Biological Opinion

On the Effects of the U.S. Army Corps of Engineers' East Rockaway Inlet to Rockaway Inlet Coastal Storm Risk Management Project Queens County, New York, on the Piping Plover (*Charadrius melodus*), Red Knot (*Calidris canutus rufa*), and Seabeach Amaranth (*Amaranthus pumilus*)

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INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service or USFWS) Biological Opinion (Opinion), in accordance with section 7 of the Endangered Species Act, as amended (Act; 87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.). It evaluates the effects of the U.S. Army Corps of Engineers' (Corps or USACE) proposed project entitled, "East Rockaway Inlet to Rockaway Inlet and Jamaica Bay Reformulation Study, Queens County, New York" (hereafter referred to as the proposed project) on the federally listed Atlantic Coast piping plover (*Charadrius melodus*; threatened), seabeach amaranth (*Amaranthus pumilus*; threatened), and red knot (*Calidris canutus rufa*; threatened). The proposed project is a coastal storm risk reduction project on the Rockaway Peninsula, involving the construction and maintenance of dunes, berms, seawalls, groins, rock sills, and other features over 50 years.

This Opinion is based on information provided in the USACE's Draft General Reevaluation Report/Environmental Impact Statement (GRR/EIS; cited as USACE 2018a) and biological assessment (BA; cited as USACE 2018b) dated August 2018. Both reports are incorporated by reference into the Opinion. Additional project information was obtained via coordination with the Corps, field investigations, and other sources. A complete administrative record of this consultation is on file in this office.

In addition to the species listed above, the federally listed roseate tern (*Sterna dougallii dougallii*; endangered) is occasionally observed roosting on the Rockaway Peninsula and Jamaica Bay portions of the project area. The BA did not provide a determination for roseate tern. After consideration of the project description and the avoidance and minimization measures, the Service does not anticipate any adverse impacts to this species. Therefore, no further consultation with the Service is required pursuant to the Act. Should project plans change, or if additional information on this species becomes available, this evaluation may be reconsidered.

The proposed project has a 50-year project life, but is currently at a 15 to 30 percent design level. As a result, the project description may change based on public and agency comments on the Draft GRR/EIS, as well as new information (Mazey pers. comm. February 20, 2019). Consequently, the Corps will need to consult with the Service to determine if re-initiation of formal consultation is warranted.

I. DESCRIPTION OF THE PROPOSED ACTION

As defined in section 7 of the Act, "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02).

A. Proposed Project

The proposed project area stretches from East Rockaway Inlet to Rockaway Inlet, Queens County, New York (NY) (Figure 1). An overview of the proposed project is shown in Figure 1. The Atlantic Ocean component consists of dune and beach construction with periodic renourishment over 50 years, groin extension and rehabilitation, construction of new groins, sand fence installation, vegetation planting, vehicle access ways, pedestrian walkovers, and a composite seawall. The proposed project also includes construction of bulkheads, floodwalls, drainage, and pump stations, rock sills, and wetland restoration in Jamaica Bay in the neighborhoods of Cedarhurst-Lawrence, Edgemere, Arverne, Hammels, and Motts Basin.

Figure 1.—Overview illustration of the proposed project for the Atlantic Ocean and Jamaica Bay shorelines. Illustration credit: USACE (2018a).

1. Atlantic Ocean Project Features

An enhanced overview of the proposed project on the ocean beach is shown in Figure 2. Detailed plan overviews are shown in Figures 3 through 6.

The oceanside project features span 7.7 miles (mi) of shorefront from Beach 9th Street to Beach 169th Street and include:

- A composite seawall with a crest elevation of +17 feet (ft) North American Vertical Datum 1988 (NAVD88) and a sand dune elevation of +18 ft NAVD88 from Beach 19th Street to Beach 149th Street. The bottom of the proposed composite dune/seawall extends to 15 ft below the dune crest.

- A design beach berm with a width of 60 ft and elevation of +8 ft NAVD88 from Beach 9th Street to Beach 149th Street;

- A total beachfill quantity of about 1,600,000 cubic yards (CY) for initial construction and 1,021,000 CY for renourishment every 4 years;

- A sand borrow area located approximately 2 mi south of the Rockaway Peninsula and 6 mi east of the Rockaway Inlet (The sand borrow area is about 2.6 mi long, 1.1 mi wide, and has depths between 35 and 60 ft. It contains about 17 million CY of sand, which exceeds the required initial fill and all periodic renourishment fill operations); and

- The extension of five existing groins and construction of 13 new groins.

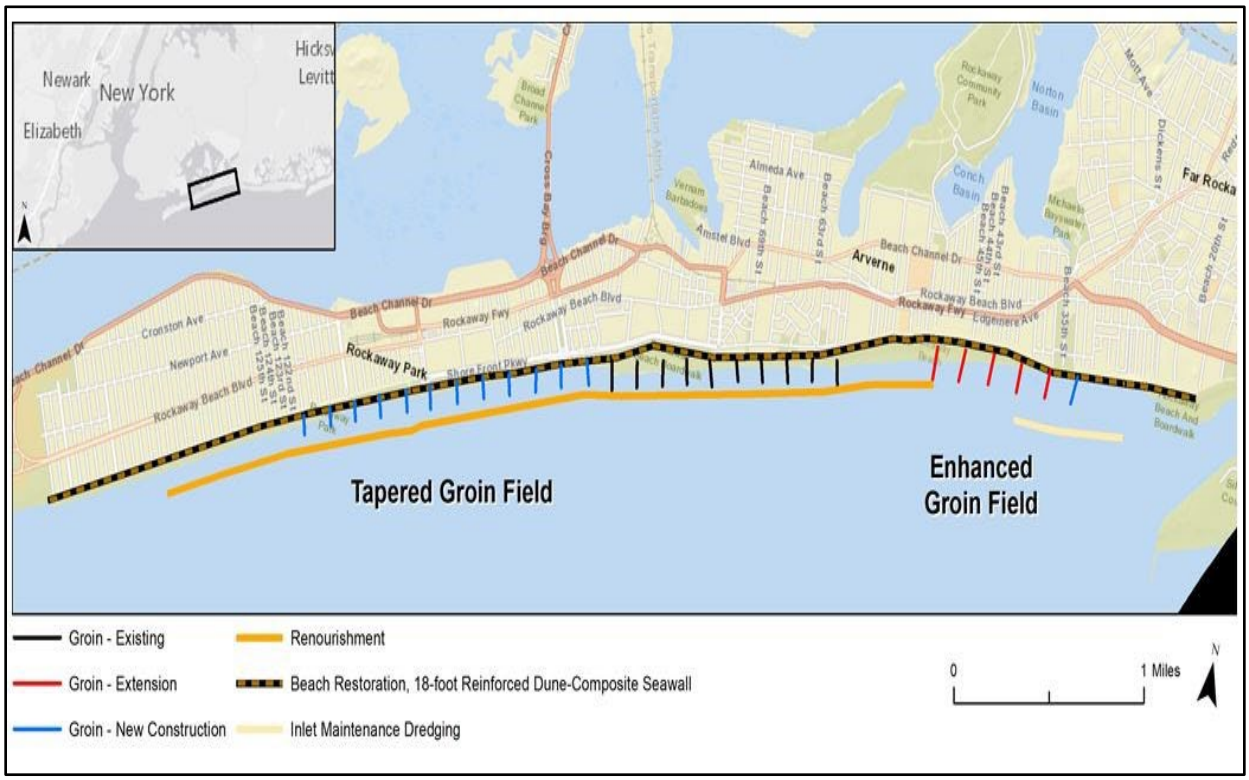

Figure 2.—Enhanced overview of proposed project features on the ocean beach. Illustration credit: USACE (2018a).

FIGURE 3.—Overview of ocean beach project features on the western end of the proposed project area. Illustration credit: USACE (2018a).

FIGURE 4.—Overview of ocean beach project features in the central part of the proposed project area. Illustration credit: USACE (2018a).

FIGURE 5.—Overview of ocean beach project features in the eastern portion of the proposed project area. Illustration credit: USACE (2018a).

FIGURE 6.—Continuation of overview of ocean beach project features along the eastern end of the proposed project area. Illustration credit: USACE (2018a).

2. Composite Seawall and Berm Description

Design profiles of the composite seawall are shown in Figures 7 and 8. A composite seawall in New Jersey (NJ), similar to the design proposed for this project, is shown in Figure 9.

The composite seawall is planned from Beach 16th Street to Beach 149th Street. It would consist of an impermeable core of steel sheet-pile and concrete cap, with a rock mound structure located seaward of the wall. In certain areas, the seawall would be covered with sand and only the top and concrete cap would be exposed on the landward side of the structure. Between Beach 126th Street and Beach 149th Street, a modified version of the seawall would include a splash apron on the landward side of the sheet-pile. The seawall may be adapted in the future to rising sea levels by adding a layer of armor stone and extending the concrete cap up to the elevation of the armor stone (USACE 2018a).

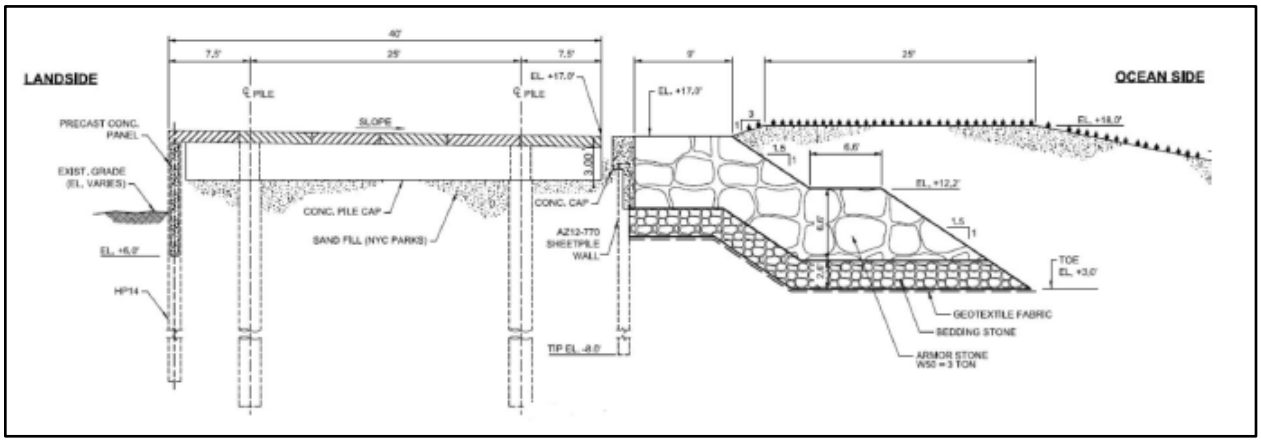

FIGURE 7.—Composite seawall design—Beach 19th Street to Beach 126th Street. Illustration credit: USACE (2018a).

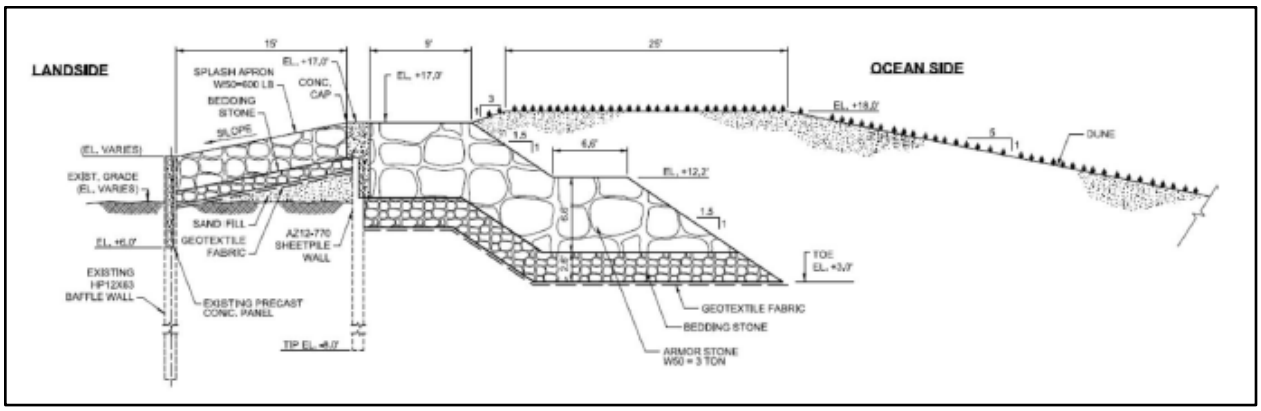

FIGURE 8.—Composite Seawall Design—Beach 126th Street to Beach 149th Street. Illustration credit: USACE (2018a)

FIGURE 9.—Construction of a composite seawall in New Jersey. Illustration credit: USACE (2018a).

3. Dune and Berm Construction Description

Dune and berm construction (including tapers) would extend from Beach 9th Street to Beach 169th Street. The dune design includes a top elevation of +18 ft above NAVD88, a top width of 25 ft, and landward and seaward slopes of 1 vertical (V):5 horizontal (H) that extend along the entire footprint (1V:3H on landward slope fronting the boardwalk) (Figure 10). The alignment of the dune follows the unnatural alignment of the boardwalk and, as a result, the distance between the toe of the dune and the seaward crest of the berm varies.

The width of the design berm is controlled by the alignment of the baseline, which is aligned with the natural shoreline. The distance from the baseline to the design shoreline is always 243 ft.

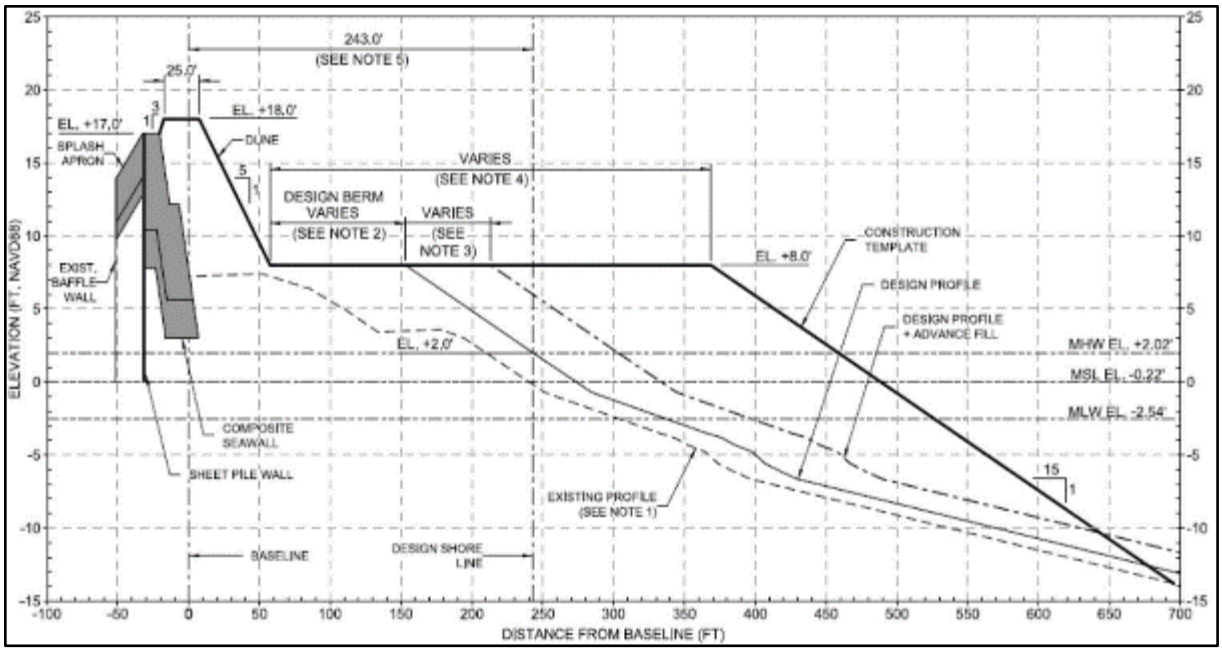

FIGURE 10.—Typical design cross-section of the proposed dune and berm. Illustration credit: USACE (2018a).

4. Berm Construction Tapers

In the eastern portion of the project area, the ocean berm will be tapered about 3,000 ft from Beach 9th Street to Beach 19th Street. Of the total taper length, there will be 1,000 ft of dune, composite seawall, and berm taper, and 2,000 ft of sand dune and berm tapers. In addition to the tapering of berm width, the dune elevation also tapers from an elevation of +18 ft NAVD88 at Beach 19th Street down to +12 ft NAVD88 at Beach 9th Street, which will be tied into the existing grade.

In the western portion of the project area, the ocean berm will be tapered 5,000 ft from Beach 149th Street to Beach 169th Street in front of the National Park Service's (NPS) Gateway National Recreation Area (GNRA) Jacob Riis Park. In addition, a tapered groin system comprised of three rock groins is proposed in this section.

5. New Groin Construction, Existing Groin Extension and Rehabilitation

The proposed project includes five new groins from Beach 110th Street to Beach 121st Street; seven new groins from Beach 92nd Street to Beach 108th Street; and one new groin plus five groin extensions between Beach 34th Street and Beach 49th Street. The extension lengths range from 75 to 200 ft. Three groins will also be rehabilitated in front of Jacob Riis Park.

6. Jamaica Bay High-Frequency Flooding Risk Reduction Features (HFFRRF)

The Jamaica Bay projects consist of three separate HFFRRFs, including Cedarhurst-Lawrence HFFRRF, Motts Basin North HFFRRF, and Mid-Rockaway HFFRRF. As described below, there are several proposed Nature and Nature Based Features (NNBF) within the Mid-Rockaway HFFRRF which are intended to contribute to coastal storm risk management.

a. Cedarhurst-Lawrence

The Cedarhurst-Lawrence HFFRRF (Figure 11) consists of about 1,000 ft of deep bulkhead that follows an existing bulkhead line around the southern end of the channel at Johnny Jack Park, and continues north along the west side before being connected to high-ground behind the Five Towns Mini Golf and Batting Facility with a 23-ft segment of medium floodwall. Preliminary design elevations have been established at +10 ft NAVD88. Three existing outfalls in the area where the bulkhead will be raised would be modified to add a valve chamber along with a sluice gate and flap valve. The outlet pipes will be replaced if the design phase indicates it is necessary. Drainage along the landward side of the bulkhead will be provided by a small ditch or drainage collection pipe, with inlets that will be connected to the existing or additional drainage outlets. When the drainage outlets are blocked by a storm tide, the ditch or pipes will direct runoff towards a pump station.

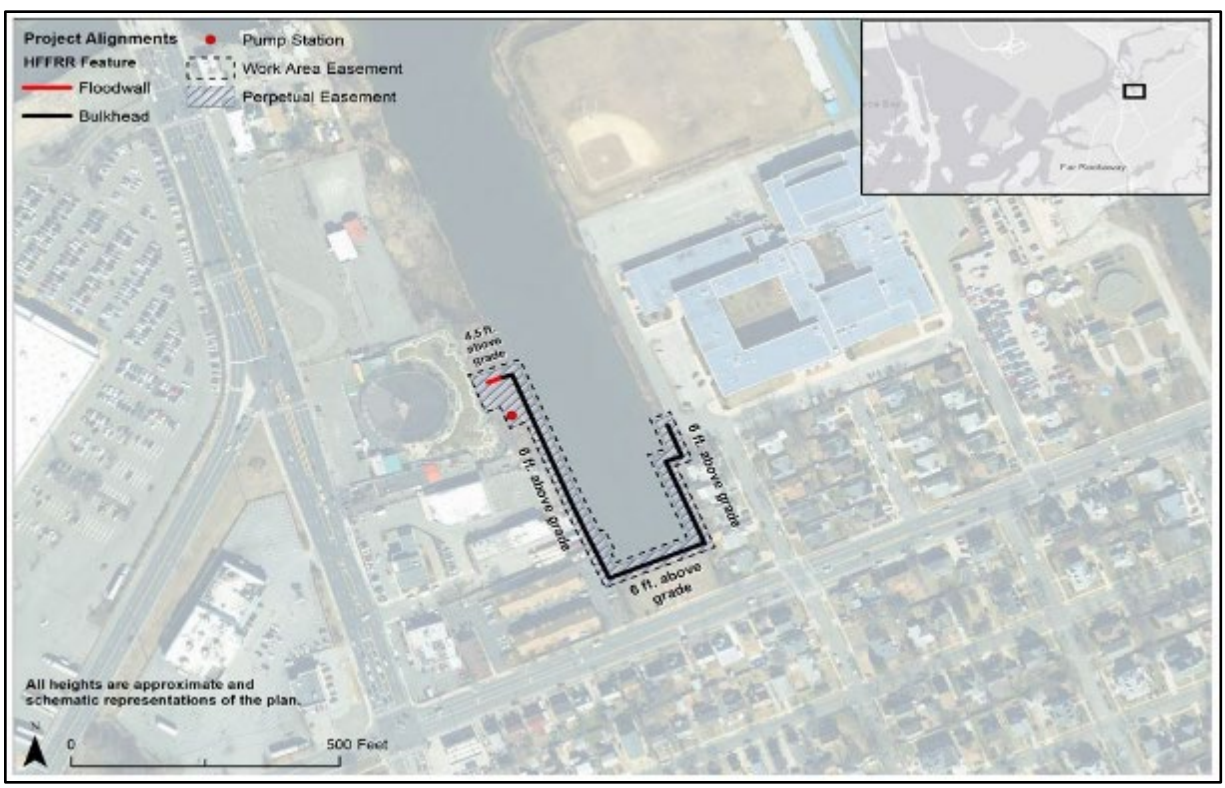

FIGURE 11.—Cedarhurst-Lawrence HFFRRF Project Plan. Illustration credit: USACE (2018a).

b. Motts Basin North

The Motts Basin North HFFRRF consists of the construction of 540 ft of floodwall, beginning just north of the corner Alameda Avenue and Waterfront Boulevard, and running parallel to Waterfront Boulevard on its south side (Figure 12). The line of protection then shifts to a section of medium[1] floodwall above an existing outfall, continuing east for 47 ft before transitioning back into a low floodwall for an additional 105 ft. Project design elevations of +8 ft NAVD88 have preliminarily been established based on the expected wave exposure.

An existing outlet will be modified to add a valve chamber, sluice gate, and flap valve to prevent high tides or storm surge from flooding through the drainage system. The outlet pipes will be replaced if the design phase indicates it is necessary. Drainage along the landward side of the bulkhead will be provided by a small ditch. Inlets will connect to an existing outlet and a single proposed outlets.

FIGURE 12.—Aerial photo with plan layout of Motts Basin North HFFRRF. Illustration credit: USACE (2018a).

[1] The floodwall "types" are defined in the Engineering and Design Appendix as low floodwall = +8 ft NAVD88, medium floodwall = +10 ft NAVD88, high floodwall = +11 ft NAVD88. These vary between 2 ft at grade to 5 ft at grade.

c. Mid-Rockaway

Edgemere Area

The Edgemere HFFRRF is aligned along the coastal edge of Edgemere (USACE 2018a; Figure 13). The alignment consists of approximately 480 ft of medium floodwall, 660 ft of high floodwall, 1,510 ft of low berm, 2,060 ft of medium berm, 80 ft of high berm, 2,260 ft of hybrid berm, and 250 ft of bulkhead. One road ramp is included to maintain access to the waterfront. Three existing outlets will be modified to prevent flow reversal and flooding through the drainage system. Twelve new outfalls and three new pump stations are included within the design. As described below, two NNBFs will be constructed in this area, east and west of the peninsula.

NNBF Descriptions:

- Edgemere 1: A rock sill is proposed on the west side of Edgemere to protect some of the existing eroding wetlands habitats and provide for the establishment of some high marsh – scrub/shrub habitat. The rock sills are also intended to provide habitat for attached fauna such as ribbed mussels (*Guekensia demissa*) and oysters (*Crassostrea virginica*).

- Edgemere 2: Intertidal habitat restoration is proposed, including planting of low and high marsh and ribbed mussel and oyster reef restoration, and removal of common reed (*Phragmites australis*).

Arverne Area

The Arverne Area HFFRRF would begin north of Alameda Avenue and Beach 58th Street (Figure 14). The alignment consists of the construction of approximately 3,170 ft of low floodwall, 480 ft of medium floodwall, 440 ft of high floodwall, 2,630 ft of low berm, 580 ft of hybrid berm, 890 ft of bulkhead, and 990 ft of revetment, as well as three areas where NNBFs are proposed as described below. Three road ramps and one vehicle access gate are included to maintain access to the waterfront. Eight existing drainage outlets will be modified to add a valve chamber that will include sluice gates and flap valves. Eight new outfalls (5 ft by 3 ft) and three new pump stations are included within the design.

NNBF Descriptions:

- Arverne 1: Rock sill construction is proposed on the north-west corner of Brant Point. A formal a wetland delineation has not yet been performed and the design of the rock sill is not final. Some existing uplands features are to be regraded to high marsh. A portion of the existing upland maritime forest between the berm feature and the wetlands are to remain undisturbed and expanded where practical.
- Arverne 2: Between Beach 69th Street and Beach 65th Street, construction of rock sills in Jamaica Bay to create a vegetated intertidal flat is proposed. To the

east, intertidal marsh would be regraded to provide high marsh habitat adjacent to the existing upland habitats. Additional materials or techniques for oyster and ribbed mussel restoration may be included in the final design.

- Arverne 3: To the east of Marina 59, intertidal flat restoration with a rock sill is proposed. Intertidal marsh creation, via the regrading of the higher elevation areas, is also proposed.

FIGURE 13.—Aerial photo with plan layout of Edgemere Area HFFRRF. Illustration credit: USACE (2018a).

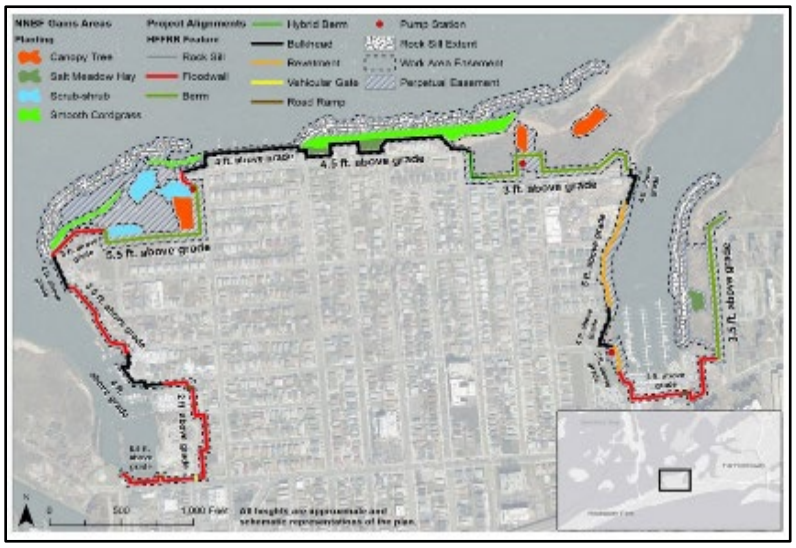

FIGURE 14.—Aerial photo with showing plan layout of Arverne Area HFFRRF. Illustration credit: USACE (2018a).

Hammels Area

The Hammels HFFRRF consists of approximately 2,550 ft of low floodwall, six road ramps, two pump stations, and three new outfalls (Figure 15). The three existing outlets will be modified to add a valve chamber that will include a sluice gate and flap valve.

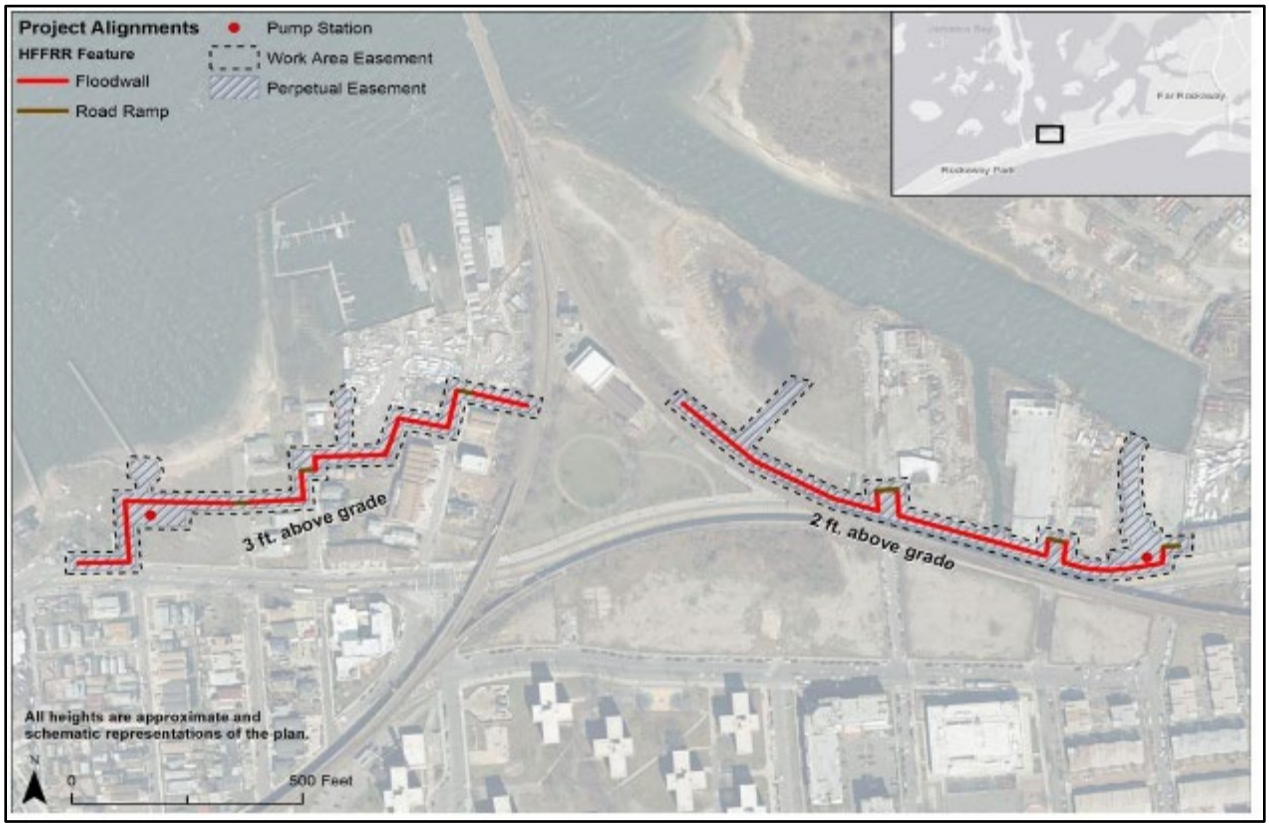

FIGURE 15.—Aerial photo with plan layout of Hammels HFFRRF. Illustration credit: USACE (2018a).

B. Endangered Species Avoidance and Minimization Measures

The project description includes the following avoidance and minimization measures (see USACE 2018b). The Corps indicated that additional measures could be developed during the preconstruction and engineering design phase of the project and will further consult with the Service, as appropriate (USACE 2018b). In some cases the avoidance and minimization measures have been modified based on coordination with the Corps.

1. Piping Plover Avoidance and Minimization Measures

1.1 A time-of-year (TOY) no-dredge/work restriction for piping plover from April 1 through September 1 beginning 1,000 meters (m) east of Beach 19th Street to 1,000 m west of Beach 70th Street. Pre-construction surveys will be undertaken to determine the presence of plovers in the remainder of the project area. If located, their breeding areas will be protected and no construction activities will occur within 1,000 m of the delineated breeding area and the Corps will undertake all practicable measures to avoid incidental taking of the species.

1.2 Breeding areas will be delineated by a qualified biologist on the basis of behavioral observations regarding territorial, courtship, nest building, egg-laying and brood rearing behaviors.

1.3 In the event of project delays due to bad weather or equipment failure, the Corps indicated they may have to work inside either end of the restriction window. In the event that occurs, construction activities will avoid all delineated locations of the species by maintaining a 1,000-m buffer (D. Mazey, USACE, email correspondence dated October 24, 2018) during the plover breeding season and will undertake all practicable measures to avoid incidental taking of the species.

1.4 The Corps will conduct or coordinate with existing land managers to conduct pre-, concurrent, and post-construction piping plover surveys in the project area. In the area from Beach 19th Street to Beach 70th Street the Corps will either obtain survey data from the New York City Department of Parks and Recreation (NYCDPR) or conduct the surveys via a qualified monitor. The Corps will coordinate with the land managers (NYCDPR) regarding funding/staff to undertake this effort prior to each nourishment cycle.

Surveys will occur during the spring/summer and prior to construction activities. Surveys will identify nesting plovers in the project area, document all known locations of plovers, and document any other federal- or state-listed wildlife species observed in the project area. The Corps will initiate consultation with the appropriate federal and state agencies as necessary.

Productivity and population surveys will be conducted each year for the life of the project. 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 (i.e., 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 are taken to avoid take.

Surveys will be recorded and summarized, and plover locations would be recorded on maps, indicating areas surveyed and habitat types. Daily reports shall be furnished to the Service and shall 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;
- predator trail indices and identification of predators;
- geographical position system (GPS) coordinates of symbolic fencing, and nest, brood, and adult foraging locations;
- location of nearest vehicle cuts; and
- reports of disturbance factors such as pedestrians, off-road vehicles (ORV), or fireworks.

Prior to implementation of the monitoring program, the Corps will consult with, and obtain agreement from, the Service on the methodology. Surveys would be conducted daily with observations evenly distributed over a minimum time period (to be determined). Survey time periods should 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 might seek protected areas during these times.

1.5 The Corps will erect symbolic fencing and signs around all plover nests and brood rearing areas located in the construction area to deter human use of the area and protect sites from incidental disturbance from construction activities.

1.6 The Corps will erect interpretive signs in the project area for seabeach amaranth, piping plover, and red knot. The Corps will also coordinate with the NYCDPR so as to support their endeavors to educate residents, landowners, beach visitors, and beach managers on piping plover.

1.7 The Corps will seek to minimize the loss of interdunal habitat on the ocean beach south of Beach 19th Street as much as possible. Further, the Corps will, in coordination with the Service, restore any of this lost habitat through the grading of this area to mimic pre-construction conditions.

1.8 In order to address the potential loss/degradation of piping plover breeding habitat, the Corps will conduct annual inspections of shoreline changes and downdrift erosion, groins, and composite seawall burial to assess project integrity and potential need to adjust the re-nourishment cycle and/or remedial actions. Additionally, pre-construction surveys of beach profiles will be conducted prior to renourishment.

1.9 The shorefront design is intended to balance the Atlantic Shorefront sediment transport such that erosion is reduced to minimize losses of sand from storms and seasonal variability. Should the project over time cause unintended persistent change in the shoreline position landward (i.e., create an erosional hotspot which reduces critical nesting habitat for plovers) at the plover nesting area between Beach 49th Street and Beach 60th Street, exceeding normal variability, then the Corps will take action to remediate the problem.

1.10 The Corps will reinitiate consultation with the Service to identify mutually agreed-upon acceptable protective measures should any changes to the project or species elicit a trigger to support such reinitiation as provided in 50 CFR part 402.16.

2. Red Knot Avoidance and Minimization Measures

2.1 On the Atlantic shorefront, the Corps will use the plover TOY restriction (April 1 to September 1), which will overlap with a portion of the red knot migration season (April 1 to November 30). From September 2 through November 20, the Corps will monitor construction activities and no work would occur within 300 m of any red knots (Mazey 2018, pers comm.).

2.2 The Corps will support the NYCDPR's pre- and post-construction surveys of the Project area to determine the presence of red knot.

2.3 The Corps will restrict construction activities within areas of known red knot populations.

2.4 The Corps will support the NYCDPR's education of residents, landowners, beach visitors, and beach managers.

2.5 The Corps will check for historical records of red knots at the Mid-Rockaway NNBF locations and will undertake spring and fall surveys at Mid-Rockaway NNBF locations to determine red knot presence during migration. The Corps will coordinate with the Service to develop a survey protocol (Mazey 2018, pers. comm.).

2.6 At Mid-Rockaway NNBF locations where red knot usage has been established, the Corps will enact a TOY restriction, which would preclude NNBF work from

occurring from mid-May through early June and from late-July through November. NNBF work in areas where red knots are not detected would occur without a TOY restriction, but red knot monitoring would occur at the start of construction and periodically during construction. All other work associated with HFFRRFs would occur without a TOY restriction and without monitoring (Mazey 2018, pers. comm.).

2.7 The Corps will avoid activities likely to impact horseshoe crabs by potentially entrapping, entangling, or blocking adults; entraining larvae; interfering with spawning; or disturbing spawning habitat.

3. Seabeach Amaranth Avoidance and Minimization Measures

3.1 The Corps will coordinate with the NYCDPR and, as necessary, will either provide funding for, or supplement, surveys prior to and post construction, to identify seabeach amaranth in the project area and to document all known locations of the species.

3.2 Construction activities will avoid all delineated locations of the plant and the Corps will undertake all practicable measures to avoid incidental taking of the plant

3.3 A TOY no-dredge/work restriction for seabeach amaranth will be from June 1 through November 1, when the presence of this species within an area of potential effect (i.e., where plants have been established) is confirmed.

3.4 The Corps will erect symbolic fence and signs around all seabeach amaranth plants located in the construction area to deter use of the area and to protect plants.

3.5 For individual plants whose destruction could not be avoided, the Corps will ensure that: seed collection or transplants will be attempted as a means of mitigating potential loss; and seeds from plants to be translocated may be harvested prior to plants being moved.

With input from the Service and species experts, all or a portion of the seeds may be:

(a) immediately transferred to an area of suitable habitat elsewhere within the project area;
(b) stored under controlled conditions to be later replanted in the project area; or
(c) sent to a qualified greenhouse for germination and eventual replanting of germinated plants or propagated seeds in suitable habitats elsewhere in the project area.

If no seeds are collected on-site, then a portion of the transplanted plants may be sent to a qualified greenhouse and propagated to produce seeds or plants for the purposes listed above.

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

3.6 The Corps will install interpretive signs for seabeach amaranth and will coordinate with the NYCDPR so as to support their endeavors to educate residents, landowners, beach visitors and beach managers on seabeach amaranth.

II. ACTION AREA

A. Description of the Action Area

The "action area" is defined as all areas to be affected directly, or indirectly, by the federal action, and not merely the immediate areas involved in the action. Action areas for each of the species have been defined below.

The action area on the oceanside stretches from Beach 9th Street to Beach 184th Street (Figure 16) for a total of 8.3 mi. Between Beach 19th Street and Beach 67th Street and at Fort Tilden, piping plover and seabeach amaranth occurrences are concentrated due to management activities. In the case of piping plover, individual occurrences have been reported outside these concentration areas where records show individual birds during the breeding and migration seasons. Known occurrences for red knot on the ocean beach portion of the project area are from eBird.org (Cornell Lab of Ornithology). These are somewhat limited in scope, but it is reasonable to expect the species is present along the ocean beach as it contains suitable foraging and roosting habitats for the species.

For much of this area, dense residential, commercial and infrastructure development generally extends to the ocean beach, except at Jacob Riis Park and Arverne by the Sea. A municipally-owned boardwalk runs immediately north of the beach from Beach 9th Street to Beach 126th Street, encompassing the entirety of the eastern portion of the action area.

The action area also includes bayside habitat for red knot. While many bayside areas of the Rockaway Peninsula have been hardened, red knot foraging and sheltering habitats are still present in the form of fringing saltmarsh and unvegetated intertidal areas. These habitats are adjacent to hardened and unhardened (i.e., around Dubos Point and Brant Point) shoreline areas. All lengths of shoreline with these habitats present within 500 m of proposed Mid-Rockaway

Arverne and Edgemere HFFRRF projects and where disturbance to red knots would reasonably occur from construction activities are included in the bayside action area, totaling approximately 3.5 mi of shoreline. This determination was based on factors such as the types of construction activities, the equipment that would be involved, whether there were clear lines of sight, and avoidance or flight initiation distances for non-construction activities reported in the literature. The Jamaica Bay Ecosystem Research and Restoration Team (JABERRT) confirmed the presence of red knots at two locations within the Mid-Rockaway Arverne Area (Brant Point and Dubos Point) (Viet et al. 2002), however, the Service is not aware of any other systematic surveys on the Rockaway Peninsula.

FIGURE 16.—Map showing location of piping plover, seabeach amaranth, and red knot action area and piping plover concentration areas.

III. STATUS OF THE SPECIES

As per section 7 of the Act (50 CFR 402.14(g)(2)), it is the Service's responsibility to "evaluate the current status of the listed species or critical habitat."

To assess the current status of the species, it is helpful to understand the species' conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events – numbers, growth rates), redundancy (ability of a species to withstand catastrophic events – number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions) (collectively known as the three Rs).

A. Piping Plover

The rangewide status of the piping plover, along with its life history, habitat requirements, recovery strategy and criteria, population dynamics and demographic status, and threats are found in USFWS (1996 a/b and 2009, https://www.fws.gov/northeast/pipingplover, https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=6039), Cohen et al. (2009), Loegering and Fraser (1995), and Wilcox (1959), and the references contained therein, which are incorporated by reference into this Opinion.

The Atlantic Coast population grew from approximately 790 pairs in 1986 to an estimated 1,941 pairs in 2016, which has reduced the Atlantic Coast piping plover's vulnerability to extinction since listing under the Act. However, the distribution of population growth remains very uneven. The demographic status of each recovery unit and implications for the survival and recovery of the coastwide population are summarized at https://www.fws.gov/northeast/pipingplover/pdf/Abundance_Productivity_2016_Update_final.pdf, which discusses the population in terms of representation, redundancy, and resiliency.

Currently, as a whole, the rangewide status of piping plover is improving (https://www.fws.gov/northeast/pipingplover).

To meet the goal of recovery of the piping plover, the following criteria are required to support a delisting recommendation from the Service (from USFWS 1996a).

- Criterion 1: Increase and maintain for 5 years a total of 2,000 breeding pairs, distributed among four recovery units as specified below:

  - Atlantic Canada - 400 pairs
  - New England - 625 pairs
  - New York-New Jersey - 575 pairs
  - Southern (Delaware-Maryland-Virginia-North Carolina) - 400 pairs;

- Criterion 2: Verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long-term;

- Criterion 3: Achieve five-year average productivity of 1.5 fledged chicks per pair in each of the four recovery units described in criterion 1. Data to evaluate progress toward meeting this criterion should be obtained from sites that collectively support at least 90 percent of the recovery unit's population;

- Criterion 4: Institute long-term agreements among cooperating agencies, landowners, and conservation organizations that will ensure protection and management sufficient to maintain the population targets and average productivity for each recovery unit as specified in criteria 1 and 3; and

- Criterion 5: Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

The primary factors influencing the status of the piping plover include habitat loss and degradation via coastal development and stabilization, predation, and human disturbance.

B. Red Knot

The rangewide status of the species, life history, habitat requirements, recovery strategy and criteria, population dynamics and demographic status, and threats are found at https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=1864, https://www.fws.gov/northeast/redknot, and USFWS (2014).

Currently, as a whole, the rangewide status of red knot is declining (USFWS 2014).

A draft recovery outline for this species is under development at this time, so recovery goals and conservation needs have not been formally identified by the Service. However, threats to the species have been identified for conservation actions. A detailed discussion of threats is found in USFWS (2014).

The primary factor(s) affecting the status of the red knot include habitat loss and degradation via coastal development and stabilization, stability of foraging resources, and predation.

C. Seabeach Amaranth

The species description, life history, population dynamics, and threats to the population are described in USFWS (1996b and 2018) and https://ecos.fws.gov/ecp0/profile/speciesProfile?sId=8549, which are incorporated by reference into this Opinion.

Since listing the species has remained extant in New York, North Carolina, and South Carolina and has been rediscovered in four states: New Jersey, Delaware, Maryland, and Virginia. There has been no change in historic range of the species since its listing. Populations in Maryland, Virginia, New Jersey, New York, and South Carolina have shown general trend of decline since

2002, while the total number of plants in North Carolina has increased during that time. For additional information see USFWS (2018).

Currently, as a whole, the rangewide status of seabeach amaranth is declining over most of its range (USFWS 2018).

Delisting of seabeach amaranth requires that the species exist in at least six of the states within its historic range and when a minimum of 75 percent of the sites with suitable habitat in those States are occupied by amaranth population for 10 consecutive years (USFWS 1996b and 2018).

The primary factors influencing the status of the seabeach amaranth include habitat loss and degradation via coastal development and stabilization, plant competition, and herbivory.

IV. STATUS OF CRITICAL HABITAT

Critical Habitat for piping plover has been designated in the wintering grounds in Texas and North Carolina (*Federal Register* Notices 74 FR 23476 and 73 FR 62816, respectively); however, this action does not affect these areas. No Critical Habitat has been designated for red knot or seabeach amaranth.

V. ENVIRONMENTAL BASELINE

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

A. Status of the Species within the Action Area

1. Piping Plover

Surveys for piping plover occur at Fort Tilden and Jacob Riis Parks, Rockaway Beach, from Beach 19th Street to Beach 67th Street (including Arverne by the Sea, and Far Rockaway Long Island Colonial Waterbird and Piping Plover Survey (LICWS) sites) (Figure 17). The LICWS is an annual window count that occurs across Long Island. The window count aims to count plovers across Long Island during a standard window (June 1 - June 9) each year. The limited window helps to prevent double counting, as birds may move among sites throughout the season. Adjacent areas that have suitable habitat are monitored and managed for piping plover and seabeach amaranth by the NYCDPR when the species are detected. The NYCDPR also manages these areas for recreation and maintenance activities. Plover monitoring occurs at least 5 days a week (NYCDPR 2017), while monitoring of adjacent areas is less frequent due to limited resources and plover breeding history. The NYCDPR installs symbolic fencing (fence-posts connected by flagged string) between Beach 38th Street and Beach 57th Street by April 1

of each calendar year to protect breeding areas. The NYCDPR installs symbolic fencing in the areas between Beach 19th Street and Beach 38th Street and Beach 57th Street and Beach 149th Street once breeding behaviors (territory establishment, scrapes, mating, nests, etc.) are observed. The NPS sporadically monitors plovers at Jacob Riis Park due to the limited history of breeding, which is influenced by the extensive recreational activities coupled with low level of plover habitat management, and installs symbolic fencing when plover breeding behaviors are observed.

FIGURE 17.—Map of NYSDEC LICWS sites in the action area.

Existing habitat conditions are shown in Figures 18 through 20.

FIGURE 18.—Dune and ephemeral pool complex near Beach 17th Street to Beach 20th Street. Photo credit: Steve Sinkevich, USFWS, November 2018.

FIGURE 19.—Backshore area, Arverne by the Sea (Beach 35th Street to Beach 73rd Street) piping plover breeding area looking west. Photo credit: Kerri Dikun, USFWS, November 2018.

FIGURE 20.—Landward side of artificial dune, Arverne by the Sea (Beach 35th Street to Beach 73rd Street) looking east. Photo credit: Kerri Dikun, USFWS, November 2018.

In the action area, five NYSDEC LICWS sites are monitored for piping plover, three of which are active (Figure 17):

- Far Rockaway (Beach 9th Street to Beach 35th Street; managed by the NYCDPR);
- Arverne by the Sea (Beach 35th Street to Beach 72nd Street; managed by the NYCDPR); and
- Fort Tilden (managed by the NPS).

Piping plovers nest along the ocean beach from the areas above the high water line landward to the backdune areas. In some areas, the backdune areas are used as refugia from predators by adults with their unfledged chicks (NYCDPR 2017). While the ocean beach was renourished by the Corps as part of the post-hurricane Sandy beach stabilization efforts in 2014, important micro-habitats have since formed that provide forage and refugia habitats, such as those within the interdunal areas present on the ocean beach near Beach 19th Street.

Based on LICWS data, plover abundance ranged from 10 to 22 pairs, with an average of 17 pairs, from 2000 to 2018. The highest abundance of 22 pairs occurred in 2018. Twenty-one pairs were reported in 2004, 2010, and 2017. Arverne by the Sea is the major breeding area. Between 2000 and 2018, Arverne by the Sea accounted for 78 percent of the pairs in the action area and 32 percent of the pairs on the Rockaway Peninsula. Piping plover nest distribution is shown in Figure 21 and total and site abundances are shown in Figure 22.

In addition to the LICWS count, site managers also monitor sites for annual productivity (chicks fledged per pair). Productivity monitoring includes tracking the total pairs, total nests, and the total number of fledglings at each site throughout the breeding season. As plovers may move among sites throughout the season, productivity pair counts may differ from LICWS pair counts. From 2001 through 2018, productivity pairs within the action area ranged from 11 pairs to 26 pairs, with an average of 18 pairs. Productivity has varied over the past 18 years (Figure 23). In 2001, productivity was 1.0, and then increased to 2.0 in 2002. Between 2007 and 2013, productivity was below 1.24 chicks/pair or the minimum productivity rate necessary for a stable population (see USFWS 1996a). Productivity then increased to 2 in 2014. In 2015, productivity decreased to 1.41 and then increased to 1.94 and 2.1 in 2016 and 2017, respectively. Productivity dropped to 1.42 in 2018. Service biologists speculate that a decrease in predators (gulls and ghost crabs [*Ocypode quadrata*]), possibly associated with hurricane Sandy in 2012, may have contributed to increases after 2013.

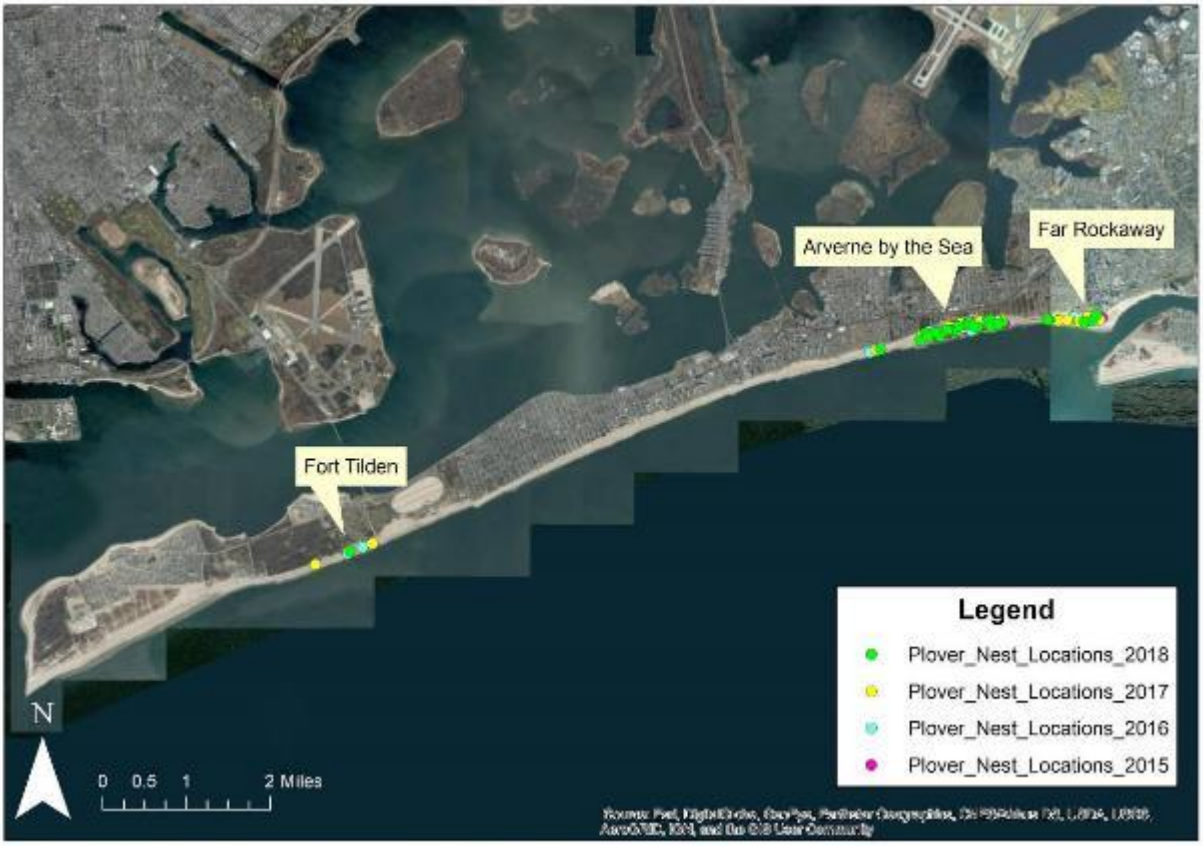

FIGURE 21.—Piping plover nest distribution in the action area, 2015 to 2018.

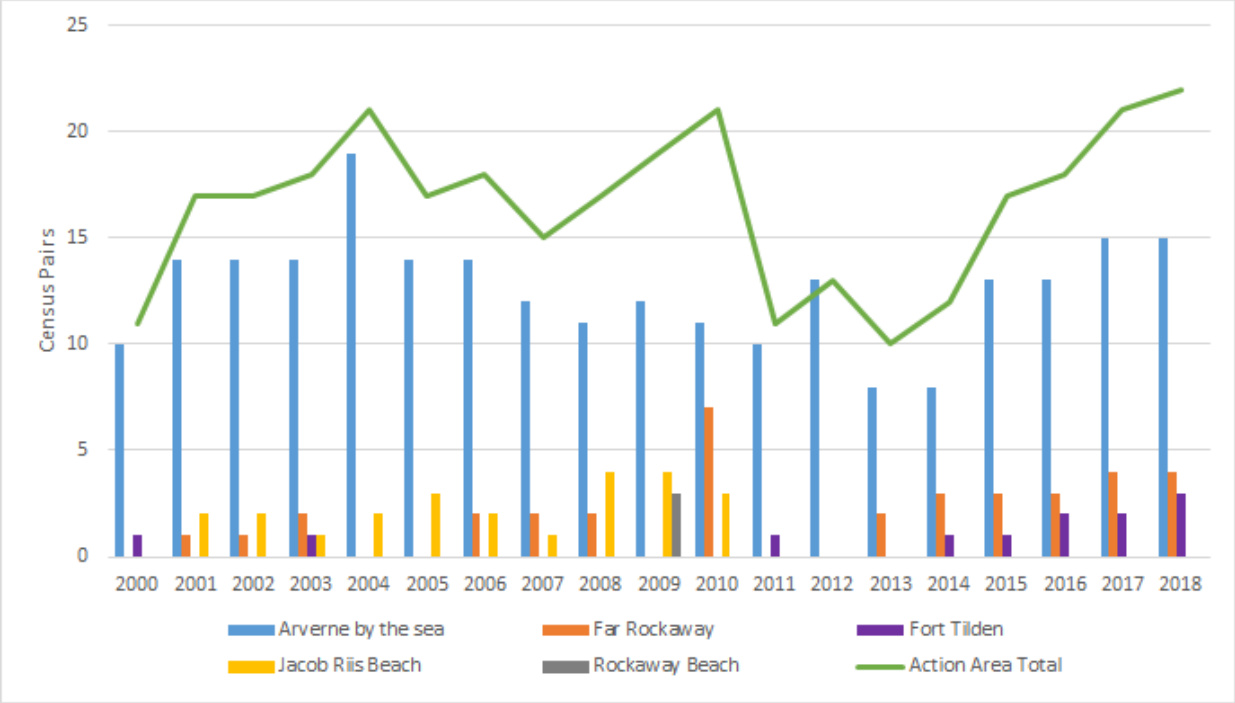

FIGURE 22.—Total and site piping plover abundance given as number of LICWS census pairs in the action area—2000 to 2018.

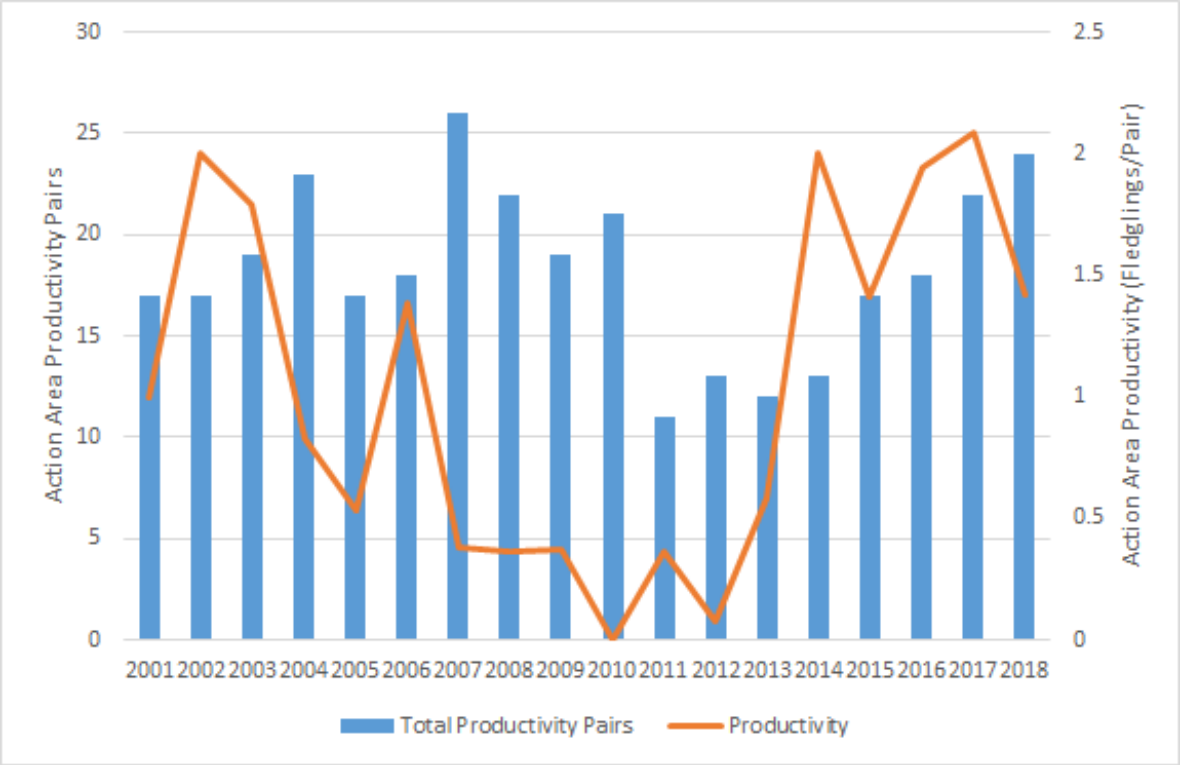

FIGURE 23.—Piping plover productivity pair abundance and productivity (fledglings/pair) in the action area—2001 to 2018.

2. Red Knot

In New York and New Jersey, red knots use sandy beaches and back-bay areas during spring and fall migration (Niles et al. 2008, as cited in USFWS 2014). As stated above, the Service is not aware of comprehensive monitoring of red knots within the action area, however, best available data from eBird.org and avian surveys performed in 2000 and 2001 by the JABERRT were used by the Service in describing the status of the species in the action area. Red knots were observed at Dubos Point and Brant Point (Viet et al. 2002) on the bayside, as well as at various locations on Rockaway Beach, Jacob Riis Park, and Fort Tilden (Table 1) on the oceanfront. Records from eBird.org do not reflect comprehensive survey efforts, and may not accurately represent the full extent of red knot presence within the action area.

TABLE 1.—Red knot counts for the action area's ocean beach (https://eBird.org as of December 2018).

Location	Red Knot Count or Range	Date or Date Range
Fort Tilden - Battery Harris Platform	1	10/6/2018
Fort Tilden - Battery Harris Platform	5	8/15/2014
Jacob Riis Park	1	9/3/2017
Rockaway Beach	23	8/4/2012
Rockaway Beach	4	8/31/2013
Rockaway Beach - Edgemere (Beach 32nd Street - Beach 56th Street)	1	8/28/2018
Rockaway Beach - Edgemere (Beach 32nd Street - Beach 56th Street)	1	8/26/2018
Rockaway Beach - Edgemere (Beach 32nd Street - Beach 56th Street)	1	6/9/2018
Rockaway Beach - Edgemere (Beach 32nd Street - Beach 56th Street)	1	9/6/2015

3. Seabeach Amaranth

Surveys for seabeach amaranth are conducted annually at Jacob Riis Park, Arverne by the Sea, and Far Rockaway beaches. Amaranth plants are generally found where symbolic fencing is installed for piping plover, least tern (*Sterna antillarum*), common tern (*Sterna hirundo*), black skimmer (*Rynchops niger*), and American oystercatcher (*Haematopus palliatus*) (NYCDPR 2017).

From 1990 until 2001, seabeach amaranth abundance generally increased, reaching a peak abundance of 5,889 plants in 2001 (Figure 24). From 2001 through 2009, the population declined from 5,889 to 6 plants. Abundance remained low until 2016 and 2017 when it increased to 2,517 and 4,881 plants, respectively. Abundance then decreased to 1,862 plants in 2018.

The action area has supported from 0 to 88 percent (16 percent average) of the NY population since 1990. From 2016 to 2018, the action area has supported between 26 and 57 percent of the NY population.

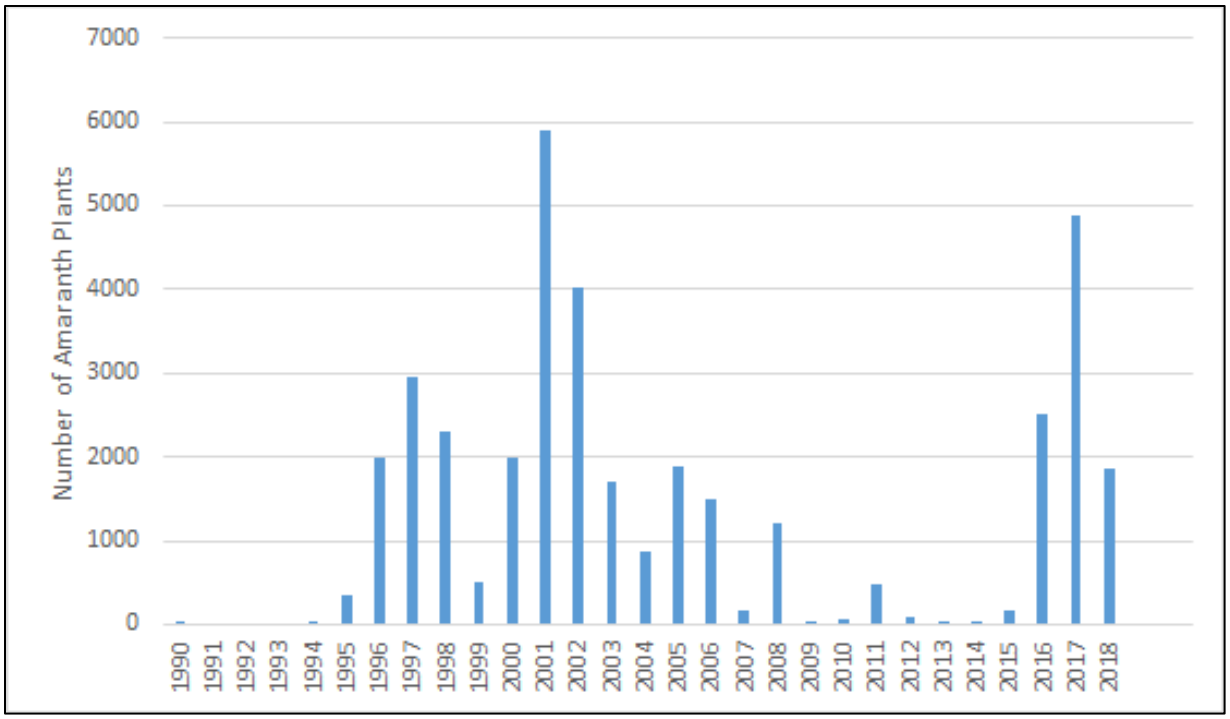

FIGURE 24.—Total number of seabeach amaranth in the action area—1990 to 2018.

VI. STATUS OF CRITICAL HABITAT WITHIN THE ACTION AREA

No Critical Habitat for piping plover, red knot, and seabeach amaranth is present in the action area.

VII. FACTORS AFFECTING THE SPECIES ENVIRONMENT WITHIN THE ACTION AREA

Habitat modification, loss, fragmentation, beach stabilization, predators, recreation, administrative and beach maintenance ORV use, and burial of food resources, are all factors that have negatively affected environment, distribution, reproduction and abundance of red knot and piping plover in the action area. Seabeach amaranth experiences all of these factors, as well, except for burial of food resources and predation. Piping plover and seabeach amaranth monitoring and protection programs are undertaken in the action area by the NPS and the

NYCDPR. Suitable piping plover habitats with a recent history or indication of breeding activities are delineated each year and protected with symbolic fencing and monitored by staff. There are currently no red knot management plans underway at this time in the action area.

A. Beach Stabilization

Public and private beach stabilization efforts have occurred over many decades and include beach scraping, sand fence installation, and structural shoreline stabilization (dunes, beaches, revetments, and groins). These activities affect dune and beach morphology by preventing the creation of transitory, storm-created habitats that are important to piping plover, red knot, and seabeach amaranth.

Over the last 10 years, the following federal beach stabilization projects have occurred within the action area:

- NPS GNRA Jacob Riis Beach Nourishment (2014) and Ongoing Beach Scraping: The NPS completed informal consultation under the Act and placed 200,000 CY of borrow-area dredged material at Jacob Riis Park. The NPS also continues to scrape sand at Jacob Riis Park, placing the scraped sand in eroded areas. All work is completed outside of the piping plover breeding season to avoid direct adverse effects from construction activities.

- Corps' Formerly Constructed Civil Engineering Project (Post-Hurricane Sandy Emergency Nourishment Project; 2014): The Corps informally consulted with the Service and completed an emergency storm damage protection project through the Public Law 84-99 authorization involving the placement of borrow-area dredged material on the Atlantic Beach shoreline from Beach 9th Street to Beach 149th Street. Any construction activities within historic breeding areas were completed outside of the breeding season while construction activities completed during the breeding season were conducted in areas where no plover breeding was observed.

- Corps' Operations and Maintenance Dredging of East Rockaway Inlet (Periodic): Maintenance dredging involves the dredging and disposal on the beach of approximately 500,000 CY from the federal channel every 3 to 4 years. Typically, dredge material is placed between Beach 27th Street and Beach 38th Street, and between Beach 92nd Street and Beach 103rd Street. The next maintenance cycle is planned for the winter/spring of 2019, extending into the early part of the piping plover breeding season and limited to areas where no historical breeding activity has occurred and 1,000 m from known breeding locations. Prior to this, the project was dredged in 2016 and completed outside of the piping plover breeding season as per informal consultation with the Service.

- New York City Parks Boardwalk Reconstruction (2015): Following Hurricane Sandy, the U.S. Department of Housing and Urban Development (HUD) funded the reconstruction of the boardwalk and pedestrian ramps present within the

action area. The New York City Office of Management and Budget, designated by the HUD as the non-federal representative, completed informal consultation under the Act, with major construction activities undertaken outside of the breeding season, but with hand tool construction activities during the season.

In addition, the Corps undertook projects between 1975 and 1978, and 1996 and 2004 on the Rockaway Peninsula beaches for beach erosion control.

Within the LICWS survey areas, there are beach stabilization structures. These have been inventoried in USACE (2018a). Within the plover concentration areas, rock groins extend from Beach 36th Street to Beach 57th Street, and from Beach 60th Street to Beach 67th Street. Wooden groins are visible on 2008 aerial photos of the area extending from Beach 32nd Street to Beach 39th Street. The eastern shoreline of Jacob Riis Park also contains several groin structures. Vegetative reinforcement of dunes and the installation of sand fences have been used, and are still common practices to achieve dune and beach stabilization in the action area. Both activities can prevent the formation of suitable nesting and foraging habitats for plovers (Massachusetts Barrier Beach Task Force 1994; MacIvor 1990; Elias-Gerken 1994) and growing areas for seabeach amaranth (USFWS 1996b). Dune building activities may destroy or prevent plovers from accessing preferred foraging and brood rearing habitats, including interdunal swales, wet meadows, and ephemeral pools (MacIvor 1990; Elias-Gerken 1994) or refugia present in the backdune and foredune habitats within the action area as described above in Section II (see NYCDPR 2017). The use of sand fences to capture drifting sand and/or to build dunes may produce steepened dune faces, or by themselves, create physical barriers to plover movement (Strauss 1990).

B. Predation

Piping plover and red knot are susceptible to predation in the action area. Predators include American crow (*Corvus brachyrhynchos*), greater black-backed gulls (*Larus marinus*), herring gulls (*L. argentatus*), feral cats (*Felis catus*), dogs (*Canis lupus familiaris*), raccoons (*Procyon lotor*) and possibly ghost crabs. Both red knots and piping plovers are less likely to escape detection by predators on stabilized beaches, which lack variability otherwise present on naturally functioning beaches. Hard structures such as groins can also provide perches for avian predators. The Service is unaware of any comprehensive predator control programs in the action area, beyond the use of predator exclosures.

C. Human Disturbance

Potential sources of human disturbance to listed species include, but are not limited to, beach raking and cleaning, recreational fishing, kite-flying, bird-watching, surfing, dog-walking, fireworks events, and municipal beach maintenance activities. Disturbance from all of these sources can cause plovers and red knots to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002). Overall, these disturbances can affect local abundance, survival, and productivity of piping plovers (Zonick and Ryan 1995; Zonick 2000) and red knots.

In the context of recreational activities, pedestrians may flush incubating plovers from nests (Flemming et al. 1988; Cross 1990; Cross and Terwilliger 1993), exposing eggs to predators or excessive temperature. Repeated exposure of shorebird eggs on hot days may result in embryo death (Bergstrom 1991); excessive cooling may kill embryos, retard their development, or delay hatching dates (Welty 1982). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Disturbance can force unfledged chicks out of preferred habitats, resulting in a decrease in foraging time and expenditure of energy (Strauss 1990; Burger 1991; Loegering 1992; Hoopes 1993; Goldin 1993). Recreational activity on beaches can be responsible for plover chick displacement into habitats with lower food availability, resulting in lower feeding rates, slower growth, and decreased survival (DeRose-Wilson et al. 2018). Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than from people (Lafferty 2001a/b; Thomas et al. 2002). Dogs which are off-leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Beaches with ORV use during the nesting and brood rearing periods generally have fewer breeding plovers than available nesting and feeding habitat can support. In contrast, plover abundance and productivity has increased on beaches where ORV restrictions during chick-rearing periods have been combined with protection of nests from predators (Goldin 1993).

Recreational threats to seabeach amaranth in the action area include pedestrians and ORVs. (https://www.nps.gov/search/?affiliate=nps&query=Off-Road+Recreational+Driving&sitelimit=nps.gov%2Fgate).

Mechanized beach raking represents one of the primary disturbances to seabeach amaranth. This practice can kill plants by ripping them from the substrate or by crushing. Since seabeach amaranth prefers habitats similar to those used by piping plovers, some protection for seabeach amaranth from beach raking is realized through the installation of symbolic fencing that keeps vehicles out of areas where the plants grow. The amount of symbolic fencing installed on the beach varies from year to year, depending on where federally and state-listed shorebirds and coastal plants occur. Typically, about 20 percent of the available habitat within the action area shoreline is fenced each season.

Beach raking can be deleterious to shorebirds as it removes the organic material including seaweed, seashells, driftwood and other materials deposited on beaches by tidal action, known as wrack, an important food source for shorebirds. Piping plovers feed on invertebrates, such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989). Important feeding areas may include intertidal portions of ocean beaches, overwash areas, mudflats, sandflats, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, or saltmarshes (Gibbs 1986; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993; Elias-Gerken 1994; Cohen 2005; Houghton 2005). Jones (1997) identified the presence of wrack that supports abundant invertebrate fauna as a likely explanation for higher breeding success of piping plovers on ocean beaches at Cape Cod Seashore compared with

piping plover study sites further south. Piping plover chicks foraged extensively and exhibited high peck rates in wrack, where arthropod abundance indices were also high (Cohen et al. 2009). In oceanfront habitats, terrestrial invertebrates tend to be concentrated in the wrack line (Loegering and Fraser 1995; Hoopes et al. 1992), a habitat used by foraging plover adults and chicks (Goldin 1993; Hoopes 1993; Hoopes et al. 1992). Availability of wrack is especially important at sites where ephemeral pool and bayside foraging areas are not available (Elias et al. 2000). Consequently, the removal of wrack has a significant impact on piping plovers, such as decreased food availability and uptake, the expenditure of energy to move to areas where wrack is present, and susceptibility to predators.

In some states, wrack on ocean beaches is an important foraging resource and bayside beaches are important roosting habitat for red knots at their migration stopover sites (USFWS 2015). Wrack material concentrates certain invertebrates such as amphipods, insects, and marine worms (Kluft and Ginsberg 2009), which are secondary prey species for red knots. Because shorebird numbers are positively correlated with wrack cover and biomass of their invertebrate prey that feed on wrack (Dugan et al. 2003; Hubbard and Dugan 2003), beach grooming could potentially lower bird numbers (Defeo et al. 2009; USFWS 2015).

D. Accelerating Sea-level Rise

Over the past 100 years, the globally-averaged sea level has risen approximately 10 to 25 centimeters (cm) (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001, as cited in Hopkinson et al. 2008). The International Panel on Climate Change (IPCC) suggests that by 2080, sea-level rise could convert as much as 33 percent of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea-level rise are predicted, estimated timeframes and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007; CCSP 2009). Inundation of piping plover, red knot, and seabeach habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird and plant habitat and protection for mainland developments. Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20 to 70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively.

New York State has developed the sea-level rise projections for New York City/Lower Hudson Region as shown in Table 2, which spans the 50-year timeframe of the proposed project (https://www.dec.ny.gov/regulations/103877.html). It is not clear how the project features would respond to sea-level rise, nor the impacts they would cause to natural beach ecosystems under these scenarios, especially since the project is only at the 15 to 30 percent design phase.

TABLE 2.— Sea-level rise prediction for New York City and the Lower Hudson Region. From (https://www.dec.ny.gov/regulations/103877.html).

Time Interval	Low Projection	Low-Medium Projection	Medium Projection	High-Med-Projection	High Projection
2020s	2 inches	4 inches	6 inches	8 inches	10 inches
2050s	8 inches	11 inches	16 inches	21 inches	30 inches
2080s	13 inches	18 inches	29 inches	39 inches	58 inches
2100	15 inches	22 inches	36 inches	50 inches	75 inches

VIII. EFFECTS OF THE ACTION

Direct effects are the direct or immediate effects of the project on the species, its habitat, or designated/proposed critical habitat. Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Direct and indirect effects of the proposed project along with the effects of interrelated/interdependent activities are all considered together as the "effects of the action."

All of the proposed project activities may overlap with portions of piping plover breeding season, red knot migration season, and seabeach amaranth growing season causing impacts to these species over the long- and short-term.

Long-term and permanent impacts are anticipated in the form of:

(a) Adverse effects due to construction activities (all three species);
(b) Adverse effects due to habitat loss and modification (all three species);
(c) Adverse effects due to the prey resource burial (piping plover and red knot);
(d) Adverse effects due to increased predation (piping plover and red knot); and

(e) Adverse effects due to increased recreational, maintenance and patrol activities (all three species).

A. Effects from Construction Activities - All Species

We note that adhering to the TOY restrictions for each species is the recommended measure by the Service to preclude adverse impacts from construction activities to piping plover (April 1 to September 1), red knot (April 1 to November 30), and seabeach amaranth from (May 1 to November 1).

The use of heavy machinery and equipment (e.g., dredge pipes, trucks and bulldozers) may adversely affect piping plovers and red knot, causing disturbance and significant disruption of normal activities such as breeding, feeding, or sheltering. As discussed below, these activities while most likely limited to non-lethal effects to the species, could force birds to expend valuable energy reserves to seek available habitat elsewhere, delay feeding, breeding behaviors, or interfere with sheltering activities. Figures 25 and 26 illustrate the location of nests relative to project features proposed for construction. Construction activities are very disruptive to the beach environments and the habitats that support these listed species (Figures 27 and 28).

1. Piping Plovers

The Corps has proposed (1) an April 1 to September 1 TOY restriction for piping plovers between Beach 19th and Beach 70th Street, and (2) a 1000-m buffer between work activities and plovers exhibiting breeding behaviors (scraping, courtship, territorial displays, nesting) when they need to work for an unspecified amount of time at the beginning, or end, of the breeding season. If plovers exhibit breeding behavior within 1,000 m of work activities, the construction would stop and equipment would be removed from the buffer area.

Home range distances of breeding and non-breeding piping plovers, or distances traveled to and from forage and breeding areas, average between 500 m (Haffner et al. 2009) and 1,590 m (Hermanns et al. 2018), respectively. Considering this information, we anticipate that a 500-m buffer around adult breeding piping plovers would be protective. However, implementation of a buffer zone plus monitoring plan would be needed to determine whether the 500-m buffer is sufficiently protective of both breeding and non-breeding plovers in the project area,

The proposed TOY and 1,000-m buffer zone would permit heavy construction or demobilization activities directly along the borders of known and long established piping plover breeding areas, resulting in disturbance to feeding, breeding, and sheltering behaviors. We anticipate that such disturbances would be non-lethal yet still reduce individual fitness due to site abandonment, relocation to less suitable habitats, competition for nesting habitat with conspecifics, and loss of foraging opportunities. In addition, individuals outside the concentration areas would likely be subject to disruption of breeding, feeding, or sheltering behaviors due to heavy equipment operation, installation of the dredge pipe, and other

construction related activities. These effects would be additive to existing adverse effects to the species' distribution and abundance driven by habitat limitation due to existing land use.

Dredging and construction operations that encroach closer than 500 m of delineated plover breeding areas, or closer than 1,000 m from plover chicks[2], have the potential to disturb adult piping plover and piping plover chicks, resulting in territory abandonment, disruption of pair bonds, nest abandonment, elevated predation of eggs and chicks, and increased chick mortality due to reduced foraging opportunities. An inability to monitor at night would potentially cause injury to adult and unfledged piping plovers through disruption of foraging and sheltering behaviors. Without buffers or TOY restrictions for plovers observed outside of the concentration areas, we would expect plovers would be disturbed, at a minimum, from feeding and sheltering, and possibly breeding.

Overall, the timing and proximity of heavy construction activities, the limited nesting habitat, and the lack of detailed construction monitoring plans, create the likelihood of non-lethal adverse effects to plovers on edges of concentration areas between Beach 19th Street and Beach 67th and at Fort Tilden. Over the past four years, and average of five pairs have nested at the edges of these areas and within 500 m of proposed work. A proportion of these nests (depending on timing of work and nests, length of exposure to construction activities, distance from construction activities, and individual responses of birds) will experience reduced fitness during initial construction and each nourishment event. We also anticipate non-lethal effects of two piping plovers outside of the concentration areas due to inadequate buffer zones and unknown monitoring protocols for initial construction and each nourishment event.

2. Red Knots

The Corps will employ a red knot TOY restriction from mid-May through early June and then from late July through November for the Mid-Rockaway NNBFs if red knot presence has been established. Limiting the TOY restriction to only peak migration periods is not fully protective of the species as red knots may occur in the action area at any time from April 1 through November 30. TOY restrictions will not be used at Mid-Rockaway NNBF locations without confirmed red knot presence, but the Corps will monitor for red knots at the start of, and periodically during, construction in these areas.

Limiting surveys and monitoring to only the NNBF locations is not fully protective of the species because construction activities elsewhere at HFFRRF locations would likely prevent them from foraging or roosting, thereby reducing fitness of individuals on their migratory stopover site. Furthermore, details regarding monitoring protocols or actions to be taken if red knots are located on the bayside have not been provided. The Service, therefore, cannot fully evaluate if these measures will avoid or minimize effects on red knots.

[2] Patterson (1988), Cross (1990), Coutu et al. (1990), Strauss (1990), and Loegering (1992) observed that plover chicks may move up to 1,000 m from their nest sites, so a 1,000-m buffer zone would put activities at what may be considered an outer limit of movement based on these studies.

The Corps also proposed a 300-m buffer for the protection of red knot on the ocean beach and indicated that some activities such as beach nourishment would occur 24 hours non-stop. The lack of a detailed monitoring plan and inherent difficulties in monitoring at night would create conditions leading to impacts such as foraging and roosting area abandonment (Pfister et al. 1992). We note that specific studies on disturbance flush distances of red knots in response to major beach construction activities are not available, however, red knots avoid roost areas within 1,000 m of higher than average boat traffic (Peters and Otis 2007), and are generally very sensitive to disturbance (Pfister and Lavine 1992; Pfister et al. 1992).

The proportion of red knots using the ocean beach habitat to be directly impacted by these activities is anticipated to be small, on the order of two red knots during the initial construction and each renourishment cycle. This is a conservative estimate, given the species is likely under surveyed in the area.

FIGURE 25.—Map showing location of plover nests (2015-2018) near the proposed composite seawall and berm design layout in the eastern portion of the proposed project area.

FIGURE 26.—Map showing location of plover nests (2014 to 2018) near the proposed beach taper and groin design layout in the western end of the proposed project area.

3. Seabeach Amaranth

Seabeach amaranth would be protected from direct disturbance in the plover breeding areas and buffer areas from April 1 to September 1. However, after September 1, the Corps would try to implement mitigative measures such as transplantation or seed collection to avoid or minimize impacts to the species, but these measures represent adverse effects to the species, in and of themselves.

The Service anticipates that the proposed project would result in adverse effects to seabeach amaranth as beach nourishment would occur from September 1 to November 1, or possibly before September 1. The Corps has committed to avoid all delineated locations of the plant and undertaking all practicable measures to avoid taking of the plant (Mazey pers. comm. February 13, 2019). However, this will not completely avoid all impacts to the species. To address this, the Corps would attempt to either collect seed from these plants or transplant them as described in Section II. C.3 (3.5), above, if seabeach amaranth plants are identified within the direct construction footprint (Mazey pers. comm. February 13, 2019).

Composite seawall, groin, and beach construction can impact seabeach amaranth through direct loss of habitat, burial, trampling, or accelerated interspecific competition via planting of monotypic stands of perennial beachgrass (Murdock 1993). When beach nourishment is conducted during the growing season, plants that germinated may be killed and their seed destroyed (Weakley and Bucher 1992). Beach nourishment, which is conducted in the winter, would likely have minimal impacts to adult plants as they will already have set seed. But, burying seeds with up to 14 ft of sand would also severely affect their ability to germinate in the next growing season, having potential deleterious effects on local populations. Any seeds

dispersed to the project area from nearby populations prior to beach nourishment would also likely be buried after beach nourishment commenced. Overall, the Service expects up to 100 percent burial of the amaranth seed bank within the template of the beach nourishment design profiles contained in the proposed project.

FIGURE 27.—Beach nourishment equipment on the beach. Photo credit: Steve Papa, USFWS, 2004.

FIGURE 28.—Dredge pipe and equipment on the beach. Photo credit: Steve Papa, USFWS, 2015.

B. Habitat Loss and Modification - All Species

The proposed project will result in habitat loss and modification of piping plover and seabeach amaranth habitat within the concentration areas, and red knot habitat, through construction of composite seawall and berm, groins, walkovers, and road access points. Habitat loss and modification would affect or create the following conditions: loss of nesting habitat area, scarped shoreline conditions, reduced or degraded foraging and loafing areas, and plant competition, ultimately resulting in injury or death to piping plovers and injury to red knots

1. Piping Plover and Red Knot

a. Loss of early successional berm habitat

It is anticipated that all of the existing early successional beach habitat consisting of open, sparsely vegetated beach areas in the project area would be impacted by the proposed project through aspects of the project, including sand fence and beachgrass (*Ammophila breviligulata*) planting, berm, dune, seawall construction, groin, bulkhead, and rock sill construction.

Sand fences and beachgrass planting will likely promote the southern expansion of the dune at the expense of berm habitat (Figure 29), and can affect dune topography and promote the formation of steep, uniform dunes (Bocomazu et al. 2011). Cohen et al. (2008) noted that once beachgrass becomes dense, it may have to be thinned each growing season to retain characteristics of suitable piping plover nesting habitat. While the proposed project provides that beachgrass can be planted at 24-in on-center where piping plover nesting is present or has the potential for nesting, there are no plans to ensure that plant density remains low enough to support characteristics of early successional beach habitats that are preferred by plovers. Installation of sand fences and planting of beachgrass include potential for direct disturbance and injury to plovers if installed during the breeding season, as installation requires teams of workers, vehicles, and necessary equipment.

Berm and seawall construction is planned in areas where significant plover breeding activities occur. Specifically, berm construction would occur in habitat where 68 percent of the nests were located from 2015 to 2018. It would also bury existing vegetation and widen the beach in some areas, potentially providing a short-term benefit in terms of an increase in potential nesting habitat, but the suitability of such habitat of the engineered beach is unknown, considering impacts to foraging resources, substrate characteristics, predators, and recreational disturbance.

The constructed berm may provide only suboptimal habitat for red knots, as a steeper beach profile is created when sand is stacked on the beach during the nourishment process, sometimes taking a year for the beach equilibration process to reach the natural angle of repose. For some highly eroded beaches, nourishment may have a beneficial effect on the habitat's ability to support migrating red knots, but this is expected to be temporary due to the long-term erosion rates in the area and the impacts of sea-level rise.

Composite seawall and dune construction is planned where 32 percent of the piping plover nest site locations in the action area were located between 2015 and 2018, either removing or significantly modifying existing nesting habitat. In terms of habitat modification, the composite seawall capped with sand does not replicate a natural dune, and will not migrate or permit the formation of microhabitats such as dune blowouts or depressions. The construction of the proposed seawall will result in the permanent loss of around 4.2 acres (ac) of dune habitat. It is unknown if piping plovers would nest in the substrate above the buried seawall, or if plovers would avoid nesting there due to factors such as substrate temperature, settling of sediments into seawall crevices or holes, etc.

Both composite seawall and berm construction will also likely adversely affect a portion of the roughly 3.5 ac of interdunal and moist open sandy habitat near Beach 19th Street through direct or partial loss. This area is used for foraging and sheltering. The Corps indicated that it would attempt to minimize this loss as much as possible and restore any of the lost habitat; however, as of this time, plans have not been developed for the Service to review to determine whether restoration would be successful or not.

Loss of habitat may also be seen downdrift of the proposed tapered groins (USACE 2006, 2018a) through erosional processes. We recognize that sand accretion on the up-drift side of the groins may potentially offset potential decreases in habitat area (USACE 2018), but this is

uncertain and is not quantified in the BA. Since renourishment is scheduled every 4 years and is contingent upon available funding, any gains of available breeding, feeding, or roosting areas would be temporary in nature.

Coastal engineering features, such as stabilized dunes and vegetation planting, discourage shorebird occupancy throughout the breeding season (Webber 2011). These habitat types are important as they provide breeding, feeding, and sheltering areas for plover adults and chicks (Cohen et al. 2009; Elias et al. 2000), and sheltering and feeding areas for red knots. A reduction or loss of this habitat would negatively affect both species.

b. Loss of quality and access to foraging habitats

After construction, the berm is expected to equilibrate due to wave action, resulting in scarps, or sharp discontinuities in the beach slope (see Alegria-Arzaburu et al. 2013) (Figure 30). A scarp feature would inhibit the movement of plover chicks into intertidal foraging areas and delay the formation of wrack lines which are deposited on shallow-sloped beaches. Scarp formation plus impacts to the species' foraging resources from sand burial, and interruption of wrack delivery may lead to "population sinks" where plovers yield reproduction levels less than the level necessary to achieve a stationary population (see USFWS 1996a). It is not clear how long equilibration would take, and, therefore, how long habitats would be impacted from both a physical and biological perspective.

FIGURE 29.—Sand fence installed in the Corps' Westhampton Interim Storm Damage Protection Project area to promote lateral expansion of the dune at the expense of berm habitat. Photo credit: NYSDEC 2012.

FIGURE 30 .—A widened berm and scarp formation at Smith Point County Park, Suffolk County, New York, during construction of the Corps' Fire Island Inlet to Moriches Inlet Stabilization Project. Photo credit: Steve Papa, USFWS, March 2015.

These effects will likely reduce the amount of available habitat for this species and create degraded habitat conditions. Because piping plovers demonstrate breeding site fidelity (USFWS 1996a), they are likely to persist in attempting to breed in these areas, even if these habitats degrade and plover productivity declines in future years.

Chicks frequently move between the upper berm or foredune to access wrack lines to feed, as these features are a source of many invertebrate prey species. These foraging habitats will likely be temporarily impacted by beach nourishment activities. While the recovery rates of invertebrate prey resources in wrack is unknown following beach nourishment, they may be expected to be low during the winter period of low invertebrate activity and more rapid during warmer weather. The Service expects that prey abundance in the wrack will not be lowered for more than one nesting season following the initial berm construction or periodic nourishment cycle, except where curtailed or delayed by scarping.

It is also anticipated that the nourished beach, while initially providing some additional beach nesting habitat (provided ORV use is curtailed), is expected to erode back between renourishment cycles (Figure 31).

In addition to the Atlantic shorefront components, the proposed project also includes the construction of HFFRRFs on the bay shoreline. On the bayside, about 0.14 mi of shoreline

within the action area will be impacted by the installation of shoreline stabilization features such as revetments. Hard shore-parallel structures could have negative impacts on red knots in the action area by decreasing the amount or quality of potential foraging habitat due to potential erosional loss of intertidal habitat and creation of deeper waters (Prosser et al. 2017; Dugan et al. 2011). Intertidal habitat may also be reduced as a result of placement loss from shoreline structures. Armored shoreline may also cause loss of marsh and intertidal habitat as sea level rises and marshes are unable to migrate inland. In addition to decreased intertidal area, armored shorelines have lower intertidal invertebrate abundance and biomass, and fewer shorebirds (Dugan and Hubbard 2010).

NNBFs are proposed for approximately 1.6 mi of shoreline within the action area. The NNBFs will consist of rock sills coupled with saltmarsh restoration and creation efforts. Rock sills are hard structures and may cause impacts associated with traditional hard structures (e.g. end scour, placement loss). However, rock sills may also have positive impacts such as reduced erosion of existing saltmarsh or intertidal habitat, and can aid in restoration and creation of marsh habitat. As red knots use salt marsh as foraging habitat, this may protect existing, or create, additional foraging areas. However, it should be noted that red knot use of different foraging habitats may be disproportionate, so conversion of habitats (e.g., unvegetated intertidal to saltmarsh) resulting from the installation of rock sills or wetland creation may impact red knot foraging. Additionally, marshes behind sills may experience deposition of coarser sediments and lower organic matter than natural marshes (Bilkovic and Mitchell 2013), which may affect infauna colonization (Bilkovic et al. 2016; Sacco et al. 1994). Decreases in benthic invertebrates may negatively impact the quality of the habitat for foraging.

The design of a sill may also influence its relative impact on red knot habitat. Sill height, placement relative to the shore, sill porosity, and presence or absence of gaps can influence the quality and community structure of the saltmarsh behind the sill, tidal flushing, and the ability of aquatic organisms to access the marsh. Marsh sills placed too close to the marsh, that are designed too high, that do not have any gaps, or that have rock that is packed too tightly may limit tidal exchange, cause marsh to die off behind the sill, and restrict access of aquatic organisms (Bilkovic et al. 2016; Subramanian et al. 2008; Duhring 2008; Bosch et al. 2006). These impacts may lead to a loss of suitable foraging habitat for red knots within the action area.

FIGURE 31 .—Erosion of nourished beach within the Corps' FIMI Project area 3 years after construction. Narrowing of berm seen in foreground. Extreme erosion seen in shoreline at top of photo. Photo credit: Steve Papa, USFWS, 2018.

Overall, the proportion of red knots using the ocean beach and bay habitats impacted by the project is anticipated to be small, on the order of three red knots during the initial construction and each renourishment cycle. This is a conservative estimate, given the species is likely under surveyed in the area.

We anticipate that the habitat modifications resulting from the project will effect up to three pairs due to potential reduction in site capacity from loss of nesting habitat.

2. Seabeach Amaranth

As noted earlier, the action area has a history of significant development and stabilization which has limited seabeach amaranth to the ocean beach and isolated interdunal areas. The proposed project would perpetuate the artificial creation and maintenance of suboptimal barrier island habitats in the action area, leading to limits in available suitable habitat for growing, and accelerated plant competition. We anticipate that these effects will negatively influence the distribution and abundance of these species in the action area. Additional project effects include

increased recreational activities and associated beach raking in growing areas (discussed below).

High-quality seabeach amaranth habitat is generally characterized by sparse vegetation. Unstabilized dunes and interdunal swales provide more potential seabeach amaranth habitat as they tend to have a more gently sloping foredune face than stabilized dunes. Conversely, artificially constructed and stabilized dunes provide less suitable habitat for seabeach amaranth (Weakley and Bucher 1992). This is especially likely with the creation of the rock/sand dunes that will be built along the ocean shoreline. The installation and maintenance of a continuous rock/sand dune line will indirectly affect this species by interrupting natural processes that maintain suitable habitat. Interdunal swales and gently-sloping foredune habitats become important when the berm has been narrowed by erosion, as happens following severe coastal storms or toward the end of a recurring sand renourishment cycle; this project will impede the formation of such features over the 50-year project life

Dune vegetation planting and sand fence will contribute to the habitat modifications that are detrimental to the species abundance and distribution in the action area. Weakley and Bucher (1992) report that stabilization of seabeach amaranth habitat allows for succession to a densely-vegetated perennial community, rendering the beaches only marginally suitable for seabeach amaranth. Because seabeach amaranth is susceptible to habitat fragmentation (Weakley and Bucher 1992; Murdock 1993), destruction of a single and sizeable population could result in local extirpation.

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

C. Effects Due to Prey Resource Burial - Piping Plover and Red Knot

The Service expects that 100 percent of the intertidal infaunal prey base within initial construction and renourishment areas will be covered by sand placement, based on the project description. Foraging resources include marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent 1929; Cairns 1977; Nicholls 1989). On the oceanfront, terrestrial invertebrates tend to be concentrated in the wrack line (Loegering and Fraser 1995; Hoopes et al. 1992), a habitat used by foraging plover adults and chicks (Goldin 1993; Hoopes 1993; Hoopes et al. 1992). Availability of wrack is especially important at sites where ephemeral pool and bayside foraging areas are not available (Elias et al. 2000) or in short supply. Consequently, the proposed project will likely impact foraging habitats and prey resources in the ocean intertidal, foreshore, and backshore habitats through extreme burial and change in elevation of existing habitats.

Specifically, the proposed project will bury foraging resources with up to 14 ft of dredged material. Although some benthic invertebrate species can burrow through a thin layer of additional sediment (38 to 89 cm for different species), thicker layers (i.e., greater than 1 m) are

likely to smother these sensitive benthic organisms (Greene 2002). If the material used in a sand placement project does not closely match the native material on the beach, the sediment incompatibility may result in modifications to the macroinvertebrate community structure, because several species are sensitive to grain size and composition (Rakocinski et al. 1996; Peterson, Hickerson, and Johnson 2000; Peterson, Bishop, Johnson, D'Anna, and Manning 2006; Peterson and Bishop 2005; Colosio et al. 2007; Defeo et al. 2009).

Numerous studies of such effects indicate that the recovery of benthic fauna after beach nourishment can take anywhere from 6 months to 2 years, or possibly longer (Thrush et al. 1996; Peterson et al. 2000; Zajac and Whitlatch 2003; Bishop et al. 2006; Peterson et al. 2006, Wooldridge et al. 2016; USACE 2018b). Recovery rates 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.

As the timing of initial construction and each renourishment cycle is not known, except as constrained by an April 1 to September 1 TOY restriction between Beach 19th Street and Beach 67th Street, the Service must base its analysis of effects on a worst-case scenario. Therefore, renourishment starting in December or January and finishing close to March 15 would probably have the most severe adverse effects on piping plovers from depression of the intertidal prey resource, owing to the slowest recovery rates at that time of year.

Based on the above scenario, the Service anticipates that over the life of the project, there is the possibility of up to 24 full nesting and migration seasons (as a consequence of 12 renourishment cycles every 4 years over 50 years having effects lasting up to 2 years) of reduced prey availability along 5.2 mi of piping plover habitat within the concentration areas and 9.5 mi (7.7 mi of Atlantic shoreline and 1.8 mi of bay shoreline) of red knot habitat, causing reduced fitness for both species. Piping plovers breeding in the action area would potentially experience reduced productivity, or possibly abandonment of their breeding areas as a result of decreased foraging resources. Similarly, red knots would experience depressed foraging resources and be forced to seek suitable habitat elsewhere, expending vital energy resources in the process.

The Service anticipates that the physical configuration of the construction template will negatively affect the access to foraging habitats, and the prey available to adults and unfledged piping plover chicks for up to 2 years following initial construction and then for each renourishment. Chick home range may increase for adequate food intake, increasing the probability of intraspecific and interspecific competition, and disturbance from humans as plover chicks move from the protected areas. The potential effects include reduced or insufficient weight gain in chicks leading to delayed fledging or death, decreases in productivity, and possibly abandonment of nesting areas. Adults and post-fledged plovers preparing for migration would be similarly affected by reduced prey resources.

Additional adverse effects are likely if scarping occurs, which can prevent wrack deposition and limit chick foraging to upper beach areas following initial construction and each renourishment cycle. The overall effect on red knot is very similar, with the potential for reduced foraging opportunities during spring and fall migration. This would result in a potential reduction in individual fitness as energy must be expended to find alternative suitable foraging habitats.

Long-term impacts could include a hindrance in the ability of migrating red knots to recuperate from their migratory flight to or from their breeding grounds or to build fat reserves in preparation for migration. Long-term impacts may also result from changes in the physical characteristics of the beach from the placement of the sand.

Beach nourishment will occur across the entire plover concentration area from Beach 19th Street to Beach 67th Street, and therefore all chicks produced in that area have the potential to be impacted, although it is expected that only a proportion will be harmed. Some chicks will be able to find other foraging opportunities (e.g. newly deposited wrack, or sparsely vegetated areas) and some will successfully fledge despite lowered prey availability. From 2015 to 2018, the pairs in the plover concentration area produced, on average, 31 chicks per season. It is likely that due to lowered prey base and physical changes to the beach, a small proportion of these chicks that would otherwise survive to fledge would die.

D. Predation - Piping Plover and Red Knot

We anticipate that the proposed project would create habitat for, affect the movements of, and influence the search behaviors of mammalian and avian predators of the piping plover and red knot. We also anticipate that increased recreation will exacerbate predator activities and may lead to increased predator abundances in the action area. Beach construction, along with the installation of sand fences, planting of vegetation, and a hardened dune system creates a uniform beach system, affecting the species ability to evade detection as opposed to a natural beach system (Koivula and Ronka 1998). The expansion of planted beachgrass from the composite seawall to the berm would reduce the width of sparsely or unvegetated berm areas, lowering both species ability to elude predators more efficiently (Gomez-Serrano and Lopez-Lopez 2014; Rogers 2003; Rogers et al. 2006, as cited in Zimmerman 2010). Sand fence may increase the risk of depredation by providing cover for predators in close proximity to plover nests. The composite seawall will also provide an elevated feature which may be used as perches for avian predators and increase their search efficiency (e.g., Andersson et al. 2009).

Increased recreation would likely increase food availability (from litter or refuse) in the project area, thereby attracting and increasing the carrying capacity of predators. As a result, we anticipate that an increase in predator abundance would occur, causing increased risk of disturbance, nest loss, and adult mortality of plovers, and red knots. In response, both species may expend more energy in predator surveillance and avoidance, and that energy expenditure could decrease overall fitness. Overall, we would expect that increased predation pressures would result in some plover and red knot territory desertion, delayed or interrupted piping plover courtship, loss of adults, disturbance to incubating plovers with some loss of nests or delayed hatch times, and disturbance to foraging plover chicks with delayed fledging.

E. Impacts Due to Recreation and Administrative ORV Use–All Species

1. Piping Plover and Red Knot

The proposed project will initially widen, and over the long term, maintain wide beaches to meet the project's design criteria. As a result, it is anticipated that recreational activities will increase on the ocean beaches near existing piping plover breeding areas and new habitats created as a result of the project to which plovers may be attracted (USACE 2018a and b). The proposed project will also create new vehicle and pedestrian access points that will pose potential threat to piping plover because they would provide access and increase vehicle and public use of beach areas, disrupting breeding plovers (USACE 2018b). The proposed avoidance and minimization measures will not completely avoid indirect adverse effects of recreational activities and will likely result in injury to piping plovers and red knot.

Recreational activities that may potentially adversely affect piping plovers include unleashed pets, fireworks, kite-flying, and an increase in garbage and refuse concomitant with increased recreational activities. Unleashed pets, such as dogs and cats, can prey on piping plovers. Kite-flying is also a popular recreational activity leading to disturbance of plovers, as it is believed that plovers perceive kites as avian predators, such as hawks, gulls, or crows. Adult plovers may abandon their nest site entirely, be flushed off their nest and, therefore, be unable to defend the nest from actual predators, or similarly be unable to defend their chicks from actual predators in these instances (USFWS 1996a).

The effects of foot traffic to breeding plovers can range from relatively minor disturbance that temporarily interferes with normal breeding, feeding, and sheltering behavior to injury or death of chicks, destruction of an entire nest, or sustained disturbance resulting in nest abandonment. After hatching, young plovers are likely to move away from nesting areas, making them vulnerable to these effects throughout a much larger area. Recreational use of coastal habitats can limit the functional availability of shorebird foraging habitat, particularly intertidal foraging habitat, resulting in demographic consequences (DeRose-Wilson et al. 2018). Plover chicks in areas with high recreational use can experience lower survival and longer times to fledging than chicks in areas with lower recreational use, as they are forced to move to areas with lower prey densities (DeRose-Wilson et al. 2018). Food resources may also be depleted in heavily-trafficked areas, with implications for reduced fitness and lowered survival rates for first year birds (Schlacher et al. 2016). Chicks may die because human disturbance hinders normal brooding such that chicks, especially young ones, are vulnerable to hypothermia during inclement weather (Colwell et al. 2007).

Further, beach maintenance and patrols may involve operation of vehicles or heavy equipment on the beach in areas where plovers may occur. Maintenance vehicles can crush nests, eggs, or hatchlings and they can also create ruts capable of trapping plover chicks. The continuation and possible increase of vehicles 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 (see Kluft and Ginsburg 2009).

As currently managed, the symbolic fencing installed by April 1 between Beach 38th Street and Beach 57th Street is expected to ameliorate the impacts associated with the increase in recreation in this portion of the beach to piping plovers, but these impacts could preclude plover breeding in the remaining areas of Beach 19th Street to Beach 38th Street and Beach 57th Street

to Beach 149th Street where this fencing is not installed until plover breeding behaviors are observed.

Increased recreation will likely affect red knot and their foraging and roosting areas both directly and indirectly, causing habitat damage (Schlacher and Thompson 2008; Anders and Leatherman 1987), abandonment of preferred habitats, and disruption to the species' energy balances. Recreational activities can likewise affect the availability of shorebird food resources by causing direct mortality of prey.

Although red knots normally feed low on the beach, they may also utilize the wrack line (Karpanty et al. 2011). Beach raking removes wrack from the beach, and may therefore negatively impact red knot foraging. Kluft and Ginsberg (2009) found that ORVs (including beach raking/beach maintenance vehicles) killed and displaced invertebrates and lowered the total amount of wrack, in turn lowering the overall abundance of wrack dwellers. Other studies have found higher impacts to benthic invertebrates from driving (Sheppard et al. 2009; Schlacher, Thompson, and Walker 2008; Schlacher, Richardson, and McLean 2008; Wheeler 1979), although it can be difficult to discern results specific to the wet sand zone where red knots typically forage. The severity of direct impacts (e.g., crushing) depends on the compactness of the sand, the sensitivity of individual species, and the depth at which they are buried in the sand (Schlacher, Thompson, and Walker 2008; Schlacher, Richardson, and McLean 2008). The extent to which mortality of beach invertebrates from recreational activities propagates through food webs is unresolved (Defeo et al. 2009). However, the Service concludes that these activities likely cause at least localized reductions in red knot prey availability in a system that is already experiencing multiple stressors due to shoreline stabilization and high density human development.

Given documented past activity, it is likely that public harm or harassment will continue to occur in these areas. These recreational activities are likely to decrease reproductive success where they occur. The Corps has committed to working with local landowners regarding outreach efforts, such as posting signs that restrict access to breeding areas, which will contribute to reducing human disturbance during the nesting season.

2. Seabeach Amaranth

Within Sea Bright and Monmouth Beach, New Jersey, evidence of adverse impacts to seabeach amaranth was obvious in areas of intensive recreational use, such as at beach access paths or at a site near a volleyball net. The primary effect of increased recreation activities is trampling or crushing of plants. 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 (USFWS 2002).

IX. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section, because they require separate

consultation. This section combines the discussion for all three species as there is overlap in the cumulative effects on the species and their habitats.

Other than beach nourishment projects that would require federal (e.g., Corps) authorization, local/state actions that are reasonably certain to occur in the action area that could potentially affect the red knot, piping plover, and seabeach amaranth include beach cleaning, installation of sand fencing, recreational use of migratory stopover areas, and horseshoe crab harvesting. Each of these activities affects the species by contributing to piping plover breeding, seabeach amaranth growing habitat, and red knot foraging and loafing habitat degradation and loss.

Mechanized beach raking/cleaning is a beach management practice that does occur above the high tide line within the action areas. It crushes and removes invertebrates and the total amount of wrack, effectively lowering the overall abundance of wrack-dwelling species on which the red knot and piping plover feed.

Installation of snow fencing or the planting of beachgrass are common practices in attempting to stabilize nourished beaches and have occurred on other sites on Long Island without federal (Service, Corps) or state (NYSDEC) coordination/authorization. It is anticipated that these will be undertaken in the action area by the NPS and the NYCDPR. Vegetation planting and snow fence placement, in association with beach nourishment, will artificially accelerate growth of dense vegetation that precludes use of habitat by piping plover, red knot, and seabeach amaranth. Overall, these actions will limit the amount of available suitable habitat for all listed species and will create suboptimal habitat conditions.

The NYCDPR and the NPS authorize pedestrian access on the Rockaway Peninsula from Beach 9th Street through Beach 193rd Street. The impacts described in the **Effects of the Action** are incorporated by reference into this section.

X. JEOPARDY AND ADVERSE MODIFICATION ANALYSIS

Section 7(a)(2) of the Act requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

A. Jeopardy Analysis Framework

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on 4 components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

B. Analysis for Jeopardy/Adverse Modification

The jeopardy analysis in this Opinion relies on four components: (1) the Status of the Species, which describes the rangewide conditions of the species, the factors responsible for those conditions, and the survival and recovery needs; (2) the Environmental Baseline, which analyzes the conditions of these species in the action area, the factors responsible for those conditions, and the relationship of the action area to the survival and recovery of the species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the species; and (4) the Cumulative Effects, which evaluates the effects of future, non-federal activities, that are reasonably certain to occur in the action area, on the species.

Impacts to Individuals – As discussed in the Effects of the Action, potential effects of the action include effects to piping plover, red knot, and seabeach amaranth during their respective breeding, growing, and migration periods over the 50-year project life. Effects generally include disturbance from construction activities, habitat modification and loss, reduction in foraging base, recreational disturbance, increases in predation, and plant competition. The potential for effects would be during the period these species are present during their migration or breeding seasons as in the case of red knot and piping plover, and during the growing season for seabeach amaranth. Seabeach amaranth seed banks which are stored in the berm habitat have a longer period of effects as the species is present year round in the system. The proposed plover TOY restriction (April 1 to September 1) and delayed buffer establishment will be only partially protective of direct effects for piping plover, especially in areas immediately adjacent to the breeding concentration sites. This TOY restriction is also not fully protective of red knot and seabeach amaranth whose migration period and growing seasons extend beyond September 1. Avoidance and minimization measures for construction activities that are specific to red knots are not fully protective of the species (e.g., they do not cover the entire migration period or do not apply to all areas in which red knots may be located) or are unable to be evaluated due to lack of details provided. The other impacts related to habitat modification and loss, degradation of foraging resources, increases in recreation, increases in predation, and plant competition will be chronic effects over the 50-year project and create conditions resulting in potential potential reductions in annual or daily survival rates, reproductive rates, and site fidelity.

Impacts to Populations – As we have concluded that individual piping plover, red knot, and seabeach amaranth are likely to experience some reductions in their annual or lifetime reproductive success and abundance, we need to assess the aggregated consequences of these anticipated reductions in fitness (i.e., reproductive success and long-term viability) of the exposed individuals on the Rockaway Peninsula populations of these species. .

Individuals of piping plover, red knot, and seabeach amaranth will be affected. As the project is only at a 15 to 30 percent design level, it is difficult to predict how the proposed project will function and the total degree of impacts that it will cause, and, therefore, whether the effects are expected to measurably decrease the fitness of these populations. The effects of construction will introduce disturbance, permanently or temporarily transform their habitat, and present chronic issues related to red knot and piping plover habitat and prey resources. In addition, the

proposed project will contribute to, or compound, other issues such as recreational disturbance and predation that affect these species. Overall, the proposed project would impact a significant proportion of the Rockaway Peninsula piping plover breeding population and introduce disturbance to red knots at their migratory stopover site.

Impacts to Species –We have concluded that populations of red knot, piping plover, and seabeach amaranth are likely to experience effects that may contribute to reductions in their fitness. It is difficult for the Service to predict the scale that the harmful effects associated with the proposed project will have on the RND of each species as a whole. To understand the consequences of population-level effects at the species level, we need to factor in the RND needs of the species. As discussed in the Status of the Species, these species need naturally functioning habitats with access to suitable nesting, foraging, and growing habitats, and minimal human disturbance and predation pressure to achieve reproductive success. This project will not contribute to those needs. In the case of piping plover, the species as a whole displays an increasing population trend but has still not met the recovery criteria established in USFWS (1996a). Both red knot and seabeach amaranth are displaying negative population trends across their ranges, and the proposed project places additional obstacles on them to reach population sustainability.

XI. CONCLUSION

We considered the current overall status of piping plover (improving), red knot (declining), and seabeach amaranth (declining) and the conditions of the species within the action area. We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of these species. It is the Service's Opinion that the proposed project, is not likely to jeopardize the continued existence of the species covered in this Opinion. Since there are no Critical Habitat designations, none will be affected by the proposed project.

Piping Plover:

We based our conclusion on piping plover based on the following: The plover breeding sites in the project area represent 4 out of 60-80 active plover breeding areas on Long Island and an even smaller percentage on a NY-NJ Recovery Unit basis. As a result, the proposed project is not reasonably expected, directly or indirectly, to diminish the species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced.

Red Knot:

The number of red knots in the project area based on the best available information suggests a small proportion of the overall migrating population of the rufa subspecies in New York and along the western Atlantic. Red knot abundance in the project and action areas is also a smaller proportion of the red knots known to use the Jamaica Bay and Rockaway Peninsula, based on the best available information. As a result, the proposed project is not reasonably expected,

directly or indirectly, to diminish the species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced.

Seabeach Amaranth:

While there are significant seabeach amaranth populations in the project and action areas, these would be protected to a large degree by the proposed avoidance and minimization measures, such as commitments to work with landowners on public outreach and avoidance and transplantation of plants that may be destroyed during construction activities, will reduce some of the effects of the project. As a result, the proposed project is not reasonably expected, directly or indirectly, to diminish the species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced.

XII. INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by the Corps and become binding conditions of any grant or permit issued to the (applicant), as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (50 CFR §402.14(i)(3)).

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the removal and reduction to possession of federally-listed endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered

plants on non-federal areas in violation of state law or regulation or in the course of any violation of a state criminal trespass law.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (MBTA; 16 U.S.C. 703-712), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

XIII. AMOUNT OR EXTENT OF TAKE ANTICIPATED

The level of take of red knots and piping plovers utilizing the project and action areas can be anticipated by the Project because:

1. Red knots are known to migrate through the project and action areas. Piping plovers are known to breed and migrate in the project and action areas.

2. A reduction of the invertebrate prey base base (up to 2 years following initial construction and each renourishment cycle) will occur due to sand placement which would affect the red knot's ability to forage and store enough fat reserves for migration back to the breeding grounds for multiple wintering seasons. Such an effect could result in reduced fitness. The reduction in prey resources would affect adult and chick piping plovers ability to obtain food necessary for growth, reproduction, and migration.

3. Increased levels of human disturbance are expected for the duration of construction (initial and renourishment) activities and as a result of increased recreation which would make the project and action areas less desirable to piping plovers and red knots, and which may cause increased energy expenditure as birds move away from construction activities.

4. The project would reduce habitat variability through the creation of an engineered beach consisting of hard and soft structures, making piping plover and red knot susceptible to predation from mammalian or avian predators.

The amount of incidental take discussed below is based on the information and evaluations presented in the **Effects of the Action.** Where information is unavailable to assist us in quantifying take, we have determined, based on best professional judgement, the levels of incidental take.

A. Piping Plover and Red Knot

1. Incidental Take from Direct Effects of the Initial Construction Activities

The Service anticipates incidental take of two piping plovers in the form of harm from direct effects from construction activities for piping plovers that occur outside of the concentration areas during initial construction and each renourishment cycle. These individuals may be either

foraging outside of the concentration area or migrants and subject to the effects of construction activities.

The Service also anticipates the incidental take of 2 pairs (4 individuals) within the plover concentration area during initial construction and each renourishment event from lack of a protective buffer zone and construction activities occurring immediately adjacent to the concentration area.

The Service anticipates incidental take of 2 individual red knots in the form of harm from construction activities, depending on the time of year, sequencing and type of construction activity in the action area for initial construction and each renourishment over the life of the project.

2. Incidental Take Due to Habitat Loss, Degradation, or Modification

Over the 50-year project, the Service anticipates incidental take of three pairs of piping plovers, due to the quantitative and qualitative loss of habitat from these activities, which significantly impairs essential behavioral patterns, including breeding, feeding, or sheltering.

Incidental take in the form of harm of 3 red knots is expected to occur over the 50-year life of the project on the Atlantic ocean and bayside shorelines as a result of the loss of habitat, which significantly impairs essential behavioral patterns, including migrating, feeding, or sheltering.

3. Incidental Take Due to Reductions in Infauna in the Intertidal Zone and Subaerial Beaches

Incidental take due to effects of reductions in foraging resources is anticipated due to elevated mortality of unfledged plover chicks due from lower quality foraging habitat. We anticipate these effects will lead to the incidental take of three piping plover chicks during initial construction and each renourishment cycle, and for the following nesting season after initial construction and after each nourishment. Lowered prey availability for red knots is anticipated to result in reduced fitness of red knots, therefore, we also anticipate the non-lethal incidental take of 3 red knots during initial construction and each renourishment cycle.

4. Incidental Take Due to Enhancement of Predator Habitat and Populations

Incidental take due to increased predation is anticipated. The BA did not describe the effects of the proposed project on predation of plovers or propose any conservation measures that they would undertake to address enhancement of predator habitat or increases in predator abundance other than the use of predator exclosures. Overall, the Service anticipates that incidental take of piping plovers in the form of the loss of one nest and the death of three plover chicks every year over the life of the project for a total of 150 chicks and 50 nests.

The Service anticipates up to 2 red knots will be taken each year over the life of the project due to these effects.

5. Incidental Take Due to Increased Recreation and ORV Activities

The Service anticipates incidental take in the form of harm as a result of delayed establishment of nests, nest abandonment, and mortality of chicks due to the adverse effects associated with recreation and ORV use. Specifically, we believe that incidental take of piping plover is anticipated from the abandonment of one nest each year over the life of the project for a total of 50 nests over the life of the project and the death of one chick every 5 years for a total of 10 chicks over the life of the project. Incidental take to red knots is anticipated due to lost foraging opportunities amounting to 2 red knots each year over the life of the project

If, during the course of the action, the levels of incidental take are exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

TABLE 3.—Amount and type of anticipated incidental take.

Species	Amount of Take Anticipated (either in habitat or individuals)	Life Stage When Take is Anticipated	Type of Take	Take is Anticipated as a Result of	Total over 50-year Project Life
Piping Plover	27 pairs over 50 yrs	Adults	Harm	Reduction in foraging; Disturbance to breeding activities; Disturbance from construction activities; Habitat modification affecting nest site; Increased recreational disturbance; Increased predation	27 pairs
Piping Plover	24 Individuals over 50 yrs	Adults	Harm	Disturbance from construction activities	24 individuals
Piping Plover	2 nests/yr	Eggs	Harm	Increased predation; Increased recreation and ORV use	100 nests
Piping Plover	3 chicks/ nourishment cycle, 2-yr benthic recovery; 3 chicks/yr; 1 chick/5 yrs	Chicks	Harm	Reduction in foraging; Increased predation; Increased recreation and ORV use	238 chicks
				Total Incidental Take of Piping Plovers	27 pairs plus 24 individuals, 100 nests, and 238

					chicks/50 yrs
Red Knot		Adults or First-year birds	Harm	Reduction in foraging area and quality; Disturbance from construction activities	263 red knots
				Total Incidental Take of Red Knot	263 red knots

XIV. EFFECT OF THE TAKE

A. Piping Plover and Red Knot

The Service has determined that the level of take anticipated, as described above, from the proposed action is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

XV. REASONABLE AND PRUDENT MEASURES

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

A comprehensive report describing the actions taken to implement the RPMs and terms and conditions associated with this incidental take statement shall be submitted to the Service's Long Island Field Office by January 15 of the year following completion of all required surveys.

In order to determine if the amount of take due to harm from indirect impacts on habitat is approached or exceeded, the Corps shall ensure the implementation of the terms and conditions outlined below.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of piping plover and red knot:

1. Reduce adverse effects to piping plover and red knot from construction and maintenance of composite seawall/dune, dune grass planting, sand fence installation, artificial beach, groin construction, and HFFRRF and NNBF projects;

2. Monitor pre-, concurrent, and post-habitat conditions in the action area;

3. Monitor implementation of avoidance and minimization measures and report to our office. (50 CFR 402.14[i][3]) requires federal agency or applicant to report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.);

4. Ensure that all project engineers, contractors, and construction staff are fully informed of and compliant with all conservation measures contained in the project description, RPMs, and terms and conditions; and

5. Ensure that NYCDPR, state, and Service field staff have continued access to all portions of the project area necessary to carry out the endangered species management over the life of the project.

XVI. TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary and apply to the piping plover and red knot.

1. **Terms and Conditions for Reasonable and Prudent Measure 1** (Reduce adverse effects from construction and maintenance of composite seawall/dune, dune grass planting, sand fence installation, artificial beach, groin construction, and HFFRRF and NNBF projects):

   1.1 The Corps shall provide maps and drawings to the Service, showing the extent of the work zones and all access routes for the first element of construction at least 30 days prior to initial construction. Subsequent construction phase work zones and access route maps will also be provided 30 days prior to construction.

   1.2 The Corps shall remove any construction material or equipment staged or stored within delineated breeding areas between Beach 19th Street and Beach 67th Street (or other known breeding areas based on LICWS data and areas where plovers exhibit territorial, courtship, nesting, and brood-rearing activities) by April 1 of any given year over the life of the project and pre-migration staging areas.

1.3 During construction, the Corps shall work with the NYCDPR and the NPS to ensure that plover breeding habitat from Beach 19th Street to Beach 67th Street, and 500 m from breeding areas in Jacob Riis and Fort Tilden Parks is protected during construction activities from April 1 to September 1 with symbolic fencing, signs, etc.

1.4 If construction occurs during the piping plover season, the Corps shall establish no construction activity zones from Beach 14th Street to Beach 74th Street (this includes a 500-m buffer for protection of breeding adults early in the season), and 500 m on either side of the western end of the western taper by April 1 of any given year. To protect plover chicks, this buffer shall be increased to 1,000 m one week before the first nest is scheduled to hatch.

Should pre-and during-project monitoring (discussed below) establish plover presence extending either west of Beach 67th Street or east of Beach 169th Street, then the Corps shall extend the buffer area from the new location of the plover breeding area to maintain the 500-m buffer.

1.5 If construction on the Oceanside occurs during the red knot migration season (April 1 through November 30), the Corps shall undertake pre-construction and concurrent construction surveys (discussed below). A minimum 500-m buffer shall be used to protect the species from direct disturbance. For the bayside Mid-Rockaway Arverne and Edgemere HFFRRFs, the Corps shall monitor construction activities from May 1 through November 30 and implement a 500-m buffer around red knots observed for at least fifteen minutes.

1.6 The Corps shall conduct renourishment, repair, construction and maintenance of the composite seawall, walkover, vehicle access points, groins, and other structures using a 500-m buffer until one week before the first nest hatches. A 500-m buffer should be used from migrating, staging, or other nonbreeding plovers after September 1, and from red knots at all times. Exposed composite seawall or groin rocks above spring hide tide must be covered between Beach 9th Street and Beach 82nd Street prior to April 1 of any given year over the life of the project.

1.7 A vegetation planting plan for the artificial dune shall be coordinated with and approved by the Service. At a minimum, it shall incorporate a mix of native dune plant species (no woody vegetation) and not be limited to a single grass species. Plantings should be made in a random manner and not rows with uniform spacing. The plantings should mimic natural dune vegetation in the region in species diversity, density, and spacing. The dune planting plan shall be completed and approved 3 months prior to initial construction.

1.8 The beach placement areas shall be finished to the same backshore and foreshore slopes as the surrounding natural or design beach profiles depending on location.

The area shall be graded at a gentle uniform slope with no piles, ridges, or holes left in the final graded beach placement materials.

1.9 If there are no breeding or chick foraging activities by July 15 in either of the two plover breeding areas or within the buffer zones, then work may proceed in those areas provided a 500-m buffer is maintained to protect nonbreeding plovers and red knots, and post fledge plovers.

1.10 The Corps shall work with the NYCDPR and the NPS to ensure that all suitable piping plover breeding habitat with a recent history (last five years) of plover breeding is protected by April 1 of each year to address the adverse effects associated with the expected increase in recreation.

2. **Terms and Conditions for Reasonable and Prudent Measures 2 and 3 - MONITORING** (50 CFR 402.14[i][3] requires federal agency or applicant to report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.)

2.1 The Corps shall develop and implement pre-, concurrent, and post-construction monitoring plans for piping plover and red knot and their habitats with guidance and approval from the Service. This shall be completed and submitted to the Service 3 months before initial construction for approval. The basic elements of the monitoring plan shall include transect locations, frequency of monitoring, habitat type, construction activities that are present less than and greater than 500 m, time of day, tidal phase, etc.

2.2 The Corps shall document the topography, area, and habitat characteristics of the 3.5 ac of dune/ephemeral pool habitat present south of Beach 19th Street to determine whether it meets the Corps' project design profile. If so, construction in the dune and ephemeral pool habitats shall be avoided. Heavy equipment shall avoid the ephemeral pool areas to prevent any compaction of the sediment and crushing of the invertebrate fauna that are the prey base of these species. If habitat loss is unavoidable, then the Corps shall develop a restoration and implementation plan, in coordination with the Service, 3 months prior to initial construction.

2.3 As part of the Corps Inspection of Completed Works Program and the local sponsor's OMRR&R responsibilities, the Corps shall annually monitor the beach placement areas, beach profiles, composite seawalls, and new/modified groins to identify any erosion hotspots or areas where the project is not performing as intended to better inform any possible needed changes to the renourishment cycles. Any sandfill used for associated remedial actions shall be same sand grain size, percent composition, and sorting coefficient as the existing, naturally-occurring substrate in the project area.

2.4 The Corps shall devise an early successional beach habitat restoration plan for the berm habitat between Beach 9th and Beach 82nd in coordination with the Service. The plan shall be finalized 3 months prior to initial construction of the project. Ten percent vegetation coverage shall be the target vegetation density with a threshold action of 17 percent coverage for planning purposes between Beach 9th Street and Beach 82nd Street, so as to keep this in an early successional habitat stage, as this is within the zone of potential chick movement.

2.5 The Corps shall assess the potential for, or actual, erosion associated with hard structures (e.g., groins and rock sills) between Beach 49th Street to 82nd Street, and at Jacob Riis and Fort Tilden Parks that may impact plover habitat, and throughout the ocean and bayside shoreline for red knots as the final designs are developed.

Concurrently, develop a remedial action plan through further coordination with the Service for erosion that causes a loss of breeding, foraging, or roosting habitat. The plan shall be completed 3 months prior to initial construction.

2.6 The Corps shall undertake monitoring of wrack and wrack invertebrates in the intertidal zone, and berm based on a sampling program that has been devised in consultation with, and agreed to, by the Service prior to its implementation. The information collected during this monitoring program shall be used to adaptively manage the operation and maintenance phases of the project to further avoid and minimize take. The monitoring plan should include, but not be limited to, the response of the wrack and wrack invertebrates during and after sand placement within breeding and pre-migration staging, and foraging areas, including such information as estimates of total recovery time, recovery rates, abundance, biomass, diversity, and composition of prey items, and spatial coverage of wrack. The plan shall be finalized 3 months prior to initial construction of the project.

2.7 The Corps shall develop a biological monitoring program for the action area, to be approved by the Service, in coordination with the NYCDPR and the NPS, and implemented by the Service or Service-approved entity to address the impacts of the dune, berm, composite seawall, and groin construction on plover and red knot biology and ecology. The monitoring program shall span the pre-initial construction, initial construction, and a determined period of the renourishment phases of the project. The monitoring program shall evaluate red knot and plover population and behavioral responses to habitat changes in the action area, such as avoiding existing foraging, roosting, or breeding areas, as a whole, or as in the case of plovers, any shifts in the species distribution relative to the hard and soft shoreline protection structures. The plan shall be finalized 3 months prior to initiation of the biological monitoring plan.

2.8 By April 1 of each year, the Corps shall monitor and ensure that the subaerial extent (from spring hide tide to the base of the dune) of the proposed and

extended groins are covered following initial construction and then during the maintenance phases of the project to minimize habitat fragmentation and ensure plover chicks are able to traverse nesting and foraging areas. (A monitoring component to evaluate species habitat use relative to the new groins shall be made part of the biological monitoring plan requirements).

2.9 Between Beach 16th Street and Beach 82nd Street, the Corps shall reduce the potential of plover chicks or eggs from falling or getting trapped in crevices of the composite seawall and shall reduce potential of garbage collecting in crevices thus attracting predators.

2.10 To reduce the anticipated level of take due to increases in disturbances from recreational activities, the Corps shall, in coordination with the NYCDPR and the NPS, ensure the full implementation of the Service's "Guidelines for Managing Piping Plovers on Recreational Beach in Order to Avoid Take Under the Endangered Species Act" (found in USFWS 1996a) in the project area, including working with the NYCDPR and the NPS to ensure implementation and enforcement of plover management activities over the life of the project.

2.11 The Corps shall work with the NYCDPR and the NPS, in coordination with the Service, in developing a predator management plan for the action area where predators of piping plovers are identified, management objectives designed and implemented, and results are documented.

2.12 As the project involves nighttime construction activities and no night time monitoring is proposed, all construction personnel and the Service shall be provided a daily report at the end of each day providing the location of all breeding activities, including territories, courtship areas, nest building areas, nest sites and chick rearing areas. All lights shall be directed away from these areas.

2.13 The Corps shall undertake monitoring of physical beach parameters that requires the use of "sleds" or other beach equipment outside of the plover breeding season (April 1 to September 1) or not within 500 m of breeding adults or 1,000 m of chicks. When undertaking this work, a 500-m buffer should be used from migrating, staging, or other nonbreeding plovers whenever encountered. The 500-m buffer shall be applied to red knots from April 1 through November 30 on both the ocean- and bay-side action areas.

2.14 Report the extent of direct incidental take of piping plover and red knot to the Service within 30 days of completing construction activities related to the composite seawall and dune, new groins or groin extensions, beachfill, renourishment, HFFRRFs, or NNBFs. Through the Endangered Species Management Program, document annually the extent of observed indirect incidental take of piping plovers from recreational activities and beach management practices. In the event of take, a system of notification shall be implemented following the guidelines:

(a) Exercise care in handling any specimens of dead piping plover adults, young, or non-viable eggs and adult red knot to preserve biological material in the best possible state. In conjunction with the preservation of any specimens, the finder is responsible for ensuring that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. Finding dead or non-viable specimens does not imply enforcement proceedings pursuant to the Act. Reporting dead specimens is required for the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

(b) Upon locating a dead piping plover or red knot, initial notification shall be made to the following Service's Law Enforcement office:

Resident Agent in Charge
USFWS
Office of Law Enforcement
70 East Sunrise Highway, Suite 419
Valley Stream, NY 11581
516-825-3950

and

USFWS
Long Island Field Office
340 Smith Road
Shirley, NY 11967
631-286-0485

3. **Terms and Conditions for Reasonable and Prudent Measure 4** (Ensure construction contractors informed of all conservation measures)

3.1. A construction field meeting will be held on or before March 1 and should include the local cost sharing sponsors, a representative from the Corps, Service, the qualified monitors, and the construction crew to provide all information on avoidance and minimization measures and reasonable and prudent measures that must be implemented. A checklist shall be provided to ensure that all conservation measures are followed.

The Corps shall provide oversight and coordination with all project engineers, contractors, and construction staff to inform and provide to them all conservation measures contained in the project description, RPMs, and terms and conditions to ensure full compliance.

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

4. Terms and Conditions for Reasonable and Prudent Measure 5 (Ensure that NYCDPR, state, and Service field staff have continued access to all portions of the project area necessary to carry out the endangered species management over the life of the project)

4.1 The Corps shall ensure the NYCDPR, the NYSDEC, the Service, and the NPS have continued access to all portions of the project area necessary to carry out endangered species management over the life of the project.

XVII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

A. Piping Plover

1. The Corps should identify areas on Long Island within their Civil Works program where natural process can form bay to overwash habitat and promote optimal plover habitat formation. The focus should be on areas outside of sites that already provide opportunities for these types of habitat development.

2. The Corps should identify mechanisms to contribute to plover protection measures, either by providing equipment, personnel, or funds, to local land managers within areas affected by their Civil Works projects.

3. The Corps should work with the Service, state, local municipalities, and nongovernmental organizations to develop an outreach program to promote the recovery of piping plover.

B. Red Knot

1. The Corps should avoid dredging submerged and emergent shoals to preserve beach dynamics and shorebird habitat on the bayside.

2. The Corps should avoid or reduce damage to wrack during project construction by requiring that vehicles drive above or below the primary wrackline.

3. The Corps should coordinate with the NYCDPR to protect wrack by ceasing or reducing wrack removal during beach-cleaning activities.

4. The Corps should incorporate provisions prohibiting introduction of (and requiring removal of existing) invasive plant species that degrade beach and dune habitats.

5. The Corps should coordinate with the NPS and the NYCDPR to place symbolic fencing around or otherwise protect roosting and staging areas during the time of year when red knots are present.

6. The Corps should coordinate with the NYCDPR to reduce disturbance by prohibiting dogs on the beach during the time of year when red knots are present.

C. Seabeach Amaranth

1. Both the NYCDPR and the NPS currently conduct surveys and erect symbolic fencing and signage to protect seabeach amaranth. Additionally, these agencies manage several state-listed shorebirds, including the common tern, least tern, and black skimmer along the ocean beach shoreline within the action area. In order to avoid duplicative efforts and minimize the potential to disturb nesting shorebirds during seabeach amaranth surveys, the Corps should coordinate with the NYCDPR and the NPS prior to implementing any surveys or installation of fencing within the action area.

XVIII. REINITIATION NOTICE

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

XIX. CONSULTATION HISTORY

The history of the consultation request includes any informal consultation, prior formal consultations on the action, documentation of the date consultation was initiated, a chronology of subsequent requests for additional data, extensions, and other applicable past or current actions (USFWS and National Marine Fisheries Service 1998).

August 8, 2017	The Corps requests via electronic correspondence the Service's point(s) of contact for the endangered species consultation.
August 9, 2017	The Service responds to the Corps' request for points of contact.
July 10, 2018	The Corps transmits the Draft BA via electronic correspondence to the Service.
July 16, 2018	The Service provides initial comments on the BA to the Corps via electronic correspondence.
August 6, 2018	The Corps transmits the Revised Draft BA to the Service via electronic correspondence.
September 25, 2018	The Service provides additional comments/questions on the revised BA.
September 27, 2018	The Corps responds via electronic correspondence to the Service's September 25th questions and requests the Service's concurrence with a not likely to adversely affect (NLTAA) determination.
September 27, 2018	The Service responds via electronic correspondence to the Corps to the Corps' NLTAA concurrence request. The Service provides a justification for formal consultation for the piping plover, seabeach amaranth, and red knot.
September 27, 2018	The Corps transmits a letter to the Service requesting initiation of formal consultation for the piping plover and seabeach amaranth and concurrence with their NLTAA determination for the red knot.
October 15, 2018	Letter from the Service to the Corps acknowledging receipt of the Corps' September 27, 2018, initiation of formal consultation.
October 24, 2018	Electronic correspondence from the Service to the Corps requesting a description of the measures proposed to protect federally listed species (no-work buffers and TOY restrictions).
October 24, 2018	The Corps, via electronic correspondence, provides a description of endangered species protection measures.

October 25, 2018	The Service, via electronic correspondence to the Corps, requests clarification on proposed avoidance and minimization measures and a justification for the Corps' likely to adversely affect (LTAA) determination for the red knot.
November 1, 2018	The Corps, via electronic correspondence to the Service, transmits their LTAA determination for the red knot.
November 20, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding proposed improvements to the groins at Jacob Riis Park.
December 3, 2018	The Corps, via electronic correspondence, identifies remedial actions and monitoring for downdrift erosion.
December 10, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding the preservation/restoration of interdunal system south of Beach 19th Street.
December 11, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding downdrift erosion between Beach 49th Street and Beach 60th Street.
December 12, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding the project life and duration of impacts.
December 13, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding shoreline alignment/post-construction monitoring.
December 14, 2018	The Corps, via electronic correspondence, responds to the Service inquiries regarding design of nature-based features.
December 17, 2018	The Corps, via electronic correspondence, responds to the Service's inquiries regarding design of nature-based features.
December 20, 2018	The Service, via electronic correspondence, provides draft Avoidance and Minimization Measures for the Corps' consideration.
December 21, 2018	The Corps, via electronic correspondence, responds to the Service's draft Avoidance and Minimization Measures.
February 7, 2019	The Service, via electronic correspondence to the Corps, requests information on thresholds for remedial actions.
February 20, 2019	The Corps, via electronic correspondence, responds to the Service regarding the thresholds for remedial actions.

February 21, 2019	The Corps, via electronic correspondence, responds to the Service's inquiries regarding TOY restrictions for red knots.
February 27, 2019	The Service, via electronic correspondence to the Corps, transmits the Draft RPMs and Terms and Conditions.
March 1, 2019	The Corps, via electronic correspondence, provides their comments on the Draft RPMs and Terms and Conditions to the Service.
March 7, 2019	The Service, via electronic correspondence to the Corps, responds to the Corps' comments on the Draft RPMs and Terms and Conditions.
March 13, 2019	The Corps, via electronic correspondence, provided additional comments on the Draft RPMs and Terms and Conditions to the Service.
March 19, 2019	The Service and Corps, via several electronic correspondences, coordinated on the development of a beach management plan; the sequence of construction activities; specifics of piping plover monitoring; and NPS' input on the Reasonable and Prudent Measures.
March 20, 2019	The Service, via electronic correspondence to the Corps, provided a list of tasks/deliverables for each agency to complete as part of this consultation. The Service and Corps also coordinated on proposed beach/berm widths and vegetation management.
March 26, 2019	The Corps, via electronic correspondence, provided a breakdown of the daily schedule of construction activities.

XX. LITERATURE CITED

Alegria-Arzaburu, A.R., I. Mariño-Tapia, R. Silva, and A. Pedrozo-Acuña. 2013. Post-Nourishment Beach Scarp Morphodynamics. *Journal of Coastal Research* Special Issue 65.

Anders, F.J., and S.P. Leatherman. 1987. Disturbance of Beach Sediment by Off-Road Vehicles. *Environmental Geology and Water Science*s 9:183–189.

Andersson, M., J. Wallander, and D. Isaksson. 2009. Predator Perches: A Visual Search Perspective. *Functional Ecology* 23:373–379.

Bent, A.C. 1929. Life Histories of North American Shorebirds. *U.S. Natural Museum Bulletin* 146:232–246.

Bilkovic, D.M., and M.M. Mitchell. 2013. Ecological Trade Offs of Stabilized Saltmarshes as a Shoreline Protection Strategy: Effects of Artificial Structures on Macrobenthic Assemblages. *Ecological Engineering* 61:469–481.

Bilkovic, D.M., M. Mitchell, P. Mason, and K. Duhring. 2016. The Role of Living Shorelines as Estuarine Habitat Conservation Strategies. Special Issue (Conserving Coastal and Estuarine Habitats) in *Coastal Management Journal* 44:161–174.

Bosch, J., C. Foley, L. Lipinski, C. McCarthy, J. McNamara, A. Naimaster, A. Raphael, A. Yang, and A. Baldwin. 2006. Constructed Wetlands for Shoreline Erosion Control: Field Assessment and Data Management. Final Report. Baltimore, Maryland: Maryland Department of the Environment, Wetlands and Waterways Program. 76 pp.

Burger, J. 1991. Foraging Behavior and the Effect of Human Disturbance on the Piping Plovers (*Charadrius melodus*). *Journal of Coastal Research* 7:39–52.

Cairns, W.E. 1977. Breeding Biology of Piping Plovers in Southern Nova Scotia. M.S. Thesis. Dalhousie University, Halifax, Nova Scotia. 115 pp.

Climate Change Science Program (also referenced as CCSP). 2009. Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. J.G. Titus, coordinating lead author. Environmental Protection Agency, Washington, D.C.

Cohen, J.B. 2005. Factors Limiting Piping Plover Nesting Pair Density and Reproductive Output on Long Island, New York. Ph.D. Dissertation. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 251 pp.

Cohen, J.B., E.H. Wunker, and J.D. Fraser. 2008. Substrate and Vegetation Selection by Nesting Piping Plovers. *The Wilson Journal of Ornithology* 120(2):404–407.

Cohen, J.B., L.M. Houghton, and J.D. Fraser. 2009. Nesting Density and Reproductive Success of Piping Plovers in Response to Storm- and Human- Created Habitat Changes. *Wildlife Monographs* 173:1–24.

Colwell, M.A., S.J. Hurley, J.N. Hall, and S.J. Dinsmore. 2007. Age-Related Survival and Behavior of Snowy Plover Chicks. *The Condor* 109:638–647.

Coutu, S.D., J.D. Fraser, J.L. McConnaughey, and J.P. Loegering. 1990. Piping Plover Distribution and Reproductive Success on Cape Hatteras National Seashore. Unpublished Report submitted to the National Park Service. 67 pp.

Cross, R.R. 1990. Monitoring Management and Research of the Piping Plover at Chincoteague National Wildlife Refuge. Unpublished Report. Virginia Department of Game and Inland Fisheries, Richmond, Virginia. 68 pp.

Defeo, O., A. McLachlan, D.S. Schoeman, T. Schlacher, J.E. Dugan, A. Jones, M. Lastra, and F. Scapini. 2009. Threats to Sandy Beach Ecosystems: A Review. *Estuarine, Coastal, and Shelf Science* 81(1):1–12.

DeRose-Wilson, A.L., K.L. Hunt, J.D. Monk, D.H. Catlin, S.M. Karpanty, and J.D. Fraser. 2018. Piping Plover Chick Survival Negatively Correlated with Beach Recreation. *Journal of Wildlife Management* 82(8):1608–1616.

Douglas, B.C., M. Kearney, and S. Leatherman. 2001. Sea-Level Rise: History and Consequences. Academic Press, Inc., New York, New York.

Dugan, J.E., D.M. Hubbard, M.D. McCrary, and M.O. Pierson. 2003. The Response of Macrofauna Communities and Shorebirds to Macrophyte Wrack Subsidies on Exposed Sandy Beaches of Southern California. *Estuarine, Coastal, and Shelf Science* 58:25–40.

Dugan, J.E., and D.M. Hubbard. 2010. Ecological Responses to Coastal Armoring on Exposed Sandy Beaches. *Shore & Beach* 74(1):10–16.

Dugan J.E., L. Airoldi, M.G. Chapman, S.J. Walker, and T. Schlacher. 2011. *In* E. Wolanski and D. McLusky, eds. Estuarine and Coastal Structures: Environmental Effects, a Focus on Shore and Nearshore Structures. Treatise on Estuarine and Coastal Science. Academic Press, pp. 17–41.

Duhring, K.A. 2008. A Comparison of Structural and Nonstructural Methods for Erosion Control and Providing Habitat in Virginia Saltmarshes. Proceedings of the 2006 Living Shoreline Summit (Williamsburg, Virginia), Gloucester Point, Virginia: Coastal Resources Commission (CRC) Publication No. 08-164, pp. 41–47.

eBird.org. 2018. eBird: An online database of bird distribution and abundance [web application]. Cornell Lab of Ornithology, Ithaca, New York. Available online at: <http://www.ebird.org/>.

Elias-Gerken, S.P. 1994. Piping Plover Habitat Suitability on Central Long Island, New York Barrier Islands. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 247 pp.

Elias, S.P., J.D. Fraser, and P.A. Buckley. 2000. Piping Plover Brood Foraging Ecology on New York Barrier Islands. *Journal Wildlife Management* 64(2):346–354.

Flemming, S.P., R.D. Chiasson, P.C. Smith, P.J. Austin-Smith, and R.P. Bancroft. 1988. Piping Plover Status in Nova Scotia Related to its Reproductive and Behavioral Responses to Human Disturbance. *Journal of Field Ornithology* 59(4):1–330.

Galbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington, and G. Page. 2002. Global Climate Change and Sea-Level Rise: Potential Losses of Intertidal Habitat for Shorebirds. *Waterbirds* 25:173–183.

Goldin, M.R. 1993. Effects of Human Disturbance and Off-Road Vehicles on Piping Plover Reproductive Success and Behavior at Breezy Point, Gateway National Recreation Area, New York. M.S. Thesis. University of Massachusetts, Department of Forestry and Wildlife Management.

Gomez-Serrano, A.M., and P. Lopez-Lopez. 2014. Nest Site Selection by Kentish Plover Suggests a Trade-Off between Nest-Crypsis and Predator Detection Strategies. PLOS One 9(9):1–9.

Hoopes, E.M. 1993. Relationship Between Human Recreation and Piping Plover Foraging Ecology and Chick Survival. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 106 pp.

Hoopes, E.M., C.R. Griffin, and S.M. Melvin. 1992. Atlantic Coast Piping Plover Winter Distribution Survey. Unpublished Report submitted to the USFWS, Sudbury, Massachusetts. 6 pp.

Hopkinson, C.S., A.E. Lugo, M. Alber, A.P. Covich, and S.J. Van Bloem. 2008. Forecasting Effects of Sea-Level Rise and Windstorms on Coastal and Inland Ecosystems. *Frontiers in Ecology and Environment* 6:255–263.

Hubbard, D.M., and J.E. Dugan. 2003. Shorebird Use of An Exposed Sandy Beach in Southern California. *Estuarine, Coastal, and Shelf Science* 58:41–54.

Intergovernmental Panel on Climate Change [IPCC]. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change: Cambridge University Press, Cambridge, United Kingdom, and New York, New York.

Karpanty, S.M., J. Cohen, J.D. Fraser, and J. Berkson. 2011. Sufficiency of Horseshoe Crab Eggs for Red Knots During Spring Migration Stopover in Delaware Bay, United States of America. *Journal of Wildlife Management* 75(5):984–994.

Kluft, J.M., and H.S. Ginsburg. 2009. The Effect of Off-Road Vehicles on Barrier Beach Invertebrates at Cape Cod and Fire Island National Seashores. Technical Report NPS/NER/NRTR—2009/138. Boston, Massachusetts.

Koivula, K., and A. Ronka. 1998. Habitat Deterioration and Efficiency of Antipredator Strategy in a Meadow-Breeding Wader, Temminck's Stint (*Calidris temminckii*). *Oecologia* 116:348–355.

Loegering, J.P. 1992. Piping Plover Breeding Biology, Foraging Ecology, and Behavior on Assateague Island National Seashore, Maryland. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 247 pp.

Loegering, J.P., and J.D. Fraser. 1995. Factors Affecting Piping Plover Chick Survival in Different Brood-Rearing Habitats. *Journal of Wildlife Management* 59(4):646–655.

MacIvor, L.H. 1990. Population Dynamics, Breeding Ecology, and Management of Piping Plovers on Outer Cape Cod, Massachusetts. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 100 pp.

Massachusetts Barrier Beach Task Force. 1994. Guidelines for Barrier Beach Management in Massachusetts. Massachusetts Coastal Zone Management Program, Boston, Massachusetts. 265 pp.

Murdock, N. 1993. Endangered and Threatened Wildlife and Plants: *Amaranthus pumilus* (Seabeach Amaranth) Determined to be Threatened. U.S. Department of the Interior, Fish and Wildlife Service, *Federal Register* 58(65):18035–18042.

New York City Department of Parks and Recreation [NYCDPR]. 2017. Rockaway Beach Endangered Species Nesting Area. 2017 Final Report. Wildlife Unit. 31 pp.

Nicholls, J.L. 1989. Distribution and Other Ecological Aspects of Piping Plovers (*Charadrius melodus*) Wintering Along the Atlantic and Gulf Coasts. M.S. Thesis. Auburn University, Auburn, Alabama. 150 pp.

Niles, L.J., H.P. Sitters, A.D. Dey, P.W. Atkinson, A.J. Baker, K.A. Bennett, R. Carmona, K.E. Clark, N.A. Clark, and C. Espoza. 2008. Status of the Red Knot (*Calidris canutus rufa*) in the Western Hemisphere. *Studies in Avian Biology* 36:1–185.

Patterson, M.E. 1988. Piping Plover Breeding Biology and Reproductive Success in Assateague Island. M.S. Thesis. Virginia Polytechnic Institute and State University, Blacksburg, Virginia. 131 pp.

Peters, K.A., and D.L. Otis. 2007. Shorebird Roost-Site Selection at Two Temporal Scales: Is Human Disturbance a Factor? *Journal of Applied Ecology* 44:196–209.

Peterson, C.H., and M.J. Bishop. 2005. Assessing the Environmental Impacts of Beach Nourishment. *BioScience* 55(10):887–896.

Peterson, C.H, D.H.M. Hickerson, and G.G. Johnson. 2000. Short-Term Consequences of Nourishment and Bulldozing on the Dominant Large Invertebrates of a Sandy Beach. *Journal of Coastal Research* 16(2):368–378.

Peterson, C.H., M.J. Bishop, G.A. Johnson, L.M. D'Anna, and L.M. Manning. 2006. Exploiting Beach Filling as an Unaffordable Experiment: Benthic Intertidal Impacts Propagating Upwards to Shorebirds. *Journal of Experimental Marine Biology and Ecology* 338:205–221.

Pfister, C., B.A. Harrington, and M. Lavine. 1992. The Impact of Human Disturbance on Shorebirds at a Migration Staging Area. *Biological Conservation* 60(2):115–126.

Prosser, D.J., J.L. Nagel, S. Howlin, P.R. Marban, D.D. Day, and R.M. Erwin. 2017. Effects of Local Shoreline and Sub Estuary Watershed Condition on Waterbird Community Integrity: Influences of Geospatial Scale and Season in the Chesapeake Bay Region. Estuaries and Coasts. Available online at: <https://doi.org/10.1007/s12237-017-0288-0>.

Rahmstorf, S., A. Cazenave, J.U. Church, J.E. Hansen, R.F. Keeling, D.E. Parker, and R.C.J. Somerville. 2007. Recent Climate Observations Compared to Projections. *Science* 316:709.

Rogers, D.I. 2003. High-Tide Roost Choice by Coastal Waders. *Wader Study Group Bulletin* 100:73–79.

Rogers, D.I., T. Piersma, and C.J. Hassell. 2006. Roost availability may constrain shorebird distribution: Exploring the energetic costs of roosting and disturbance around a tropical bay. *Biological Conservation* 133:225–235.

Sacco, J.N., E.D. Seneca, and T.R. Wentworth. 1994. Infaunal Community Development of Artificially Established Saltmarshes in North Carolina. *Estuaries* 17:489–500.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason. D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. *Estuaries* 25(2):149–164.

Schlacher, T.A., and L.M.C. Thompson. 2008. Physical Impacts Caused by Off-Road Vehicles (ORVs) to Sandy Beaches: Spatial Quantification of Car Tracks on an Australian Barrier Island. *Journal of Coastal Research* 24:234–242.

Schlacher, T.A., L.M.C. Thompson, and S.J. Walker. 2008. Mortalities Caused by Off-Road Vehicles (ORVs) to a Key Member of Sandy Beach Assemblages, the Surf Clam *Donax deltoids*. *Hydrobiologia* 610:345–350.

Schlacher, T.A., D. Richardson, and I. McLean. 2008. Impacts of Off-Road Vehicles (ORVs) on Macrobenthic Assemblages on Sandy Beaches. *Environmental Management* 41:878–892.

Schlacher, T.A., L.K. Carracher, N. Porch, R.M. Connolly, A.D. Olds, B.L. Gilby, K.B. Ekanayake, B. Maslo, and M.A. Weston. 2016. The Early Shorebird Will Catch Fewer Invertebrates on Trampled Sandy Beaches. *PLOS One* DOI:10.1371/journal.pone.0161905. August 26, 2016. pp. 1–13.

Sheppard, N., K.A. Pitt, and T.A. Schlacher. 2009. Sub-Lethal Effects of Off-Road Vehicles (ORVs) on Surf Clams on Sandy Beaches. *Journal of Experimental Marine Biology and Ecology* 380:113–118.

Strauss, E. 1990. Reproductive Success, Life History Patterns, and Behavioral Variation in Populations of Piping Plovers Subjected to Human Disturbance (1982-1989). Ph.D. Dissertation. Tufts University, Medford, Massachusetts. 143 pp.

Subramanian, B., E. Slear, K.M. Smith, and K.A. Duhring. 2008. Current Understanding of the Effectiveness of Nonstructural and Marsh Sill Approaches. Proceedings of the 2006 Living Shoreline Summit (Williamsburg, Virginia), Coastal Resources Commission (CRC) Publication No. 08-16, pp. 35–37.

U.S. Army Corps of Engineers [USACE]. 2018a. Draft Final, Integrated Hurricane Sandy General Reevaluation Report and Environmental Impact Statement, Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay. New York District, New York, New York. August 2018. Available online at: <https://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/East-Rockaway-Inlet-to-Rockaway-inlet-Rockaway-Beach>.

_____. 2018b. Draft Final, Integrated Hurricane Sandy General Reevaluation Report and Environmental Impact Statement, Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay. Appendix D Environmental Compliance, Attachment D2a Endangered Species Act Compliance Biological Assessment for: Piping Plover (*Charadrius melodus)*; Seabeach Amaranth (*Amaranthus pumilus*); Rufa Red Knot (*Calidris canutus*). August 2018. Available online at: <https://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/East-Rockaway-Inlet-to-Rockaway-inlet-Rockaway-Beach>.

U.S. Climate Change Science Program [CCSP]. 2009. Coastal Sensitivity to Sea-Level Rise: A focus on the Mid-Atlantic Region. U.S. Climate Change Science Program synthesis and assessment product 4.1. U.S. Geological Survey, Reston, Virginia. Available online at: <http://downloads.globalchange.gov/sap/sap4-1/sap4-1-final-reportall.pdf>.

U.S. Fish and Wildlife Service [USFWS]. 1996a. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.

_____. 1996b. Recovery Plan for Seabeach Amaranth (*Amaranthus pumilus*) Rafinesque. U.S. Department of the Interior, Fish and Wildlife Service, Atlanta, Georgia. 55 pp., plus Appendices.

_____. 2009. Piping Plover (*Charadrius melodus*) 5–Year Review: Summary and Evaluation. Northeast Regional Office, Hadley, Massachusetts. Available online at: <http://www.fws.gov/northeast/endangered/pdf/piping_plover_five_year_review_and_summary.pdf>. Accessed: March 25, 2014.

_____. 2014. Rufa Red Knot Background Information and Threats Assessment Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*) [Docket No. FWS–R5–ES–2013–0097; RIN AY17]. USFWS Northeast Region New Jersey Field Office Pleasantville, New Jersey. 383 pp.

_____. 2018. Seabeach Amaranth (*Amaranthus pumilus*) 5-Year Review: Summary and Evaluation. USFWS Southeast Region, Raleigh Ecological Service Field Office, Raleigh, North Carolina. 57 pp.

U.S. Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS]. 1998. Endangered Species Consultation Handbook. 315 pp.

Weakley, A.S., and M. Bucher. 1992. Status Survey of Seabeach Amaranth (*Amaranthus pumilus* Rafinesque) in North and South Carolina, Second Edition (After Hurricane Hugo). Report to North Carolina Plant Conservation Program, North Carolina Department of Agriculture, Raleigh, North Carolina, and Endangered Species Field Office, USFWS, Asheville, North Carolina. 178 pp.

Webber, A.F. 2011. How do Human Disturbance, Beach Characteristics, and Coastal Engineering Affect Snowy Plover (*Charadrius alexandrinus*) Habitat Selection of the Florida Panhandle? A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Biology Boise State University. 78 pp.

Welty, J.C. 1982. *The Life of Birds*. Saunders College Publishing, New York. 754 pp.

Wheeler, N.R. 1979. Effects of Off-Road Vehicles on the Infauna of Hatches Harbor, Cape Cod National Seashore, Massachusetts. University of Massachusetts/National Park Service Cooperative Research Unit Report No. 28. Unpublished Report by the National Parks Service Cooperative Research Unit.

Wilcox, L. 1959. A Twenty-Year Banding Study of the Piping Plover. *Auk* 76:129–152.

Zajac, R.N., and R.B. Whitlatch. 2003. Community and Population-Level Responses to Disturbance in a Sandflat Community. *Journal of Experimental Marine Biology and Ecology* 294(1):101–125.

PERSONAL COMMUNICATIONS

Mazey, D. 2019. Section Chief, Watershed & Navigation. Email of March 18, 2019. U.S. Army Corps of Engineers, New York District, New York.

Mazey, D. 2019. Section Chief, Watershed & Navigation. Email of February 20, 2019. U.S. Army Corps of Engineers, New York District, New York.

Mazey, D. 2019. Section Chief, Watershed & Navigation. Email of February 13, 2019. U.S. Army Corps of Engineers, New York District, New York.