FISH AND WILDLIFE COORDINATION ACT 2 (b) REPORT
FIRE ISLAND INLET TO MORICHES INLET
STABILIZATION PROJECT

Prepared for:
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EXECUTIVE SUMMARY

This Fish and Wildlife Coordination Act Report (DFWCAR) has been prepared at the request of the U.S. Army Corps of Engineers (Corps) in partial fulfillment of Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The purpose of the FWCA is to assure equal consideration and coordination of fish and wildlife conservation with other project purposes. This FWCAR provides the U.S. Fish and Wildlife Service's (Service) comments on the biological and procedural issues relevant to the Corps' Fire Island Inlet to Moriches Inlet, Fire Island Stabilization Project (FIMI). Section 2(b) of the FWCA requires that the final report of the Secretary of the Interior: (1) determine the magnitude of the direct, indirect, and cumulative impacts of the proposed projects on fish and wildlife resources, and (2) make specific recommendations as to measures that should be taken to conserve those resources.

In the short-term, the Corps' recommended plan will have direct and indirect adverse impacts on fish and wildlife resources and their supporting ecosystems. Initial beach fill will directly impact 19 miles of subaerial, nearshore intertidal, and subtidal marine habitats and up to 590 ac of subaqueous borrow areas. These impacts include burial of benthic organisms, turbidity, and modification of habitats.

In the long-term, the beach fill/dune construction plan will have cumulative impacts extending to 10 years after the nourishment project, causing adverse impacts on fish and wildlife habitat and the overall condition of the barrier island through reduction in the frequency of coastal processes which maintain the barrier islands as natural protective features. Coastal processes keep the barrier island above water and protect Long Island's south shore from direct influences of ocean waves and also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species.

In the course of its review, the Service has determined that this beach fill/dune construction project could have significant ecological impacts upon the barrier islands, back-bays, and their fish and wildlife communities. In turn, these impacts may negatively affect human activities, such as recreation, commercial fishing, and wildlife viewing. The implementation of the conservation/mitigation measures proposed by the Corps and the Service, as described in this report, will assist the Corps in ameliorating the potential adverse impacts presented in this report.

Finally, this report does not constitute a Biological Opinion under Section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). A detailed discussion of the impacts of the proposed project on the Federally-listed threatened piping plover (*Charadrius melodus*), Federally-listed endangered roseate tern (*Sterna dougallii dougallii*), and the Federally-listed threatened seabeach amaranth (*Amaranthus pumilus)* were transmitted to the Corps as a Biological Opinion on May 23, 2014.

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I. Project Purpose, Scope, and Authority

A. FIRE ISLAND INLET TO MORICHES INLET FIRE ISLAND STABILIZATION PROJECT (FIMI)

This section is excerpted from the U.S. Army Corps of Engineers' (Corps) Fire Island Inlet to Moriches Inlet Fire Island Stabilization Project Hurricane Sandy Limited Re-evaluation Report of the Draft Evaluation of a Stabilization Plan for Coastal Storm Risk Management In Response to Hurricane Sandy & Public Law 113-2 published in March 2014 (Corps 2014a).

> *"The purpose /goal of the on-going and overall parallel FIMP Reformulation Study effort, as described is to manage risks along the mainland and barrier island by reducing the potential for breaching and overwash of the barrier island, and directly addressing residual flooding risks along the bayside shoreline that occur independent of the barrier island condition. Future breaching and overwash is considered imminent given the eroded state of the barrier island as a result of the impacts of Hurricane Sandy. Therefore, the short-term goal of this FIMI Stabilization effort is to provide immediate stabilization and storm risk management to the communities on or behind the Fire Island barrier island. The stabilization project utilizes analysis conducted to date for the overall FIMP Reformulation Study, described below, but does not pre-suppose the outcome of the Reformulation or limit the range of options that could be implemented as part of the overall FIMP project.*
>
> *The Fire Island Inlet to Montauk Point (FIMP), NY, Combined Beach Erosion Control and Hurricane Protection Project was originally authorized by the River and Harbor Act of 14 July 1960 in accordance with House Document (HD) 425, 86th Congress, 2d Session, dated 21 June 1960, which established the authorized overall FIMP project. The authorized project provides for beach erosion control and hurricane protection along five reaches of the Atlantic Coast of New York from Fire Island Inlet to Montauk Point by widening the beaches along the developed areas to a minimum width of 100 feet, with an elevation of 14 feet above mean sea level, and by raising dunes to an elevation of 20 feet above mean sea level, from Fire Island Inlet to Hither Hills State Park, at Montauk and opposite Lake Montauk Harbor. This construction would be supplemented by grass planting on the dunes, by interior drainage structures at Mecox Bay, Sagaponack Lake and Georgica Pond and the construction of up to 50 groins, and by providing for subsequent beach nourishment for a period of ten years, as amended.*
>
> *This authorization has been modified by Section 31 of the Water Resources Development Act (WRDA) of 1974 (P.L. 93-251), and Sections 103, 502, and 934 of the WRDA of 1986 (P.L. 99-662), which principally impact cost-sharing percentages and the period of renourishment. The project is also presented in this report considering the cost-sharing provisions within Public Law (PL) 113-2 of January 29, 2013, Disaster Relief Appropriations. The initial construction cost in accordance with the provisions of P.L. 113-2 is 100% Federal. PL 113-2 states that 'the completion of ongoing construction*

projects receiving funds provided by this division shall be at full Federal expense with respect to such funds.

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

Reach 1 – Fire Island Inlet to Moriches Inlet (FIMI)
Reach 2 – Moriches Inlet to Shinnecock Inlet
Reach 3 – Shinnecock Inlet to Southampton
Reach 4 – Southampton to Beach Hampton
Reach 5 – Beach Hampton to Montauk Point"

B. FIRE ISLAND INLET TO MONTAUK POINT PROJECT HISTORY

1. Authorization/Construction

Since the proposed interim project is being considered as an interim action under the authorization of the Fire Island Inlet to Montauk Point, NY, Beach Erosion Control and Hurricane Protection Project (FIMP), a description of the FIMP and interrelated/interdependent projects is provided below. A map depicting the Corps planning efforts for Long Island is shown in Figure 1.

The FIMP authorized project includes:

- Widening the beaches along developed areas between Kismet and Mecox Bay to a minimum of 100 feet (ft) at an elevation of 14 ft above mean sea level;
- Raising the dunes to an elevation of 20 ft above mean sea level from Fire Island Inlet to Hither Hills State Park, at Montauk, and opposite Lake Montauk Harbor;
- Planting grass on the dunes;
- Constructing interior drainage structures at Mecox Bay, Sagaponack Lake, and Georgica Pond;
- Federal participation in the cost of beach nourishment not to exceed 10 years from the year of completion of a useful nourishment unit;
- Construct, as needed, not more than 50 groins (U.S. Army Corps of Engineers 1977).

A portion of the FIMP project was built between 1965 and 1970 when 15 groins plus beach fill were constructed in Westhampton Beach and two groins were constructed in the vicinity of Georgica Pond in Southampton.

2. Reformulation of Authorized Plan: 1977 EIS Council on Environmental Quality Referral

As stated in the introduction, the FIMP is being reformulated both in response to earlier recommendations from the President's Council on Environmental Quality (CEQ) and in fulfillment of the Corps' Engineering Regulation 1105-200-2. An Environmental Impact Statement (EIS) for the FIMP project was previously released by the Corps in 1977 that proposed

work in the area west of Shinnecock Inlet as depicted in Figure 3. Subsequently, the DOI, in conjunction with the U.S. Environmental Protection Agency (USEPA) and the National Oceanic and Atmospheric Administration/Fisheries (NOAA/F), referred the final EIS to the President's CEQ based on their findings that the document inadequately addressed systemic environmental impacts, including impacts to the future condition of the barrier islands, and failed to evaluate all reasonable alternatives. The CEQ informed the Corps that the EIS was "environmentally unacceptable and that the Corps has not demonstrated that there are no practicable alternatives available." The CEQ also stated, "Because the entire project area is a system, it would be disingenuous to treat these issues solely in connection with a particular segment of the shore." The CEQ concluded with the recommendation that "the Corps revise its overall project plan to create an adequate framework within which subsequent detailed planning for specific parts--or reaches--might occur." That is, reach by reach planning was to <u>follow</u> an overall understanding of the environmental consequences of the proposed project, not to precede them.

In response to the CEQ decision, the Corps proposed a plan of study for project reformulation in 1980. However, that effort was suspended until the early 1990s due to cost sharing issues between the New York State (State) and the Corps.

II. Relevant Prior and On-going Studies/Reports/Federal Projects

A. FEDERAL PROJECTS

Additional proposed or constructed Federal projects within the FIMI/FIMP project area are described below. As per the National Environmental Policy Act (NEPA), these actions should be considered in the Corps' cumulative effects analysis for the proposed project. Unfortunately, planning for the FIMP Reformulation Study programmatic EIS was often superseded by planning efforts for the individually proposed interim projects. This has created delays in the FIMP Reformulation Study process and EIS preparation.

1. <u>30-year Westhampton Interim Storm Damage Protection Project</u>

The 30-year Westhampton Interim Project is located within Reach II: Moriches Inlet to Shinnecock Inlet of the FIMP project area, adjacently east of the FIMI Study Area (Figure 2). The Corps proposed a 30-year interim project at Westhampton Beach in September 1978. While the Westhampton Interim Project contradicted CEQ's recommendation that the FIMP area be managed as a single system, Federal agencies came to agreement by 1980 that a beach protection project to address the substantial erosion to Westhampton Beach downdrift of the Corps' groin field was mutually acceptable and could be undertaken at Westhampton. That agreement was reached, provided that the Corps commit to funding the FIMP Reformulation Study programmatic EIS. Subsequent to the agreement, the U.S. Fish and Wildlife Service (Service) identified existing literature, substantial data gaps, and required field studies as part of the FIMP Reformulation Study Planning Aid Letter (PAL) dated February of 1981 (USFWS 1981a). The PAL concluded that "In summary, there is insufficient data to assess the potential impacts on the fish and wildlife resources and their habitats from the proposed beach erosion control and hurricane protection project as described in the final environmental impact statement for the subject project."

Ultimately, initial construction of the Westhampton Interim Project was initiated and completed in the Summer of 1996 and the Fall of 1997, respectively. This project followed a breach during the Winter of 1992 and 1993. Initial construction entailed beach fill/dune construction over 21,460 ft of beach and the realignment of the two western most groins of the 15 groins that were constructed between 1965 and 1970. Over 4,480,000 cubic yards (cy) of sand were dredged from offshore borrow areas to complete the initial phase. Renourishment of the design profile will occur on an average of every 3 years, initially requiring 981,000 cy and approximately 1,179,000 cy for each renourishment thereafter.

2. Breach Contingency Plan (BCP)

In addition to the larger scale, longer term, interim proposals and projects, the Corps and other interested Federal, State, and local governments developed the BCP for the 50 miles of barrier beach (Fire Island Inlet to Southampton Barrier Spit) within the FIMP Reformulation Study area for the purpose of closing breaches in an expedited manner. The Biological Opinion for the BCP has expired and the Corps needs to reinitiate Section 7 of the Endangered Species Act (ESA) consultation to continue this plan.

In October of 2012, Superstorm Sandy created three breaches and extensive overwash areas on the eastern end of Fire Island. Three breaches formed on Fire Island at Smith Point (40.750156N, -72.811806W), Old Inlet (40.723509N, -72.894704W), and eastern Fire Island Pines (40.667489N, -73.055264W). Based upon Service personnel observations, the breach at Smith Point was a relatively small breach that did not appear to exhibit exchange of ocean and bay waters at low tide, but was closed by the Corps under the provisions of the Corps' BCP in December of 2012. The breach at Old Inlet remains open and options concerning its management are being explored by the National Park Service (NPS) in accordance with the Fire Island Wilderness Act of 1983 (Public Law 95-585) and NEPA. The breach at eastern Fire Island Pines did not require any action under the Corps' BCP as no exchange of bay and ocean water was observed after the storm passed and tidal levels subsided.

3. Fire Island Inlet Federal Navigation Project authorized in 1948 and Shore Westerly Project (Corps; Active)

The following was excerpted from the Corps web site (http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/10863/fact-sheet-fire-island-inlet-and-shores-westerly-to-jones-inlet-new-york.aspx).

DESCRIPTION: This is a multi-purpose project that provides navigation and shore protection benefits through the periodic maintenance dredging of Fire Island Inlet with placement of dredged sand along the shoreline several miles west of the inlet at designated barrier island's critical erosion area [Gilgo Beach]. The sand placed at Gilgo is intended to nourish the westerly beaches and provide storm damage protection.

AUTHORIZATION/PROJECT DESCRIPTION: Authorized by the Rivers and Harbors Act of 1937 and subsequently modified by the Rivers and Harbors Acts of 1958 and 1962. In August

1988, the existing project was modified to provide for the maintenance of a realigned channel in the vicinity of the naturally deep channel to a depth of 14 feet plus 2 feet allowable overdepth. The material from the dredged channel will be used as nourishment along the shoreline several miles west of the inlet at the designated beach, Gilgo Beach, for erosion control. This project is cost shared by New York State Department of Environmental Conservation.

STATUS: Work planned for FY14 includes: completion of a contract to replace the 1.2M cy of sand lost during Hurricane Sandy using sand from Fire Island Inlet. The Federal portion of this rehabilitation work is being completed under P.L. 84-99 with 100% Federal funds. The State has also contributed State funds to perform additional work at Tobay and Town of Babylon beaches under this same contract.

Last maintenance dredging cycle was completed in Winter 2007-08. The work included dredging and placement of 619,000 CY along the critical erosion area at Gilgo Beach. The project was completed with a combination of O&M funding and FCCE funding. Dredging and placement at Gilgo Beach was completed on March 26, 2008.

In past cycles, additional sand has been dredged from the channel and deposition area and placed at RMSP at full non-Federal cost (State).

The previous maintenance dredging cycle was completed in FY03/04. A total of 953,263 cubic yards of sand was dredged and placed as beach nourishment along the Gilgo Beach shoreline. An additional, 135,983 cy of dredged sand was placed as beach nourishment along RMSP Beach.

4. Long Island Intracoastal Waterway, New York-Federal Navigation Channel

The following was excerpted from the Corps web site: (http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/9192/fact-sheet-long-island-intracoastal-waterway-new-york-federal-navigation-channel.aspx).

DESCRIPTION**:** Complete plans and specifications, award a contract to perform maintenance dredging, and perform maintenance dredging during this fiscal year due to the channel being impacted by Hurricane Sandy. Dredged sand will be placed at upland locations after coordination with local sponsors.

AUTHORIZATION/PROJECT DESCRIPTION: The Rivers and Harbors Act of August 26, 1937 authorized the Long Island Intracoastal Waterway Federal Navigation Project. The existing project provides for a navigation channel 6 feet deep, 100 feet wide from the Federally-improved channel in Great South Bay, opposite Patchogue, to the south end of Shinnecock Canal. The lengthy 33.6 mile project traverses the inland waters through the Great South Bay, the Bellport Bay, the Narrow Bay, the Moriches Bay, the Quantuck Bay and the Shinnecock Bay.

STATUS: Three USCG Stations utilize this waterway for Search and Rescue (SAR) missions. Many commercial and recreational boaters use this sheltered route along the Atlantic Ocean between three of the south shore inlets as a sheltered route parallel to the ocean coast line.

During this fiscal year, maintenance dredging contract will be completed for the Federal channel in the Moriches Bay area. This Federal channel was used as a borrow source of sand to close the breach at Smith Point Park as a result of Hurricane Sandy. The previous maintenance cycle, a contract for maintenance dredging of approximately 70,000 cy in the Moriches Bay area was completed in FY2010/11. Maintenance dredging was completed in two phases with two separate mobs. First phase in the May-June 2010 time frame for the most critical shoal, and the second phase in the Fall of 2010 when the environmental window allowed dredging to continue. Based on a request by Town of Brookhaven, a 5,600 cy stockpile of sand was constructed on Cupsogue beach. Town of Brookhaven transported sand from the stockpile for placement at a bayside beach.

Prior work includes maintenance of the Long Island Intracoastal Waterway performed November 2003 through January 2004. The total volume of dredge material removed from of the Shinnecock Bay Reach in FY2004 was 26,085 cy. Prior to that, the Moriches Bay reach was dredged in FY2003 with the removal of 53,000 cy with placement of dredged material on East Inlet Island. The East Inlet Island, which was used as a dredged material placement site in FY2003, was tilled to eliminate areas of hard-packed mud and was then planted with native grassland species. The purpose of this project was to restore and enhance habitat for threatened and endangered shorebirds. The remediation was completed in October 2006.

5. Moriches Inlet Navigation Project

The following was excerpted from the Corps web site (http://www.nan.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/11241/Article/8248/fact-sheet-moriches-inlet-new-york-maintenance-and-stewardship.aspx).

DESCRIPTION: This project is in caretaker status. The last maintenance dredging of the inlet was performed in January 2009 by the Suffolk County Department of Public Works (SCDPW).

AUTHORIZATION/PROJECT DESCRIPTION: The Moriches Inlet Project was authorized by the Rivers and Harbors Act of 1960 and the 1985 Supplemental Appropriation Act. The existing Moriches Inlet Federal Navigation Project provides for a channel, 10 ft deep, 200 ft wide, extending from that depth in the Atlantic Ocean to Moriches Bay, at a length of approximately 0.8 mile, and a channel, 6 ft deep, 100 ft wide, to the Long Island Intracoastal Waterway, length approximately 1.1 miles. In addition, the project includes a deposition area at the entrance of the channel, 14 ft deep plus 2 feet overdepth, 350 ft wide, and 3,000 ft in length.

STATUS: During this FY, continued monitoring of the conditions of the Federal channel will be performed and a Controlling Depth Report will be published. Coordination with local stakeholders will also continue.

The inlet was used as a borrow source of sand to close the breach at Cupsogue Beach that was created by Hurricane Sandy. Approximately 200,000 cy of sand were removed from the inlet for this effort.

The last maintenance dredging cycle occurred during the winter of 2009. Approximately 460,000 cy of material was removed by Suffolk County and placed at Cupsogue Beach, Smith Point and other areas. Prior to this last cycle, maintenance dredging of the inlet was last performed by the Corps in February 2004 using Federal/non-Federal cost-share funds. Approximately 250,250 cy of material were removed from the channel and deposition basin and placed along the shoreline west of the jetty. The most recent condition survey of the Inlet and Controlling Depth Report is located on the webpage below.

6. <u>West of Shinnecock Inlet Interim Storm Damage Protection Project</u>

The West of Shinnecock Inlet Storm Damage Protection Project was developed as an interim plan by the Corps to provide protection of the eastern end of Westhampton Island until the FIMP Study was completed. The project includes beach nourishment along the 4,000 ft long shoreline immediately west of Shinnecock Inlet, as a means to mitigate for the loss of beach resulting from the construction of the Federal Shinnecock Inlet Jetty Project. The project initially included periodic renourishment every 2 years for a period of 6 years. The Corps constructed the West of Shinnecock Inlet Interim project in 2005, placing approximately 610,000 cy of sand. The project consisted of dunes with a crest of 15 ft above National Geodectic Vertical Datum (NGVD) and a 90-ft-wide beach berm.

The Corps recently reconstructed this project due to sediment losses resulting from Hurricane Sandy. Even though the project had expired, the Corps indicated that it was authorized through the Disaster Relief Appropriations Act of 2013 to restore projects impacted by Hurricane Sandy to their original design profile and they determined this project was eligible for reconstruction. The Corps placed approximately 301,000 cy of sand at just after Hurricane Sandy using emergency funds from Hurricane Irene. Of that approximately 301,000 cy of sand, approximately 173,000 cy were placed to replace sand lost during Hurricane Sandy. The Corps recently awarded a contract in the Fall of 2013 for the placement of approximately 450,000 cy of additional sand in the project area to restore the project to its original design profile in the Fall of 2013. Sand will be dredged from an offshore borrow area. Work is expected to be completed in the winter of 2014. (http://www.nan.usace.army.mil/Portals/37/docs/civilworks/SandyFiles/Army%20Corps%20West%20of%20Shinnecock%20Inlet_FCCE_FactSheet.pdf)

B. FEDERALLY AUTHORIZED LOCAL ACTIONS

The Corps Regulatory Division: Issuance of permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act, including Suffolk County Department of Public Works

Channel Maintenance Dredging and beach disposal projects (21 sites/projects in the Town of Islip and 33 in the Town of Brookhaven-Ethan C. Eldon Associates, Inc. 1995). Specific volumes of dredged and placed material was not available during the time of this report preparation but an estimated 6. 5 million cy of dredge material from back bay navigational channels/creeks were placed on Fire Island from 1949-1980 (Suffolk County Planning Dept. 1985).

Additionally, two recent dredging projects were authorized by the Corps' regulatory district that occur within the FIMI project area and are described as follows:

1. Captree Boat Basin Dredging

The Corps Regulatory Division authorized the on-going Captree Boat Basin Project which involves the dredging of navigable waters in the Captree Boat Basin located in western Great South Bay, with dredge material placement on the ocean shoreline of Fire Island in Robert Moses State Park (RMSP). Specifically, a Corps permit was issued to the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) in 2011 for 10-year maintenance dredging, via hydraulic dredge, of approximately 169,000 cy of material from the irregularly shaped East Captree Channel, with dredge material placement on ocean beaches in RMSP or placed in state-approved upland designated surplus material areas. The Corps issued a modification to expand the authorized dredging area and prism for an additional 320,000 cy of material for emergency shoreline repair work needed in response to Superstorm Sandy and completed Section 7 of the ESA consultation (Service correspondence dated March 6, 2013). Dredging for this portion of the project (the east channel) was completed in April-May of 2013 with dredge material placement in fields 4 and 5 of RMSP.

The NYSOPRHP requested a second modification for 10-year maintenance dredging of an additional 400,000 cy from the Captree State Channel west of the Robert Moses Bridge. The irregularly-shaped West Captree Channel is approximately 400 feet by 3,550 feet in length and will be dredged, via hydraulic dredge, to a depth of approximately 14-feet below mean low water. The dredged materials will be pumped directly on approximately 12,000 linear feet of ocean beaches in RMSP (figure included in the public notice depicts an area between fields 2 and 3 eastward to 5), or the dredged material will be placed in state-approved upland designated surplus material areas (figure included in the public notice depicts an area just west of Field 4 of RMSP). Approximately 108,000 cy of material would be deposited below the Spring High Water line. This work is being completed by the Spring of 2014.

The total volume of sand authorized to be dredged from the Captree Boat Basin is, therefore, 889,000 cy.

The stated purpose of the proposed action is to maintain safe navigable water depths for the vessels that use the waterway by removing sand shoaling resulting from Superstorm Sandy and provide beach nourishment for adjacent beaches damaged by Superstorm Sandy.

2. New York State Department of Transportation (NYSDOT) Emergency Repair of Ocean Parkway

Under authority of the Corps Regional General Permit Number 15, Authorizing Remedial Activities Undertaken in Response to Major Storms: The NYSDOT hydraulically dredged approximately 790,000 cy of sand from Fire Island Inlet Federal Navigation Channel for the expedited repair/replacement to pre-storm conditions of Ocean Parkway, RMSP Traffic Circle, and adjacent Atlantic Ocean shorelines damaged by Hurricane Sandy, including dune systems and the Atlantic Ocean beaches seaward of dunes. Approximately 566,000 cy of dredged material were placed along Ocean Parkway and 224,000 cy in the vicinity of the Robert Moses Causeway Traffic Circle and Field 5 of RMSP in the Spring of 2013.

3. 2008 Fire Island Short-term Protection Projects

This project addressed short-term storm surge protection for 5 miles of ocean beach fronting the Fire Island National Seashore (FIIS) Communities by using beach scraping and beach nourishment for the period between 2008 and 2013. Over 1.8 million cy of dredged material was obtained from offshore borrow areas to construct the proposed project. The intention was to: (1) provide protection for residential, commercial, and municipal structures, as well as public infrastructure within the communities from storm waves, tidal and wave surges, and flooding; (2) provide or improve beach width adequate for safe vehicular passage during all tidal cycles; and (3) enhance recreational use of the beaches (National Park Service 2008).

C. COMPLETED AND ON-GOING STUDIES/REPORTS

1.) FIMP Borrow Area Benthic Macro-Invertebrate Sampling (Reformulation Benthos (3 Reports, Fall 2000 – 2003)

2.) Aerial Photographic Analysis/Vegetative Mapping, Fire Island Inlet to Montauk Point (Report, 2000)

3.) Analysis of Historic Vegetative Zonation Changes Associated with Breach and Overwash Events (First report complete, will be expanded to include 3 breach sites in Summer of 2003)

4.) Mapping the Submerged Aquatic Vegetation (SAV) Beds in the Back-bay Habitats (1999-2003)

- SAV Report, Phase I (with maps): Complete
- SAV Report, Phase II ("Shape" and GIS database): Complete
- SAV Report, Phase III (2003 sampling efforts)
- SAV Report, Phase IV (2004-5 sampling efforts, entitled, "2006 Evaluation Report")
- SAV Report, Phase V (2006 sampling efforts)

Associated Reports:

- Draft determination of potential SAV in Great South Bay, Moriches Bay, and Shinnecock Bay (2004, for 2003 data)
- "SAV Bed Characterization" (Final, with report above)
- "SAV Evaluation Report" (2006, for years 2004-2005)

5.) Hard Clam (*Mercenaria mercenaria*) Growth Rates (2001 – 2003)

- Report No. 1: Complete (2000)
- Report No. 2: 2001 Efforts
- Report No. 3: 2003 Efforts

6.) FIMP "Beach Insects" Invertebrate Survey (2003)

7.) Conceptual Model: Phases I, II, III (Final, 2002-2006)

8.) FIMP Final Avian (Shorebird) and Terrestrial Summary Survey (Final, 2001-2003)

The following Reports resulted:

- Final Avian Survey Summary Report (October 2003), same as No. 8 above. (Note: No. 8 on small sheet, on web)
- Small Mammal and Herpetile Survey Summary Report (May-August 2002)

9.) Cultural Projects (2003-4)

10.) Geographic Information System (GIS) Database/Web Coordination (2004-2006)

11.) Final Backbay Benthic Invertebrate Survey (2003)

12.) EIS Preparation (Starting 2003; Ending 2006/2007)

13.) Air Quality Analysis Report (Starting 2004)

14.) Water Quality Report (1999)

15.) Borrow Area Comparison (2003 – 2004)

16.) Piping Plover Habitat Suitability Index (HSI) Model (1996 – 2001)

17.) FIMP Shorebird Habitat Evaluation Procedure (HEP) Analysis (2001-2003)

18.) FIMP Analysis of Breach and Overwash Sediment Transport: Summary of Known Impacts Physical and Biological (Position Paper, 2001)

19.) Atlantic Coast of Long Island: FIMP Storm Damage Reduction Reformulation Study, Mitigation Screening (1999)

20.) Atlantic Coast of Long Island: FIMP Storm Damage Reduction Reformulation Study, Data Gap Analysis/Interim Progress Memorandum (1999)

21.) Atlantic Coast of Long Island: FIMP Reformulation Study, Intertidal Wetland and Estuarine Finfish (backbay botany and finfish – borrow sites) (One Report for Year #1 and Year #2, 2000-2002)

22.) CREEL Surveys (Draft 2000)

23.) Surf Clam Survey (2002)

24.) "Cover Type" Mapping (1) of Fire Island (FIMP) Vegetation (2001-2003)

25.) "Cover Type" Mapping (2) of Fire Island (FIMP) Vegetation (2003 – 2004)

26.) FIMP Storm Damage Reduction Reformulation Study: Reach Delineation

27.) Atlantic Coast of Long Island, FIMP Reformulation Study: Fire Island and West of Shinnecock Inlet (WoSI) Storm Damage Reduction Projects (1999)

28.) Environmental Scoping Document: Atlantic Coast of Long Island, FIMP Storm Damage Reduction Reformulation Study (1996)

29.) Atlantic Coast of Long Island, FIMP Reformulation Study: Alternatives Screening (1998)

30.) PAL, Restoration (2004)

31.) HEP/Restoration Site Selection, 2004-2005 (Continued, Part 2, 2006) (Note: This is a 2-part study.)

Westhampton WoSI Interim Project, Etc.:

1.) Westhampton Dunes Intertidal Benthic Invertebrate Survey
- Year 1 Westhampton (post placement)
- Year 2 Westhampton (post placement)
- "Eastern Shore Zone" sampling 1998-1999 (Final, 2003)

2.) Surf Clam Study (Summer 2001 and pre-dredging events)

3.) Finfish in the Backbay (Pikes Breach) (Completed 2001)

4.) Pikes Breach Closure Area Backbay Benthic Habitat Survey (2003)

5.) FIMP (Reformulation Study), WoSI, and Cherry Grove, "Offshore Borrow Area Multi-Species Sampling," (3 Separate reports - 6 month report, 1 year report [2000] and the upcoming 2003 data)

6.) Comparative Study of Beach Invertebrates on the Westhampton Barrier Island for Reformulation Study (Final, 1999)

7.) Monitoring Study: Effects of the Westhampton Interim Storm Damage Protection Project on Piping Plover Habitat at Pikes Beach 1993-2004

8.) General Investigation of Infauna from the Westhampton Borrow Areas (Final Report, CEB/Corps, 1996)

9.) WoSI Environmental Assessment (EA) (1999)

10.) Shinnecock Bay Finfish Survey (1986 – Present)

11.) Fire Island Interim and West of Shinnecock Borrow Area Benthic Invertebrate (and Water Quality Sampling)

12.) Atlantic Coast of Long Island, FIMP Reformulation Study: WoSI Multi-species Sampling (2000)

Fire Island and Others:

1.) Fire Island Interim EIS (Complete, 1999)

2.) FIMP: BCP (EA and Executive Summary, 1996)

3.) FIMP: Moriches to Shinnecock Inlet Reach, Interim Plan for Storm Damage Reduction Protection (Technical Support Document with Final EA: Corps, 1995)

4.) FIMP: Reach 1: Fire Island Inlet to Moriches Inlet, Interim Plan for Storm Damage Reduction Protection (Technical Appendices, volumes 1 and 2: Corps, 1996-1999)

5.) Fire Island Draft EIS: Atlantic Coast of Long Island (FIMP: Preliminary Draft EIS for Fire Island Interim Plan: 1999) - For related, see Final EIS, No. 1c.

6.) Jones Inlet Study: Basic Services Report (1982)

7.) EA: Moriches Inlet Sand Stockpiling Modification: Cupsogue County Park (1996)

8.) Benthic Invertebrate Survey: Napeague to East of Fire Island Inlet (2001)

9.) Virginia Tech Shorebird Project- Response of Piping Plovers and their Invertebrate Prey to Habitats Created By Hurricane Sandy (On-going, initiated in 2013): The goal of this project is to provide a broader ecological understanding of the ways in which breaches and Corps breach-fill projects affect piping plover populations and their invertebrate prey communities by comparing the dynamics of bird use and invertebrate densities in a breach area, two filled breach areas, overwash areas, and other areas. Ultimately the results will help refine the understanding of the time frame and manner in which piping plover habitat develops and persists.

In addition to monitoring breeding piping plovers, a key goal in the first year of the study was to band piping plover adults and chicks to allow comparison of the relative contribution of local recruitment versus immigration to population growth in storm-created habitat and artificially closed breaches in subsequent years of the study.

Additional Reports:

1.) Surface Water Quality Monitoring (1976 - Present)

2.) USEPA Water Quality Monitoring (1970 – present)

3.) EA for Proposed Maintenance Dredging at Fire Island Pines: Town of Brookhaven (2002)

4.) Fire Island: EA, Rehabilitate Beach Facilities and Habitats at Barrett Beach and Talisman Beach (2001)

5.) Impacts of Barrier Island Breaches on Selected Biological Resources of Great South Bay, NY (NY SeaGrant, Final 2001)

6.) Estuarine Resources of the FIIS and Vicinity (NY SeaGrant, 1993)

7.) Fish and Wildlife Resource Studies for the FIMP Beach Erosion Control and Hurricane Protection Project Reformulation Study: Estuarine Resource Component (USDOI: Fish and Wildlife Service, Region 5, 1983)

8.) Peconic Estuary Program: SAV Study (1996)

- Benthic sampling conducted in Westhampton Interim Project Area
- Borrow Area in spring/fall of 1996 and 1997;

- Piping Plover Monitoring Study at Village of Westhampton Dunes (1995-present);

- Formulation of HIS for the Piping Plover at Selected Locations (in progress);
- Multi-species finfish sampling of WoSI and Fire Island Interim Project (FIIP) off-shore borrow areas;
- WoSI intertidal placement area benthic invertebrate sampling;
- WoSI off-shore borrow area surf clam and benthic invertebrate sampling;
- Intertidal benthic invertebrate sampling for the FIMP;
- Vegetation mapping for the FIMP;
- Vegetation Change Analysis for the FIMP;
- Shinnecock and Easthampton Creel Surveys for the FIMP;
- Submerged Aquatic Vegetation surveys for the FIMP;
- Marsh/backbay finfish surveys for the FIMP;
- Pikes Beach Benthic recovery for the FIMP; and
- Hard Clam growth analysis (backbay) for the FIMP.

III. DESCRIPTION OF THE STUDY AREA

A. STUDY AREA

The FIMI study area extends from Fire Island Inlet easterly to Moriches Inlet along the south shore of Long Island and Atlantic Coast of Suffolk County and is approximately 31 miles long (U.S. Army Corps of Engineers 2014a). The study area is part of a barrier island system, composed of narrow, sandy beaches and peninsulas separated from the mainland by shallow bays (Tanski 2007). This barrier island system includes two estuarine bays: Great South Bay and Moriches Bay, and two inlets, Fire Island Inlet and Moriches Inlet. The Corps' Inlet Modifications Report (U.S. Army Corps of Engineers 2007) provides a detailed history of these inlets. The bays are estuaries in that they are semi-enclosed by land with open access to the open ocean, and the ocean's waters are at least occasionally diluted by freshwater runoff from the land by way of numerous freshwater rivers and tributaries (Jones and Schubel 1980). Three barrier islands are present within the FIMP study area, referred to as Fire Island, the Westhampton barrier island, the Southampton barrier island, and the Fire Island barrier island within the FIMI.

Hurricane Sandy

On October 29, 2012, Hurricane Sandy made landfall on Long Island. According to the National Hurricane Center, Hurricane Sandy, at nearly 2,000 kilometers (km) in diameter, is the largest storm on historical record in the Atlantic basin (Hapke et al. 2013). It affected extensive areas of the east coast of the United States, and on Long Island, the storm caused substantial beach erosion. In some areas, dunes were extensively overwashed and several breaches formed as the storm made landfall during astronomical high tides (Hapke et al. 2013). While strong coastal storms such as Hurricane Sandy can often result in severe damages to physical structures, particularly on the barrier islands, they are an important natural process of barrier islands that allow these systems to evolve in response to sea-level rise (Hapke et al. 2013).

Both developed and undeveloped beaches on Fire Island experienced profound changes as a result of the storm (Hapke et al. 2013). The storm created three breaches and extensive overwash areas on the eastern end of Fire Island. The U.S. Geological Survey (USGS) undertook a rapid assessment of the areal extent and depth of overwash deposits shortly after the storm (Hapke et al. 2013). In the western portion of the island, 147 acres (ac) of overwash areas were identified. However, these deposits were limited in many locations by residential development and other infrastructure. Much of the material was deposited on private property, concrete walkways, etc., and was mechanically redistributed back on the beach during post-storm clean up and dune construction activities. In the central areas of Fire Island, the occurrence of overwash was relatively low (31 ac) and primarily confined to existing dune cuts that served as vehicle access points or other lows spots between the dunes. The greatest areal extent of overwash deposits, or 220 ac, occurred on eastern Fire Island, and were concentrated in the vicinity of Old Inlet in the Federal wilderness area and east of the TWA Flight 800 Memorial at Smith Point County Park (Hapke et al. 2013).

Three breaches formed on Fire Island at Smith Point (40.750156N, -72.811806W), Old Inlet (40.723509N, -72.894704W), and eastern Fire Island Pines (40.667489N, -73.055264W). The breach at Smith Point was a relatively small breach that did not appear to exhibit exchange of ocean and bay waters at low tide (Papa, personal observation), but was closed by the Corps under the provisions of the Corps' BCP in December 2012. The breach at Old Inlet remains open and options concerning its management are being explored by the NPS in accordance with the Fire Island Wilderness Act of 1983 (Public Law 95-585) and NEPA. The breach at eastern Fire Island Pines did not require any action under the Corps' BCP as no exchange of bay and ocean water was observed after the storm passed and tidal levels subsided.

Land use within the FIMI includes recreational beaches, residential communities, summer resort communities, open space/parkland/refuges, and commercial/industrial development.

<u>Federal Lands</u>

The NPS-FIIS is located along the Atlantic Ocean on the Fire Island barrier island, Great South Bay, and Moriches Bay shoreline, and is approximately 21 miles long, including the 7 mile long Otis Pike Wilderness Area. The property consists of open ocean, marine intertidal, marine beach, dunes and swale, maritime forest, and back-bay habitats, as well as primarily seasonal

communities. The 2,220-acre William Floyd Estate is also a unit of the FIIS. Located in Mastic Beach on the mainland/south shore of Long Island, the estate consists of upland fields and forests and tidal marshes.

State Lands

Robert Moses State Park – RMSP is owned and administered by the NYSOPRHP. It is located on the western 5 miles of Fire Island and falls outside the administrative boundary of the FIIS. This 875-acre park, located along the Atlantic Coast shoreline, consists of bathing beaches, pavilions, parking areas, piers, boat basins, marine beach, dune and swale areas, tidal wetlands, and ocean and bay shorelines.

County Lands

Suffolk County owns and administers Smith Point County Park, which occupies the eastern 6 miles of Fire Island. Smith Point County Park is within the FIIS and is subject to obtaining Special Use Permits from the NPS for certain activities it undertakes. This County Park is 2,413 ac in area, consisting of ocean shoreline, dunes, swales, tidal wetlands, camping areas, a pavilion, and paved parking areas.

Village, Town of Islip, and Town of Brookhaven Lands

Seventeen Fire Island communities are within the project area, stretching from Kismet in the west to Davis Park in the east. This area also contains the incorporated Villages of Ocean Beach and Saltaire. The communities of Kismet, Fair Harbor, Dunewood, Lonelyville, Atlantique, Robbins Rest, Ocean Beach, and Corneille Estates are located in the Town of Islip. Ocean Bay Park, Point O'Woods, Cherry Grove, Fire Island Pines, Water Island, and Davis Park are located in the Town of Brookhaven.

Audubon Important Bird Areas (IBA)

The Audubon Society has designated five areas within or adjacent to the FIMI as IBA's (See Figure 4). The IBA program is a bird conservation initiative whose goal is to identify the most important places for birds and conserve them (Burger and Liner 2005). The IBA's and descriptions (excerpted from Audubon website: http://iba.audubon.org/iba/stateIndex.do?state=US-NY) are listed as follows:

Captree Island Vicinity

Site Description: This site includes the barrier islands on the south shore of Long Island, and the islands and marshes on the bayside. Sandy beach and dune systems, natural saltmarshes, and spoil islands are included. According to the NY-GAP land cover data, approximately 20% of the site is saltmarsh habitat. The site extends from the Nassau/Suffolk County line east to and including Captree Island and RMSP. It includes the eastern end of Jones Beach Island and the western tip of Fire Island. The interior of the barrier island is bisected by a four-lane highway with associated heavily developed recreational areas and large parking areas. Ownership is a mix

of public (Captree Island State Park, Gilgo State Park, and RMSP, administered by NYSOPRHP), municipal, and private.

Ornithological Summary: This site supports high numbers of wading birds during the breeding season: 125 pairs in 1993, 140 in 1992, 54 in 1991, 206 in 1990, 365 in 1989, 194 in 1988, 305 in 1987, 375 in 1986, 171 in 1985, and 120 in 1984. Wading birds include great egrets (*Casmerodius albus*) (6 pairs in 1995, representing 1% of the State's coastal population), snowy egrets (*Egretta thula*) (10 pairs in 1995; 2% of the State population), little blue herons (*E. caerulea*) (5 pairs in 1995; 19% of State population), tricolored herons (*E. tricolor*) (10 pairs in 1995; 38% of the State population), black-crowned night herons (*Nycticorax nycticorax*) (75 pairs in 1995; 4% of the State coastal population), and glossy ibis (*Plegadis falcinellus*) (80 pairs in 1995; 11% of the State population). In recent years, the total number of wading birds has dropped to under 100 individuals. The site supports at-risk species, including northern harriers (*Circus cyaneus*) (breeds and migrant), black rails (*Laterallus jamaicensis*) (one pair in 1997, the only known breeding location in the State), piping plovers (8 pairs in 1994; 4% of the State breeding population), American oystercatchers (*Haematopus palliatus*) (31 pairs in 1995; 17% of the State population), herring gulls (*Larus argentatus*) (893 pairs in 1995; 8% of the State population), great black-backed gulls (*L. marinus*) (68 pairs in 1995; 1% of the State population), roseate terns (*Sterna dougallii*) (75 pairs in 1994; 5% of the State population), common terns (*S. hirundo*) (2,000 pairs in 1994; 12% of the State coastal population), least terns (*S. antillarum*) (200 pairs in 1994; 8% of the State population), black skimmers (*Rynchops niger*) (33 pairs in 1994; 6% of the State population), short-eared owls (*Asio flammeus*) (breeds), horned lark (*Eremophila alpestris*) (breeds and migrant), saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*), and seaside sparrow (*A. maritimus*). Other saltmarsh breeders include clapper rails (*Rallus longirostris*) and willets (*Catoptrophorus semipalmatus*). The area is also important for passerine migrants and raptors, particularly in the fall. The tidal area at Democrat Point at the western tip of Fire Island hosts a great diversity and abundance of shorebirds. This is one of the few sites in the State with regularly breeding Chuck-will's-widow (*Caprimulgus carolinensis*).

Great South Bay

Site Description: This site is a protected, open water bay behind Fire Island and Jones Beach Islands, extending roughly from the Nassau/Suffolk County line in the west to Bellport Bay in the east, including eastern Jones Beach (Gilgo and Cedar Beaches). It is the largest shallow saltwater bay in the State, with sandy shoals and extensive eelgrass beds. Great South Bay is a highly productive ecosystem and supports a regionally important commercial and recreational fishery. Sea turtles, including the Kemp's ridley turtle (*Lepidochelys kempi*), loggerhead turtle (*Caretta caretta*), and green sea turtle (*Chelonia mydas*), regularly forage in the area.

Ornithological Summary: This is an important waterfowl wintering area. It supports an estimated 25% of the State's wintering American black ducks (*Anas rubripes*) and
22% of the State's wintering scaup, according to an analysis done by the New York State Department of Environmental Conservation (NYSDEC) using aerial waterfowl surveys from 1973-1994. The Captree Christmas Bird Count (CBC), which covers a portion of the site, has documented averages from 1980-1989 of 1,842 (maximum 3,379) brants (*Branta bernicla*); 1,501

(maximum 2,383) American black ducks; and 8,262 (maximum 18,028) greater scaup (*Aythya marila*). Mixed Species - 5,681 individuals in 2004; 8,296 in 2003; 8,707 in 2002; 1,652 in 2001; 9,019 in 2000; 3,685 in 1999, Winter. Congregations: Shorebirds/Mixed Species - 196 individuals on May 18, 1995; 528 on August 18, 1994; 408 on July 24, 1993; 617 on August 10, 1992; 1,416 on August 11, 1991, Migration.

Fire Island

Site Description: This site includes all but the westernmost few miles of Fire Island, a 32-mile long, quarter-mile wide barrier beach island off the southern shore of Long Island. According to the NY-GAP land cover data, over 15% of this site is beach/dune habitat. A site almost 8 miles long – the Otis G. Pike Wilderness Area - is the only Federal wilderness area in the State. A number of small communities are scattered along the island. The Fire Island Lighthouse, located 5 miles from the western tip, is located near a bird banding station and hawk watch site.

Ornithological Summary: This site supports colonial nesting species, including piping plovers, common terns, and least terns. The site serves as a raptor migration corridor, with an average of 5,000 hawks and a maximum of 6,654 between 1980 and 1995. Especially high numbers of American kestrels (*Falco sparverius*) (average 2,400; maximum 3,523), merlins (*Falco columbarius*) (average 1,230; maximum 1,638), and peregrine falcons (*Falco peregrinus*) (average 146; maximum 249) have been documented. The area is a stopover for diverse passerine migrants, with thousands of birds visiting in the fall. A full-scale banding operation that had been discontinued for several years has been resumed.

Carmans River Estuary

Site Description: Situated on the south shore of Long Island, this site includes the Carmans River, a New York State designated Wild and Scenic River, and its estuary, as well as uplands composed of oak and pine barren vegetation (part of the Long Island Pine Barrens). The core protected portion of the area is the 2,550-acre Wertheim National Wildlife Refuge (NWR). According to the NY-GAP land cover data, this site includes approximately 675 ac of saltmarsh habitat. The estuary provides an important spawning and nursery area for an abundance of fish and other aquatic life and is one of only four known breeding sites in the State for the eastern mud turtle (*Kinosternon subrubrum*). The site is primarily owned by the Service and Suffolk County Parks, and the rest is privately owned.

Ornithological Summary: This site is important for breeding and wintering waterfowl (3,000-4,000 on average), including large numbers of American black ducks (60% of all waterfowl at the site) and greater scaup at the mouth of the river. Hooded and common mergansers (*Lophodytes cucullatus* and *Mergus merganser*, respectively) winter further upriver, where the site provides open water in the winter when the bay freezes. The area also supports the largest breeding population of wood ducks (*Aix sponsa*) on Long Island. Carmans River's marshes support breeding at-risk birds, including the American black duck, American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*) (winters), saltmarsh sharp-tailed sparrow (probably exceeds IBA threshold, but

further data is needed), and seaside sparrow. Clapper rails and willets are also found here. During fall migration, the marshes support 5-10 shorebirds per acre, including the semipalmated plover (*Charadrius semipalmatus*), greater and lesser yellowlegs (*Tringa melanoleuca* and *T. flavipes*, respectively), semipalmated sandpiper (*Calidris pusilla*), least sandpiper (*C. minutilla*), and pectoral sandpiper (*C. melanotos*). Also, wading birds can be seen along the river and refuge marshes, including the great blue heron (*Ardea herodias*), great egret, snowy egret, little blue heron, and glossy ibis. Migrating tree swallows (*Tachycineta bicolor*) come to the marshes along the Carmans River in the last weeks of September to roost. The swallows primarily congregate in the marshes that are part of the Wertheim NWR. The estimated flock size is many thousands, numbering in the tens of thousands on some nights. These marshes also provide important habitat for thousands of red-winged blackbirds (*Agelaius phoeniceus*). The banks are bordered mostly with common reed (*Phragmites australis*), with some common cattail (*Typha latifolia*) and other brackish tolerant species.

Moriches Bay

Site Description: This site consists of a bay, marsh, and barrier beach complex (with adjoining uplands) on the south shore of Long Island, extending from the Floyd Estate in Mastic (mainland portion of the FIIS) in the west to Westhampton Beach in the east. The site includes Haven's

Estate and Cupsogue County Park, both owned by Suffolk County. It is a productive area for marine finfish, shellfish, and other wildlife.

Ornithological Summary: This site is important for nesting wading birds. West Inlet Island alone supports large numbers of great egrets (108 pairs in 2004), snowy egrets (59 pairs in 2004), little blue heron (2 pairs in 2004), tricolored heron (1 pair in 2004), black-crowned night heron (155 pairs in 2004), and glossy ibis (44 pairs in 2004). The site also supports at risk species such as osprey (breeds), piping plovers (48 pairs in 1998), roseate terns (four pairs in 1998), common terns (631 pairs in 1999), least terns (6 pairs in 1999), black skimmers (23 pairs in 1998), and seaside sparrow (breeds). Herring gulls (368 pairs in 1995, 3% of the State population.) and great black-backed gulls (168 pairs in 1995; 3% of the State population) nest here, as well. The saltmarshes support breeding clapper rails, American oystercatchers, willets, and saltmarsh sharp-tailed sparrows. The site is also an important waterfowl wintering area. The NYSDEC mid-winter aerial waterfowl surveys from 1975-1984 documented over 5,000 individuals on average (8,382 in peak year). These included an average of 350 brant (580 maximum), 400 Canada geese (*Branta canadensis*) (870 maximum), 1,100 American black ducks (1,580 maximum), 225 mallards (*Anas platyrhynchos*) (430 maximum), 2,150 scaup (4,470 maximum), and 400 red-breasted mergansers (*Mergus serrator*) (920 maximum). Congregations: Waterfowl/Mixed Species - Over 5,000 individual waterfowl on average, with 8,382 individuals during the peak year. Congregations: Waterbirds/Terns - Estimated 637 pairs in 1999; 1,129 in 1998; 920 in 1997; 1,504 in 1996; 586 in 1995; 216 in 1994; and 948 in 1993. Congregations: Wading Birds/Mixed Species - Islands in the bay easily support more than 100 pairs of nesting herons.

B. HABITAT AND ECOSYSTEM DESIGNATIONS

The study area consists of numerous communities, ecosystems, and habitats that have been designated and identified in several publications and efforts. These efforts/publications include the FIMP Habitat Evaluation Team, the Service's Restoration PAL, the Corps' Conceptual model publications, and the Corps' cover type designations. The following is a listing of the effort or publication and the corresponding cover type/community/habitat designations:

For the purposes of this report and for consistency with the Corps' efforts, the Service shall use the habitat designations developed by the Corps in their conceptual model Phase III publication (U.S. Army Corps of Engineers 2006b). (The Service also designates two additional habitats – Bay Islands within the Bay Ecosystem and Mainland Uplands/Wetlands within the Terrestrial Upland portion of the Barrier Island Ecosystem.) The publication identifies four ecosystems within the project area as follows (Figure 3):

Coastal Marine Ecosystem;

Ocean Beach and Dune Ecosystem;

Bay Ecosystem; and

Barrier Island Ecosystem.

<u>Coastal Marine Ecosystem</u>

This ecosystem consists of the following habitats:

Offshore - Subtidal marine habitat ranging in depth from 10 to 30 meters (m); includes pelagic and benthic zones.

Nearshore – Mean low water (MLW) to depth of 10 m; includes pelagic and benthic components.

Marine Intertidal - Extends from the boundary of the marine nearshore at MLW, to mean high water (MHW); sandy substrate.

<u>Ocean Beach and Dune Ecosystem</u>

This ecosystem consists of the following habitats:

Marine Beach - Extends from the MHW line on the oceanside to the boundary of the primary dune and swale habitat with the terrestrial upland; sandy substrate.

Dunes and Swales - Primary dune through most landward primary swale system.

Bay Ecosystem

This ecosystem consists of the following habitats:

Bay Intertidal - Extends from the terrestrial upland boundary with MHW, or landward limit of high marsh vegetation of the barrier island terrestrial upland habitat, to MLW; includes other habitats such as tidal marsh, shoals, and/or mud flat.

Bay Subtidal - Bayside aquatic areas below the MLW, includes SAV beds (bayside vegetation communities found within the subtidal zone).

Inlets - Areas of water interchange between backbay and ocean zones (e.g., Fire Island Inlet, Moriches Inlet, and Shinnecock Inlet).

Bay Islands - An important habitat present within the FIMP study area that the Corps does not account for in their habitat designations is bay islands, which, for the purposes of this document, are defined as upland islands in one of the bays, landward of the bay intertidal areas but not connected to the mainland of Long Island.

Barrier Island Ecosystem

This ecosystem consists of the following habitat:

Terrestrial Upland - Extends from the landward boundary of the primary dunes and swales on the oceanside, to the MHW boundary of the bay intertidal habitat on the bay side of the island; contains all upland and wetland habitats, including the maritime forest; scrub/shrub are also included in this habitat, along with bayside beach areas.

C. PHYSICAL PROCESSES AND HABITAT FORMATION

The Service recognizes that the project area contains land development, and hence the proposal for the project. However, the review of the project includes an analysis of the barrier island system as a whole; therefore, discussions include descriptions of the processes which occur over the entire system.

A constantly evolving and changing habitat complex, unusual in other landforms, is typical of barrier islands. Changes in the islands' shape and position occur from season to season, and even day to day. The sandy ocean beachfront constantly adjusts to the balance between two factors: (1) the erosive forces of storm winds and waves, and (2) the restorative powers of prevailing geological, oceanic, and meteorological actions. In response to the interplay of these forces, the whole system of beaches, barrier islands, and dunes shift more or less continuously (Clark 1977).

Over a longer time span, the mass/energy interaction has resulted in a relatively continuous, though intermittent, landward migration (Panageotou et al. 1985) of Long Island's barrier island system. The force driving the islands landward is rising sea level. The relative sea level rise in

the New York area has averaged about 2 millimeters (mm) (0.1 inch) per year during the past 50+ years (Leatherman et al. 1985). However, higher rates of sea level rise have been predicted for the next century (Beatley 1991). Globally, sea level may rise between 10 inches and 6.5 ft (between 25 and 200 centimeters [cm]) in the next century (Bokuniewicz and Schubel 1991; Beatley 1991).

The phenomenon of migration is often termed erosion by some, but this is not accurately descriptive for barrier beaches. What happens to the whole barrier landform is not erosion in the sense that the barrier is being chopped away and is gradually disappearing; barriers retreat or migrate and they do so as entire ecological units. In marked contrast to the sea cliffs which erode from fixed positions, coastal barriers move themselves backwards onto marsh and lagoonal deposits as they climb the slope of the continental shelf (Department of the Interior 1983).

As the barrier landform retreats, its transported sand buries parts of its system, such as saltmarshes, but new marshes develop further landward on the leading edge of the new sediment. Although a barrier's movement is in response to the steadily rising sea level, the pace of its migration is not steady. Its migration depends in large part upon crucial events which occur during storms: inlet formation and overwash. These are the primary mechanisms by which sand is transported landward from the oceanfront, along with a third process which occurs on some coastal barriers: wind-blown dune migration (Department of the Interior 1983).

All three processes can be affected by stabilized dune systems. Formation and stabilization of well-developed dunes can significantly moderate a barrier's dynamic of change. Inlets contribute to barrier island retreat. Enormous quantities of sand can be swept through a new inlet. Then new marshes form on the flood tidal delta. The net result of these dynamics is the further retreat of the barrier system with all ecological units retained (Department of the Interior 1983).

1. Overwash

Barrier beaches in active retreat actually roll over themselves into the lagoon or back-bay. The most common mechanism for accomplishing this is overwash, the breaching of dunes by a severe storm surge which carries beach and dune sand onto the backdune region (Figures 18 and 19). Depending on the storm's magnitude and the island's width, the overwash area of newly transported sand may go no further than the dunes, or it may spread onto the marshes or into the lagoon. In general, major overwashes only occur during exceptionally severe storms (Department of the Interior 1983).

Overwash processes can provide a source of sediments to the barrier island and contribute to elevational changes. In locations where the dunes are not breached during a major storm, washover deposits are negligible, and the dominant sediment transport direction is seaward. In locations where the dune is absent or breached, overwash processes are uni-directional, delivering sand to the island surface, but not removing sand from the littoral system as an inlet would (Leatherman 1985). These rare but potentially large overwashes generally result in localized accretion on the bay side (New York Sea Grant Institute 1993). Hurricane/Superstorm Sandy caused extensive overwash on Fire Island, although inland deposits accounted for only 14% of the

volume lost from beaches and dunes, indicating that the majority of this material was moved offshore (Hapke, et al. 2013).

2. Inlet Dynamics

Barrier ecosystems seem to rely mainly upon inlet dynamics for landward displacement. Migrating and temporary inlets/breaches provide flood tidal deltas upon which the barrier island environments are established. A flood tidal delta exhibits a deltaic pattern upon full development, and when an inlet closes or migrates it becomes prime substrate for saltmarsh development. These actually become the substrates for marsh growth and thereby extend the bay shoreline landward. Wind-carried and overwash sediments then are deposited on top of this accretionary base. These two types of sediment movement (via wind and overwash) are what makes it possible for a barrier to grow vertically (Department of the Interior 1983). While inlet formation is an infrequent process in this barrier island system, it is within the range of natural variability of that system. It is gradually becoming apparent that major disturbance events, such as avalanches, fires, and floods, are integral to the effective function of dynamic systems that are prone to such disturbance (Sousa 1984; Holling and Meffe 1996; Murray 1996).

Significant storm conditions are required in order to induce the formation of an inlet. This fact is emphasized by the number of washovers that occur during large storms. Few of these washovers cross the island completely, much less produce new inlets. Of the four inlets that opened into Shinnecock Bay in 1938, only Shinnecock Inlet persisted, eventually being stabilized by the Corps in 1954. The hurricane of 1938 washed over the entire beach between Democrat Point and Ocean Beach and many other places as well (Bokuniewicz and Schubel 1991). After that, 63 washovers occurred after a hurricane in 1944. Thirteen washovers were found after a storm in 1949. A storm in 1953 caused seven or more washovers, while nine washovers were reported after a storm in 1960. Fifty more occurred after another storm in 1962. A storm in 1963 produced four washovers on eastern Fire Island. None of these washovers resulted in a permanent inlet. For inlet formation to occur, certain geophysical and meteorological conditions must be met. Leatherman (1982) states that overwash is a relatively common event, happening during most major storms, but that inlets are relatively rare, occurring only once in 50 to 75 years along some shorelines. This implies that the opportunity for inlet-based habitat formation is an equally rare occurrence.

Inlets of varying size and number have developed at various times in Fire Island's history, particularly in eastern Fire Island. By examining the barrier island chain from Fire Island to Montauk Point, it can be demonstrated that 59% of the system has been subject to inlet activity (Leatherman et al. 1985). Other parts of Fire Island, particularly the central portion, have been stable for hundreds of years. For example, Fire Island's Sunken Forest, a true maritime forest, could only have developed under conditions of prolonged limitation of environmental stresses, particularly salt spray and saltwater flooding (Leatherman et al. 1985). The development of the Sunken Forest is due to the fact that it is protected behind a high secondary dune. In this location, washovers do not penetrate the secondary dune, which is also effective at screening back-barrier vegetation from salt spray. The western part of Fire Island has not migrated landward but has narrowed while following the migration of Fire Island Inlet to the west.

As stated above, three breaches formed on Fire Island at Smith, Old Inlet, and eastern Fire Island Pines. The breach at Smith Point was a relatively small breach that did not appear to exhibit exchange of ocean and bay waters at low tide (Papa, personal observation), but was closed by the Corps under the provisions of the Corps' BCP in December 2012. The breach at Old Inlet remains open and options concerning its management are being explored by the NPS in accordance with the Fire Island Wilderness Act of 1983 (Public Law 95-585) and NEPA. The breach at eastern Fire Island Pines did not require any action under the Corps' BCP as no exchange of bay and ocean water was observed after the storm passed and tidal levels subsided.

3. Habitat Formation

Along the south shore of Long Island, the normal evolution for an inlet results in sediments and geomorphic features moving both northward (landward) and westward (downdrift) (Leatherman 1985). This inlet migration in two directions over time gives rise to complex sedimentary patterns involving a variety of different inlet-related environments: bay bottom, deep to shallow inlet channel, active and relict flood and ebb tidal deltas (Figure 20), spit platform, and spit (Figure 21) (Leatherman 1985). Each of these sedimentary forms has specific niche functions in the ecology of Great South Bay (New York Sea Grant Institute 1993) and Moriches Bay. The outstanding biological diversity and abundance of Long Island's south shore estuary is, in part, a consequence of the variety of habitat types within the system.

Through time, an unstabilized inlet achieves a net downdrift migration and eventually becomes choked with sand and closes. Marsh islands develop in the bay if the flood tidal delta achieves sufficient elevation and the bay hydrodynamic environment supports its development. Eelgrass beds may develop below the MLW line of the flood tidal delta at a depth controlled by turbidity and bay wave turbulence. The presence of saltmarsh islands and the wide bayside marshy plains on the northern shore of Long Island's barrier islands can be an impediment to inlet development because of the resistance of the marshy substrate to erosion. Inlet migration and closure depend upon the longshore current and the tidal jet flushing capacity (Leatherman 1985). The subsequent formation of flood tidal deltas varies in time depending on the forces at the inlet.

Comparison of wetland areas and historical inlet locations illustrate that barrier islands have widened and strengthened at historical inlet sites. Creation of these wetland areas has also led to habitat formation. Inlet processes are mainly responsible for providing sediment to the barrier bayshore, causing a widening of the island at inlet locations and, therefore, promoting landward migration (Leatherman et al. 1985). When the inlet closes, this large sedimentary deposit becomes an excellent substrate for potential saltmarsh colonization (Gregg 1982; Leatherman 1982; National Park Service 1995). The marsh islands in the bay and most, if not all, of the bayshore marshes formed atop flood-tidal delta sediments (Leatherman et al. 1985; New York Sea Grant Institute 1993) in locations where bay wave energies are sufficiently small.

Overwash contributes in several important ways to maintaining barrier islands and their ecosystem functions, especially as habitat for many plant and animal species. In the process of the barrier island's growth through overwash, several important unique landforms are produced, including overwash channels, overwash fans, vegetated and non-vegetated subtidal flats, and backdunal

swales. Overwash that crosses the entire barrier island leaves behind distinct corridors known as washovers (Kana and Krishnamohan 1994). These areas are important biological corridors, linking ocean and bay habitat. Several species, especially the piping plover, are known to take advantage of the increased access to bayside forage areas afforded by overwash corridors. Overwash areas produced the highest densities of piping plover nesting in the State during the 1995 and 1996 breeding seasons (NYSDEC 1997).

Overwash maintains unvegetated intertidal sand flats by providing a vital clearing function, similar to naturally occurring forest fires and river bank floods. Bayside sand spits are especially productive for shorebirds and wading birds. A new spit and shoal complex formed following the 1992 breach at Westhampton and has become a highly productive nesting and forage area for shorebirds, including black skimmer (*Rhynchops niger*), American oystercatcher (*Haematopus palliatus*), willet (*Catoptrophorous semipalmatus*), least tern, common tern, and piping plover. This area produced one of the highest nesting densities of piping plover in the state of New York from 1995 to 1996 (NYSDEC 2001).

Both overwash fans and flood tidal deltas are prime spawning grounds for the horseshoe crab (*Limulus polyphemus*) (New York Sea Grant Institute 1993). Intertidal beaches are used by several fish species as a spawning site. The Atlantic silverside deposits its eggs in filamentous algae (*Enteromorpha* spp.) or other vegetative material in the upper intertidal zone of saltmarshes and open beaches (Conover and Kynard 1984). The mummichog (*Fundulus heteroclitus*) also deposits eggs in the upper intertidal zone either on stems of *Spartina*, within empty mussel shells, or amongst filamentous algae (Able and Castagna 1975; Taylor et al. 1977). The unvegetated stretch of sand between MHW and the upper tidal limit is also prime feeding habitat for numerous species of shorebirds, especially during spring and fall migrations, and prime nesting habitat for several beach nesting birds, including piping plover, common and least terns, black skimmer, and American oystercatcher (Bull and Farrand 1977).

IV. FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

The purpose of consultation under the Fish and Wildlife Coordination Act (FWCA) is to ensure equal consideration of fish and wildlife resources in the planning of water resource development projects. The Service's emphasis in this regard is to identify means and measures to mitigate the potential adverse impacts of the proposed project and to make positive contributions to fish and wildlife resource problems and opportunities.

This report was prepared concurrently with other Corps' environmental review requirements. From the Service's perspective, a desired output of the proposed project is to ensure the protection of healthy marine, estuarine, and terrestrial ecological communities. Specifically, the Service recommends that conservation of fish and wildlife resources be accomplished by: (1) ensuring that the proposed project evaluate alternatives which achieve and maintain high biological diversity; (2) ensuring natural areas are protected and monitored throughout the life of the project; (3) ensuring construction designs promote high value habitats for Service trust species; (4) establishing conservation easements over the life of the project; and (5) incorporating education

and outreach activities to the project to inform the public about the uniqueness and fragility of the coastal ecosystem.

Ultimately, the Service's Mitigation Policy (January 23, 1981, Federal Register v. 46 n. 15 pp. 7644-7663) establishes a number of criteria which, if met, would allow the Service to support a water resource development project. These criteria are:

1) The projects are ecologically sound.
2) The least environmentally damaging alternative is selected.
3) Every reasonable effort has been made to avoid or minimize damage or loss of fish and wildlife resources and uses.
4) All mitigation recommendations have been adopted with guaranteed implementation to satisfactorily compensate for unavoidable damage or loss consistent with the appropriate mitigation goal.
5) For wetlands and shallow water habitats, the proposed activity is clearly water dependent and there is a demonstrated public need.

V. EVALUATION METHODS

The Corps' planning schedule and funding limitations precluded the Service from conducting field surveys and investigations for significant wildlife resources, such as migratory birds, in the study and FWCA analysis areas. As a result, descriptions of natural resources are based on previous studies for similar projects, relevant grey and peer-reviewed literature, local, State, and Federal fish and wildlife reports and plans, and personal communications with knowledgeable biologists, planners, coastal geologists, and engineers.

In this report, the Service provides a discussion of Federal trust resources (i.e., migratory birds, wetlands, endangered species, and anadromous fish), as well as shellfish, for the project area. However, our analysis focuses on migratory birds and wetlands due to the fact that the Corps will likely have to complete an Essential Fish Habitat assessment for a number of marine shellfish and finfish species during consultation with NOAA/F, and consultation under the ESA will be required for Federally-listed species in the proposed project area.

In developing mitigation recommendations, the Service relied on experience, literature searches, and local, State, and Federal conservation plans (e.g., bird conservation plans and local, State, and Federal land and water conservation plans), and special designations (e.g., Federally- and State-identified Significant Fish and Wildlife Habitat Complexes) to derive appropriate recommendations for mitigation and fish and wildlife enhancement opportunities.

Fish and wildlife enhancement opportunities are presented which represent actions that are recommended as part of existing conservation plans, which would benefit migratory birds and the habitats in the study area that support them.

As discussed in more detail in the following section, this report discusses fish and wildlife resources which use the three major ecological systems (marine, estuarine, and terrestrial) found in the significant land and water complexes of the proposed project area.

VI. DESCRIPTION OF FISH AND WILDLIFE RESOURCES

The following text includes descriptions within the context of the entire FIMP study area and, where specific information is available, descriptions within the specific FIMI project.

A. COASTAL MARINE ECOSYSTEM

1. Offshore

The offshore marine community consists of benthic organisms such as worms (*Polygordius triestinus*), sand dollar (*Echinarachnius parma*), small clam (*Tellina agilis*), surf clam, and finfish such as summer flounder (*Paralichthys dentatus*) and little skate (*Raja erinacea*) (U.S. Army Corps of Engineers 1999). Marine mammals such as the harbor seal and sea turtles, such as the leatherback sea turtle, have been reported to utilize the open marine community as well (U.S. Army Corps of Engineers 1999).

Surf clams are a dominant species of inshore benthic infauna and also an important commercial fishery resource. Most surf clam beds off of Long Island occur from the beach zone to a depth of approximately 150 ft (Fay et al. 1983). Adult surf clams rarely voluntarily vacate their burrows, usually only being displaced by oceanic storms (Fay et al. 1983). The Corps surveys, conducted in August and September of 2001 (most recent known comprehensive surveys), of 9 sampling areas distributed along the FIMP study area shoreline, indicated that many survey areas had very small or no localized surf clam populations with the exception of areas off of Fire Island Pines (borrow area 2AD, east of FIMI borrow area 2C) and areas east of Shinnecock Inlet (U.S. Army Corps of Engineers 2002). Surf clams were found in the FIMI borrow areas 2c (maximum of 2 bushels of clams in one of the survey stations) and in the vicinity of area 4c (FIMP borrow area 4A- maximum of 11 bushels) during these 2001 surveys, but the abundance was relatively low when compared to the borrow 2AD area that had a maximum of 67 bushels. Although these results indicate general trends in surf clam distribution within the FIMP area, these surveys occurred in potential borrow areas and sampling points were not necessarily distributed to quantify surf clam populations for the entire FIMP study area.

Many benthic macro-invertebrate species within the offshore marine substrate are important prey/forage for commercially and ecologically important finfish species. The Corps conducted benthic invertebrate surveys of potential borrow areas in the Fall of 2000 and Spring of 2001 (U.S. Army Corps of Engineers 2004a). Dominant species observed in the fall of 2000 included amphipods (*Gammarus oceanicus* and *Protohaustorius wigleyi*), polychaete worms (*Magelona rosea* and *Tharyx acutus*), archiannelid worms (*Polygordius triestinus),* tanaid/crustaceans (*Leptochelia savignyi),* sand dollars, and bivalves (*Tellina agilis*). Dominant benthic invertebrate species observed during the Spring of 2001 surveys included amphipods (*G. oceanicus, P. wigleyi,* and *Amphiporeia gigantean*), Nematoda, archiannelid worms (*P. triestinus*), bivalves (*T. agilis*),

and polychaete worms (*Spiophanes bombyx* and *Syllidae* spp.). The Corps concluded that abundances and diversity of benthic invertebrates were generally consistent among borrow areas and between seasons (U.S. Army Corps of Engineers 2004a).

Dominant fish species observed during Corps surveys of four potential borrow areas in 1999-2002 included Atlantic silverside, striped anchovy (*Anchoa hepsetus*), bay anchovy (*Anchoa mitchilli*), spotted hake (*Urophycis regia*), butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), Atlantic herring (*Clupea harengus*), silver hake (*Merluccius bilinearis*), winter flounder (*Pseudopleuronectes americanus*), winter skate (*Raja ocellata*), and little skate (U.S. Army Corps of Engineers 2004b). The Corps found that the greatest abundance of finfish occurred in the fall months at depths greater than 30 ft and that the off-shore bottom predominantly consisted uniformly of sand. A review of the Corps' finfish database indicate that the areas within the vicinity of Shinnecock Inlet and borrow area 2b (offshore of Fire Island Pines) had the highest diversity of finfish species (U.S. Army Corps of Engineers 2004b).

The Corps also surveyed the same four borrow areas for squid, a carnivore that feeds upon small fish, crustaceans, benthic worms, and shrimp, that is an important commercial fishery resource and prey species for many finfish species, including bluefish and silver hake. Squid were observed at each of the borrow areas with the greatest numbers occurring in the fall months (U.S. Army Corps of Engineers 2004b). Squid abundance appears to be evenly distributed, except for a slightly higher abundance at the Shinnecock borrow area in the summer and borrow area 2c (offshore of Sailors Haven) in the winter and spring.

Artificial Reefs

The NYSDEC Division of Marine Resources develops and manages artificial reefs to provide fishing opportunities for fish species that frequent hard bottom habitat. These species include tautog, black sea bass (*Centropristis striata*), and scup (New York State Department of Environmental Conservation 2006). Artificial reefs present within the FIMP study area include:

Fisherman (Great South Bay, 1.0 nautical miles northeast of the Robert Moses water tower);

Kismet (Great South Bay, north of Kismet);

Fire Island (Atlantic Ocean, 1.8 nautical miles south of Fire Island Lighthouse);

Moriches (Atlantic Ocean, 2.1 nautical miles south of Moriches Inlet), proposed to be significantly expanded from 14 to over 400 ac; and

Shinnecock (Atlantic Ocean, 2.0 nautical miles south of Shinnecock Inlet) proposed to be significantly expanded from 35 to over 400 ac.

These reefs consist of red shale, jetty stone, barges, ship hulls, and buoy anchors.

Essential Fish Habitat (EFH)

The EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act authorize the NOAA/F to evaluate development projects proposed or licensed by Federal agencies, including the Corps. If coastal development projects have the potential to adversely affect marine, estuarine, or anadromous species or their habitat, the NOAA/F makes recommendations on how to avoid, minimize, or compensate these impacts (National Oceanic and Atmospheric Administration website http://www.nero.noaa.gov/hcd/webintro.html).

The Act also establishes measures to protect EFH. The NOAA/F must coordinate with other Federal agencies to conserve and enhance EFH, and Federal agencies must consult with NOAA/F on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. In turn, NOAA/F must provide recommendations to Federal and State agencies on such activities to conserve EFH. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from actions or proposed actions authorized, funded, or undertaken by that agency.

The EFH areas are depicted in NOAA/F's website http://www.nero.noaa.gov/hcd/webintro.html). Several of the dominant species discussed above are designated as EFH species by the NOAA/F, including the Atlantic butterfish, scup, and winter flounder. The Corps will need to complete EFH consultation with the NOAA/F for this project.

2. Nearshore

The Service (U.S. Fish and Wildlife Service 1996) defines the nearshore zone as the aquatic area between the offshore 20-m depth contour and the MLW line. The nearshore bottom is a gently sloping terrace composed of a uniform sand sediment surface (U.S. Fish and Wildlife Service 1996b). The NYSDEC's New York Natural Heritage Program (NYNHP) defines the community within this area as the Marine Deepwater Community (New York Natural Heritage Program 2002).

The nearshore community within the project area is also a sandy, sparsely vegetated aquatic community dominated by benthic organisms such as the polychaete worm (*Mageloma papillicornis*) and dwarf tellin (*Tellina agilisa*), and sea turtles, such as the Kemp's ridley sea turtle (U.S. Army Corps of Engineers 1999). Finfish observed in the nearshore zone include bluefish, striped bass (*Morone saxitilis),* alewife, Atlantic menhaden (*Brevoortia tyrannus*), northern kingfish (*Menticirrhus saxatilis*), and striped sea robin (*Prionotus evolans*) (U.S. Fish and Wildlife Service 1981a).

3. Marine Intertidal

The marine intertidal gravel/sand beach community is characterized by tidal or wave inundation and has sand or gravel substrates (New York Natural Heritage Program 2002). This community is present along the majority of the Atlantic shoreline within the FIMP study area. The marine rocky intertidal community is also influenced by tidal and wave inundation, but its substrate

consists of boulders/rocks. This community is present in the eastern portion of the FIMP study area, specifically along the south shore of the Montauk Peninsula (New York Natural Heritage Program 2002). The marine riprap/artificial shore community is present at the groins and jetties located along the FIMP area, Atlantic Ocean shoreline, including the jetties at Fire Island, Moriches, and Shinnecock Inlets, and groins at Westhampton Beach.

Corps Surveys

West of Shinnecock Inlet

The Corps beach invertebrate surveys were conducted at twelve locations from Fire Island to Shinnecock Inlets in the Spring and Fall of 2003, using benthic cores, wrackline observations and pitfall traps (discussed in the Marine Beach community section). Overall, dominant species observed in benthic cores included oligochaeta, nematoda, and blue mussel. In the spring, oliochaeta and nematoda were dominant in the low, mid, and high tide zones and the wrack line, while blue mussel and turbellaria flatworms were dominant only in the low tide zone. In the fall, oliochaeta and nematoda were dominant in each portion of the intertidal area, with oliochaeta being more dominant in the upper zones (high tide and wrack line) and Nematoda being more dominant in the lower zones (low, mid, and high tide zones). Dominant wrack line organisms observed included springtail (*Anurida maritima),* bivalves, amphipod beach fleas, and common sea star (*Asterias forbesii*). The total number of benthic organisms appeared to fluctuate randomly along a west-to-east gradient, while the stations fronting Shinnecock Bay had the highest mean abundance (U.S. Army Corps of Engineers 2005a). There was a greater abundance of benthic organisms observed in the fall. In the spring, benthic organism abundance was highest at the mid-tide zone while abundance was more evenly distributed in the fall.

A comparison of the findings of this study and the study of the eastern portion of the FIMP study area described above, indicated seasonal similarities in abundances and taxa, but differences along the transects. In this study of the western portion of the study area, there were a higher number of benthic invertebrates found in the high tide line and wrack locations, while the study of the eastern portion of the study area showed higher organism abundances in the mid and surf zones than the wrack (U.S. Army Corps of Engineers 2005a). This phenomenon may be due to the fact that the shoreline of the eastern portion of the study area, primarily Montauk Point and Ditch Plains, is armored with stones, boulders, and coarse sand, while the western portions consist of sand. Additionally, off-road vehicle traffic affects wrackline abundances.

Refer to Corps 2005a for a complete listing of species observed and a more comprehensive discussion of study findings.

B. OCEAN BEACH AND DUNE ECOSYSTEM

1. Marine Beach

Vegetation

Landward of the sandy intertidal zone is the maritime beach community that is typically dominated by American beachgrass (*Ammophila breviligulata*), sea-rocket (*Cakile edentula*), seaside goldenrod, seaside spurge (*Chamaesyce polygonifolia*), and the Federally-listed threatened seabeach amaranth (New York Natural Heritage Program 2002).

The NPS-FIIS, U.S. Geological Survey (USGS), NYNHP, The Nature Conservancy (TNC), and Conservation Management Institute completed the mapping of vegetation within the FIIS in 2002 (Conservation Management Institute 2002). These maps (too large to be incorporated into this document) are available at http://biology.usgs.gov/npsveg/fiis/index.html. Dominant species observed in this effort within the Marine Beach habitat (classified as North Atlantic Upper Ocean Beach in their report) included American beachgrass, seaside goldenrod, and beach pea (*Lathyrus japonicus*).

Benthic Species

Dominant species/taxa observed in pitfall traps (in the wrackline, supratidal, and grass zones) from above-described surveys conducted in the Spring and Fall of 2003, included brine fly (*Ephydridae* spp.) and ground beetle (*Clivinia* spp.), beach flea amphipods (*Talorchestia longicornis* and *T. megalopthalma*), and incidental collections of blue mussel (U.S. Army Corps of Engineers 2005a). In the spring, *T. longicornis* was more dominant while *T. megalopthalma* was more dominant in the fall. Generally, *T. longicornis* was more dominant in the wrack line and supratidal zone while *T. megalopthalma* was more dominant in the grass zone. There was a greater abundance of invertebrates captured/observed in the spring than the fall, with the greatest abundance along the beaches fronting the Great South Bay (Old Inlet).

Significant Habitats

The Service's Significant Habitat and Habitat Complexes of the New York Bight Watershed Report identifies sandy beach areas within the following significant habitat complexes:

Moriches Bay

Smith Point County Park, Pikes Beach, Westhampton Beach, and Cupsogue County Park - Piping plovers and least terns nest on these sandy beaches and harbor seals haul-out at Cupsogue County Park in the winter.

Great South Bay

Democrat Point, FIIS Wilderness Area - Piping plovers and least terns nest and seabeach amaranth grows on these sandy beaches.

The following New York State Department of State (NYSDOS)-designated Significant Coastal Habitats (SCH) are present within this zone (excerpts from NYSDOS web-site):

Smith Point County Park

Smith Point County Park is one of the largest segments of undeveloped barrier beach on Long Island, comprising a rare ecosystem type in New York State. This area contains the largest extent of saltmarsh in Moriches Bay, and is an important habitat for many fish and wildlife species throughout the year. Piping plovers nest on the upper beach. The dunelands at Smith Point County Park comprise a significant segment of the fall migration corridor for raptors moving south along the Atlantic Coast. Undeveloped dune areas such as this provide critical feeding and resting areas for thousands of migrating raptors each year.

Cupsogue County Park

Cupsogue County Park is an important segment of undeveloped barrier beach on Long Island. This area is a valuable habitat for a variety of wildlife species, including foraging and breeding habitat for least terns and piping plovers. Barrier beach dunelands, such as that found on Cupsogue County Park, are also essential resting and feeding areas for migrating raptors, especially falcons and accipiters, which move south through a very narrow corridor along the south shore. These birds forage extensively among the undeveloped barrier beaches, where concentrations of small mammals, migrant shorebirds, and passerine birds provide an important prey base. The wetland areas in Cupsogue County Park are valuable feeding areas for a variety of shorebirds and waterfowl throughout the year, and contribute significantly to the biological productivity of Moriches Bay.

Corps Avian Surveys

The Corps conducted a 1-year survey of avian species within the FIMP study, specifically along the barrier islands from Fire Island Inlet to just east of Shinnecock Inlet, along 20 transects from May 2002-May 2003 (U.S. Army Corps of Engineers 2003). Beach habitat, including intertidal and supratidal areas, consisted of the largest percentage of habitat surveyed. Dominant species observed during these surveys include:

Black-bellied plover (*Pluvialis squatarola*), forages in beach habitat during winter and migration;
Dunlin (*Calidris alpine*), forages in beach habitat during winter and migration;
Great black-backed gull, year-round foraging;
Herring gull, year-round foraging;
Least tern, forages and breeds in spring/summer;

Piping plover, forages and breeds in spring/summer;
Sanderling, forages during winter and migration.

Other species regularly observed in the beach habitat include the American oystercatcher, which forages and breeds in the spring/summer, and semi-palmated plover, which forages during migration.

The Service conducted avian surveys for the FIMP project from May-July of 1982, from Moriches Inlet to Montauk Point. These surveys identified many of the above listed species as dominant in the marine beach habitat, as well as the American kestrel and horned lark, both year-round residents (U.S. Fish and Wildlife Service 1983).

Federally- and State-listed Species

Beach habitat also provides essential foraging and nesting habitats for nesting waterbirds, including the Federally-listed threatened piping plover, endangered roseate tern, and State-listed threatened least tern, common tern, and species of special concern black skimmer. The red knot (*Calidris canutus rufa*), a candidate species for ESA protection, does utilize sandy beaches within the FIMP/FIMI study area as stop-over/foraging habitat during spring and fall migrations. However, this species is more concentrated in areas where horseshoe crab eggs are available for forage, which is in the bay intertidal habitat discussed more below. Seabeach amaranth is a Federally-listed threatened plant that grows in this habitat.

Within the FIMI area, the piping plover and least tern nest in Marine Beach and Dune and Swale, Terrestrial Upland, bayside beach and bay island habitats along the ocean shoreline, and back-bay areas as well. Specifically, the following areas have had recent (since 2009) piping plover and least tern breeding: Democrat Point, FIIS Lighthouse Tract, FIIS Sunken Forest, FIIS Wilderness Area, and Smith Point County Park. Plovers have also bred in the RMSP and East Inlet Island, while the least tern has also bred at East Fire Island. Plovers forage on invertebrates primarily along the ocean and bay shorelines, while the least tern forages for fish in ocean and bay open waters.

The roseate and common terns breed on bay islands and forage for fish in ocean and bay open waters. Black skimmers also breed on bay islands in tern colonies and forage in ocean and bay waters for fish. Specifically within the FIMI, roseate terns breed in a common tern breeding colony at New Made Island in Moriches Bay, while the common tern has nested at: New Made Island, FIIS Wilderness Area at Long Cove, Carter's Island, Tuthill Cove, and West Inlet Island in Moriches Bay, Pattersquash Island in Narrow Bay, Ridge Island in Bellport Bay, and Sexton Island and East Fire Island in Great South Bay. Black skimmers have not nested recently within the FIMI project area, with the nearest breeding occurring at the adjacent Tuthill Cove in Moriches Bay.

Seabeach amaranth only grows on sparsely vegetated ocean beaches (USFWS 1996a). This annual plant usually grows at Democrat Point, RMSP, and along ocean beaches within FIIS, as well as Smith Point County Park.

A summary of population trends for these species (NYSDEC Long Island Colonial Waterbird and Piping Plover data) within New York State (Long Island) are listed as follows:

Table 1. Federally and State-Listed Species Within the FIMI Study Area

Species (1-Number of Pairs, 2-Number of individuals)						
Year	Piping Plover[1]	Roseate Tern[1]	Common Tern[2]	Least Tern[2]	Black Skimmer[2]	Seabeach Amaranth*
2000	289	2104	19,664	2,103	331	138,600
2001	309	1815	17,499	2,737	512	179,300
2002	369	1853	15,790	3,267	491	190,500
2003	386	1938	18,405	2,678	378	112,128
2004	384	1804	19,116	2,069	265	30,831
2005	374	1380	19,330	3,382	418	16,813
2006	422	1835	20,097	2,798	390	32,473
2007	456	1,832	17,548	2,792	483	3,914
2008	472	1324	21,441	3,669	622	4,416
2009	475	1328	17463	2817	690	5,402
2010	428	1315	18,177	2832	589	534
2011	334	1505	8,161	2311	538	2,662
2012	391	1501	15,616	1720	508	1,213
2013	344	1,544	17,453	2,281	557	729

* - Number of plants

A more detailed assessment of the piping plover, seabeach amaranth, and roseate tern will be completed during ESA Section 7 consultation.

Although not a Federally or State-listed species, the American oystercatcher (*Haematopus palliates)* is a ground-nesting shorebird which breeds within the ocean beach, dunes and swales, terrestrial upland, bayside beach, and bay island habitats within Federally and State-listed species communities within FIMI. Specifically, this species breeds at: East Inlet, Carter's and New Made Islands in Moriches Bay, John Boyle, Ridge, Pelican and Hospital Islands in Bellport Bay, the Islip spoil island in Great South Bay, and on the Fire Island barrier island at Democrat Point, and FIIS in the Lighthouse tract and Long Cove.

Limiting factors in shorebird productivity include disturbances from recreational activities, flooding/inundation of nests, predation, beach stabilization practices, and loss of habitat from development. Limiting factors in seabeach amaranth growth include trampling from off-road vehicles and/or pedestrians, loss of habitat from development, beach stabilization practices which promote dense beach grass growth, flooding during extreme storm events, and competition with perennial plants as beach habitat is stabilized (USFWS 1996a).

2. Dunes and Swales

Vegetation

The vegetated beach community consists of the vegetated dune and back-dune areas which are dominated by American beachgrass, bayberry (*Myrica pennsylvanica*), dusty miller, beach plum (*Prunus maritima*), beach heath (*Hudsonia tomentosa*), beach pea (*Lathyrus japonicus*), Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Rhus radicans*), and common saltwort (*Salsola kali*).

The NPS-FIIS vegetation mapping efforts (Conservation Management Institute 2002) designated several vegetation classes/communities present within dunes and swales, listed in Table 2.

Table 2. NPS-FIIS Dunes and Swales Vegetative Communities of Fire Island

Vegetation Class/Community	Description	Dominant Species
Northern Beach Grass Dune	Perhaps the most prevalent on Fire Island. It is found on the ocean side of the interdunal area from the crest through the high saltmarsh	American beachgrass, seaside goldenrod
Overwash Dune Grassland	Occurs on recent overwash areas near the foredune	American beachgrass
Brackish Interdunal Swale	Found behind primary and secondary dunes where saline surface water is found	Three square bulrush (*Scirpus pungens*), saltmeadow cordgrass (*Spartina patens*)
Northern Sandplain Grassland	Rare and limited to the wider parts of the Otis Pike Wilderness Area	Bayberry
Beach Heather Dune	Widespread on Fire Island and is found from Fire Island Inlet to the Moriches Inlet predominantly in the interdunal zone	Beach heather (*Hudsonia tomentosa*), American beachgrass
Northern Interdunal Cranberry Swale	Found in the interdunal zone as small, pond-like bodies of shallow water	Cranberry (*Vaccinium macrocarpon*), highbush blueberry (*Vaccinium corymbosum*), Canadian rush (*Juncus canadensis*)
Northern Dune Shrubland	Dominates the interdunal areas on Fire Island	Beach plum, American beachgrass, bayberry
Maritime Vine Dune	Located on dunes	Poison Ivy, greenbrier (*Smilax rotundifolia*)
Vegetation Class/Community	Description	Dominant Species
Highbush Blueberry Shrub Forest	Located in noticeable depressions or swales throughout the interdunal area	Juneberry (*Amelanchier canadensis*), Swamp azalea (*Rhododendron viscosum*), Highbush blueberry
Northern Salt Shrub	Located in backdunes, usually near	Bayberry, sassafras (*Sassafras*

	wetlands	*albidum*), black cherry *(Prunus serotina*)

Migrating Hawks

Hawks migrate along the south shore of Long Island above the dunes and swales each fall. Since 1982, the Fire Island Raptor Enumerators (FIRE) organization has conducted annual surveys of these migrating hawks, at a station located at the eastern portion of RMSP, and provides annual data on their website (http://www.battaly.com/fire/). Dominant species observed by FIRE include: the Osprey (*Pandion haliaetus*), northern harrier *(Circus cyaneus*), sharp-shinned hawk *(Accipiter striatus)*, Cooper's hawk *(Accipiter cooperii)*, American kestrel *(Falco sparverius)*, and merlin *(Falco columbarius).* The FIRE's annual data indicates significant variations from year to year, perhaps due to inclement weather, changes in migration patterns, and/or hawk movements when surveyors were not present.

Corps Avian Surveys

Dominant species observed within the dune/swale habitats during Corps surveys (U.S. Army Corps of Engineers 2003) from May 2002-May 2003 included:

Brown-headed cowbird (*Molothrus ater*), year-round resident;
Common yellowthroat (*Geothlypis trichas*), summer resident, spring and fall migrant;
Mourning dove (*Zenaida macroura*), year-round resident;
Dark-eyed junco (*Junco hyemalis*), winter resident, spring and fall migrant;
Northern mockingbird (*Mimus polyglottos*), year-round resident;
Rufous-sided towhee (*Pipilo erythrophthalmus*), year-round resident;
Red-winged blackbird, year-round resident;
Sharp-tailed sparrow, year-round resident;
Song sparrow (*Milospiza melodia*), year-round resident; and
Yellow-rumped warbler (*Dendroica coronata*), winter resident, spring and fall migrant.

Piping plovers, common terns, black skimmers, and least terns will also nest in blow-out or overwashed areas within dune/swale areas.

Corps Small Mammal and Herpetile Surveys

The Corps conducted small mammal and herpetile (reptiles and amphibians) surveys in May through August of 2002. The white-footed mouse (*Peromyscus leucopus*) and meadow vole (*Pennsylvaniana maniculatus*) were the most dominant small mammals observed in the dune and swale habitats. Other mammals observed within this habitat include the house mouse (*Mus musculus*), white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), and red fox (*Vulpes vulpes*). The eastern garter snake (*Thamnophis sirtalis*) and Fowler's toad (*Bufo woodhousei*) were the only herpetiles observed within this habitat (U.S. Army Corps of Engineers 2004c).

The Corps' herpetile surveys echo the findings of the Service in herpetile surveys conducted in April-July 1982 for the FIMP study (from Moriches Inlet to Montauk Point, adjacent to the FIMI), in which the Fowler's toad and eastern garter snake were dominant (U.S. Fish and Wildlife Service 1983). An additional species observed during Service surveys within dune and swale habitats was the eastern spadefoot toad (*Scaphiopus holbrookii*).

C. BARRIER ISLAND ECOSYSTEM

1. Terrestrial Upland

Vegetation

The NPS-FIIS vegetation mapping efforts (Conservation Management Institute 2002) designated several vegetation classes/communities present within the terrestrial uplands, listed in Table 3.

Table 3. NPS-FIIS Terrestrial Vegetative Communities of Fire Island

Vegetation Class/Community	Description	Dominant Species
Maritime Holly Forest	Occurs just behind (landward of) the backdune	American holly (*Ilex opaca*), shadblow serviceberry (*Amelanchier canadensis*), sassafras, black gum (*Nyssa sylvatica*), black cherry, and pitch pine (*Pinus rigida*)
Old Field Red-Cedar Forest	Found on William Floyd Estate. Individual trees are smaller-crowned and scattered in with hardwoods	Red cedar (*Juniperus virginiana*), autumn olive (*Eleagnus umbellate*), and winged sumac (*Rhus copallina*)
Maritime Post Oak Forest	Limited to the edge of waterways on the William Floyd Estate	Black oak (*Quercus velutina*), post oak (*Quercus stellata*), and northern bayberry
Coastal Oak-Heath Forest	Covers a large portion of the William Floyd Estate	Black oak, white oak (*Quercus alba*), mockernut hickory (*Carya tomentosa*), and lowbush blueberry (*Vaccinium pallidum*)
Acidic Red Maple Basin Swamp Forest	Found on both the Floyd Estate and Fire Island	Black gum, red maple (*Acer rubrum*), highbush blueberry, and swamp azalea
Japanese Black Pine Forest	Found in many isolated patches on Fire Island. It is often used to stabilize the fore dune – especially on the eastern end of the island and around human communities.	Japanese black pine (*Pinus thunbergii*), pitch pine (*Pinus rigida*), and switchgrass (*Panicum virgatum*)
Pitch Pine Woodland	Found throughout Fire Island behind the primary dune	Pitch pine, northern bayberry, switchgrass
Maritime Deciduous Scrub Forest	Found on the bay side, often behind a large primary dune on wider parts of the island	Mockernut hickory, black oak, sassafras, northern bayberry, Pennsylvania sedge

Vegetation Class/Community	Description	Dominant Species
		(*Carex pennsylvanica*)

Bayside Beach

Bayside shorelines within the FIMI vary, with many areas transitioning from terrestrial upland habitat to tidal marsh, while some bay shoreline transitions from dune habitat to open sand shoreline (bayside beach). This habitat is sparsely vegetated, with beach grass dune habitat present landward of the shoreline. The bayside beach habitat is an important habitat for many wading birds and is breeding habitat for the diamondback terrapin.

White-tailed Deer Status on Fire Island

The white-tailed deer population on Fire Island has grown dramatically since 1983. Deer density in the eastern half of the island appears to have stabilized at 25-35 deer/square kilometers (km^2) while densities are 3-4 times higher in the western half within residential communities (Underwood 2005). Deer can have a significant impact on vegetation that they browse upon, most evident in Sunken Forest, where the herbaceous layer is sparse (Underwood 2005). Deer populations on the main land of Long Island and at FIIS has increased dramatically since the early 1980's and is impacting local flora, including the globally rare maritime holly forest at Sunken Forest (NPS 2009).

D. BAY ECOSYSTEM

1. Bay Intertidal

Vegetation

The dominant vegetation in the bay intertidal community includes saltmarsh cordgrass, saltmeadow grass, glasswort (*Salicornia* spp.), and groundselbush (*Baccharis halimifolia*). Wildlife found in this community includes the muskrat (*Ondatra zibethica*), great egret, northern harrier, and seaside sparrow. Fish found in the tidal pools and ditches within this community include the mummichog, silverside, and fish which use marshes as nurseries, including striped bass and winter flounder.

Saltmarshes are tidal marshes of brackish or saltwater, along estuaries and behind barrier beaches. Tidal marsh generally consists of dense stands of herbaceous wetland vegetation dominated by *Spartina alterniflora* and *S. patens* and subject to variation in water depth during each tidal cycle (McCormick and Associates 1975). Saltmarshes are among the most productive communities known. Most of the tremendous production of saltmarshes is used in the form of organic detritus (Odum 1961). This organic detritus, mostly *Spartina* wrack (New York Sea Grant Institute 1993), is then distributed throughout the system (Odum 1961). Coastal marshes are also important in stabilizing shorelines and as wildlife habitat (New York Sea Grant Institute 1993).

The NPS-FIIS vegetation mapping efforts (Conservation Management Institute 2002) designated several vegetation classes/communities present within bay intertidal areas, listed in Table 4.

Table 4. NPS-FIIS Bay Intertidal Vegetative Communities of Fire Island

Vegetation Class/ Community	Description	Dominant Species
Reedgrass Marsh	Widespread, found in and around most wetland areas on both the Floyd Estate and Fire Island	Common reed, groundselbush, poison ivy
Low Saltmarsh	More regularly flooded parts of the saltmarsh	Saltmarsh cordgrass, spikegrass, glasswort (*Salicornia sp*.)
High Saltmarsh	Found in close proximity to *Spartina alterniflora* on the less-frequently flooded portions of the saltmarsh	Salt meadow grass, spikegrass, black grass (*Juncus geradii*), glasswort
Brackish Marsh	Found uncommonly near the highest portions of the saltmarsh on the bay side of Fire Island	Salt meadow grass, switchgrass, Canadian rush, blackgrass

It should be noted that bulkheads are common on the bay shoreline in developed communities and areas. Bulkheads prevent sand from entering the littoral drift system, causing sediment starvation in unprotected areas downdrift (Nordstrom et al. 2005). Bulkheaded areas are generally void of tidal marsh vegetation and are of minimal habitat quality. Also, nearly all the back-barrier fringe marshes on Fire Island have been grid ditched for mosquito control (NPS 2009).

Sand shoals and mud flats provide important forage habitat for wading birds such as the black-bellied and piping plover, greater yellow-legs, sanderling, American oystercatcher, and dunlin (U.S. Fish and Wildlife Service 1983). These areas also provide important loafing/resting/ stopover habitat for many shorebirds, such as the roseate tern, common tern, least tern, and black skimmer. Sand shoals and mudflats also provide breeding habitat for the horseshoe crab, discussed further below.

NPS-FIIS Evaluation of Marsh Development

The NPS-FIIS conducted a monitoring program to quantify marsh elevation change in relation to sea-level rise and to identify factors and/or processes that influence the development and maintenance of Fire Island saltmarshes. Monitoring was conducted in three marsh areas, Great Gun Meadows, Hospital Point, and Watch Hill from August 2002 to May 2007. The NPS determined that the development of the three marshes coincided with the establishment of the Hallets (1788) and Smiths (1773) inlets. Storm-induced inlets and barrier island overwash transport sediment from the ocean and barrier island to the bay. As such, inlets and associated flood tidal deltas support the establishment of back-barrier saltmarsh habitat (Roman et al. 2007).

See Section V-B for a discussion of NPS-FIIS's findings regarding marsh elevation and sea-level rise.

Wetland Trends

Having an understanding of the trends of wetland accretion/gains or losses in the bays will assist decision-makers and biologists in assessing the status of this important resource within the FIMP study area. This assessment will assist in determining and gauging/weighing the significance in impacts of the proposed action, should the proposed action alter the natural processes that form these habitats (cross-island sediment transport, bayside shoreline processes).

The NYSDEC conducted a trend analysis of New York State's tidal wetlands in Moriches and Shinnecock Bays using GIS analysis. Although there was loss of some wetland areas, Moriches Bay showed a net gain of approximately 100 ac of tidal wetlands as a result of a landward movement of the tidal wetlands boundary from 1974 to 1998 (NYSDEC website: http://www.dec.ny.gov/lands/4940.html). Shinnecock Bay showed a loss of some wetland areas as well, but a net gain of 161 ac of tidal wetlands as a result of a landward movement of the tidal wetlands boundary from 1974 to1995 (Fallon and Mushacke 1996).

The main cause of wetlands loss/destruction has shifted from human caused factors, such as filling, to natural factors, such as storms and flow restrictions (Fallon and Mushacke 1996). The NYSDEC analysis did find a substantial loss of bay island tidal wetlands (both man-made dredge deposition islands and natural islands). In Shinnecock Bay, there were thirteen separate islands, by 1995, six of the islands had completely disappeared and the remaining islands had a loss of wetland areas (Fallon and Mushacke 1996). Service personnel have observed the loss of Warner's South Island (Little Warner's) in Shinnecock Bay, which was historically an important colony site for the endangered roseate tern. The island supported the colony until 2001-2002, when the island was flooded over. The loss of these islands appears to be caused by storm events, rising sea levels, and erosion. Erosion may be caused by: a) the apparent deficit of sediment in the bays due to maintenance dredging activities (Intracoastal Waterways and each of the inlets); b) the maintenance of relatively deep channel depths for navigation which increases tidal flow velocities; and c) boat wake reflection.

Significant Habitats

Significant bay intertidal habitats within the FIMI are present in Great South Bay and Moriches Bay. A general description of each of these waterbodies (excerpted from the Service's SHCR) is provided below.

<u>Great South Bay</u>

The Great South Bay complex as defined here includes 47 km (29 miles) of this system from South Oyster Bay east to Moriches Bay. This part of the Long Island backbarrier system is characterized by shallow open water habitat with extensive saltmarshes along the backside of the barrier beach and along tidal creeks and rivers feeding into the bay from the mainland. Great South Bay occupies an area of 243 km^2 (151 $miles^2$) and has an estuarine drainage of 1,360 km^2 (845 $miles^2$), with a daily average freshwater inflow of 19.8 m^3 per second (700 ft^3 per second). The majority of this flow originates from six groundwater-fed bodies: Orowoc Creek, Champlin

Creek, Connetquot River, Swan River, Beaverdam Creek, and Carmans River. Great South Bay is the only one of the Long Island south shore bays that has major riverine input (from the Carmans and Connetquot Rivers) (U.S. Fish and Wildlife Service 1996).

Moriches Bay

The Moriches Bay habitat complex includes the entire 3,836-hectare (ha) (9,480-ac) aquatic environment of Moriches Bay, Moneybogue Bay, and Quantuck Bay; this includes open water, saltmarshes, dredged material islands, and intertidal flats, as well as the eastern end of the Fire Island barrier island, the western end of the Westhampton Beach barrier island (the barrier island between Moriches and Shinnecock Inlets), Moriches Inlet, and the nearshore waters of the New York Bight. The western boundary of this complex is the Smith Point Bridge; the eastern boundary is the eastern edge of Quantuck Bay. This habitat complex also includes the tidal creeks and marshes feeding into Moriches Bay from the Long Island mainland and the adjacent uplands of the William Floyd Estate. This boundary encloses regionally significant habitat for fish and shellfish, migrating and wintering waterfowl, colonial nesting waterbirds, beach-nesting birds, migratory shorebirds, raptors, and rare plants (U.S. Fish and Wildlife Service 1996). Moriches Bay is a regionally-significant habitat for fish and shellfish, migrating and wintering waterfowl, colonial nesting waterbirds, beach-nesting birds, migratory shorebirds, raptors, and rare plants. There are 105 species of special emphasis in the Moriches Bay complex, incorporating 42 species of fish and 41 species of birds (U.S. Fish and Wildlife Service 1996).

In addition to the tidal marshes present throughout each of the identified bays, the Service's SHCR identifies specific bay intertidal areas within the following significant habitat complexes:

Moriches Bay

William Floyd Estate - One of the few remaining sites where tidal wetlands are contiguous to an undeveloped upland buffer.

Great South Bay

Connetquot River Estuary - A unique 4,500-ac undeveloped coastal watershed that is an important wintering area for waterfowl.

Champlin Creek - A brackish coastal stream which provides rich spawning and nursery habitats for commercially valuable marine species.

Orowoc Creek - A freshwater coastal stream that harbors a locally rare population of naturally reproducing brook trout.

Swan River - Supports both native brook trout and sea-run brown trout (*Salmo trutta*).

Beaverdam Creek - Supports sea-run brown trout.

Carmans River Estuary - Extensive and undeveloped tidal wetlands on both sides of the river provide outstanding habitat for a great diversity of fish and wildlife species, specifically being one of the most significant nursery areas for yearling striped bass in Great South Bay.

With the exception of the William Floyd Estate, each of the above designated significant habitat complexes are also designated as SCH's by the NYSDOS.

Finfish/Invertebrates

2001-2002 Surveys

The Corps conducted a finfish/invertebrate survey of back-bay intertidal areas in 2001 and 2002. Beach seining was conducted along the shoreline and in tidal ponds, while throw traps were used in marsh areas. A total of 15 stations were sampled from June 2001 to May 2002, along the backbay side of the barrier island intertidal zone from Fire Island Inlet to Shinnecock Inlet. Seven stations were sampled along Great South Bay: Kismet, Clam Pond, Sailor's Haven, Barrett Beach, Watch Hill, Old Inlet, and Pattersquash. Five stations were sampled along Moriches Bay: Cupsogue, Dune Lane, Pikes Beach, Picket Point, and Jessup Lane. Three stations were sampled along Shinnecock Bay: Tiana Beach, Ponquogue West, and Ponquogue East. Sampling was conducted bimonthly (twice per month, typically every other week) during the course of the study. There was a four-month hiatus in sampling from December 2001 through March 2002 - a winter period when productivity was minimal (U.S. Army Corps of Engineers 2005b). Samples were collected along the shoreline and in tidal ponds.

The surveys found that the dominant finfish species in the intertidal shoreline areas were Atlantic silverside, striped killifish (*Fundulus majalis*), and bay anchovy. Total numbers of finfish collected at each station ranged from the lowest catch at Barrett Beach (372) to highest catch at Clam Pond (14,533). Finfish species diversity appears to fluctuate randomly throughout all stations and bays. Dominant invertebrate species included sand shrimp (*Crangon septemspinosa*), marsh grass shrimp (*Palaemonetes vulgaris*), and blue crab (*Callinectes sapidus*). Total abundances were highest in October (8,705) and lowest in July (1,123). Spatially, the number of species and diversity appears to fluctuate randomly (U.S. Army Corps of Engineers 2005b).

In tidal ponds, sheepshead minnow (*Cyprinodon variegates*) was the most abundant species, comprising 42% of the total catch. Striped killifish were also collected in large numbers, representing 26% of the total catch. Spatially, pond abundances were highest at Ponquogue East (519) and Cupsogue (420). Lowest abundances were at Picket Point (149) and Old Inlet (202). On a monthly basis, finfish abundances were highest in July (495) and lowest in April (6) and May (21). Marsh grass shrimp was the dominant invertebrate species collected representing 69% of the total catch. Monthly abundances were highest in May (27), April (25), and October (24). Months with the lowest catches occurred in September (3), July (4), and August (5) (U.S. Army Corps of Engineers 2005b).

To complement other FIMP studies, sediment was analyzed for sediment type as well for benthic organisms from six stations along West Hampton Island: Cupsogue, Dune, Picket Point, Jessup, Ponquogue West, and Ponquogue East. Samples were collected at seven tidal locations from each site (U.S. Army Corps of Engineers 2005b). This study found that all samples were composed primarily of sand, with several stations (dispersed throughout the study area) consisting of sand with gravel, and several with sand and silt (U.S. Army Corps of Engineers 2005b). Annelids, arthropods, and mollusks dominated the collections during both seasons (spring and fall). During Year 2, annelids, arthropods, and mollusks were still dominant, as were aschelminths (spring and summer). Aschelminths, during Year 2, were much more abundant at all stations than during Year 1. In addition, at Ponquogue East, summer collections showed that over half of the benthos sampled were platyhelminths (U.S. Army Corps of Engineers 2005b).

Corps Avian Surveys

Dominant species observed within *Spartina*-dominated saltmarsh/tidal wetland habitats during Corps surveys from May 2002-May 2003 (U.S. Army Corps of Engineers 2003) include:

Canada goose year-round resident;
Least sandpiper, foraging during migration;
Mallard, year-round resident;
Greater yellowlegs, foraging during winter and migration;
Red-winged blackbird, year-round resident;
Seaside sparrow, year-round resident;
Sharp-tailed sparrow, year-round resident; and
Willet, foraging in summer

Although not a numerically dominant species, an important predator within this habitat is the northern harrier, a fall migrant/year-round resident, which preys upon small mammals, birds, and reptiles.

Dominant species observed within *Phragmites*-dominated bay intertidal habitats during Corps surveys from May 2002-May 2003 (U.S. Army Corps of Engineers 2003) include:

Song sparrow, year-round resident;
Yellow warbler, summer resident, spring and fall migrant;
Yellow-rumped warbler, winter resident, spring and fall migrant;
Red-winged blackbird, year-round resident;
Dark-eyed junco, winter resident, spring and fall migrant; and
Common grackle, year-round resident

Dominant species observed within bay intertidal flat habitats during Corps surveys from May 2002-May 2003 (U.S. Army Corps of Engineers 2003) include:

American oystercatcher, summer breeder, spring and fall migrant;
Black-bellied Plover (*Pluvialis squatarola*), forages in beach habitat during winter and migration;
Common tern, summer breeder, spring and fall migrant;
Dunlin (*Calidris alpine*), forages in beach habitat during winter and migration;
Greater yellowlegs, foraging during winter and migration;
Herring gull, year-round foraging;
Ruddy turnstone (*Arenaria interpres*), spring and fall migrant;
Sanderling, forages during winter and migration; and
Willet, foraging in summer

Red Knot/Horseshoe Crab

The red knot, a candidate species for ESA protection, does utilize low-energy bay intertidal areas (tidal flats and tidal marshes) within the FIMP study area as stop-over/foraging habitat during spring and fall migrations (New Jersey Department of Environmental Protection 2007). This species is more concentrated in areas where horseshoe crab eggs are available for forage. Horseshoe crab eggs are an essential food source for many other migrating shorebirds as well (NYSDEC website: http://www.dec.ny.gov/animals/36195.html).

Although the Service is not aware of comprehensive horseshoe crab and/or red knot surveys being conducted within the FIMP area, the NYSDEC and Cornell University Cooperative Extension are monitoring horseshoe crab spawning activity at select sites on Long Island, including two sites within the FIMP study area, Captree Island (within the FIMI), and Pikes Beach (east of the FIMI within the FIMP) Westhampton (Cornell University Cooperative Extension website: http://counties.cce.cornell.edu/suffolk/Vanderbilt/Horseshoe-research.htm). The NYSDEC has indicated that Pikes Beach is a heavily utilized area for horseshoe crab spawning (Sclafani pers. comm. 2007), but has identified the majority of the bay shoreline of Fire Island as potential spawning habitat (Sclafani, et.al 2009). One hundred and thirteen horseshoe crabs were observed spawning at Captree Island in 2007, where peak spawning occurred on June 3 (Sclafani, et. al. 2009). Similar habitats along bay intertidal flats and/or marshes are expected to have horseshoe crab spawning activity and associated red knot foraging.

Corps Small Mammal and Herpetile Surveys

The Corps surveys in May through August of 2002 (U.S. Army Corps of Engineers 2004c) indicated that the white-footed mouse, meadow vole, and masked shrew were the most dominant small mammals within bay intertidal habitats, while the white-tailed deer, raccoon (*Procyon lotor*), muskrat, and red fox were also observed. Although not observed during these surveys, the diamond-back terrapin is a common species found in bay intertidal habitats and was observed during Service surveys in 1982 (U.S. Fish and Wildlife Service 1983).

2. Back-Bay Subtidal

Seagrass beds represent a critical habitat for at least one species, the bay scallop (*Argopecten irradians*) (New York Sea Grant Institute 1993). The rock crab (*Cancer irroratus*) was found to be restricted to thick eelgrass areas (WAPORA 1982). The blue mussel and hard clam are species found in moderate to dense vegetation (O'Connor 1972). Seagrass beds provide hard clams with protection from whelks (*Buscyon* spp.), and possibly other predators as well (Peterson 1982). The venus clam (*Gemma gemma*) is an extremely abundant, suspension feeding bivalve found in especially high abundance in eelgrass regions (WAPORA 1982). It is an important forage species for shorebirds.

Seagrass beds are also noted for high densities of fish, in part because of the abundant food supply (Heck et al. 1989). The importance of eelgrass as a habitat for the juvenile and adult stages of numerous marine fishes has been frequently documented (New York Sea Grant Institute 1993). Many studies have shown that eelgrass beds support significantly higher faunal densities than other habitats (Orth et al. 1984). Eelgrass is the predominant submerged vascular plant, while widgeon grass (*Ruppia maritima*) is also an important seagrass species present within the FIMP bays, although distributed in small patches (Bokuniewicz et al. 1993). Abundances of sand shrimp were found to be approximately 70% greater in widgeon grass beds than in eelgrass beds (New York Sea Grant Extension Program 2001).

New York Sea Grant Institute (1993) reported that juvenile tautog and cunner (*Tautogolabrus adspersus*) depend strongly on eelgrass habitat as a shelter and/or nursery. Winter flounder also appear to use eelgrass beds as nursery areas (Heck et al. 1989). Again, forage fish species critical to the bay food web, particularly stickleback species (*Apeltes quadracus* and *Gasterosteus aculeatus*), also depend upon this habitat.

Eelgrass is an important foraging resource for avian species, especially brant. The distribution of major waterfowl feeding and nesting areas in the adjacent Great South Bay (New York Sea Grant Institute 1993) closely corresponds to the distribution of eelgrass meadows.

Open Water/Non-Vegetated Bay Bottom: The substrate in this community consists of sand and silts in the low energy areas. Benthic organisms found in this habitat include the hard clam and clam worm (*Platynereis dumerilii*). Finfish found in this community include the striped bass and summer flounder, while wading birds and shorebirds, such as the great blue heron and piping plover, respectively, forage in the shallow/exposed bay bottom. Additionally, harbor seals have been documented using the bay and exposed sand shoals (U.S. Army Corps of Engineers 1999).

The following NYSDOS-designated SCH's are present within this zone (excerpts from NYSDOS website: http://www.nyswaterfronts.com/waterfront_natural_narratives.asp#LongIsland):

Great South Bay (East)

Great South Bay-East comprises approximately one-half of the largest protected, shallow, coastal bay area in New York State. This broad expanse of open water is highly productive, and supports

a tremendous diversity of fish and wildlife species. Many species of migratory birds which typically occur in coastal habitats are found nesting or feeding in the remaining natural areas along the north and south shores of Great South Bay-East. These include green-backed heron, black-crowned night heron, snowy egret, American bittern, Canada goose, mallard, black duck, gadwall, northern harrier, osprey, least tern, herring gull, willet, horned lark, fish crow, marsh wren, red-winged blackbird, sharp-tailed sparrow, and seaside sparrow. Great South Bay-East is also one of the most important waterfowl wintering areas (November - March) on Long Island, especially for diving ducks, which feed on eelgrass, invertebrates, and small fish. Mid-winter aerial surveys of waterfowl abundance for the 10-year period 1975-1984 indicate average concentrations of over 10,700 birds in the bay each year (25,409 in peak year), including approximately 6,600 scaup (21,155 in peak year), 1,000 red-breasted mergansers (2,470 in peak year), 750 black ducks (2,710 in peak year), 700 brant (2,121 in peak year), 600 common goldeneye (1,750 in peak year), and 430 Canada geese (750 in peak year), along with lesser numbers of oldsquaw, bufflehead, mallard, mute swan, and canvasback. Based on these surveys, it appears that Great South Bay-East supports the largest wintering waterfowl concentrations in New York State, and is probably one of the most important areas for diving ducks in the northeastern United States.

Concentrations of waterfowl also occur in the area during spring and fall migrations (March - April and October - November, respectively). In addition to having significant bird concentrations, Great South Bay-East is an extremely productive area for marine finfish, shellfish, and other wildlife. Great South Bay-East serves as a major spawning, nursery, and foraging area (April - November, generally) for winter flounder, kingfish, bluefish, blue crab, and forage fish species, such as Atlantic silverside, striped killifish, mummichog, northern pipefish, and sticklebacks. The entire Great South Bay-East area is inhabited by local concentrations of hard clams along with local concentrations of American oyster.

Moriches Bay

Moriches Bay is one of three major protected, shallow, coastal bay areas on the south shore of Long Island, which constitutes one of the largest estuarine ecosystems in New York State. This highly productive bay supports a variety of fish and wildlife species throughout the year. Many species of migratory birds nest among the saltmarshes and spoil islands in Moriches Bay, including roseate terns (historically), common terns, and black skimmers. Other species nesting in the area include black duck, mallard, gadwall, American oystercatcher, great black-backed gull, herring gull, willet, clapper rail, fish crow, sharp-tailed sparrow, and seaside sparrow. The saltmarshes are used extensively as feeding areas by birds nesting in the area, and by a variety of herons, egrets, and other shorebirds. Moriches Bay is one of the most important waterfowl wintering areas (November - March) on Long Island. Mid-winter aerial surveys of waterfowl abundance for the 10 year period 1975-1984 indicate average concentrations of over 5,000 birds in the bay each year (8,382 in peak year), including approximately 2,150 scaup (4,470 in peak year), 350 brant (580 in peak year), 1,100 black ducks (1,580 in peak year), 400 red-breasted mergansers (920 in peak year), 400 Canada geese (870 in peak year), and 225 mallards (430 in peak year), along with lesser numbers of common golden-eye, bufflehead, oldsquaw, American widgeon, and

canvasback. Based on these surveys, Moriches Bay supports wintering waterfowl concentrations of State-wide significance.

Concentrations of waterfowl also occur in the area during spring and fall migrations (March - April and October - November, respectively). In addition to having significant waterfowl concentrations, Moriches Bay is a productive area for marine finfish, shellfish, and other wildlife. Moriches Bay serves as a nursery and feeding area (April - November, generally) for bluefish, winter flounder, summer flounder, tomcod, American eel, blue crab, and forage fish species, such as Atlantic silverside, striped killifish, pipefish, and sticklebacks. Moriches Inlet is an especially significant component of the bay, as a corridor for fish migrations, as a source for the exchange and circulation of bay waters, and as an area where feeding by many fish and wildlife species is concentrated. As a result of the abundant fisheries resources in the bay, especially winter flounder, fluke, and baitfish species, Moriches Bay receives heavy recreational and commercial fishing pressure, of regional significance. Moriches Bay is inhabited by hard clams, bay scallops, and blue mussels, and most of the bay waters are certified for commercial shellfishing.

Corps Surveys

SAV Surveys

The Corps funded ecological inventory surveys of six SAV beds, two in each of the three bays within the FIMP study area. The East Fire Island and Bellport beds are located in the Great South Bay, Great Gunn, and Cupsogue beds are in Moriches Bay, and Tiana and Ponquogue East beds are in Shinnecock Bay. Surveys were conducted from June through October of 2003, in 2004 (time of year not provided), and from May through November of 2005 (U.S. Army Corps of Engineers 2006b). Major components of the field survey included the collection of finfish and invertebrates in the eelgrass beds using a seine net, eelgrass quadrate analysis (eelgrass height and density), collection of water quality data, and sediment grain size.

Finfish

2004 Survey

Atlantic silverside was the most commonly distributed species found at all six SAV sites. Blackfish (*Tautoga onitis*), winter flounder, and cunner were the most abundant finfish, representing 23.8%, 16.7%, and 15.1%, respectively, of the total catch (U.S. Army Corps of Engineers 2004d, 2006b).

Eastern-most sites were most productive, with Tiana and Ponquogue East stations having the highest abundances and biodiversity. The lowest levels of abundance and diversity were recorded at Bellport in Great South Bay.

2005 Survey

The Atlantic silverside was the most common species, representing 26.0% of the total catch. The next most commonly occurring species include bay anchovy and Atlantic tomcod (*Microgadus tomcod*), representing 16.5% and 13.9% of the total catch, respectively.

From a temporal perspective, the greatest diversity occurred during the months of July through September and the lowest in November (U.S. Army Corps of Engineers 2006b). A breakdown of dominant species and percent of total catch by month is listed as follows:

May: Atlantic tomcod (46.8%), fourspine stickleback (*Apelte quadracus*), and pollock (*Pollachius virens*), 46.8%, 13.5%, and 12.3%, respectively;

June: Atlantic silverside, Atlantic tomcod, and pollock, 46.0%, 16.9%, and 9.7%, respectively;

July: Bay anchovy, fourspine stickleback, and Atlantic tomcod, 59.6%, 7.7%, and 7.2%, respectively;

August: Atlantic silverside and northern sennet (*Sphyraena borealis*), 61.0%, and 8.8%, each respectively;

September: Cunner, Atlantic silverside, and blackfish, 41.0%, 35.0%, and 5.9%, respectively;

November: Northern pipefish (*Sygnathus fuscus*) and Atlantic silverside, 43.5% and 39.1%, respectively.

From a spatial perspective, the lowest catch was at Bellport in Great South Bay while the highest catch was at Cupsogue in Moriches Bay. Diversity was greatest at Ponquogue East (eastern-most site), where 27 species were observed, while the lowest diversity occurred at East Fire Island (western-most site), where 12 species were observed (U.S. Army Corps of Engineers 2006b).

Invertebrates

2004 Survey

Marsh grass shrimp was the most abundant and common species, representing 38.8% of the total catch and was found at all six locations. Comb jelly (*Mnemiopsis leidyi*) and green crabs (*Carcinus maenas*) were the second and third most commonly occurring invertebrate species, accounting for 25.1% and 11.0% of the total catch respectively.

In regards to a spatial perspective, there were no discernible geographical trends, with the Cupsogue station in Moriches Bay having the greatest abundance and diversity of invertebrates and Ponquogue East in Shinnecock Bay had the lowest abundance and diversity (U.S. Army Corps of Engineers 2006b). There was a relative consistency of abundance and diversity between five

of the six stations (the exception being Ponquogue East), indicating a uniformed distribution of invertebrates and habitat.

2005 Survey

The blue mussel was the most dominant species, although it was associated with a post-larval settlement on algae at the time of the sampling. Besides the blue mussel, the green crab consisted of 44.2% of the total counted catch, mud crab (*Panopeus herbstii*) with 15.0%, spider crab (*Libinia emarginata*) with 7.2%, and blue crab with 6.7% of the total counted catch (U.S. Army Corps of Engineers 2006b).

From a temporal perspective, invertebrate biodiversity was the lowest in May and the highest in June. The greatest invertebrate abundance was documented during the June sampling event, with August being the least productive. However, no obvious temporal trends could be established.

From a spatial perspective, the lowest diversity occurred at the Cupsogue station and the highest diversity at the East Fire Island station. The greatest abundance occurred at Ponquogue East Station while the least productive station was Cupsogue.

This study did determine a significantly negative correlation between finfish abundance and invertebrate biodiversity.

Landings Data

Landings of soft shell clams, oysters (*Crassostrea virginicus*), mussels, and conch (*Busycotypus canaliculatum*) in the Great South Bay were modest in the 1990's (most recent available data). Soft shell clam landings peaked in 1967 (over 3,000 bushels) and in 1985 (over 2, 500 bushels), and less than 100 bushels in 1999. Oyster landings peaked in 1961 (over 8,000 bushels) and have not gone above 100 bushels since 1981. Mussel landings peaked in 1965 (over 7,000 bushels) and less than 200 bushels since 1995. Conch landings peaked in 1985 (over 2,000 bushels) and have been less than 200 bushels since 1992. Blue crab landings increased in the early 1990's, peaking at over 450 pounds in 1990 (New York Sea Grant Extension Program 2001).

Shellfish

Shellfish present within the subtidal habitat of the backbays include the hard clam, blue mussel, soft shell clam (*Mya arenaria*), oyster, and bay scallop (*Aequipecten irradians concentricus*). Hard clams and other shellfish such as bay scallop and soft clam play a critical role in the bays, filtering water and serving as an important link in the food web. During the 1970s, there were enough hard clams to filter 40% of Great South Bay every day. Today, only 1% of the Great South Bay is filtered daily (The Nature Conservancy website: http://www.nature.org/wherewework/northamerica/states/newyork/press/press1616.html). Since 1976, the hard clam harvest has declined 100 fold (Hinga 2005). The shellfish stocks have been declining steadily since the 1960s. The causes of the decline are still not proven, but poor natural recruitment, over-harvesting, increased predation, long-term climatic changes in

temperature and salinity, and toxic algal blooms, such as brown tide, have been identified as possible factors (Town of Southampton 2001).

High abundances of hard clams are found in sediments with a larger fraction of course-grained materials, especially shell fragments, which appear to provide a more diverse habitat community of suspension feeders and carnivores (Hinga 2005). The South Shore Estuary Council (2001) recommended in their Comprehensive Management Plan that hard clam populations in Great South Bay, Moriches Bay, and Shinnecock Bay be enhanced through shell augmentation projects, using shell materials from appropriate sources (South Shore Estuary Reserve Council 2001).

Optimal temperature and salinity for adult hard clam growth has been estimated to be 20-30° Celsius (C) and 26-27 parts per thousand (ppt) (New York Seagrant Extension Program 2001). For the past 3 years, TNC has been involved in restocking its 13,000-ac underwater holdings in the Great South Bay with adult clams in the hopes that they will reproduce, and ultimately restore, the bay. A milestone in this effort was recently reached as the one millionth clam was dropped into the bay. The TNC has also planted over 10,000 bay scallops. Shellfish pump large volumes of water to feed on plankton and other organic particles. This, in turn, influences the entire food web and enhances ecosystem stability (The Nature Conservancy website: http://www.nature.org/wherewework/northamerica/states/newyork/press/press1616.html). The Service recommended shellfish bed restoration in its Planning Aid Report in 2005 for the FIMP, which identified potential restoration projects within the FIMP Study Area (U.S. Fish and Wildlife Service 2005).

Several municipalities also have clam restocking programs. The Town of Islip operates a shellfish culture facility to provide a sustainable source of seed clams to assist the recovery of stocks and to rebuild the public resource in the bay (Great South Bay). The facility is designed to produce up to forty million seed clams for planting annually (Town of Islip website: http://www.isliptown.org/details.cfm?did=110).

The Town of Babylon operates a spawning sanctuary - an area stocked with clams at high densities with the hope of enhancing reproduction. To date, over 6, 200 bushels of clams have been stocked. The Town of Babylon also operates a seed clam growout program in which one million 3-5 mm seed clams grow-out in rafts. Approximately 20 mm clams are broadcast into the bay. Over 25,000,000 clams have been introduced since the program's inception (Town of Babylon website: http://www.townofbabylon.com/departments/details.cfm?did=9).

The Town of Brookhaven's Division of Environmental Protection actively manages a Shellfish program, involving placement of approximately 100,000 spawner clams into Great South Bay annually and 1,000,000 12 mm seed clams in 2005. The Town of Brookhaven is planning to open a grow-out facility whose clams will be planted on the south shore in Great South Bay (Carrano pers. comm. 2007).

Scientists hope that rebuilding the populations of these filter feeders will help control development of nuisance algae blooms like brown tide. Brown tide blooms periodically in each of the bays. This species appears to mechanically interfere with shellfish ingestion of other types of

phytoplankton, essentially starving these herbivores. Hard clams can experience significant mortalities (67%) during brown tide blooms, and these blooms also prevent light penetration to the bottom, thereby affecting SAV as well (Hinga 2005). The primary cause of these blooms appears to be related to the relatively high levels of dissolved organic matter and dissolved organic carbon (Hinga 2005).

Eelgrass Height and Density

Eelgrass provides critical habitat for finfish, invertebrates, and waterfowl. The health of an eelgrass bed is better measured by density rather than height, because plant stability is gained through the expansion of rhizomes (U.S. Army Corps of Engineers 2006c).

2004 Survey

Eelgrass density (mean percent coverage within 1 m [3.3 ft] squared quadrants) ranged from 25 to 80%, with the least dense bed occurring at the Cupsogue station in Moriches Bay in August, and the densest at East Fire Island in Great South Bay and Tiana in Shinnecock Bay during July and August, respectively (U.S. Army Corps of Engineers 2006c). Average density was highest for Shinnecock Bay and lowest for Moriches Bay.

2005 Survey

Eelgrass bed density was greatest at East Fire Island in Great South Bay in June and least at Cupsogue in Moriches Bay in June, as well. Average density was highest in Shinnecock Bay and lowest in Moriches Bay.

From a temporal perspective, the month when each station had its maximum eelgrass bed density is listed as follows:

Great South Bay:	East Fire Island	June (95%)
	Bellport	September (90%)
Moriches Bay:	Great Gunn	August (80%)
	Cupsogue	September (60%)
Shinnecock Bay:	Tiana	November (90%)
	Ponquogue East	August and September (65%)

An analysis of the relationship between eelgrass bed height and density and abundance and diversity of finfish and invertebrates indicated that there was no correlation. This conclusion suggests that faunal abundance and density are not dependent on eelgrass height or density.

Grain Size

Samples primarily consisted of medium (size class of 0.25 mm to 0.50 mm) sand. Tiana in Shinnecock Bay had the highest percentage (65.45%) of medium sand while site with the lowest percentage of medium sand was found at East Fire Island in Great South Bay (which had the highest percentage of fine sand). However, the Corps determined that grain size between stations did not vary significantly and were statistically indistinguishable from each other, and that no significant correlations between grain size and effects of eelgrass density could be made. The Corps noted that sediment sampling of back-bay stations only entailed a grain size analysis. An analysis of organic material content was not conducted as part of the Corps' sampling effort (U.S. Army Corps of Engineers 2006c).

Eelgrass Height and Density Summary

The Corps' general conclusions of the study are listed as follows:

Eelgrass density and height were greatest when temperatures were highest;
Eelgrass density and height were greatest in Shinnecock and Moriches Bays;
Finfish abundance and diversity increased from west to east (greater in the eastern portions of the study area), and diversity increased with temperature;
Finfish abundance and diversity greatest in Shinnecock Bay and poorest in Great South Bay;
No major differences in invertebrate abundance or diversity within the bays; and
Shinnecock Bay probably the healthiest bay, but two remaining bays do not differ drastically in terms of production.

Hurricane Sandy Effect on Shellfish, Benthic Organisms, and Eelgrass Beds

Hurricane Sandy, while likely having long-term beneficial effects further described below, did bury sessile benthic organisms and submerged aquatic vegetation in Great South Bay in concentrated areas where overwash reached the bay side of the barrier island, in the vicinity of existing inlets where sediment was transported and where the breaches occurred. The largest areas of eelgrass and benthic organism burial occurred in the vicinity of Fire Island Inlet and the breach area at Old Inlet (Flagg 2013, Peterson pers. com. 2014).

Pre-Hurricane Sandy Water Quality (FIMP Area - Corps Surveys)

Water quality parameters measured during the 2005 survey at each station included temperature, salinity, DO, and turbidity. Temperature values ranged from 9.79° Celsius (C) at Cupsogue in Moriches Bay to 26.15° C at Bellport in Great South Bay. However, study participants found no significant differences in temperature existed either spatially or temporally, and no general geographic patterns of increase or decrease were evident. The highest average DO concentrations were observed at the Ponquogue East station (10.66 milligrams [mg]/liter [L]). All station values, except for Tiana in September, were above 4.8 mg/L (USEPA minimum criteria for chronic and acute effects on biota). However, study participants indicated that that this reading may have been due to temporary equipment malfunction. Study participants found no differences in DO

concentrations either spatially or temporally, and no general geographic patterns (U.S. Army Corps of Engineers 2006c).

Salinity ranged from 17.30 ppt at East Inlet Island in Great South Bay in June to 29.80 ppt at Ponquogue East in Shinnecock Bay in September. Salinity generally decreased by bay from east to west; however, study participants determined that it was unlikely that these decreases would have a negative impact on local biota (U.S. Army Corps of Engineers 2006c).

Turbidity values ranged from 0.00 Nephelometric Turbidity Units (NTU) at both Ponquogue East and Bellport stations during the August sampling event to 10.80 NTU at the Bellport station in Great South Bay in November. According to Singleton (2001), the management guideline for supporting marine life is < 8 NTU. Although two turbidity values were greater than the maximum standard, average values did not exceed this guideline and study participants state that these two values may have been due to equipment malfunction. Participants found no significant differences in turbidity either spatially, temporally, or from a geographic pattern perspective (U.S. Army Corps of Engineers 2006c).

When determining if environmental factors contributed to faunal and floral abundances and diversity, study participants found a positive correlation between temperature and finfish biodiversity (U.S. Army Corps of Engineers 2006c).

Water Quality (Great South Bay – NPS-FIIS)

A review of water quality data in Great South Bay, an effort sponsored by the NPS-FIIS, indicates that the salinity of the bay ranges from 25 to 30 ppt, surface water temperatures range from 25 to 29° C in the summer, and usually 0 to 2° C in the winter (Hinga 2005). Fecal coliform concentrations, although approaching levels of concern in some bayside beaches and marinas (see further below in South Shore Estuary discussion), are acceptable while there is an encouraging trend of decreasing dissolved inorganic nitrogen over the past quarter century, perhaps due to implementation of sewage management practices where sewage is discharged in the Atlantic Ocean instead of from individual septic systems (Hinga 2005). Sediment contamination levels are far below the levels that one would expect to have a major impact on the majority of organisms in the system (Hinga 2005). The DO concentrations in Great South Bay did not approach hypoxic (reduction of oxygen supply below physiological levels) or anoxic (without oxygen) concentrations that would be of concern to organisms, and oscillated between 6 mg/l and 12 mg/l with peaks in the winter and lower DO in the summer (Hinga 2005).

Post-Hurricane Sandy Water Quality Conditions

http://po.msrc.sunysb.edu/GSB/

The Great South Bay Project sponsored by Stonybrook University and the NYSDOS, has been collecting water quality data in Great South Bay prior to and after Hurricane Sandy. Results from this monitoring indicates that the Fire Island breaches caused an initial increase in sea-level in Bellport Bay, but over the next 4 days after the breaches (October 30, 2012), the sea-level

gradually returned to its normal level, as did the tidal range and phase (Flagg 2014). Water Quality data collected in 2013 from the Great South Bay Project buoy in Great South Bay, located in the middle of Great South Bay south of Sayville, lists the salinity range from 30.851 practical salinity units (psu) in November to 23.904 psu in February; a temperature range of -1.50°C in January to 29.40°C in July. Temperature and salinity measurements are similar to those reported by Hinga in 2005 (Hinga 2005). However, Flagg and Gobler (Flagg 2014, Gobler 2014) report that while the overall salinity for much of Great South Bay is similar to pre-Hurricane Sandy conditions, there is a net increase (3 to 6 units higher) in salinity in the eastern half of Great South Bay.

The net effect of the existing breach at Old Inlet on the water quality of eastern Great South/ Bellport and western Moriches Bays is an increase in bay salinity and an associated increase in water quality, and no significant change in the tidal dynamics and no increased risk from storm surges (Flagg 2014). Nitrogen can have potential negative side effects since they are quickly utilized by phytoplankton, leading to elevated chlorophyll levels (NPS 2009). Nitrogen concentrations in eastern Great South Bay are significantly lower than before the Old Inlet Breach (Gobler 2014). Water clarity has also improved, where secchi disc depths observed in 2013 (an indicator of water clarity) increased 35% in eastern Great South Bay (Gobler 2014). Increased ocean flushing and lowered nitrogen levels caused by the breach seem to have also lead to a decrease in phytoplankton levels in eastern Great South Bay. Although a large (1,000,000 cells per milliliter) brown tide occurred across most of Great South Bay during the Summer and Fall of 2013, the ocean inlets and the breach at Old Inlet were spared of this tide (Gobler 2014).

Backbay Benthic Invertebrate Survey

The Corps contracted EEA, Inc., to conduct a benthic invertebrate survey at three locations: Sailor's Haven in Great South Bay, Pike's Beach in Moriches Bay, and Tiana Beach in Shinnecock Bay in August of 2000 (EEA, Inc. 2003). The purpose of the survey was to define the benthic invertebrate communities behind the Pike's Inlet Breach (breached in 1992) area and compare these findings to two areas (control sites) where breaches had not recently, or ever, occurred. The percent of abundance of dominant species at each location are listed as follows:

Sailors Haven – 47% polychaete worms (*Prionospio* spp.), 12% sipunculan worms (*Oligochaeta* spp.), 12% nematodes (Nematoda spp.), 12% tanaids (*Leptochelia savignyi*), and 10% amphipods (*Ampelisca abdita)*. Biomass was dominated by annelid worms, arthropods, and mollusks (EEA, Inc. 2003)*;*

Pikes Beach – 65% bivalves (*Gemma gemma*), 25% amphipods (*Paraphoxus epistomus*), 6% polychaete worms (*Capitellidae* spp.), and 5% tanaids. Biomass was evenly distributed between annelids, mollusks, and arthropods (EEA, Inc. 2003).

Tiana Beach – 67% polychaete worms (*Streblospio benedicti*, *Capitellidae* spp.), 11% nematodes, and 10% bivalve mollusks. Biomass was dominated by annelid worms, arthropods, and mollusks (EEA, Inc. 2003).

There was a greater abundance of benthic species at Pikes Beach, but a greater diversity of species at Sailors Haven. The data at Pikes Beach (higher abundances and lower diversity) is indicative of an area that is in recovery from a "disturbance" (albeit a natural "disturbance"). Surveyors also noted that SAV beds at the Pikes Beach station were more patchy and sparse than at the control sites (EEA, Inc. 2003).

Anadromous Fish

Numerous small creeks and rivers drain into the three bays and coastal ponds. Historically, these tributaries have supported fish migration from the sea to freshwater. Many of the significant habitats designated in the Service's SHCR were given this designation due to the presence of anadromous fish (fish that spend most of their lives in saltwater but migrate to fresh water to spawn), including the alewife, white perch (*Morone americana*), American smelt (*Osmerus mordax*), and diadromous (migrate between fresh and saltwater) fish, including sea-run brown trout. Dams constructed in these tributaries have blocked access and extirpated many of these migrations/runs.

The South Shore Estuary Reserve (SSER) and the Oceans Program of Environmental Defense have formed and chaired a diadromous fish conservation workgroup to address conservation within the Reserve Area (including the FIMP area) and evaluate the present status, threats, and potential actions (including fish passageways) to conserve and improve these fish populations. The workgroup has had several meetings (since December of 2004) and is currently identifying potential actions, survey needs, and funding sources.

Further information on the SSER can be found at their web site at: http://www.estuary.cog.ny.us/.

The Service's Southern New England/New York Bight Office, in partnership with the NYSDEC's Fisheries Division, has proposed fish passageways for Mud Creek and Swan River (Halavik pers. com. 2004). These fishways would allow access for anadromous fish, primarily alewife.

Corps Avian Surveys

Dominant species observed within bay subtidal/open water habitats during Corps surveys from May 2002-May 2003 include:

Red-breasted merganser, winter resident;
Mallard, year-round resident;
Greater black-backed gull, year-round resident;
Herring gull, year-round foraging;
Gadwall (*Anas strepera*), year-round resident;
American black duck, year-round resident;
Bufflehead (*Bucephala albeola*), winter resident;
Common loon (*Gavia immer*), winter resident; and
Common merganser, winter visitor

The Corps found this habitat to have the highest species richness and abundance during their avian surveys in 2002 and 2003 (U.S. Army Corps of Engineers 2003).

South Shore Estuary Reserve

The SSER Council, a multi-agency/stakeholder organization, was established to protect and manage the South Shore Estuary Reserve system as a single integrated estuary (from Nassau County line to the Town of Southampton, including the Great South, Moriches, and Shinnecock Bays). The council identified numerous goals/outcomes to halt further degradation of the Reserve's natural resources and to improve them. Some of these goals, deemed to be applicable to the FIMP study, are listed as follows (South Shore Estuary Reserve 2001):

Reduction of Nonpoint Pollution - Elevated levels of coliform bacteria are responsible for the year-round closure of 12, 886 ac of shellfish beds in Great South Bay and 6,170 ac of shellfish beds in Moriches and Shinnecock Bays. Due to impervious surfaces within the watersheds, polluted storm water runoff is the primary issue, as well as waterfowl and vessel discharges.

Reduction of Point Source Pollution - Although point source pollution is not as widespread as and less significant than non-point pollution, it can still cause water quality degradation in immediate areas. Such sources include wastewater treatment plants and other discharges regulated by the State Pollution Discharge Elimination System permits, and solid waste disposal sites.

Increase in the Harvest Levels of Hard Clams and Other Estuarine Shellfish Species:

Seeding of hard clams;
Expansion of Islip Hatchery;
Increase in grow-out (size of) shellfish;
Enhancement of hard clam habitat through shell augmentation;
Evaluation of spawner sanctuaries; and
Creation of a reserve shellfish management forum

Coastal Habitats Protected and Restored to Support Shellfish, Finfish, and Coastal Bird Populations:

Restoration of tidal wetlands;
Coordination of restoration efforts;
Restoration of anadromous fish;
Habitat restoration of tributaries;
Evaluation and restoration of eelgrass beds;
Vegetation management for coastal birds;
Recognition of shorebird reserves;
Increased protection of marine turtle populations;
Management of upland ponds; and
Augmentation of stream flow

3. Bay Islands

The bay islands have many of the above described communities present, typically including low marsh, high marsh, and terrestrial uplands. Although many of the islands are man-made from dredge material placement, they provide important breeding habitat for shorebirds (tern colonies) and wading birds (heron rookeries).

As stated in Section VI subsection D, there has been a net loss of the number and size of bay islands (both man-made and natural) within the FIMP area due to storm events, rising sea levels, and erosion.

Significant Habitats

Service-designated significant bay island habitats include:

Moriches Bay

Carter's, New Made, and West Inlet Islands - New York State-listed common terns historically nested in large numbers.

East Inlet Island - Federally-listed roseate tern and State-listed common terns nested on the island until 1998.

Shinnecock Bay

Lanes Island and Warner's Island - Historically supported roseate and common tern colonies.

Sedge Island, Greater Greenbacks Island, and Lesser Greenbacks Island - Historically supported common tern colonies.

Service Bay Island Investigations

The Service's Long Island Field Office (LIFO) has conducted numerous site investigations of bay islands to identify restoration sites in Great South, Moriches, and Shinnecock Bays. Appendix A lists each of the back-bay islands visited, the type of vegetation observed, history of wading bird and shorebird nesting (as of 2003) and restoration potential (U.S. Fish and Wildlife Service 2005).

4. Inlets

In addition to the actual bays identified below, the Service's SHCR identifies specific bay subtidal areas within the following significant habitat complexes:

Moriches Bay

Moriches Inlet - Provides a corridor for fish migration into the bay and a foraging area for harbor seals in the winter.

Shinnecock Bay

Shinnecock Inlet - Important haul-out area for harbor seals in the winter, as well as a corridor for juvenile loggerhead and green sea turtles that feed in the bay.

Great South Bay

Fire Island Inlet - Important in daily flushing of Great South Bay, corridor and habitat for finfish, and foraging habitat for the Federally-listed roseate tern. Piping plover and least terns nest at Democrat Point on the east side of the inlet and Cedar Beach on the west side of the inlet.

VII. DESCRIPTION OF SELECTED PLAN AND EVALUATED ALTERNATIVE

A. *GENERAL DESCRIPTION OF THE PROPOSED PROJECT*

The Corps proposed project is an engineered dune and beach system which is planned for 19 miles of Fire Island's beaches (Corps 2014a). The proposed project includes dredge material placement in existing overwash habitat in the project area. It will also prevent the formation of new overwash habitats. The project will occur in many breeding and growing areas for endangered species, and will result in significant short and long term changes to their nesting, foraging, and chick rearing habitats. The volume of sand in the proposed project, approximately 7,000,000 cy, would represent the largest single project ever construction on Fire Island and would be accomplished at a full Federal cost of about $185,000,000 (U.S. Army Corps of Engineers 2013 [LRR Report]).

For this project, the Corps proposed two alternatives including "No-Action" and "Dune and Beach Construction" (the preferred alternative). The Corps' preferred alternative is a continuation of a long standing practice of shoreline stabilization on Long Island.

B. CORPS' PREFERRED ALTERNATIVE

The physical and biological components of the proposed plan are discussed in more detail in the numbered sections below. The Corps' preferred alternative includes dune and/or beach construction for 19 miles (95,800 ft) of the entire 30 miles, or 63%, of Fire Island's coastline. The proposed project would affect 100% of the overwash habitat created by Hurricane Sandy in the project area that is used by, or could be utilized by, piping plover and seabeach amaranth, as well as other beach strand habitat-dependent species (including, but not limited to the least tern, American oystercatcher, common tern, and black skimmer). The proposed action also includes conservation measures for piping plover and seabeach amaranth in the form of bay and oceanside habitat maintenance and oceanside habitat restoration at Smith Point County Park. The details of these conservation measures have not been provided to the Service, beyond a delineation of the

areas where these actions are proposed and a short statement about the Corps intent to undertake these measures. Sand for dune and beach construction would be obtained from designated offshore sand mining areas. The construction schedule would entail continuous dredging, sand placement, dune building, and beach construction over 2 consecutive years.

Project Design and Layout

The proposed project includes several design templates including a Berm Only, Small, and Medium design templates. Each of these designs includes a foreshore slope of 12.1 on 1 from +9.5 to +2 ft. National Geodetic Vertical Datum (NGVD). Below MHW, which is at roughly +2 ft. NGVD, the submerged morphological profile, representative of each specific reach, is translated and used as the design profile.

The Berm Only design template is applicable to areas where eroded berm conditions have been observed, but where existing dune elevation and width are sufficient to reduce the risk of overwashing and breaching. The Berm Only and Small templates are applied to RMSP and in Smith Point County Park in the area in front of the TWA Flight 800 Memorial.

The Small template is sufficient to reduce the risk of breaching, but does not prevent a significant portion of the damages to oceanfront structures (U.S. Army Corps of Engineers 2014 LRR). As a result, the Corps has proposed to apply the Small design template to areas with limited oceanfront structures, including the eastern section of RMSP, Fire Island Lighthouse Tract, and the eastern section of Smith Point County Park.

Finally, the Corps proposes a Medium size template for areas it has deemed has the greatest potential for damages to oceanfront structures which includes the 17 Communities on FIIS, the minor federal land tracts in this area, and the western section of Smith Point County Park.

1. Offshore Sand Mining Locations (Sand Borrow Areas) and Dredged Material Volumes

The proposed project area includes nearshore ocean bottom habitat for the purpose of sand mining. Sand, shell, sessile organisms, and benthic infauna, would be dredged and transported to the beaches via a series of pipes and pumps. Once transported to the beach, the dredged material would be dewatered, redistributed by bulldozers and other heavy equipment to create the dune and beach, then further stabilized with sand fencing and beach grass plantings.

The sandy offshore habitats which are designated as sand mining areas for the proposed project are known as Borrow Area 2C and Borrow Area 4C. Borrow Area 2C is located approximately 2 miles offshore of Point O' Woods. It is roughly 500 ac in area and contains an estimated 9,000,000 cy of compatible sediment (U.S. Army Corps of Engineers 2013 LRR Report). Borrow Area 4C is located approximately 1.5 miles offshore of Pikes Beach. It is roughly 90 ac in area and contains an estimated 2,000,000 cy of compatible sediment (U.S. Army Corps of Engineers 2013 – LRR Report).

Material for initial construction is proposed as follows: 5,000,000 cy of sand would be dredged from Borrow Area 2C and deposited between Fire Island Inlet and Davis Park, and 2,000,000 cy would be dredged from Borrow Area 4C and deposited between Smith Point County Park and Moriches Inlet. In Borrow Area 2C, the northern portion would be dredged first, followed by the remaining northeastern (deepest) portion, and the shallower (southwest) portion last (Corps 2014a). The total initial project fill volume would be 6,992,145 cy, which represents the volume of sand necessary to achieve the design fill, advance fill, overfill, and contingency profiles for 19 miles of beach. The Corps has indicated that there will be no renourishment cycles planned for the proposed project.

2. Land Acquisition and Relocation

Dune and beach construction will require the removal or relocation of 48 existing residential structures within the FIIS communities. The Corps has budgeted $57,000,000.00 plus 40% contingency or $22,800,000.00 for a total of $79,800,000.00 for the acquisition of properties (41 houses and properties mostly in the communities of Davis Park and Ocean Bay Park), and relocation of 6 houses. This figure also includes costs for any necessary permanent or temporary easements.

3. Dune and Beach Construction Areas on New York State Lands

The western end of the overall proposed project area includes 23,200 ft of dredge material placement for dune and beach construction at RMSP, beginning near Field 2 and extending to the eastern boundary of this park. The construction activity is proposed in areas which experienced partial overwash and is being undertaken to protect the park's infrastructure, such as recreational facilities, roads, and water supply. As will be discussed in later sections of this FWCAR, the proposed project would directly impact piping plover and seabeach amaranth in RMSP.

4. Dune and Beach Construction Areas on Federal Lands

Proceeding eastward in the proposed project area, the plan includes 9,600 ft of dredge material placement on Federal lands within the FIIS. It includes 2,100 ft of beach fill tapers (lateral extensions of the dune and beach construction areas) at Sailors Haven, Carrington Tract, Talisman, Blue Point Beach, and Watch Hill. According to the Corps, the tapers are necessary to create a gradual, more natural appearing shoreline and to provide storm damage protection to the terminus of each filled area.

In addition to these tapers, the Corps has proposed a total of 7,500 ft of dredge material placement for dune and beach construction on Federal lands, including the NPS' Fire Island Lighthouse Tract as well as the so-called minor Federal tracts near the western and central communities of Kismet and Robbins Rest in areas which experienced partial overwash. Dune and beach construction is proposed in these areas to protect private infrastructure, residential development, non-federal recreational facilities, roads, and water supply.

The largest area of partial overwash habitat that formed in these areas is at Lighthouse Beach and is a known breeding location of piping plovers and growing area for seabeach amaranth.

5. Dune and Beach Construction Areas in the Community Districts

The proposed project includes 37,700 ft of dredge material placement for dune and beach construction within the FIIS Community Districts. As mentioned above, this would entail the acquisition of about 41 residences and properties and relocation of six residential structures. Additional fill known as advanced fill would also be placed during the time of construction. Piping plover breeding activities and seabeach amaranth have been documented at Water Island, Ocean Bay Park, Davis Park, Point O'Woods, and Robbins Rest and discussed in more detail in Section XX, below.

6. Dune and Beach Construction on County Lands

The proposed project includes 27,200 ft of dredge material placement for dune and beach construction at Smith Point County Park on the eastern end of Fire Island. Advance fill is also planned to provide protection to the design template over the life of the project. Of this subtotal, 6,400 ft is planned for areas directing fronting infrastructure and recreational facilities at Smith Point County Park. The remaining 20,800 ft is planned for undeveloped areas of the park, which is the major piping plover breeding and seabeach amaranth habitat in the county park.

7. Endangered Species Conservation Measures

The Corps has proposed a number of Conservation Measures to avoid or minimize adverse effects of the dune and beach construction to the piping plover and seabeach amaranth. The conservation measures would be implemented by the Corps for 10 years. The intended purpose of these conservation measures is to avoid or minimize adverse effects of the beach nourishment project to Federally-listed species. The Corps indicated that it will follow recommendations provided by the NYSDEC and the Service previously (USACE 1998, USFWS 1999) to minimize potential adverse indirect impacts on other species that may use coastal habitats in the project area, including several State-listed shorebird species.

Modifications of Fill Tapers on Federal Lands

The Corps has proposed to modify the extent of length of each fill taper on Federal lands to 300 ft. The following provides the lengths of each section as per the Corps' plan layout design:

C17 - Current design acceptable
C18 - Change taper to 300' -- end at 607+00
C19 - Change taper to 300' -- end at 643+00 (last full section at 640+00)
C20 - Change taper to 300' -- end at 655+00 (last full section at 658+00), last two properties are owned by the Federal government so end dune at 658+00
C22 - Current design acceptable
C23 - Change taper to 200' -- end at 789+00
C24 - Change taper to 300' -- end at 813+50
C25 - Change taper to 300' -- end at 853+50
C27 - Change taper to 300' -- end at 901+20
C28 - End taper at 1294+00 (last full section at 1297+00)

Modifications to Dune Slopes and Alignment in the Project Area

Lighthouse Tract

At the Federal Lighthouse Tract approximately 3,800 ft of dune will be built to a 1 on 10 slope (refer to Figure 3 above) (Consultation under Section 106 of the National Historic Preservation Act of 1966 (NHPA) is required to finalize this modification). The tolerances for the berm elevation would also be reduced from 1 ft to 0.5 ft to minimize heights immediately following construction.

Specifically, from Station 223+50 to 274+50: The Corps has proposed a straight dune alignment. The landward slope of the dune will intersect with the existing topography. The dune design template includes a dune with a 1V:10H seaward slope, 25 ft crest width, and 1V:10H landward slope East of Station 274+50, the Corps has proposed dunes with slopes of 1V:5H with the seaward dune toe to match alignment.

The dunes will be realigned to meet up with existing dune line at the Lighthouse tract. The 13 ft dune will go from a 1 on 5 slope to a 1 on 10 slope. Although no vegetation will be planted, it is the Service's understanding that vegetation will not be managed as it naturally grows back, thereby limiting these areas as breeding habitat for piping plovers and other ground-nesting shorebirds, as well as coastal plants found in sparsely vegetated beach habitats.

West of Robbins Rest

In the area between Atlantique and Robbins Rest approximately 900 ft of dune would be realigned north to the vegetation line west of Robbins Rest to an effort to conserve early successional overwash habitat that formed in this area due to Hurricane Sandy. The Corps has indicated that the area east of Robbins Rest currently has an access road to the beach and is heavily used and would thus be unsuitable for productive use by plovers (U.S. Army Corps of Engineers 2014b). The Corps has also proposed to monitor and undertake an adaptive management plan to maintain this habitat as early successional habitat for 10 years. The tolerances for the berm height will also be reduced from 1 ft to 0.5 ft to minimize berm height after construction.

The dune design template in this area would include a 1V:5H seaward slope, 25 ft crest width, and 1V:15H landward slope.

All Other Communities' Dunes

Standard Medium design template alignment and dune slopes.

Smith Point County Park

The Corps has indicated that it is not feasible to eliminate the proposed dune system or vary its height in Smith Point County Park without compromising coastal storm risk reduction or severely curtailing county park management, operations, and use.

Amended Conservation Measures

During completion of the ESA consultation process, the Corps developed amended conservation measures documented in their May 20, 2014, correspondence to the Service that are listed in Table 5. With the exception of the New Made disposal habitat location 6 HA expansion further described below, these measures are expected to partially ameliorate impacts to other fish and wildlife resources, including ground-nesting shorebirds and coastal plants that prefer sparsely vegetated beach habitats.

TABLE 5. Amended Corps-proposed Conservation Measures

Plan Modifications	
Pattersquash Island Overwash – 13 HA	
Dune location	Seaward location, as shown on plans.
Dune Slopes	1:5 slopes.
Dune Planting	Vegetated 18" spacing.
Dune De-vegetation	No dune management.
Bayside De-vegetation	De-vegetate when >30% cover, 10 yrs.
Project Sand-Fencing	No project installed sand fencing.
Locally-installed fencing	No limitation on locally-installed sand fencing within dune and within 75 ft buffer (allow for vehicle management).
Road location	Burma Road located within 75 ft buffer north of landward toe of dune to maximize bayside habitat.
Smith Point Breach Overwash – 6.1 HA	
Dune Location	Seaward location, as shown on plans.
Dune Slopes	1:5 slopes.
Dune Planting	Vegetated 18" spacing.
Dune De-vegetation	No dune management.
Bayside De-vegetation	De-vegetate when >30% cover, 10 yrs.
Project Sand-Fencing	No project installed sand fencing.
Locally-installed fencing	No limitation on locally-installed sand fencing within dune and within 75 ft buffer (allow for vehicle management).

Smith Point Breach Overwash – 6.1 HA	
Road location	Burma Road located within 75 ft buffer north of landward toe of dune to maximize bayside habitat.
New Made Island Overwash – 10.5 HA	
Dune location	Seaward location, as shown on plans.
Dune Slopes	1:5 slopes.
Dune Planting	Vegetated 18" spacing.
Dune De-vegetation	No dune management.
Bayside De-vegetation	De-vegetate when >30% cover, 10 yrs.
Project Sand-Fencing	No project installed sand fencing.
Locally-installed fencing	No limitation on locally-installed sand fencing within dune and within 75 ft buffer (allow for vehicle management).
Road Location	Burma Road located within 75 ft buffer north of landward toe of dune to maximize bayside habitat.
Great Gun Area & expanded Great Gun East - 34 HA	
Recontouring	Maintain existing dune adjacent to the road. The berm would be configured as +9 that steps down to elevation +7 to promote ephemeral pools. Specific plans to be developed. Need to assess volume of sand, and will keep sand in the system.
Construction – De-vegetating berm	De-vegetate fronting berm, as part of recontouring.
Adaptive De-vegetation	De-vegetate when >30% cover, 10 yrs.
Adaptive pool management	Maintain berm height if too high. Focus on pre-season efforts to maintain height. Subject to adaptive management.

New Made Dredge disposal habitat location - 4HA + 2 HA expansion	
Recontouring	Lower dike to adjacent grades, regrade existing substrate, and cover with 2 ft of ocean sand. Achieve desired slopes and percentage of foraging / nesting habitat. Specific plans to be developed, possible connection to the east for an additional 2 HA.

The Service is concerned with the proposed New Made Island dredge disposal habitat location 6 HA expansion. The dredge disposal material from the Forge River contains silts and other fine material that could contain contaminant material. The Service recommends that the Corps test the material for contamination and coordinate with the Service prior to undergoing these construction activities.

Vegetation Control

In the Pattersquash, Smith Point Breach Fill, and New Made Island subareas in Smith Point County Park, the Corps has proposed vegetation planting of the dunes. The Corps has proposed to monitor and adaptively manage the bayside habitat areas as early successional habitat over 10 years.

The Corps will coordinate with the Service in the preparation of a de-vegetation plan within the identified areas three primary overwash bayside areas in the park (the areas of New Made Island, the recently closed Smith Point County Park breach, Pattersquash Island, and Great Gun). The plan will be required for 10 years.

Predator Management

The Corps will coordinate with the Service in the preparation of a predator plan (mammalian) for pre-season and in-season predator monitoring program for all project areas. The predator monitoring plan will include measures needed to protect piping plovers, nests, and chicks, as well as other ground-nesting shorebirds. The plan will be required for 10 years.

Habitat Restoration

The Corps has proposed to restore 34 hectares (84 ac) of a now heavily vegetated area at Great Gun Beach to early successional habitat, and monitor and maintain that as previously described for the other areas. The Corps will keep the vegetation at a 30-40% coverage in that area. The vegetation will be removed via mechanical, hand, or chemically, whichever the land manager and State regulations will allow in a particular area. This restoration could potentially provide suitable habitat for ground-nesting shorebirds and coastal plants.

Coordination and Notification

The Corps has proposed to:

(1) Contact the Service upon initiation and completion of construction activities. In addition, the Corps would conduct pre-construction meetings with all project staff to provide all information on resource protection and terms of the project permit.
(2) Provide all project personnel, construction staff, etc., with information regarding the conditions of the project (including all conservation measures).

Time-of-Year Restrictions

The Corps has proposed time-of-year restrictions, which will provide for no activities between April 1 and September 1 to protect piping plovers and May 1 to October 15 to protect seabeach amaranth except within the boundaries of the FIIS Communities. Their restrictions include the provision that if no breeding piping plovers are observed in a proposed project area, or are not within 1,000 m of the project area by July 15, then project activities may commence, following consultation with the agencies. To minimize indirect impacts, the Corps will conduct surveys during the spring/summer, and prior to construction activities, to identify nesting plovers in the Project area, and to document all known locations of piping plovers. In addition, the Corps will document any other Federal or State-listed wildlife species observed in the Project area during surveys and will initiate consultation with appropriate State and Federal agencies.

The Corps is proposing to only undertake low impact construction activities, such as beach surveying during the piping plover breeding season and utilizing a 300-ft protective buffer zone.

Surveying, Monitoring, and Adaptive Management

The Corps has proposed the following measures:

- Surveying and monitoring of the action area for threatened and endangered species during the spring and summer nesting seasons will be implemented for 10 years. The monitoring will be completed in coordination with the NPS, Suffolk County, and the Service. Monitoring will include identification of suitable habitat, nesting areas, and symbolic fencing and signage, based on this monitoring.

- Surveying and monitoring will be undertaken by a qualified, designated biologist(s). Qualified biologists 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) in community beach nourishment project areas.

- The qualified biologist will also recommend and implement changes in the location and configuration of symbolic fencing and warning signs and gauge the effectiveness of management actions. Biologists will be educated about the biology of listed species and required to attend a piping plover management course organized by the Service, the NYSDEC, and TNC, prior to undertaking surveying, monitoring, or management actions.

- 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) and predation will be undertaken following the conditions outlined below. These

conditions are also intended to offset impacts of habitat degradation and to assist in the recovery of the species.

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

- 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 or seabeach amaranth growing seasons, the applicant will coordinate with the land manager(s) and the Service biologists to design a "symbolic fencing plan."

- Coordination on the placement of symbolic fencing will incorporate field population and habitat data for the project area and visual assessment of all oceanside and bayside habitats each year. Habitats will be deemed suitable if piping plovers and seabeach amaranth were observed at the site in previous years or the beach width, slope, cover material (shell fragments), etc., are deemed adequate by the Service.

- Consistent with current Service management measures, breeding and growing areas shall be protected with symbolic fencing using steel or CarsoniteTM fiberglass posts placed approximately 33 ft apart and connected with string or twine. Fluorescent flagging material will be tied to the string every 1.6 ft to increase visibility, and piping plover or seabeach amaranth habitat warning signs shall be placed on every second or third post. Posts stretch from the toe of the dune seaward to about 40 ft south of the toe of dune line. As sand accretes through the season, posts and fences may need to be moved seaward to maintain symbolic fencing at this distance.

- All pedestrian and ORV access into, or through, the breeding or growing areas shall be prohibited. Walkways may be permitted after an assessment by a qualified biologist and with the permission of the Service. 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 15, and as long thereafter as viable eggs or unfledged chicks are present. If no breeding piping plovers or their chicks are observed in the symbolically fenced areas, the fencing may be removed or reduced, in scale, provided that the seabeach amaranth is not present or the site is not suitable for seabeach amaranth. Symbolic fencing erected to protect seabeach amaranth shall be in place until the plant dies, or until October 15, whichever comes first.

- Productivity and population surveys will be conducted each year. 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 eggs, chicks, and adults that occurred, including reasons for take and actions that were taken to avoid take.

- 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:

  - date;
  - time begin/end;
  - weather conditions;
  - tidal stage;
  - area of coverage;
  - ownership of site;
  - number of adults observed;
  - number of pairs observed;
  - habitat type;
  - nearest known plover occurrence;
  - banded plovers; and
  - predator trail indices

- Prior to implementation of the monitoring program, the Corps will consult with, and obtain agreement from, the Service on the methodologies and reporting frequencies to be utilized. Surveys would 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 wide 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.

Seabeach Amaranth

Surveys

If any beach nourishment activities are scheduled to occur during the growing season of seabeach amaranth (defined as May 15 to October 15), a qualified biologist hired by the Corps or their contractor will survey the project area(s) for this species twice a month from June 1 to October 1, and also immediately prior to any construction or other work. Plant locations, numbers, and sizes will be recorded.

Fencing and Avoidance of Seabeach Amaranth

If construction personnel or ORVs will be present in, or may pass through, seabeach amaranth growing areas, symbolic fencing will be erected encompassing a 10 ft protective buffer around the plants if practical. All construction activities will avoid all delineated locations of seabeach amaranth where feasible. The Corps or their contractor will undertake all practicable measures to avoid any adverse impacts to plants.

Transplantation of Seabeach Amaranth Likely to be Destroyed

In the event that seabeach amaranth is present in the action area, and it is likely that the plants will be destroyed, the Corps or their contractor will transplant the individual plants to a similar habitat near, or within, the action area to lessen the impact. Transplantation will include removal of a sufficiently large and intact volume of sand to include the full extent of the roots. Transplanted individuals will be monitored until their deaths, and the monitoring results will be provided to the Service.

Seed Collection and Other Measures

In consultation and cooperation with the Service, beginning in 2014, the applicant will develop and implement a plan to compensate for plant mortality and burial of the seed bank, involving collection of a portion of the seabeach amaranth seeds produced in all areas to be nourished or renourished where the plant is present. Seeds will be sent to a qualified greenhouse. A portion of the collected seeds will be stored under controlled conditions appropriate for the species (e.g., temperature, humidity, and light) and later redistributed within the action area.

Qualified practitioners will attempt to germinate the remainder of the seeds. If successful, germinated plants will be replanted in suitable habitats within the action area, according to plans coordinated with the Service. If the number of wild plants bearing seeds is insufficient to collect an adequate amount of seeds, individual plants will be sent to a qualified greenhouse and propagated to produce additional seeds to be used for the purposes described above.

Transplanted individuals will be monitored until their deaths, and the monitoring results will be provided to the Service.

Based upon the best available scientific data, the Service will determine an acceptable course of action to compensate for seed bank burial, including the amount of seeds to be collected, thresholds for collecting and propagating plants for production of additional seeds, the proportions of collected seeds to be stored versus germinated, protocols for collection, storage, germination, and reintroduction of plants and seeds into the project area, and procedures for scraping and re-spreading sand, if deemed appropriate. The applicant will monitor reintroduced plants and seeds for the duration of the growing season and report the results to the Service.

These actions will be undertaken to offset the anticipated adverse impacts to the seed bank and individual plants whose destruction cannot be avoided. These actions will serve to compensate for any such loss, but will not be construed as a long-term commitment to species propagation between renourishments. Such activities will not continue past the second year of placement cycle.

<u>Evaluation of Seabeach Amaranth Conservation Measures</u>

In consultation and cooperation with the Service, the Corps will evaluate the success of measures to protect seabeach amaranth and will revise these protective measures as appropriate.

Access

The Corps has proposed that the Service and their authorized representatives would be allowed unrestricted access to all project sites within the action area for the purposes of conducting research, monitoring, enforcement, looking for evidence of rare, threatened, or endangered wildlife or plants, preserving or protecting habitat, and erecting symbolic fencing or exclosure fencing for the purpose of protecting wildlife or plants. Access will be permitted from the landward toe of the dune to the water's edge.

8. Project Life

The following is an excerpt from the Corps' Draft Limited Re-evaluation Report (Corps 2014a) regarding the FIMI project life:

> The Project is designed with advance fill to ensure that the design conditions are maintained for a period of 5 years, under normal conditions. After this time, the project will erode into the design template, and offer residual, diminished protection. It is difficult to project the amount of time that residual protection from the fill will remain. It is estimated, under typical conditions, that the residual effect of the fill placement could last another 5 years. Even after the residual effect of beachfill has diminished, there is a longer residual effect that is provided by the acquisition and relocation of structures. Based upon the setback distances and background erosion rate, it has been projected that the residual effects of relocating these buildings would be an additional 10 years. The economics modeling has confirmed that the with-out future condition and with-project condition results converge after 20 years, supporting a period of analysis of 20 years.

As such, the Service is of the understanding that, due to advance fill, the project design will be maintained for 5 years, and that residual effects could occur over an additional 10 years. The Service will, therefore, consider the project life to be 10 years.

C. NO-ACTION ALTERNATIVE/FUTURE WITHOUT PROJECT CONDITIONS

*Assumption*s

For the purposes of this analysis, it is assumed, in the Future Without Project condition, that the following projects shall continue to be implemented within the FIMI and FIMP Study Area:

Corps: BCP;

Corps: Westhampton Interim Project (until 2027);

Corps: West of Shinnecock Inlet Interim Project;

Corps: Fire Island Inlet Federal Navigation Project authorized in 1948 and Shore Westerly Project;

Corps: Moriches Inlet Federal Navigation Channel, Jetty Rehabilitation Project, authorized in 1959;

Corps: Shinnecock Inlet Federal Navigation Channel and Jetty Rehabilitation Project;

Corps: Long Island Intracoastal Waterway Federal Navigation Channel Project;
State: Shinnecock Inlet dune and beach fortification;

Suffolk County Department of Public Works: Channel Maintenance Dredging and Beach Disposal;

Non-federal storm damage protection projects are likely to be designed and implemented within the FIMI/FIMP, such as the FIIS Short-term Community Storm Surge Protection Plan.

The following assessment is made within the context of both the FIMI 10 year project life as well as the FIMP, which could potentially have a 50 year project life.

Ocean Beach/Barrier Islands

On Fire Island, there is an insufficient amount of sediment coming to the island from all potential sources (Psuty et al. 2005). Sediment deficits are greatest along the eastern portion of the island, while the central and western areas are buffered due to contributions from an offshore source. In fact, there is no evidence of historic inlets within the central portion (between Ocean Beach and Watch Hill) of Fire Island over the last several centuries (Tanski 2007), suggesting that this portion of Fire Island is relatively stable with regards to the potential for breaching. The recent acceleration of sea-level rise, coupled with the negative sediment budget, will result in continued beach erosion and dune displacement, with greater effects occurring in the eastern portion of the island (Psuty et al. 2005). Future sea levels are expected to rise at a greater rate, causing increased frequency of overwash and creation of new inlets/breaches (Hinga 2005) in the FIMI study area (more so in the eastern portion of Fire Island). Small-scale storm damage protection projects and sand by-passing associated with maintenance dredging of the inlets would stabilize the ocean shoreline to some extent, which may minimize/limit the occurrence of overwash and new inlet formation, but presumably at a smaller scale than a FIMI project would due to the smaller volumes of sand.

Increased frequency of overwash and/or breach events could result in the creation of early successional habitat/sparsely vegetated habitat preferred by many shorebirds (piping plovers, least tern, etc.) and annual coastal plants, such as seabeach amaranth, which, if left undisturbed, could result in an increase in abundance and productivity of these species (provided areas are properly managed, an issue to be addressed during the ESA Section 7 consultation). However, storm damage protection measures (beach nourishment, beach scraping, beach grass planting, and/or sand fencing installation) are likely to occur.

Barrier islands, such as those within the FIMI study area, move in a continuous process whereby sand is transported across the island from the ocean to the bay, allowing the islands to migrate

landward (Tanski 2007) and maintain an elevation that prevents submergence due to rising sea levels (Leatherman 1988). Barrier island migration appears to be a phenomenon that occurs over periods of time greater than the project life of the FIMI or the FIMP, and that even increased sea level rise would not significantly change the rates of shoreline change/barrier island migration in a 50 year time frame (Tanski 2007).

Bay Intertidal Areas

Increased frequency of overwash and/or breach events could result in the creation of additional tidal wetlands and/or tidal flats in the bays. However, relatively short-lived inlets that are only open for one or two years are not as important in terms of marsh creation because they do not move enough sand to the back-bay (Tanski 2007). Additionally, bulkheads, which are common on the bay shore in developed communities, replace natural formations landward of them and prevent sand from entering the littoral drift system, causing sediment starvation/accelerated erosion in unprotected areas downdrift (Nordstrom and Jackson 2005). The accelerated erosion will continue to narrow the width of the barrier island in these areas and potentially cause breaching from the bayside of the barrier island.

Sea Level Rise and Tidal Marsh Elevation Change

The NPS-FIIS conducted a monitoring program to quantify marsh elevation change in relation to sea-level rise and to identify factors and/or processes that influence the development and maintenance of Fire Island saltmarshes. Monitoring was conducted in three marsh areas, Great Gun Meadows, Hospital Point, and Watch Hill from August 2002 to May 2007. The NPS-FIIS concluded that all three sites revealed an elevation deficit when compared to sea level rise and that the marshes do not appear to be keeping pace with rates of sea level rise (Roman et al. 2007). Sea level rise over the past 60 to 100 years from NOAA water level stations in the vicinity of Great South Bay ranged from 2.52 mm/year to 3.79 mm/year (Roman et al. 2007), all greater than measured marsh elevation. If the observed elevation deficit continues, it is likely that these marshes will become wetter and high marsh vegetation may convert to Spartina alterniflora and areas of open water and marsh submergence may increase (Roman et al. 2007), which could negate the trend of increased tidal marsh areas found by the NYSDEC. With marsh submergence, soils become waterlogged and anaerobic soil conditions persist, causing plant death, collapse of peat, and ultimate increased flooding (Roman et al. 2007). Additionally, there would likely be a landward encroachment of marshes to upland areas, provided that man-made structures (bulkheads) do not impede this migration. This trend may exacerbate if predictions of an accelerated rate of sea-level rise in response to global warming occurs (Roman et al. 2007).

Great South and Bellport Bay

Suffolk County monitoring data indicates an improvement in water quality in the Great South Bay due to the implementation of sewage management practices (Hinga 2005) and this trend is likely occurring in Moriches and Shinnecock Bays, as well. Improvements in water quality (fecal coliform, concentrations of nutrients, etc.) may improve the chances of successful shellfish stocking and increase the diversity of biota (finfish, benthic organisms, etc.) in the bays (by

increasing flushing and dilution of fecal coliform and nutrients, increasing light penetration, and reducing the potential for brown tide [New York Sea Grant Extension Program 2001]). An increase in the occurrence of breaching may also improve water quality in the bays, but would also increase salinity of the bays, which could allow for more predators of shellfish (finfish) to frequent the bays (Tanski 2007).

It is expected that the number and size of bay islands within the FIMI/FIMP study area will continue to decrease due to storm events, rising sea levels, and erosion.

Inlets/Mainland

As previously stated, the inlets will likely be maintained through maintenance dredging and maintenance of the jetties. On the mainland, rising sea levels could cause the migration of marshes landward, if there is room (possible in undeveloped areas/open space), or cause some submergence of marshes and create more open water areas along the bayshore line.

VIII. DESCRIPTION OF PROPOSED ACTION IMPACTS ON FISH AND WILDLIFE RESOURCES

A. DIRECT AND INDIRECT IMPACTS

The proposed action has the potential to directly and indirectly adversely impact fish and wildlife resources within the project area and the overall condition of the barrier island due to the reduced likelihood of natural processes occurring unhindered resulting from the Corps' beach nourishment and dune construction project.

Direct impacts include:

- Loss and habitat modification of off-shore borrow area habitats, benthic/fisheries resources, and overwash/early successional habitat;
- Burial of marine intertidal and marine beach invertebrate species and temporal modification of intertidal and marine habitats; and
- Increased turbidity of off-shore and intertidal habitats.

Indirect impacts include:

- Decreases habitat values for Federally and State-listed plant and animal species;
- Reduces potential to form and create early successional barrier island habitats;
- Reduces opportunities for water quality improvement in backbay;
- Reduces the potential to form new inlet channel habitat;
- Reduces the potential to recruit finfish and crustaceans to backbay;
- Reduces sediment transport to the bay;
- Reduces rates of formation of SAV and saltmarsh habitats;
- Accelerates vegetative succession on barrier island and backbay;
- Decreases biodiversity at the community level;
- Develops habitat preferred by mammalian and avian predators; and

· Reduces habitat values for waterfowl and migratory shorebirds.

1. Offshore/Nearshore Communities

The Corps states the following in regards to the environmental impacts of dredging the borrow areas in their EA (Corps 2014b):

- Although this community would be disturbed, such disturbance would be of a temporary nature and would occur in dynamic/high energy environments where species have adapted to these conditions.

- Preconstruction surveys would ensure that impacts to highly diverse areas containing substantial surf clam populations are avoided or minimized.

- The portion of borrow areas actively dredged for all the Federal projects located along the south shore represent a very small percentage of the total available habitat.

- These areas also are spatially distributed so that dredging impacts are not concentrated in any one portion of the Study Area.

- In addition, the borrow areas are sloped in a manner to prevent anoxic conditions, and the substrate in the borrow areas is similar in composition to pre- and post-construction conditions, allowing for the re-colonization of these areas, which should occur within 12 to 18 months following dredging operations.

A description of the potential physical and biological changes resulting from dredging of borrow areas and their associated direct impacts is given in Minerals and Management Service (2001). Some notable potential biological effects to fish and invertebrates include, but are not limited to, (1) removal or loss of infauna and epifauna at the borrow site for one to five years to a community with comparable pre-disturbance abundance and diversity and biomass but different species composition and structure, (2) altered energy transfer on the food chain and altered composition of fish prey base, (3) loss of spawning habitat, (4) loss of overwintering habitat, and (5) changes in community structure (species present, diversity, abundance, and biomass in surrounding areas (Minerals Management Service 2001).

The primary adverse direct impact on the environment due to dredging operations at a borrow area involves the disturbance and destruction of benthic resources and their habitats, which would result in a loss of benthic organisms from the immediate area. Woodward-Clyde Consultants (1975) concluded that dredging may lower the productivity of a borrow area, and thus, the usefulness of the site for the production of fish and shellfish may decrease until a typical community is re-established in the borrow area. As previously stated, surf clam surveys conducted in 2001 indicate that this species was present in the project borrow areas, although in relatively small numbers.

Dredging also directly effects fish by displacing fish populations from the dredging operation site (Woodhead 1992). Fish utilizing borrow pits may potentially be exposed to elevated contaminant levels due to the siltation of contaminated fine material into the borrow pit. Small deep pits are the poorest habitat due to reduced water circulation and high sedimentation rates which could lead to anoxic conditions lethal to species using the pits. However, as indicated in studies by Woodhead and McCafferty (1986), borrow areas and channels often contain higher levels of fish than adjacent shoals, indicating that borrow areas do not demonstrate adverse impacts to resources once the construction period is over. Also, as described above, the Corps has designed the slopes of the borrow areas to prevent anoxic conditions.

Decreased water quality and increased turbidity in the marine nearshore subtidal zone could result from the actual beach nourishment activity (Mineral Management Service 2001). Sand particles suspended by dredging are dense and fall quickly back to the bottom while the fine sediments stay in suspension longer than sand, only sinking slowly (Woodhead 1992). Fish tolerance to suspended solids varies from species to species and by age. Beach nourishment can affect fish populations by delaying hatching time of fish eggs, by killing the fish by coating their gills, and by reducing DO concentrations to stressful levels (Naqvi and Pullen 1982).

Localized turbidity plumes can have lethal and sublethal effects on benthos and fish, including hematological compensation for reduced gas exchange across gill surfaces, abrasion of epithelial tissue, packing of the gut with large quantities of ingested solids which may have little nutritive value, disruption of gill tissues (abrasion, clogging, increased activity of mucosa), and increased activity with a reduction of stored metabolic reserves (Profiles Research and Consulting Groups, Inc., 1980). Other effects of increases in turbidity include a decrease in light penetration, mechanical abrasion of the filter feeding and respiratory structures of animals, possible resuspension of contaminants and nutrients, burial of non-motile eggs, larvae, and adults, and absorption of essential nutrients from the water column (Stern and Stickle 1978).

The potential for oxygen deprivation problems in borrow areas is a very real concern. Reduced water circulation and high siltation/sedimentation of fine material can lead to anoxic conditions lethal to organisms which may be utilizing a borrow pit. These adverse direct/indirect impacts have been found to be minimal in areas with strong currents where oxygen can be quickly replenished (Tuberville and Marsh 1982). Elimination of small deep pit designs can alleviate potential oxygen deprivation problems.

In addition, dredging activities may also directly impact migratory or overwintering seabirds (Minerals Management Service 2004). Seabirds also use these habitats and can experience loss of foraging resources due to dredging, which can result in shifts in foraging patterns (U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, pers. comm. 2004). The Minerals Management Service, which oversees exploration of offshore areas for mining, and oil and gas reserves, has recognized the potential impacts of their programs to seabirds and has undertaken, in certain areas of the country, surveys to understand seabird distribution and abundance in their project areas.

2. Marine Intertidal and Marine Beach

The primary direct impacts of the proposed action on the marine intertidal beach communities are the burial of benthic organisms and turbidity associated with the placement of sand. The FIMI entails the deposition of 7,000,000 cy of material on 19 miles of beach in the primary beach fill/dune construction area, burying the existing profile to an average depth of approximately 5 ft.

Recent studies present varied evidence as to both short- and long-term impacts of beach nourishment along the western coast of the Atlantic Coast, and focus principally on beach and benthic/pelagic invertebrate and finfish communities of the western Atlantic Coast (e.g., Mineral and Management Service 2001). On the other hand, relatively little information on the effects of beach nourishment on shorebirds and waterbirds is present in the literature (CZR, Inc. 2003).

Based on the review of the literature, the proposed project has the potential to result in a number of direct and indirect physical and biological impacts in terms of scale and duration in the marine intertidal, maritime beach, and maritime dune communities in the proposed project area. Direct adverse impacts to these communities include, but are not limited to, impacts to breeding and non-breeding avian species through habitat modification, burial of prey resources at the disposal sites, removal of prey resources in the offshore dredging areas, and disturbance of breeding, loafing, roosting, and foraging activities of avifauna.

Potentially beneficial impacts of beach nourishment have been observed at other Corps sites existing on Long Island (wider beaches provide more shorebird breeding areas/growing areas for coastal plants); however, these are not well studied and remain anecdotal as to their long-term contribution to resource conservation.

In addition to the above, direct impacts also include burial of benthic resources due to the covering of these existing habitats with sand (Corps 2014b). Peterson and Manning (2001) stated that long-term adverse impacts to benthic fauna at North Topsail Beach, NC, occurred following beach nourishment. Lindquist and Manning (2001) reported that periodic nourishment of these beaches appeared to prevent the full recovery of benthic species.

The timing of dredging and placement of sand during the nourishment activities will also be a major factor regarding short- and long-term impacts for non-endangered shorebird and waterbird species. The direct effects include disruption of breeding, foraging, and roosting activities. Beach construction activities are usually very intensive environmentally disruptive operations, which involve the mobilization and use of heavy equipment and vehicles on the ocean beaches. The operation of dredging equipment immediately adjacent to a shoreline that is used as a courtship, nesting, and brood rearing area has the potential to disturb shorebirds to the point where they may not successfully nest and fledge young. Dredging equipment that is operated immediately adjacent to shorebird breeding habitat may preclude shorebirds from using the habitat entirely, forcing them to seek appropriate habitat elsewhere. Operation of machinery used to move dredge pipeline and to grade the nourished beach can greatly disturb shorebirds, their nests, and can endanger the lives of chicks (U.S. Fish and Wildlife Service 1995). However, even low levels of human activity have been shown to result in disturbance and displacement of shorebirds at migrational staging and roosting areas (Pfister et al. 1992). Migratory shorebirds are

particularly vulnerable to disturbance at roosting sites at high tides where the habitat available for roosting is diminished (U.S. Fish and Wildlife Service 1998). Long-term indirect impacts are likely, as recreational activities would increase as a result of the proposed project. Human activities may adversely affect productivity of shorebirds (Ruhlen et al. 2002) and influence foraging activity of some shorebird species (Burger and Gochfeld 1991). Combine this with nourishment cycles for the Fire Island and Moriches Inlets, the Intracoastal Waterway and Captree Boat Basin dredging, the effect of the FIMI beach placement becomes compounded. The Service is concerned that birds migrating or wintering along newly created beaches would be at risk of not meeting their nutritional needs, which are particularly high during these periods.

The proposed project will also result in changes to the existing dune structure, burial of dune vegetation, and vegetation succession. The proposed project will create a monotypic stand of American beach grass through artificial planting at densities which may or may not be beneficial to avifauna. If vegetation succession and increased human disturbance is encouraged, shorebirds will most likely be discouraged from occupying these habitats.

The recovery of benthic macrofauna (those animals 0.5 mm or larger in size) after beach nourishment varies from one site to another. Studies completed in the 1970s indicate that when nourishment ceases, the recovery of benthic macrofauna is rapid, and complete recovery might occur within one or two seasons (Reilly and Bellis 1978). The ability of macrofauna to recover is due to: (a) their short life cycles, (b) their fast reproductive potential, and (c) the recruitment of plankton larvae and motile macrofauna from nearby unaffected areas (Naqvi and Pullen 1982). The Corps reported intertidal benthos communities recovered from beachfill impacts within 6 months, and impacts to the intertidal benthic community were more significant when sand particle size of nourished material did not match that of the existing beach, based upon monitoring of beach nourishment impacts on the New Jersey shoreline of the Atlantic Ocean (U.S. Army Corps of Engineers 2001). The Corps EA states that sediment suitability analyses were performed in 1998 and the texture of the borrow area material was found to be compatible with the native Fire Island sand (USACE 2014b).

Meiofauna (animals smaller than 0.5 mm [0.02 inches] and equal to or larger than 0.062 mm [0.002 inches]) tend to recover very slowly from a major disturbance, perhaps due to their slow reproduction, limited ability to migrate, and their highly specialized adaptations to a restricted environment (Naqvi and Pullen 1982). However, meiofaunal recovery can be rapid following minor disturbances (Naqvi and Pullen 1982).

Turbidity, while comparatively unimportant to benthic organisms, may be relatively more important to fish and the fish community structure. Suspended solids in water can affect the fish population by delaying the hatching time of fish eggs (Schubel and Wang, 1973), killing the fish by coating their gills, and by anoxia (O'Connor et al. 1976). Sherk et al. (1974) found that demersal fish are more tolerant to suspended solids and filter-feeding fish are least tolerant, giving an advantage to demersal fish and a disadvantage to filter feeders. Mobile organisms, such as fish, appear to be the least affected by beach nourishment activities as they are able to move to avoid disturbances (Hurme and Pullen 1988). Such motile species are able to return to the area when conditions are suitable again.

In conclusion, the proposed action will bury the benthic organisms present within this community and it could take up to 2 years for this community to recover. The loss of these organisms will impact finfish and shorebirds which feed on these organisms. These impacts are compounded by nourishment associated with the maintenance dredging of each of the inlets, Intracoastal Waterway and Captree Boat Basin. The project could also directly impact fish communities by increasing turbidity in the placement area.

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. In 2003, the time period for benthic recolonization was approximately 12 to 18 months for the Fire Island Community project area (Land Use Ecological Services, Inc., 2005).

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). Despite the example cited by the Corps, time frames for intertidal invertebrate recruitment and re-establishment following beach nourishment are generally reported as taking between 12 and 18 months (National Resource Council 1995) and this time frame is consistent with the findings of Land Use Ecological Services, Inc. (2005) for the Fire Island beaches.

It should also be noted that the continuation and possible increase of ORV use within Smith Point County Park and throughout the Fire Island National Seashore following implementation of the proposed project, suggests that the abundances of prey resources in wrack habitat would be reduced via mortality, displacement or lowered total amount of wrack, but additional research is needed to evaluate recolonization rates under varying driving conditions (Kluft and Ginsburg 2009).

The Service emphasizes the need to quantify the long term effects of projects similar to the FIMI. Pre-project, during construction, and post-construction studies need to be completed to assess benthic invertebrate recovery, and impacts to migratory and wintering shorebirds as well as finfish.

Recreational Impacts to Fish and Wildlife Resources

The ORV access is authorized by the NYSOPRHP in RMSP, the NPS in FIIS, and by Suffolk County in Smith Point County Park. Each of these entities allow for ORV access while also managing their beaches for Federally and State-listed ground nesting shorebirds during the plover breeding season, including the restriction of vehicle access when unfledged piping plover chicks are present. Due to Hurricane Sandy, the expanse of ocean-to-bay overwash areas in Smith Point County Park are some of the highest for ecological value, providing habitat for the Federally-listed threatened piping plover and seabeach amaranth, as well as the State-listed threatened least tern and common tern, the black skimmer, a State species of special concern, and the American oystercatcher, a ground-nesting shorebird which breeds in this habitat as well (USFWS 1996b). The Federally-listed threatened seabeach amaranth, as well as other coastal plants, grows in this habitat as well (USFWS 1996a). Although the Corps has proposed several measures to minimize the effect of constructing a dune in this area (lowered dunes heights, vegetation management, etc.), Smith Point County Park has heavy ORV traffic in the spring and summer months. The ORV access extends from the park entrance eastward to Moriches Inlet (approximately 5.5 miles). Suffolk County installed sand fencing and allowed ORV access in the breach fill/overwash area at Cupsogue County Park located adjacently east of Moriches Inlet. It is not clear whether the County will manage the ORV access at Smith Point County Park in a similar fashion, but the potential exists. Although recreational activities on this property are beyond the jurisdiction of the Corps, these activities and associated management may affect the success of the Corps conservation measures in this area. The Service notes that all overwash areas within the FIMI study area will be altered by dune construction.

3. Dunes and Swales

The Corps' recommended beach fill/dune construction plan could have significant direct and indirect impacts on barrier island vegetation present within the project area. The deposition of material and stabilization of the shoreline would alter, and could limit the creation of, sparsely vegetated overwash areas and inter-dunal swales. Proposed dune alignments would occur in extensive sparsely vegetated overwash areas created by Hurricane Sandy. The Corps has incorporated project features to diversify the shoreline; however, the simplified shoreline proposed in the remainder of the project area would not provide the range of habitat features critical to species diversity on the barrier islands.

This simplified shoreline would represent a loss of biodiversity at the community level, if not at the species level. Denser grassy vegetation, an attractive habitat for many mammals, could make the project area less suitable for nesting shorebirds, including the Federally-listed piping plover and State-listed common and least terns, black skimmer, and American oystercatcher. In addition, several species of reptiles that use seashores during their egg laying life stages, including the Eastern mud turtle and the diamondback terrapin, could be adversely affected by this predicted habitat change.

The seashore habitat includes open sandy beaches, sand flats, mudflats, and dunes, the latter covered with beach grass (Bull and Farrand 1977). Nesting shorebird populations have declined

severely and several shorebird species are either in danger of or threatened with extinction. A number of birds that are known to use this habitat are either Federally-listed (roseate tern and piping plover) or State-listed (least tern and common tern). Other breeding birds, such as the American oystercatcher (Melvin et al. 1991), and black skimmer (Safina and Burger 1983), are also affected by human activity on Atlantic Coast beaches. Though not currently State- or Federally-listed, the reliance of these species on this habitat puts them at risk for population decline which could warrant future listing. The current trend on Long Island south shore beaches to foster stabilization activities is adversely affecting those species (plovers, terns, seabeach amaranth, etc.) that are dependent on dynamic changes to the barrier beach.

The FIMI shoreline design profile is an uninterrupted, unconsolidated, trapezoidal feature. Interdunal habitat and its diversity of microhabitats and microclimates that would normally be found in the sheltered low areas between dune crests, are not proposed for this project. The loss of niche habitats represented by the replacement of the existing beach surface with a more uniform system represents a significant change in habitat quality and diversity.

The amount and type of vegetation on the surface of the barrier islands is largely controlled by the amount of sea spray and overwash. The amount of saltwater exposure defines the type of vegetation that can survive in a given location, contributing to habitat patchiness and diversity. Several shorebirds, including the piping plover, the least tern, and the black skimmer, and reptiles such as the northern diamondback terrapin, must nest in areas where overwash regularly thins or clears away the vegetation. By reducing the frequency and extent of overwash, the FIMI would also limit/eliminate this ecologically critical beach clearing function, especially if land managers install sand fencing and supplemental vegetation plantings occur during post-construction phases of the project which have occurred or are proposed to occur in RMSP and Smith Point County Park.

The project area contains a Federally-listed threatened plant, seabeach amaranth, which colonizes areas created by overwash and breaching. The Recovery Plan for this species (U.S. Fish and Wildlife Service, 1996b) states that "any stabilization of shoreline is detrimental for a pioneer, upper beach annual whose niche or 'life strategy' is the colonization of unstable, unvegetated, or new land, and which is unable to compete with perennial grasses." On North Carolina's barrier islands, the zone where seabeach amaranth is absent corresponds almost exactly with the presence of an artificial barrier dune built and maintained by various Federal agencies from the 1930's to 1950's (U.S. Fish and Wildlife Service, 1996b). Because seabeach amaranth survives by colonizing new patches of suitable habitat, these new patches must be extensive enough and close enough to each other for the plant to propagate. Fortifying a lengthy portion of the barrier island shoreline may preclude the survival of seabeach amaranth and similar plants, such as seabeach knotweed *(Polygonum glaucum)*, throughout the barrier island system. Refer to the Service's biological opinion for this project for more detailed information and analysis.

The most likely change in vegetation patterns in the dune and swale communities would be from sparsely vegetated beach to vegetated beach and grassland. This would alter the competition among species for this area, favoring bird species which have adapted to more heavily vegetated beach areas elsewhere, particularly black-backed gull (*Larus marinus*), herring gull (*Larus*

argentatus), and ring-billed gull (*Larus delawarensis*). Each of these species are common on today's beaches and prey upon unfledged plover, skimmer, and tern chicks. Densely vegetated areas also serve as habitat for the red fox and raccoon, two highly effective mammalian predators that have flourished on beaches associated with human recreation and development. The presence of both the gull and mammalian predators has contributed to the decline of plover and tern populations. Common species able to tolerate denser stands of beach grass would tend to displace and prey upon rarer species requiring bare or sparsely vegetated sand, which represents a potential loss of species diversity for the barrier beach/back-bay community.

4. Terrestrial Upland

Increasing thicket vegetation at the expense of sparsely vegetated beach would change the species distribution on the barrier islands. The net result would favor mammals, which have already adapted relatively well to the human presence on the barrier islands, and the species of birds and reptiles found on the Long Island mainland, over the remaining examples of seaside species. The Corps' preferred alternative would result in the reduced probability of overwash and inlet formation, resulting in an increase in vegetation density, leading to thicket formation, favoring bird species such as the American robin (*Turdus migratorius*), song sparrow (*Melospiza melodia*), mourning dove (*Zenaida macroura*), and gray catbird (*Dumetella caroliniensis*). McCormick & Associates (1975) identified the following reptiles as using thickets on Fire Island as probable breeding habitat: box turtle (*Terrapene carolina*), Eastern hognose snake (*Heterodon platyrhinos*), and black racer (*Coluber constrictor*). They tend to favor moist, shaded environments. The black racer is the most indiscriminate predator, eating rodents, small birds, lizards, snakes, frogs, and insects (Conant and Collins 1991).

The mammals of the barrier islands would be afforded a great increase in nesting and forage habitat by any increase in dense, woody vegetation. The following mammals have been identified as breeding in thicket or woodland habitat (McCormick & Associates 1975): Opossum (*Didelphis marsupialis*), short tailed shrew (*Blarina brevicauda*), Norway rats (*Rattus norvegicus*), red fox (*Vulpes fulva*), and long tailed weasel (*Mustela frenata*). Several of these animals are omnivorous, and all will eat birds if they can catch them (Godin 1977). Unfledged birds are particularly vulnerable to this predation. Herbivorous mammals in the area include Eastern cottontail (*Sylvilagus floridanus*), grey squirrel (*Sciurus carolinensis*), and white-tailed deer (*Odocoileus virginianus*). Small mammals are an important component of the prey base of migrating birds during the spring and fall.

A potential positive impact of the proposed action is the protection of the Maritime Holly Forest at Sunken Forest within FIIS. Sunken Forest is the northern-most holly-dominated maritime forest on the Atlantic barrier island chain. This community is considered globally rare by TNC (NPS 2009). Although no beachfill is proposed in front of this community, the addition of sand updrift (east) of this community could result in a wider beach and more storm damage protection over time.

5. Bay Intertidal

The Corps' recommended beach fill/dune construction plan has the potential to indirectly impact fish and wildlife resources by potentially altering the balance between marsh creation and marsh loss in the adjacent backbay habitats. The impact from the FIMI depends upon the extent to which the plan achieves the stated goal of reducing overwash and inlet/breach formation within the project area. If the project is effective, the potential to form saltmarsh would be reduced. The NPS determined that the development of the three marshes in FIIS coincided with the establishment of the Hallets (1788) and Smiths (1773) inlets. Storm-induced inlets and barrier island overwash transport sediment from the ocean and barrier island to the bay. As such, inlets and associated flood tidal deltas support the establishment of back-barrier saltmarsh habitat (Roman et al. 2007). The loss of plant detritus producing regions of the estuary such as *Spartina* marshes will greatly lower the productivity of the estuary and directly limit its potential to produce commercially important species of fish and crustaceans (Odum 1970).

Cashin Associates (1993) points out that tidal marsh areas near active, migrating inlets will stay in the early stages of vegetative succession, maintaining their highest rate of organic production and export to the estuary. In comparison, long-term stability will result in decreased productivity. Beach nourishment reduces the potential for the creation of new wetlands by reducing the frequency and extent of natural barrier island processes (Cashin Associates 1993). Without new inlet formation to compensate for wetland loss, tidal wetlands will eventually decline in the area.

If the FIMI reduces the frequency and extent of inlet/breach formation and overwash, the ground elevation rises from aeolian transport of sand above the tidal range and barrier-flat grasses and shrubs colonize the washover surface (Leatherman et al. 1985). As discussed above in the Dunes and Swales section, if the recommended plan reduces the probability of an overwash, there is likely to be a major change in both the plant and animal communities. If both overwash and inlet formation processes are impacted, marsh will still be lost to rising sea level and bayside erosion, again without compensating marsh formation.

6. Bay Subtidal

Barrier island and coastal processes, including breaches and inlet formation, may positively affect water quality in the back-bay area within the project area by reducing the number of water-borne pathogens from tidal exchange, reducing turbidity, and moderating bay temperatures. All of these could prove favorable to the production of shellfish, especially the hard clam. However, the Corps' recommended plan is designed to reduce the frequency and extent of such processes, a potential indirect impact of the proposed action.

The Corps (1995) has expressed concern that a breach within the project area may cause changes in bay salinity that would be damaging to shellfish, and New York Sea Grant concluded that breaches would have both negative and positive impacts on the hard clam (New York Sea Grant Extension Program 2001). The salinity and temperature changes (as described in Section VI) could slow the development of fertilized eggs and larvae as well as increase mortality and the abundance of shellfish predators (channel whelks and moon snails) (New York Sea Grant

Extension 2001). However, larger oceanic plankton species may improve food quality and more moderate winter water temperatures may decrease over-winter mortality (New York Sea Grant Extension 2001). There was a significant increase in shellfish populations in Moriches Bay after the two breaches occurred in 1992 (S. Kiernan, pers. comm.). Increased salinity allows for an accelerated rate of shellfish growth and improved larval development (Cashin Associates 1993). Higher salinity appears to be more favorable to hard clam growth at non-optimal temperatures ($\geq$30 or $\leq$20°C) (Malouf 1991). Growth rings on hard clams in Bellport Bay were reported to be larger in 2013 than in pre-breach conditions (Gobler pers. com. 2014).

Increased tidal flushing in the bay resulting from a breach within the project area could reduce the number of water-borne pathogens in shellfish growing areas present within Great South Bay and Bellport Bay, leading to a possible reduction in the number of areas now closed to commercial and recreational clamming (Cashin Associates 1993). Cashin Associates (1993) also notes that increased flushing reduces turbidity, which may have positive effects on both shellfish and eelgrass. Turbidity also affects the feeding efficiency of filter feeders such as the hard clam (Schubel 1991). Many bivalves, including hard clams, have the ability to sort the food particles (phytoplankton) from the nonfood particles (silt) that they filter out of suspension (Bricelj and Malouf 1984), but hard clams tend to respond to increasing silt loads by reducing their filtration rates (Bricelj and Malouf 1984). Therefore, it appears that hard clams are less well adapted for survival in a turbid environment than many other bivalve species and are more dependent on less turbid waters, conditions that would occur with a breach.

As light penetration is a major limiting factor affecting the primary productivity of submerged aquatic vegetation in the bays (U.S. Fish and Wildlife Service 1996), reduced turbidity associated with increased tidal flushing could increase light penetration and with it, primary productivity and the habitat structure that submerged aquatic vegetation provides in Great South/Bellport Bay. Although the breach at Old Inlet did result in the burial of eelgrass beds in the immediate vicinity, increases in water quality due to increased flushing of Great South Bay may lead to an increase in vegetated bottoms elsewhere in the bay. Sediment passing through a new inlet/breach would create sand flats elevated above the bay bottom, potentially compensating for some of the eelgrass area that will be lost to increased water depth. In this manner, a new inlet could be beneficial to the eelgrass population of the bays by providing new substrate for growth. For example, the densest eelgrass beds in Great South Bay are near the existing inlets (Cashin Associates 1993). This has been attributed to the clearer water and sediment input which is suitable for eelgrass development available in these locations. It is possible that a new inlet could more than compensate for short-term physical damage with a long term improvement in conditions.

The introduction of additional ocean water through a breach in the project area might also moderate Great South/Bellport Bay temperature (Cashin Associates 1993), as the annual temperature range for ocean water is from 4 to 21°C (U.S. Fish and Wildlife Service 1981a), narrower than the bay water temperature range of 0 to 30°C. Hard clam growth is disrupted outside of the optimal temperature range, approximately 20 to 23°C (Malouf 1991). Moderation of bay temperature would tend to reduce these disruptions (Cashin Associates 1993).

Finfish would be largely unaffected by a breach within the project area, although the new channel might provide attractive habitat for certain species (New York Sea Grant 2001). Unvegetated bay bottom is the preferred habitat of several benthic fishes. Sogard (1992) found that juvenile winter flounder were more abundant in unvegetated habitats than in eelgrass habitats; there was also some suggestion that winter flounder may grow faster in unvegetated habitats with coarse sediments. However, flounder populations are not limited by any shortage of non-vegetated bottom habitat (New York Sea Grant Institute 1993), and the flounder population would not be increased by the creation of more non-vegetated bottom area.

7. Bay Islands

As stated above, the NYSDEC analysis did find a substantial loss of bay island tidal wetlands (both man-made dredge deposition islands and natural islands) within the FIMP area. The loss of these islands appears to be caused by storm events, rising sea levels, and erosion. Erosion may be caused by: a) the apparent deficit of sediment in the bays due to maintenance dredging activities (Intracoastal Waterways and each of the inlets), b) the maintenance of relatively deep channel depths for navigation which increase tidal flow velocities, and c) boat wake reflection. Although some back-bay islands were created from dredge placement activities (New Made Island), these back-bay islands are important habitat for colonial waterbirds, piping plovers, American oystercatchers, and heron rookeries.

Dune building projects restrict the delivery of sediment to the bay by inlets/breaches, wave overwash, and Aeolian transport, thereby increasing bay sediment budget deficiencies and potentially increasing bay island erosion and/or loss (Nordstrom et. al 2005).

8. Inlets

The FIMI does not reduce the amount of presently available channel habitat, but is intended to reduce the likelihood of formation of any new inlet channel habitat associated with a breach within the project area. Inlet channels, and their attendant physical features, appear to be preferred habitat for bluefish and may provide essential foraging habitat for black skimmers, common terns, and roseate terns. The roseate tern is a Federally-listed endangered species. Safina (1990 a,b) found that common terns were able to take advantage of prey that had been driven to the surface by bluefish, which tend to congregate near inlets, while roseate terns relied on physical features associated with inlet channels, such as shoals, which cause prey to move up into their diving range.

Although the interim BCP was intended to close any new inlet quickly, short-term impacts of a breach may be ecologically important, including the habitat provided by the temporary existence of the new channel itself and the changes in bottom topography due to delivery of new sediment to Great South Bay and Bellport Bay.

B. CUMULATIVE IMPACTS

As a preface to the discussion below, Berg (1977) and Hobbs et al. (1981) noted that the FIMP Reformulation Study, as initiated in 1980, was intended to address the entire barrier system as a

unit, because action under a comprehensive plan that considers the erosion processes over the full length of the receding shore segment is both more effective and more economical, and because, as the CEQ noted, actions in one part of the system tend to affect other parts of the system. As such, the Service recommends that the Corps include the entire FIMP study area in their cumulative analysis. The Corps' current planning strategy is segmenting the FIMP and prohibits our ability to evaluate the environmental effects of all project activities within the FIMP planning area and make comprehensive recommendations.

The Corps' cumulative impact analysis for the FIMI (Corps 2014b) included the following summarized conclusions:

> -The cumulative impact assessment of federal nourishment projects on the south shore of Long Island indicate that federal project actions would occur in a dynamic environment whose inhabitants have adapted to these conditions.
>
> -Studies indicate that borrow area and sand placement areas re-colonize shortly after construction activities are completed.
>
> -Best Management Practices/conservation measures (Time-of-year restrictions, place only suitable material on beaches, properly graded, etc.) will lessen temporary impacts;
>
> -The used and proposed borrow areas in the No Action Alternative would disturb about 2.3% of the total nearshore and offshore areas that could be used (areas between the 18- and 60-foot contours from Breezy Point to Montauk Point).

When including the FIMI borrow areas, which total 590 ac, (500 ac in area 2c and 90 ac in area 4c), the preferred alternative would disturb about 3.5% of the total nearshore and offshore areas along the south shore of Long Island.

Agency Planning/Environmental Analysis

As described in the Service's Mitigation Policy, the Service must consider project impacts as part of its review, including: (1) the total long-term biological impact of the project, including any secondary or indirect impacts regardless of location, and (2) any cumulative effects when viewed in the context of existing or anticipated projects. Direct impacts occur in the same place and location. Indirect impacts can occur later in time or farther removed in distance, but are still reasonably foreseeable. The CEQ defined cumulative impacts (40 CFR 1508.7) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions...." Also, "...cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time."

Shoreline stabilization projects in the form of beach nourishment have been undertaken on Long Island since the 1920s. Since the 1930s, the beaches on Fire Island have been stabilized via sand fence placement, dune construction, jetty construction, and beach nourishment. The first large-scale dune and beach construction was undertaken in the developed FIIS communities in the

late 1940s (Gravens 1999). It is estimated that a total of 6.9 m cy of beachfill was placed along Fire Island from 1933-1989 (Gravens 1999).

If the WoSI, the FIMI, the BCP, the Westhampton Interim Project and the Westhampton groin field are considered together, the Corps' interim projects would encompass nearly 50 miles of the original 83-mile FIMP study area. Recent (since 2008) Federal projects or Federally-authorized projects within or adjacent (Long Shore current up-drift) to the FIMI are listed as follows:

Project	Most recent yr. of construction	Beach Fill(cy)
Fire Island Inlet Navigation Project	2014	2,235,000
	2008	619,000
NYSDOT Ocean Parkway Repair	2013	790,000
Captree Boat Basin	2013, 2014	889,000
Fire Island Communities	2008	1,800,000
Long Island Intracoastal Waterway	2011	70,000
Moriches Inlet Navigation Project	2009	460,000
BCP	2012	200,000
Westhampton Interim Project	2014	1,180,000
	2008	1,180,000
WoSI	2013, 2014	751,000
	Total:	10,174,000

Therefore, over 10 m cy of material have been dredged and placed along ocean beaches within and adjacent to the FIMI project area since 2008. This amount of material resulted in direct and indirect impacts summarized as follows:

Direct impacts include:

- Loss and habitat modification of off-shore borrow area habitats, benthic/fisheries resources, and overwash/early successional habitat;
- Burial of marine intertidal and marine beach invertebrate species and temporal modification of intertidal and marine habitats; and
- Increased turbidity of off-shore and intertidal habitats.

Indirect impacts include:

- Decreases habitat values for Federally and State-listed plant and animal species;
- Reduces potential to form and create early successional barrier island habitats;
- Reduces opportunities for water quality improvement in backbay;
- Reduces the potential to form new inlet channel habitat;
- Reduces the potential to recruit finfish and crustaceans to backbay;
- Reduces sediment transport to the bay;
- Reduces rates of formation of SAV and saltmarsh habitats;
- Accelerates vegetative succession on barrier island and backbay;
- Decreases biodiversity at the community level;
- Develops habitat preferred by mammalian and avian predators;
- Reduces habitat values for waterfowl and migratory shorebirds;
- Potential for snow fencing, planting of vegetation, and beach raking;
- Increase in recreational activity.

The FIMI, WoSI, Westhampton Interim Project, and Fire Island Community projects involve the dredging of an off-shore borrow area with placement on the ocean shoreline. The Fire Island Inlet and Moriches Inlet Navigation projects, the Long Island Intracoastal Project, the NYSDOT Ocean Parkway Repair, BCP, and Captree Boat Basin projects involve the dredging of back-bay/flood shoal and/or inlet and ebb shoal areas with dredge material placement on the ocean shoreline. This removal of sediment from the back-bay and inlet habitats is further exasperated by the limiting/prevention of cross-island sediment transport (overwash and breaching) that occurs from the cyclical nourishment of these ocean beaches.

As such, the Service concludes that the beach fill/dune construction plan will have cumulative impacts causing adverse impacts on fish and wildlife habitat and the overall condition of the Fire Island barrier island through reduction in the frequency of coastal processes which maintain the barrier islands as natural protective features. Coastal processes keep the barrier island above water and protect Long Island's south shore from direct influences of ocean waves and also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species.

Other than beach nourishment projects, local/State actions that are reasonably certain to occur in the project area that could potentially affect fish and wildlife resources include beach cleaning, the installation of sand fencing, and increase in the amount of recreational activity.

The installation of snow fencing or the planting of beach grass are common practices in attempting to stabilize nourished beaches and have occurred on other sites on Long Island without Federal (Service, Corps) or NYSDEC coordination/authorization. Vegetation planting and snow fence placement, in association with beach nourishment, will artificially accelerate growth of dense vegetation that precludes use of habitat by species which prefer open or sparsely vegetated beach habitats, including ground-nesting shorebirds and coastal plants. This effect will limit the amount of available suitable habitat for these species and will create suboptimal habitat conditions. Artificially planted areas that rapidly grow into dense areas of perennial vegetation precludes use by this species. For example, 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, which is rarely encountered in areas that have been snow fenced.

Another beach management practice not mentioned in the project description which could occur over the life of the project is beach raking. Beach raking/cleaning does occur within RMSP and Smith Point County Park. Mechanized beach cleaning adversely affects seabeach amaranth and other coastal plants through the direct crushing of plants and removes the wrack line, an important forage microhabitat for shorebirds.

The NYSOPRHP and Suffolk County authorize off-road vehicle access on Fire Island ocean beaches at RMSP and Smith Point County Park respectively. Service personnel have observed heavy (hundreds of vehicles) traffic within suitable ocean beach habitats in these areas, which severely limits ground-nesting shorebirds and coastal plant habitat suitability through the disturbance of foraging and breeding behaviors, as well as crushing of unfledged chicks and plants.

Increase in Recreational Activities

Indirect effects of disturbance to ground-nesting shorebirds also occurs by limiting breeding habitat to oceanside habitats that are simultaneously made more attractive for recreational activities by beach stabilization projects. Recreational activities that may potentially adversely affect these species include an increase in beach patrons and associated activities (ORV use, sunbathing, sports, playing loud music, etc.), unleashed pets, fireworks, kite-flying, and increase in garbage and refuse concomitant with increased recreational activities. Unleashed pets, such as dogs and cats, can prey on shorebirds. Kite-flying may disturb these species as it is believed that the ground-nesting shorebirds perceive kites as avian predators.

The level of recreational impacts within potential ground-nesting shorebird areas is expected to increase in the near term. Wide beaches with little human disturbance at the time these species initiate nesting (March to May) often experience heavy recreational pressure later in the nesting season (June through August), potentially creating sufficient disturbance to cause abandonment of nests, interfere with foraging, cause broods to be separated from adults, or attract predators. The degree to which increases in recreational activity and predator habitat result in mortality or disturbances to ground-nesting shorebirds and their chicks depends on the degree to which the protection measures are implemented.

Seabeach amaranth and other coastal plant colonization is unlikely to occur on intensively used recreational beaches, but would be more likely in areas fenced for the protection of piping plovers and other beach nesting birds (U.S. Fish and Wildlife Service 2002).

The ORVs can also affect shorebird foraging habitat. Kluft and Ginsberg (2009, p. vi) found that ORVs killed and displaced invertebrates and crushed/decimated wrack, in turn lowering the overall abundance of wrack dwellers. In the intertidal zone, invertebrate abundance is greatest in the top 12 inches (30 cm) of sediment (Carley et al.2010, p. 9). Intertidal fauna are burrowing organisms, typically 2 to 4 inches (5 to 10 cm) deep; burrowing may ameliorate direct crushing.

However, shear stress of ORVs can penetrate up to 12 inches (30 cm) into the sand (Schlacher and Thompson 2008, p. 580).

IX. MITIGATION/FISH AND WILDLIFE ENHANCEMENT RECOMMENDATIONS

Service Mitigation Policy

The Service's Mitigation Policy (Policy) (U.S. Fish and Wildlife Service 1981b) was developed to guide our preparation of recommendations on mitigating the adverse impacts of land and water developments on fish, wildlife, their habitats, and uses thereof. It helps both the Service and the Federal action agency, in this case, the Corps, by assuring consistent and effective recommendations, by outlining policy for the levels of habitat mitigation needed, and the various methods for accomplishing mitigation for habitat losses associated with such projects. It allows Federal action agencies to anticipate Service recommendations and to assist in the preparation of mitigation measures early, thus avoiding delays and assuring equal consideration of fish and wildlife resources with other project features and purposes (Fish and Wildlife Coordination Act (16 USC 661-667[e]).

The term "mitigation" is defined in the Service's Policy (U.S. Fish and Wildlife Service 1981b) as: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating impacts over time; and, (e) compensating for impacts by replacing or providing substitute resources or habitats.

Corps Proposed Conservation Measures

The Corps has proposed the following measures that will avoid and/or minimize some of the project's impacts to fish and wildlife resources in their EA (Corps 2014b) and May 20, 2014, correspondence to the Service:

-Time-of-year (April 1-September 1) restrictions for Federal and State-listed ground-nesting shorebirds outside of the Fire Island communities;
-Reduction in the size of the tapers of beach nourishment along NPS Federal tract borders;
-maintain sparse (30%) vegetation cover in bayside overwash areas at Smith Point;
-Management of Federal and State-listed ground-nesting shorebird predators;
-Restore 34 ha (84 ac) of heavily vegetated areas at Great Gunn, including creation and maintenance of ephemeral pools for 10 years;
-Avoid dune construction in RMSP, Federal tracts and Wilderness area;
-Lower dune height design (+13 ft) at the Lighthouse Tract and Smith Point County Park;
-Preconstruction surveys of the borrow areas will ensure that impacts to highly diverse areas containing substantial surf clam populations are avoided or minimized;
-The borrow areas are sloped in a manner to prevent anoxic conditions.

Service Recommended Conservation Measures

Revise Project Design to Avoid and/or Minimize Project Impacts

Additional measures that the Corps could incorporate into the project design to further avoid and/or minimize projects include:

> -Preserve ocean-to-bay overwash habitat at Smith Point: Where feasible, avoid dune construction in the overwash areas which are important Federal and State-listed ground-nesting shorebird, as well as coastal plant habitat;
> -Revise the dune alignment landward to preserve overwash habitat: The dune alignments at the Lighthouse Tract could be moved landward to preserve more overwash habitat;
> -Time-of-year restrictions: Implement time-of-year restrictions for the entire project area (not proposed for Fire Island Communities) to promote Federal and State-listed ground-nesting shorebird breeding;

Service Planning Aid Letter 2005

With Corps funding, the Service prepared a PAL entitled "Identification of Restoration Opportunities within the Fire Island to Montauk Point Reformulation Study Area" published in April of 2005 (Service 2005). Although the site investigations occurred in 2005 and 2004, much of the information and observations are still relevant. This document listed numerous potential restoration projects for fish and wildlife resources/habitats ranging from wetlands, Federal and State-listed ground-nesting shorebirds, shellfish, and anadromous fish. The following table summarizes the PAL findings. The Corps could implement projects identified here to rectify/compensate for project impacts.

Table 6. Potential Restoration Projects Within the FIMP Study Area

SITE	LOCATION	APPROXIMATE SIZE	TYPE OF RESTORA-TION	OWNER-SHIP	BENEFIT TO T&E SPECIES	NOTES
Cupsogue County Park	Moriches Inlet	5 acres	Clearing of vegetation for plovers and terns	Suffolk County	Yes	Past restora-tion has been success-ful
Democrat Point	Fire Island Inlet	25 acres	Clearing of vegetation for plovers and terns	New York State	Yes	Heavy recrea-tional use
Pikes Beach	Moriches Bay, Westhampton	10 acres	Clearing of vegetation for plovers	Town of Southampton	Yes	History of Plover

SITE	LOCATION	APPROXIMATE SIZE	TYPE OF RESTORA-TION	OWNER-SHIP	BENEFIT TO T&E SPECIES	NOTES
			and terns			nesting
Warner's South Island	Shinnecock Bay	2 acres	Dredge material placement for terns	Suffolk County	Yes	History of ROTE nesting
Shirley Marina	Bellport Bay	10 acres	Clearing of vegetation for terns	Suffolk County	Yes	History of LETE nesting
John Boyle Island	Bellport Bay	5 acres	Clearing of vegetation for terns	Town of Brookhaven	Yes	History of LETE nesting
New Made Island	Moriches Bay, West of Moriches Inlet	3 acres	Clearing of vegetation for terns	Town of Brookhaven	Yes	History of COTE nesting
East Inlet Island	Moriches Inlet	5 acres	Removal of dredge spoil for terns	Town of Brookhaven	Yes	History of ROTE nesting
Wertheim Refuge	Carmens River	100 acres	Removal of Common Reed	USFWS	No	Also propose to restore hydro-logy
Brown's Creek	Great South Bay, Sayville	2 acres	Shoreline stabilization, Spartina plantings	Suffolk County	No	Corps Opera-tions Division project
Roosevelt Estate County Park	Sayville	5 acres	Common Reed Control	Suffolk County	No	Local support for view-shed restora-tion
Islip Meadows County Nature	Great South Bay, East Islip	25 acres	Common Reed control	Suffolk County	No	Adja-cent to Islip Nature

SITE	LOCATION	APPROXIMATE SIZE	TYPE OF RESTORA-TION	OWNER-SHIP	BENEFIT TO T&E SPECIES	NOTES
Preserve						Preserve
Green's Creek	Great South Bay, West Sayville	2 acres	Common Reed control	Suffolk County	No	Public support for restora-tion
Beaver Dam Creek	Bellport Bay	5 acres	Common Reed control, removal of dredge spoil	New York State	No	Portion of work comp-lete, Multi-partners
Seatuck Refuge	Champlin Creek Great South Bay	5 acres	Remove dredge spoil and restore hydrology	USFWS	No	Service Refuge
Blue-points Bottom-lands	Great South Bay	11,500 acres	Shellfish and SAV beds	TNC	No	Multi-Partners hips
Mud Creek	Moriches Bay	10 acres	Alewife fishway	Suffolk County	No	Com-mon Reed removal also propos-ed
Swan River	Patchogue Bay	1 acre	Alewife fishway	Privately owned	No	Fishway for brook trout, as well
Kismet	Great South Bay	2 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	No	Re-align ment of marina
Sailor's Haven	Great South Bay	10 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of marina

SITE	LOCATION	APPROXIMATE SIZE	TYPE OF RESTORA-TION	OWNER-SHIP	BENEFIT TO T&E SPECIES	NOTES
Saltaire	Great South Bay	5 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	No	Re-align ment of marina
Great Gun	Moriches Bay	5 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of marina
Robbins Rest	Great South Bay	5 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of harden-ed Shore-line
Point of Woods	Great South Bay	10 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of harden-ed shore-line
Cherry Grove	Great South Bay	5 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of harden-ed shore-line
Fire Island Pines	Great South Bay	10 acres	Restore littoral drift	Privately owned/ Fire Island National Seashore	Possibly, plover foraging habitat	Re-align ment of harden-ed shore-line

SITE	LOCATION	APPROXIMATE SIZE	TYPE OF RESTORA-TION	OWNER-SHIP	BENEFIT TO T&E SPECIES	NOTES
Abbetts Creek	Patchogue Bay	5 acres	Remove dredge spoil and restore hydrology	Town of Brookhaven	No	Adjac-ent tidal wetlands
Moriches Avenue Site	Moriches Bay	5 acres	Remove dredge spoil and restore hydrology	Town of Brookhaven	No	Adjac-ent tidal wetlands

Service February 13, 2008, Correspondence

The Service provided a list of potential habitat creation, restoration, and/or enhancement in a February 13, 2008, correspondence to the Corps. A summary of each project identified on Fire Island are listed as follows:

-Democrat Point/RMSP: Clear dense vegetation to restore early successional habitat (308 ac);
-Lighthouse Beach: create bayside overwash habitat (58 ac);
-Robin's Rest: create bayside overwash habitat (27 ac);
-Sailor's Haven: create bayside overwash habitat (24 ac);
-Carrington Tract: create bayside overwash habitat (12 ac);
-John Boyle Island: Restore tern habitat (5 ac, also identified in the PAL);
-Talisman: create bayside overwash habitat (acreage not provided);
-Blue Point Beach Tract: create bayside overwash habitat (acreage not provided);
-FIIS Wilderness Area: create bayside overwash habitat (20 ac);
-West and East Inlet Islands: Restore plover and tern habitat (32 ac);

The Corps could implement projects identified here to rectify/compensate for project impacts.

Open Marsh Water/Integrated Management

The NPS determined that nearly all backbarrier marshes on Fire Island have been ditched for mosquito control (NPS 2009). A potential measure to mitigate for the prevention/altering of cross-island sediment transport for marsh development could be to practice open-marsh water/integrated management which includes the filling in ditches and creating new tidal creeks and ponds, which allow small fish and other mosquito predators back into the marsh (USFWS website: http://www.fws.gov/refuge/Wertheim/wildlife_and_habitat/index.html).

NPS-Proposed Conservation Measures

The NPS would likely undergo these studies; the Corps could assist in the funding of these beneficial efforts.

Bayside Shoreline Processes

The NPS's FIIS has identified areas within the National Seashore's jurisdiction, where the littoral drift is being interrupted by hard structures (bulkheads, revetments, marinas, etc.) and adjacent non-hardened areas are being eroded. Through coordination with the Service during our efforts in identifying restoration projects for the PAL in 2005 (Service 2005), eight specific areas having the potential for restoration of bayside shoreline processes. Four areas are eroded due to adjacent marinas, including Sailor's Haven, Great Gun, Kismet, and Saltaire. Additionally, four areas are eroded due to adjacent hardened shorelines, including east of Fire Island Pines, east of Point of Woods, east and west of Cherry Grove, and east and west of Robbins Rest. For each of these sites, restoration would involve the redesigning/realignment of these hard structures to restore littoral drift. These sites are listed in the PAL and in the above summary table.

Study Needs

The NPS identified the following data/study needs for the FIIS in their Assessment of Natural Resource Conditions Report (NPS 2009), these studies are listed as follows:

• The retreat of bayside shoreline should be monitored closely, and management actions to mitigate the effects of existing and proposed bulkheads should be considered.

• A detailed analysis of recent nutrient monitoring data is warranted to determine if ambient nutrient concentrations are increasing. Seasonal monitoring of nutrients and DO in coastal embayments surrounding Great South Bay would identify problem areas requiring remediation, hopefully before nutrient loading in these areas has a negative impact on Great South Bay and FIIS. Similarly, only limited monitoring of groundwater nutrient levels has been conducted recently. It is recommended that a more extensive monitoring effort be implemented to determine the spatial extent and depth of nitrogen contamination, both within the groundwater system and within shallow bay habitats. These measurements should be continued with particular emphasis on monitoring during time periods of maximal drawdown during the summer. Monitoring of fecal and total coliforms or other suitable markers of sewage bacterial contamination should be expanded in Great South Bay and Moriches Bay, particularly in the waters near FIIS, to ensure that this potential risk to human health is adequately assessed and support management plans enacted to reduce impacts.

• There are almost no data on levels of non-nutrient contaminants in Great South Bay and Moriches Bay in general and FIIS in particular. Analysis of contaminants in indigenous filter feeding organisms, such as that underway in NOAA's Mussel Watch program, at several year intervals at some sites within or near FIIS waters, would be a way to address this

issue. Such a program would provide a measure of bioavailable contaminants within the waters of the park.

• Conduct an assessment of shellfish populations within its bayside boundary to better assess this resource. Determining the sustainable harvest rate of these populations might help regenerate shellfish populations baywide and provide a form of biological control on brown tide. Efforts to restore shellfish and eelgrass communities in Great South Bay being conducted by TNC and the NYDOS should be closely followed. Data generated from these efforts should be considered in future management plans.

• Deer population levels should be monitored along with herbaceous regeneration and the recruitment of tree canopy seedlings, especially within the maritime holly forest. The FIIS should consider reducing or controlling deer populations via appropriate and acceptable methods in areas where overbrowsing is most severe.

• Continue to monitor the introduction and spread of invasive plants into the various habitats on Fire Island. In particular, the spread of phragmites into the upper fringes of saltmarshes and brackish habitats should be closely monitored. Management plans should include actions that would help eradicate or prevent the spread of this species.

• Monitor visitor recreational use of the natural habitats, especially beaches, dunes, and maritime forests. Off trail trampling of vegetation may increase erosion, spread invasive species, and disturb ground-nesting birds. This threat can be minimized via adequate trail signage and appropriately placed string fencing.

The Service also suggests the funding and implementing of studies to assess the impacts of Hurricane Sandy on fish and wildlife resources within Great South Bay and Bellport Bay through surveys of benthic organisms, SAV beds, bay water quality, and finfish and tidal marshes, for comparison to pre-storm conditions.

X. SERVICE POSITION

Section 2(b) of the FWCA requires that the final report of the Secretary of the Interior: 1) determine the magnitude of the impacts of the proposed projects on fish and wildlife resources; and 2) make specific recommendations as to measures that should be taken to conserve those resources. The Service has reviewed the current literature on the biological and physical processes effecting the barrier island and coastal ecosystems. Although system specific data are limited, it is clear that when the project is considered within the context of the existing and foreseeable coastal projects, this project has the potential to have significant adverse ecological impacts to fish and wildlife resources of national significance. However, the implementation of the conservation/mitigation measures proposed by the Corps and the Service, as described in this report, will assist the Corps in offsetting many of the potential adverse impacts presented in this report.

In the short-term, the Corps' recommended plan will have direct and indirect adverse impacts on fish and wildlife resources and their supporting ecosystems. Initial beach fill will directly impact 19 miles of subaerial, nearshore intertidal, and subtidal marine habitats, and up to 590 ac of subaqueous borrow areas. These impacts include burial of benthic organisms, turbidity, and modification of habitats.

In the long-term, the beach fill/dune construction plan will have cumulative impacts extending to 10 years after the nourishment project, causing adverse impacts on fish and wildlife habitat and the overall condition of the barrier island through reduction in the frequency of coastal processes which maintain the barrier islands as natural protective features. Coastal processes keep the barrier island above water and protect Long Island's south shore from direct influences of ocean waves and also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species.

In the course of its review, the Service has determined that this beach fill/dune construction project could have significant ecological impacts upon the barrier islands, back-bays, and their fish and wildlife communities. The implementation of the conservation/mitigation measures proposed by the Corps and the Service, as described in this report, will assist the Corps in ameliorating many of the potential adverse impacts presented in this report.

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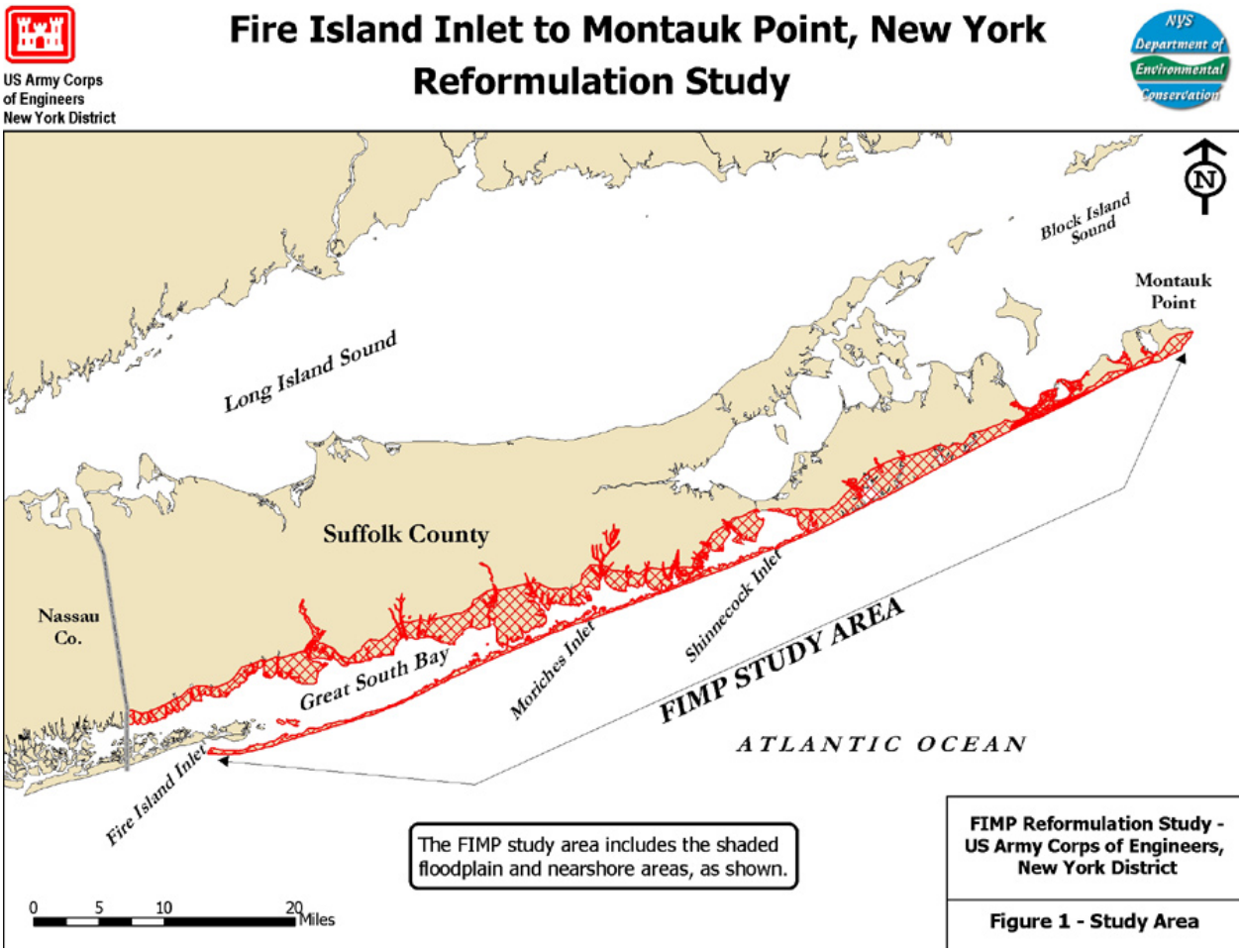
FIGURE 1

FIMP STUDY AREA



From U.S. Army Corps of Engineers' Website:
http://www.nan.usace.army.mil/Missions/CivilWorks/ProjectsinNewYork/FireIslandtoMontaukPointReformulationStudy/FIMPStudyArea.aspx

FIGURE 2

FIMI Study Area

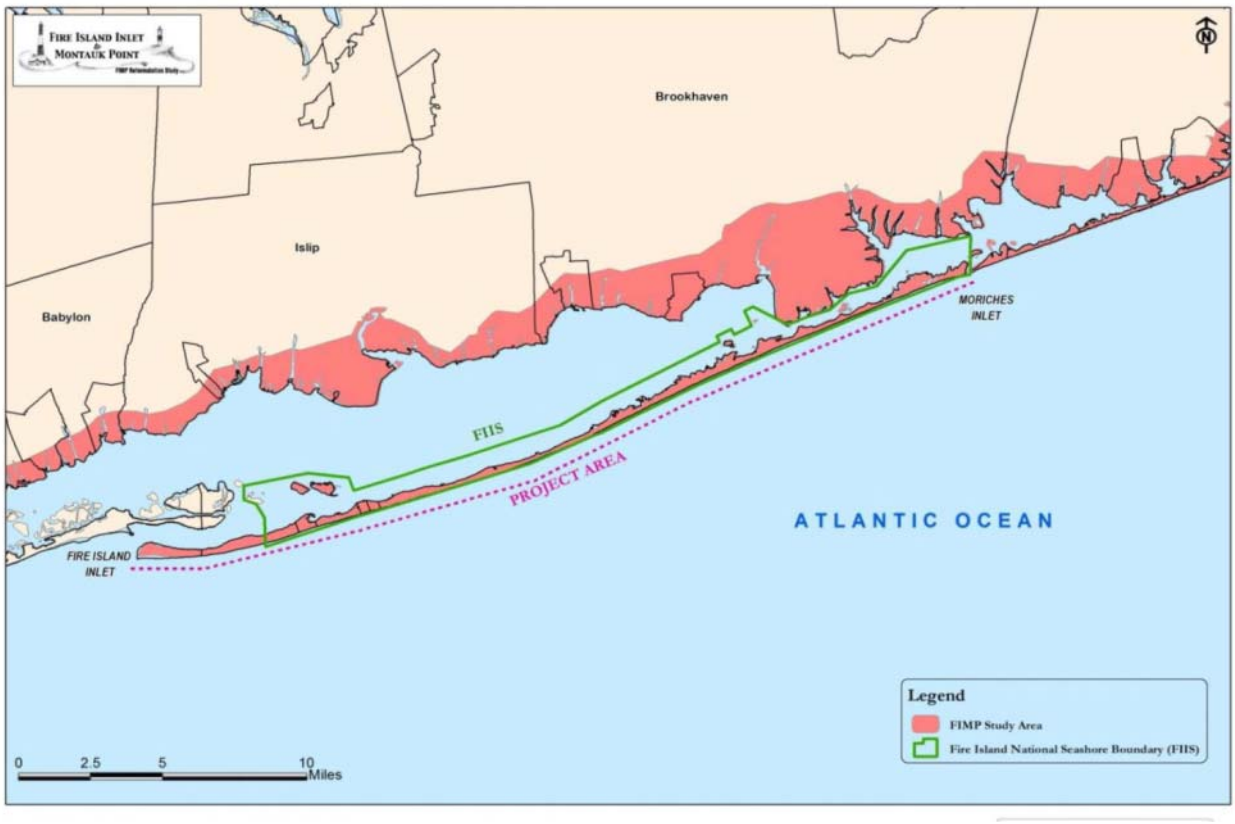
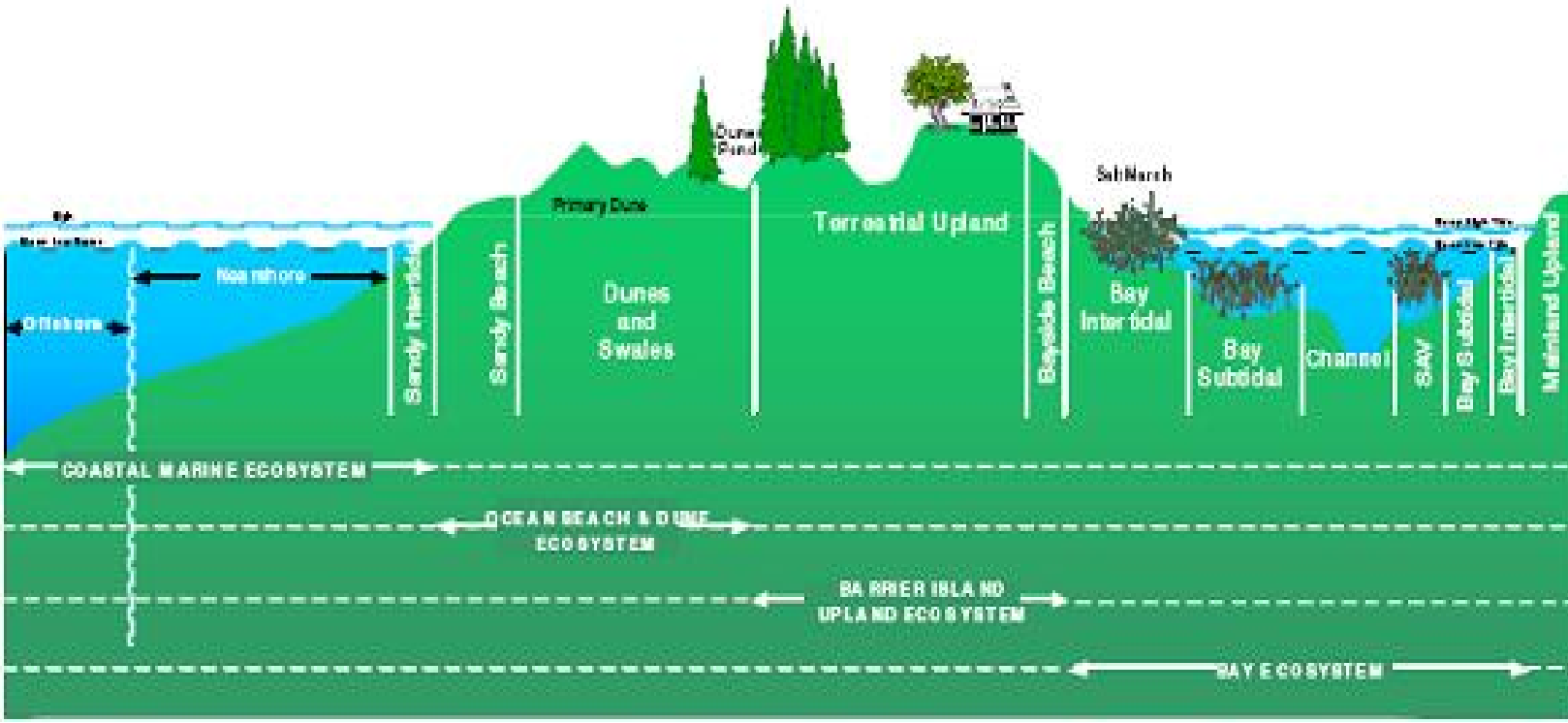


Figure 2. Map of FIMI Project Area. From U.S. Army Corps of Engineers (2014b).

FIGURE 3

Idealized Transect of Barrier Island Ecosytems

Figure 3. - Idealized Transect of Barrier Island Ecosystems.



(Illustration from: U.S. Army Corps of Engineers. Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York Reformulation Study, Work Order 38, Phase 3 Development of the Conceptual Ecosystem Model for the Fire Island Inlet to Montauk Point Study Area. Final Report.)

APPENDIX A

Fire Island to Montauk Point Service Back-Bay Island Investigations

Fire Island to Montauk Point Service Back-Bay Island Investigations.

Island	History of Dredge Placement	Cover-type	Location	Wildlife Use	Ownership	Prior Designations	Notes	Restoration Potential
Sexton Isl.	No	Spartina marsh	Great South Bay	2003* - COTE, ROTE	NPS		Site visited 7/14/03	None
Islip Spoil Isl.	Yes	Scrub shrub & grassland	Great South Bay	2003* - GREG, SNEG, TRHE, GLIB, BLHE	Town of Islip		Heron Rookery; visited on 7/14/03	Minimal
John Boyle Isl.	Yes	Phragmites/ beachgrass/ spartina	Bellport Bay	Historic – AMOY, BLSK, LETE	Town of Brookhaven	SSLIEI & NYSDOS	NPS jurisdiction, may need NEPA document prep.; visited on 9/01/04	In phragmites areas at southern portion
Hospital Isl.	No	Spartina marsh	Bellport Bay	No records of shorebird breeding	Town of Brookhaven		Visited on 10/07/03	None
Pelican Isl.	No	Spartina marsh	Bellport Bay	No records of shorebird breeding	Town of Brookhaven	Identified by SSLIEI	Visited on 10/7/03	None
Ridge Isl.	No	Spartina marsh	Bellport Bay	Historic - COTE	Town of Brookhaven	Identified by SSLIEI	Visited on 10/07/03	None
Goose Point Isl.	No	Spartina marsh	Bellport Bay	No records of shorebird breeding	Town of Brookhaven		Visited on 10/07/03	None
Pattersquash Isl.	No	Spartina marsh	Moriches Bay	2003 - COTE	Town of Brookhaven	Identified by SSLIEI	Visited on 9/01/04	None
Carter's Island	No	Spartina marsh	Moriches Bay	2003 – COTE; Historic – LETE, BLSK	Town of Brookhaven		Visited on 2/26/02	None
New Made Isl.	Yes	Phragmites	Moriches Bay	Historic – COTE, BLSK	Town of Brookhaven		Within NPS jurisdiction; visited on 9/1/04	High
West Inlet Isl.	Yes	Phragmites, beachgrass, spartina marsh	Moriches Bay	2003 - COTE and AMOY; Historic - BLSK, GLIB, SNEG, GREG	Town of Brookhaven	Identified by SSLIEI	Phragmites only along shoreline; visited on 9/01/04	Limited
East Inlet Isl.	Yes	Open sand, beachgrass, spartina marsh	Moriches Inlet	Historic - ROTE, COTE, BLSK	Town of Brookhaven	Identified by SSLIEI	Beneficial use of dredge material project completed in 2004; visited on 9/1/04	Moderate

Island	History of Dredge Placement	Cover-type	Location	Wildlife Use	Ownership	Prior Designations	Notes	Restoration Potential
Swan Isl.	No	Spartina marsh	Moriches Bay	2003 – COTE, AMOY	Town of Brookhaven		Visited on 9/1/04	None
Sedge Spoil Isl.	Yes	Spartina marsh	Shinnecock Bay	Information not available	Town of Southampton		Visited on 3/12/03	Limited
Sedge Isl.	No	Spartina marsh	Shinnecock Bay	2003 - COTE	Town of Southampton		Visited on 3/12/03	None
Tiana Marsh	No	Spartina marsh	Shinnecock Bay	Information not available	Town of Southampton		Visited on 3/12/03	None
Lesser Greenbacks Isl.	No	Spartina marsh	Shinnecock Bay	Historic – COTE, AMOY	Town of Southampton		Visited on 3/12/03	None
Lanes Isl.	No	Spartina marsh	Shinnecock Bay	2003 - COTE, FOTE, ROTE, BLSK, AMOY	Town of Southampton		Visited on 3/12/03	None
Ponquogue Spoil Isl.	Yes	Shrubs, beachgrass, phragmites	Shinnecock Bay	Historic - AMOY, GLIB, LIHE, RHE, BLHE, SNEG, GREG	Town of Southampton		Visited on 3/12/03	Limited, existing heron rookery

2003* - Observed by the Service during the 2003 breeding season.

2003 – NYSDEC/Long Island Colonial Waterbird and Piping Plover (LICWPPS) data for the 2003 season.

Historic – NYSDEC/LICWPPS data, 1994-2002 breeding seasons.

Shorebird Abbreviations:

COTE–Common tern (*Sterna hirundo*)
LETE–Least tern (*Sterna antillarum*)
BLHE–Black-crowned night-heron (*Nycticorax nycticorax*)
GRHE–Green heron (*Butorides striatus*)
GREG–Great egret (*Casmerodius albus*)
AMOY–American oystercatcher (*Haematopus palliates*)
ROTE–Roseate tern (*Sterns dougallii*)
GLIB–Glossy ibis (*Plegadis falcinellus*)
LIHE–Little blue heron (*Florida caerulea*)
TRHE–Tri-colored heron (*Hydranassa tricolor*)
SNEG–Snowy egret (*Egretta thula*)
BLSK–Black skimmer (*Rynchops niger*)

Other Abbreviations:

Isl. – Island
NYSDOS - New York State Department of State
SSLIEI - South Shore Long Island Embayments Initiative