plover habitat and results in increased human disturbance. Additional disturbance comes in the form of recreational use of beach habitats. While legal restrictions on coastal development may slow the future pace of physical habitat destruction, the trend in habitat availability for this species is inexorably downward. Furthermore, habitat availability for the species is compromised by the ever increasing human access to, and recreational use of, these coastal habitats. The decrease in habitat availability may force birds to nest in suboptimal habitats, the effects of which could manifest itself in poor future reproductive success. A decline in habitat quality and quantity may prompt increased competition for space leading to displacement of some individuals. As high quality habitat continues to decrease, and low quality of remaining habitat persists, it is unlikely that new immigrants would be attracted to a site (Cohen et al. 2006). The decrease in the functional suitability of the plover's habitat due to accelerating recreational activity on the Atlantic Coast may impact productivity. Functional habitat loss occurs when suitable nesting sites are made unusable because high human and/or animal use precludes the birds from successfully nesting. Human population growth along both the U.S. and Canadian coasts fosters an ever increasing demand for beach recreation. In 2004, about 30 percent of the U.S. Atlantic Coast population of piping plovers nested on Federally-owned (most often, by the NPS, which is chronically underfunded for activities such as plover monitoring) where some protection is afforded under Section 7 of the ESA. The remaining 70 percent of the birds nested on state, town, or privately-owned beaches where plover managers are implementing protections in the face of increasing disturbance from recreation and development. Unfortunately for the piping plover, recreational activities and public use of Federally-owned beaches have also increased. Pressure on Atlantic Coast beach habitat from development and human disturbance continues (U.S. Fish and Wildlife Service 1996a).

Predators also have played a major role in preventing the species recovery. Research and reports indicate that predation poses a continuing (and perhaps intensifying threat) to Atlantic Coast piping plovers. Erwin et al. (2001) found a marked increase in the range of raccoons and foxes on the Virginia barrier islands between the mid-1970s and 1998, and concurrent declines in colonies of beach-nesting terns and black skimmers. Boettcher et al. (2007) identified predation as "the primary threat facing plovers in Virginia." Review of egg losses from natural and artificial nests at Breezy Point, New York, found that gulls, crows, and rats were major predators (Lauro and Tanacredi 2002). Recommendations included removal of crow nests to complement ongoing removal of gull eggs and nests. Modeling by Seymour et al. (2004) using red fox movement data from northern England indicated that risk of fox predation on ground-nesting bird species in long, linear habitats increased with narrowing habitat width, and was sensitive to changes in habitat width of even a few meters. Stantial and Cohen (2015) found on southern New Jersey beaches that as the distance to dunes increased, the probability of habitat use by red foxes decreased. Free-roaming domestic and feral cats, particularly those associated with human-subsidized feral cat colonies, appear to be an increasing threat to piping plovers and other beach-nesting birds (USFWS 2009).

Although predator numbers are undiminished or increasing, effectiveness of predator exclosures (wire cages placed around nests, a key management tool in the early years of the recovery program) has declined. Pre-use evaluation is recommended to assess the likelihood of increased hatching rates against increasing the risk of mortality to one or both incubating adults, which is often evidenced by nest abandonment (Roche et al. 2010, Cohen et al. 2016). A decision-support tool (Darrah et al. 2017) has been developed to assist this evaluation, as well as decisions to remove exclosures if elevated abandonment rates are observed.

Climate change: A recent IPCC summary report (IPCC 2014) notes that recent climate changes have had widespread impacts on human and natural systems. Furthermore, the IPCC stated that it is evident that the atmosphere and oceans have warmed and sea level has risen as a result of the warming of the climate system. In addition to sea-level rise, the climate-related extremes, including more frequent and energetic storms and extreme storm surges have increased and are widely recognized climate change-related concerns for coastal regions (IPCC 2014). Potential effects of accelerating sea-level rise on coastal beaches, including piping plover nesting and foraging habitats, may be highly variable and potentially severe. Important factors influencing future habitat losses and gains include the amount of sea-level rise, which may vary regionally due to subsidence or uplift and the specific landforms occurring within a region (Galbraith et al. 2005; Gutierrez et al. 2007). Gutierrez et al. (2007) predicted varying responses of spits, headlands, wave-dominated barriers, and mixed-energy barriers for four sea-level rise scenarios in the U.S. mid-Atlantic region (overlapping most of the piping plover's New York-New Jersey and southern recovery units). Development and testing of models linking predictions of sea-level rise, changes in beach geomorphology, and piping plover nesting habitat is currently in progress (Gutierrez et al. 2011; Gieder et al. 2014; Gutierrez et al. 2015). Human responses, especially coastal armoring, will play key roles in the effects of sea-level rise on the quantity, quality, and distribution of piping plover habitats. The U.S. Climate Change Science Program (CCSP 2009), for example, stated that "To the degree that developed shorelines result in erosion of ocean beaches, and to the degree that stabilization is undertaken as a response to sea-level rise, piping plover habitat will be lost. In contrast, where beaches are able to migrate landward, piping plovers may find newly available habitat." A review of impacts of sea-level rise and climate change on the coastal zone of southeastern New Brunswick reached similar conclusions, stating that "…coastal ecosystems have a natural capacity to respond to climate and water-level variability … [but] future impacts of sea-level rise and climate change could be exacerbated by development pressures or infrastructure protection projects." (Environment Canada 2006). Recent modeling by Lentz et al. (2016) further illustrates the importance of dynamic response mechanisms to maintaining the resiliency of barrier beaches under accelerating sea-level rise. Timing and spatial distribution of habitat gains and losses will also be critical (Galbraith et al. 2002); demographically vulnerable species such as piping plovers will be especially susceptible to lags between habitat loss and formation. Increased coastal storm activity is a second climate change-related threat to piping plovers in their Atlantic Coast breeding range. Although there is uncertainty about whether and how storm frequency or intensity will change relative to 20th century trends (CCSP 2009), sea-level rise alone will increase coastal flooding during storm surges and amplify rates of habitat change on coastal beaches. Increased numbers and intensity of storms during the breeding season could directly affect piping plover breeding success by increasing long-term rates of nest inundation, nest abandonment, or chick mortality due to harsh weather. Although poorly understood and not discussed further, we do not discount the potential for other climate change-related effects on piping plovers (e.g., changes in predator communities, emergence of new diseases, increases in competition for nesting territories with other beachnesting bird species on a reduced habitat base).

Seabeach amaranth

Species/Critical Habitat Description:

Seabeach amaranth (*Amaranthus pumilus*) is an annual plant that grows on Atlantic barrier islands and ocean beaches currently ranging from South Carolina to New York. It was listed as threatened under the ESA on April 7, 1993 (58 FR 18035) because of its vulnerability to human and natural impacts and the fact that it had been eliminated from two-thirds of its historic range (USFWS 1996b). Seabeach amaranth stems are fleshy and pink-red or reddish, with small rounded leaves that are 0.5 to 1.0 inches in diameter. The green leaves, with indented veins, are clustered toward the tip of the stems, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous, borne in clusters along the stems. There is no designation of critical habitat for seabeach amaranth.

Life History:

Seabeach amaranth is an annual plant. Germination of seabeach amaranth seeds occurs over a relatively long period, generally from April to July. Upon germinating, this plant initially forms a small unbranched sprig, but soon begins to branch profusely into a clump. This clump often reaches one foot in diameter and consists of five to 20 branches. Occasionally, a clump may get as large as three feet or more across, with 100 or more branches. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June, but more typically commencing in July and continuing until the death of the plant in late fall. Seed production begins in July or August and peaks in September during most years, but continues until the death of the plant. Weather events, including rainfall, hurricanes, and temperature extremes, and predation by webworms have strong effects on the length of the reproductive season of seabeach amaranth. Because of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July. Under favorable circumstances, however, the reproductive season may extend until January or sometimes later (Radford et al. 1968; Bucher and Weakley 1990; Weakley and Bucher 1992).

Population dynamics:

Within New York and across its range, seabeach amaranth numbers vary from year to year. Data in New York is available from 1987 to 2016. Recently, the number of plants across the entire state dwindled from a high of 244,608 in 2000 to 4,985 in 2016. This trend of decreasing numbers is seen throughout its range. A total of 249,261 plants were found throughout the species' range in 2000. By 2016, those numbers had dwindled to 9,221 plants (Table 6). Seabeach amaranth is dependent on natural coastal processes to create and maintain habitat. However, high tides and storm surges from tropical systems can overwash, bury, or inundate seabeach amaranth plants or seeds, and seed dispersal may be affected by strong storm events. In September of 1989, Hurricane Hugo struck the Atlantic Coast near Charleston, South Carolina, causing extensive flooding and erosion north to the Cape Fear region of North Carolina, with less severe effects extending northward throughout the range of seabeach amaranth. This was followed by several severe storms that, while not as significant as Hurricane

Hugo, caused substantial erosion of many barrier islands in the seabeach amaranth's range. Surveys for seabeach amaranth revealed that the effects of these climatic events were substantial (Weakley and Bucher 1992). In the Carolinas, populations of amaranth were severely reduced.

In South Carolina, where the effects of Hurricane Hugo and subsequent dune reconstruction were extensive, amaranth numbers declined from 1,800 in 1988 to 188 in 1990, a reduction of 90 percent. A 74 percent reduction in amaranth numbers occurred in North Carolina, from 41,851 plants in 1988 to 10,898 in 1990. Although population numbers in New York increased in 1990, range-wide totals of seabeach amaranth were reduced 76 percent from 1988 (Weakley and Bucher 1992). The influence stochastic events have on long-term population trends of seabeach amaranth has not been assessed.

Year	DE	NY	MD-VA	NC	NJ	SC	RI-CT-MA	Total
1987	0	0	0	10278	0	1341	0	11619
1988	0	0	0	20261	0	1800	0	22061
1989	0	0	0	0	0	0	0	0
1990	0	331	0	4459	0	188	0	4978
1991	0	2251	0	1170	0	0	0	3421
1992	0	422	0	32160	0	15	0	32597
1993	0	195	0	22214	0	0	0	22409
1994	0	182	0	13964	0	560	0	14706
1995	0	599	0	33514	0	6	0	34119
1996	0	2263	0	8455	0	0	0	10718
1997	0	11918	0	1445	0	2	0	13365
1998	0	10699	2	11755	0	141	0	22597
1999	0	31196	1	596	0	196	0	31989
2000	37	244608	1160	105	1039	2312	0	249261
2001	71	205233	3331	5088	5813	231	0	219767
2002	417	193412	2794	4459	10908	0	0	211990
2003	12	114535	503	11233	5087	1381	0	132751
2004	9	30942	535	11866	6817	2110	0	52279
2005	6	16813	627	20718	5795	671	0	44630
2006	39	32553	1551	3251	6522	721	0	44637
2007	19	3914	2179	875	2191	60	0	9238
2008	11	4416	1048	1606	1141	51	0	8273
2009	44	5402	1260	785	3226	26	0	10743
2010	29	534	203	2574	926	0	0	4266
2011	33	2662	240	373	2614	0	0	5922
2012	302	1213	251	154	1239	0	0	3159
2013	104	729	8	166	316	0	0	1323
2014	75	902	39	543	1287	0	0	2846
2015	267	1008	122	1661	2488	231	0	5777
2016	39	4985	47	827	3323	0	0	9221
State Totals	1514	923917	15901	226555	60732	12043	0	1240662

Table 6. Seabeach Amaranth Range-Wide Plant Counts 1987-2016 (USFWS, Raleigh Field Office, 2016).

Status and distribution:

The species historically occurred in nine states from Rhode Island to South Carolina (USFWS 2003c). By the late 1980s, habitat loss and other factors had reduced the range of this species to

North and South Carolina. Since 1990, seabeach amaranth has reappeared in several states that had lost their populations in earlier decades. However, threats like habitat loss have not diminished, and populations are declining overall. It is currently found in New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, and South Carolina. The typical habitat where this species is found includes the lower foredunes and upper beach strands on the ocean side of the primary sand dunes and overwash flats at accreting spits or ends of barrier islands.

Threats:

Seabeach amaranth has been and continues to be threatened by destruction or adverse alteration of its habitat. As a fugitive species dependent on a dynamic landscape and large-scale geophysical processes, it is extremely vulnerable to habitat fragmentation and isolation of small populations. Further, because this species is easily recognizable and accessible, it is vulnerable to taking, vandalism, and the incidental trampling by curiosity seekers. The most serious threats to the continued existence of seabeach amaranth are construction of beach stabilization structures, natural and man-induced beach erosion and tidal inundation, fungi (i.e., white wilt), beach grooming, herbivory by insects and mammals, and off-road vehicles. Herbivory by webworms, deer, feral horses, and rabbits is a major source of mortality and lowered fecundity for seabeach amaranth. However, the extent to which herbivory affects the species as a whole is unknown.

Potential effects to seabeach amaranth from vehicle use on the beaches include vehicles running over, crushing, burying, or breaking plants, burying seeds, degrading habitat through compaction of sand and the formation of seed sinks caused by tire ruts. Seed sinks occur when blowing seeds fall into tire ruts, then a vehicle comes along and buries them further into the sand preventing germination. If seeds are capable of germinating in the tire ruts, the plants are usually destroyed before they can reproduce by other vehicles following the tire ruts. Those seeds and their reproductive potential become lost from the population.

Pedestrians also can negatively affect seabeach amaranth plants. Seabeach amaranth occurs on the upper portion of the beach which is often traversed by pedestrians walking from parking lots, hotels, or vacation property to the ocean. This is also the area where beach chairs and umbrellas are often set up and/or stored. In addition, resorts, hotels, or other vacation rental establishments may set up volleyball courts or other sporting activity areas on the upper beach at the edge of the dunes. All of these activities can result in the trampling and destruction of plants. Pedestrians walking their dogs on the upper part of the beach, or dogs running freely on the upper part of the beach, may result in the trampling and destruction of seabeach amaranth plants. The extent of the effects that dogs have on seabeach amaranth is not known.

Recovery Criteria:

Seabeach amaranth will be considered for delisting when the species exists in at least six states within its historic range and when a minimum of 75 percent of the sites with suitable habitat within each state are occupied by populations for 10 consecutive years (USFWS 1996b). The recovery plan states that mechanisms must be in place to protect the plants from destructive habitat alterations, destruction or decimation by off-road vehicles or other beach uses, and protection of populations from debilitating webworm predation.

Red knot

Species/Critical Habitat Description:

The red knot was listed as a threatened species under the Endangered Species Act January 12, 2015 (Federal Register No. 238, December 11, 2014). The Service has not yet designated Critical Habitat for the species. The red knot is a large, bulky sandpiper with a short, straight, black bill. During the breeding season, the legs are dark brown to black, and the breast and belly are a characteristic russet color that ranges from salmon-red to brick-red. Males are generally brighter shades of red, with a more distinct line through the eye.

Life History:

Breeding-The red knot breeds in the central Arctic, from the islands of northern Hudson Bay to the Foxe Basin shoreline of Baffin Island, and west to Victoria Island (Morrison and Harrington 1972). Red knots generally nest in dry, slightly elevated tundra locations, often on windswept slopes with little vegetation. Breeding areas are located inland, but near arctic coasts. Nests may be scraped into patches of mountain avens (*Dryas octopetala*) plants, or in low spreading vegetation on hummocky (characterized by knolls or mounds) ground containing lichens, leaves, and moss. After the eggs hatch, red knot chicks and adults quickly move away from high nesting terrain to lower, freshwater wetland habitats.

Pair bonds form soon after the birds arrive on breeding grounds, in late May or early June, and remain intact until shortly after the eggs hatch (Niles et al. 2008, Harrington 2001). Female red knots lay only one clutch per season, and, as far as is known, do not lay a replacement clutch if the first is lost. The usual clutch size is four eggs, though three egg clutches have been recorded. The incubation period lasts approximately 22 days from the last egg laid to the last egg hatched, and both sexes participate equally in egg incubation. Young are precocial, leaving the nest within 24 hours of hatching and foraging themselves (Niles et al. 2008). Females are thought to leave the breeding grounds and start moving south soon after the chick hatch in mid-July. Thereafter, parental care is provided solely by the males, but about 25 days later (around August 10) males also abandon the newly fledged juveniles and move south. Not long after, they are followed by the juveniles (Niles et al. 2008). Breeding success varies dramatically among years in a somewhat cyclical manner. Two main factors seem to be responsible for the annual variation: abundance of arctic lemmings (*Dicrostonyx torquatus* and *Lemmus sibericus*) (by indirectly affecting predation pressure on shorebirds) and weather (Piersma and Lindstrom 2004, Blomqvist et al. 2002, Summers and Underhill 1987). Growth rate of chicks is very high compared to similarly sized shorebirds nesting in more temperate climates and is strongly correlated with weather-induced and seasonal variation in availability of invertebrate prey (Schekkerman et al. 2003).

Migration-Each year some red knots make one of the longest distance migrations known in the animal kingdom, travelling up to 19,000 miles annually. Before takeoff, the birds accumulate and store large amounts of fat to fuel migration and undergo substantial changes in metabolic rates. Because stop-overs are time constrained, red knot require areas that have easily digestible food to achieve adequate weight gain (Niles et al. 2008, van Gils et al. 2005a,b; Piersma et al. 1999) that fuels the next migratory flight and, upon arrival in the Arctic, also fuels a body transformation in breeding condition (Morrison 2007). At some stages of migration, very high proportions of entire shorebird populations may use a single migration staging site to prepare for long flights. Well known spring stop-over areas along the Atlantic coast include areas in Argentina, eastern Brazil, northern Brazil, the Southeast United States (e.g., Carolinas to Florida); the Virginia barrier islands; and Delaware Bay (Delaware and New Jersey). Large and small groups of red knots can occur in suitable habitats all along the Atlantic and Gulf coasts from Argentina to Massachusetts (Niles et al. 2008).

Feeding- Red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab eggs. On the breeding grounds, knots mainly eat insects. Large flocks of red knots arrive at stopover areas along the Delaware Bay and New York/New Jersey's Atlantic coast each spring, with many of the birds having flown directly from northern Brazil. The spring migration is timed to coincide with the spawning season for the horseshoe crab (*Limulus polyphemus*). Horseshoe crab eggs provide a rich, easily digestible food source for migrating birds. Mussel beds on New Jersey's southern Atlantic coast and intertidal/wrack line areas on New York's coast are also important forage habitats for migrating knots. Birds arrive at stopover areas with depleted energy reserves and must quickly rebuild their body fat to complete their migration to Arctic breeding areas. During their brief 10- to 14-day spring stay in the mid-Atlantic, red knots can nearly double their body weight.

In Delaware Bay, red knots preferentially feed in microhabitats where horseshoe crab eggs are concentrated, such as at horseshoe crab nests (Fraser et al. 2010), at shoreline discontinuities (e.g., creek mouths) (Botton et al. 1994), and in the wrack line (Nordstrom et al. 2006, Karpanty et al. 2011). The wrack line is the beach zone just above the high tide line where seaweed and other organic debris are deposited by the tides. Wrack may also be a significant foraging microhabitat outside Delaware Bay, for example where mussel spat (i.e., juvenile stages) are attached to deposits of tide-cast material. Wrack material also concentrates certain invertebrates such as amphipods, insects, and marine worms (Kluft and Ginsberg 2009), which are secondary prey species for red knots.

Sheltering-For many shorebirds, the supra-tidal (above the high tide) sandy habitats of inlets provide important areas for roosting, especially at higher tides when intertidal habitats are inundated (Harrington 2008). Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats, including sand spits, islets, shoals, and sandbars, often associated with inlets (Harrington 2008, Winn and Harrington *in* Guilfoyle et al. 2006, Harrington *in*

Guilfoyle et al. 2007). From South Carolina to Florida, red knots are found in significantly higher numbers at inlets than at other coastal sites (Harrington 2008).

Rangewide Status:

In the United States, red knot populations declined sharply in the late 1800s and early 1900s due to excessive sport and market hunting, followed by hunting restrictions and signs of population recovery by the mid-1900s (Urner and Storer 1949, Stone 1937, Bent 1927). However, it is unclear whether the red knot population fully recovered its historical numbers (Harrington 2001) following the period of unregulated hunting.

More recently, long-term survey data from two key areas (Tierra del Fuego wintering area and Delaware Bay spring stopover site) both show a roughly 75 percent decline in red knot numbers since the 1980s (A. Dey pers. comm. October 12, 2012, G. Morrison pers. comm. August 31, 2012, as cited in Service 2014c; Dey et al. 2011a, Clark et al. 2009, Morrison et al. 2004, Morrison and Ross 1989, Kochenberger 1983, Dunne et al. 1982, Wander and Dunne 1982). Survey data are also available for the Brazil, Northwest Gulf of Mexico, and Southeast-Caribbean wintering areas, but are insufficient to infer trends.

Recovery Plan:

A recovery plan has not yet been developed for red knot at this time.

Threats:

Current threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at stopover areas; disturbance by vehicles, people, dogs, aircraft, and boats; and climate change.

The remainder of this section (Threats) is excerpted from Endangered and Threatened Wildlife and Plants: Proposed Threatened Status for the Rufa Red knot (*Calidris canutus rufa*); Proposed Rule Supplement (Service 2014c).

Much of the U.S. coast within the range of the red knot is already extensively developed. Direct loss of shorebird habitats occurred over the past century as substantial commercial and residential developments were constructed in and adjacent to ocean and estuarine beaches along the Atlantic and Gulf coasts. In addition, red knot habitat was also lost indirectly, as sediment supplies were reduced and stabilization structures were constructed to protect developed areas.

Past and ongoing stabilization projects alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components of which red knots rely. Past loss of stopover and wintering habitat likely reduces the resilience of the red knot by making it more dependent on those habitats that remain, and more vulnerable to threats (e.g., disturbance, predation, reduced quality or abundance of prey, increased intraspecific and interspecific competition) within those restricted habitats.

Where shorebird habitat has been severely reduced or eliminated by hard stabilization structures, beach nourishment may be the only means available to replace any habitat for as long as the hard structures are maintained (Nordstrom and Mauriello 2001), although such habitat will persist only with regular nourishment episodes (typically on the order of every 2 to 6 years). In Delaware Bay, beach nourishment has been recommended to prevent loss of spawning habitat for horseshoe crabs (Kalasz 2008, Carter et al. *in* Guilfoyle et al. 2007, Atlantic States Marine Fisheries Commission (ASMFC) 1998), and is being pursued as a means of restoring shorebird habitat in Delaware Bay following Hurricane Sandy (Niles et al. 2013, USACE 2012). However, red knots may be directly disturbed if beach nourishment takes place while the birds are present. On New Jersey's Atlantic coast, beach nourishment has typically been scheduled for the fall when red knots are present because of various constraints at other times of year. In addition to causing disturbance during construction, beach nourishment often increases recreational use of the widened beaches that, without careful management, can increase disturbance of red knots. Beach nourishment can also temporarily depress, and sometimes permanently alter, the invertebrate prey base on which shorebirds depend.

In addition to disturbing the birds and impacting the prey base, beach nourishment can affect the quality and quantity of red knot habitat (M. Bimbi pers. comm., November 1, 2012, as cited in USFWS 2014c; Greene 2002). The artificial beach created by nourishment may provide only suboptimal habitat for red knots, as a steeper beach profile is created when sand is stacked on the beach during the nourishment process. In some cases, nourishment is accompanied by planting of dense beach grasses, which can directly degrade habitat, as red knots require sparse vegetation to avoid predation. By precluding overwash, especially where large artificial dunes are constructed, beach nourishment can also lead to further erosion on the bayside and promote bayside vegetation growth, both of which can degrade the red knot's preferred foraging and roosting habitats (sparsely vegetated flats in or adjacent to intertidal areas). Preclusion of overwash also impedes formation of new red knot habitats. Beach nourishment can also encourage further development, bringing further habitat impacts, reducing future alternative management options such as a retreat from the coast, and perpetuating the developed and stabilized conditions that may ultimately lead to inundation where beaches are prevented from migrating (M. Bimbi pers. comm., November 1, 2012, as cited in USFWS 2014c, Greene 2002).

In wintering and migration areas, the most common predators of red knots are peregrine falcons (*Falco peregrinus*), harriers (*Circus* spp.), accipiters (Family Accipitridae), merlins (*F. columbarius*), shorteared owls (*Asio flammeus*), and greater black-backed gulls (*Larus marinus*) (Niles *et al.* 2008). In addition to greater black-backed gulls, other large gulls (e.g., herring gulls (*Larus argentatus*)) are anecdotally known to prey on shorebirds (Breese 2010). Peregrines are known to hunt shorebirds in the red knot's Virginia and Delaware Bay stopover areas (Niles 2010a, Niles et al. 2008), and peregrine predation on red knots has been observed in Florida (A. Schwarzer pers. comm., June 17, 2013, as cited in USFWS 2014c).

Red knots' selection of high-tide roosting areas on the coast appears to be strongly influenced by raptor predation, something well demonstrated in other shorebirds (Niles et al. 2008). Red knots require roosting habitats away from vegetation and structures that could harbor predators (Niles et al. 2008). Red knots' usage of foraging habitat can also be affected by the presence of predators, possibly affecting the birds' ability to prepare for their final flights to the arctic breeding grounds (Watts 2009) (e.g., if the knots are pushed out of those areas with the highest prey density or quality). Outside of the breeding grounds, predation is not directly impacting red knot populations despite some direct mortality. At key stopover sites, however, localized predation pressures are likely to exacerbate other threats to red knot populations, such as habitat loss, food shortages, and asynchronies between the birds' stopover period and the occurrence of favorable food and weather conditions. Predation pressures worsen these threats by pushing red knots out of otherwise suitable foraging and roosting habitats, causing disturbance, and possibly causing changes to stopover duration or other aspects of the migration strategy.

Commercial harvest of horseshoe crabs has been implicated as a causal factor in the decline of the red knot by decreasing the availability of horseshoe crab eggs in the Delaware Bay stopover (Niles et al. 2008). Notwithstanding the importance of the horseshoe crab and Delaware Bay, other lines of evidence suggest that the red knot also faces threats to its food resources throughout its range. Although threats to food quality and quantity are widespread, red knots in localized areas have shown some ability to switch prey when the preferred prey species became reduced (Escudero et al. 2012, Musmeci et al. 2011), suggesting some adaptive capacity to cope with this threat.

The quantity and quality of red knot prey may also be affected by the placement of sediment for beach nourishment or disposal of dredged material. Invertebrates may be crushed or buried during project construction. Although some benthic species can burrow through a thin layer of additional sediment, thicker layers (over 35 in (90 cm)) smother the benthic fauna (Greene 2002). By means of this vertical burrowing, recolonization from adjacent areas, or both, the benthic faunal communities typically recover. Recovery can take as little as 2 weeks or as long as 2 years, but usually averages 2 to 7 months (Greene 2002, Peterson and Manning 2001).

The invertebrate community structure and size class distribution following sediment placement may differ considerably from the original community (Zajac and Whitlatch 2003, Peterson and Manning 2001, Hurme and Pullen 1988, Wooldridge et al. 2016). Recovery may be slow or incomplete if placed sediments are a poor grain size match to the native beach substrate (Bricker 2012, Peterson et al. 2006, Greene 2002, Peterson et al. 2000, Hurme and Pullen 1988) or if placement occurs during a seasonal low point in invertebrate abundance (Burlas 2001).

Recovery is also affected by the beach position and thickness of the deposited material (Schlacher et al. 2012). Reduced prey quantity and accessibility caused by a poor sediment size match have been shown to affect shorebirds, causing temporary but large (70 to 90 percent) declines in local shorebird abundance (Peterson et al. 2006).

Recreational activities can likewise affect the availability of shorebird food resources by causing direct mortality of prey. Studies from the United States and other parts of the world have documented recreational impacts to beach invertebrates, primarily from the use of off-road vehicles (ORVs), but even heavy pedestrian traffic can have effects. Few studies have examined the potential link between these invertebrate impacts and shorebirds. However, several studies on the effects of recreation on invertebrates are considered the best available information as they involve species and habitats similar to those used by red knots.

In some wintering and stopover areas, red knots and recreational users (e.g., pedestrians, ORVs, dog walkers, boaters) are concentrated on the same beaches (Niles et al. 2008, Tarr 2008). Recreational activities affect red knots both directly and indirectly. These activities can cause habitat damage (Schlacher and Thompson 2008, Anders and Leatherman 1987), cause shorebirds to abandon otherwise preferred habitats, negatively affect the birds' energy balances, and reduce the amount of available prey. Effects to red knots from vehicle and pedestrian disturbance can also occur during construction of shoreline stabilization projects including beach nourishment. Red knots can also be disturbed by motorized and nonmotorized boats, fishing, kite surfing, aircraft, and research activities (K. Kalasz pers. comm. November 17, 2011, as cited in USFWS 2014c; Niles et al. 2008, Peters and Otis 2007, Harrington 2005, Meyer et al. 1999, Burger 1986) and by beach raking.

4. Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private activities in the action area described above, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early consultation, and the impact of State or private actions that are occurring in the action area. As defined in 50 CFR §402.02, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole, or in part, by Federal agencies in the United States or upon the high seas.

The environmental baseline reflects both the substantial increases in the areal extent of piping plover habitat on Fire Island due to Hurricane Sandy and the resultant losses (from just after Hurricane Sandy to when this biological assessment was written) of this habitat due to post-Hurricane Sandy stabilization efforts and other activities or natural processes that degraded or destroyed newly formed coastal habitats. It also accounts for the impacts of previous stabilization efforts on piping plovers and their habitats.

Habitat Loss and Fragmentation:

Inlets (excerpted from Rice (2016))

Inlets are a highly valuable habitat for piping plover, red knots, other shorebirds, and waterbirds for foraging, loafing, and roosting (Harrington 2008, Lott et al. 2009, Maddock et al. 2009). Artificially closed inlets provide a different mosaic of habitats than those that have closed naturally. Naturally closed inlets tend to be low in elevation, to have no or sparse vegetation initially, and are wide, especially if the tidal deltas or shoals have welded to the island. Artificially closed inlets, on the other hand, have higher elevations, tend to have a substantial constructed berm and dune system tying in to the adjacent beach and dune systems, and are often manually planted with dune grasses and/or other vegetation to stabilize the area. The materials used to fill the inlet and construct the berm and dune ridge typically are mined nearby, often disturbing the local sediment supply and transport system. The overwash occurring periodically at a naturally closed inlet is prevented at an artificially closed inlet by the constructed dune ridge, or in some cases by additional hard structures or sandbags.

New York – Atlantic Ocean Shoreline

Tidal Inlet Habitat Changes between Hurricane Sandy and 2015 (excerpted from Rice (2016))

Hurricane Sandy opened 3 inlets or breaches along the South Shore of Long Island (Rice 2015). Of the 3 breaches or inlets opened by Hurricane Sandy on the South Shore of Long Island, 2 were closed artificially to protect life and safety in highly populated suburban areas within two months and the third, at Fire Island National Seashore, remains open and is one of only two inlets between Montauk, NY, and Chincoteague, VA, that are not modified in any manner (the other inlet being Little Egg Inlet, NJ, which has been proposed for dredging). In the 3 years after Hurricane Sandy, the breach complex at Fire Island National Seashore continued to evolve with shoals and spits accreting, or growing, and retreating; the breach has remained relatively stable in its position (Flagg et al., http://po.msrc.sunysb.edu/ESB; Michael Bilecki, NPS, pers. communication, 8/10/16 as cited in Rice (2016)). The depth of the Fire Island Inlet breach also varies seasonally and with time. Flagg et al. (http://po.msrc.sunysb.edu/ESB) indicated that the inlet may be on a course to close although aerial photography since then has suggested a return to flows through the breach. In the three years following Hurricane Sandy, nearly all 9 inlets modified by dredging on the South Shore were dredged (including Shinnecock, Moriches and Fire Island Inlet in the action area). Periodic pond letting at Georgica, Sagaponack, and Mecox Ponds continued. Suffolk County dredged Shinnecock Inlet area channels in 2015 and placed dredged material on beaches to both the east and west of the inlet (USACE 2015n). Moriches Inlet was dredged for breach fill (~200,000 cy) to close the breach opened by Hurricane Sandy at Cupsogue Beach County Park in November-December 2012 (USACE 2013i). Fire Island Inlet was dredged in 2014 by the USACE with 1,200,000 cy of sediment placed at Tobay Beach and Gilgo Beach. Fire Island Inlet was dredged removing 790,000 cy of sediment in 2013-14 by the New York State Department of Transportation to construct an artificial dune/levee along Ocean Parkway at Tobay and Gilgo Beaches plus an artificial dune/levee to protect the traffic circle at Robert Moses SP (USFWS 2014c). The inlet was dredged for navigation maintenance 13 times since 1985.

Beach habitat (excerpted from Rice (2017)

Sandy beaches are a valuable habitat for piping plovers, red knots, other shorebirds and waterbirds for nesting, foraging, loafing, and roosting. In 2015 there were 125.69 miles (202.28 km) of sandy shoreline on the South Shore of Long Island, with 122.57 miles (197.26 km) of sandy beaches and 3.12 miles (5.02 km) of armored shoreline where no sandy beach was present (Rice (2017)). Another 0.65 miles (1.04 km) of shoreline in Montauk were predominantly rocky. Where sandy beaches were present, the beachfront was 43% developed and 57% undeveloped. When sections of shoreline where sandy beaches were absent due to hard shoreline stabilization structures are included, the beachfront that was developed increases to 45% and the beachfront that was undeveloped decreases to 55%. Of the 3.12 miles (5.02 km) of armored shoreline where sandy beaches were absent in 2015, 0.13 miles (0.21 km) were scheduled to receive sediment placement in 2016 as part of the Federal Emergency Stabilization Project which initiated construction in 2015; as a result, the length of shoreline armored with no beach is anticipated to decrease to 2.99 miles (4.81 km) in the very near future.

The beaches of New York have multiple layers of governance and management. Most of Long Island falls within Suffolk and Nassau Counties. Nassau County, although part of this Environmental Baseline of the South Shore of Long Island, is outside of the FIMP project area. Within the counties, there are a number of Towns such as Southampton, East Hampton, Brookhaven and Islip. These towns have multiple incorporated villages or hamlets (e.g., Montauk, Sagaponack, Westhampton Beach, West Hampton Dunes and Long Beach) as well as unincorporated areas. The Dongan Patent of 1686 granted the Towns ownership of the waters and beaches (amongst other natural resources) within their boundaries, which the Towns manage via Boards of Trustees. These Boards of Trustees are separate from the Town Councils or Boards. The sandy beaches of Long Island are therefore publicly owned by the various Towns, although their use is often restricted to residents of the Town. The property immediately adjacent to the beach, however, is most often privately owned.

In 2015, 61.60 miles (99.13 km) of sandy beach were present within public or NGO-owned beachfront lands, a slight increase due to the identification of new public beachfront lands in the Town of Southampton. The proportion of sandy beach within public or NGO-ownership therefore increased slightly to 50% in 2015. It is unknown whether the Towns' ownership and management of the beaches (through the Dongan Patent) will move along with the beaches as they migrate with rising sea level, or if the adjacent private property will affect that ownership and/or management of the sandy beaches.

Shoreline Hardening Measures

Removing overlapping hard shoreline stabilization structures, a total of 7.06 new miles (11.36 km) of sandy beaches on the South Shore (considering both Suffolk and Nassau Counties) were armored with bulkheads and revetments from late 2012 to 2015. Most of this increase was due to the construction of sandfilled geotextile revetments, referred to as “sand cubes,” “geocubes,” or the brand-name “TrapBags.” Another 3.24 miles (5.21 km) of sandy beach armored with hard shoreline stabilization structures were identified following Hurricane Sandy; these structures were exposed by Hurricane Sandy or hurricane rebuilding efforts. Altogether the length of sandy beach armored considering both Suffolk and Nassau County (both newly constructed and newly identified) in the three years following Hurricane Sandy was 10.30 miles (10.58 km), an increase of 41% from the length of shoreline armored prior to the storm. As of the end of 2015, 35.63 miles (57.34 km), or 28%, of Atlantic Ocean shoreline of New York was armored (Rice 2017). Of the 35.63 miles (57.34 km) of armored beaches identified three years after Hurricane Sandy, 3.12 miles (5.02 km) had no sandy beach present at the time the 2015 aerial imagery was taken. Altogether the South Shore of Long Island, considering both Suffolk and Nassau Counties, had 114 seawalls / bulkheads / revetments, at least 295 groins, 8 jetties and 1 breakwater as of the end of 2015 (Rice 2017).

Sediment Placement Modifications

Prior to Hurricane Sandy, ~65 miles (~105 km) of sandy beach on the South Shore of Long Island had been modified by sediment placement, and another 5.00 miles (8.05 km) had been proposed. In the three years following Hurricane Sandy, 44.98 miles (72.39 km) of the South Shore’s sandy beaches were modified with sediment placement, with 32.31 miles (52.00 km) of those beaches having previously been modified with sediment placement and 12.67 miles (20.39 km) of those beaches newly modified after Hurricane Sandy, an increase of 20% (Rice 2017). Altogether, as of the end of 2015, 77.27 miles (124.35 km), or 62%, of sandy beaches on the Atlantic Ocean shoreline of New York had been modified with sediment placement at least once.

As of the end of 2015, an additional 15.88 miles (25.56 km) of sandy beaches were proposed or scheduled to be modified with sediment placement; 10.22 miles (16.45 km) of the proposed project areas have previously been modified by sediment placement, and 5.66 miles (9.11 km) have not. The 11 proposed project areas include the developed communities on Fire Island, which received fill as part of the federal Fire Island to Moriches Inlets (FIMI) Project, and the federal Jones Inlet to East Rockaway Inlet (Long Beach) Hurricane and Storm Damage Reduction Project (which is also constructed 4 new groins as described in the Armor section above). At least 125 separate project areas or sections received or were proposed to receive beach and/or dune fill in the three years after Hurricane Sandy along the Atlantic Ocean coast of New York. Of the 43 projects where sediment volume data were available, 17,292,352 cubic yards (cy) of sediment were placed or in the process of being placed at the end of 2015. An additional 7,962,285 cubic yards (cy) were anticipated to be placed as part of the FIMI and Long Beach projects beginning in 2016, and another 1,100,100 cy (841,087 m3) has been proposed for placement in a community-wide project in Quogue and a private property project in Montauk. Three years after Hurricane Sandy, 68% of the South Shore’s sandy beaches (82.93 miles or 1332.46 km) have been or are proposed to be modified by sediment placement projects, an increase of 15% from the proportion of sandy beaches modified by sediment placement prior to Hurricane Sandy.

Beach Scraping Modifications

In the three years following Hurricane Sandy, at least 22.48 miles (36.18 km), or 18%, of sandy beach on the South Shore of Long Island were modified with beach scraping or grading (Rice 2017). The beach can be scraped or graded to create artificial dunes or levees immediately following a storm event, to remove overwash material from developed or paved areas along the beachfront, or to bury newly constructed geotextile revetments, bulkheads or sand retaining walls. Several communities on the Atlantic Ocean shoreline of New York have communitywide, 10-year beach scraping or grading permits from NYS DEC to scrape or grade the beach whenever conditions permit. Note that beach scraping or grading that scraped/graded fill material as part of a sediment placement project was excluded, unless the fill material was from an upland source and placed to bury or build an artificial dune/levee and involved scraping of the beach in addition to the fill. Technically every sediment placement project involves scraping or grading of the fill material to the design specifications – this metric was intended to capture habitat modifications resulting from scraping of the natural beach profile and sediment, not strictly fill material placed on top of the natural profile. Beach scraping or grading occurred in all but 8 of the 30 of the communities along the South Shore in the three years since Hurricane Sandy. The sandy beaches in Napeague, Amagansett, Westhampton Beach, Captree SP in the Town of Islip, Tobay Beach in the Town of Oyster Bay, Atlantic Beach, Manhattan Beach, and Sea Gate were not modified by beach scraping or grading in the three years after Hurricane Sandy. Beach scraping or grading modified varying proportions of the sandy beaches in the other 22 communities.

Sand Fencing Modifications

Twelve of the South Shore's 30 communities have had at least 50% of their sandy beaches modified with sand fencing since Hurricane Sandy (Rice 2017). A total of at least 57.85 miles (93.10 km) of sandy beach have been modified with sand fencing, or 46% of the South Shore's sandy beaches (Rice 2017). At least 530 separate sections of sand fencing were identified on the sandy beaches of Long Island's South Shore in the three years following Hurricane Sandy. Only Captree SP in Islip and the Sea Gate area in Brooklyn did not have any sand fencing during the three-year period.

The sandy beach habitat on South Shore of Long Island has been significantly modified by anthropogenic activities. Nearly half (45%) of the beachfront has been developed (Rice 2017). Twenty-eight percent of the beachfront is known to be armored with hard shoreline stabilization structures. More than two-thirds (68%) of the beaches have been or are proposed to be modified by sediment placement projects. At least 18% of the beaches were scraped or graded in the three years following Hurricane Sandy. And nearly half (46%) of the sandy beaches were modified by sand fencing between 2012 and 2015.

Three areas in particular on the South Shore of Long Island have been heavily modified in the three years since Hurricane Sandy: (1) the beaches from East Hampton Village through the Village of Southampton, (2) Fire Island, and (3) the Rockaway peninsula. Each of these three areas has had significant cumulative impacts to its sandy beaches since Hurricane Sandy. In the six adjacent communities of East Hampton Village, Wainscott, the Village of Sagaponack, Bridgehampton, Water Mill and the Village of Southampton, which includes 18.62 miles (29.97 km) of sandy beach habitat, a significant number of private and local projects modified the beaches from 2012 to 2015 (Rice 2017). The largest of these were two locally sponsored sediment placement projects constructed in 2013-2014 that modified 5.63 miles (9.06 km) of sandy beach habitat in the Village of Sagaponack, Bridgehampton and Water Mill. This was the longest contiguous new sediment placement project on the South Shore in the three years after Hurricane Sandy. The only previous time that any of these beaches were known to be modified with sediment placement was in 1962 following the Ash Wednesday Storm. Numerous private property owners modified the sandy beaches of their individual properties as well following Hurricane Sandy (Rice 2017). At least 28 individual property owners modified the sandy beaches in this area with hard shoreline stabilization structures in the three years after Hurricane Sandy, with 26 contiguous sections of revetments, bulkheads and/or seawalls identified (either new structures or improvements to pre-existing but previously buried structures). Fifty-seven private property owners are known to have placed sediment on the beach; additional property owners may have placed fill directly underneath their buildings where the hurricane exposed their pilings and foundations. The same number of private property owners (57) scraped or graded the beach, often to fill and/or bury newly constructed sandbag revetments. Sand fencing is also prevalent in these communities, with 99 separate, contiguous sections of sand fencing totaling 12.65 miles (20.36 km) identified in the three years after Hurricane Sandy.

The cumulative impacts of these individual projects is significant for this section of sandy beach habitat. In the two years prior to Hurricane Sandy, the NYS DEC received coastal erosion management permits for 7 and 4 projects respectively within the Town of Southampton (covering the communities from the Village of Sagaponack to West Hampton Dunes). In the two months following Hurricane Sandy, NYS DEC received 108 permit applications that would allow property owners to modify oceanfront sandy beaches through armoring, sediment placement or beach scraping/grading in the Town of Southampton. In 2013, 41 permit applications were received. In 2014 only 3 permit applications were received, and in 2015 none. Virtually all of these state permits were issued, resulting in a significant cumulative impact to the Town’s sandy beach habitat. In comparison, within the neighboring Town of East Hampton (covering the communities of Montauk to Wainscott), far fewer NYS DEC permit applications were received: 10 in the two months following the hurricane, 20 in 2014, 8 in 2014 and 1 in 2015. The order of magnitude fewer permit applications by property owners in the Town of East

Hampton is most likely due to the Town's Local Waterfront Revitalization Plan, which includes a number of protective measures for sandy beach habitat that are approved by the state of New York and the U.S. Office of Ocean and Coastal Resources Management.

On Fire Island, the cumulative impacts of sandy beach habitat modifications in the three years following Hurricane Sandy are also significant. Although 98% of the island has been modified with sediment placement at least once, in the two decades preceding Hurricane Sandy, sediment placement was restricted to Robert Moses State Park at the west end, 11 of the developed communities within the Fire Island National Seashore, and Smith Point County Park at the east end; these projects modified 13.42 miles (21.60 km), or 43%, of Fire Island between 1992 and 2012, but in smaller lengths spread out periodically over the 20 years preceding Hurricane Sandy. The federal Fire Island to Moriches Inlets (FIMI) project, placed sediment along 19 miles (30.58 km) of Fire Island beaches, modifying 63% of the barrier island's sandy beach habitat within an anticipated 3 year time period. In addition to FIMI, four other sediment placement projects have been constructed at Robert Moses State Park since Hurricane Sandy and a breach opened by the storm at Smith Point County Park was closed artificially with fill material immediately after the storm. The National Park Service placed a small volume of sediment dredged from the Watch Hill Marina along approximately 600 ft (183 m) of oceanfront beach in Davis Park in 2014. In addition to the habitat modifications resulting from sediment placement projects, 11 of the 17 developed communities on Fire Island constructed TrapBag revetments along their entire beachfronts within one year of Hurricane Sandy. These revetments increased the length of sandy beach on Fire Island modified by armoring by 4.86 miles (7.82 km), or ten times the length of beach armored on the island before the hurricane. A total of 85 contiguous sections of sand fencing were installed on the island from late 2012 through 2015, modifying 13.65 miles (21.97 km), or 43%, of the island's sandy beaches.

The sandy beach habitat along the South Shore of Long Island continues to be threatened by development, sediment placement projects, armoring, beach scraping and sand fencing. Only one individual property on which a house was destroyed by Hurricane Sandy has not been rebuilt. In a few other locations, beachfront lots that were vacant prior to the storm have been developed. The length of sandy beach modified by sediment placement increased significantly. Several new miles of hard shoreline stabilization structures have been constructed. A number of communities have 10-year state permits to modify their entire beachfronts with beach scraping as conditions allow. And sand fencing modifies nearly half of the South Shore's sandy beaches. In one community – Quogue – local ordinances actually require private property owners to install and maintain sand fencing on the dunes or beach. The cumulative impacts of these habitat modifications are particularly significant along the entire South Shore shoreline.

The breach at Old Inlet on NPS property is currently open, and NPS has decided to postpone moving forward with a consultation and proposal to fill in this breach caused by Hurricane Sandy. This decision is meant, in part, to maintain newly created habitat as beneficial habitat for piping plovers for a period longer than if the breach were closed immediately through human action. As important habitat for the Fire Island population, maintaining this area as is should augment the status of the species in this recovery unit, versus if the breach were closed. However, it is difficult to quantify the effects of this decision, it is believed to provide a net benefit to the environmental baseline for piping plovers over the life of this project. Current piping plover data collected over the past 3 years as part of the FIMI project shows that use of the Wilderness Area as plover nesting habitat has been variable with 4-6 nests/year from 2013-2016 and 12 nests in 2017 (Carey et al. 2017).

Several restoration projects were identified in the FIMI Biological Opinion (BO) (USFWS 2014) to help offset take that was anticipated to occur from the project. Early successional and foraging habitat was created at Great Gunn Beach and early successional habitat was created in the New Made Dredge Area. Three natural overwash areas (Pattersquash, Narrow Bay and Narrow Bay East) were to be maintained as early successional habitat with vegetation control.

Estimates of vegetation in these areas were evaluated in 2013, 2015, and 2016 (Ritter et al. 2015, Carey et al. 2017). By 2017, vegetation growth exceeded the 30 percent vegetation trigger specified in the FIMI BO in all areas except for Great Gun. The Corps obtained a waiver in 2018 from the county for herbicide application of vegetation for a portion of Great Gunn and New Made Dredge Area.

In several of the FIMI project areas, landowners have implemented their own dune maintenance measures such as enhancing existing dunes through beach scraping and installation of sand fencing. At Smith County Park, silt fencing was placed in areas along Berma Road to prevent piping plovers chicks from crossing the road. In 2017, chicks were still able to cross the road despite placement of the silt fencing (Carey et al 2017).

Status of Piping Plover In the Action Area:

Piping plover monitoring on Fire Island has been occurring since the species was first placed on the endangered species list in 1986 (USFWS 2016, Long Island Field Office). The 1996 Recovery Plan identifies a recovery goal for the New York-New Jersey Recovery Unit as 575 pairs with a 5 year average productivity of 1.5 fledged chicks per pair (USFWS 1996). Long term monitoring for the New York-New Jersey Recovery Unit demonstrate that there has been a general increase of nesting pairs over time peaking in 2007, and then declining from 2007- 2014 with a modest increase in 2015 and 2016 (Figure 1). Most of the nesting pairs in the New York-New Jersey Recovery Unit can be attributed to the New York portion of the Recovery Unit. Productivity for piping plovers has fluctuated over time in New York, it was below 1.5 from 2007-2014, and below 1.0 in 2009, 2010, 2012, and 2013 but then increased to 1.52 in 2015 and 1.72 in 2016. Fluctuations and declines in productivity may occur due to a combination of reasons, e.g., changes in predator populations, development, human use, and vegetation encroachment.

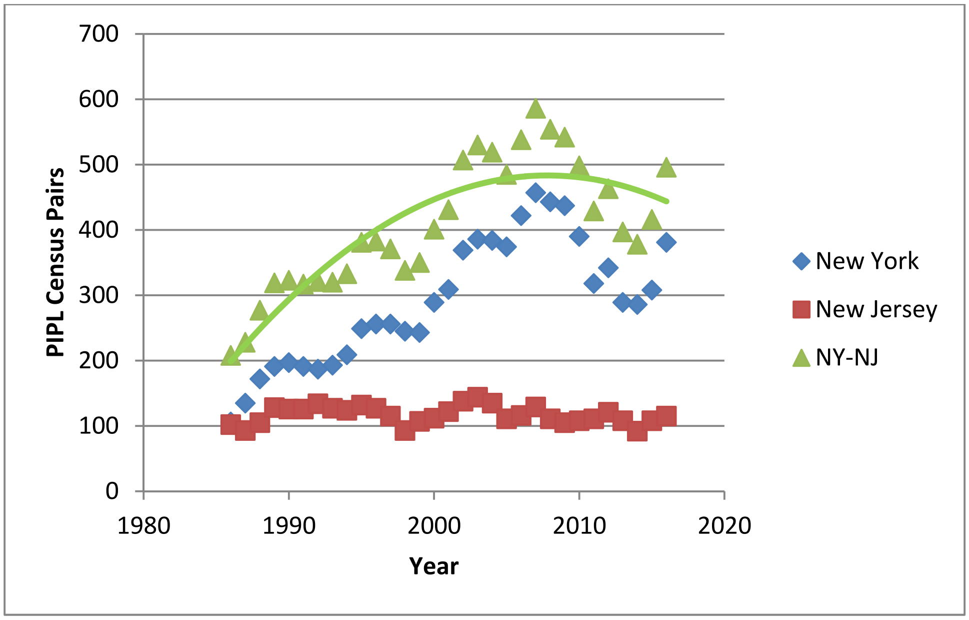


Figure 1. Piping plover census pairs over time 1986-2016 New York New Jersey Recovery Unit (source USFWS 2016).

Within the project area, there are 4 subunits identified for long-term monitoring. These subunits are geographical areas identified as: Fire Island; West Hampton; South Hampton; and East Hampton. The Corps has provided funding and support for monitoring as part of the Westhampton Interim Damage Protection Project, FIMI, West of Shinnecock Storm Damage Protection Project, and the Fire Island Inlet Maintenance Dredging Project at Democrat Point. Over the last sixteen years, the number of nesting pairs has been steadily decreasing (Figure 2). The decrease in the Project area can partly be explained by the development of West Hampton.

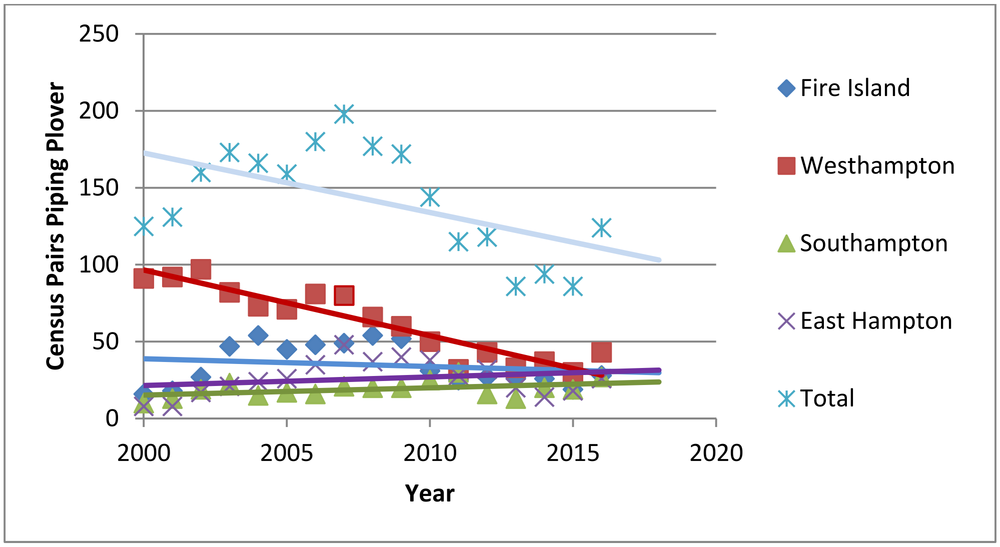


Figure 2. PIPL census pairs over time 2000-2016 Fire Island including Fire Island, West Hampton, South Hampton and East Hampton geographic units (Source USFWS LIFO, 2016)

West Hampton is a community that was hit hard in 1992 by a Northeaster creating a breach and washover area. This breach and washover area became important nesting habitat for piping plover (Cohen et al. 2009). The Corps filled the breach and repaired the dune to protect life and safety in this residential area which indirectly resulted in succession and increased predation. Ultimately, the township developed this area, which resulted in a steep decline in nesting habitat. This reduction in habitat directly led to a reduction in the number of nesting pairs in this area. (Figure 3).

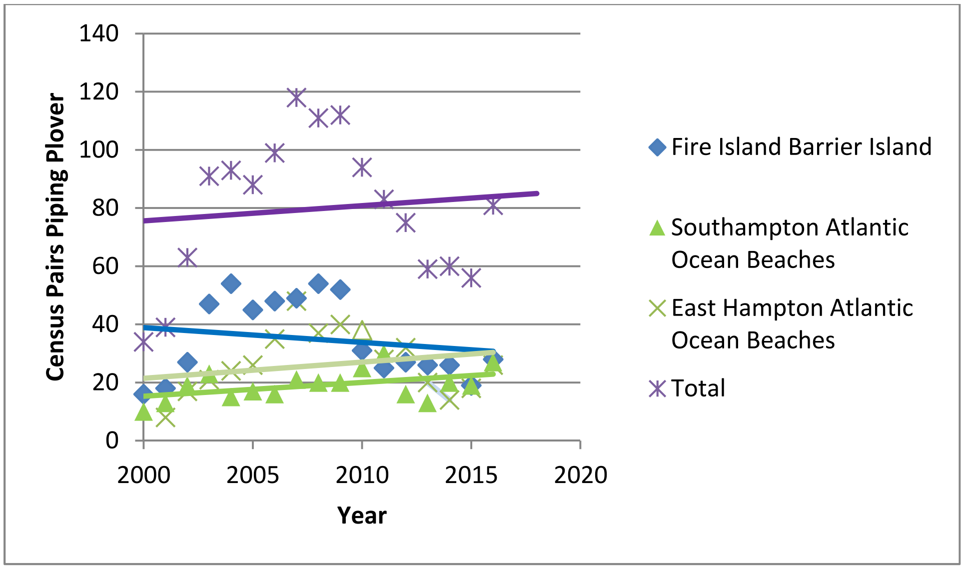


Figure 3. Piping plover census pairs over time 2000-2016, Fire Island geographic units excluding West Hampton (Source USFWS LIFO, 2016.)

In 2012 Hurricane Sandy hit the New York-New Jersey Recovery Unit creating three new breaches on Fire Island. Two of the three breaches occurred within the Fire Island geographic unit: one at the Otis Pike Wilderness area; and one at the Smith Point County Park. The third breach occurred at the West Hampton geographic unit at Cupsogue Beach County Park. In response to this storm the Corps initiated emergency breach response activities as well as the Fire Island inlet to Moriches Inlet (FIMI) Stabilization Project to fill the breaches and stabilize the dunes over 19 miles of Fire Island. Construction of the FIMI started in the winter of 2014 (Carey et.al. 2016). The FIMI project will stabilize and maintain (through the State) the dune system for 10 years as well as provide funding for monitoring of plovers and predators.

As part of the FIMI, Virginia Tech is conducting in-depth project specific monitoring throughout the 19 mile area on Fire Island. Virginia Tech has further broken down the West Hampton and Fire Island geographic units to include Fire Island National Seashore, Smith Point County Park, Cupsogue County Park, and Robert Moses State Park. Virginia Tech further broke these sub geographic units into 26 subsites that could be easily monitored (Carey et al. 2016). Monitoring began in 2013 and will continue until the end of the project. A summary of nesting pairs from 2013-2016 can be found in Figure 3. With only four years of data it is difficult to draw any conclusions regarding trends in nesting pairs. However, it is clear that there has not been a dramatic increase or decrease in nesting piping plover during this time period.

In addition to monitoring the nesting pairs, Virginia Tech is monitoring productivity and what created nesting failure. Virginia Tech suggests predation, primarily fox, is the largest single influence on nesting failure of piping plover in the study area. In 2015, there was a high degree of nest depredation and a large number of fox. The over-population of fox led to a mange outbreak which resulted in a greatly reduced population in 2016 (Carey et al., 2016). As a result of the decreased number of fox in 2016, there is a corresponding increase in nesting success of piping plover (Figure 4).

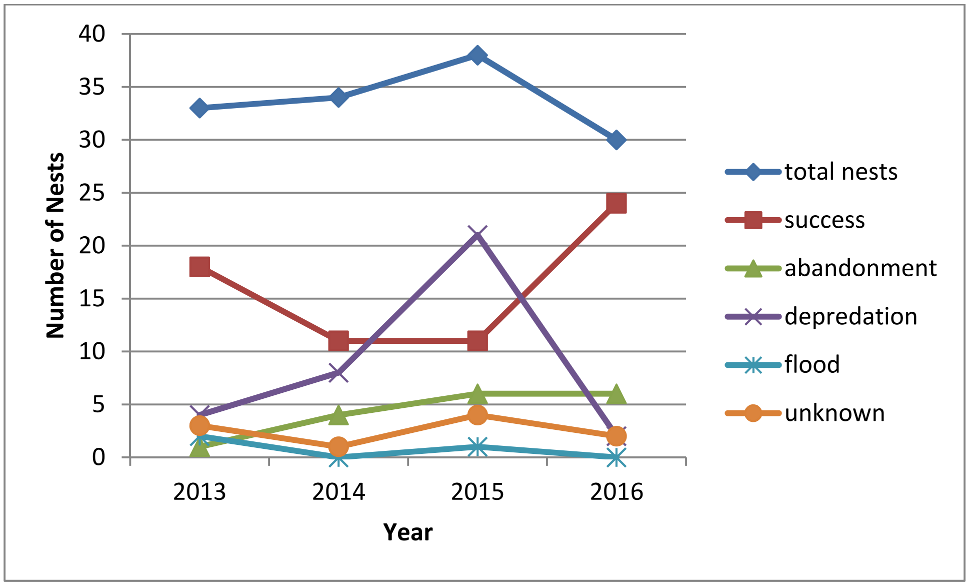


Figure 4. Fate of piping plover nest in FIMI Project 2013-2016 (source Carey et al. 2016).

Factors Affecting Piping Plover in the Action Area:

Habitat loss, fragmentation, beach stabilization, avian and mammalian predators, recreation, and ORV use (commercial, recreational, residential, and the NPS' administrative activities) are all factors negatively affecting the species environment, distribution, reproduction and abundance throughout the project area. Beneficial actions include monitoring and protection programs implemented by the Corps New York District (under the FIMI project), NPS FIIS, NYSOPRHP, and Suffolk County Department of Parks, Recreation, and Conservation. Suitable habitats are delineated each year and protected with symbolic fencing and monitored by staff. Vehicle closures are implemented around breeding areas when flightless chicks are present. Within each respective park, suitable habitats are mostly found where human activities are relatively less intense. However, in some areas like Robert Moses State Park and Smith Point County Park, which manage their respective properties for multiple recreational activities associated with a public park, protecting all suitable habitat for plovers can be challenging.

Habitat loss and modification

Public and private beach stabilization efforts have occurred on the ocean beaches in the action area between 1938 and 2016 (Rice 2017) and are described in the Environmental Baseline section above. Dune building activities may prevent plovers from accessing preferred foraging and brood rearing habitats, including interdunal swales, wet meadows, and ephemeral pools (MacIvor 1990; Elias-Gerken 1994). Planting of beachgrass and erection of sand fencing were conducted throughout the 1990s in association with individual community nourishment and beach scraping projects, as well as the 2003 and 2008 FIIS community beach nourishment projects. The use of sand fences and Christmas trees to capture drifting sand and/or to build dunes may produce steepened dune faces, or by themselves, created physical barriers to plover movement (Strauss 1990). Beach stabilization has also been conducted through the process of beach scraping, involving the use of heavy machinery to remove approximately the top 6-in layer of sand over a wide section of the dry beach. The material is then deposited to augment or reconstruct artificial dunes.

Predation

Piping plover predators on Fire Island include red fox, gull species, American crow, feral cats, dogs, and possibly ghost crabs (*Ocypode quadrata*). Red fox is a major predator of piping plover, their nests, and chicks on Fire Island (NPS 2010, Carey et al. 2017). Carey et al. (2017) estimated abundance of red fox at Robert Moses State Park, Fire Island National Seashore from Watch Hill to Old Inlet, Fire Island National Seashore east of Old Inlet and Smith Point County Park. They monitored 10 breeding dens at Robert Moses State Park during April-September 2016 and estimated that there were at least 12 adults and 16 kits. They monitored 7 breeding dens at Fire Island National Seashore between Watch Hill and Old Inlet and estimated that there were at least 8 adults and 14 kits. A sarcoptic mange outbreak was observed beginning in summer-fall 2015 and spread throughout the Old Inlet East area of Fire Island National Seashore and Smith Point County Park, leading to a large scale die-off. No red fox were present in these areas between April-September 2016. A density of 3.05/km^2 and 4.07 kits/km^2 was estimated at Robert Moses State Park and of 1.69 adults/km^2 and 2.95 kits/km^2 between Watch Hill and Old Inlet at Fire Island National Seashore. Averaging densities across the project area, they estimated a red fox population density of 2.37 adults/km^2 and 3.51 kits/km^2, a total available area of 16.18 km^2 and a total red fox population size of 39 adults and 57 kits between April-September 2016.

The stabilized beach system on Fire Island has limited piping plover to narrower beaches, making them less likely to escape detection by red fox. Plovers that nest on human-made dunes may also be more susceptible to detection by red fox (NPS 2012; NPS Assateague Island).

In addition to mammalian predators, black-backed gulls (*Larus marinus*), herring gulls (*Larus argentatus*), crows, and other avian predators have been identified in these areas. Ghost crabs also pose a risk to plover chicks and the FIIS Resource Management Staff observed adult plovers defending their young from ghost crabs in 2007 (NPS 2007). The Service is not aware of any comprehensive predator control or trapping programs currently being implemented by the NYSOPRHP, Suffolk County, or FIIS.

Habitat Destruction, and Species Disturbance from Recreational Activities and ORVs

There are numerous potential sources of disturbance to plovers that may utilize the project area including, but not limited to, ORVs, aircraft, recreational fishing, kite-flying, bird-watching, surfing, dog-walking, fireworks events, and vehicle patrols undertaken by law enforcement agencies.

The NYSOPRHP prohibits ORV use from Field 5 to Field 2 in Robert Moses State Park, but allows ORV use west of Field 2 through Democrat Point. Provisions are in place to prohibit ORV use on Democrat Point once chicks hatch. Like many areas on Long Island, breeding habitat on Democrat Point is limited due to establishment of recreational ORV areas. However, in 2010 two chicks were found dead in tire tracks on the ocean beach west of the Field 2 breeding area. It was determined that these chicks had moved to the west of their nest site. The adults were likely leading them to foraging areas at Democrat Point. ORV tire tracks can cause deep ruts which are impassable to chicks, causing them to become entrapped.

The NPS regulates ORV access within the FIIS. In 2013 the NPS issued 145 driving permits to year-round residents, 66 permits to part-time residents, 80 permits to contractors, 30 permits to businesses operating a total of 56 vehicles, 3 fleet permits to utilities (phone, water, electric) allowing 68 vehicles, 17 permits for municipal employees, and 16 discretionary permits. The NPS indicated that not all permit holders drive on the beach, and they do not maintain records of vehicles passes on the beach. Anders and Leatherman (1987) reported that on the western end of Fire Island alone, 44,175 trips per year, with an average trip distance of 3.1 miles, were recorded. This use can reduce the quality of available foraging habitat and compact and reduce any existing foraging base. These activities may also result in mortality of adults, nests, and chicks. In most areas of the FIIS, ORV use is seasonally heavy. In addition to the chick mortality noted above, two piping plover chicks were found crushed in tire tracks at Watch Hill and Sailor's Haven in 1991 and 1992 (Melvin et al. 1994). Beach recreation also results in pollution. Garbage can attract piping plover predators such as red fox and gull species.

Status of Seabeach Amaranth in the Action Area:

Surveys for seabeach amaranth on Fire Island to Montauk Point are conducted annually by the New York State Office of Parks, Recreation and Historic Preservation at Robert Moses State Park, the NPS in FIIS, and Suffolk County at Smith Point County Park since 2009 (NYNHP conducted surveys prior to 2009). Surveys for seabeach amaranth on Westhampton Island are conducted annually by Suffolk County Department of Parks, Recreation and Conservation at Cupsogue County Park, and Shinnecock County Park West Shinnecock; Cashin Associates at the Village of Westhampton Dunes; and by Southampton Town Trustees at Hampton Beach and Tiana Beach. Suffolk County also surveys east of Shinnecock Inlet at Shinnecock County Park East. Southampton Town Trustees survey annually east of Shinnecock Inlet at: Southampton Village Beach, Gin Lane Beach, Water Mill Beach, Sams Creek Beach, Sagaponack Pond, and Fairfield Pond Lane Beach. Town of East Hampton conducts surveys for amaranth is some years at Wainscott Beach, Georgica Beach, East Hampton Beach, Napeague Beach, and Montauk Beach.

Robert Moses State Park

Most plants within RMSP occur at Democrat Point, with plants also present within the bathing beach fields. Since 2000, Democrat Point had a peak plant count of 825 in 2002 and a low of 1 plant in 2013.

FIIS

In FIIS, the occurrence of seabeach amaranth has been reported to be patchy and only found on the oceanside beaches. From 1997 to 2003, plants had been observed on the ocean beaches in front of Talisman/Barrett Beach, Lighthouse Tract, and Atlantique (New York Natural Heritage Program 2003). Seabeach amaranth was not observed in the western communities of Fire Island (Kismet to Point O'Woods) until 2001 and the Fire Island Pines survey area until 1999. Since 2000, a peak plant count of 250 plants occurred in 2003 at Sunken Forest. In 2016, 61 plants were observed in the Lighthouse tract, the western communities, the Fire Island Pines area, and the Wilderness Area.

Smith Point County Park

Since 2000, Smith Point County Park had a peak count of 816 plants in 2006 and a low of 4 plants in 2016.

Westhampton Island (Including Southampton Properties)

Seabeach amaranth populations on Westhampton Island have fluctuated greatly since 1991. The island saw a peak of amaranth numbers in 2003 when it supported 85,802 plants – with the greatest number of plants found at Cupsogue County Park (55,832 plants). However, there has been a sharp decline in the amaranth population on the island since 2003 and it reached a low in 2012 with only 21 plants documented. Since 2012, the numbers have increased slightly, with 247 plants in 2016. In 2016, the Village of West Hampton Dunes supported the largest proportion of the plants (161 plants).

Southampton (East of Shinnecock Inlet)

Of the Southampton sites that are east of Shinnecock Inlet, Southampton Beach has supported the highest numbers of amaranth in more years than any of the other sites, and has also supported the largest amaranth counts of any of the sites, with a high of 1139 plants in 2004. However, the amaranth population at this site has been very variable, and in 2015 Southampton Beach didn't have any amaranth plants. In 2016, Southampton Beach supported 8 plants, and Sagaponack Pond had the greatest number of plants of any Southampton site with 12 plants.

East Hampton

There have been very few amaranth surveys performed at East Hampton Beaches since 1991.

Entire FIMP Study Area

Fire Island to Montauk Point once supported large numbers of amaranth, reaching peak numbers in the early 2000s, with the greatest number of plants being found in 2003 (88,195). In more recent years, however, the numbers have decreased within the study area. The number of observed amaranth plants from Fire Island to Montauk Point has averaged 231 plants from 2000-2016 with a maximum of 364 plants observed in 2016 and a minimum of 87 plants observed in 2013 (Figure 5). The largest concentrations of amaranth are found on Fire Island and Westhampton Island (Table 7).

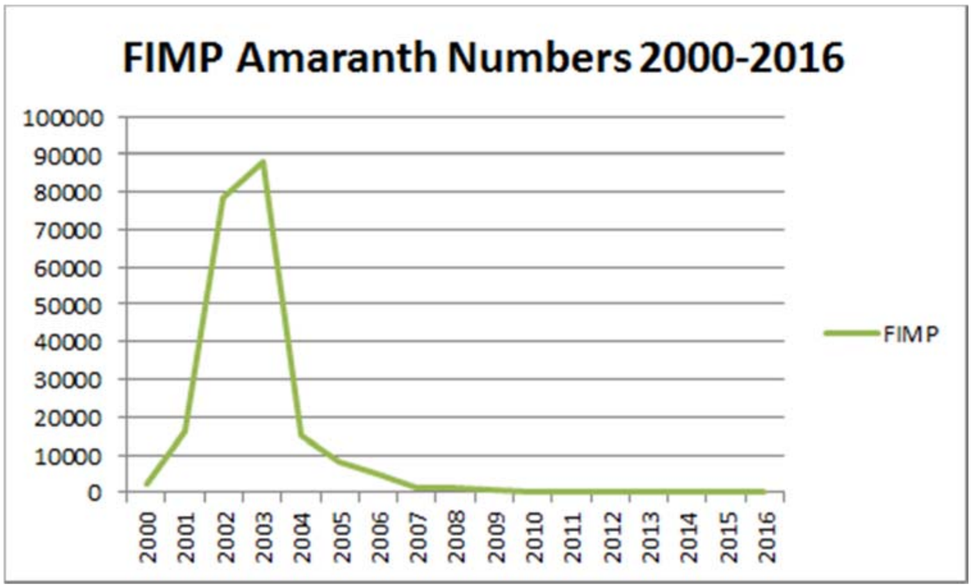


Figure 5. Seabeach amaranth numbers in the project area from 2000-2016.

Site Name	2010	2011	2012	2013	2014	2015	2016
Fire Island							
Robert Moses State Park	23	55	64	5	48	21	30
Fire Island National Seashore	11	40	26	15	68	108	31
Snuith Point County Park	40	86	32	8	44	7	4
West Hampton							
Cuspogue County Park	42	28	1	8	0	12	8
Village of West Hampton Dune	24	20	10	10	?	44	161
Hampton Beach	0	12	9	30	113	41	63
Tiana Beach	0	12	NS	NS	1	0	3
Shinnecock County Park West	1	16	1	6	40	12	12
Southampton East of Shinnecock Inlet							
Shinnecock County Park East	0	NS	0	NS	NS	0	NS
Southhampton Village Beach	15	15	1	3	1	NS	8
Gin Lane Beach	4	2	2	2	2	1	1
Water Mill Beach	0	2	3	0	1	0	0
Sams Creek Beach	0	0	0	0	0	0	1
Sagaponacck Pond	0	0	0	0	1	2	12
Fairfield Pond Lane Beach	0	0	0	0	1	0	0
East Hampton							
Wainscott Beach	NS		NS	NS	NS	NS	NS
Georgica Beach	NS		NS	NS	NS	NS	NS
East Hampton Beach	NS		0	NS	NS	NS	NS
Napeague Beach	NS		0	NS	NS	NS	NS
Montauk Beach	NS		NS	NS	NS	NS	NS

Table 7. Number of individual plants at surveyed sites from Fire Island to Montauk Point since 2010.

FIMP Study Area Contributions to the New York Total Population

Since 2000, Fire Island to Montauk Point has contributed an average of 25 percent of the New York total population, contributing a low of 1.5 percent in 2000, and a peak of 79 percent in 2003. In 2016, Fire Island to Montauk Point (364 plants) contributed 7 percent of the New York total (4985 plants) (Figure 6).

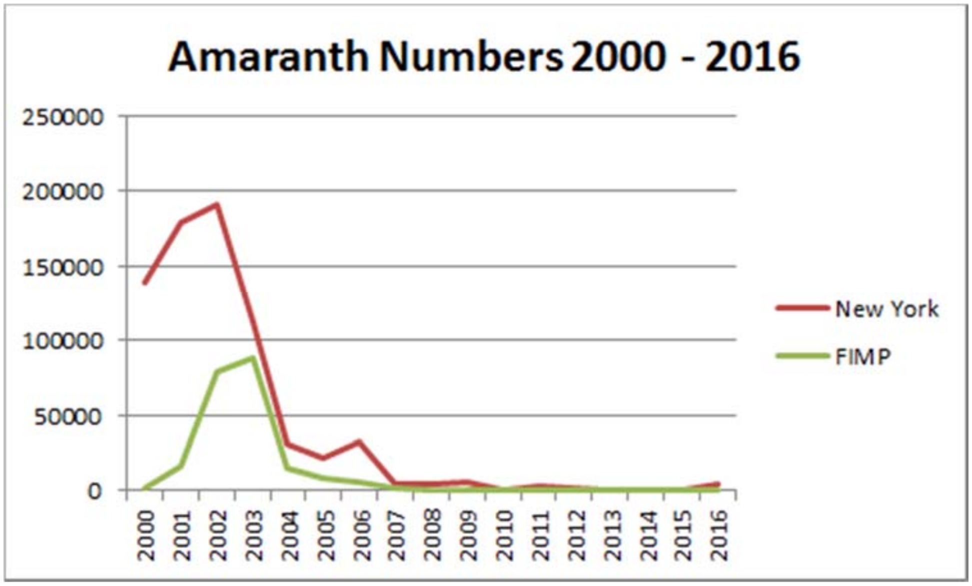


Figure 6. FIMP study area contribution of seabeach amaranth to New York.

Factors affecting the species environment within the Action Area:

Beach stabilization, beach scraping, barrier island and vegetative stabilization, and ORV use (commercial, recreational, residential, and the NPS' administrative activities) are all factors that have contributed to the lack of suitable seabeach amaranth habitats in the action area. Suitable habitats are mostly found where human activities, such as ORV use, dune stabilization, and intense recreational activities, are generally prohibited or restricted.

Status of red knot in the action area:

Red knots, and other long-distance migrants, take advantage of seasonally abundant food resources at migration stopovers to build up fat reserves for continued migration. Key stopover and staging areas serve as stepping stones between wintering and breeding areas. Key concentration areas along the Atlantic coast include Delaware Bay and the New Jersey Coast. Fire Island and the Long Island area are not considered to be a key migration stopover area (USFWS 2014). Red knots do occur occasionally in many areas of Fire Island; ebird records stretch along many areas of the beach with most observations made from the Jones Beach area (southern part of Nassau County) in the south or northern areas such as Cupsogue Beach County Park. Most birds are observed in late summer during fall migrations but there are scattered observations at other times as well. Observations are generally less than 20 birds with the maximum records of about 100 birds ((https://ebird.org/ebird/ accessed 8/16/2017). Thus we would describe Fire Island as having occasional use by migrating red knots across the island.

5. Effect of the Action

Piping plover

1. Direct Effects:

Construction Activities

When major construction activities such as FIMP are undertaken during the piping plover nesting season there is the potential for significant disturbance and for mortality of plover eggs and chicks. Impacts may include territory abandonment, disruption of pair bonds, nest abandonment, elevated predation of eggs and chicks due to adults being less attentive, and increased chick mortality due to reduced foraging opportunities. These effects will adversely affect piping plover productivity.

Dredging and construction operations that are within 1000 m of established plover courtship, nesting and brood rearing areas that were undisturbed during the beginning of the breeding season have the potential to disturb both adults and chicks that use this habitat. Nourishment activities occurring within 1000 m of chick rearing areas will create the possibility that chicks and eggs will be accidentally crushed. Data from Patterson (1988), Cross (1990), Coutu et al. (1990), Strauss (1990), and Loegering (1992) show that plover chicks may move up to 1000 m from their nest sites, commonly traveling more than 200 meters in the first week post hatching.

In order to minimize the effects of construction activities on piping plover, construction activity will not occur during the breeding season (April 1 to September 1) in Smith Point County Park, Fire Island Lighthouse Beach and Robert Moses State Park. There may be some work allowed during the breeding season if there are weather related stoppages or equipment failure but this would only occur up to three times over the life of the project, work would have to conclude by the end of April, and a qualified monitor would have to be present to ensure no work is occurring within 1,000m of known nesting areas. Within the FIIS Communities, the Corps proposes to maintain a 1,000 m buffer between piping plover breeding areas and construction activities.

Fragmentation and Degradation of Preferred Breeding Habitats (Nesting and Foraging)

The effect of the project is to reduce the likelihood of natural barrier island habitats, such as blowouts, overwash fans, and large expanses of wide, low slope beaches with variable dune heights and vegetation patterns, as well as bay to ocean habitat connectivity. If allowed to form naturally, breeding areas would be characterized by fairly flat, low lying beaches and increased areas of moist open sandy habitats either on the bayside or from the bay to ocean. The dune and beach fill will raise both the berm and dune elevation of the barrier island, reducing the potential for the continued formation of these features and promoting succession of vegetation.

Based on long-term observation of plover densities on Westhampton beaches reported in Cohen et al. (2009), it is expected that bay to ocean overwash habitats at Smith Point County Park would likely support plover nesting densities of about 1 pair per hectare (ha), whereas oceanside or bayside only habitats would likely support 0.5 pr/ha). Bay to ocean overwash habitats are extremely important to developing chicks and provide critical areas where reproductive output can be maximized. Inlet and overwash processes are the primary mechanism of sediment deposition into the bay system (Leatherman 1987). This mechanism of sediment transport and resultant habitat formation is currently occurring at Old Inlet where extensive intertidal and subtidal shoals are being created via the natural deposition of sediments during the flood tides. Similarly, a very large flood tidal shoal complex was formed when Pikes Inlet was open in 1992 and provided high quality foraging habitats for piping plovers which nested on the bay and ocean side beaches at West Hampton Dunes. Under natural conditions, the prey base is developed over time in response to complex processes of wind and wave sorting of sediment grain size, texture, and composition, and along environmental gradients. Carey et al. (2017) found that in the project area invertebrate prey were more available in bay intertidal and ephemeral pools compared to breach fills and restoration areas, and the greatest prey densities were found in overwashes and mudflats.

However, these processes will be significantly interrupted if not precluded entirely due to the project and existing infrastructure, likely resulting in a reduction in high quality foraging areas that would have otherwise formed via breaching and overwash processes. As most time-budget studies reveal that plover chicks spend a very high proportion of their time feeding and select for bayside foraging habitats (Cairns 1977; Elias et al. 2000), it is critical that high quality foraging habitats be maintained and be available. Cohen et al. (2009) reported that reproductive output was typically higher than 1.0 when chicks had access to these habitats and predator populations were controlled in highly modified or managed situations.

The project will construct and maintain nine coastal process features throughout the project to provide ocean or bayside only habitat that mimics the effect of storm washover while maintaining the integrity of the dune system. The Corps is committed to adaptively manage these coastal process features in order to maximize the amount of piping plover nesting, brooding and chick foraging habitat. Metrics will be developed to evaluate the effectiveness of the CPFs and there will be triggers identified for adaptive management to come into effect.

2. Indirect Effects:

Dune and Beach Maintenance Activities

Dune vegetation planting and snow fences are proposed in the FIIS Community portion of the project area and at Smith Point County Park on the dunes in the plover breeding areas. These practices are intended to artificially accelerate growth of dense vegetation and dune growth in order to further stabilize the barrier island (Bocomazo et al. 2011). Sand fencing can affect dune topography and promote the formation of steep, uniform dunes. Replicate treatments using sand fences oriented parallel to the shore, parallel with perpendicular additions, and zigzag (also termed oblique or diagonal) and vegetation plantings at Timbalier Island, Louisiana and Santa

Rosa Island, Florida demonstrated appreciable vertical height and volume accumulation over controls (Mendelssohn et al. 1991, Miller et al. 2001). Fences filled rapidly, with half the accumulation over three years occurring in the first six months in Florida, 64 percent in the first 14 months in Louisiana. In sand deficient systems, however, the shoreline will continue to erode back toward the dune unless the beach also is nourished (Mendelssohn et al. 1991, Freestone and Nordstrom 2001). This effect will likely limit the amount of available preferred habitat for these species and will likely create degraded habitat conditions.

The Corps proposes to plant beach grass at densities of 18 in on center in the project area in an effort to stabilize the artificial dunes. Vegetation does serve to trap sand (USACE 1967), but, initially it plays a smaller role than sand fences in sand accumulation (Mendelssohn et al. 1991, Miller et al. 2001). Over time, however, vegetation will continue to accumulate sand through upward and lateral growth (Miller et al. 2001).

Jones (1997) stated that the use of sand fencing or discarded Christmas trees will degrade piping plover nesting habitat if these installations create dune slopes >10 percent. Cohen et al. (2008) noted that once beach grass becomes dense, it may have to be thinned each growing season to retain characteristics of suitable piping plover nesting habitat. Maslo et al. (2011) concluded that recovery and persistence of piping plovers will depend on conservation and restoration of breeding habitats with very low slopes, dune heights, and vegetative cover. Piping plovers at the Corps Westhampton Interim Project area placed most of their nests on the bay side of the beach in the first years following the breach and its closing, but redevelopment and revegetation of the bayside shifted nesting to the ocean beach (Cohen et al. 2009). Sand fences and vegetation plantings accelerate loss of sparsely vegetated foredune habitats, forcing piping plovers, human beach-goers and life safety risk reduction measures to compete for the same narrowing swath of seaward beach.

Foraging Habitats and Prey Resources

Piping plovers feed on invertebrates, such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989). On oceanfront habitats, terrestrial invertebrates tend to be concentrated in the wrack line (Loegering and Fraser 1995; Hoopes et al. 1992), a habitat used by foraging plover adults and chicks (Goldin 1993; Hoopes 1993; Hoopes et al. 1992). Availability of wrack is especially important at sites where ephemeral pool and bayside foraging areas are not available (Elias et al. 2000).

The project will temporarily impact foraging habitats and prey resources in the habitat through sand placement and through the creation of coastal process features. The recovery of marine invertebrate prey resources will vary depending on the timing of the fill activity relative to the periods of highest biological activity in these zones of the beach, as well as compatibility of the dredged material with the existing beach substrate. Areas receiving sand in autumn will likely have a longer prey resource recovery period than areas receiving fill in the winter and early spring.

The Corps (1999) examined the effects of beach nourishment on oceanside intertidal benthos in Monmouth County, NJ. They found that the recovery time of the intertidal infaunal community was as short as two months following renourishment carried out between early August and early October. Recovery time following renourishment in mid- to late-October was reported to take between 2.0 to 6.5 months. However, studies conducted in Florida, NC, and SC show that re-colonization rates by benthic invertebrates are variable and dependent on the time of year in which the nourishment occurs, beginning within days and taking up to one year for full recovery of some species (Reilly and Bellis 1983; Bacca and Lankford 1988; Lynch 1994; Peterson et al. 2000). Further, the macrofaunal community after re-colonization may differ considerably from the original community. Once established, it may be difficult for species of the original community to displace the new colonizers (Hurme and Pullen 1988). Time frames for intertidal invertebrate recruitment and re-establishment following beach nourishment are generally reported as taking between 12 and 18 months for FIIS beaches (National Resource Council 1995; Land Use Ecological Services, Inc. 2005). Sand placement would be expected to impact prey resources for breeding adults and their chicks at least one breeding season.

A productivity threshold will also be utilized to document whether additional actions need to be made to address forage.

<u>Impacts Due to Recreational Activities</u>

Even without the project, recreational use has occurred in piping plover breeding areas. However, by building, maintaining, and vegetating dunes the habitat used by the birds is confined to the same narrow backshores that are also the focus of human recreation. Natural beaches used by plovers are typically much wider due to dunes not occurring in a linear fashion, offering the birds and people much more area to disperse.

Recreational activities that may potentially, adversely affect piping plovers include unleashed pets, fireworks, kite-flying, and increase in garbage. Unleashed pets, such as dogs and cats, can prey on piping plovers. For example, at least two nests were lost to predation by unleashed dogs in the Corps' Westhampton Interim Storm Damage Protection Project Area, Suffolk County, NY, as reported in Houghton (2005).

Wide beaches with little human disturbance at the time piping plovers initiate nesting (March to April) often experience heavy recreational pressure later in the nesting season (May through August), adversely affecting reproductive success by disturbing nesting birds. DeRose-Wilson et. al (in press) found that chick daily survival rates were lowest on weekend days and increased with time since the weekend. Chicks that hatched in low recreational use areas were more likely to survive to fledgling than those hatched in high recreational use areas. Chicks spent less time in moist foraging habitat, less time foraging, and made fewer foraging attempts per minute on weekends than weekdays. In addition, chicks had higher mass at 22 days of age in low use areas. Overall, the degree to which increases in recreational activity result in mortality or disturbances to plovers and their chicks depends on the degree to which the protection measures are implemented. The conservation measures described in this document are intended to minimize the adverse effects from recreational activities. A productivity threshold will also be utilized to document whether additional actions need to be made to address disturbance.

Predators

The project would potentially create habitat, affect the movements of, and influence the search behaviors of mammalian (red fox, raccoon, feral cats) and avian predators (crows, raptors, gulls) of the piping plover. Modeling by Seymour et al. (2004) using red fox movement data from northern England indicated that risk of fox predation on ground-nesting bird species in long, linear habitats increased with narrowing habitat width, and was sensitive to changes in habitat width of even a few meters.

Wider, irregular barrier island features may allow piping plovers to be more efficient in eluding predators, by reducing the degree of spatial overlap of their habitats. The installation of sand fences and other elevated features such as artificially constructed dune systems may be used as perches for avian predators and increase their search efficiency (e.g., Andersson et al. 2009).

The degree to which increases in predator habitat result in mortality or disturbances to plovers and their chicks depends on the degree to which predator control measures are implemented. We would expect some territory desertion, delayed or interrupted courtship, disturbance to incubation with some loss of nests or delayed hatch times, disturbance to foraging chicks with delayed fledging, and lower productivity. Predators are also a cause of chick mortality.

A productivity threshold will also be utilized to document whether additional actions need to be made to address predation.

Seabeach amaranth

Factors to be considered

Proximity of action: Beach renourishment will occur within and adjacent to seabeach amaranth habitat.

Distribution: Project construction activities that may affect seabeach amaranth plants would occur where seabeach amaranth occurs.

Timing: The timing of project construction could directly and indirectly impact seabeach amaranth.

Nature of the effect: The effects of the project construction include burying, trampling, or injuring plants as a result of construction operations and/or sediment disposal activities; burying seeds to a depth that would prevent future germination as a result of construction operations and/or sediment disposal activities; and destruction of plants by trampling or breaking as a result of increased recreational activities.

Duration: These may be recurring activities, expected to last up to five and a half months each time. Thus, the direct effects would be expected to be short-term in duration. Indirect effects from the activity may continue to impact seabeach amaranth in subsequent seasons after sand placement.

Disturbance frequency: Disturbance from each event will be short term, lasting up to two years. However, sand placement activities may take place several times over the life of the project. Recreational disturbance may increase after project completion and have long-term impacts.

Disturbance intensity and severity: Project construction is anticipated to be conducted during portions of the seabeach amaranth growing and flowering season. Conservation measures have been incorporated into the project to minimize impacts.

Plants have not yet been observed by Corps monitors in association with the FIMI project construction.

Analyses for effects of the action:
Beneficial Effects: The placement of beach-compatible sand may benefit this species by providing additional suitable habitat or by redistributing seed sources buried during past storm events, beach disposal activities, or natural barrier island migration. Disposal of sand may be compatible with seabeach amaranth provided the timing of beach disposal is appropriate and the material placed on the beach is compatible with the natural sand. Further studies are needed to determine the best methods of beach disposal in seabeach amaranth habitat (Weakley and Bucher 1992).

Direct Effects: Sand placement activities may bury or destroy existing plants, resulting in mortality, or bury seeds to a depth that would prevent future germination, resulting in reduced plant populations. Increased traffic from recreationists and their pets can also destroy existing plants by trampling or breaking the plants.

Indirect Effects: The installation and maintenance of a continuous dune line, as opposed to a dune swale, blowout, or overwash-configured project design, will indirectly affect this species by interrupting natural processes that maintain suitable habitat. Interdunal swales and gently-sloping foredune habitats become important when the berm has been narrowed by erosion, as happens following severe coastal storms or toward the end of a recurring sand renourishment cycle.

Dune vegetation planting and snow fence placement, in association with beach nourishment and beach scraping, that have previously occurred within developed portions of the action area, will artificially accelerate growth of dense vegetation that preclude use of habitat by seabeach amaranth. This effect will limit the amount of available suitable habitat for this species and will create suboptimal habitat conditions. Naturally occurring or managed sparse vegetation plots pose limited adverse effects to seabeach amaranth, but artificially planted areas that rapidly grow into dense areas of perennial vegetation precludes use by this species. The planting of perennial grasses will substantially limit the area of seabeach amaranth habitat that is currently available and will introduce added pressures to the species via inter-specific competition. Weakley and Bucher (1992) report that stabilization of seabeach amaranth habitat allows for succession to a densely-vegetated perennial community, rendering the beaches only marginally suitable for seabeach amaranth. Because seabeach amaranth is susceptible to habitat fragmentation (Weakley and Bucher 1992), destruction of a single and sizeable population could result in local extirpation. Seabeach amaranth is rarely encountered in areas that have been snow fenced (Weakley and Bucher 1992), but the relationship between snow fencing and seabeach amaranth populations has not been fully investigated on Long Island. Further, vertical sand accretion and burial caused by sand fences are detrimental to seabeach amaranth and their use is contradictory to seabeach amaranth recovery.

Species' response to the proposed action

The placement of sand in the Action Area could bury existing plants if work is conducted during the growing season. Sand placement at any time of year could also bury seeds to a depth that would prevent germination.

Sand placement on beaches could also have positive impacts on seabeach amaranth by creating additional habitat for the species, if the material is compatible. Although more study is needed before the long-term impacts can be accurately assessed, several populations are shown to have established themselves on beaches receiving dredged sediments, and have thrived through subsequent applications of dredged material (Weakley and Bucher 1992).

Red knot

Continuing beach nourishment activity associated with this project will occur during times when red knots are in the vicinity of Fire Island, and can cause disturbance from equipment and people as well as changes in the nature of foraging habitat. This can cause birds to flush and leave areas in response to this disturbance. However, the maintenance activity will not occur everywhere simultaneously and we anticipate that there will be ample areas where red knots can move to if disturbed. There is no evidence of concentration areas where food resources are so good that large numbers of birds routinely stop on migration and depend on the area for food to continue their migration. Rather, it appears that the project area provides some general foraging and resting habitat. Flushing the birds from a beach site occasionally does not constitute sufficient harm that would result in take and we anticipate sufficient areas to be available for birds to move into. Some of the Coastal Process Features that will be built on the bayside could result in additional foraging habitat in the future.

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6. Appendix A. Detailed Description of Project Features

1.11 Inlet Management Plan

The selected inlet management plans at all three inlets consists of continuation of the existing authorized projects and additional dredging of the ebb shoal, outside of the navigation channel, with downdrift placement. Sediment placement will create a berm. No dunes will be constructed with the sediment. Ebb shoal dredging would be undertaken in conjunction with scheduled Operations and Maintenance (O&M) dredging of the inlets and would increase sediment bypassing and reduced future renourishment fill requirements.

Fire Island Inlet

- O&M on 2 year interval (Authorized);
- 819,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at Gilgo Beach;
- 214,000 cy (per O&M event) dredged from channel and expanded deposition basin and placed updrift at RMSP;
- 327,000 cy (per O&M event) dredged from ebb shoal and placed downdrift at to offset deficit.

Moriches Inlet

- O&M on 1 year interval (Authorized);
- 98,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at SPCP;
- 73,000 cy (per O&OM event) dredged from ebb shoal and placed downdrift at Gilgo Beach to offset sediment deficit.

Despite being authorized for O&M on a 1-year interval, Moriches Inlet has only been dredged about once every 4 years. Even if the inlet continues to be dredged once every 4 years there should be sufficient sediment available from the channel, deposition basin, and ebb shoal to meet the renourishment requirements at MB-1A.

Shinnecock Inlet

- O&M on 2 year interval (Authorized);
- 170,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at Sedge Island, Tiana Beach, and West of Shinnecock (WOSI);
- 105,000 cy (per O&M event) dredged from ebb shoal and placed downdrift at SPCP to offset sediment deficit.

Placement of sediment downdrift at Sedge Island, Tiana Beach, SPW, and WOSI will maintain the natural longshore transport, increase sediment bypassing, increase stability of these shorelines, and reduce future Proactive BRP fill requirements.

1.1.1.1 Inlet Management – Initial Construction

Initial construction quantities include the estimated quantity to restore the channel to its authorized dimensions as well as dredging of the ebb shoal for bypassing. Initial construction quantities were estimated based on expected sedimentation in the authorized channel over the period between the last dredging operation and start of construction for FIMP in 2018. Table 1 shows the date of last dredging event and the number of years in which sedimentation may occur.

Table 1. Number of Years between Last Inlet Dredging Operation and FIMP

Inlet	Sedimentation (years)	Last Dredging Event
Fire Island Inlet	4	Fall 2014
Moriches Inlet	6	Fall of 2012
Shinnecock Inlet	4	March of 2014

Sedimentation rates at the three inlets are based on the Existing Conditions sediment budget at each inlet. These sedimentation rates may lead to an over estimation of the initial dredging quantities since the anticipated time between dredging events is larger than normal and the sedimentation rates may decrease over time as the inlets shoal. Table 2 presents the initial construction dredging volumes and placement locations for the Inlet Management Plan. Actual dredging volumes and distribution of the fill placement will be refined during PED based on surveys of the inlets and beach prior to construction.

Table 2. Inlet Management Bypassing and Backpassing (Initial Construction)

Location	Subreach	Fill Length (ft.)	Volume (cy)
Fire Island Inlet – Initial Construction			
Gilgo Beach		12,700	2,126,469
RMSP	GSB-1A	12,000	214,531
		Total	**2,341,000**
Moriches Inlet – Initial Construction			
SPCP-West	MB-1A	6,900	67,470
SPCP-East	MB-1B	13,100	330,840
Great Gunn	MB-2A	4,500	113,691
		Total	**512,000**
Shinnecock Inlet – Initial Construction			
SPW	SB-1D	3,400	99,350
WOSI	SB-2B	2,700	449,650
		Total	**275,000**

1.1.1.2 Inlet Management – Life Cycle

Following the initial dredging of the inlets to authorized depths, future maintenance quantities are expected to on average equal the values outlined in the TSP. A summary of the dredging quantities and placement locations for bypassing and backpassing for all future dredging operations is shown in Table . As described earlier, if Moriches Inlet is dredged at a longer interval than it is expected that the majority of the dredged material will be placed at SPCP-West.

Table 3. Inlet Management Bypassing and Backpassing (Life Cycle)

Location	Subreach	Fill Length (ft.)	Volume per Operation (cy)
Fire Island Inlet – 2 year Dredging Cycle			
Gilgo Beach		12,700	1,145,469
RMSP	GSB-1A	12,000	214,531
		Total	**1,360,000**
Moriches Inlet – 1 year Dredging Cycle			
SPCP-West	MB-1A	6,900	22,490
SPCP-East	MB-1B	13,100	110,528
Great Gunn	MB-2A	4,500	37,982
		Total	**171,000**
Shinnecock Inlet – 2 year Dredging Cycle			
Sedge Island	SB-1B	5,600	47,419
Tiana Beach	SB-1C	3,400	28,790
SPW	SB-1D	3,400	28,790
WOSI	SB-2B	2,700	170,000
		Total	**275,000**

1.1.2 Nonstructural Plan

The plan for the mainland will remain consistent with the Plan NS-3 that provides for storm risk management for a total of 4,134 structures, of which xx would be elevated, xx would receive flood proofing, xx would receive ringwalls, xx would be rebuilt and 4 would be bought out.

Following Hurricane Sandy, multiple post storm recovery programs have proposed nonstructural treatments within the study area. The specific NS scale and treatment will be reviewed and refined in the PED phase to ensure that the treatment proposed and the applicable population are appropriately identified.

The locations are conceptually shown in Figure 1 in red based on the 10-year flood plain. The detailed plans are shown in the Plates Appendix.

1.1.3 Breach Response Plans

Breach response plans include Proactive Breach Response with 13 ft. dune/90 ft. berm, Reactive Breach Response with 9.5 ft. berm only template, Conditional Breach Response with 9.5 ft. berm only template, and Wilderness Conditional Breach Response with 9.5 ft. berm only template.

1.1.3.1 Proactive Breach Response Plan

The Proactive Breach Response Plan is an alternative that includes measures to take action to prevent breaches from occurring at locations vulnerable to breaching, when a breach is imminent. This alternative provides a beach cross-section area that is comparable to the Breach Response Alternatives, and smaller than a beach fill alternative.

These plans are not specifically designed with the intent of minimizing ocean shorefront development from overwash, wave attack or storm induced erosion losses, and the plans allow for a greater level of overwash and dune lowering during a storm, so long as the overwash extent is below the threshold that would result in breaching.

This feature includes the +13 ft. NGVD dune section. A typical Proactive BRP section is shown in Figure 1.

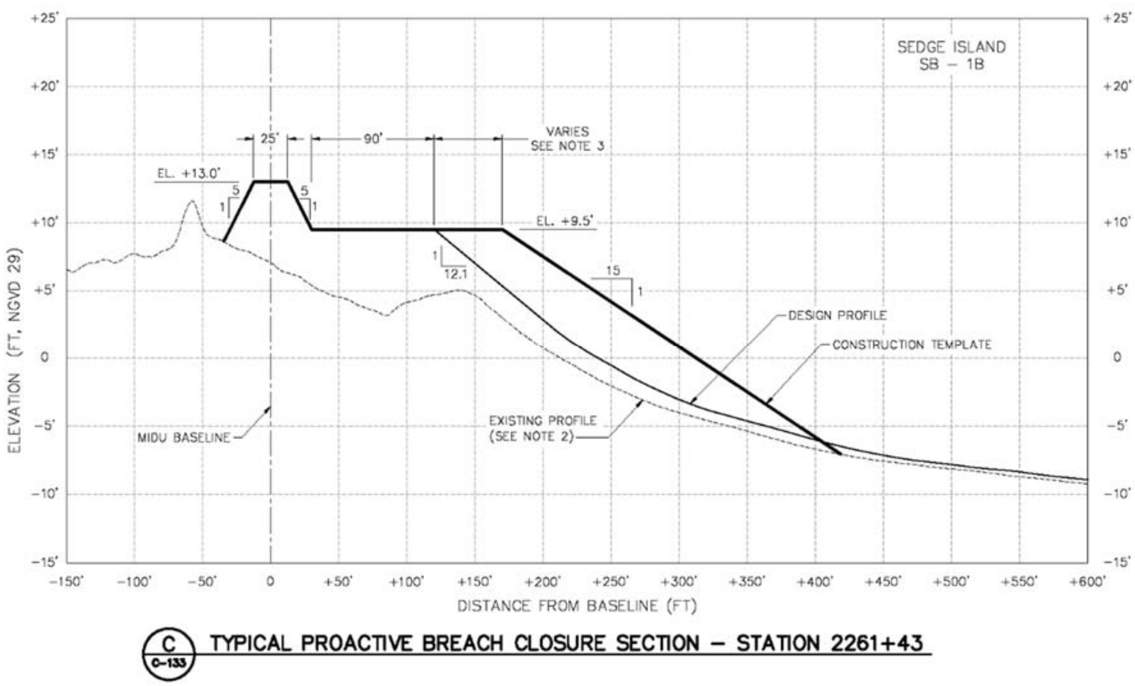

Figure 1. Typical Proactive BRP Section

Initial Construction (Proactive BRP)

Four of the Proactive BRP reaches were recently nourished as part of either FIMI (FILT, SPCP-East, and Great Gunn) or the WOSI Interim Project (WOSI). Due to the relatively low erosion rates at FILT, SPCP-East, and Great Gunn it is not expected that Proactive BRP would be required at any of these locations at the time of initial construction in 2018. However, due to the relatively high erosion rates at WOSI, initial Proactive BRP beach fill placement is expected to be required at this location. Initial construction volumes at WOSI were estimated following the same approach as the Beach Fill Plan reaches based on predicted losses.

At the other Proactive BRP reaches along Shinnecock Bay an assessment was conducted to determine if the existing effective beach width is below the Proactive BRP thresholds warranting beach fill placement during initial construction of FIMP. LIDAR data collected by the CORPS on November 14, 2012 (two weeks following Hurricane Sandy) was used to define the existing conditions. The effective beach width at three reaches, Sedge Island, Tiana Beach, and SPW was below the threshold. Initial construction volume estimates at these three locations is derived from quantity takeoffs based on the 2012 LIDAR data and Proactive BRP template. Average-end-area calculations were completed based on profiles spaced 200 feet apart. All Proactive BRP quantities include 15% overfill and 15% contingency/tolerance. No advance fill is included in the Proactive BRP.

A summary of the initial construction quantities for the Proactive BRP is provided in Table.

Table 4. Proactive BRP Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Sedge Island	SB-1B	BA 5Bexp	10,200	1,007,463
Tiana Beach	SB-1C	BA 5Bexp	3,400	131,220
SPW	SB-1D	BA 5Bexp	3,400	187,148
SPW	SB-1D	SI	3,400	99,350
WOSI	SB-2B	SI	2,700	449,650
			Total	**1,875,000**

1.1.3.2 Reactive and Conditional Breach Closure

Reactive Breach Response is to be implemented in response to the occurrence of a breach at any locations along the barrier islands, except within several of the large federally-owned tracts within Fire Island National Seashore. Conditional Breach Response applies to a subset of these FIIS tracts, in which the breach response team will assess if the breach is closing naturally or if mechanical closure is required. An additional criteria has also been added for the Wilderness Area, where a Wilderness Conditional Response has been developed.

The Reactive and Conditional BRP templates are similar. In several locations (as described on the reach description table) the Reactive template has a +13' NGVD dune to reduce the potential for rebreaching. In other locations, the reactive template is a berm-only plan. Both breach closure templates have a berm width height of +9.5 ft. NGVD. A typical breach closure section at Old Inlet West and WOSI is shown in Figure 3. Since the intent of the closure is to fill a breach, a specific berm width has not been established. Instead the intent is to generally match the berm width with conditions prior to the breach and within adjacent areas. The design foreshore slope is 1 on 12 which is also the same slope defined for the beach fill design templates. The design profile below MHW would match the representative morphological profile corresponding to each specific location. At a minimum, bayside slopes and shorelines would generally match the preexisting adjacent shorelines. Based on the existing topography the bayside design slope was selected as 1 on 20 from the bayside crest of the berm to an elevation of +6 ft. NGVD. It is recognized that breaches result in the transport of sand that introduces sediment into the bay, and that the mechanical closure of breaches would reduce the amount of sediment that could be transported. The breach closure plans will include an additional quantity of sand on the bayside of the barrier island to replicate this process, to enhance the long-term stability and resiliency of the closure action. The features cannot be designed in advance because they are dependent on the location of the breach and the conditions present. A quantity was estimated, but the exact/optimal placement would be designed during PED after a breach has occurred.

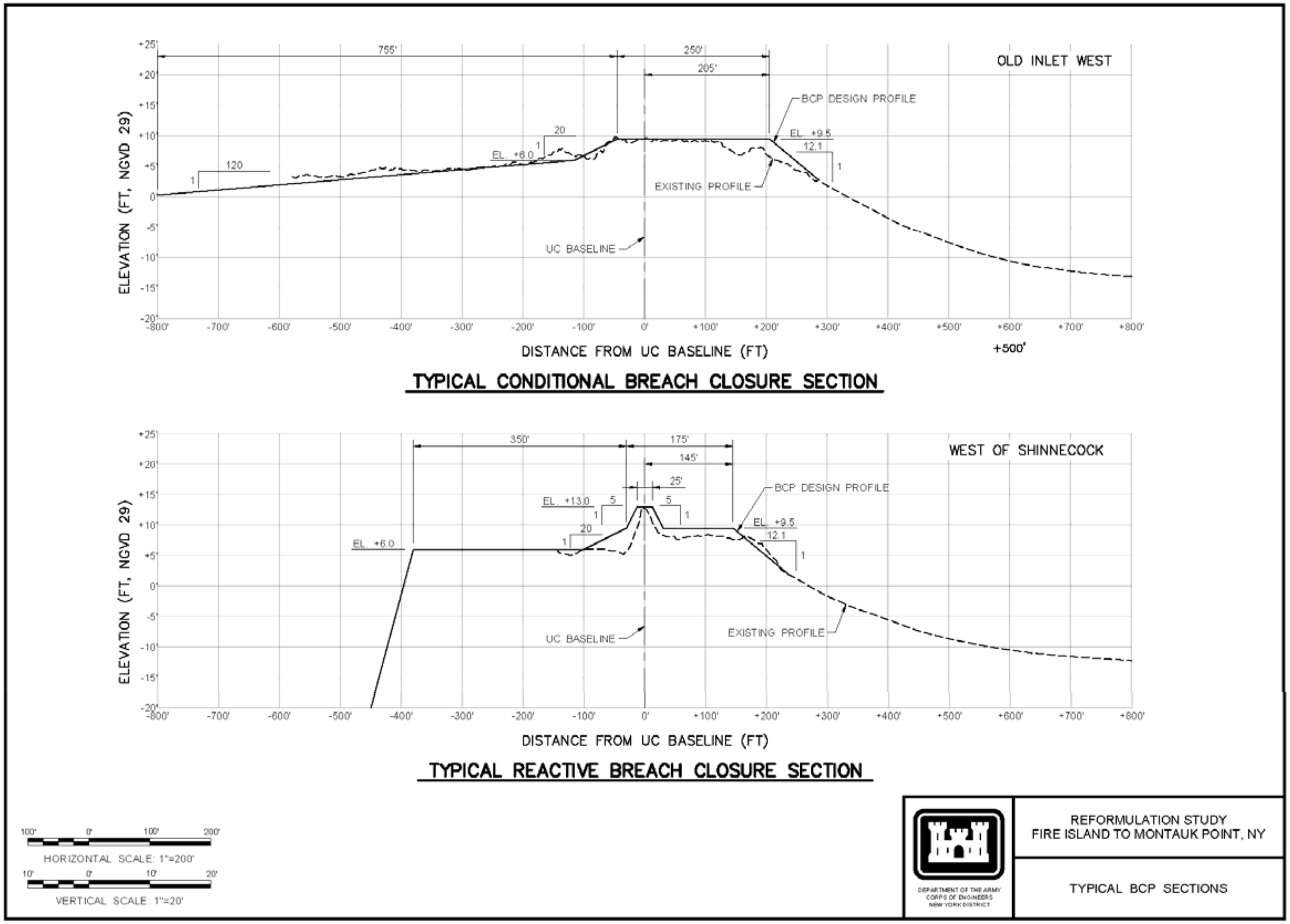

Figure 3. Typical Breach Closure Sections

1.1.4 Beach Fill Plan

Specific locations for backfill are outlined in

Table 5. The extend of beachfill east of Fire Island (Cupsogue County Park, Pikes & Westhampton) remained consistent with the earlier TFSP. There have been refinements in the beachfill plan on Fire Island (15 ft. dune/90 ft. berm included only along the developed shorefront areas of the barrier backed by Great South Bay and Moriches Bay on Fire Island, and on the barrier from Moriches Inlet to Quantuck Channel; East of Shinnecock to Montauk Point CSRM features are identical to NED Plan; 6,440,283 CY (initial beachfill quantity), renourishment (all 30 years) - 30,360,800 CY).The *Berm Only* and *Medium* design templates are used in the selected plan. The *Medium* design template has a dune with a crest width of 25 feet and dune elevation of +15 feet NGVD. Both design templates have a berm width of 90 feet at elevation +9.5 feet NGVD. The proposed design (not construction) foreshore slope (from +9.5 to +2 feet NGVD) is roughly 12.1 on 1. Below MHW (roughly +2 feet NGVD) the submerged morphological profile, representative of each specific reach, is translated and used as the design profile. Figure 4. and Figure 5 shows typical design section for the *Berm Only* and *Medium* design templates.

Table 5 provides an overview of the dune elevations by location along the selected plan.

The *Berm Only* template is applicable to areas in which the existing condition dune elevation and width reduce the risk of breaching but have eroded beach berm conditions. The 90 feet design berm provides protection to the existing dunes and ensure vehicular access during emergency response and evacuation. The *Berm Only* template is applied to RMSP (GSB-1A) and SPCP-West (MB-1A).

The *Medium* template was identified as having the highest net benefits and provides for approximately a 50-yr level of risk reduction. The Medium template is applied to the areas with the greatest potential for damages to oceanfront structures.

Advance fill is a sacrificial quantity of sand which acts as an erosional buffer against long-term and storm-induced erosion as well as beach fill losses cause by “spreading out” or diffusion. The required advance berm width was computed based on representative erosion rates and expected renourishment interval, 4 years. The representative erosion rates were calculated based on the historical sediment budget, volumetric changes in measured profiles between 1988 and 2012, the performance of recent beach fill projects, and anticipated beach fill spreading.

The Beach Fill Plan includes taper (transition) to reduce end losses and increase the longevity of the fill. The taper lengths along Fire Island are consistent with the plans for FIMI. Tapers are accounted for in initial and renourishment volume estimates.

Table 5. Beach Fill Locations

Location	Subreach	Plan Component	Max Fill Length (ft.)	Ren. Fill Length (ft.)	Dune Elv. (ft., NGVD)
RMSP	GSB-1A	Beach Fill & Inlet Mgmt.	16,600	12,000	-
Kismet to Lonelyville	GSB-2A	Beach Fill	8,900	8,900	15
Town Beach to Corneille Est.	GSB-2B	Beach Fill	4,500	4,500	15
Ocean Beach to Seaview	GSB-2C	Beach Fill	3,800	3,800	15
OBP to POW	GSB-2D	Beach Fill	7,300	7,300	15
Cherry Grove	GSB-3A	Beach Fill	3,000	3,400	15
Fire Island Pines	GSB-3C	Beach Fill	6,500	7,000	15
Water Island	GSB-3E	Beach Fill	1,200	1,600	15
Davis Park	GSB-3G	Beach Fill	4,200	5,000	15
SPCP-West	MB-1A	Beach Fill & Inlet Mgmt.	6,300	6,300	-
Cupsogue	MB-2C	Beach Fill	4,300	2,000	15
Pikes	MB-2D	Beach Fill	9,600	9,600	15
Westhampton	MB-2E	Beach Fill	10,900	10,900	15

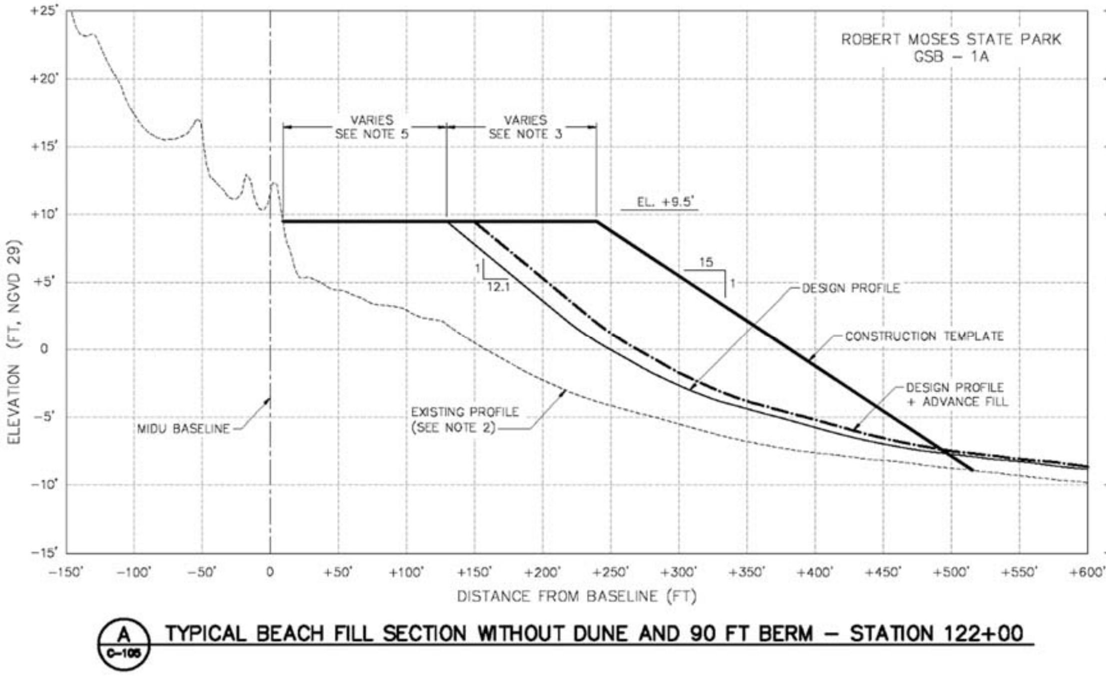

Figure 4. Berm Only Beach Fill Design Profile

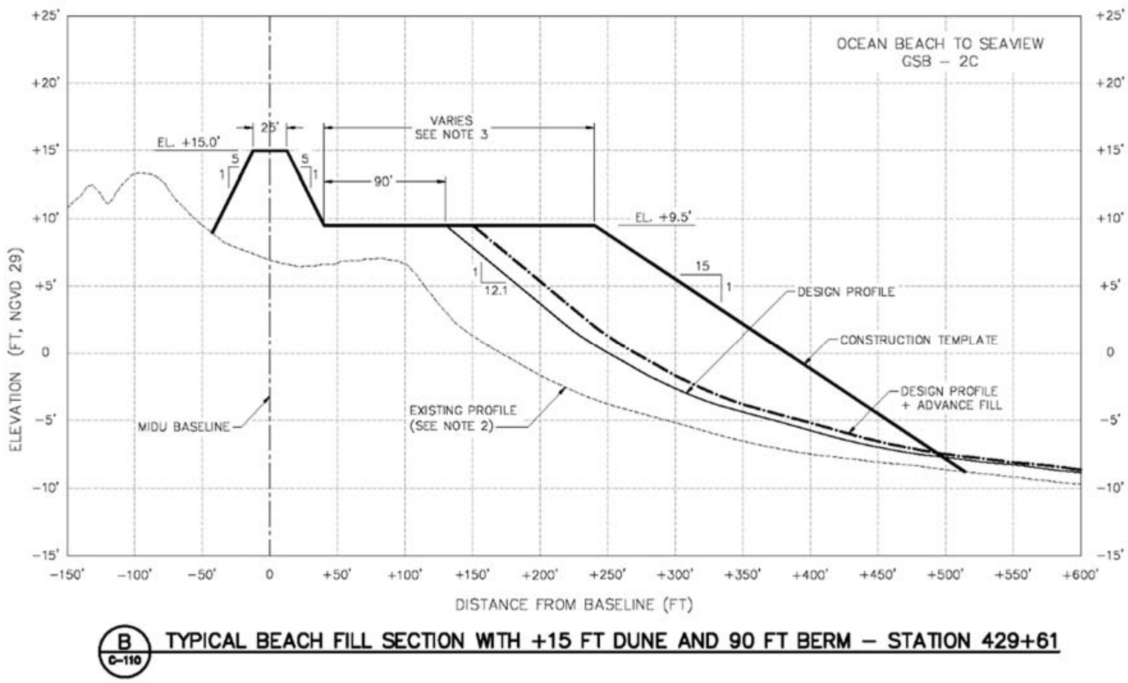

Figure 5. +15 FT NGVD Dune Design Profile

1.1.4.1 Beach Fill Plan – Initial Construction

With the exception of Cupsogue, all of the beach fill design reaches have been recently constructed or are soon to be under construction as part of the Fire Island to Moriches Inlet (FIMI) Stabilization Project or Westhampton Interim Project. Therefore, it is not possible to use the existing beach conditions to estimate initial construction beach fill volumes at the start of the FIMP project in 2018. Instead, initial beach fill volumes were estimated based on predicted sediment losses following the completion of the FIMI and Westhampton Interim projects.

It is noted that advance fill was included in the design and construction of FIMI and the Westhampton Interim Project. Therefore, by restoring sediment losses the initial construction estimates for FIMP indirectly include advance fill. All beach fill quantity estimates include advance fill, 15% overfill, and 15% for contingency/tolerance. A summary of the initial construction quantities for the Beach Fill Plan is shown in Table 6.

Table 6. Beach Fill Plan Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	159,432
Town Beach to Corneille Estates	GSB-2B	2C	4,500	40,484
Ocean Beach to Seaview	GSB-2C	2C	3,800	33,538
OBP to POW	GSB-2D	2C	7,300	65,396
Cherry Grove	GSB-3A	2H	3,400	12,117
Fire Island Pines	GSB-3C	2H	7,000	125,751
Water Island	GSB-3E	2H	1,600	5,589
Davis Park	GSB-3G	2H	5,000	107,029
			Fire Island Subtotal	**549,000**
Cupsogue	MB-2C	4C	2,000	107,265
Pikes	MB-2D	4C	9,600	464,834
Westhampton	MB-2E	4C	10,900	351,015
			Westhampton Subtotal	**923,000**
			Total	**1,472,000**

Notes: RMSP and SPCP-West are not shown here because the required fill material is coming from the Inlet Management Plan.

1.1.4.2 Beach Fill Plan – Life Cycle

The required renourishment fill volumes have been computed based on representative erosion rates and expected renourishment interval, 4 years. The representative erosion rates were calculated based on the historical sediment budget, volumetric changes in measured profiles between 1988 and 2012, the performance of recent beach fill projects, and anticipated beach fill spreading. All beach fill quantity estimates include advance fill, 15% overfill, and 15% for contingency/tolerance.

A summary of the renourishment quantities for the Beach Fill Plan is provided Table 7.

Table 7. Beach Fill Plan - Renourishment Quantities Per Operation

Location[1]	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	318,864
Town Beach to Corneille Estates	GSB-2B	2C	4,500	161,935
Ocean Beach to Seaview	GSB-2C	2C	3,800	134,153
OBP to POW	GSB-2D	2C	7,300	261,584
Cherry Grove	GSB-3A	2H	3,400	48,470
Fire Island Pines	GSB-3C	2H	7,000	503,003
Water Island	GSB-3E	2H	1,600	22,354
Davis Park	GSB-3G	2H	5,000	428,117
			Fire Island Subtotal	**1,878,000**
Cupsogue	MB-2C	4C	2,000	71,510
Pikes	MB-2D	4C	9,600	6,197,792
Westhampton	MB-2E	4C	10,900	468,020
			Westhampton Subtotal	**1,159,000**
			Total	**3,038,000**

[1]RMSP and SPCP-West are not shown here because the required fill material is coming from the Inlet Management Plan.

1.1.5 Sediment Management Plan

The sediment management plans include the establishment of two feeder beaches at Potato Road and Downtown Montauk (Montauk Beach) as shown in Table. The construction template is a berm with a variable width at an elevation of +9.5 feet NGVD29. The berm width will be determined based on a fill volume of either 120,000 cy for Potato Road or 400,000 CY for Downtown Montauk. As described previously, these volumes are designed to offset the long-term erosion within these areas, and to maintain a stable beach configuration. A typical section of the sediment management feature is shown in Figure 6.

Table10. Sediment Management Fill Volumes

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Potato Road	P-1G	BA 6I	3,300	120,000
Downtown Montauk	M-1F	BA 8D	5,000	400,000
			Total	**520,000**

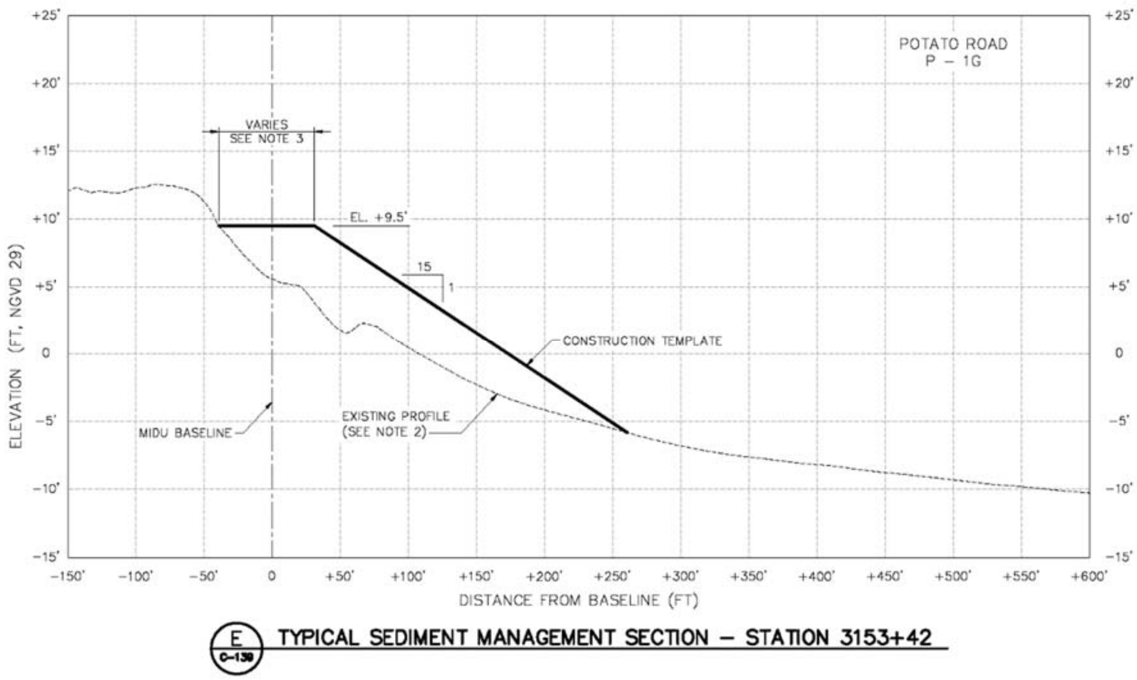

Figure 6. Typical Sediment Management Construction Template

1.1.6 Groin Modification Plan

The groin modification plan is an adapted version of the TFSP, amended to reflect public and agency input following the publication of the draft report and the NEPA process, and updated economic analysis. It includes:

- Removal of 2 groins at Ocean Beach. Final plan to be determined.

1.1.7 Coastal Process Features

CPFs are required for the interagency mutually acceptable plan in order to achieve risk rmanagement in back bay areas through no net loss of overwash sediment due to dune placement on barrier. The Corps will place 4.7M CY of sediment in conjunction with renourishment efforts over 30 years, with no responsibility for OMRR&R between renourishments.

CPFs currently include:

* Features which compensate for impacts to <u>Alongshore Transport</u> (Groin modification or shortening, sand bypassing, sediment management.)
* Features which compensate for reductions in <u>Cross-Island Transport</u> (Overwash fan and bay beach creation or reinforcement.)
*Features which compensate for sediment loss to the bay or <u>Bay Shoreline Processes</u> by establishing resilient and sustainable uplands.

FIMP CPFs bolster the CSRM functions provided by natural coastal landforms and complement the FIMP risk management features. Damages in the FIMP study area are calculated by projecting the degree of flooding that will occur on the mainland of Long Island due to breaching and overwash of the barrier island. Risk management measures, such as berms and dunes constructed on the ocean coastline, are proposed to reduce breaching and overwash. CPFs complement these measures, by adding volume to the bay side of the barrier system. Judicious siting of CPFs will ensure that risk management features do not unnecessarily interrupt barrier island processes such as 'barrier island rollover.' Rollover is the gradual movement in geologic time of a barrier island as sediment is eroded from the ocean coast and transported by overwash to the bay shore. The rollover process contributes to barrier island integrity and robustness and supports the natural CSRM functions provided by heathy barrier island systems. Without CPFs, the FIMP risk management features would reduce the amount of sediment that enters the back bay environment, interrupting the rollover process and resulting in the degradation of the barrier island's natural CSRM functions. Therefore, CPFs are recommended along the back bay coast to maintain the long-term sustainability of the barrier island system and reduce vulnerability of the barrier island to breaching, which will reduce water levels within the bay, and the resulting flooding.

Placement of approximately 4.7M CY of sediment in the backbay environment, and the resulting habitat is necessary to satisfy the mutually acceptable requirement of "no net loss" of sediment transport into the back bay. The CSRM features proposed to reduce risk along the shoreline will reduce the frequency of overwash and breaching, which naturally transports sediment into the back bay. The most CPFs are a negotiated Section 7 compensation for the interruption in natural coastal processes which result from the shoreline measures, and are necessary to achieve a mutually acceptable plan to reduce risk in the study area and increase the sustainability of the barrier island.

All CPFs will be constructed in conjunction with the construction of the FIMP project, and renourished when the beachfill features are renourished, currently proposed as a 4 year cycle.

The restoration framework identified 5 key physical processes to be targeted for restoration, including 1) alongshore transport, 2) cross-island transport, 3) dune growth and evolution, 4) bay shoreline processes, and 5) estuarine circulation and water quality. There are a number of measures that can be applied to achieve these restoration objectives.

The following is a brief discussion of the types of specific restoration that can be undertaken to achieve these restoration objectives.

The table provides an overview of the sites. Please note, some of the sites have been identified as CPF's, which contribute to strengthening the integrity of the barrier island. There are additional sites that have been identified as candidate sites for ESA offsets, which do not specifically meet the Corps definition for a CPF.

	Summary of Candidate Environmental Sites							
Site #	Type	Status	source	Coastal Process Features	Location	Measure	Action	Status
1	ESA	Landowner support	New	Democrat Point - west of Jetty	Robert Moses State Park	veg management / pond opening	design	RMSP supports plan features, concerned about: 1) attracting more boaters (channel opening), destabilizing the area, maintenance requirements for the park.
2	ESA	Landowner support	New	Democrat Point - bayside, east of jetty	Robert Moses State Park	maintain plover habitat	design	RMSP supports a plan for this area
3	ESA	Landowner support	New	Dunefield east of Field 2, between 2/3	Robert Moses State Park	maintain plover habitat	design	RMSP believes no action required now, would support future deveg. Concerned about maintenance requirements
4	ESA	No landowner support	New	Dunefield west of field 4	Robert Moses State Park	maintain plover habitat	stop	RMSP does not believe this location provides viable habitat
5	Mitigation	Not Supported in FIMP	New	Wetland North of Field 5	Robert Moses State Park	Reestablish wetland function	stop	RMSP supports, but believes effort would be large
6	CPF	Support	New	Clam Pond	Saltaire	reestablish spit	design	understanding is that Saltaire supports. Is confirmation necessary?
7	CPF	Support	Existing	T25 Atlantique to Corneille	Atlantique	bayside beach, overwash	design	understanding is that NPS supports, based upon Dec meeting
8	CPF	Needs landowner support	New	Point O' Woods	Point O' Woods	bayside beach		
9	CPF	Support	Existing	T2 Sunken Forest / Sailor's Haven	Sunken Forest	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
10	CPF	Support	New	Carrington Tract	Carrinngton Tract	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
11	CPF	Support	Existing	T3 Regan Property / Talisman	Talisman, FI Pines	bay beach, overwash, possible sill	design	understanding is that NPS supports, based upon Dec meeting
12	CPF	Support	New	Talisman	Talisman	Overwash fan / spit / feeder beach	design	understanding is that NPS supports, based upon Dec meeting
14	CPF / ESA	Needs landowner support	New	Smith Point County Park Pattersquash	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports feature, concerned about 1) allowing use of berma road, 2) long-term maintenance requirements
15	CPF / ESA	Needs landowner support	New	Smith Point County Park Breach / New	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports, same concerns as above
16	CPF	Needs landowner support	New	Smith Point County Park Marsh	Smith Point County Park	reestablish degraded wetland height	design	SPCP supports marsh efforts
17	ESA	Needs landowner support	New	Great Gunn Shorefront	Smith Point County Park	Maintain the FIMI ephemeral pool	design	SPCP supports, with concerns regarding the maintenacne requirements
18	ESA	Needs landowner support	New	Cupsogue	Cupsogue County Park	bayside beach, relocate recreation use	stop	SPCP does not support
19	ESA	Unlikely, Landowner Issues	New	Westhampton Spit	Westhampton	veg management / regrading	stop	property is currently in litigation over ownership
20	CPF	Needs landowner support	New	Sedge Island	Southampton	reestablish wetlands		
21	CPF	Needs landowner support	New	Tiana - mermaid lane	Southampton	establish bayside sandspit / wetland		
22	CPF	Needs landowner support	Existing	T7 Tiana - Rd K	Southampton	establish bayside sandspit / wetland		
23	CPF	Needs landowner support	Existing	T8 WOSI	Southampton	establish bayside beach		
	CPF / ESA	Needs to be developed	New	Tiana - WOSI	Southampton	setback dune, shorefront natural process		County Parks would like to discuss further, believes there is quality habitat.
24	CPF	Needs to be developed	New	Pepperidge Hall Wetland	Islip	reestablish degraded wetland, add height		
25	CPF	Needs to be developed	New	Fireplace Neck / Bellport Wetlands	Brookhaven	reestablish degraded wetland, add height		
26	CPF	Needs to be developed	New	Mastic Beach Wetlands	Brookhaven	reestablish degraded wetland, add height		
27	CPF	Needs to be developed	New	Forge River Wetlands	Brookhaven	reestablish degraded wetland, add height		

Longshore Sediment Transport.

Restoration of the longshore process can help to maintain a more natural shoreline condition, and a more natural beach profile. Restoring these processes can reduce the need for future activities to address erosion in these areas. Restoration of longshore transport can be undertaken through a number of options. The most effective way to accomplish this is in the removal of the barrier. If removal of the barrier is not possible, modification of the structure (such as shortening or notching) could be considered. If neither of these options are viable, it may be possible to consider replicating the processes that would have naturally occurred (i.e bypassing sand at the inlets).

Cross-Island Transport

Opportunities for restoration of this habitat are similar to those identified for longshore transport. The preferred approach would be to allow these processes to continue unimpeded, or promote the occurrence of these processes in areas where they have been negatively impacted. If these processes can't be restored through this process, it may be possible to replicate the processes as they would have naturally occurred (i.e. the construction or restoration of overwash habitats).

Dune Development and Evolution.

In much of the study area, the long-term trend is erosional. In these areas, under a natural condition, the dunes would tend to evolve and migrate, over time. To varying degrees, the existing dunes are unable to do this, due to development, and the past efforts undertaken to maintain a beach and dune to protect existing development. Past decisions have impacted the natural growth and evolution of the dunes. Significant amounts of dune habitat have been degraded, due to the presence of buildings on the dunes. Opportunities for restoration of the dune process include: removing buildings to provide the necessary space to allow for dune evolution. If this is not viable, the next available opportunity could be construction of a dune, or enhancement of an existing dune that is allowed to move over time through phased acquisition.

Bayside shoreline Processes

The possible solutions for restoring these bayside processes include removal of the actions that have caused or are causing the disruption. There may be some areas where removal of bayside bulkheading, or filling of channels could be a viable option. In areas where this is not feasible, the next set of scenarios could consider reducing the impact of these structures through modification of the structure. Lastly, it may be possible to consider taking actions to replicate the processes, through the infusion of material to offset the impact of the disturrbance.

Estuarine Circulation

The magnitude of human changes within the estuary, and the complexity of the interaction between the physical processes and the environment make it difficult to identify a clear objective for the restoration of estuarine circulation processes, although the topographic and bathymetric changes within the estuaries can provide clear opportunities for habitat restoration

CPF SITE 1 DEMOCRAT POINT- WEST OF JETTY-REACH GSB-1A

The most notable CPF needs at this location is reducing the elevation to allow for more frequent overwashing. This will allow sediment into the bays through cross island transport. It will create early successional habitat which provides nesting and foraging area for shore birds. A section along the bayside of Democrat point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east is high. Vehicle access to the beach is provided via open cuts in the dune located to the east of the area surveyed for this CPF. The negative impacts to cross-island transport (overwash) will be offset through the lowering of the berm and dune elevation to 6 feet.

- Removal of approximately 187,000 cy (70 ac) of material
- Regrade 70 ac of early successional habitat

Specific activities would include regrading approximately 70 acers to an elevation of +6 foot elevation as well as removal of approximately 187,000 cys of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevations in this area this CPF is expected to positively affect cross island transport as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species.

CPF SITE-2 DEMOCRAT POINT BAYSIDE EAST OF JETTY-REACH GSB-1A

The most notable CPF needs at this location is reducing the elevation to allow for more frequent tidal effects. This will control the amount of vegetation that may want to recut in this area. It will create early successional habitat which provides nesting and foraging area for shore birds.

Recreational use in the area is high. Vehicle access to the beach is provided via open cuts located to the east of the area surveyed for this CPF. The negative impacts to cross-island transport will be offset through the lowering of the berm and dune elevation to 6 feet.

- Removal of approximately 52,000 cy (32 ac) of material
- Regrade 32 ac of early successional habitat

Specific activities would include regrading approximately 32 acers to an elevation of +6 foot elevation as well as removal of approximately 52,000 cys of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevation in this area this CPF is expected to create early successional habitat for shorebirds and threatened and endangered (T&E) species.

CPF SITE-3 DUNE FIELD EAST OF FIELD 2-REACH GSB-1A

The most noteworthy CPF needs at this location is reducing the amount of vegetation to allow for nesting shorebirds. It will create early successional habitat which provides nesting and foraging area for shore birds. A section along the bayside of Democrat point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east is high. The negative impacts from limiting overwash transport will be offset through the de-vegetation of the dune.

- De-vegetate 15 ac of early successional habitat

Specific activities would include regrading approximately 15 acers to remove the vegetation. The vegetation of the existing community will be modified, but the overall width/size would not. By reducing the vegetation in this area this CPF is expected to positively affect early successional habitat for shorebirds and threatened and endangered (T&E) species.

CPF SITE-4 DUNE FIELD WEST OF FIELD 4-REACH GSB-1A

The most noteworthy CPF needs at this location is reducing the amount of vegetation to allow for nesting shorebirds. It will create early successional habitat which provides nesting and foraging area for shore birds. A section along the bayside of Democrat point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east and the west is high. The negative impacts from limiting overwash transport will be offset through the de-vegetation of the dune.

- De-vegetate 5 ac of early successional habitat

Specific activities would include regrading approximately 5 acers to remove the vegetation. The vegetation of the existing community will be modified, but the overall width/size would not. By reducing the vegetation in this area this CPF is expected to positively affect early successional habitat for shorebirds and threatened and endangered (T&E) species.

CPF SITE-5 WETLAND NORTH OF FIELD 5-REACH GSB-1A

The most prominent CPF needs at this location is reducing the elevation to allow for more frequent overwashing. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh in this area.

Recreational use in the area to the south is high. The negative impacts to cross-island transport will be offset through the lowering of the bayside elevation to +3 feet.

- Removal of approximately 7,600 cy (15 ac) of material

- Regrade 15 ac of early successional habitat

Specific activities would include regrading approximately 15 acers to an elevation of +3 foot elevation as well as removal of approximately 7,600 cys of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevations in this area this CPF is expected to positively affect cross island transport as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert to a low marsh.

CPF SITE-6 CLAM POND-REACH GSB-2A

The most prominent CPF needs at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to +3 elevation. Approximately 56,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 56,000 cy (8 ac) of sand
- Creation of 8 ac of early successional habitat

Specific activities would include placing approximately 56,000 cy of sand to an elevation of +3 foot elevation. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-7 ATLANTIQUE TO CORNEILLE-REACH GSB-2B

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the highly developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 12,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 12,000 cy (9 ac) of sand
- Creation of 9 ac of early successional habitat

Specific activities would include pumping approximately 12,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-8 POINT O' WOODS-REACH GSB-2D

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the highly developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 8,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 8,000 cy (21 ac) of sand
- Creation of 21 ac of early successional habitat

Specific activities would include pumping approximately 8,000 cy of sand to an elevation of -1 to -2 elevation. However, due to the velocity of water flow in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of upland habitat. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well.

CPF SITE-9 SUNKEN FOREST AND SAILOR'S HAVEN-REACH GSB-2E

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the highly developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 24,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 24,000 cy (35 ac) of sand
- Creation of 35 ac of early successional habitat

Specific activities would include pumping approximately 24,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-10 Carrington Tract-Reach GSB-3B

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the highly developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 26,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 26,000 cy (16 ac) of sand
- Creation of 16 ac of early successional habitat

Specific activities would include pumping approximately 26,000 cy of sand to an elevation of -1 to -2 elevation. However, due to the velocity of water flow in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of upland habitat. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well.

CPF Site-11 Regan Property/Talisman-Reach GSB-3D

The most prominent CPF needs at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to -1 to -2 feet elevation. Approximately 3,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 3,000 cy (11 ac) of sand
- Creation of 11 ac of early successional habitat

Specific activities would include placing approximately 3,000 cy of sand to an elevation of to -1 to -2 feet. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-12 TALISMAN-REACH GSB-3D

The most prominent CPF needs at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to -1 to -2 feet elevation. Approximately 6,500 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 6,500 cy (14 ac) of sand
- Creation of 14 ac of early successional habitat

Specific activities would include placing approximately 6,500 cy of sand to an elevation of -1 to -2 feet. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-14 PATTERSQUASH REACH MB-1B

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the sand spit. The area will be filled to -1 elevation (12 ac) in conjunction with vegetation removal of about 45 ac. Approximately 25,000 cy of sand will be placed in the bay. It will create 57 ac of early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 25,000 cy (12 ac) of sand
- Maintain 45 ac of early successional habitat

Specific activities would include placing approximately 25,000 cy of sand to an elevation of -1 feet and mechanically/chemically de-veg the area. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-15 NEW MADE ISLAND REACH MB-2A

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the sand spit. The area will be filled to -1 elevation in conjunction with vegetation removal of about 100 ac. Approximately 17,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 17,000 cy (100 ac) of sand
- Creation of 100 ac of early successional habitat

Specific activities would include placing approximately 17,000 cy of sand to an elevation of -1 feet. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-16 SMITH POINT COUNTY PARK MARSH REACH MB-2A

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the wetland. The surrounding marsh areas have linear man-made channel that bisects the site from east to west. The area will be elevated approximately 3 inches to establish higher elevation to allow for wetland species to root. Approximately 100,000 cy of sand will be placed in the wetland. It will create early successional habitat which provides areas for native plants species to establish where before they could not survive do to inundation. The area will also provide CSRM through higher elevation of the barrier island and wave attenuation.

Recreational use in the area is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 100,000 cy (250 ac) of sand
- Creation of 250 ac of early successional habitat

Specific activities would include fine spraying of sand approximately 100,000 cy to increase the elevation by3 inches throughout the wetland. By enhancing the wetland in this area this CPF is expected to positively affect cross island transport and Back Bay sediment circulation as well as create early successional habitat for wetland species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as a low marsh.

CPF SITE-17 GREAT GUN REACH MB-2B

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the early successional habitat through with vegetation removal of about 100 ac. It will create early successional habitat which provides nesting and foraging area for shore birds.

- Creation of 100 ac of early successional habitat

Specific activities would include mechanical /chemical vegetation removal of about 100 ac. By creating this early successional habitat this CPF is expected to positively affect habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert back to a natural dune system.

CPF SITE-18 CUPSOGUE MB-2C

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the early successional habitat through with vegetation removal of about 100 ac. The area will be filled to -1 elevation in conjunction with vegetation removal of about 11.5 ac. Approximately 18,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

- Creation of 11.5 ac of early successional habitat
- Placement of approximately 18,000 cy (3.33 ac) of sand

Specific activities would include mechanical /chemical vegetation removal of about 8.2 ac and placing 18,000 cy to create 3.3 ac. By creating this early successional habitat this CPF is expected to positively affect habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert back to a natural dune system.

CPF SITE-19 WESTHAMPTON SPIT REACH MB-2E

OMITTED PROPERTY IS IN LITIGATION

CPF SITE-20 SEDGE ISLAND-REACH SB-1B

This area is a highly developed with residential housing. Vegetation loss and substrate disturbance from pedestrian use of uplands is noticeable throughout the site. Despite the recreational uses of the area, the adjacent wetlands are of relatively high quality. The most prominent CPF needs at this location is reconnecting the bisected wetlands. The surrounding marsh areas have linear man-made channel that bisects the site from east to west. The area will be filled to +2 elevation to tie into adjacent marsh elevations. Approximately 125,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through wave attenuation and strengthening the barrier island through widening it.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 125,000 cy (16.5 ac) of sand
- Creation of 16.5 ac of early successional habitat

Specific activities would include placing approximately 125,000 cy of sand to an elevation of +2 foot elevation. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species which will eventually become low march over time. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert to a low marsh.

CPF SITE-21 MERMAID LANE-REACH SB-1C

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 9,500 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 9,500 cy (15 ac) of sand
- Creation of 15 ac of early successional habitat

Specific activities would include pumping approximately 9,500 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-22 TIANA-K-ROAD-REACH SB-1C

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings and various human activities associated with the developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 20,000 cy of sand will be placed in the bay. It will create early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 20,000 cy (12 ac) of sand
- Creation of 12 ac of early successional habitat

Specific activities would include pumping approximately 20,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF SITE-23 WOSI REACH SB-2B

The WOSI restoration site currently provides parking and access to the beach for recreational activities. Bayside, the site is characterized by an asphalt parking lot, relatively steep bayside dunes, and impacts to bayside dunes caused by pedestrian access from the parking lot to the bay shoreline. A relatively high quality salt marsh is located in the northeastern portion of the site, however the marsh does contain invasive *Phragmites*. The site is at a relatively narrow portion of the barrier island, however, the dunes and beach in this area are relatively wide and stable due to beach renourishment activities that were recently completed for the site. This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and in particular have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF needs at this location is reestablishing the sand spit. The area will be filled to -1 elevation (8 ac) in conjunction with vegetation removal of about 21 ac. Approximately 12,000 cy of sand will be placed in the bay. It will create 29 ac of early successional habitat which provides nesting and foraging area for shore birds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

- Placement of approximately 12,000 cy (8 ac) of sand
- Maintain 29 ac of early successional habitat

Specific activities would include placing approximately 12,000 cy of sand to an elevation of -1 feet and mechanically/chemically deveg the area. By creating the spit in this area this CPF is expected to positively affect cross island transport and Back Bay circulation as well as create early successional habitat for shorebirds and threatened and endangered (T&E) species. The adaptive management plan being develop in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

1.1.8 Land Management and Acquisition Program

The existing Land management efforts, and opportunities to improve land management are described in Appendix H- Land Use. These programs are a collaborative effort between Federal, State and local entities and cannot be unilaterally implemented by the Corps of Engineers. These programs will be implemented as complementary plans to the overall FIMP project. As part of the FIMP Project, permanent easements will be obtained in locations where beachfill is to be placed. These permanent easements also have the effect of restricting development from encroaching on the dune and beach that is constructed as part of the project. The land management appendix recognizes this element of the project as an effective tool that will ensure the constructed dunes are not encroached-upon.

- Improve the effectiveness of the existing regulatory program, by establishing common and clearly communicated boundaries for regulated hazard areas, increasing training of local officials, and coordination to ensure consistent implementation across regulatory boundaries.
- Establish post-storm response plans to guide recovery following major, catastrophic events.

1.2 Borrow Area Investigations

Appendix B- Borrow Areas provides a detailed discussion of the studies that have been undertaken to identify potential sources of suitable sand for both the initial construction and periodic renourishment. Potential borrow areas were evaluated based on a set of screening criteria. These criteria included the evaluation of the availability of adequate data, the sufficiency of quantity in each potential source, beach and dune compatible sediment characteristics, identification of those offshore sources which would minimize adverse wave attenuation, the consideration of geomorphological effects of mining of offshore ridges on barrier island shoreline position and sediment budget, identification of those offshore sources that contained minimal overburden and minimal quantity of fine grained material, and which had minimal adverse environmental effects and minimal effect on cultural resources.

Potential borrow sources identified included upland quarries, maintenance dredge material from navigation channels, the mining of ebb and flood shoals, and offshore borrow areas. Table 5 of Appendix B – Borrow Areas summarizes the results of the Borrow Delineation and Table 6 of Appendix B presents the Available Borrow Volumes.

Appendix B- Borrow Areas recommends utilizing the lowest impact borrow areas first for the initial construction, while continuing to perform pre-and post-dredging monitoring to get a better understanding of the sediment transport processes before utilizing other borrow sites during periodic renourishment. In addition to the three inlets, six borrow areas were selected for initial construction: 2C, 2H, 4C, 5Bexp, 6I, 8D. Figure 7 shows the delineation of the selected borrow areas and **Error! Reference source not found.** 9 lists their respective initial construction quantities.

The offshore portion of Borrow Area 2C, which is an offshore sand ridge, is being used for the Fire Island Inlet to Moriches Inlet Interim Project beach and dune construction. The removal of material from this ridge (or other future uses of sand ridges as borrow sources) may interrupt the onshore migration of material from the ridges to the barrier island shore face. CORPS acknowledges that the potential for this onshore movement is a plausible process. The impact of the proposed nearshore sand mining on cross-shore transport rate is not yet quantified. Modifications of the nearshore topography of the sand ridges offshore of western Fire Island will be the subject of cooperative monitoring between the USGS and CORPS, and will be part of monitoring/adaptive management programs under FIMP.

Table 9. Borrow Areas – Initial Construction

Borrow Area	Location	Volume (cy)
2C	Kismet to POW	299,000
2H	Cherry Grove to Davis Park	250,000
4C	Cupsogue to Westhampton	923,000
5Bexp	Sedge Island to SPW	1,326,000
6I	Potato Road	120,000
8D	Montauk Beach	120,000
Fire Island Inlet*	Gilgo Beach to RMSP	2,341,000
Moriches Inlet*	SPCP to Great Gunn	512,000
Shinnecock Inlet*	SPW to WOSI	549,000
		Total 6,440,000

*Includes Ebb Shoal.

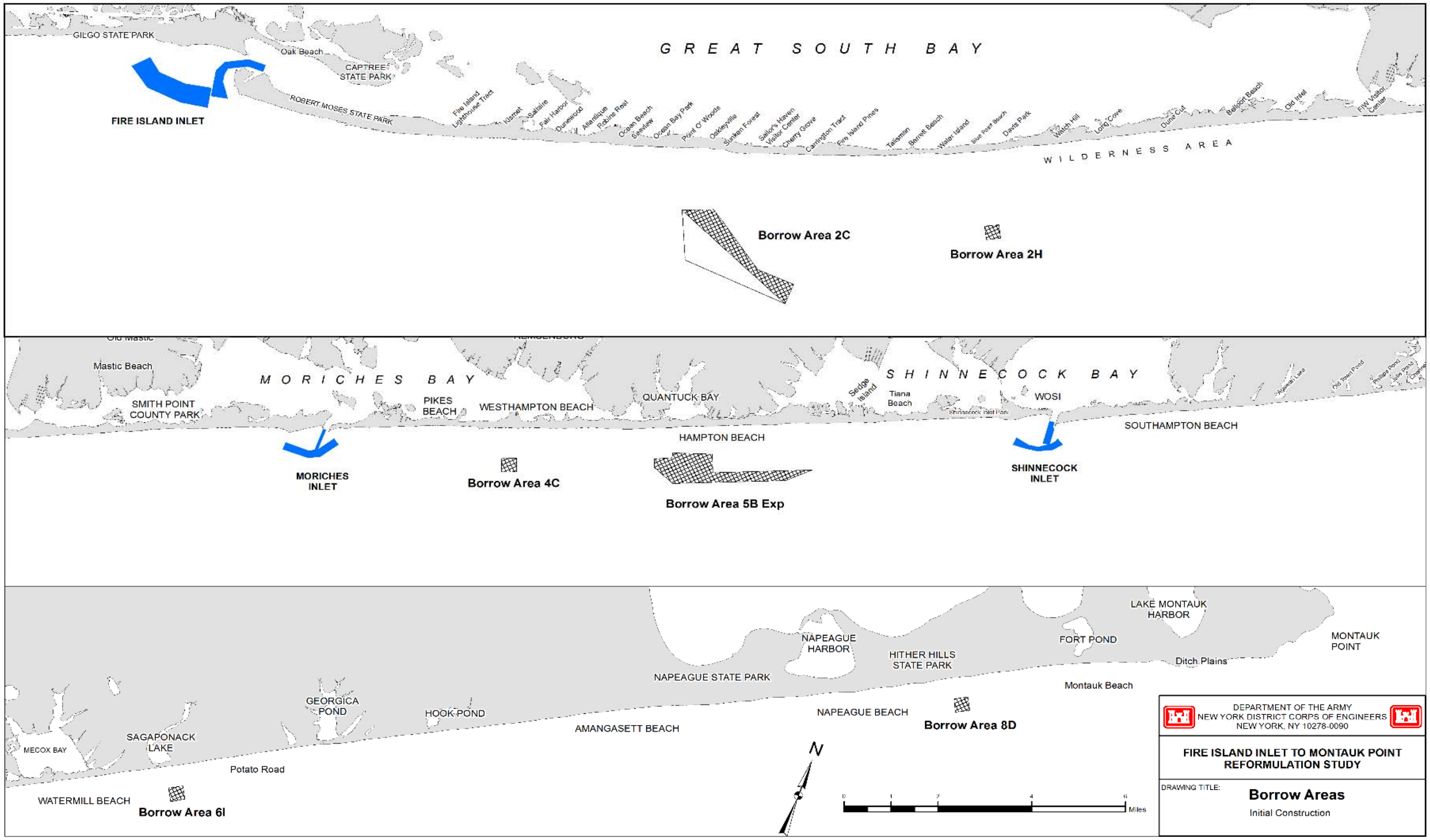

Figure 7. Borrow Areas – Initial Construction

APPENDIX B2

USFWS Programmatic Biological Opinion (March 2019)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 Westgate Center Drive
Hadley, MA 01035-9589

In Reply Refer To:
FWS/Region 5/ES

MAR 29 2019

Colonel Thomas D. Asbery
District Engineer
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Asbery:

This document transmits the U.S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (PBO), based on our review of the proposed "Fire Island to Montauk Point Coastal Risk Management Stabilization Project (FIMP), and its effects on federally listed as threatened piping plover (*Charadrius melodus*) and seabeach amaranth (*Amaranthus pumilus*) in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 *et seq.*). Your request for formal consultation was received on April 5, 2018.

If you have any questions, please contact Spencer Simon 413-253-8578 or Julie Thompson at 410-573-4595.

Sincerely,

ACTING

Paul R. Phifer, Ph.D
Assistant Regional Director
Ecological Services

U.S. Fish & Wildlife Service

Programmatic Biological Opinion

Effects of Fire Island Inlet to Montauk Point Coastal Storm Risk Management Project, Suffolk County, NY on Piping Plover (Charadrius melodus) and Seabeach Amaranth (Amaranthus pumilus)

photo credit: Jim fenton (jfenton@jfentonphoto.com)

Programmatic Biological Opinion

Effects of Fire Island Inlet to Montauk Point Coastal Storm Risk Management Project, Suffolk County, NY on Piping Plover (*Charadrius melodus*) and Seabeach Amaranth (*Amaranthus pumilus*)

Prepared for:

U.S. Army Corps of Engineers New York District New York, New York 10278-0090
By:

U.S. Fish and Wildlife Service
Chesapeake Bay Field Office

Preparers:
Julie Slacum and Chris Guy

March 29, 2019

EXECUTIVE SUMMARY

The proposed project is coastal storm risk management to be conducted along a portion of the 83-mile long study area for the south shore of Long Island, New York from Fire Island Inlet to Montauk Point. The proposed project includes a combination of: (1) inlet modifications (sand bypassing in conjunction with existing authorized navigation projects at Fire Island, Moriches, and Shinnecock Inlets; including dredging, downdrift placement of dredge material, placement of dredge material on the berm, and monitoring); 2) non-structural measures (primarily building retrofits, with limited relocations and buy-outs); (3) breach response for the barrier islands for up to 50 years; (4) beach and dune fill with renourishment: up to 30 years, approximately every 4 years on sections of Fire Island and Westhampton Island, and Southampton beaches; (5) sediment management, with the construction of a feeder beach in East Hampton; (6) groin removal on Fire Island; (7) Coastal Process Features (CPFs); and (8) adaptive management.

By stabilizing the dune and beaches, the project will preclude 55 hectares of early successional ocean-to-bay washover habitat from forming, which will reduce carrying capacity for nesting piping plover (*Charadrius melodus*) and seabeach amaranth (*Amaranthus pumilus*). The Programmatic Biological Opinion (PBO) relies on the development and maintenance of CPFs to offset habitat loss. Seabeach amaranth will also be monitored and transplantation will occur as necessary. Indirect effects of the project on piping plovers such as predation and human disturbance not addressed through the Service's recreational guidelines (Service 1994) will be addressed through adaptive management based on the annual monitoring of pairs and productivity. However, it is important to note that early successional habitat must be created and maintained (in the form of CPFs) to ensure that there is habitat carrying capacity for an increasing population.

The PBO contains four conservation measures for piping plover and one conservation measure for seabeach amaranth to minimize impacts of the project and promote recovery of the species. The conservation measures for piping plover include: 1) continuing consultation with the Service throughout the life of the project; 2) general construction modifications of the material to be used in dune and beach nourishment; 3) specific modifications of construction practices to minimize impacts on piping plovers; and 4) monitoring and management of piping plover and piping plover habitat. For seabeach amaranth specific construction modification and monitoring are identified to reduce and offset any potential impacts.

The PBO uses best available information to quantify take and to evaluate the effectiveness of habitat offsets. Systematic planning using the Data Quality Objectives (DQO) process was used to evaluate data and make decisions regarding impacts to piping plovers and seabeach amaranth. The DQO process is a hierarchy of data based on the amount of site specific applicability and scientific scrutiny the data has received. The PBO used five tiers of data to support this hierarchy. Tier 1 is the highest quality data and was always considered first. Tiers two through five are progressively lower and were considered in that order. Tier 1 DQO data is site specific, peer reviewed published data and represents the highest quality. Tier 2 DQO data is site specific monitoring data and/or site specific white paper/report. Tier 3 data is non-site specific, peer reviewed published data. Tier 4 is non-site specific monitoring data or white paper/report. Tier 5 data is best professional judgement. In the analysis, all available information was considered. Where there was disagreement or a range in the value used for an assumption, the data with the highest DQO Tier was used.

The project strives to meet no net loss of nesting habitat through the creation and maintenance of CPFs. Adaptive management and monitoring address uncertainty of mitigation outcomes and maximize performance. Annual monitoring of breeding pairs and productivity for piping plover and censusing for seabeach amaranth inform whether additional actions are needed to address indirect effects of the project.

INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service) PBO in accordance with Section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.) (ESA) and the effects of the proposed Fire Island to Montauk Point Coastal Risk Management Stabilization Project (FIMP), Suffolk County, New York, to be carried out or authorized by the U.S. Army Corps of Engineers, New York District (Corps) over the next 50 years. The proposed project implements coastal storm risk management along a portion of the 83-mile long study area for the south shore of Long Island, New York from Fire Island Inlet to Montauk Point.

The proposed project includes a combination of: (1) inlet modifications (sand bypassing in conjunction with existing authorized navigation projects at Fire Island, Moriches, and Shinnecock Inlets; including dredging, downdrift placement of dredge material, placement of dredge material on the berm, and monitoring); 2) non-structural measures (primarily building retrofits, with limited relocations and buy-outs); (3) breach response for the barrier islands for up to 50 years; (4) beach and dune fill with renourishment: up to 30 years, approximately every four years on sections of Fire Island and Westhampton Island, Southampton beaches and Town of Montauk beaches; (5) sediment management, with the construction of a feeder beach in East Hampton; (6) groin removal on Fire Island; (7) Coastal Process Features (CPFs); and (8) adaptive management. This project will utilize approximately 6.44 million cubic yards (CY) of beach fill for construction of dunes, berms and sand bypassing and will occur over the next 30 years. After 30 years, the Federal and non-Federal commitment would transition to a Breach Response Plan for the remainder of the 50 years (i.e., proactive and conditional) and would repair the beach and dunes in those areas identified for proactive breach response, when the threshold is met.

The Corps' Biological Assessment (BA) and request for formal consultation was accepted by the Service on April 5, 2018. This PBO is based on information provided in the Service and Corps' final BA (USFWS and U.S. Army Corps of Engineers 2018) along with other sources of information cited herein. The record for this consultation is on file at the Service's Chesapeake Bay Field Office in Annapolis, Maryland, and prior to May 2017 records are on file at the Long Island and New York Field Offices, and Northeast Regional Office.

PURPOSE OF THIS CONSULTATION

The Service concurs with the Corps' likely to adversely affect determinations. Therefore, this consultation examines whether the FIMP Project is likely to jeopardize the continued existence of the federally threatened piping plover (*Charadrius melodus*) and federally threatened seabeach amaranth (*Amaranth pumilus*).

SPECIES' NOT LIKELY TO BE ADVERSELY AFFECTED

The Service concurs with the Corps' determination that the Project may affect, but is not likely to adversely affect the federally threatened red knot (*Calidrus canutus rufa*) and federally endangered roseate tern (*Sterna dougallii dougallii*) (Appendix A).

CONSULTATION HISTORY

This consultation is the most recent in a long history of activities regarding coastal storm protection/risk management activities along the south shore of Long Island, New York. The consultation history only addresses this project and does not include meetings, calls, or e-mails related to the Fire Island Inlet to Moriches Inlet Stabilization (FIMI) Project that is presently undergoing construction and was issued a Biological Opinion in 2014. This project adopts the project features constructed under FIMI and expands the geographic area to include other activities described below in the Proposed Action.

May 3, 2017 - Long Island Field Office provides Corps' Draft BA to Chesapeake Bay Field Office.

May 5, 2017 - Conference call with the Service (Julie Slacum, Chris Guy, and Paul Phifer) and the Corps (Peter Weppler and Catherine Alcoba). Introductions were made and Slacum and Alcoba were identified as the new leads to work together to get a BA and PBO done by October 2017. Corps to provide information on beach nourishment areas, coastal process features (CPFs), permissions within land ownership, and management ongoing for CPFs.

May 19, 2017 - The Service (Slacum and Guy) attend field meeting with the Corps (Alcoba and Robert Smith), visiting West Hampton Dunes, Smith Point County Park, and the communities within Fire Island National Seashore (FIIS). The Corps provided an updated spreadsheet on the shoreline beach features and a description and maps of the proposed CPFs. The Service left the meeting asking for a revised project schedule and Geographic Information System (GIS) shapefiles of the project including the CPFs.

June 1, 2017 - Conference call (Slacum and Guy, Service) with the Corps (Alcoba) regarding information needed for the BA, schedule, when and how often we would have conference calls, and a table that Guy was developing which he would send the Corps and the Long Island Field Office to assess the success of conservation measures implemented as part of the FIMI project.

June 15, 2017 - Conference call (Slacum and Guy, Service) with the Corps (Alcoba) discussing needs for a revised BA that would better represent the proposed activities being considered under FIMP.

June 22, 2017 - Conference call (Slacum and Guy, Service) with the Corps (Alcoba and Couch). Couch provided information on how they calculated 4.7 million cubic yards of sand needed (later re-calculated to 4.2 million cubic yards) to offset sediment precluded from entering the back bays from the Project. The Service and the Corps then discussed answers to a list of questions the Service provided the week before that would be needed to complete the BA.

June 29, 2017 - Conference call (Guy, Service) with the Corps (Alcoba). The Service and the Corps discussed potential conservation measures for FIMP based on what was in the FIMI BO and the table that the Service's Chesapeake Bay Field Office developed with conservation measures from the FIMI. The intent of the discussion was to get the Service and the Corps to individually state which conservation measures each agency thought were successful/not successful based on past experiences. Guy asked for the U.S. Geological Survey (USGS) memo on the Corps' calculation of no net loss of sediment that would be precluded from entering the back bays from the Project.

July 7, 13, 20, 27, 2017 - The Service continues to discuss with the Corps whether conservation measures in the FIMI were achieved.

July 26, 2017 - Conference call (Guy and Phifer, Service) with the Corps (Alcoba and Weppler) to discuss the status of the consultation. Guy stated that progress was slow but steady and was moving forward. Guy explained that there were three issues that had to be explored in more detail in the FIMP: 1) cross island transport; 2) predator control; and 3) vegetation management. Weppler asked how the Service would analyze incidental take for habitat loss. Guy said that the Service was discussing this and had not fully committed to a method yet. His thought was that we might look at the amount of washover being prevented by the dunes and then to estimate birds/hectare that use the optimal washover habitat multiplied by the number of hectares of washover that the project would prohibit per year for 50 years. That approach made sense to the Corps.

August 10, 2017 - Conference call (Guy and Slacum, Service) and the Corps (Alcoba). Guy presented a draft spreadsheet that estimated incidental take and how CPFs would offset that take; how the Service would evaluate success; and the timeframe for implementing the new CPFs. The Service requested review of the spreadsheet by the Corps to confirm acreages and which projects were likely to benefit plovers. The Service also requested endangered species monitoring reports from the FIMI project (piping plover abundance and productivity and predator control).

August 15, 2017 - Conference call (Guy and Phifer, Service) and Corps (Alcoba and Weppler). Guy presented the Service's approach to quantifying and off-setting incidental take. One of the strategies to offset incidental take is to over-compensate with the number of CPFs constructed, such that if any given feature fails, the Corps can still have a viable strategy to meet population and productivity goals via another CPF or CPFs. The group generally liked the approach, but the Corps had reservations about how tightly success would be tied to the number of birds that actually used the CPF versus the number of birds predicted to use the CPF. Guy explained that the concept would allow for credit of constructed habitat as long as one pair used it and successfully fledged one chick. By over creating CPFs, the project can allow for some failure or suboptimal use, but each one will require long-term management and maintenance. The Corps stated that their budgets are tied to project's scheduled renourishment cycles (subject to the availability of funds) and the project would not be able to provide active maintenance during interceding years between nourishment. To address this, the Corps will explore whether the non-federal sponsor (State) could provide this as part of their match. The Corps also suggested, as part of the adaptive management, that future consultations could be tied to the renourishment cycles approximately every 4 years.

August 17, 2017 - Conference call (Guy, Service) and Corps (Alcoba). Guy and Alcoba recapped the discussion from the management team meeting on August 15, 2017 and finished the FIMI conservation measure spreadsheet discussion. This will be presented as part of the baseline for FIMP. Guy stated that draft BA would be provided in the next few days (draft was provided on August 22, 2017). Guy requested that the Corps confirm names and acreages for the no-net-loss spreadsheet.

August 22, 2017 - Service (Guy) provides revision of BA to Corps (Alcoba).

August 30, 2017 – Corps (Alcoba) provides suggested revisions and comments on BA to Service (Guy).

September 5, 2017 – Service (Guy) provides updated BA and responses to comments to Corps (Alcoba).

September 14, 2017 - Conference call (Guy, Slacum, and Robbie Callahan, Service) with Corps (Alcoba, Smith, Weppler, Neal Kolb, Karen Ashton, and Frank Verga) to discuss CPFs as offset. Guy provided an overview of the no-net-loss table and guidance on how to optimize habitat creation based on the Maslo et al. 2011 paper (design criteria). Vegetation management and annual predator control would be a key part of an adaptive management process.

September 20, 2017 - Conference call (Guy, Slacum, Phifer, Service) with the Corps (Weppler and Alcoba). Phifer states that the Service will allow incidental take from the project with CPFs managed on 4-year nourishment cycles. The landowners will be responsible for maintenance of the CPFs.

September 20 and 21, 2017 - Conference call (Guy and Slacum, Service) with Corps (Alcoba, Smith, Kilb, Ashton, and Verga) to discuss each CPF and provide relative rankings to them.

October 5, 2017 - Conference call (Guy and Slacum, Service) and the Corps (Weppler, Ashton, and Couch). The Service went over items that were still needed from the Corps: no-net-loss table: final review of BA; and an estimate of overwash that is not breach-related that would occur without the project. The Service stated that they would provide their incidental take analysis to help with completing the no-net-loss offset table. Couch explained where they were with reviewing the no-net-loss offset volume of 4.2 million cubic yards and stated that a life cycle model could be used to calculate the overwash areas not created by breaches. The Corps hoped to have that to the Service us by the end of October. The group also discussed the plan for meeting at Fire Island on October 18, 2017, to look at and discuss the CPFs. The Service would be meeting with Virginia Tech (VA Tech) on the October16 and 17 and then with the Corps on October 18.

October 16 and 17, 2017 - The Service (Julie Slacum, Chris Guy, Anne Hecht, and Steve Papa) met with Virginia Tech (Jim Fraser, Dan Catlin, Sam Robinson, Hen Bellman, and Katie Walker) to get an update on their interim progress of their FIMI monitoring to date. The group also went through the proposed CPFs and provided relative rankings (i.e., high, med, low) and issues with regard to potential for piping plover habitat and discussed design considerations such as elevation and slope.

October 18, 2017 - The Service and VA Tech meet with the Corps (Weppler, Ashton, Smith, and Craig) to discuss the FIMI restoration sites (how they are functioning with respect to piping plover use and any issues). Guy and Slacum then accompanied the Corps to look at sites at Robert Moses State Park with particular emphasis on Democrat Point.

October 25, 2017 - Guy and Slacum provide an update on the consultation to Anne Hecht, Marty Miller, and Glenn Smith of the Service's Northeast Regional Office.

October 26, 2017 - The Service (Guy and Slacum) discussed no-net-loss habitat offset/incidental take table with Corps (Ashton and Smith). The Service needed to look over the table further before we could discuss whether we agreed with the numbers. The Service sent the draft incidental take estimate to the Corps.

October 15, 2017 – The Service receives conceptual design for the Democrat Point CPF. Conference call (Guy and Slacum) with the Corps (Weppler and Ashton) to discuss CPF design criteria table and disclaimer.

November 27, 2017 - Service (Guy and Slacum) review BA comments with the Corps (Weppler and Ashton).

December 7, 2017 - The Corps (Couch) goes through their revised estimate of Cross-Island-Transport (breach related and non-breach related overwash). This estimate does not take into account reactive and conditional breach response since those events would only occur in response to a particular storm. Some discussion occurred about the CPF designs, mainly the Service's concern over language that stated that the Corps would recommend that the landowner conduct management of the CPFs. The Service asked to spend more time looking through the designs.

December 19, 2017 - The Service (Slacum and Guy) talked about how most of the CPFs for plover fell out based on the design criterion of a buffer of adjacent vegetation (woody vegetation). The Corps (Weppler and Smith) did not agree with the distance that the Service cited but were unable to provide scientific support to reject it. The Service agreed to provide more citations/support for the vegetation buffer distance.

January 4, 2018 - The Service (Slacum and Guy) went through the Data Quality Objectives (DQO) process with the Corps (Alcoba, Smith, and Weppler) for supporting numbers used in the design criteria for the CPFs. Using the process, the Service refined the numbers for adjacent vegetation and non off-road vehicle (ORV) disturbance. The Corps will review that, the revised incidental take estimate, the Communications Plan, and the Conservation Measures.

February 8, 2018 - VA Tech presents monitoring results from FIMI to date.

February 27, 2018 The Service (Slacum) and the Corps (Ashton, Craig, Smith, Weppler, and Couch) meet with the public landowners (State Parks, County Parks, and National Park Service) to discuss CPFs proposed on their properties.

March 7, 2018 - The Corps (Couch) walk the Service (Guy, Slacum, Hecht, and Papa) through the revised Cross Island Transport Model write up (with overwash added in the modeling) and go through the Service's questions/comments. The Service asks for USGS review of the revised version on the model, completed by USGS on December 5, 2017. Those comments were provided to the other Service offices on May 1, 2018.

March 29, 2018 - The Service (Slacum) asks the Corps (Alcoba) to send the Service a letter requesting initiation of formal consultation. Slacum stated that she thought that the Service could work with the Corps to finalize the Conservation Measures the following week.

April 5, 2018 - The Corps initiates formal consultation with the Service via written correspondence.

April 9, 2018 - Corps sends revised State and County Park CPF designs based on comments from those landowners at the February 27, 2018, landowner meeting.

May 30, 2018 - Corps sends preliminary comments on Draft Biological Opinion.

May 31, 2018 - Corps (Weppler, Alcoba, and Smith) talk about concerns with having the in-lieu fee language in the Reasonable and Prudent Measures section. They would rather have it under Conservation Measures as a way to address adaptive management, if needed, during years in which construction activities are not occurring. They also cite concerns over some of the conservation measures that were drafted for seabeach amaranth. The Service (Slacum) stated that she would speak to the seabeach amaranth recovery lead on what conservation measures are typically included for beach fill/dune construction projects. Slacum also stated that she would check to see if Conservation Measures are an appropriate place to put the potential use of an in-lieu fee. In the 2017 Sandy Hook Programmatic Biological Opinion, it was included as a conservation measure (Offset Plan) and had more detailed information in the Appendices.

June 7, 2018 - The Corps (Alcoba and Smith) and the Service (Slacum and Guy) discussed how we might approach quantifying a change in habitat for reactive and conditional breach response for future consultation (Tier 2).

June 13, 2018 - The Service (Slacum and Guy) receive comments from the Service's Piping Plover recovery lead.

July 6, 2018 - The Service (Slacum and Guy) receive comments from the Service's Region 5 Section 7 coordinator.

July 13, 2018 - The Service (Slacum and Guy) receive comments from the Service's Long Island Field Office, New York Field Office, and Piping Plover recovery lead.

July 19, 2018 - The Service (Slacum) asks the Corps (Alcoba) to answer questions related to the project description: where sediment is being placed from the Fire Island Navigation Project (e.g., Cedar Beach, Gilgo Beach, Jones Beach); whether the sediment management is addressed in the Cross Island Transport Model; and whether the model addresses proactive breach response. Slacum also asks whether breach response identified in areas in years 1 to 30 would also occur in years 31 to 50. The Corps (Alcoba) provides written responses to these questions via e-mail on August 18, 2018. Slacum reminds the Corps that we need a formal response to USGS' December 5, 2017, comments on the revised Cross Island Transport Model.

August 15, 2018 – The Service (Slacum) and the Corps (Alcoba) discuss and agree that a 30-day extension from the August 18, 2018, due date (September 17, 2018) is needed to provide the Corps more time for review of the Draft PBO.

September 13, 2018 - The Service (Slacum) and the Corps (Alcoba) discuss and agree that a 30-day extension from the September 17, 2018, due date (October 17, 2018) is needed to provide the Corps more time to provide a final project description and for review of the Draft PBO.

October 17, 2018 - The Service (Slacum) and the Corps (Alcoba) discuss and agree that a 30-day extension from the October 17, 2018 due date (November 16, 2018) is needed to provide the Corps more time to provide a final project description and for review of the Draft PBO.

November 15, 2018 - The Service (Slacum) and the Corps (Alcoba) discuss and agree that a 30-day extension from the November 16, 2018, due date (December 16, 2018) is needed to provide the Corps more time to provide a final project description and determine the best mechanism to provide funding for adaptive management.

November 21, 2018 - The Corps (Alcoba) and the Service (Slacum) have a call to discuss adaptive management. Alcoba states that they had a conversation with their Headquarters office and they cannot commit to up front funding for management of CPFs in between nourishment cycles. She explains that funding that was authorized for FIMI was a one time deal. Slacum asks whether the Corps could fund management with a Military Interdepartmental Purchase Request (MIPR) to the Service on an as needed basis. Alcoba states that if funding is available, a MIPR with the Service would be a possibility but they would also be speaking with the landowners in the next week to talk about the potential for them to fund and conduct some of the management.

November 29, 2018 - The Corps (Alcoba and Smith) state that they have an updated project description and will send to the Service once they confirm everything is correct. The Corps (Smith) clarified that funding for adaptive management could be requested most years through the sand placement activities (inlet dredging and nourishment cycles). The Service thought, based on their conversation the previous week, that it would be every 4 years. There was discussion about the design criteria regarding symbolic fencing. The Corps (Smith) stated that they didn’t think it is feasible to keep boaters out of areas and to expand the fencing to the entire beach. The Service (Slacum) explained that not every design criterion has to be followed for every CPF, but the Corps would still be tied to making sure they reach nesting pair and productivity thresholds. If not it would require re-initiation. The Corps and the Service also discussed the adaptive management table. The Corps thought that the table indicated that if a vegetation threshold was reached, it would require re-initiation. The Service explained that the bottom of the table states that it would mean they would lose credit which is color coded as yellow.

December 12, 2018 - The Corps submits Final Draft of Project Description. Missing from the Final Project Description is the Corps’ response to December 5, 2017, USGS comments.

December 14, 2018 - The Service requests a 30-day extension citing the need to see the response to December 5, 2017 USGS comments, which provide the basis for the take estimates, and a need to complete final edits.

December 14, 2018 - The Corps grants a 30-day extension to January 16, 2019.

December 21, 2018 through January 24, 2019 - The Federal Government experiences a partial shutdown prohibiting the Service from working on the PBO during this period.

January 30, 2019 - The Service requests a 45-day extension from January 16 to March 1, 2019, citing the shutdown as the cause for the delay.

January 31, 2019 - The Corps and the Service meet to resolve the final wording of the PBO. The Service begins final internal review. The Corps provides response to USGS comments from December 5, 2017, and confirmation of acreages and offsets for piping plover, satisfying all outstanding requests from the Service.

March 25, 2019 – The Service requests and receives from the Corps an extension in providing the PBO until March 29, 2019.

CONSULTATION APPROACH

The purpose of this Section 7 consultation is to evaluate the effects of the project on listed species. There currently is no critical habitat designated in the action area. If critical habitat is designated for a federally listed species in the future, re-initiation of consultation on the proposed action will be necessary. The Service and the Corps determined that a programmatic consultation would address the same actions (i.e., beach and dune fill, dredging of inlets, sediment bypassing, sediment management, and proactive breach response) that will be carried out by the Corps, approximately every 4 years for beach and dune fill and reactive breach response and every 2 years for inlet dredging over the next 30 years. To ensure the protection of federally listed species, the Corps developed programmatic conservation measures to be incorporated into each dredging and beach and dune fill, and proactive breach response cycle implemented or permitted within the Project area. Under the Service's 2015 policy on incidental take statements (*Federal Register* Vol. 80, No. 90, pp. 26832-26845), the Federal actions covered by this PBO constitute a "mixed programmatic action." A mixed programmatic action includes two elements: (1) Tier 1 consultation which is one or more Federal actions that will not be subject to further formal consultation (i.e., beach and dune fill, sediment management, and proactive breach response that will occur every 4 years and dredging, and sand bypassing that will occur every 3 years for 30 years), but will require information on the actions to ensure that they comply with the conservation measures, terms and conditions, and reasonable and prudent measures before each nourishment cycle; and (2) a framework for the development of future actions that are authorized, funded, or carried out at a later time (i.e., reactive and conditional breach response for up to 50 years). Take of listed species would not occur unless and until those actions are carried out and would be subject to further consultation. Consistent with this policy, the incidental take statement included with this PBO covers the beach and dune fill, and dredging actions only for a period of 30 years. Proactive breach response is covered for 50 years. Tier 2 consultation will be conducted for conditional breach response for years 1 through 50. To ensure the protection of federally listed species, the Corps developed programmatic conservation measures to be incorporated into each dredging, beach and dune fill, and proactive breach response cycle implemented or permitted within the Project area.

This PBO encompasses the Corps overall program of coastal storm risk management from Fire Island Inlet to Montauk Point. The proposed activities that will occur over the next 50 years are described below (see 5.0 Description of the Proposed Action). The Service evaluated the overall Project with the conservation measures proposed by the Corps to minimize, avoid, or mitigate for adverse impacts to piping plover and seabeach amaranth.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action includes dredging of offshore borrow areas, and navigation/dredging/sand bypassing activities at Fire Island, Moriches, and Shinnecock Inlets; non-structural building retrofits, flood proofing, relocation, acquisition, and road raising; beach and dune fill; and berms (see Figure 1, and Tables 1 and 2). More detail on project design is provided in Appendix B. Construction of the project will not start before October 2020.

A continuous beach and dune fill area (building upon the features already constructed as part of the FIMI Stabilization Project) will occur along the developed ocean beach shoreline areas that front Great South Bay, Moriches Bay, and Shinnecock Bay. The dune construction follows natural dune alignment and includes a realignment of the dune further seaward in areas where multiple structures would need to be relocated or acquired in a more landward alignment. These areas include most of the developed communities in Fire Island and include Cherry Grove and Water Island. Sub-reaches where beach fill was not considered included Sailors Haven, Wilderness Area-West, Great Gun, Hampton Beach, and most of the shoreline between Shinnecock Inlet and Montauk Beach. The total initial fill for the proposed action is approximately 6.44 million cubic yards. A 30-year commitment of Federal and non-Federal renourishment is proposed. After 30 years, the Federal and non-Federal commitment would transition to a Breach Response Plan (including repair of beach and dune if the thresholds are met for proactive breach response) for the remainder of the 50 years.

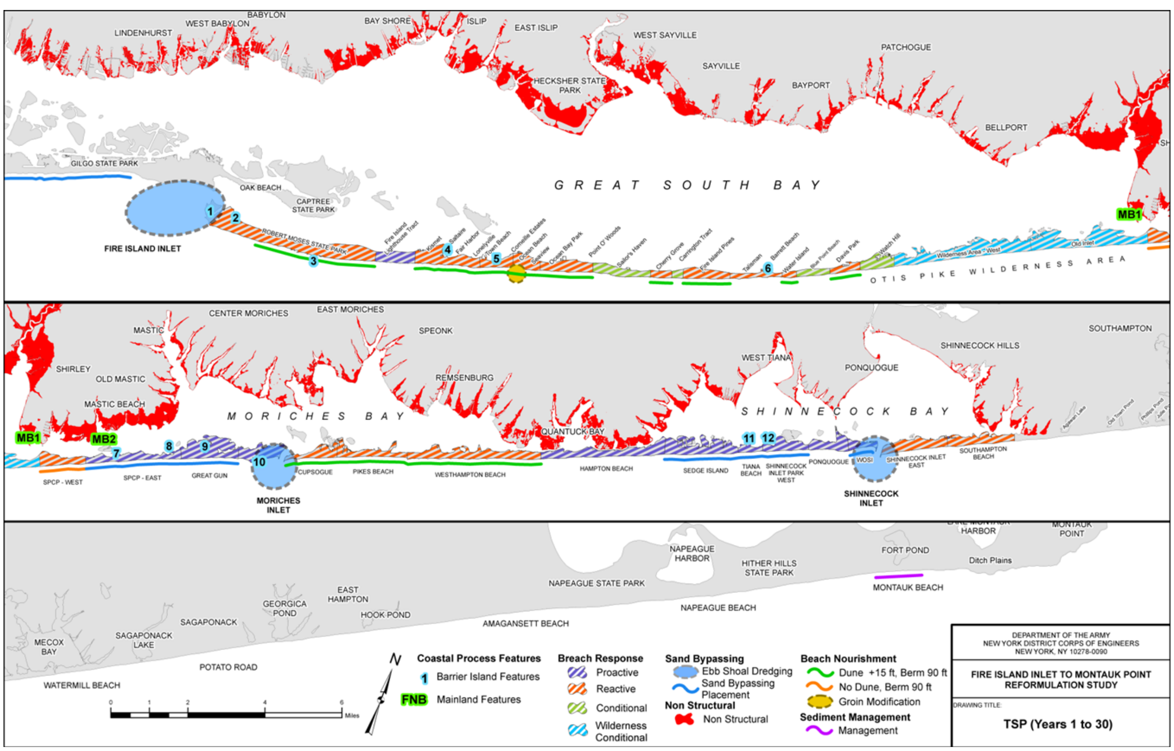

Figure 1. Map of FIMP project area. From: Service and U.S. Army Corps of Engineers (2018).

Inlet Management
Management of the inlets involves the continuation of authorized navigation projects, and scheduled Operations and Maintenance (O&M) dredging with beneficial reuse of sediment at beach habitat adjacent to Fire Island, Moriches and Shinnecock Inlets, which would be accomplished via the existing authorized navigation projects. Under FIMP, there will be additional dredging of 73,000 to 379,000 cubic yards from the ebb shoals of each inlet, outside of the navigation channel, with downdrift shoreline placement undertaken in conjunction with scheduled O&M dredging of the inlets. There will be placement of sand in a berm template, as needed in identified placement areas. There will be monitoring to facilitate adaptive management changes in the future to determine if changes in the volume, frequency, dredging, and disposal location are required to effectively reestablish the alongshore transport.

Mainland Structural Component
Addresses approximately 4,717 structures within the 10-year floodplain using nonstructural measures, primarily through voluntary building retrofits, with limited relocations and buy-outs, based upon structure type and condition. It also includes localized acquisition in areas subject to high frequency flooding, and reestablishment of floodplain function all of which has to be determined sometime in the future planning process.

Barrier Islands Beach and Dune Fill
Provides for a continuous 90 ft. width berm and +15-foot National Geodetic Vertical Datum (NGVD) dune design profile along the developed shorefront areas fronting Great South Bay and Moriches Bay and beach habitat on Fire Island and Westhampton barrier islands. On Fire Island the alignment follows the post-Sandy optimized alignment (middle alignment) that includes overfill in the developed locations which effectively widens the berm, and minimizes tapers into Federal tracts. Renourishment is scheduled for 30 years, as needed, generally every 4 years, contingent upon funding and need for material. In areas of beachfill, proactive breach response will be undertaken from years 31 to 50.

Barrier Islands Breach Response
Proactive breach response is a plan triggered when the beach and dune are lowered below a 25-year design level of risk reduction and provides for restoration to the design condition (+13 ft. NGVD dune and 90 ft. berm). This plan will be utilized on Fire Island in the Lighthouse Tract, Smith Point County Park East (to supplement when needed the sand bypassing), Smith Point County Park West, and on the Westhampton barrier island fronting Shinnecock Bay.

Reactive Breach Response
This response plan is triggered when a breach has occurred (e.g., the condition where there is an exchange of ocean and bay water during normal tidal conditions). It will be used as needed when a breach occurs, in locations that receive beach and dune placement or are being maintained through proactive breach response. Reactive breach response is also recommended in additional locations where there is agreement that a breach should be closed quickly, including locations within Robert Moses State Park and the Talisman Federal tract, with a closure template consisting of a berm at elevation +9.5 ft. NGVD. Reactive breach response will require Tier 2 consultation with the Service (see Conservation Measure 1b) if the criteria of emergency consultation are not met pursuant to 50 CFR Part 402.05.

Conditional Breach Response

This is a response plan that applies to the large, Federally-owned tracts within Fire Island National Seashore (FIIS), where the breach closure team determines whether the breach is closing naturally, and if it is not found to be closing, closure begins on Day 60. Conditional Breach closure provides for a 90 ft. wide berm at elevation +9.5 ft. NGVD only. Conditional breach response will require Tier 2 consultation if the criteria of emergency consultation are not met pursuant to 50 CFR Part 402.05.

Wilderness Conditional Breach Response

This is a response plan that applies to the Wilderness area within FIIS, where the breach closure team determines whether a breach should be closed, based upon whether or not the breach is closing naturally and whether the breach is likely to cause significant damage. Wilderness conditional breach closure provides for a 90 ft. wide berm at elevation +9.5 ft. NGVD only. Wilderness conditional breach response will require Tier 2 consultation if the criteria of emergency consultation are not met pursuant to 50 CFR Part 402.05.

The Tentatively Selected Plan

Provides for 81,000 ft. of fill related to initial construction of beach and dune construction plus proactive breach response from years 1 through 30. Reactive and conditional breach response would occur as needed. The plan then provides for 89,000 ft. of proactive breach response fill to maintain a 13 ft. high dune and 90 ft. wide beach in years 31 through 50, and reactive and conditional breach response would occur as needed.

Sediment Management at Downtown Montauk (Montauk Beach)

In Downtown Montauk, the plan includes the placement of approximately 450,000 CY of sand during initial construction, and the placement of approximately 400,000 CY of sand on the front face of the existing berm approximately every 4 years as advance fill to offset erosion at Downtown Montauk subject to availability of funds and need for material. The plan in Downtown Montauk is to provide sufficient sand to offset the long-term erosion rate. The plan does not offset seasonal changes, and it is not intended to maintain a designed beach width, however, it is expected that offsetting the long-term erosion trends would generally provide a beach with a width of 40 ft.

Groin Modifications

Involves monitoring existing Westhampton groins (1-13) to reaffirm the functioning of the groins; removal of the existing Ocean Beach groins (relocation of Ocean Beach Water Supply presently underway, which reduces the need for these structures); and continued monitoring of the Georgica Pond groins to reaffirm the functioning of the groins.

Coastal Process Features

Fourteen locations for CPFs along the bayside shoreline are proposed (12 back bay and 2 mainland) with the goal of reestablishing the coastal processes that are reduced by the placement of sediment along the Atlantic Coast to provide Coastal Storm Risk Management (CSRM) (see Table 2). Eight of these 14 are provided to meet the goal of no net loss, 9 CPFs are for ESA offset purposes.

CPFs: include features that compensate for

- Impacts to alongshore transport (groin modification or shortening, sand bypassing, sediment management);
- Reductions in cross-island transport (overwash fan and bay beach creation or reinforcement which provide early successional habitat for the listed species); and
- Sediment loss to the bay or bay shoreline processes by establishing resilient and sustainable uplands.

The purpose of the FIMP CPFs is to bolster the CSRM functions provided by natural coastal landforms and complement the FIMP risk reduction features. Structural damages to buildings and infrastructure in the FIMP study area are calculated by projecting the degree of flooding that will occur on the mainland of Long Island due to breaching and overwash of the barrier island. Risk reduction measures, such as berms and dunes constructed on the ocean coastline, are proposed to reduce breaching and overwash. The intent of the CPFs are to complement these risk reduction measures, by adding volume to the bay side of the barrier system. Judicious siting of CPFs are intended to help address inhibition of ‘barrier island rollover resulting from the project. Rollover is the movement in geologic time of a barrier island as sediment is eroded from the ocean coast and transported by overwash and breaching to the bay shore. The rollover process contributes to barrier island integrity and robustness and supports the natural CSRM functions provided by healthy barrier island systems. Without CPFs, the FIMP risk reduction features would reduce the amount of sediment that enters the back bay environment, interrupt the rollover process, and degrade the barrier island’s natural CSRM functions. Therefore, CPFs are recommended along the back bay coast to help maintain the long-term sustainability of the barrier island system and reduce vulnerability of the barrier island to breaching, which will reduce water levels within the bay, and the resulting flooding.

Placement of approximately 4.2M CY of sediment in the back bay environment, and the resulting habitat is necessary to satisfy the mutually acceptable requirement (Department of Interior agencies and the Corps) of “no net loss” of sediment transport into the back bay. The CSRM features proposed to reduce risk along the shoreline will reduce the frequency of overwash and breaching, which naturally transports sediment into the back bay.

CPFs will be constructed in conjunction with the construction of the FIMP project, and the associated renourishment, which is currently proposed as a 4-year cycle (renourishment is subject to availability of funds and the need for material).

To mimic features of overwash events that were likely to occur in the project area over time, CPFs will be constructed to provide early successional habitat for the listed species. Fourteen CPFs are being proposed by the Corps to meet the offset goal of no net loss of sediment. The Service evaluated the likelihood that the proposed CPFs would support piping plover nesting habitat using design criteria (Table 4) that was based on literature and monitoring conducted for the FIMI project. Preliminary designs for nine CPFs (Table 3) that met design criteria are provided in Appendix C. CPFs intended to offset piping plover habitat will be subject to annual monitoring and as needed adaptive management (see Monitoring and Adaptive Management below) to evaluate whether the CPF acreage can be counted as an offset (see Extent of Anticipated Incidental Take below) and how habitat might be initially formed and improved over time. CPFs will be maintained through year 50 and acreages tracked on an annual basis based on final design and adherence to design criteria.

				Subreach Recommended Plan			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	Design Subreach	Sub-Reach Name	Length (ft)	Plan	Berm (Ht. and width)	Dune	Breach Response	Breach Response Plan	CPF located in Sub-reach	Purpose (CSRM, ESA)	Lifecycle Response Years 1-30	Lifecycle Response Years 31-50	Years 31-50 Dune Height
GSB (Great South Bay)		Fire Island Inlet and Gilgo Beach	N/A	Inlet Dredging and bypassing (FI)	+9.5 ft berm section	No Dune	NA	NA			FI Inlet bypassing, 2 yr cycle	FI Inlet bypassing, 2 yr cycle	No dune
	1A	**Robert Moses State Park - West (need Plate -from Parkway to Jetty)**	**6,700**	**No Action**	+9.5 ft, 90 ft wide	No Dune	**Reactive**	9.5 ft berm, 90 ft wide	1 Democrat Point West 2 Democrat Point East	**ESA** **ESA**	**Reactive Breach Response**	**Reactive Breach Response**	**No dune**
	1A	Robert Moses State Park - East	19,000	Beach, Dune, Berm, Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide	3 Dunefield West of Field 4	ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	1B	FI Lighthouse Tract	6,700	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune, no planting	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			**Proactive Breach respone**	**Proactive Breach respone**	13 ft dune
	2A	Kismet to Lonelyville	8,900	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide	4 Clam Pond	CSRM, ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2B	**Town Beach to Corneille Estates**	5,100	**Beach, Dune and Renourishment**	**+9.5 ft, 90 ft wide**	**15 ft dune**	**Reactive**	**15 ft dune, 9.5 ft berm, 90 ft wide**	5Atlantique to Corneille	**CSRM, ESA**	Periodic renourishment (approx. 4 year cycle)	**Proactive Breach respone**	**13 ft dune**
	2C	Ocean Beach & Seaview	3,800	Beach, Dune, Renourish, Groin Modification	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2D	**OBP to Point O' Woods**	7,400	**Beach, Dune and Renourishment**	+9.5 ft, 90 ft wide	**15 ft dune**	**Reactive**	**15 ft dune, 9.5 ft berm, 90 ft wide**		**CSRM, ESA**	**Periodic renourishment (approx. 4 year cycle)**	**Proactive Breach respone**	**13 ft dune**
	2E	Sailors Haven	8,100	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.		CSRM, ESA	Conditional Breach Closure	Conditional Breach Closure	No dune
	3A	Cherry Grove	3,000	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3B	**'Carrington Tract**	**1,500**	**Conditional Breach Response**	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	**No dune. Berm closure width to taper to adjacent area.**		**CSRM, ESA**	**Conditional Breach Closure**	**Conditional Breach Closure**	**No dune**
	3C	Fire Island Pines	6,600	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3D	Talisman to Water Island	7,300	Reactive Breach Response	+9.5 ft, 90 ft wide	No Dune	Reactive	**No dune. Maximum berm height 9.5 ft. Berm closure width to taper to adjacent area.**	6 Talisman	CSRM, ESA CSRM, ESA	**Reactive Breach Closure**	**Reactive Breach Closure**	**No dune**
	3E	Water Island	2,000	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3F	**Water Island to Davis Park**	**4,700**	**Conditional Breach Response**	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	**No dune. Berm closure width to taper to adjacent area.**			**Conditional Breach Closure**	**Conditional Breach Closure**	**No dune**
	3G	Davis Park	4,100	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3H	Watch Hill	5,000	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	**No dune. Berm closure width to taper to adjacent area.**			**Conditional Breach Closure**	**Conditional Breach Closure**	**No dune**
	4A	Wilderness Area - West	19,000	Wilderness Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.			Wilderness Conditional Closure	Wilderness Conditional Closure	No dune
	4B	Old Inlet	16,000	Wilderness Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	**No dune. Berm closure width to taper to adjacent area.**			**Wilderness Conditional Closure**	**Wilderness Conditional Closure**	**No dune**

				Subreach Recommended Plan			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	Design Subreach	Sub-Reach Name	Length (ft)	Proposed Plan	Berm (Ht. and width)	Dune	Breach Response	Breach Response Plan	CPF located in Sub-reach	Purpose (CSRM, ESA)	Lifecycle Response Years 1-30	Lifecycle Response Years 31-50	Years 31-50 Dune Height
MB (Moriches Bay)	1A	Smith Point CP- West	6,300	Reactive Breach Response and nourishment	+9.5 ft closure section (max berm ht.)	No Dune	Reactive	No dune. Berm closure width to taper to adjacent area			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	1B	**Smith Point CP - East**	**13,500**	**Proactive Breach Response, sand bypassing**	+9.5 ft, 90 ft wide	13 ft dune	Proactive	**13 ft dune, 9.5 ft berm, 90 ft wide**	7 Pattersquash Reach 8 New Made Is. Reach	**CSRM, ESA; CSRM, ESA**	**Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response**	**Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response**	**13 ft dune**
	2A	Great Gun	7,600	Proactive Breach Response, sand bypassing	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	9 Smith Point County Park Marsh	CSRM	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	13 ft dune
	2B	Moriches Inlet - West	6,200	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	10 Great Gun	ESA	**Proactive Breach respone (actual dimentsions to conform with Great Gunn FIMI CPF)**	**Proactive Breach respone (actual dimentsions to conform with Great Gunn FIMI CPF)**	**13 ft dune**
		Moriches Inlet		Inlet Dredging and bypassing - 1-yr cycle	+9.5 ft, 90 ft wide						Inlet Dredging and bypassing - 1-yr cycle	Inlet Dredging and bypassing - 1-yr cycle	
	2C	**Cupsogue Co Park**	**7,500**	**Beach, Dune and Renourishment**	+9.5 ft, 90 ft wide	15 ft dune	Reactive	**15 ft dune, 9.5 ft berm, 90 ft wide**		**ESA**	**Periodic renourishment (approx. 4 year cycle)**	**Proactive Breach respone**	**13 ft dune**
	2D	Pikes	9,700	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2E	Westhampton	18,300	Beach, Dune, Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			**Periodic renourishment (approx. 4 year cycle)**	**Proactive Breach respone**	**13 ft dune**
SB (Shinnecock Bay)	1A	Hampton Beach	16,800	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Proactive Breach respone	Proactive Breach respone	13 ft dune
	1B	**Sedge Island**	**10,200**	**Shinnecock Inlet bypassing placement; Proactive Breach Response**	+9.5 ft, 90 ft wide	13 ft dune	**Proactive**	**13 ft dune, 9.5 ft berm, 90 ft wide**	**11 Dune Road, East Quogue**	**CSRM**	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	1C	Tiana Beach	3,400	Shinnecock Inlet bypassing placement; Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	12 Tiana Bayside Park	CSRM	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	1D	Shinnecock Inlet Park West	6,300	**Shinnecock Inlet bypassing placement; Proactive Breach Response**	+9.5 ft, 90 ft wide	13 ft dune	**Proactive**	13 ft dune, 9.5 ft berm, 90 ft wide			Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	2A	Ponquogue	5,300	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Proactive Breach respone	Proactive Breach respone	13 ft dune
	2B	**WOSI**	**3,900**	**Shinnecock Inlet bypassing placement; Proactive Breach Response**	+9.5 ft, 90 ft wide	**13 ft dune**	**Proactive**	13 ft dune, 9.5 ft berm, 90 ft wide			Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
		Shinnecock Inlet		Inlet Dredging and bypassing - 2-yr cycle							Inlet Dredging and bypassing - 2-yr cycle	Inlet Dredging and bypassing - 2-yr cycle	13 ft dune
	2C	**Shinnecock Inlet - East**	**9,800**	**Reactive Breach Response**	+9.5 ft, 90 ft wide	13 ft dune	**Reactive**	**13 ft dune, 9.5 ft berm, 90 ft wide**			**Reactive breach response, initial 30 yrs**	**Reactive breach response, Years 31-50**	**13 ft dune**
	3A	Southampton Beach	9,200	Reactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Reactive	13 ft dune, 9.5 ft berm, 90 ft wide			Reactive breach response, initial 30 yrs	Reactive breach response, Years 31-50	13 ft dune
	3B	Southampton	5,300	No Federal Action									
	3C	Agawam	3,800	No Federal Action									

				TSP Description			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	Design Subreach	Sub-Reach Name	Length (ft)	Proposed Plan	Berm (Ht. and width)	Dune	Breach Response	Breach Response Plan	CPF located in Sub-reach	Purpose (CSRM, ESA)	Lifecycle Response Years 1-30	Lifecycle Response Years 31-50	Years 31-50 Dune Height
P (Ponds)	**1A**	**Wickapogue**	**7,700**	**No Federal Action**									
	1B	Watermill	8,800	No Federal Action									
	1C	Mecox Bay	1,400	No Federal Action									
	1D	Mecox to Sagaponack	10,400	No Federal Action									
	1E	**Sagaponack Lake**	**1,100**	**No Federal Action**									
	1F	Sagaponack to Potato Rd	9,300	No Federal Action									
	1G	**Potato Rd**	**4,300**	**No Federal Action**									
	1H	Wainscott	4,600	No Federal Action									
	1I	**Georgica Pond**	**1,200**	**No Federal Action**									
	1J	Georgica to Hook Pond	11,200	No Federal Action									
	1K	**Hook Pond**	**1,100**	**No Federal Action**									
	1L	Hook Pond to Amagansett	19,200	No Federal Action									
M (Montauk)	**1A**	**Amagansett**	**10,400**	**No Federal Action**									
	1B	Napeague State Park	9,100	No Federal Action									
	1C	Napeague Beach	9,900	No Federal Action									
	1D	Hither Hills SP	7,000	No Federal Action									
	1E	**Hither Hills to Montauk B**	**15,800**	**No Federal Action**									
	1F	Montauk Beach	4,700	Sediment Management	+9.5 ft feeder beach	No dune	NA	NA	NA		Renourishment, approx. 4 yr cycle	None	
	1G	Montauk Beach to Ditch Plains	4,700	No Federal Action									
	1H	Ditch Plains	3,400	No Federal Action									
	1I	**Ditch Plains to Montauk Pt**	**19,300**	**No Federal Action**									

Table 1. FIMP Recommended Plan Shorefront Reach Features

CPF Number	CPF Name	CPF Purpose	CPF Description	Construction Contract	Initial Volume (CY)	Renourish volume (4-year) (CY)
1	Democrat Point West	ESA	Regrade and devegetate; modify pond to improve functionality of existing wetland/create new foraging habitat; conserve on site sand volume.	FI Inlet bypassing	n/a	n/a
2	Democrat Point East	ESA	Regrade and devegetate bay side; modify sand stockpiles to form barrier between recreation and ESA areas; conserve on site sand volume.	FI Inlet bypassing	n/a	n/a
3	Dunefield West of Field 4	ESA	Devegetate ocean side; maintain vegetation buffer with road on north side.	FI Inlet bypassing	n/a	n/a
4	Clam Pond	CSRM / ESA	Bay side fill placement to simulate cross island transport; possible living shoreline on north side per adaptive management plan.	Fire Island Renourishment	deferred to Year 4	123,000
5	Atlantique to Corneille	CSRM /	Bay side fill placement to simulate cross island transport.	Fire Island Renourishment	deferred to Year 4	162,000
6	Talisman	ESA	Bay side fill placement to simulate cross island transport.	Fire Island Renourishment	deferred to Year 4	221,000
7	Pattersquash Reach	CSRM / ESA	Devegetate bay side; shallow water bay side fill placement; south boundary follows Burma Rd alignment, includes physical barrier.	Moriches Inlet Bypassing	26,000	15,000
8	New Made Island Reach	CSRM / ESA	Devegetate bay side; shallow water bay side fill placement; south boundary follows Burma Rd alignment, includes physical barrier.	Moriches Inlet Bypassing	133,000	29,000
9	Smith Point County Park Marsh	CSRM / ESA	Bay side marsh restoration; fill placement to simulate cross island transport; regrade marsh elevation filling ditches and creating channels for tidal exchange.	Moriches Inlet Bypassing	343,000	18,000
10	Great Gun	CSRM	Devegetate ocean side parcel.	Moriches Inlet Bypassing	n/a	n/a
11	Dune Rd Bayside Shoreline	ESA	Bay side fill placement; bulkhead/groin removal; possible additional fill within offshore channel.	Shinnecock Inlet bypassing / PBRP	66,000	31,000
12	Tiana Bayside Park	CSRM	Bay side fill placement at east side of site; PED will determine fate of existing gabions.	Shinnecock Inlet bypassing / PBRP	48,000	47,000
				TOTAL VOLUME	616,000	425,000
MB 1	Mastic Beach 1	CSRM	Regrade and vegetate in conjunction with NS acquisition	Non-Structural Contract	n/a	n/a
MB 2	Mastic Beach 2	CSRM	Regrade and vegetate in conjunction with NS acquisition	Non-Structural Contract	n/a	n/a

Table 2. Proposed Coastal Process Feature sites.

Take Offset based on proposed Coastal Process feature*				
Coastal Process Feature (CPF)	CPF acres early successional habitat created (AC)	CPF acres early successional habitat created (HA)	Maximum expected pairs (0 .5 PR per HA of suboptimal CPF created habitat)**	total nest that have fledged chics 2013-2017***
Site 1 Democrat Point West	69.6	28.17	14	4
Site 2 Democrat Point Bayside East of Jetty	27	10.93	5	2
Site 3 Dune Field West of Field 4	18.7	7.57	4	1
Site 4 Clam Pond	8	3.24	2	0
Site 5 Atlantique to Corneille	14.1	5.71	3	0
Site 6 Talisman	14	5.67	3	
Site 7 Pattersquash Reach	49.4	19.99	10	5
Site 8 New Made Island Reach	100.1	40.51	20	8
Site 10 Great Gun Reach	107.7	43.58	22	7
Total	379	165.35	83	27
*USFWS, 2017c draft proposed coastal process features for FIMP. Acreage is estimated based on conceptual design				
** Estimated loss of nesting pair based on habitat needs described in Cohen et al, 2009. Nesting Density and Reproductive Success of Piping Plover in Response to Storm- and Human- Created Habitat Changes				
***VA Tech monitoring reports 2014-2017				

Table 3. Proposed CPFs that meet design criteria and are considered as offset for piping plover nesting habitat.

Recommended Design Criteria and Rationale for piping plover Coastal Process feature.			
	ocean	**bay**	**Rationale**
Least cost distance to ocean/bay *	Distance to Ocean ≤ 195 m	Distance to Bay ≤ 88 m	As part of the monitoring for FIMI, Va Tech determined that Least Cost Distance (LCD) to bay side foraging habitat is the most important factor influencing nest site selection. In an analysis of 2015 data, Va Tech identified 3 independent variables that most influence nest site selection. To summarize, nest sites differed from other sandy sites of the study area in that nest sites were closer to the bay shoreline, closer to the ocean shoreline and in areas with wider backshore. (In their analysis backshore was defined as the upper, usually dry, zone of the shore or beach, lying between the high-water line of mean spring tides and the upper limit of shore-zone processes; it was acted upon by waves or covered by water only during exceptionally severe storms or unusually high tides. Backshore occurs between the mean high water line and a back beach barrier. In the Va Tech analysis, the back beach barrier was defined as: the toe of the dune; the edge of developed areas, or the edge of dense vegetation or forest (i.e., greater than 17 percent vegetation; see vegetation criteria below) or in the absence of these barriers, at the bay side waterline. The design of the Coastal Process Features (CPFs) does not have to include the full forage area. However, the CPFs should have direct access by land for brood forage areas outside the CPF. On the bayside this can be exposed mud or sand flats, on oceanside this is generally the wrack line, but can also be ephemeral pools in the dune system. Since most of the proposed CPFs only have 2 of the 3 key features, the LCD features that are available should be optimized whenever possible. In order to maximize the potential for the CPF to provide habitat, we recommend using design features based on the most reasonably conservative estimates around the mean for the key distances. For distance to ocean we recommend the 75th percentile and bay we recommend the 25th percentile around the mean, and for the back shore width we recommend the 75th percentile around the mean based on nest locations from 2015 and imagery from spring of 2015.
Backshore width	Backshore width > 262 m	Backshore width > 262 m	
Elevation (above mean high water)*	4-10 ft.	3-10 ft.	Statistics were used to compare nest elevation temporally (2013-2017) as well as spatially (ocean vs. bay). There was no significant change in nest elevation from 2013 to 2017. However, the bayside nests were statistically lower by about a foot when compared to oceanside. The mean nest elevation bayside was 6.3 ft. The mean oceanside elevation was 7.6 ft. Although the bayside was statistically lower elevation, 64 percent of the nests were found between 4-10 feet. Likewise, 67 percent of the oceanside nests were between 4-10 feet. Elevations above 10 ft. and below 4 ft . are not considered viable piping plover nesting habitat for mitigation purposes in the Biological Opinion. Note: the nest elevation data was based on the Va Tech monitoring conducted after FIMI was constructed. Lower elevations in the 3 to 4 ft range would be expected in a natural habitat setting and should be strived for in the bayside CPFs. Oceanside could be slightly higher in the 4 to 6 ft range. All Elevations are based on recent LIDER Data and are relative to Datum NAVD 88.
Symbolic Fencing	mean high tide to 10ft.	mean high tide to 10 ft.	Symbolic fencing should encompass the entire nesting area within the Coastal Process Features intended as mitigation for piping plover, to 10 Ft. elevation. The symbolic fencing should be in place no later than April 1, and should not be removed until all chicks are fledged. Floating boom should be placed in the water adjacent to the CPF to protect all bay side foraging habitat. If Floating boom is not practicable symbolic fencing alone will be used.
Beach Slope*	2-3 %	2-3 %	Statistics were used to evaluate the difference between bayside and oceanside nesting beach slopes. There is a statistical difference between bayside and oceanside slopes. The bayside nesting beaches generally have a more gentle 2 percent slope. The oceanside nesting beaches were slightly steeper and averaged a 3 percent slope. On the oceanside, 58 percent of the nests were found on beaches with slopes of less than 3 percent. Fifty three percent of the bayside nest occur on slopes less than 3 percent. Beach slopes that continue on a gentle grade below mean high water on the bayside are critical to creating mud flats and Least Cost Distance to forage. Slopes greater than 4% will not be considered viable mitigation for piping plover as part of the Biological Opinion.
Vegetation #**	0%	0%	Cohen et al. (2008) found that plovers nesting in the Fire Island study site preferred vegetation cover between 9 and 16 percent. Maslo et al. (2011) identifies 10 percent cover as optimal habitat, and 17 percent as a trigger for vegetation management. Every effort should be made to work with the landowner to control vegetation before it reaches 17 percent. We also recommend no planting on the Coastal Process Features (CPF) intended to be piping plover nesting , brooding, and foraging habitat. Once the vegetation exceeds 17 percent the habitat values for the CPF will be discounted until such time as the renourishment cycle can be used to restore the habitat.
adjacent vegetation	>109 m from trees and shrubs	>109 m from trees and shrubs	"The fit of the global models of the effect of potential disturbances (pedestrians, dogs, off road vehicles (ORVs), gulls, crows, other (anything that is likely to disturb a plover, i.e. terns, oystercatchers, willets, hawks, cats etc.) within 100 meters of nests on nest survival was poor enough to preclude further analysis (Logistic regression, Mean number of potential disturbances: χ2 2 = 0.5300, P = 0.971; Frequency of observation of potential disturbances: χ2 2 = 0.5215, P = 0.970)." (Houghton L.M. 2005 ##). prey (ringed plover) visibility increased with perch height and proximity. At long distances (80 m and 120 m) target visibility from the 8m perch height was low or zero if the vegetation was higher than the prey (7 cm). At the shortest distances (20 m or less), the prey was also detected in higher vegetation. At the lowest perches, the visibility of prey decreased steeply with increasing distance, for instance less than 20 percent at 40m. From the highest perch (8m), target visibility was still 40% at 120m if veg lower than prey (Andersson et. al. 2009##). Lambert and Ratcliff (1981) studdied piping plover habitat in Michigan and found that nests range from 40 m to greater than 400 m from the treeline with an the average nesting distance of 109 meters for piping plovers.
Shell/Pebble Cover#**	17-18% grain size should be between 2 and 64 mm	17-18% grain size should be between 2 and 64 mm	Cohen et al. (2008) concluded that 60 percent of the nests on Fire Island Study area chose sand substarate that had coarse grains between 2 an 64 mm for nesting. Maslo et al. (2011), identifies 17-18% shell and pebble material as optimal for nesting habitat. Birds will bring shell and pebbles into their nest from nearby sources. Having shell and pebbles in the Coastal Process Feature may increase the habitat value for plovers. The expectation is that the dredge material should have sufficient shell and pebble material that the birds need. However, it should be evaluated as part of adaptive management, and if necessary, outside shell material may need to be brought in during the nourishment cycles.
Off Road Vehicle &	restricted during nesting and brooding	restricted during nesting and brooding	ORV use should be strictly prohibited on Coastal Process Features that are identified as piping plover mitigation during the nesting season April 1 until fledge. The Corps will work with landowners to ensure that CPFs meet the Service ORV guidelines (U.S. Fish and Wildlife Service 1994).
DISTANCE FROM STRUCTURE	>50 m	>50 m	On beaches where pedestrians, joggers, sun- bathers, picnickers, fishermen, boaters, horseback riders, or other recreational users are present in numbers that could harm or disturb incubating plovers, their eggs, or chicks, areas of at least 50 m radius around nests above the high tide line should be delineated with warning signs and symbolic fencing. U.S. FWS 1994.
Predators	0	0	Although predator densities will likely not be zero, predator control should occur on an annual basis to depress predators in the Coastal Process Features and maximize reproductive success to fledge.
Forage Area	Between LAT and HAT	Between LAT and HAT	Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.
* Virginia Tech monitoring data 2013-2017***			
** Maslo, B., Handel, S.N. & Plover, T. (2011). Restoring Beaches for Atlantic Coast Piping Plovers (Charadrius melodus): A Classification and Regression Tree Analysis of Nest Site Selection Restoration Ecology 19, 194-203.			
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Table 4. Design criteria for piping plover CPFs.

Monitoring and Adaptive Management

Monitoring of piping plover breeding pair numbers and productivity on an annual basis will occur throughout the Project area to evaluate incidental take over the life of the project and to evaluate and address indirect effects (e.g., change in prey resources, predators, recreational disturbance). Project success criteria were developed to analyze and track take, productivity, and credits for CPFs and to provide clear triggers and thresholds for adaptive management actions and whether re-initiation or formal consultation might be necessary (see Appendix D, Adaptive Management Plan). The Project will have an interagency team (consisting of Federal, State and local agencies as well as the landowners) that will meet at least bi-annually (before and after the nesting season, which will be initiated and scheduled by the Corps) that will discuss success criteria and adaptive management needs (see Appendix E).

Communications Plan

A communications plan was developed to provide transparency and consistency for implementation of conservation measures, monitoring, and adaptive management. It will also serve to provide a process for resolving disputes or differences in opinion that may arise over the life of the project (see Appendix E).

Conservation Measures

The Service's Consultation Handbook defines "Conservation Measures" as "actions to benefit or promote the recovery of listed species that are included by a Federal agency as an integral part of a proposed action under ESA consultation. These actions will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review. These may include actions taken prior to the initiation of consultation, or actions which the Federal agency or applicant have committed to complete in a biological assessment or similar document (USFWS and NMFS 1998)." When used in the context of ESA, "Conservation Measures" represent actions pledged in the project description that the action agency or the applicant will implement to further the recovery of the species under review. Such measures may be tasks recommended in the species' recovery plan, should be closely related to the action, and should be achievable within the authority of the action agency or applicant. Because conservation measures are part of the proposed action, their implementation is required under the terms of the consultation (USFWS and NMFS 1998). In identifying conservation measures, the Service recommends the use of the full offset sequence to achieve, at a minimum, "no net loss" in the species conservation. The offset sequence should be observed (i.e., to avoid first, then minimize, then compensate), except where specific circumstances may warrant a departure from this preferred sequence.

CONSERVATION MEASURES (CMs) PROPOSED TO MINIMIZE IMPACTS TO FEDERALLY LISTED SPECIES

As part of the proposed Project, the Corps will carry out the following measures to avoid and minimize adverse effects to piping plovers and seabeach amaranth.

1. Continuing Consultation with the Service (Tier 1)

a. The Corps will initiate informal consultation with the Service on dredging, sediment management, and beach and dune fill and proactive breach response activities (Tier 1 activities covered by the PBO with an Incidental Take Statement) at least 3 months prior to work occurring to re-evaluate any potentially changed conditions (e.g., inability to implement conservation measures) and to determine where and what work is taking place. If a changed condition occurs that was not covered by the existing PBO, or if relevant new information regarding federally listed species has become available (e.g., newly listed species, changes in distribution or concentrations of species such as the red knot or roseate tern), the Corps will reinitiate formal consultation at that time. For unforeseen changes during the construction, the 3-month requirement would not apply (e.g., dredge breaks down 3 days before cycle completion and activities would need to occur past the time of year restriction).

b. Tier 2 Consultation and Agency Coordination: Under the Service's 2015 policy on incidental take statements (Federal Register Vol. 80, No. 90, pp. 26832-26845), the Federal actions covered by this PBO constitute a "mixed programmatic action." Consistent with this policy, the incidental take statement included with this PBO covers the dredging, dune and beach fill, sediment management, and proactive breach response only. Tier 2 consultation will be conducted for all future reactive and conditional breach response described in this PBO. An incidental take statement for future actions will be issued, if appropriate, with each Tier 2 consultation. Via letter, the Corps will initiate Tier 2 consultation at least 60 days before the start of each future breach response unless the action meets the criteria for emergency consultation pursuant to 50 FR Part 402.05. Emergency consultation would require the same information as needed for a Tier 2 consultation. The Tier 2 initiation letter will include: information on the location and timing of the breach response; the location and volume of material to be dredged to fill the breach; quantification of nesting and foraging habitat created by the breach; quantification of nesting and foraging habitat lost and maintained (through implementation of design criteria and managing as a CPF) through breach fill; and the start and end dates of the dredging and breach fill. The Tier 2 initiation letter will also include detailed information for any equipment or temporary structures proposed to be on the ground during breach response, as well as the estimated number of Corps and contractor staff that will be present, and a Corps point of contact responsible for overseeing and directing field operations on the ground during breach response. Finally, the Tier 2 initiation letter will confirm adherence to all Conservation Measures and Terms and Conditions listed in this PBO, and will include, if appropriate, a brief explanation of how specific PBO provisions will be carried out. The Service will review the above-listed information, coordinate with the Corps and the landowners as necessary, and issue a Tier 2 formal consultation letter within 45 days of receiving complete project information from the Corps. The Tier 2 formal consultation letter will include an action-specific incidental take statement, if take of listed species is anticipated.

2. Construction Activities (General)

a. Materials and Material Placement

All fill shall consist of "clean" sand material (i.e., 90 percent or greater sand) obtained from approved off-shore borrow areas, or inlet sources. Grain size of fill material will be suitable for beach nourishment and will be similar in composition to the existing beach substrate on the targeted deposition site. Excavated sediments shall be placed directly onto the placement site to the greatest extent possible.

b. Materials Stockpiling and Equipment Storage

Any materials or equipment stored adjacent to known piping plover nesting areas will be removed prior to the nesting season (April 1). If de-mobilization (removal of all pipeline material, machinery, equipment, and construction crews, and grading of fill to the construction template) must occur into the nesting season (April), conditions for working in the nesting season must be followed (see CM 3, vi (a-k)).

3. Conservation Measures to Protect Piping Plovers During Construction

For the purposes of this PBO a piping plover "nesting area" is defined by the Service as an area currently occupied by courting, territorial, incubating, or brood-rearing piping plovers, nests with eggs, unfledged chicks, or fledged chicks that have not yet left their natal area, or any site so occupied during any of the three most recent nesting seasons. Nesting areas will be based on the three most recent nesting seasons unless there is a dispute on whether symbolic fencing should have been placed. In that case, best available information and the Service's best professional judgement will be used (monitoring data or modeling conducted by VA Tech or evaluation of design criteria (see Table 4)). If agreement cannot be reached between the Corps and Service, the conflict resolution process will be used (see Appendix E. Communication Plan).

"Potentially suitable" piping plover nesting habitat is habitat that contains natural features associated with known plover habitat and that could be reasonably expected to be occupied by piping plovers either in the upcoming nesting season or in the reasonably foreseeable future. Determination of whether an area could be potentially suitable habitat will be based on site specific information (e.g., VA Tech modeling or design criteria). For the purposes of this PBO, a "fledged chick" will be defined as one that has been observed in flight for more than 15 meters. If demobilization activities must occur during the nesting season (after April 1), the Corps will provide the Service with information and maps defining the nesting areas in proximity to the target demobilization area and the boundaries of the associated buffer areas (see CM 3, vi (g)).

a. Project Scheduling, Timing Restrictions, and Buffers for Construction

i. During the Tier 1 informal consultation process (see CM 1 above), the Corps will coordinate with the Service to develop a written project plan including specifications of piping plover nesting areas of concern within and adjacent to the Planned Program activity[1] (if work is going to occur into the active piping plover season (demobilization)). Nourishment will be scheduled and sequenced to avoid or minimize construction activities during the nesting season within known piping plover nesting areas or areas likely to be occupied during the affected nesting season.

[1] For projects that do not comply with the protective conservation measures and terms and conditions of this PBO, the Corps must initiate individual formal consultation and allow sufficient time for the full formal consultation process (at least 135 days from the Service's receipt of a complete initiation package).

ii. The Service shall be notified via e-mail at least 2 weeks before the start and completion date of the dredging and nourishment activities (see Communication Plan).

iii. A Time of Year restriction will be implemented during the piping plover breeding season (April 1 to September 1, or until the last chick has fledged) for beach fill and dune construction, dredging, and dredge placement activities.

iv. Fire Island Communities - In the Fire Island communities, if there are nesting areas or breeding piping plovers are observed, construction activities will not occur after July 1 or within 1,000 m (i.e., the buffer should be measured on each side of a line drawn through the nest site and perpendicular to the long axis of the beach) of the nesting area or where there is brood activity (brood rearing, and the entire area used by unfledged chicks), and no activities within 200 m of fledged chick foraging areas within their nesting area (not transient, fledged juveniles). If breeding piping plovers are not observed in a proposed project area, or are not within 1000 m of the project area by July 15, then project activities may commence, following consultation with the Service.

If potentially suitable habitat is identified in the Fire Island communities, no construction activities will take place between April 1 and July 15 unless the qualified monitor has determined that the vicinity of the active construction site is unoccupied. Work in non-nesting portions of the project area may commence only if the construction monitor has detected no piping plovers in the area after 4 days of surveying, throughout the full tidal cycle, in the preceding week. The qualified monitor will be kept apprised of the construction schedule to ensure that surveys have been completed within any areas where work will commence within the next week. If a piping plover is observed at any time in a previously unoccupied area, the construction monitor will immediately notify the Corps' Contracting Officer or designated representative and the Service (during normal working hours). The qualified monitor will ensure that temporary buffers are established immediately until the monitor can determine whether the plovers are migrants or are engaged in breeding activity. A temporary buffer of 300 m will be established around areas (the whole area they are using) newly occupied by foraging adult plovers or plovers displaying territorial behavior. If nesting behavior (i.e., active scrapes or copulation) is confirmed, or if nests or chicks are found, a buffer of at least 1,000 m in size to prevent disturbance to nesting birds and/or to protect unfledged broods will be established and will remain in effect until the chicks have fledged. If birds are not displaying any signs of nesting behavior (i.e., are likely to be non-nesting birds or spring migrants) or are no longer sighted after 4 days of observation, the temporary buffers will be removed. If buffers cannot be implemented, work should not continue until the last chick has fledged.

v. In all other project areas with nesting areas, the time of year restriction will be followed unless an unplanned or unforeseen delay occurs (i.e., weather-related work stoppages or equipment failures). The Corps should provide sufficient time to remove all pipeline material, machinery, equipment, and construction crews, and grading to fill to the construction template before the nesting season occurs (April 1).

vi. To provide for flexibility in Project implementation, the Project as proposed includes a maximum of three (3) times in which the Corps could conduct de-mobilization activities (removal of all pipeline material, machinery, equipment, and construction crews, and stockpiling fill) during the nesting season (i.e., three times total over the entire Project area, with the exception of the Fire Island Communities, for the life of the Project, and occurring once over a 10-year period) ending by May 1. This does not include beach and dune fill activities. If work in a nesting area or potentially suitable nesting area becomes necessary, the Corps will implement all of the following protective measures:

a) The Service must be contacted via a formal letter (See Communication Plan) at least two weeks before the construction field meeting. A construction field meeting (different from the semi-annual meetings scheduled for overall piping plover coordination, but possibly utilizing the regular weekly construction field meeting for this discussion) will be held on or before continuation of work that is to occur after the start of the piping plover breeding season (April 1) and should include a representative from the Corps, Service, the qualified biological monitor(s), and the construction crew to provide all information on conservation measures that must be implemented. The Service will provide a checklist (see Appendix E) to ensure that all conservation measures are followed. A summary report of the meeting including all decisions and comments will be drafted by the Corps and maintained as part of the administrative record.

b) The Corps will arrange for a qualified biological monitor to be on-site at all times until removal of all pipeline material, machinery, equipment, and construction crews, and grading of fill to the construction template is complete. A qualified monitor is a person who has the skills, knowledge, and ability regarding piping plover biology and behavior, monitoring procedures, and data collection. Skills of a qualified monitor include, but are not limited to identifying potential nesting habitat; detecting and recording locations of territorial and courting adults; interpreting plover behaviors; identifying distinct nesting pairs or territories; confirming incubation through hatch data; locating broods; confirming fledging of chicks; and documenting observations in legible, complete field notes. Aptitude for monitoring includes ability to observe shorebirds, experience observing birds or other wildlife for sustained periods, patience, and familiarity with avian biology (see Appendix E, 1 for minimum qualifications).

c) The qualified monitor will conduct daily observation of all piping plovers in the demobilization area while work is in progress.

d) The monitor will maintain field notes (including documentation of negative survey data) as agreed upon by the Service, and provide copies to the Service.

e) Fencing will be used to delineate the nesting areas, and protective buffers will be set up around these areas. Work restrictions and buffer sizes will be as follows:

- Adult (both migratory and breeding birds) foraging areas:
  - no activities within 100 m.
- Courtship/territorial areas (the entire area being used or defended):
  - No activities within 200 m;
- Nests with eggs:
  - No non-motorized activities within 100 m
  - No motorized activities within 200 m with a monitor present;

f) The extent of areas used by piping plovers will be determined by the monitor, mapped, and sent to the Corps for input and Service concurrence (this can be done via e-mail).

g) All protective buffers will be enlarged, reduced, or otherwise modified as needed based upon any disturbance of piping plovers observed by the monitor, and the boundaries of fenced areas will be moved or adjusted as needed to reflect changes in use based on the monitor's observations of the birds' movements. If temporary intrusions into buffer areas become necessary, the Service will be notified prior to entry via phone, and construction personnel will be accompanied by the monitor. The activity will be curtailed if any disturbance to piping plovers is observed.

h) A system of notification will be established. If any de-mobilization activities result in observed disturbances or harassment of piping plovers, the monitor will immediately initiate corrective actions to avoid further disturbance and contact the Corps and Service via phone. The on-site contractors will be notified immediately, and activities adjusted or halted by the monitor as needed to avoid or minimize any immediate threat to the birds.

i) If for any reason, at any time over the life of the Project, additional de-mobilization in April becomes necessary (i.e., more than three times over the Project duration, and once per decade), the Corps will reinitiate consultation with the Service to reevaluate project impacts.

4. Non-Construction Related Surveying, Monitoring, and Management during the Breeding Season for Piping Plover

The Corps will develop a monitoring plan and implement monitoring of piping plovers on a yearly basis within the FIMP project area, beginning with the first nesting season after initial project construction and continuing for the life of the project or until assumed by the State or local project sponsor. Monitoring breeding nesting pairs and productivity will help track take and indirect impacts from alteration of prey resources, recreational impacts, and predation. Monitoring of CPFs will also occur to track offset of take of piping plovers. An adaptive management plan will have triggers which elicit a management response (e.g., predator trapping, vegetation management, development of beach management plans). If, at any time during the life of the Project, sufficient Corps funding is no longer available to continue funding monitoring to inform triggers (threshold) for re-initiation the Corps will reinitiate formal[2] consultation with the Service to reevaluate project impacts.

a. Surveying and monitoring of the project area will occur for piping plover during the spring and summer nesting seasons. The monitoring will be completed in coordination with the land manager(s) and the Service. Monitoring will include identification of suitable habitats, nesting areas, establishment of symbolic fencing, and signage.

b. Monitors should be able to: quickly and accurately detect territorial males and courting pairs; detect nests (or incubating pairs, where thick vegetation precludes locating the nest) using appropriate cues (e.g., tracks, scrapes, vocalizations, foraging adults) to detect breeding activity without causing undue disturbance to the birds; ensure symbolic fencing (or other protection) is sufficient to encompass habitat where adult plovers are conducting breeding activities which include territorial, courtship displays, egg laying, and brood rearing; ensure symbolic fencing (or other protection) provides sufficient buffer to prevent flushing of incubating adults; and ensure all areas where unfledged chicks are present/detected are receiving protections. Refer to "Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the Endangered Species Act" (USFWS 1994).

c. Species monitors shall also work on the threatened and endangered species management activities (e.g., coordinating with local communities and agencies, as well as organizing the pre-season planning) within the FIMP project areas. The species monitor will also recommend and implement changes in coordination with the Corps, Service, and relevant landowners regarding the location and configuration of symbolic fencing and warning signs and gauge the effectiveness of management actions.

d. Protection of breeding piping plovers in the action area from human disturbance (e.g., ORVs and recreational activities).

e. Symbolic fencing and warning signs are intended to avoid or minimize accidental crushing of nests and repeated flushing of incubating adults, as well as provide an area where chicks can rest and seek shelter when people are on the beach. Therefore, prior to the piping plover breeding season (April 1), the Corps will develop a written symbolic fencing plan in coordination with the land manager(s) and the Service biologists for areas identified by the Service (identified on GIS maps) and the Corps as nesting areas and potentially suitable habitat for piping plovers. These written plans will be re-visited annually at the post-breeding adaptive management meeting.

f. Breeding and growing areas shall be protected with symbolic fencing using steel or fiberglass posts or other acceptable materials connected with string or twine. Fluorescent

[2] As the Program is key to the Service's analysis of indirect effects to listed species from recreational impacts, beach management, and predation, and is critical to accurate delineation of piping plover nesting areas, reinitiation of formal consultation will be required if diminishment or elimination of the Program causes an effect on the species not considered in this Opinion.

flagging material will be tied to the string to increase visibility and piping plover habitat warning signs shall be placed on every second or third post. Posts will be adjusted seaward as the beach widens. As sand accretes through the season, posts and fences may need to be moved further seaward to maintain symbolic fencing at this distance.

g. All pedestrian and ORV access into or through symbolically fenced areas is prohibited. Enforcement of this is a landowner responsibility. Only persons engaged in monitoring, management, or research activities shall enter the protected areas. These areas shall remain symbolically fenced for piping plovers until at least July 1, and as long thereafter as viable eggs or unfledged chicks are present. If after July 1, no breeding piping plovers, nests, or chicks are observed in the symbolically fenced areas, the fencing may be removed. Symbolic fencing erected to protect seabeach amaranth shall be in place until the plant dies, or until November 1, whichever comes first.

h. Population survey information shall include the total number of breeding pairs; the total number of piping plovers, paired and unpaired, within the action area; and detailed mapping of breeding (courtship, territorial, scrapes, egg-laying, incubating, and brood-rearing) and foraging use habitats in the action area. Productivity information shall include the total number of nests, the total number of fledged chicks per pair, and quantification of take, if observed, including causes of nest loss, death of chicks or adults that occurred, and reasons for take and actions that taken to avoid take.

i. Surveys will be recorded and summarized, piping plover locations will be recorded on maps, indicating areas surveyed and habitat types. Information collected will include the following:
    i. Date
    ii. time begin/end
    iii. weather conditions
    iv. tidal stage
    v. site name (location)
    vi. number of adults observed
    vii. number of pairs observed
    viii. courtship locations
    ix. brood locations
    x. nest locations
    xi. number of chicks fledged/adult pair
    xii. habitat type
    xiii. banded plovers
    xiv. predator trail indices

j. Surveys shall be conducted three times weekly with observations evenly distributed over a minimum time period (to be determined based on discussion with the State Heritage Program). Survey time periods shall be conducted during daylight hours from 30 minutes after sunrise to 30 minutes before sunset and should include a full range of tidal conditions and habitat types. Areas should be surveyed slowly and thoroughly and should not be conducted during poor weather (e.g., heavy winds greater than 20 miles per hour (mph), heavy rains, and severe cold), since birds may seek protected areas during these times.

k. Predator Management: Based on needs identified at the adaptive management meeting that will to be held semi-annually, the Corps will provide to the Service a written plan for a pre-season and in-season predator monitoring and control program for all project areas (see Appendix E Communications Plan).

l. ORV Management:

   i. ORV management will be implemented by the landowner. Issues with implementation will be reported to the Corps, and the Corps will contact the landowner via phone followed up with a letter requesting adherence to the conditions provided below (or measures identified in a beach management plan if developed) which the Service will be copied on (see Appendix E Communication Plan).

   ii. Sections of beaches where unfledged piping plover chicks are present shall be temporarily closed to all ORVs. Areas where ORVs are prohibited shall include all dune, beach, and intertidal habitat within the chicks' foraging range, to be determined by either of the following methods:

   The vehicle-free area should extend 1000 m on each side of a line drawn through the nest site and perpendicular to the long axis of the beach. The resulting 7,560-ft. wide area of protected habitat for piping plover chicks should extend from the oceanside, low-water line to the farthest extent of dune habitat.

OR

   If nests and chicks are monitored at least daily, vehicle-free areas may be reduced to not less than 200 m on each side of the brood location. The size and location of the protected area should be adjusted in response to the observed mobility of the brood, and in some cases, highly mobile broods may require protected areas up to 1000 m, even where they are intensively monitored. Protected areas should extend from the oceanside, low-water line to the farthest extent of dune habitat.

   iii. Restrictions on the use of ORVs in areas where unfledged piping plover chicks are present should begin on, or before, the date that hatching begins and continue until the chicks have fledged. For purposes of ORV management, piping plover chicks are considered fledged when observed in sustained flight for at least 15 m, irrespective of age. In most cases, piping plovers attain flight capability by 35 days of age, but longer pre-fledge periods may occur. When piping plover nests are found before the last egg is laid, restrictions on ORVs should begin on the 26th day after the last egg is laid. This assumes an average incubation period of 27 days and provides 1 day margin of error. When piping plover nests are found after the last egg has been laid, making it impossible to predict the hatch date, ORV restrictions shall begin on a date determined by one of the following scenarios:

a. With intensive monitoring: If the nest is monitored at least twice per day, at dawn and dusk (before 0600 hrs and after 1900 hrs) by a qualified biologist, vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with spotting scope or binoculars to minimize disturbance to incubating plovers.

OR

b. Without intensive monitoring: Restrictions should begin on May 10 (the earliest probable hatch date). If the nest is discovered after May 10, then restrictions should start immediately. If ruts are present that are deep enough, as determined by the Service, to restrict the movements of piping plover chicks, then restrictions on ORVs should begin at least 5 days prior to the anticipated hatching date of the piping plover nests. If a piping plover nest is found with a complete clutch, precluding estimation of hatching date, and deep ruts have been created that could reasonably be expected to impede chick movements, then restrictions on ORVs should begin immediately. A corridor that is 25-ft. (7.5 m) wide along the water's edge, above the mean high water (MHW) line will be kept free of symbolic fencing but will only be used as a maintenance and emergency response corridor.

m. Habitat Creation and Enhancement: Design features have been incorporated into several CPFs to create nesting and foraging habitat for piping plover (see Appendix B Project Features and Table 4). These features, developed in conjunction with the Service, are intended to provide piping plover with alternate nesting and feeding habitat in the project areas. These areas will be monitored to assess whether design criteria are being met and whether adaptive management (e.g., vegetation management, predator control, minimizing disturbance) is needed. Number of nesting pairs, nesting success, productivity, and issues with disturbance will also be monitored.

5. Conservation Measures to Protect Seabeach Amaranth

a. A biologist/botanist or designated representative will survey the area immediately prior to any construction activity within the seabeach amaranth growing season (May 1 to November 1). Approximately twice a week the construction area will be surveyed. Records shall include species locations, numbers of individuals, and size of plants. If there is any seabeach amaranth present, seabeach amaranth locations will be recorded. If construction personnel or vehicles are at the site or might transit the site, symbolic fencing will be placed in a 3 m diameter ring.

b. All construction activities shall avoid all delineated locations of seabeach amaranth where feasible. The Corps will undertake all practicable measures to avoid crushing or smothering plants. In the unlikely event that the species appears at the placement area, and there is a good possibility that the surrounding placed sand will encroach upon and smother the plant, the Corps proposes to transplant the individual plant to a similar habitat near or within the project area to lessen the impact of placement. Transportation will include removal of a sufficiently large enough and intact volume of sand to include the full extent of the roots. This action, when necessary, will occur as soon as possible after the plant is identified, and every attempt will be made to include the entire (undamaged) root system.

c. It is understood that this action, when feasible, will be undertaken for individual plants whose destruction could not be avoided. Seed collection or transplants will be attempted as a means of mitigating potential loss. Seeds from plants to be translocated may be harvested prior to plants being moved. With input from the Service, and species experts, all or a portion of the seeds may be: (a) immediately transferred to an area of suitable habitat elsewhere within the project area; (b) stored under controlled conditions to be later replanted in the project area; or (c) sent to a qualified greenhouse for germination and eventual replanting of germinated plants or propagated seeds in suitable habitats elsewhere in the project area. If no seed is collected on-site, a portion of the transplanted plants may be sent to a qualified greenhouse and propagated to produce seeds or plants for the purposes listed above.

   If translocation/seed collection are not viable options, or have proven ineffective, construction that would destroy live plants will be postponed, if possible, until individual plants in the construction footprint naturally die. Whether or not construction can be postponed until the death of plants in the construction footprint, the Corps will endeavor to salvage and transfer the seedbank of such plants to the extent practicable. Within a 3 m radius of each plant or group of plants (alive or recently alive), the top layer of sand substrate will be “scraped” and then re-spread on a suitable habitat in the project area.

ACTION AREA

The “action area” is defined as all areas to be affected directly or indirectly by the proposed Federal action. The action area includes all the areas identified on the above map (the Atlantic Ocean and bay shorelines from Fire Island to Montauk Point, including ocean beaches, intertidal areas, interdunal areas, bay side habitats, and borrow areas. The action area includes sand placement sites, and adjacent areas where sand deposition is not proposed. These additional areas are included in the action area because of the potential for indirect effects (i.e., those effects that are caused by or will result from the proposed action and are later in time, but are still reasonably certain to occur) from littoral drift of sediments from the renourished reaches and thus, changes to the downdrift beaches in unnourished reaches.

SPECIES STATUS

Piping Plover

On January 10, 1986, the piping plover was listed as threatened and endangered under provisions of the ESA. Three distinct populations were identified by the Service during the listing process: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). No critical habitat has been designated or proposed in the Atlantic Coast breeding area which is the focus of this PBO.

Piping plovers are small, sand-colored shorebirds approximately 7 inches long, with a wingspread of about 15 inches (Palmer 1967). The Atlantic Coast population breeds on coastal beaches from Newfoundland to North Carolina (and, occasionally, in South Carolina) and winters along the Atlantic Coast from North Carolina southward, along the Gulf Coast, and in the Caribbean.

Piping plovers are present on Long Island during the breeding season, generally between April 1 and August 31, though some birds return in March and post-breeding plovers and migrants may be present through October. Nests are usually found in areas above the high tide line, usually on sandy ocean beaches and barrier islands, but also on gently sloping foredunes, blowout areas behind primary dunes, washover areas cut into or between dunes, the ends of sandspits, and deposits of suitable dredged or pumped sand. Piping plovers often select nest sites near moist substrate habitats. Piping plover nests consist of a shallow scrape in the sand, frequently lined with shell fragments and often located near small clumps of vegetation. Females lay four eggs that hatch in about 25 days, and surviving chicks learn to fly (fledge) after about 25 to 35 days. The flightless chicks follow their parents to feeding areas, which include the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes (Gibbs 1986; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Cohen 2005; Houghton 2005). Piping plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989).

Threats

Habitat loss and degradation

Loss and degradation of habitat due to development and shoreline stabilization (i.e., stabilized with seawalls, jetties, artificial dunes, and other structural engineering techniques) have been major contributors to the species' population decline. These anthropogenic shoreline modifications which are intended to protect coastlines from storm induced erosion and flooding can ultimately prevent some types of early successional habitats from forming that nesting shorebirds such as piping plover rely on (Schupp et al. 2013). Disturbance by humans and pets from development and recreation often reduces the functional suitability of habitat and causes direct and indirect mortality of eggs and chicks. Predation has also been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites, and substantial evidence shows that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation (U.S. Fish and Wildlife Service 1996a).

Much of the piping plover's historic habitat along the Atlantic Coast has already been destroyed or permanently degraded by inlet stabilization activities, beach and dune construction, development, and human use. Dune construction, sand fencing, and vegetation planting result in hastening of successional habitats and bifurcation of bay to ocean overwash areas. The construction of houses and commercial buildings on and adjacent to barrier beaches directly removes piping plover habitat. Zeigler et al. (2018) demonstrated that the amount and longevity of new habitat created by storms appeared to be influenced by the level of human development. The percentage in increase in the amount of habitat gained between pre-and post-Sandy periods was inversely proportional to the amount of development at Fire Island (Democrat Point to Cupsogue County Park). Construction results in increased human disturbance and additional disturbance comes in the form of recreational use of beach habitats. As high quality habitat continues to degrade, and low quality of remaining habitat persists, it is unlikely that new first-time breeders would be attracted to a site (Cohen et al. 2006). The decrease in the functional suitability of the piping plover's habitat due to accelerating recreational activity on the Atlantic Coast may impact productivity. Functional habitat loss occurs when suitable nesting sites are made unusable because high human and/or animal use precludes the birds from successfully nesting.

Climate Change

A recent IPCC summary report (IPCC 2014) notes that it is evident that the atmosphere and oceans have warmed and sea level has risen as a result of the warming of the climate system. In addition to sea-level rise, the climate-related extremes, including more frequent and energetic storms and extreme storm surges, have increased and are widely recognized climate change-related concerns for coastal regions. Potential effects of accelerating sea-level rise on coastal beaches, including piping plover nesting and foraging habitats, may be highly variable and potentially severe. Human responses, especially coastal armoring, will play key roles in the effects of sea-level rise on the quantity, quality, and distribution of piping plover habitats. The U.S. Climate Change Science Program (CCSP 2009), for example, stated that, "To the degree that developed shorelines result in erosion of ocean beaches, and to the degree that stabilization is undertaken as a response to sea-level rise, piping plover habitat will be lost. In contrast, where beaches are able to migrate landward, piping plovers may find newly available habitat." Increased coastal storm activity is a second climate change-related threat to piping plovers in their Atlantic Coast breeding range. Although there is uncertainty about whether and how storm frequency or intensity will change relative to 20th century trends (CCSP 2009), sea-level rise alone will increase coastal flooding during storm surges and amplify rates of habitat change on coastal beaches. Increased numbers and intensity of storms during the breeding season could directly affect piping plover breeding success by increasing long-term rates of nest inundation, nest abandonment, or chick mortality due to harsh weather.

Recovery Plan

The Piping Plover Recovery Plan (Plan) for the Atlantic Coast population of the piping plover (USFWS 1996a) delineates four recovery units: Atlantic Canada, New England, New York-New Jersey and Southern (Delaware, Maryland, Virginia, and North Carolina). Recovery criteria established in the Plan set population and productivity goals for each recovery unit, as well as for the entire population. The population goals for the Atlantic Canada, New England, New York-New Jersey, and Southern Recovery Units are 400, 625, 575, and 400 pairs, respectively. The productivity goal for each of the recovery units is to achieve a 5-year average productivity of 1.5 chicks fledged per pair. The Plan states: "A premise of this plan is that the overall security of the

Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population." Thus, in accordance with the Consultation Handbook (USFWS and NMFS 1998), this PBO focuses on the effect of the project in the New York-New Jersey Recovery Unit.

The Plan identifies a recovery objective to ensure the long-term viability of the Atlantic Coast plover population in the wild, thereby allowing for the delisting of this species, along with five criteria for meeting the objective: 1) the population goal of 2,000 breeding pairs, distributed among four recovery units, and maintained at that level for 5 years; 2) the adequacy of a 2,000-pair population of piping plovers has been verified to maintain heterozygosity and allelic diversity over the long-term; 3) a 5-year average productivity of 1.5 chicks fledged per pair has been achieved in each of the recovery units; 4) long-term agreements have been instituted to assure protection and management sufficient to maintain the population targets and average productivity in each recovery unit; and 5) long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution has been ensured to maintain survival rates for a 2,000-pair population.

The subpopulation abundance and distribution targets in recovery criterion #1 ensure **representation, redundancy, and resiliency** for Atlantic Coast piping plovers in their breeding range, consistent with recent Service recovery planning guidance (see also Schaffer and Stein 2000).

Representation supports the adaptability and evolutionary capacity of a species to accommodate long-term environmental changes (e.g., climate, habitat conditions or structure across large areas, emerging pathogens, novel competitors and/or predators, invasive species). The breadth of genetic, ecological, demographic, and behavioral diversity across a range of ecologically diverse locations or niches on the landscape are the best available and most useful expressions of representation (USFWS 2016). A comprehensive molecular-genetic investigation of piping plovers by Miller et al. (2010) found strong genetic structure, supported by significant correlations between genetic and geographic distances in both mitochondrial and microsatellite data sets for birds breeding along the Atlantic Coast from Newfoundland to North Carolina. Atlantic birds showed evidence of isolation-by-distance patterns, indicating that dispersal, when it occurs, is generally associated with movement to relatively proximal breeding territories. Maintaining geographically distributed subpopulations across the four recovery units serves to conserve representation of genetic diversity and adaptability to variable environmental selective pressures. Further evidence of adaptive variability across recovery unit subpopulations is found in latitudinal differences in Atlantic Coast piping plover breeding habitat requirements. Although piping plovers breeding in the northern part of their Atlantic Coast range avoid sections of beach with high steep foredunes (Strauss 1990, Fraser et al. 2005), they are capable of thriving on beaches where chick access is limited to ocean foraging habitats (Jones 1997, Boyne et al. 2014). In New York and New Jersey, however, the species demonstrates strong preference for sites that also offer chick access to ephemeral pools and bayside tidal flats (Elias et al. 2000, Cohen et al. 2009). In Delaware, Maryland, Virginia, and North Carolina, Southern Recovery Unit breeding sites are almost completely restricted to low-lying barrier island flats and spits that also feature moist foraging substrates away from the ocean intertidal zone (McConnaughey et al. 1990, Loegering and Fraser 1995, Boettcher et al. 2007, NPS 2008). In addition to these well-documented geographic differences in habitat preferences, latitudinal variability may also provide Atlantic Coast piping plovers with adaptive capacity for changing climatic factors such as breeding season temperatures and storm patterns that may affect the birds directly or indirectly (e.g., via changes in prey composition or phenology).

Another line of evidence for latitudinal adaptation within Atlantic Coast piping plovers is manifested in a strong pattern of higher productivity rates needed to maintain stable populations with increasing latitude (Hecht and Melvin 2009) and concomitant differences in annual survival rates. Although the underlying causes and mechanisms are not yet well understood, this striking demographic variability among recovery units may also contribute to evolutionary capacity. In summary, maintaining geographically well-distributed populations across the four recovery units serves to conserve representation of genetic diversity and adaptations to variable environmental selective pressures evidenced by genetic structure, diverse habitat requirements, and differences in vital rates.

Redundancy safeguards the ability of representative units to withstand catastrophic events. The number and distribution of resilient populations within each representative unit contribute to redundancy, thereby assuring that the loss of an individual population does not lead to loss of representation (USFWS 2016b). The 1996 recovery plan articulates the role of the recovery units in buffering Atlantic Coast piping plovers against catastrophic events such as large storms and oil spills during the breeding season, and this need is likewise served by attaining and maintaining robust, well-distributed populations within each recovery unit. The probability of piping plover dispersal is inversely proportional to distance from previous breeding and natal sites, and movements of piping plovers between recovery units are rare (Wilcox 1959, MacIvor et al. 1987, Loegering 1992, Cross 1996, Cohen et al. 2006, Hecht and Melvin 2009, Rioux et al. 2011, Stantial pers. comm. 2016, as cited in USFWS 2017). Thus, the ability of piping plovers in each recovery unit to rebound from events that depress unit-wide productivity or survival and to colonize newly formed or improved habitat (e.g., after storms or artificial habitat enhancement projects) depends on within-unit redundancy that is measured via progress towards abundance targets. Maintenance of these abundance targets for at least 5 years provides evidence that recovery will be sustainable.

Resiliency is the ability to sustain populations in the face of demographic variation and environmental stochasticity. Resiliency depends on a number of vital rates that ultimately affect population size and growth rate, as well as distribution (USFWS 2016b). In the case of Atlantic Coast piping plovers, resiliency (like redundancy) is provided via widely distributed populations meeting abundance targets for breeding pairs within each recovery unit. Hecht and Melvin (2009) found significant positive relationships between productivity and population growth in the subsequent year for each of the three U.S. recovery units, and abundance of piping plovers in each recovery unit population is almost entirely dependent on within-recovery unit productivity. As noted above, dispersal rates decline steeply with distance from previous breeding and natal sites. Thus, robust numbers of evenly distributed breeding pairs support dispersal and within-recovery unit recolonization of any sites that experience declines or local extirpations due to low productivity and/or temporary habitat succession (Gilpin 1987, Goodman 1987, and Thomas 1994).

Wide distribution of breeding pairs within representative units also provides a buffer against environmental stochasticity. For example, weather events such as storms that flood nests may affect the south-facing beaches within a recovery unit in a given year more than north- and east-facing sites (or vice-versa). When environmental factors adversely affect productivity across a region, more abundant populations are inherently less susceptible to reaching the very low numbers from which it is difficult to rebound and which make them vulnerable to local or regional extirpations if multiple years of poor productivity occur in close succession. Similarly, robust numbers of breeding pairs in each recovery unit will provide Atlantic Coast piping plovers with a buffer against stressors (e.g., weather, habitat degradation, disturbance) in their migration and wintering range that may affect survival rates (Saunders et al. 2014, Gibson et al. 2016).

Representation, redundancy, and resiliency are interconnected. Populations must be resilient in order to contribute to redundancy or representation. Likewise, redundant populations within a representative genotype or ecological setting contribute to maintenance of adaptive and evolutionary capacity (USFWS 2016b). For Atlantic Coast piping plovers, this is provided via subpopulation targets for four representative recovery units, thereby increasing the likelihood of survival and recovery of the Atlantic Coast population as a whole. Dispersal of the population across its breeding range in four robust subpopulations serves to protect against environmental and demographic variation and catastrophic events, and to conserve adaptive capacity. Further, it should be noted that from an ESA Section 7 interagency consultation perspective, the Service must assess the status of the species by the established recovery units and as a species in its entirety.

The Atlantic Coast piping plover population estimate reached a post-listing high of 1,941 pairs in 2016, almost two and half times the 1986 estimate of 790 pairs. Discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort (USFWS 1996), the population doubled between 1989 and 2016. (Table 5). However, productivity rates continue to fall short of the recovery criterion (Table 6), and rangewide population growth is tempered by geographic and temporal viability. Periodic regional declines illustrate the continuing risk of rapid reversals in abundance trends. Examples include decreases of 21 percent in the Eastern Canada population in just 3 years (2002 to 2005) and 68 percent in the southern half of the Southern Recovery Unit during the 7-year period from 1995 to 2001. The 64 percent decline in the Maine population between 2002 and 2008, from 66 pairs to 24 pairs, followed only a few years of decreased productivity (USFWS 2017).

Number of nesting pairs in the New York-New Jersey Recovery Unit increased 55 percent between 1989 and 2016. However, the population declined sharply (35 percent) from 586 pairs in 2007 to 378 pairs in 2014, following 7 years of low productivity (including 4 years when it was less than 1.0 chicks per pair). Improved productivity in 2014 and 2015 fueled a partial rebound to 496 pairs in 2016, and there was high productivity in 2016 (1.62 chicks per pair). The New Jersey piping plover population has fluctuated at low numbers (1989 to 2016 ranging from 92 to 144 pairs), and totaled 115 pairs in 2016, when 85 percent of the New Jersey nesting pairs were concentrated along less than 14 percent of the state's ocean shoreline (Rice 2017, Pover and Davis 2016). Changes in the Long Island population account for most of the increases and decreases in that recovery unit population.

An unevenly distributed small population is inherently more vulnerable to stochastic variability in vital rates as well as catastrophic events. Thus, it is important to address the downward trend in New York-New Jersey Recovery Unit (USFWS 2016). The primary factors influencing the status of piping plover in this recovery unit include a history of shoreline stabilization, ongoing coastal engineering, and a high level of human development and use primarily for recreation.

State/Recovery Unit	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maine	15	12	20	16	17	18	24	32	35	40	60	47	60	56	50	55	66	61	55	49	40	35	24	27	30	33	42	44	50	62	66
New Hampshire											5	5	6	6	7	7	7	7	4	3	3	3	3	5	4	4	6	7	6	8	7
Massachusetts	139	126	134	137	140	160	213	289	252	441	454	483	495	501	496	495	538	511	488	467	482	558	566	593	591	656	676	666	663	687	649
Rhode Island	10	17	19	19	28	26	20	31	32	40	50	51	46	93	49	52	58	71	70	69	72	73	77	84	85	86	90	92	91	99	98
Connecticut	20	24	27	34	43	36	40	24	30	31	26	26	21	22	22	32	31	37	40	34	37	36	41	44	43	52	51	45	51	62	63
New England	184	179	200	206	228	240	297	376	449	552	590	612	627	624	623	641	700	687	657	622	634	705	711	753	753	831	865	854	861	918	883
New York	106	135	172	191	197	191	187	193	209	249	256	256	245	243	289	309	369	386	384	374	422	457	443	437	390	318	342	289	286	308	381
New Jersey	102	93	105	128	126	126	134	127	124	132	127	115	93	107	112	122	138	144	135	111	116	129	111	105	108	111	121	108	92	108	115
NY-NJ	208	228	277	319	323	317	321	320	333	381	383	371	338	350	401	431	507	530	519	485	538	586	554	542	498	429	463	397	378	416	496
Delaware	8	7	3	3	6	5	2	2	4	5	6	4	6	4	3	6	6	6	7	8	9	9	10	10	9	8	7	6	6	6	8
Maryland	17	23	25	20	14	17	24	19	32	44	61	60	56	58	60	60	60	59	66	63	64	64	49	45	44	36	41	45	38	36	34
Virginia	100	100	103	121	125	131	97	106	96	118	87	88	95	89	96	119	120	114	152	192	202	199	208	193	192	188	259	251	245	256	291
North Carolina	30	30	40	55	55	40	49	53	54	50	35	52	46	31	24	23	23	24	20	37	46	61	64	54	61	62	70	56	65	64	53
South Carolina	3		0		1	1		1			0					0						0									
Southern	158	160	171	199	201	194	172	181	186	217	189	204	203	182	183	208	209	203	245	300	321	333	331	302	306	294	377	358	354	362	386
USTotal	550	567	648	724	752	751	790	877	968	1150	1162	1187	1168	1156	1207	1280	1416	1420	1421	1407	1493	1624	1596	1597	1557	1554	1705	1609	1593	1696	1765
Eastern Canada **	240	223	238	233	230	252	223	223	194	200	202	199	211	236	230	250	274	256	237	217	256	266	253	252	225	209	179	184	186	179	176
Atlantic Coast Total	790	790	886	957	982	1003	1013	1100	1162	1350	1364	1386	1379	1392	1437	1530	1690	1676	1658	1624	1749	1890	1849	1849	1782	1763	1884	1793	1779	1875	1941

** includes 1-5 pairs on the French Islands of St. Pierre and Miquelon, reported by Candaian Wildlife Service

Table 5. Number of census pairs from 1986-2016 in each state in the Atlantic Coast Recovery Unit (USFWS 2017).

State/Recovery Unit	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Maine	1.75	0.75	2.38	1.53	2.5	2	2.38	2	2.38	1.63	1.98	1.47	1.63	1.6	1.98	1.39	1.28	1.45	0.55	1.35	1.06	1.75	1.7	1.63	2.12	1.52	1.93	1.94	1.95	1.53
New Hampshire											0.6	2.4	2.67	2.33	2.14	0.14	1	1	0	0.67	0.33	2	0.4	1.5	2	0.67	1.71	0.33	1.5	2.14
Massachusetts	1.1	1.29	1.59	1.38	1.72	2.03	1.92	1.81	1.62	1.35	1.33	1.5	1.6	1.09	1.49	1.14	1.26	1.38	1.14	1.33	1.25	1.41	0.91	1.5	1.18	0.85	0.87	1.18	1.29	1.44
Rhode Island	1.12	1.58	1.47	0.88	0.77	1.55	1.80	2.00	1.68	1.56	1.34	1.13	1.79	1.20	1.50	1.95	1.03	1.50	1.43	1.03	1.48	1.68	1.46	1.76	1.49	1.06	0.98	1.63	1.58	1.48
Connecticut	1.29	1.70	1.79	1.63	1.39	1.45	0.38	1.47	1.35	1.31	1.69	1.05	1.45	1.86	1.22	1.87	1.30	1.35	1.62	2.14	1.92	2.49	1.68	1.91	1.37	1.18	1.82	2.27	1.81	1.38
New England	1.19	1.32	1.68	1.38	1.62	1.91	1.85	1.81	1.67	1.40	1.39	1.46	1.62	1.18	1.53	1.26	1.24	1.40	1.15	1.34	1.30	1.51	1.04	1.56	1.27	0.93	1.00	1.33	1.40	1.45
New York	0.90	1.24	1.02	0.80	1.09	0.98	1.24	1.34	0.97	1.14	1.36	1.09	1.35	1.11	1.27	1.62	1.15	1.46	1.44	1.55	1.15	1.21	0.93	0.79	1.07	0.72	0.71	1.30	1.52	1.72
New Jersey	0.85	0.94	1.12	0.93	0.98	1.07	0.93	1.16	0.98	1.00	0.39	1.09	1.34	1.40	1.29	1.17	0.92	0.61	0.77	0.84	0.67	0.64	1.05	1.39	1.18	0.72	0.85	1.36	1.29	1.35
NY-NJ	0.86	1.03	1.08	0.88	1.04	1.02	1.08	1.25	0.97	1.07	1.02	1.09	1.35	1.19	1.28	1.49	1.07	1.23	1.28	1.36	1.03	1.10	0.96	0.92	1.09	0.72	0.74	1.32	1.46	1.62
Delaware		0.00	2.33	2.00	1.60	1.00	0.50	2.50	2.00	0.50	1.00	0.83	1.50	1.67	1.50	1.17	2.33	1.14	1.50	1.44	1.33	0.30	1.30	1.56	1.00	1.00	1.17	1.33	1.17	1.63
Maryland	1.17	0.52	0.90	0.79	0.41	1.00	1.79	2.41	1.73	1.49	1.02	1.30	1.09	0.80	0.92	1.85	1.56	1.86	1.25	1.06	0.78	0.41	1.42	1.09	1.25	1.02	0.76	1.55	1.31	1.47
Virginia		1.02	1.16	0.65	0.88	0.59	1.45	1.66	1.00	1.54	0.71	1.01	1.21	1.42	1.52	1.19	1.90	2.23	1.52	1.19	1.16	0.87	1.19	1.35	1.36	0.95	1.15	1.34	1.26	0.92
North Carolina			0.59	0.43	0.07	0.41	0.74	0.36	0.45	0.86	0.23	0.61	0.48	0.54	0.50	0.17	0.46	0.65	0.92	0.87	0.26	0.30	0.70	0.77	0.77	0.59	0.96	0.22	0.64	0.15
Southern	1.17	0.85	0.88	0.72	0.68	0.62	1.18	1.37	1.05	1.34	0.68	0.99	1.04	1.09	1.22	1.27	1.63	1.95	1.38	1.12	0.92	0.67	1.14	1.20	1.21	0.89	1.07	1.15	1.35	0.88
US Average	1.04	1.11	1.28	1.06	1.22	1.35	1.47	1.56	1.35	1.30	1.16	1.27	1.45	1.17	1.40	1.34	1.24	1.43	1.24	1.30	1.13	1.19	1.03	1.27	1.21	0.86	0.94	1.29	1.37	1.37
Eastern Canada **		1.65	1.58	1.62	1.07	1.55	0.69	1.25	1.69	1.72	2.10	1.84	1.74	1.47	1.77	1.18	1.62	1.93	1.82	1.82	1.14	1.47	1.22	1.59	1.19	1.38	1.36	1.37	1.60	1.39

** includes 1-5 pairs on the French Islands of St. Pierre and Miquelon, reported by Candaian Wildlife Service

Table 6. Estimated productivity from 1987-2016 for states in the Atlantic Coast Recovery Unit (USFWS 2017).

Piping plover monitoring on Long Island has occurred since the species was placed on the endangered species list in 1986 (USFWS 2016, Long Island Field Office). Productivity for piping plovers has fluctuated over time in New York, it was below 1.5 from 2007 to 2014, and below 1.0 in 2009, 2010, 2012, and 2013 but then increased to 1.52 in 2015 and 1.72 in 2016, and 1.28 in 2017. The 2000 to 2017 average productivity was 1.12. Fluctuations and declines in productivity may occur due to a combination of reasons (e.g., via predator abundance and composition, pets, disturbance, and habitat degradation from fencing or planting).

Within the project area, there are four subunits identified for long-term monitoring. These subunits are geographical areas identified as: Fire Island; Westhampton Groin Field; West Hampton Dunes; Southampton; and East Hampton. The Corps has provided funding and support for past monitoring as part of the Westhampton Interim Damage Protection Project, FIMI, West of Shinnecock Inlet Storm Damage Protection Project, and the Fire Island Inlet and Shores Westerly to Jones Inlet Beach Erosion control and Navigation Project at Democrat Point. Over the last 16 years, the number of nesting pairs has been steadily decreasing (Figure 2). The decrease in the Project area can partly be explained by the development of the Village of Westhampton Dunes.

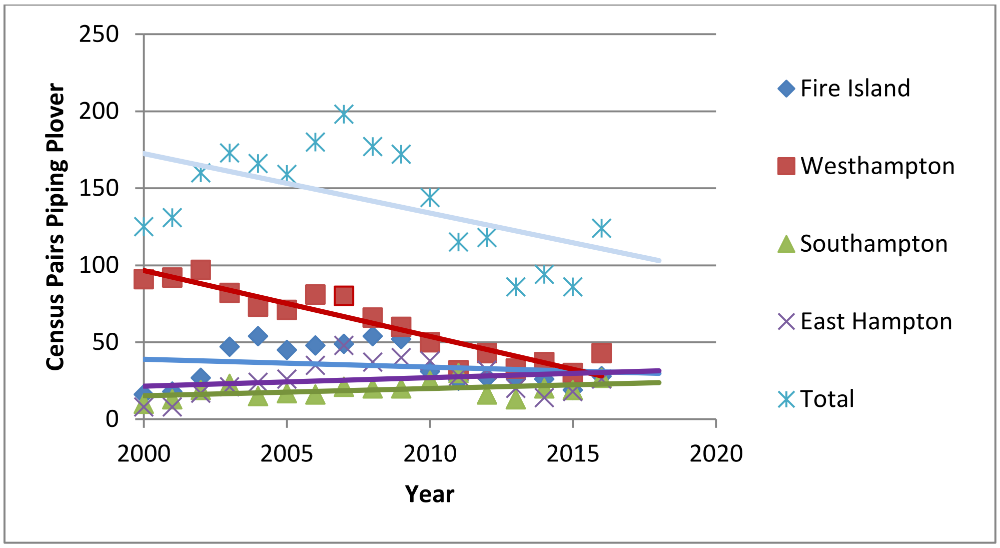

Figure 2. PIPL census pairs over time 2000-2016 including Fire Island, West Hampton, Southampton and East Hampton geographic units (Source USFWS LIFO, 2016)

The Village of West Hampton Dunes is a community that was hit hard in 1992 by a Northeaster creating a breach and washover area. This breach created washover areas that became important nesting habitat for piping plover (Cohen et al. 2009). The Corps filled the breach and repaired the dune and beach indirectly resulting in succession and increased predation and recreation. Ultimately, the Village developed this area, which resulted in a steep decline in nesting habitat on the bayside. This reduction in habitat directly led to a reduction in the number of nesting pairs in this area (Figure 3).

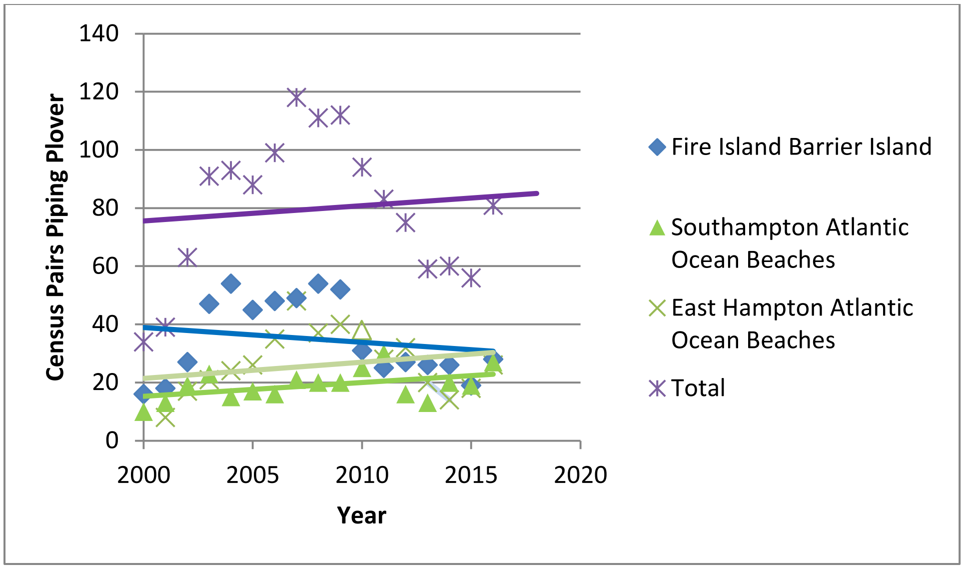

Figure 3. Piping plover census pairs over time 2000-2016, Fire Island-East Hampton geographic units excluding Westhampton (Source USFWS LIFO, 2016.)

In 2012, Hurricane Sandy impacted the New York-New Jersey Recovery Unit creating three new breaches on the south shore of Long Island. Two of the three breaches occurred within the Fire Island geographic unit: one at the Otis Pike Wilderness area and one at the Smith Point County Park. The third breach occurred at the West Hampton Dunes geographic unit at Cupsogue Beach County Park. In response to this storm, the Corps initiated emergency breach response activities as well as the FIMI to fill two of the three breaches and stabilize the dunes over 19 miles of Fire Island. Construction of the FIMI started in the winter of 2014 (Carey et al. 2016) and is ongoing. The FIMI project will stabilize and maintain (through the State) the dune system for 10 years as well as provide funding for monitoring of piping plovers and predators, while creating and maintaining early successional habitat. The Corps also initiated the restoration of the dune and beach profiles at the West of Shinnecock Inlet Interim Storm Damage Protection and Westhampton Interim Storm Damage Protection Projects pursuant to Public Law (PL) 84-99.

As part of the FIMI, the Corps has funded VA Tech for a limited time period to conduct in-depth project specific monitoring throughout the 19-mile area on Fire Island and the western end of Cupsogue County Park. VA Tech has further broken down the West Hampton Dunes and Fire Island geographic units to include FIIS, Smith Point County Park, Cupsogue County Park, and Robert Moses State Park. VA Tech divided these sub geographic units into 26 sub-sites that could be easily monitored (Carey et al. 2016). Monitoring was initiated under the Breach Contingency Plan in 2013 between Old Inlet and Moriches Inlet and was expanded under the FIMI as described above. A summary of the number of nests (total and number of successful) from 2013 to 2016 is included (Figure 4). With only 4 years of data it is difficult to draw any conclusions regarding trends. However, with 2017 census data now available, it is important to note that there was a 50 percent increase in the number of nesting pairs on Fire Island between 2013 and 2017, from 26 to 39 pairs and Smith Point increased 300 percent from 5 pairs (2013) to 20 pairs (2017). Presumably, the piping plover increases were attributed to increased habitat availability created from Hurricane Sandy, and sand placement from FIMI where succession has not yet occurred.

VA Tech is also monitoring productivity and sources of nest failure. In addition to vehicle and recreational disturbances, monitoring suggests predation has influenced nesting failure of piping plover in the study area. In 2015, there was a high degree of nest depredation and a large number of fox present. The over-population of fox led to a mange outbreak which resulted in a greatly reduced fox population in 2016 (Carey et al., 2016), resulting in a corresponding increase in nesting success of piping plover (Figure 4).

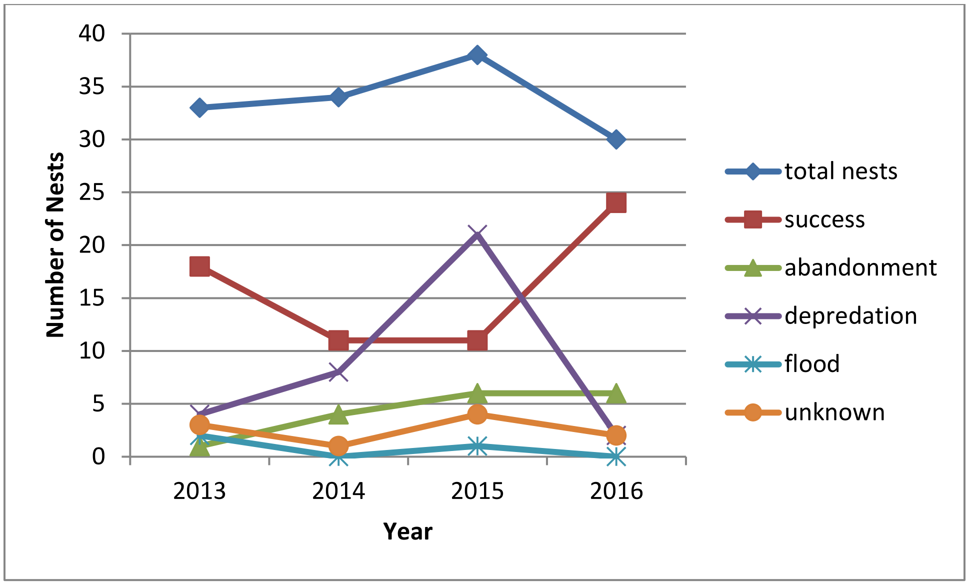

Figure 4. Fate of piping plover nests in FIMI project, 2013-2016 (source Carey et al. 2016).

Seabeach Amaranth

Seabeach amaranth is an annual plant that grows on Atlantic barrier islands and ocean beaches currently ranging from South Carolina to New York. It was listed as threatened under the ESA on April 7, 1993 (58 FR 18035) because of its vulnerability to human and natural impacts and the fact that it had been eliminated from two-thirds of its historic range (USFWS 1996b). Seabeach amaranth stems are fleshy and pink-red or reddish, with small rounded leaves that are 0.5 to 1.0 inches in diameter. The green leaves, with indented veins, are clustered toward the tip of the stems, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous, borne in clusters along the stems. There is no designation of critical habitat for seabeach amaranth.

Germination of seabeach amaranth seeds occurs over a relatively long period, generally from April to July. Upon germinating, this plant initially forms a small unbranched sprig, but soon begins to branch profusely into a clump. This clump often reaches 1 foot in diameter and consists of 5 to 20 branches. Occasionally, a clump may get as large as 3 feet or more across, with 100 or more branches. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June, but more typically commencing in July and continuing until the death of the plant in late fall. Seed production begins in July or August and peaks in September during most years, yet continues until the death of the plant. Weather events, including rainfall, storm and temperature extremes, and predation by webworms affect the length of the reproductive season of seabeach amaranth. Because of one or more of these influences, the flowering and fruiting period can be terminated as early as June or July. Under favorable circumstances, however, the reproductive season may extend until January or sometimes later (Radford et al. 1968; Bucher and Weakley 1990; Weakley and Bucher 1992). The relative roles of the fresh seed crop versus banked seeds are unknown in seabeach amaranth. It is known, however, that century-old seeds of some species of amaranth are capable of successful germination and growth (USFWS 2004, 1996b), and a long-lived seed bank is presumed.

The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches (landward of the wrackline), although the species occasionally establishes small temporary populations in other habitats, including sound-side beaches, blowouts in foredunes, inter-dunal areas, and on sand and shell material deposited for beach replenishment or as dredge spoil. Seabeach amaranth usually grows on a nearly pure sand substrate, occasionally with shell fragments mixed in. Seabeach amaranth is, at least during periods of sea level rise, a species primarily of inlets (USFWS 1996b).

Seabeach amaranth occupies elevations from 8 inches to 5 feet above mean high tide. The plant grows in the upper beach zone above the high tide line, and is intolerant of even occasional flooding during its growing season. The habitat of seabeach amaranth is sparsely vegetated with annual herbs and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. Vegetative associates of seabeach amaranth include sea rocket (*Cakile edentula*), seabeach spurge (*Chamaesyce polygonifolia*), and other species that require open, sandy beach habitats. However, this species is intolerant of competition and does not occur on well-vegetated sites. Seabeach amaranth is often associated with beaches managed for the protection of beach nesting birds (USFWS 2004, 1996b).

This species historically occurred in nine states from Rhode Island to South Carolina. By the late 1980s, habitat loss and other factors had reduced the range of this species to North Carolina and South Carolina. Since 1990, seabeach amaranth has reappeared in several states that had lost their populations in earlier decades. However, threats like habitat loss have not diminished, and populations are declining overall (USFWS 2007). Threats to seabeach amaranth include beach stabilization, intensive recreational use, beach raking, and herbivory by insects (USFWS 1996b).

Seabeach amaranth will be considered for delisting when the species exists in at least six states within its historic range and when a minimum of 75 percent of the sites with suitable habitat within each state are occupied by populations for 10 consecutive years (USFWS 1996b). The recovery plan states that mechanisms must be in place to protect the plants from destructive habitat alterations, destruction or decimation by off-road vehicles or other beach uses, and protection of populations from debilitating webworm predation.

Within New York and across its range, seabeach amaranth numbers vary from year to year. Data in New York are available from 1987 to 2016. Recently, the number of plants across the entire state dwindled from a high of 244,608 in 2000 to 4,985 in 2016. This trend of decreasing numbers is seen throughout its range. A total of 249,261 plants were found throughout the species' range in 2000. By 2016, those numbers had dwindled to 9,221 plants (Table 7). Seabeach amaranth is dependent on natural coastal processes to create and maintain habitat. However, high tides and storm surges from tropical systems can overwash, bury, or inundate seabeach amaranth plants or seeds, and seed dispersal may be affected by strong storm events. In September of 1989, Hurricane Hugo struck the Atlantic Coast near Charleston, South

Carolina, causing extensive flooding and erosion north to the Cape Fear region of North Carolina, with less severe effects extending northward throughout the range of seabeach amaranth. This was followed by several severe storms that, while not as significant as Hurricane Hugo, caused substantial erosion of many barrier islands in the seabeach amaranth's range. Surveys for seabeach amaranth revealed that the effects of these climatic events were substantial (Weakley and Bucher 1992). In the Carolinas, populations of amaranth were severely reduced.

In South Carolina, where the effects of Hurricane Hugo and subsequent dune reconstruction were extensive, seabeach amaranth numbers declined from 1,800 in 1988 to 188 in 1990, a 90 percent. A 74 percent reduction in seabeach amaranth occurred in North Carolina, from 41,851 plants in 1988 to 10,898 in 1990. Although population numbers in New York increased in 1990, rangewide totals of seabeach amaranth were reduced 76 percent from 1988 (Weakley and Bucher 1992). The influence stochastic events have on long-term population trends of seabeach amaranth has not been assessed.

Year	DE	NY	MD-VA	NC	NJ	SC	RI-CT-MA	Total
1987	0	0	0	10278	0	1341	0	11619
1988	0	0	0	20261	0	1800	0	22061
1989	0	0	0	0	0	0	0	0
1990	0	331	0	4459	0	188	0	4978
1991	0	2251	0	1170	0	0	0	3421
1992	0	422	0	32160	0	15	0	32597
1993	0	195	0	22214	0	0	0	22409
1994	0	182	0	13964	0	560	0	14706
1995	0	599	0	33514	0	6	0	34119
1996	0	2263	0	8455	0	0	0	10718
1997	0	11918	0	1445	0	2	0	13365
1998	0	10699	2	11755	0	141	0	22597
1999	0	31196	1	596	0	196	0	31989
2000	37	244608	1160	105	1039	2312	0	249261
2001	71	205233	3331	5088	5813	231	0	219767
2002	417	193412	2794	4459	10908	0	0	211990
2003	12	114535	503	11233	5087	1381	0	132751
2004	9	30942	535	11866	6817	2110	0	52279
2005	6	16813	627	20718	5795	671	0	44630
2006	39	32553	1551	3251	6522	721	0	44637
2007	19	3914	2179	875	2191	60	0	9238
2008	11	4416	1048	1606	1141	51	0	8273
2009	44	5402	1260	785	3226	26	0	10743
2010	29	534	203	2574	926	0	0	4266
2011	33	2662	240	373	2614	0	0	5922
2012	302	1213	251	154	1239	0	0	3159
2013	104	729	8	166	316	0	0	1323
2014	75	902	39	543	1287	0	0	2846
2015	267	1008	122	1661	2488	231	0	5777
2016	39	4985	47	827	3323	0	0	9221
State Totals	1514	923917	15901	226555	60732	12043	0	1240662

Table 7. Seabeach amaranth rangewide plant counts 1987-2016 (USFWS, Raleigh Field Office, 2016).

Surveys for seabeach amaranth within the FIMP study area are conducted annually by the New York State Office of Parks, Recreation and Historic Preservation at Robert Moses State Park, the NPS in FIIS, and Suffolk County at Smith Point County Park since 2009 (New York Natural Heritage Program conducted surveys prior to 2009). Surveys for seabeach amaranth on Westhampton Island are conducted annually by Suffolk County Department of Parks, Recreation and Conservation at Cupsogue County Park and Shinnecock County Park, West Shinnecock; by Cashin Associates at the Village of Westhampton Dunes; and by Southampton Town Trustees at Hampton Beach and Tiana Beach. Suffolk County also surveys east of Shinnecock Inlet at Shinnecock County Park East. Southampton Town Trustees survey annually east of Shinnecock Inlet at Southampton Village Beach, Gin Lane Beach, Water Mill Beach, Sams Creek Beach, Sagaponack Pond, and Fairfield Pond Lane Beach. Town of East Hampton conducts surveys for seabeach amaranth in some years at Wainscott Beach, Georgica Beach, East Hampton Beach, Napeague Beach, and Montauk Beach. The Corps is also surveying for seabeach amaranth during FIMI construction activities.

Robert Moses State Park

Most plants occur at Democrat Point, with plants also present within the bathing beach fields. Since 2000, Democrat Point had a peak plant count of 825 in 2002 and a low of 1 plant in 2013.

FIIS

The occurrence of seabeach amaranth has been reported to be patchy and only found on the oceanside beaches. From 1997 to 2003, plants had been observed on the ocean beaches in front of Talisman/Barrett Beach, Lighthouse Tract, and Atlantique (New York Natural Heritage Program 2003). Seabeach amaranth was not observed in the western communities of Fire Island (Kismet to Point O'Woods) until 2001 and the Fire Island Pines survey area until 1999. Since 2000, a peak plant count of 250 plants occurred in 2003 at Sunken Forest. In 2016, 61 plants were observed in the Lighthouse Tract, the western communities, the Fire Island Pines area, and the Wilderness Area.

Smith Point County Park

Since 2000, Smith Point County Park had a peak count of 816 plants in 2006 and a low of 4 plants in 2016.

Westhampton Island (including Southampton Properties)

Seabeach amaranth populations on Westhampton Island have fluctuated greatly since 1991. The island saw a peak of amaranth numbers in 2003 when it supported 85,802 plants – with the greatest number of plants found at Cupsogue County Park (55,832 plants). However, there has been a sharp decline in the seabeach amaranth population on the island since 2003 with a low in 2012 of only 21 plants documented. Since 2012, the numbers have increased slightly, with 247 plants in 2016. In 2016, the Village of West Hampton Dunes supported the largest proportion of the plants (161 plants).

Southampton (East of Shinnecock Inlet)

Of the Southampton sites that are east of Shinnecock Inlet, Southampton Beach has supported the highest numbers of seabeach amaranth in more years than any of the other sites, and the largest seabeach amaranth counts of any of the sites, with a high of 1,139 plants in 2004. However, the amaranth population at this site has been variable, and in 2015 Southampton Beach did not have any seabeach amaranth plants. In 2016, Southampton Beach supported 8 plants, and Sagaponack Pond had the greatest number of plants of any Southampton site with 12 plants.

East Hampton

There have been few amaranth surveys performed at East Hampton Beaches since 1991.

Entire FIMP Project Area

The FIMP study area once supported large numbers of seabeach amaranth, reaching peak numbers in the early 2000s, with the greatest number of plants being found in 2003 (88,195). In more recent years, however, the numbers have decreased within the study area. The number of observed seabeach amaranth plants from Fire Island to Montauk Point has averaged 231 plants from 2000 to 2016 with a maximum of 364 plants observed in 2016 and a minimum of 87 plants observed in 2013 (Figure 5). The largest concentrations of seabeach amaranth are found on Fire Island and Westhampton Island (Table 8).

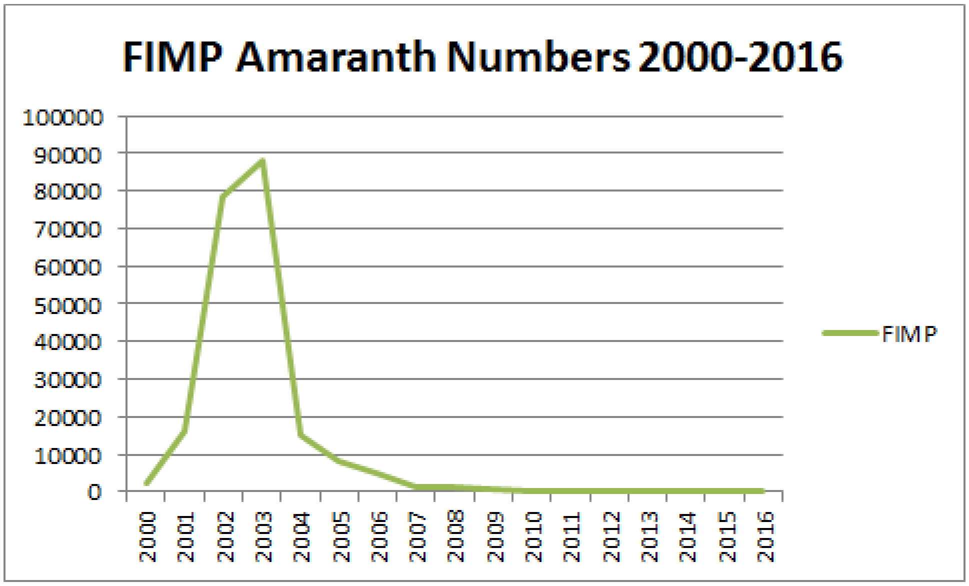

Figure 5. Seabeach amaranth numbers in the project area from 2000-2016.

Site Name	2010	2011	2012	2013	2014	2015	2016
Fire Island							
Robert Moses State Park	23	55	64	5	48	21	30
Fire Island National Seashore	11	40	26	15	68	108	31
Snuith Point County Park	40	86	32	8	44	7	4
West Hampton							
Cuspogue County Park	42	28	1	8	0	12	8
Village of West Hampton Dunes	24	20	10	10	?	44	161
Hampton Beach	0	12	9	30	113	41	63
Tiana Beach	0	12	NS	NS	1	0	3
Shinnecock County Park West	1	16	1	6	40	12	12
Southampton East of Shinnecock Inlet							
Shinnecock County Park East	0	NS	0	NS	NS	0	NS
Southhampton Village Beach	15	15	1	3	1	NS	8
Gin Lane Beach	4	2	2	2	2	1	1
Water Mill Beach	0	2	3	0	1	0	0
Sams Creek Beach	0	0	0	0	0	0	1
Sagaponacck Pond	0	0	0	0	1	2	12
Fairfield Pond Lane Beach	0	0	0	0	1	0	0
East Hampton							
Wainscott Beach	NS		NS	NS	NS	NS	NS
Georgica Beach	NS		NS	NS	NS	NS	NS
East Hampton Beach	NS		0	NS	NS	NS	NS
Napeague Beach	NS		0	NS	NS	NS	NS
Montauk Beach	NS		NS	NS	NS	NS	NS

Table 8. Number of individual plants at surveyed sites from Fire Island to Montauk Point since 2010.

FIMP Study Area Contributions to the New York Total Population

Since 2000, Fire Island to Montauk Point has contributed an average of 25 percent of the New York total population, contributing a low of 1.5 percent in 2000, and a peak of 79 percent in 2003. In 2016, Fire Island to Montauk Point (364 plants) contributed 7 percent of the New York total (4985 plants) (Figure 6).

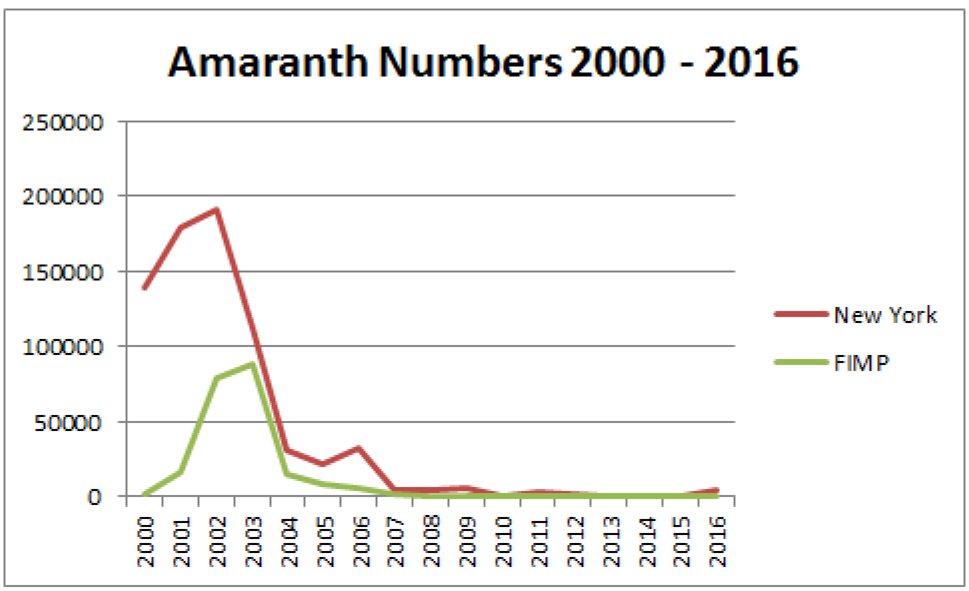

Figure 6. FIMP study area contribution of seabeach amaranth to New York.

ENVIRONMENTAL BASELINE

In the context of consultation under Section 7 of the ESA, the environmental baseline is: the past and present impacts of all Federal, state, or private actions including human activities in an action area; the anticipated impacts of all proposed Federal projects in an action area that have already undergone Section 7 consultation; and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). In determining whether a proposed action is likely to jeopardize the continued existence of a species', non-Federal actions likely to affect the species in the future must be considered.

The status of each species within the action area was given above. Here we present the factors affecting the species environment within the action area, which are similar for the two species. The environmental baseline reflects both the substantial increases in the areal extent of piping plover habitat on Fire Island due to Hurricane Sandy and the resultant losses of this habitat due to post-Hurricane Sandy stabilization efforts and other activities or natural processes that degraded or destroyed newly formed coastal habitats. It also accounts for the impacts of previous stabilization efforts on piping plovers and their habitats.

Habitat Loss and Fragmentation

Coastal storms may be damaging to human habitats yet they also create early successional habitat for a variety of species including piping plover. Coastal storms transfer sand and other materials from the beach to the nearshore zone, erode backshore areas, flatten dunes, carry sediments to the back barrier in overwash fans, and open inlets (Carter 1988; Leatherman 1979; Dillon 1970; Sallenger and Morton 2003). Development and anthropogenic shoreline modifications can ultimately prevent some types of early successional habitats from forming or being maintained (Schupp et al. 2013). The project area contains a mix of anthropogenically modified coastlines with communities, housing developments, roads, and infrastructure interspersed with Federal, state and county lands with minimal development near the dunelines (Zeigler et al. 2017). Sand fencing, hotels, homes, and other human structures alter the aeolian transport and act as obstacles for the deposition of dune sediments and overwash (Kratzmann and Hapke 2012; Rogers et al. 2015). Even dunes and berms intentionally constructed to add elevation along barrier islands can restrict overwash processes and affect barrier island evolution (Plant et al. 2014).

After Hurricane Sandy, the average loss of vertical dune height was from 1 to 2 m from the New York/New Jersey border to Fire Island (Democrat Point to Cupsogue Beach). Beaches and dunes lost more than 54 percent of their pre-storm volume and dunes experienced overwash along 46 percent of Fire Island (Hapke et al. 2013). Although the island experienced seven additional storms with significant wave heights greater than 4 m during the winter of 2012/2013, the majority of the breaches rapidly returned to pre-Sandy conditions. By April 2013, 90 percent of beach profiles examined had beach volumes similar to those immediately before Sandy (Hapke et al. 2013). Zeigler et al. (2017) found that the amount and longevity of new habitat formed by Hurricane Sandy appeared to be inversely related to the level of human development with Fire Island being considered moderately developed (31 percent of the 32-km^2 area had beach habitat directly abutting housing development and paved recreational infrastructure). The amount of habitat pre-Sandy (October 2011) increased from 1.4 km^2 to 3.0 km^2 post-Sandy (October 2012) then decreased back to 2.5 km^2 (2 years post-Sandy). The net change in habitat was +114 percent pre- to post-Sandy and 17 percent 2 years post-Sandy. The authors hypothesized that landowner and Corps actions such as mechanical closure of breaches, placement of multiple rows of sand fencing along undeveloped beaches, and stockpiling sand likely further inhibited the amount of post-Sandy habitat growth.

Inlets (excerpted from Rice (2016))

Inlets are a highly valuable habitat for piping plover, red knots, other shorebirds, and waterbirds for foraging, loafing, and roosting (Harrington 2008, Lott et al. 2009, Maddock et al. 2009). Artificially closed inlets provide a different mosaic of habitats than those that have closed naturally. Naturally closed inlets tend to be low in elevation, to have no or sparse vegetation initially, and are wide, especially if the tidal deltas or shoals have welded to the island. Artificially closed inlets, on the other hand, have higher elevations, tend to have a substantial constructed berm and dune system tying in to the adjacent beach and dune systems, and are often manually planted with dune grasses and/or other vegetation to stabilize the area. The materials used to fill the inlet and construct the berm and dune ridge typically are often mined nearby, which can disturb the local sediment supply and transport system. The overwash occurring periodically at a naturally closed inlet is prevented at an artificially closed inlet if there is a constructed dune ridge, or in some cases by additional hard structures or sandbags.

Inlet Hardening

Shinnecock and Moriches Inlets have hard structures along their entire shoreline which has eliminated sandy beach habitat available for foraging and roosting. The single jetty at Fire Island Inlet is nearly landlocked with the accretion of Democrat Point to the west of the jetty but is included as an existing structure that is influencing the inlet. The inlet was quickly migrating to the west at an average of 61 m/year prior to construction of the jetty (McCormick et al. 1984). The growth of Democrat Point has been considerably slower at roughly 15 m/year since the jetty was completed in 1941. There is also an earthen and riprap dike on its northern and western shoreline extending perpendicular to the shoreline and inlet.

Tidal Inlet Habitat Changes between Hurricane Sandy and 2015

Hurricane Sandy opened three inlets or breaches along the South Shore of Long Island (Rice 2015). Of the three breaches or inlets opened by Hurricane Sandy on the South Shore of Long Island, two were closed artificially to protect life and safety in highly populated suburban areas within 2 months and the third, at FIIS, remains open and is one of only two inlets between Montauk, New York, and Chincoteague, Virginia, that are not modified in any manner (the other inlet being Little Egg Inlet, New Jersey, which has been proposed for dredging). In the 3 years after Hurricane Sandy, the breach complex at FIIS continued to evolve with shoals and spits accreting, or growing, and retreating; the breach has remained relatively stable in its position (Flagg et al., http://po.msrc.sunysb.edu/ESB; Michael Bilecki, NPS, pers. communication, August 10, 2016 as cited in Rice (2016). The depth of the Fire Island Inlet breach also varies seasonally and with time. Flagg et al. (http://po.msrc.sunysb.edu/ESB) indicated that the inlet may be on a course to close although aerial photography since then has suggested a return to flows through the breach. In the 3 years following Hurricane Sandy, nearly all nine inlets modified by dredging on the South Shore were dredged (including Shinnecock, Moriches, and Fire Island Inlets in the action area). Periodic pond letting at Georgica, Sagaponack, and Mecox Ponds continued. Suffolk County dredged Shinnecock Inlet area channels in 2015 and placed dredged material on beaches to both the east and west of the inlet (USACE 2015n). Moriches Inlet was dredged for breach fill (~200,000 CY) to close the breach opened by Hurricane Sandy at Cupsogue Beach County Park in November through December 2012 (USACE 2013i). Fire Island Inlet was dredged in 2014 by the Corps with 1,200,000 CY of sediment placed at Tobay Beach and Gilgo Beach. Fire Island Inlet was dredged removing 790,000 CY of sediment in 2013 through 2014 by the New York State Department of Transportation to construct an artificial dune/levee along Ocean Parkway at Tobay and Gilgo Beaches plus an artificial dune/levee to protect the traffic circle at Robert Moses State Park (USFWS 2014c). The inlet was dredged for navigation maintenance 13 times since 1985.

Beach Habitat (excerpted from Rice (2017))

Sandy beaches are a valuable habitat for piping plovers, red knots, other shorebirds and waterbirds for nesting, foraging, loafing, and roosting. In 2015 there were 202.28 km of sandy shoreline on the South Shore of Long Island, with 197.26 km of sandy beaches and 5.02 km of armored shoreline where no sandy beach was present (Rice 2017). Another 1.04 km of shoreline in Montauk were predominantly rocky. Where sandy beaches were present, the beachfront was 43 percent developed and 57 percent undeveloped. When sections of shoreline where sandy beaches were absent due to hard shoreline stabilization structures are included, the beachfront that was developed increases to 45 percent and the beachfront that was undeveloped decreases to 55 percent. Of the 5.02 km of armored shoreline where sandy beaches were absent in 2015, 0.21 km were scheduled to receive sediment placement in 2016 as part of the Federal Emergency Stabilization Project which initiated construction in 2015. As a result, the length of shoreline armored with no beach is anticipated to decrease to 4.81 km in the near future.

The beaches of New York have multiple layers of governance and management. Most of Long Island falls within Suffolk and Nassau Counties. Nassau County, is outside of the FIMP project area. Within Suffolk County, there are a number of towns such as Babylon, Islip, Brookhaven, Southampton, and East Hampton within the FIMP study area. These towns have multiple incorporated villages or hamlets (e.g., Amityville, Lindenhurst, Babylon, Bellport, Quogue, Montauk, Sagaponack, Westhampton Beach, and West Hampton Dunes) as well as unincorporated areas. The sandy beaches of Long Island are therefore publicly owned by the various Towns, although their use is often restricted to residents of the Town. The property immediately adjacent to the beach, however, is most often privately owned.

In 2015, 99.13 km of sandy beach were present within public or non-government organization (NGO)-owned beachfront lands, a slight increase due to the identification of new public beachfront lands in the Town of Southampton. The proportion of sandy beach within public or NGO-ownership therefore increased slightly to 50 percent in 2015. It is unknown whether the Towns' ownership and management of the beaches will move along with the beaches as they migrate with rising sea level, or if the adjacent private property will affect that ownership and/or management of the sandy beaches.

Shoreline Hardening Measures

A total of 11.36 km of sandy beaches on the South Shore (considering both Suffolk and Nassau Counties) were armored with bulkheads and revetments from late 2012 to 2015. Most of this increase was due to the construction of sandfilled geotextile revetments, referred to as sand cubes, geocubes, or the brand-name TrapBag™. Another 5.21 km of sandy beach armored with hard shoreline stabilization structures were identified following Hurricane Sandy; these structures were exposed by Hurricane Sandy or hurricane rebuilding efforts. Altogether the length of sandy beach armored in Suffolk and Nassau Counties (both newly constructed and newly identified) in the 3 years following Hurricane Sandy was 10.58 km, an increase of 41 percent from the length of shoreline armored prior to the storm. As of the end of 2015, 57.34 km, or 28 percent, of Atlantic Ocean shoreline of New York was armored (Rice 2017). Of the 57.34 km of armored beaches identified, 5.02 km had no sandy beach present at the time the 2015 aerial imagery was taken. The project area (Montauk to Fire Island in Table 16 (Rice 2017), had 31 groins, 5 jetties, 57 seawalls, bulkheads, and/or revetments.

Sediment Placement Modifications

Prior to Hurricane Sandy, ~105 km of sandy beach on the South Shore of Long Island had been modified by sediment placement, and another 8.05 km had been proposed. In the 3 years following Hurricane Sandy, 72.39 km of the South Shore's sandy beaches were modified with sediment placement, with 52 km of those beaches having previously been modified with sediment placement and 20.39 km of those beaches newly modified, an increase of 20 percent (Rice 2017). Altogether, as of the end of 2015, 124.35 km, or 62 percent of sandy beaches on the Atlantic Ocean shoreline of New York had been modified with sediment placement at least once.

As of the end of 2015, an additional 25.56 km of sandy beaches were proposed or scheduled to be modified with sediment placement; 16.45 km of the proposed project areas have previously been modified by sediment placement, and 9.11 km have not. The 11 active and proposed project areas include the developed communities on Fire Island, which received fill as part of the Federal FIMI project, and the Federal Jones Inlet to East Rockaway Inlet (Long Beach) Hurricane and Storm Damage Reduction Project (which has also constructed 4 new groins as described in the Armor section above). Three years after Hurricane Sandy, 68 percent of the South Shore's sandy beaches (1,332.46 km) have been or are proposed to be modified by sediment placement projects, an increase of 15 percent from the proportion of sandy beaches modified by sediment placement prior to Hurricane Sandy.

Beach Scraping Modifications

In the 3 years following Hurricane Sandy, at least 36.18 km, or 18 percent, of sandy beach on the South Shore of Long Island were modified with beach scraping or grading (Rice 2017). The beach can be scraped or graded to create artificial dunes or levees immediately following a storm event, to remove overwash material from developed or paved areas along the beachfront, or to bury newly constructed geotextile revetments, bulkheads, or sand retaining walls. Several communities on the Atlantic Ocean shoreline of New York have communitywide, 10-year beach scraping or grading permits from New York State Department of Environmental Conservation (NYS DEC). This permit allows the communities to scrape or grade the beach whenever conditions permit. Note that beach scraping or grading material as part of a sediment placement project is excluded, unless the fill material was from an upland source and placed to bury or build an artificial dune/levee and involved scraping of the beach in addition to the fill. Technically every sediment placement project involves scraping or grading of the fill material to the design specifications – this metric was intended to capture habitat modifications resulting from scraping of the natural beach profile and sediment, not strictly fill material placed on top of the natural profile. Beach scraping or grading occurred in all but 8 of the 30 communities along the South Shore in the 3 years since Hurricane Sandy. The beaches in Napeague, Amagansett, Westhampton Beach, and Captree State Park in the Town of Islip were not modified by beach scraping or grading in the 3 years after Hurricane Sandy. Beach scraping or grading modified varying proportions of the sandy beaches in the other communities.

Sand Fencing Modifications

Twelve of the South Shore's 30 communities have had at least 50 percent of their sandy beaches modified with sand fencing since Hurricane Sandy (Rice 2017). A total of at least 57.85 miles (93.10 km) of sandy beach have been modified with sand fencing, or 46 percent of the South Shore's sandy beaches (Rice 2017). At least 530 separate sections of sand fencing were identified on the sandy beaches of Long Island's South Shore in the 3 years following Hurricane Sandy. Only Captree State Park in Islip did not have any sand fencing during the 3-year period.

The sandy beach habitat on the South Shore of Long Island has been modified by anthropogenic activities. Nearly half (45percent) of the beachfront has been developed (Rice 2017). Twenty-eight percent of the beachfront is known to be armored with hard shoreline stabilization structures. More than two-thirds (68 percent) of the beaches have been or are proposed to be modified by sediment placement projects. At least 18 percent of the beaches were scraped or graded in the 3 years following Hurricane Sandy. Nearly half (46 percent) of the sandy beaches were modified by sand fencing between 2012 and 2015.

Three areas in particular on the South Shore of Long Island have been heavily modified in the years since Hurricane Sandy: (1) the beaches from East Hampton Village through the Village of Southampton; (2) Fire Island; and (3) the Rockaway peninsula. Each of these areas has had significant cumulative impacts to its sandy beaches since Hurricane Sandy. In the six adjacent communities of East Hampton Village, Wainscott, the Village of Sagaponack, Bridgehampton, Water Mill, and the Village of Southampton, which includes 29.97 km of sandy beach habitat, a significant number of private and local projects modified the beaches from 2012 to 2015 (Rice 2017). The largest of these were two locally sponsored sediment placement projects constructed in 2013 to 2014 that modified 9.06 km of sandy beach habitat in the Village of Sagaponack, Bridgehampton, and Water Mill. This was the longest contiguous new sediment placement project on the South Shore in the 3 years after Hurricane Sandy. The only previous time that any of these beaches were known to be modified with sediment placement was in 1962 following the Ash Wednesday Storm. Numerous private property owners modified the sandy beaches of their individual properties as well following Hurricane Sandy (Rice 2017). At least 28 individual property owners modified the sandy beaches in this area with hard shoreline stabilization structures in the 3 years after Hurricane Sandy, with 26 contiguous sections of revetments, bulkheads, and/or seawalls identified (either new structures or improvements to pre-existing but previously buried structures). Fifty-seven private property owners are known to have placed sediment on the beach; additional property owners may have placed fill directly underneath their buildings where the storm exposed their pilings and foundations. The same number of private property owners (57) scraped or graded the beach, often to fill and/or bury newly constructed sandbag revetments. Sand fencing is also prevalent in these communities, with 99 separate, contiguous sections of sand fencing totaling 20.36 km identified in the 3 years after Hurricane Sandy.

There are cumulative impacts of these individual projects for this section of sandy beach habitat. In the 2 years prior to Hurricane Sandy, the NYS DEC received coastal erosion management permits for seven and four projects, respectively within the Town of Southampton (covering the communities from the Village of Sagaponack to West Hampton Dunes). In the 2 months following Hurricane Sandy, NYS DEC received 108 permit applications that would allow property owners to modify oceanfront sandy beaches through armoring, sediment placement, or beach scraping/grading in the Town of Southampton. In 2013, 41 permit applications were received. In 2014 only three permit applications were received, and in 2015 none. Virtually all of these state permits were issued, resulting in a significant cumulative impact to the Town's sandy beach habitat. In comparison, within the neighboring Town of East Hampton (covering the communities of Montauk to Wainscott), far fewer NYS DEC permit applications were received: 10 in the 2 months following Hurricane Sandy, 20 in 2014, 8 in 2014, and 1 in 2015.

On Fire Island, there are also cumulative impacts of sandy beach habitat modifications in the 3 years following Hurricane Sandy. Although 98 percent of the island has been modified with sediment placement at least once in the two decades preceding Hurricane Sandy, sediment placement was restricted to Robert Moses State Park at the west end, 11 of the developed communities within the Fire Island National Seashore, and Smith Point County Park at the east end. These projects modified 21.60 km, or 43 percent, of Fire Island between 1992 and 2012, but in smaller lengths spread out periodically over the 20 years preceding Hurricane Sandy. The Federal FIMI project, placed sediment along 30.58 km of Fire Island beaches, modifying 63 percent of the barrier island's sandy beach habitat within an anticipated 3 year time period. In addition to FIMI, four other sediment placement projects have been constructed at Robert Moses State Park since Hurricane Sandy and a breach opened by the storm at Smith Point County Park was closed artificially with fill material immediately after the storm. The National Park Service (NPS) placed a small volume of sediment dredged from the Watch Hill Marina along approximately 183 m of oceanfront beach in Davis Park in 2014. In addition to the habitat modifications resulting from sediment placement projects, 11 of the 17 developed communities on Fire Island constructed TrapBag™ revetments along their entire beachfronts within 1 year of Hurricane Sandy. These revetments increased the length of sandy beach on Fire Island modified by armoring by 7.82 km, or ten times the length of beach armored on the island before the storm. A total of 85 contiguous sections of sand fencing were installed on the island from late 2012 through 2015, modifying 21.97 km, or 43 percent, of the island's sandy beaches.

The sandy beach habitat along the South Shore of Long Island continues to be affected by development, sediment placement projects, armoring, beach scraping, and sand fencing. The length of sandy beach modified by sediment placement increased significantly. Several new miles of hard shoreline stabilization structures have been constructed. A number of communities have 10-year state permits to modify their entire beachfronts with beach scraping as conditions allow and sand fencing modifies nearly half of the South Shore's sandy beaches. The cumulative impacts of these habitat modifications are especially seen along the entire South Shore shoreline.

The breach at Old Inlet on NPS property is currently open, and NPS has decided to postpone moving forward with a consultation and proposal to fill in this breach caused by Hurricane Sandy. This decision is meant, in part, to maintain newly created habitat for piping plovers for a period longer than if the breach were closed immediately through human action. Maintaining this area as is should augment the status of the species in this recovery unit. While it is difficult to quantify the effects of this decision, it is believed to provide a net benefit to the environmental baseline for piping plovers over the life of this project. Current piping plover data collected over the past 3 years as part of the FIMI project shows that use of the Wilderness Area as piping plover nesting habitat has been variable with 4 to 6 nests/year from 2013 to 2016 and 12 nests in 2017 (Carey et al. 2017).

Several restoration projects were identified in the FIMI BO (USFWS 2014) to help offset take that was anticipated to occur from the project. Early successional and foraging habitat was created at Great Gun Beach and early successional habitat was created in the New Made Dredge Spoil Area. Three natural overwash areas (i.e., Pattersquash, Narrow Bay, and Narrow Bay East) were to be maintained as early successional habitat with vegetation control.

Estimates of vegetation in these areas were evaluated in 2013, 2015, and 2016 (Ritter et al. 2015, Carey et al. 2017). By 2015, vegetation growth exceeded the 30 percent vegetation trigger specified in the FIMI BO in all areas except for Great Gun. The Corps manually de-vegetated 98 acres of which 14 acres of vegetation was removed twice at New Made Island over a 2-year period. The Corps obtained a waiver from the Suffolk County Pesticide committee in March 2018 for herbicide application of vegetation for a portion of Great Gun Beach and New Made Dredge Area as test areas. Herbicide application is not generally permitted on county property and the effects on health and the environment are debated by local environmental groups.

In several of the FIMI project areas, landowners have implemented their own dune maintenance measures such as enhancing existing dunes through beach scraping and installation of sand fencing. At Smith Point County Park, silt fencing was placed in areas along Burma Road to prevent piping plover chicks from crossing the road with mixed results. In 2017, chicks were still able to cross the road despite placement of the silt fencing (Carey et al. 2017). In 2018, one chick was killed on Burma Road by a recreational ORV (Papa pers. comm. 2019).

EFFECTS OF THE ACTION

In evaluating the effects of the Federal action under consideration in this consultation, 50 CFR 402.2 and 402.14(g)(3) require the Service to evaluate both the direct and indirect effects of the action on the species, together with the effects of other activities that are interrelated or interdependent with the action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for project justification.

Interdependent actions are those that have no independent utility apart from the action under consideration. The proposed Project will cause direct and indirect adverse effects to listed species within the Project area. Adverse effects are discussed below.

Piping Plover

Direct Effects to Piping Plover

Construction Activities

If major construction activities such as dredging, sediment placement from dredging, beach and dune fill, and breach response are undertaken during the piping plover nesting season there is the potential for significant disturbance and for mortality of plover eggs and chicks. Sand obtained from borrow areas which are 1-2 miles offshore are not expected to impact piping plover since plovers would not be using these areas for forage or nesting habitat. These areas could also be avoided during migration. Impacts may include territory abandonment, disruption of pair bonds, nest abandonment, elevated predation of eggs and chicks due to adults being less attentive, and increased chick mortality due to reduced foraging opportunities. These effects will adversely affect piping plover productivity.

Dredging and construction operations that are within 1,000 m of established piping plover courtship, nesting, and brood rearing areas that were undisturbed during the beginning of the breeding season have the potential to disturb both adults and chicks that use this habitat. Nourishment activities occurring within 1,000 m of chick rearing areas will create the possibility that chicks and eggs will be accidentally crushed. Data from Patterson (1988), Cross (1990), Coutu et al. (1990), Strauss (1990), and Loegering (1992) show that piping plover chicks may move up to 1,000 m from their nest sites, commonly traveling more than 200 m in the first week post hatching. If construction is conducted between mid-summer and mid-fall, it may affect prospecting by post-fledglings. Post-fledging prospecting has been shown (Davis et al. 2016) to affect nest site selection by first-year recruits on the Missouri River.

In order to minimize the effects of construction activities on piping plover, dredging, sediment placement from dredging, beach and dune fill, and breach response (unless emergency consultation criteria are met) will not occur during the breeding season (April 1 to September 1 or until the last chick is fledged after September 1). There may be some work allowed (de-mobilization) during the breeding season if there are weather related stoppages or equipment failure but this would:

- only occur up to three times over the life of the project;
- work would have to conclude by the end of April; and
- a qualified monitor would have to be present to ensure no work is occurring within 200 m of known or potential nesting areas.

Within the FIIS communities, the Corps proposes to maintain a 1,000 m buffer between piping plover nest and construction activities.

<u>Fragmentation and Degradation of Preferred Breeding Habitats (Nesting and Foraging)</u>
The effect of the Project is to reduce the likelihood of natural barrier island habitats, such as blowouts, overwash fans, and large expanses of wide, low slope beaches with variable dune heights and vegetation patterns, as well as bay-to-ocean habitat connectivity. If allowed to form naturally, breeding areas would be characterized by fairly flat, low-lying beaches and increased areas of moist open sandy habitats either on the bayside or from the bay to ocean. The dune and beach fill and the filling of breaches will raise both the berm and dune elevation of the barrier island, reducing the potential for the continued formation of these features and promoting succession of vegetation. Even with the construction of piping plover and non-plover CPFs which will result in a no net loss of sediment to the project area, the construction of dunes can affect the long-term building of island width, and elevation associated with barrier island rollover. Barrier island rollover is primarily driven by moderate-sized storms large enough to produce overwash that penetrates landward of the dune line. Artificial dunes exclude most moderate-sized storms re-scaling the overwash regime to longer temporal and larger spatial scales characteristic of impacts from larger, less frequent storms. The island will no longer undergo a relatively continuous evolution in response to sea-level rise but rather adjusts infrequently with high amplitude disturbances (Magliocca et al. 2015).

Based on long-term observation of piping plover densities on Westhampton beaches reported in Cohen et al. (2009), it is expected that bay-to-ocean overwash habitats at Smith Point County

Park would likely support plover nesting densities of about 1.0 pair per hectare (pr/ha), whereas oceanside or bayside only habitats would likely support 0.5 pr/ha). Bay-to-ocean overwash habitats are extremely important to developing chicks and provide critical areas where reproductive output can be maximized. Inlet and overwash processes are the primary mechanism of sediment deposition into the bay system (Leatherman 1987). The prey base is developed over time in response to complex processes of wind and wave sorting of sediment grain size, texture, and composition, and along environmental gradients. Carey et al. (2017) found that in the Project area invertebrate prey were more available in bay intertidal and ephemeral pools compared to breach fills and restoration areas, and the greatest prey densities were found in overwashes and mudflats.

However, these processes will be significantly interrupted if not precluded entirely due to the Project and existing infrastructure, likely resulting in a reduction in high quality foraging areas that would have otherwise formed via breaching and overwash processes. Most time-budget studies reveal that piping plover chicks spend a high proportion of their time feeding and select bayside foraging habitats (Cairns 1977; Elias et al. 2000). Therefore, it is critical that high quality foraging habitats be maintained and be available. Cohen et al. (2009) reported that reproductive output was typically higher than 1.0 pr/ha when chicks had access to these habitats and predator populations were controlled in highly modified or managed situations.

Adaptive Management

The Project will construct and maintain CPFs throughout the Project's lifespan to provide ocean or bayside only habitat that mimics the effect of storm washover while maintaining the integrity of the dune system. Offset projects constructed or to be maintained as early successional habitat for FIMI have underperformed (based on # pairs/ha predicted in the FIMI BO) likely due to a variety of factors but primarily due to a lack of vegetation management. This PBO is predicated on the commitment of the Corps to adaptively manage these CPFs in order to maximize the amount of piping plover nesting, brooding, and chick foraging habitat. Specific criteria have been developed and included in this PBO that will guide evaluating the effectiveness of the CPFs. If specific triggers are met during this evaluation further steps (also identified) will be required (see Appendix D Adaptive Management and Figure 4 Design Criteria table).

Indirect Effects to Piping Plover

Dune and Beach Maintenance Activities

Dune vegetation planting and snow fences are proposed in the FIIS community portion of the Project area and at Smith Point County Park on the dunes in the piping plover breeding areas. These practices are intended to artificially accelerate growth of dense vegetation and dune growth in order to further stabilize the barrier island (Bocomazo et al. 2011). Sand fencing can affect dune topography and promote the formation of steep, uniform dunes. Replicate treatments using sand fences oriented parallel to the shore, parallel with perpendicular additions, and zigzag (also termed oblique or diagonal) and vegetation plantings at Timbalier Island, Louisiana and Santa Rosa Island, Florida demonstrated appreciable vertical height and volume accumulation over controls (Mendelssohn et al. 1991, Miller et al. 2001). Fences filled rapidly, with half the accumulation over 3 years occurring in the first 6 months in Florida, 64 percent in the first 14 months in Louisiana.

The Corps proposes to plant beach grass at densities of 18 in. on center in the Project area in an effort to stabilize the artificial dunes. Vegetation does serve to trap sand (USACE 1967), but, initially it plays a smaller role than sand fences in sand accumulation (Mendelssohn et al. 1991, Miller et al. 2001). Over time, however, vegetation will continue to accumulate sand through upward and lateral growth (Miller et al. 2001).

Jones (1997) stated that the use of sand fencing or discarded Christmas trees will degrade piping plover nesting habitat if these installations create dune slopes greater than 10 percent. Cohen et al. (2008) noted that once beach grass becomes dense, it may have to be thinned each growing season to retain characteristics of suitable piping plover nesting habitat. Maslo et al. (2011) concluded that recovery and persistence of piping plovers will depend on conservation and restoration of breeding habitats with low slopes, dune heights, and vegetative cover. Piping plovers at the Corps Westhampton Interim Project area placed most of their nests on the bay side of the beach in the first years following the breach and its closing, but re-development and re-vegetation of the bayside shifted nesting to the ocean beach (Cohen et al. 2009). Sand fences and vegetation plantings accelerate loss of sparsely vegetated fore-dune habitats, forcing piping plovers, human beach-goers, and safety risk reduction measures to compete for the same narrowing swath of seaward beach.

Foraging Habitats and Prey Resources

Piping plovers feed on invertebrates, such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989). On oceanfront habitats, terrestrial invertebrates tend to be concentrated in the wrack line (Loegering and Fraser 1995; Hoopes et al. 1992), a habitat used by foraging piping plover adults and chicks (Goldin 1993; Hoopes 1993; Hoopes et al. 1992). Availability of wrack is especially important at sites where ephemeral pool and bayside foraging areas are not available (Elias et al. 2000).

In areas where shoals are dredged, important forage areas will be lost. Where there is sand placement, the Project will temporarily impact foraging habitats and prey resources. The recovery of marine invertebrate prey resources will vary depending on the timing of the fill activity relative to the periods of highest biological activity in these zones of the beach, as well as compatibility of the dredged material with the existing beach substrate. Areas receiving sand in autumn will likely have a longer prey resource recovery period than areas receiving fill in the winter and early spring.

The Corps (1999) examined the effects of beach nourishment on oceanside intertidal benthos in Monmouth County, New Jersey. They found that the recovery time of the intertidal infaunal community was as short as 2 months following renourishment carried out between early August and early October. Recovery time following renourishment in mid-to late-October was reported to take between 2.0 to 6.5 months. However, studies conducted in Florida, North Carolina, and South Carolina show that re-colonization rates by benthic invertebrates are variable and dependent on the time of year in which the nourishment occurs, beginning within days and taking up to 1 year for full recovery of some species (Reilly and Bellis 1983; Bacca and Lankford 1988; Lynch 1994; Peterson et al. 2000). Time frames for intertidal invertebrate recruitment and re-establishment following beach nourishment are generally reported as taking between 12 and 18 months for FIIS beaches (National Resource Council 1995; Land Use Ecological Services, Inc. 2005). Sand placement would be expected to impact prey resources for breeding adults and their chicks for at least one breeding season after every nourishment cycle (currently proposed as a 4 year cycle).

A productivity threshold will be used to assess and address through adaptive management the effects of the project on forage base (see Appendix D Adaptive Management Plan).

Impacts Due to Recreational Activities

Even without the project, recreational use has occurred in piping plover breeding areas. However, by building, maintaining, and vegetating dunes, the habitat used by the birds is confined to those areas that are also the focus of human recreation. Beaches that have a non-engineered dune system are typically much wider due to dunes not occurring in a linear fashion, offering the birds and people much more area to disperse.

Recreational activities that may potentially, adversely affect piping plovers include unleashed pets, fireworks, kite-flying, and increase in garbage. Unleashed pets, such as dogs and cats, can prey on piping plovers. For example, at least two nests were lost to predation by unleashed dogs in the Corps' Westhampton Interim Storm Damage Protection Project Area, Suffolk County, New York, as reported in Houghton (2005).

Wide beaches with little human disturbance at the time piping plovers initiate nesting (March to April) often experience heavy recreational pressure later in the nesting season (May through August), adversely affecting reproductive success by disturbing nesting birds. DeRose-Wilson et. al (2018) found that chick daily survival rates were lowest on weekend days and increased with time since the weekend. Chicks that hatched in low recreational use areas were more likely to survive to fledgling than those hatched in high recreational use areas. Chicks spent less time in moist foraging habitat, less time foraging, and made fewer foraging attempts per minute on weekends than weekdays. In addition, chicks had higher mass at 22 days of age in low use areas. Overall, the degree to which increases in recreational activity result in mortality or disturbances to piping plovers and their chicks depends on the degree to which the protection measures are implemented.

The conservation measures described in this document are intended to minimize the adverse effects from recreational activities. A productivity threshold will also be used to document whether additional actions need to be made to address disturbance.

Predators

The Project would potentially create habitat, affect the movements of, and influence the search behaviors of mammalian (e.g., red fox, raccoon, feral cats) and avian predators (e.g., crows, raptors, gulls) of the piping plover. Modeling by Seymour et al. (2004) using red fox movement data from northern England indicated that risk of fox predation on ground-nesting bird species in long, linear habitats increased with narrowing habitat width, and was sensitive to changes in habitat width of even a few meters.

Wider, irregular barrier island features may allow piping plovers to be more efficient in eluding predators, by reducing the degree of spatial overlap of their habitats. The installation of sand fences and other elevated features such as artificially constructed dune systems may be used as perches for avian predators and increase their search efficiency (e.g., Andersson et al. 2009).

The degree to which increases in predator habitat result in mortality or disturbances to piping plovers and their chicks depends on the degree to which predator control measures are implemented. We would expect some territory desertion, delayed or interrupted courtship, disturbance to incubation with some loss of nests or delayed hatch times, disturbance to foraging chicks with delayed fledging, and lower productivity. Predators are also a cause of chick mortality.

A productivity threshold will also be used to document whether additional actions need to be made to address predation (see Appendix D Adaptive Management).

Seabeach Amaranth:

Beneficial Effects: The placement of beach-compatible sand may benefit this species by providing additional suitable habitat or by redistributing seed sources buried during past storm events, beach disposal activities, or natural barrier island migration. Disposal of sand may be compatible with seabeach amaranth provided the timing of beach disposal is appropriate and the material placed on the beach is compatible with the natural sand. Further studies are needed to determine the best methods of beach disposal in seabeach amaranth habitat (Weakley and Bucher 1992).

Direct Effects to Seabeach Amaranth

Sand placement activities may bury or destroy existing plants, resulting in mortality, or bury seeds to a depth that would prevent future germination, resulting in reduced plant populations. Increased traffic from recreationists and their pets can also destroy existing plants by trampling or breaking the plants.

Indirect Effects to Seabeach Amaranth

The installation and maintenance of a continuous dune line, as opposed to a dune swale, blowout, or overwash-configured project design, will indirectly affect this species by interrupting natural processes that maintain suitable habitat. Interdunal swales and gently-sloping foredune habitats become important when the berm has been narrowed by erosion, as happens following severe coastal storms or toward the end of a recurring sand renourishment cycle.

Dune vegetation planting and snow fence placement, in association with beach nourishment and beach scraping, that have previously occurred within developed portions of the action area, will artificially accelerate growth of dense vegetation that preclude use of habitat by seabeach amaranth. This effect will limit the amount of available suitable habitat for this species and will create suboptimal habitat conditions. Naturally occurring or managed sparse vegetation plots pose limited adverse effects to seabeach amaranth, but artificially planted areas that rapidly grow into dense areas of perennial vegetation precludes use by this species. The planting of perennial grasses will substantially limit the area of seabeach amaranth habitat that is currently available and will introduce added pressures to the species via inter-specific competition. Weakley and Bucher (1992) reported that stabilization of seabeach amaranth habitat allows for succession to a densely-vegetated perennial community, rendering the beaches only marginally suitable for seabeach amaranth. Because seabeach amaranth is susceptible to habitat fragmentation (Weakley and Bucher 1992), destruction of a single and sizeable population could result in local extirpation. Seabeach amaranth is rarely encountered in areas that have been snow fenced

(Weakley and Bucher 1992), but the relationship between snow fencing and seabeach amaranth populations has not been fully investigated on Long Island. Further, vertical sand accretion and burial caused by sand fences are detrimental to seabeach amaranth and their use is contradictory to seabeach amaranth recovery.

The placement of sand in the Project area could bury existing plants if work is conducted during the growing season. Conservation measures proposed by the Corps, if effectively implemented by sufficient numbers of skilled monitors, are expected to minimize losses of seabeach amaranth plants.

The Service anticipates that most, or all, of the seabeach amaranth seed bank will be buried at depths sufficient to significantly reduce or completely prevent germination for one or more growing seasons following renourishment. Preventing or considerably reducing germination in any of the project areas where nourishment will occur, will likely cause additional declines in the Project area and in the State. However, species experts believe that seabeach amaranth seeds are long-lived, and buried seeds in the Project area may remain viable long enough after renourishment to eventually germinate after being exposed by erosion. As mentioned previously, the placement of beach-compatible sand also may benefit this species by providing additional suitable habitat or by redistributing seed sources buried during past storm events, beach disposal activities, or natural barrier island migration. Disposal of sand may be compatible with seabeach amaranth provided the timing of beach disposal is appropriate and the material placed on the beach is compatible with the natural sand. The Service anticipates that even complete burial of the naturally occurring seed bank in a Project area, with complete loss of germination the following year, will not entirely eliminate seabeach amaranth populations from the area since the Corps' conservation measures will ensure that any plants are restored to affected sites.

CUMULATIVE EFFECTS

As used in the context of consultations under Section 7 of the ESA, cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 404.02).

Beach nourishment activities that occur within the boundaries of the NPS would require issuance of a special use permit, a Federal action that would require Section 7 consultation with the Service. All other beach nourishment related projects along the ocean shoreline would require Corps authorization. Therefore, cumulative effects from beach nourishment projects, which include the effects of future State, local, or private actions that are reasonably certain to occur in the action area, would not be likely due to Federal jurisdiction of all activities on Fire Island.

Private projects (not requiring Federal authorization) to stabilize beaches, increase recreation, or build ORV roads are expected to degrade or destroy beach habitats such that piping plover population expansion is curtailed. Large-scale habitat fragmentation is occurring at Smith Point County Park as the Suffolk County Department of Parks Recreation and Conservation further establishes Burma Road as an ORV route within overwash habitat and piping plover breeding areas. This infrastructure, along with unregulated recreational activities such as boat landing and unrestricted pedestrian access, will disturb adults and prevent chicks from accessing bay side foraging habitats. Suffolk County will also maintain and install additional sand fences and plant beach grass, further stabilizing the beaches, and adversely affecting piping plovers and their habitats.

NYSDEC would be expected to continue to issue tidal wetland permits for ocean and bay side stabilization activities, such as bulkhead construction, dune stabilization through sand bags and geotubes, and beach scraping which would decrease sandy beach habitat. However, it is uncertain the extent to which this action is expected to continue into the future to meet the infrastructure needs of the developed FIIS communities, as well as NPS, New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP), and Suffolk County as the proposed project may address some of these future needs.

The NYSOPRHP will likely continue to stabilize their beaches using material from dredging projects or upland sources. Some of these actions will require permits from the Corps Regulatory Branch and would therefore undergo separate ESA consultation. However, some beach maintenance actions that fall outside the Corps regulatory jurisdiction would continue. These would involve beach scraping and the construction of dunes, the installation of sand fences, and the planting of beach grass which would further degrade and fragment nesting habitat.

Local entities would be expected to continue to install sand fences and plant beach grass as part of their effort of beach stabilization. Suffolk County Parks has installed miles of sand fences at Smith Point.

Both NYSOPRHP and Suffolk County Parks would continue to issue thousands of ORV permits for use on their beaches.

Effects of all of these activities will result in losses of individuals (chick mortality) and decreased productivity on an annual basis. These activities will also further reduce habitat carrying capacity which the survival and recovery of the species is dependent on.

Seabeach amaranth would be affected by beach cleaning, installation of sand fencing, and issuance of ORV permits.

Beach raking/cleaning (not described above for piping plover) does occur within Robert Moses State Park and Smith Point County Park. Mechanized beach cleaning adversely affects seabeach amaranth through direct crushing of plants. Vehicles driven within suitable ocean beach habitats for seabeach amaranth can result in crushing of plants.

JEOPARDY ANALYSIS

"Jeopardize the continued existence" of a species, as defined in regulations implementing the ESA, means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery in the wild by reducing the reproduction, numbers, and distribution of that species (50 CFR 402.02). The following analysis relies on four components: (1) status of the species; (2) environmental baseline; (3) effects of the action; and (4) cumulative effects. The jeopardy analysis in this PBO emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within that context that we evaluate the significance of the recurrent actions, taken together with cumulative effects, for purposes of making the jeopardy determination.

Effects to Individuals

There is the potential for piping plover productivity to be affected from the indirect effects of recreational use of beaches. Piping plover chick mortality has been documented due to ORV use in areas where birds are unfledged. Piping plover chicks may be disturbed, potentially rising to the level of take due to a decrease in the ability to forage, particularly on high use weekend days. Predation and alteration of the forage base can also affect individual chick survival. Habitat will be precluded from forming and existing habitat will be degraded through succession of vegetation from the project, including from breach response and from activities described in the Cumulative Effects section (e.g., sand fencing, beach scraping, creation of roads for ORV) affecting breeding and foraging of adult birds and chicks. As habitat degrades, there will also be density-dependent effects on the reproductive output of birds that established fidelity when carrying capacity was higher. Impeding the processes that create and maintain habitat will result in birds not finding places to breed. This impediment is another effect on reproduction. While we cannot quantify the direct effect of the Project on productivity, we have established targets in which the population would, at a minimum, be maintained through the use of a productivity threshold (See Appendix D).

Some numbers of seabeach amaranth plants and seeds will be lost as a result of nourishment activities. All of these direct/indirect impacts to the species will be minimized through the Conservation Measures, and monitored/addressed through adaptive management.

Effects to Populations

As we have concluded that individuals are likely to experience some reductions in their fitness or distribution, we need to assess the aggregated consequences of the anticipated impacts of the exposed individuals on the population to which these individuals belong. We also consider the relative importance of the action area for the species and the populations that make up the species (see Status of the Species). Take of piping plover is estimated at 55 pairs based on the modeling of breaches and overwash that will not occur due to the Project over the next 50 years (see Extent of Anticipated Take below).

One way to understand how the loss of 55 nesting pairs of piping plovers affects the project area, recovery unit, and Atlantic Coast breeding population is to amortize this amount over the Project's 50-year duration. Given the Project's implementation schedule, the loss of the 55 nesting pairs will not occur immediately upon initiation of the Project. The habitat will be affected simultaneously with the construction that occurs over time, yet it is over the course of the entire Project period that the 55 nesting pairs are impeded in their nesting (based on the assumption that without the Project, habitat would decrease and increase sporadically in response to storm events).

Based on this approach, the Project will cause the loss of 1.1 piping plover nesting pairs per year. This represents a loss of 0.78 percent of the piping plover population in the Project area, on an annual basis (1.1 piping plover nesting pairs divided by the average number of pairs (141) from 2000 to 2017). It would also be a loss of 0.27 percent of the piping plover recovery unit on an annual basis (1.1 piping plover nesting pairs divided by the average number of pairs (407.7) from 1986 to 2016).

Alternatively, and although highly unlikely, it is helpful to look at impacts of the loss of 55 pairs annually, which would be an overestimate but is based on the assumption that 55 hectares of habitat would be created during a major storm event without the Project. This would represent a loss of 39.63 percent of the piping plover population in the Project area on an annual basis (55 piping plover nesting pairs divided by the average number of pairs (141) from 2000-2017). It would also be a loss of 13.49 percent of the recovery unit on an annual basis (55 piping plover nesting pairs divided by the average number of pairs (407.7) from 1986 to 2016). The previous two scenarios are unrealistic; however, the Service believes the implementation of CPFs and adaptive management will minimize the effect of the loss of piping plover.

Seabeach amaranth is primarily found in the Fire Island and West Hampton portion of the Project. A limited number of plants are also found in Southampton (east of Shinnecock Inlet). Numbers within states and ranges vary widely. Numbers were high in New York from 2000 to 2003 (244,608 to 114,535 plants) and then decreased steadily to 4,985 in 2016 (see Table 7). Numbers in the Project area from 2010 to 2016 have been low with the highest number of plants found at Hampton Beach in 2014 (113) and the Village at West Hampton Dunes in 2016 (161).

The total number of plants found in the Project area from 2010 to 2016 was 1,317 which is 9 percent of the statewide total. While numbers in the Project area provide only a small contribution to the statewide total, contributions to the statewide populations are of high conservation value and importance due to periods of time when there are low numbers statewide and rangewide. The Federal actions covered in the PBO will reduce seabeach amaranth distribution in the Project area, and may affect numbers and reproduction. Direct damage/loss of plants and seeds will be minimized through the implementation of conservation measures.

Effects to the Species

As we have concluded that the FIMP project area populations of piping plover and seabeach amaranth are likely to experience reductions in numbers, reproduction, or distribution, we need to assess the aggregated consequences of the anticipated loss of long-term viability of the exposed populations on the recovery unit and species as a whole.

Changes in the Long Island population of piping plover account for most of the absolute growth in the recovery unit population through 2007 and most of the decrease that has occurred in the last 10 years. On Long Island, the south shore has been the greatest contributor to population changes (both positive and negative), supporting about 50 percent of the entire recovery unit population. Low abundance in New Jersey and recent steep decreases in abundance on Long Island (especially on the south shore) contribute to the recovery unit's demographic vulnerability. The range of effect from the Project estimated loss of 0.27 percent to 39.63 percent of the recovery unit on an annual basis, and 0.07 percent to 13.49 percent of the Atlantic Coast breeding population on an annual basis. The creation of CPFs, monitoring, and adaptive management (see Appendix D, Adaptive Management) are expected to offset take (with a goal of no net loss of habitat based on the loss of 55 pairs over the life of the Project), and track whether additional actions are needed to prevent significant decline and help meet recovery goals in the recovery unit.

Seabeach amaranth requires extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, allowing it to disperse across the landscape, occupying suitable habitat as it becomes available. Although the size and quality of habitat will be reduced, the Project area will continue to be an important contributor to the rangewide population (24.7 percent of the rangewide population from 2010-2016). Implementation of the conservation measures will help maintain that rangewide contribution.

Conclusion

We considered the current overall status of piping plover (New York-New Jersey Recovery Unit) and seabeach amaranth. For piping plover the status is stable and increasing, however, productivity rates continue to fall short of the recovery criterion for the Atlantic Coast breeding population. Periodic regional declines illustrate the continuing risk of rapid reversals in abundance trends and cumulative effects from landowner actions not covered in this PBO further reduce habitat carrying capacity (e.g., sand fencing, sand stockpiles, and creation of roads in nesting areas). The maintenance of artificial dunes over a 30-year time period (and for 50 years for areas with proactive breach response) will result in long term habitat fragmentation and loss and will also delay or reduce island rollover, resulting in the long term narrowing of the barrier island and a decrease in elevation requiring sediment being placed from outside of the system in a more frequent basis to address sea level rise and erosion.

Seabeach amaranth has maintained populations in six of the seven states range-wide over the last 10 years, however with sustained decreases in the number of plants. We also considered the condition of the species in the action area (environmental baseline). We then assessed the effects of the action covered in this PBO and the potential for cumulative effects in the action area on individuals, populations, and the species. The types of effects of the covered actions are currently considered among the primary factors influencing the status of both species (e.g., habitat loss from coastal engineering).

The conservation measures included in this PBO are intended to minimize the impacts of the incidental take associated with the Project activities and further the recovery of the two covered species. Variation in annual numbers of breeding pairs and productivity for piping plover and numbers of plants for seabeach amaranth is expected. However, the viability of the two covered species is ensured through implementation of conservation measures, creation and maintenance of CPFs to offset habitat loss, adaptive management with triggers, and thresholds to address plover productivity and CPF performance, and a Communications Plan (Appendix E) to provide for frequent communication and coordination given the spatial and temporal scale of the Project and the number of landowners involved. The Corps is responsible for selecting and building the CPFs, attaining the design criteria, and implementing adaptive management (see Appendix D-Adaptive Management).

After reviewing the current status of the piping plover and seabeach amaranth, the environmental baseline for the action area, the effects of the proposed FIMP project, and the cumulative effects, it is the Service's biological opinion that the FIMP, as proposed, is not likely to jeopardize the continued existence of the piping plover or seabeach amaranth. No critical habitat has been designated for these species in the action area, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Definition of Incidental Take

Section 9 of the ESA and the Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. *Take* is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. *Harm* is further defined by the Service to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns such as breeding, feeding, or sheltering. *Harass* is defined by the Service as intentional or negligent actions that create the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. *Incidental take* is defined as take that is incidental to, and not the purpose of carrying out an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered a prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

<u>Extent of anticipated take</u>

Take for the Project, as described in the ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.), results from the loss of plover nesting, brooding, and chick foraging habitat due to the construction of the FIMP project. This take estimate is based on the fact that the Project is engineered to withstand catastrophic storm events and prevent breaching and some washover (described as proactive breach response, maintenance of a +13 ft. NGVD dune and 90 ft. berm). Washover events are still predicted to occur and piping plover habitat will still be created. However, frequency and duration of this habitat creation will be affected precluding the formation of some new habitat for piping plover. Using the methods described below we can reasonably estimate the amount of habitat that will not be created because of initial construction throughout the 50 years of the Project. This estimate does not include the take associated with the reactive and conditional breach response. These actions only occur in response to a specific storm when actions associated with proactive breach response fail (i.e., reactive response) or when the NPS determines that a breach in the Federal tracts or Wilderness Area needs to be closed (i.e., conditional response and wilderness conditional response) (for definitions, see Project Description above). In reactive and conditional breach response, piping plover habitat is formed but removed by closing the breach with a 90 foot-wide berm at an elevation of +9.5 ft. NGVD after the fact. The take associated with reactive and conditional breach response will need to be assessed during the renourishment cycle associated with that event through Tier 2 consultation unless criteria for emergency consultation has been met. However, since a breach would result in open water, closing a breach and maintaining early successional habitat and keeping the berm elevation below 10 feet (3.084 m) could potentially increase habitat. Take was not quantified for recreational impacts, predation, and changes in prey resources. Recreational impacts and predation would occur without the Project and it is unknown what the difference in impacts would be with the Project. Conservation measures were developed (CM 4 a-o, ORV management, and predator control) that are intended to minimize these impacts and decreased productivity is addressed through adaptive management triggers and thresholds.

Analytical Methods

In order to quantify take associated with the proposed action, it is necessary to estimate the amount of breach related washover habitat that will be precluded due to construction of the Project. In 2017, the Corps produced a white paper (see Appendix F) that predicts the acres of breach and washover area that will be prevented over the life of the Project (USACE 2017b). In this paper, the Corps concludes that 2 to 3 breaches would be precluded that would be otherwise expected to occur without the Project (see Table 1, Appendix F). In addition, the Corps concluded that washover areas would still form with or without the project but would decrease because of the project. The expected amount of overwash reduction from the project was estimated using overwash area versus frequency relationships. This estimate was subsequently adjusted to account for the effect of re-vegetation of the original bare-sand area, which has been recently observed to take place at a rate of approximately 10 percent per year. Overall, this analysis suggests that 80 acres of breaches and 30 acres of in-bay overwash would be precluded from forming due to the Project (see Table 3, Appendix F). The Service asked the USGS to review this paper and the feedback provided was that the Corps' analysis was reasonable given the complexity of the topic.

Cohen et al. (2009) evaluated piping plover breeding habitat at the Westhampton breach area from 1992 to 2004[3]. In this study, the authors evaluated ocean-to-bay habitat created by the washover area, and compared it to an adjacent site that only provided ocean side habitat. The authors concluded that the density of plovers on natural washover could be optimized to approximately 1.0 nesting pair/ha. In the reference area for this study, the birds only had access to ocean side habitat. In this case the birds needed twice as much habitat for nesting and foraging, and the density averaged 0.5 nesting pair/ha. For the purposes of this analysis, the Service assumed conservatively that all future breach and washover areas being prevented by the Project would have created optimal habitat for piping plover, resulting in the loss of 1.0 breeding pair/ha. Therefore, 80 acres of breaches and 30 acres of in-bay overwash precluded by the Project results in the loss of 55 pairs of breeding piping plover over the 50-year life of the project (Table 10).

The Service is using loss of habitat as a means to determine the take of piping plover breeding pairs, given the highly applicable data in Cohen et al. (2009). This take will be monitored and assessed on an annual basis in two ways. The first way is through annual monitoring of the design criteria on the CPFs, and the second is monitoring the pairs that are using the Project area.

[3] Two barrier island breaches were formed in Westhampton, New York, in December 1992, following an extratropical storm. The December 1992 Nor'easter along with the Blizzard of 1993 severely impacted the barrier island, causing extensive erosion and the loss of many homes. Two breaches broke through the island, eventually creating an opening larger than the neighboring inlets. One breach was closed by the Corps in two months and the other breach remained open for eight months, growing the entire time. Emergency actions to close the breach were initiated in July 1993. The closure project consisted of placing 1.5 million cubic yards of sand fill {from an offshore source} and installing 1,800 linear feet of steel sheeting. The project was completed in November 1993.

*Note, a hectare consists of approximately 2.47 acres.

If the CPFs fail to fledge a chick or exceed the vegetation threshold, they will no longer be considered offset for piping plover until they meet those criteria. If the number of pairs falls below fully successful criteria, the Corps must evaluate the appropriate action to increase the number of pairs. If the thresholds for pairs and/or productivity are met re-initiation will be necessary (Table 9).

CPF Monitoring, Success, Trigger and Thresholds						
Criteria	**Ocean**	**Bay**	**Fully successful**	**Minimally successful**	**Trigger - for adaptive management**	**Threshold for loss of Credit or Consultation Reinitiation***
CPF success			Each CPF has greater than or equal to 1/2 pair per hectare with each nest fledging at least 1 bird each year of the nourishment cycle.	Each CPF fledges at least 1 bird per year	Trigger for each CPF: an individual CPF fledges less than 1 bird per year in nourishment cycle or vegetation exceeds 17% (Also see Table 2 for design criteriafor other potential design failure)	An individual CPF fledges less than 1 bird per year in nourishment cycle or vegetation exceeds 30%; meet design criteria (Table 2)
Timing of CPF's and acreage			CPFs exceed no net loss for each nourishment cycle. Greater than 50% of acreage achieved within the first 15 years. Greater than 100% achieved in 30 years.	At least 1 new CPF created per nourishment cycle, 50% of acreage achieved within the first 15 years,100% achieved in 30 years	Less than 1 CPF created per nourishment cycle. CPFs do not continually meet design criteria (See Table 2)	Find alternative CPF or **re-initiate**
Project area Pairs			Combined project area is above 141 pairs annually.	Combined project area maintains or is above 141 pairs annually	Combined project area achieves between 86 pairs and 140 pairs annually	Project drops below baseline (baseline is average nesting pairs (141 pairs) from (2000-2017) minus allowable take (55 pairs)) = **85 pairs** for the project site. **Re-initiation necessary.**
Productivity			Project area maintains a productivity of greater than 1.5 fledglings per nest for at least 5 consecutive years.	Project area maintains productivity greater than 1.24 over 10 years and productivity does not fall below 1.06 for three consecutive years	Productivity falls below 1.06 in 3 consecutive years. And cause is either unknown or can be attributed to project activities.	Productivity falls below 1.06 for four consecutive years in the project area. And cause is either unknown or can be attributed to project activities. **Re-initiation necessary**. Productivity falls below 1.24 over 10 years. And cause is either unknown or can be attributed to project activities. **Reinitiation necessary.**
**** Re-initiaton trigger is highlighted in blue: CPF no credit Threshold highlighted in yellow***						

Table 9. CPF Monitoring, Success, Trigger and Thresholds

Predicted Washover Area	Washover area lost due to Project (ac)*	Washover area lost due to Project (ha)	Predicted take from Project (1 pr./ha in optimal washover habitat)**
Fire Island Lighthouse Tract/Kismet to Corneille Estates	**31**	**12.55**	**13**
Talisman to Blue Point Beach/Davis Park	**27**	**10.93**	**11**
Smith County Park	**23**	**9.31**	**9**
Sedge Island/Tiana Beach	**16**	**6.47**	**6**
West of Shinnecock Inlet	**10**	**4.05**	**4**
Overland + In Bay overwash	**30**	**12.14**	**12**
Total	**137**	**55.44**	**55**
*** Source ACOE, 2017b FIMP Evaluation of Cross Island Sediment Transport** **** Estimated loss of nesting pair based on habitat needs described in Cohen et al., 2009. Nesting Density and Reproductive Success of Piping Plover in Response to Storm and Human Created Habitat Changes. Pairs of plovers are rounded to the nearest whole number.**			

Table 10. Take analysis based on habitat that will not form because of the FIMP project.

Offset of Take

Because the Project is specifically intended to stop breaches and washover from occurring, the Corps believes that allowing or creating ocean to bay washover habitat is contrary to the purpose and need of the Project. Therefore, all habitat created as offset for the take of piping plover habitat is proposed ocean side only or bay side only, and would result in a sub-optimal density of 0.5 pair/ha, therefore 110 hectares of early successional habitat is needed to fully offset the take of the Project. The one exception Democrat Point East, which has ocean-to-bay habitat. So, 1.0 pr/ha will be considered if monitoring shows that the CPF is supporting that density. In order to maintain and potentially increase the piping plover breeding population in the Project area, the Corps is responsible for selecting and building CPFs that provide nesting habitat with access to foraging habitat. The Corps is responsible for designing and building CPFs using the design criteria (Table 4) to mimic the early successional features of washover areas. Because natural washover will be minimized, these areas will need active management (e.g., vegetation control and predator management) to maintain early successional features and suitable breeding habitat throughout the life of the project. It is possible the proposed CPFs could meet and exceed the goal of no net loss of piping plover pairs if they are used fully by plovers and managed as early successional habitat. Annual monitoring of nesting piping plovers is required per this PBO to confirm that the CPFs are providing the expected benefits.

No-net-loss credits are based on habitat, therefore, as long as the CPF is minimally successful the Corps will receive full credit (See Appendix D Adaptive Management for details and conditions). The Corps has the latitude to substitute or create new CPFs if CPFs that were predicted to meet the design criteria do not successfully fledge birds. The intention is that densities and credits can go up and down as conditions change without having to re-initiate formal ESA consultation when a CPF does not meet its intended goal. However, the adaptive management criteria also provide clear incentives (i.e., productivity and pair thresholds) to the Corps to maximize the piping plover productivity per CPF, without penalizing the Corps for not achieving the nesting density identified in the offset analysis for any given CPF (see Appendix D Adaptive Management).

Take Offset based on proposed Coastal Process feature*				
Coastal Process Feature (CPF)	**CPF acres early successional habitat created (AC)**	**CPF acres early successional habitat created (HA)**	**Maximum expected pairs (0 .5 PR per HA of suboptimal CPF created habitat)****	**total nest that have fledged chics 2013-2017*****
Site 1 Democrat Point West	**69.6**	**28.17**	**14**	**4**
Site 2 Democrat Point Bayside East of Jetty	**27**	**10.93**	**5**	**2**
Site 3 Dune Field West of Field 4	**18.7**	**7.57**	**4**	**1**
Site 4 Clam Pond	**8**	**3.24**	**2**	**0**
Site 5 Atlantique to Corneille	**14.1**	**5.71**	**3**	**0**
Site 6 Talisman	**14**	**5.67**	**3**	
Site 7 Pattersquash Reach	**49.4**	**19.99**	**10**	**5**
Site 8 New Made Island Reach	**100.1**	**40.51**	**20**	**8**
Site 10 Great Gun Reach	**107.7**	**43.58**	**22**	**7**
Total	**379**	**165.35**	**83**	**27**
***USFWS, 2017c draft proposed coastal process features for FIMP. Acreage is estimated based on conceptual design**				
**** Estimated loss of nesting pair based on habitat needs described in Cohen et al, 2009. Nesting Density and Reproductive Success of Piping Plover in Response to Storm- and Human- Created Habitat Changes**				
***VA Tech monitoring reports 2014-2017				

Table 11. Predicted number of hectares offset by proposed CPFs meeting design criteria.

<u>Other Factors That May Lead to Take</u>

Adverse effects of the Project also include a temporary reduction in prey resources, increased recreational activities, and the creation of habitat conditions that may facilitate an increase in predators.

The Atlantic Coast Piping Plover Recovery Plan has productivity goal of 1.5 fledged chicks per pair for 5 consecutive years (USFWS 1996). Cohen (2009) studied productivity of nests in West Hampton and concluded that productivity remaining above 1.24 was sufficient to maintain a stationary population of piping plover. Likewise, VA Tech, as funded by the Corps, has been monitoring post Hurricane Sandy (2012 to 2017) and has preliminary data suggesting that a stationary population is possible in the Project area with productivity between 1.06 and 1.24 pair per nest (Carey et al. 2017). To determine whether prey base, recreational activity, and predation are contributing to a decrease in productivity, productivity will be monitored. No Take is expected as long as productivity remains above 1.06 fledged chicks per pair in any 3-year rolling period and averages greater than 1.24 fledged chicks per pair over a 10-year period. If the average productivity falls below 1.24 fledged chicks per pair over any 10-year period, consultation under ESA will need to be re-initiated to evaluate additional take. However, if productivity falls below 1.06, for 3 consecutive years, and there is a correlation through monitoring that altered prey base, predators, or recreational activities are contributing to this sustained decline, this will trigger discussion between the Corps and the Service on what conservation actions are needed to address the decline. If productivity falls below 1.06 for 4 consecutive years, consultation will need to be re-initiated under ESA to evaluate additional take due to sustained decreased productivity levels that would result in a decrease in the population.

Post-construction monitoring of nesting piping plovers is required by this PBO to confirm that the CPFs are providing the expected benefits. If the monitoring demonstrates that the CPFs are not functioning as predicted, adjustments to design and construction will be discussed and alternative projects will be considered through the described adaptive management process (see Appendix D Adaptive Management).

The contingency plan outlined under Conservation Measure 3 vi (a-k) allows de-mobilization to proceed in a nesting area during the nesting season until May 1 on three occasions over the life of the Project, with numerous protective measures in place, including a system of protective buffers. The proposed protective measures and buffers are sufficient to eliminate most direct disturbances to nesting birds. For demobilization activities (i.e., removal of all pipeline material, machinery, equipment, and construction crews, and stockpiling sand), the Corps proposes 200-m nest buffers for motorized activities, with a monitor present. The 200-m buffer is consistent with distances generally recommended by the Service for such highly disruptive activities. Courtship and territorial areas are likewise afforded 200-m buffers by the Corps, an appropriate precaution as total site abandonment is the most likely result of severe disturbance during the earliest part of the nesting season.

On each occasion in which demobilization activities occur in a nesting area or potentially suitable nesting area, the Service anticipates that nesting piping plovers will be disturbed one time. After one disturbance, the Corps protective measures are expected to enable field monitors and construction crews to respond by adjusting buffers or activities as needed to avoid a second disturbance. The Service anticipates that the nature of each disturbance will be minor and brief, and will not result in actual injury or death of birds (i.e., temporary interruption of courtship behaviors or foraging, flushing an incubating bird off its nest, brief defensive display of adults or distress behavior of chicks). Therefore, the disturbances are not included in the total take estimate. Up to three brief, minor instances of harassment are expected to occur from demobilization activities due to direct disturbance of nesting birds from Project activities, if de-mobilization occurs outside of the time-of year restriction in a nesting area.

<u>EFFECT OF TAKE</u>

The Service has determined that the level of take anticipated, as described above, from the Federal actions covered in this PBO is not likely to result in jeopardy to the species.

REASONABLE AND PRUDENT MEASURES

Reasonable and Prudent Measures (RPMs) are measures considered necessary or appropriate to minimize the amount or extent of anticipated incidental take of the species. The Service has concluded that the RPMs identified below are necessary and appropriate to minimize impacts of incidental take of piping plovers and seabeach amaranth. The RPMs and associated terms and conditions are non-discretionary, and must be implemented by the Corps.

The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to demonstrate clear compliance with the RPMs and their implementing terms and conditions in this PBO; or (2) fails to require Corps staff, contractors, or permittees to adhere to the terms and conditions of the incidental take statement; or (3) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse.

RPM1: Report on the progress of the action and its impact on the species, as part of an annual adaptive management report (See Appendix D. Adaptive Management).

RPM2: Work cooperatively with the Service to schedule sand placement to minimize the potential for having to de-mobilize equipment due to equipment failures or weather delays and to allow maximum recovery time of benthic prey resources, development of the wrack line, and adjustment of the beach profile.

RPM3: Develop and implement an annual monitoring program throughout the Project area to monitor breeding pairs and productivity, to track incidental take over the life of the project, and to determine whether additional management is needed to address decreased productivity from indirect effects (e.g., human recreation, alteration of prey resources, and predation). CPFs will be monitored annually to evaluate whether they meet the design criteria and need to be adaptively managed.

RPM4: Meet with the Service and landowners each year for the life of the Project before and after each breeding season to discuss symbolic fencing plans, any issues with the implementation of Conservation Measures, how CPFs performed the previous year, and whether any triggers or thresholds have been exceeded or are on track to be exceeded, necessitating adaptive management or possible ESA consultation re-initiation.

RPM5: Ensure that all landowners, Project engineers, contractors, and construction staff are fully informed of and compliant with all Conservation Measures, RPMs, and Terms and Conditions.

RPM6: Work with local beach managers to encourage their increased cooperation and participation in endangered species protection.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. Exercise care in handling any specimens of dead or injured piping plovers to preserve biological material in the best possible state. In conjunction with the preservation of any specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or non-viable specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is

reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

The discovery of a dead bird must be reported to the following Service Law Enforcement office:

Senior Resident Agent
U.S. Fish and Wildlife Service
Division of Law Enforcement
70 East Sunrise Highway, Suite 419
Valley Stream, NY 11581-1233

2. Meet with the Service 3 months prior to a nourishment cycle to develop a written plan that includes specifications for piping plover nesting areas of concern within and adjacent to the planned Program activity. Nourishment will be scheduled and sequenced to avoid or minimize construction activities (demobilization) during the nesting season within known piping plover nesting areas or areas likely to be occupied during the affected nesting season.

3. Follow the Communications Plan to improve communication, cooperation, and transparency, and to provide a mechanism for addressing disagreements on an issue.

4. Develop a formal monitoring plan for piping plover and for monitoring of CPFs intended to offset piping plover habitat at least 1 year before the Project occurs for Service review.

5. The Corps will fund annual monitoring of piping plovers. Estimates of costs/timing of actions needed for adaptive management should be provided to the Service prior to initial construction based on results of VA Tech monitoring data from FIMI and funding for adaptive management will be requested by the Service from the Corps during construction cycles (during dredge cycles occurring every 2 years or nourishment occurring every 4 years).

REINITIATION-CLOSING STATEMENT

This concludes formal consultation on the action outlined in the request. As provided 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded (see Adaptive Management); (2) new information reveals effects of the agency action that may affect listed species in a manner or to an extent not considered in this Opinion or the project has not been initiated within 5 years of issuance of this PBO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

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APPENDIX A. SPECIES NOT LIKELY TO BE ADVERSELY AFFECTED

The project spans approximately 83 miles in length and will be conducted periodically, in phases affecting no more than 3 miles of shoreline at one time, over a 50 year period. Human presence and heavy equipment including bulldozers, graders, trucks, all-terrain-vehicles, pumps and piping may be in use on sections of beach being renourished or constructed. These impacts are anticipated to be temporary, localized, and last for several weeks as areas are constructed.

The project area contains suitable habitat for the red knot (*Calidrus canutus rufa*; threatened) and the species has been observed in the project area. For Suffolk County, New York, Ebird (2019) reports the highest average count of 31.7 birds during the first week of August. Niles et al. (2008) does not identify the project area as being significant for red knot; however, areas outside of the project area, to the west, including the Jamaica Bay Wildlife Refuge are identified as "secondary areas" and "suitable" because of horseshoe crab spawning.

The project activities described above may diminish or reduce the diversity of prey items on the beach and dredging of shoals and breach response could remove potential foraging habitat. Active construction may occur year round including periods of use by red knot. If construction occurs during the time of year that red knot may still be migrating through the area (September or October), birds may be temporarily displaced out of the construction area.

Given the small number of red knots using the area and the availability of the adjacent foraging areas, the Service believes adverse effects to red knot are insignificant or discountable.

The roseate tern (*Sterna dougallii dougallii*; endangered) has occasionally been observed roosting on Fire Island with very few pairs breeding on the islands within the back bays (Great South, Moriches and Shinnecock Bays). Most nesting activity on Long Island occurs at Great Gull Island, approximately 13 nautical miles from Montauk Point. Nesting in the project area is not anticipated. The roseate tern's nesting season is consistent with that of the piping plover. In the unlikely event that a roseate tern nest occurs in the project area, time of year restrictions described in the conservation measures for the piping plover (CM 3 a iii) should result in adverse to the roseate tern being avoided.

APPENDIX B. DETAILED DESCRIPTION OF THE PROJECT

1.11 Inlet Management Plan

The selected inlet management plans at all three inlets consists of continuation of the existing authorized projects and additional dredging of the ebb shoal, outside of the navigation channel, with downdrift placement. Sediment placement will create a berm. No dunes will be constructed with the sediment. Ebb shoal dredging would occur in conjunction with scheduled Operations and Maintenance (O&M) dredging of the inlets and would increase sediment bypassing and reduced future renourishment fill requirements.

Fire Island Inlet

O&M on 2-year interval (Authorized)

819,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at Gilgo Beach

214,000 cy (per O&M event) dredged from channel and expanded deposition basin and placed updrift at Robert Moses State Park (RMSP)

327,000 cy (per O&M event) dredged from ebb shoal and placed downdrift at to offset deficit

Moriches Inlet

O&M on 1 year interval (Authorized)

98,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at Smith Point County Park (SPCP)

73,000 cy (per O&OM event) dredged from ebb shoal and placed downdrift at Gilgo Beach to offset sediment deficit

Despite being authorized for O&M on a 1-year interval, Moriches Inlet has only been dredged about once every 4 years. Even if the inlet continues to be dredged once every 4 years there should be sufficient sediment available from the channel, deposition basin, and ebb shoal to meet the renourishment requirements at Mastic Beach 1A (MB-1A).

Shinnecock Inlet

O&M on 2-year interval (Authorized)

170,000 cy (per O&M event) dredged from channel and deposition basin and placed downdrift at Sedge Island, Tiana Beach, and West of Shinnecock (WOSI)

105,000 cy (per O&M event) dredged from ebb shoal and placed downdrift at Smith Point County Park (SPCP) to offset sediment deficit

Placement of sediment downdrift at Sedge Island, Tiana Beach, Shinnecock Park West (SPW), and West of Shinnecock Inlet (WOSI) will maintain the natural longshore transport, increase sediment bypassing, increase stability of these shorelines, and reduce future Proactive Breach Response Plan (BRP) fill requirements.

Inlet Management – Initial Construction

Initial construction quantities include the estimated quantity to restore the channel to its authorized dimensions as well as dredging of the ebb shoal for bypassing. Initial construction quantities were estimated based on expected sedimentation in the authorized channel over the period between the last dredging operation and start of construction for FIMP in 2018. Table 1 shows the date of last dredging event and the number of years in which sedimentation may occur.

Table 1. Number of Years between Last Inlet Dredging Operation and FIMP

Inlet	Sedimentation (years)	Last Dredging Event
Fire Island Inlet	4	Fall 2014
Moriches Inlet	6	Fall of 2012
Shinnecock Inlet	4	March of 2014

Sedimentation rates at the three inlets are based on the existing conditions sediment budget at each inlet. These sedimentation rates may lead to an over estimation of the initial dredging quantities since the anticipated time between dredging events is larger than normal and the sedimentation rates may decrease over time as the inlets shoal. Table 2 presents the initial construction dredging volumes and placement locations for the Inlet Management Plan. Actual dredging volumes and distribution of the fill placement will be refined during Preconstruction Engineering and Design (PED) based on surveys of the inlets and beach prior to construction.

Table 2. Inlet Management Bypassing and Backpassing (Initial Construction)

Location	Subreach	Fill Length (ft.)	Volume (cy)
Fire Island Inlet – Initial Construction			
Gilgo Beach		12,700	2,126,469
RMSP	GSB-1A	12,000	214,531
Total			2,341,000

Location	Subreach	Fill Length (ft.)	Volume (cy)
Moriches Inlet – Initial Construction			
SPCP-West	MB-1A	6,900	67,470
SPCP-East	MB-1B	13,100	330,840
Great Gunn	MB-2A	4,500	113,691
Total			512,000
Shinnecock Inlet – Initial Construction			
SPW	SB-1D	3,400	99,350
WOSI	SB-2B	2,700	449,650
Total			275,000

Inlet Management – Life Cycle

Following the initial dredging of the inlets to authorized depths, future maintenance quantities are expected to on average equal the values outlined in the recommended plan. A summary of the dredging quantities and placement locations for bypassing and backpassing for all future dredging operations is shown in Table 3. As described earlier, if Moriches Inlet is dredged at a longer interval than it is expected, the majority of the dredged material will be placed at SPCP-West.

Table 3. Inlet Management Bypassing and Backpassing (Life Cycle)

Location	Subreach	Fill Length (ft.)	Volume per Operation (cy)
Fire Island Inlet – 2 year Dredging Cycle			
Gilgo Beach		12,700	1,145,469
RMSP	GSB-1A	12,000	214,531
Total			1,360,000
Moriches Inlet – 1 year Dredging Cycle			
SPCP-West	MB-1A	6,900	22,490
SPCP-East	MB-1B	13,100	110,528

Location	Subreach	Fill Length (ft.)	Volume per Operation (cy)
Great Gunn	MB-2A	4,500	37,982
Total			171,000
Shinnecock Inlet – 2 year Dredging Cycle			
Sedge Island	SB-1B	5,600	47,419
Tiana Beach	SB-1C	3,400	28,790
SPW	SB-1D	3,400	28,790
WOSI	SB-2B	2,700	170,000
Total			275,000

Nonstructural Plan

The plan for the mainland will remain consistent with the Plan Non-Structural Plan 3 (NS-3) that provides for storm risk management for a total of 4,134 structures.

Following Hurricane Sandy, multiple post storm recovery programs have proposed nonstructural (NS) treatments within the study area. The specific NS scale and treatment will be reviewed and refined in the PED phase to ensure that the treatment proposed and the applicable population are appropriately identified.

The locations are conceptually shown in Figure 8 in the main text (in red) based on the 10-year flood plain.

Breach Response Plans

Breach response plans include Proactive Breach Response with 13 ft. dune/90 ft. berm, Reactive Breach Response with 9.5 ft. berm only template, Conditional Breach Response with 9.5 ft. berm only template, and Wilderness Conditional Breach Response with 9.5 ft. berm only template.

Proactive Breach Response Plan

The Proactive Breach Response Plan is an alternative that includes measures to take action to prevent breaches from occurring at locations vulnerable to breaching, when a breach is imminent. This alternative provides a beach cross-section area that is comparable to the Breach Response Alternatives, and smaller than a beach fill alternative.

These plans are not specifically designed with the intent of minimizing ocean shorefront development from overwash, wave attack, or storm induced erosion losses, and the plans allow for a greater level of overwash and dune lowering during a storm, so long as the overwash extent is below the threshold that would result in breaching.

This feature includes the +13 ft. NGVD dune section. A typical Proactive BRP section is shown in Figure 1.

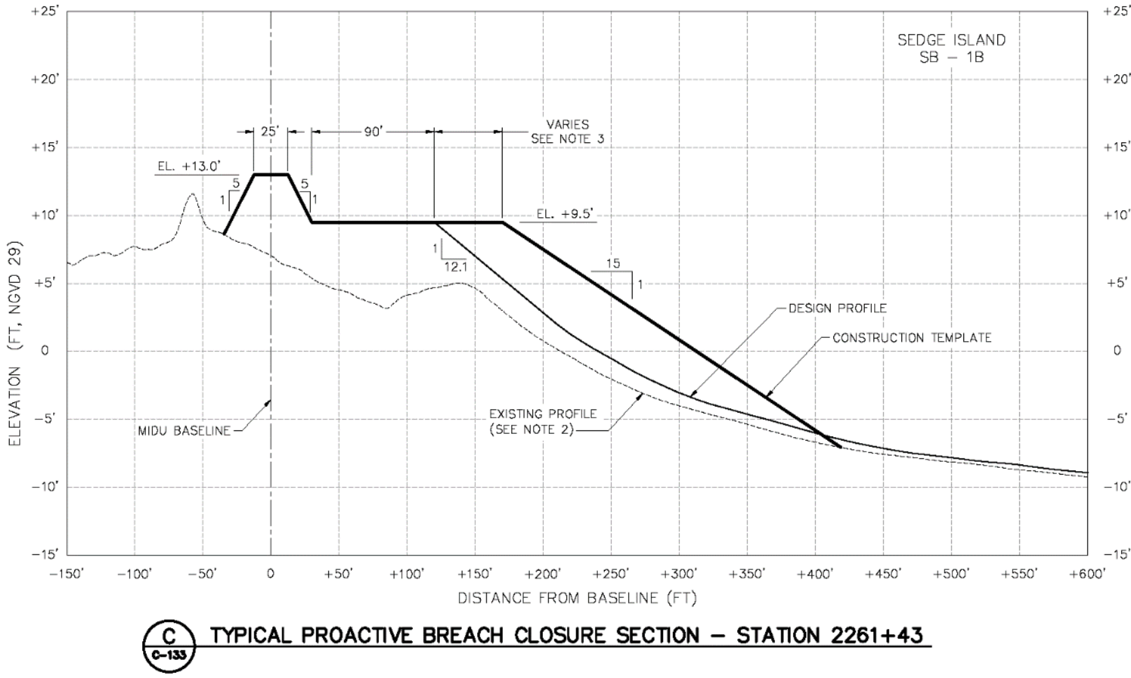


Figure 1. Typical Proactive BRP Section

Initial Construction (Proactive BRP)

Four of the Proactive BRP reaches were recently nourished as part of either FIMI (Fire Island Lighthouse Tract (FILT), SPCP- East, and Great Gunn) or the WOSI Interim Project (WOSI). Due to the relatively low erosion rates at FILT, SPCP-East, and Great Gunn it is not expected that Proactive BRP would be required at any of these locations at the time of initial construction in 2018. However, due to the relatively high erosion rates at WOSI, initial Proactive BRP beach fill placement is expected to be required at this location. Initial construction volumes at WOSI were estimated following the same approach as the Beach Fill Plan reaches based on predicted losses.

At the other Proactive BRP reaches along Shinnecock Bay an assessment was conducted to determine if the existing effective beach width is below the Proactive BRP thresholds warranting beach fill placement during initial construction of FIMP. LiDAR data collected by the Corps on November 14, 2012 (2 weeks following Hurricane Sandy) was used to define the existing conditions. The effective beach width at three reaches, Sedge Island, Tiana Beach, and SPW was below the threshold. Initial construction volume estimates at these three locations were derived from quantity takeoffs based on the 2012 LiDAR data and Proactive BRP template. Average-end-area calculations were completed based on profiles spaced 200 feet apart. All Proactive BRP quantities include 15 percent overfill and 15 percent contingency/tolerance. No advance fill is included in the Proactive BRP.

A summary of the initial construction quantities for the Proactive BRP is provided in Table 4.

Table 4. Proactive BRP Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Sedge Island	SB-1B	BA 5Bexp	10,200	1,007,463
Tiana Beach	SB-1C	BA 5Bexp	3,400	131,220
SPW	SB-1D	BA 5Bexp	3,400	187,148
SPW	SB-1D	SI	3,400	99,350
WOSI	SB-2B	SI	2,700	449,650
Total				1,875,000

Reactive and Conditional Breach Closure

Reactive Breach Response is to be implemented in response to the occurrence of a breach at any locations along the barrier islands, except within several of the large federally-owned tracts within Fire Island National Seashore (FIIS). Conditional Breach Response applies to a subset of these FIIS tracts, in which the breach response team will assess if the breach is closing naturally or if mechanical closure is required. An additional criteria has also been added for the Wilderness Area, where a Wilderness Conditional Response has been developed.

The Reactive and Conditional BRP templates are similar. In several locations (as described on the reach description table 11 in the main text of this biological opinion) the Reactive template has a +13 ft. NGVD dune to reduce the potential for rebreaching. In other locations, the reactive template is a berm-only plan. Both breach closure templates have a berm width height of +9.5 ft. NGVD. A typical breach closure section at Old Inlet West and WOSI is shown in Figure 2. Since the intent of the closure is to fill a breach, a specific berm width has not been established. Instead the intent is to generally match the berm width with conditions prior to the breach and within adjacent areas. The design foreshore slope is 1 on 12 which is also the same slope defined for the beach fill design templates. The design profile below MHW would match the representative morphological profile corresponding to each specific location. At a minimum, bayside slopes and shorelines would generally match the preexisting adjacent shorelines. Based on the existing topography the bayside design slope was selected as 1 on 20 from the bayside crest of the berm to an elevation of +6 ft. NGVD. It is recognized that breaches result in the transport of sand that introduces sediment into the bay, and that the mechanical closure of breaches would reduce the amount of sediment that could be transported. The breach closure plans will include an additional quantity of sand on the bayside of the barrier island to replicate this process, enhancing the long-term stability and resiliency of the closure action. The features cannot be designed in advance because they are dependent on the location of the breach and the conditions present. A quantity was estimated, but the exact/optimal placement would be designed during PED after a breach has occurred.

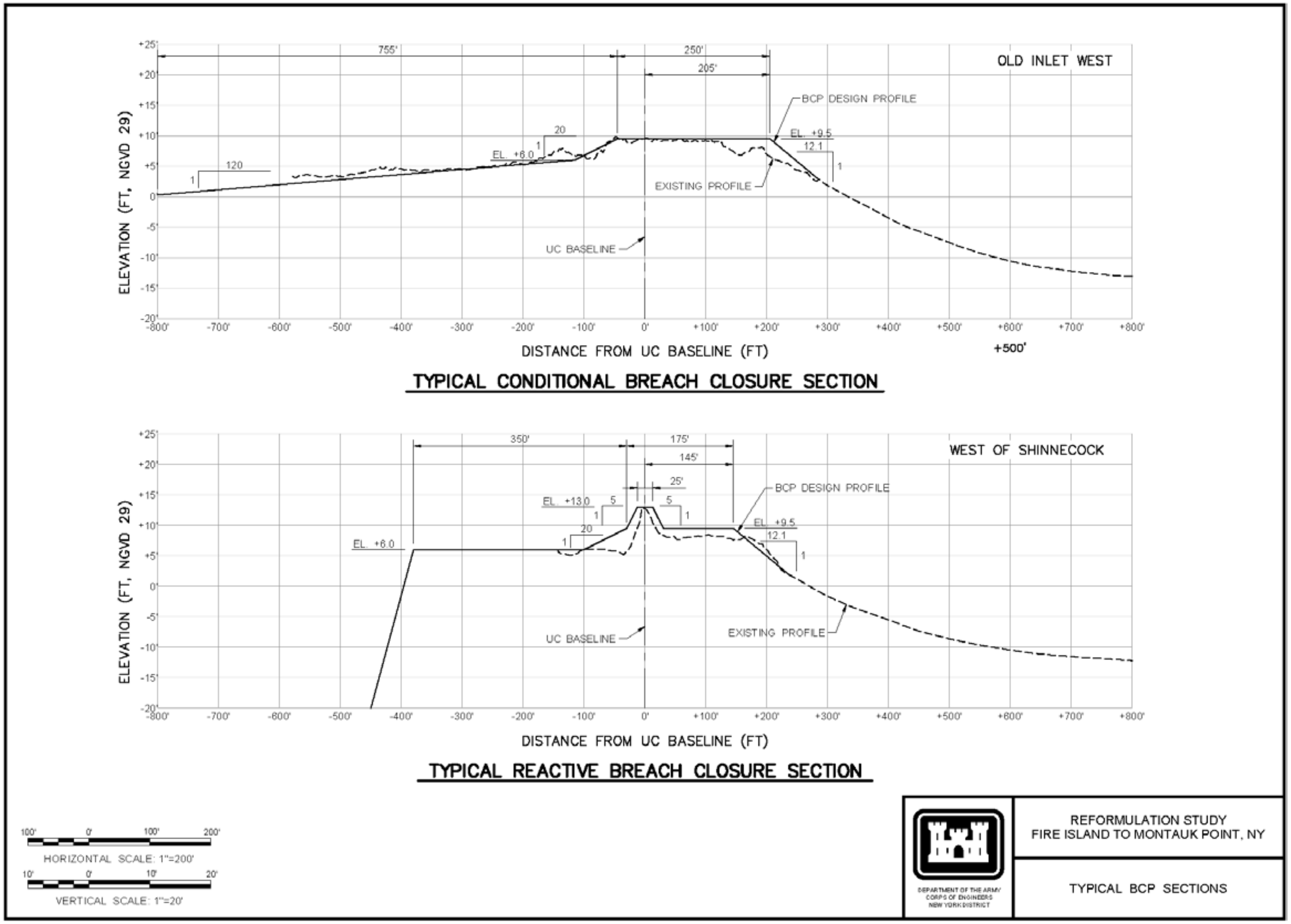


Figure 2. Typical Breach Closure Sections

Beach Fill Plan

Specific locations for backfill are outlined in Table 5. The extent of beachfill east of Fire Island (Cupsogue County Park, Pikes and Westhampton) remained consistent with the earlier Tentative Federally Supported Plan (TFSP). There have been refinements in the beachfill plan on Fire Island: 15 ft. dune/90 ft. berm included only along the developed shorefront areas of the barrier backed by Great South Bay and Moriches Bay on Fire Island, and on the barrier from Moriches Inlet to Quantuck Channel; East of Shinnecock to Montauk Point Coastal Storm Risk Management (CSRM) features are identical to National Economic Development Plan (NED) Plan; 6,440,283 CY (initial beachfill quantity); and renourishment (all 30 years - 30,360,800 CY).The Berm Only and Medium design templates are used in the selected plan. The Medium design template has a dune with a crest width of 25 feet and dune elevation of +15 feet NGVD. Both design templates have a berm width of 90 feet at elevation +9.5 feet NGVD. The proposed design (not construction) foreshore slope (from +9.5 to +2 feet NGVD) is roughly 12.1 on 1. Below MHW (roughly +2 feet NGVD) the submerged morphological profile, representative of each specific reach, is translated and used as the design profile. Figure 4 and Figure 5 show typical design section for the Berm Only and Medium design templates.

Table 5 provides an overview of the dune elevations by location along the selected plan.

The Berm Only template is applicable to areas in which the existing condition dune elevation and width reduce the risk of breaching but have eroded beach berm conditions. The 90 feet design berm provides protection to the existing dunes and ensures vehicular access during emergency response and evacuation. The Berm Only template is applied to RMSP (GSB-1A) and SPCP-West (MB-1A).

The Medium template was identified as having the highest net benefits and provides for approximately a 50-year level of risk reduction. The Medium template is applied to the areas with the greatest potential for damages to oceanfront structures.

Advance fill is a sacrificial quantity of sand which acts as an erosional buffer against long-term and storm-induced erosion as well as beach fill losses cause by “spreading out” or diffusion. The required advance berm width was computed based on representative erosion rates and expected renourishment interval, 4 years. The representative erosion rates were calculated based on the historical sediment budget, volumetric changes in measured profiles between 1988 and 2012, the performance of recent beach fill projects, and anticipated beach fill spreading.

The Beach Fill Plan includes taper (transition) to reduce end losses and increase the longevity of the fill. The taper lengths along Fire Island are consistent with the plans for FIMI. Tapers are accounted for in initial and renourishment volume estimates.

Table 5. Beach Fill Locations

Location	Subreach	Plan Component	Max Fill Length (ft.)	Ren. Fill Length (ft.)	Dune Elv. (ft., NGVD)
RMSP	GSB-1A	Beach Fill & Inlet Mgmt.	16,600	12,000	-
Kismet to Lonelyville	GSB-2A	Beach Fill	8,900	8,900	15
Town Beach to Corneille Est.	GSB-2B	Beach Fill	4,500	4,500	15
Ocean Beach to Seaview	GSB-2C	Beach Fill	3,800	3,800	15
OBP to POW	GSB-2D	Beach Fill	7,300	7,300	15
Cherry Grove	GSB-3A	Beach Fill	3,000	3,400	15
Fire Island Pines	GSB-3C	Beach Fill	6,500	7,000	15
Water Island	GSB-3E	Beach Fill	1,200	1,600	15
Davis Park	GSB-3G	Beach Fill	4,200	5,000	15
SPCP-West	MB-1A	Beach Fill & Inlet Mgmt.	6,300	6,300	-
Cupsogue	MB-2C	Beach Fill	4,300	2,000	15
Pikes	MB-2D	Beach Fill	9,600	9,600	15
Westhampton	MB-2E	Beach Fill	10,900	10,900	15

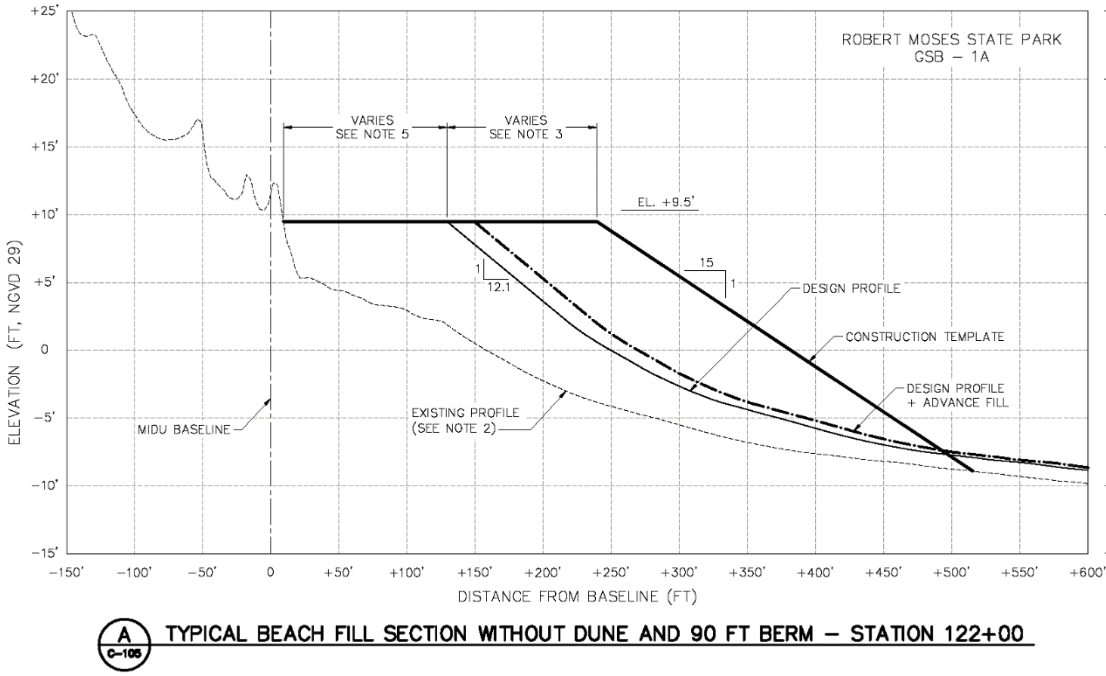


Figure 4. Berm Only Beach Fill Design Profile

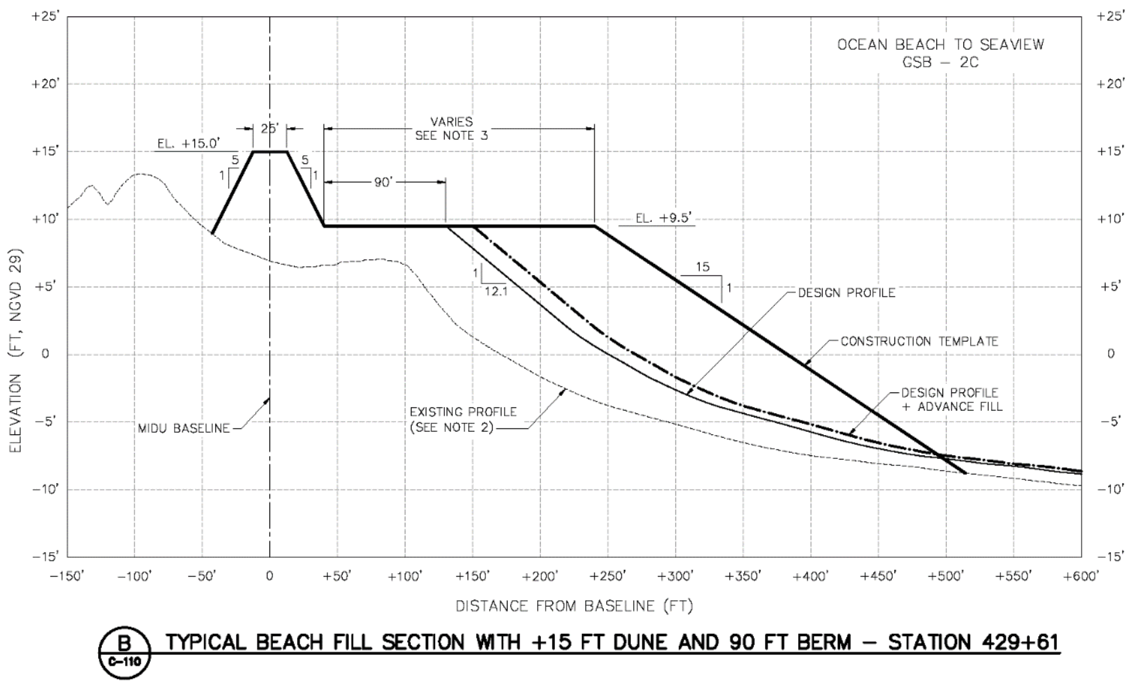


Figure 5. +15 FT NGVD Dune Design Profile

Beach Fill Plan – Initial Construction

With the exception of Cupsogue, all of the beach fill design reaches have been recently constructed or are soon to be under construction as part of the Fire Island to Moriches Inlet

(FIMI) Stabilization Project or Westhampton Interim Project. Therefore, it is not possible to use the existing beach conditions to estimate initial construction beach fill volumes at the start of the FIMP project in 2018. Instead, initial beach fill volumes were estimated based on predicted sediment losses following the completion of the FIMI and Westhampton Interim projects.

It is noted that advance fill was included in the design and construction of FIMI and the Westhampton Interim Project. Therefore, by restoring sediment losses the initial construction estimates for FIMP indirectly include advance fill. All beach fill quantity estimates include advance fill, 15 percent overfill, and 15 percent for contingency/tolerance. A summary of the initial construction quantities for the Beach Fill Plan is shown in Table 6.

Table 6. Beach Fill Plan Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	159,432
Town Beach to Corneille Estates	GSB-2B	2C	4,500	40,484
Ocean Beach to Seaview	GSB-2C	2C	3,800	33,538
OBP to POW	GSB-2D	2C	7,300	65,396
Cherry Grove	GSB-3A	2H	3,400	12,117
Fire Island Pines	GSB-3C	2H	7,000	125,751
Water Island	GSB-3E	2H	1,600	5,589
Davis Park	GSB-3G	2H	5,000	107,029
Fire Island Subtotal				549,000
Cupsogue	MB-2C	4C	2,000	107,265
Pikes	MB-2D	4C	9,600	464,834
Westhampton	MB-2E	4C	10,900	351,015
Westhampton Subtotal				923,000
Total				1,472,000

Notes: RMSP and SPCP-West are not shown here because the required fill material is coming from the Inlet Management Plan.

Beach Fill Plan – Life Cycle

The required renourishment fill volumes have been computed based on representative erosion rates and expected renourishment interval, 4 years. The representative erosion rates were calculated based on the historical sediment budget, volumetric changes in measured profiles between 1988 and 2012, the performance of recent beach fill projects, and anticipated beach fill spreading. All beach fill quantity estimates include advance fill, 15 percent overfill, and 15percent for contingency/tolerance. A summary of the renourishment quantities for the Beach Fill Plan is provided in Table 7.

Table 7. Beach Fill Plan - Renourishment Quantities Per Operation

Location1	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	318,864
Town Beach to Corneille Estates	GSB-2B	2C	4,500	161,935
Ocean Beach to Seaview	GSB-2C	2C	3,800	134,153
OBP to POW	GSB-2D	2C	7,300	261,584
Cherry Grove	GSB-3A	2H	3,400	48,470
Fire Island Pines	GSB-3C	2H	7,000	503,003
Water Island	GSB-3E	2H	1,600	22,354
Davis Park	GSB-3G	2H	5,000	428,117
Fire Island Subtotal				1,878,000
Cupsogue	MB-2C	4C	2,000	71,510
Pikes	MB-2D	4C	9,600	6,197,792
Westhampton	MB-2E	4C	10,900	468,020
Westhampton Subtotal				1,159,000
Total				3,038,000

1RMSP and SPCP-West are not shown here because the required fill material is coming from the Inlet Management Plan.

Sediment Management Plan

The sediment management plans include the establishment of two feeder beaches at Potato Road and Downtown Montauk (Montauk Beach) as shown in Table 8. The construction template is a berm with a variable width at an elevation of +9.5 feet NGVD 29. The berm width will be determined based on a fill volume of either 120,000 cy for Potato Road or 400,000 cy for Downtown Montauk. As described previously, these volumes are designed to offset the long-term erosion within these areas, and to maintain a stable beach configuration. A typical section of the sediment management feature is shown in Figure 6.

Table 8. Sediment Management Fill Volumes

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Potato Road	P-1G	BA 6I	3,300	120,000
Downtown Montauk	M-1F	BA 8D	5,000	400,000
Total				520,000

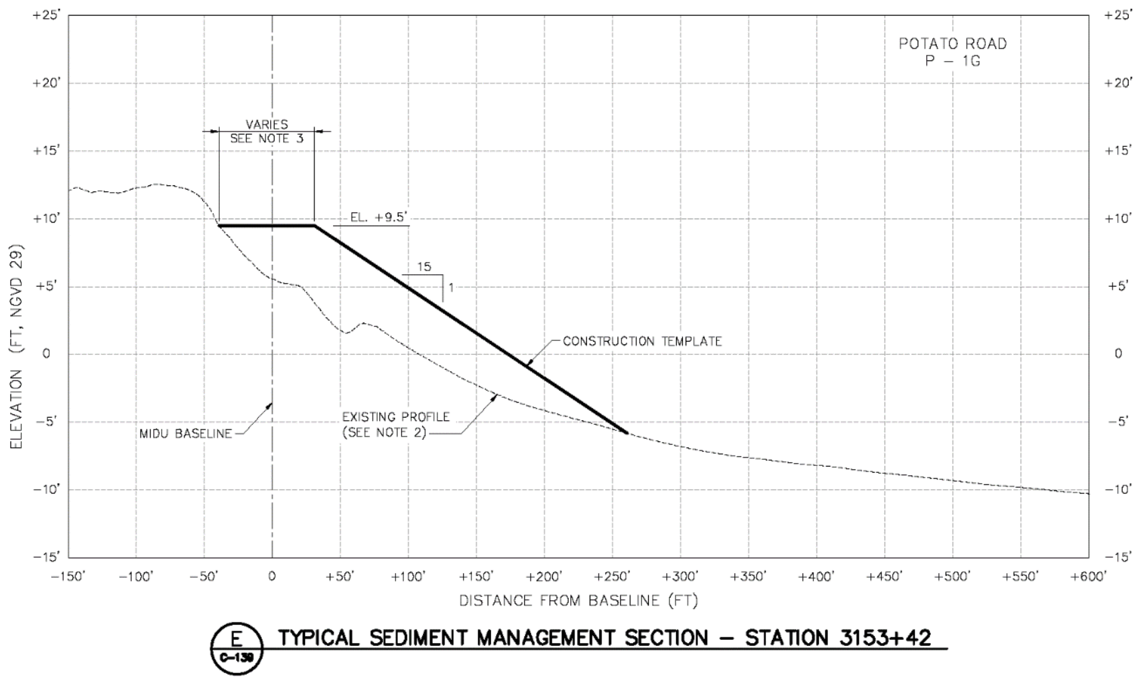


Figure 6. Typical Sediment Management Construction Template

Groin Modification Plan

The groin modification plan is an adapted version of the TFSP, amended to reflect public and agency input following the publication of the draft report and the National Environmental Policy Act (NEPA) process, and updated economic analysis. It includes:

Removal of two groins at Ocean Beach. Final plan to be determined.

Coastal Process Features

Coastal Process Features (CPFs) are required for the interagency mutually acceptable plan in order to achieve risk management in back bay areas through no net loss of overwash sediment due to dune placement on barrier. The Corps will place 4.2 M cy of sediment in conjunction with renourishment efforts over 30 years, with no responsibility for Operation, Maintenance, Repair, Replanement and Rehabilitation (OMRR&R) between renourishments.

CPFs currently include:

Features which compensate for impacts to Alongshore Transport (groin modification or shortening, sand bypassing, sediment management);

Features which compensate for reductions in Cross-Island Transport (overwash fan and bay beach creation or reinforcement);

Features which compensate for sediment loss to the bay or Bay Shoreline Processes by establishing resilient and sustainable uplands.

FIMP CPFs bolster the CSRM functions provided by natural coastal landforms and complement the FIMP risk management features. Damages in the FIMP study area are calculated by projecting the degree of flooding that will occur on the mainland of Long Island due to breaching and overwash of the barrier island. Risk management measures, such as berms and dunes constructed on the ocean coastline, are proposed to reduce breaching and overwash. CPFs complement these measures by adding volume to the bay side of the barrier system. Judicious siting of CPFs will ensure that risk management features do not unnecessarily interrupt barrier island processes such as barrier island rollover. Rollover is the gradual movement, in geologic time, of a barrier island as sediment is eroded from the ocean coast and transported by overwash to the bay shore. The rollover process contributes to barrier island integrity and robustness and supports the natural CSRM functions provided by heathy barrier island systems. Without CPFs, the FIMP risk management features would reduce the amount of sediment that enters the back bay environment, interrupt the rollover process, and result in the degradation of the barrier island's natural CSRM functions. Therefore, CPFs are recommended along the back bay coast to maintain the long-term sustainability of the barrier island system and reduce vulnerability of the barrier island to breaching, which will reduce water levels within the bay, and the resulting flooding.

Placement of approximately 4.2 M cy of sediment in the backbay environment, and the resulting habitat is necessary to satisfy the mutually acceptable requirement of "no net loss" of sediment transport into the back bay. The CSRM features proposed to reduce risk along the shoreline will reduce the frequency of overwash and breaching, which naturally transports sediment into the back bay. The most CPFs are a negotiated Section 7 compensation for the interruption in natural coastal processes which result from the shoreline measures, and are necessary to achieve a mutually acceptable plan to reduce risk in the study area and increase the sustainability of the barrier island.

All CPFs will be constructed in conjunction with the construction of the FIMP project, and renourished when the beachfill features are renourished, currently proposed as a 4-year cycle.

The restoration framework identified five key physical processes to be targeted for restoration, including: 1) alongshore transport, 2) cross-island transport, 3) dune growth and evolution, 4) bay shoreline processes, and 5) estuarine circulation and water quality. There are a number of measures that can be applied to achieve these restoration objectives.

The following is a brief discussion of the types of specific restoration that can be undertaken to achieve these restoration objectives.

The table 17 provides an overview of the sites. Some of the sites have been identified as CPFs, which contribute to strengthening the integrity of the barrier island. There are additional sites that have been identified as candidate sites for ESA offsets, which do not specifically meet the Corps definition for a CPF.

Site #	Type	Status	source	Coastal Process Features	Location	Measure	Action	Status
	Summary of Candidate Environmental Sites							
1	ESA	Landowner support	New	Democrat Point - west of Jetty	Robert Moses State Park	veg management / pond opening	design	RMSP supports plan features, concerned about: 1) attracting more boaters (channel opening), destabilizing the area, maintenance requirements for the park.
2	ESA	Landowner support	New	Democrat Point - bayside, east of jetty	Robert Moses State Park	maintain plover habitat	design	RMSP supports a plan for this area
3	ESA	Landowner support	New	Dunefield east of Field 2, between 2/3	Robert Moses State Park	maintain plover habitat	design	RMSP believes no action required now, would support future deveg. Concerned about maintenance requirements
4	ESA	No landowner support	New	Dunefield west of field 4	Robert Moses State Park	maintain plover habitat	stop	RMSP does not believe this location provides viable habitat
5	Mitigation	Not Supported in FIMP	New	Wetland North of Field 5	Robert Moses State Park	Reestablish wetland function	stop	RMSP supports, but believes effort would be large
6	CPF	Support	New	Clam Pond	Saltaire	reestablish spit	design	understanding is that Saltaire supports. Is confirmation necessary?
7	CPF	Support	Existing	T25 Atlantique to Corneille	Atlantique	bayside beach, overwash	design	understanding is that NPS supports, based upon Dec meeting
8	CPF	Needs landowner support	New	Point O' Woods	Point O' Woods	bayside beach		
9	CPF	Support	Existing	T2 Sunken Forest / Sailor's Haven	Sunken Forest	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
10	CPF	Support	New	Carrington Tract	Carrinngton Tract	bayside beach, possible sill	design	understanding is that NPS supports, based upon Dec meeting
11	CPF	Support	Existing	T3 Regan Property / Talisman	Talisman, FI Pines	bay beach, overwash, possible sill	design	understanding is that NPS supports, based upon Dec meeting
12	CPF	Support	New	Talisman	Talisman	Overwash fan / spit / feeder beach	design	understanding is that NPS supports, based upon Dec meeting
14	CPF / ESA	Needs landowner support	New	Smith Point County Park Pattersquash	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports feature, concerned about 1) allowing use of berma road, 2) long-term maintenance requirements
15	CPF / ESA	Needs landowner support	New	Smith Point County Park Breach / New	Smith Point County Park	Overwash, Spit & maintain	design	SPCP supports, same concerns as above
16	CPF	Needs landowner support	New	Smith Point County Park Marsh	Smith Point County Park	reestablish degraded wetland height	design	SPCP supports marsh efforts
17	ESA	Needs landowner support	New	Great Gunn Shorefront	Smith Point County Park	Maintain the FIMI ephemeral pool	design	SPCP supports, with concerns regarding the maintenacne requirements
18	ESA	Needs landowner support	New	Cupsogue	Cupsogue County Park	bayside beach, relocate recreation use	stop	SPCP does not support
19	ESA	Unlikely, Landowner Issues	New	Westhampton Spit	Westhampton	veg management / regrading	stop	property is currently in litigation over ownership
20	CPF	Needs landowner support	New	Sedge Island	Southampton	reestablish wetlands		
21	CPF	Needs landowner support	New	Tiana - mermaid lane	Southampton	establish bayside sandspit / wetland		
22	CPF	Needs landowner support	Existing	T7 Tiana - Rd K	Southampton	establish bayside sandspit / wetland		
23	CPF	Needs landowner support	Existing	T8 WOSI	Southampton	establish bayside beach		
	CPF / ESA	Needs to be developed	New	Tiana - WOSI	Southampton	setback dune, shorefront natural process		County Parks would like to discuss further, believes there is quality habitat.
24	CPF	Needs to be developed	New	Pepperidge Hall Wetland	Islip	reestablish degraded wetland, add height		
25	CPF	Needs to be developed	New	Fireplace Neck / Bellport Wetlands	Brookhaven	reestablish degraded wetland, add height		
26	CPF	Needs to be developed	New	Mastic Beach Wetlands	Brookhaven	reestablish degraded wetland, add height		
27	CPF	Needs to be developed	New	Forge River Wetlands	Brookhaven	reestablish degraded wetland, add height		

Longshore Sediment Transport.

Restoration of the longshore process can help to maintain a more natural shoreline condition, and a more natural beach profile. Restoring these processes can reduce the need for future activities to address erosion in these areas. Restoration of longshore transport can be undertaken through a number of options. The most effective way to accomplish this is in the removal of the barrier. If removal of the barrier is not possible, modification of the structure (such as shortening or notching) could be considered. If neither of these options are viable, it may be possible to consider replicating the processes that would have naturally occurred (i.e. bypassing sand at the inlets).

Cross-Island Transport

Opportunities for restoration of this habitat are similar to those identified for longshore transport. The preferred approach would be to allow these processes to continue unimpeded, or promote the occurrence of these processes in areas where they have been negatively impacted. If these processes can't be restored through this process, it may be possible to replicate the processes as they would have naturally occurred (i.e. the construction or restoration of overwash habitats).

Dune Development and Evolution.

In much of the study area, the long-term trend is erosional. In these areas, under a natural condition, the dunes would tend to evolve and migrate over time. To varying degrees, the existing dunes are unable to do this, due to development, and the past efforts undertaken to maintain a beach and dune to protect existing development. Past decisions have impacted the natural growth and evolution of the dunes. Significant amounts of dune habitat have been degraded, due to the presence of buildings on the dunes. Opportunities for restoration of the dune process include removing buildings to provide the necessary space to allow for dune evolution. If this is not viable, the next available opportunity could be construction of a dune, or enhancement of an existing dune that is allowed to move over time through phased acquisition.

Bayside Shoreline Processes

The possible solutions for restoring these bayside processes include removal of the actions that have caused or are causing the disruption. There may be some areas where removal of bayside bulkheading or filling of channels could be a viable option. In areas where this is not feasible, the next set of scenarios could consider reducing the impact of these structures through modification of the structure. Lastly, it may be possible to replicate the processes, through the infusion of material to offset the impact of the disturbance.

Estuarine Circulation

The magnitude of human changes within the estuary, and the complexity of the interaction between the physical processes and the environment make it difficult to identify a clear objective for the restoration of estuarine circulation processes, although the topographic and bathymetric changes within the estuaries can provide clear opportunities for habitat restoration

CPF Site 1 Democrat Point- West of Jetty-Reach GSB-1A

The most notable CPF need at this location is reducing the elevation to allow for more frequent overwashing. This will allow sediment into the bays through cross-island transport. It will create early successional habitat, providing nesting and foraging areas for shorebirds. A section along the bayside of Democrat Point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east is high. Vehicle access to the beach is provided via open cuts in the dune located to the east of the area surveyed for this CPF. The negative impacts to cross-island transport (overwash) will be offset through the lowering of the berm and dune elevation to 6 feet.

Removal of approximately 187,000 cy (70 ac) of material

Regrade 70 ac of early successional habitat

Specific activities would include regrading approximately 70 acres to an elevation of +6 foot elevation as well as removal of approximately 187,000 cys of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevations in this area this CPF is expected to positively affect cross-island transport as well as create early successional habitat for shorebirds and threatened and endangered species.

CPF Site-2 Democrat Point Bayside East of Jetty-Reach GSB-1A

The most notable CPF needs at this location is reducing the elevation to allow for more frequent tidal effects. This will control the amount of vegetation that recut in this area. It will create early successional habitat, providing nesting and foraging areas for shorebirds.

Recreational use in the area is high. Vehicle access to the beach is provided via open cuts located to the east of the area surveyed for this CPF. The negative impacts to cross-island transport will be offset through the lowering of the berm and dune elevation to 6 feet.

Removal of approximately 52,000 cy (32 ac) of material

Regrade 32 ac of early successional habitat

Specific activities would include regrading approximately 32 acres to an elevation of +6 foot elevation as well as removal of approximately 52,000 cy of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevation in this area this CPF is expected to create early successional habitat for shorebirds and threatened and endangered species.

CPF Site-3 Dune Field East of Field 2-Reach GSB-1A

The most noteworthy CPF need at this location is reducing the amount of vegetation to allow for nesting shorebirds. It will create early successional habitat, providing nesting and foraging areas for shorebirds. A section along the bayside of Democrat Point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east is high. The negative impacts from limiting overwash transport will be offset through the de-vegetation of the dune.

De-vegetate 15 ac of early successional habitat

Specific activities would include regrading approximately 15 acres to remove the vegetation. The vegetation of the existing community will be modified, but the overall width/size would not. By reducing the vegetation in this area, this CPF is expected to positively affect early successional habitat for shorebirds and threatened and endangered species.

CPF Site-4 Dune Field West of Field 4-Reach GSB-1A

The most noteworthy CPF need at this location is reducing the amount of vegetation to allow for nesting shorebirds. It will create early successional habitat, providing nesting and foraging areas for shorebirds. A section along the bayside of Democrat Point will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh and tidal pools.

Recreational use in the area to the east and the west is high. The negative impacts from limiting overwash transport will be offset through the de-vegetation of the dune.

De-vegetate 5 ac of early successional habitat

Specific activities would include regrading approximately 5 acres to remove the vegetation. The vegetation of the existing community will be modified, but the overall width/size would not. By reducing the vegetation in this area this CPF is expected to positively affect early successional habitat for shorebirds and threatened and endangered species.

CPF Site-5 Wetland North of Field 5-Reach GSB-1A

The most prominent CPF need at this location is reducing the elevation to allow for more frequent overwashing. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will be lowered to reconnect the tidal cycle that has sustained the emergent low marsh in this area.

Recreational use in the area to the south is high. The negative impacts to cross-island transport will be offset through the lowering of the bayside elevation to +3 feet.

Removal of approximately 7,600 cy (15 ac) of material

Regrade 15 ac of early successional habitat

Specific activities would include regrading approximately 15 acres to an elevation of +3 foot elevation as well as removal of approximately 7,600 cy of material. The grade of the existing community will be modified, but the overall width/size would not. By reducing the elevations in this area this CPF is expected to positively affect cross-island transport as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert to a low marsh.

CPF Site-6 Clam Pond-Reach GSB-2A

The most prominent CPF need at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to +3 elevation. Approximately 56,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shore birds. The area will also provide CSRM through wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and backbay circulation will be offset through this CPF.

Placement of approximately 56,000 cy (8 ac) of sand

Creation of 8 ac of early successional habitat

Specific activities would include placing approximately 56,000 cy of sand to an elevation of +3 foot elevation. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-7 Atlantique to Corneille-Reach GSB-2B

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the highly developed communities. The most prominent CPF need at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 12,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 12,000 cy (9 ac) of sand

Creation of 9 ac of early successional habitat

Specific activities would include pumping approximately 12,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-8 Point O' Woods-Reach GSB-2D

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the highly developed communities. The most prominent CPF needs at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 8,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shore birds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

Placement of approximately 8,000 cy (21 ac) of sand

Creation of 21 ac of early successional habitat

Specific activities would include pumping approximately 8,000 cy of sand to an elevation of -1 to -2 elevation. However, due to the velocity of water flow in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of upland habitat. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well.

CPF Site-9 Sunken Forest and Sailor's Haven-Reach GSB-2E

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the highly developed communities. The most prominent CPF need at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 24,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

Placement of approximately 24,000 cy (35 ac) of sand

Creation of 35 ac of early successional habitat

Specific activities would include pumping approximately 24,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-10 Carrington Tract-Reach GSB-3B

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the highly developed communities. The most prominent CPF nees at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 26,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 26,000 cy (16 ac) of sand

Creation of 16 ac of early successional habitat

Specific activities would include pumping approximately 26,000 cy of sand to an elevation of -1 to -2 elevation. However, due to the velocity of water flow in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of upland habitat. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well.

CPF Site-11 Regan Property/Talisman-Reach GSB-3D

The most prominent CPF need at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to -1 to -2 feet elevation. Approximately 3,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 3,000 cy (11 ac) of sand

Creation of 11 ac of early successional habitat

Specific activities would include placing approximately 3,000 cy of sand to an elevation of to -1 to -2 feet. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-12 Talisman-Reach GSB-3D

The most prominent CPF need at this location is reestablishing the sand spit. The area will have an engineered living structure on the north side to hold the sand in place. However, due to the velocity of water flow and wind in this area, vegetated gabion (or other) bioengineering structures may be necessary to ensure the long-term stability of the site and protection of the spit habitat. The area will be filled to -1 to -2 feet elevation. Approximately 6,500 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

Placement of approximately 6,500 cy (14 ac) of sand

Creation of 14 ac of early successional habitat

Specific activities would include placing approximately 6,500 cy of sand to an elevation of -1 to -2 feet. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-14 Pattersquash Reach MB-1B

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope, and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large saltmarsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the sand spit. The area will be filled to -1 elevation (12 ac) in conjunction with vegetation removal of about 45 ac. Approximately 25,000 cy of sand will be placed in the bay. It will create 57 ac of early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 25,000 cy (12 ac) of sand

Maintain 45 ac of early successional habitat

Specific activities would include placing approximately 25,000 cy of sand to an elevation of -1 feet and mechanically/chemically de-veg the area. By creating the spit in this area this CPF is expected to positively affect cross island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-15 New Made Island Reach MB-2A

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area.

Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the sand spit. The area will be filled to -1 elevation in conjunction with vegetation removal of about 100 ac. Approximately 17,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 17,000 cy (100 ac) of sand

Creation of 100 ac of early successional habitat

Specific activities would include placing approximately 17,000 cy of sand to an elevation of -1 feet. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-16 Smith Point County Park Marsh Reach MB-2A

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope, and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the wetland. The surrounding marsh areas have linear man-made channel that bisects the site from east to west. The area will be elevated approximately 3 inches to establish higher elevation to allow for wetland species to root. Approximately 100,000 cy of sand will be placed in the wetland. It will create early successional habitat, providing areas for native plants species to establish where before they could not survive due to inundation. The area will also provide CSRM through higher elevation of the barrier island and wave attenuation.

Recreational use in the area is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 100,000 cy (250 ac) of sand

Creation of 250 ac of early successional habitat

Specific activities would include fine spraying of sand approximately 100,000 cy to increase the elevation by 3 inches throughout the wetland. By enhancing the wetland in this area this CPF is expected to positively affect cross-island transport and back bay sediment circulation as well as create early successional habitat for wetland species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as a low marsh.

CPF Site-17 Great Gun Reach MB-2B

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope, and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large saltmarsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the early successional habitat through with vegetation removal of about 100 ac. It will create early successional habitat, providing nesting and foraging areas for shorebirds.

Creation of 100 ac of early successional habitat

Specific activities would include mechanical/chemical vegetation removal of about 100 ac. By creating this early successional habitat this CPF is expected to positively affect habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert back to a natural dune system.

CPF Site-18 Cupsogue MB-2C

This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large salt marsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the early successional habitat through with vegetation removal of about 100 ac. The area will be filled to -1 elevation in conjunction with vegetation removal of about 11.5 ac. Approximately 18,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Creation of 11.5 ac of early successional habitat

Placement of approximately 18,000 cy (3.33 ac) of sand

Specific activities would include mechanical/chemical vegetation removal of about 8.2 ac and placing 18,000 cy to create 3.3 ac. By creating this early successional habitat this CPF is expected to positively affect habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert back to a natural dune system.

CPF Site-19 Westhampton Spit Reach MB-2E

Omitted property is in litigation

CPF Site-20 Sedge Island-Reach SB-1B

This area is a highly developed with residential housing. Vegetation loss and substrate disturbance from pedestrian use of uplands is noticeable throughout the site. Despite the recreational uses of the area, the adjacent wetlands are of relatively high quality. The most prominent CPF need at this location is reconnecting the bisected wetlands. The surrounding marsh areas have linear man-made channel that bisects the site from east to west. The area will be filled to +2 elevation to tie into adjacent marsh elevations. Approximately 125,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through wave attenuation and strengthening the barrier island through widening it.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 125,000 cy (16.5 ac) of sand

Creation of 16.5 ac of early successional habitat

Specific activities would include placing approximately 125,000 cy of sand to an elevation of +2 foot elevation. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as early successional habitat or allowed to convert to a low marsh.

CPF Site-21 Mermaid Lane-Reach SB-1C

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the developed communities. The most prominent CPF need at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 9,500 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 9,500 cy (15 ac) of sand

Creation of 15 ac of early successional habitat

Specific activities would include pumping approximately 9,500 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-22 Tiana-K-Road-Reach SB-1C

The predominant need at this site is the severely eroding bayside shoreline banks as well the bayside shoreline and estuarine processes that have been negatively impacted and appear to be most affected by hard structures such as extensive bulk heading, boat slips, buildings, and various human activities associated with the developed communities. The most prominent CPF need at this location is creating the sand lobe. The area will be filled to -1 to -2 elevation. Approximately 20,000 cy of sand will be placed in the bay. It will create early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM by strengthening the width of the barrier island.

Recreational use in the area to the east and west is high. The negative impacts to cross-island transport and back bay circulation will be offset through this CPF.

Placement of approximately 20,000 cy (12 ac) of sand

Creation of 12 ac of early successional habitat

Specific activities would include pumping approximately 20,000 cy of sand to an elevation of -1 to -2 elevation. By creating the lobe in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. It is possible that low marsh volunteer species will establish in this area as well. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

CPF Site-23 WOSI Reach SB-2B

The WOSI restoration site currently provides parking and access to the beach for recreational activities. Bayside, the site is characterized by an asphalt parking lot, relatively steep bayside dunes, and impacts to bayside dunes caused by pedestrian access from the parking lot to the bay shoreline. A relatively high quality saltmarsh is located in the northeastern portion of the site, however the marsh does contain invasive Phragmites. The site is at a relatively narrow portion of the barrier island, however, the dunes and beach in this area are relatively wide and stable due to beach renourishment activities that were recently completed for the site. This area is a public recreational park, and use of the area is high. Vegetation loss and substrate disturbance from pedestrian and vehicle use of uplands and dune areas is significant throughout the site. Despite the recreational uses of the area, the adjacent dunes and beach are of relatively high quality in terms of vegetation, slope, and width. The bayside shoreline and estuarine processes at the site have been negatively impacted from various human uses in the area. Impacts have directly and indirectly affected the shoreline, intertidal, and aquatic areas of the site and, in particular, have altered hydrologic connection to a relatively large saltmarsh community on site. Evidence of erosion is present on the bayside shoreline, but is not as severe as other sites such as Reagan and Sunken Forest. The most prominent CPF need at this location is reestablishing the sand spit. The area will be filled to -1 elevation (8 ac) in conjunction with vegetation removal of about 21 ac. Approximately 12,000 cy of sand will be placed in the bay. It will create 29 ac of early successional habitat, providing nesting and foraging areas for shorebirds. The area will also provide CSRM through widening the barrier island and wave attenuation.

Recreational use in the area to the south is high. The negative impacts to cross-island transport and Back Bay circulation will be offset through this CPF.

Placement of approximately 12,000 cy (8 ac) of sand

Maintain 29 ac of early successional habitat

Specific activities would include placing approximately 12,000 cy of sand to an elevation of -1 feet and mechanical/chemical vegetation removal the area. By creating the spit in this area this CPF is expected to positively affect cross-island transport and back bay circulation as well as create early successional habitat for shorebirds and threatened and endangered species. The adaptive management plan being developed in conjunction with FIMP will be used to determine if the site will be maintained as ephemeral, early successional habitat or allowed to convert to a low marsh.

Land Management and Acquisition Program

These programs are a collaborative effort between Federal, State and local entities and cannot be unilaterally implemented by the Corps. These programs will be implemented as complementary plans to the overall FIMP project. As part of the FIMP, permanent easements will be obtained in locations where beachfill is to be placed. These permanent easements also restrict development from encroaching on the dune and beach that is constructed as part of the project. Land management recognizes this element of the project as an effective tool that will ensure the constructed dunes are not encroached-upon.

Improve the effectiveness of the existing regulatory program, by establishing common and clearly communicated boundaries for regulated hazard areas, increasing training of local officials, and coordination to ensure consistent implementation across regulatory boundaries.

Establish post-storm response plans to guide recovery following major, catastrophic events.

Borrow Area Investigations

Borrow Area Investigations provides a detailed discussion of the studies that have been undertaken to identify potential sources of suitable sand for both the initial construction and periodic renourishment. Potential borrow areas were evaluated based on a set of screening criteria. These criteria included: the evaluation of the availability of adequate data; the sufficiency of quantity in each potential source; beach and dune compatible sediment characteristics; identification of those offshore sources which would minimize adverse wave attenuation; the consideration of geomorphological effects of mining of offshore ridges on barrier island shoreline position and sediment budget; identification of those offshore sources that contained minimal overburden and minimal quantity of fine grained material; and which had minimal adverse environmental effects and minimal effect on cultural resources.

Potential borrow sources identified included upland quarries, maintenance dredge material from navigation channels, the mining of ebb and flood shoals, and offshore borrow areas

Borrow Areas recommends utilizing the lowest impact borrow areas first for the initial construction, while continuing to perform pre-and post-dredging monitoring to get a better understanding of the sediment transport processes before utilizing other borrow sites during periodic renourishment. In addition to the three inlets, six borrow areas were selected for initial construction: 2C, 2H, 4C, 5Bexp, 6I, 8D. Figure 7 shows the delineation of the selected borrow areas. Table 10 lists their respective initial construction quantities.

The offshore portion of Borrow Area 2C, which is an offshore sand ridge, is being used for the Fire Island Inlet to Moriches Inlet Interim Project beach and dune construction. The removal of material from this ridge (or other future uses of sand ridges as borrow sources) may interrupt the onshore migration of material from the ridges to the barrier island shore face. The Corps acknowledges that the potential for this onshore movement is a plausible process. The impact of the proposed nearshore sand mining on cross-shore transport rate is not yet quantified. Modifications of the nearshore topography of the sand ridges offshore of western Fire Island will be the subject of cooperative monitoring between the U.S. Geological Survey (USGS) and the Corps, and will be part of monitoring/adaptive management programs under FIMP.

Table 10. Borrow Areas – Initial Construction

Borrow Area	Location	Volume (cy)
2C	Kismet to POW	299,000
2H	Cherry Grove to Davis Park	250,000
4C	Cupsogue to Westhampton	923,000
5Bexp	Sedge Island to SPW	1,326,000
6I	Potato Road	120,000
8D	Montauk Beach	120,000
Fire Island Inlet*	Gilgo Beach to RMSP	2,341,000
Moriches Inlet*	SPCP to Great Gunn	512,000
Shinnecock Inlet*	SPW to WOSI	549,000
Total 6,440,000		

*Includes Ebb Shoal.

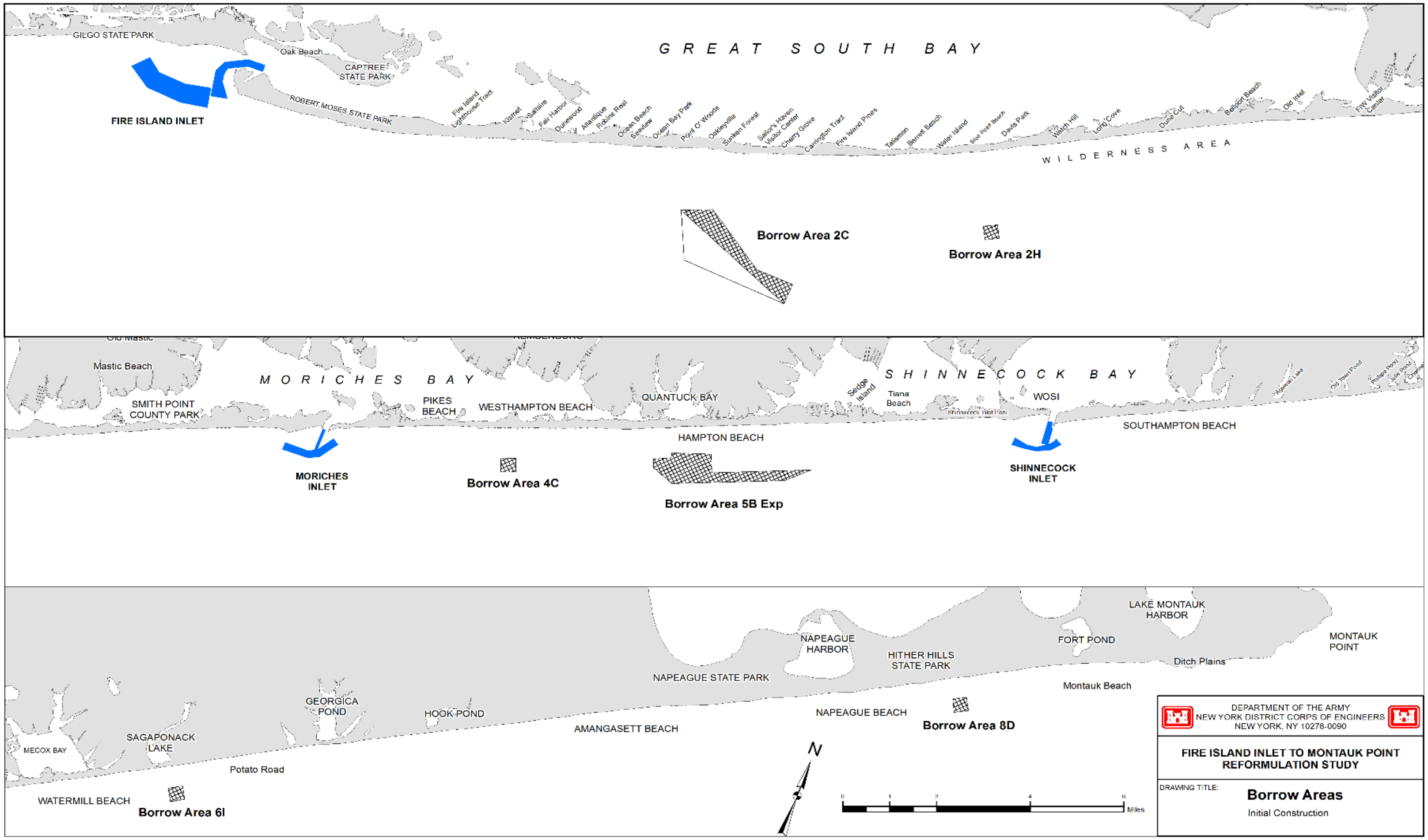


Figure 7. Borrow Areas – Initial Construction

The Recommended Plan is shown in Figure 8 and Figure 9 and summarized below and in Table 11.

Inlet Sand Bypassing

Provides for sufficient sand bypassing across Fire Island, Moriches, and Shinnecock Inlets to restore the natural longshore transport of sand along the barrier island for 50 years. Scheduled O&M dredging of the authorized navigation channel and deposition basin with sand placement on the barrier island will be supplemented, as needed, by dredging from the adjacent ebb shoals of each inlet to obtain the required volume of sand needed for bypassing.

The bypassed sand will be placed in a berm template at elevation +9.5 ft. NGVD in identified placement areas.

Monitoring is included to facilitate adaptive management changes.

Mainland Nonstructural

Addresses approximately 4,432 structures within the 10-year floodplain using nonstructural measures, primarily, structural elevations and building retrofits, based upon structure type and condition.

Includes localized acquisition in areas subject to high frequency flooding, and reestablishment of natural floodplain function.

Breach Response on Barrier Islands – Provides for the following types of Breach Response

Proactive Breach Response – is a response plan which is triggered when the beach and dune are lowered below a 4 percent level of performance and provides for restoration of a dune at +13 ft. NGVD and a 90 ft. berm.

Reactive Breach Response – is a response plan which is triggered when a breach has physically occurred (e.g., the condition where there is an exchange of ocean and bay water during normal tidal conditions). It is utilized, as needed, in locations that receive beach and dune placement and also in locations where there is agreement that a breach should be closed quickly, such as Robert Moses State Park and the Talisman Federal tract.

Conditional Breach Response – is a response plan that applies to the large, federally-owned tracts within Fire Island National Seashore where the Breach Closure Team determines whether the breach is closing naturally, and if found not to be closed at Day 60, that closure would begin on Day 60. Conditional Breach closure provides for a 90 ft. wide berm at elevation +9.5 ft. and no dune.

Wilderness Conditional Breach Response – is a response plan that applies to the Wilderness federally-owned tracts within Fire Island National Seashore, where the Breach Closure Team determines whether a breach should be closed, based upon whether the breach is closing naturally and whether the breach is likely to cause significant damage.

Beach and Dune Fill on Shorefront

Provides for a 90 ft. wide berm and +15 ft. dune along the developed shorefront areas on Fire Island and Westhampton barrier islands.

All dunes will be planted with dune grass except where noted in Table 11.

On Fire Island the post-Hurricane Sandy optimized alignment is followed and includes overfill in the developed locations to minimize tapers into Federal tracts.

Renourishment takes place approximately every 4 years for up to 30 years after project completion; while proactive breach response takes place from years 31 to 50.

Provides for adaptive management to ensure the volume and placement configuration accomplishes the design objectives of offsetting long-term erosion.

Provides for construction of a feeder beach every 4 years for up to 30 years at Montauk Beach.

Groin Modifications

Provides for removal of the existing Ocean Beach groins.

Coastal Process Features (CPFs)

Provides for 12 barrier island locations and two mainland locations (Figure 8) as coastal process features

Includes placement of approximately 4.2 M cy of sediment in accordance with the Policy Waiver for a Mutually Acceptable Plan between the Department of the Army and the Department of the Interior. Sediment will be placed along the barrier island bayside shoreline over the period of analysis that reestablishes the coastal processes consistent with the reformulation objective of no net loss of habitat or sediment. The placement of sediment along the bay shoreline will be conducted in conjunction with other nearby beach fill operations undertaken on the barrier island shorefront.

The CPFs will compensate for reductions in cross-island transport and sediment input to the bay, offset Endangered Species Act impacts from the placement of sediment along the barrier island shorefront, augment the resiliency, and enhance the overall barrier island and natural system coastal processes.

Adaptive Management

Provides for monitoring and the ability to adjust specific project features to improve effectiveness and achieve project objectives.

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.

Integration of Local Land Use Regulations and Management

Upon project completion, the Corps' annual Inspection of Completed Works (ICW) program provides for monitoring and reporting of any new development within the project area to the appropriate federal, state, and local entities responsible for enforcing applicable land use regulations.

Table 11 summarizes the shorefront recommended plan features and includes a description of the recommended plan for each of the project sub-reaches, the type of breach response plan, and the Life Cycle Plan following project construction for Years 1-30 (Figure 8) and Years 31-50 (Figure 9).

Summary of Changes from 2016 Draft Report

The following is a summary of the changes that have been made to the recommended plan subsequent to the draft report being released for public review.

Overall, the plan has been updated to reflect current conditions.

Road raising features along the mainland have been eliminated and replaced with non-structural treatments for structures within the 10-year floodplain.

In several mainland locations, acquisition of structures and reestablishment of floodplain function is recommended instead of building retrofits

The specific criteria for breach response have been updated, and clarified for each location. A response specific to the Otis Pike Wilderness Area has been identified, in addition to the proactive, reactive, and conditional responses.

The sediment management feature has been updated for the area of Downtown Montauk, which increases the volume for initial construction and renourishment, and incorporates the existing geotextile reinforced dune as part of the FIMP Project.

The sediment management feature at Potato Road in the Village of Sagaponack has been deleted from the plan, based upon changes in the without project condition.

The plans for further modification of the Westhampton Groins have been deleted from the recommended plan.

The Ocean Beach groins are recommended to be removed, rather than modified.

The Coastal Process Features have been updated and refined based upon public and agency input.

A detailed description of each of the plan components follows.

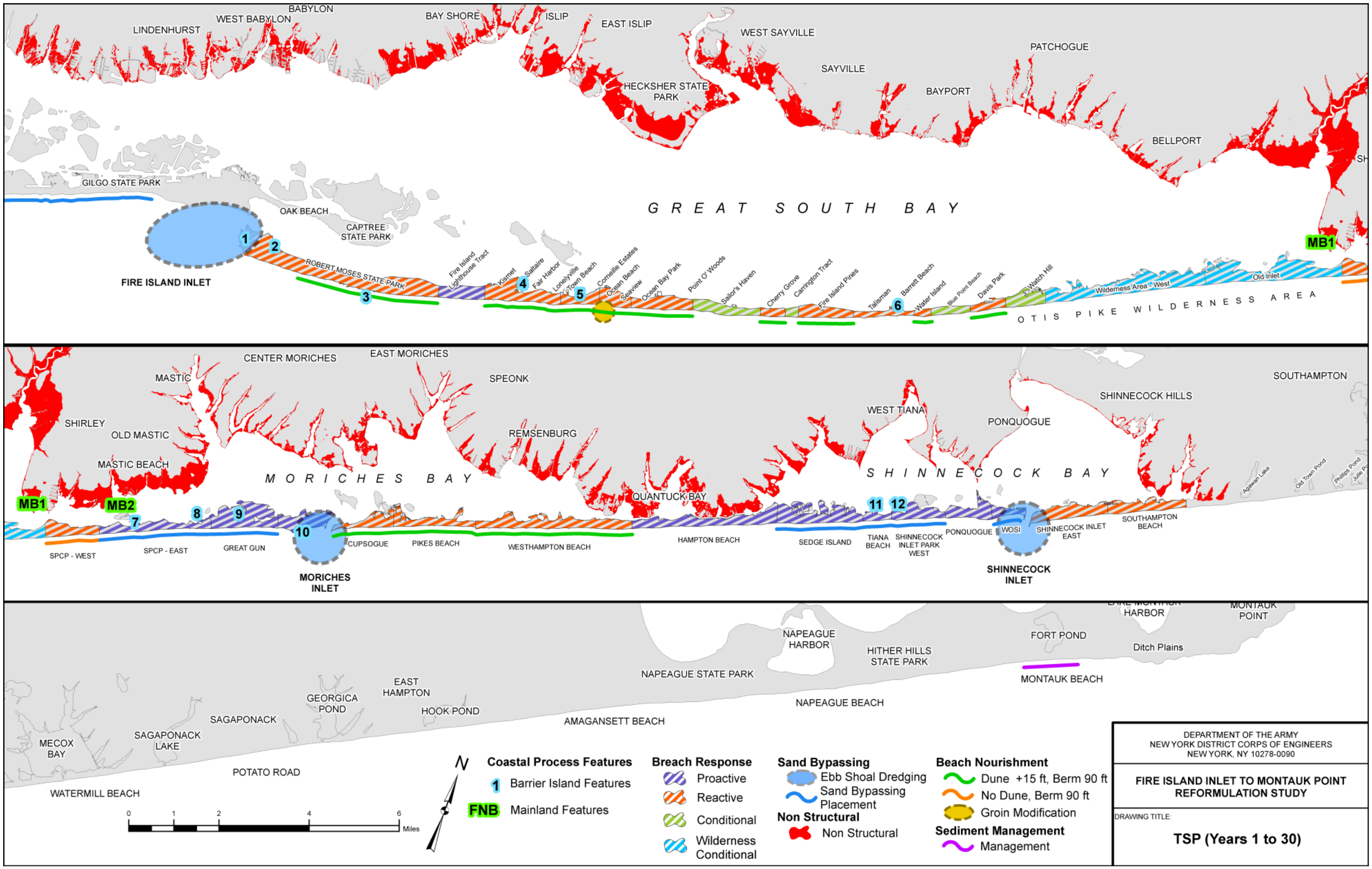


Figure 8. Recommended Plan (Years 1 to 30)

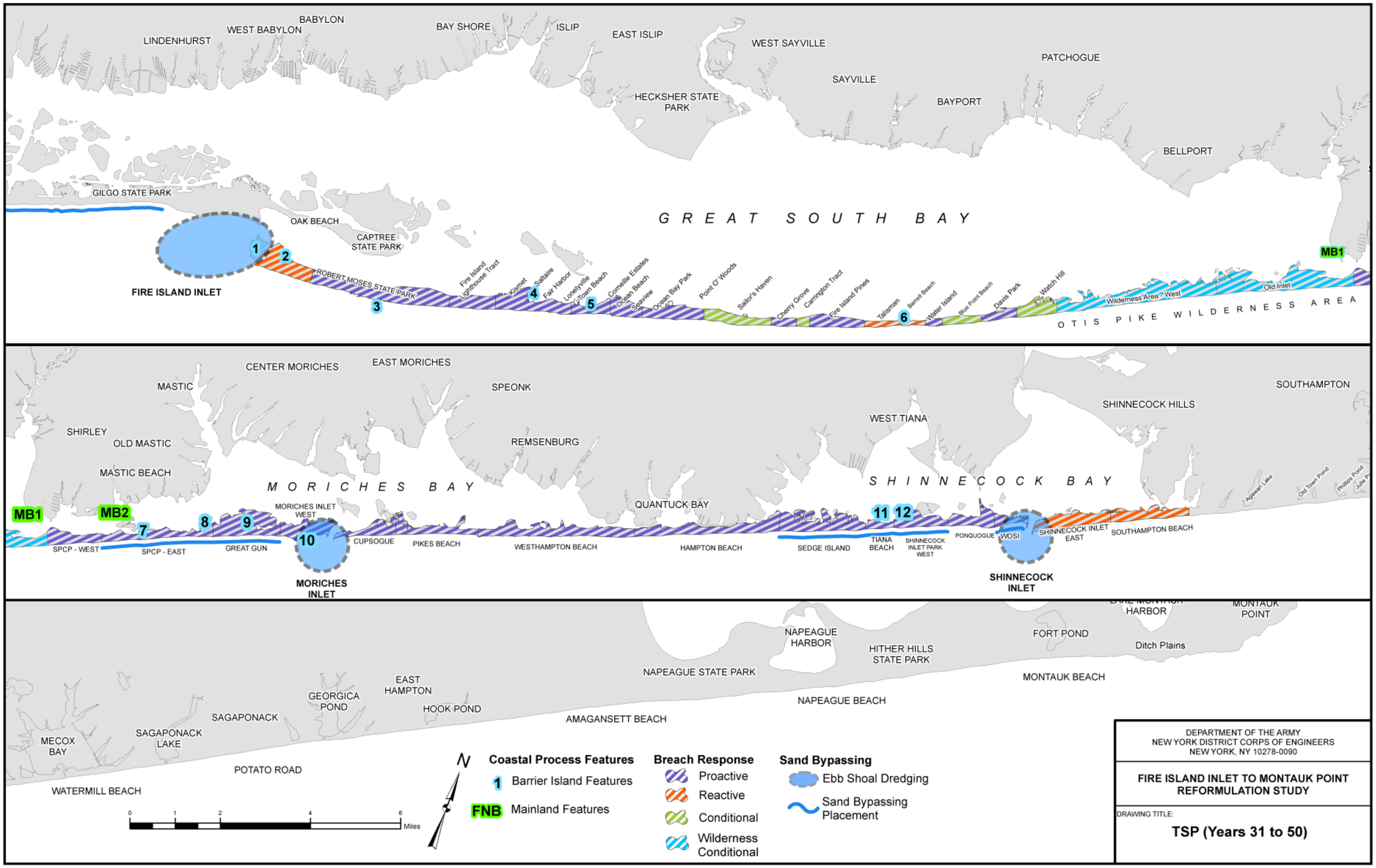


Figure 9. Recommended Plan (Years 31 to 50)

Table 11. FIMP Recommended Plan Shorefront Reach Features

				Subreach Recommended Plan			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	**Design Subreach**	**Sub-Reach Name**	**Length (ft)**	**Plan**	**Berm (Ht. and width)**	**Dune**	**Breach Response**	**Breach Response Plan**	**CPF located in Sub-reach**	**Purpose (CSRM, ESA)**	**Lifecycle Response Years 1-30**	**Lifecycle Response Years 31-50**	**Years 31-50 Dune Height**
GSB (Great South Bay)		Fire Island Inlet and Gilgo Beach	N/A	Inlet Dredging and bypassing (FI)	+9.5 ft berm section	No Dune	NA	NA			FI Inlet bypassing, 2 yr cycle	FI Inlet bypassing, 2 yr cycle	No dune
	1A	Robert Moses State Park - West (need Plate -from Parkway to Jetty)	6,700	No Action	+9.5 ft, 90 ft wide	No Dune	Reactive	9.5 ft berm, 90 ft wide	1 Democrat Point West 2 Democrat Point East	ESA ESA	Reactive Breach Response	Reactive Breach Response	No dune
	1A	Robert Moses State Park - East	19,000	Beach, Dune, Berm, Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide	3 Dunefield West of Field 4	ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	1B	FI Lighthouse Tract	6,700	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune, no planting	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Proactive Breach respone	Proactive Breach respone	13 ft dune
	2A	Kismet to Lonelyville	8,900	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide	4 Clam Pond	CSRM, ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2B	Town Beach to Corneille Estates	5,100	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide	5Atlantique to Corneille	CSRM, ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2C	Ocean Beach & Seaview	3,800	Beach, Dune, Renourish, Groin Modification	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2D	OBP to Point O' Woods	7,400	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide		CSRM, ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2E	Sailors Haven	8,100	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.		CSRM, ESA	Conditional Breach Closure	Conditional Breach Closure	No dune
	3A	Cherry Grove	3,000	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3B	`Carrington Tract	1,500	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.		CSRM, ESA	Conditional Breach Closure	Conditional Breach Closure	No dune
	3C	Fire Island Pines	6,600	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3D	Talisman to Water Island	7,300	Reactive Breach Response	+9.5 ft, 90 ft wide	No Dune	Reactive	No dune. Maximum berm height 9.5 ft. Berm closure width to taper to adjacent area.	6 Talisman	CSRM, ESA CSRM, ESA	Reactive Breach Closure	Reactive Breach Closure	No dune
	3E	Water Island	2,000	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3F	Water Island to Davis Park	4,700	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.			Conditional Breach Closure	Conditional Breach Closure	No dune
	3G	Davis Park	4,100	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	3H	Watch Hill	5,000	Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.			Conditional Breach Closure	Conditional Breach Closure	No dune
	4A	Wilderness Area - West	19,000	Wilderness Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.			Wilderness Conditional Closure	Wilderness Conditional Closure	No dune
	4B	Old Inlet	16,000	Wilderness Conditional Breach Response	+9.5 ft closure section (max berm ht.)	No Dune	Conditional	No dune. Berm closure width to taper to adjacent area.			Wilderness Conditional Closure	Wilderness Conditional Closure	No dune

				Subreach Recommended Plan			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	**Design Subreach**	**Sub-Reach Name**	**Length (ft)**	**Proposed Plan**	**Berm (Ht. and width)**	**Dune**	**Breach Response**	**Breach Response Plan**	**CPF located in Sub-reach**	**Purpose (CSRM, ESA)**	**Lifecycle Response Years 1-30**	**Lifecycle Response Years 31-50**	**Years 31-50 Dune Height**
	1A	Smith Point CP- West	6,300	Reactive Breach Response and nourishment	+9.5 ft closure section (max berm ht.)	No Dune	Reactive	No dune. Berm closure width to taper to adjacent area.			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	1B	Smith Point CP - East	13,500	Proactive Breach Response, sand bypassing	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	7 Pattersquash Reach 8 New Made Is. Reach	CSRM, ESA; CSRM, ESA	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	13 ft dune
	2A	Great Gun	7,600	Proactive Breach Response, sand bypassing	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	9 Smith Point County Park Marsh	CSRM	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	Moriches Inlet sand bypassing placement- 1-yr cycle, and proactive response	13 ft dune
	2B	Moriches Inlet - West	6,200	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	10 Great Gun	ESA	Proactive Breach respone (actual dimentsions to conform with Great Gunn FIMI CPF)	Proactive Breach respone (actual dimentsions to conform with Great Gunn FIMI CPF)	13 ft dune
MB (Moriches Bay)		Moriches Inlet		Inlet Dredging and bypassing - 1-yr cycle	+9.5 ft, 90 ft wide						Inlet Dredging and bypassing - 1-yr cycle	Inlet Dredging and bypassing - 1-yr cycle	
	2C	Cupsogue Co Park	7,500	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide		ESA	Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2D	Pikes	9,700	Beach, Dune and Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	2E	Westhampton	18,300	Beach, Dune, Renourishment	+9.5 ft, 90 ft wide	15 ft dune	Reactive	15 ft dune, 9.5 ft berm, 90 ft wide			Periodic renourishment (approx. 4 year cycle)	Proactive Breach respone	13 ft dune
	1A	Hampton Beach	16,800	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Proactive Breach respone	Proactive Breach respone	13 ft dune
	1B	Sedge Island	10,200	Shinnecock Inlet bypassing placement; Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	11 Dune Road, East Quogue	CSRM	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	1C	Tiana Beach	3,400	Shinnecock Inlet bypassing placement; Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide	12 Tiana Bayside Park	CSRM	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	1D	Shinnecock Inlet Park West	6,300	Shinnecock Inlet bypassing placement; Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
	2A	Ponquogue	5,300	Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Proactive Breach respone	Proactive Breach respone	13 ft dune
SB (Shinecock Bay)	2B	WOSI	3,900	Shinnecock Inlet bypassing placement; Proactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Proactive	13 ft dune, 9.5 ft berm, 90 ft wide			Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	Shinnecock sand bypassing placement - 2 yr cycle, and proactive breach respone	13 ft dune
		Shinnecock Inlet		Inlet Dredging and bypassing - 2-yr cycle							Inlet Dredging and bypassing - 2-yr cycle	Inlet Dredging and bypassing - 2-yr cycle	13 ft dune
	2C	Shinnecock Inlet - East	9,800	Reactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Reactive	13 ft dune, 9.5 ft berm, 90 ft wide			Reactive breach response, initial 30 yrs	Reactive breach response, Years 31-50	13 ft dune
	3A	Southampton Beach	9,200	Reactive Breach Response	+9.5 ft, 90 ft wide	13 ft dune	Reactive	13 ft dune, 9.5 ft berm, 90 ft wide			Reactive breach response, initial 30 yrs	Reactive breach response, Years 31-50	13 ft dune
	3B	Southampton	5,300	No Federal Action									
	3C	Agawam	3,800	No Federal Action									

				TSP Description			Breach Response Plan		Coastal Process Features		Lifecycle Plan		
Project Reach	**Design Subreach**	**Sub-Reach Name**	**Length (ft)**	**Proposed Plan**	**Berm (Ht. and width)**	**Dune**	**Breach Response**	**Breach Response Plan**	**CPF located in Sub-reach**	**Purpose (CSRM, ESA)**	**Lifecycle Response Years 1-30**	**Lifecycle Response Years 31-50**	**Years 31-50 Dune Height**
P (Ponds)	1A	Wickapogue	7,700	No Federal Action									
	1B	Watermill	8,800	No Federal Action									
	1C	Mecox Bay	1,400	No Federal Action									
	1D	Mecox to Sagaponack	10,400	No Federal Action									
	1E	Sagaponack Lake	1,100	No Federal Action									
	1F	Sagaponack to Potato Rd	9,300	No Federal Action									
	1G	Potato Rd	4,300	No Federal Action									
	1H	Wainscott	4,600	No Federal Action									
	1I	Georgica Pond	1,200	No Federal Action									
	1J	Georgica to Hook Pond	11,200	No Federal Action									
	1K	Hook Pond	1,100	No Federal Action									
	1L	Hook Pond to Amagansett	19,200	No Federal Action									
M (Montauk)	1A	Amagansett	10,400	No Federal Action									
	1B	Napeague State Park	9,100	No Federal Action									
	1C	Napeague Beach	9,900	No Federal Action									
	1D	Hither Hills SP	7,000	No Federal Action									
	1E	Hither Hills to Montauk B	15,800	No Federal Action									
	1F	Montauk Beach	4,700	Sediment Management	+9.5 ft feeder beach	No dune	NA	NA	NA		Renourishment, approx. 4 yr cycle	None	
	1G	Montauk Beach to Ditch Plains	4,700	No Federal Action									
	1H	Ditch Plains	3,400	No Federal Action									
	1I	Ditch Plains to Montauk Pt	19,300	No Federal Action									

Inlet Sand Bypassing

The Project's inlet management plans at all three inlets consists of dredging the ebb shoals, and placing the material on downdrift berms in the quantities needed to restore littoral transport of sediment across the inlets for 50 years. No dunes will be constructed with the sediment. Ebb shoal dredging would be undertaken in conjunction with scheduled/authorized navigational Operations and Maintenance (O&M) dredging of the inlets, and would increase sediment bypassing and reduce future renourishment fill requirements. These inlet bypassing features are designed to complement the existing navigation projects.

Fire Island Inlet

O&M maintenance dredging of authorized channel and deposition basin to take place on a 2-year interval, as authorized

379,000 cy (per O&M event) dredged from the ebb shoal (as needed to offset sediment deficit) and placed downdrift at Gilgo Beach

Moriches Inlet

O&M maintenance dredging of authorized channel to take place on a 1-year interval (as authorized)

Approximately 73,000 cy (per O&M event) dredged from the from ebb shoal (as needed to offset sediment deficit) and placed downdrift at Smith Point County Park

Shinnecock Inlet

O&M maintenance dredging of authorized channel to take place on a 2-year interval as authorized)

105,000 cy (per O&M event) dredged from channel/deposition basin, and from ebb shoal (as needed to offset sediment deficit) and placed downdrift at Sedge Island, Tiana Beach, and West of Shinnecock (WOSI)

Mainland Nonstructural Plan

The plan for the mainland provides for coastal storm risk management for a total of 4,432 structures that are located within the existing 0.1 percent exceedance floodplain. Of these 3,675 would be elevated, 650 would receive flood proofing, 93 would receive ringwalls, and 14 would be bought out. The design elevation level includes 2 ft. of freeboard consistent with State of New York Building Code, and Hurricane Sandy Recovery guidelines.

It is noted that following Hurricane Sandy, multiple post storm recovery programs have proposed nonstructural treatments within the study area. The specific nonstructural scale and treatment will be reviewed and refined in the PED phase to ensure that the treatment proposed and the applicable population is appropriately identified.

The number of non-structural treatments initially proposed by town are as follows:

Babylon	1,523
Islip	942
Brookhaven	1,269
Southampton	705

The locations are conceptually shown in Figure *in red based on the 10-year floodplain.

Breach Response on Barrier Islands

As shown in Table 11, the Recommended Plan includes four types of responses to breaches as described below.

Proactive Breach Response Plan

The Proactive Breach Response Plan (BRP) includes measures to prevent breaches from occurring which is triggered when the beach and dune are lowered below the 4 percent level of performance. The Proactive BRP allows for overwash and dune lowering during storms. As a result, ocean shorefront development would be more vulnerable to wave attack and storm induced erosion losses. The Proactive BRP provides for a +13 ft. NGVD 29 dune, and a 90 ft. wide berm at +9.5 ft. NGVD 29 beach cross-section area. A typical Proactive BRP section is shown in Figure 10.

Initial Construction (Proactive BRP)

Four of the Proactive BRP reaches were recently nourished as part of either Fire Island to Moriches Inlet (FIMI) (Fire Island Lighthouse Tract (FILT), Smith Point County Park (SPCP)-East, Great Gunn, or the West of Shinnecock Inlet Interim Project (WOSI). Due to the relatively low erosion rates at FILT, SPCP-East, and Great Gunn it is not expected that Proactive BRP would be required at any of these locations at the time of initial construction. However, due to the relatively high erosion rates at WOSI, initial Proactive BRP beach fill placement is assumed at this location. Initial construction volumes at WOSI were estimated following the same approach as the Beach Fill Plan reaches based on predicted losses.

Initial construction volumes for the other Proactive BRP reaches along Shinnecock Bay, Sedge Island, Tiana Beach, and Shinnecock Inlet Park West were determined based on LiDAR data collected by the USACE on November 14, 2012 (two weeks following Hurricane Sandy), plus additional data collection since 2012 using the same approach as the Beach Fill Plan reaches based on predicted losses. All Proactive BRP quantities include 15 percent overfill and 15 percent contingency/tolerance. No advance fill is included in the Proactive BRP.

A summary of the initial construction quantities for the Proactive BRP is provided in Table 12.

Table 12. Proactive BRP Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Sedge Island	SB-1B	BA 5Bexp	10,200	1,037,000
Tiana Beach	SB-1C	BA 5Bexp	3,400	207,000
SIPW	SB-1D	BA 5Bexp	3,400	427,000
SIPW	SB-1D	SI	3,400	0
WOSI	SB-2B	SI	2,700	700,000
Total				2,371,000

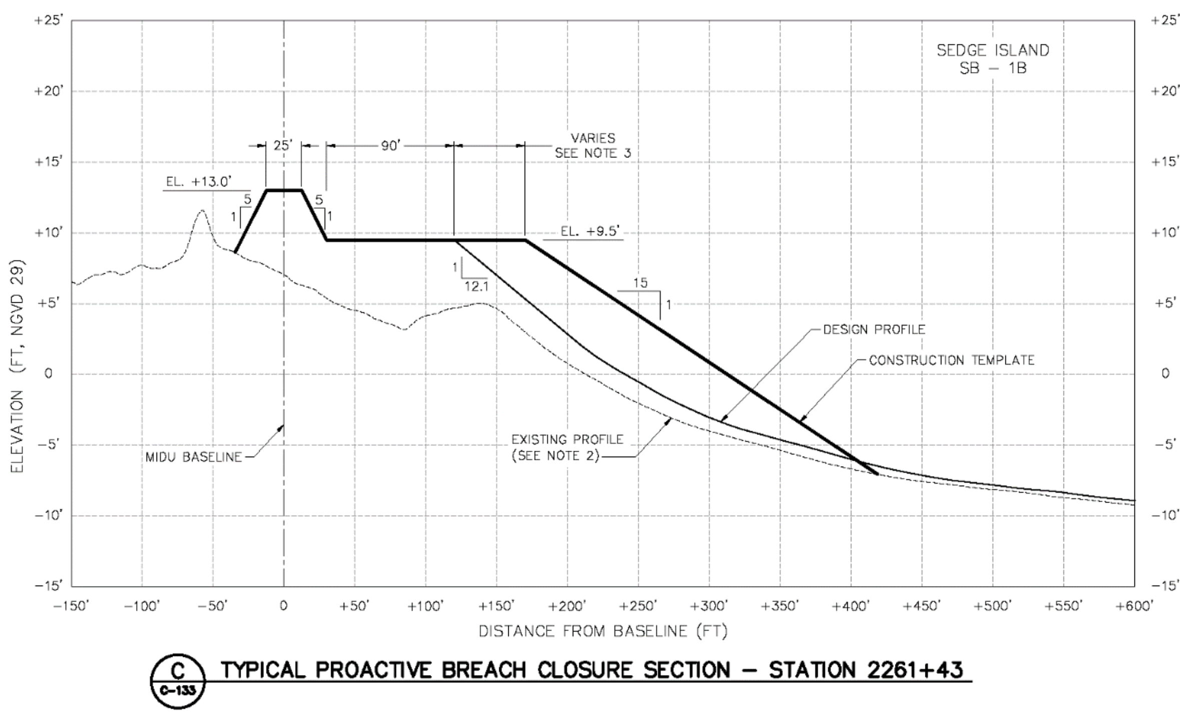


Figure 10. Typical Proactive BRP Section

Proactive Breach Response Triggers

Proactive Breach Response (PBR) triggers have been developed based on dimensions than can be easily measured and monitored as part of the FIMP project. These triggers are reach specific and consider historic breaching/overwash data, modeling results, and overall understanding of the hydraulic conductivity at each location. Breaching response is a multidimensional problem, so there is not one single measurement that can be monitored and used as threshold for action. Therefore, the following relevant dimensions are measured and considered instead:

Barrier island width: distance between bay and ocean MHW contours

Elevation: generally characterized by volume/area above +10 ft. NGVD29

Beach width: distance between baseline (generally the natural dune alignment) and the MHW contour

Specific PBR thresholds by reach are summarized in Table 13 below. When one or more of these proposed thresholds is exceeded, the risk of a partial breach is at the 25-year return period level and proactive action should be taken to rebuild the PBR template and reduce the risk of breaching. Note that if one of these thresholds is met over a very small area but the barrier island is generally in good condition otherwise, the risk of breaching is significantly less than if the threshold is met over a large area. Therefore, the response triggers recommended in Table 13 are based on both widespread but not necessarily contiguous weakness within a reach and smaller, localized, but potentially weaker spots.

Reach			Barrier Island Width		Area Above +10 ft. NGVD					Beach Width			
			Contiguous		Total		Contiguous			Total		Contiguous	
ID	Name	Length (ft.)	Length	Island Width	Length	Width above +10	Length	Width above +10	Beach Width	Length	Beach Width	Length	Beach Width
GSB-1B	Fire Island Lighthouse (FILT)	6,700	200	1,000	2,000	50	100	50	100	3,000	100	1,000	100
MB-1B	Smith Point County Park (SPCP) East	13,500	200	400	2,000	100	100	100	150	6,000	150	500	100
MB-2A	Great Gun	7,600	200	400	2,000	100	100	100	150	4,000	150	500	100
MB-2B	Moriches Inlet - West	6,200	200	1,200	2,000	50	100	50	100	3,000	100	1,000	100
SB-1A	Hampton Beach	16,800	200	600	2,000	50	100	50	100	8,000	100	1,000	100
SB-1B	Sedge Island	12,200	200	500	2,000	100	100	100	150	6,000	100	500	100
SB-1C	Tiana Beach	3,400	200	400	2,000	100	100	100	150	2,000	100	500	100
SB-1D	Shinnecock Park West (SPW)	6,300	200	600	2,000	50	100	50	100	3,000	100	500	100
SB-2A	Ponquogue	5,300	200	600	2,000	50	100	50	100	3,000	100	1,000	100
SB-2B	West of Shinnecock (WOSI)	3,900	100	350	2,000	100	100	100	150	2,000	100	300	100
SB-2C	Shinnecock Inlet - East	9,800	200	800	2,000	50	100	50	100	5,000	100	1,000	100
SB-3A	Southampton Beach	9,200	200	600	2,000	50	100	50	100	5,000	100	1,000	100

Table 13. Summary of Proposed Proactive Breach Response (PBR) Triggers

Reactive Breach Closure

Reactive Breach Response is triggered in response to the occurrence of a breach at any locations along the barrier islands, except for most of the large federally-owned tracts within Fire Island National Seashore. Conditional and Wilderness Breach Responses typically apply to these FIIS tracts, in which the Breach Response Team will assess if the breach is closing naturally or if mechanical closure is required. Exceptions include the Fire Island Lighthouse and Talisman tracts, where Proactive and Reactive Breach Response, respectively, would be implemented (see Figure 8 and Figure 9). A typical Reactive BRP section is shown in Figure 11.

The Reactive BRP template would restore the design beachfill template in locations where beachfill is recommended (dune at +15 ft. NGVD 29 and 90 ft. wide berm at +9.5 ft. NGVD 29). At Talisman, where breach response does not include a dune, the berm width would match conditions in adjacent areas. A typical breach closure section at Robert Moses State Park is shown in Figure 11. The design foreshore slope is 1 on 12 which is also the same slope defined for the beach fill design templates. The design profile below MHW would match the representative morphological profile corresponding to each specific location. At a minimum, bayside slopes and shorelines would generally match the preexisting adjacent shorelines. Based on the existing topography the bayside design slope was selected as 1 on 20 from the bayside crest of the berm to an elevation of +6 ft. NGVD 29. The specific layout will be developed as part of the breach closure plan at the time of the closure operation, and may include more placement of sediment along the bay shoreline than existed prior to the breach in order to replicate cross-island sediment transport, and to achieve the project goals of no net loss of sediment.

Conditional and Wilderness Conditional Breach Closure

Conditional or Wilderness Conditional Breach Responses apply to most FIIS tracts as shown in Figure 8 and Figure 9. As part of the Conditional BRP, the Beach Closure Team may delay breach closure up to 60 days to determine whether the breach is closing naturally. Under this scenario, construction would be initiated after 60 days, if the breach does not close naturally within these first 60 days. Under the Wilderness Conditional BRP a breach would be closed only if it is determined that the breach is not closing naturally, and that significant damage is likely to occur. This approach is consistent with the NPS recommended plan for the existing Wilderness Area breach.

The Conditional and Wilderness Conditional BRP templates do not include a dune. Both breach closure templates have a berm with height of +9.5 ft. NGVD 29. A typical breach closure section is shown in Figure 11. The intent of the conditional response template is to match the berm width with conditions prior to the breach and within adjacent areas. The design foreshore slope and bayside slopes and shorelines would generally match the preexisting adjacent shorelines. The specific dimensions and configuration will be developed as part of the breach closure plan at the time of the closure operation, and may include more placement of sediment along the bay shoreline than existed prior to the breach in order to replicate cross-island sediment transport, and to achieve the project goals of no net loss of sediment.

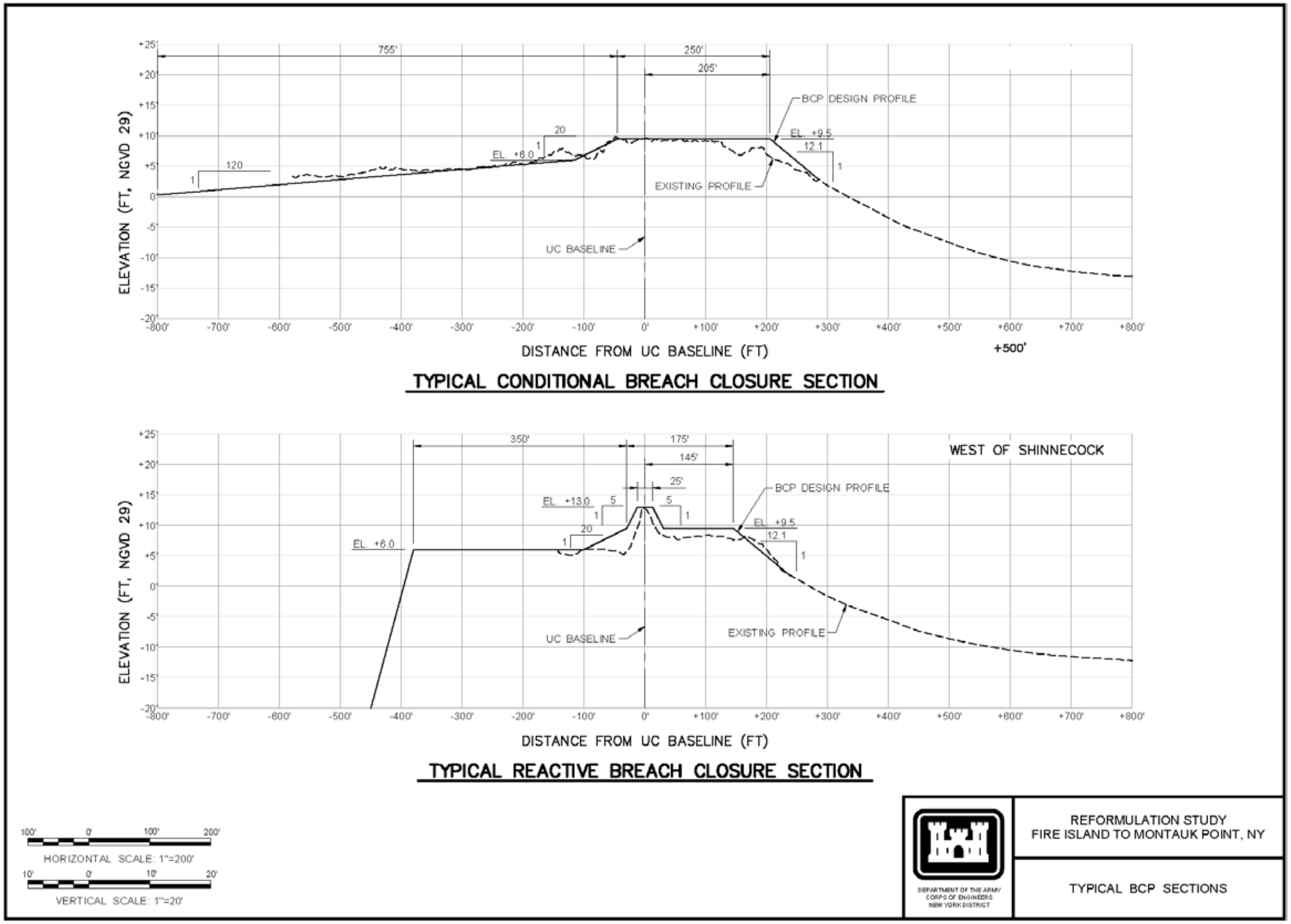


Figure 11. Typical Breach Closure Sections

Barrier Island

Specific locations for sand placement are outlined in Figure 8 and Figure 9.

The design template has a dune with a crest width of 25 feet and dune elevation of +15 feet NGVD 29 and a berm width of 90 feet at elevation +9.5 feet NGVD 29. The proposed design (not construction) foreshore slope (from +9.5 to +2 feet NGVD 29) is roughly 12.1 on 1. Below MHW (roughly +2 feet NGVD 29) the submerged morphological profile, representative of each specific reach, is translated and used as the design profile. Figure 12 shows typical design section for the Berm Only and Figure 13 shows the typical design section for the design template with the +15ft NGVD 29 dune plan.

The Berm Only template is applicable to areas in which the existing condition dune elevation and width reduce the risk of breaching but have eroded beach berm conditions. The 90-foot design berm (width) provides protection to the existing dunes and ensures vehicular access during emergency response and evacuation.

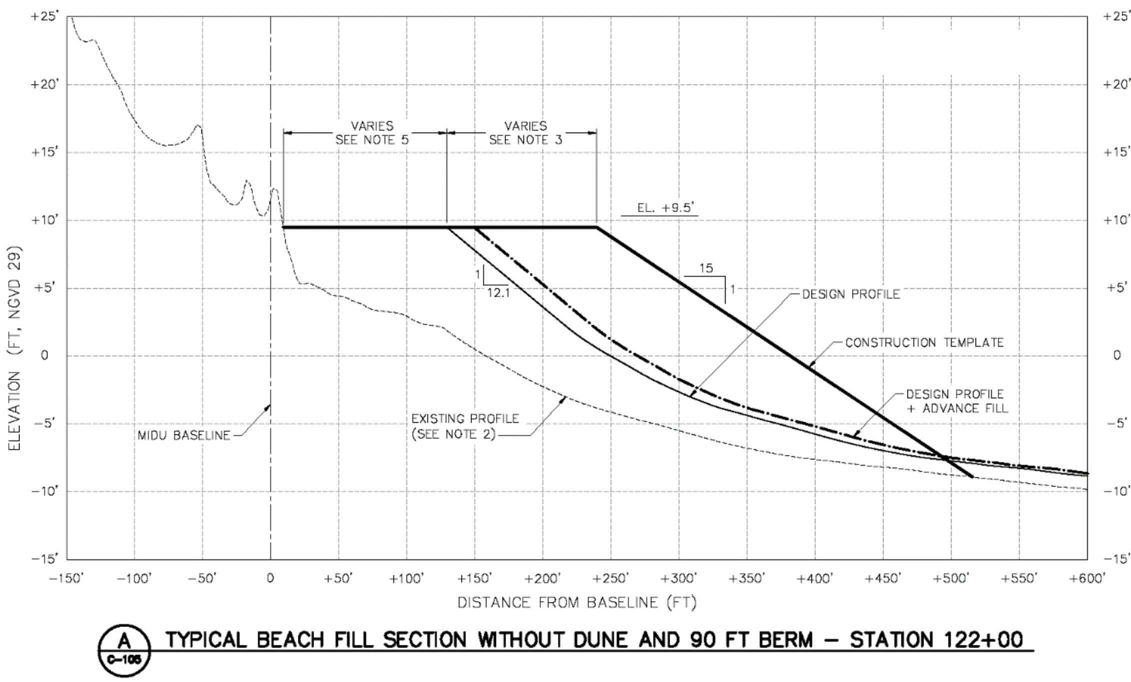


Figure 12. Berm Only Beach Fill Design Profile

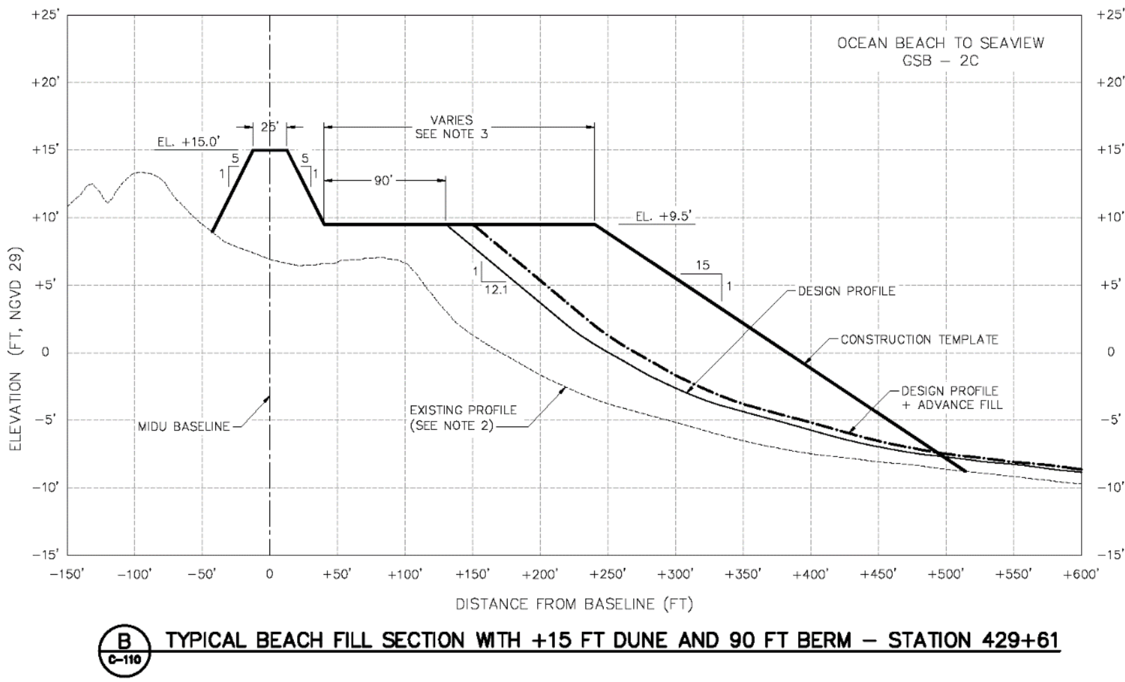


Figure 13. Beach Fill Design Template

The Beach Fill Plan includes taper (transition) to reduce end losses and increase the longevity of the fill. The taper lengths along Fire Island are consistent with the plans for FIMI. Tapers are accounted for in initial and renourishment volume estimates. In the major NPS Federal tracts (including the Otis Pike Wilderness Area), the baseline will be allowed to migrate landward. Outside the Federal tracts the established FIMP dune alignment will generally be maintained, within an adaptive management framework.

Beach Fill Plan – Initial Construction

With the exception of Cupsogue, all of the beach fill design reaches have been recently constructed or are soon to be under construction as part of the Fire Island to Moriches Inlet (FIMI) Stabilization Project or Westhampton Interim Project. Therefore, it is not possible to use the existing beach conditions to estimate initial construction beach fill volumes at the start of the FIMP project. Instead, initial beach fill volumes were estimated based on predicted sediment losses following the completion of the FIMI and Westhampton Interim projects.

It is noted that advance fill was included in the design and construction of FIMI and the Westhampton Interim Project. Therefore, by restoring sediment losses, the initial construction estimates for FIMP indirectly include advance fill. All beach fill quantity estimates include advance fill, 15 percent overfill, and 15 percent for contingency/tolerance. A summary of the initial construction quantities for the Beach Fill Plan is shown in Table 14.

Table 14. Beach Fill Plan Initial Construction Quantities

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	deferred to Yr 4
Town Beach to Corneille Estates	GSB-2B	2C	4,500	deferred to Yr 4
Ocean Beach to Seaview	GSB-2C	2C	3,800	deferred to Yr 4
OBP to POW	GSB-2D	2C	7,300	deferred to Yr 4
Cherry Grove	GSB-3A	2H	3,400	deferred to Yr 4
Fire Island Pines	GSB-3C	2H	7,000	deferred to Yr 4
Water Island	GSB-3E	2H	1,600	deferred to Yr 4
Davis Park	GSB-3G	2H	5,000	deferred to Yr 4
Fire Island Subtotal				0
Cupsogue	MB-2C	4C	2,000	156,000
Pikes	MB-2D	4C	9,600	232,000
Westhampton	MB-2E	4C	10,900	176,000
Westhampton Subtotal				564,000
Total				564.000

Notes: RMSP and SPCP-West are not shown here because the required fill material is coming from inlet dredging.

Beach Fill Plan – Life Cycle

The required renourishment fill volumes have been computed based on representative erosion rates and expected renourishment interval of approximately every 4 years. The representative erosion rates were calculated based on the historical sediment budget, volumetric changes in measured profiles between 1988 and 2012, the performance of recent beach fill projects, and anticipated beach fill spreading. All beach fill quantity estimates include advance fill, 15 percent overfill, and 15 percent for contingency/tolerance. A summary of the renourishment quantities for the Beach Fill Plan is provided in Table 15.

Table 15. Beach Fill Plan - Renourishment Quantities Per Operation

Location1	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Kismet to Lonelyville	GSB-2A	2C	8,900	777.000
Town Beach to Corneille Estates	GSB-2B	2C	4,500	354.000
Ocean Beach to Seaview	GSB-2C	2C	3,800	293,000
OBP to POW	GSB-2D	2C	7,300	425,000
Cherry Grove	GSB-3A	2H	3,400	79,000
Fire Island Pines	GSB-3C	2H	7,000	817,000
Water Island	GSB-3E	2H	1,600	64,000
Davis Park	GSB-3G	2H	5,000	669,000
Fire Island Subtotal				2,809,000
Cupsogue	MB-2C	4C	2,000	72,000
Pikes	MB-2D	4C	9,600	620,000
Westhampton	MB-2E	4C	10,900	468,000
Westhampton Subtotal				1,160,000
Total				3,969,000

1RMSP and SPCP-West are not shown here because the required fill material is coming from inlet dredging.

Montauk Beach Feeder Beach

The sediment management plans include the establishment of a feeder beach on Montauk Beach as shown in Table 16.

The feeder beach is different than a traditional beachfill design, in that the intent is to provide adequate sand into the system to maintain the existing, natural beach width rather than creating and maintaining a larger beach width than currently exists. The rationale for the feeder beach in this location is that the existing natural berm provides a reasonable level of risk reduction, and it is not cost-effective or economically justified to construct and maintain a larger, traditional beachfill project. The feeder beach has been designed to account for the sediment loss that is expected over a 4-year cycle. The feeder beach is not designed to maintain a specific beach width, nor to account for seasonal variability in the beach.

The feeder beach is designed to work in conjunction with the existing geotextile bag structure constructed as part of the Downtown Montauk Stabilization. During design and implementation of the stabilization project, a portion of the existing geotextile bag structure was relocated seaward, in order to minimize real estate acquired for the project, to expedite construction. This re-alignment has resulted in a greater level of exposure of the bags, along this portion of the project. As part of the FIMP Project, the necessary real estate will be acquired landward of the structure to allow for the partial reconstruction of the geotextile revetment in a more landward, sustainable location.

The feeder beach is not designed to provide any specific beach width. The beach width is expected to vary seasonally and in response to storm events and long-term erosion. The construction template is a berm with a width of approximately 60 ft. at an elevation of +9.5 feet NGVD 29. Based upon the expected erosional losses over the 4-year renourishment interval, this would provide sufficient volume of sand to offset the long-term erosion rate. The initial construction volume is estimated as 450,000 cy. The renourishment volume is estimated as 400,000 cy every 4 years. These volumes are estimates and will be based upon site conditions at the time of construction, and revisited over the project life, based upon observed performance.

The location of the proposed feeder beach is observed to have relatively large seasonal changes in beach width. The trend is a beach that is significantly narrower in the winter than in the summer. The feeder beach is not designed to account for seasonal variability and the pattern of seasonal variability is expected to occur throughout the project life.

A typical section of the sediment management feature is shown in Figure 14.

Table 16. Sediment Management Fill Volumes

Location	Subreach	Sediment Source	Fill Length (ft.)	Volume (cy)
Montauk Beach	M-1F	BA 8D	6,000	450,000

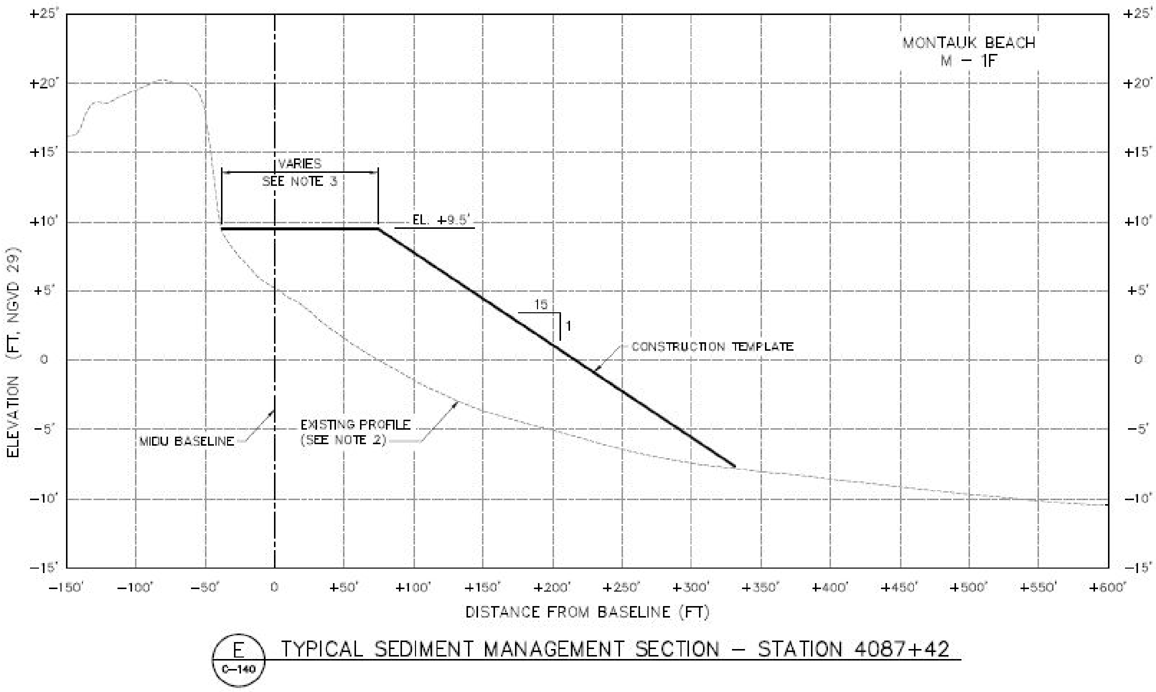
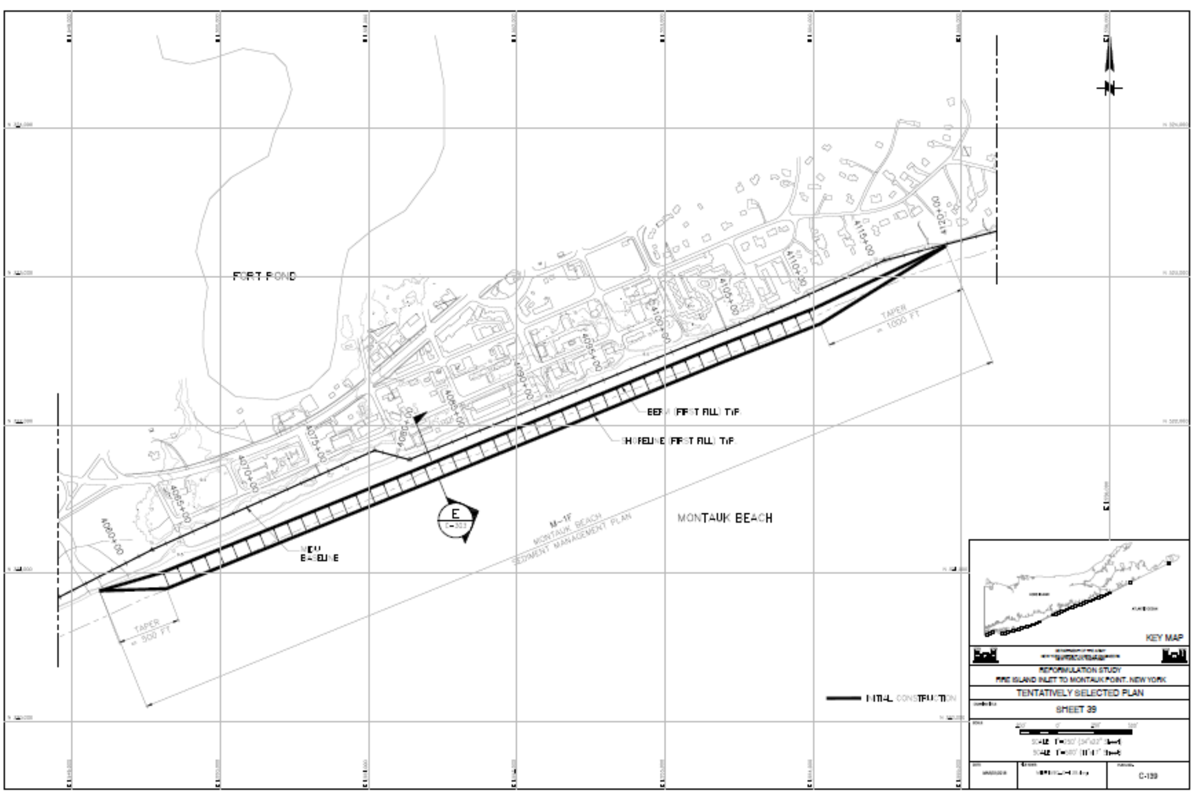


Figure 14. Typical Sediment Management Construction Template



Groin Modification Plan

The groin modification plan includes the removal of two groins at Ocean Beach. The final requirements for removal will be finalized during the design phase. The General Reevaluation Report (GRR) cost estimate assumes complete removal of these structures.

Coastal Process Features

A key objective of the FIMP project is to restore the natural coastal processes that have been impacted by past development of the barrier island, including: 1) alongshore transport; 2) cross-island transport; 3) dune growth and evolution; 4) bay shoreline processes; and 5) estuarine circulation and water quality.

To achieve these objectives and to provide offsets for Endangered Species Act (ESA) impacts and Coastal Storm Risk Management (CSRM) impacts, the project provides for 12 Barrier Island CPFs and 2 Mainland CPFs that are shown in Figure 1, Figure 2, and Figure 8. A summary of the CPFs are provided in Table 7 and a more detailed description of the each of the CPFs is provided in Appendix C.

As CPF sites are advanced to the PED phase, conceptual profiles for each CPF site that more accurately depict existing and proposed gradients at each site would be developed. The design criteria and/or configuration of CPFs selected may also be refined. In addition to stakeholder and community outreach, the PED phase will include field studies, surveys, and data collection inputs to a more detailed design of CPFs. Accordingly, the concept level plans simply illustrate the desired features at the identified sites to provide or improve CPFs.

Barrier Island Coastal Process Features

The CSRM sites address the expected sediment deficit into the bay system from the implementation of the FIMP beach fill plan components. The expected reduction in the number of island breaches and overtopping events during the life of the project will reduce the amount of sediment and associated overwash fan habitat introduced into the bay system during those events. As part of the cross-island transport analyses, there would be a total reduced sediment volume to the back bay system of approximately 4.2 M cy of sediment over the 50-year project life. The CSRM CPFs make up for this volume by considering the expected site-specific erosion rates at each CSRM CPF and determining the total volume anticipated placed over the project life.

Construction activities will range from standard beach fill placement techniques, to submerged nearshore bayside placement, to thin layer placement, and marsh regrading. The CPFs will be constructed in conjunction with the construction of other FIMP beach placement projects, and renourished when the beachfill features are nourished, currently estimated to be approximately a 4-year cycle.

The ESA CPFs seek to produce no net loss of habitat for ESA species of concern – specifically piping plovers. Both nesting and foraging habitat have been considered based on criteria established by the U.S. Fish and Wildlife Service (Service) during the plan development process. The Service's criteria includes, among others, shoreline slope, elevation, vegetation cover, buffers, and predator control. Each CPF has been evaluated for ESA offsets based on these criteria, and the total portfolio of CPFs provides the required total acreage offset as determined by the Service.

Specific criteria values under consideration include nesting habitat between elevations +4 and +9 ft. NGVD, foraging habitat between the locally determined lowest astronomical tide (LAT) and highest astronomical tide (HAT) elevation, beach slope no steeper than 4 percent, vegetation coverage less than 17 percent to qualify for full credit, and various buffer distances based on the adjacent upland land cover.

ESA CPF construction activities include a combination of regrading existing on-site sand to meet the target slopes and elevations and devegetation of upland areas to meet the target cover goals. Regrading will occur through use of standard earthmoving equipment. Devegetation will occur either via mechanical processes or the targeted application of herbicides.

All barrier island CPFs will be evaluated for ESA offsets during the project's monitoring and adaptive management phase.

CPF initial construction will coincide with the adjacent beach fill initial construction. CPF maintenance activities are expected to follow the beach fill's anticipated 4-year nourishment cycle. Adaptive management principles will be applied to the CPFs during each maintenance cycle, including CPF design criteria such as fill template elevations, and the need for living shoreline features.

Table 17 summarizes the recommended CPFs and identifies the sediment requirements for initial construction and for renourishment. The estimated sediment placement does not meet the 4.2 M cy requirement over a period of 30 years. In order to meet the 4.2 M cy requirements, the Corps is committed to adaptive management of the project. The adaptive management will include the following considerations for achieving the 4.2 M cy volume requirement:

1) Since inlet bypassing is recommended to continue for 50 years, renourishment of CPFs in proximity to inlet bypassing activities would continue beyond 30 years, and can achieve the quantity requirements, with no other modifications.

2) As part of adaptive management, the size and scope of each site will be revisited, and assessed to determine if additional quantity during renourishment would achieve the volumetric requirements.

3) There are several sites along Fire Island that were eliminated from consideration, due to landowner concerns. These sites could be revisited through the adaptive management process to achieve the sediment objectives.

4) Over the project life, if there is the need for a breach closure action, there is an opportunity to place an additional quantity of sand on the bay shoreline as part of this closure operation, which is not accounted for, and would increase the amount of sediment placed. The first option is currently included within the project cost estimate.

The following CPFs comprise the final plan:

Table 17. Description of Coastal Process Features (CPF)

CPF Number	CPF Name	CPF Purpose	CPF Description	Construction Contract	Initial Volume (cy)	Renourish volume (4-year) (cy)
1	Democrat Point West	ESA	Regrade and devegetate; modify pond to improve functionality of existing wetland/create new foraging habitat; conserve on site sand volume.	FI Inlet bypassing	n/a	n/a
2	Democrat Point East	ESA	Regrade and devegetate bay side; modify sand stockpiles to form barrier between recreation and ESA areas; conserve on site sand volume.	FI Inlet bypassing	n/a	n/a
3	Dunefield West of Field 4	ESA	Devegetate ocean side; maintain vegetation buffer with road on north side.	FI Inlet bypassing	n/a	n/a
4	Clam Pond	CSRM	Bay side fill placement to simulate cross island transport; possible living shoreline on north side per adaptive management plan.	Fire Island Renourishment	deferred to Year 4	123,000
5	Atlantique to Corneille	CSRM	Bay side fill placement to simulate cross island transport.	Fire Island Renourishment	deferred to Year 4	162,000
6	Talisman	CSRM	Bay side fill placement to simulate cross island transport.	Fire Island Renourishment	deferred to Year 4	221,000
7	Pattersquash Reach	CSRM/ESA	Devegetate bay side; shallow water bay side fill placement; south boundary follows Burma Rd alignment, includes physical barrier.	Moriches Inlet Bypassing	26,000	15,000
8	New Made Island Reach	CSRM/ESA	Devegetate bay side; shallow water bay side fill placement; south boundary follows Burma Rd alignment, includes physical barrier.	Moriches Inlet Bypassing	133,000	29,000

9	Smith Point County Park Marsh	CSRM	Bay side marsh restoration; fill placement to simulate cross island transport; regrade marsh elevation filling ditches and creating channels for tidal exchange.	Moriches Inlet Bypassing	343,000	18,000
10	Great Gun	ESA	Devegetate ocean side parcel.	Moriches Inlet Bypassing	n/a	n/a
11	Dune Rd Bayside Shoreline	CSRM	Bay side fill placement; bulkhead/groin removal; possible additional fill within offshore channel.	Shinnecock Inlet bypassing / PBRP	66,000	31,000
12	Tiana Bayside Park	CSRM	Bay side fill placement at east side of site; PED will determine fate of existing gabions.	Shinnecock Inlet bypassing / PBRP	48,000	47,000
				TOTAL VOLUME	616,000	425,000
MB 1	Mastic Beach 1	CSRM	Regrade and vegetate in conjunction with NS acquisition	Non-Structural Contract	n/a	n/a
MB 2	Mastic Beach 2	CSRM	Regrade and vegetate in conjunction with NS acquisition	Non-Structural Contract	n/a	n/a

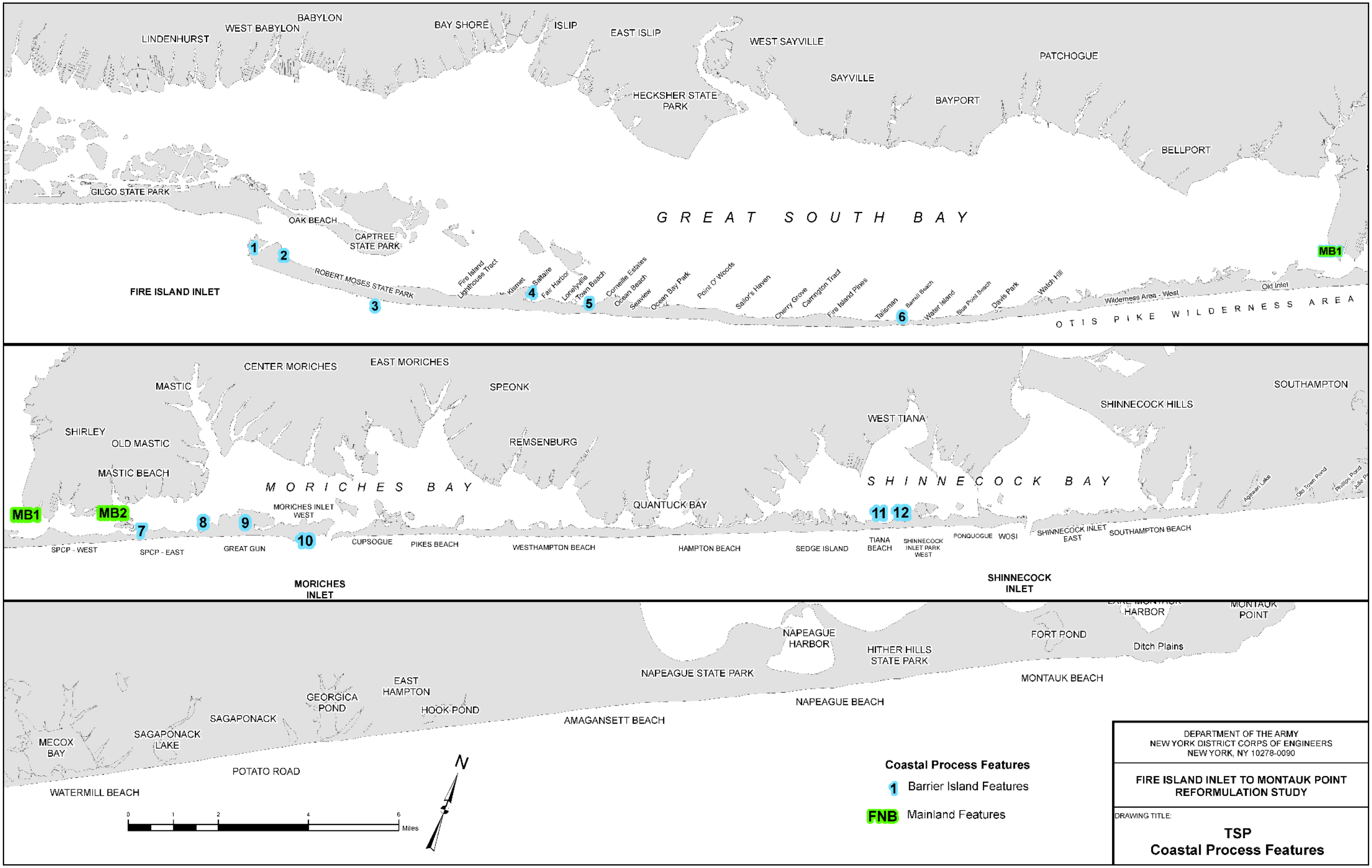


Figure 15. Location of Coastal Process Features

Mainland Coastal Process Features

Through agency coordination, opportunities to combine the nonstructural plans with restoration of natural systems for a more effective CSRM plan have been identified. In a letter dated Oct 11, 2017, the Assistant Secretary of the Army (Civil Works) concurred that the FIMP Mutually Acceptable Plan with the Department of the Interior may provide: "Localized acquisition would be included in areas subject to high frequency flooding, with reestablishment of natural floodplain functions."

Working with partner agencies, the Corps has identified two sites on the Mastic Beach Peninsula along the Long Island mainland where the natural protective features are not functioning to reduce damages, or are functioning at reduced capacity and could be reestablished. Factors contributing to the reduced CPF functions may include but are not limited to: loss of the habitat feature through erosion or past human activities; encroachment of development; or ecosystem degradation, possibly attributable to excessive nutrient loading, invasive species, alteration of hydrology or sea-level changes

For each site, the Corps compared the cost of the currently proposed non-structural retrofit plan to the cost of acquiring the properties to provide expanded CPF restoration opportunities. Preliminary concept level plans for re-establishing the protective features of natural areas at these locations have been developed. The mainland nonstructural CPFs would be implemented by the acquisition of buildings where the ground elevation is relatively low, and susceptible to very frequent inundation due to sea level rise. The acquisition of these buildings provides a vacant area for reestablishing floodplain function. The mainland CPF sites also contain privately and publically owned vacant lands. Real estate interests will need to be acquired on these adjacent vacant lands, in order to provide a continuous, connected site for reestablishing floodplain function.

The mainland CPF restoration concepts were developed to provide both CSRM benefits by providing a buffer to reduce wave energy and impacts to the developed areas and to provide sustainable natural habitats. There are two basic design profiles:

Some parts of the sites have a typical tidal marsh profile, in which low marsh vegetation lines the shore within the intertidal zone between mean low water (MLW) and mean high water (MHW). High marsh would be located at roughly the high tide line (HTL) and would extend to a little above mean higher high water (MHHW), with high marsh grasses found at the lower elevation in this zone and high marsh shrubs dominating the higher elevations. The high marsh shrubs would form a mosaic with upland forest species in the transition zone above tidal influence, yielding to a dominant upland maritime forest community.

Other parts of the sites currently have higher elevation areas along the shoreline. Although this may be from historic filling associated with development, removal of fill and lowering of the elevation would be counter to the intended objective of providing CPF. This existing condition gives a different profile of CPFs when viewed from the shoreline. At these locations a maritime forest community would border the shoreline, followed by a high marsh shrub, high marsh grasses, and low marsh. The transition would be reversed leading to an upland forest community toward the mainland. Locations with interior tidal channels or creeks may have a similar profile.

Integration of Local Land Use Regulations and Management

The existing land management regulations and opportunities to improve land management are summarized below:

The National Park Service enforces regulations regarding zoning and development within the boundaries of the Fire Island National Seashore and is committed to work with the towns and villages on Fire Island to ensure their compliance with the 'Federal Zoning Standards'.

Before construction of any Corps project for coastal storm risk management (CSRM), the non-Federal sponsor must agree to participate in and comply with Federal floodplain management.

Development restrictions exist within the easements for beachfill projects. These are enforceable restrictions. The proposed construction of the CSRM features, including a beach and dune will require the acquisition of permanent easements along the shorefront. These easements preclude future development on lands within the beach and dune footprint. These easements would be enforced by State and local authorities to ensure no development within the easements.

Additionally, within the study area there are existing land use regulations to address building and rebuilding in the high hazard areas along the coast. State and local agencies have authority to restrict development within shoreline areas through zoning or special district restrictions. Efforts should be made to ensure that these zoning overlays are consistent in their geographic applicability.

While the Corps has no authority to enforce other entities' laws and regulations it does have authority to enforce FIMP project agreements, easements, and other project elements. In addition, the Inspection of Completed Works program provides a mechanism for monitoring and reporting of any new development within the project area to the appropriate federal, state, and local entities responsible for enforcing applicable land use regulations.

CPF #1 DEMOCRAT POINT WEST

Democrat Point is located on the western end of Fire Island within Robert Moses State Park. Democrat Point defines the south and east boundary of Fire Island Inlet with Oak Beach to the north and west. Democrat Point is a complex coastal area. At the western end lies a continuously evolving sand spit. A wetland encompasses portions of the center of Democrat Point. A rock jetty spanning the width of the island defines the east boundary of Democrat Point. Democrat Point contains dunes with heavy vegetation near the center. These taper toward the water on the north, west, and south sides. A small tidal pond, located just east of the Point's center, is surrounded by wetlands.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +7 ft.-NAVD88 at Democrat Point.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for regrading and devegetating proposed habitat. Foraging habitat encompasses the area between the LAT and the highest astronomical tide (HAT), while nesting habitat extends from the HAT to an elevation of +9.5 ft.-NAVD88. Habitat is proposed on the north and south sides of the Point with a berm spanning the interior portion at a maximum elevation of +8.3 ft.-NAVD88. Modifications are not proposed along the western side of the project due to the migrating sand spit. Fill will be placed in the vicinity of the wetland and tidal pond area to improve the productivity and functionality of the wetland. Through the proposed activities at Democrat Point, early successional habitat will be created.

FIMP designates the Democrat Point CPF as a species protection zone and recommends prohibiting installation of beach stabilization features. The Corps recommends the local land management agency consider predator management in newly set-aside areas.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure the resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future sediment placement.

CPF #2 DEMOCRAT POINT EAST

Democrat Point (East of Jetty) is located on the western end of Fire Island within Robert Moses State Park. Democrat Point (East of Jetty) lies just east of the Fire Island Inlet with Oak Beach to the north and west. Democrat Point (East of Jetty) is a sandy bayside beach, where sand was previously stockpiled after dredging projects in the vicinity. The project area contains coastal dunes with sporadic vegetation.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +5 ft.-NAVD88 at Democrat Point (East of Jetty).

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for regrading and devegetating the site. The regrading template includes a 2 percent slope on the north bank to allow for viable shorebird habitat. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to a constructed elevation of +5 ft.-NAVD88.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management in newly created CPFs. In addition, the Corps anticipates the park's ORV policy will be implemented during nesting season.

CPF #3 DUNEFIELD WEST OF FIELD 4

Dunefield West of Field 4 is located on the western end of Fire Island, southeast of the Robert Moses Causeway, within Robert Moses State Park on the oceanside. Dune Field West of Field 4 contains dunes with heavy vegetation. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting).

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for removing vegetation from the site. No regrading is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +10 ft.-NAVD88 at Dune Field West of Field 4.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating to produce both foraging and nesting habitat within the project site. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to the naturally occurring +10 ft.-NAVD88 elevation contour.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management in newly established CPFs.

CPF #4 CLAM POND

Clam Pond is located on the western portion of Fire Island between Saltaire and Fair Harbor. Clam Pond lies south of the West and East Fire Islands. The Clam Pond area is shallow with an average depth of approximately 1 ft. with a maximum of about 5 ft. Historically a sand spit existed at this location. This CPF seeks to add fill to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by simulating cross island transport.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA’s reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +5 ft.-NAVD88 at Clam Pond.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for fill placement and grading over a project area of approximately 15.3 acres (ac). The project area includes 4.4 ac of proposed newly created nesting habitat and 8.2 ac of proposed foraging habitat. The foraging habitat consists of both newly created and existing habitat between the HAT and LAT elevations. On the north side of the project, fill will slope from the +5 ft.-NAVD88 contour to the intersection with existing grade. A living shoreline will be placed on the north side of the project site to help retain fill. On the south side, fill will slope at 3 percent between +5 ft.-NAVD88 and the HAT elevation, then at 1 percent to the intersection with existing grade.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management.

CPF #5 ATLANTIQUE TO CORNEILLE

Atlantique to Corneille is located on the western portion of Fire Island, on the bay just east of Atlantique Park. The average nearshore water depth on the bayside at Atlantique to Corneille is approximately 3 ft. Boat docks exist to the east and west of this CPF, while several small bulkheads lie on either side of the site. The CPF design fill must limit impacts to navigation features. This CPF design seeks to add fill to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by simulating cross island transport.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +4 ft.-NAVD88 at Atlantique to Corneille.

To simulate cross island transport and create early successional habitat that provides nesting and foraging for shorebirds, plans call for the placement of fill, transitioning from the western bulkhead area to the spit to the east. The regrading template includes 3 percent and 1 percent slopes on the north bank to allow for viable shorebird habitat, and a 4 percent slope below the LAT to tie into the existing grade. The landward side of the fill profile will tie into existing grade at +4 ft.-NAVD88. The cross shore extent of this CPF is limited due to the overall site configuration.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management and symbolic fencing to the +10 ft.-NAVD88 contour.

CPF #6 TALISMAN

Talisman is located in the central portion of Fire Island within Barrett Island Park between Fire Island Pines and Water Island. The average nearshore water depth on the bayside at Talisman range from 1 ft. to 3 ft. Historically a sand spit existed at this location. The west side of Talisman includes a park dock extending approximately 400 ft. into the bay. The proposed fill extends eastward approximately 1,400 ft. A private dock lies to the east of this CPF. Fill placed at this CPF should account for potential impacts to these structures. This CPF design seeks to add fill to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by simulating cross island transport.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation up to +4 ft.-NAVD88 at Talisman.

To simulate cross island transport and create early successional habitat that provides nesting and foraging for shorebirds, plans call for the reestablishment of approximately 1,400 ft. of the historic shoreline through the placement of fill. A living shoreline will be placed on the north side of the project site to help reduce the erosion rate. The regrading template includes 3 percent and 1 percent slopes on the north bank to create viable shorebird habitat, and a 4 percent slope below the LAT to tie into the existing grade. Some of the upland portions of this CPF lie below the design berm elevation of +4 ft.-NAVD88. As such, the landward side of the fill profile will transition to existing grade at a 4 percent slope, where necessary. Otherwise the berm will tie in to the existing grade at +4 ft.-NAVD88. This will preserve the area as nesting habitat. The cross shore extent of this CPF is limited due to the overall site configuration.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management and symbolic fencing to the +10 ft.-NAVD88 contour.

CPF #7 PATTERSQUASH REACH

Pattersquash Reach is located on the eastern portion of Fire Island on the bayside within Smith Point County Park. Pattersquash Reach lies between two inlets, Old Inlet to the west and Moriches Inlet to the east. The project area contains coastal dunes with vegetation and an historically ephemeral sand spit. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by placing fill to simulate cross island transport.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating the site. All devegetation will occur north of Burma Road. In addition, in-water sediment placement to an elevation of -1 ft.-NAVD88 will simulate cross island transport. No upland regrading is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to the naturally occurring +8 ft.-NAVD88 contour at Pattersquash Reach.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management and symbolic fencing to the 10 ft.-NAVD88 contour.

CPF #8 NEW MADE ISLAND REACH

New Made Island Reach is located on the eastern portion of Fire Island on the bayside, within Smith Point County Park. New Made Island Reach lies between two inlets, Old Inlet to the west and Moriches Inlet to the east. The project area contains coastal dunes with vegetation and an historically ephemeral sand spit. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by placing fill to simulate cross island transport.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating the site. All devegetation will occur north of Burma Road. In addition, in-water sediment placement to an elevation of -1 ft.-NAVD88 over 15.8 ac will simulate cross island transport. No upland regrading is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA’s reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to the naturally occurring +10 ft.-NAVD88 contour at New Made Island Reach.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management and symbolic fencing to the 10 ft.-NAVD88 contour.

CPF #9 SMITH POINT COUNTY PARK MARSH

Smith Point County Park Marsh is located on the eastern portion of Fire Island on the bayside, within Smith Point County Park. Smith Point County Park Marsh lies between two inlets, Old Inlet to the west and Moriches Inlet to the east. The project area contains a large coastal salt marsh with linear man-made ditches cut through the wetland. The north/south running ditches are cut at approximately 1,000 ft. intervals while the east/west running ditches are cut at approximately 200 ft. intervals. This CPF design seeks to add fill to provide CSRM benefits by simulating cross island transport.

To restore cross island transport, plans call for placement of fill across the salt marsh. The site will be regraded to allow for wetland vegetation reestablishment. Higher elevations buffer the project area mimicking its current state. The existing man-made ditches will be filled to reestablish a uniform marsh across the entire project area. Tidal channels will be established. These are design features that will allow tidal exchange to extend to the interior of the marsh.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management.

CPF SITE #10 GREAT GUN

Great Gun is located on the eastern portion of Fire Island on the Atlantic Ocean side within Smith Point County Park. Great Gun lies immediately west of Moriches Inlet. The project area contains coastal dunes with vegetation. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting).

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for removing vegetation. No regrading is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA’s reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +10 ft.-NAVD88 at Great Gun.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating the site. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to the naturally occurring +10 ft.-NAVD88 elevation contour or 640 ft. from the HAT.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management in newly established CPFs.

CPF SITE #11 DUNE ROAD, EAST QUOGUE

45, 47, and 51 Dune Road, East Quogue is located on the eastern portion of Westhampton Island, on the bayside just west of Shinnecock Inlet and Shinnecock County Park West. The average nearshore water depth on the bayside at 45, 47, and 51 Dune Road, East Quogue is approximately 3 ft. with a maximum of about 6 ft. A couple bulkheads and groins lie in the center of the project site while multiple pile supported and floating docks associated with Tiana Bayside Park lie just to the east. The CPF design fill must limit impacts to adjacent navigation features. This CPF design seeks to add fill to provide CSRM benefits by simulating cross island transport.

As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and the Highest Astronomical Tide (HAT) as the upper bound for the tide range.

To restore cross island transport, plans call for removal of the bulkheads and groins and placement of fill across the embayment centered on the currently bulkheaded properties. The fill template includes a berm extending bayward from the existing HAT contour with a landward extension to the intersection with native ground. The template includes an assumed 5 percent slope from the bayside edge of berm to the intersection with the bay bottom. The cross shore extent of this CPF is limited due to the overall site configuration. This is considered the base project for CPF 37.

The design may add CSRM benefits by considering additional fill within the existing offshore channel. Additional Fill 1 involves placing 7,021 cy of fill within a 350 x 600 ft. area immediately north of the base project. Additional Fill 2 extends this area an additional 500 ft. to the north and adds 8,581 cy. Combined Additional Fill 1 and 2 provide capacity for an additional 15,602 cy.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management.

CPF SITE #12 TIANA BAYSIDE PARK

Tiana Bayside Park is located on the eastern portion of Westhampton Island, on the bayside just west of Shinnecock Inlet and Shinnecock County Park West. The average nearshore water depth on the bayside at Tiana Bayside Park is approximately 3 ft. with a maximum of 6 to 7 ft. in an offshore channel. Several pile supported and floating docks lie along the western half of the project site. A 750 ft. long line of rock-filled gabions fronts the shoreline within the dock structures. The CPF design fill must limit impacts to navigation features. This CPF design seeks to add fill to provide CSRM benefits by simulating cross island transport.

As a proxy for the local spring tide range, the following discussion applies NOAA’s reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for the tide range.

To restore cross island transport, plans call for the placement of fill from the eastern bulkhead area across the adjacent bayside shoreline to the east. The landward side of the fill profile will tie into the closer of the existing grade at +4 ft.-NAVD88 or the adjacent roadway right-of-way. The fill template includes a berm extending bayward. The template includes an assumed 5 percent slope from the bayside edge of berm to the intersection with the bay bottom. The cross shore extent of this CPF is limited due to the overall site configuration.

The base design includes fill placed to -3 ft.-NAVD88 within the eastern half of the navigation channel immediately offshore of the project area. The total fill currently envisioned in the project area is 36,647 cy.

The eastern 350 ft. of gabions may be treated in one of three possible ways. First, they may be left as-is in place. Second, they may be removed and replaced with a small amount of fill to soften the shoreline. Finally, they may be left in place and buried beneath a small amount of fill to soften the shoreline while retaining the shoreline protection should erosion re-expose the gabions.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The Corps will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The Corps recommends the local land management agency consider predator management.

CPF SITE MB#1 MASTIC BEACH #1

Mastic Beach #1 is a roughly 25 acre site located on the “mainland” of Long Island in the town of Mastic Beach, north of Narrow Bay. It is situated west of Pattersquash Creek and east of Sheepen Creek and includes the shoreline and adjacent areas along Riviera Drive, roughly between Montauk Drive and Hickory Road. This CPF site predominantly consists of vacant land, but also includes eight buyout parcels in residential areas that are subject to very frequent flooding and low lying roads that in some locations are lower than adjacent areas and provide conduits for floodwaters. Undeveloped areas consist primarily of common reed dominated wetlands, some existing uplands and high marsh shrub areas. Linear channels within the existing marshes are visible on the aerial photos, indicating that alterations in hydrology have contributed to degradation of the natural marsh ecosystem.

The conceptual CPF plan for MB#1 consists of reestablishment of a natural vegetation community transition, beginning with forested uplands adjacent to the remaining residential areas, followed by high marsh shrub, high marsh grasses and low march near the shoreline. Following selective acquisition, former private parcels and abandoned roads would be restored to forested areas, enhancing the CPF function of this vegetation type by increasing the width of this community. Where higher elevations exist along the shoreline, these areas would be expanded if possible to create and enhance a high marsh shrub vegetation community. Although not depicted on the concept plan, existing linear channels would be replaced with more sinuous natural configurations to enhance the hydrologic function of the wetland. The channel configuration and refinement of the various planting zones would be developed during the PED phase. The current concept level plan consists of approximately 2 acres of maritime forest, approximately 14 acres of high marsh and approximately 9 acres of low marsh habitat creation and enhancement.

CPF SITE MB#2 MASTIC BEACH #2

Mastic Beach 2 consists of two areas in the town of Mastic Beach and east of Pattersquash Creek. Area 1 has two sections. One section to the west is south of Grove Road West and west of Jefferson Drive. It consists of primarily vacant land, with one buyout property. The other section consists of marshes and adjacent vacant lands on either side of the tidal creek between Jefferson Drive and Beaver Drive. Mastic Beach 2 Area 2 is located west of Lawrence Creek and is bordered on the east by the William Floyd Estate section of Fire Island National Seashore. There are five buyout parcels associated with MB#2 Area 2. Mastic Beach 2 consists primarily of common reed dominated wetlands, some of which have been hydrologically altered as a result of linear channel construction. Other locations appear to be hydrologically isolated and low lying. Low marsh vegetation is present in lower lying areas and adjacent to channels. Uplands and scattered residences are present throughout the site.

The CPF approach for MB#2, Areas 1 and 2, are similar to that for MB#1. Basically, the forested upland perimeter would be enhanced or established at existing high ground, including selectively acquired properties and abandoned roads. Wetland hydrology would be enhanced and high marsh and low marsh would be established or enhanced at suitable elevations. The hydrologic enhancements and refinement of the various planting zones would be developed during the PED phase. The current concept level plan for MB#2 Area 1 consists of approximately 2 acres of maritime forest, approximately 9 acres of high marsh and approximately 13 acres of low marsh habitat creation and enhancement, for a total of approximately 24 acres. MB#2 Area 2 is smaller, totally approximately seven acres. The current concept level plan for MB#2 Area 2 consists of approximately 2 acres of maritime forest, approximately 2 acres of high marsh and approximately 3 acres of low marsh habitat creation and enhancement.

APPENDIX C OVERVIEW OF FIMP PROCESS FEATURES

CPF Site 1 Democrat Point West	West of Jetty-Reach GSB-1A 40.625280° N / 73.307751° W

CPF SITE GOALS

- Earthwork to meet target elevations and slopes for ESA credit
- Maximum elevation target = 8.33 ft-NAVD88 (9.5 ft-NGVD29)
- Fill pond to reduce depth and improve overall productivity and funtionality of existing wetland and create new foraging habitat
- Conserve sand volume on site
- Devegetate area to meet ESA goals

Democrat Point West is located on the western end of Fire Island within Robert Moses State Park. Democrat Point West defines the south and east boundary of Fire Island Inlet with Oak Beach to the north and west. Democrat Point West is a complex coastal area. At the western end lies a continuously evolving sand spit. A rock jetty spanning the width of the island defines the east boundary of Democrat Point West. Democrat Point West contains heavily vegetated dunes near the center of the site. These dunes taper in elevation toward the water on the north, west, and south sides. A small tidal pond, located just east of the Point's center, is surrounded by wetlands.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +8.3 ft-NAVD88 at Democrat Point. Establishing the maximum elevation at +8.3 ft-NAVD88 should allow overwash of the site to occur multiple times a year.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for regrading and devegetating approximately 69.6 acres (ac) of proposed habitat. The regrading template includes a 3% slope extending from the lowest astronomical tidal (LAT) elevation and/or the wetland boundary to the +7 ft-NAVD88 contour. Along the spine of the site, a raised dune feature will extend to +8.3 ft-NAVD88 (+9.5 ft-NGVD29). Foraging habitat (64.2 ac) encompasses the area between the LAT and the highest astronomical tide (HAT), while nesting habitat (52.1 ac) extends from the HAT to an elevation of +8.33 ft-NAVD88. The migrating sand spit (35.9 ac) along the western side of the CPF is considered foraging habitat. On the eastern side of the project area a 23.4 ac wetland and tidal pond exists. The pond will be filled to an elevation of -2.0 ft-NAVD88 to improve the wetland's overall productivity and functionality and establish the area as foraging habitat. Connectivity to bayside foraging habitat is maintained along the shallow creek on the northeast corner of the pond. Through the proposed activities at Democrat Point West, early successional habitat will be created.

FIMP designates the Democrat Point West CPF as a species protection zone and recommends prohibiting installation of beach stabilization features. The USACE recommends the local land management agency consider predator management in newly set-aside areas.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure the resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future sediment placement.

1

CPF Site 1 Democrat Point		West of Jetty-Reach GSB-1A 40.625280° N / 73.307751° W
CPF PARAMETERS		
Feature	ESA	
Cut Volume (cy)	-187,017	
Fill Volume (cy)	168,514	
Net Volume (cy)	-18,503	
Acreage (Nesting\Foraging\Devegetation)	139.5 (52.1\64.2\69.6)	
Activity	Regrade & de-vegetate	
DATA SOURCES		
Topographic	USGS, 2016	
Bathymetric	USGS, 2016	
Aerial Imagery	Google Earth, 2016	
Vegetation	N/A*	
REAL ESTATE INFORMATION		
Property Owner	New York State Fire Island State Park	
Municipality	Islip	
County	Suffolk	
CBRA	NY-59, System Unit	

*up to date vegetation data were not available for the study area

CPF Site 1 Democrat Point				West of Jetty-Reach GSB-1A 40.625280° N / 73.307751° W
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)				
Closest Tidal Benchmark	Fire Island, NY		Highest Astronomical Tide (HAT)	2.79
			Mean Higher High Water (MHHW)	1.85
Coordinates	40.627811° N 73.306047° W		Mean High Water (MHW)	1.58
			Mean Sea Level (MSL)	-0.16
0 ft-NAVD	1.17 ft-NGVD		Mean Tide Level (MTL)	-0.24
Range (MHW-MLW)		3.64	Mean Low Water (MLW)	-2.06
Diurnal Range (MHHW - MLLW)		4.06	Mean Lower Low Water (MLLW)	-2.22
Largest Tidal Range (HAT-LAT)		5.89	Lowest Astronomical Tide (LAT)	-3.10

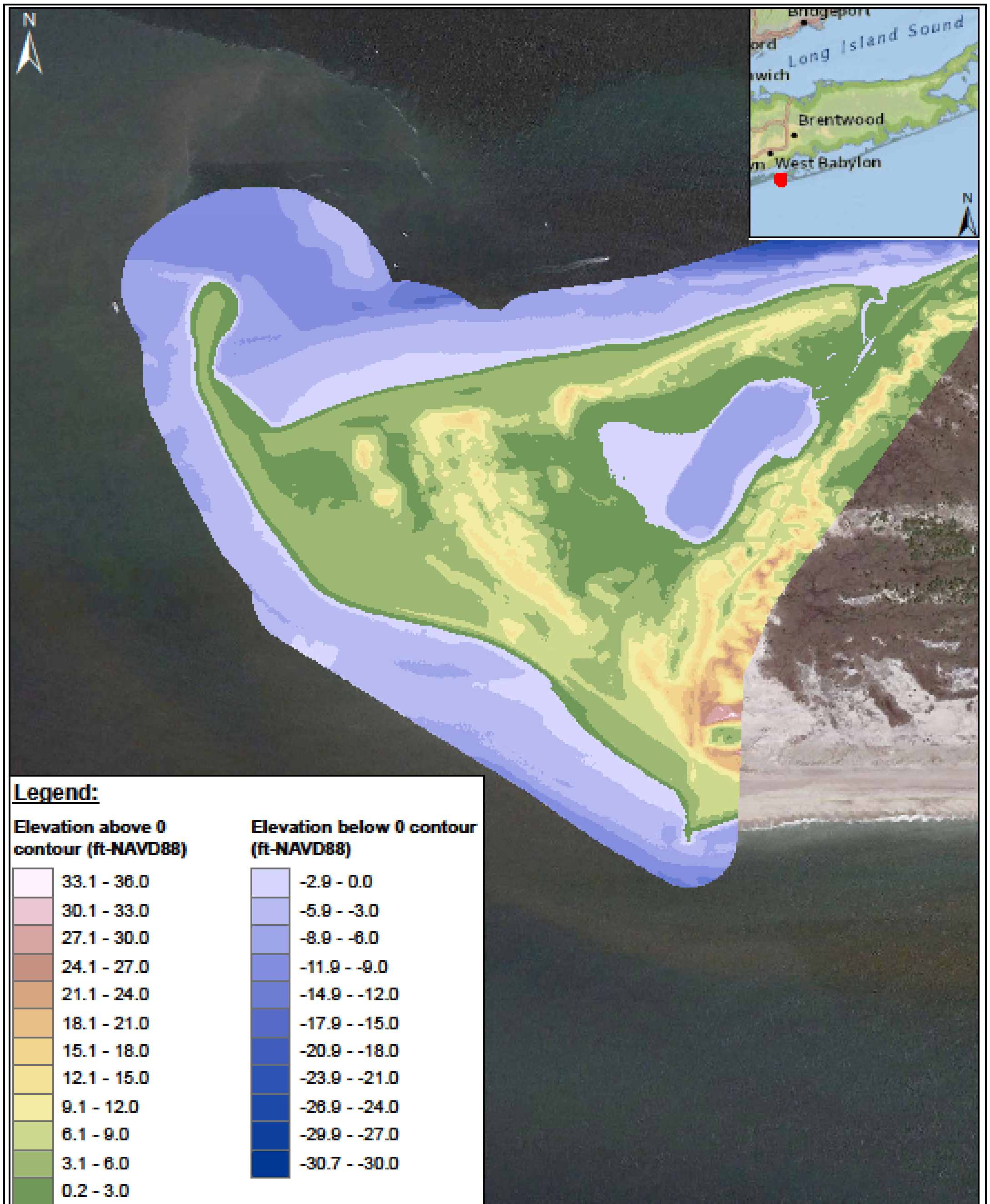
BAYSIDE WAVE ENVIRONMENT

Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft)
1-year	10,059	2.3	0.05	1.02	6.16
5-year	10,059	2.9	0.08	1.23	7.00
10-year	10,059	3.2	0.10	1.31	7.40

OCEANSIDE TIDAL ENVIRONMENT (ft-NAVD88)				
Closest Tidal Benchmark	Fire Island, NY		Highest Astronomical Tide (HAT)	3.00
			Mean Higher High Water (MHHW)	2.06
Coordinates	40.62171° N 73.308894 ° W		Mean High Water (MHW)	1.76
			Mean Sea Level (MSL)	-0.18
0 ft-NAVD	1.17 ft-NGVD		Mean Tide Level (MTL)	-0.22
Range (MHW-MLW)		3.96	Mean Low Water (MLW)	-2.20
Diurnal Range (MHHW - MLLW)		4.41	Mean Lower Low Water (MLLW)	-2.36
Largest Tidal Range (HAT-LAT)		6.24	Lowest Astronomical Tide (LAT)	-3.24

OCEANSIDE WAVE ENVIRONMENT

Return Period	Deep Water Wave Height (ft)	Surf Zone Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Surf Zone Wave Height (ft)
1-year	14.2	6.8	1.00	0.92	11.51
5-year	19.4	7.1	1.83	2.01	13.73
10-year	21.7	7.2	2.32	2.48	14.79

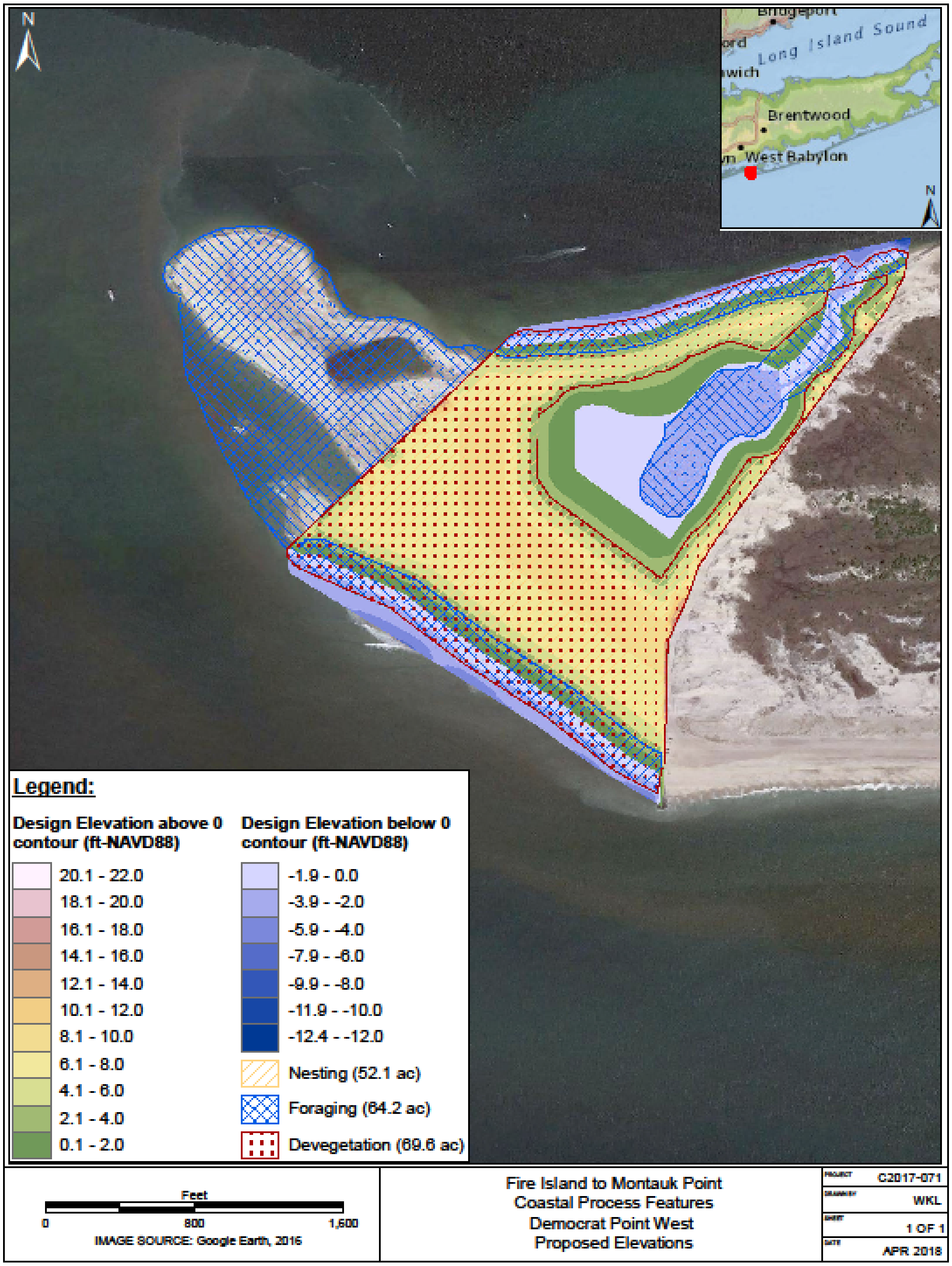


Feet
0 800 1,600
IMAGE SOURCE: Google Earth, 2016

Fire Island to Montauk Point
Coastal Process Features
Democrat Point West
Existing Conditions

C2017-071
WKL
1 OF 1
MAR 2018

4


N
Bridgeport
Long Island Sound
Brentwood
West Babylon
Legend:
Design Elevation above 0 contour (ft-NAVD88)
20.1 - 22.0
18.1 - 20.0
16.1 - 18.0
14.1 - 16.0
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.1 - 2.0
Design Elevation below 0 contour (ft-NAVD88)
-1.9 - 0.0
-3.9 - -2.0
-5.9 - -4.0
-7.9 - -6.0
-9.9 - -8.0
-11.9 - -10.0
-12.4 - -12.0
Nesting (52.1 ac)
Foraging (64.2 ac)
Devegetation (69.6 ac)
Feet
0
800
1,600
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Democrat Point West
Proposed Elevations
C2017-071
WKL
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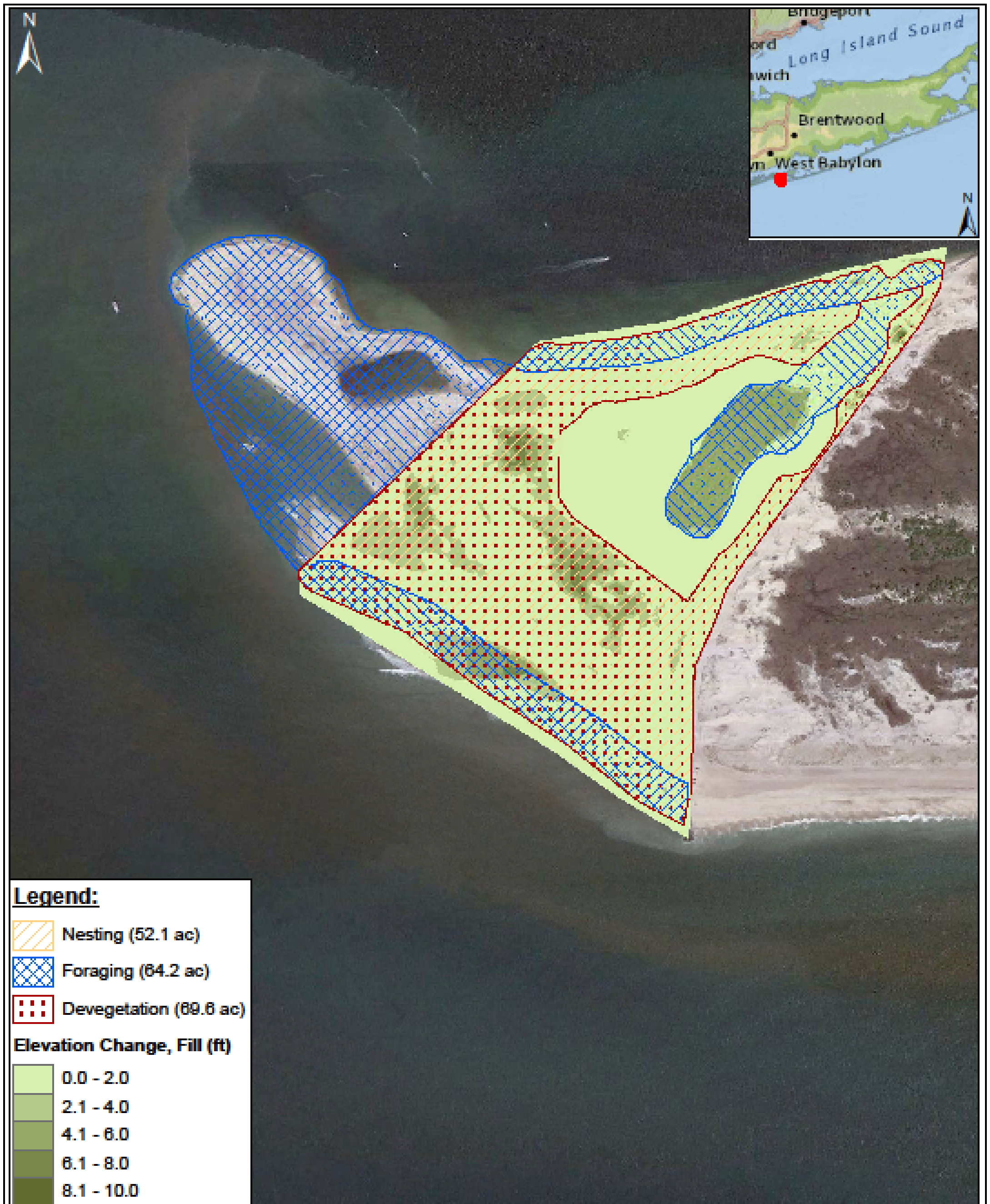
APR 2018

5



Feet

0 800 1,600

IMAGE SOURCE: Google Earth, 2016

Fire Island to Montauk Point
Coastal Process Features
Democrat Point West
Proposed Elevation Changes

PROJECT	C2017-071
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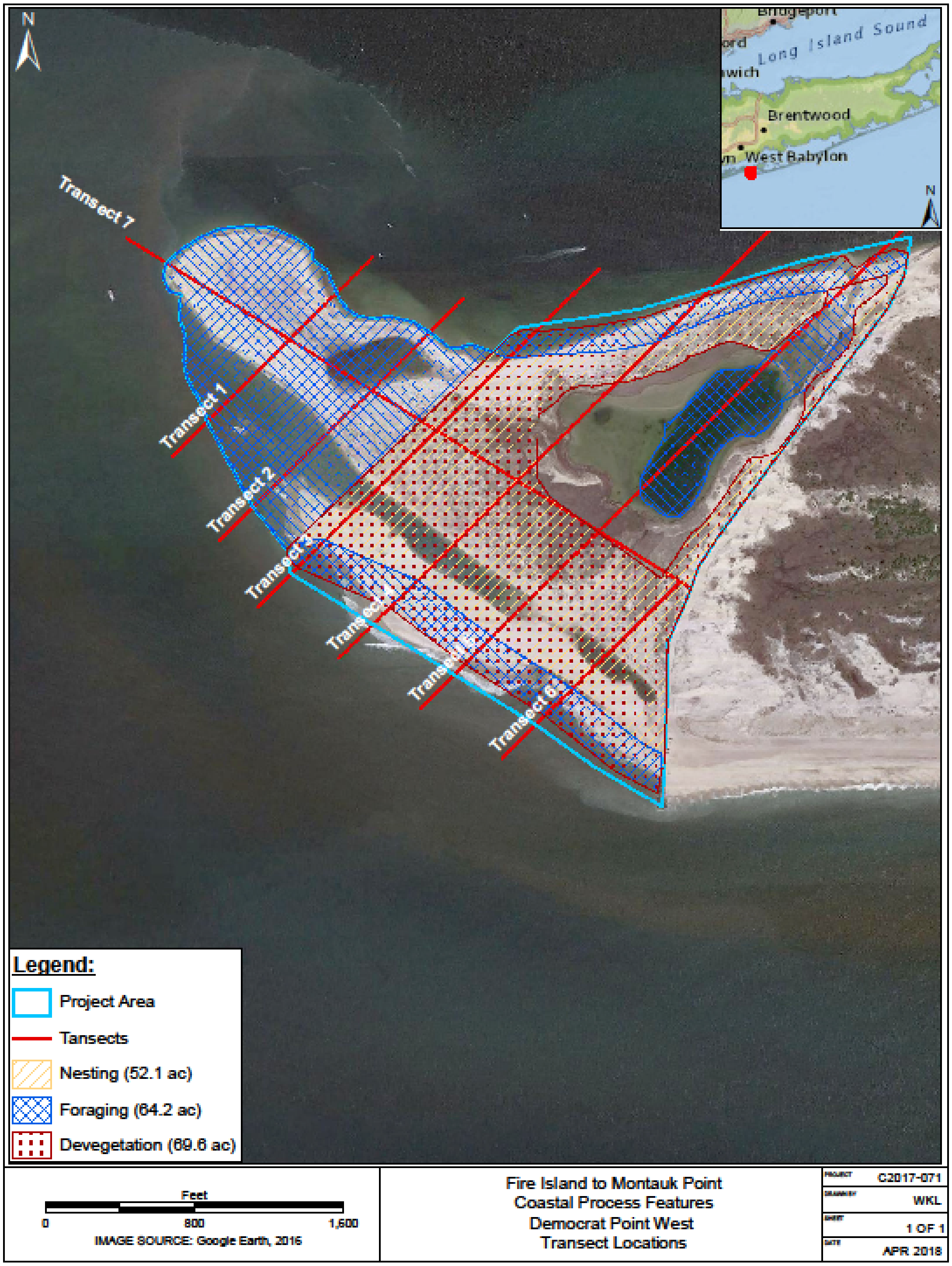
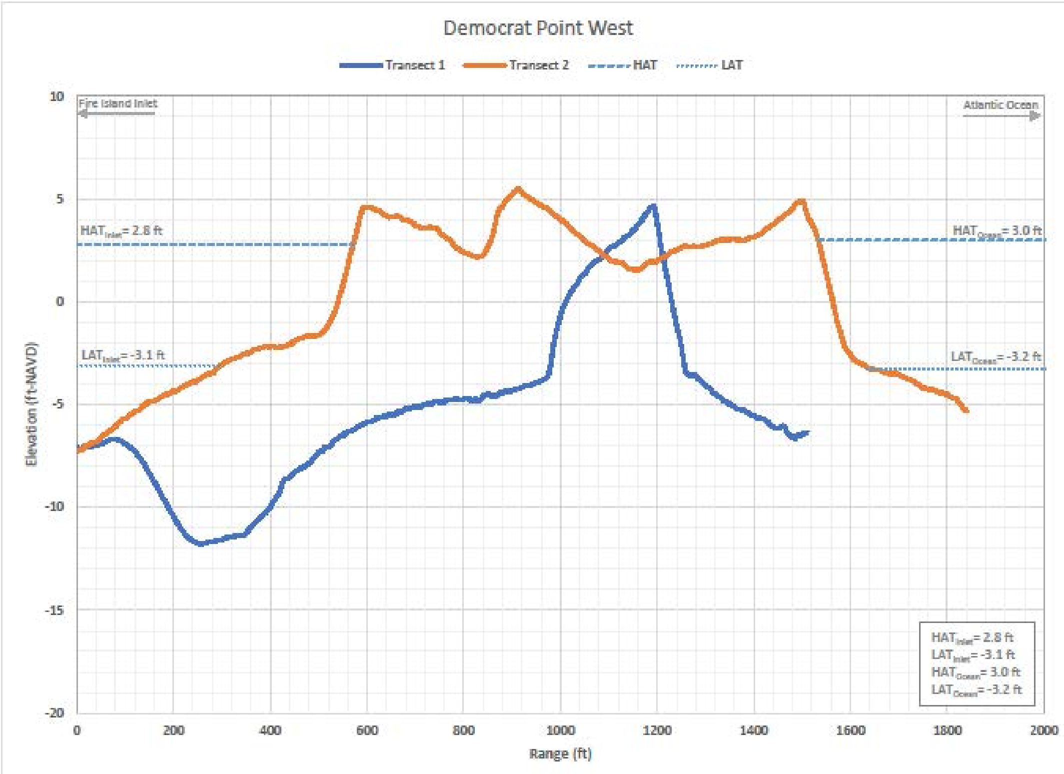
DATE	APR 2018



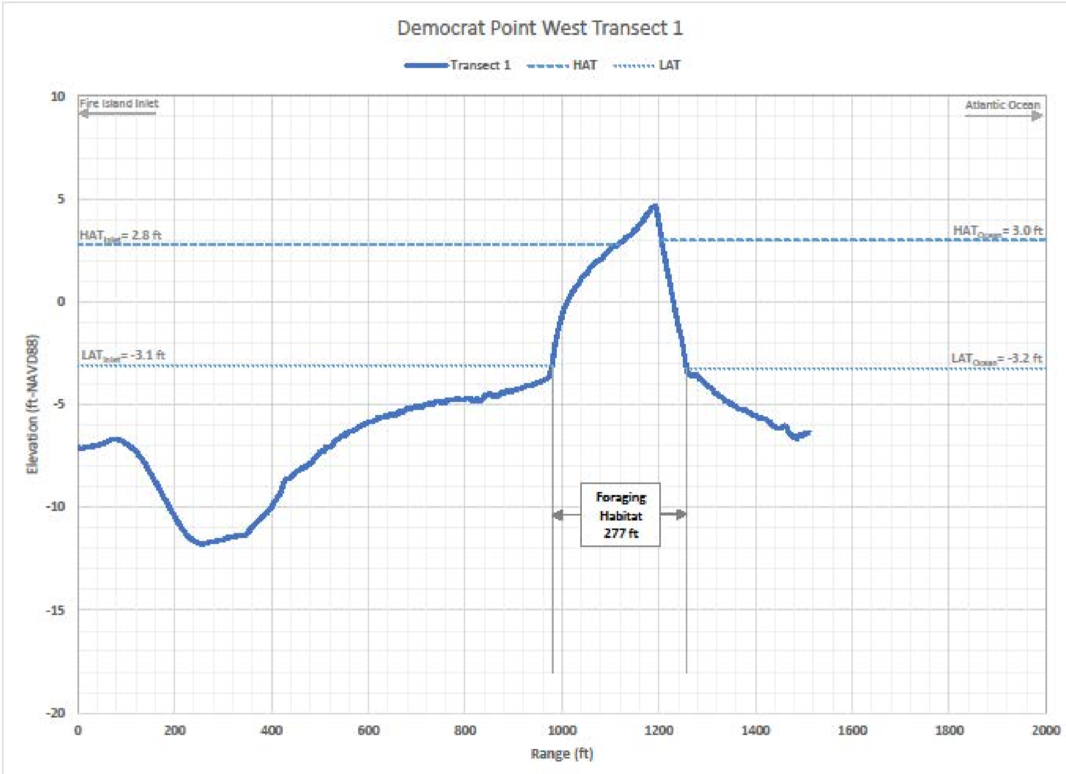
N
Bridgeport
Long Island Sound
Brentwood
West Babylon
Transect 7
Transect 1
Transect 2
Transect 6
Legend:
Project Area
Tansects
Nesting (52.1 ac)
Foraging (64.2 ac)
Devegetation (69.6 ac)
Feet
0
800
1,600
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Democrat Point West
Transect Locations
C2017-071
WKL
1 OF 1
APR 2018

7



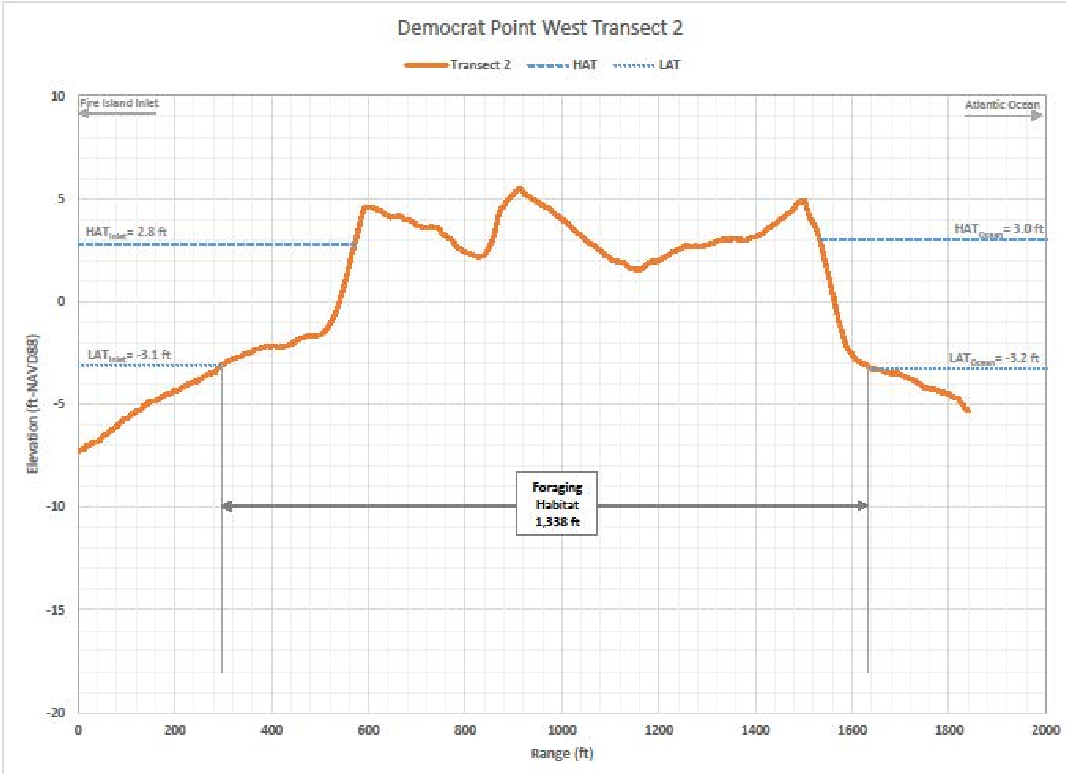
Democrat Point West
Transect 1
Transect 2
HAT
LAT
Fire Island Inlet
Atlantic Ocean
HAT$_{Inlet}$= 2.8 ft
HAT$_{Ocean}$= 3.0 ft
LAT$_{Inlet}$= -3.1 ft
LAT$_{Ocean}$= -3.2 ft
HAT$_{Inlet}$= 2.8 ft
LAT$_{Inlet}$= -3.1 ft
HAT$_{Ocean}$= 3.0 ft
LAT$_{Ocean}$= -3.2 ft
Elevation (ft-NAVD)
Range (ft)

8



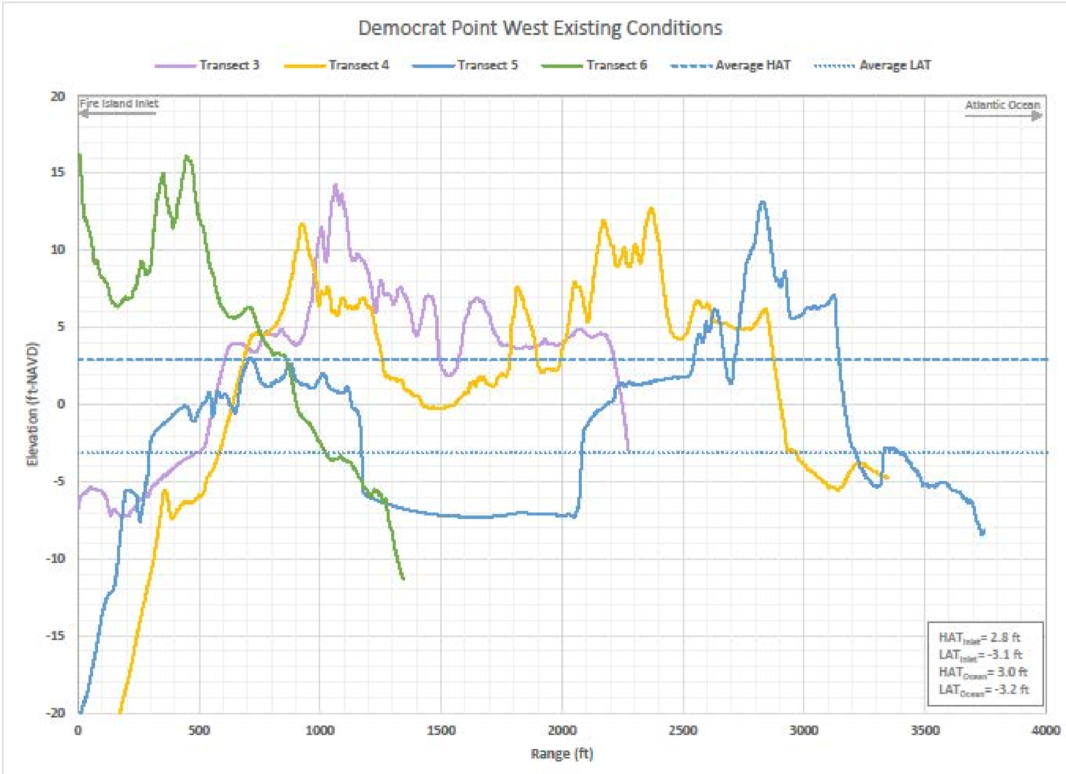
Democrat Point West Transect 1
Transect 1
HAT
LAT
Fire Island Inlet
Atlantic Ocean
HAT Inlet = 2.8 ft
HAT Ocean = 3.0 ft
LAT Inlet = -3.1 ft
LAT Ocean = -3.2 ft
Foraging Habitat 277 ft
Elevation (ft-NAVD88)
Range (ft)

9

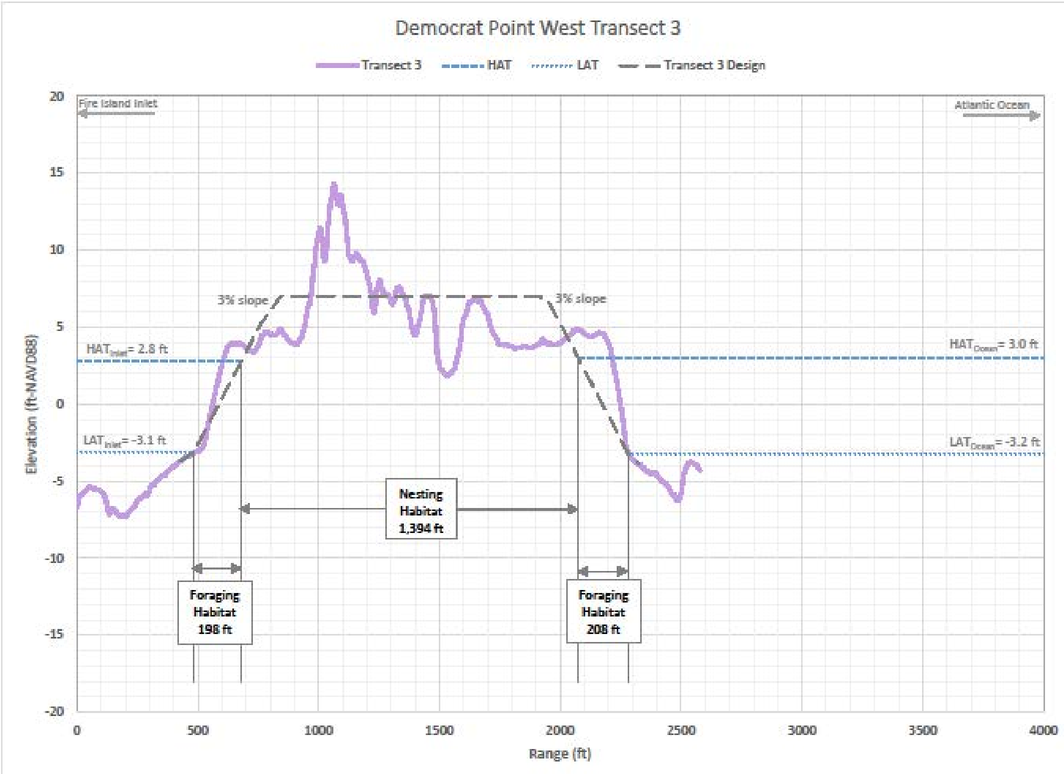


Democrat Point West Transect 2
Transect 2
HAT
LAT
Fire Island Inlet
Atlantic Ocean
HAT Inlet = 2.8 ft
HAT Ocean = 3.0 ft
LAT Inlet = -3.1 ft
LAT Ocean = -3.2 ft
Foraging Habitat 1,338 ft
Elevation (ft-NAVD88)
Range (ft)

10

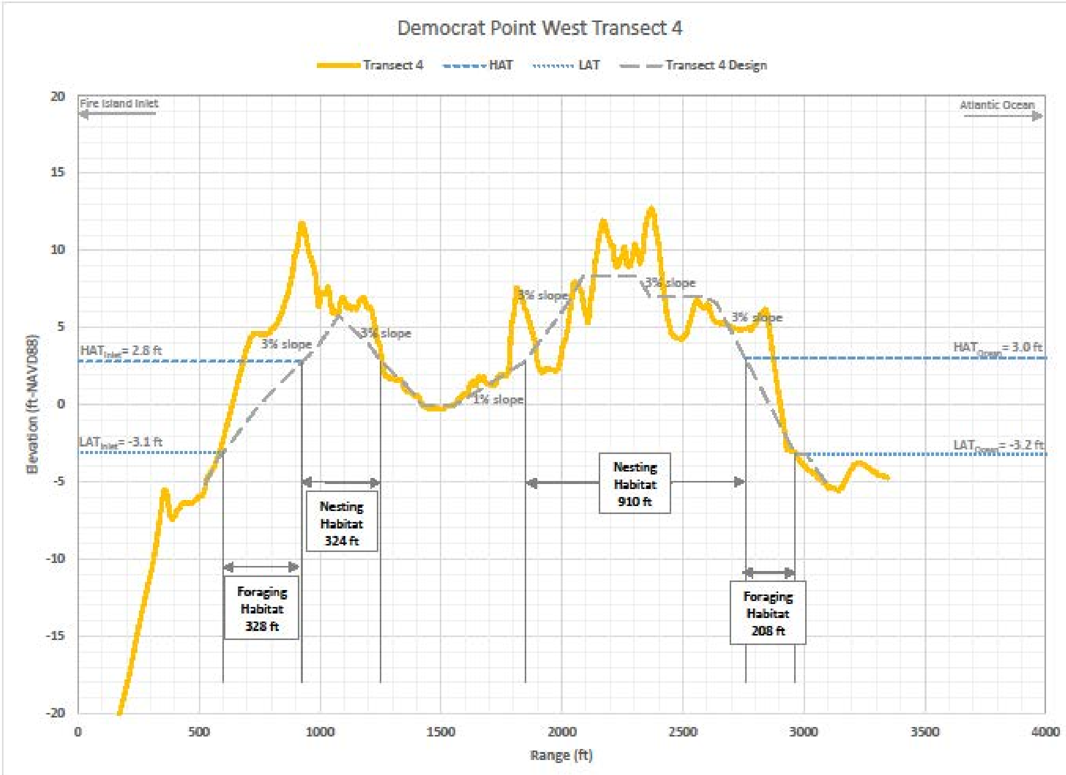

Democrat Point West Existing Conditions
Transect 3
Transect 4
Transect 5
Transect 6
Average HAT
Average LAT
Fire Island Inlet
Atlantic Ocean
Elevation (ft-NAVD)
20
15
10
5
0
-5
-10
-15
-20
0
500
1000
1500
2000
2500
3000
3500
4000
Range (ft)
HAT_{Inlet} = 2.8 ft
LAT_{Inlet} = -3.1 ft
HAT_{Ocean} = 3.0 ft
LAT_{Ocean} = -3.2 ft

11



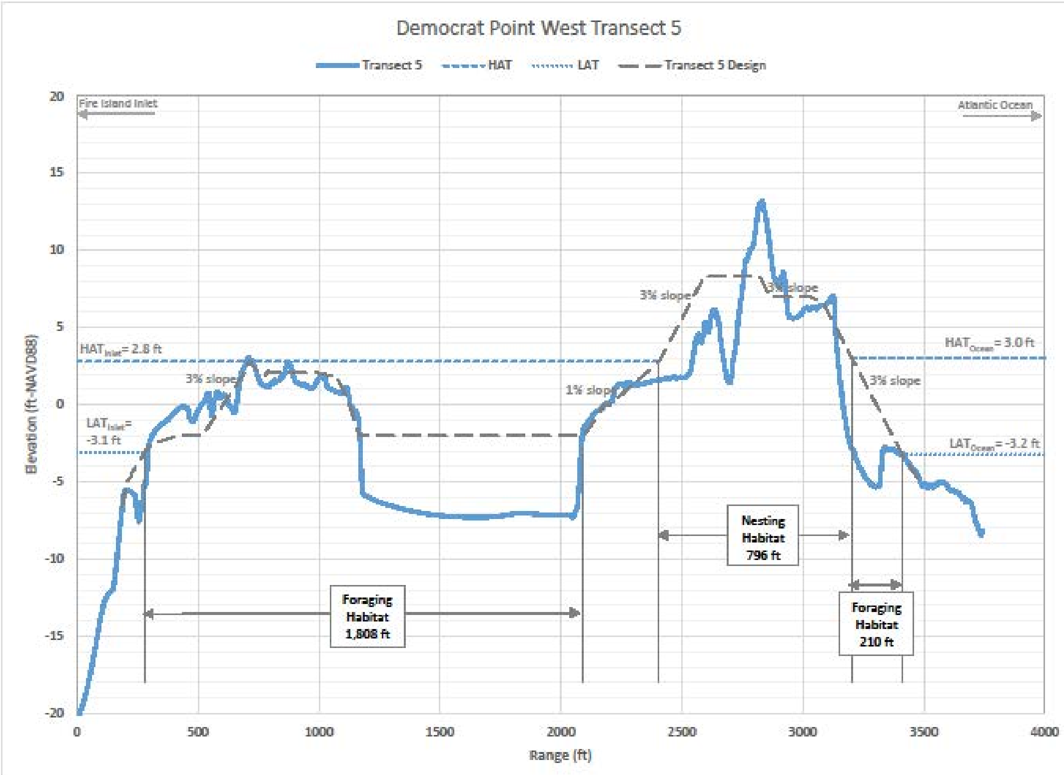
Democrat Point West Transect 3
Transect 3
HAT
LAT
Transect 3 Design
Fire Island Inlet
Atlantic Ocean
3% slope
3% slope
HAT Inlet = 2.8 ft
HAT Ocean = 3.0 ft
LAT Inlet = -3.1 ft
LAT Ocean = -3.2 ft
Nesting Habitat 1,394 ft
Foraging Habitat 198 ft
Foraging Habitat 208 ft
Elevation (ft-NAVD88)
Range (ft)

12

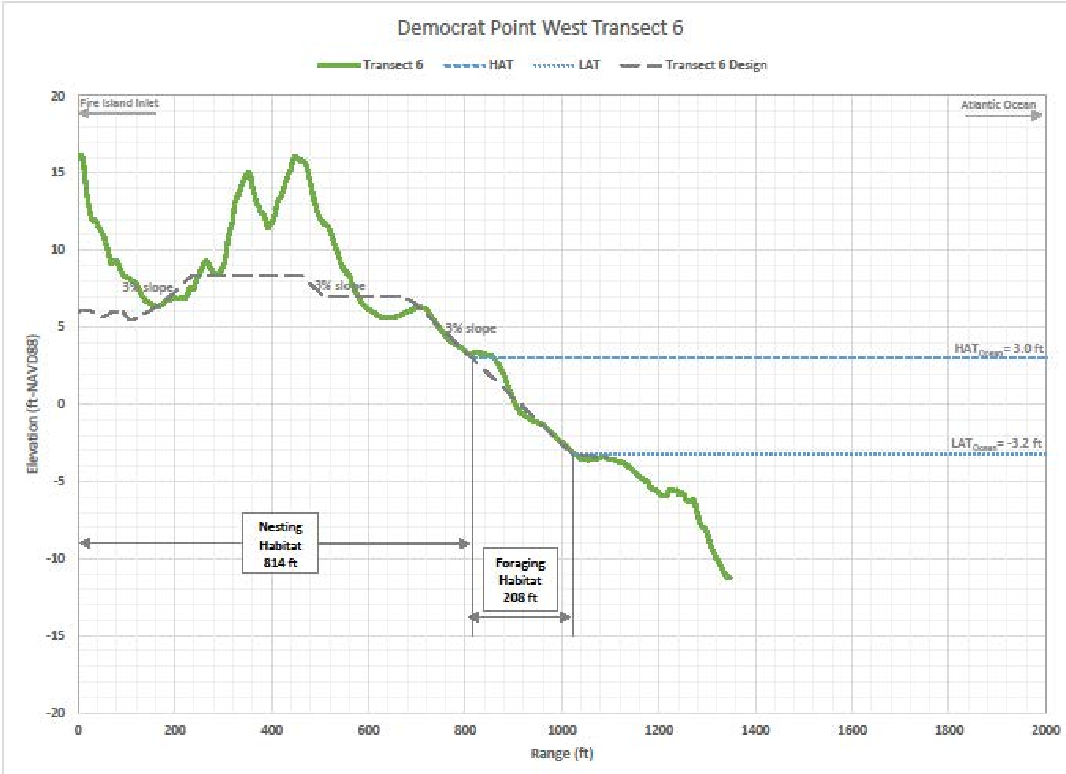


Democrat Point West Transect 4
Transect 4
HAT
LAT
Transect 4 Design
Fire Island Inlet
Atlantic Ocean
Elevation (ft-NAVD88)
Range (ft)
3% slope
3% slope
3% slope
3% slope
3% slope
1% slope
Foraging Habitat 328 ft
Nesting Habitat 324 ft
Nesting Habitat 910 ft
Foraging Habitat 208 ft

13

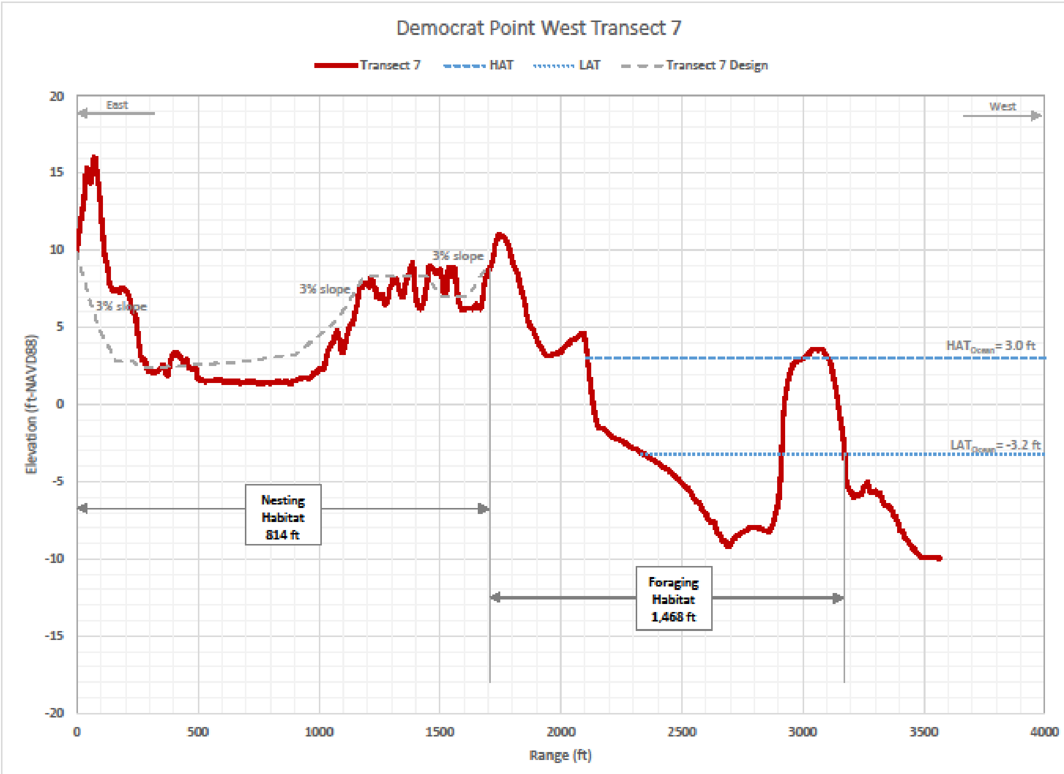

Democrat Point West Transect 5
Transect 5
HAT
LAT
Transect 5 Design
Fire Island Inlet
Atlantic Ocean
Elevation (ft-NAVD88)
Range (ft)
3% slope
1% slope
Nesting Habitat 796 ft
Foraging Habitat 1,808 ft
Foraging Habitat 210 ft

14



Democrat Point West Transect 6
Transect 6
HAT
LAT
Transect 6 Design
Fire Island Inlet
Atlantic Ocean
3% slope
3% slope
3% slope
HAT$_{Ocean}$ = 3.0 ft
LAT$_{Ocean}$ = -3.2 ft
Nesting Habitat 814 ft
Foraging Habitat 208 ft
Elevation (ft-NAVD88)
Range (ft)

15



Democrat Point West Transect 7
Transect 7
HAT
LAT
Transect 7 Design
East
West
3% slope
3% slope
3% slope
HAT$_{Ocean}$ = 3.0 ft
LAT$_{Ocean}$ = -3.2 ft
Nesting Habitat 814 ft
Foraging Habitat 1,468 ft
Elevation (ft-NAVD88)
Range (ft)

16

CPF Site 2 Democrat Point Bayside East of Jetty	East of Jetty-Reach GSB-1A 40.626794° N / 73.293164° W

CPF SITE GOALS

- Earthwork to meet target elevations and slopes for ESA credit
- Shift existing sand stockpile to form barrier between recreational use (east) and ESA areas (west)
- Converve sand volume on site by adding any surplus to stockpile and/or back areas
- Devegetate area to meet ESA goals

Democrat Point (East of Jetty) is located on the western end of Fire Island within Robert Moses State Park. Democrat Point (East of Jetty) lies just east of the Fire Island Inlet with Oak Beach to the north and west. Democrat Point (East of Jetty) is a sandy bayside beach, where sand was previously stockpiled after dredging projects in the vicinity. The project area contains coastal dunes with sporadic vegetation.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +5 ft-NAVD88 at Democrat Point (East of Jetty) as depicted in the Proposed Elevation figure.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for regrading and devegetating approximately 27.0 acres (ac). This includes 5.1 ac of foraging habitat and 19.3 ac of nesting habitat. The regrading template includes a 2% slope on the north bank to allow for viable shorebird habitat. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to a constructed elevation of +5 ft-NAVD88.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management in newly created CPF's. In addition, the USACE anticipates the park's ORV policy will be implemented during nesting season.

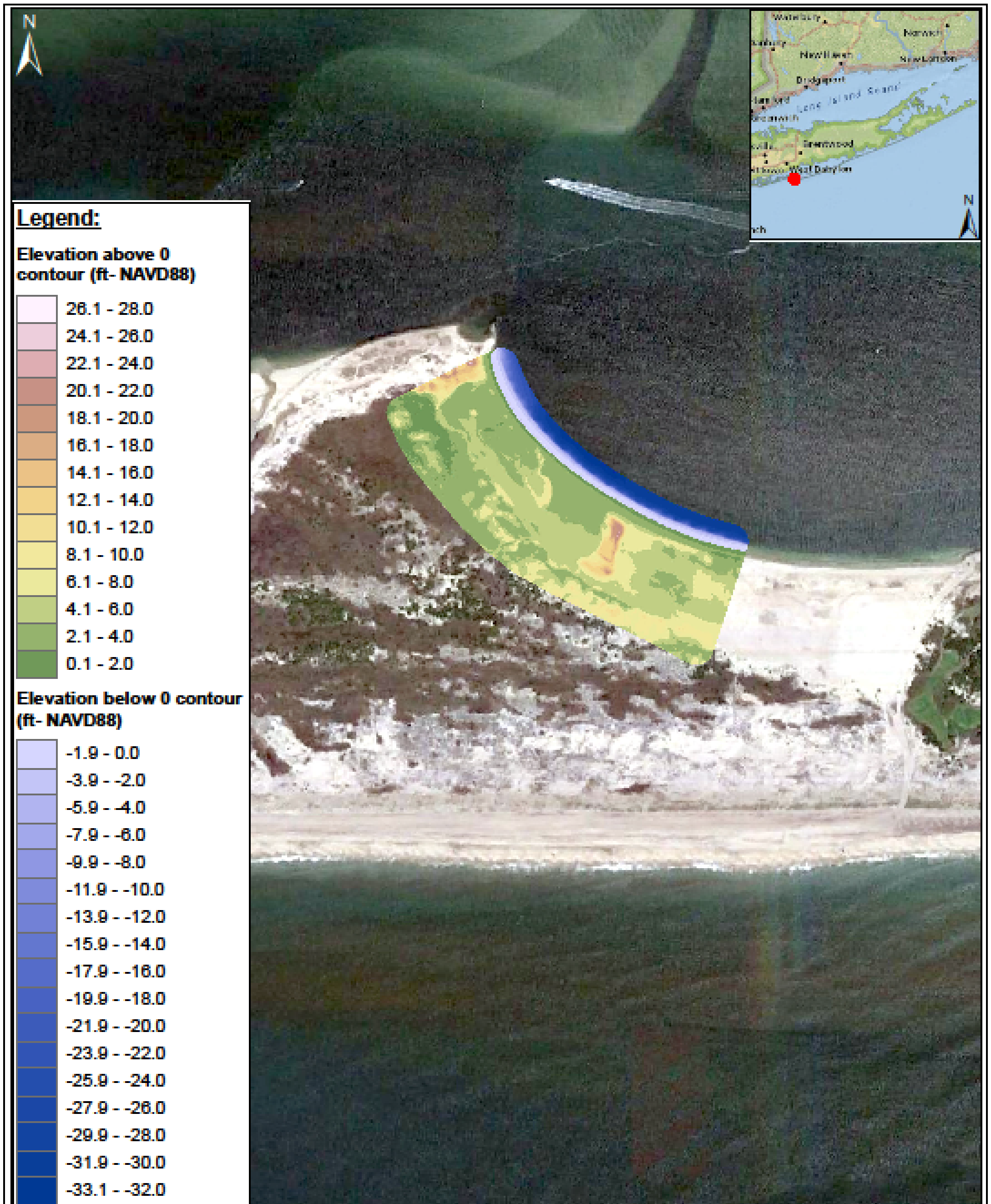
CPF Site 2 Democrat Point Bayside East of Jetty		East of Jetty-Reach GSB-1A 40.626794° N / 73.293164° W
CPF PARAMETERS		
Feature	ESA	
Cut Volume (cy)	-42,997	
Fill Volume (cy)	40,428	
Net Volume (cy)	-2,569	
Acreage (Nesting\Foraging\Devegetation)	27.0 (19.3\5.1\27.0)	
Activity	Regrade / Devegetate	
DATA SOURCES		
Topographic	USGS, 2016	
Bathymetric	USGS, 2016	
Aerial Imagery	Google Earth, 2016	
Vegetation	NPS, 2010	
REAL ESTATE INFORMATION		
Property Owner	New York State Fire Island State Park	
Municipality	Islip	
County	Suffolk	
CBRA	NY-59, System Unit	

CPF Site 2 Democrat Point Bayside East of Jetty			East of Jetty-Reach GSB-1A 40.626794° N / 73.293164° W
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)			
Closest Tidal Benchmark	Fire Island, NY	Highest Astronomical Tide (HAT)	2.01
		Mean Higher High Water (MHHW)	1.54
Coordinates	40.626667° N 73.260000° W	Mean High Water (MHW)	1.30
		Mean Sea Level (MSL)	-0.14
0 ft-NAVD = 1.16 ft-NGVD		Mean Tide Level (MTL)	-0.15
Range (MHW-MLW)	2.89	Mean Low Water (MLW)	-1.59
Diurnal Range (MHHW - MLLW)	3.26	Mean Lower Low Water (MLLW)	-1.72
Largest Tidal Range (HAT-LAT)	4.21	Lowest Astronomical Tide (LAT)	-2.20

BAYSIDE WAVE ENVIRONMENT

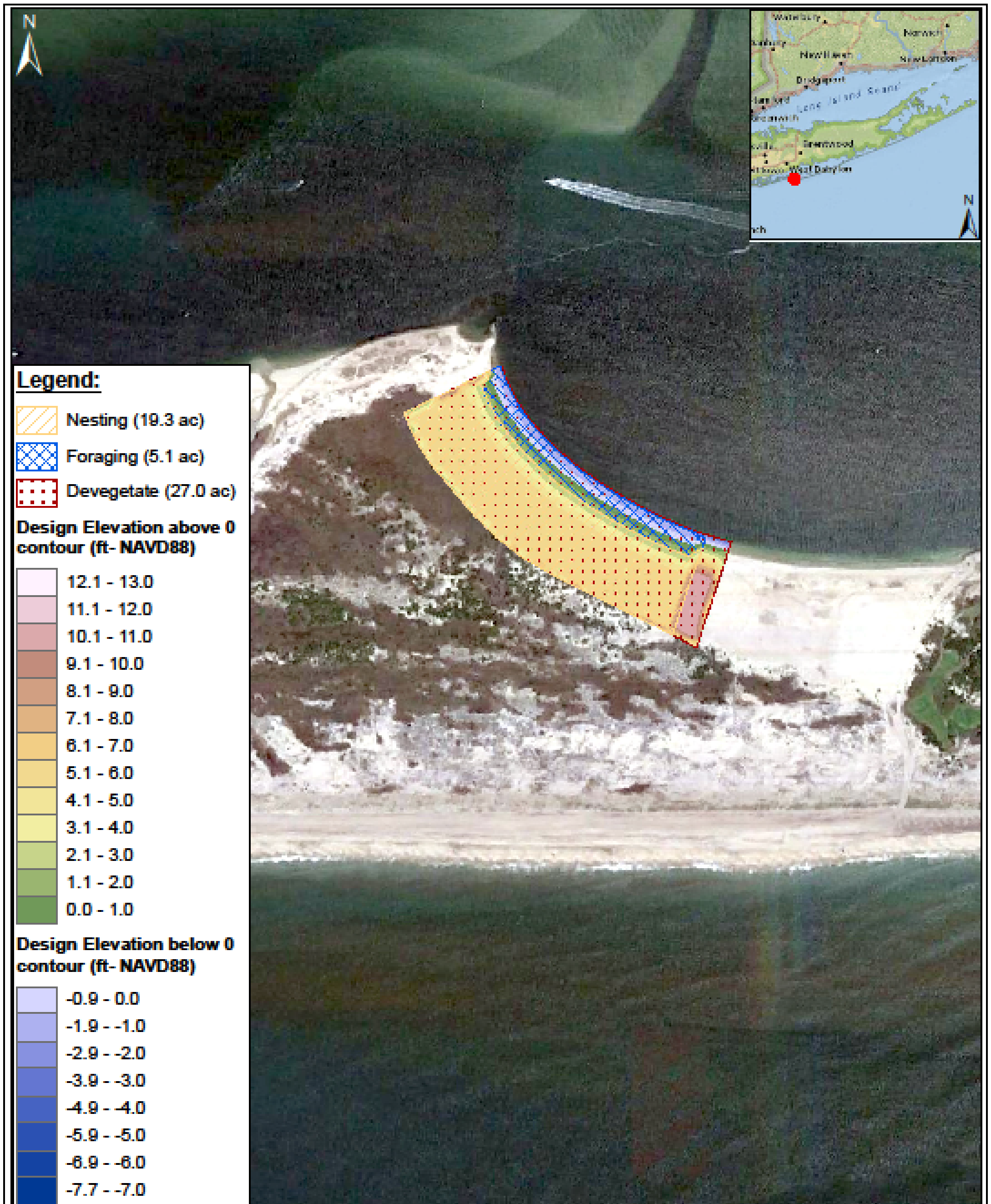
Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft-NAVD88)
1-year	9,404	2.2	0.06	1.08	5.35
5-year	9,404	2.9	0.11	1.33	6.35
10-year	9,404	3.2	0.13	1.44	6.78

2



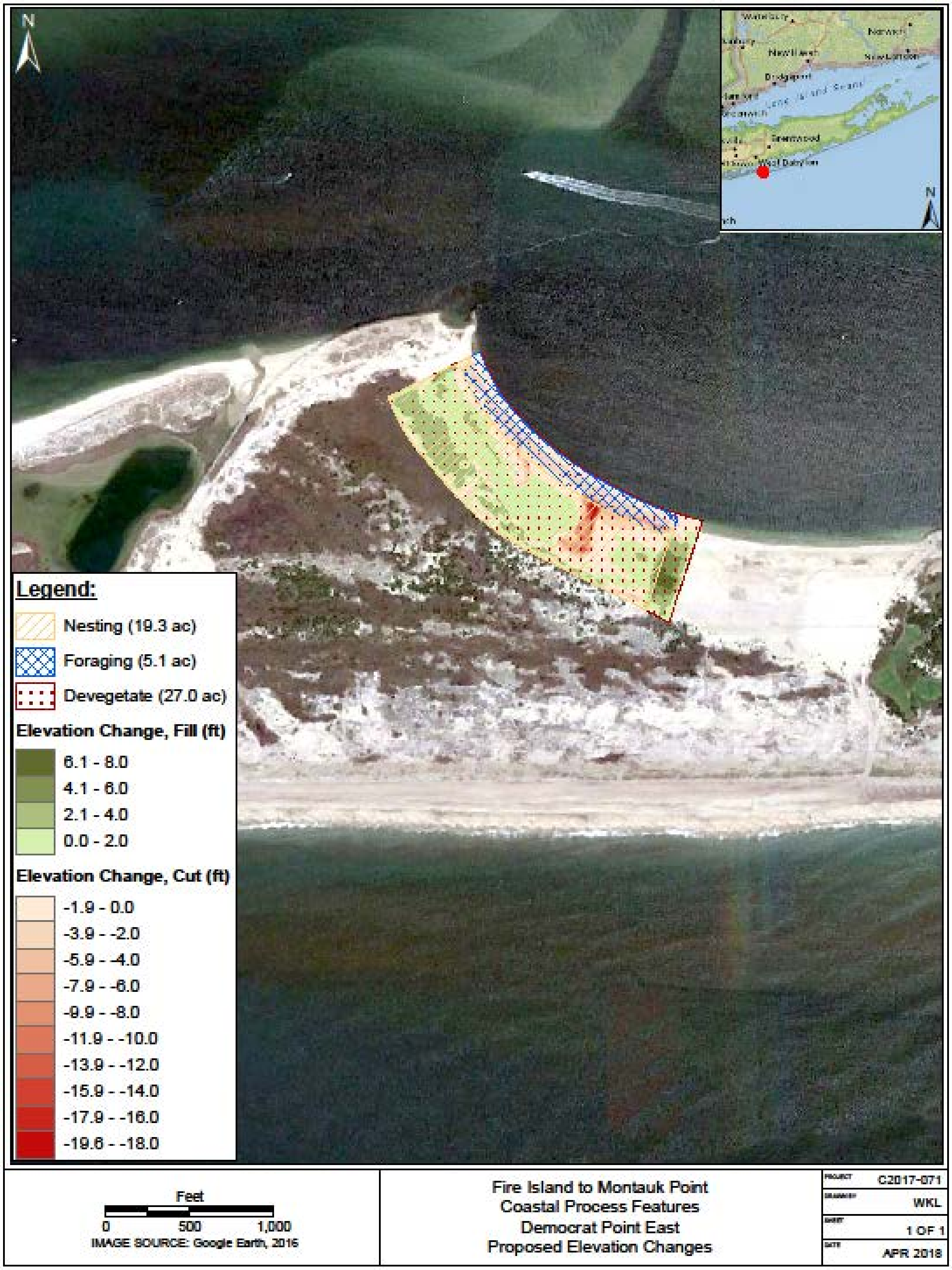
Feet 0 500 1,000 IMAGE SOURCE: Google Earth, 2016	Fire Island to Montauk Point Coastal Process Features Democrat Point East Existing Conditions	PROJECT	C2017-071
		DRAWN BY	WKL
		SHEET	1 OF 1
		DATE	APR 2018

3



Feet 0 500 1,000 IMAGE SOURCE: Google Earth, 2016	Fire Island to Montauk Point Coastal Process Features Democrat Point East Proposed Elevations	PROJECT C2017-071 DRAWN BY WKL SHEET 1 OF 1 DATE APR 2018

4


N
Waterbury
Norwich
New Haven
New London
Bridgeport
Long Island Sound
Brentwood
West Babylon
N
Legend:
Nesting (19.3 ac)
Foraging (5.1 ac)
Devegetate (27.0 ac)
Elevation Change, Fill (ft)
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.0 - 2.0
Elevation Change, Cut (ft)
-1.9 - 0.0
-3.9 - -2.0
-5.9 - -4.0
-7.9 - -6.0
-9.9 - -8.0
-11.9 - -10.0
-13.9 - -12.0
-15.9 - -14.0
-17.9 - -16.0
-19.6 - -18.0
Feet
0 500 1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Democrat Point East
Proposed Elevation Changes
PROJECT C2017-071
DRAWN BY WKL
SHEET 1 OF 1
DATE APR 2018


N
Transect 1
Transect 2
Transect 3
Transect 4
Legend:
Project Area
Transects
Nesting (19.3 ac)
Foraging (5.1 ac)
Devegetate (27.0 ac)
Feet
0 500 1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Democrat Point East
Transect Locations
C2017-071
WKL
1 OF 1
APR 2018

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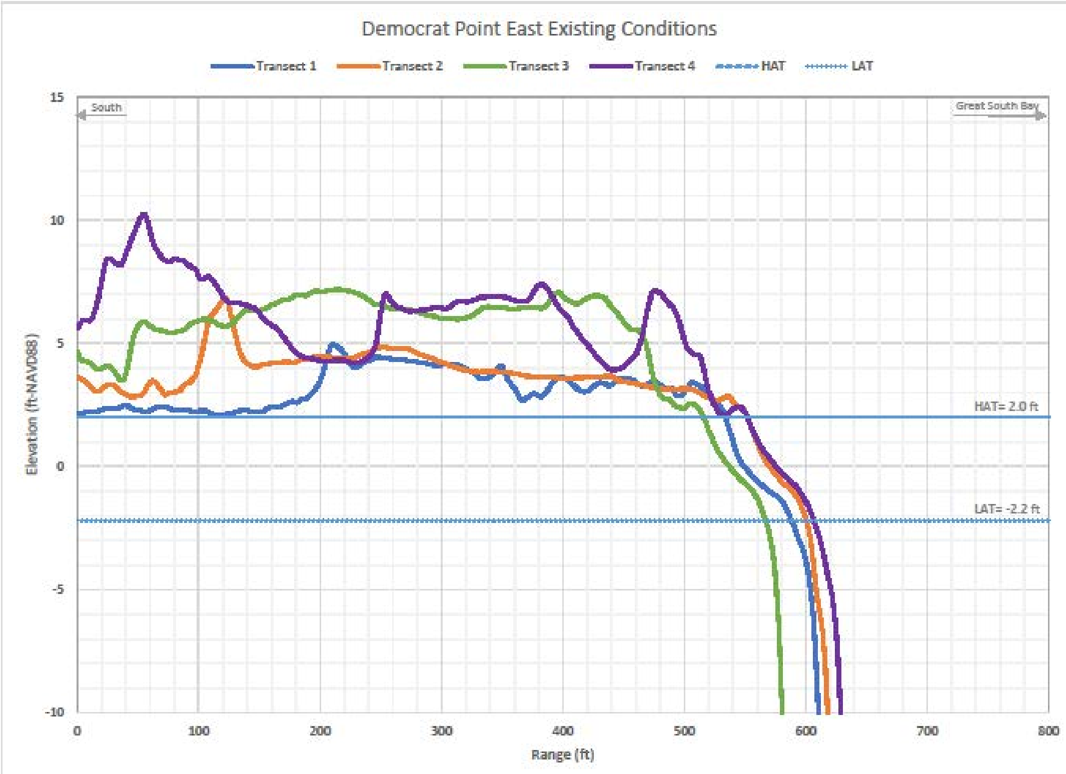
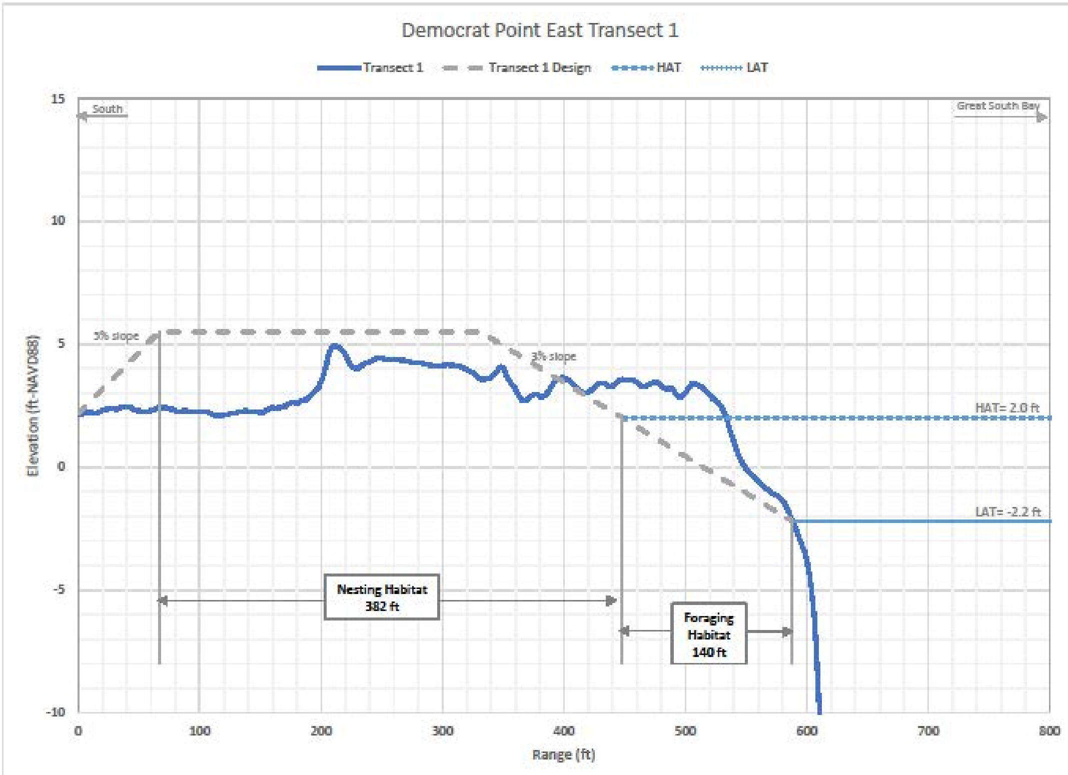


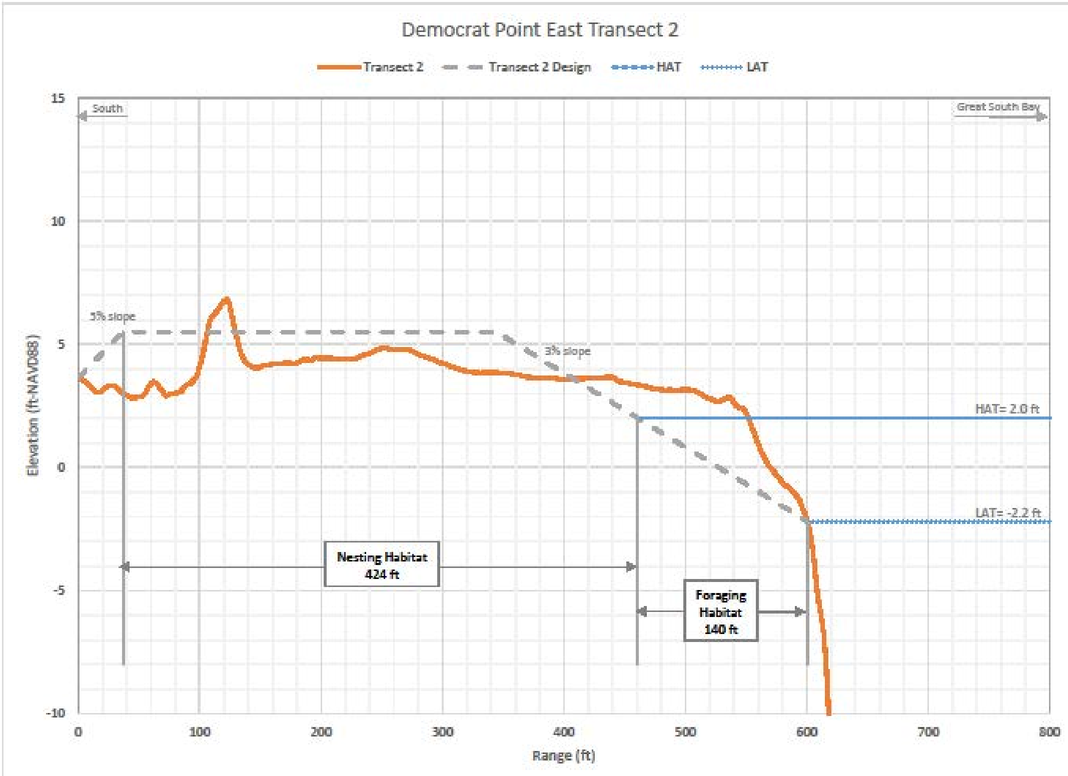
Democrat Point East Existing Conditions
Transect 1
Transect 2
Transect 3
Transect 4
HAT
LAT
South
Great South Bay
HAT= 2.0 ft
LAT= -2.2 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
100
200
300
400
500
600
700
800

7



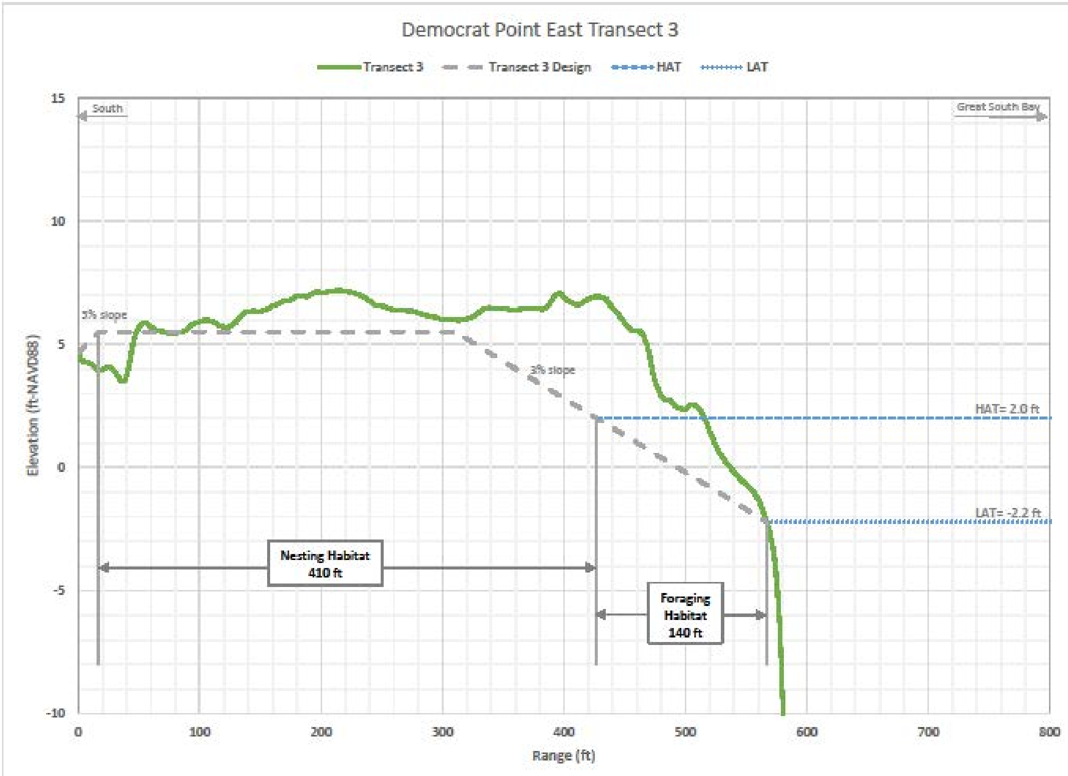
Democrat Point East Transect 1
Transect 1
Transect 1 Design
HAT
LAT
South
Great South Bay
5% slope
3% slope
HAT= 2.0 ft
LAT= -2.2 ft
Nesting Habitat
382 ft
Foraging Habitat
140 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
100
200
300
400
500
600
700
800

8



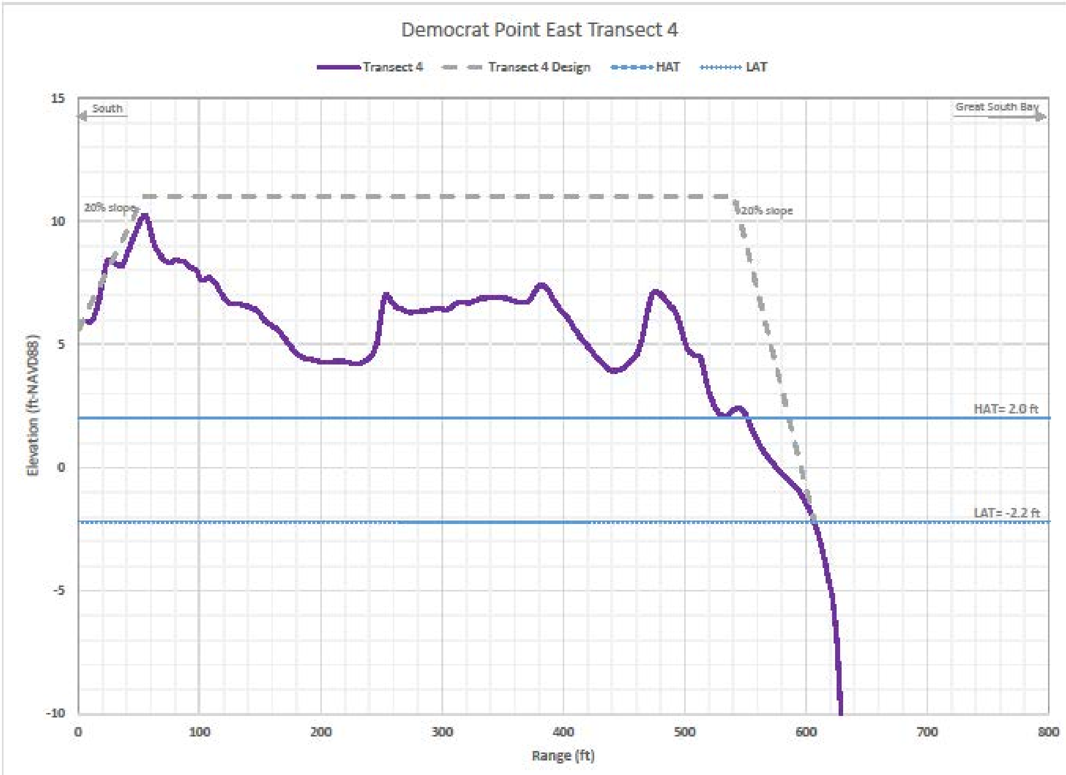
Democrat Point East Transect 2
Transect 2
Transect 2 Design
HAT
LAT
South
Great South Bay
3% slope
3% slope
HAT= 2.0 ft
LAT= -2.2 ft
Nesting Habitat
424 ft
Foraging
Habitat
140 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
100
200
300
400
500
600
700
800

9



Democrat Point East Transect 3
Transect 3
Transect 3 Design
HAT
LAT
South
Great South Bay
3% slope
3% slope
HAT= 2.0 ft
LAT= -2.2 ft
Nesting Habitat
410 ft
Foraging
Habitat
140 ft
Elevation (ft-NAVD88)
Range (ft)

10


Democrat Point East Transect 4
Transect 4
Transect 4 Design
HAT
LAT
South
Great South Bay
20% slope
20% slope
HAT= 2.0 ft
LAT= -2.2 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
100
200
300
400
500
600
700
800

11

CPF Site 4 Dunefield West of Field 4	Reach GSB-1A 40.622158° N / 73.252615° W

CPF SITE GOALS

- Devegetate area to meet ESA goals
- Maintain vegetation buffer on north side between road and site to discourage offroad parking

Dunefield West of Field 4 is located on the western end of Fire Island, southeast of the Robert Moses Causeway, within Robert Moses State Park on the oceanside. Dune Field West of Field 4 contains dunes with areas of heavy vegetation. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting).

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for removing vegetation from approximately 18.7 acres (ac). Beachfront topography will approximate the anticipated FIMP beach fill template between stations 139+00 and 160+00. A high elevation dune exists on the eastern side of the project area behind the FIMP beach fill template. No regrading of the site beyond the FIMP beach fill plan is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +10 ft-NAVD88 at Dune Field West of Field 4 as depicted in the Proposed Devegetation figure.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating approximately 18.7 acres (ac). This results in 3.9 ac of foraging habitat and 11.4 ac of nesting habitat within the project site. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to the +10 ft-NAVD88 elevation contour.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management in newly established CPF's.

CPF Site 4 Dunefield West of Field 4	Reach GSB-1A 40.622158° N / 73.252615° W

CPF PARAMETERS	
Feature	Total Project Area
Cut Volume (cy)	n/a
Fill Volume (cy)	n/a
Net Volume (cy)	n/a
Acreage (Nesting\Foraging\Devegetation)	19.4 (11.4\3.9\18.7)
Activity	Devegetate

DATA SOURCES	
Topographic	USGS, 2016
Bathymetric	USGS, 2016
Aerial Imagery	Google Earth, 2017
Vegetation	NPS, 2010

REAL ESTATE INFORMATION	
Property Owner	New York State Robert Moses State Park
Municipality	Islip
County	Suffolk
CBRA	NY-59, System Unit

CPF Site 4 Dunefield West of Field 4			Reach GSB-1A 40.622158° N / 73.252615° W	
OCEANSIDE TIDAL ENVIRONMENT (ft-NAVD88)				
Closest Tidal Benchmark	Fire Island, NY		Highest Astronomical Tide (HAT)	2.97
			Mean Higher High Water (MHHW)	2.03
Coordinates	40.626667° N 73.260000° W		Mean High Water (MHW)	1.72
			Mean Sea Level (MSL)	-0.22
0 ft-NAVD = 1.16 ft-NGVD			Mean Tide Level (MTL)	-0.25
Range (MHW-MLW)		3.93	Mean Low Water (MLW)	-2.21
Diurnal Range (MHHW - MLLW)		4.40	Mean Lower Low Water (MLLW)	-2.37
Largest Tidal Range (HAT-LAT)		6.22	Lowest Astronomical Tide (LAT)	-3.25

OCEANSIDE WAVE ENVIRONMENT

Return Period	Deep Water Wave Height (ft)	Surf Zone Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Surf Zone Wave Height (ft)
1-year	14.2	6.8	1.00	0.92	11.71
5-year	19.4	7.1	1.83	2.01	13.93
10-year	21.7	7.2	2.32	2.48	14.99

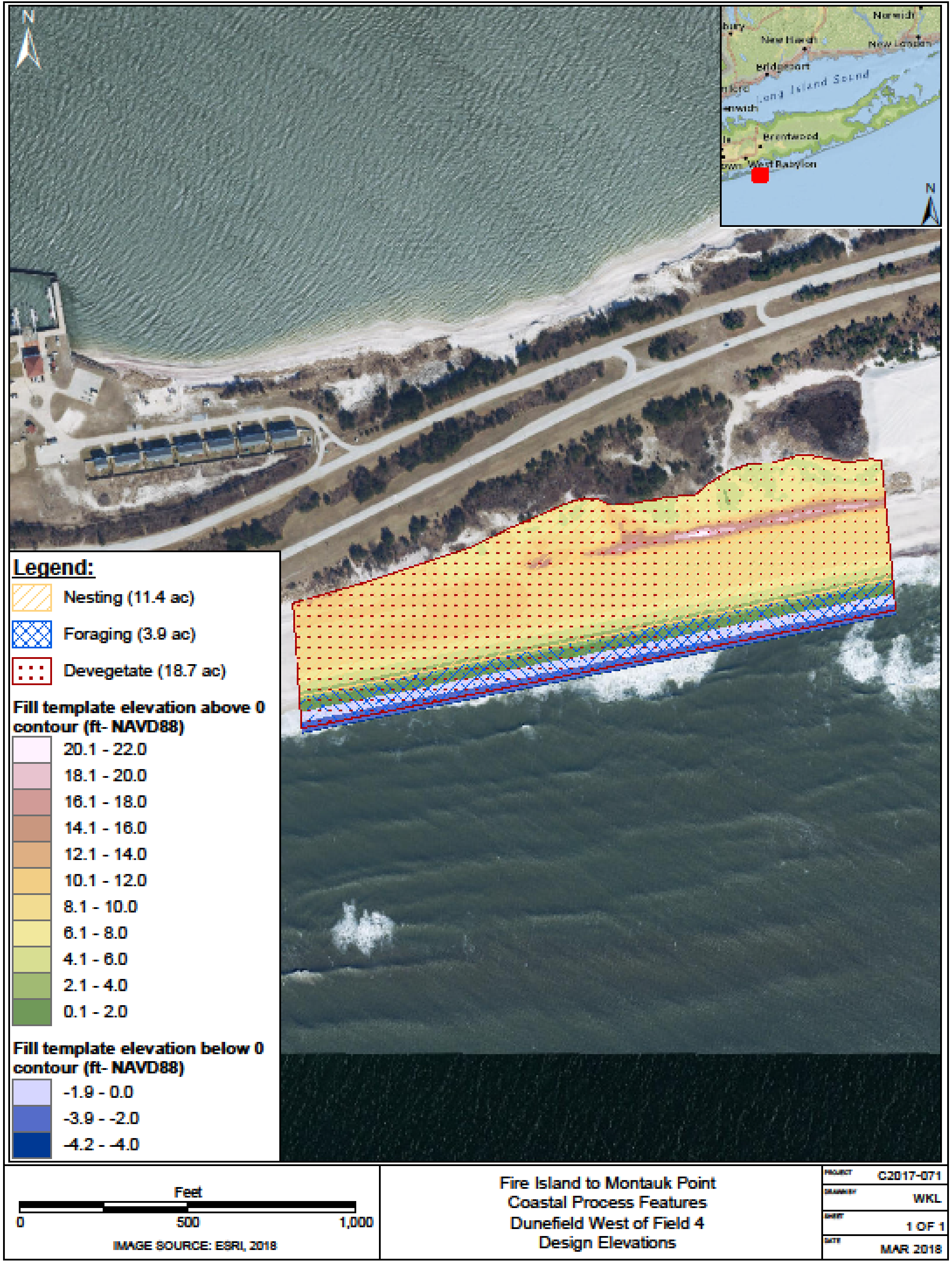
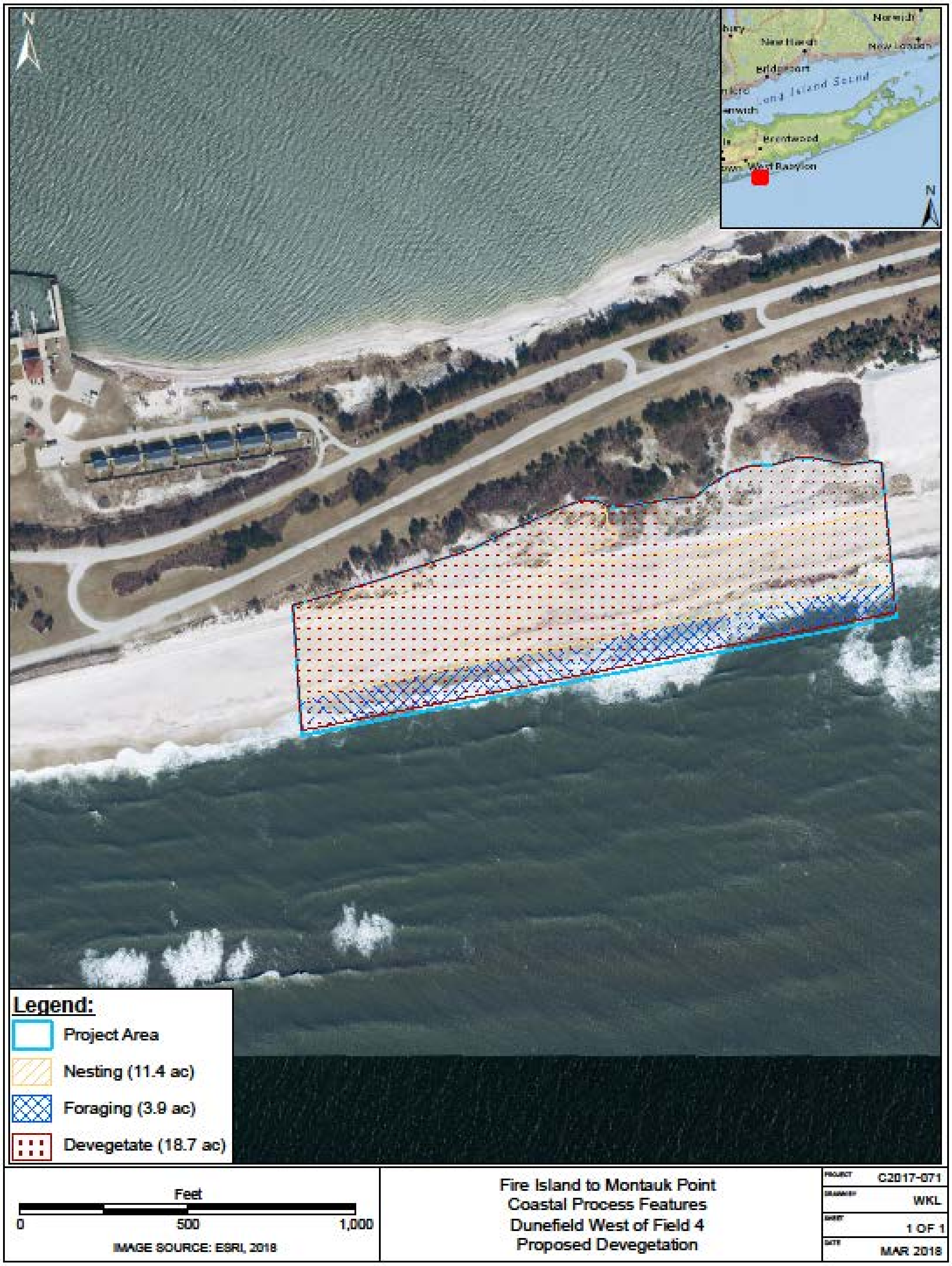


IMAGE SOURCE: ESRI, 2018

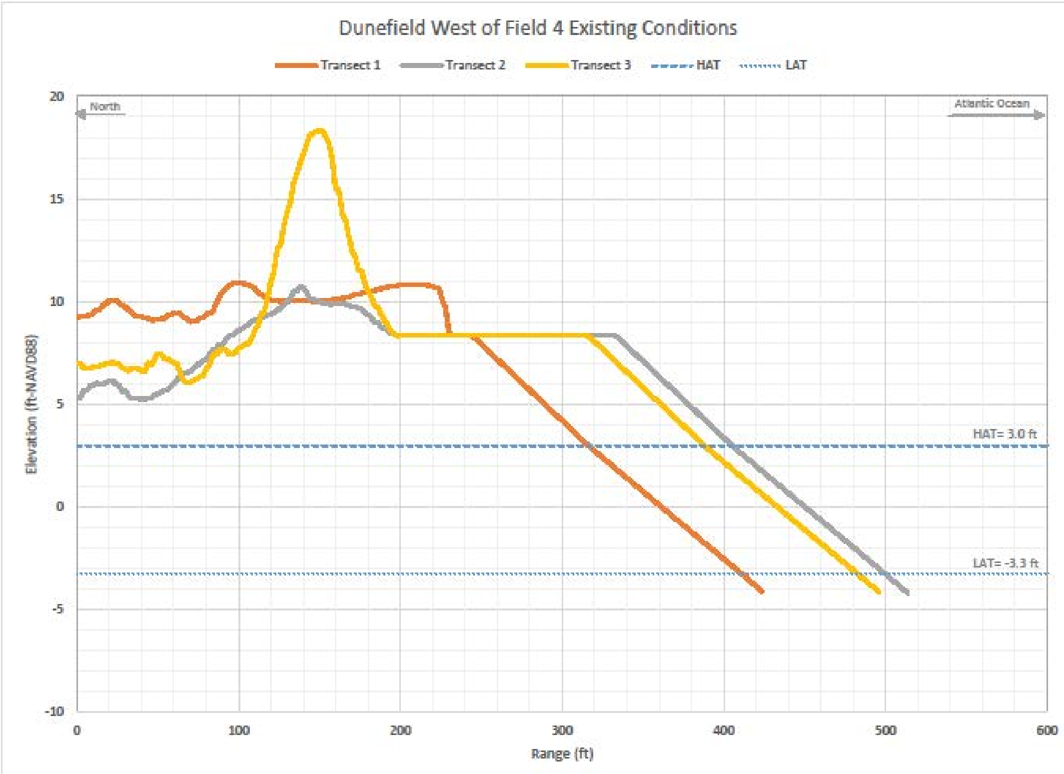
Fire Island to Montauk Point
Coastal Process Features
Dunefield West of Field 4
Design Elevations

PROJECT	C2017-071
DRAWN BY	WKL
SHEET	1 OF 1
DATE	MAR 2018

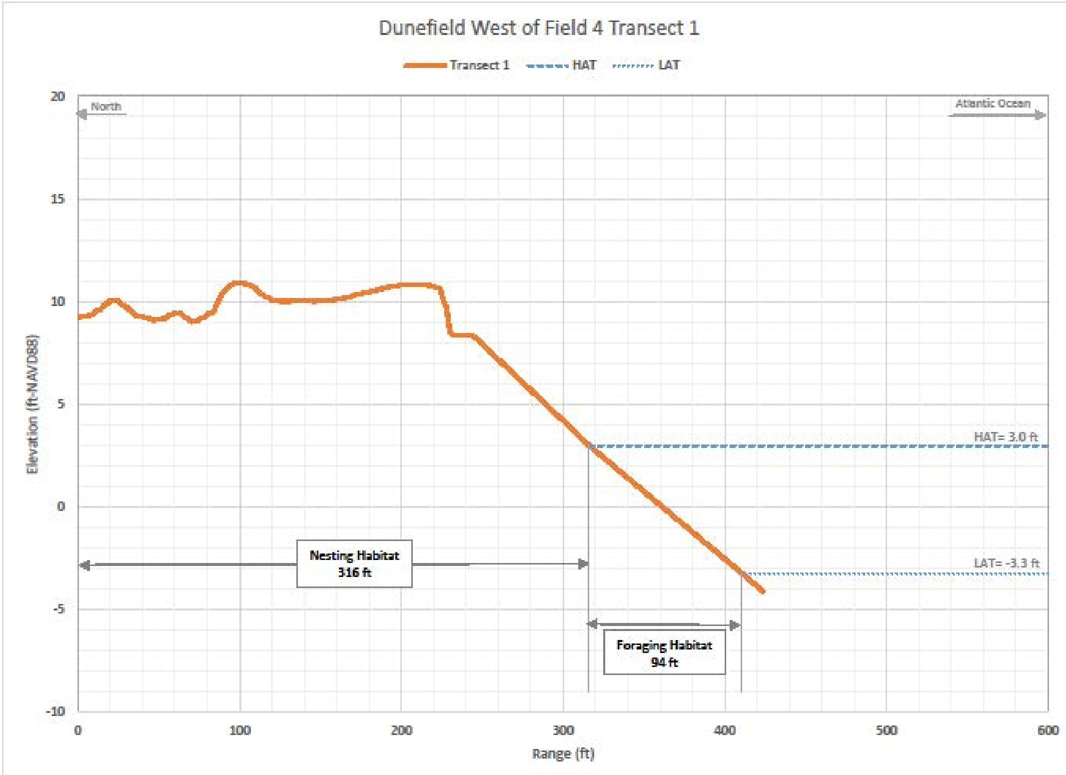

N
Legend:
Project Area
Nesting (11.4 ac)
Foraging (3.9 ac)
Devegetate (18.7 ac)
Feet
0
500
1,000
IMAGE SOURCE: ESRI, 2018
Fire Island to Montauk Point
Coastal Process Features
Dunefield West of Field 4
Proposed Devegetation
C2017-071
WKL
1 OF 1
MAR 2018

4

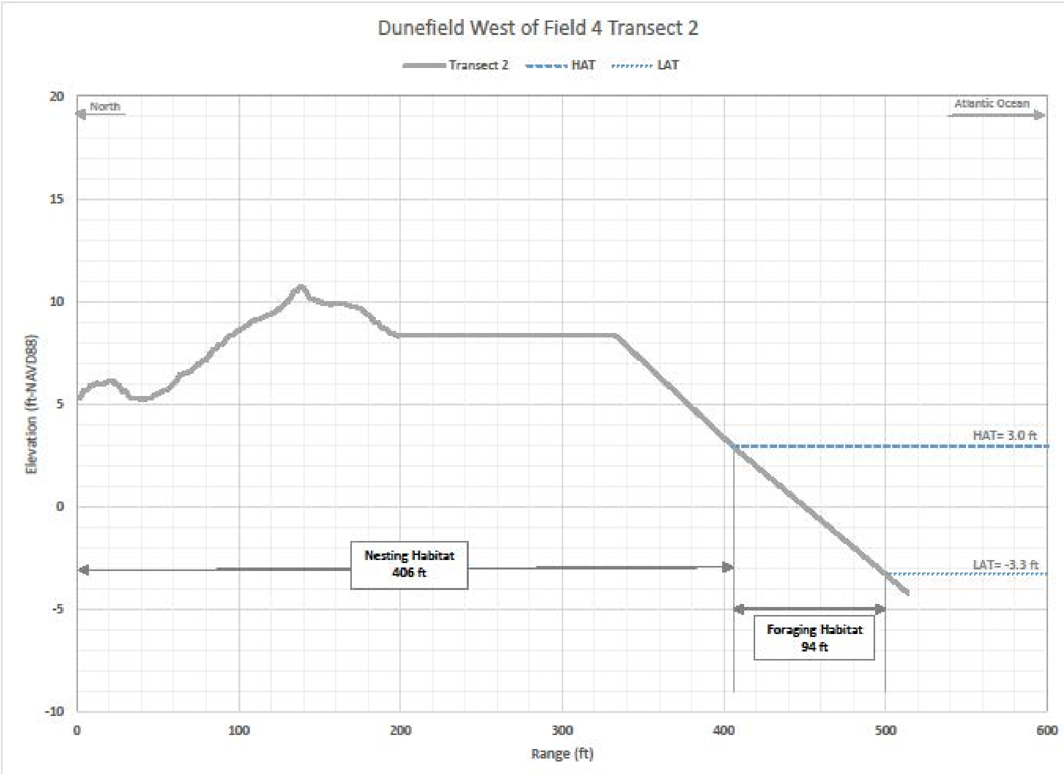

N
Transect 1
Transect 2
Transect 3
Legend:
Project Area
Transects
Nesting (11.4 ac)
Foraging (3.9 ac)
Devegetate (18.7 ac)
Feet
0
500
1,000
IMAGE SOURCE: ESRI, 2018
Fire Island to Montauk Point
Coastal Process Features
Dunefield West of Field 4
Transect Locations
C2017-071
WKL
1 OF 1
MAR 2018
5


Dunefield West of Field 4 Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
North
Atlantic Ocean
HAT= 3.0 ft
LAT= -3.3 ft
Elevation (ft-NAVD88)
Range (ft)
20
15
10
5
0
-5
-10
0
100
200
300
400
500
600

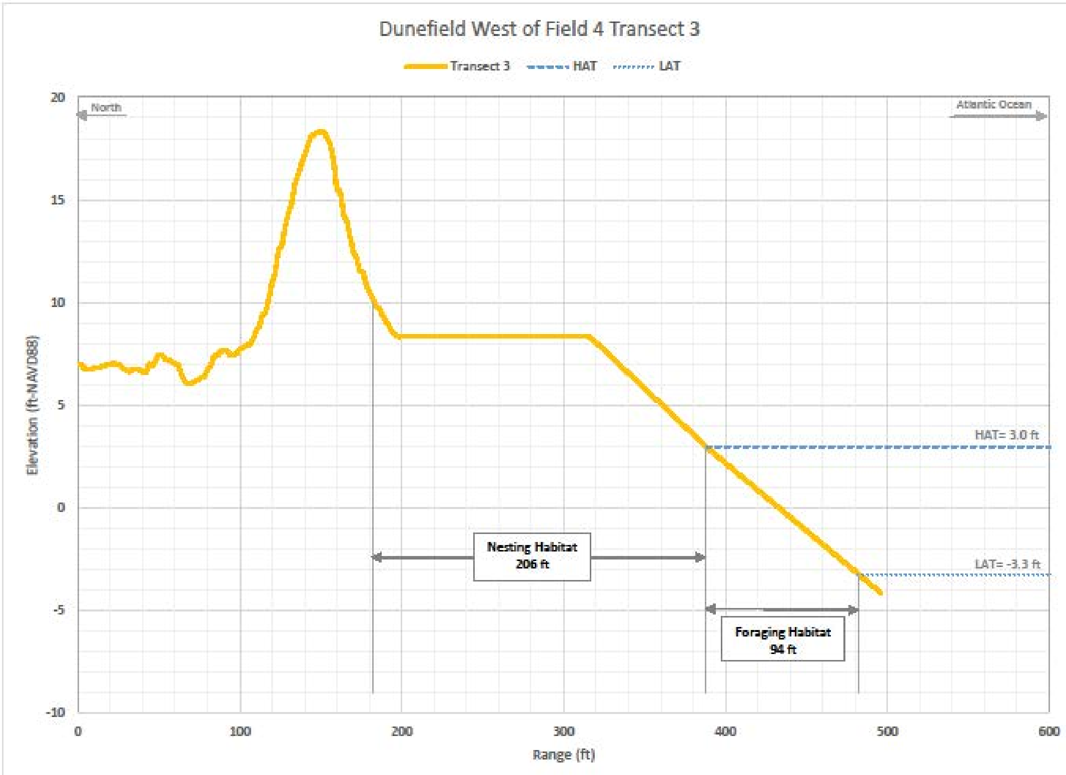
6


Dunefield West of Field 4 Transect 1
Transect 1
HAT
LAT
North
Atlantic Ocean
HAT= 3.0 ft
LAT= -3.3 ft
Nesting Habitat
316 ft
Foraging Habitat
94 ft
Elevation (ft-NAVD88)
Range (ft)
20
15
10
5
0
-5
-10
0
100
200
300
400
500
600

7


Dunefield West of Field 4 Transect 2
Transect 2
HAT
LAT
North
Atlantic Ocean
HAT= 3.0 ft
LAT= -3.3 ft
Nesting Habitat
406 ft
Foraging Habitat
94 ft
Elevation (ft-NAVD88)
Range (ft)
20
15
10
5
0
-5
-10
0
100
200
300
400
500
600

8


Dunefield West of Field 4 Transect 3
Transect 3
HAT
LAT
North
Atlantic Ocean
HAT= 3.0 ft
LAT= -3.3 ft
Nesting Habitat
206 ft
Foraging Habitat
94 ft
Elevation (ft-NAVD88)
Range (ft)
20
15
10
5
0
-5
-10
0
100
200
300
400
500
600

9

CPF Site 7 Atlantique to Corneille	Reach GSB-2B 40.644944° N / 73.167889° W

Atlantique to Corneille is located on the western portion of Fire Island, on the bay just east of Atlantique Park. The average nearshore water depth on the bayside at Atlantique to Corneille is approximately 3 ft. Boat docks exist to the east and west of this CPF, while several small bulkheads lie on either side of the site. The CPF design fill must limit impacts to navigation features. This CPF design seeks to add fill to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by simulating cross island transport.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +4 ft-NAVD88 at Atlantique to Corneille as depicted in the figure on page 4.

To simulate cross island transport and create early successional habitat that provides nesting and foraging for shorebirds, plans call for the placement of fill over 15.8 acres (ac), transitioning from the western bulkhead area to the spit to the east. Within the project area there is a total of 4.2 ac of foraging habitat and 9.9 ac as nesting habitat. The regrading template includes 3% and 1% slopes on the north bank to allow for viable shorebird habitat, and a 4% slope below the LAT to tie into the existing grade. The landward side of the fill profile will tie into existing grade at +4 ft-NAVD88. The cross shore extent of this CPF is limited due to the overall site configuration.

Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management, symbolic fencing to the +10 ft-NAVD88 contour, and floating boom in the nearshore area to control vessel access in newly created CPF's.

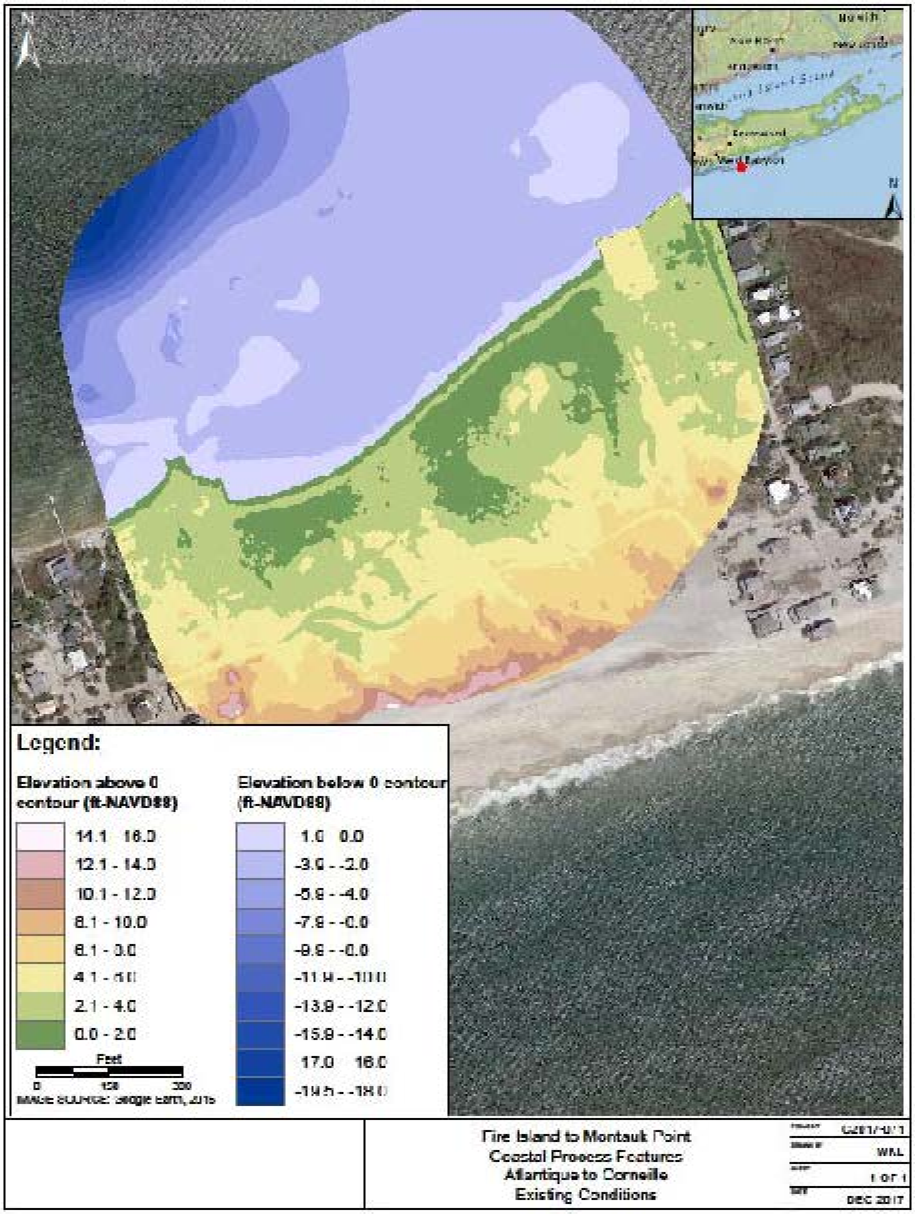
CPF PARAMETERS		
Feature	Habitat	Total
Cut Volume (cy)	0	0
Fill Volume (cy)	62,694	64,640
Net Volume (cy)	62,694	64,640
Acreage	14.1	15.8
Activity	Fill	Fill
DATA SOURCES		
Topographic	USGS, 2016	
Bathymetric	USGS, 2016	
Aerial Imagery	Google Earth, 2016	
Vegetation	N/A*	
REAL ESTATE INFORMATION		
Property Owner	USA, Town of Islip	
Municipality	Islip	
County	Suffolk	

*up to date vegetation data were not available for the study area

CPF Site 7 Atlantique to Corneille					Reach GSB-2B 40.644944° N / 73.167889° W
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)					
Closest Tidal Benchmark	Seaview Ferry Dock, NY		Highest Astronomical Tide (HAT)		1.09
			Mean Higher High Water (MHHW)		0.62
Coordinates	40.648333° N 73.150000° W		Mean High Water (MHW)		0.45
			Mean Sea Level (MSL)		-0.01
0 ft-NAVD = 1.13 ft-NGVD			Mean Tide Level (MTL)		-0.03
Range (MHW-MLW)		0.97	Mean Low Water (MLW)		-0.52
Diurnal Range (MHHW - MLLW)		1.23	Mean Lower Low Water (MLLW)		-0.61
Largest Tidal Range (HAT-LAT)		2.18	Lowest Astronomical Tide (LAT)		-1.09

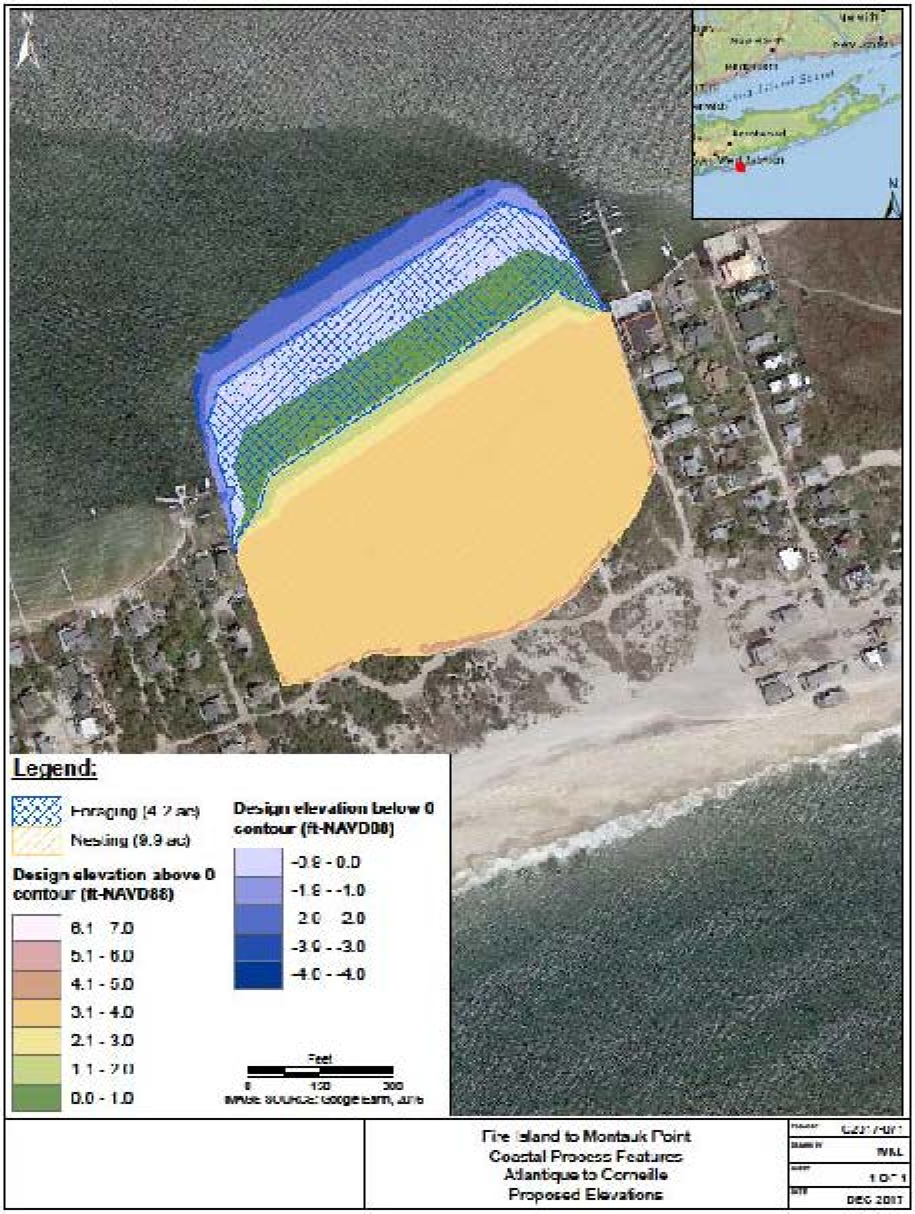
BAYSIDE WAVE ENVIRONMENT

Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft-NAVD88)
1-year	43,334	3.5	0.56	1.13	6.28
5-year	43,334	4.6	0.95	1.18	7.82
10-year	43,334	5.1	1.16	1.20	8.55



Legend:
Elevation above 0 contour (ft-NAVD88)
14.1 16.0
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
4.1 - 6.0
2.1 - 4.0
0.0 - 2.0
Feet
0
150
300
Elevation below 0 contour (ft-NAVD88)
1.0 0.0
-13.9 - -12.0
-15.9 - -14.0
17.0 16.0
Fire Island to Montauk Point
Coastal Process Features
Atlantique to Corneille
Existing Conditions
WRL
1 of 1
DEC 2017

3

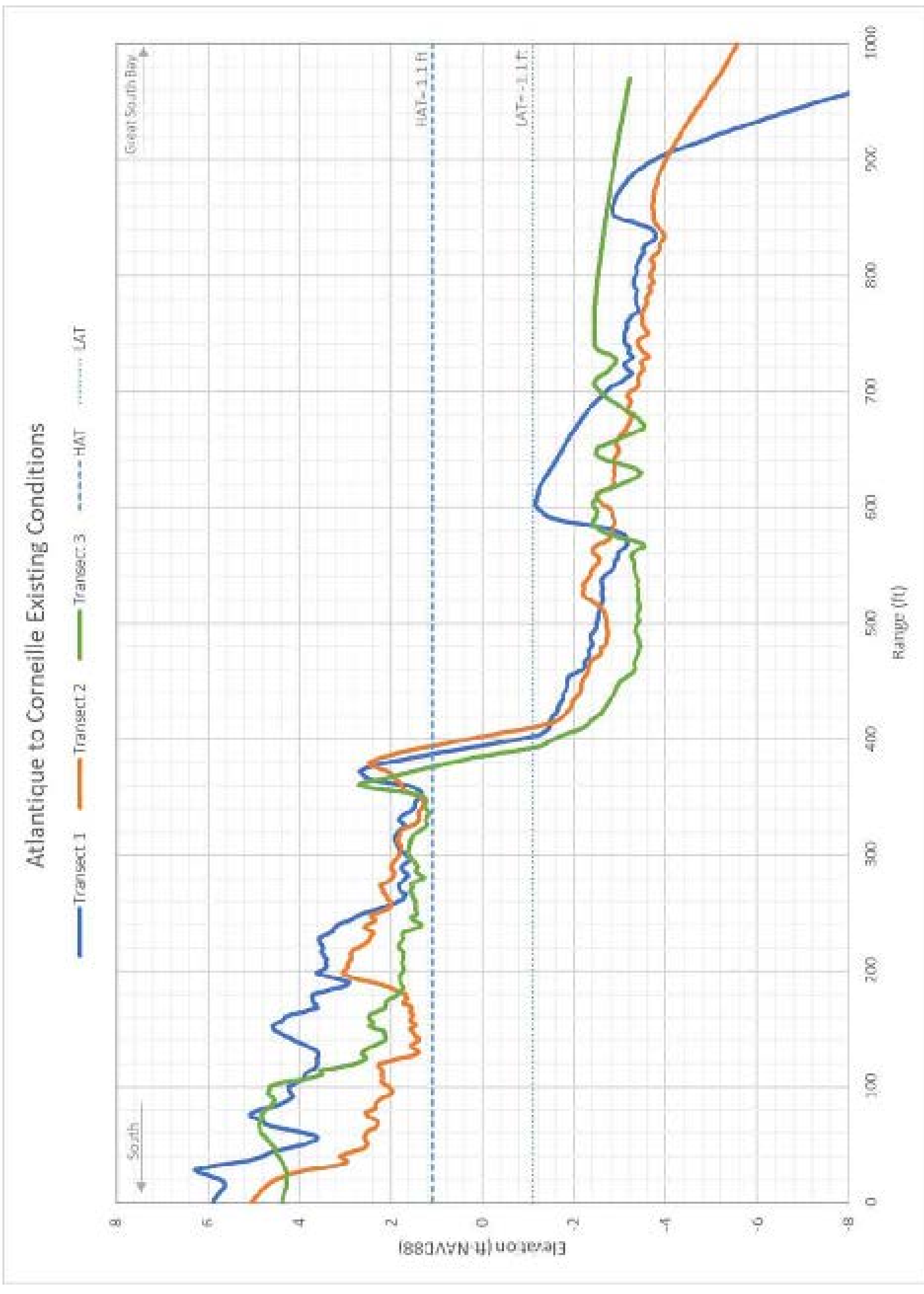

N
Legend:
Foraging (4.2 ac)
Nesting (9.9 ac)
Design elevation above 0 contour (ft-NAVD88)
6.1 - 7.0
5.1 - 6.0
4.1 - 5.0
3.1 - 4.0
2.1 - 3.0
1.1 - 2.0
0.0 - 1.0
Design elevation below 0 contour (ft-NAVD88)
-0.9 - 0.0
-1.9 - -1.0
-2.0 - -2.0
-3.9 - -3.0
-4.0 - -4.0
Feet
0
150
300
Fire Island to Montauk Point
Coastal Process Features
Atlantique to Corneille
Proposed Elevations
WAL
1 OF 1
DEC 2017

4


N
Legend:
Foraging (4.2 ac)
Nesting (0.0 ac)
Elevation Change, Fill (ft)
0.0 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
Feet
0
150
300
Fire Island to Montauk Point
Coastal Process Features
Atlantique to Corneille
Proposed Elevation Changes
WAL
DEC 2017

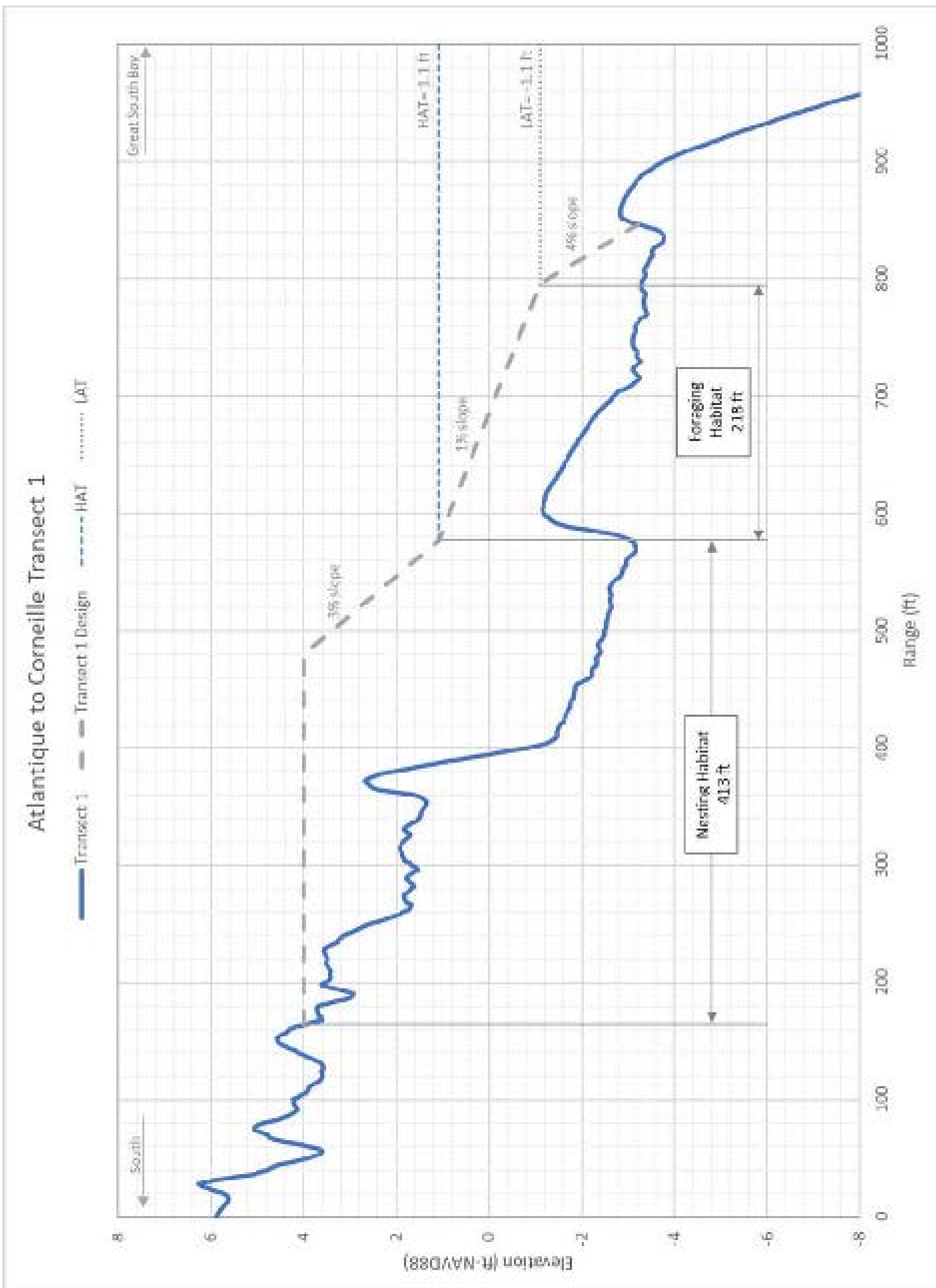
5


Transect 1
Transect 2
Transect 3
Legend:
Project Area
Transects
Foraging (4.2 ac)
Nesting
Feet
0
150
300
Fire Island to Montauk Point
Coastal Process Features
Atlantique to Corneille
Transect Locations
DEC 2017

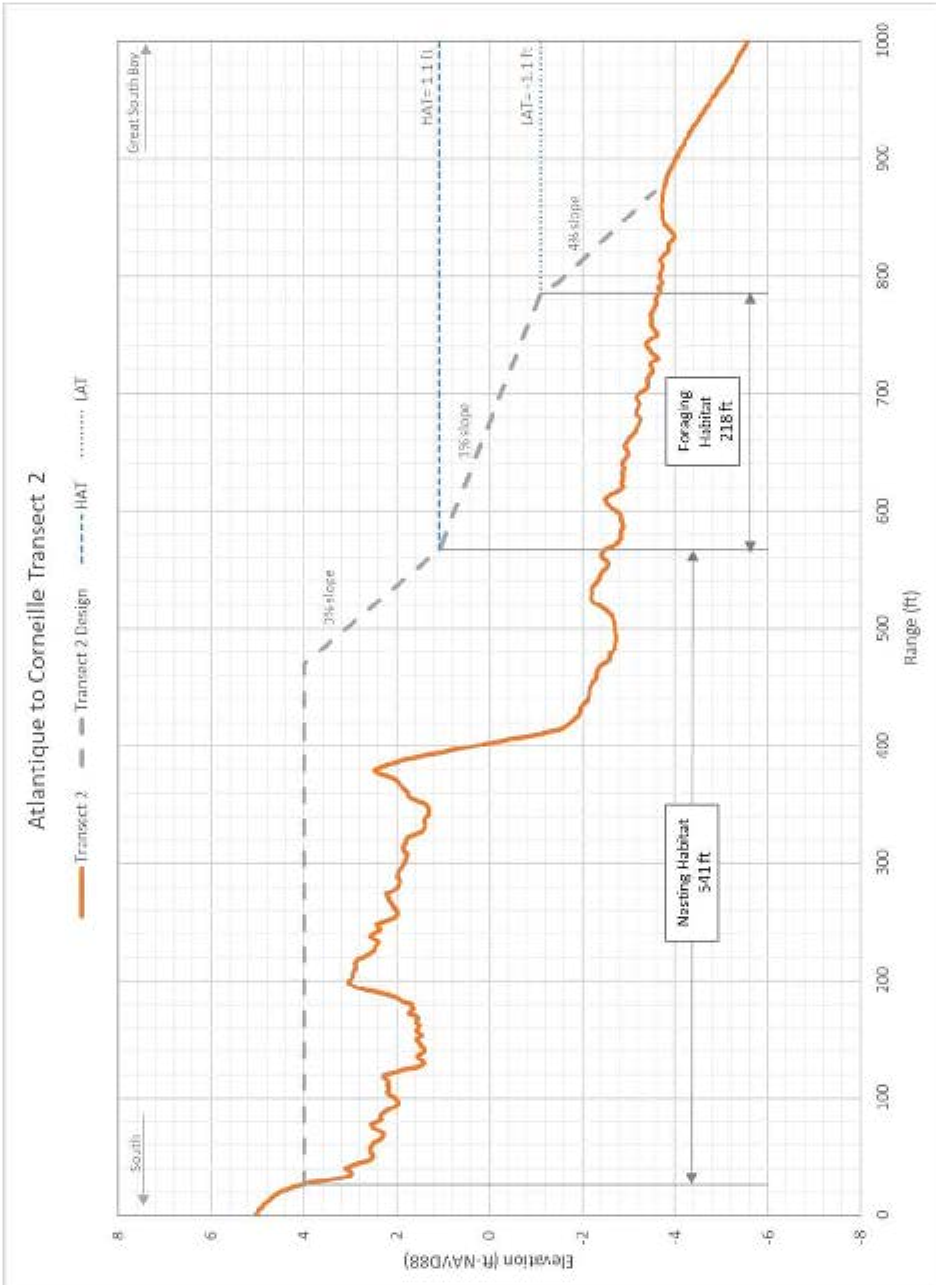


Atlantique to Corneille Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
HAT = 1.1 ft
LAT = -1.1 ft
South
Great South Bay
Elevation (ft-NAVD88)
Range (ft)

7

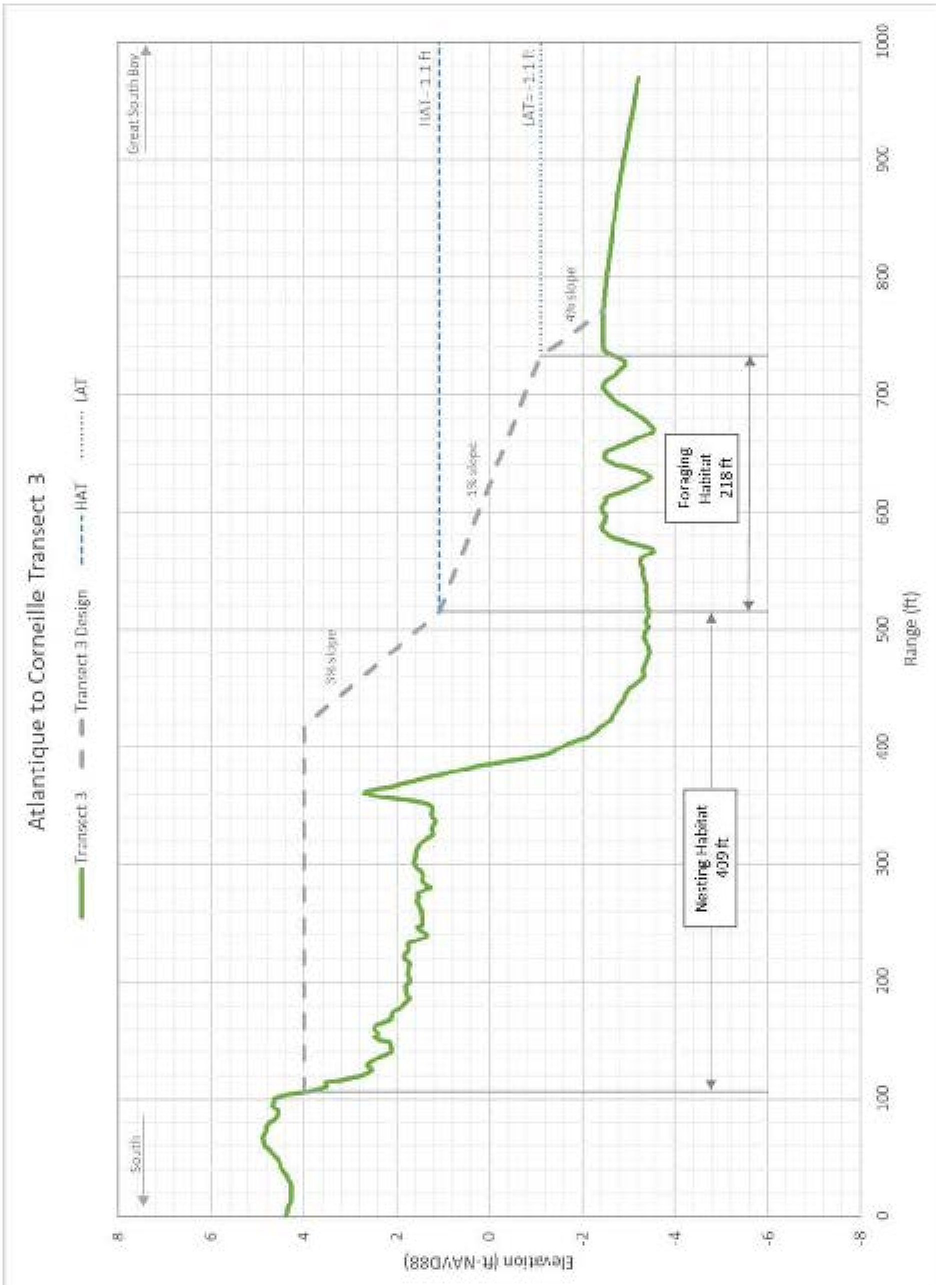

Atlantique to Corneille Transect 1
Transect 1
Transect 1 Design
HAT
LAT
South
Great South Bay
HAT = 1.1 ft
LAT = -1.1 ft
3% slope
1% slope
4% slope
Nesting Habitat
413 ft
Foraging Habitat
218 ft
Range (ft)
Elevation (ft-NAVD88)

8



Atlantique to Corneille Transect 2
Transect 2
Transect 2 Design
HAT
LAT
South
Great South Bay
HAT = 1.1 ft
LAT = -1.1 ft
3% slope
1% slope
4% slope
Nesting Habitat
541 ft
Foraging Habitat
218 ft
Elevation (ft-NAVD88)
Range (ft)
8
6
4
2
0
-2
-4
-6
-8
0
100
200
300
400
500
600
700
800
900
1000

9



Atlantique to Corneille Transect 3
Transect 3
Transect 3 Design
HAT
LAT
South
Great South Bay
HAT = 1.1 ft
LAT = -1.1 ft
5% slope
1% slope
4% slope
Nesting Habitat
409 ft
Foraging Habitat
218 ft
Elevation (ft-NAVD88)
Range (ft)

CPF Site 14 Pattersquash Reach	Reach MB-1B 40.746433° N / 72.83247° W

CPF SITE GOALS

- Devegetate area to meet ESA goals
- Shallow water fill to meet CSRM goals
- Southern boundary follows Burma Road alignment and includes physical barrier to limit chick movement into and beyond road

Pattersquash Reach is located on the eastern portion of Fire Island on the bayside within Smith Point County Park. Pattersquash Reach lies between two inlets, Old Inlet to the west and Moriches Inlet to the east. The project area contains coastal dunes with vegetation and an historically ephemeral sand spit. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by placing fill to simulate cross island transport.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating approximately 49.4 acres (ac), all of which qualify as proposed habitat. All devegetation will occur north of Burma Road. This includes 21.4 ac of foraging habitat and 27.0 ac of nesting habitat. In addition, in-water sediment placement extends from the +1 ft-NAVD88 contour offshore to -1 ft-NAVD88. Fill then follows the -1 ft-NAVD88 contour offshore for approximately 300 ft at which point the fill toes into the existing grade at a 2% slope. No upland regrading is anticipated.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to the naturally occuring +8 ft-NAVD88 contour at Pattersquash Reach as depicted in the Proposed Elevations figure.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. CPF maintenance operations may be modified based on the adaptive management plan to meet ESA/CSRM criteria. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management in newly created CPFs.

CPF Site 14 Pattersquash Reach

Reach MB-1B
40.746433° N / 72.83247° W

CPF PARAMETERS	
Feature	ESA\CSRM
Cut Volume (cy)	0
Fill Volume (cy)	19,396
Net Volume (cy)	19,396
Acreage (Nesting\Foraging\Devegetation)	49.4 (27.0\21.4\49.4)
Activity	Devegetate and Fill
DATA SOURCES	
Topographic	USGS, 2016
Bathymetric	USGS, 2016
Aerial Imagery	Google Earth, 2016
Vegetation	NPS, 2010
REAL ESTATE INFORMATION	
Property Owner	County of Suffolk Town of Brookhaven
Municipality	Brookhaven
County	Suffolk
CBRA	NY-59P, Otherwise Protected Area

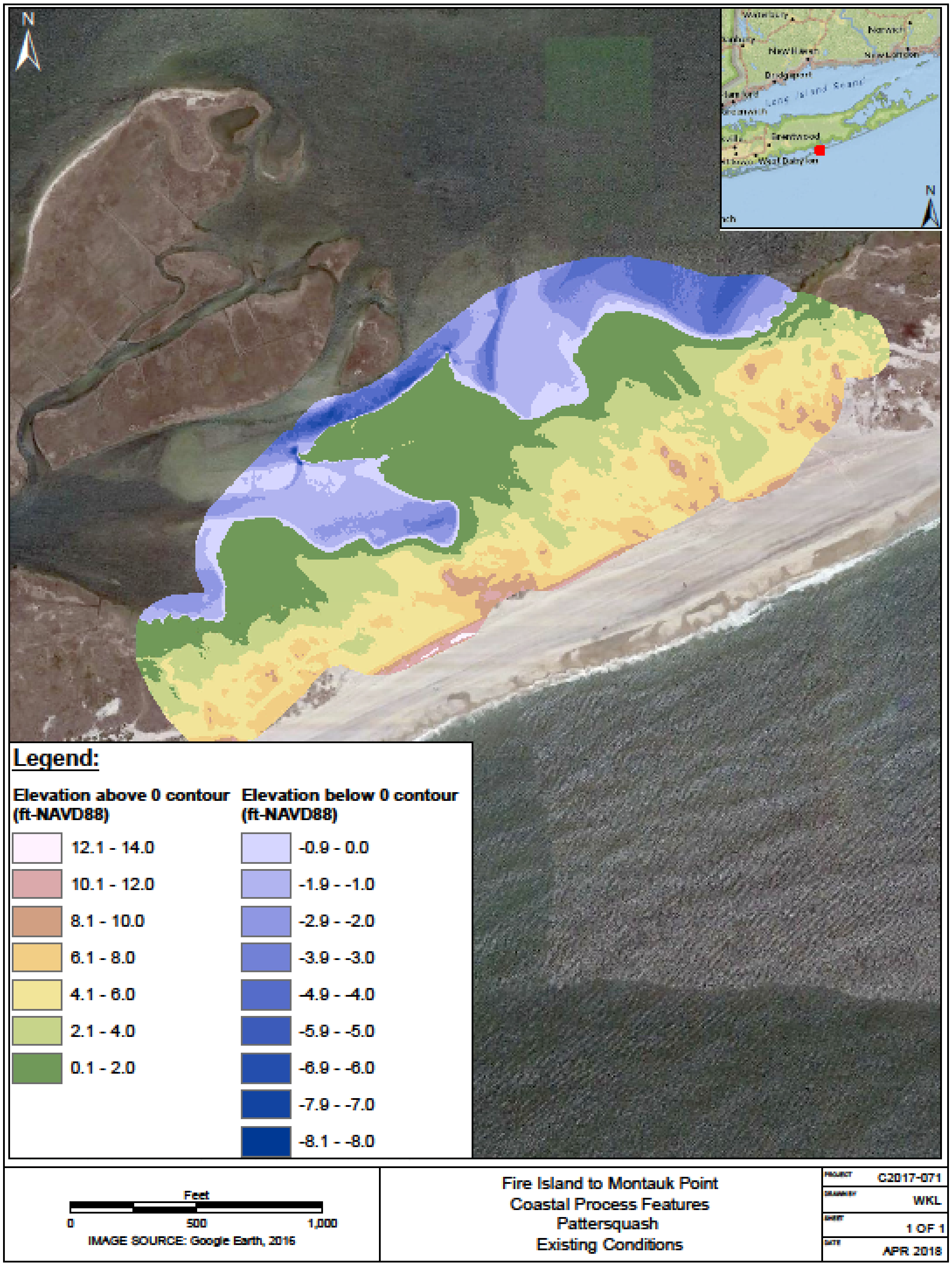
CPF Site 14 Pattersquash Reach

Reach MB-1B
40.746433° N / 72.83247° W

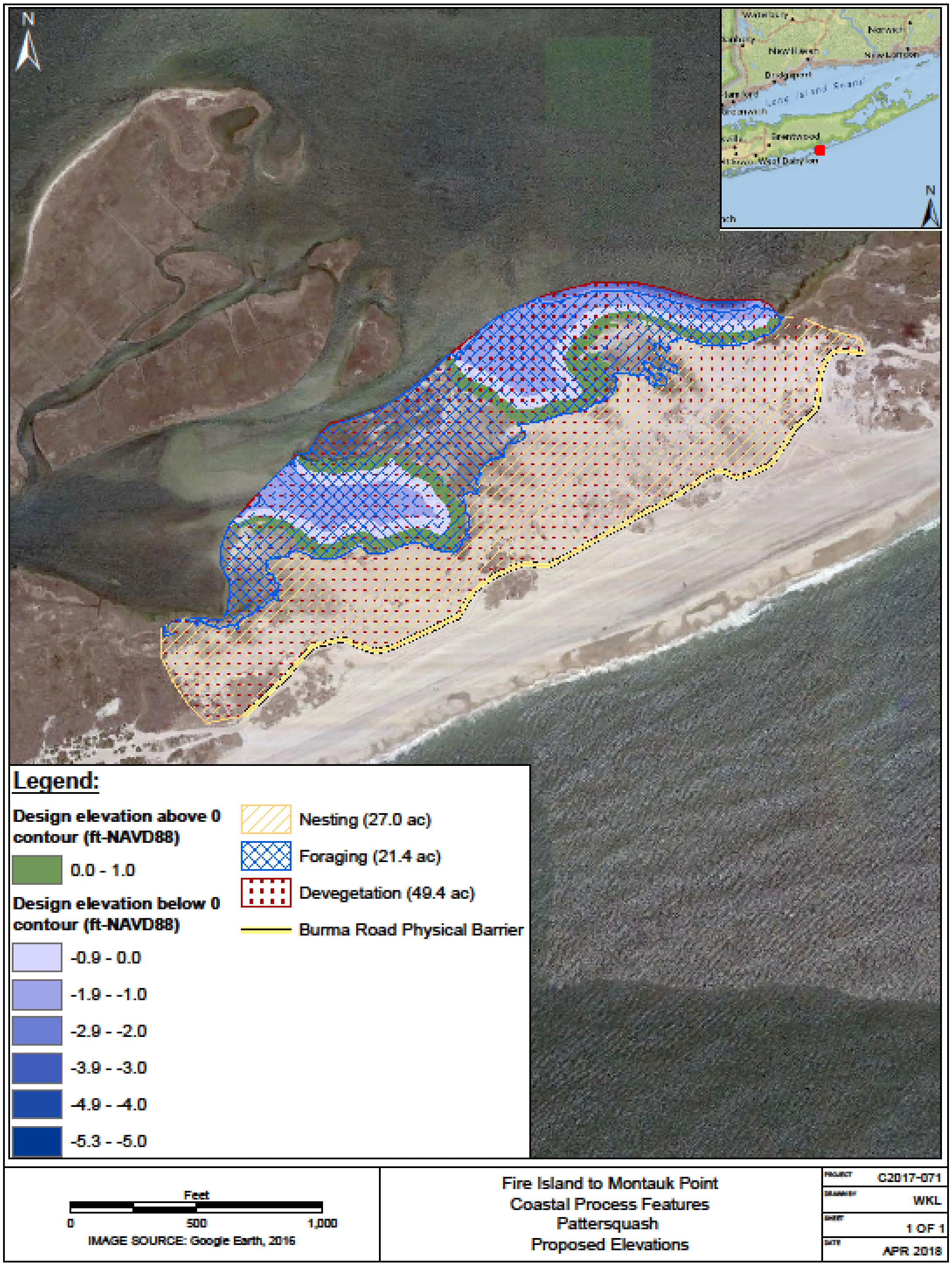
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)			
Closest Tidal Benchmark	Smith Point Bridge, NY	Highest Astronomical Tide (HAT)	1.42
		Mean Higher High Water (MHHW)	0.95
Coordinates	40.738333° N 72.868333° W	Mean High Water (MHW)	0.75
		Mean Sea Level (MSL)	-0.09
0 ft-NAVD = 1.04 ft-NGVD		Mean Tide Level (MTL)	-0.10
Range (MHW-MLW)	1.70	Mean Low Water (MLW)	-0.95
Diurnal Range (MHHW - MLLW)	2.01	Mean Lower Low Water (MLLW)	-1.07
Largest Tidal Range (HAT-LAT)	2.97	Lowest Astronomical Tide (LAT)	-1.55

BAYSIDE WAVE ENVIRONMENT

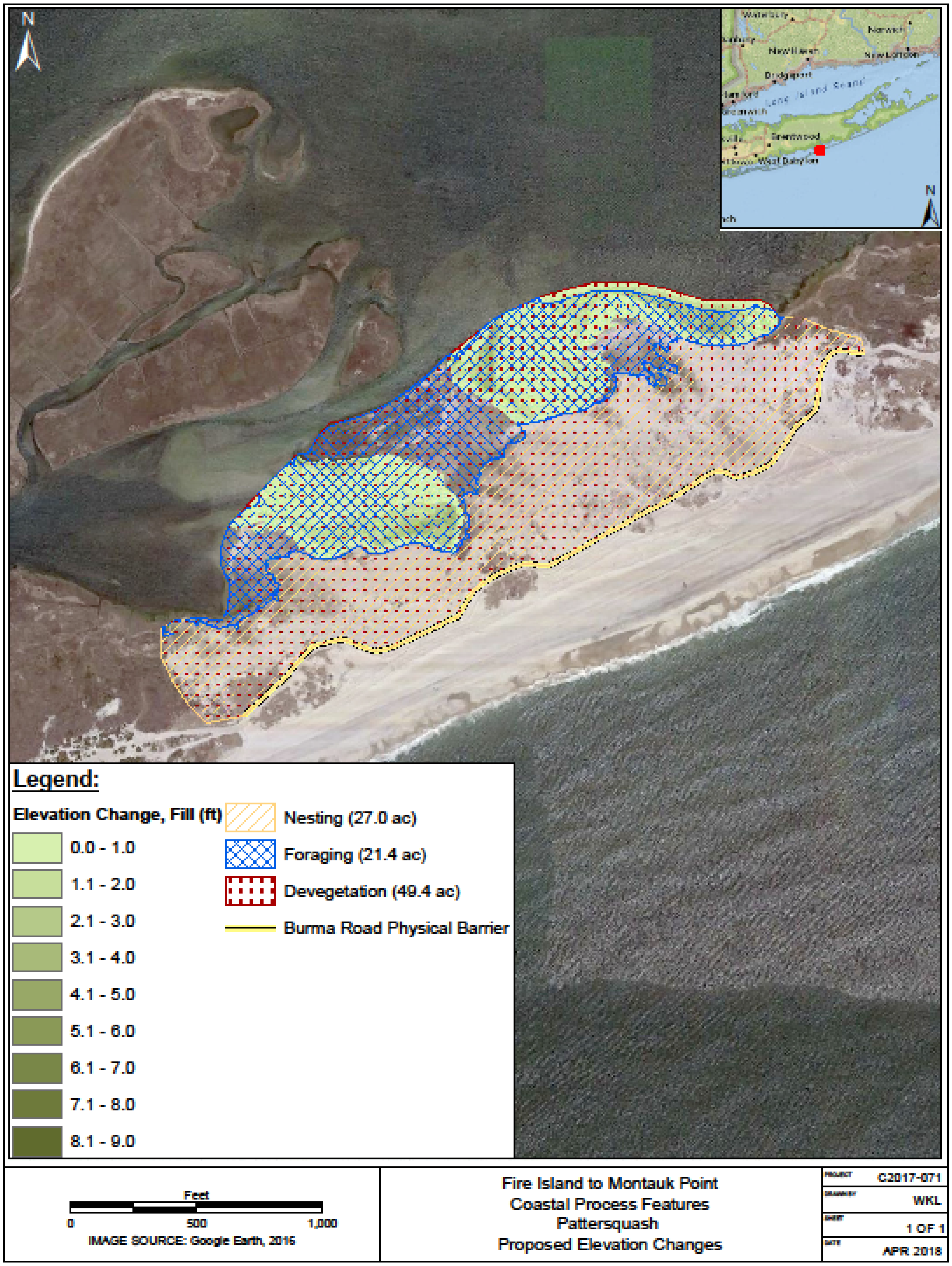
Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft-NAVD88)
1-year	19,180	2.5	0.14	0.81	4.87
5-year	19,180	3.3	0.24	0.82	5.78
10-year	19,180	3.7	0.29	0.83	6.24


N
Legend:
Elevation above 0 contour (ft-NAVD88)
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.1 - 2.0
Elevation below 0 contour (ft-NAVD88)
-0.9 - 0.0
-1.9 - -1.0
-2.9 - -2.0
-3.9 - -3.0
-4.9 - -4.0
-5.9 - -5.0
-6.9 - -6.0
-7.9 - -7.0
-8.1 - -8.0
Feet
0 500 1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Pattersquash
Existing Conditions
C2017-071
WKL
1 OF 1
APR 2018

3


N
Legend:
Design elevation above 0 contour (ft-NAVD88)
0.0 - 1.0
Design elevation below 0 contour (ft-NAVD88)
-0.9 - 0.0
-1.9 - -1.0
-2.9 - -2.0
-3.9 - -3.0
-4.9 - -4.0
-5.3 - -5.0
Nesting (27.0 ac)
Foraging (21.4 ac)
Devegetation (49.4 ac)
Burma Road Physical Barrier
Feet
0
500
1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Pattersquash
Proposed Elevations
C2017-071
WKL
1 OF 1
APR 2018

4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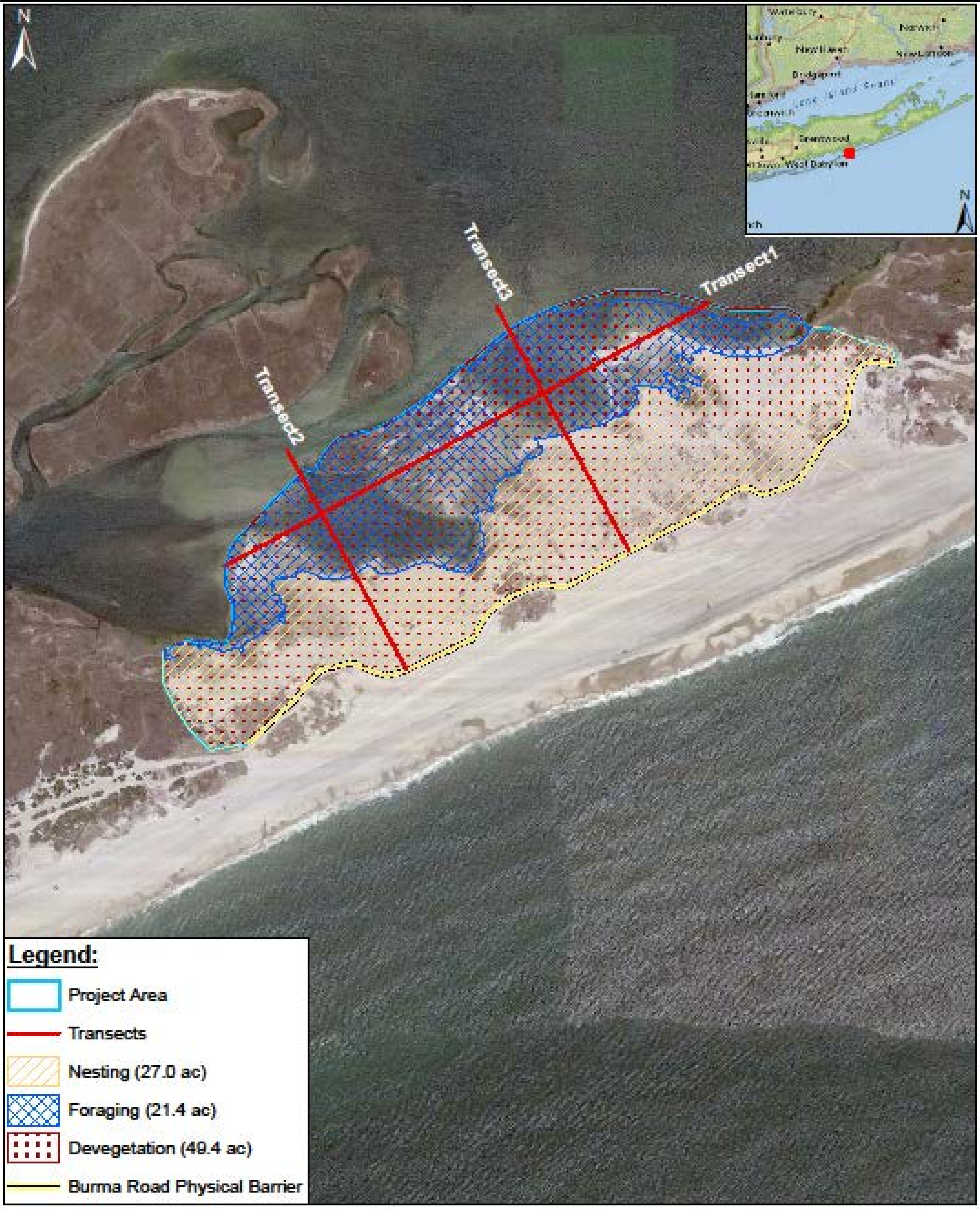
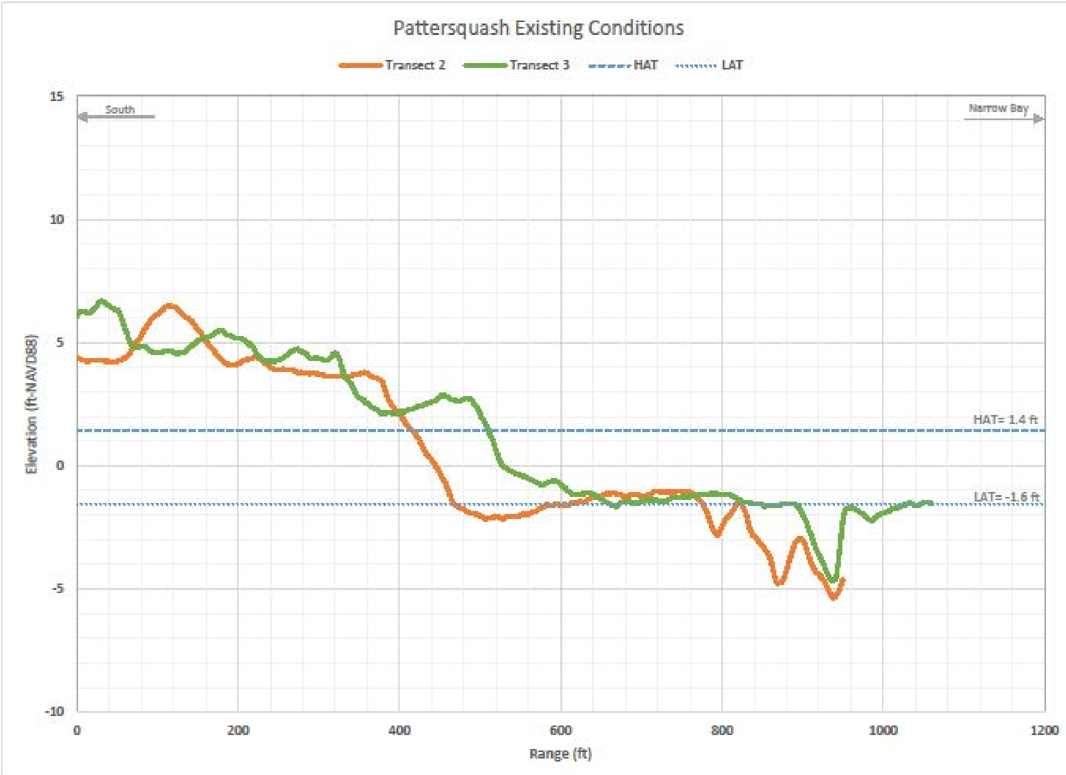
Legend:
Elevation Change, Fill (ft)
0.0 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
Nesting (27.0 ac)
Foraging (21.4 ac)
Devegetation (49.4 ac)
Burma Road Physical Barrier
Feet
0
500
1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Pattersquash
Proposed Elevation Changes
PROJECT C2017-071
DRAWN BY WKL
SHEET 1 OF 1
DATE APR 2018



Feet
0 500 1,000
IMAGE SOURCE: Google Earth, 2016

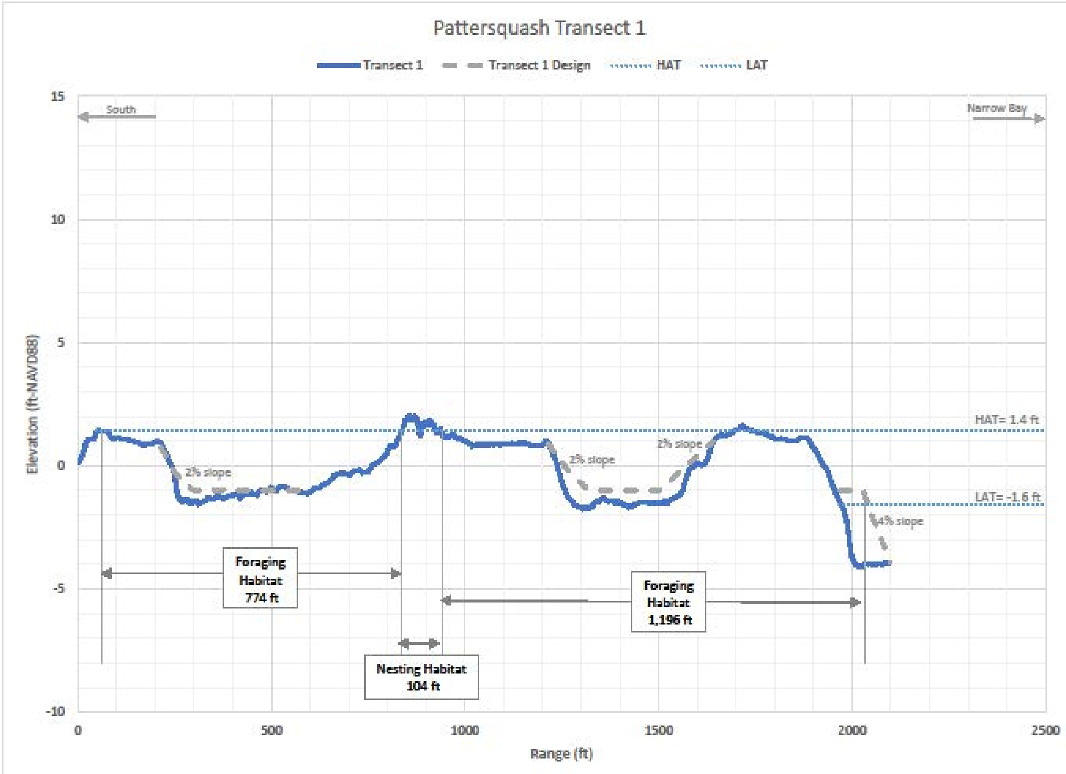
Fire Island to Montauk Point
Coastal Process Features
Pattersquash
Transect Locations

PROJECT	C2017-071
DRAWN BY	WKL
SHEET	1 OF 1
DATE	APR 2018



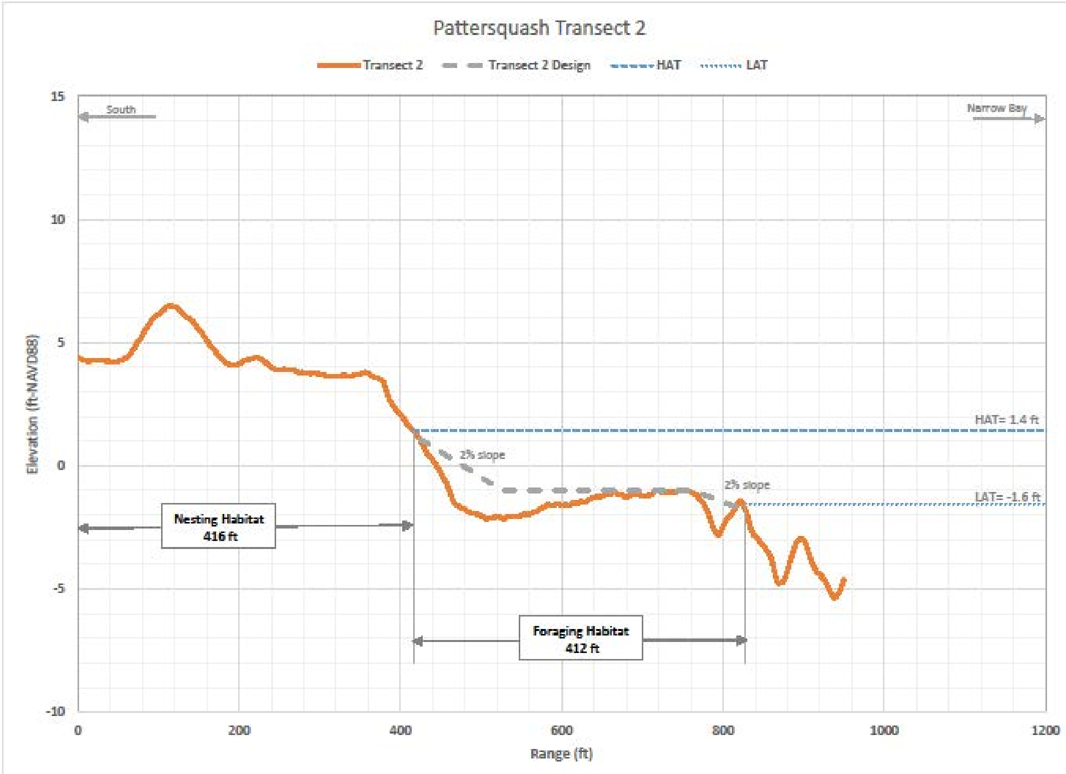
Pattersquash Existing Conditions
Transect 2
Transect 3
HAT
LAT
South
Narrow Bay
HAT= 1.4 ft
LAT= -1.6 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200

7



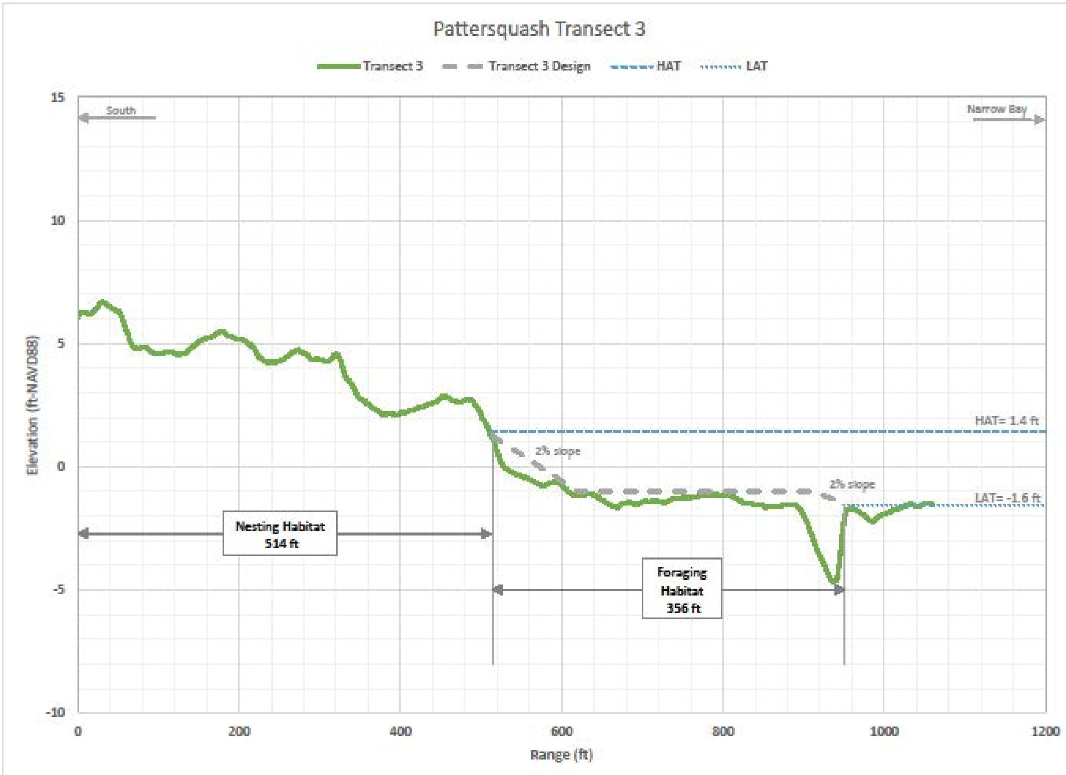
Pattersquash Transect 1
Transect 1
Transect 1 Design
HAT
LAT
South
Narrow Bay
HAT= 1.4 ft
LAT= -1.6 ft
2% slope
2% slope
2% slope
4% slope
Foraging Habitat 774 ft
Nesting Habitat 104 ft
Foraging Habitat 1,196 ft
Elevation (ft-NAVD88)
Range (ft)

8



Pattersquash Transect 2
Transect 2
Transect 2 Design
HAT
LAT
South
Narrow Bay
Elevation (ft-NAVD88)
HAT= 1.4 ft
LAT= -1.6 ft
2% slope
2% slope
Nesting Habitat
416 ft
Foraging Habitat
412 ft
Range (ft)

9


Pattersquash Transect 3
Transect 3
Transect 3 Design
HAT
LAT
South
Narrow Bay
HAT= 1.4 ft
2% slope
2% slope
LAT= -1.6 ft
Nesting Habitat
514 ft
Foraging
Habitat
356 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200

10

CPF Site 15 New Made Island Reach	Reach MB-2A 40.753186° N / 72.80777° W

CPF SITE GOALS

- Devegetate area to meet ESA goals
- Shallow water fill to meet CSRM goals
- Southern boundary follows Burma Road alignment and includes physical barrier to limit chick movement into and beyond road

New Made Island Reach is located on the eastern portion of Fire Island on the bayside, within Smith Point County Park. New Made Island Reach lies between two inlets, Old Inlet to the west and Moriches Inlet to the east. The project area contains coastal dunes with vegetation and an historically ephemeral sand spit. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by placing fill to simulate cross island transport.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating approximately 100.1 acres (ac), all of which qualifiy as proposed habitat. All devegetation will occur north of Burma Road. This includes 28.9 ac of foraging habitat and 71.1 ac of nesting habitat. In addition, in-water sediment placement extends at a 1% slope from +1 ft-NAVD88 to the intersection with existing grade in the offshore direction. No upland regrading is anticipated.

Vehicular traffic on Burma Road presents a potential hazard for chicks and older birds. As such, a physical barrier shall be constructed to limit the ability of birds to enter traffic lanes. Past efforts using sand/snow fencing have had limited success primarily due to pedestrian openings in the fencing. Additional types of barriers shall be considered during the PED phase of the project. Possible physical barrier components may include dredge pipe, sand/snow fencing, etc., and elevated pedestrian cross walks to limit the number of openings through the barriers. Future detailed CPF design will be completed in close coordination with FWS, Suffolk County, and NY State Parks.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to the naturally occuring +8 ft-NAVD88 contour at Pattersquash Reach as depicted in the Proposed Elevations figure.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. In addition, future renourishment of the site is subject to the adaptive management plan. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management and symbolic fencing to the 10 ft-NAVD88 contour.

CPF PARAMETERS	
Feature	ESA with CSRM Features
Cut Volume (cy)	0
Fill Volume (cy)	100,583
Net Volume (cy)	100,583
Acreage (Nesting\Foraging\Devegetation)	107.9 (71.1\28.9\100.1)
Activity	Habitat Creation / Devegetation
DATA SOURCES	
Topographic	USGS, 2016
Bathymetric	USGS, 2016
Aerial Imagery	Google Earth, 2016
Vegetation	N/A*
REAL ESTATE INFORMATION	
Property Owner	County of Suffolk Town of Brookhaven
Municipality	Brookhaven
County	Suffolk
CBRA	NY-59P, Otherwise Protected Area

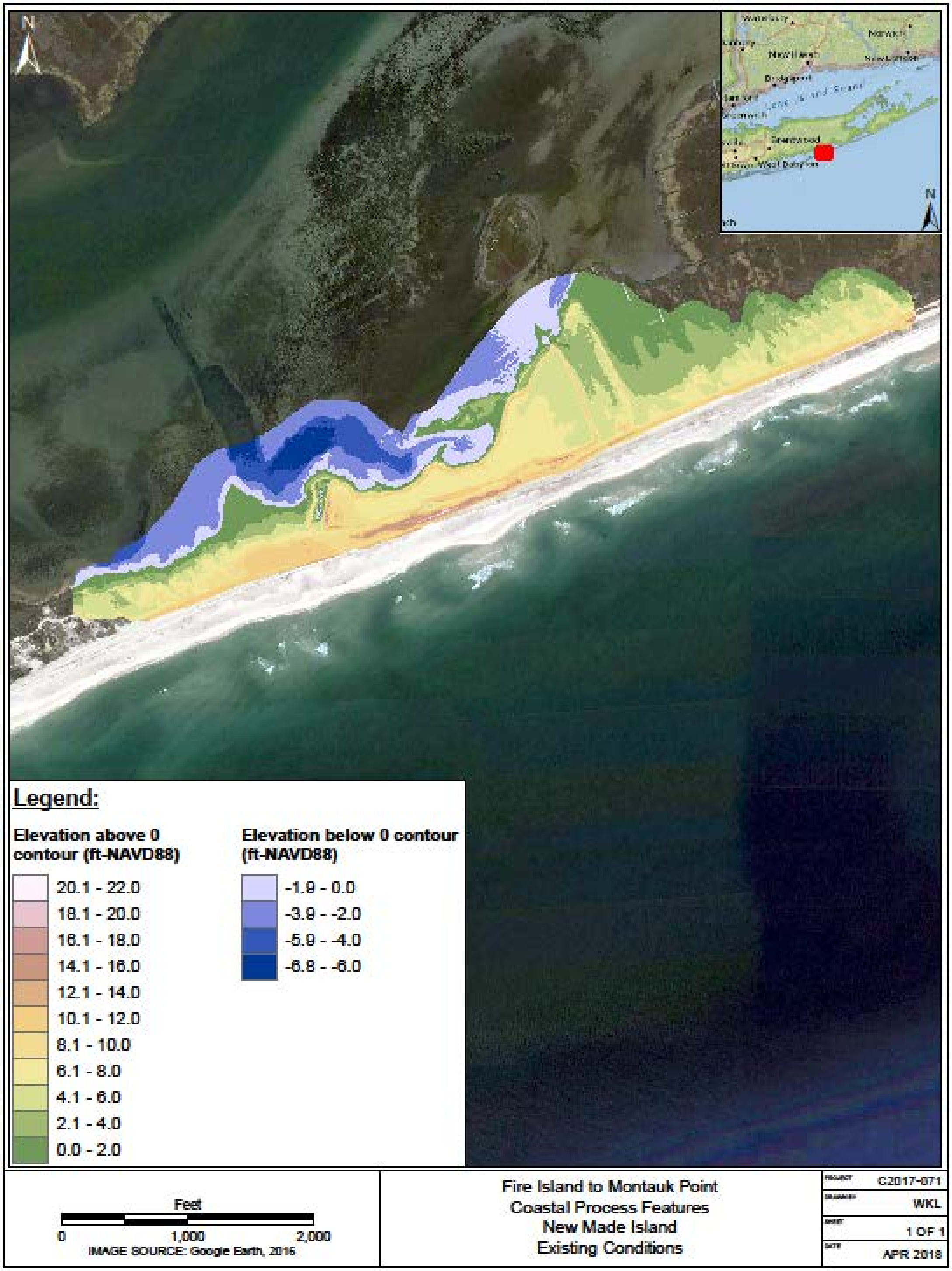
*up to date vegetation data were not available for the study area

CPF Site 15 New Made Island Reach			Reach MB-2A 40.753186° N / 72.80777° W	
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)				
Closest Tidal Benchmark	Smith Point Bridge, NY		Highest Astronomical Tide (HAT)	1.46
			Mean Higher High Water (MHHW)	0.99
Coordinates	40.738333° N 72.868333° W		Mean High Water (MHW)	0.78
			Mean Sea Level (MSL)	-0.11
0 ft-NAVD = 1.03 ft-NGVD			Mean Tide Level (MTL)	-0.12
Range (MHW-MLW)	1.80		Mean Low Water (MLW)	-1.02
Diurnal Range (MHHW - MLLW)	2.12		Mean Lower Low Water (MLLW)	-1.14
Largest Tidal Range (HAT-LAT)	3.08		Lowest Astronomical Tide (LAT)	-1.62

BAYSIDE WAVE ENVIRONMENT

Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft-NAVD88)
1-year	13,672	2.1	0.13	0.75	4.44
5-year	13,672	2.8	0.21	0.76	5.23
10-year	13,672	3.1	0.26	0.76	5.58

2


N
Legend:
Elevation above 0 contour (ft-NAVD88)
20.1 - 22.0
18.1 - 20.0
16.1 - 18.0
14.1 - 16.0
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.0 - 2.0
Elevation below 0 contour (ft-NAVD88)
-1.9 - 0.0
-3.9 - -2.0
-5.9 - -4.0
-6.8 - -6.0
Feet
0
1,000
2,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
New Made Island
Existing Conditions
C2017-071
WKL
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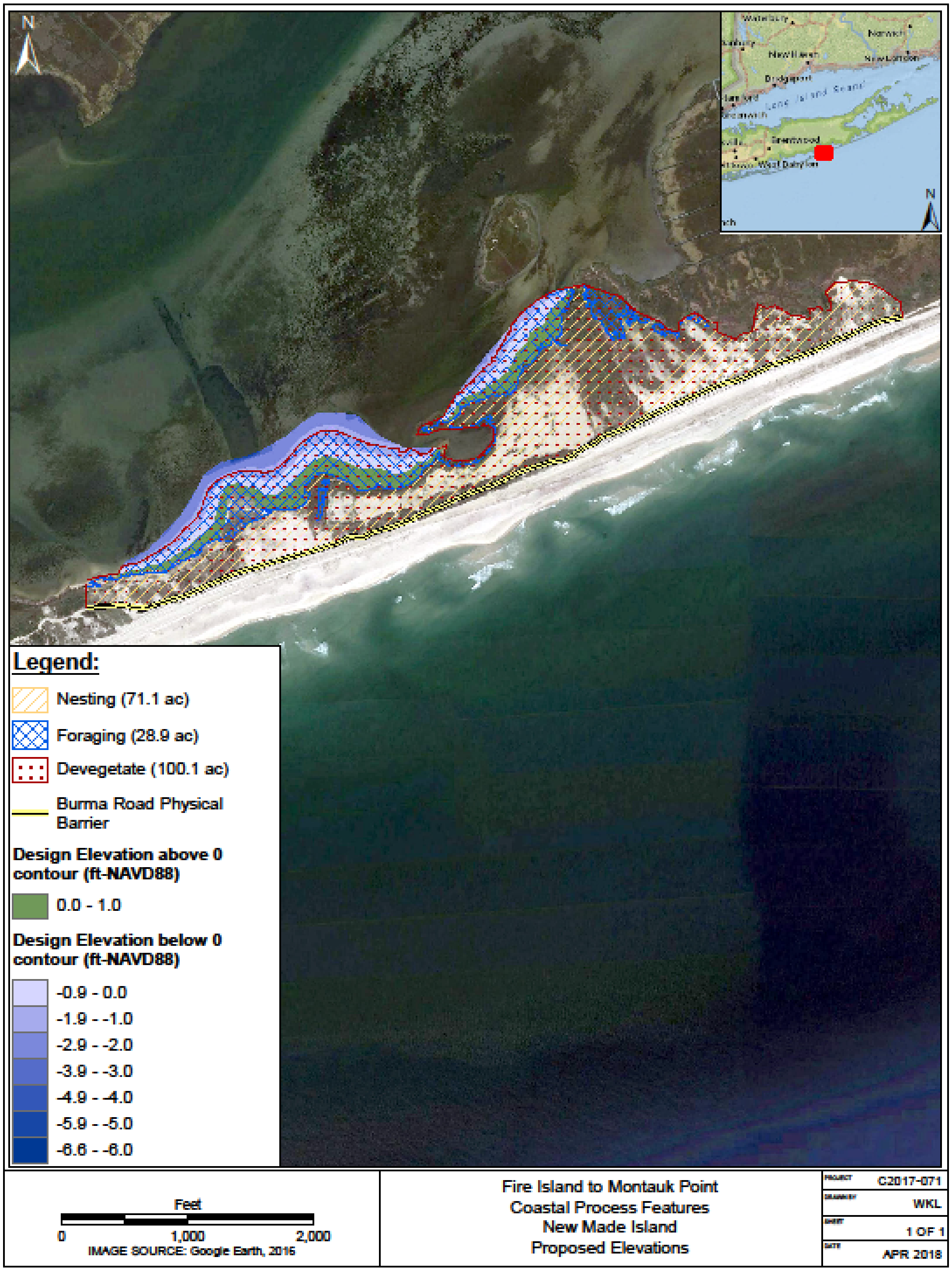
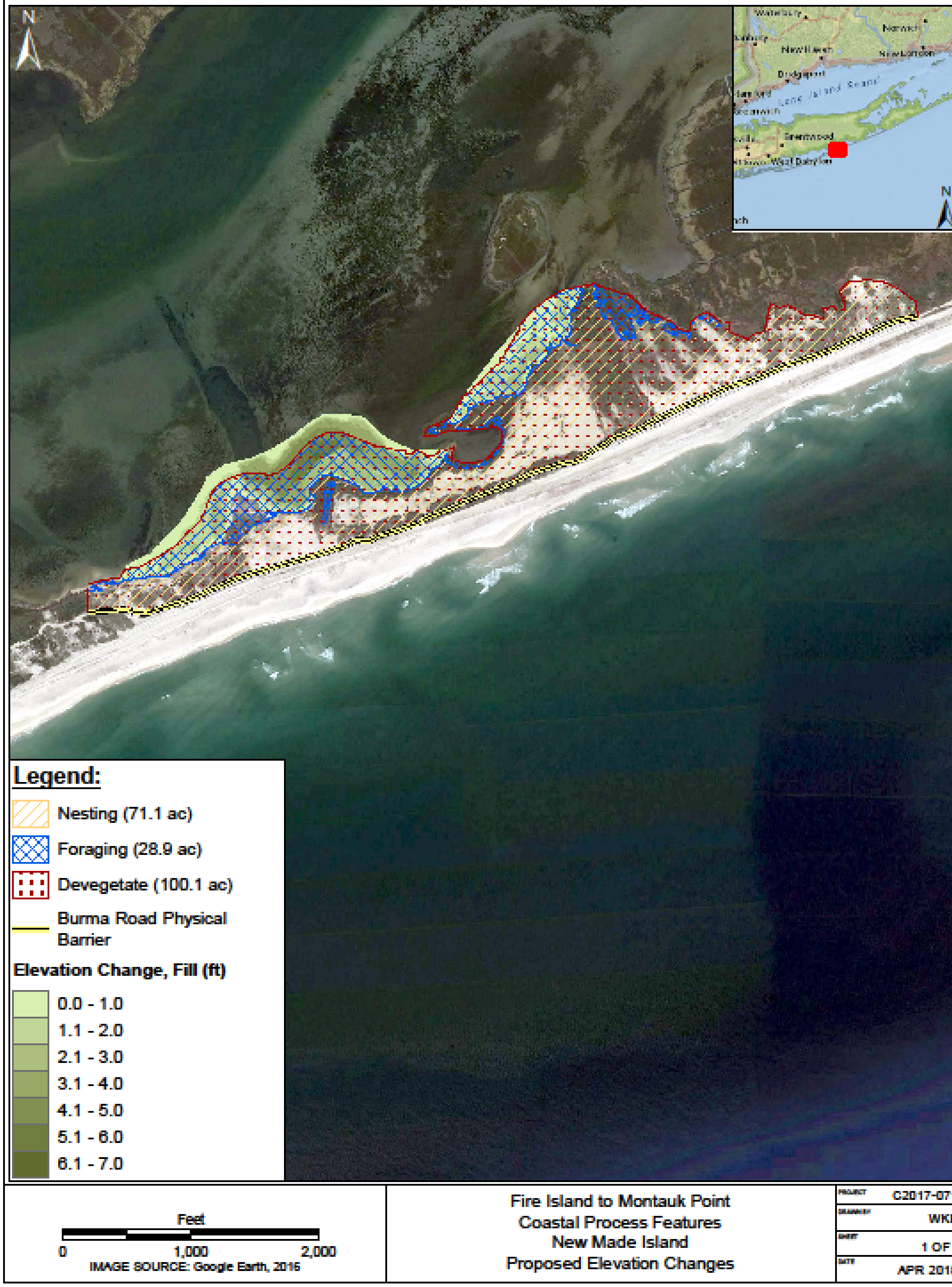
3



Legend:
Nesting (71.1 ac)
Foraging (28.9 ac)
Devegetate (100.1 ac)
Burma Road Physical Barrier
Design Elevation above 0 contour (ft-NAVD88)
0.0 - 1.0
Design Elevation below 0 contour (ft-NAVD88)
-0.9 - 0.0
-1.9 - -1.0
-2.9 - -2.0
-3.9 - -3.0
-4.9 - -4.0
-5.9 - -5.0
-6.6 - -6.0
Feet
0
1,000
2,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
New Made Island
Proposed Elevations
C2017-071
WKL
1 OF 1
APR 2018

4



Fire Island to Montauk Point
Coastal Process Features
New Made Island
Proposed Elevation Changes

PROJECT	C2017-071
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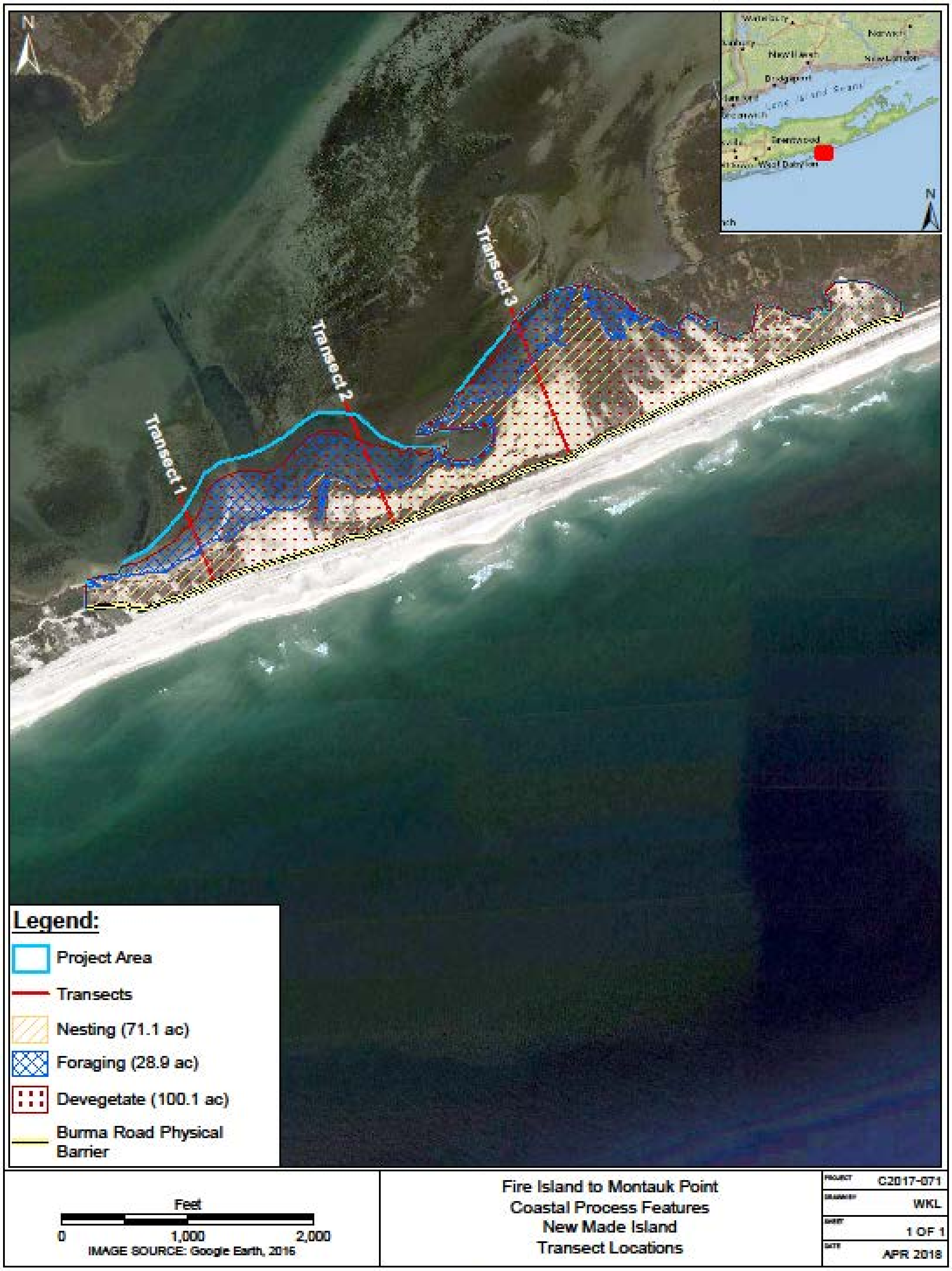
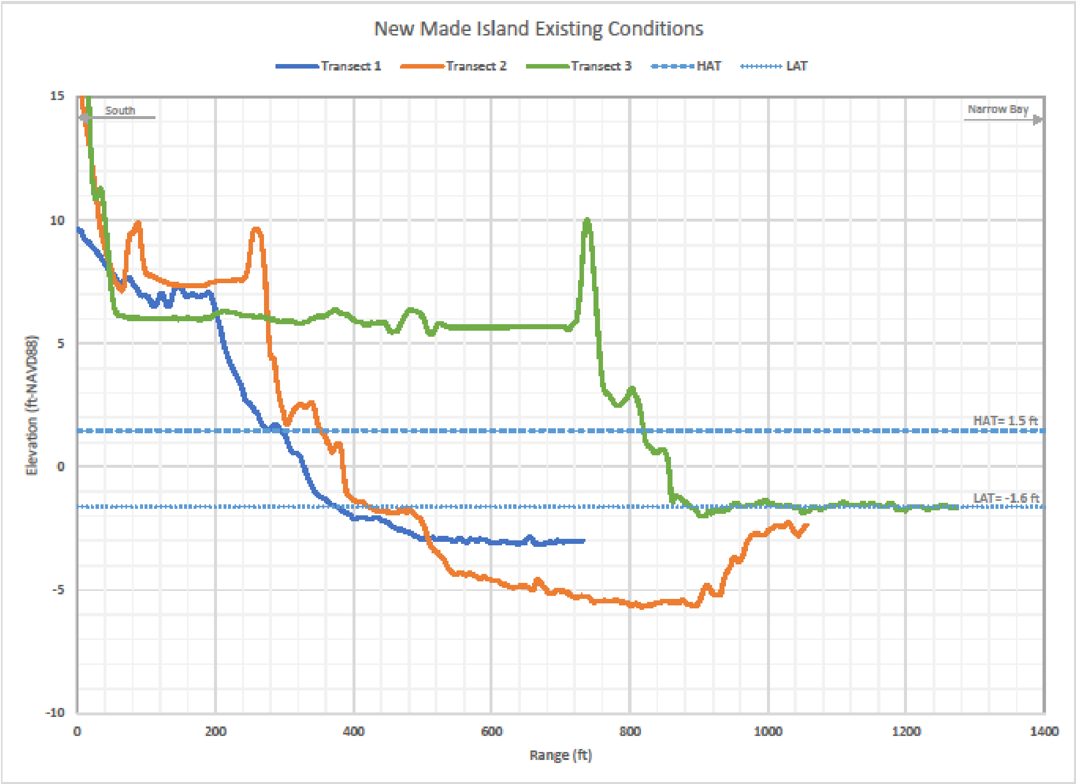
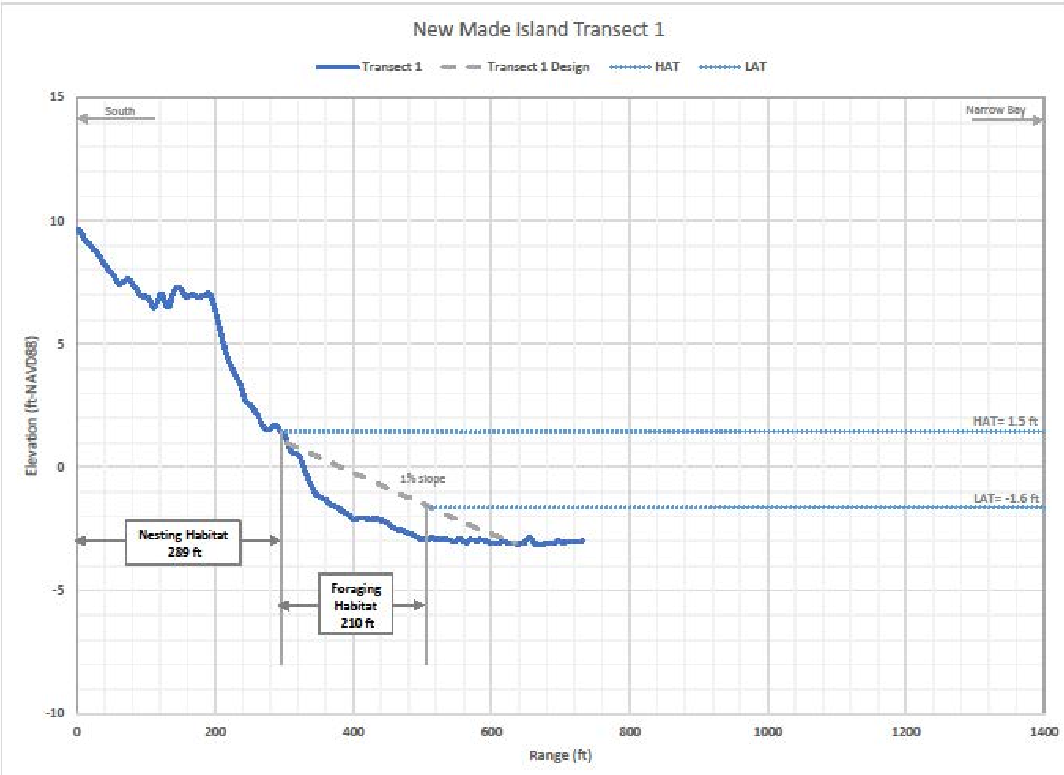
DATE	APR 2018


N
Transect 1
Transect 2
Transect 3
Legend:
Project Area
Transects
Nesting (71.1 ac)
Foraging (28.9 ac)
Devegetate (100.1 ac)
Burma Road Physical Barrier
Feet
0
1,000
2,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
New Made Island
Transect Locations
C2017-071
WKL
1 OF 1
APR 2018

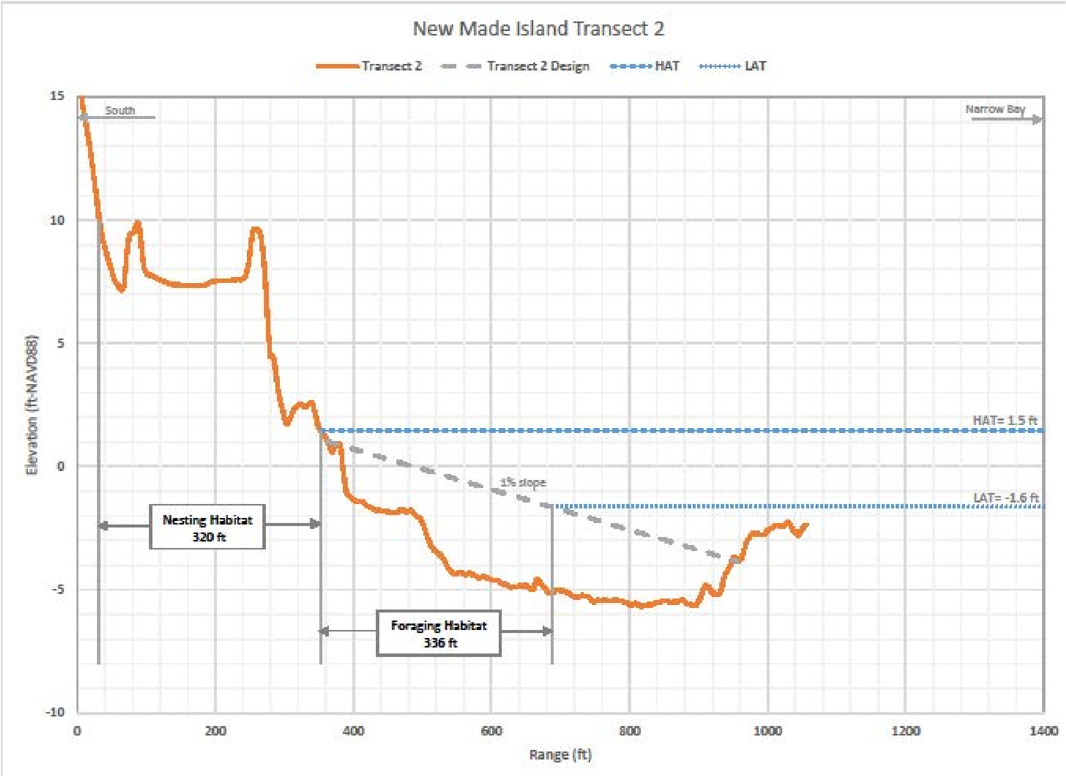
6


New Made Island Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
South
Narrow Bay
HAT= 1.5 ft
LAT= -1.6 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200
1400

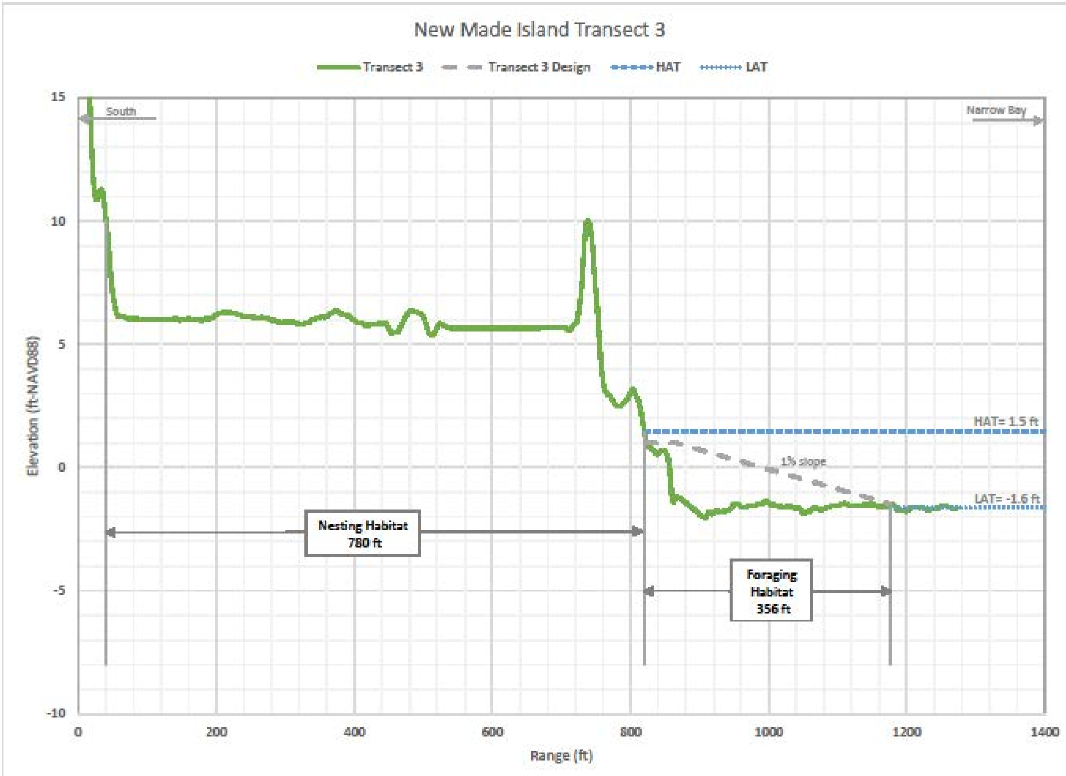
7


New Made Island Transect 1
Transect 1
Transect 1 Design
HAT
LAT
South
Narrow Bay
Elevation (ft-NAVD88)
Range (ft)
HAT= 1.5 ft
LAT= -1.6 ft
1% slope
Nesting Habitat
289 ft
Foraging
Habitat
210 ft
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200
1400

8


New Made Island Transect 2
Transect 2
Transect 2 Design
HAT
LAT
South
Narrow Bay
HAT= 1.5 ft
LAT= -1.6 ft
1% slope
Nesting Habitat
320 ft
Foraging Habitat
336 ft
Elevation (ft-NAVD88)
Range (ft)
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200
1400

9



New Made Island Transect 3
Transect 3
Transect 3 Design
HAT
LAT
South
Narrow Bay
HAT= 1.5 ft
1% slope
LAT= -1.6 ft
Nesting Habitat
780 ft
Foraging
Habitat
356 ft
Elevation (ft-NAVD88)
Range (ft)

10

CPF Site 17 Great Gun	Reach MB-2B 40.760937° N / 72.762574° W

CPF SITE GOALS

- Devegetate area to meet ESA goals

Great Gun is located on the eastern portion of Fire Island on the Atlantic Ocean side within Smith Point County Park. Great Gun lies immediately west of Moriches Inlet. The project area contains coastal dunes with vegetation. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting).

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for removing vegetation from approximately 107.7 acres (ac). Beachfront topography will approximate the anticipated FIMP beach fill template between stations 1572+00 and 1623+00. The design template includes a high dune extending above the vertical limit for ESA bird habitat. No regrading of the site beyond the FIMP beach fill plan is anticipated.

Vehicular traffic on Burma Road presents a potential hazard for chicks and older birds. As such, a physical barrier shall be constructed to limit the ability of birds to enter traffic lanes. Past efforts using sand/snow fencing have had limited success primarily due to pedestrian openings in the fencing. Additional types of barriers shall be considered during the PED phase of the project. Possible physical barrier components may include dredge pipe, sand/snow fencing, etc., and elevated pedestrian cross walks to limit the number of openings through the barriers. Future detailed CPF design will be completed in close coordination with FWS, Suffolk County, and NY State Parks.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +10 ft-NAVD88 at Great Gun as depicted in the Proposed Devegetation figure.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating approximately 107.7 acres (ac), all of which qualify as proposed habitat. This includes 82.7 ac of nesting habitat and 6.3 ac of foraging habitat. Foraging habitat encompasses the area between the LAT and the HAT, while nesting habitat extends from the HAT to the naturally occuring +10 ft-NAVD88 elevation contour or 640 ft from the HAT.

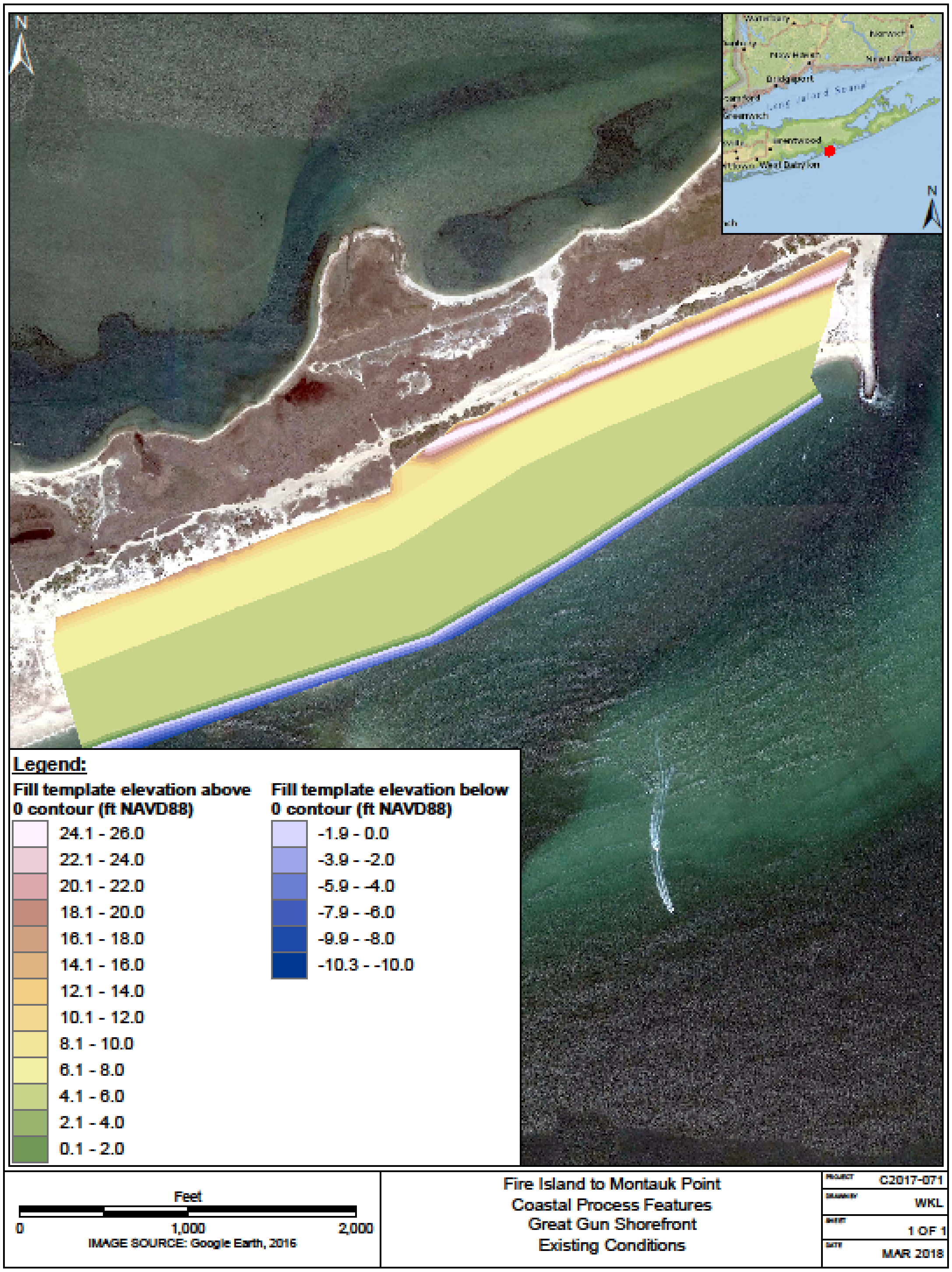
Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. CPF maintenance operations may be modified based on the adaptive management plan to meet ESA/CSRM criteria. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management in newly established CPF's.

CPF Site 17 Great Gun		Reach MB-2B 40.760937° N / 72.762574° W
CPF PARAMETERS		
Feature	ESA	
Cut Volume (cy)	n/a	
Fill Volume (cy)	n/a	
Net Volume (cy)	n/a	
Acreage (Nesting\Foraging\Devegetation)	107.7 (82.7\6.3\107.7)	
Activity	Devegetate	
DATA SOURCES		
Topographic	USGS, 2016	
Bathymetric	USGS, 2016	
Aerial Imagery	Google Earth, 2016	
Vegetation	N/A*	
REAL ESTATE INFORMATION		
Property Owner	State of New York County of Suffolk	
Municipality	Southampton	
County	Suffolk	
CBRA	NY-59P, Otherwise Protected Area	

*up to date vegetation data were not available for the study area

CPF Site 17 Great Gun					Reach MB-2B 40.760937° N / 72.762574° W
OCEANSIDE TIDAL ENVIRONMENT (ft-NAVD88)					
Closest Tidal Benchmark	Moriches Inlet, NY		Highest Astronomical Tide (HAT)		2.67
			Mean Higher High Water (MHHW)		1.73
Coordinates	40.763333° N 72.755000° W		Mean High Water (MHW)		1.45
			Mean Sea Level (MSL)		-0.23
0 ft-NAVD = 1.01 ft-NGVD			Mean Tide Level (MTL)		-0.25
Range (MHW-MLW)		3.38	Mean Low Water (MLW)		-1.94
Diurnal Range (MHHW - MLLW)		3.80	Mean Lower Low Water (MLLW)		-2.08
Largest Tidal Range (HAT-LAT)		5.63	Lowest Astronomical Tide (LAT)		-2.96
OCEANSIDE WAVE ENVIRONMENT					
Return Period	Deep Water Wave Height (ft)	Surf Zone Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Surf Zone Wave Height (ft-NAVD88)
1-year	15.0	6.8	0.80	1.09	11.36
5-year	21.9	7.2	1.50	2.53	13.90
10-year	24.9	7.4	1.90	3.16	15.13

2


N
Legend:
Fill template elevation above 0 contour (ft NAVD88)
24.1 - 26.0
22.1 - 24.0
20.1 - 22.0
18.1 - 20.0
16.1 - 18.0
14.1 - 16.0
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.1 - 2.0
Fill template elevation below 0 contour (ft NAVD88)
-1.9 - 0.0
-3.9 - -2.0
-5.9 - -4.0
-7.9 - -6.0
-9.9 - -8.0
-10.3 - -10.0
Feet
0
1,000
2,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Great Gun Shorefront
Existing Conditions
C2017-071
WKL
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MAR 2018

Feet

0 1,000 2,000

IMAGE SOURCE: Google Earth, 2016

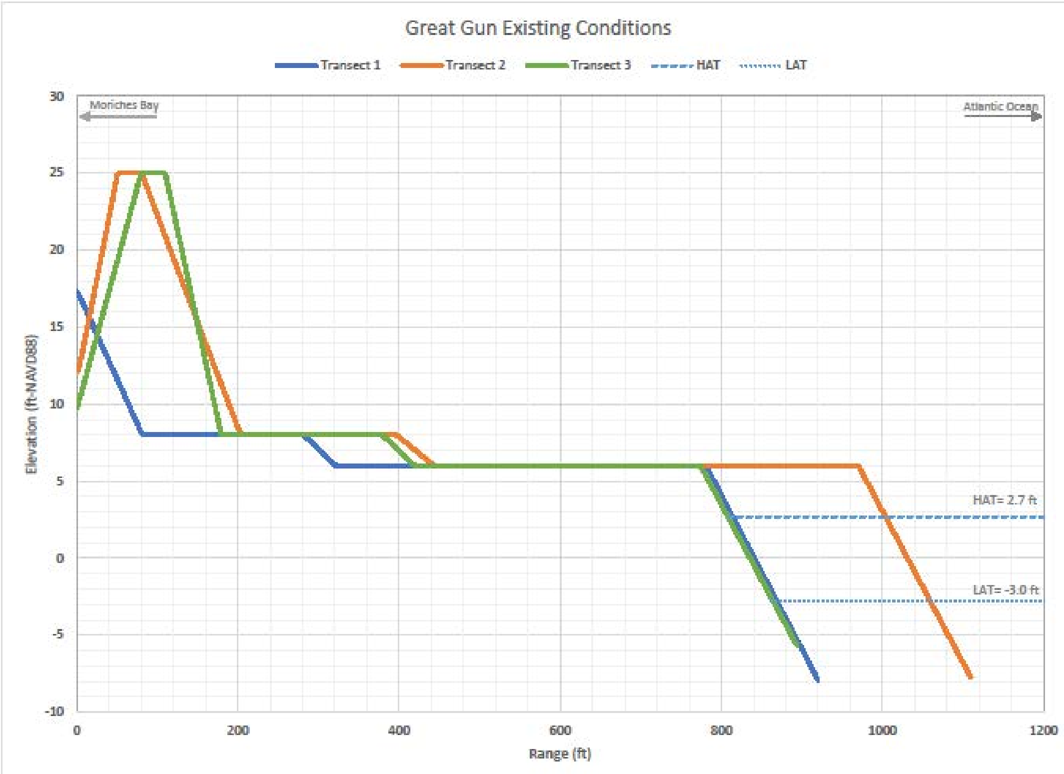
Fire Island to Montauk Point
Coastal Process Features
Great Gun Shorefront
Proposed Devegetation

PROJECT	C2017-071
DRAWN BY	WKL
SHEET	1 OF 1
DATE	MAR 2018

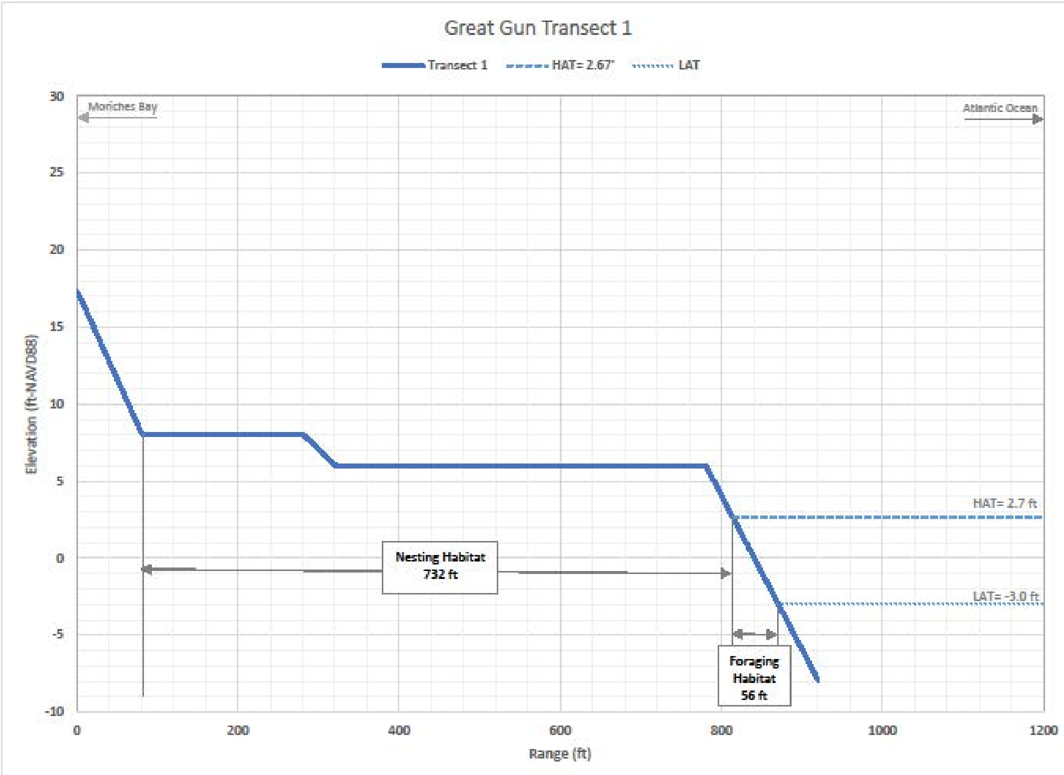
Fire Island to Montauk Point
Coastal Process Features
Great Gun Shorefront
Transect Locations

PROJECT	C2017-071
DRAWN BY	WKL
SHEET	1 OF 1
DATE	MAR 2018

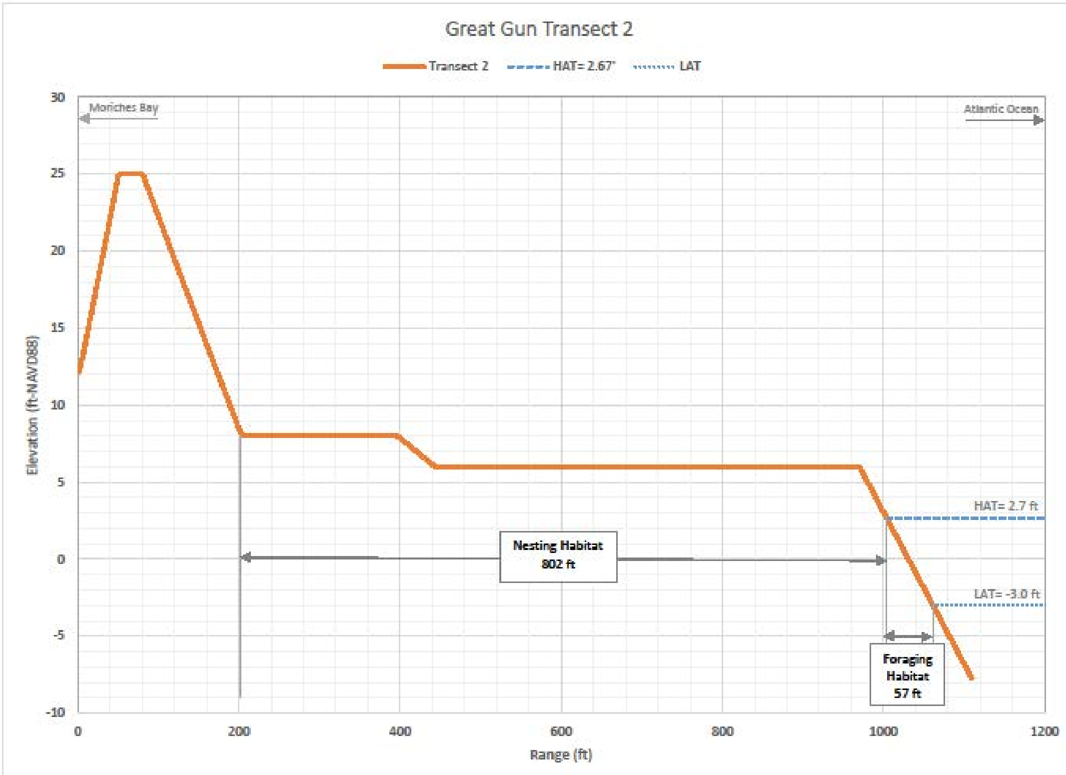
5


Great Gun Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
Moriches Bay
Atlantic Ocean
HAT= 2.7 ft
LAT= -3.0 ft
Elevation (ft-NAVD88)
Range (ft)
30
25
20
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200

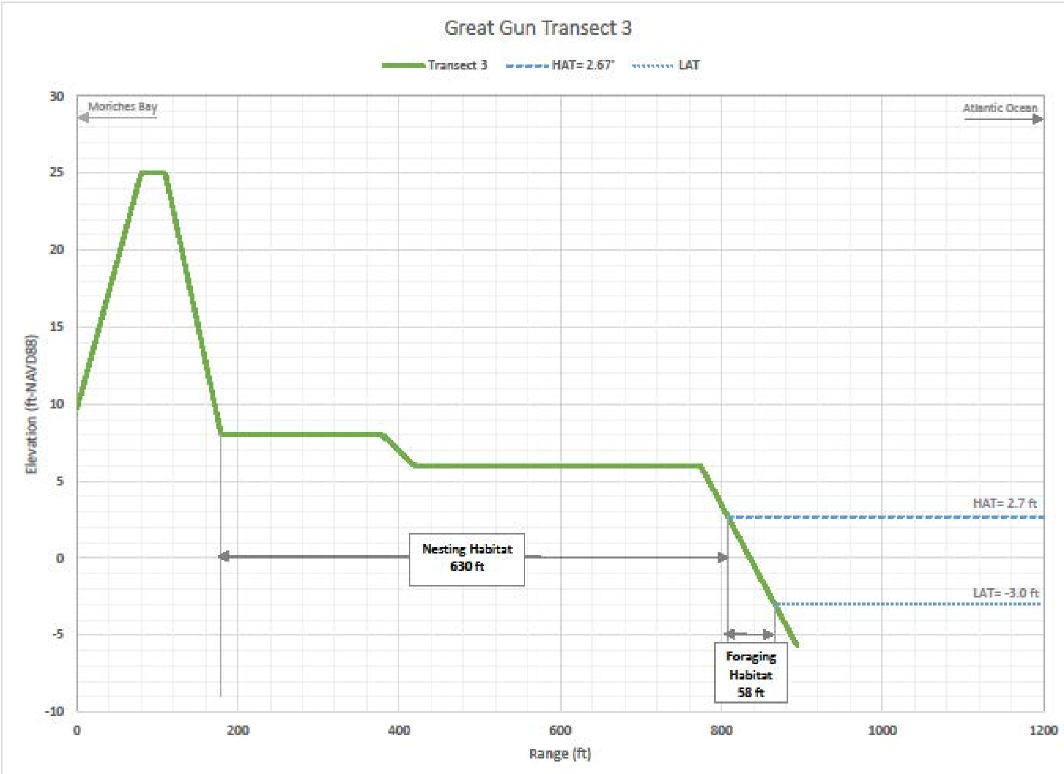
6


Great Gun Transect 1
Transect 1
HAT= 2.67'
LAT
Moriches Bay
Atlantic Ocean
Elevation (ft-NAVD88)
Range (ft)
HAT= 2.7 ft
LAT= -3.0 ft
Nesting Habitat
732 ft
Foraging
Habitat
56 ft

7


Great Gun Transect 2
Transect 2
HAT= 2.67'
LAT
Moriches Bay
Atlantic Ocean
HAT= 2.7 ft
LAT= -3.0 ft
Nesting Habitat
802 ft
Foraging
Habitat
57 ft
Elevation (ft-NAVD88)
Range (ft)
30
25
20
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200

8


Great Gun Transect 3
Transect 3
HAT= 2.67'
LAT
Moriches Bay
Atlantic Ocean
Elevation (ft-NAVD88)
Range (ft)
HAT= 2.7 ft
LAT= -3.0 ft
Nesting Habitat
630 ft
Foraging
Habitat
58 ft
30
25
20
15
10
5
0
-5
-10
0
200
400
600
800
1000
1200

CPF Site 18 Cupsogue	Reach MB-2C 40.767252° N / 72.749476° W

CPF SITE GOALS

- Devegetate area to meet ESA goals
- Maintain road access to jetty area, alignment follows back side of beachfront dunes
- Consider physical barriers at road if dune elevations are not sufficient to restrict bird access
- Shallow water fill to meet CSRM goals
- Ocean front fill follows FIMP beach fill template

Cupsogue is located on the barrier island bayside within Cupsogue Beach County Park. Cupsogue lies immediately east of Moriches Inlet. The project area contains coastal dunes with vegetation. This CPF design seeks to devegetate uplands to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by placing fill to simulate cross island transport.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for devegetating approximately 34.0 acres (ac), all of which qualify as proposed habitat. This includes 9.5 ac of foraging habitat and 19.6 ac of nesting habitat. In addition, in-water sediment placement to an elevation of -1 ft-NAVD88 over 3.3 ac will simulate cross island transport. No upland regrading north of the road is anticipated. The FIMP beach fill template between stations 1637+00 and 1655+00 will form the area to the south of the road. The dune feature in the FIMP beach fill template will be planted with native vegetation.

Vehicular traffic on Dune Road presents a potential hazard for chicks and older birds. As such, a physical barrier shall be constructed to limit the ability of birds to enter traffic lanes. Past efforts using sand/snow fencing have had limited success primarily due to pedestrian openings in the fencing. Additional types of barriers shall be considered during the PED phase of the project. Possible physical barrier components may include dredge pipe, sand/snow fencing, etc., and elevated pedestrian cross walks to limit the number of openings through the barriers. Future detailed CPF design will be completed in close coordination with FWS, Suffolk County, and NY State Parks.

Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tide-induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

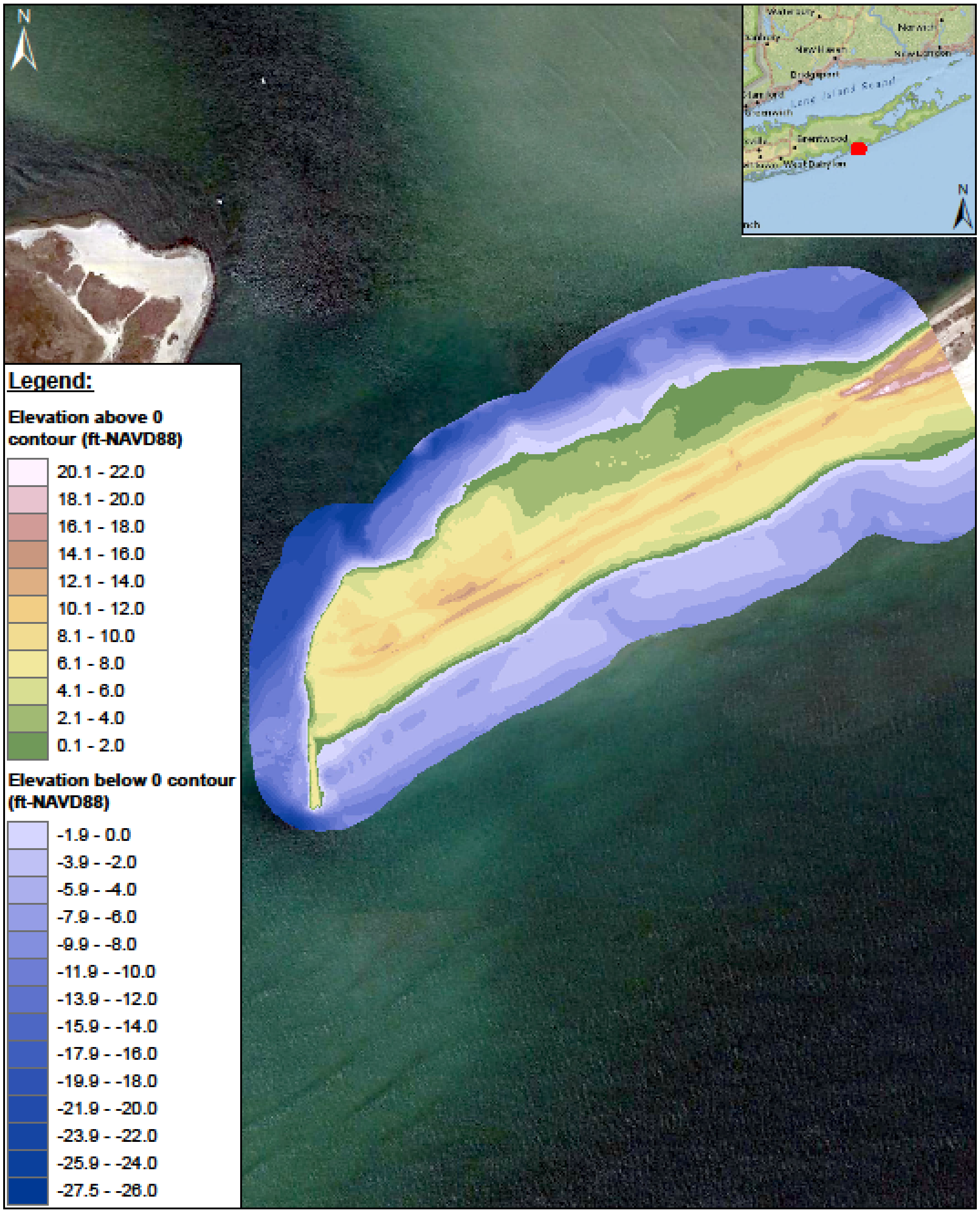
Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to the naturally occuring +10 ft-NAVD88 contour at Cupsogue as depicted in the Proposed Elevations figure.

Maintenance activities at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and are subject to monitoring to ensure resolution of project objectives. CPF maintenance operations may be modified based on the adaptive management plan to meet ESA/CSRM criteria. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management in newly established CPF's.

CPF Site 18 Cupsogue		Reach MB-2C 40.767252° N / 72.749476° W
CPF PARAMETERS		
Feature	ESA \ CSRM	
Cut Volume (cy)	0	
Fill Volume (cy)	3,184 (bayside)	
Net Volume (cy)	3,184 (bayside)	
Acreage (Nesting\Foraging\Devegetation)	38.1 (19.6\9.5\34.0)	
Activity	Fill and Devegetate	
DATA SOURCES		
Topographic	USGS, 2016	
Bathymetric	USGS, 2016	
Aerial Imagery	Google Earth, 2016	
Vegetation	N/A*	
REAL ESTATE INFORMATION		
Property Owner	State of New York County of Suffolk Town of Brookhaven	
Municipality	Southampton	
County	Suffolk	
CBRA	NY-59P, Otherwise Protected Area	

*up to date vegetation data were not available for the study area

CPF Site 18 Cupsogue					Reach MB-2C 40.767252° N / 72.749476° W
BAYSIDE TIDAL ENVIRONMENT (ft-NAVD88)					
Closest Tidal Benchmark	Moriches Inlet, NY			Highest Astronomical Tide (HAT)	2.43
				Mean Higher High Water (MHHW)	1.49
Coordinates	40.763333° N 72.755000° W			Mean High Water (MHW)	1.24
				Mean Sea Level (MSL)	-0.20
0 ft-NAVD = 1.00 ft-NGVD				Mean Tide Level (MTL)	-0.26
Range (MHW-MLW)	3.00			Mean Low Water (MLW)	-1.76
Diurnal Range (MHHW - MLLW)	3.38			Mean Lower Low Water (MLLW)	-1.89
Largest Tidal Range (HAT-LAT)	5.20			Lowest Astronomical Tide (LAT)	-2.77
BAYSIDE WAVE ENVIRONMENT					
Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft-NAVD88)
1-year	17,432	2.6	0.11	1.14	6.28
5-year	17,432	3.2	0.18	1.14	6.95
10-year	17,432	3.5	0.22	1.15	7.30



Feet

0 500 1,000

IMAGE SOURCE: Google Earth, 2016

Fire Island to Montauk Point
Coastal Process Features
Cupsogue
Existing Conditions

PROJECT	C2017-071
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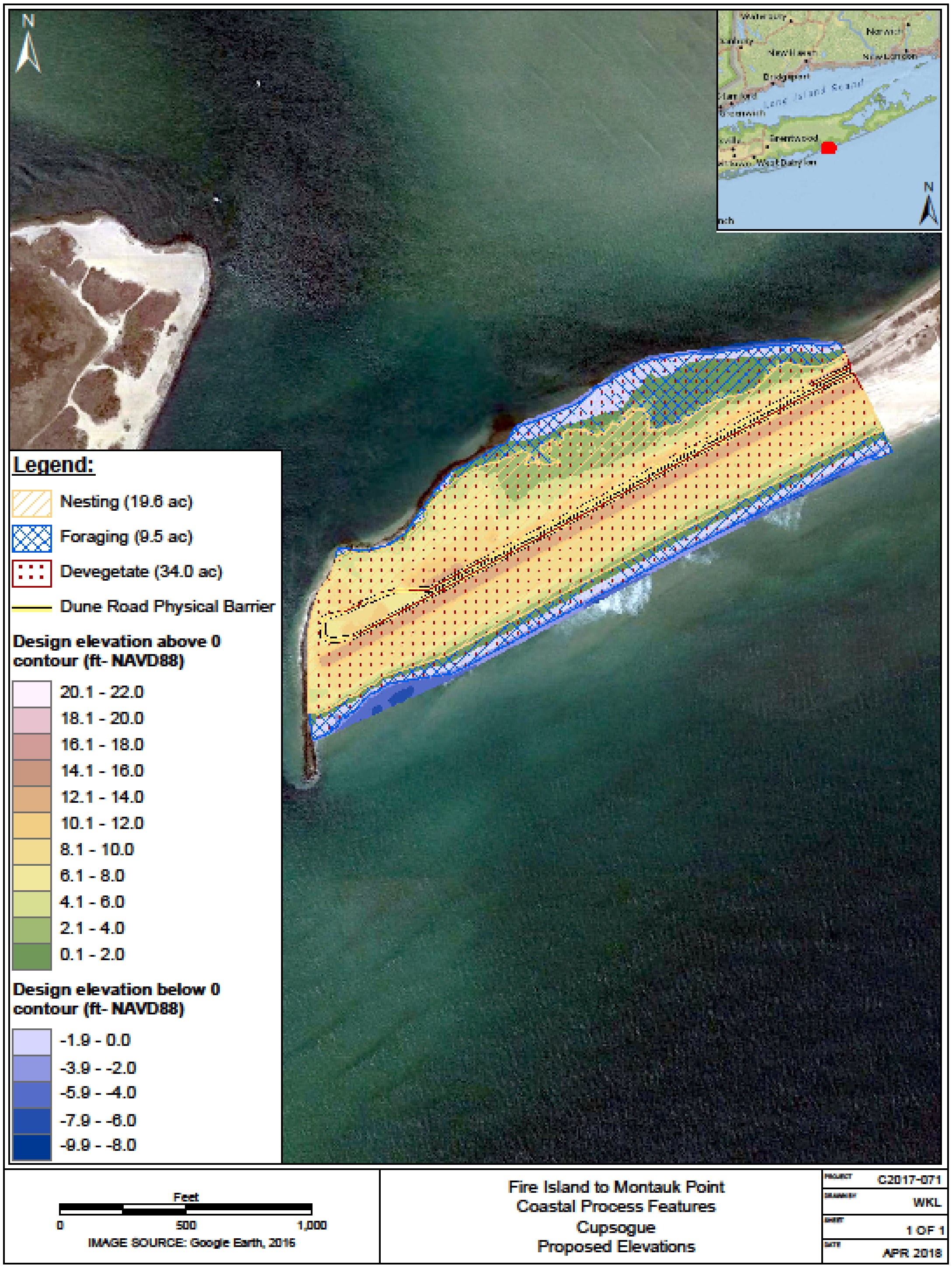
N
Legend:
Nesting (19.6 ac)
Foraging (9.5 ac)
Devegetate (34.0 ac)
Dune Road Physical Barrier
Design elevation above 0 contour (ft- NAVD88)
20.1 - 22.0
18.1 - 20.0
16.1 - 18.0
14.1 - 16.0
12.1 - 14.0
10.1 - 12.0
8.1 - 10.0
6.1 - 8.0
4.1 - 6.0
2.1 - 4.0
0.1 - 2.0
Design elevation below 0 contour (ft- NAVD88)
-1.9 - 0.0
-3.9 - -2.0
-5.9 - -4.0
-7.9 - -6.0
-9.9 - -8.0
Feet
0
500
1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Cupsogue
Proposed Elevations
C2017-071
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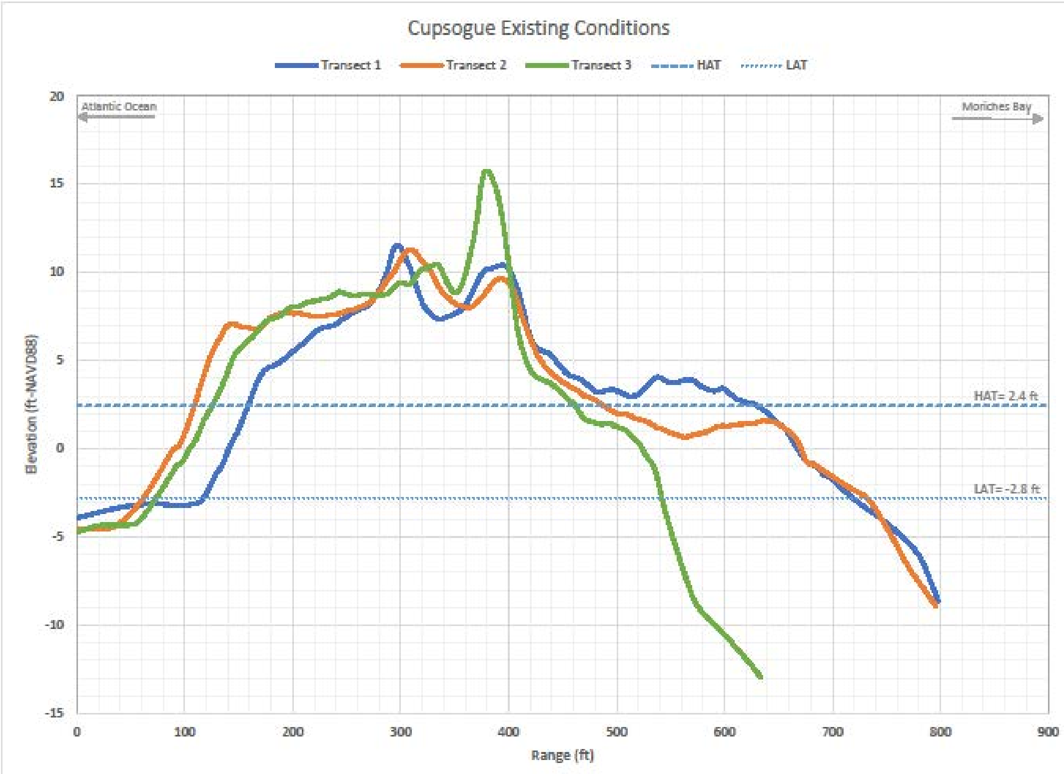
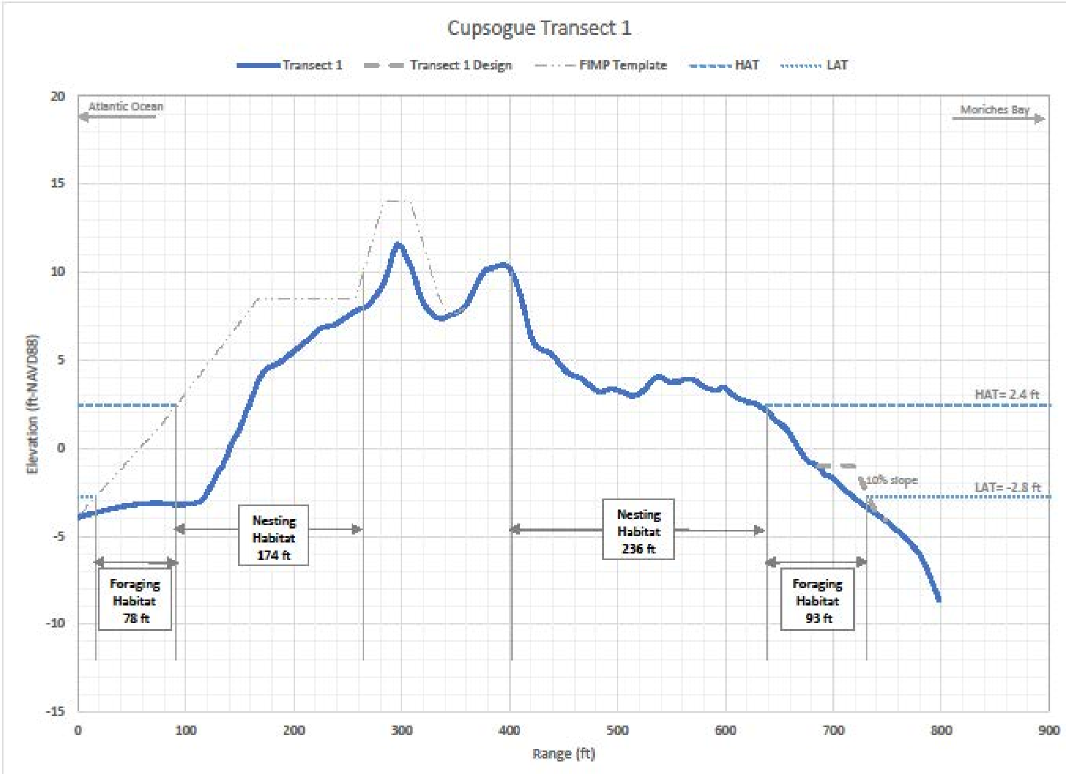
N
Waterbury
Norwich
New Haven
New London
Bridgeport
Stamford
Greenwich
Long Island Sound
Brentwood
West Babylon
N
Legend:
Nesting (19.6 ac)
Foraging (9.5 ac)
Devegetate (34.0 ac)
Dune Road Physical Barrier
Elevation Change, Fill (ft)
0.0 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
Feet
0
500
1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Cupsogue
Proposed Elevation Changes
PROJECT C2017-071
DRAWN BY WKL
SHEET 1 OF 1
DATE APR 2018

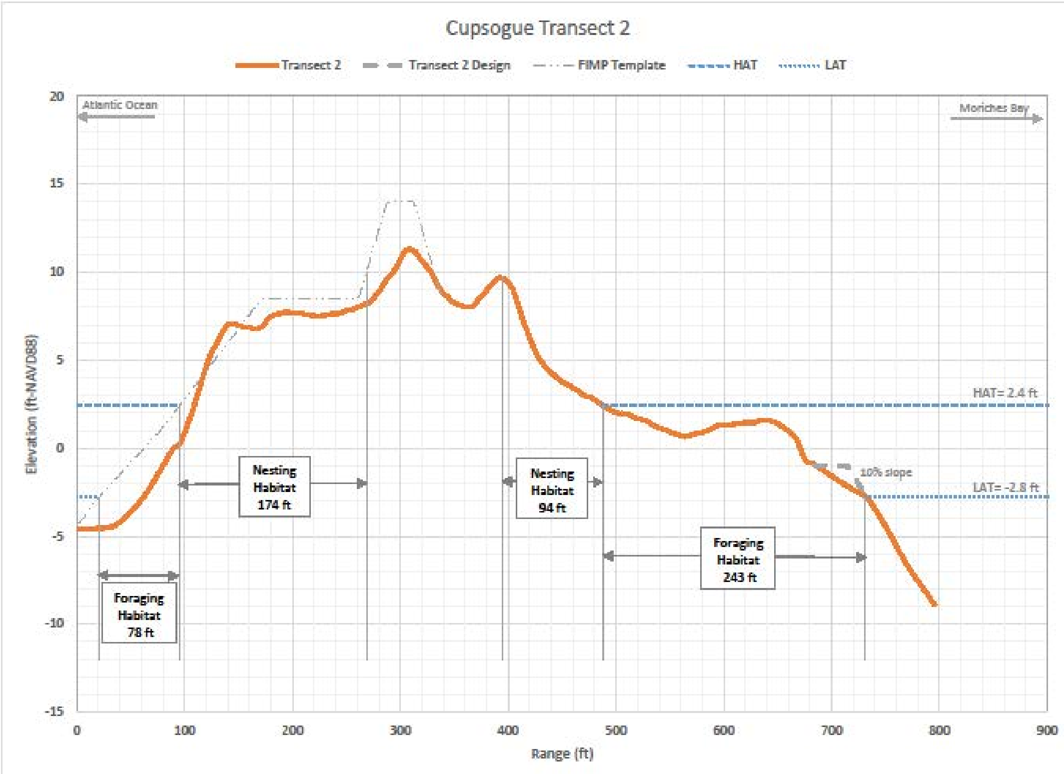

N
Transect 1
Transect 2
Transect 3
Legend:
Project Area
Transects
Nesting (19.6 ac)
Foraging (9.5 ac)
Devegetate (34.0 ac)
Dune Road Physical Barrier
Feet
0
500
1,000
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Cupsogue
Transect Locations
C2017-071
WKL
1 OF 1
APR 2018



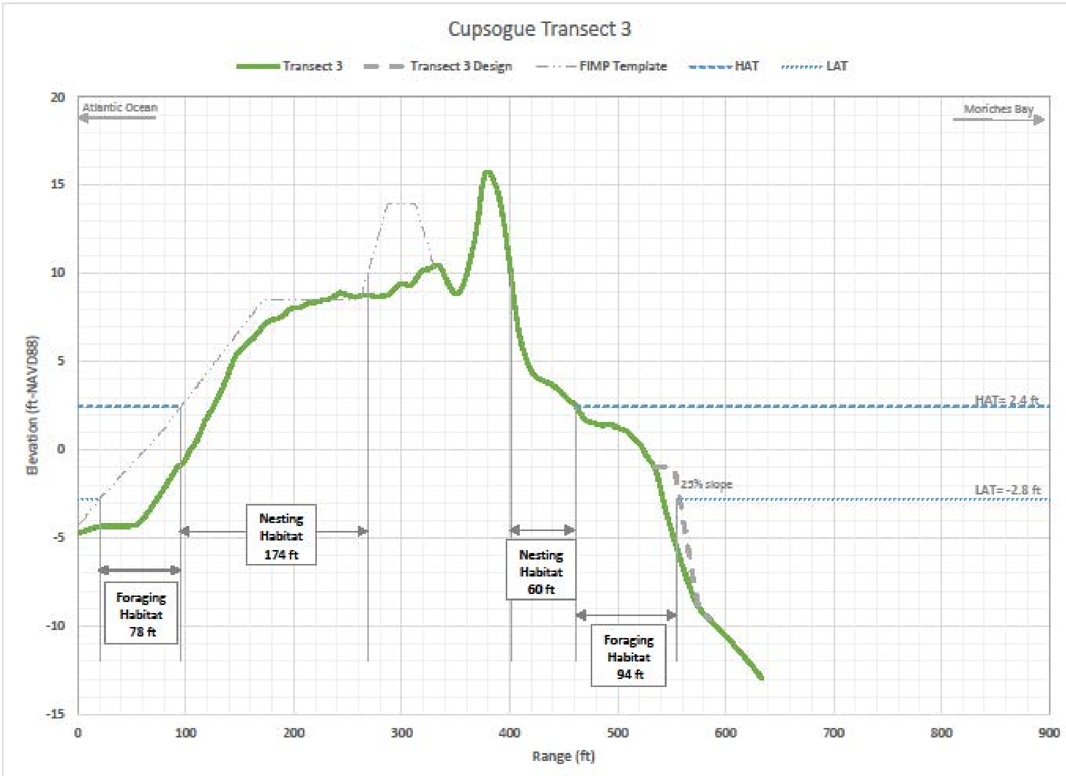
Cupsogue Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
Atlantic Ocean
Moriches Bay
HAT= 2.4 ft
LAT= -2.8 ft
Elevation (ft-NAVD88)
Range (ft)
20
15
10
5
0
-5
-10
-15
0
100
200
300
400
500
600
700
800
900



Cupsogue Transect 1
Transect 1
Transect 1 Design
FIMP Template
HAT
LAT
Atlantic Ocean
Moriches Bay
HAT= 2.4 ft
LAT= -2.8 ft
10% slope
Nesting Habitat 174 ft
Nesting Habitat 236 ft
Foraging Habitat 78 ft
Foraging Habitat 93 ft
Elevation (ft-NAVD88)
Range (ft)



Cupsogue Transect 2
Transect 2
Transect 2 Design
FIMP Template
HAT
LAT
Atlantic Ocean
Moriches Bay
HAT= 2.4 ft
LAT= -2.8 ft
10% slope
Nesting Habitat 174 ft
Nesting Habitat 94 ft
Foraging Habitat 78 ft
Foraging Habitat 243 ft
Elevation (ft-NAVD88)
Range (ft)



Cupsogue Transect 3
Transect 3
Transect 3 Design
FIMP Template
HAT
LAT
Atlantic Ocean
Moriches Bay
HAT= 2.4 ft
LAT= -2.8 ft
25% slope
Nesting Habitat 174 ft
Foraging Habitat 78 ft
Nesting Habitat 60 ft
Foraging Habitat 94 ft
Elevation (ft-NAVD88)
Range (ft)

CPF Site 6 Clam Pond	Clam Pond-Reach GSB-2B
	40.642437° N / 73.191492° W

Clam Pond is located on the western portion of Fire Island between Saltaire and Fair Harbor. Clam Pond lies south of the West and East Fire Islands. The Clam Pond area is shallow with an average depth of approximately 1 ft with a maximum of about 5 ft. Historically a sand spit existed at this location. This CPF design seeks to add fill to provide ESA bird habitat (foraging and nesting) as well as provide CSRM benefits by simulating cross island transport.

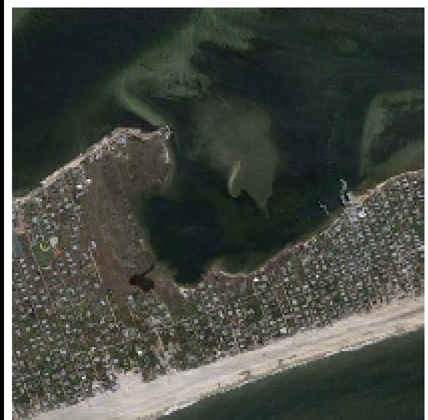
Foraging habitat is defined as the intertidal area that is intermittently submerged and exposed during tidal induced water surface fluctuations. As a proxy for the local spring tide range, the following discussion applies NOAA's reported Lowest Astronomical Tide (LAT) as the lower bound and Highest Astronomical Tide (HAT) as the upper bound for foraging habitat.

Nesting habitat is located immediately upland of foraging habitat and extends from the HAT elevation to +5 ft-NAVD88 at Clam Pond.

To create early successional habitat that provides nesting and foraging for shorebirds, plans call for fill placement and grading over a project area of approximately 15.3 acres (ac). The project area includes 4.4 ac of proposed newly created nesting habitat and 8.3 ac of proposed foraging habitat. The foraging habitat consists of both newly created and existing habitat between the HAT and LAT elevations. The nesting habitat all fall within 289 ft (88 m) of the foraging habitat. On the north side of the project, fill will slope from the +5 ft-NAVD88 contour to the intersection with existing grade. A living shoreline will be placed on the north side of the project site to help retain fill. On the south side, fill will slope at 3% between +5 ft-NAVD** and the HAT elevation, then at 1% to the intersection with existing grade.

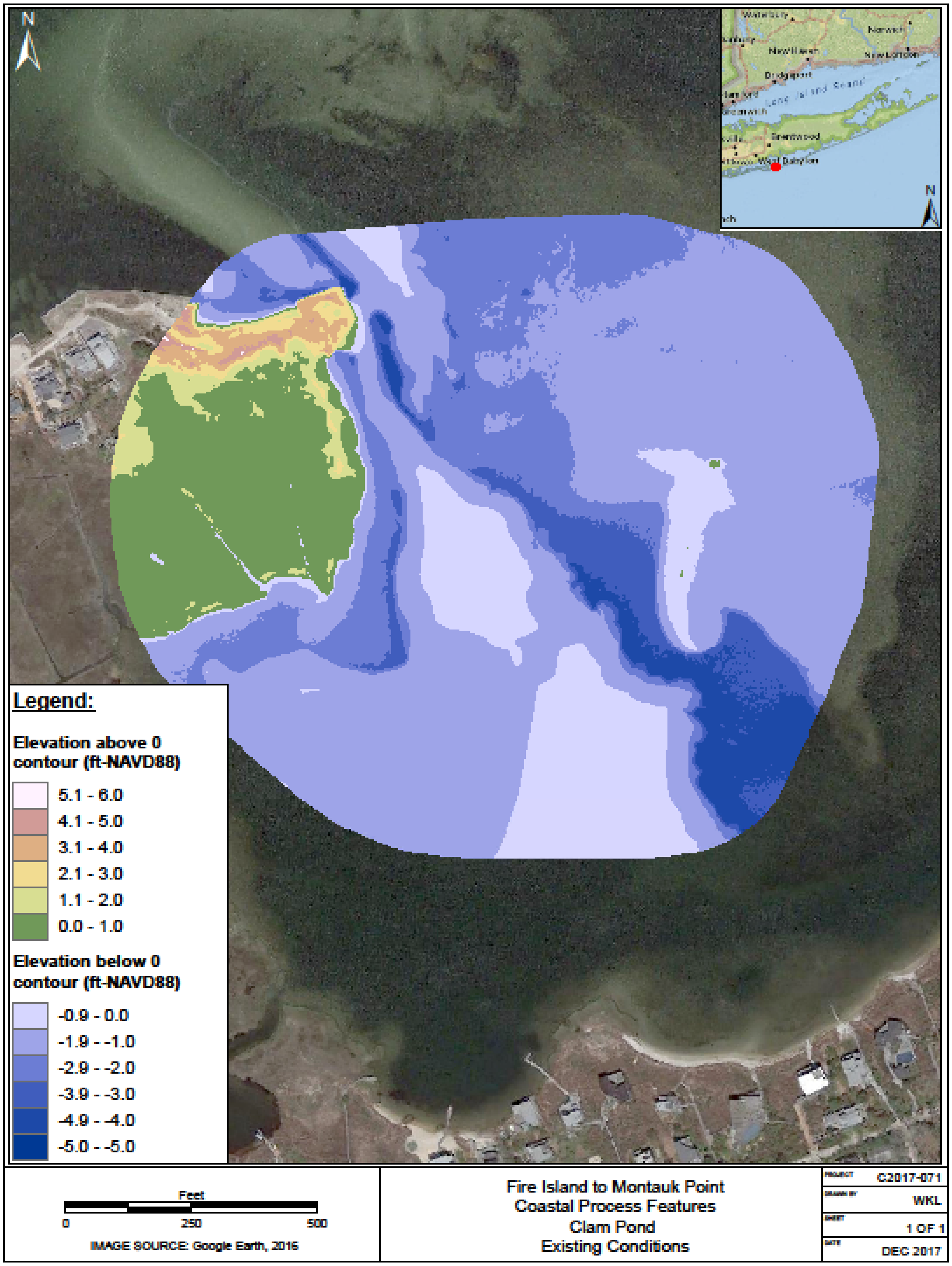
Sand placement at the CPF sites will be performed in coordination with renourishment cycles of the beachfill features and subject to monitoring to ensure resolution of project objectives. The USACE will not implement vegetation management or manipulation of the sites unless conducted as an incidental action associated with future placement. The USACE recommends the local land management agency consider predator management.

CPF PARAMETERS			
Feature	Habitat	Living Shoreline	Total
Cut Volume (cy)	0		0
Fill Volume (cy)	51,312		52,235
Net Volume (cy)	51,212		52,235
Acreage	12.7		15.3
Activity	Regrade		Regrade
DATA SOURCES			
Topographic	USGS, 2016		
Bathymetric	USGS, 2016		
Aerial Imagery	Google Earth, 2016		
Vegetation	N/A*		
REAL ESTATE INFORMATION			
Property Owner			
Municipality	Islip		
County	Suffolk		

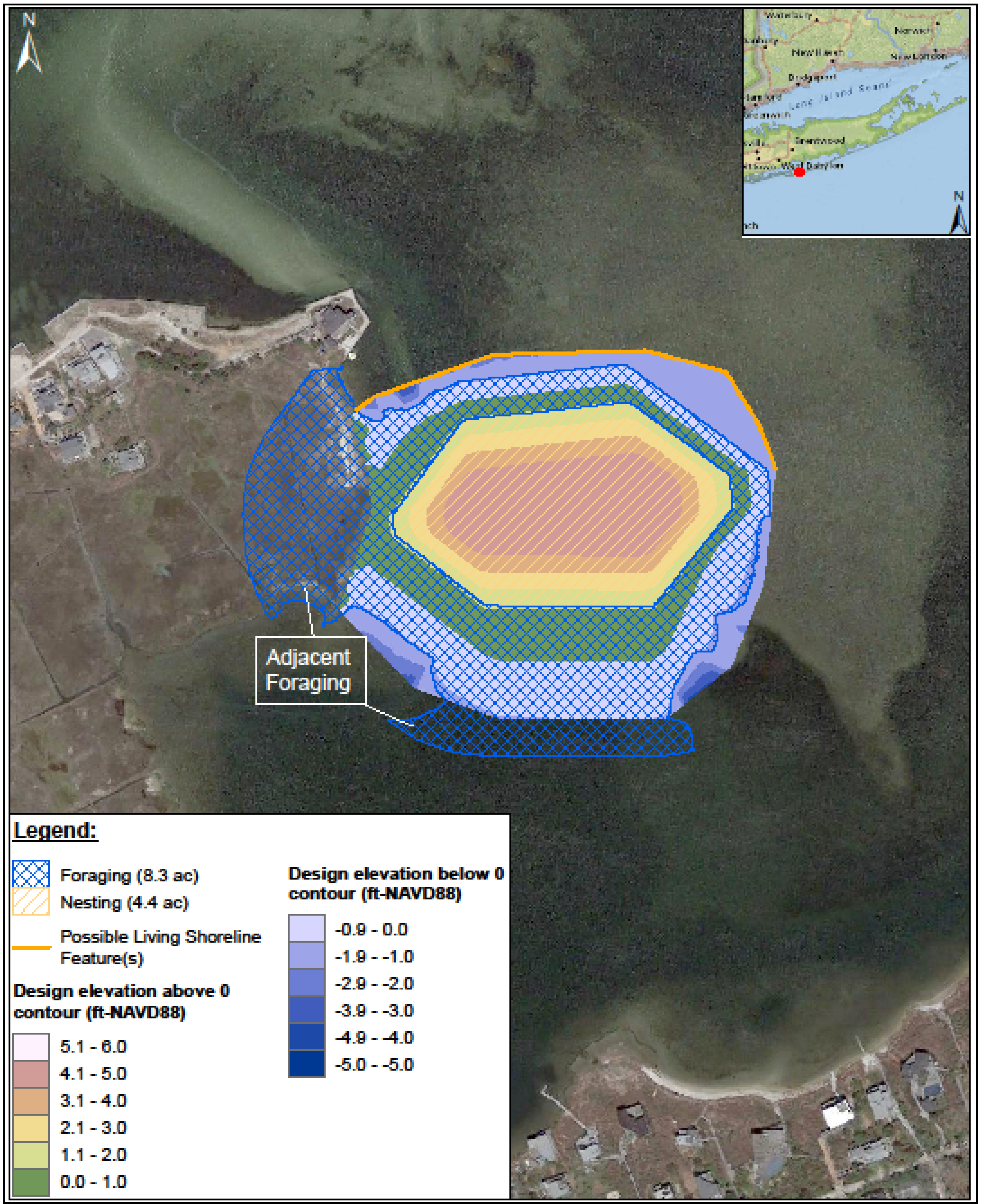


*up to date vegetation data were not available for the study area

CPF Site 6 Clam Pond					
				Clam Pond-Reach GSB-2B	
				40.642437° N / 73.191492° W	
BAYSIDE TIDAL ENVIORNMENT (ft-NAVD88)					
Closest Tidal Benchmark	Sea View Ferry Dock, NY		Highest Astronomical Tide (HAT)	1.08	
			Mean Higher High Water (MHHW)	0.60	
Coordinates	40.642437° N 73.191492° W		Mean High Water (MHW)	0.44	
			Mean Sea Level (MSL)	-0.02	
0 ft-NAVD	1.139 ft-NGVD		Mean Tide Level (MTL)	-0.04	
Range (MHW-MLW)	0.96		Mean Low Water (MLW)	-0.52	
Diurnal Range (MHHW - MLLW)	1.22		Mean Lower Low Water (MLLW)	-0.62	
Largest Tidal Range (HAT-LAT)	2.18		Lowest Astronomical Tide (LAT)	-1.10	
BAYSIDE WAVE ENVIORNMENT					
Return Period	Fetch (ft)	Wave Height (ft)	Wind Setup (ft)	Wave Setup (ft)	HAT + Setup + Wave Height (ft)
1-year	69,860	4.3	0.14	1.01	6.53
5-year	69,860	5.7	0.24	1.03	8.05
10-year	69,860	6.1	0.28	1.04	8.50

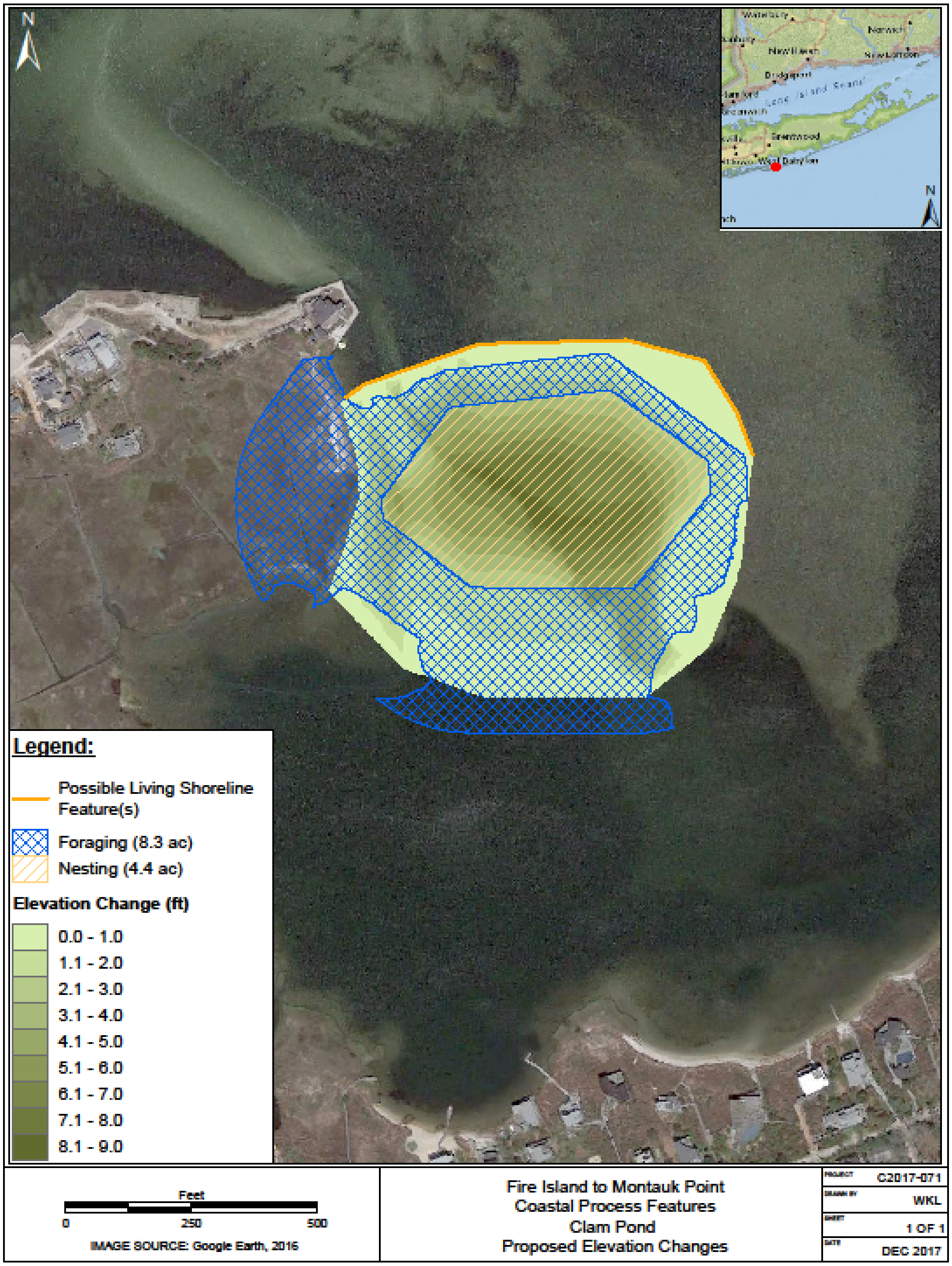

N
Legend:
Elevation above 0 contour (ft-NAVD88)
5.1 - 6.0
4.1 - 5.0
3.1 - 4.0
2.1 - 3.0
1.1 - 2.0
0.0 - 1.0
Elevation below 0 contour (ft-NAVD88)
-0.9 - 0.0
-1.9 - -1.0
-2.9 - -2.0
-3.9 - -3.0
-4.9 - -4.0
-5.0 - -5.0
Feet
0
250
500
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Clam Pond
Existing Conditions
C2017-071
WKL
1 OF 1
DEC 2017

3

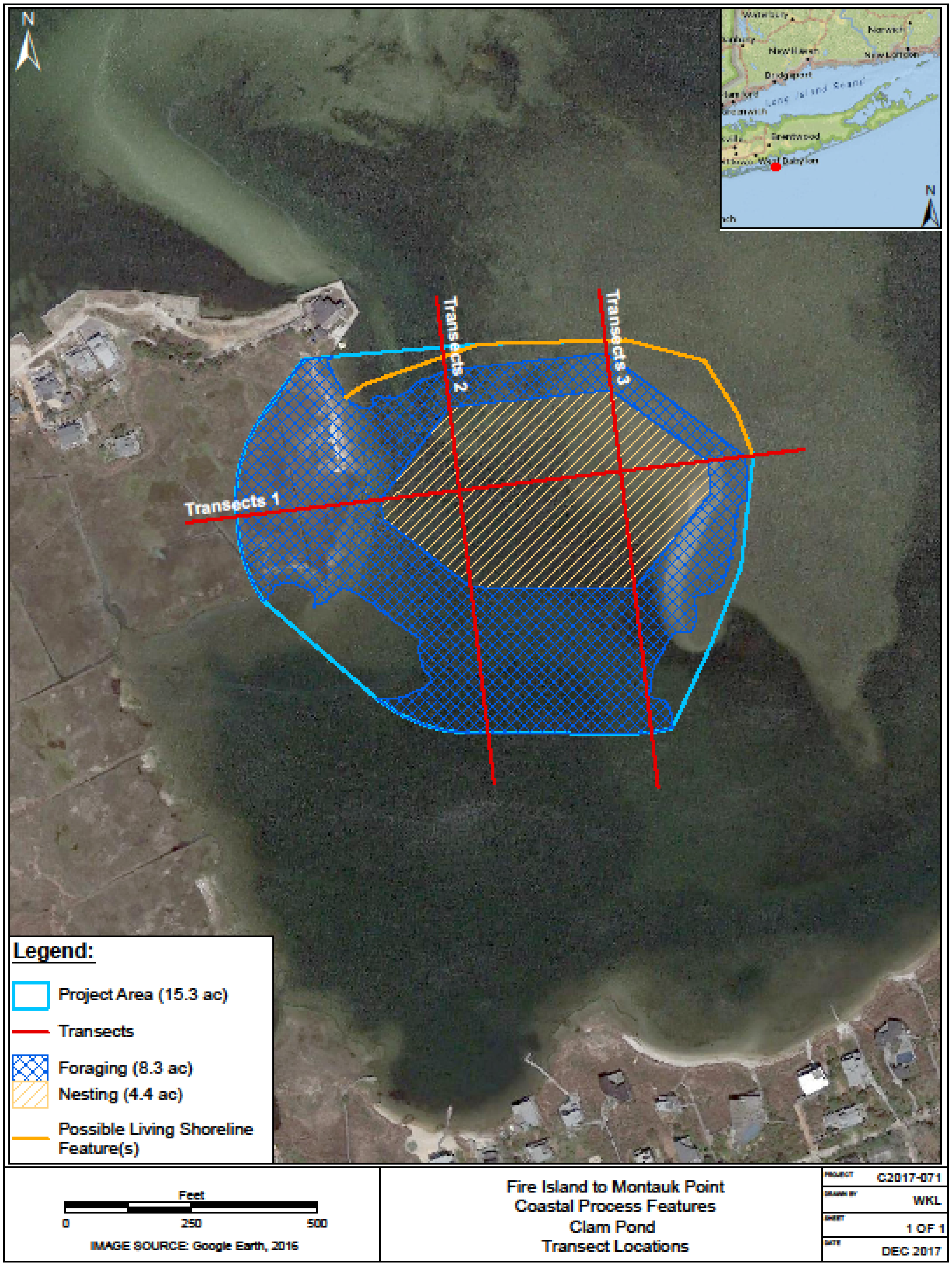


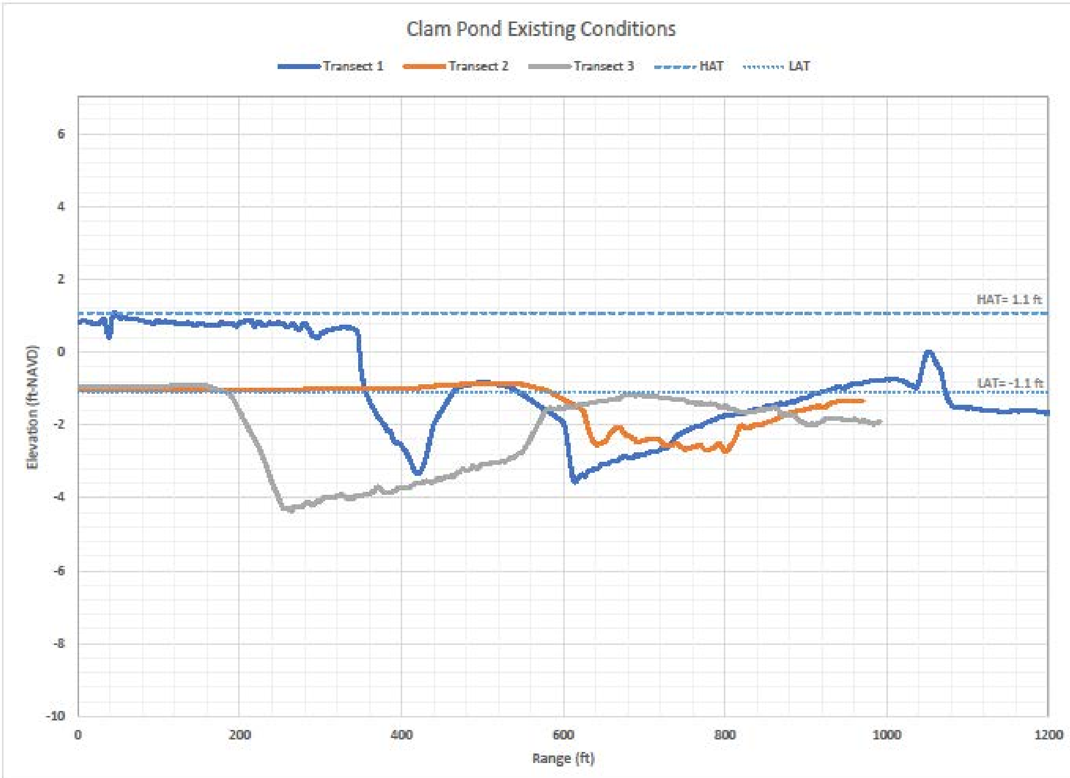
Feet 0 250 500 IMAGE SOURCE: Google Earth, 2016	Fire Island to Montauk Point Coastal Process Features Clam Pond Proposed Elevations	PROJECT C2017-071 DRAWN BY WKL SHEET 1 OF 1 DATE DEC 2017

4


N
Legend:
Possible Living Shoreline Feature(s)
Foraging (8.3 ac)
Nesting (4.4 ac)
Elevation Change (ft)
0.0 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
Feet
0
250
500
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Clam Pond
Proposed Elevation Changes
C2017-071
WKL
1 OF 1
DEC 2017

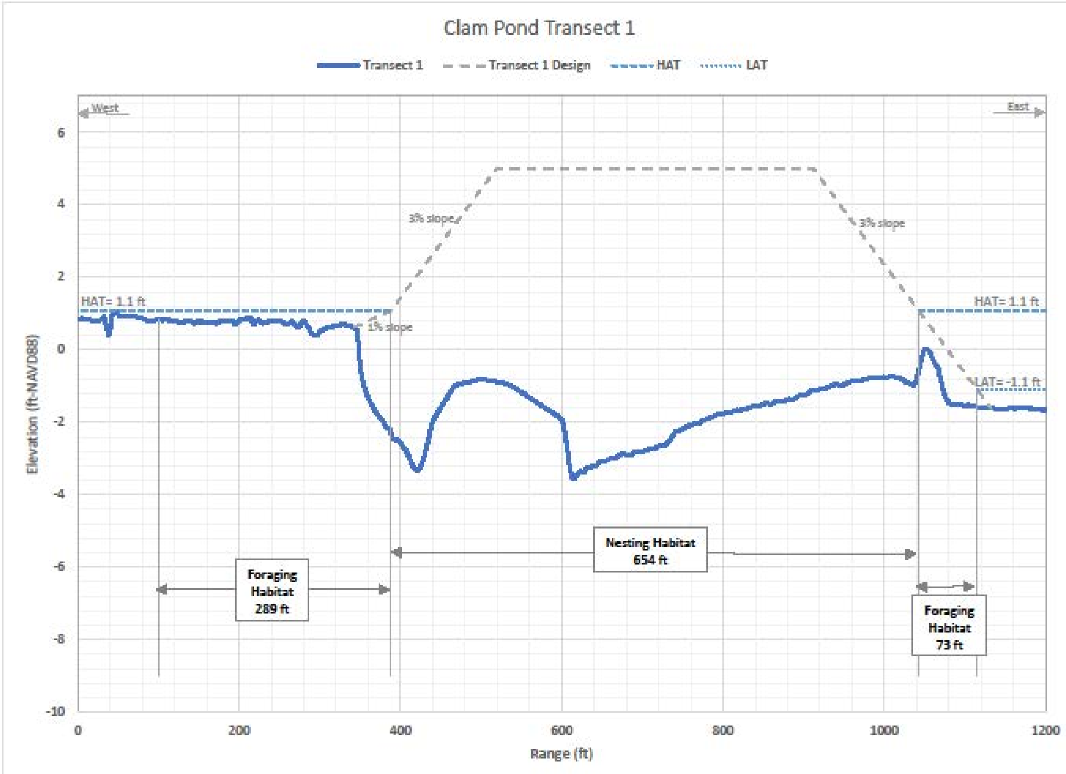
5


N
Transects 1
Transects 2
Transects 3
Waterbury
Norwich
New Haven
New London
Bridgeport
Long Island Sound
Brentwood
West Babylon
Legend:
Project Area (15.3 ac)
Transects
Foraging (8.3 ac)
Nesting (4.4 ac)
Possible Living Shoreline Feature(s)
Feet
0 250 500
IMAGE SOURCE: Google Earth, 2016
Fire Island to Montauk Point
Coastal Process Features
Clam Pond
Transect Locations
PROJECT C2017-071
DRAWN BY WKL
SHEET 1 OF 1
DATE DEC 2017

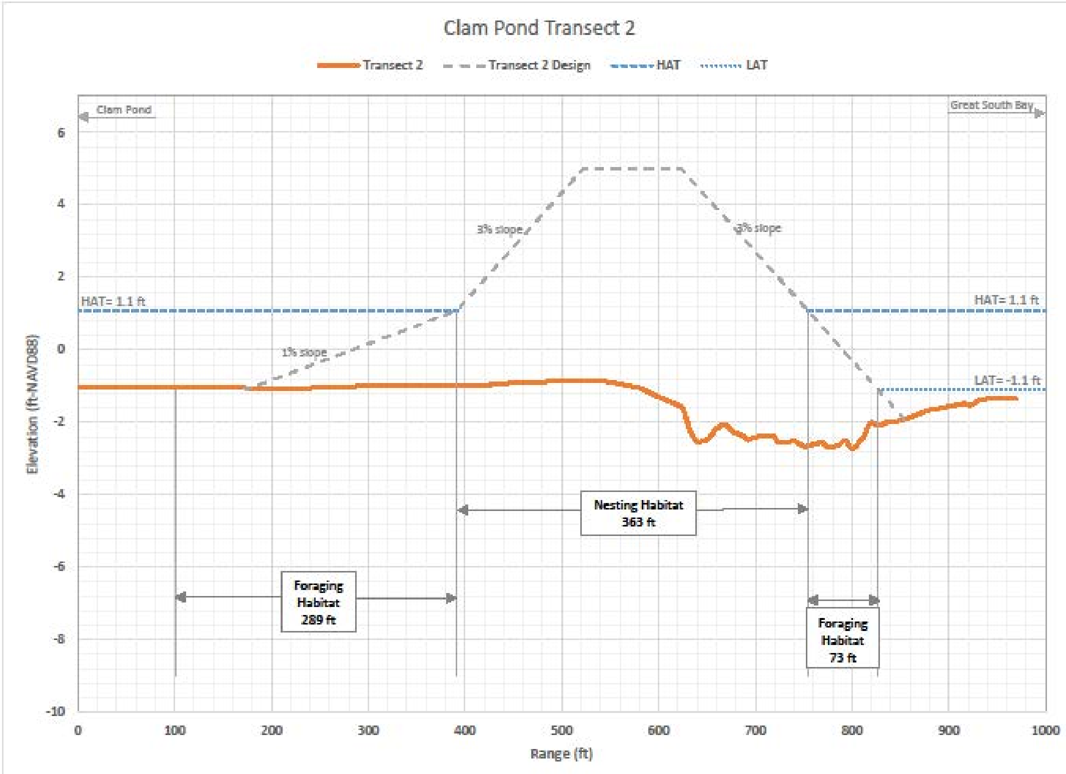


Clam Pond Existing Conditions
Transect 1
Transect 2
Transect 3
HAT
LAT
HAT= 1.1 ft
LAT= -1.1 ft
Elevation (ft-NAVD)
Range (ft)
6
4
2
0
-2
-4
-6
-8
-10
0
200
400
600
800
1000
1200

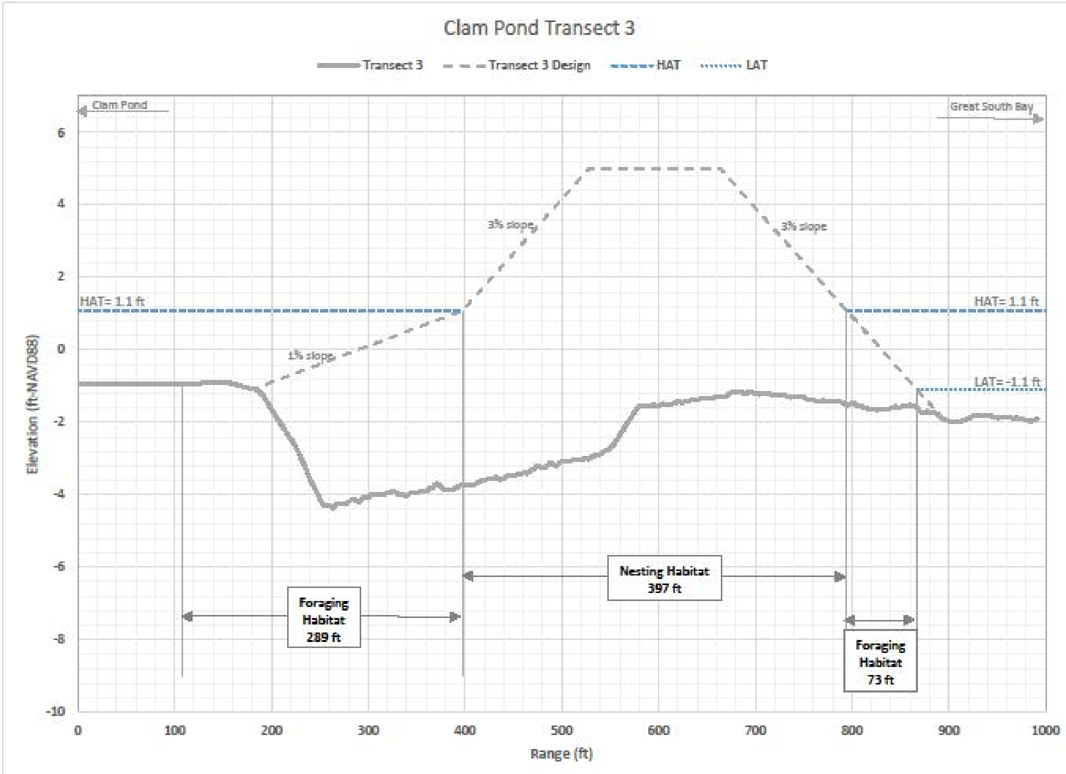
7


Clam Pond Transect 1
Transect 1
Transect 1 Design
HAT
LAT
West
East
HAT= 1.1 ft
HAT= 1.1 ft
LAT= -1.1 ft
3% slope
3% slope
1% slope
Foraging Habitat 289 ft
Nesting Habitat 654 ft
Foraging Habitat 73 ft
Elevation (ft-NAVD88)
Range (ft)

8


Clam Pond Transect 2
Transect 2
Transect 2 Design
HAT
LAT
Clam Pond
Great South Bay
3% slope
3% slope
1% slope
HAT= 1.1 ft
HAT= 1.1 ft
LAT= -1.1 ft
Nesting Habitat 363 ft
Foraging Habitat 289 ft
Foraging Habitat 73 ft
Elevation (ft-NAVD88)
Range (ft)

9



Clam Pond Transect 3
Transect 3
Transect 3 Design
HAT
LAT
Clam Pond
Great South Bay
HAT= 1.1 ft
HAT= 1.1 ft
LAT= -1.1 ft
1% slope
3% slope
3% slope
Foraging Habitat 289 ft
Nesting Habitat 397 ft
Foraging Habitat 73 ft
Elevation (ft-NAVD88)
Range (ft)

10

APPENDIX D. ADAPTIVE MANAGEMENT PLAN

Adaptive management allows for decision making that can be adjusted to address uncertainties as outcomes from management actions and other events become better understood through rigorous monitoring. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process within set parameters. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a 'trial and error' process, but rather emphasizes learning while doing within strict thresholds for success. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. The true measure of adaptive management success is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders (USGS 2009). Adaptive management is also a practical tool for large-scale, long-term projects like FIMP that have many logistical, social, and ecological challenges, and competing factors influencing where and how mitigation occurs.

Methods and Analysis

The Service evaluated the likelihood that the proposed CPFs would support piping plover nesting habitat using design criteria (Table 4 in the PBO) that was based on the best available scientific information, including monitoring conducted for the FIMI project. It is impossible to know exactly how the piping plovers will respond to any CPF, so in addition to the design criteria, the Service is requiring monitoring to ensure that each CPF will be used by breeding piping plover pairs and that successful fledging occurs.

Figure 1 identifies the process of how decisions will be made to inform adaptive management for this Project. The adaptive management approach allows the Project to have standards that must be met to be minimally or fully successful. In addition, each criterion for the Project has a trigger which requires discussion and action, and then a threshold in which to determine if the criteria has failed. As part of initial construction, the Corps will create at least one new CPF with each nourishment cycle while maintaining existing FIMI projects. Piping plover habitat credits (acreage) will be tallied each year to assess how the Project is performing in relation to the goal of no net loss and whether additional sites are needed.

Table 1 provides the criteria that will be monitored as part of the Project, a requirement of the PBO. This table identifies expectations of what is fully or minimally successful, as well as triggers that would require discussion and action to ensure the CPFs perform as designed and the desired biological response is achieved. Finally, this table identifies failure thresholds, which means the Project is not meeting its no net loss goal. Failure to meet these goals means the Corps must either adaptively manage a constructed CFP to meet the performance standard, find additional CPFs, re-initiate formal consultation, or some combination of these three options.

Figure 1. Piping plover no net loss success criteria credits and relationship to adaptive management

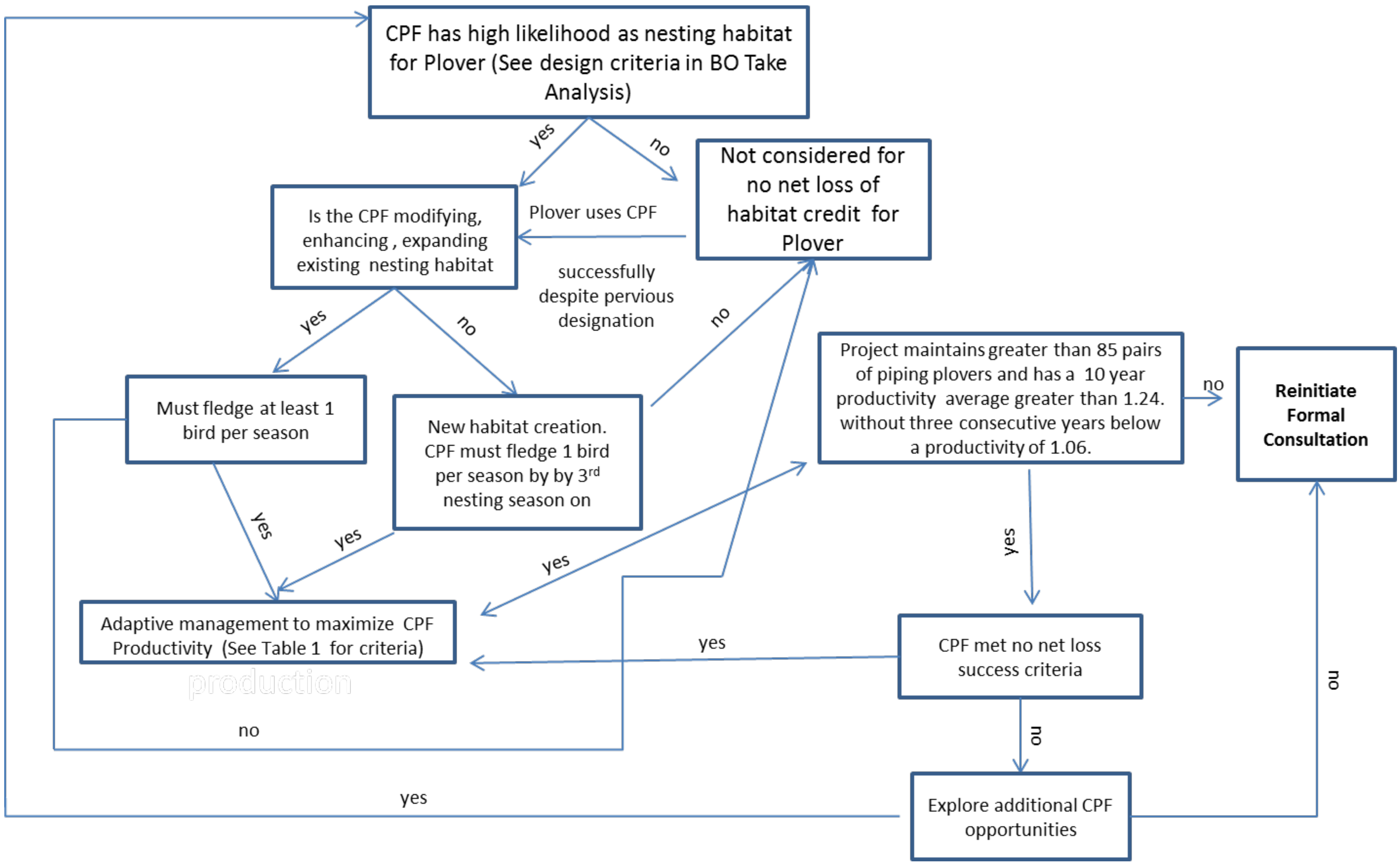


Table 1. CPF Monitoring, Success, Trigger and Thresholds						
Criteria	**Ocean**	**Bay**	**Fully successful**	**Minimally successful**	**Trigger - for adaptive management**	**Threshold for loss of Credit or Consultation Reinitiation**
CPF success			Each CPF has greater than or equal to 1/2 pair per hectare with each nest fledging at least 1 bird each year of the nourishment cycle.	Each CPF fledges at least 1 bird per year	Trigger for each CPF: an individual CPF fledges less than 1 bird per year in nourishment cycle or vegetation exceeds 17% (Also see Table 2 for design criteriafor other potential design failure)	An individual CPF fledges less than 1 bird per year in nourishment cycle or vegetation exceeds 30%; meet design criteria (Table 2)
Timing of CPF's and acreage			CPFs exceed no net loss for each nourishment cycle. Greater than 50% of acreage achieved within the first 15 years. Greater than 100% achieved in 30 years.	At least 1 new CPF created per nourishment cycle, 50% of acreage achieved within the first 15 years,100% achieved in 30 years	Less than 1 CPF created per nourishment cycle. CPFs do not continually meet design criteria (See Table 2)	Find alternative CPF or **re-initiate**
Project area Pairs			Combined project area is above 141 pairs annually.	Combined project area maintains or is above 141 pairs annually	Combined project area achieves between 86 pairs and 140 pairs annually	Project drops below baseline (baseline is average nesting pairs (141 pairs) from (2000-2017) minus allowable take (55 pairs)) = **85 pairs** for the project site. **Re-initiation necessary.**
Productivity			Project area maintains a productivity of greater than 1.5 fledglings per nest for at least 5 consecutive years.	Project area maintains productivity greater than 1.24 over 10 years and productivity does not fall below 1.06 for three consecutive years	Productivity falls below 1.06 in 3 consecutive years. And cause is either unknown or can be attributed to project activities.	Productivity falls below 1.06 for four consecutive years in the project area. And cause is either unknown or can be attributed to project activities. **Re-initiation necessary**. Productivity falls below 1.24 over 10 years. And cause is either unknown or can be attributed to project activities. **Reinitiation necessary.**
	Re-initiation trigger					
	CPF no credit					

Conclusion

The Communication Plan (Appendix E), Conservation Measures, Reasonable and Prudent Measures, and Terms and Conditions require that the Corps have two meetings a year (before and after the breeding season) with all relevant stakeholders throughout the life of the project. These meetings are intended as part of the implementation of adaptive management. At a minimum, these meetings should include discussions on the results of piping plover and seabeach amaranth monitoring, symbolic fencing plans, issues associated with the implementation of Conservation Measures, how CPFs performed, and whether any success criteria triggers or thresholds have been exceeded or are on track to be exceeded.

APPENDIX E: COMMUNICATION PLAN FOR IMPLEMNTATION OF CONSERVATION MEASURES AND ADAPTIVE MANAGEMENT

1. Timing of actions associated with the Conservation Measures, Reasonable and Prudent Measures, and Terms and Conditions are provided in table 1 below.
2. Project points of contact (POC) from the Corps and the Service should be specified. These individuals will be the POCs for all communication associated with the Project. A representative from the local sponsor (including all local cost-sharing partners and each landowner or land manager) should also be identified. Agency and landowner representatives should be updated annually.
3. A Project meeting will be held twice a year to discuss:
    a. any issues associated with implementation of conservation measures;
    b. how CPFs related to early successional, piping plover habitat are functioning;
    c. any adaptive management actions recommended for the upcoming year;
    d. any piping plover management plans that are required (e.g., predator management, symbolic fencing).
    e. This meeting should occur at least 60 days prior to the piping plover breeding season (April 1) and should be attended at a minimum by the POCs identified above. A second meeting will be held within 60 days after the end of the breeding season (September 1) to discuss lessons learned.
4. The Service contact shall be notified via e-mail at least two weeks before work is starting and ending, location and types of anticipated activity. The Service should be contacted via a formal letter if demobilization needs to continue into the breeding season (April), and advance notice given to allow for a qualified monitor(s) to be hired by the Corps (if demobilization is taking place after April 1) or its designated construction representative and approved by the Corps (see qualified monitor requirements-Appendix E.1) and shared with the Service.
5. If for any reason demobilization is scheduled to continue into the early breeding season outside of the communities,[4] a pre-construction meeting should be held and include the Corps construction staff member and project biologist, a representative from the Service, the qualified plover/amaranth monitor, and the construction crew to provide all information on conservation measures that must be implemented. A checklist and training materials will be provided by the Service to ensure that all conservation measures are followed.
6. The Corps will work with the Service annually to identify where symbolic fencing will be placed in the Project area (on GIS maps). This should be done well in advance of the

[4]The FIMI BO (USFWS 2014, p. 20) states, "The Corps has proposed that construction activities would not occur during the piping plover breeding season April 1 to September 1, except within the boundaries of the FIIS communities."

breeding season when possible, ideally at the pre-season Project meeting. If the landowner develops the plan, they should submit it to the Corps who will then share it with the Service within two weeks.

7. Any issues that come up regarding implementation of conservation measures or adaptive management should be communicated between the agencies and landowner representative immediately (via e-mail or phone and then followed up with a formal letter). Representatives from each agency and landowner will be identified for this purpose).
8. A standardized data sheet will be obtained from the state for population surveys (see Population survey data should be given to the Corps representative no later than two months after surveys have ended. Information should be populated by the biologist in Microsoft Excel and sent to the Corps electronically.

Actions	Timing	Who is Responsible
Initiate informal consultation on Tier 1 actions with the Service 3 months before each nourishment to discuss any changed conditions, the development of individual project plans and specifications, piping plover nesting areas of concern within and adjacent to the Planned Program activity.	Each beach fill and dune nourishment cycle; each dredging cycle	Corps
Notify the Service 2 weeks before the start and end of each nourishment cycle	Each beach fill and dune nourishment cycle; each dredging cycle	Corps
Via letter, the Corps will initiate Tier 2 consultation as soon as practicable unless the action meets the criteria for emergency consultation.		Corps
The Service will review the information required for the Tier 2 Consultation (See CM 1b), coordinate with the Corps and the landowners as necessary, and issue a Tier 2 formal consultation letter within 30 days of receiving complete project information from the Corps.	30 days after receiving complete project information, issue Tier 2 formal consultation letter	FWS
If de-mobilization occurs during the nesting season, the Service must be contacted via a formal letter at least two weeks before a construction field meeting would take place. Qualified monitor needs to be hired and qualifications reviewed by the Service. Construction field meeting and training must occur before de-mobilization activities can continue up until May 1 over 3 times over the life of the Project.		Corps

Adaptive Management Meeting	At least 60 days before breeding season and 60 days after breeding season	Corps (lead), Service, and landowners
Develop a formal monitoring plan for piping plover and for monitoring of CPFs intended to offset plover	One year before first nourishment cycle	Corps
Estimates of costs/timing of actions needed for adaptive management based on results of Virginia Tech monitoring data from FIMI and White-paper developed by the Service	One year before first nourishment cycle	Corps
Funding of monitoring/management	Each dredging or nourishment cycle with a mechanism for addressing management costs/needs in out years	Corps
ORV management	Annually (can be addressed at adaptive management meetings)	Landowner, Corps, Service
The Corps will develop a symbolic fencing plan for all project areas to be reviewed and discussed with the Service and applicable landowners, these written plans will be revisited annually at the post-breeding adaptive management meeting.	One year before first nourishment cycle, and annually	Corps, Service, landowners

Table 1. Timing of Actions associated with implementation of Conservation Measures, Reasonable and Prudent Measures and Terms and Conditions.

Appendix E1. Piping plover:

A Qualified Lead Monitor is a person who has the skills, knowledge, and ability regarding piping plover biology and behavior, monitoring procedures, and data collection. Skills of a qualified monitor include, but are not limited to: identifying potential nesting habitat, detecting and recording locations of territorial and courting adults, interpreting plover behaviors, identifying distinct nesting pairs or territories, confirming incubation through hatch data, locating broods, confirming fledging of chicks, and documenting observations in legible, complete field notes.

Aptitude for monitoring includes ability to observe shorebirds, experience observing birds or other wildlife for sustained periods, patience, and familiarity with avian biology.

Qualified monitors shall have the following minimum qualifications:

- Have working knowledge of State and Federal Guidelines for the protection of piping plovers and other listed shorebird species on multi-use recreational beaches.
    - Identify piping plovers, piping plover tracks, and nests
    - Observe territorial behavior and identify territories
    - Able to estimate age of piping plover chicks after hatching
    - Identify mammal tracks and other predator sign by sight
    - Use a GPS to collect geospatial data (UTM or decimal degrees in NAD83)
- Good observational skills; ability to follow survey protocols outlined in Site Safety Protocol
- Ability to perform physical labor associated with the placing of posts, signage, symbolic fencing, and protective enclosures in habitat areas.
- Ability to work independently with little direct supervisory oversight.
- Strong people skills, team oriented, and ability to work in a collaborative, problem solving environment.

A resume should be provided and checked by the Corps and provided to the Service before the monitor is hired.

Seabeach amaranth:

A qualified monitor is a person who has the skills, knowledge, and ability to accurately observe seabeach amaranth. The monitor should be familiar with native and non-native vegetation that occurs on Atlantic Coast barrier islands. A resume should be provided and checked before the monitor is hired.

Project Level Contact-To be documented/updated each year through adaptive management meetings

Corps of Engineers, NYD

U.S. Fish and Wildlife Service

National Park Service

Smith Point County Park

Robert Moses State Park

Appendix F: FIRE ISLAND TO MONTAUK POINT (FIMP) EVALUATION OF CROSS-ISLAND SEDIMENT

Executive Summary

The severity of coastal storm impacts in the areas surrounding Great South, Moriches and Shinnecock Bays is strongly dependent on the integrity of the barrier islands from Fire Island Inlet to Southampton. Overwashing and particularly breaching of the barrier islands can lead to greater storm damages as bay storm tide elevations are increased. Reduction of overwashing/breaching frequency and severity are, consequently, required to meet one of the stated objectives of the FIMP Reformulation Study: reduce tidal flooding on the mainland and barrier islands and attendant loss of life, property and economic activity.

On the other hand, barrier island overwashing and breaching also contribute to cross-island sediment transport and natural habitat changes. One of the other objectives of the Study is to reestablish coastal processes and utilize coastal process measures to reduce storm damages and provide resiliency to the system. This paper presents estimates of the expected impact that currently proposed FIMP project features will have on cross-island sediment transport due to overwashing/breaching and identifies targets for reestablishing this transport. These targets will be used to inform the development of coastal process features (CPFs) which will aim to replicate the cross-island transport of sediment, provide barrier island resiliency, and long-term sustainability.

As part of the FIMP Reformulation Study, several models were developed to investigate a full range of relevant physical processes (Corps, 2016). These models ranged from relatively simple analytical tools based on empirical data used to estimate breach growth to state-of-the-art process-based numerical models used to simulate storm surge, waves, beach profile erosion, overwashing, and barrier island breaching. Results from this suite of models were then used as input to an economics lifecycle model to evaluate the benefits associated with various plans. Output from these models, including number of breaches over the Project's 50-year life, expected breach area growth. Overwash areas for a range of extreme storm events were used to estimate differences in Future Without-Project conditions vs. Future With-Project conditions (FWOPC and FWPC) cross-island sediment transport with a focus on new, above mean sea level (MSL), habitat in the bays.

Different approaches were used to investigate the potential impacts of the Project on breaching vs. overwash. Lifecycle estimates of the number of breaches were combined with empirically-based breach growth projections to examine the Project impacts on breaching-induced cross-island sediment transport. This event-based analysis suggested a reduction in sediment transport into the bays due to breaching of approximately 4.3 MCY and 80 acres of habitat above MSL based on the expected difference in the number of breaches over the 50-year Project life (equivalent to 1.6 acres/year).

The target for overwash transport was estimated using overwash area vs. frequency relationships to calculate the expected annual amount of overwash reduction due to the project. The analysis suggest that the project is expected to result in a reduction of approximately 6.7 acres/yr of total (i.e., overland plus in-bay) overwash and 2.5 acres/yr of in-bay overwash above MSL (i.e., new land) in years 0 to 30. In years 31 to 50 there would be a reduction of 4.4 acres/yr of total overwash and 1.1 acres/yr of in-bay overwash above MSL (i.e., new land) in the project area.

Both the breaching and overwash difference estimates were subsequently adjusted to account for the fact that bare-sand early successional habitat will naturally vegetate over time and eventually become fully vegetated. Therefore, the annual differences presented above will not persist over time and accumulate over 50 years. Assuming vegetation rate of 10 percent per year, the expected average difference in total (i.e., overland plus in-bay) bare-sand habitat above MSL over the 50-year Project life of 38 acres; 30 acres due to overwash and 8 acres due to breaching. The in-bay (i.e., new land) habitat difference is estimated at 19 acres; 11 due to overwash and 8 due to breaching. Note that breaching only contributes to in-bay habitat differences.

It is important to recognize that there is significant uncertainty associated with the estimation of breaching, overwashing, and associated cross-island sediment transport. For example, uncertainty in the number of breaches over the 50-year Project life results in breaching-related sediment transport differences over 50 years between 2.4 MCY / 45 acres and 5.2 MCY / 97 acres (25 and 75 percentiles). Uncertainties concerning other aspects of this analysis like breach growth, distribution of below vs. above MSL habitat, overwashing locations and quantities, and revegetation are also significant contributors to the overall uncertainty in the projection of cross-shore island sediment transport and are very difficult to quantify given the relative scarcity of historical data. Therefore, the cross-island sediment transport targets recommended in this paper should be further refined in the future through the process of monitoring and adaptive management.

Introduction and Background

The FIMP Project includes reestablishment of coastal processes as a necessary element of coastal storm risk management. The existing FIMP Draft General Reevaluation Report (GRR) (USACE, 2016) identifies five key coastal processes for reestablishment. Two of the processes that focus on the movement of sediment are the alongshore coastal transport, and cross-island sediment transport. The Draft GRR includes project features to address both of these coastal processes, and acknowledges the need to continue to develop project features to address cross-island sediment transport. The Draft GRR uses the sediment budget as the basis for identifying the objectives for reestablishing alongshore sediment transport. The Draft GRR does not specifically identify a target for reestablishing cross-island sediment transport, and the Corps has agreed to identify objectives for reestablishing this cross-island transport. This paper has been prepared to identify this target for reestablishing cross-island sediment transport.

In defining cross-island transport, this is intended to quantify the amount of sediment transport into the bay, and the amount of supratidal habitat that is formed in areas that are now subtidal habitats (i.e. "new habitat" that is formed in the bay). The process of breaching, including the time a breach remains open, and overwash contribute to cross-island sediment transport. A review of the effect of historic storms in the project area indicates that most of cross-island transport into the bays that creates "new habitat" is dominated by the breaching process, including the transport of sediment that occurs while a breach remains open. Overwash during storm events rarely is of the scale to transport sand into the bay and primarily results in increasing the height of the barrier island (USACE, 1999).

As described below, the estimate of cross-island sediment transport is based upon a projection of what is expected to happen in the future. Cross-island transport is driven by episodic storm events that are also relatively infrequent. This estimate of cross-island transport is different than the estimate of alongshore transport, which tends to be driven by normal wave climate, and can be more readily observed based upon the long-term evolution of project features. As a result, there is an inherent uncertainty in projecting cross-island sediment transport, which needs to be recognized.

Cross-island Transport due to Breaching

The FIMP Reformulation Study has undertaken engineering models to predict the scenarios under which breaches would form, and lifecycle modeling to identify the expected number of breaches that would occur over the Project life, both with and without the Project in place. Additional work has been done to assess the amount of sediment transport that is expected into the bay and the expected amount of habitat above MSL that is likely to form as a result of a breach. The engineering modeling and economic lifecycle modeling has been updated to account for current conditions following Hurricane Sandy. The estimates of sediment transport into the bay during a breach have been updated based upon observations from the Wilderness Area breach.

Expected Number of Breaches

The lifecycle simulation model that was developed as part of the FIMP reformulation effort was used to estimate the expected number of breaches that are likely to occur in the Future Without Project Condition (FWOPC), and in the Future With Project Condition (FWPC), over 50 years assuming the historic rate of relative sea level change (see Table 1). For reference, the range of uncertainty in these estimates (25th and 75th percentile) is also shown for the FWOPC and FWPC scenarios.

Table 2. Estimated Number of Breaches over 50-year Project Life

Breach Area	Potential Breach Locations	WOPFC (mean)	25th percentile	75th percentile	WPFC (mean)	25th percentile	75th percentile
1	Fire Island Lighthouse	1.7	1.0	2.0	1.1	0.0	2.0
2	Kismet to Corneille						
3	Talisman to Blue Pt.	2.1	0.0	3.0	1.7	0.0	3.0
4	Davis Park						
5	Old Inlet West	N/A	N/A	N/A	N/A	N/A	N/A
6	Old Inlet East						
7	Smith Point County	1.6	1.0	2.0	0.5	0.0	1.0
8	Sedge Island	1.1	0.0	2.0	0.4	0.0	1.0
9	Tiana Beach						
10	West of Shinnecock	1.7	0.0	3.0	1.3	0.0	2.0
	Total	8.2	2.0	12.0	5.0	0.0	9.0

Breach Growth Estimates

When a breach remains open, sediment is transported into the bay over time. The CorpsE examined historic breach data to determine long-term growth characteristics and sediment transport processes for the Breach Contingency Plan (BCP) Report (USACE, 1995). Breach growth characteristics for the BCP Report were based on three breaches that occurred during and after 1938 and remained open for several months or more: Shinnecock Inlet Breach (September 1938), Cupsogue Breach (January 1980), and Pikes Beach Breach (1992). The BCP presented a method for estimating breach along-shore cross-sectional area versus time according to the following exponential breach growth equation:

$$A(t) = A_0\left(1 - e^{-kt}\right)$$

Where t is the time in months from breach initiation, A0 is the maximum breach cross sectional area, and k is the breach growth coefficient which varies from 0.15 to 0.30 month, with an average of 0.2 to 0.3 month, depending on location (Table 2). These parameters vary depending on the bay where the breach occurs and were obtained as part of the breach inlet stability analysis (USACE-NAN, 1995). Specifically, the maximum breach cross sectional area is based on long-term stable values corresponding to existing tidal inlet areas, except at Fire Island Inlet.

As such, breach growth would be attended by a reduction of tidal inlet area, although the trade-off between inlet and breaches areas may not be absolute.

Within Great South Bay, breach growth estimates made prior to Hurricane Sandy were based upon an assumption of the breach growth rates used at that time. The estimates of the amount of deposition have been updated to account for the uncertainty in the breach growth rates, and the potential for smaller breaches as observed in the Wilderness Area. Specifically, additional breach growth estimates were developed at all Great South Bay breach locations for a smaller breach with a maximum breach cross sectional area, A0, of 6,500 square feet. Estimated A0 and range of k values are summarized for Great South Bay, Moriches Bay, and Shinnecock Bay in Table 2.

Table 3. Breach Growth parameters

Project Reach	A0 (sq. ft.)	k (month)-1
GSB - Small	6,500	0.15-0.3 (0.2 average)
GSB - Large	36,200	0.15-0.3 (0.2 average)
MB	16,000	0.15-0.4 (0.3 average)
SB	17,750	0.15-0.4 (0.3 average)

Estimated potential breach cross-sectional areas are shown in Table 3, assuming probable breach closure scenarios based on the experience at Westhampton Beach and recommendations of the BCP (i.e., 1 to 12 months). For Great South Bay breaches the numbers presented in Table 3 represent the average of the breach parameters presented in Table 2 and therefore reflect lower growth rates observed at the breach in the Wilderness Area.

Table 4. Estimated Long-term Potential Breach Cross-sectional Areas

Project Reach	Breach Areas (sq. feet)				
	1 Month	3 Months	6 Months	9 Months	12 Months
GSB (Average)	3,870	9,630	14,920	17,820	19,410
MB	4,150	9,490	13,360	14,920	15,560
SB	4,600	10,530	14,820	16,560	17,270

Breach Sediment Transport Estimates

Long-term bay deposition following breach formation reflects the initial breaching event and then expansion of the breaches following the empirical growth formula presented above. Cross-sectional areas shown in Table 3 were multiplied by barrier island widths to calculate the volume of barrier island sediment (below NGVD) removed due to the breach. Unit barrier island volumes above NGVD were then multiplied by breach widths, which were calculated based on breach cross-sectional areas and depth. Total bay deposition values shown in Table 4 represent the combined sediment volumes above and below NGVD, including transport during breach formation.

Table 5. Estimated Bay Deposition Volumes During Breach Growth

Design Subreach		**Bay Deposition Volumes (x1,000 CY)**				
ID	Name	1 Month	3 Months	6 Months	9 Months	**12 Months**
GSB-1B	FI Lighthouse Tract	320	800	1,240	1,480	**1,610**
GSB-2B	Kismet to Corneille States	260	650	1,000	1,190	**1,300**
GSB-3D	Talisman to Wat r Island	160	410	630	750	**820**
GSB-3G	Davis Park	300	740	1,150	1,370	**1,490**
MB-1B	Smith Point CP - East	250	570	810	900	**940**
SB-1B	Sedge Island	350	810	1,140	1,270	**1,330**
SB-1C	Tiana Beach	180	410	570	640	**670**
SB-2B	**WOSI**	**160**	**370**	**520**	**580**	**600**

Breach Deposition Area Estimates

In-bay deposition areas (above and below MSL) associated with sediment transport volumes presented in Table 4 above were estimated based on morphological changes computed by Delft3D for Baseline Conditions (USACE-NAN, 2006a and 2006b). Specifically, these estimates suggest that during initial breach formation (i.e., during the storm), the average thickness of the in-bay sediment layer deposited by overwash and breaching processes is on the order of 5 feet. Deposition area estimates based on this assumption are presented in Table 5.

Table 6. Estimated Total Bay Deposition Areas During Breach Growth

Design Subreach		**Bay Deposition Area (acres)**				
ID	Name	1 Month	3 Months	6 Months	9 Months	**12 Months**
GSB-1B	FI Lighthouse Tract	40	99	154	183	**200**
GSB-2B	Kismet to Corneille States	32	81	124	148	**161**
GSB-3D	Talisman to Water Island	20	51	78	93	**102**
GSB-3G	Davis Park	37	92	143	170	**185**
MB-1B	Smith Point CP - East	31	71	100	112	**117**
SB-1B	Sedge Island	43	100	141	157	**165**
SB-1C	Tiana Beach	22	51	71	79	**83**
SB-2B	**WOSI**	**20**	**46**	**64**	**72**	**74**

Above and below MSL areas were also estimated based on Delft3D morphological model results and the subsequent analysis performed by USACE-NAN (2006a and 2006b). Specifically, model results suggest that the area above MSL varies between 15 and 40 percent of the total deposition area. However, recent experience and observations from the Wilderness Area breach suggest that most of sediment transport does not result in the elevation of habitat above MSL. Therefore, the estimates presented in Table 6 below reflect the assumption that the area above MSL is 15 percent of the total area for all breaches.

Table 7. Estimated Bay Deposition Areas Above MSL During Breach Growth

Design Subreach		**Bay Deposition Area above MSL (acres)**				
ID	Name	1 Month	3 Months	6 Months	9 Months	**12 Months**
GSB-1B	FI Lighthouse Tract	6	15	23	28	**30**
GSB-2B	Kismet to Corneille States	5	12	19	22	**24**
GSB-3D	Talisman to Water Island	3	8	12	14	**15**
GSB-3G	Davis Park	6	14	21	25	**28**
MB-1B	Smith Point CP - East	5	11	15	17	**17**
SB-1B	Sedge Island	7	15	21	24	**25**
SB-1C	Tiana Beach	3	8	11	12	**12**
SB-2B	**WOSI**	**3**	**7**	**10**	**11**	**11**

Lifecycle Estimates of Breach Sediment Transport

The above information, including breach sediment transport estimates and lifecycle breaching events, were used to estimate the amount of sediment that would be transported into the bay without-project condition, where breaches would be open for a period of 1 year. The with-project analysis considered the change in breach frequency at a given location, based upon the recommended plan of improvement (USACE, 2016), and the estimated amount of time any breach would remain open, based upon the proposed breach response in each location. In each scenario, the estimated mean number of breaches over the 50-year Project life (Table 1) and the estimated amount of sediment transport per breach (Table 4 and Table 6) were multiplied together to determine the total amount of cross-island sediment transport in terms of volume and area above MSL. Table 7 shows a summary of the results.

Table 8. Lifecycle Estimates of Cross-island Sediment Transport Due to Breaching

Breach Area	**Potential Breach Locations**	**WOPFC**		**WPFC**		**Difference**	
		Volume (CY)	Area above MSL (acres)	Volume (CY)	Area above MSL (acres)	Volume (CY)	**Area Above MSL (acres)**
1	FI Lighthouse Tract & Kismet to Corneille	2,470,000	46	800,000	15	1,670,000	**31**
2							
3	Talisman to Blue Pt. Beach & Davis Park (2)	2,430,000	45	980,000	18	1,450,000	**27**
4							
7	SPCP (1)	1,504,000	28	285,000	5	1,219,000	**23**
8	Sedge Island & Tiana Beach (1)	1,100,000	20	244,000	5	856,000	**16**
9							
10	WOSI (1)	1,020,000	19	481,000	9	539,000	**10**
Total		8,524,000	158	2,790,000	52	5,734,000	**107**
Talisman to Blue Point Beach & Davis Park Sand Placement						-1,450,000	**-27**
Overall Target (50-Year Project Life)						4,284,000	**80**
Decadal Target (Over Five Decades)						856,800	**16**

(1) Assumes 12-month closure in WOPFC and rapid (3-month) breach closure in WPFC
(2) Assumes 12-month closure in WOPFC and conditional breach response with 6-month

Table 7 shows that the expected change between the with and without project condition in the number of breaches, and expected change in the duration of a breach remaining open, results in a difference of approximately 5.7 MCY of sand into the bay, and a difference of approximately 107 acres of habitat above MSL. Since no action is being taken at Talisman to reduce the likelihood of breaching, it is assumed that the difference in the amount of sediment transport into the bay (approximately 1.5 MCY and 27 acres of habitat above MSL) could be offset, through a combination of 1) sand transported into the bay, while the breach is open, and 2) placement of sand in the bay as a plan feature in the closure process. This assumption has not been applied in other breach locations, because the plan in all other locations includes project features that reduce the potential for breaching.

With the assumption that locations of conditional breach response would be sediment neutral, the expected difference for sediment transport into the bay due to breaching is 4.3 MCY of sand, and 80 acres of habitat above MSL over the 50-year Project life (equivalent to 1.6 acres/year). Similar to the proposals for reestablishing alongshore sediment transport, it is not expected that this entire quantity of sand or acreage of habitat would be constructed during initial construction. Instead, it is expected that there would be a component of initial construction that would meet a portion of this amount, and the Project would include recurring costs over the Project life (similar to reestablishment of alongshore transport) for meeting the lifecycle objectives of cross-island transport. These lifecycle efforts would be based upon monitoring and adaptive management of the coastal process features, and could include renourishment of the project features or additional, similar coastal process features in new locations, identified through the monitoring and adaptive management.

Moreover, early successional habitat established by breaching and/or overwash is temporary and time dependent. New bare sand areas will naturally vegetate at a rate dependent upon several conditions, including the potential for future breaching or overwash which would reset the state of succession. Recent monitoring of the post-Sandy overwash and restoration areas at Smith Point County Park suggest that these areas have significantly revegetated. Specifically, by 2016 vegetation growth had exceeded the 30 percent vegetation cover trigger specified in U.S. Fish and Wildlife Service's (USFWS) Programmatic Biological Opinion. In fact, as of the 2016 survey, vegetation covered 50 to 75 percent of the management/restoration areas (other than Great Gun Restoration Area). For the purposes of this analysis an annual vegetation rate of 10 percent has been assumed (i.e., complete revegetation after 10 years). Assuming 10 percent annual vegetation, and based on 1.6 acres/year difference in breaching related sediment transport into the bays between with- and without-Project conditions, the average bare sand acreage difference over the 50-year Project life would be approximately 8 acres.

Uncertainty

As stated upfront, it is readily acknowledged that there is a tremendous amount of uncertainty in the projections presented in this analysis. Table 1 shows the range in the potential number of breaches that could occur over the Project life, based upon the uncertainty analysis contained in the lifecycle modeling, and the unknowns regarding future storms. The 25 to 75 percent range estimates presented in Table 1 suggest that there is a 50 percent probability that the overall impact of the Project on cross-island sediment transport related to breaching would be between 2.4 MCY / 45 acres and 5.2 MCY / 97 acres. Conversely, there is 50 percent probability that the impact will be smaller or greater than that range. In addition to the uncertainty regarding the expected number of breaches, there is also uncertainty in the breach characteristics (size of the breach, sediment transport associated with the breach, resulting natural bayside breach features, and bayside features that are indirectly created as a result of any closure operation), based both on the underlying uncertainty in breach processes, and in the approach used in developing these estimates.

Overriding all this analysis is also the projection of future sea level rise. This analysis is based upon the historic rate of RSLC. A projection of a greater increase in RSLC would result in a greater number of breaches in both the without-project condition, and the with-project condition. This analysis also focuses on the changes in breach potential as a result of the proposed action in this report, and does not consider the effect that prior actions within the project area may have had on cross-island sediment transport (acknowledging that there are past activities that have both increased cross-island transport and decreased cross-island transport at particular locations).

Cross-Island Transport due to Overwash

Overwash, the landward transport of beach/dune sediments, is also a potential contributor to cross-island sediment transport. Consequences of this process are highly dependent on site-specific conditions, including the volume and disposition of overwashed sediments, barrier island width, adjacent bay water depths, and character of the backbarrier environment. Historically, overwashing has involved significant volumes of beach sediments.

The actual consequence of these occurrences is strongly dependent on the width of the overwashed barrier island, adjacent bay water depths, and character of adjacent backbarrier habitat. At narrow barrier island locations backed by shallow bay waters, overwash may deposit in the bay providing substrate for future marsh development. On the other hand, wide barrier island segments are more resistant to overwashing causing materials to be deposited either on the barrier itself or on leeward marshes (where present). This situation can result in the establishment of a secondary dune system or marsh burial. Some overwashed sediments are deposited on adjacent roadways and other developed areas and then mechanically moved seaward as part of dune rebuilding.

Overwash Deposition Estimates

As part the of the FIMP Reformulation Study, the Corps developed a methodology to estimate significant overwash deposits (USACE, 2006a). Specifically, the goal of this analysis was to determine approximate dimensions and locations of new habitat area created by sand overwash deposits resulting from specific actual or possible storm events impacting the barrier islands between Fire Island Inlet and Montauk Point.

Estimates were made based on output from the Delft 3D MOR morphological change model using the 1996 ocean and bay shorelines as a reference. Simulation results for storms listed in Table 8 below were examined, for the Baseline Conditions (BLC), representing 2000 topography, and Future Vulnerable Conditions (FVC) that can be expected to occur based on existing erosional trends.

Table 9. Storms Used for Significant Overwash Computation

Baseline Conditions	Future Vulnerable Conditions
Historical September 1938	Historical September 1938
September 1938 Alternate Tide	Historical September 1944
November 1950 Alternate Tide	Historical November 1950
September 1985 Alternate Tide	Historical March 1962
	Historical December 1992

Delft 3D output graphics were used to determine the location of overwashes, partial breaches, and full breaches. Areas of overwash were measured separately for on-land overwash and in-bay overwash, using the 1996 bay shoreline as the delimiter. Results for the most vulnerable FIMP locations and for relatively small (10-year Return Period) and large (100-year Return Period) events are summarized in Table 9. Note that the analysis at the time included two additional vulnerable locations at Old Inlet in the Fire Island Wilderness Area. However, those results are not shown since that is generally the area where the existing Sandy breach is currently located. The results summarized in Table 9 confirm the historical knowledge that in-bay overwash deposition areas are smaller than the on-land changes, particularly for small storm events.

Table 10. Overwash Deposition Estimates (in acres) for Small (10 yr) and Large (100 yr) Events

Design Subreach		Baseline Conditions (BLC)				Future Vulnerable Conditions (FVC)			
		on-land		in-bay (above MSL)		on-land		in-bay (above MSL)	
ID	Name	Small (10 yr)	Large (100 yr)	Small (10 yr)	Large (100 yr)	Small (10 yr)	Large (100 yr)	Small (10 yr)	Large (100 yr)
GSB-1B	FI Lighthouse Tract	10	16	0	0	25	50	0	5
GSB-2B	Town Beach to Corneille Estates (at Robins Rest)	0	20	0	3	110	25	5	20
GSB-3D	Talisman to Water Island	0	0	0	0	10	10	0	10
GSB-3G	Davis Park	0	2	0	0	0	0	0	0
MB-1B	Smith Point CP - East	5	50	5	42	25	5	10	80
SB-1B	Sedge Island	0	20	0	0	15	75	0	10
SB-1C	Tiana Beach	10	50	0	18	20	70	3	20
SB-2B	WOSI	0	22	0	3	5	10	2	4
TOTAL		25	180	5	66	210	245	20	149

Estimated Reduction in Annual Overwash Areas

The overwash area vs. frequency relationships summarized in Table 9 above were used to develop estimates of FWOPC overwash deposition areas by considering cumulative annual exceedance probabilities and the average of the BLC and FVC results as being representative of the average condition over the Project lifetime. Unfortunately, model results are only available at the breach vulnerable reaches listed in Table 9. Therefore, estimates for other reaches had to be approximated based on the results from the closest vulnerable reach and scaled based on reach length. In general, all the other reaches are less vulnerable to overwash, so the BLC condition, as opposed to the more degraded BLC-FVC average, was assumed to estimate the annual overwash areas at these other locations.

FWOPC annual total and in-bay overwash results are summarized in Table 10. Only reaches where significant differences are expected in FWOPC and FWPC conditions and overwash response were considered. For example, any reaches where the proposed plan is only Reactive or Conditional/ Contingent Breach Response were not included in the analysis. This is because in these reaches the proposed breach response plan is only expected to impact cross-shore sediment volumes in the event of a breach and these impacts have already been captured in the breaching volumes/areas estimates presented in Section 2.0 above. Overwash processes should otherwise remain largely unaffected in the FWPC.

In addition, it was assumed that on-land overwash deposits (computed as part of the "total" overwash numbers) in developed areas (e.g., Kismet to Lonelyville) would not likely persist long-term as bare-sand habitat and therefore these on-land overwash areas were not considered in the analysis. On the other hand, in-bay overwash area differences were evaluated at every project reach.

Table 11. FWOPC Annual Overwash Estimates

Design Subreach	Reach Name	Reach Length (feet)	Total Annual Overwash (acres/year)	In-Bay Annual Overwash (acres/year)
Great South Bay (GSB)				
1A	Robert Moses State Park - East	19,000	1.32	0.00
1B	FI Lighthouse Tract	6,700	3.20	0.04
2A	Kismet to Lonelyville	8,900	0.17	0.17
2B	Town Beach to Corneille Estates	5,100	0.57	0.57
2C	Ocean Beach & Seaview	3,800	0.07	0.07
2D	OBP to Point O' Woods	7,400	0.14	0.14

3A	Cherry Grove	3,000	0.07	0.07
3C	Fire Island Pines	6,600	0.15	0.15
3G	Davis Park	4,100	0.09	0.09
Subtotal GSB			5.8	1.3
Moriches Bay (MB)				
1A	Smith Point CP- West	6,300	0.82	0.82
1B	Smith Point CP - East	13,500	4.85	2.16
2A	Great Gun	7,600	2.55	1.20
2B	Moriches Inlet - West	6,200	1.74	0.81
2C	Cupsogue Co Park	7,500	2.10	0.98
2D	Pikes	9,700	1.26	1.26
2E	Westhampton	18,300	1.91	1.91
Subtotal MB			15.2	9.1
Shinnecock Bay (SB)				
1A	Hampton Beach	16,800	0.82	0.82
1B	Sedge Island	10,200	4.85	2.16
1C	Tiana Beach	3,400	2.55	1.20
1D	Shinnecock Inlet Park West	6,300	1.74	0.81
2A	Ponquogue	5,300	2.10	0.98
2B	WOSI	3,900	1.26	1.26
2C	Shinnecock Inlet - East	9,800	1.91	1.91
3A	Southampton Beach	9,200	0.82	0.82
Subtotal SB			3.5	0.8
TOTAL			24.5	11.3

FWPC estimates of overwash were developed by considering the changes in the probability of an overwash event due to the effect of the proposed plan. Specifically, along the developed reaches where beach and dune fill has proposed for the first 30 years, SBEACH simulations suggest that the selected 90 ft. width berm and +15 ft. dune will provide a 25-year level of protection against overwash initiation5. Therefore, annual overwash estimates for these reaches were reduced accordingly by removing any overwash below that threshold. For reaches where Proactive Breach Response is the proposed solution, overwash below the 10-year level was removed to reflect the impacts of the proposed +13 ft. dune in the Proactive Breach Response fill template. For years 31 through 50, there would also be Proactive Breach Response in the developed reaches, which would slightly increase estimated annual overwash areas relative to years 0 to 30. A summary of the results based on these assumptions is presented in Table 11 below.

Table 12. FWPC Annual Overwash Estimates

Design Subreach	Reach Name	Proposed Plan	Total Annual Overwash (acres/year)	In-Bay Annual Overwash (acres/year)
Great South Bay (GSB)			Y0-30 / Y31-50	Y0-30 / Y31-50
1A	Robert Moses State Park - East	Beach, no Dune, Renourishment	0.8 / 1.3	0.0 / 0.0
1B	FI Lighthouse Tract	Proactive Breach Response	1.9 /1.9	0.0 / 0.0
2A	Kismet to Lonelville	Beach, Dune and Renourishment	0.2 / 0.2	0.2 / 0.2
2B	Town Beach to Corneille Estates	Beach, Dune and Renourishment	0.2 /0.4	0.2 / 0.4
2C	Ocean Beach & Seaview	Beach, Dune, Renourish, Groin Modification	0.1 /0.1	0.1 /0.1

[5] Excess runup, the difference between the wave runup elevation and the profile crest height, was used as the indicator of potential overwash.

2D	OBP to Point O' Woods	Beach, Dune and Renourishment	0.1 /0.1	0.1 /0.1
3A	Cherry Grove	Beach, Dune and Renourishment	0.1 / 0.1	0.1 / 0.1
3C	Fire Island Pines	Beach, Dune and Renourishment	0.1 / 0.2	0.1 / 0.2
3G	Davis Park	Beach, Dune and Renourishment	0.1 /0.1	0.1 /0.1
Subtotal GSB			3.5 / 4.3	0.8/1.1
Moriches Bay (MB)				
1A	Smith Point CP- West	Beach, Dune and Renourishment	0.6 / 0.8	0.6 / 0.8
1B	Smith Point CP - East	Proactive Breach Response, sand bypassing	3.2 / 3.2	1.6 / 1.6
2A	Great Gun	Proactive Breach Response, sand bypassing	2.1 / 2.1	1.0 / 1.0
2B	Moriches Inlet - West	Proactive Breach Response	1.4 / 1.7	0.6 / 0.8
2C	Cupsogue Co Park	Beach, Dune and Renourishment	1.6 / 2.1	0.7 / 1.0
2D	Pikes	Beach, Dune and Renourishment	0.9 / 1.3	0.9 / 1.3
2E	Westhampton	Beach, Dune and Renourishment	1.8 / 1.9	1.8 / 1.9
Subtotal MB			11.6 / 13.1	7.3 / 8.4
Shinnecock Bay (SB)				
1A	Hampton Beach	Proactive Breach Response	0.0 / 0.0	0.0 / 0.0
1B	Sedge Island	Proactive Breach Response, sand bypassing	1.4 / 1.4	0.1 / 0.1

1C	Tiana Beach	Proactive Breach Response, sand bypassing	0.4 / 0.4	0.4 / 0.4
1D	Shinnecock Inlet Park West	Proactive Breach Response, sand bypassing	0.4 / 0.4	0.0 / 0.0
2A	Ponquogue	Proactive Breach Response	0.3 / 0.3	0.0 / 0.0
2B	WOSI	Proactive Breach Response, sand bypassing	0.1 / 0.1	0.1 / 0.1
2C	Shinnecock Inlet - East	Proactive Breach Response	0.0	0.0 / 0.0
3A	Southampton Beach	Proactive Breach Response	0.0	0.0 / 0.0
Subtotal SB			2.8 / 2.8	0.7 / 0.7
TOTAL			17.8 / 20.2	8.8 / 10.1

Finally, expected differences between FWOPC and FWPC are presented in Table 12. This table shows that the proposed plan is expected to result in approximately 6.7 acres/yr less of total overwash and 2.5 acres/yr less of in-bay overwash above MSL (i.e., new land) in years 0 to 30. In years 31 to 50 there would be a reduction of 4.4 acres/yr of total overwash and 1.1 acres/yr of in-bay overwash above MSL (i.e., new land) in these reaches.

Table 13. Estimated Reduction in Annual Overwash Areas

Design Subreach	Reach Name	Years 0 to 30		Years 31 to 50	
		Total Annual Overwash Reduction (acres/year)	In-Bay Annual Overwash Reduction (acres/year)	Total Annual Overwash Reduction (acres/year)	In-Bay Annual Overwash Reduction (acres/year)
Great South Bay (GSB)					
1A	Robert Moses State Park - East	0.54	0.00	0.00	0.00
1B	FI Lighthouse Tract	1.31	0.00	1.31	0.00

2A	Kismet to Lonelyville	0.02	0.02	0.00	0.00
2B	Town Beach to Corneille Estates	0.38	0.38	0.19	0.19
2C	Ocean Beach & Seaview	0.01	0.01	0.00	0.00
2D	OBP to Point O' Woods	0.02	0.02	0.00	0.00
3A	Cherry Grove	0.01	0.01	0.00	0.00
3C	Fire Island Pines	0.02	0.02	0.00	0.00
3G	Davis Park	0.02	0.02	0.00	0.00
Subtotal GSB		2.3	0.5	1.5	0.2
Moriches Bay (MB)					
1A	Smith Point CP- West	0.21	0.21	0.00	0.00
1B	Smith Point CP - East	1.69	0.56	1.69	0.56
2A	Great Gun	0.42	0.21	0.42	0.21
2B	Moriches Inlet - West	0.33	0.16	0.00	0.00
2C	Cupsogue Co Park	0.52	0.25	0.00	0.00
2D	Pikes	0.33	0.33	0.00	0.00
2E	Westhampton	0.14	0.14	0.00	0.00
Subtotal MB		3.6	1.9	2.1	0.8
Shinnecock Bay (SB)					
1A	Hampton Beach	0.21	0.21	0.00	0.00
1B	Sedge Island	1.69	0.56	1.69	0.56
1C	Tiana Beach	0.42	0.21	0.42	0.21
1D	Shinnecock Inlet Park West	0.33	0.16	0.00	0.00
2A	Ponquogue	0.52	0.25	0.00	0.00

2B	WOSI	0.33	0.33	0.00	0.00
2C	Shinnecock Inlet - East	0.14	0.14	0.00	0.00
3A	Southampton Beach	0.21	0.21	0.00	0.00
Subtotal SB		0.8	0.2	0.8	0.2
TOTAL ANNUAL REDUCTION		6.7	2.5	4.4	1.1

Average Reduction in Overwash Bare-sand Habitat over Project Life

As with the breaching transport and habitat analysis presented above, an annual vegetation rate of 10 percent has been assumed (i.e., complete revegetation after 10 years) for early successional habitat established as a result of overwash. This assumption combined with the expected annual differences in overwash presented in the tables above results in an expected average reduction of the total and in-bay overwash bare sand habitat over the 50-year Project life of 30 and 11 acres, respectively. These results are summarized in Table 13.

Table 14. Average Reduction in Overwash Bare-sand Habitat over 50-year Project Life

Design Subreach	Reach Name	Total Annual Bare-sand Overwash Reduction (acres)	In-Bay Annual Bare-sand Overwash Reduction (acres)
Great South Bay (GSB)			
1A	Robert Moses State Park - East	2.44	0.00
1B	FI Lighthouse Tract	5.92	0.00
2A	Kismet to Lonelyville	0.10	0.09
2B	Town Beach to Corneille Estates	1.69	1.56
2C	Ocean Beach & Seaview	0.04	0.04
2D	OBP to Point O' Woods	0.08	0.08

3A	Cherry Grove	0.04	0.04
3C	Fire Island Pines	0.09	0.08
3G	Davis Park	0.09	0.09
Subtotal GSB		10.5	2.0
Moriches Bay (MB)			
1A	Smith Point CP- West	0.96	0.88
1B	Smith Point CP - East	7.62	2.33
2A	Great Gun	1.91	0.88
2B	Moriches Inlet - West	1.51	0.67
2C	Cupsogue Co Park	2.36	1.05
2D	Pikes	1.47	1.35
2E	Westhampton	0.62	0.57
Subtotal MB		16.4	7.7
Shinnecock Bay (SB)			
1A	Hampton Beach	0.00	0.00
1B	Sedge Island	2.54	0.00
1C	Tiana Beach	0.51	0.47
1D	Shinnecock Inlet Park West	0.00	0.00
2A	Ponquogue	0.00	0.00
2B	WOSI	0.34	0.31
2C	Shinnecock Inlet - East	0.00	0.00
3A	Southampton Beach	0.00	0.00
Subtotal SB		3.4	0.8
AVERAGE REDUCTION OVER PROJECT LIFE		30	11

Comparison to Historic Overwash

In general, historical data suggests that the principal impact of overwash is the increase of barrier island elevations as salt marsh habitats are converted to barrier island environments. The net result of overwash is that bay shorelines have either remained relatively stable or marsh acreage has been lost while subaerial barrier island habitat has increased. Leatherman and Allen (1985) found that overwash has contributed little to new land creation and barrier island migration. They estimated the total contribution of overwash to new marshland to be about 5.7 acres between 1938 and 1962, mostly from storms in 1938, 1954, 1960, and 1960. This total area is equivalent to only 0.24 acres/year.

More recently, overwash resulted in approximately 34 acres of new land from 1980 to 1995 (2.3 acres/year), comprised of 30, 2.5, and 1.5 acres at Swan Island, Smith Point, and Pelican Island, respectively (USACE, 1999). This new land area represents approximately 20 percent of the total overwash area experienced during this 15-year period (approximately 170 acres or 11.3 acres/year).

A review of post-Sandy aerial imagery supports the finding that the majority of the overwash habitat resulted in the conversion of one upland type to another. Specifically, Hurricane Sandy resulted in approximately 13.5 acres of "new land" because of overwash (excluding breach areas), with 11 acres of this new land in Smith Point County Park:

Approximately 0.7 acres of "new land" at the Reagan Property,

Approximately 0.3 acres of "new land" in the wilderness area east of the breach,

Approximately 9 acres near Pattersquash, and 2 acres near the SPCP breach of "new land" in Smith Point County Park, and

Approximately 0.5 acres of "new land" in Tiana Beach.

Compared to the overall amount of overwash that was formed due to Hurricane Sandy, the creation of only 13.5 acres, supports the previous findings that the majority of overwash results in habitat conversion, rather than the creation of new land.

As summarized above, historic rates of overwash and new land creation vary significantly, from 0.24 acres/year between 1938 and 1962 to 2.3 acres/year in the 1980 to 1995 period. Between 1995 and 2017, the only significant in-bay overwash event was Hurricane Sandy in 2012, which resulted in 13.5 acres of new land due to overwash (equivalent to 0.6 acres/year). Therefore, the estimates of future with- and without-project overwash areas presented above appear to be conservative relative to historic observations. Specifically, the FWOPC estimates summarized in Table 10 suggest approximately 11.3 acres/year of in-bay overwash area above MSL for the reaches considered. Similarly, FWPC estimates summarized in Table 11 range from 8.8 to 10.1 acres/year, for years 0 to 30 and 31 to 50, respectively.

Given the uncertainty in the breaching and overwash area projections, it is recommended that an initial volume/area of sediment be targeted as the basis for coastal process reestablishment, and that these features be adaptively managed with continuing construction over the Project life (akin to the sediment bypassing,and renourishment). Future construction could include the renourishment of these features, or alternately the construction of features in additional locations. The initial construction of these coastal process features is expected to occur in conjunction with the beachfill being undertaken along the adjacent ocean shoreline (a similar approach would also be expected during future construction). Since beachfill work is expected to occur over several years in multiple construction contracts, the construction of these coastal process features will be phased, to allow for lessons learned in the construction process.

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APPENDIX G: COST ESTIMATE AND EFFECTIVENESS OF CONTROL OPTIONS ASSOCIATED WITH MAINTAINING CPFS/DESCRIPTION OF HERBICIDES AND EVALUATION OF TOXICITY

1. PREDATOR CONTROL

The project strives to meet no net loss of nesting habitat through the creation and maintenance of CPFs. Adaptive management and monitoring address uncertainty of mitigation outcomes and maximize performance. Annual monitoring of breeding pairs and productivity for piping plover and census for seabeach amaranth inform whether additional actions are needed to address indirect effects of the project.

This SOW addresses predator management to ensure the Corps can meet the conditions set forth in the PBO.

On Long Island, Cohen et al. (2009), showed that plover reproductive output in West Hampton Dunes was improved when foxes and cats were removed. Virginia Tech's (VT) piping plover monitoring work at Robert Moses State Park, Fire Island National Seashore and Smith Point County Park on Long Island (Carey et al. 2016) showed that red foxes (*Vulpes vulpes*) were common in all areas, and an important predator of piping plovers on Fire Island with impacts varying across years. Predator management is an important part of piping plover management along the entire U.S. coast, and management of red foxes at these sites on Long Island, whether through lethal removal of adults, destruction of active den sites, or simple nest exclosure, may be important for piping plover populations (USFWS 1996, 2014).

Between April-September 2016, VT estimated a minimum red fox density of 3.05 adults/km2 and 4.07 kits/km2 at Robert Moses State Park and of 1.69 adult/km2 and 2.95 kits/km2 between Watch Hill and Old Inlet at Fire Island National Seashore. VT found no red foxes at Smith Point County Park or Old Inlet East in Fire Island National Seashore during this reporting period. Averaging these densities, and extrapolating to the available area between Fire Island Inlet and Old Inlet, VT estimated a red fox population density of 2.37 adults/km2 and 3.51 kits/km2, a total available area of 16.18 km2 and a total red fox population size of 39 adults and 57 kit. Other predators that could be impacting productivity in the Project area include opossum, skunks, feral cats, and raccoons. Given species specific dispersal behavior, predator populations cannot realistically be totally removed over large areas, nor should they be. They are important components of functioning ecosystems. Conversely however, populations can be substantially depressed during critical periods allowing piping plover and other shorebirds to successfully nest and produce fledglings.

The Service has been trapping Cape May Point State Park to North Brigatine Natural Area in New Jersey annually from 2015-2017 to help increase nesting success of piping plover. The predator control strategy for New Jersey was designed to meet management objectives and minimize disturbance to local ecosystems. Additionally, due to the high amount of public use many of the areas experience year round, trapping needs to be conducted discreetly in a fashion that lessens the probability of negative interactions with the public.

Field operations in NJ were driven by when young are dependent, dispersal, periodicity of home range establishment, and the inherent vulnerabilities of both the species being controlled and the species being protected. Ideally to benefit piping plovers, predators should be removed after they have established home ranges, prior to having dependent young, and before shorebirds arrive during their spring migration (January-March time period).

The large geographic area of FIMP supports self-sustaining predator populations. Intense systematic control measures conducted on a yearly basis could conceivably reduce overall population densities. If this is not feasible, a reduced level of intensity can still provide some relief to shorebirds when trapping is conducted annually during the appropriate time period.

Red fox foraging behavior is relatively fast, somewhat random and encompasses large areas. This predatory strategy is 'hit or miss', but it is compensated for by covering large areas thereby increasing opportunity. Conversely, as a result of their foraging behavior raccoon, opossum, and skunk can also be responsible for substantial nest and fledgling loss. They have much smaller home ranges than canines and utilize local resources more completely. Their predatory strategy can be characterized as 'slow, plodding, and thorough'. This allows location of resources on a smaller scale and tends to permit fuller exploitation of available food sources in a methodical and inclusive fashion.

Although every precaution is undertaken to conceal predation management activities from the public it is inevitable that conflicts will arise. Obstacles posed by people and pets frequenting these public use areas cannot be totally avoided and can impede efforts to trap in certain areas.

1A. SCOPE OF WORK

Trap annually in late winter to depress populations, determine areas to trap based on where birds are nesting, predator home ranges, and by looking at how the landscape may funnel predators, and where conflicts with humans and domestic pets would be an issue. A site visit would be conducted in late September or early October 2018 to evaluate where trapping could feasibly and effectively be conducted. Areas would be identified for discussion with the Corps and then with landowners. Problematic predators could be trapped during the active season but only on an as needed basis to reduce the potential for disturbance to nesting birds and to minimize the potential for conflict with recreational beach use. While trapping in the winter would be approximately 4 weeks, they would be 16 hour days, 7 days a week to allow for trapping to occur in various locations from Democrat Point to Shinnecock Inlet. We would estimate 8 weeks total and 10 days to apply for and secure permits, work with the Corps to get landowner permission, keys for access, etc., and to produce a report. Trapping would be achieved using foothold traps and cage traps to allow for trapping of foxes and the other smaller mammalian predators identified.

1B. SERVICE TASK SCHEDULE

Table 1. Project Tasks and Milestones (based on work conducted by the USFWS)

Tasks and Milestones	Completion Date
Prepare for and execute annual trapping	February 1- March 31
Service submits draft report within 30 days of the completed trapping season	April 1-April 30
Corps has 45 days to review draft report	May 1- June 15
Service submits final report within 45 day of receiving Corps comments	June 15-August 1

1C. COST ESTIMATE

Cost agreements would be done on an annual basis and will change based on the change in bio day rate and if additional tasks are added to ***the Scope above***

E**stimated Cost of Completing Work Elements:**

TASK	Biologist Day	Biologist DayCost @551/day
Assist Corps with permit and landowner access. Attend twice a year meeting	15	$8,265
Trapping Activities	45	$24,795
report writing	5	$2,755
travel costs 53 days @$198/day		$10,494
Equipment Traps, lures and miscellaneous		$3,000
subtotal		$49,309
overheat 22 percent		$10,848
Total		**$60,157**

2. Cost and Effectiveness of Control Options Associated with Maintaining Early Successional Habitat for Piping Plover to Offset Habitat Loss from FIMP

To mimic overwash events that were likely to occur in the project area over time, CPFs will be constructed to provide early successional habitat for piping plover. Twenty-four CPFs are being proposed by the Corps to meet the goal of no net loss of sediment. The Service evaluated the likelihood that the proposed CPFs would support piping plover nesting habitat using design criteria (Table 4 in the PBO) that was based on literature and monitoring conducted for the FIMI project. Preliminary designs for 9 CPFs that met design criteria are provided in Appendix C of the PBO. To meet the design criteria, and to get nesting habitat acreage credits, vegetation cannot exceed 30 percent (see Appendix D for Project Success Criteria). American beachgrass (*Ammophila breviligulata*) quickly colonizes bare sand and can spread rapidly – 6 to 10 feet (1.8 to 3.0 m) annually – through the sand by subsurface runners (rhizomes), and can produce up to 100 stems per clump annually. They can tolerate burial in as much as 3 feet (0.9 m) of sand; sand burial stimulates the rhizomes to grow vertically, and is essential to plant vigor. The following document provides cost estimates associated with management strategies documented to control American beachgrass.

Table 1. Coastal Process Features intended to provide nesting and foraging habitat for piping plover (*Charadrius* melodus) on the south shore of Long Island.

Table 6. Take Offset based on proposed Coastal Process feature*				
Coastal Process Feature (CPF)	**CPF acres early successional habitat created (AC)**	**CPF acres early successional habitat created (HA)**	**Maximum expected pairs (0 .5 PR per HA of suboptimal CPF created habitat)**	**total nest that have fledged chics 2013-2017*** **
Site 1 Democrat Point West	**69.6**	**28.17**	**14**	**4**
Site 2 Democrat Point Bayside East of Jetty	**27**	**10.93**	**5**	**2**
Site 3 Dune Field East	**18.7**	**7.57**	**4**	**1**
Clam Pond Reach GSB 2A	**8**	**3.24**	**2**	**0**
Site 7 Atlantique to Corneille	**14.1**	**5.71**	**3**	**0**
Site 14 Pattersquash Reach	**49.4**	**19.99**	**10**	**5**
Site 15 New Made Island Reach	**100.1**	**40.51**	**20**	**8**
Site 17 Great Gun Reach	**107.7**	**43.58**	**22**	**7**
Site 18 Cupsogue	**34**	**13.76**	**7**	**9**
Total	**379**	**173.45**	**87**	**36**
***USFWS, 2017c draft proposed coastal process features for FIMP. Acreage is estimated based on conceptual design**				
**** Estimated loss of nesting pair based on habitat needs described in Cohen et al, 2009. Nesting Density and Reproductive Success of Piping Plover in Response to Storm- and Human- Created Habitat Changes**				
***VA Tech monitoring reports 2014-2017				

Management of beach grass through sand placement will stimulate growth (Gemmell et al. 1953, Greig-Smith 1961) necessitating more management in out-years. Further repeated placement of sand could affect design criteria being met with potential to increase elevation and slope.

The Service spoke to several state and federal agency people from California and Oregon who are responsible for controlling European beach grass (*Ammophila arenaria*) on the coastal dunes along the Pacific Coast (conducted in spring 2018 by USFWS CBFO employee Bill Schultz). They are removing this beach grass from the dunes to provide nesting habitat for the federally listed western snowy plover (*Charadrius alexandrines*) and to provide habitat for a variety of rare native beach dune plants. On the east coast we propose to remove American beach grass (*A. breviligulata*) so that we can provide nesting habitat for the piping plover. *Ammophilia*, with its extensive underground rhizome network, is extremely tenacious and its eradication has proven to be a continuing challenge to managers. It has required a decade of research and experimental trials to develop effective eradication techniques, and when applied on a large scale these methods show variable success (Pickart 1997, Pickart and Sawyer 1998). There are three general methods for removing beach grass and other vegetation on the Pacific Coast. These include manual removal, bulldozer scraping and disposal or burial, and herbicide spraying and disking.

Manual Removal

Manual removal has been used with great success, but also at great expense. By the early 1980s the first *Ammophila* eradication/dune restoration project was born at the Lanphere Dunes (then a preserve of The Nature Conservancy, and now a unit of Humboldt Bay National Wildlife Refuge). Early experiments revealed that repeated manual removal was the most effective treatment of those studied (VanHook 1983), causing depletion of stored carbohydrates while preventing photosynthesis. The first removal was carried out in March, as plants emerged from dormancy. A shovel was used to sever rhizomes at a depth of about eight inches, since the majority of active rhizomes were found to be in this region. Grass was pulled and then later burned. Resprouting occurred throughout the season, more vigorous at first. Crews returned to pull and/or dig resprouts an average of eight times over the first season, and seven times the second season. By the end of the second season plants were largely eradicated. By 1992 a large-scale project was begun, and by 1996 over 4 hectares of beachgrass had been effectively eradicated from the Lanphere Dunes and restored to dune mat and fore-dune grassland. As predicted by small-scale field experiments, dune vegetation recruits quickly from nearby sources (Pickart and Sawyer 1998). Annually, a one-day "*Ammophila* Sweep" is conducted by a dozen refuge staff and partners who fan out over approximately 40 hectares of dunes to look for fresh starts or overlooked plants. The most labor intensive part of manual control is the first dig, due to the large biomass, density of stems, and the difficulty of severing rhizomes. To determine whether the first dig could be replaced with a labor saving controlled burn, the Center for Natural Lands Management established an experiment at the Manila Beach and Dunes in Humboldt Bay dunes (Pickart 1998). Burning is known to stimulate growth in *Ammophila* (Van Hook 1983), and is assumed to increase resprout vigor or density. However, it is hypothesized that the increased labor required to remove resprouts after a burn may still represent a time savings over the initial dig.

Manual removal costs for European beach grass (*Ammophila arenaria*) at Point Reyes National Seashore and Sunset State Beach in California cost between $20,100 and $54,600 per acre in year 2018 dollars. If 303 acres are treated (80 percent of all the CPF acreages), the cost of the initial treatment will total between $6.09 million and $16.54 million dollars. During the second year, costs for manual removal will drop by approximately 50 percent ($3.04 million to $8.27 million). During subsequent years, costs will drop to approximately 20 percent of the initial costs or between $1.22 million and $3.31 million a year.

Bulldozer scraping and removal/burial

Bulldozer scraping requires you to grade three feet down and to push the beach grass into a long linear pile. Heavy equipment has been used extensively to control *Ammophila* at Oregon Dunes National Recreation Area using a D-8 Caterpillar. You can then pick the beach grass up with a skid steer and grapple fork and load it into a dump truck for disposal in a landfill. Or you can pile the grass to the side and then dig a trench with an excavator or bulldozer and bury the grass. Clean sand (without beach grass roots), at least three feet deep will then need to be place back on the scraped areas. At Point Reyes National Seashore the cost in 2018 dollars ranged from $4,000.00 to $21,300.00 per acre. The first-year costs for 303 acres of treatment would range from $1.2 million to $6.45 million. The follow-up treatment would involve hand pulling (see above) or herbicide spraying in September of scattered re-emerging beach grass which would cost approximately $500 to $1,000/acre. Hand pulling or herbicide re-treatment will need to be completed annually to keep overall costs down and to maintain piping plover nesting habitat. For a large area, and if done with sufficient quality control, it should be more cost-effective than manual removal.

Herbicide Treatment and Disking

Glyphosate (Roundup or Rodeo) has been used with some success on *Ammophila*, although its effectiveness is dependent on consistency and thoroughness. A label recommendation of 8 percent Rodeo plus 0.5 to 1.5 percent nonionic surfactant was developed for Oregon, Washington, and California following trials by the California Department of Recreation, Oregon Department of Fish and Wildlife, and the Monsanto Company. Rodeo, a form of glyphosate without surfactant, was preferred in Oregon because of concerns about groundwater contamination. Rodeo is approved for aquatic use because it lacks the polyethoxylated tallowarnine present in the surfactant in Roundup. The label also recommends wiper applications for selective control, using a 33 percent solution plus 1.0 to 2.5 percent nonionic surfactant. For either method, plants are treated during active plant growth. An imazapyr, glyphosate mix has also been used with success for species that spread through rhizomes like Phragmites (Mozdzer et al. 2008). Typically, a mix of 1.5 percent imazapyr, 2 percent glyphosate and 0.75 percent surfactant that is safe to use in aquatic environments is used for high volume foliar spray. Blue dye will need to be mixed with this formulation so the applicators know which plants have been sprayed. The Service recommends that a 4-wheel drive truck with a 100 to 200 gallon tank sprayer with a hose reel that has the capacity to hold 400 feet of 3/8 inch high pressure hose (600-800 pounds of pressure per square inch) be used to spray the vegetation. A jet nozzle should be attached to the hose that can dispense the formulation at a rate of 5 to 30 gallons per minute for a distance of 50 to 70 feet. If a truck sprayer cannot be used because the sand is too soft to drive a truck on, a crew using backpack sprayers will need to be hired and mixes adjusted to low volume foliar rates of application. Once the grass is dead, it will need to be incorporated into the sand with a disc during the fall or winter. The initial treatment with backpack sprayers will cost approximately $4,500 per acre. A truck sprayer could substantially reduce the first year costs by an unknown amount. Using backpack sprayers, the total first year cost will be approximately $1.36 million. After the first year, costs should range from $500.00 to $1,000.00 an acre using backpack sprayer to kill the re-emerging grass. The grass will be sufficiently sparse in most years that it will not need to disked into the sand. Total annual maintenance cost will range between $151,500 to $303,000. Annual review of literature on herbicide treatment of aquatic plant species that spread by rhizomes should be done to ensure that the project is using the best available information to maximize effectiveness of treatment, and to limit the amount of chemical used.

3. Description of Herbicides and Evaluation of Toxicity

Imazapyr is part of the imidazolinone chemical class, and is a systemic, non-selective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds. Imazapyr is applied either as an acid or as the isopropylamine salt. The mode of toxic action of imazapyr in plants as an amino acid synthesis inhibitor has been well described. Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It inhibits the enzymatic production of the amino acids valine, leucine, and isoleucine. Plant death is usually slow and can take up to several weeks. Imazapyr does not bind readily to soil, and it has high mobility and a relatively long soil half-life (1 to 5 months). Due to these characteristics, it can damage or kill non-target vegetation.

Imazapyr has relatively low toxicity to birds, mammals, fish, and invertebrates, but it is considered an eye and skin irritant. In tests, rats rapidly excreted imazapyr through feces and urine, and no residues accumulated in liver kidney or muscle. It has not been found to cause mutations, birth defects, or cancer in birds or mammals.

Glyphosate is a broad-spectrum systemic herbicide that kills plants by interfering with amino acid synthesis and enzyme production. It is water soluble, but is strongly adsorbed to soil particles, making it relatively non-mobile in the environment and unlikely to be taken up by the roots of non-target plants once it has entered the soil. It is broken down by microbial action, but due to its strong adsorption to soil, its average soil half-life is approximately 2 months (Tu *et al*. 2001). Glyphosate is of relatively low toxicity to birds, mammals, and fish (EPA 1993).

A surfactant is often used to increase the efficacy of glyphosate. At this time, the Service's Region 5 Environmental Contaminants Program recommends the use of LI-700® , which the Service has rated as "practically nontoxic" to aquatic organisms. Supporting documentation is provided in *"Acute Toxicity of Various Nonionic Surfactants/Spreaders Used with Glyphosate Products and Toxicity of Formulated Glyphosate Products"* prepared by Elaine Snyder-Conn, National Pest Management Coordinator for the Regional Pest Managers Meeting, Ellsworth ME August 26, 2002, and in Monheit et al. (2004), Solomon and Thompson (2003), and Syracuse Environmental Research Associates (1997).

Tu et al. (2001) characterizes imazapyr as practically non-toxic (the EPA's lowest toxicity category) to fish, invertebrates, birds and mammals. Toxicity tests were not conducted on amphibians or reptiles. It does not bioaccumulate in animal tissues. Concentrated imazapyr has low acute toxicity on the skin or if ingested, but is harmful if inhaled and may cause irreversible damage if it gets in the eyes.Applicators should wear chemical-resistant gloves while handling, and persons not involved in application should avoid the treatment area during treatment. Chronic toxicity tests for imazapyr indicate that it is not carcinogenic, mutagenic, or neurotoxic. It also does not cause reproductive or developmental toxicity, and is not a suspected endocrine disrupter. Imazapyr degradates are no more toxic than imazapyr itself, and are excreted faster than imazapyr when ingested.

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APPENDIX H: ANALYSIS OF FIRE ISLAND TO MONTAUK POINT COMMUNITIES AS SUITABLE PIPING PLOVER HABITAT

Introduction

Features that maximize access to reliable food sources drive piping plover nest site selection on Fire Island (Granger et al., 2017). Piping plover nesting habitat is susceptible to loss and degradation due to recreational use and development (including shoreline protection measures) that occur along barrier islands. The Fire Island to Montauk Point communities are a constant stressor on the ability of piping plover to nest and forage successfully due to the close proximity of houses, recreation, domestic pets, and Off Road Vehicle Use. Because these communities are part of the Project study area in the Programmatic Biological Opinion (PBO), the Service is evaluating whether the communities should be subject to the conservation measures that address time of year restrictions and the need to symbolically fence areas for piping plover (see Section 7.0. Conservation Measures in the PBO). The Army Corps of Engineers has proposed that the communities be exempt from implementing time of year restrictions and installing symbolic fencing, because the baseline condition of the communities (pre-FIMI) make them unsuitable for successful piping plover nesting and fledging.

Methods:

The Virginia Tech Shorebird Program modeled piping plover nest site selection before and after Hurricane Sandy (Granger et al., 2017). The objectives of this study were to: 1) identify coarse-scale habitat variables that influence piping plover nest site selection; 2) determine if piping plovers selected nest sites differently before and after Hurricane Sandy; 3) estimate how much suitable piping plover habitat was available before and after Hurricane Sandy; 4) highlight areas of high probability nesting for informing future management. The Service used the information from this report and the community features through aerial imagery and GIS to determine whether there was suitable habitat in the communities.

Suitable habitat criteria were developed by the Service with input from Virginia Tech and the Corps of Engineers to evaluate the potential for mitigation for the project (the ability to mimic overwash prevented by the project, see Table 5. of the PBO). The design criteria are a refinement of the coarse suitable habitat identified by Virginia Tech.

The Service conducted an analysis of how the design criteria applied in the communities including evaluation of least cost distance to forage, backshore slope, elevation and proximity to structures at the 4ft elevation contour (LIDAR, 2017). Areas that fall inside any one of these polygons are not suitable habitat for piping plover and do not require time of year restrictions or symbolic fencing. Any area that is outside these structural polygons required further evaluation against additional components of the design criteria including, adjacent vegetation height and density, predators, and off road vehicle usage before the Service made a determination of suitability. Finally, the size had to be large enough to support a nesting pair of piping plover. The highest density that ocean-side only habitat is predicted to support is 0.5 pair per hectare (see Section 12 of PBO for explanation).

Results:

Using the methodology above, none of the communities is suitable habitat for piping plover (Figure 1.)

Conclusion:
Using the method described above, areas in front of the communities in Fire Island are not suitable piping plover habitat. However, there are areas between communities or community segments that are suitable habitat and should have symbolic fencing and appropriate time of year restrictions. The Corps should use the 50 m development buffer from structures as the demarcation point for where symbolic fencing and time of year restrictions are necessary.

Although there is not suitable habitat analysis for the communities west of Moriches Inlet to Montauk Point, the 4 ft. contour can be used as a surrogate until suitable habitat analysis is complete for these communities. Attachment 1. is a series of maps showing suitable habitat, the 4 ft. elevation contour, and the 50 m boundary for the communities. These maps provide an estimate of where symbolic fencing and time of year restrictions are required. If piping plover chose to nest in these beaches segments within the communities not currently identified as suitable habitat, the Corps should immediately implement all conservation measures for piping plover, as described in the PBO in consultation with the Service.

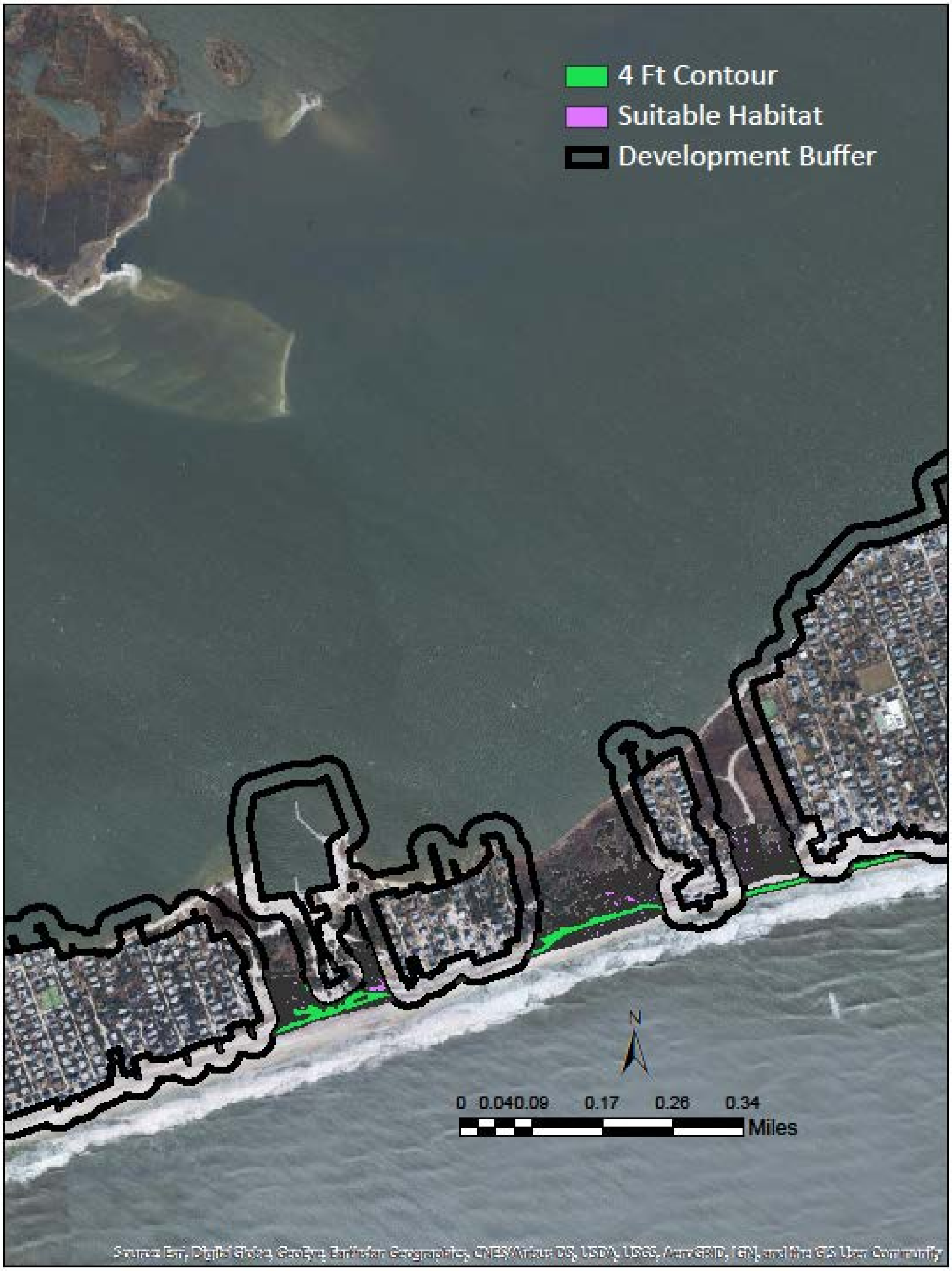

Figure 1. Section of a Fire Island community. The purple polygon represents suitable habitat from Granger et al. (2017). The green polygon is the 4ft contour from 2017 Lidar data. The black line is the 50 m development buffer identified as part of the design criteria identified in the PBO.

References:

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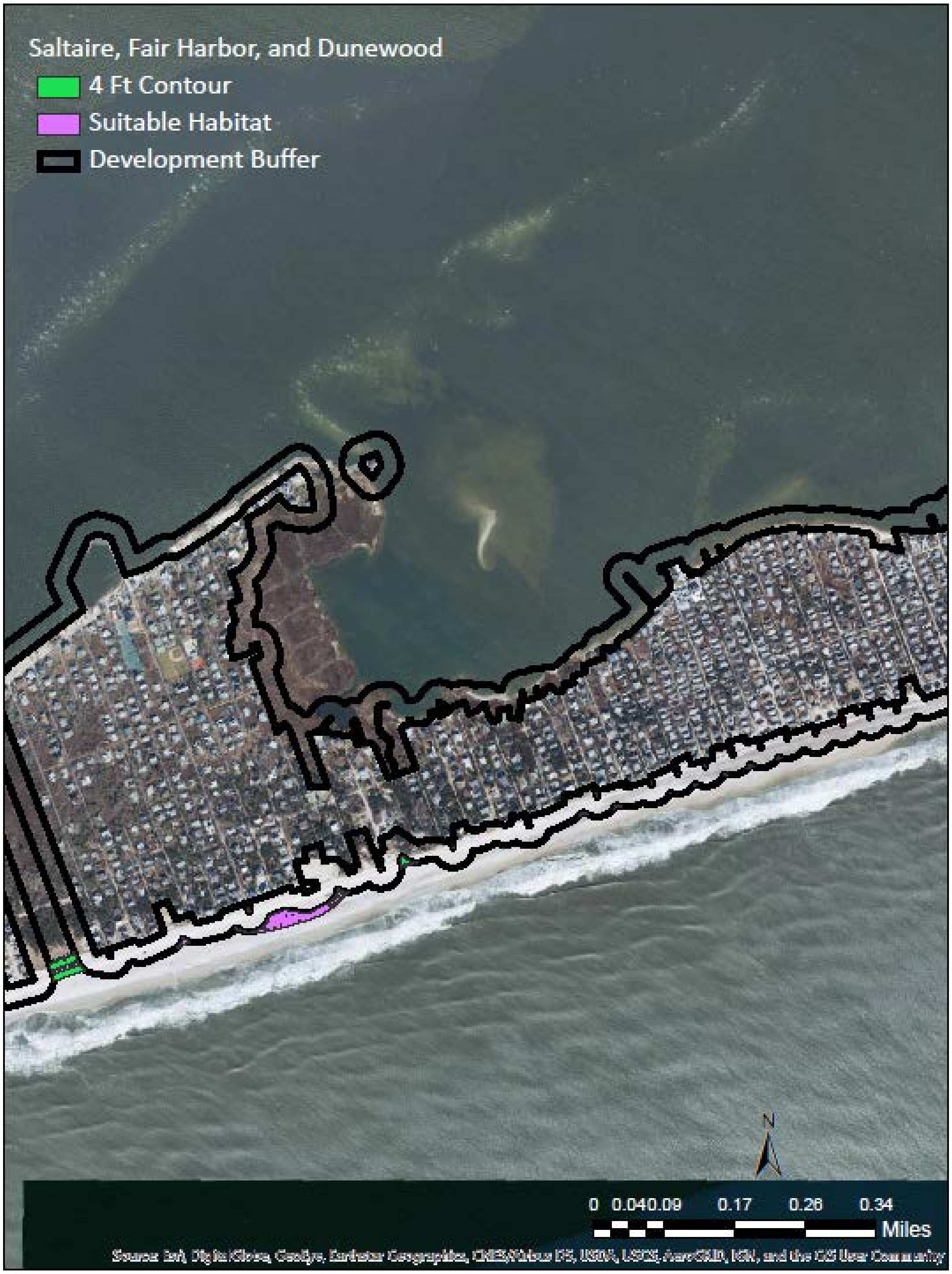
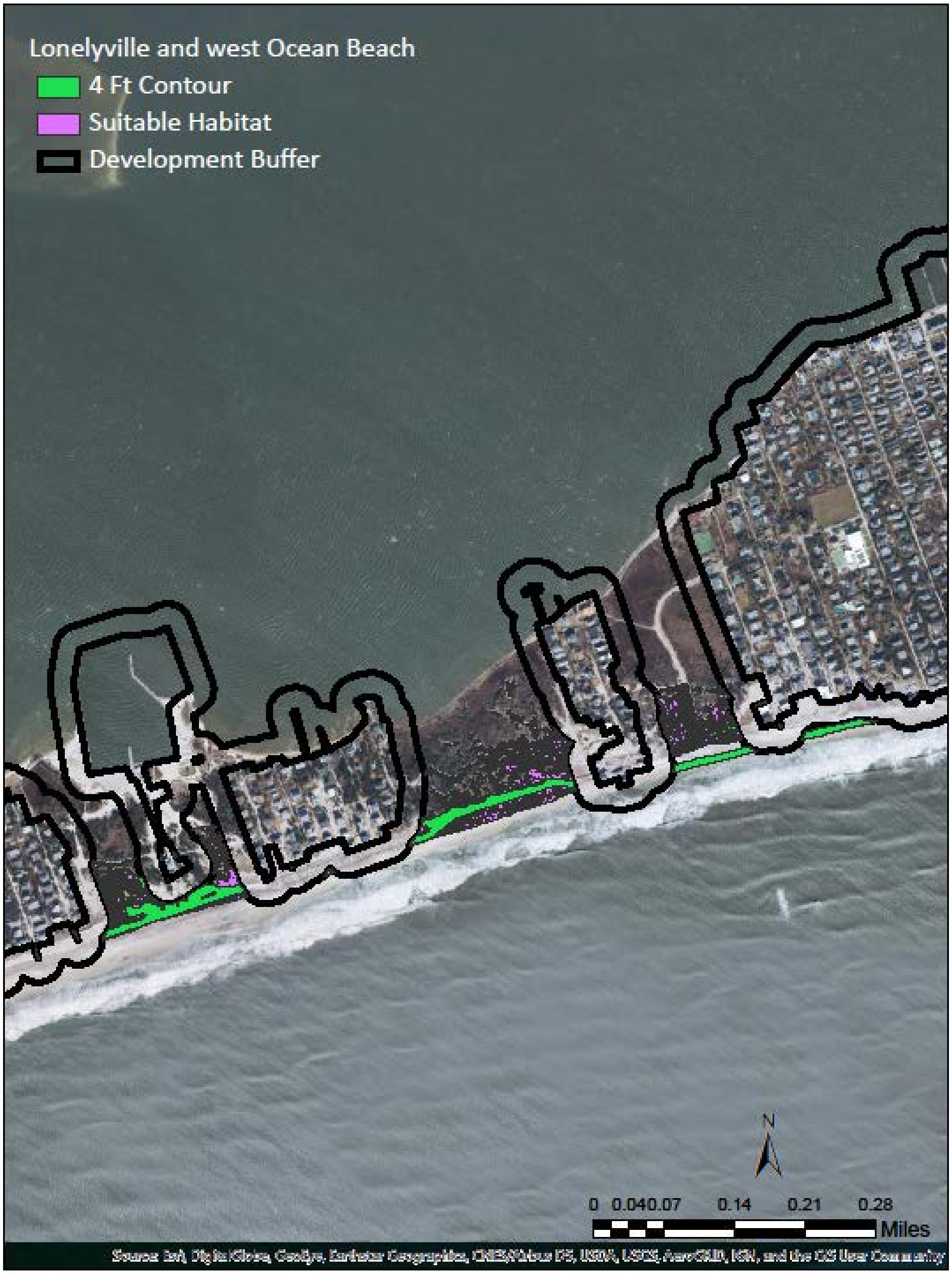
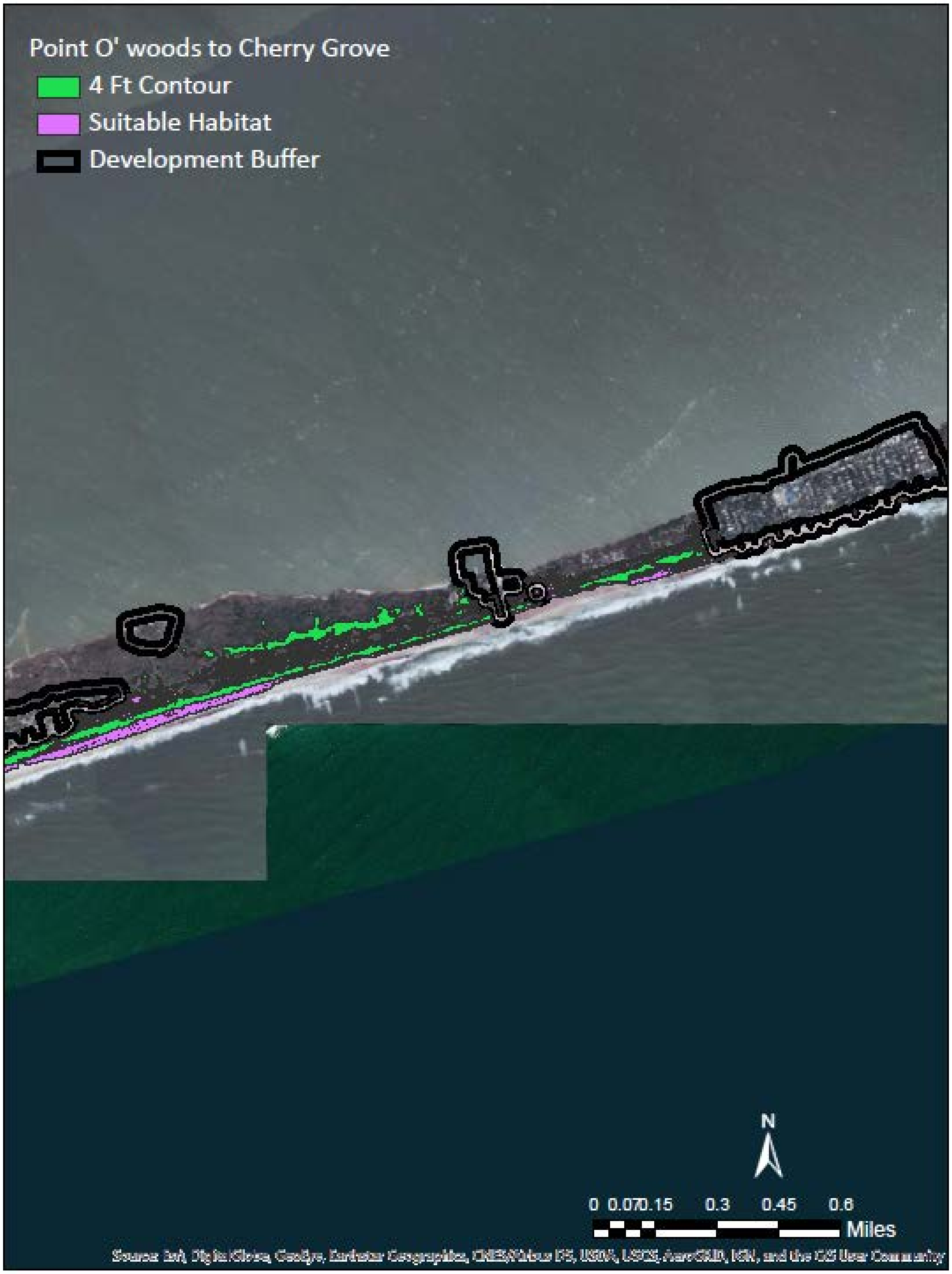
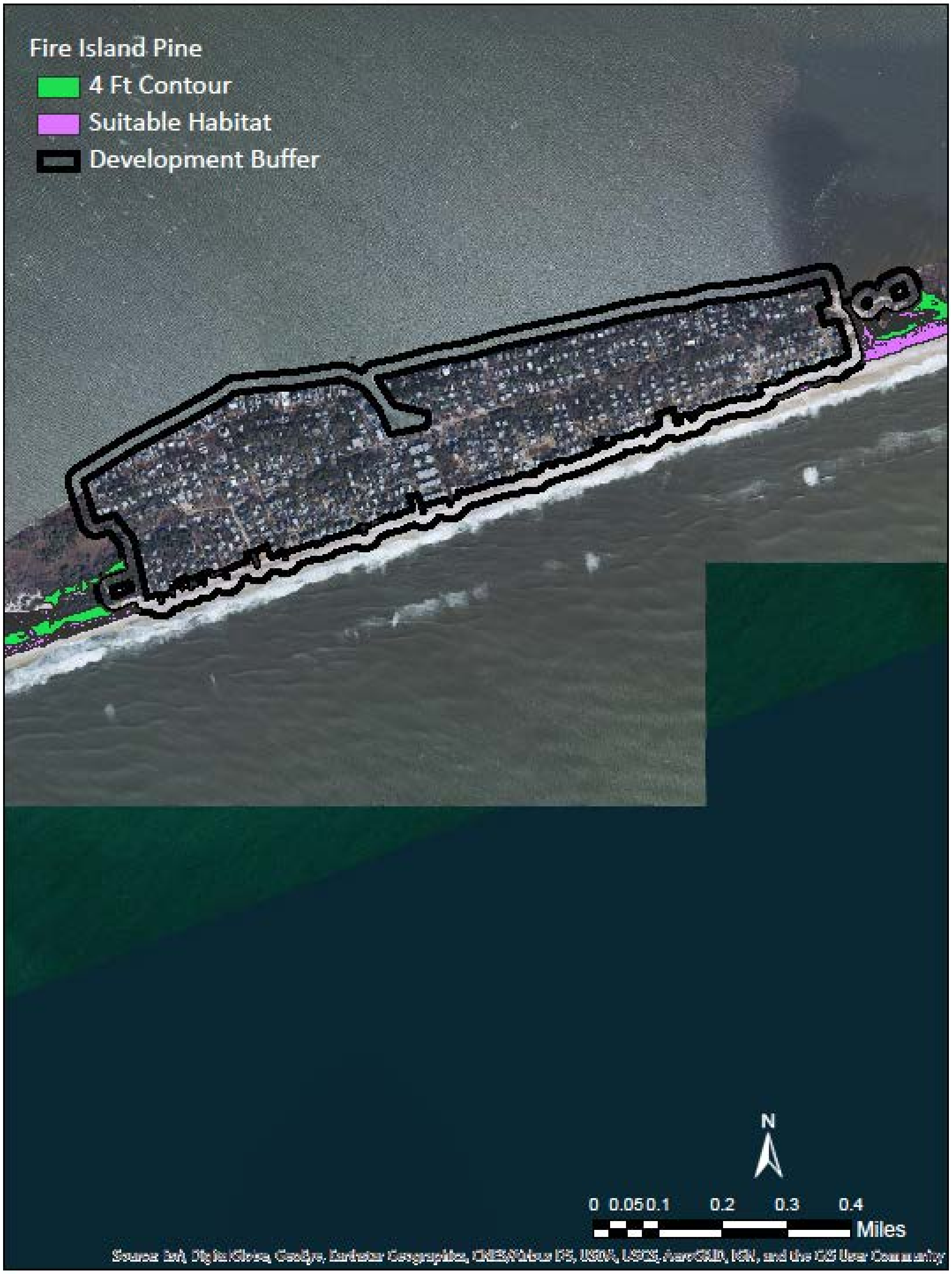
Attachment 1


Saltaire, Fair Harbor, and Dunewood
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.040.09 0.17 0.26 0.34
Miles

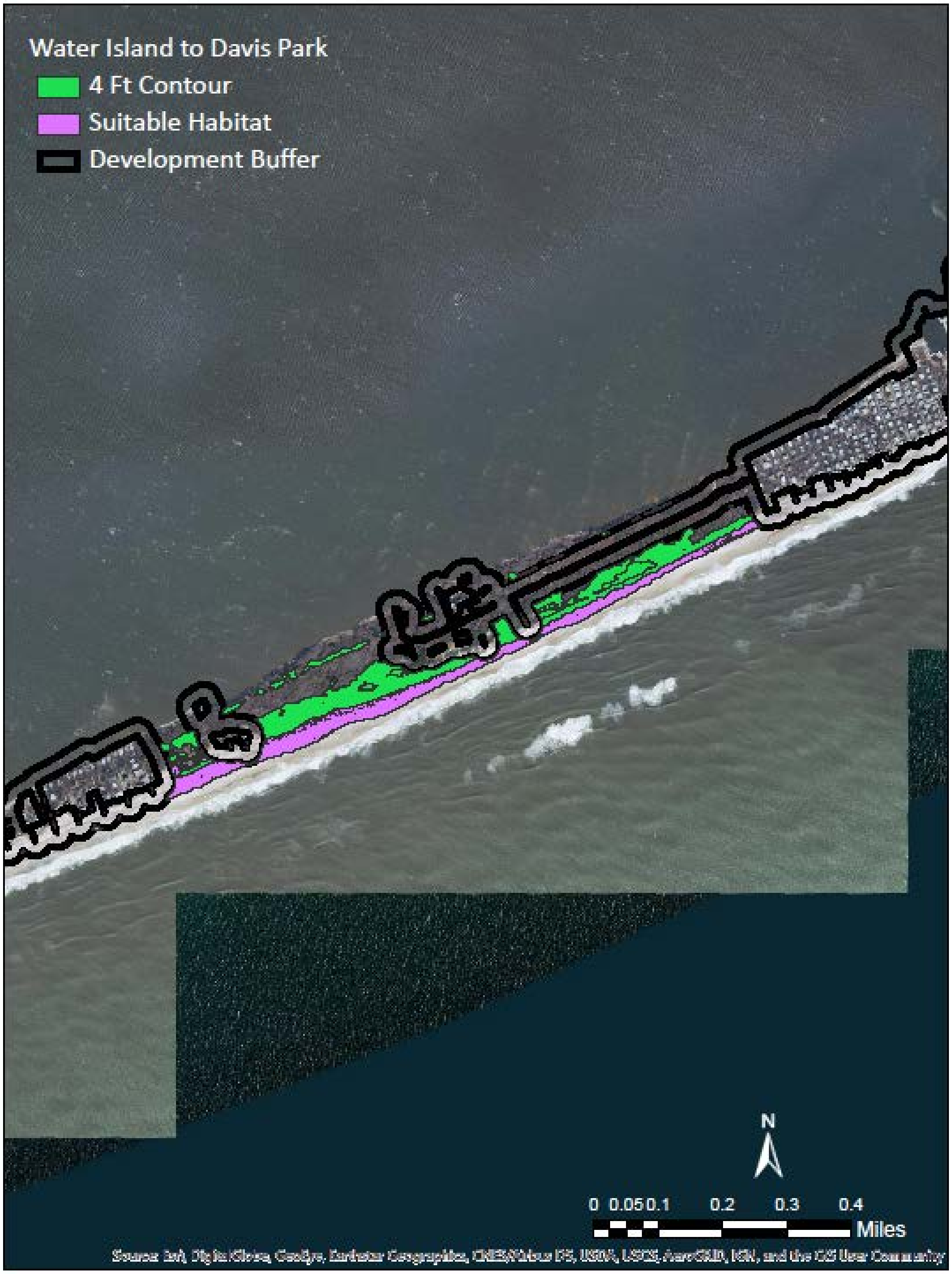

Lonelyville and west Ocean Beach
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.040.07 0.14 0.21 0.28
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

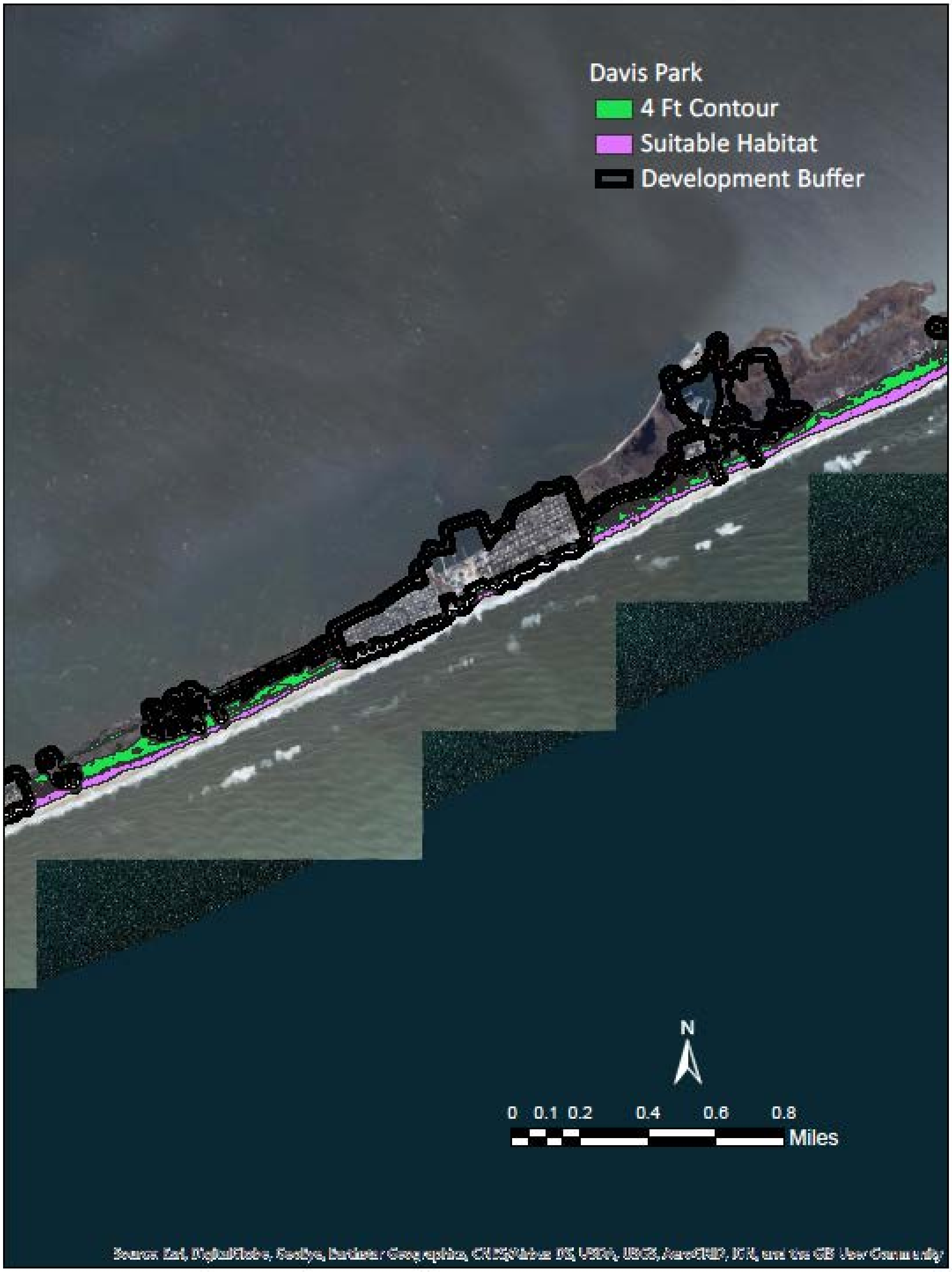

Point O' woods to Cherry Grove
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.070.15 0.3 0.45 0.6
Miles

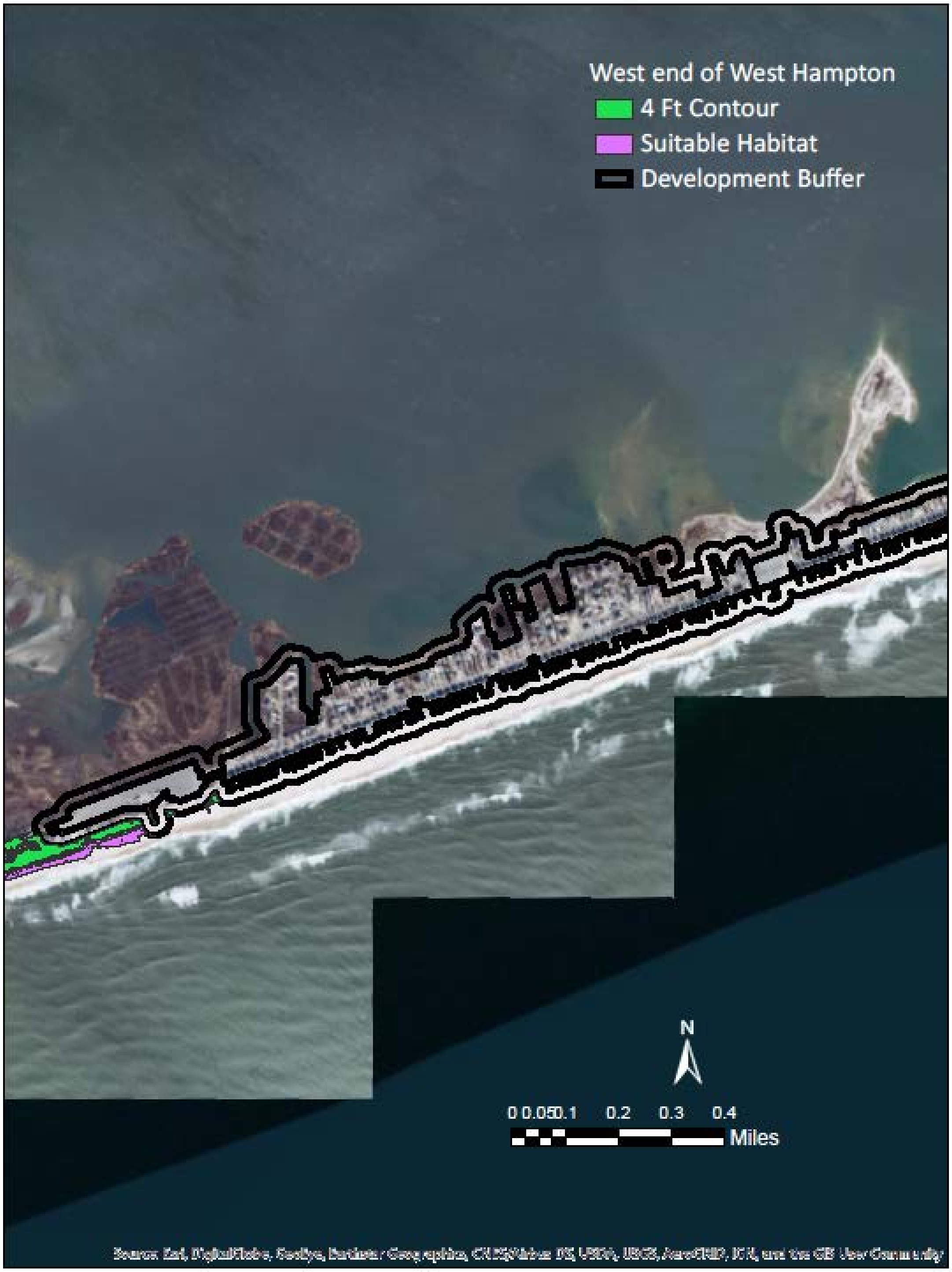

Cherry Grove
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.040.07 0.14 0.21 0.28
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

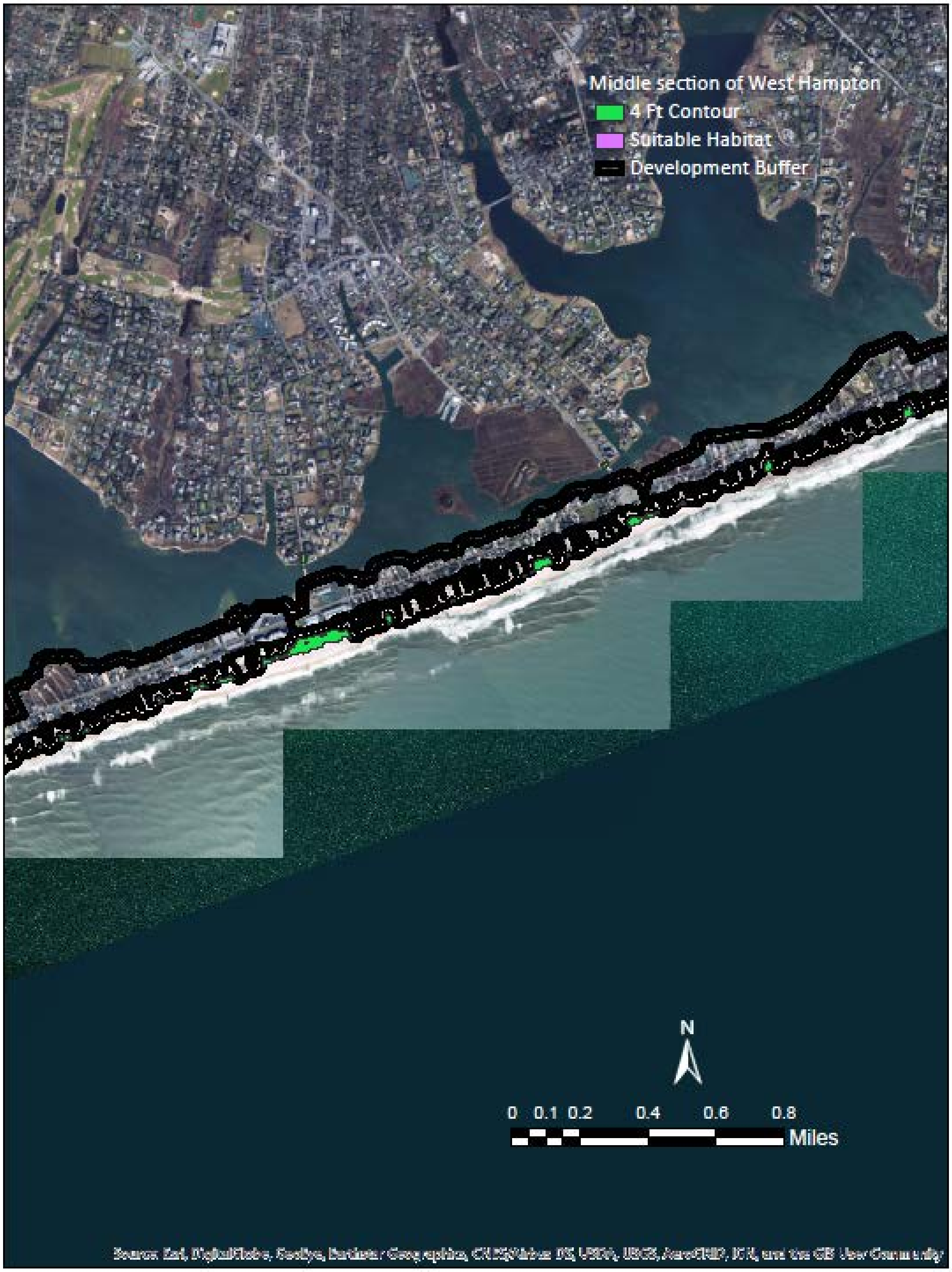

Fire Island Pine
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.05 0.1 0.2 0.3 0.4
Miles

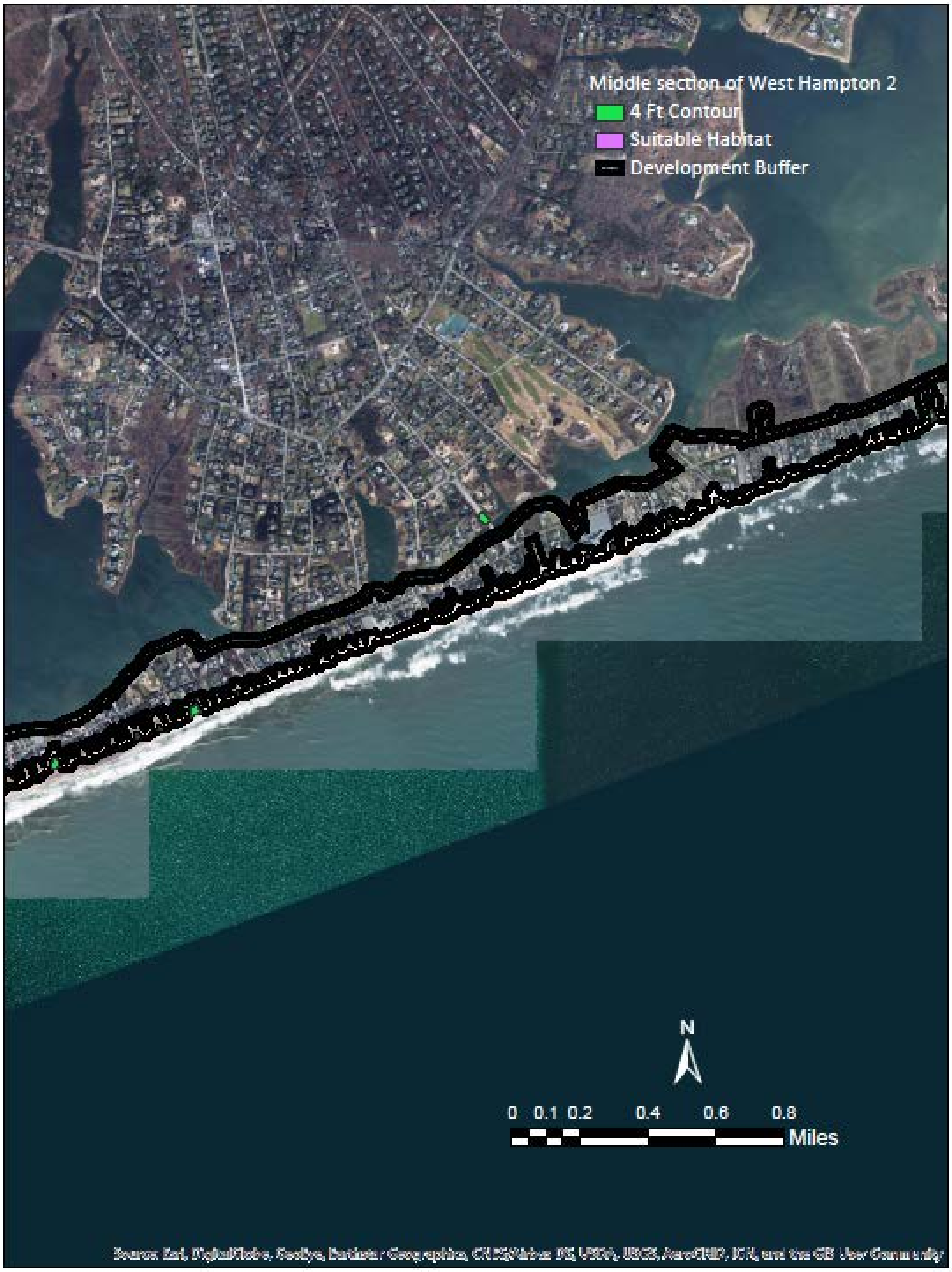

Fire Island Pines to Water Island
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.05 0.1 0.2 0.3 0.4
Miles

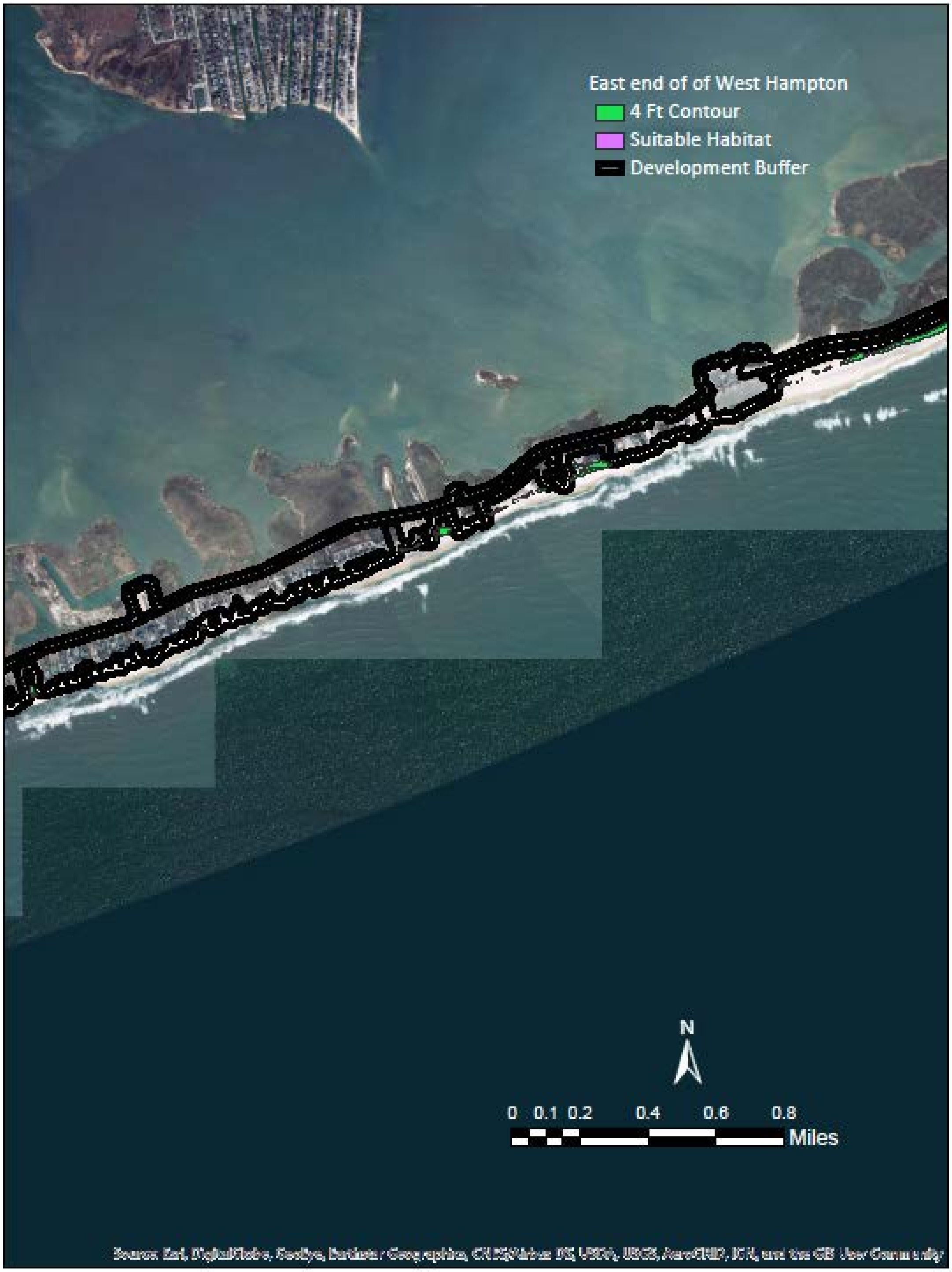

Water Island to Davis Park
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.050.1 0.2 0.3 0.4
Miles


Davis Park
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles

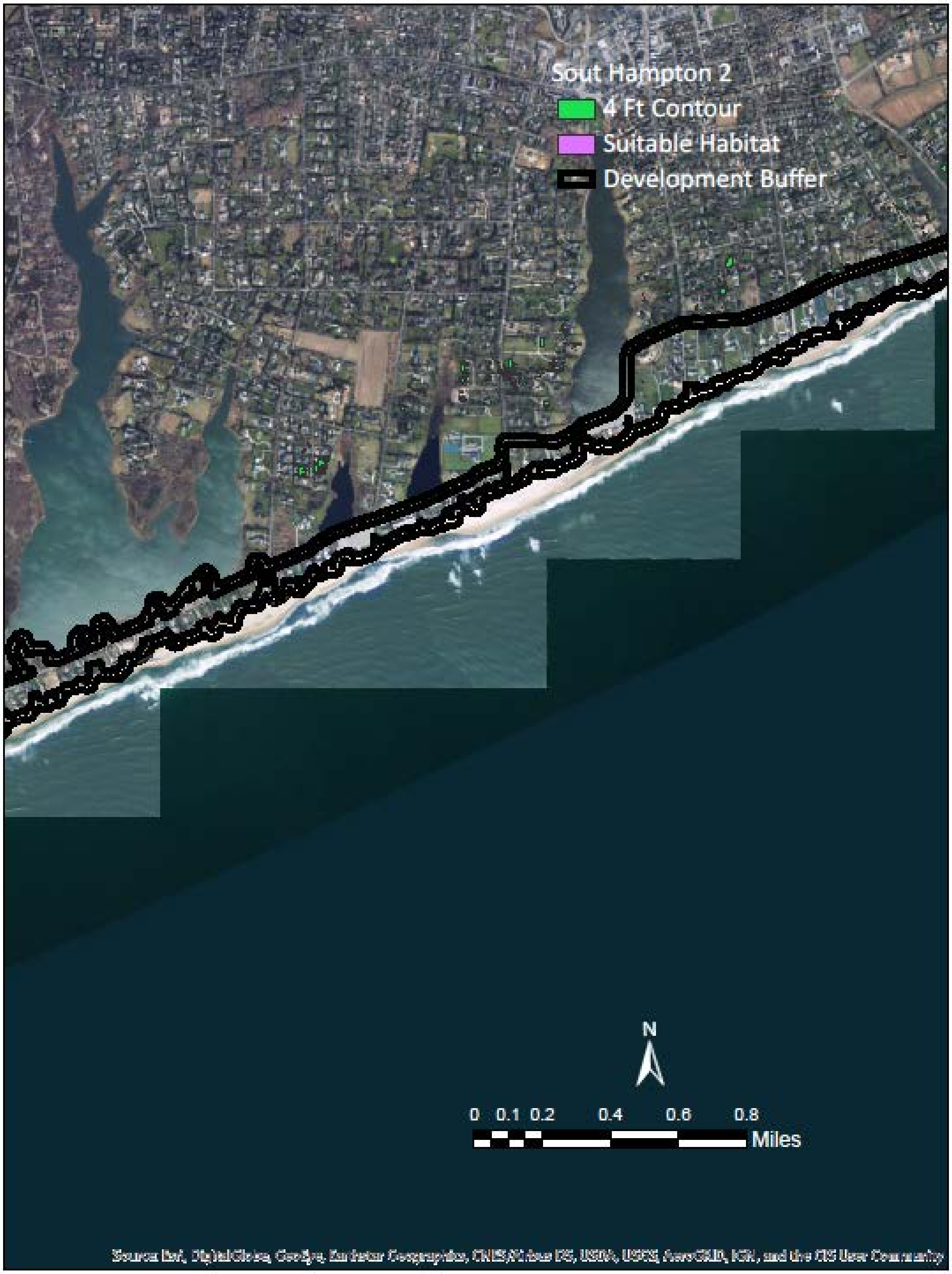

West end of West Hampton
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.050.1 0.2 0.3 0.4
Miles


Middle section of West Hampton
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles


Middle section of West Hampton 2
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles


East end of of West Hampton
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles

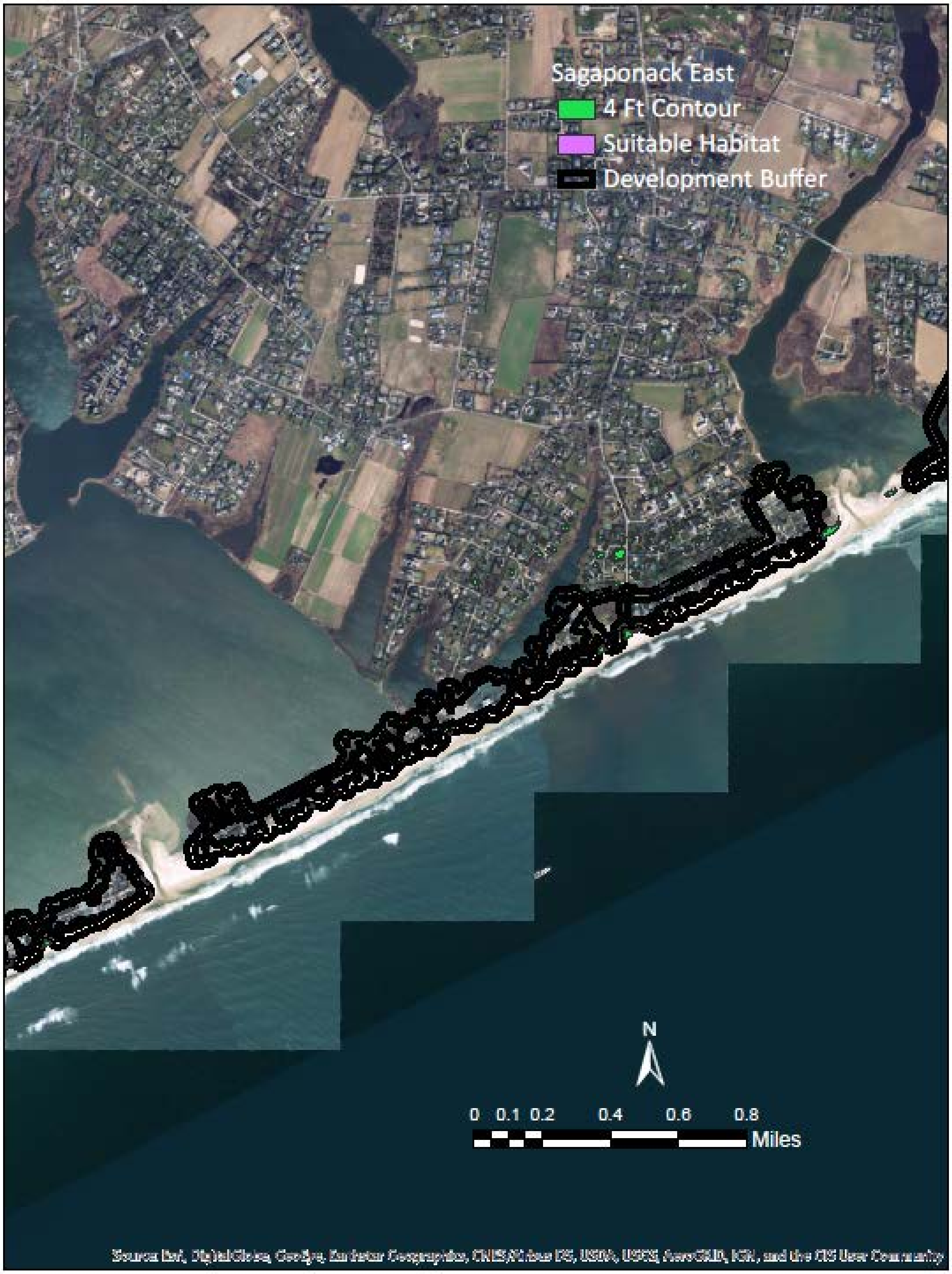

Sout Hampton 1
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



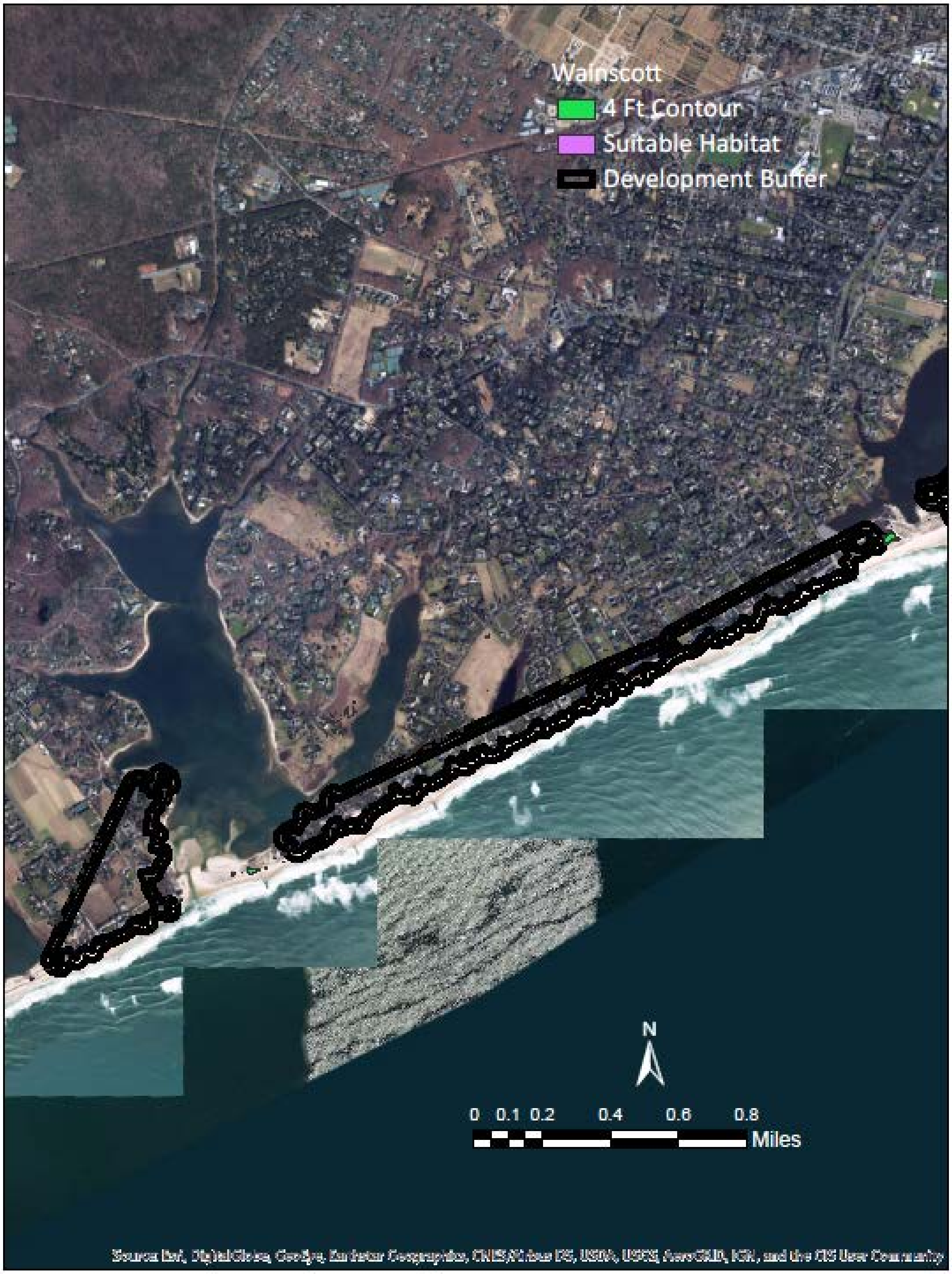
Sout Hampton 2
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Sout Hampton 3
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.050.1 0.2 0.3 0.4
Miles


Sout Hampton to Sagaponack
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

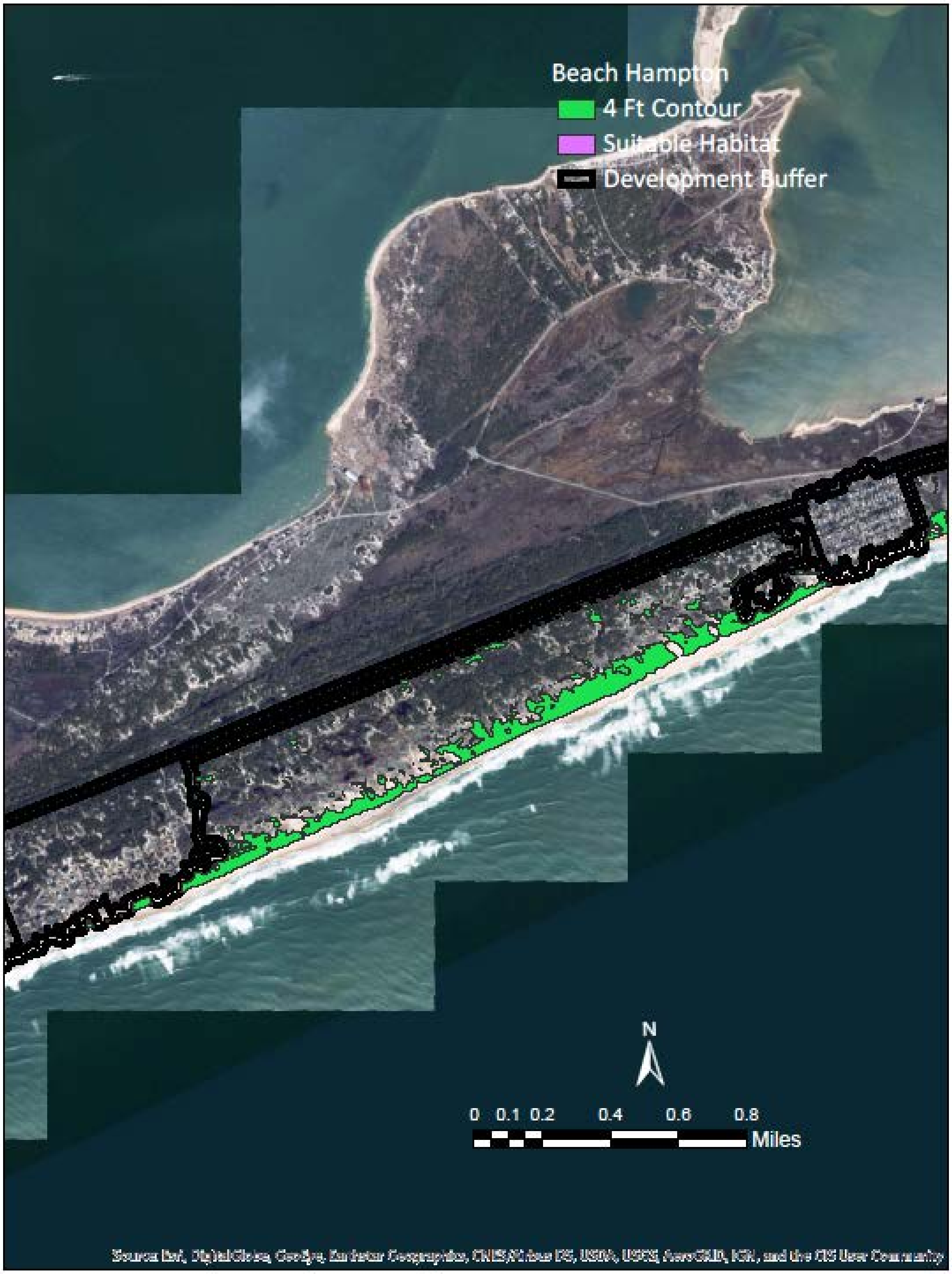

Sagaponack East
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles


Sagaponack West
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles


Wainscott
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


East Hampton
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Amagansett
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Beach Hampton
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.1 0.2 0.4 0.6 0.8
Miles


Napeague
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.15 0.3 0.6 0.9 1.2
Miles


Montauk East
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.15 0.3 0.6 0.9 1.2
Miles


Montauk West
4 Ft Contour
Suitable Habitat
Development Buffer
N
0 0.15 0.3 0.6 0.9 1.2
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Prepared for:
U.S. Army Corps of Engineers
New York District
New York, New York 10278-0090

By:
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office

Preparers:
Julie Slacum and Chris Guy

March 29, 2019

APPENDIX B3

NOAA Protected Resources Division concurrence (USACE letter dated 2/2/2016; NOAA PRD letter dated 3/29/2016)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930-2276

MAR 29 2016

Peter Weppler
Chief, Environmental Analysis Branch
Department of the Army
New York District, Corps of Engineers
Jacob K. Javits Federal Building
New York, NY 10278-0090

Dear Mr. Weppler,

We have completed our consultation under section 7 of the Endangered Species Act (ESA) in response to your letter received February 2, 2016, regarding a Coastal Storm Risk Management Project off the Atlantic Coast of Long Island from Fire Island to Montauk Point (FIMP), New York. We concur with your determination that the proposed project may affect, but is not likely to adversely affect, any species listed by us as threatened or endangered under the ESA of 1973, as amended. Our supporting analysis is provided below.

Proposed Project

The U. S. Army Corps of Engineers (ACOE) is proposing to provide shoreline protection for five reaches of the south shore of Long Island between Fire Island Inlet and Montauk Point, a distance of approximately 83 miles. It includes the barrier island chains from Fire Island Inlet to Shinnecock Inlet, and also the back-bay and lands adjacent to Great South Bay, Moriches Bay, and Shinnecock Bay, which comprise over 200 miles of shoreline. The beaches will be widened to a minimum width of 100 feet, with an elevation of 14 feet above mean sea level. The project will start in April, 2016, and will be finished in January, 2025. No in-water work will occur from April 1 to September 1 of any year.

The study area also includes approximately 126 square miles on the mainland that are vulnerable to flooding. The land based components of the proposed project will have no effect on ESA-listed species and will not be considered as part of this consultation.

The project will involve use of one hopper dredge and one cutterhead dredge. A cutterhead dredge will be use to dredge three inlets for a total of 3,402,000 cubic yards (cy) of material. Approximately 2,341,000 cy of material will be removed from Fire Island Inlet, 512,000 cy from Moriches Inlet, and 549,000 cy from Shinnecock Inlet. The dredged material will be delivered via a pipeline connected to the dredge to surrounding areas of the Inlets and used for inlet management and beach nourishment.

The proposed project will also extract sand using a hopper dredge from six different borrow areas located less than 1.5 miles south of Long Island. The sand will be used for inlet management and beach nourishment. Approximately 3,038,000 cy will be removed from the borrow areas and delivered to the placement sites via a pipeline connected to the dredge. Depths in the borrow areas are approximately 25 - 60 feet. Additionally, stone groins will be repaired using land based equipment.

Common to all hopper dredging activities are:

- All dredges will be equipped with turtle/sturgeon deflectors that have been properly installed in front of the draghead and will be used at all times.
- Starting immediately upon project commencement, all project vessels will have an on deck observer to monitor for Atlantic sturgeon, sea turtles, and whales. Monitoring requirements include checking for turtles or sturgeon (whole or parts) impinged on the draghead, in the hopper, and swimming/present at or near the surface. If the observer on board observes a whale in the vicinity of the vessel during transit throughout the project area, maximum vessel speeds will be limited to 10 knots. If a right whale is observed, the vessel will maintain a 500 yard buffer from the whale. For all other whale species, a 100 yard buffer will be maintained.
- The draghead will remain on the bottom at all times during a pumping action except when: the dredge is not in pumping operation, or, the pumps are completely shut off; the dredge is being re-oriented to the next dredge line during dredging activities; or the vessel's safety is at risk.
- Upon completion of the dredge track line, the drag tender will throttle back on the RPMs of the suction pump engine to idle speed prior to raising the draghead off the bottom so that no flow of material is coming through the pipe into the hopper. Prior to raising the draghead, no suction will remain in the draghead or the dragarm in order to prevent impingement of listed species during the dragarm lifting phase. Prior to actual lifting of the dragarm from the bottom, the draghead will be held firmly on the bottom for 10 to 15 seconds (with no suction) then lifted rapidly to midwater to further reduce the potential for an interaction with an ESA-listed species. The dredge will then be re-oriented quickly to the next dredge line and the draghead will be firmly repositioned on the bottom before bringing the suction pump up to pumping speed.

Description of the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR§402.02). For this project, the action area includes the offshore borrow areas, the vessel transit route within the borrow areas, the area of the pipeline from the dredge to the beach nourishment sites, and the underwater areas where the effects of dredging and fill placement (i.e., increases in suspended sediment) will be experienced. In the vicinity of hopper dredging operations, a near-bottom turbidity plume of resuspended bottom material may extend 2,300 to 2,400 feet down current from the dredge (USACE 1983). In the immediate vicinity of the dredge, a well-defined upper plume is generated by the overflow process. Approximately 1,000 feet behind the dredge, the two plumes merge into a single plume (USACE 1983). By a distance of 4,000 feet from the dredge, plume concentrations are expected to return to background levels (USACE 1983). For cutterhead dredging, the maximum distance of increased suspended sediment is likely to be a distance of 1,000 feet from the dredge (ACOE 1983). We anticipate elevated total suspended sediment (TSS) concentrations associated with the active beach nourishment site to be limited to a narrow area of the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves) up to 1,640 feet down current from the discharge pipe (Burlas *et al.* 2001).

Based on this information, the action area consists of the project footprint of the areas that will be dredged, the vessel transit route within the borrow areas, the area of where the pipeline will be, areas within 4,000 feet down current of the dredging operation, as well as the area within 1,640 feet down current from the site where sediments will be deposited. These areas are expected to encompass all of the direct and indirect effects of the operations. The sediments in the areas to be dredged consist of mostly sand and gravel (90% sand). Benthic resources at the borrow area is limited, but does include a diversity of species including those types considered primary prey species for sturgeon and sea turtles (crustaceans and mollusks). There are no sea grasses and only very sparse SAV at the borrow areas.

NMFS Listed Species in the Project Area

Whales

Federally endangered North Atlantic right, humpback, and fin whales, are seasonally present in the waters off New York. These species use the nearshore, coastal waters of the Atlantic Ocean as they migrate to and from calving and foraging grounds. Humpback and fin whales primarily occur in the waters of New York during the spring, summer and fall months, while the North Atlantic right whale primarily occurs in these waters from November 1 through April 30, although transient right whales can be present outside of this time frame. Although humpback, right, fin whales are not expected to occur in the portions of the action area located in the shallow nearshore waters of New York where sand will be placed, ESA listed species of whales may occur in the vicinity of the borrow areas (i.e., the Atlantic Ocean).

Sea Turtles

Four species of federally threatened or endangered sea turtles under our jurisdiction are found seasonally in the coastal waters of New York: federally threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead (*Caretta caretta*), and the federally endangered Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea*) sea turtles. In general, listed sea turtles are seasonally distributed in coastal U.S. Atlantic waters, migrating to and from habitats extending from Florida to New England, with overwintering concentrations in southern waters. As water temperatures rise in the spring, these turtles begin to migrate northward. As temperatures decline rapidly in the fall, turtles in northern waters begin their southward migration. Sea turtles are expected to be in the waters of New York in warmer months, typically the months of May through November, with the highest concentration of sea turtles present from June through October (Morreale 1999; Morreale 2003; Morreale and Standora 2005; Shoop and Kenney 1992).

Several studies have examined the seasonal distribution of sea turtles in New York waters. In most years, sea turtles begin to arrive in New York waters in June (Morreale and Standora, 1993; Morreale and Burke, 1997). Tracking studies on juvenile Kemp's ridleys demonstrate that all tagged turtles had traveled south from New York coastal waters by the first week in November (Standora *et al.* 1992). In 2002 and 2003, Morreale conducted a study of loggerhead, Kemp's ridley and green sea turtles captured in pound nets fishing in the Peconic Bay area. Sea turtles were not encountered after the last week in October (Morreale 2003). Tracking studies summarized in Morreale and Standora (2005) indicate that loggerhead and Kemp's ridley sea turtles begin leaving New York waters in October and generally by the first week of November, turtles head southward past the Virginia border. Similar migratory patterns are expected for green and leatherback sea turtles (Shoop and Kenney 1992; Morreale 1999). Based on this information, sea turtles may occur in the action area between May through November.

Atlantic Sturgeon

There are five DPSs of Atlantic sturgeon listed as threatened or endangered. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as endangered, while the Gulf of Maine DPS is listed as threatened. The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida.

At around three years of age, subadults exceeding 2.3 feet in total length begin to migrate to marine waters (Bain et al. 2000). After emigration from the natal river/estuary, subadults and adult Atlantic sturgeon travel within the marine environment, typically in waters less than 164 feet in depth, using coastal bays, sounds, and ocean waters (ASSRT 2007). In rivers and estuaries, Atlantic sturgeon typically use the deepest waters available; however, Atlantic sturgeon also occur over shallow (8.2 feet), tidally influenced flats and mud, sand, and mixed cobble substrates (Savoy and Pacileo 2003). Occurrence in these shallow waters is thought to be tied to the presence of benthic resources for foraging.

Based on the above information, adult and subadult Atlantic sturgeon from any of five DPSs could occur in the project area; however, as Atlantic sturgeon spawn in freshwater portions of large rivers and early life stages are not tolerant of salinity, no eggs, larvae or juvenile Atlantic sturgeon occur in the action area.

Effects of the Action

The primary concerns for loggerhead, Kemp's ridley, and green sea turtles is entrainment and loss of forage, while the primary concern for leatherbacks is vessel collision as the dredge transits the borrow area. Due to their large size, whales are not vulnerable to entrainment in dredges; as such, effects of impingement or entrainment on whales will not be considered in this consultation. The primary concern for listed species of whales is the potential for vessel collisions as the dredge transits the borrow area. The primary concerns for Atlantic sturgeon is entrainment, loss of forage, and vessel collision as the dredge transits the borrow area. The potential effects of a temporary increase in turbidity and sedimentation as a result of dredging and beach nourishment on listed species are also discussed below.

The pipeline connecting the dredge to the shore will float on the surface of the water or will be laid on the bottom, presenting no possibility of intake of an ESA-listed species or adverse interaction with an ESA-listed species, and will not present a barrier to ESA-listed species. These effects will not be discussed further in this consultation.

Below, we discuss the effects of both hopper and cutterhead dredging on ESA-listed species and exposure to: (1) entrainment and impingement of Atlantic sturgeon and sea turtles; (2) alteration of listed species prey items and foraging behavior due to dredging; (3) suspended sediment associated with dredging operations. The potential for interactions (i.e., vessel strikes) between project vessels and individual Atlantic sturgeon, whales or sea turtles is discussed separately.

Hopper Dredging: Impingement / Entrainment

Sea Turtles

Loggerhead, Kemp's ridley, and green sea turtles are known to be vulnerable to entrainment and/or impingement in hopper dredges.[1] Factors that are believed to contribute to the likelihood of sea turtle entrainment include: 1) dredge duration (e.g., greater number of interactions associated with longer duration dredging); 2) Hydraulic pump operation (i.e., interactions rates increase with hydraulic pumps operating during the placement/removal of draghead); 3) the location, habitat, and geography of the project site (e.g., open estuarine environment versus confined channel areas); and, 4) the species' use of, and behavior within, the affected location (e.g., foraging, brumating, breeding, resting, transiting).

As the draghead of a hopper dredge operates on the bottom, interactions with sea turtles primarily occur when a sea turtle is foraging or resting on the bottom; these interactions occur more frequently in areas where sea turtle forage is abundant, and thus, sea turtle densities are high. Habitat conditions in the borrow areas are not consistent with the areas where brumation has been documented; therefore, we do not anticipate that brumating sea turtles are present in the project area. Sea turtles are not known to concentrate in, or use the waters of the borrow areas affected by dredging operations as an essential foraging or resting ground; instead it is believed that they use these waters to transit to other waterways of New York. Although sea turtle forage exists within the United States coastal waters of the Atlantic Ocean (e.g., crabs, mollusks, submerged aquatic vegetation (SAV)), there is no optimal foraging habitat within the portion of the action area affected by the sand mining operations. The borrow areas have been used previously as a dredge site. As a result, the benthos in the borrow areas are absent of a diverse and abundant benthic invertebrate community and has very sparse SAV. As such, the borrow areas are unsuitable for sea turtle foraging. Based on the best available information, sea turtle species are not expected to be foraging or resting in these portions of the project area and thus, are not expected to be on the benthos where the draghead of the hopper dredge will be operating. Instead, within the project area, these species of sea turtles are expected to be found in the water column, migrating to and from foraging, breeding, or resting grounds found in nearshore coastal bays and estuaries located outside of the borrow areas (e.g., Long Island bays and estuaries). As sea turtles are not expected to occur within the vicinity of the draghead, the likelihood of an interaction between a sea turtle and the dredge head is extremely unlikely.

In addition to the habitat characteristics of the project area, the location and geography of a project may also affect the likelihood of entrainment. The risk of entrainment is believed to be

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[1] Due to the large size of leatherback sea turtles, leatherback sea turtles are not vulnerable to entrainment in hopper dredges. To date, this species has never been documented entrained in any dredge operation along the U.S. Atlantic Coast (USACE Sea Turtle Warehouse, 2013).

highest in areas where the movements of animals are restricted (e.g., rivers, narrow confined channels) and therefore, where the animal has limited opportunity to move away from the dredge. If these restricted areas also occur within sites in which species are known to concentrate, the likelihood of an interaction further increases. These characteristics; however, are not present within the project area. The borrow areas are situated within the nearshore waters of the Atlantic Ocean, an area we consider an open environment; that is, an unconfined body of water in which the shorelines of the surrounding land masses do not encroach on the body of water to an extent that narrow waterways are created. The distance from the borrow areas to the shoreline is approximately 1.5 mile or less to the north. As dredging operations will occur in an open environment, sea turtle movements will be unrestricted, with ample space surrounding the dredging area for sea turtles to move and avoid the dredge or dredge site and continue normal behaviors in other waterways of New York. Further, because sea turtles are only expected to transit the project area, and not congregate, the density of sea turtles in any portion of the project area is expected to be low. Based on this information, combined with the fact that sea turtles are not expected to occur on the benthos to forage or rest, the potential for an interaction with a dredge is further reduced.

Based on the information above, and the following factors, we conclude that the risk factors that increase the likelihood for sea turtle entrainment are not present. First, hydraulic pumps will be only turned on once the draghead is on the bottom; thereby, directing and maintaining the suction velocity to the benthos of the borrow areas, and thus, within an area where sea turtles are not expected to occur. Second, prior to the actual lifting of the dragarm from the bottom, the draghead will be held firmly on the bottom for 10 to 15 seconds (with no suction) then lifted rapidly to midwater. Third, a turtle deflector draghead will be properly installed in front of the draghead and used at all times. Based on this information, it is extremely unlikely that there will be any impingement or entrainment of sea turtles. Effects of hopper dredging on sea turtles are discountable.

Atlantic Sturgeon

Atlantic sturgeon are known to be vulnerable to entrainment and/or impingement in hopper dredges. Factors that are believed to contribute to the likelihood of Atlantic sturgeon entrainment include: 1) dredge duration (e.g., greater number of interactions associated with longer duration dredging); 2) hydraulic pump operation (i.e., interactions rates increase with hydraulic pumps operating during the placement/removal of draghead); 3) the location, habitat, and geography of the project site (e.g., open estuarine environment versus confined channel areas); and, 4) the species' use of, and behavior within, the affected location (e.g., foraging, overwintering, spawning, resting).

Information suggests that Atlantic sturgeon in the marine environment do not move along the bottom, but instead move further up in the water column during their migratory movements along the coast line. However, Atlantic sturgeon forage on the benthos and as the draghead of a hopper dredge operates on the bottom, an interaction is possible with a foraging Atlantic sturgeon within the area being dredged. Atlantic sturgeon feed on benthic invertebrates (e.g., amphipods, gastropods, annelids, decapods) and occasionally on small fish. Foraging also often occurs at, or near, areas with SAV or shellfish resources. As forage may be present in the project area, opportunistic foraging may occur at the site. If an Atlantic sturgeon is foraging opportunistically within this portion of the project area, there could be a risk of interacting with the dredge. However, because the dredge moves very slowly, and there is ample space for movements (see below), it is likely that subadult or adult Atlantic sturgeon can easily avoid the dredge. This assumption is supported by recent monitoring work, completed in the James River (Virginia) and the Delaware River (New Jersey) (Cameron 2010; ERC 2011), as well as work undertaken on a related species, the white sturgeon, in the Columbia River (Parsley and Popoff 2004). During these studies, the movements of tagged Atlantic, white, and/or shortnose sturgeon were tracked near the dredge (mechanical and hydraulic). No interactions between sturgeon and the dredge occurred. Some tagged sturgeon moved through the area where the dredge was operating multiple times during the study, while others remained within the vicinity of the dredging operation with no incidence. The risk is further increased at overwintering areas because evidence suggests that sturgeon may be less responsive to stimuli while overwintering, which may make it less likely that sturgeon would avoid a dredge during this time period. However, overwintering grounds are not known to exist in the borrow areas and therefore, no overwintering sturgeon were likely to occur in the portion of the project area where dredging operations will occur. As a result, these increased risk factors are not present.

In addition to the habitat characteristics of the project area, the location and geography of a project may also affect the likelihood of entrainment. The risk of entrainment is believed to be highest in areas/environments where the movements of animals are restricted (e.g., rivers, narrow confined channels, small semi-enclosed harbors) and therefore, where the animal has limited opportunity to move away from the dredge. If these restricted areas also occur within sites in which a species is known to concentrate, the likelihood of an interaction further increases. These characteristics; however, are not present within the project area. The borrow areas are situated within the Atlantic Ocean, an area we consider an open ocean environment; that is, an unconfined, body of water in which the shorelines of the surrounding land masses do not encroach on the body of water to an extent that narrow waterways are created. The distance from the borrow areas to the nearest shoreline is approximately 1.5 miles or less to the north. As dredging operations will occur in an open environment, Atlantic sturgeon movements will be unrestricted, with ample space surrounding the project area for sturgeon to move and avoid the dredge, or dredge site and continue normal behaviors in other waterways of New York. Further, because Atlantic sturgeon are expected to be using the borrow areas only as they move to other areas, the density of Atlantic sturgeon in any portion of the project area is expected to be low and thus, if an Atlantic sturgeon occurs in the area to be dredged, there is ample space and ability for the sturgeon to avoid the dredge. Based on this information, combined with the fact that Atlantic sturgeon are not expected to occur at the bottom of the borrow areas, the potential for an interaction with a dredge is further reduced.

Based on the information above, and the following factors, we conclude that the risk factors that increase the likelihood for Atlantic sturgeon entrainment are not present. First, hydraulic pumps will only be turned on once the draghead is on the bottom, thereby, directing and maintaining the suction velocity to the benthos of the borrow areas, and thus, within an area where ESA listed species are not expected to occur. Second, prior to the actual lifting of the dragarm from the bottom, the draghead will be held firmly on the bottom for 10 to 15 seconds (with no suction) then lifted rapidly to midwater. Based on this information, it is extremely unlikely that any impingement or entrainment of Atlantic sturgeon will occur. Effects of dredging on Atlantic sturgeon are discountable.

Cutterhead Dredging: Impingement / Entrainment

Sea Turtles

Sea turtles are not known to be vulnerable to entrainment in cutterhead dredges, presumably because they are able to avoid the relatively small intake area and low intake velocity. Thus, if a sea turtle were to be present at the dredge site, it would be extremely unlikely to be injured or killed as a result of dredging operations carried out by a hydraulic cutterhead dredge. Based on this information, effects to sea turtles from the hydraulic cutterhead dredge are discountable.

Atlantic Sturgeon

Impingement or entrainment in hydraulic cutterhead dredges may kill or injure sturgeon. In order for sturgeon to be impinged or entrained in the cutterhead dredge, sturgeon would have to be on the bottom. Sturgeon do occur on the bottom, especially while foraging; however, studies indicate that small, juvenile sturgeon (less than 0.6 foot fork length) need to be within 4.9 feet to 6.6 feet of the cutterhead for there to be any potential entrainment (Boysen and Hoover 2009). Sturgeon in the action area are considerably bigger (subadults and adults), and as they are stronger swimmers, are even less vulnerable to being overcome by the suction of the dredge and to becoming entrained. Because the dredge moves slowly and sturgeon are highly mobile, strong swimmers, it is likely that sturgeon would easily be able to avoid the dredge. This assumption is supported by recent monitoring work completed in the James River (Virginia) and the Delaware River (New Jersey) (Reine *et al.* 2014; ERC 2012). During these two studies, while the movements of tagged sturgeon were traced near a dredge, there were no interactions between tagged sturgeon and the dredge. Furthermore, tagged sturgeon moved through the dredge area during the study multiple times while the dredge was operating.

While entrainment of smaller sturgeon in cutterhead dredges has been observed (as evidenced by the presence of a few individual shortnose sturgeon at the Money Island Disposal Site in the Delaware River in 1996 and 1998), these instances are rare and have been limited to dredging events that occur near sturgeon overwintering areas where sturgeon are known to form dense aggregations. However, although sturgeon may be present in the action area year round, the action area is not a known overwintering area for Atlantic sturgeon. The risk of entrainment is also higher for small fish, including early life stages and small juveniles. Because these life stages are not present in the action area and the smallest sturgeon present would be at least 2.3 feet (the size at which we expect them to begin migrations from their natal river), the risk of entrainment is minimal in the action area. Increased risk factors (i.e., small fish, overwintering area) are not present in the action area, overall. Therefore, it is extremely unlikely that any sturgeon would be impinged or entrained in a cutterhead dredge operating within the project site; effects to sturgeon from the proposed hydraulic dredging operations are discountable.

Dredging, Beach Nourishment, Inlet Management, and Fill Placement Effects on Foraging and Migration

Whales

ESA listed species of whales may be present within the borrow areas where dredging will occur. Because whales forage upon pelagic prey items (e.g., krill, copepods), dredging and its impacts on the benthic environment will not have any direct effects on whale prey/foraging items. Additionally, the proposed project will have an observer on board and dredging operations will be stopped if a whale is in the vicinity of the project. Therefore, as dredging operations will not be undertaken within the vicinity of ESA listed species of whales, migratory behaviors of ESA listed whales will also not be affected. ESA listed species of whales will not occur in the shallow, nearshore area where fill placement for the repair of the groins will occur and will not experience any effects from fill placement activities. As such, the remainder of this section will discuss the effects of dredging and the alteration of sea turtle and Atlantic sturgeon foraging habitat.

Atlantic Sturgeon and Sea Turtles
Dredging can cause effects on Atlantic sturgeon and sea turtles by reducing prey species through the alteration of the existing biotic assemblages and habitat. As forage for both species may be present in the project area (e.g., polychaetes, bivalves, and gastropods), opportunistic foraging may occur at the site and thus, dredging and the placement of fill (e.g., beach nourishment, groin repair) may cause effects to sturgeon and sea turtles by reducing prey species through the alteration of existing biotic assemblages and habitat. This reduction, however, will be temporary (i.e., recolonization will begin within two months, with complete recolonization in a year; Burlas *et al.* 2001; Guerra-Garcia and Garcia-Gomez 2006). Due to the limited benthic foraging in the borrow area, some nearshore areas may be more desirable to certain turtles or sturgeon due to prey availability. The pipeline may also lay on the ocean floor causing a temporary reduction in available prey. There is no information to indicate that the dredged areas, sand placement sites, or pipeline placement sites have more abundant sturgeon and turtle prey or better foraging habitat than other surrounding areas. The assumption can be made that sturgeon and sea turtles are not likely to be more attracted to the waters of the action area than to other foraging areas in the waters of NY and will be able to find sufficient prey in these alternate areas.

While dredging, sand placement activities, and the placement of the pipeline may temporarily disrupt normal feeding behaviors for sturgeon and sea turtles by causing them to move to alternate areas, these activities are not likely to remove critical amounts of prey resources. Based on this and the best available information, we believe the impacts of dredging, fill operations, and placement of the pipeline on Atlantic sturgeon and sea turtle foraging are insignificant.

During dredging operations, ESA-listed species will avoid the immediate area when dredging, pipeline placement, and fill placement takes place. The proposed action will not alter the habitat in any way that prevents sturgeon or sea turtles from transiting the action area to other near-by areas suitable for foraging. Additionally, as the sand will be placed along the shoreline, placement of fill will not impede the transiting or passage of sea turtles or Atlantic sturgeon through the area. Based on this and the best available information, we believe the impacts of dredging, sand placement, and pipleine operations on Atlantic sturgeon and sea turtle migration are insignificant.

Water Quality Effects: Dredging, Beach Nourishment, Inlet Management, and Groin Construction
Beach Nourishment and Inlet Management
Beach nourishment and inlet management operations require the placement of large quantities of

sand below the mean high water mark of a shoreline. The placement of dredged material along beaches or shorelines cause an increase in localized turbidity in the nearshore environment. Nearshore turbidity impacts from fill placement are directly related to the quantity of fines (silt and clay) in the nourishment material. As the material from the borrow areas consists of beach quality sand of similar grain size and composition as indigenous beach sands, we expect short suspension time and containment of sediment during and after placement activities. As such, turbidity impacts would be short-term (*i.e.*, turbidity impacts will dissipate completely within several hours of the cessation of operations (Greene 2002)) and will be spatially limited to the vicinity of the dredge outfall pipe, the pump out buoy/mooring station, and dredge anchor points.

The Atlantic States Marine Fisheries Commission (Greene 2002) review of the biological and physical impacts of beach nourishment cites several studies that report that the turbidity plume and elevated total suspended solids (TSS) levels drop off rapidly seaward of the sand placement operations. Wilber *et al.* (2006) evaluated the effects of a beach nourishment project along the coast of northern New Jersey and reported that maximum bottom surf zone and nearshore TSS concentrations related to nourishment activities were 64.0 mg/L and 34.0 mg/L, which were only slightly higher than background maximum bottom TSS concentrations in the surf and nearshore zones on unnourished portions of the beach (i.e., less than 20.0 mg/L). Additionally, Wilber *et al.* (2006) reported that elevated TSS concentrations associated with the active beach nourishment site were limited to within 1,312 feet of the discharge pipe in the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves), while other studies found that the turbidity plume and elevated TSS levels are expected to be limited to a narrow area of the swash zone up to 1,640 feet down current from the discharge pipe (Schubel *et al.* 1978; Burlas *et al.* 2001). Based on this and the best available information, turbidity levels created by beach nourishment and inlet management operations along the shoreline are expected to be between 34.0 to 64.0 mg/l; limited to an area approximately 1,640 feet down current from the area of sand placement; and, are expected to be short term, only lasting several hours.

Stone Fill Placement

The placement of stone fill for the groin repair will be done at depths of up to 20 feet from land based equipment and will disturb shoreline sediments and may cause a temporary increase in suspended sediment in the nearshore area. However, suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity will be short term. Turbidity levels associated with any sediment plume are expected to be only slightly elevated above background levels. The equipment used will place the stone at slow speeds which will allow any ESA-listed species to avoid being directly struck by the placement of fill. Additionally, this activity will take place in a shallow area and any species in the vicinity is expected to move away from the construction activities prior to the placement of any fill. Based on this information, effects of stone placement to ESA-listed species are extremely unlikely, and therefore, discountable.

Dredging

Dredging operations cause sediment to be suspended in the water column. This results in a sediment plume in the water, typically radiating from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (ACOE 1983).

Cutterhead Dredging
Based on a conservative total suspended solids (TSS) background concentration of 5 mg/L, modeling results of cutterhead dredging indicated that elevated TSS concentrations (i.e., above background levels) would be present throughout the bottom six feet of the water column for a distance of approximately 1,000 feet (USACE 1983). Based on these analyses, elevated suspended sediment levels are expected to be present only within a 1,000 foot radius of the location of the cutterhead dredge. Turbidity levels associated with cutterhead dredge sediment plumes typically range from 11.5 to 282 mg/L with the highest levels detected adjacent to the cutterhead dredge and concentrations decreasing with greater distance from the dredge (Nightingale and Simenstad 2001).

Hopper Dredging
Resuspension of fine-grained dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. In the vicinity of hopper dredge operations, a near-bottom turbidity plume of resuspended bottom material may extend 2,300 to 2,400 feet down current from the dredge (USACE 1983). In the immediate vicinity of the dredge, a well-defined upper plume is generated by the overflow process. Approximately 1,000 feet behind the dredge, the two plumes merge into a single plume (USACE 1983). Suspended solid concentrations may be as high as several tens of parts per thousand (ppt; grams per liter) near the discharge port and as high as a few parts per thousand near the draghead. In a study done by Anchor Environmental (2003), nearfield concentrations ranged from 80.0-475.0 mg/l. Turbidity levels in the near-surface plume appear to decrease exponentially with increasing distance from the dredge due to settling and dispersion, quickly reaching concentrations less than 1 ppt. By a distance of 4,000 feet from the dredge, plume concentrations are expected to return to background levels (USACE 1983). Studies also indicate that in almost all cases, the vast majority of resuspended sediments resettle close to the dredge within one hour, and only a small fraction takes longer to resettle (Anchor Environmental 2003).

Effects on Whales, Atlantic Sturgeon, and Sea Turtles
No information is available on the effects of TSS on juvenile and adult sea turtles. Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993).

TSS is most likely to affect sea turtles, subadult and adult Atlantic sturgeon, or whales if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle or sturgeon prey. As whales, sturgeon, and sea turtles are highly mobile, they are likely to be able to avoid any sediment plume and any effect on their movements is likely to be insignificant. Additionally, the TSS levels expected from dredging (11.5 to 475.0 mg/L) or beach nourishment/inlet management (34.0 to 64.0 mg/l) are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical; see summary of scientific literature in Burton 1993). While the increase in suspended sediments may cause whales, Atlantic sturgeon, and sea turtles to alter their normal movements, any change in behavior is not able to be measured or detected, as it will only involve minor movements that alter their course out of the sediment plume which will not disrupt any essential life behaviors. Based on this information, we believe the effects of suspended sediment on whales, Atlantic sturgeon, and sea turtles resulting from increased turbidity from dredging and beach nourishment operations are insignificant.

Effects of Vessel Interactions

Whales, sea turtles, and sturgeon may be injured or killed as a result of being struck by boat hulls or propellers. The factors relevant to determining the risk to these species from vessel strikes vary, but may be related to the size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of individuals in the area (e.g., foraging, migrating, overwintering, etc.). We have considered the likelihood that an increase in vessel traffic associated with the project increases the risk of interactions between listed species and vessels in the project areas, compared to baseline conditions. The use of one hopper dredge and one cutterhead dredge will cause a small, localized, temporary increase in vessel traffic. Given the large volume of traffic in the project area, the increase in traffic associated with the projects is extremely small. Based on this information, we believe the effects of vessel traffic on whales, sea turtles, and sturgeon from dredging operations are insignificant.

Conclusion

Based on the analysis that any effects to ESA-listed species will be insignificant or discountable, we concur with your determination that the proposed project is not likely to adversely affect any listed species under our jurisdiction. Therefore, no further consultation pursuant to section 7 of the ESA is required. Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) If a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted. If there is any incidental take of a listed species, reinitiation would be required. Should you have any questions regarding these comments, please contact Daniel Marrone at Daniel.Marrone@noaa.gov or by phone (978-282-8465).

Technical Assistance for Proposed Species

On March 23, 2015, we published a proposed rule to list three distinct population segments (DPS) of green sea turtles as endangered and eight distinct population segments of green sea turtles as threatened, including the North Atlantic DPS (80 FR 15272). This rule, when finalized, would replace the existing listing for green sea turtles. Once a species is proposed for listing, the conference provisions of the ESA may apply (see ESA section 7(a)(4) and 50 CFR § 402.10). Conference is defined as "a process which involves informal discussions between a Federal agency and the Service... regarding the impact of an action on proposed species or proposed critical habitat and recommendations to minimize or avoid the adverse effects" (50 CFR § 402.02). Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat (50 CFR § 402.10).

Currently, green sea turtles are listed as threatened, except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green sea turtles are currently considered endangered wherever they occur in U.S. waters. In the analysis above, we have considered effects to the current global listing of green sea turtles. Green sea turtles in the action area are from the North Atlantic DPS. As explained above, all effects to green sea turtles will be insignificant and discountable, and the proposed action will not result in the injury or mortality of any green sea turtles; as this determination was based on the potential effects to individuals, the proposed change in status for these sea turtles (i.e., from endangered to threatened) would not change these determinations. As all effects of the proposed action are insignificant and discountable, and the proposed action will not result in the injury or mortality of any green sea turtles, the action is not likely to appreciably reduce the survival and recovery of any DPS of green sea turtle, including the North Atlantic DPS. Therefore, it is not reasonable to anticipate that this action would be likely to jeopardize the continued existence of any DPS of green sea turtles. As such, we have determined that no conference is necessary for green sea turtles.

Essential Fish Habitat Comments

NMFS Habitat Conservation Division (HCD) is responsible for overseeing programs related to Essential Fish Habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act and other NOAA trust resources under the Fish and Wildlife Coordination Act. HCD will provide comments separately on this project. If you wish to discuss this further, please contact Karen Greene at (732) 872-3023 or Karen.Greene@Noaa.gov.

Sincerely,

for Kimberly B. Damon-Randall
Assistant Regional Administrator
for Protected Resources

EC: Marrone, GAR/PRD
Greene, GAR/HCD
Gallo, ACOE

File Code: Section 7\ Non-Fisheries\ACOE\Informal\ 2016\New York\Fire Island to Montauk Point (FIMP)PCTS: NER-2016-13119

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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

Environmental Analysis Branch

Ms. Kim Damon-Randall
Assistant Regional Administrator for Protected Resources
United States Department of Commerce
National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Northeast Region
55 Great Republic Drive
Gloucester, MA 01930-2276

SUBJECT: Atlantic Coast of Long Island, Fire Island to Montauk Point (FIMP) Coastal Storm Risk Management Project

Dear Ms. Damon-Randall:

In compliance with our agencies' commitment to streamline Endangered Species Act (ESA) coordination, the U.S. Army Corps of Engineers, New York District (USACE-NYD) is submitting a request for informal Section 7 consultation on the above referenced project.

The New York District determined that the proposed action may affect, but is not likely adversely affect ESA listed species under your jurisdiction that may occur in the project area. Please see the Attachment for our Determination of Effects statement for the FIMP project.

It is requested that your office concur with the USACE-NYD determination. We thank you for your coordination and cooperation on this action. Additional information about the project is located at: www.nan.usace.army.mil/FIMP. If there are any questions or you require clarification on any of our submittals please do not hesitate to contact Jenine Gallo, Regional Technical Specialist at 917-790-8617, Catherine Alcoba, Section Chief at 917-790-8216 or Peter Weppler, Branch Chief at 917-790-8634.

Encl.

Sincerely,

Peter Weppler
Chief, Environmental Analysis Branch

Attachment

Fire Island to Montauk Point

1. *Project Description*

The Fire Island Inlet to Montauk Point, NY, Combined Beach Erosion Control and Hurricane Protection Project (FIMP) was authorized by the River and Harbor Act of 14 July 1960. The authorization 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, a distance of about 83 miles, 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.

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 1960. The project is being reformulated to identify a long-term solution to manage the risk of coastal storm damages along the densely populated and economically valuable south shore of Long Island, New York in a manner which balances the risks to human life and property, while maintaining, enhancing, and restoring ecosystem integrity and coastal biodiversity, and achieving multiple agency objectives.

There is a long history of damaging storms along the south shore of Long Island, as well as many efforts to mitigate the damages, including construction of several features of the authorized FIMP project that are described later in this chapter. The study area also includes critical coastal habitat and environmentally sensitive areas, such as the Fire Island National Seashore and the Smith Point County Park.

The project need has been demonstrated by repeated storms and breaches in the study area and the most recent impacts of Hurricane Sandy. A coordinated effort is necessary to reduce uncoordinated efforts to reduce vulnerability by various agencies and municipalities.

The Study Area extends from Fire Island Inlet east to Montauk Point along the Atlantic Coast of Suffolk County, Long Island, New York, a distance of about 83 miles (Figure 1.). It includes the barrier island chains from Fire Island Inlet to Shinnecock Inlet, and also the back-bay and lands adjacent too Great South, Moriches, and Shinnecock Bays, which comprise over 200 miles of shoreline that comprises the back bay and estuary system. The study area includes about 126 square miles on the mainland that are vulnerable to flooding.

Within the study area, ocean shoreline sand generally moves east to west alongshore, in response to waves, and currents during normal conditions and during storms. This alongshore movement of sand maintains the prevailing shoreline conditions. In addition to alongshore movement, sediment is also exchanged in the cross-shore direction, through erosion and accretion of the beach and dune, exchange of sand through tidal inlets, and during large storm events through the episodic transport of sand over the island through overwash or breaching.

There has been extensive development on both the barrier islands and the mainland floodplains and significant modifications to the natural systems and coastal processes. These include constructing jetties and providing navigation channels through Fire Island, Moriches, and Shinnecock Inlets and within the bays; constructing of groins, seawalls, revetment, bulkheads and other structures along the ocean and bays, placing fill and sand along the beaches; and ditching of wetlands for mosquito control.

The Study Area includes portions of the Towns of Babylon, Islip, Brookhaven, Southampton and Easthampton and 12 incorporated Villages. The Fire Island National Seashore (FIIS), the Poospatuck Indian Reservation and the Shinnecock Indian Reservation are all within the study area. The study area contains over 46,000 buildings, including 42,600 homes and more than 3,000 businesses. There are 60 schools, 2 hospitals, and 21 firehouses and police stations in the study area. Of the buildings within the study area, more than 9,000 fall within the modeled 100-yr floodplain (storm with a 1% probability of occurring in any given year, based upon current modeling).

Approximately 150,000 people reside within the coastal 100-year floodplain of the South Shore of Suffolk County (2010 U.S. Census). The study area is also includes a popular summer recreation area with a large seasonal influx of beachgoers and visitors, as well as businesses which support the year round and seasonal population of the area.

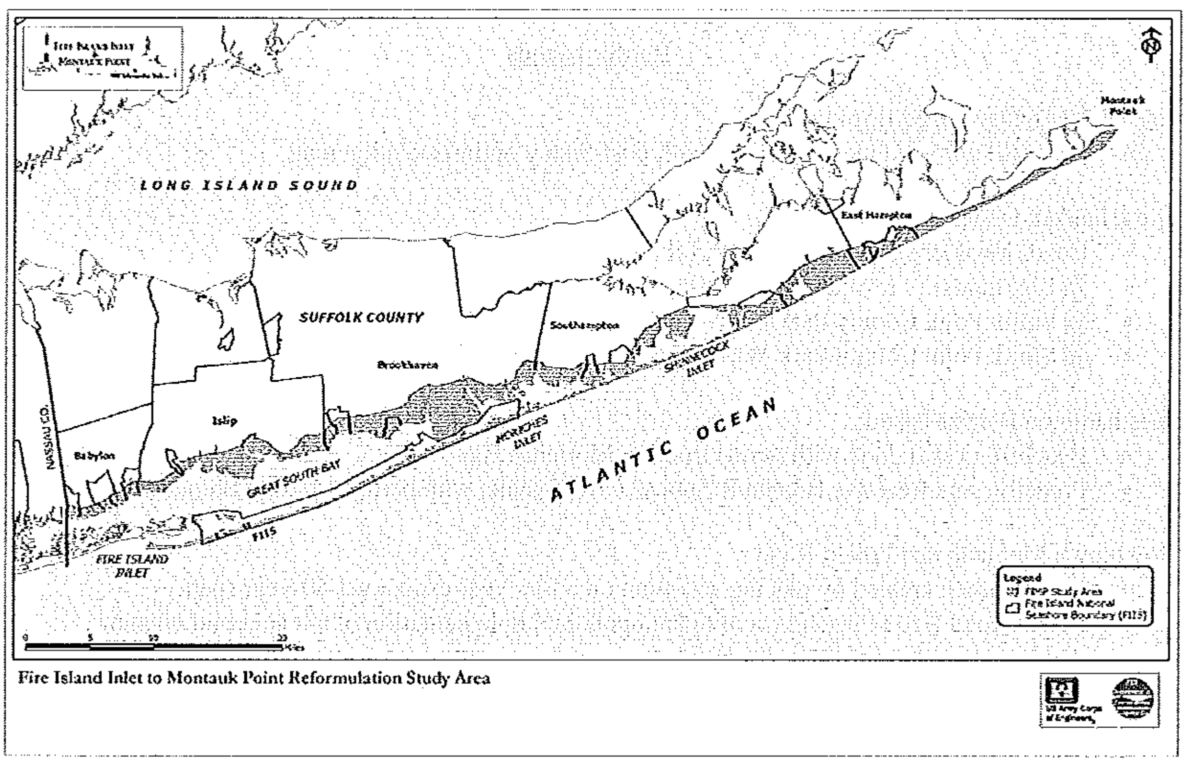

Figure 1. FIMP project area.

2. *Tentatively Selected Plan (TSP)*

The TSP for the FIMP project area is comprised of the following physical components:

Inlets: Fire Island, Moriches, Shinnecock

- Additional dredging of the ebb shoal, outside navigation channel, with downdrift placement;
- Placement of a +13 ft dune and berm, as needed in identified placement areas;

Mainland Non-Structural

- 10-year floodplain non-structural building retrofits, floodproofing, relocation, and acquisition
- Road raising in 4 locations
    - Amityville 6,600 ft
    - Lindenhurst 5,300 ft
    - Lindenhurst 9,000 ft
    - Mastic Beach 10,500 ft

Barrier Islands

Fire Island @ Developed Locations

- Beachfill (+15 ft dune with berm) with post-Sandy optimized alignment

Fire Island @ Undeveloped Locations

- Conditional Breach Response (+9.5 ft berm only)
- @ Lighthouse (+13 ft dune and berm)
- @ Smith Point County Park East - sand bypassing
- @ Smith Point County Park West - short term beachfill in western, developed section

Westhampton Barrier Island:

- Beachfill (+15 ft dune with berm) fronting Moriches Bay
- Proactive and Reactive Breach Response (+13 ft dune, with berm), fronting Shinnecock Bay

Downtown Montauk and Potato Road

- Feeder beach created by placing sediment on a four year cycle over 50-year span.
- Potato Road feeder beach is contingent upon the implementation of a local pond opening management plan for Georgica Pond

Groin Modification

- Taper existing Westhampton Groins and existing Ocean Beach Groins
- Shortening of groins 1 through 13
- Taper existing Ocean Beach Groins

Natural/Nature-Based Features (Nnbf)

- A variety of NNBFs will be addressed and specifically identified in the EIS, including:
    - Enhance upper beach/dune width/slope/height
    - Close some access roads and trails
    - Remove sand fence
    - Raise boardwalks above dunes
    - Enhance salt marsh by restoring hydrologic connection

- Remove parking lot, re-grade to natural contours
- Enhance the existing salt marsh through the use of herbicides to control *Phragmites*
- Ditch plugging and pool creation
- Convert disturbed areas to salt marsh
- Reconfigure existing tidal channels
- Remove bulkhead, re-grade shoreline, and restore marsh through plantings

3. *Environmental Conditions*

Oceanfront beach and deepwater ocean habitats constitute the majority of the Project area. The beach community includes upper, intertidal, and nearshore subtidal areas.

The intertidal zone extends from the low tide line to the high tide line and is submerged and exposed according to daily tidal cycles. Species diversity in this zone is relatively low due to limited ability of species to withstand the daily submersion and exposure. Micro and macro-invertebrates known to inhabit this zone include crabs, shrimp, bivalves, and worms.

The affected near shore subtidal zone extends from the low water line down to 25 feet below mean low water (-25' MLW) and is nearly continuously submerged. The area contains a rich diversity of aquatic micro and macro-invertebrates including crabs, shrimp, bivalves, worms, and finfish. In addition, numerous man-made groins extend from the intertidal zone into the subtidal zone from 200 to 600 feet (USACE 1998).

The offshore subtidal zone is located approximately 1.5 miles south of the FIMP project area is between 25 feet MLW and to about 60 feet MLW. The area contains a diversity of benthic organisms and phytoplankton and diverse assemblages of shellfish, gastropods, amphipods, isopods and crustaceans (USACE 2004b). The area also provides a migratory pathway and spawning, feeding and nursery area for many common mid-Atlantic fish species (USACE 2004b).

Habitat and Species that Occur in the Project Area

Both the nearshore and offshore waters of the Project area support seasonally abundant populations of many recreational and commercial finfish (USFWS 1989, 1995, USACE 1998). Primary fish species include black sea bass (*Centropristis striata*), summer flounder (*Paralichthys dentatus*), winter flounder (*Pseudopleuronectes americanus*), weakfish (*Cynosion regalis*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), striped bass (*Morone saxatillis*), and Atlantic mackerel (*Scomber scombrus*). In addition, other common species in near shore waters include tautog (*Tautoga onitis*), northern puffer (*Sphoeroides maculates*), windowpane (*Scophthalmus aquosus*) and American eel (*Anguilla rostrata*).

A number of migrant anadromous and catadromous species are found throughout the Project area. Common migrant species include the Atlantic sturgeon (*Acipenser oxyhinchus*), blueback herring (*Alosa aestivalis*), alewife (*alosa pseudoharengus*), American shad (*Alosa sapidissima*), Atlantic silverside (*Menidia menidia*), striped bass, and American eel (Woodhead 1992).

The primary shellfish with important commercial or recreational value in the near shore portion of the Project area are the American oyster (*Crassostrea virginica*), hardshell clam [Quahog] (*Mercenaria mercenaria*), softshell clam (*Mya arenaria*), bay scallop (*Argopencten irradiens*), American lobster (*Homarus americanus*), and blue crab (*Callinectes sapidus*) (MacKenzie 1990). Surf clam

(*Spisula solidissima*), razor clam (*Ensis directus*) and tellin (*Tellina agillis*) occur in the vicinity of the offshore borrow area. Surveys conducted by the USACE in 2003 indicate that the borrow area itself contains very small, to no, localized populations of surf clam (USACE 2004b).

Beginning in 1966, there have been at least 17 major sediment-benthic macrofauna sampling efforts in the region. As reported in these studies, the sediment composition of the Project area consists of a silty sand, medium coarse grain sand, and hard substrate community (USACE 1998, 2004b). The benthic community of the near shore portion of the Project area is dominated by polychaetous annelids, followed by malacostracans, bivalves, and gastropods (Reid et al. 1991,Ray and Clarke 1995, Ray 1996, Way 1998, USACE 2004b). The silty-sand substrates are dominated by bivalves such as the blue mussel (*Mytilis edulis*), and polychaetes such as red-lined worms (*Nephtys incisa*) (Steimle and Stone 1973).

Medium coarse sand substrates are dominated by bivalves (e.g., dwarf tellin [*Tellina agilis]*), echinoidea (e.g., sand dollar [*Echinarachnius parma]*, amphipods (e.g., *Protohaustraius deichmaae* and *Unicola irrorata)*, and polychaetes *(e.g.,* burrowing scale worm [*Sthenelais limicola*], lumbrinerid thread worms [*Lumbrineris fragilis*], and mud worm [*Spiophanes bombyx*]) (Steimle and Stone 1973). Hard substrates such as groins are dominated by blue mussel (Steimle and Stone 1973).

ESA Listed Species Present in the Project Area; General Information

Whales

The federally endangered North Atlantic right, humpback, and fin whales, are seasonally present in the waters off New York; however, these ESA listed species of whales are not known to occur in the shallow, near shore (i.e., within 1 miles from shore) waters of eastern Long Island, and thus, are not expected to occur in the project area. Based on this information, ESA listed species of humpback, fin, and North Atlantic right whales will not be considered further in our assessment.

Sea Turtles

Four species of federally listed threatened or endangered sea turtles under NMFS jurisdiction may be found seasonally (late spring thru early fall) in the coastal waters of New York and New Jersey: the threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, and the endangered Kemp's ridley, green and leatherback sea turtles. In general, listed sea turtles are seasonally distributed in coastal U.S. Atlantic waters, migrating to and from habitats extending from Florida to New England, with overwintering concentrations in southern waters. As water temperatures rise in the spring, these turtles begin to migrate northward. As temperatures decline rapidly in the fall, turtles in northern waters begin their southward migration. Sea turtles are expected to be in the waters of Long Island in warmer months (NMFS 2013)

Atlantic Sturgeon

There are five DPSs of Atlantic sturgeon listed as threatened or endangered. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as endangered, while the Gulf of Maine DPS are listed as threatened (77 FR 5880; 77 FR 5914; February 6, 2012). The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida.

Atlantic sturgeon are known to occur in the coastal and oceanic waters of the Atlantic Ocean, primarily using these bodies of water throughout the year as a migratory pathway to and from overwintering, and/or foraging grounds throughout their range. As young remain in their natal river/estuary until approximately age 2, and at lengths of 30-36 inches before emigrating to open ocean as subadults (ASSRT 2007), only subadult and adult Atlantic sturgeon will be found in this system. Since Atlantic sturgeon may be present within the coastal waters of the project area, there is the potential that they will be exposed to the direct and indirect effects of dredging operations. Specifically, an aggregation of sturgeon is documented as utilizing an area near Breezy Point, nearly fifty (50) miles west of the nearest project site.

4. Potential Adverse Effects

Indirect

Negligible increases in near shore turbidity and suspended solids may result during placement of the beach fill from disturbance of subsurface sediments. But, because the fill material is 100% coarse grain sand, these minor and temporary increases in turbidity will not cause any adverse effects (Naqvi and Pullen 1982).

Direct

The proposed action under analyses for this determination is that of utilizing a cutterhead dredge to dredge three inlets at Fire Island, Moriches and Shinnecock and procuring sand utilizing a hopper dredge from the three borrow areas, and pumping sand utilizing a pipeline from the hopper dredge to the beach. The protected species that is considered for analysis in this determination is the Atlantic sturgeon since sea turtles do not generally occur in the project area during the fall-winter months when dredge operations will occur.

The inlets dredging accounts for approximately 3.4MCY dredged material removal, and the sand mining operations at the borrow areas will collect approximately 3MCY required for the beach repair and nourishment portion. These dredge operations will be divided up into five (5) contracts. The seasonal restriction to protect piping plover, annually, from 1 April to 1 September in all five contract areas, will suspend all inlet dredging and borrow area sand mining fill placement activities at borrow areas and at the placement sites. The six months per year that hopper operations will be permitted to occur, coupled with the fact that the borrow areas are significantly distant, at a minimum over 50 miles from the Breezy Point sturgeon aggregate, justifies our contention that it is unlikely that there would be interaction between hopper dredge operations at the ecologically barren borrow area sites and sturgeon during the brief duration of the hopper dredge operations. Please see Appendix A (Borrow Area [Figure/Plate B-3] and Beach Fill data)

The pipeline operations that deliver the sand from the dredge to the beach pose no risk to protected species since the pipeline connecting the dredge to the shore either is floated upon the surface of the water or is laid on the bottom, presenting no possibility of intake of an individual or adverse interaction with an individual.

5. Conclusion

USACE has determined that adverse effects to sea turtles and Atlantic sturgeon resulting from the proposed Federal action at FIMP will be discountable and insignificant since these species occurrence, or utilization of habitat, in the project area for the timeframe proposed for construction is either rare or nonexistent.

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