BIOLOGICAL OPINION ON THE EFFECTS OF RECURRENT MAINTENANCE DREDGING OF THE SANDY HOOK CHANNEL, MONMOUTH COUNTY, NEW JERSEY ON FOUR FEDERALLY LISTED SPECIES

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October 2017

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INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion in accordance with Section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.) (ESA), on the effects of recurrent maintenance dredging of the Sandy Hook Federal Navigation Channel (Sandy Hook Channel, or channel), Monmouth County, New Jersey, to be carried out or authorized by the U.S. Army Corps of Engineers, New York District (Corps) over the next 20 years. This Programmatic Biological Opinion (PBO) also concludes after-the-fact formal consultation on a 2015 Corps dredging action for which emergency consultation was conducted. The dredging actions covered by this PBO are limited to those in the vicinity of the Sandy Hook peninsula (Sandy Hook), which is managed by the National Park Service (NPS) as the Sandy Hook Unit of Gateway National Recreation Area. The tip of Sandy Hook, which currently intersects the channel, supports four federally listed (threatened) species: piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), and seabeach amaranth (*Amarantus pumilus*). There is currently no critical habitat designated in New Jersey for any of these species.

Programmatic consultation involves a two-tiered approach. Tier 1 consists of the programmatic consultation on the overall agency program[1] while Tier 2 involves streamlined consultations on individual actions carried out under a program. Individual Corps actions (including authorizations) must continue to undergo individual (Tier 2) consultation to ensure consistency with the Project Description as given in this PBO (including all Conservation Measures), as well as consistency with the Reasonable and Prudent Measures (RPMs) and Terms and Conditions (TCs). Site-specific information for individual dredging actions will also be evaluated by the Service to ensure continued consistency with the conclusions in this PBO regarding effects to listed species. Proposed actions conforming with all provisions of this PBO will receive expedited review by the Service. Individual actions that cannot be designed or carried out to conform to the provisions of this PBO will require separate, individual consultations.

CONSULTATION HISTORY

April 21, 2008	Via letter, the Service concluded informal consultation for maintenance dredging of the channel, which was separated from habitats on Sandy Hook by approximately 500 feet of open water at that time. Work in the section of the channel closest to Sandy Hook, called Reach B, was to be seasonally restricted from March 15 to August 15. The Service updated the consultation in 2009 for additional dredging in Reach B, and noted that future dredging efforts would require further consultation.
June 27, 2011	The Corps issued a Public Notice for proposed maintenance dredging of the Sandy Hook Channel.

[1] Consistent with final regulations published May 11, 2015 (*Federal Register* Vol. 80, No. 90, p. 26845), this PBO evaluates a "mixed programmatic action." As such, the Incidental Take Statement included with this PBO is only for those program actions that are reasonably certain to cause take and are not subject to further Section 7 consultation (*i.e*., the Statement covers the 2015 and 2017 dredging actions only). Additional incidental take resulting from actions subsequently carried out or authorized by the Corps will be assessed in the Tier 2 consultation process.

March 7, 2012	Via letter, the Corps notified the Service that work began in November 2011 but was suspended due to equipment damage. Completion of work was scheduled for March 4 through March 31, 2012.
March 19, 2012	The Corps, the NPS, the New Jersey Division of Fish and Wildlife, and the Service met to discuss the ongoing dredging, which involved removal of material above the Mean Lower Low Water (MLLW) line. The Corps agreed to perform piping plover monitoring until the March 31, 2012 dredging end date. The Corps also agreed to provide security fencing around an approximately 6-foot-high, 200-foot-long scarp near the channel. The Service advised the Corps that re-consultation would be needed for future dredging actions, focused on preclusion of habitat use and formation.
March 30, 2012	The Corps notified the Service that the scarping had been eliminated by natural forces as of March 29, 2012.
September 27, 2012	The Corps, the NPS, and the Service met to discuss next steps.
May 3, 2013	The Corps issued a Public Notice for proposed maintenance dredging of the Sandy Hook Channel.
May 20, 2013	Via letter, the Corps initiated consultation for the 2013 dredging.
June 7, 2013	Via conference call, the Corps, the NPS, and the Service discussed the 2013 dredging, which was scheduled for fall and expected to involve removal of material above the MLLW line. During the course of this and subsequent discussions, the Corps agreed to provide transfer funding to the NPS. In the end, $62,000 was provided to NPS for law enforcement and species monitoring. Projects were also discussed to improve piping plover habitat (*e.g.*, by controlling invasive vegetation) and to use some of the dredged material for a beneficial NPS project (*e.g.*, beach nourishment near a historic structure); however, no such actions were carried out.
February 20, 2014	Via letter, the Service advised the Corps to prepare a Biological Assessment for future dredging activity.
March 18, 2014	The Corps, the NPS, and the Service met to discuss next steps.
May 12, 2014	Via letter, the Corps summarized recent discussions regarding next steps.
May 30, 2014	Via email, the Corps provided a white paper explaining why neither relocation nor abandonment of the channel were viable alternatives to continued dredging.
March 13, 2015	The Corps issued a Public Notice for proposed maintenance dredging of the Sandy Hook Channel.

July 24, 2015	Via email, the Corps provided survey maps showing the 2015 dredging action would involve removal of material above the MLLW line. The NPS indicated they did not wish to pursue a beneficial use project for material dredged during 2015.
August 20, 2015	The Corps and the Service held a call to discuss consultation for the 2015 dredging.
September 11, 2015	Via letter, the Corps initiated informal consultation for the 2015 dredging.
September 23, 2015	Via letter, the Corps initiated emergency consultation for the 2015 dredging.
September 25, 2015	Via letter, the Service provided recommendations regarding the 2015 emergency dredging, and advised formal, programmatic consultation for future dredge cycles to include dredging by both the Corps and the U.S. Navy (Navy).
February 2, 2016	Via conference call with the Service, the Corps agreed to prepare a formal consultation initiation package.
April 18, 2016	The Service learned that the Navy was dredging the channel near Sandy Hook under a under a permit issued by the Corps' Regulatory Branch. No intertidal beach was removed, but the dredge was in close proximity to the beach during the piping plover nesting season. The Service coordinated with the Navy and the NPS, who jointly monitored the birds during the event, which continued through May 24, 2016.
October 6, 2016	Via letter, the Service reiterated our advice for the Corps to submit an initiation package for programmatic formal consultation.
December 22, 2016	Via email, the Corps transmitted a preliminary Biological Assessment. The Service provided comments via email on January 27, 2017.
February 14, 2017	The Corps issued a Public Notice for proposed maintenance dredging of the Sandy Hook Channel.
March 31, 2017	The Corps transmitted a final Biological Assessment.
April 25, 2017	Via email, the Service noted some missing information preventing us from starting the 90-day consultation "clock," and proposed an alternative schedule for completing formal consultation in time for the 2017 dredging action.
May 17, 2017	The Corps, the NPS, the Navy, and the Service met to discuss the consultation.

May 19, 2017	The Service transmitted to the Corps a Scope of Work to fund northeastern beach tiger beetle surveys. Adult surveys were conducted in July and August, and a larval survey in September. No beetles were found. Surveys will be conducted again in 2018.
June to October, 2017	The Service provided draft sections of the PBO for Corps, Navy, and NPS review, and coordinated via telephone and email.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Sandy Hook Channel - Background

The Port of New York and New Jersey is the largest port on the East Coast. One key component of the Port is New York Harbor—a major maritime shipping port and center of commerce (see Figure 1). Under the New York Harbor Federal Navigation project, the Corps is tasked with maintaining and improving access to, and navigation within, New York Harbor. This Federal project includes several components, such as managing and monitoring ocean placement of dredged material at the Atlantic Ocean's Historic Area Remediation Site (HARS) and at man-made reef sites that accept dredged material from navigation projects within the New York Harbor, as well as overseeing all sediment sampling and testing, and evaluating testing data for all proposed ocean disposal projects (Corps 2017a). The New York Harbor Federal Navigation project also includes operating and maintaining the Caven Point Marine Terminal and 31 miles of Federal navigation channels and anchorage areas within the Upper and Lower New York and New Jersey Harbor. This component of the project includes preliminary engineering and design, with ocean placement testing scheduled for future maintenance dredging of various channels that comprise the Harbor (Corps 2017a).

The Sandy Hook Federal Navigation Channel (Sandy Hook Channel; also known as Bayside) (see Figure 1) is part of this system of Federal channels, adopted in 1884, and modified in 1933, 1937, 1958, 1965, 1982, and in the Water Resources Development Acts of 1986 and 1990 (Corps 2017a). The Sandy Hook Channel is a Congressionally authorized, critical, high-use deep-draft navigation channel that provides maritime access to New York Harbor. Sandy Hook Channel also provides access to Navy facilities in Raritan Bay (Corps 2017b). The Corps maintains Sandy Hook Channel to a depth of 35 feet below MLLW (Corps 2017a).

In addition to carrying out its own program of maintenance dredging, the Corps also occasionally authorizes dredging of the Sandy Hook Channel by other parties through its Regulatory Branch. Most recently, the Navy dredged the Sandy Hook Channel to a depth of 45 feet below MLLW in spring 2016, as authorized by a May 15, 2015 Corps permit (NAN-2011-00278). The Navy's 2016 dredging did not result in incidental take of listed species and is not covered by this PBO.

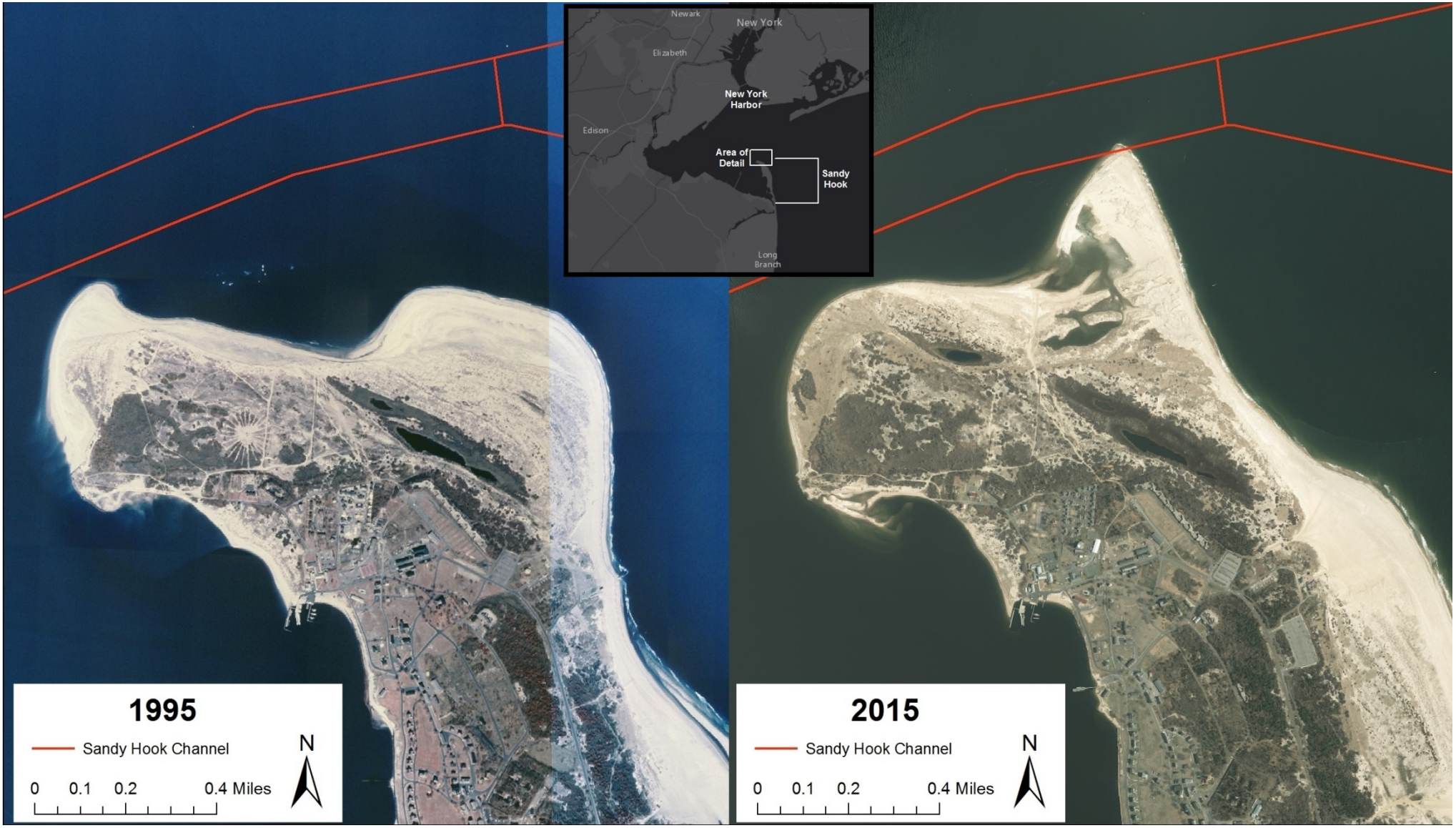

Figure 1. Map showing accretion of a sand spit into Sandy Hook Channel, 1995 to 2015

Increased Sand Transport and Dredging

Located immediately south of the Sandy Hook Channel, the northern tip of the Sandy Hook peninsula has been accreting sand at an accelerated rate in recent years (see Figure 1). Much of the recent accretion in this area is likely attributable to repeated Corps beach nourishment actions south of Sandy Hook, carried out as a shore protection measure along the developed New Jersey coastline between Sea Bright Borough and Manasquan Inlet.[2] Large periodic beach nourishment actions have occurred south (updrift) of Sandy Hook since 1995. These nourishments have added millions of cubic yards of sand to the littoral system. Sand is carried north and deposited by the northern-flowing longshore current in combination with large coastal storm events, which move large volumes of available sand into the influence of the longshore current. Evaluation of landform and shoreline changes shows that between 2002 and 2013 the northern-most portion of Sandy Hook experienced a net gain of approximately 15 acres (Corps 2017b).

As sand deposition continues along the northern tip of Sandy Hook, the accreting material has begun to encroach on the southern side of the Federal navigation channel. In recent years, the channel has experienced a dramatic increase in the rate of shoaling that has necessitated more frequent and more extensive dredging. Increased dredging is necessary to address the shallow depths of the shoals that limit the safety, reliability, and effectiveness of the navigation channel (Corps 2017b). In addition to shoaling, the accretion has also caused the growth of a sand spit north into the channel. As late as 2009, the tip of Sandy Hook was separated from the Sandy Hook Channel by approximately 500 feet of open water. Since at least 2011, however, a spit of sand has accreted to the point of intersecting the channel (see Figure 1). Corps dredging since that time has involved removal of material from the spit above the MLLW line (*i.e.*, intertidal beach), and sometimes also above the Mean High Water (MHW) line (*i.e.*, supratidal beach).

The section of the Sandy Hook Channel located north of Sandy Hook has had an active dredging history within the recent past as shown by Corps dredging actions since 1977, listed in Table 1. The greatest single dredging event, removing the largest volume of sand occurred in 1982, but as shown in Table 1, that dredging event was one of only three that occurred over a 30-year period (1977 to 2008). In contrast, from 2008 until the present, maintenance dredging has been conducted every 1 to 3 years and required dredging volumes have grown increasingly greater with each event. These increases have been necessitated by a combination of factors including deeper draft vessels and the acceleration of deposition rates within the affected section of the channel (Corps 2017b).

The accreting sand spit that has begun impeding safe navigation through the Sandy Hook Channel is located within a section of Sandy Hook known as North Beach. For management purposes, most of North Beach is designated by NPS as a Natural Zone, primarily the Sensitive Resource Subzone, as shown in Figure 2 (NPS 2014).

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[2] The Corps' program of beach nourishment covering all of Monmouth County's Atlantic coast south of Sandy Hook is known as Sections I and II of the Atlantic Coast of New Jersey Sandy Hook to Barnegat Inlet Beach Erosion Control Project (BECP). A 2002 PBO on the BECP considered potential benefits to piping plovers and seabeach amaranth from anticipated increased sand transport to Sandy Hook; however, the 2002 PBO did not anticipate the growth of Sandy Hook to the point of intersecting the Federal navigation channel. The 2002 PBO also evaluated a number of potential adverse effects to listed species (USFWS 2002).

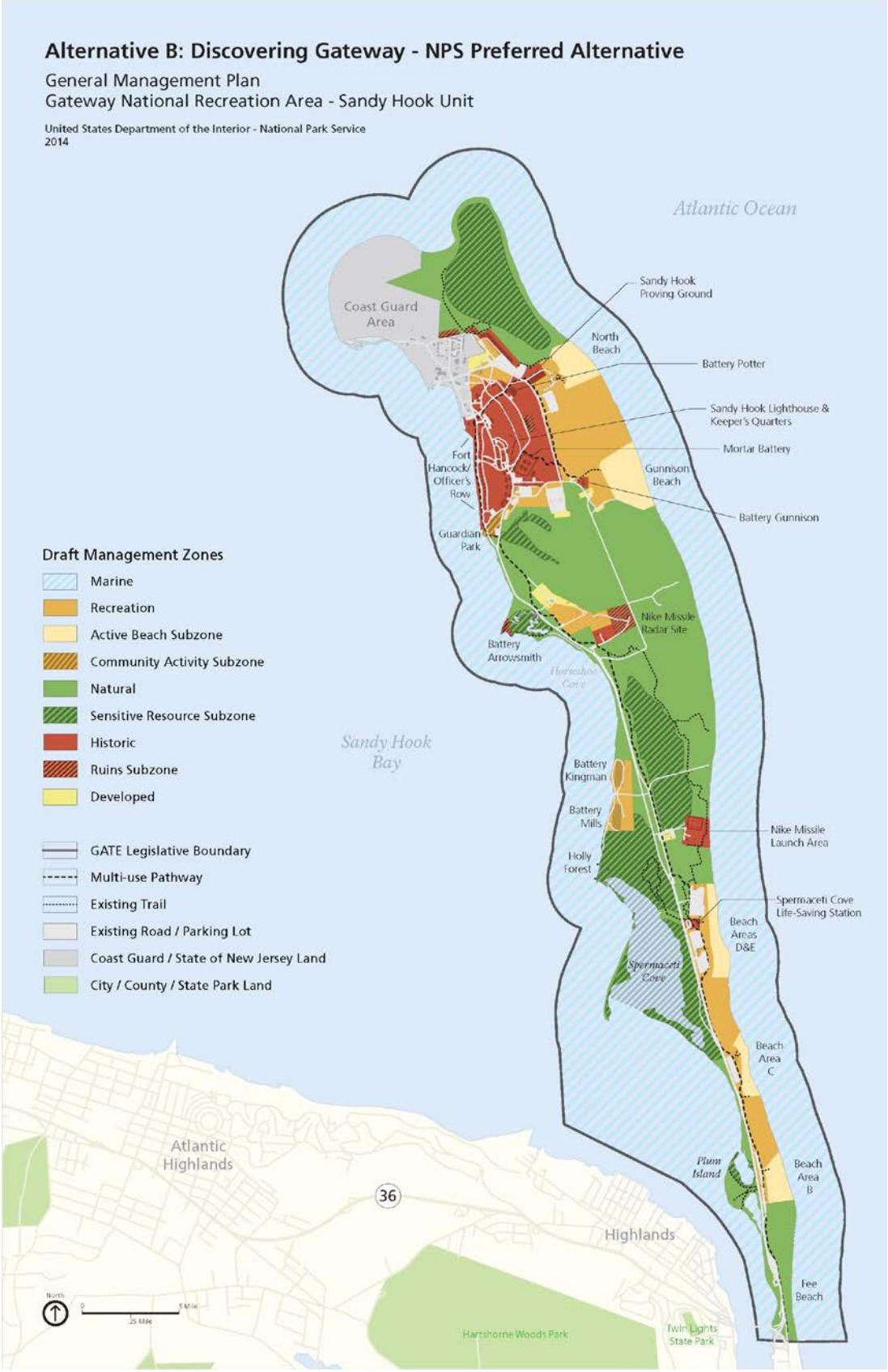

Figure 2. National Park Service Management Zones on Sandy Hook (NPS 2014)

Table 1. Past and projected (*) Corps dredging actions, 1977 to 2020 (Corps 2017b, Wrocenski pers. comm. 2017). TBD = to be determined.

Start Date	End Date	Volume (Cubic Yards)	Dredge Type	Material Removed above MLLW	Covered by this PBO
1977	1977	140,000	Unknown	No	No
1982	1982	352,166	Unknown	No	No
1997	1997	93,059	Unknown	No	No
9/13/2008	11/5/2008	24,000	Hopper	No	No
9/5/2009	9/21/2009	34,335	Hopper	No	No
12/6/2011	3/31/2012	176,215	Hopper/Mechanical	Yes (1.54 acres)	No
11/11/2013	12/13/2013	261,430	Mechanical	Yes (2.80 acres)	No
10/17/2015	12/13/2015	336,010	Mechanical	Yes (2.80 acres)	Yes
10/15/2017*	12/15/2017	350,000	Mechanical	Yes (2.57 acres)	Yes
10/15/2018*	12/15/2018	225,000	Mechanical	TBD	Yes
10/15/2019*	12/15/2019	245,000	Mechanical	TBD	Yes
10/15/2020*	12/15/2020	270,000	Mechanical	TBD	Yes

Note: Dredging by the other parties, authorized by the Corps, is not shown in the above table.

Description of Covered Federal Actions

As defined in the ESA regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The following Federal actions are covered by this PBO.

2015 Corps Dredging

This action involved mechanical dredging of 336,010 cubic yards from the tip of Sandy Hook between October 17 and December 13, 2015. Approximately 2.80 acres of beach above the MLLW line, including 2.53 acres above the MHW line, were removed from the tip of the accreting spit (Figure 3). As a result of dredging, the area of intertidal beach was reduced in size from 0.27 acre (1,120 linear feet of ocean frontage) to 0.13 acre (750 linear feet of ocean frontage). All excavated sediments were placed offshore at the HARS (Corps 2017b). Emergency consultation was conducted; via letter dated September 25, 2015, the Service concluded the emergency action was likely to adversely affect listed species. This PBO constitutes after-the-fact formal consultation on the effects of the 2015 action.

2017 Corps Dredging

This action involves mechanical dredging of approximately 350,000 cubic yards from the tip of Sandy Hook starting November 2017. The Corps expects to remove approximately 2.57 acres above the MLLW line, including approximately 1.87 acres of supratidal beach above the MHW line (Figure 4). The 2017 work will be performed using a mechanical clamshell dredge, utilizing scows to transport the material to the Sea Bright Borrow Area for ocean placement. This work is expected to take approximately 2 months starting in early November 2017 (Corps 2017b, Wrocenski pers. comm. 2017).

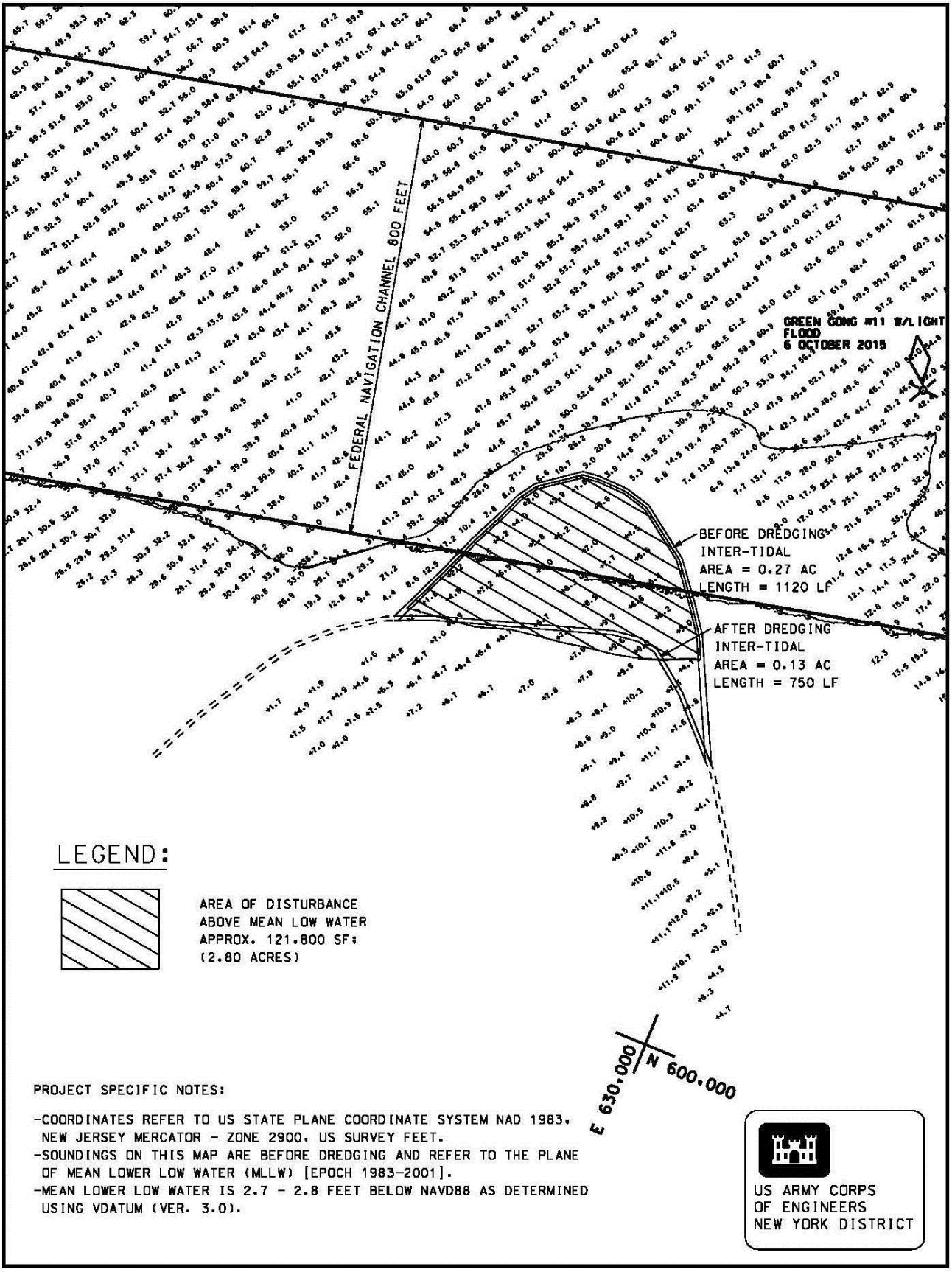

Figure 3. Limits of dredging, 2015 (Corps 2017b)

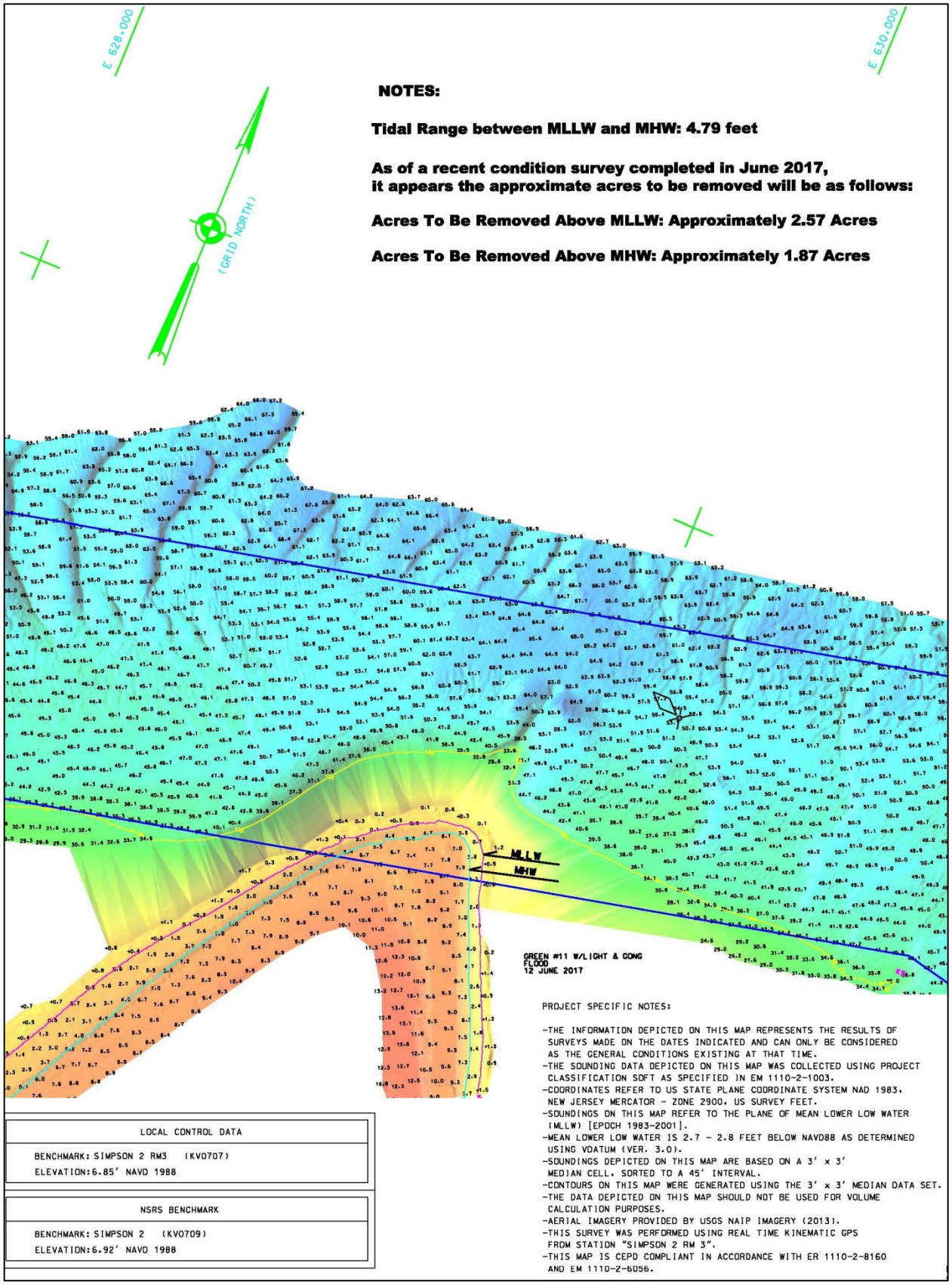

Figure 4. Corps condition survey, June 2017 (Wrocenski pers. comm. 2017)

The contractor performing the work, Weeks Marine Inc., will have a number of personnel in the action area. Most of these individuals will be on the dredge, scows, crew boats, and tugboats. Other individuals, including both contractor and Corps personnel, will be on the beach including a safety officer, a security guard, a Quality Assurance representative, a supervisor / project manager, a project engineer, and a Quality Control inspector. The Corps has scheduled a pre-construction meeting for November 1, 2017, before dredging commences. This meeting will confirm the exact number of personnel who will be on the beach. In accordance with the Contract Specifications and an NPS Special Use Permit, there will construction fencing on the beach for the duration of the work. The 2017 action will also include pre- and post-dredging topographic / bathymetric surveys conducted from both land and water (Wrocenski pers. comm. 2017).

Future Corps Dredging Actions

This action includes all future Corps maintenance dredging of the Sandy Hook Channel within 1,000 feet of the MLLW line of Sandy Hook through February 28, 2038. Dredging frequencies and volumes are expected to vary over the life of this PBO. From 2018 through 2020, annual dredging is planned with projected volumes ranging from 225,000 to 270,000 cubic yards (Table 1). After 2020, future dredging needs are estimated at 150,000 cubic yards every year (Corps 2017b).

The extent of intertidal and supratidal beach removed by each dredging action will vary over the life of this PBO. Some dredging actions may require removal of only subtidal material (*i.e.*, below the MLLW line); however, most dredging actions are expected to also include removal of intertidal and supratidal beach (Corps 2017b). We expect that the area of intertidal and supratidal beach removal will likely decrease by 2020, due to annual dredging that routinely removes newly forming subtidal shoals before they reach the point of building out the sand spit (*i.e.*, annual dredging will largely preclude the formation of intertidal and supratidal beach, rather than removing such areas).

This Federal action covers mechanical dredging, as well as the use of hopper dredges. If any new or alternative dredging methods are proposed, the Corps and the Service will evaluate the likely effects of such methods on listed species and determine if these methods can be covered by this PBO. Mechanical dredging includes clamshell and bucket dredges, which excavate material for transport to the disposal site. In contrast, hopper is a type of hydraulic dredging, which involves sucking up a mixture of sediment and water (known as slurry) from the bottom surface and then transferring the mixture through a pipeline. In the case of a hopper dredge, the material is transferred into the vessel's hopper(s) for transport to the disposal site (Welp undated). This Federal action also includes supporting activities necessary to carry out the dredging, such as bathymetric and topographic surveys, and security fencing on the beach to protect public safety.

Material dredged through actions covered by this PBO will be: (a) deposited at the HARS, which is located approximately 3.5 nautical miles east (and slightly south) of Sandy Hook; (b) deposited at the Sea Bright Borrow Area, which is located roughly 1 to 2 miles offshore of southern Sandy Hook and provides the sand source for several of Corps beach nourishment projects; (c) deposited at another approved ocean disposal area; or (d) utilized in a beneficial use project(s). Proposals to utilize dredged materials for a beneficial use project(s) on or within 1,000

feet of Sandy Hook's MLLW line must: (a) ensure that all material in question is at least 90 percent sand; and (b) be approved by the Service and the NPS pursuant to the ESA and other applicable laws, regulations, and policies.

Future Corps Dredging Authorizations

This action includes all future Corps regulatory actions authorizing dredging of the Sandy Hook Channel within 1,000 feet of the MLLW line of Sandy Hook through February 28, 2038. We anticipate the Navy may dredge under a Corps permit two times over the life of this PBO, likely involving subtidal material only. In addition to the Navy, separate dredging actions proposed by parties other than the Corps (but requiring Corps authorization) would also be covered by this PBO. As with Corps-funded dredging actions, this Federal action is restricted to mechanical and hopper dredge methods (though alternative methods may be evaluated), includes supporting activities (*e.g.*, surveys, fencing), and is restricted to the disposal options listed above.

Conservation Measures

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

For dredging actions authorized by the Corps, but not funded or carried out by the Corps, the Corps may designate (in writing) the applicant or permitee as the party responsible for implementation of Conservation Measures listed below. In such cases, the Service will coordinate directly with the applicant or permittee, with copies of all written and electronic communications provided to the Corps. The Corps retains ultimate responsibility for ensuring that an applicant or permittee implements all binding provisions of this PBO.

1. Tier 2 Consultation and Agency Coordination

Under the Service's 2015 policy on incidental take statements (*Federal Register* Vol. 80, No. 90, pp. 26832-26845), the Federal actions covered by this PBO constitute a "mixed programmatic action." A mixed programmatic action includes two elements: (1) one or more Federal actions that will not be subject to further Section 7 consultation (*i.e.*, the 2015 and 2017 dredging

actions); and (2) a framework for the development of future actions that are authorized, funded, or carried out at later time (*i.e.*, all subsequent dredging actions described above, other than the 2015 and 2017 actions) and take of listed species would not occur unless and until those actions are carried out and subject to further consultation. Consistent with this policy, the incidental take statement included with this PBO covers the 2015 and 2017 dredging actions only. Tier 2 consultation will be conducted for all future dredging actions covered by this PBO. An incidental take statement for future actions will be issued, if appropriate, with each Tier 2 consultation.

Via letter, the Corps will initiate Tier 2 consultation at least 75 days before the start of each future dredging action. The Tier 2 initiation letter will include information on the extent and timing of any bathymetric/topographic surveys (see Conservation Measure 4); the qualifications of any proposed species monitors or surveyors (*e.g.*, as may be required under Conservation Measures 4, 6, 7, or 8); the location and volume of material to be dredged; the aerial extent of any intertidal and supratidal beach to be removed; the method of dredging; the proposed dredged material disposal location; and the start and end dates of the dredging. The Tier 2 initiation letter will also include detailed information for any security fencing or other equipment or temporary structures proposed to be on the ground in Sandy Hook during dredging, as well as the estimated number of Corps and contractor staff that will be present in Sandy Hook, and a Corps point of contact responsible for overseeing and directing field operations on the ground during dredging (see Conservation Measure 5). The Tier 2 initiation letter will also include a summary of landform monitoring to date (see Conservation Measure 11). Finally, the Tier 2 initiation letter will confirm adherence to all Conservation Measures and Terms and Conditions listed in this PBO, and will include, if appropriate, a brief explanation of how specific PBO provisions will be carried out.

The Service will review the above-listed information, coordinate with the Corps and the NPS as necessary, and issue a Tier 2 formal consultation letter within 45 days of receiving complete project information from the Corps. The Tier 2 formal consultation letter will include an action-specific incidental take statement, if take of listed wildlife species is anticipated. The Corps and the Service will provide copies of all Tier 2 consultation letters and supporting documents to the NPS.

For bathymetric/topographic survey actions greater than 300 feet from the MLLW line occurring independent of dredging actions (*e.g.*, offshore condition surveys), no Tier 2 consultation or other inter-agency coordination will be necessary.

For survey actions on Sandy Hook and/or within 300 feet of the MLLW line occurring independent of dredging actions (*e.g.*, nearshore or onshore condition surveys), no Tier 2 consultation will be necessary. Instead, the Corps will notify the Service and the NPS via email at least 14 days prior to the start of the survey, and the Corps will implement Conservation Measure 4. If a species monitor will be needed pursuant to Conservation Measure 4, the qualifications of the proposed monitor will be submitted to the Service and the NPS concurrent with the 14-day notification email.

2. Dredge Equipment Siting

All dredging equipment will be located offshore in open water. No dredging will occur from land-side based equipment on Sandy Hook. No associated equipment or material (*e.g.*, pipeline) will be placed on Sandy Hook unless previously coordinated during the Tier 2 consultation.

3. Seasonal Restriction to Protect Piping Plovers

The Corps will seasonally restrict all dredging and associated activities (*e.g.*, bathymetric/topographic surveys) from March 1 through August 31 of each year (restricted season), except as noted below.

a) No exceptions will be made to this seasonal restriction for removal of intertidal or supratidal beach, or for removal of subtidal material within 300 feet of the MLLW line.

b) No exceptions will be made to this seasonal restriction for installation or removal of security fencing, pipeline, or any other temporary structures on the beach. (As per Conservation Measure 2, no dredging will occur from land-side based equipment on Sandy Hook at any time of year, and no pipeline will be placed on Sandy Hook at any time of year unless specifically coordinated during the Tier 2 consultation.)

c) On a case-by-case basis, dredging of subtidal material greater than 300 feet from the MLLW line may be approved during the restricted season if the Corps, the Service, and the NPS all agree that such dredging will not disturb any listed species or their habitats. Agency coordination and concurrence may be via email.

d) Other offshore activities associated with a dredging action (*e.g.*, bathymetric surveys; mobilization/demobilization of dredging equipment) located greater than 300 feet from the MLLW line will not be subject to the seasonal restriction.

e) If onshore or nearshore (within 300 feet of MLLW) bathymetric/topographic surveys must be conducted during the restricted season, the Corps will follow the provisions listed under Conservation Measure 4.

4. Measures to Minimize Disturbance from Bathymetric and Topographic Surveys

As per Conservation Measure 3, the Corps will strive to conduct all onshore and nearshore (within 300 feet of MLLW) bathymetric and topographic surveys outside the restricted season of March 1 to August 31. However, if onshore or nearshore (within 300 feet of MLLW) surveys must be conducted during the restricted season, the Corps will follow these provisions.

a) The Corps will coordinate surveys with the Service and the NPS. Service and/or NPS staff may elect to be present during the surveys.

b) The Corps will strive to end surveys by March 15 or, if that is not possible, by March 31. The Corps will strive to initiate surveys after all piping plover chicks at North Beach have fledged.

c) The Corps will arrange for a qualified species monitor to be on-site if surveys must occur between April 1 and the fledging of the last piping plover chick at North Beach. The species monitor will coordinate with NPS staff 1 week before the start of the survey work, 1 day before the start of survey work, and then each day the surveys continue, to obtain current information on the locations of piping plover territories, nests and/or chicks, as well as current information on the locations of other listed species. The species monitor will observe piping plover adults for signs of disturbance from the survey activities; direct surveyors away from sensitive territorial/nesting/chick habitats; and ensure that surveyors do not approach any nest sites or unfledged broods. The species monitor will also direct surveyors to minimize disturbance of red knots, northeastern beach tiger beetles, and seabeach amaranth. The species monitor may be Corps staff, contracted staff, or NPS staff (*e.g.*, via transfer funding). The qualifications of the species monitor must be reviewed and approved by the Service, with an opportunity for input from the NPS. No motorized vehicles or drones (*e.g.*, Unmanned Aerial Vehicles or Systems) will be used for bathymetric / topographic surveys on or over the beach, or offshore within 300 feet of MLLW, between April 1 and the fledging of the last piping plover chick at North Beach.

If topographic or bathymetric surveys are to be conducted between the fledging of the last piping plover chick and November 30, the Corps will follow these provisions:

a) The Corps will coordinate the surveys with the Service and the NPS. Service and/or NPS staff may elect to be present during the surveys. The Corps will request from NPS information on the most recent locations of any seabeach amaranth plants and of any migrant red knots or piping plovers—the Corps will transmit this information on species locations to the survey crew(s).

b) Survey crews will familiarize themselves with the seabeach amaranth, as well as larval and adult northeastern beach tiger beetle search images and current locations and will avoid crushing any plants or beetles.

c) Survey crews will to strive to avoid disturbing flocks of shorebirds, which could include migrant red knots and/or piping plovers.

5. Security and Other Onshore Personnel

The Corps will ensure that any security personnel or other Corps or contractor personnel operating on the ground in Sandy Hook during each dredging operation minimize their environmental impacts and coordinate closely with the NPS. With each Tier 2 initiation letter, the Corps will include information on the estimated number of Corps and contractor staff that will be present on the ground in Sandy Hook, and a Corps point of contact responsible for overseeing and directing field operations on the ground during dredging (see Conservation Measure 1). The Corps will ensure that all such personnel are familiar with the Conservation

Measures and any other relevant portions of this PBO. The Corps will ensure that personnel understand the need to avoid crushing seabeach amaranth plants and other vegetation, and to avoid disturbing flocks of shorebirds that may include red knots or migrant piping plovers. If driving on the beach is planned, the Corps will ensure that driving is kept to a minimum and restricted to a consistent travel route and/or other conditions imposed by the NPS. If any biological monitoring staff, Corps staff, or contractor staff observe[3] crushing of vegetation, disturbance of shorebird flocks, excessive/inappropriate beach driving, or other activities by onshore personnel impacting beach species or habitats, they will report such activities via email to the designated Corps point of contact for immediate corrective action, with a copy to the Corps and the Service. Within 24 hours of receiving such notification, the Corps point of contact will notify the Service and the NPS of the corrective action(s) that have been implemented.

6. Species Monitoring

The Corps will implement the Red Knot Monitoring Plan (Appendix A) to assess species presence as well as any response to the dredging. The Corps will implement the Northeastern Beach Tiger Beetle Monitoring Plan (Appendix B) as necessary and appropriate based on the results of the 2017 and 2018 Corps-funded presence/absence surveys (in progress).

7. Seabeach Amaranth Surveys and Fencing to Avoid Direct Plant Impacts

The Corps will arrange for a survey of all supratidal beach within the impact area[4] for the presence of seabeach amaranth plants no more than 14 days before the start of each dredging action that is scheduled to be initiated during the growing season[5] (May 15 through November 30). The Corps will mark any plants occurring inside the impact area, but outside of the sand removal area, with string-and-post fencing and appropriate signage and prohibit entry by project personnel and vehicles. Sand/snow fence will not be used to mark plants, as it can cause plants become buried by sand. The string-and-post fencing will allow a 10-foot buffer around each plant or group of plants. The survey and marking will be carried out by qualified Corps staff, contracted staff, and/or NPS staff (*e.g.*, via transfer funding) familiar with seabeach amaranth. The qualifications of the surveyor must be reviewed and approved by the Service, with an opportunity for input from the NPS. The Corps will report to the Service and the NPS how many plants were fenced (and will be avoided), and the number of plants (if any) that were not fenced

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[3] Such activities may also be reported to the Corps point of contact by NPS staff if, in the course of their normal duties, they happen to observe potential impacts to beach species from the actions of onshore project personnel.

[4] Throughout this document we use the following terms to describe three nested areas:
Sand removal area = All subtidal, intertidal, and supratidal areas of sand to be removed. Due to the need to establish a stable side slope, the sand removal area extends about 200 feet landward of the channel limits; see Figures 3 and 5.
Dredging footprint (limits of disturbance) = In addition to the sand removal area, the dredging footprint also includes all areas that will be disturbed by security fencing or other equipment or temporary structures, security or other ground-based personnel, beach driving, and potentially earth moving (*e.g.*, beach bulldozing), which may be conducted as part of the Scarping Abatement Plan (Appendix D).
Impact area = In addition to the sand removal area and the dredging footprint, the impact area also includes all intertidal and supratidal beach within 300 feet of the dredging footprint.

[5] Due to the seasonal restriction to protect piping plovers, dredging actions necessitating a seabeach amaranth survey cannot be initiated during the early part of the growing season. Considering Conservation Measures 3 and 7 together, seabeach amaranth surveys and fencing would only apply between September 1 and November 30.

because they cannot be avoided by dredging or security fencing, triggering the need for the Contingency Plan under Conservation Measure 8.

8. Contingency Plans to Minimize Species Impacts

The Corps will implement the Species Contingency Plan (Appendix C) as necessary and appropriate. The Contingency Plan provides for additional Conservation Measures that will apply in the event that: (a) significant numbers of red knots are harassed by dredging actions; (b) northeastern beach tiger beetle larvae are present in the dredging footprint at the time of dredging; and/or (c) seabeach amaranth plants are present in the dredging footprint at the time of dredging.

9. Scarping Abatement Plan to Minimize Indirect Habitat Impacts

The Corps will implement the Scarping Abatement Plan (Appendix D) to minimize the adverse habitat impacts resulting from dredging, and from the habitat's proximity to the deep water of the channel.

10. Habitat Offset Plan to Compensate for Unavoidable Habitat Impacts

The Corps will implement the Habitat Offset Plan (Appendix E) to abate the loss of intertidal and supratidal beach, both from direct removal of such areas and as a result of precluded habitat formation.

11. Land Form Monitoring

The Corps will annually monitor topography and morphology of the North Beach spit area, and adjacent piping plover nesting habitat (as mapped using NPS nesting data), using standard survey techniques and current in-house LIDAR imagery. The Corps will share the results with the Service and the NPS on an annual basis, as part of each Tier 2 consultation.

12. Regional Sediment Management

The Corps will invite the Service and the NPS to participate in its regional sediment management planning effort, as it relates to Sandy Hook Channel dredging.

ACTION AREA

The action area is defined at (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The Service has determined that the action area for this project includes all intertidal, beach, dune, swale, pond, and associated habitats within the North Beach section of Sandy Hook (see Figures 2 and 5), extending between the developed North Beach bathing/recreational area and the U.S. Coast Guard (USCG) property. The action area also includes all open ocean and bay waters within 1,000 feet of the North Beach MLLW line.

Based on 2015 aerial imagery, the action area includes about 225 acres of intertidal and terrestrial habitats. However, that area may change considerably over the life of this PBO due to natural processes of accretion and erosion, anthropogenic updrift sand inputs, channel dredging, and other natural and human-induced factors. Located at the northern tip of the Sandy Hook peninsula, North Beach is an undeveloped barrier beach and dune complex. The area includes a mature dune system with several interior tidal pools and flats. Seaward of the dunes is an accreting sand spit with additional wet flats and pools. The entire area is characterized as a highly dynamic coastal environment subject to both accretion and erosion driven by natural forces such as storms, tides, currents, and waves (Corps 2017b). Despite the naturally high rates of change, the recent trend of accretion (as shown in Figure 1) is expected to continue for the foreseeable future due to the updrift program of beach nourishment. The open water portion of the action area is a high-energy ocean environment. Immediately adjacent to the sand spit, and intersecting with it, is the deep fast-flowing water of the Sandy Hook Channel. Photos of the tip of the sand spit and the adjacent channel in July 2017 are provided in Appendix F.

All of the beach, dune, and intertidal areas included in the action area have been designated by the NPS as a Natural Zone, primarily the Sensitive Resource Subzone, as shown in Figure 2 (NPS 2014). Within this zone the NPS management goal is improvement of habitat conditions. The NPS seeks to maintain and protect current natural resource management practices, and to increase research and monitoring of sensitive habitat areas like the beaches on Sandy Hook's northern tip. The mosaic of coastal habitats is managed to provide unique opportunities for experiencing and learning about natural systems and native plant communities. In the Natural Zone, the NPS seeks to create a variety of natural immersion experiences to increase visitor awareness and enjoyment of the natural environments including nature study, wildlife viewing, camping, and instructional programming (NPS 2014).

PIPING PLOVER STATUS

Across the New York-New Jersey Recovery Unit

Piping plovers breed in three discrete areas, each listed separately under the ESA. The Atlantic Coast and Northern Great Plains populations are listed as threatened, while the Great Lakes population is listed as endangered. Each breeding population has its own recovery plan. Birds from all three populations winter along the U.S. coast from North Carolina to Texas, as well as in Mexico and the Caribbean (USFWS 2009). The Atlantic Coast piping plover population breeds on coastal beaches from Newfoundland to North Carolina and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast, and in the Caribbean (USFWS 1996a).The Bahamas is a particularly important wintering area for piping plovers from the Atlantic Coast breeding population (Pover 2016).

Within its Atlantic Coast breeding range, the piping plover was federally listed as threatened in 1986. The piping plover is a small shorebird approximately 7 inches long with a wingspan of about 15 inches. Piping plovers are present on the New Jersey shore during the breeding season, generally between March 1 and August 31, though migrants may be present through October. These territorial birds nest above the high tide line, usually on sandy ocean beaches and barrier islands, but also on gently sloping foredunes, blowout areas behind primary dunes, washover areas cut into or between dunes, the ends of sandspits, and deposits of suitable dredged or

pumped sand. Piping plover nests consist of a shallow scrape in the sand, frequently lined with shell fragments and often located near small clumps of vegetation. Females lay four eggs that hatch in about 25 days, and surviving chicks learn to fly (fledge) after about 25 to 35 days. The flightless chicks follow their parents to feeding areas, which include the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. Piping plover adults and chicks feed on marine macroinvertebrates such as worms, fly larvae, beetles, and crustaceans (USFWS 1996a).

Threats to piping plovers on the Atlantic Coast include habitat loss, human disturbance of nesting birds, predation, and oil spills and other contaminants. Habitat loss results from development, as well as from beach stabilization, beach nourishment, beach raking, dune stabilization, and other physical alterations to the beach ecosystem. Human disturbance of nesting birds includes foot traffic, sunbathing, kites, pets, fireworks, mechanical raking, construction, and vehicle use. These disturbances can result in crushing of eggs, failure of eggs to hatch, and death of chicks. Predation on piping plover chicks and eggs is intensified by development because predators such as foxes (*Vulpes vulpes*), rats (*Rattus norvegicus*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), crows (*Corvus* spp.), and gulls (*Larus* spp.) thrive in developed areas and are attracted to beaches by human food scraps and trash. Unleashed and feral dogs (*Canis familiaris*) and cats (*Felis domesticus*) also disturb courtship and incubation and prey on chicks and adults (USFWS 1996a).

According to the Consultation Handbook (USFWS and NMFS 1998), the Service's jeopardy analysis may be based on an assessment of impacts at the level of recovery units when those units are documented as necessary to both the survival and recovery of the species in a final recovery plan, for which a notice of availability has been published in the *Federal Register*. The Consultation Handbook also notes that, when the Service's review in a Biological Opinion (BO) focuses on the effects of the action on a discrete recovery unit, the species status section of the BO is to describe the status of that unit and its significance to the species as listed.

The recovery plan for the Atlantic Coast population of the piping plover (USFWS 1996a) delineates four recovery units: Atlantic Canada, New England, New York-New Jersey (NY-NJ) and Southern (Delaware, Maryland, Virginia, and North Carolina). Recovery criteria established within the recovery plan define population and productivity goals for each recovery unit, as well as for the population as a whole. Attainment of these goals for each recovery unit is an integral part of a piping plover recovery strategy that seeks to reduce the probability of extinction for the entire population by: (1) contributing to the population total; (2) reducing vulnerability to environmental variation (including catastrophes, such as hurricanes, oil spills, or disease); (3) increasing likelihood of genetic interchange among subpopulations; and (4) promoting re-colonization of any sites that experience declines or local extirpations due to low productivity or temporary habitat succession. The plan states: "A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood of survival of a recovery unit will also reduce the probability of persistence of the entire population." Thus, in accordance with the Consultation Handbook (USFWS and NMFS 1998), this PBO focuses on the effects of the dredging on piping plovers in the NY-NJ recovery unit.

As described in the recovery plan (USFWS 1996a) and 5-year review (USFWS 2009), the conservation needs of the Atlantic Coast ping plover population include: (1) a total of 2,000 breeding pairs, distributed among four recovery units, including 575 pairs in the NY-NJ recovery unit, sustained for at least 5 years; (2) a 5-year average productivity rate of 1.5 chicks per pair in each recovery unit; and (3) long-term maintenance of wintering habitat sufficient in quantity, quality, and distribution to maintain survival rates needed for a 2,000-pair population. These recovery criteria reflect the conservation tenets of reproduction, numbers, and distribution.

Currently, the rangewide status of the Atlantic Coast piping plover is stable to increasing. However, productivity rates continue to fall short of the recovery criterion, and rangewide population growth is tempered by geographic and temporal variability. Periodic regional declines illustrate the continuing risk of rapid reversals in abundance trends. Examples include decreases of 21 percent in the Eastern Canada population in just 3 years (2002 to 2005), and 68 percent in the southern half of the Southern recovery unit during the 7-year period from 1995 to 2001. A 64 percent decline in the Maine population between 2002 and 2008, from 66 pairs to 24 pairs, came after only a few years of decreased productivity (USFWS 2016).

The number of nesting pairs in the NY-NJ recovery unit increased 55 percent between 1989 and 2016. However, the population declined sharply (35 percent) from a peak of 586 pairs in 2007 to 397 pairs in 2014, following 7 years of low productivity (including 4 years when productivity was less than 1.0 chicks per pair). Improved productivity in 2014 and 2015 fueled a partial rebound to 496 pairs in 2016, and productivity remained high in 2016. Changes in the Long Island population account for most of the changes in the recovery unit population size (USFWS 2016). See Table 2.

An unevenly distributed small population is inherently more vulnerable to stochastic variability in vital rates as well as catastrophic events. Thus, the downward trend in New York and New Jersey must be reversed for the Atlantic Coast piping plover to recover (USFWS 2016). The primary factors influencing the status of piping plovers in the NY-NJ recovery unit include a history of shoreline stabilization, ongoing coastal engineering, and a high level of human development and use primarily for recreation. It is uncertain whether the NY-NJ population can attain and sustain abundance necessary to assure long-term resiliency without changes in shoreline stabilization practices (USFWS 2016).

As of 2015, 28 to 34 percent of the Long Island shorelines were modified with hard armor, including up to 1,988 groins, 79 jetties, 704 bulkheads/seawalls/revetments, and 19 breakwaters. At that time, 62 percent of the Atlantic Coast shoreline of Long Island had received beach nourishment, with an additional 5.7 miles proposed for nourishment (Rice 2017).

The New Jersey piping plover population has fluctuated at low levels from 1989 to 2016 (range of 92 to 144 pairs) (USFWS 2016), a hallmark of high demographic risk. This demographic vulnerability is compounded by a high and increasing geographic concentration of the State's population into just a few natural areas, where weather events or other factors could impact a high proportion of total pairs. In 2016, 85 percent of New Jersey's 115 nesting pairs were concentrated along less than 14 percent of the State's ocean shoreline (Rice 2017, Pover and Davis 2016). Since 2014, nearly half the State's population has nested in just one of these natural

areas, Sandy Hook, with another third nesting in Edwin B. Forsythe National Wildlife Refuge (EBFNWR). The proportion of New Jersey's total pairs nesting in these two natural areas rose from 47 percent in 2007 to between 75 and 85 percent from 2014 to 2016. Likewise, the proportion of New Jersey's total pairs nesting in all four of the State's remaining natural areas (*i.e.*, those where natural coastal processes still operate—Sandy Hook, EBFNWR, North Brigantine Natural Area, and Stone Harbor Point) rose from about 67 percent in 2007 to between 85 and 95 percent from 2014 to 2016 (Pover and Davis 2016).

It is not entirely clear what continues to drive the precarious condition of New Jersey's piping plover population, or its extreme contraction into just four natural areas. Human-associated predators remain problematic both within and outside of natural areas (Pover and Davis 2016). In contrast, disturbance from human activities, which can lead to low reproductive rates, is typically higher outside of these natural areas, despite intensive conservation management on more developed beaches. The plover population's geographic contraction may have been accelerated by Hurricane Sandy, which generally improved habitat conditions in those four natural areas, thus attracting more birds. (Unique to those natural areas, the effects of Hurricane Sandy effects were not reversed by the post-storm human response.) In addition, piping plovers may also be responding to suboptimal habitat features (*e.g.*, linear, erosional beaches; steep, stabilized dunes; possibly a reduced or altered prey base) in areas subject to beach nourishment. As of 2015, over 81 miles (63 percent) of New Jersey's shoreline had been nourished, with over 17 additional miles proposed (Rice 2017), much of which was constructed in 2016 (Corps 2016).

Although the causes of recent numeric and geographic population trends are not precisely known, it is clear that optimal piping plover habitats are extremely limited in New Jersey, and the few high-quality habitats that remain currently support upwards of 90 percent of the State's nesting pairs. Preferred nesting habitats include sandflats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cut into or between dunes (Maslo *et al.* 2011, USFWS 1996a). Outside of the four natural areas listed above, these habitat features are generally absent in New Jersey due to coastal development and shoreline stabilization. As of 2015, 65 percent of the New Jersey shoreline was developed, and 62 percent of the State's coastline was hard-armored with 455 groins, 11 jetties, 161 seawalls / bulkheads / revetments, and 6 breakwaters (Rice 2017). Hard stabilization structures are generally incompatible with piping plover habitat (USFWS 2009, 1996a). In addition, piping plovers show a strong preference for selecting nesting areas near inlets, particularly those that are not hardened with jetties or other stabilization features (Kisiel 2009, USFWS 1996a). As of 2015, 10 of New Jersey's 11 current inlets were modified by human activities. Nine of the State's 11 inlets are at least partly hard-stabilized, and 10 have been or continue to be dredged (Rice 2016). At New Jersey's one remaining natural inlet, dredging of the ebb shoals is in progress as of fall 2017 (USFWS 2017).

Piping plover reproductive rates and nest density are typically much higher where birds have access to non-ocean feeding areas (USFWS 2005). Thus is it not coincidental that the four natural areas listed above include the only three locations in New Jersey where unfledged plover chicks can access bayside foraging habitats. A growing body of evidence reinforces information presented in the recovery plan regarding the importance of wide, flat, sparsely-vegetated barrier beach habitats for recovery of Atlantic Coast piping plovers. Such habitats include abundant

moist sediments associated with blowouts, washover areas, spits, unstabilized and recently closed inlets, ephemeral pools, and sparsely vegetated dunes (USFWS 2009, 2005, 2002, 1996a).

Within the Action Area

As discussed above, Sandy Hook is the single largest piping plover nesting area in New Jersey, supporting around half of the State's nesting pairs in recent years. Among Sandy Hook's various beaches (*i.e.*, management units), North Beach has consistently supported the largest number of nesting pairs over the past 10 years (Pover and Davis 2016). Although productivity at North Beach declined in 2015 and 2016, it was well above the averages for both New Jersey and the NY-NJ recovery unit from 2012 through 2014 (Table 2). From 2014 through 2016, there were 28 piping plover nesting attempts on the sand spit, including 4 within 500 feet of the channel. One 2016 nest was approximately 310 feet from the channel. In 2017, 5 nests were within 500 feet of the channel, including one that was approximately 200 feet from the channel.[6]

Table 2. Numbers of nesting piping plover pairs and productivity, 2012 to 2016 (USFWS 2016; Pover and Davis 2016, 2015, 2014, 2013, 2012)

	2012 Pairs	2012 Fledges / Pair	2013 Pairs	2013 Fledges / Pair	2014 Pairs	2014 Fledges / Pair	2015 Pairs	2015 Fledges / Pair	2016 Pairs	2016 Fledges / Pair
North Beach	14	0.93	13	1.92	14	1.86	15	1.07	14	0.93
Sandy Hook	50	1.02	43	1.23	47	1.40	53	1.19	51	1.12
New Jersey	121	0.72	108	0.85	92	1.36	108	1.29	115	1.35
NY-NJ Recovery Unit	463	0.72	397	0.74	378	1.32	416	1.46	496	1.62

RED KNOT STATUS

Rangewide

The red knot was listed as threatened under the ESA in January 2015. At 9 to 10 inches long, the red knot is a large, bulky sandpiper. As with most shorebirds, the long-winged, strong-flying knots fly in groups, sometimes with other species. Red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab eggs. On the breeding grounds knots mainly eat insects. Small numbers of red knots may occur in New Jersey year-round, while large numbers of birds rely on New Jersey's coastal stopover habitats during the spring (May through early June) and fall (late-July through November) migration periods. Smaller numbers of knots may spend all or part of the winter in New Jersey (USFWS 2014).

The primary wintering areas for the red knot include the southern tip of South America (including Tierra del Fuego), northern Brazil, the Caribbean, and the southeastern and Gulf coasts of the U.S. The red knot breeds in the tundra of the central Canadian Arctic. Some of these robin-sized shorebirds fly more than 9,300 miles from south to north every spring and reverse the trip every autumn, making the rufa red knot one of the longest-distance migrating

[6] Due to the need to establish a stable side slope, the sand removal area extends about 200 feet landward of the channel limits; see Figures 3 and 5 and Appendix D.

animals. Migrating red knots can complete non-stop flights of 1,500 miles or more, converging on vital stopover areas to rest and refuel along the way. Large flocks of red knots arrive at stopover areas along the Delaware Bay and New Jersey's Atlantic coast each spring, with many of the birds having flown directly from northern Brazil. The spring migration is timed to coincide with the spawning season for the horseshoe crab (*Limulus polyphemus*). Horseshoe crab eggs provide a rich, easily digestible food source for migrating birds. Mussel beds on New Jersey's southern Atlantic coast are also an important food source for migrating knots. Birds arrive at stopover areas with depleted energy reserves and must quickly rebuild their body fat to complete their migration to Arctic breeding areas. During their brief 10 to 14-day spring stay in the mid-Atlantic, red knots can nearly double their body weight (USFWS 2014).

Coastal habitats used by red knots in migration and wintering areas are similar in character (Harrington 2001), generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Migration and wintering habitats include both high-energy oceanfront or bayfront areas, as well as tidal flats in more sheltered bays and lagoons (Harrington 2001). Preferred wintering and migration microhabitats are muddy or sandy coastal areas, specifically, the mouths of bays and estuaries, tidal flats, and unimproved tidal inlets (NCWRC 2013, Lott *et al.* 2009, Niles *et al.* 2008, Harrington 2001). In many wintering and stopover areas, quality high-tide roosting habitat (*i.e.*, close to feeding areas, protected from predators, with sufficient space during the highest tides, free from excessive human disturbance) is limited (USFWS 2014). In nonbreeding habitats, red knots require sparse vegetation to avoid predation (Niles *et al.* 2008, Piersma *et al.* 1993).

For many shorebirds, the supra-tidal (above the high tide) sandy habitats of inlets provide important areas for roosting, especially at higher tides when intertidal habitats are inundated (Harrington 2008). For red knots, unimproved tidal inlets are a preferred nonbreeding habitat (NCWRC 2013, Lott *et al.* 2009, Niles *et al.* 2008, Sitters 2005, Harrington 2001). Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats, including sand spits, islets, shoals, and sandbars, features often associated with inlets (Harrington 2008, Harrington in Guilfoyle *et al.* 2007, Winn and Harrington in Guilfoyle *et al.* 2006). From South Carolina to Florida, red knots are found in significantly higher numbers at inlets than at other coastal sites (Harrington 2008).

The red knot population that winters on Tierra del Fuego declined approximately 70 to 75 percent from the 1980s to the 2000s, and remains at a low level. Annual peak spring counts in Delaware Bay declined by about the same amount over the same period. Threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at stopover areas; disturbance by vehicles, people, dogs, aircraft, and boats; and climate change (USFWS 2014).

There is not yet a recovery plan for the red knot. Thus, we base the following conservation needs on the assessment conducted for the listing (USFWS 2014). The conservation needs of the red knot include: (1) substantial growth of the Tierra del Fuego wintering population; (2) stable or increasing numbers in other wintering regions; (3) reproductive rates (averaged over 3 to 5-periods) sufficient to support growth in the wintering populations; (4) a well-managed network of key migration staging areas (*e.g.*, Delaware Bay) across North and South America providing

an abundance of suitable food resources at the appropriate time in the annual cycle; (5) sufficient secondary migration stopover habitats to allow the species to adapt to short-term (*e.g.*, annual weather, food, predation, disturbance conditions) and long-term (*e.g.*, climate change, sea level rise, habitat modification) changes in their migratory phenology and landscape. These needs reflect the conservation tenets of numbers, reproduction, and distribution.

Since listing, the Tierra del Fuego wintering population has been stable but has not grown. Population sizes in the other wintering regions appear stable, but consistent survey effort is lacking. Because the red knot is a solitary territorial nester, with breeding grounds covering a vast and remote artic expanse, we have little information on which to assess reproductive rates or trends. The key migration staging areas are well known, and are generally managed for red knots and other shorebirds. However, several staging areas still face local and regional threats including sea level rise, development, food supply issues, and risks from oil spills. We do not know how much secondary migration stopover habitat is needed to support recovery of this species, or in what geographic distribution. Sandy Hook is considered a secondary stopover habitat—one with particularly high-quality habitats and a high level of conservation management.

Within the Action Area

We use Ebird data, which include both anecdotal reports as well as more systematic efforts such as the International Shorebird Survey (ISS), to evaluate current levels of red knot usage across secondary stopover habitats. Ebird records in North Beach to date are shown in Table 3. Despite the high suitability of the North Beach stopover habitat, high degree of conservation management, and low human usage, red knot numbers documented to date have been modest. We are not aware of an ISS or other systematic red knot surveys of North Beach. It is possible that additional survey effort may reveal somewhat higher numbers of knots. Based on the data in Table 3, red knots are using North Beach during both spring and fall migration, but more so in fall, particularly during September.

Table 3. Ebird records of red knots in North Beach as of October 2017

Number of Red Knots	Locality	Date	Species Comments
2	Sandy Hook--Migration Watch Platform	8/22/2017	
1	Sandy Hook--tip area	8/20/2017	
1	Sandy Hook--Migration Watch Platform	8/18/2016	
1	Sandy Hook--tip area	8/17/2016	
8	Sandy Hook--tip area	9/4/2015	
4	Sandy Hook--tip area	9/8/2014	
2	Sandy Hook--tip area	8/30/2014	
4	Sandy Hook--tip area	8/17/2014	
6	Sandy Hook--Migration Watch Platform	8/11/2014	
1	US-NJ-Highlands	8/25/2013	
2	Sandy Hook--tip area	8/3/2013	
1	Sandy Hook--tip area	9/11/2012	
1	Sandy Hook--tip area	9/8/2012	
1	Sandy Hook--tip area	9/7/2012	
1	Sandy Hook--tip area	9/5/2012	Solo bird. Possible juvenile or (more likely) non-breeding adult.
3	Sandy Hook--tip area	9/4/2012	
1	Sandy Hook--tip area	8/30/2012	
1	Sandy Hook--tip area	8/5/2012	
1	Sandy Hook--tip area	7/25/2012	
2	Sandy Hook--tip area	6/11/2012	
3	Sandy Hook--tip area	6/5/2012	One banded.
9	Sandy Hook--tip area	5/31/2012	
33	Sandy Hook--tip area	5/30/2012	exact count
10	Sandy Hook--tip area	5/26/2012	
9	Sandy Hook--tip area	5/19/2012	
1	Sandy Hook--Migration Watch Platform	10/2/2011	
2	Sandy Hook	9/18/2011	
5	Sandy Hook--tip area	9/16/2011	
19	Sandy Hook	9/12/2011	1 was banded.
24	Sandy Hook--Migration Watch Platform	9/11/2011	lots around
19	Sandy Hook--tip area	9/11/2011	
7	Sandy Hook--Migration Watch Platform	9/5/2011	
6	Sandy Hook--tip area	9/5/2011	
3	Sandy Hook--tip area	9/4/2011	North Point
1	Sandy Hook--tip area	8/31/2011	
2	Sandy Hook--tip area	5/26/2011	Feeding on that sand island out in the ocean.
4	Sandy Hook--tip area	5/25/2011	
6	Sandy Hook--tip area	5/21/2011	
1	Sandy Hook--tip area	5/21/2011	
1	Sandy Hook--Migration Watch Platform	5/19/2007	

NORTHEASTERN BEACH TIGER BEETLE STATUS

Rangewide

The northeastern beach tiger beetle was federally listed as threatened under the ESA in 1990. About 0.5 inch long, tiger beetles are often the dominant invertebrate predators in habitats where they occur. Adults use their long mandibles to capture small amphipods, flies, and other invertebrates along the water's edge. Adults have also been observed scavenging on dead amphipods, crabs, and fish. Larvae are "sit and wait" predators that feed mainly on amphipods (USFWS 1994). Little is known about the precise types of microarthropods eaten by the beetle larvae, but prey that have been identified include beach fleas, lice, flies, ants, and other small insects (USFWS 2012, Pearson *et. al.* 2006). Adult beetles are active from June to early

September. Adult beetles mate and lay eggs on the beach during the summer (starting in June and ending by mid-July). Eggs are laid in the mid- to above-high tide drift zone. Eggs are deposited on the beach near the sand surface or in shallow pits excavated by adults, usually within 1 inch of the beach surface (Knisley 1997). The eggs hatch in 10 to 14 days, depending on soil moisture (USFWS 2012).

Larvae dig vertical burrows in the sand and wait at the burrow mouth to capture passing prey. Larval beetles occur in a relatively narrow band of the upper intertidal to high drift zone, where they can be regularly inundated by high tides. Larvae typically occur in an area of beach 26 to 39 feet wide within and above the intertidal zone. However, the area where larvae occur may be wider in areas of washover or where the upper beach is flat and is periodically inundated by high tides (USFWS 1994). Larvae can survive flooding for 3 to 6 days, but lack a hard cuticle and are susceptible to desiccation. They tend to become inactive during hot, dry conditions. Northeastern beach tiger beetle larvae pass through three developmental stages (instars) over 2 years, over-wintering twice as larvae, pupating at the bottom of their burrows, and emerging as winged adults during their third summer (USFWS 1994).

Northeastern beach tiger beetles inhabit wide, sandy, ocean beaches from the intertidal zone to the upper beach. Beetles are rarely found on beaches less than 6.5 feet in width (Drummond 2002). Beetles are typically found on highly dynamic beaches with back beach vegetation, and they prefer long, wide beaches that have low human and vehicular activity, fine sand particle size, and a high degree of exposure (Knisley *et al*. 1987). Drummond (2002) found a correlation between the extent of shallow water fronting the beach and the number of tiger beetles present (the more sand bars, the more beetles). A beetle with sedentary larvae is susceptible to wave impacts, and work by Rosen (1980) has shown that the greater the shallow zone fronting a beach, the lower the wave energy. Knisley (1997) found that larval densities were highly variable relative to sand particle size, and that larvae are rare at sites with greater than 60 percent coarse sand (100-size mesh sieve) (Knisley 1997). Drummond (2002) found that adults occupied beaches with 40 to 80 percent coarse sand. If the sand size is too coarse, too fine, or contains a high organic content, it appears unsuitable for the larvae to burrow and maintain a larval tube. Thermal and moisture microhabitat gradients are important for larvae (USFWS 1994).

Historically, the northeastern beach tiger beetle was a common inhabitant of coastal beaches from Cape Cod, Massachusetts to central New Jersey, and along the Chesapeake Bay, from Calvert County, Maryland south through Virginia. To facilitate the reestablishment of the species across its former range, the northeastern beach tiger beetle recovery plan established nine Geographic Recovery Areas (GRAs) to provide a framework within which protection and population efforts could be ranked and implemented (USFWS 1994). Table 4 provides a summary of the status of each GRA as of 2012.

Table 4. Summary of the status of the northeastern beach beetle throughout its range (USFWS 2012)

GRA	State(s)	Status	Site Specific Comments
1	Coastal Massachusetts and Islands	Stable	• Beetle population at Westport, MA extirpated. • Martha's Vineyard overall numbers appear stable. The Squibnocket site in 2011 had a significant drop in numbers from 1,500 to 93. • Monomoy NWR translocation - beetle numbers increasing (Protected).
2 & 3	Rhode Island, Block Island, Long Island Sound, and Long Island, New York	Extirpated	• At listing extirpated from RI and NY. • No Potential suitable habitat known.
4	Sandy Hook to Little Egg Inlet, New Jersey	Uncertain/ Extirpated	• Sandy Hook, NJ translocation site, 7 adults observed in 2008, despite multiple surveys since, status still uncertain.
5	Maryland - Calvert County	Declining	• 9 of 10 occupied sites extirpated, habitat lost or in very poor condition. • The remaining site (Western Shores/Calvert Beach) declined from a high count of 4,198 in 1991 and is holding at 400-600 beetles, a 90% drop in numbers. • Remaining site is not protected.
6	Maryland - Tangier Sound	Stable	• Both sites in this GRA (Janes and Cedar Islands) are stable or may be increasing. • Both sites support large populations (≥ 1100 adults), and both are protected. • Only GRA that meets the delisting criteria.
7	Virginia - Eastern Shore	Stable to declining	• 2009 survey found the highest total count (46,082 adults) of adult beetles since the start of comprehensive surveys. • Increase was primarily the result of significant increases at 7 sites (Church Neck North, Occahannock Neck, Silver-Downings Beach, Tankards Beach, Scarborough Neck, Church Neck, and Hyslop Marsh). • 7 sites with no beetles compared to 2 in 2005. • Significant declines from 2005 have occurred at 4 sites (Picketts Harbor, Cape Charles, Elliots Creek South, and Kiptopeke), coincidental with increased shoreline modifications or other human impacts. • Largest decline was at Parkers Marsh (down from 12,554 in 2005, to 1,629 in 2009.
8 & 9	Virginia - Western Shore	Declining	• Since 2001there has been a 20% loss in occupied sites (12 of 58 sites). • Habitat loss due to Hurricane Isabel and Ernesto. • Total numbers declined 70% since 2001. • Since 2001, the 8 largest sites that support approximately 50% of the total beetles in 2001 have declined by 78%. • GRA 8 has four occupied sites that support large populations, but none are protected. There is one "other" sized population that is protected, Hughlett Point (DCR). • GRA 9 has two occupied sites that support large populations and one protected, New Point Comfort (Mathews County and TNC). There is one "other" sized population that is protected, Bethel Beach (DCR).

The primary threat to the northeastern beach tiger beetle is habitat disturbance and destruction from development, beach stabilization activities, and recreational beach uses including pedestrian and vehicle traffic, all of which affect the larvae. Other threats include spills of oil or other contaminants, pesticide use, natural or human-induced beach erosion, and natural factors such as predation and storms (USFWS 1994).

The recovery criteria of the northeastern beach tiger beetle are laid out in the recovery plan (USFWS 1994) and reflect the conservation tenets of numbers, reproduction, and distribution: (1) at least three viable populations have been established and permanently protected in each of four designated GRAs covering the subspecies' historical range in the Northeast, with each GRA having one or more sites with large populations (peak count greater than 500 adults) and sufficient protected habitat for expansion and genetic interchange; (2) at least 26 viable populations distributed throughout all five Chesapeake Bay GRAs are permanently protected; (3) life history parameters (including population genetics and taxonomy), human impacts, and factors causing decline are understood well enough to provide needed protection and management; and (4) an established, long-term management program exists in all states where the species occurs or is reintroduced.

As of 2008, none of the GRAs had met the criteria established in the recovery plan, and only one of the Chesapeake Bay GRAs had met the population targets. Progress had been made regarding research to understand life history parameters, including a population viability analysis showing that protection of 25 to 50 subpopulations is necessary to reduce extinction risk for the tiger beetle throughout Chesapeake Bay. Long-term management programs were not yet in place in every state (USFWS 2008). One of the GRAs is Sandy Hook to Little Egg Inlet, New Jersey. With the apparent failure of the translocated population (discussed below), there are no tiger beetles in this GRA.

Within the Action Area

The northeastern beach tiger beetle was found historically along New Jersey's undeveloped Atlantic coastal beaches from Sandy Hook to Holgate, but was extirpated from the State at the time of the recovery plan (USFWS 1994). Translocation work was conducted establish a population of tiger beetles in the North Beach area of Sandy Hook, using larvae from Chesapeake Bay populations. Previous experimental translocation trials in Virginia using adults were unsuccessful because the adults dispersed from the translocation sites within 1 to 2 weeks. Experimental translocations were conducted to test methods with larvae from several Virginia sites to Sandy Hook in September 1994 and 1995. The translocated larvae readily dug burrows, many survived the winter, and some emerged as adults the following summer. Additional translocations of 475 larvae each year were conducted in early May 1997, 1999, and 2000. Peak numbers of emerging adults counted each year in July increased from 178 in 1997 to 749 in 2001. Adults exhibited normal behaviors in the field (foraging, thermoregulation, and mating) and recruited larvae each year. A population seemed to be successfully established, but adult numbers declined sharply after the 2001 peak to 142 in 2002, 43 in 2003, and six in 2004. We have little evidence for the cause of this sharp decline in adult numbers, but it may have resulted from predation by gulls, dispersal triggered by the high gull densities where beetles occurred, or perhaps from coastal storm impacts causing a progressive decline in survival and recruitment of the beetle population (Knisley *et al.* 2005). In 2006, 28 adults were observed at

North Beach, evidence that at least some previously released larvae were surviving. Two beetles were observed each year in 2007 and 2008. No beetles were observed from 2009 to 2014, but surveys were conducted with limited staff. In 2015, two adult beetles were observed incidental to seabeach amaranth surveys; only a portion of North Beach was surveyed and the subspecies identification of those two beetles was not verified. The proposed dredge area was surveyed for adults in 2015, and none were found, but the area was not surveyed for larvae (Heuser pers. comm. 2015).

In 2017, the Corps funded a 2-year presence/absence survey lead by species experts, including one who had been involved with the earlier translocation work. During the 2017 surveys, no adult or larval northeastern beach tiger beetles were observed (Gwiazdowski pers. comm. 2017, Knisley 2017). Surveys will continue in 2018.

SEABEACH AMARANTH STATUS

Rangewide

Seabeach amaranth was federally listed as threatened under the ESA in 1993. An annual member of the amaranth family, seabeach amaranth has reddish stems and small, rounded, notched, spinach-green leaves. In New Jersey, these low-growing plants are typically about 4 inches across by late summer, but can occasionally reach 2 or 3 feet in diameter. The small white flowers and dark seeds are located in inconspicuous clusters along the stems. Germination begins in late May and continues through the summer. Flowering begins as soon as plants reach sufficient size (June or July) and continues until the plants die between September and December. Seed production begins in July or August and peaks in September during most years, but continues until the death of the plant. Weather events, including rainfall, hurricanes, and temperature extremes, and predation by webworms can shorten the reproductive season of seabeach amaranth. The relative roles of the fresh seed crop versus banked seeds are unknown in seabeach amaranth. It is known, however, that century-old seeds of some species of amaranth are capable of successful germination and growth (USFWS 2004, 1996b), and a long-lived seed bank is presumed.

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

Seabeach amaranth occupies elevations from 8 inches to 5 feet above mean high tide. The plant grows in the upper beach zone above the high tide line, and is intolerant of even occasional flooding during its growing season. The habitat of seabeach amaranth is sparsely vegetated with annual herbs and, less commonly, perennial herbs (mostly grasses) and scattered shrubs. Vegetative associates of seabeach amaranth include sea rocket (*Cakile edentula*), seabeach spurge (*Chamaesyce polygonifolia*), and other species that require open, sandy beach habitats.

However, this species is intolerant of competition and does not occur on well-vegetated sites. Seabeach amaranth is often associated with beaches managed for the protection of beach nesting birds (USFWS 2004, 1996b).

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

Table 5 gives available rangewide survey data. It should be noted that the data in Table 5 reflect variable levels of survey effort, and that seabeach amaranth population sizes are naturally prone to wide fluctuations. In June 2017, approximately 2,000 greenhouse-propagated seeds from locally sourced populations were planted at each of five National Wildlife Refuges in South Carolina, Virginia, New Jersey, and Massachusetts. This recovery effort continues to be monitored.

The conservation needs of seabeach amaranth are described in the recovery plan and reflect the tenets of numbers, reproduction and distribution. Seabeach amaranth will be considered for delisting when the species exists again in at least six of the States within its historic range and when a minimum of 75 percent of the sites with suitable habitat within each State are occupied by amaranth populations for 10 consecutive years. Seabeach amaranth requires extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, allowing it to disperse across the landscape, occupying suitable habitat as it becomes available (USFWS 1996b).

Progress toward the recovery criteria was aided by natural recolonization as well as outplanting of cultivated plants and seeds. If the 2017 outplanting successfully establishes a population in Massachusetts, seabeach amaranth will again be extant in at least seven States from its historic range, although the species' status in South Carolina is tenuous. Progress toward the number of extant sites per State is difficult to track due to the challenges of delineating a "site" in a dynamic coastal environment (USFWS 2007). The recovery criteria were issued as an interim objective, and are in need updating and clarification (USFWS 2007, 1996b). The landscape-level habitat needs of seabeach amaranth are quite similar to other species discussed above. See Piping Plover Status regarding habitat conditions in New York and New Jersey. Rice (2017, 2016) gives additional data on the condition of beach habitats for all States in the seabeach amaranth range except South Carolina. Habitat availability is a key limiting factor for seabeach amaranth (USFWS 2007, 1996b). In some areas, such as New Jersey, seabeach amaranth distribution is further limited by intensive beach raking (Kelly 2014).

Table 5. Available rangewide seabeach amaranth survey data (Suiter pers. comm. 2017)

Year	DE	NY	MD-VA	NC	NJ	SC	RI-CT-MA	Total
1987	0	0	0	10,278	0	1,341	0	11,619
1988	0	0	0	20,261	0	1,800	0	22,061
1989	0	0	0	0	0	0	0	0
1990	0	331	0	4,459	0	188	0	4,978
1991	0	2,251	0	1,170	0	0	0	3,421
1992	0	422	0	32,160	0	15	0	32,597
1993	0	195	0	22,214	0	0	0	22,409
1994	0	182	0	13,964	0	560	0	14,706
1995	0	599	0	33,514	0	6	0	34,119
1996	0	2,263	0	8,455	0	0	0	10,718
1997	0	11,918	0	1,445	0	2	0	13,365
1998	0	10,699	2	11,755	0	141	0	22,597
1999	0	31,196	1	596	0	196	0	31,989
2000	37	244,608	1,160	105	1,039	2,312	0	249,261
2001	71	205,233	3,331	5,088	5,813	231	0	219,767
2002	417	193,412	2,794	4,459	10,908	0	0	211,990
2003	12	114,535	503	11,233	5,087	1,381	0	132,751
2004	9	30,942	535	11,866	6,817	2,110	0	52,279
2005	6	16,813	627	20,718	5,795	671	0	44,630
2006	39	32,553	1,551	3,251	6,522	721	0	44,637
2007	19	3,914	2,179	875	2,191	60	0	9,238
2008	11	4,416	1,048	1,606	1,141	51	0	8,273
2009	44	5,402	1,260	785	3,226	26	0	10,743
2010	29	534	203	2,574	926	0	0	4,266
2011	33	2,662	240	373	2,614	0	0	5,922
2012	302	1,213	251	154	1,239	0	0	3,159
2013	104	729	8	166	316	0	0	1,323
2014	75	902	39	543	1,287	0	0	2,846
2015	267	1,008	122	1,661	2,488	231	0	5,777
2016	39	4,985	47		3,323		0	8,394
10-year Average	92	2,577	540	971	1,875	41	0	5,994

Within the Action Area

In the past 10 years, Sandy Hook has supported 90 to 99 percent of all seabeach amaranth plants in New Jersey. Table 6 gives numbers from North Beach, Sandy Hook, and New Jersey from 2013 through 2017. Despite optimal habitat and a high degree of conservation management, plant numbers at North Beach were low from 2000 through 2008. Declines from 2010 through 2014 followed a 2009 high of 369 plants. Numbers grew quickly from 2015 through 2017.

Table 6. Seabeach amaranth numbers in North Beach, Sandy Hook, and New Jersey (Heuser pers. comm. 2017, Kelly pers. comm. 2017)

Site Name	2017	2016	2015	2014	2013	5-Year Average
Sandy Hook North Beach	1,938	1,286	188	25	50	697
Sandy Hook	6,734	3,119	2,242	1,269	313	2,735
New Jersey Total	7,282	3,323	2,488	1,287	316	2,939

ENVIRONMENTAL BASELINE

In the context of consultations under Section7 of the ESA, the environmental baseline is the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone Section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). In determining whether a proposed action is likely to jeopardize the continued existence of a species, the action is viewed against the aggregate effects of everything that has led to the species' current status and those non-Federal actions likely to affect the species in the future.

The status of each species within the action area was given above. Here we present the factors affecting the species' environment within the action area, which are highly similar across all four species. The key factors include: (1) operation of natural coastal processes and a lack of hard stabilization structures; (2) updrift beach nourishment; (3) proximity of the channel and three cycles of dredging above the MLLW line since 2011; and (4) the NPS management program.

Largely due to natural coastal processes and a lack of hard stabilization structures, North Beach provides optimal habitat for nesting piping plovers, migrating red knots, and seabeach amaranth (USFWS 2014, 2009, 2007, 1996a, 1996b). Although the size and configuration of the beach was quite different at the time, the overall habitat quality and low human use at North Beach were key factors in the selection of this site for reintroduction of northeastern beach tiger beetles in the 1990s. Although no beetles were documented during the 2017 surveys, the habitat of North Beach, including the present sand spit configuration, is still considered ideal for northeastern beach tiger beetles (Gwiazdowski pers. comm. 2017).

Updrift beach nourishment likely contributed to growth of North Beach in recent years, including accretion of the sand spit (Corps 2017b). The sand spit provides highly suitable habitat for all four species including seabeach amaranth and nesting piping plovers (occupied), as well as northeastern beach tiger beetles and migrating red knots (potential).

Proximity of the channel and the recent history of dredging is a third factor affecting the species environment within the action area. Based on the condition of the accreting sand spit as of July 2017, the impact area appears to be highly suitable foraging habitat for piping plovers and red knots (see Appendix F). However, in recent years, piping plovers and red knots have concentrated their foraging activity in tidal pools and flats, away from the ocean/bay shoreline (Heuser pers. comm., 2015). The preference of these species to forage in tidal pools and flats is well known (USFWS 2014, 2009, 1996a). However, the channel may be another factor in relatively low use of tip of the spit for plover and knot foraging. The value of the very tip of the spit as foraging habitat may be reduced by the presence of the channel's deep, fast-flowing water. The deep, high-energy waters of the channel may also limit the value of the tip of the spit as habitat for northeastern beach tiger beetle larvae (Drummond 2002).

In addition to possible effects on habitat conditions from the proximity of the channel, recent dredging actions have also impeded the growth of the spit by preventing its advancement (Corps 2017b). Past dredging has also resulted in localized scarping. In March 2012 a scarp

approximately 6 feet high and 200 feet long was documented near the channel during dredging. Even when severe scarping has subsided, it is not clear if the slopes of the intertidal beach flatten to the point of suitability for listed species.

It is unknown if any northeastern beach tiger larvae or seabeach amaranth (plants or seeds) were present in the dredging footprint between 2011 and 2015. If present, these species were likely directly impacted (killed or removed) by dredging and associated activities, as well as indirectly impacted by habitat alteration.

It is likely that the updrift beach nourishment, the recent dredging actions, or a combination of the two have influenced the size, shape, configuration, and elevations of North Beach. All four listed species are highly sensitive to factors such as beach elevations and widths (Maslo *et al.* 2011). However, at this time we do not have enough information to determine how these past Federal actions have altered North Beach, other than the clearest effects at the sand spit (*e.g.*, accelerated growth and periodic truncation). For example, we do not know how beach elevations across North Beach may have been affected, or how such changes may be affecting listed species.

Management of North Beach by NPS as a Natural Zone, Sensitive Resource Subzone, is the final major factor affecting the species environment within the action area. In addition to these management designations in their 2014 General Management Plan (NPS 2014), discussed under Action Area (above), the NPS has also developed a *Shoreside Threatened and Endangered Species Beach Management Plan* (Shoreside Plan) for Sandy Hook (NPS 2009). The Shoreside Plan includes provisions to delineate sensitive beach species habitats with string and post fencing and close these areas to recreation. The Shoreside Plan also includes predator management, listed species monitoring, and other actions to actively manage and conserve listed species at North Beach and elsewhere in Sandy Hook (NPS 2009). Relative to other New Jersey beaches, recreational use of North Beach is very light, particularly during the piping plover nesting season. Significant for listed species, and unusual for New Jersey, there is no beach raking or shoreline stabilization at North Beach.

EFFECTS OF THE ACTION

The potential effects of the Federal dredging actions covered by this PBO on each federally listed species in the action area are shown in Tables 7 through 10. As noted in the tables, many of the potential adverse effects are substantially reduced or entirely avoided by the framework of Conservation Measures.

Direct Effects to Species

Direct effects to species can include injury, mortality, or removal of individuals, as well as disturbance or harassment from noise and activity. There will be no direct effects to piping plovers from dredging or onshore personnel due to the seasonal restriction (Conservation Measure 3).

Based on the numbers, timing, and foraging preferences of red knots in the action area observed to date, we expect 0 to 30 red knots to be exposed to disturbance from dredging, installation /

removal of temporary structures, and onshore personnel for each dredging cycle within the next 5 years. Red knots are sensitive to disturbance, and may respond by increased time spent alert, decreased time spent foraging or roosting, increase energy expenditure to flee the disturbance, and/or displacement from otherwise suitable habitat of variable distance and duration (USFWS 2014). We expect any displaced red knots will relocate to more inland portions of North Beach or elsewhere in Sandy Hook. It is unclear if this disturbance will rise to the level of harassment. No bodily injury or mortality of red knots is expected. Disturbance of red knots from onshore personnel will be minimized by Conservation Measure 5, and disturbance from the dredging will be minimized by Conservation Measures 2, 3, 6, and 8. The numbers, severity, and duration of red knots disturbed by dredging cycles after 5 years cannot be anticipated at this time, but will informed by the monitoring conducted under Conservation Measure 6.

Based on the best information currently available, we do not expect any northeastern beach tiger beetles to be killed, injured or removed by dredging or onshore personnel based on lack of beetles documented in the action area in recent years, including the 2017 targeted, expert survey effort. However, if beetles are documented in the action area in the future, we expect direct mortality of up to 100 percent of larvae within the dredging footprint. We have no information on which to estimate the number of larvae that may be affected. Larval mortality may be substantially reduced by the translocation effort (Conservation Measure 8), but we cannot ascertain at this time the extent to which mortality will be reduced by that measure. If beetles are found to occupy the action area, and if dredging occurs in early September, any adult beetles in the dredging footprint will be disturbed—some would likely relocate while others may be killed. We have no information on which to estimate the number of adult beetles that would likely be affected under such circumstances.

It is almost certain that seabeach amaranth seeds are present in the dredging footprint and that all seeds in the sand removal area will be lost to the beach ecosystem. It is not possible to estimate how many seeds will be affected, how many of those might have germinated absent the dredging, or how many may survive ocean placement and could eventually germinate following subsequent re-dredging and placement on a Monmouth County Beach through the Corps' beach nourishment program. The potential for seeds to be reclaimed from the ocean disposal area would only exist when the dredged material is placed at the Sea Bright Borrow Area, not the HARS or other ocean disposal areas. Potential also exists for seeds to survive and germinate if the dredged material is used for a beneficial use project in a beach environment. We expect that few seabeach amaranth plants will be destroyed based on Conservation Measures 3, 7, and 8, as well as the low topographic position of the dredging footprint (*i.e.*, most plants tend to grow higher on the beach where they are less subject to flooding (Kelly 2016, USFWS 2004)). Over the life of this PBO, it is likely that at least some plants will occur in the dredging footprint, but we cannot project how many due to the continual reconfiguration of the habitat as well as the naturally large fluctuations in population size and stochastic patterns of seed distribution via wind and water. Mortality of up to 100 percent of plants in the sand removal area may occur, but could be substantially reduced by Conservation Measure 8. Outside of the sand removal area, we expect at least some of the plants in the dredging footprint will survive and/or contribute to the current year's seed production based on Conservation Measures 7 and 8.

The potential for short-term disturbance, and potentially harassment, of piping plovers, red knots, and northeastern beach tiger beetles from bathymetric and topographic surveys will be minimized by Conservation Measure 4. Also based on Conservation Measure 4, we do not expect any physical injury or mortality of piping plovers, red knots, or seabeach amaranth from bathymetric and topographic surveys. Even with Conservation Measure 4 in place, adult or larval beetles, if present, may be crushed by vehicles conducting topographic surveys.

Indirect Effects via Habitat Modification

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). Indirect effects include habitat degradation from vehicle use (during topographic surveys or by onshore dredging personnel), and habitat disturbance during installation / removal of security fence or other temporary structures on the beach. Adverse effects to listed species from these temporary habitat impacts will be minimized by Conservation Measures 2, 3, 4, 5, 6, and 7.

Habitat effects also include direct removal of intertidal and supratidal beach by the dredging (Table 1), and further habitat loss from scarping, cumulatively resulting in a long-term loss of habitat for listed species. The recurrent dredging of the Sandy Hook Channel will continue to curtail the size of the sand spit and preclude its further growth, as discussed further under Description of the Proposed action and in Appendix E. These are considerable adverse effects to a scarce and sensitive habitat for all four listed species. We expect this direct habitat loss may be reduced by Conservation Measure 9, and will be largely or entirely offset by Conservation Measure 10.

There is also potential for the recurrent dredging to influence the habitat size, configuration, and characteristics through more subtle effects. For example, altered patterns of sand accretion could affect elevations and vegetation patterns. In addition, removal of protective shoals could increase flooding. Such potential effects are associated with high uncertainty. The Corps concluded that dredging will not increase flood risk (Corps 2017b), but agreed to periodically evaluate land form changes (Conservation Measure 11). The Offset Plan is especially important given the high uncertainty around these potential indirect influences on habitat conditions, which can have important effects on species but can be difficult to detect and to attribute to the dredging.

Effects Tables

Piping Plover Effects Table

Table 7. Piping plover effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Bathymetric survey (offshore) or topographic survey via ship or drone	Disturbance from noise/ activity	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding)	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 3, 4	Courting / territorial adults may be disturbed / harassed for a few days during March. CMs will avoid disturbance during the nesting season.
Topographic survey (ground-based, on foot or by motor vehicle)	Disturbance from noise/ activity	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 3,4	Courting / territorial adults may be disturbed / harassed for a few days during March. CMs will avoid disturbance during the nesting season.
Topographic survey (ground-based, on foot or by motor vehicle)	Crushing (birds stepped on, run over)	X	Individual birds	Eggs and chicks	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 3, 4	No vehicles will be used during the nesting season. Risk from surveyors on foot is discountable, given CMs.
Topographic survey (ground-based, on foot or by motor vehicle)	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation from tires or sleds	Nesting and foraging habitat	Adults and chicks	Breeding / Feeding / Sheltering	Adults – Negligible response Chicks – Increased energy expenditure to cross or go around ruts; risk of getting trapped in ruts (injury, mortality); reduced feeding/sheltering from wrack or vegetation impacts	Ranges from negligible to reduced chick survivorship (lower fledge rates)	Negligible to reduction in numbers	CM 3, 4	Courting / territorial adults may be exposed during March—negligible response expected. These localized, temporary habitat impacts are expected to recover naturally before the start of the nesting season, during which there will be no vehicle use. Habitat effects from surveyors on foot are insignificant, given CMs.

Table 7. Piping plover effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Security fencing, pipeline or other temporary structures on the beach[7]	Disturbance from noise/ activity during installation	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3	This potential impact is entirely avoided by the seasonal restriction.
Security fencing, pipeline or other temporary structures on the beach[7]	Crushing / killing during installation	X	Individual birds	Eggs and chicks	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3	This potential impact is entirely avoided by the seasonal restriction.
Security fencing, pipeline or other temporary structures on the beach[7]	X	Covering of habitat with structures; rutting / disturbance of substrate, wrack	Nesting and foraging habitat	Adults and chicks	Breeding / Feeding	Adults – Ranges from negligible response to displacement from otherwise suitable habitat Chicks – Increased energy expenditure to cross or go around ruts; risk of getting trapped in ruts (injury, mortality); reduced feeding from wrack impacts; displacement	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3	Courting / territorial adults may be exposed during March if these temporary habitat impacts have not naturally recovered by then—negligible response expected. Full habitat recovery from this localized impact is expected before the start of the nesting season based on CM 3.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Disturbance from noise/ activity	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3, 5	This potential impact is entirely avoided by the seasonal restriction.

[7] As per CM 2, no dredges will be placed on Sandy Hook. As per the description of "covered actions," no dredged material will be placed on Sandy Hook except as a beneficial use project approved by the NPS and the Service.

Table 7. Piping plover effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Crushing / killing	X	Individual birds	Eggs and chicks	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 5	This potential impact is entirely avoided by the seasonal restriction.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation, from tires	Nesting and foraging habitat	Adults and chicks	Breeding / Feeding / Sheltering	Adults – Ranges from negligible response to displacement from otherwise suitable habitat. Chicks – Increased energy expenditure to cross or go around ruts; risk of getting trapped in ruts (injury, mortality); reduced feeding/sheltering from wrack or vegetation impacts; displacement	Ranges from negligible to reduced survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3, 5	Courting / territorial adults may be exposed during March if these temporary habitat impacts have not naturally recovered by then—negligible response expected. Severity and extent of impact will be minimized by CM 5. Full habitat recovery is expected before the start of the nesting season based on CM 3.
Dredge Mobilization / Demobilization (offshore only as per CM 2)	Disturbance from noise/ activity	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3	This potential impact is entirely avoided by the seasonal restriction.
Dredging	Disturbance from noise/ activity	X	Individual birds	Adults and chicks	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to reduced reproduction and survivorship (lower hatch / fledge rates)	Negligible to reduction in numbers	CM 2, 3	This potential impact is entirely avoided by the seasonal restriction.

Table 7. Piping plover effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredging	Crushing / killing	X	Individual birds	Eggs and chicks	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3	This potential impact is entirely avoided by the seasonal restriction.
Dredging	X	Habitat destruction from removal of intertidal and supratidal beach	Nesting and foraging habitat	Adults and chicks	Breeding / Feeding / Sheltering	Displacement	Range from behavioral response (e.g., from increased competition) to reduced reproduction	Reduction in carrying capacity, reduction in distribution	CM 10	Direct habitat loss and reduced carrying capacity of the North Beach nesting area are expected to be largely or entirely offset by CM 10.
Dredging	X	Habitat loss and degradation from scarping	Foraging habitat	Adults and chicks	Feeding	Displacement	Range from behavioral response (e.g., avoidance of scarped area, increased competition), to reduced reproduction	Reduction in carrying capacity, reduction in distribution	CM 9, 10	The extent of habitat loss, and the severity of habitat degradation, may be reduced by CM 9, and will be largely or entirely offset by CM 10.
Dredging	X	Habitat degradation from topographic change (e.g., increased flooding in low-lying parts of North Beach from removing protective shoals; increased vegetation from altered sand accretion patterns in higher parts of North Beach)	Nesting habitat	Adults and chicks	Breeding / Sheltering	Range of responses include negligible; behavioral responses (e.g., avoidance of flooded or heavily vegetated areas, increased predator vigilance/ response); increased egg /chick loss to flooding/predators; displacement	Range from negligible, to increased competition, to reduced reproduction and survival	Range from negligible to reduction in numbers, carrying capacity, distribution	CM 11	CM 11 may help detect adverse indirect habitat impacts, but will not rectify them. There is high uncertainty around both the likelihood and the potential severity of any such impacts. Attribution of any observed habitat change(s) (outside the dredging footprint) as a result of the dredging (as opposed to natural coastal processes) is expected to be difficult.

Table 7. Piping plover effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredging	X	Precluded spit growth	Nesting and foraging habitat	Adults and chicks	Breeding / Feeding	NA	Increased competition, reduced reproduction[8]	Precluded growth in carrying capacity and curtailed expansion of distribution	CM 10	Reduced carrying capacity of the North Beach nesting area is expected to be largely or entirely offset by CM 10.

[8] Relative to the current trajectory of the environmental baseline, which is a growing spit.

Red Knot Effects Table

Table 8. Red knot effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Bathymetric survey (offshore) or topographic survey via ship or drone	Disturbance from noise/ activity	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / roosting)	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 3, 4	Migrating adults / juveniles may be disturbed / harassed for a few days between late August and November. CMs will minimize disturbance.
Topographic survey (ground-based, on foot or by motor vehicle)	Disturbance from noise/ activity	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / roosting) to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 3, 4	Migrating adults / juveniles may be disturbed / harassed for a few days between late August and November. CMs will minimize disturbance.
Topographic survey (ground-based, on foot or by motor vehicle)	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation from tires or sleds	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Ranges from negligible response to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 3, 4	Adults/juveniles may be exposed between late August and November. Localized adverse habitat conditions are expected to be short-lived (1 to 3 weeks). Minimal species response expected.
Security fencing, pipeline or other temporary structures on the beach[9]	Disturbance from noise/ activity during installation	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / roosting) to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3, 6, 8	Migrating adults / juveniles may be disturbed / harassed for a few days between September and November.

[9] As per CM 2, no dredges will be placed on Sandy Hook. As per the description of "covered actions," no dredged material will be placed on Sandy Hook except as a beneficial use project approved by the NPS and the Service.

Table 8. Red knot effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Security fencing, pipeline or other temporary structures on the beach[9]	X	Covering of habitat with structures; rutting / disturbance of substrate, wrack	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Ranges from negligible response to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3	Adults/juveniles may be exposed to localized habitat impacts for as long as 2 to 3 months between September and November.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Disturbance from noise/ activity	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / roosting) to displacement from otherwise suitable habitat.	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3, 5, 6, 8	Migrating adults and/or juveniles may be disturbed / harassed for as long as 2 to 3 months between September and November. CMs are expected to minimize impacts.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation, from tires	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Ranges from negligible response to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3, 5	Adults/juveniles may be exposed for as long as 2 to 3 months between September and November. Widespread beach driving could temporarily rise to the level of harm, but that severity of impact should be avoided by CM 5.
Dredge Mobilization / Demobilization (offshore only as per CM 2)	Disturbance from noise/ activity	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3, 6, 8	Migrating adults and/or juveniles may be disturbed / harassed for a few days between September and November.

Table 8. Red knot effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredging	Disturbance from noise/ activity	X	Individual birds	Adults and juveniles	X	Range of responses from negligible to disturbed (alert, walk, run, fly, stop feeding / incubating / brooding) to displacement from otherwise suitable habitat	Ranges from negligible to minor effects on energy budgets	Negligible (based on CMs as well as red knot numbers and habitat preferences observed to date)	CM 2, 3, 6, 8	Migrating adults and/or juveniles may be disturbed / harassed for as long as 2 to 3 months between September and November. CMs are expected to minimize impacts.
Dredging	X	Habitat destruction from removal of intertidal and supratidal beach	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Displacement	Range from behavioral response (e.g., from increased competition) to adverse effects on energy budgets	Reduction in carrying capacity, reduction in distribution	CM 10	Direct habitat loss and reduced carrying capacity of the North Beach stopover area are expected to be largely or entirely offset by CM 10.
Dredging	X	Habitat loss and degradation from scarping	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Displacement	Range from behavioral response (e.g., avoidance of scarped area, increased competition,) to adverse effects on energy budgets	Reduction in carrying capacity, reduction in distribution	CM 9, 10	The extent of habitat loss, and the severity of habitat degradation, may be reduced by CM 9, and will be largely or entirely offset by CM 10.

Table 8. Red knot effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredging	X	Habitat degradation from topographic change (e.g., increased flooding in low-lying parts of North Beach from removing protective shoals; increased vegetation from altered sand accretion patterns in higher parts of North Beach)	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	Range of responses include negligible; behavioral responses (e.g., avoidance of flooded or heavily vegetated areas, increased predator vigilance/ response); increased energy expenditure; reduce food intake rates; displacement	Range from negligible, to increased competition to adverse effects on energy budgets	Range from negligible to reduction in numbers, carrying capacity, distribution	CM 11	CM 11 may help detect adverse indirect habitat impacts, but will not rectify them. There is high uncertainty around both the likelihood and the potential severity of any such impacts. Attribution of any observed habitat change(s) (outside the dredging footprint) as a result of the dredging (as opposed to natural coastal processes) is expected to be difficult.
Dredging	X	Precluded spit growth	Foraging and roosting habitat	Adults and juveniles	Feeding / Sheltering	NA	Increased competition, adverse effects to energy budgets [10]	Precluded growth in carrying capacity and curtailed expansion of distribution	CM 10	Reduced carrying capacity of the North Beach stopover area is expected to be largely or entirely offset by CM 10.

[10] Relative to the current trajectory of the environmental baseline, which is a growing spit.

Northeastern Beach Tiger Beetle Effects Table

Table 9. Northeastern beach tiger beetle effects table. Based on best available information, we conclude this species is likely extirpated from the action area as of fall 2017. However, beetles may be rediscovered or recolonize the action area over the life of this PBO. Table 9 presents effect to any beetles that may be present in the action area (*e.g.*, assumes presence).

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Bathymetric survey (offshore) or topographic survey via ship or drone	Disturbance from noise/ activity	X	Individual beetles	Adults and larvae	X	None expected	None	None	CM 3, 4	We do not expect any response of adults or larvae to offshore ships or drones.
Topographic survey (ground-based, on foot or by motor vehicle)	Disturbance from noise/ activity	X	Individual beetles	Adults and larvae	X	Range of responses from negligible to disturbed (walk, crawl, fly, stop feeding / breeding), to short-distance displacement from otherwise suitable habitat	Negligible	Negligible	CM 3,4	Beetles may be may be disturbed / harassed for a few days. Adults (only late August through early September) may briefly fly a short distance down the beach. Larvae may remain in or retreat to burrows.
Topographic survey (ground-based, on foot or by motor vehicle)	Crushing (beetles stepped on, run over); larvae crushed in burrows	X	Individual beetles	Adults, larvae, eggs	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 3, 4	Limited risk to eggs because no vehicles will be used during the breeding season. CMs reduce but do not eliminate risk of surveyors or vehicles crushing adults or larvae.
Topographic survey (ground-based, on foot or by motor vehicle)	X	From tires or sleds: rutting / compaction of substrate; crushing / dispersal of wrack; disruption of moisture / thermal conditions in larval burrows,	Adults and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	Adults – Range from negligible response to displacement from otherwise suitable habitat Larvae – Range from increased energy expenditure to relocate; to reduced prey availability (through wrack impacts); to desiccation / unfavorable temperature exposure	Ranges from negligible to reduced larval survivorship	Negligible to reduction in numbers	CM 3, 4	Beetles may be exposed to habitat impacts from vehicle use between late August and March. Localized adverse habitat conditions are expected to be short-lived (1 to 3 weeks). Habitat effects from surveyors on foot are insignificant, given CMs.

Table 9. Northeastern beach tiger beetle effects table. Based on best available information, we conclude this species is likely extirpated from the action area as of fall 2017. However, beetles may be rediscovered or recolonize the action area over the life of this PBO. Table 9 presents effect to any beetles that may be present in the action area (*e.g.*, assumes presence).

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Security fencing, pipeline or other temporary structures on the beach[11]	Disturbance from noise/ activity during installation	X	Individual beetles	Adults and larvae	X	Range of responses from negligible to disturbed (walk, crawl, fly, stop feeding / breeding), to short-distance displacement from otherwise suitable habitat	Negligible	Negligible	CM 2, 3, 6, 8	Beetles may be may be disturbed / harassed for a few days. Adults (early September only) may briefly fly a short distance down the beach. Larvae may remain in or retreat to burrows.
Security fencing, pipeline or other temporary structures on the beach[11]	Crushing / killing during installation	X	Individual beetles	Adults, larvae, eggs	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 6, 8	No risk to eggs due to the seasonal restriction. Adults (early September only) may relocate and avoid being killed. Translocation (CM 8) may reduce but not eliminate larval mortality.
Security fencing, pipeline or other temporary structures on the beach[11]	X	Covering of habitat with structures. From tires or sleds: rutting / compaction of substrate; crushing / dispersal of wrack; disruption of moisture / thermal conditions in larval burrows	Adults and larval habitat	Adults, larvae, and eggs	Breeding / Feeding / Sheltering	Adults – Ranges from negligible response to displacement from otherwise suitable habitat Larvae – Range from increased energy expenditure to relocate; to reduced prey availability (through wrack impacts or structures covering burrows); to desiccation / unfavorable temperature exposure	Ranges from negligible to reduced larval survivorship	Negligible to reduction in numbers	CM 2, 3, 6, 8	Beetles may be exposed to localized habitat impacts for as long as 2 to 3 months. No exposure of eggs due to the seasonal restriction. Adults (early September only) are likely to relocate and avoid being killed. Translocation (CM 8) may reduce but not eliminate larval mortality.

[11] As per CM 2, no dredges will be placed on Sandy Hook. As per the description of "covered actions," no dredged material will be placed on Sandy Hook except as a beneficial use project approved by the NPS and the Service.

Table 9. Northeastern beach tiger beetle effects table. Based on best available information, we conclude this species is likely extirpated from the action area as of fall 2017. However, beetles may be rediscovered or recolonize the action area over the life of this PBO. Table 9 presents effect to any beetles that may be present in the action area (*e.g.*, assumes presence).

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Disturbance from noise/ activity	X	Individual beetles	Adults and larvae	X	Range of responses from negligible to disturbed (walk, crawl, fly, stop feeding / breeding), to short-distance displacement from otherwise suitable habitat	Negligible	Negligible	CM 2, 3, 5, 6, 8	Beetles may be may be disturbed / harassed for as long as 2 to 3 months. Adults (early September only) may briefly fly a short distance down the beach. Larvae may remain in or retreat to burrows. Translocation (CM 8) may reduce impacts to larvae.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Crushing (beetles stepped on, run over); larvae crushed in burrows	X	Individual beetles	Adults, larvae, and eggs	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 5, 6, 8	No risk to eggs due to the seasonal restriction. Adults (early September only) may relocate and avoid being killed. Translocation (CM 8) may reduce but not eliminate larval mortality.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	X	From tires: rutting / compaction of substrate; crushing / dispersal of wrack; disruption of moisture / thermal conditions in larval burrows	Adults and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	Adults – Range from negligible response to displacement from otherwise suitable habitat Larvae – Range from increased energy expenditure to relocate; to reduced prey availability (through wrack impacts); to desiccation / unfavorable temperature exposure	Ranges from negligible to reduced larval survivorship	Negligible to reduction in numbers	CM 2, 3, 5, 6, 8	Beetles may be exposed to habitat impacts for as long as 2 to 3 months. No exposure of eggs due to the seasonal restriction. Adults (September only) are likely to relocate and avoid being killed. CM 5 should limit the extent and severity of the impacts.

Table 9. Northeastern beach tiger beetle effects table. Based on best available information, we conclude this species is likely extirpated from the action area as of fall 2017. However, beetles may be rediscovered or recolonize the action area over the life of this PBO. Table 9 presents effect to any beetles that may be present in the action area (*e.g.*, assumes presence).

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredge Mobilization / Demobilization (offshore only as per CM 2)	Disturbance from noise/ activity	X	Individual beetles	Adults and larvae	X	None expected	None	None	CM 2, 3	We do not expect any response of adults or larvae to offshore activities.
Dredging	Disturbance from noise/ activity	X	Individual beetles	Adults and larvae	X	Range of responses from negligible to disturbed (walk, crawl, fly, stop feeding / breeding), to short-distance displacement from otherwise suitable habitat	Negligible	Negligible	CM 2, 3, 6, 8	Beetles may be may be disturbed / harassed for as long as 2 to 3 months. Adults (early September only) may briefly fly a short distance down the beach. Larvae may remain in or retreat to burrows. Translocation (CM 8) may reduce impacts to larvae.
Dredging	Crushing / killing / removal	X	Individual beetles	Adults, larvae, and eggs	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 6, 8	Adults (early September only) may relocate and avoid being killed. Mortality of up to 100 percent of larvae in the dredging footprint is expected. Translocation (CM 8) may reduce but not eliminate larval mortality.
Dredging	X	Habitat destruction from removal of intertidal and supratidal beach	Adult and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	Displacement	Range from behavioral response (e.g., from increased competition) to reduced survival	Reduction in carrying capacity, reduction in distribution	CM 10	Direct habitat loss and reduced carrying capacity of the North Beach habitat area are expected to be largely or entirely offset by CM 10.

Table 9. Northeastern beach tiger beetle effects table. Based on best available information, we conclude this species is likely extirpated from the action area as of fall 2017. However, beetles may be rediscovered or recolonize the action area over the life of this PBO. Table 9 presents effect to any beetles that may be present in the action area (*e.g.*, assumes presence).

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*					
Dredging	X	Habitat loss and degradation from scarping	Adult and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	Displacement	Range from behavioral response (e.g., relocation from scarped area, increased competition), to reduced survival, to mortality	Reduction in carrying capacity, reduction in distribution / numbers	CM 9, 10	The extent of habitat loss, and the severity of habitat degradation, may be reduced by CM 9, and will be largely or entirely offset by CM 10.
Dredging	X	Habitat degradation from topographic change (e.g., increased flooding in low-lying parts of North Beach from removing protective shoals; increased vegetation from altered sand accretion patterns in higher parts of North Beach)	Adult and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	Range of responses include negligible; behavioral responses (e.g., avoidance of flooded or heavily vegetated area); increased predation rates; increase flooding of larval burrows; displacement	Range from negligible, to increased competition, to reduced reproduction and survival	Range from negligible to reduction in numbers, carrying capacity, distribution	CM 11	CM 11 may help detect adverse indirect habitat impacts, but will not rectify them. There is high uncertainty around both the likelihood and the potential severity of any such impacts. Attribution of any observed habitat change(s) (outside the dredging footprint) as a result of the dredging (as opposed to natural coastal processes) is expected to be difficult.
Dredging	X	Precluded spit growth	Adult and larval habitat	Adults and larvae	Breeding / Feeding / Sheltering	NA	Increased competition, reduced reproduction[12]	Precluded growth in carrying capacity and curtailed expansion of distribution	CM 10	Reduced carrying capacity of the North Beach habitat area is expected to be largely or entirely offset by CM 10.

[12] Relative to the current trajectory of the environmental baseline, which is a growing spit.

Seabeach Amaranth Effects Table

Table 10. Seabeach amaranth effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Growth, Reproduction, Dispersal)*					
Topographic survey (ground-based, on foot or by motor vehicle)	Crushing / killing	X	Individuals	Plants and seeds	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 3, 4	Plant impacts likely avoided by CM 4. Impacts to seeds expected to be negligible based on species biology and CM 4.
Topographic survey (ground-based, on foot or by motor vehicle)	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation from tires or sleds	Habitat	Plants and seeds	Reproduction / Dispersal	Seeds may fail to germinate in impacted habitats. Or seedlings may not survive in such areas.	Reduced reproduction	Negligible to reduction in numbers	CM 3, 4	Localized, temporary habitat impacts from vehicle use will not impact current-year plants, and are expected to naturally recover before the start of the next growing season. Habitat effects from surveyors on foot are insignificant, given CMs.
Security fencing, pipeline or other temporary structures on the beach[13]	Crushing / killing	X	Individuals	Plants and seeds	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 7, 8	Plant mortality will be minimized by CM 7. Some plants in the dredging footprint will likely survive and/or contribute to the current year's seed production (CM 8). Some seeds will likely be damaged or destroyed.
Security fencing, pipeline or other temporary structures on the beach[13]	X	Covering of habitat with structures; rutting / disturbance of substrate, wrack	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	Seeds may fail to germinate in impacted habitats. Or seedlings may not survive in such areas. Any mature plants nearby may have a shortened growing season due to indirect microhabitat changes.	Ranges from to reduced reproduction to reduced survival	Negligible to reduction in numbers	CM 2, 3, 7, 8	Localized, temporary habitat impacts from vehicle use are expected to naturally recover before the start of the next growing season. Some plants indirectly impacted may survive or contribute to the current year's seed production (CM 8).

[13] As per CM 2, no dredges will be placed on Sandy Hook. As per the description of "covered actions," no dredged material will be placed on Sandy Hook except as a beneficial use project approved by the NPS and the Service

Table 10. Seabeach amaranth effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Growth, Reproduction, Dispersal)*					
Security or other personnel on the beach during dredging, on foot or using motor vehicles	Crushing / killing	X	Individuals	Plants and seeds	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 5, 7, 8	The species may be exposed to vehicle use for as long as 2 to 3 months. CMs 5 and 7 are expected to avoid plant mortality. Impacts to seeds expected to be negligible based on species biology and CM 5.
Security or other personnel on the beach during dredging, on foot or using motor vehicles	X	Rutting of substrate, crushing / dispersal of wrack, crushing of vegetation, from tires	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	Seeds may fail to germinate in impacted habitats. Or seedlings may not survive in such areas. Any mature plants nearby may have a shortened growing season due to indirect microhabitat changes.	Ranges from to reduced reproduction to reduced survival	Negligible to reduction in numbers	CM 2, 3, 5, 7, 8	Localized, temporary habitat impacts from vehicle use are expected to naturally recover before the start of the next growing season. Impacts to mature plants should be avoided by CMs 5 and 7.
Dredging	Crushing / killing / removal	X	Individuals	Plants and seeds	X	Injury or mortality	Injury or mortality	Reduction in numbers	CM 2, 3, 7, 8	Mortality of up to 100 percent of seeds in the dredging footprint is expected. Translocation (CM 8) may reduce but not eliminate plant mortality.
Dredging	X	Habitat destruction from removal of intertidal and supratidal beach	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	Displacement	Reduced survival, reproduction	Reduction in carrying capacity, reduction in distribution	CM 10	Direct habitat loss and reduced carrying capacity of the North Beach habitat area are expected to be largely or entirely offset by CM 10.

Table 10. Seabeach amaranth effects table

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality - clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Conservation Measures (CMs) for Avoidance Minimization Mitigation***	***Effects summary***
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Growth, Reproduction, Dispersal)*					
Dredging	X	Habitat loss and degradation from scarping	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	Displacement	Reduced survival, reproduction	Reduction in carrying capacity, reduction in distribution	CM 9, 10	The extent of habitat loss, and the severity of habitat degradation, may be reduced by CM 9, and will be largely or entirely offset by CM 10.
Dredging	X	Habitat degradation from topographic change (e.g., increased flooding in low-lying parts of North Beach from removing protective shoals; increased vegetation from altered sand accretion patterns in higher parts of North Beach)	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	Displacement	Range from negligible, to increased interspecific competition, to reduced reproduction and survival (*e.g.*, from increased flooding)	Range from negligible to reduction in numbers, carrying capacity, distribution	CM 11	CM 11 may help detect adverse indirect habitat impacts, but will not rectify them. There is high uncertainty around both the likelihood and the potential severity of any such impacts. Attribution of any observed habitat change(s) (outside the dredging footprint) as a result of the dredging (as opposed to natural coastal processes) is expected to be difficult.
Dredging	X	Precluded spit growth	Habitat	Plants and seeds	Growth / Reproduction / Dispersal	NA	Increased competition, reduced growth and reproduction[14]	Precluded growth in carrying capacity and curtailed expansion of distribution	CM 10	Reduced carrying capacity of the North Beach habitat area is expected to be largely or entirely offset by CM 10.

[14] Relative to the current trajectory of the environmental baseline, which is a growing spit.

CUMULATIVE EFFECTS

As used in the context of consultations under Section 7 of the ESA, cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). All foreseeable actions, actives, or management programs within the action area would be under the jurisdiction of the NPS, the Corps, the USCG and/or the Navy—all Federal agencies. The Service is not aware of any future State, tribal, local, or private actions that are reasonably certain to occur within the action area; therefore, no cumulative effects are anticipated.

JEOPARDY ANALYSIS

"Jeopardize the continued existence" of a species, as defined in regulations implementing the ESA, means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery in the wild by reducing the reproduction, numbers, and distribution of that species (50 CFR 402.02). The following analysis relies on four components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this PBO emphasizes the rangewide (or recovery unit wide) 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 recurrent dredging, taken together with cumulative effects, for purposes of making the jeopardy determination.

Effects to Individuals

No piping plovers have been or will be directly killed, injured, or disturbed. Low numbers of red knots may be disturbed, potentially rising to the level of harassment. Up to 100 percent of any northeastern beach tiger beetle larvae in the dredging footprint may be killed by sand removal, temporary structure installation/removal, and vehicle use. However, presently no beetles are believed to occur in the action area. Some number of seabeach amaranth plants and seeds will be lost as a result of the dredging. All of these direct effects to species will be minimized by the Conservation Measures. Additional impacts to individuals of all four listed species will occur due to temporary degradation; long-term, direct removal; and potentially subtle, indirect alteration of habitat. Habitat will be precluded from growing, and habitat characteristics important to species survival may be altered. We expect these adverse habitat effects to be minimized, and largely or entirely offset, by the framework of Conservation Measures.

Effects to Populations

As we have concluded that individuals of the four listed species are likely to be killed and/or experience some reductions in their fitness and/or distribution, we need to assess the aggregated consequences of the anticipated impacts of the exposed individuals on the population to which these individuals belong. We also consider the relative importance of the action area for the species and the populations that make up the species (see Status of the Species).

- The North Beach nesting area is of the highest conservation value and importance to the NY-NJ recovery unit of piping plovers. The Federal actions covered by this PBO will reduce piping plover distribution in North Beach, and may have minor effects on numbers and reproduction. Major impacts to numbers/reproduction are not expected partly based on a stable population condition following past rounds of dredging (Tables 1 and 2; Pover and Davis 2016). Substantial areas of high-quality nesting habitat will remain, and the highest-value foraging habitats (*e.g.*, tidal ponds) will not be altered. Habitat effects will be minimized and offset.

- North Beach is a high-quality, but low-use stopover habitat for migrating red knots. The Federal actions covered by this PBO will reduce red knot distribution in North Beach, but are not expected to affect numbers or reproduction. The highest-value foraging habitats (*e.g.*, tidal ponds) will not be altered. Direct disturbance of birds will be minimized, and habitat effects will be minimized and offset.

- North Beach has the potential to play a key role the recovery of northeastern beach tiger beetles by a supporting a population in the currently unoccupied GRA 4. Best available information suggests there are currently no beetles in the action area. If beetles are rediscovered or recolonize North Beach, mortality from the dredging and associated activities could be high (substantial reductions in numbers, reproduction, and distribution), but may be limited by the Consecration Measures. Habitat effects will be minimized and offset.

- North Beach is of high conservation value and importance to seabeach amaranth, particularly in the heavily developed mid-Atlantic portion of the species' range. The Federal actions covered by this PBO will reduce seabeach amaranth distribution in North Beach, and may affect numbers and reproduction. Substantial areas of high-quality habitat will remain. Direct damage/loss of plants will be minimized, and habitat effects will be minimized and offset.

Effects to Species

As we have concluded that the North Beach populations of piping plovers, red knots, northeastern beach tiger beetles, and seabeach amaranth are likely to experience reductions in numbers, reproduction, and/or distribution, we need to assess the aggregated consequences of the anticipated loss of long-term viability of the exposed populations on the species or recovery unit as a whole.

- Impacts to numbers or reproduction of piping plovers at North Beach are expected to be minimal. Any such impacts, as well as loss of habitat carrying capacity, are expected to be offset elsewhere in New Jersey. The status of piping plovers in the NY-NJ recovery unit is tenuous, and is largely limited by the quantity of optimal habitat such as that at North Beach. However, the overall condition of the North Beach habitat is expected to remain high despite the dredging, and the local population is not expected to decline—although its potential for further growth may be precluded. The habitat offset plan (Appendix E) is expected to increase the quality or quantity of habitats elsewhere in New Jersey, addressing a key conservation need for this species.

- The conservation needs of the red knot include an adequate supply of stopover habitats for migrating birds, such as those at North Beach. Although the size and quality of the habitat will be impacted, North Beach will continue to fulfill the function of high-quality stopover habitat, particularly considering the low numbers and habitat preference of red knots documented at North Beach to date, and the framework of Conservation Measures.

- The actions covered by this PBO may impede but are not expected to prevent establishment of a northeastern beach tiger beetle population in GRA 4, a key conservation need for the recovery of this species. The Offset Plan may help advance this conservation goal.

- Seabeach amaranth requires extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, allowing it to disperse across the landscape, occupying suitable habitat as it becomes available. Although the size and quality of the habitat will be reduced, North Beach will continue to serve as a of high-value habitat, particularly considering the framework of Conservation Measures. The Offset Plan is expected to increase the quality or quantity of habitats elsewhere in New Jersey, addressing a key conservation need for this species.

Conclusion

We considered the current overall status of piping plover (NY-NJ recovery unit), red knots, northeastern beach tiger beetles, and seabeach amaranth. For all four species, status is stable but low and well short of the conservation needs for long-term viability. We also considered the condition of these species within the action area (environmental baseline). We then assessed the effects of the actions covered by this PBO and the potential for cumulative effects in the action area on individuals, populations, and the species (or recovery unit) as a whole. The types of effects of the covered dredging actions are currently considered among the primary factors influencing the status of all four species (*e.g.*, habitat loss and modification from coastal engineering). As stated above, however, we expect no to minor reductions in overall numbers within the action area, and no reductions in numbers or reproduction to the species after factoring in the Offset Plan (Appendix E). Notable reductions to species distribution will occur within the action area, but will be offset elsewhere in New Jersey. It is the Service's Opinion that the dredging actions, as described in this document, are not likely to jeopardize the continued existence of piping plovers, red knots, northeastern beach tiger beetles, or seabeach amaranth. At the time of this PBO, no critical habitat has been designated for these species; therefore, no critical habitat will be affected.

INCIDENTAL TAKE STATEMENT

DEFINITION OF INCIDENTAL TAKE

Section 9 of the ESA and the federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. *Take* is defined as 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 Section 7(b)(4) and Section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered a prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

EXTENT OF ANTICIPATED TAKE

Final regulations published on May 11, 2015 (*Federal Register* Vol. 80, No. 90, p. 26845) define *framework programmatic action*, for purposes of an incidental take statement, as a Federal action that approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time, and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further Section 7 consultation. These regulations define *mixed programmatic action*, for purposes of an incidental take statement, as a Federal action that approves action(s) that will not be subject to further Section 7 consultation, and also approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of a listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further Section 7 consultation. Under these regulations, for a framework programmatic action, an Incidental Take Statement is not required at the programmatic level; any incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent (Tier 2) Section 7 consultation, as appropriate. For a mixed programmatic action, an Incidental Take Statement is required at the programmatic level only for those program actions that are reasonably certain to cause take and are not subject to further Section 7 consultation.

This PBO constitutes consultation on a mixed programmatic action. As such, this Incidental Take Statement covers the 2015 and 2017 dredging actions only. This PBO does not cover any take for future Corps dredging actions or authorizations. Incidental take from future dredging will be assessed during the Tier 2 process. Incidental take authorized in this PBO stems from the following: (1) removal of 2.8 acres of habitat in 2015; and (2) removal of an estimated 2.6 acres of habitat in 2017. We note that the 2015 pre-dredging projection of habitat removal was far lower (1.6) than the final post-dredging estimate of 2.8 acres. Thus, we expect that more than 2.6 acres could be removed in 2017.

This habitat is/was used by piping plovers, and may be/may have been used by red knots. Based on nest locations from 2014 through 2016, we conclude that the 2015 dredging caused non-lethal take in the form of harm (through nest site selection, and potentially reproductive success) of up to four pairs of plovers during the 2015 nesting season. Based on nest locations from 2017, we expect the 2017 dredging will cause non-lethal take in the form of harm (through nest site

selection, and potentially reproductive success), of up to 5 pairs of piping plovers during the 2018 nesting season.

Based on numbers of red knots documented in North Beach to date (Table 3), we conclude that no more than 10 red knots were harassed during the 2015 dredging, and that no more than 10 will be harassed during the 2017 dredging. Based on habitat preferences observed to date (Heuser pers. comm. 2015), we conclude that no additional take of red knots in the form of harm resulted from the 2015 dredging or is likely to result from the 2017 dredging.

It is possible but unlikely that northeastern beach tiger beetles were present at the time of 2015 dredging. If any beetles were present, we have no way to assess the numbers that were directly killed, but surmise that number was low based on survey data available at that time. If beetles were present at the time of the 2015 dredging, additional non-lethal take of any beetles that escaped direct mortality likely occurred in the form of harm to larvae (through relocation and/or reduced survival). Based on the best information currently available, we conclude no beetles are present at the time of the 2017 dredging; therefore, no take of beetles is expected as a result of the 2017 dredging action.

EFFECT OF THE TAKE

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

REASONABLE AND PRUDENT MEASURES

Reasonable and Prudent Measures (RPMs) are measures considered necessary or appropriate to minimize the amount or extent of anticipated incidental take of the species. The Service has concluded that the below RPMs are necessary and appropriate to minimize take of piping plovers, red knots, and northeastern beach tiger beetles. In order to be exempt from the prohibitions of Section 9 of the ESA, the Corps and its permittees must comply with the below terms and conditions, which implement the RPMs and outline monitoring and reporting requirements. The RPMs and associated terms and conditions are nondiscretionary, and must be implemented by the Corps.

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

RPM 1: Report on the progress of the action and its impact on the species, as required pursuant to 50 CFR 402.14(i)(3).

TERMS AND CONDITIONS

RPM 1: Terms and Conditions

1.1 Exercise care in handling any specimens of dead or injured piping plovers, red knots, or northeastern beach tiger beetles to preserve biological material in the best possible state. In conjunction with the preservation of any specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or non-viable specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

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

Senior Resident Agent
U.S. Fish and Wildlife Service
Division of Law Enforcement
Sea Land Building, 2nd Floor
1210 Corbin Street
Elizabeth, New Jersey 07201
(973) 645-5910

COORDINATION OF INCIDENTAL TAKE STATEMENT WITH OTHER LAWS, REGULATIONS, AND POLICIES

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. S 703-712), if such take is in compliance with the Terms and Conditions specified herein. Take resulting from activities that are not in conformance with this PBO (*e.g.*, deliberate harassment of wildlife) are not considered part of the proposed action and are not covered by this Incidental Take Statement and may be subject to enforcement action against the individual responsible for the act.

CONSERVATION RECOMMENDATIONS

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. For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

1. Continue to periodically reassess the alternative of relocating the Sandy Hook Channel such that it no longer intersects the tip of Sandy Hook.

2. Undertake detailed monitoring and modeling of North Beach and the adjacent USCG nesting area, and the natural and anthropogenic processes that influence the quality and quantity of habitat for listed species. Prepare a contingency plan for addressing adverse conditions that may develop (*e.g.*, unfavorable elevations or vegetative conditions) as a result of external human activities such as updrift sand placement and/or dredging. Also use the data and modeling to estimate the likely equilibrium size and configuration of the tip of Sandy Hook "but for" the presence of the channel, to inform both the periodic re-assessment of the Offset Plan and the potential relocation of the channel as per Conservation Recommendation 1.

REINITIATION – CLOSING STATEMENT

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

REFERENCES CITED

LITERATURE CITED

Drummond, M.R. 2002. The effects of geophysical factors on the distribution of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis* Say. Master's Thesis, Christopher Newport University. 90 pp.

Guilfoyle, M.P., R.A. Fischer, D.N. Pashley, and C.A. Lott editors. 2006. Summary of first regional workshop on dredging, beach nourishment, and birds on the south Atlantic coast. ERDC/EL TR-06-10. U.S. Army Corps of Engineers, Washington, DC. http://www.fws.gov/raleigh/pdfs/ES/trel06-10.pdf [Accessed May 5, 2016]

Guilfoyle, M.P., R.A. Fischer, D.N. Pashley, and C.A. Lott editors. 2007. Summary of second regional workshop on dredging, beach nourishment, and birds on the north Atlantic coast. ERDC/EL TR-07-26. U.S. Army Corps of Engineers, Washington, DC. http://el.erdc.usace.army.mil/elpubs/pdf/trel07-26.pdf [Accessed May 5, 2016]

Harrington, B.A. 2001. Red knot (*Calidris canutus*). In A. Poole, and F. Gill, eds. The birds of North America, No. 563, The Birds of North America, Inc., Philadelphia, Pennsylvania.

Harrington, B.A. 2008. Coastal inlets as strategic habitat for shorebirds in the southeastern United States. DOER technical notes collection. ERDC TN-DOER-E25. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. http://el.erdc.usace.army.mil/elpubs/pdf/doere25.pdf [Accessed May 5, 2016]

Hecht, A. 2016. Habitat Enhancement and Restoration for Atlantic Coast Piping Plovers: Summary of Past and Current Efforts and Recommendations for Future Implementation. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 8 pp.

Kelly, J.F., 2014. Effects of human activities (raking, scraping, off-road vehicles) and natural resource protections on the spatial distribution of beach vegetation and related shoreline features in New Jersey. Journal of Coastal Conservation 18(3), 383e398.

Kelly, J.F., 2016. Assessing the spatial compatibility of recreational activities with beach vegetation and wrack in New Jersey: Prospects for compromise management. Journal of Ocean & Coastal Management 123(2016):9-17.

Kisiel, C. 2009. The spatial and temporal distribution of piping plovers in New Jersey, 1987-2007. Rutgers University, New Brunswick, New Jersey. http://www.njfishandwildlife.com/ensp/pdf/literature/spatial+temporal_distribution_piping-plovers.pdf [Accessed May 9, 2016]

Knisley, C.B. 1997. Microhabitat preferences of *Cicindela dorsalis dorsalis*, the northeastern beach tiger beetle. Report to Virginia Department of Agriculture and Consumer Services, Richmond, Virginia.

Knisley, C.B. 2017. Fall Surveys for larvae of Northeastern Beach Tiger Beetle and Sandy Hook. Report to U.S. Fish and Wildlife Service, Galloway, New Jersey. 2 pp.

Knisley, C.B., J. Hill, and A.M. Scherer. 2005. Translocation of Threatened Tiger Beetle *Cicindela dorsalis dorsalis* (Coleoptera: Cicindelidae) to Sandy Hook, New Jersey. Annals of the Entomological Society of America 98(4): 552-557(Coleoptera: Cicindelidae) to Sandy Hook, New Jersey

Knisley, C.B., J.L. Luebke, and D.R. Beatty. 1987. Natural history and population decline of the coastal tiger beetle *Cicindela dorsalis dorsalis* Say (Coleoptera: Cicindelidae). Virginia Journal of Science 38(4):293-303.

Lott, C.A., C.S. Ewell Jr., and K.L. Volansky. 2009. Habitat associations of shoreline-dependent birds in barrier island ecosystems during fall migration in Lee County, Florida. U.S. Army Corps of Engineers, ERDC/EL TR-09-14, Washington, DC. http://el.erdc.usace.army.mil/elpubs/pdf/trel09-14.pdf [Accessed May 5, 2016]

Maslo, B. 2009. Piping Plover Restoraiton Review: Preliminary Report. Rutgers Program in Ecology and Evolution, New Brunswick, New Jersey. 5 pp.

Maslo, B., S. N. Handel, and T. Pover. 2011. Restoring beaches for Atlantic Coast piping plovers (*Charadrius melodus*): a classification and regression tree analysis of nest-site selection. Restoration Ecology Vol. 19, No. 201, pp. 194–203.

National Park Service [NPS]. 2009. Shoreside Threatened and Endangered Species Beach Management Plan for Sandy Hook Unit, Gateway National Recreation Area, New Jersey. 25 pp. + Appendices.

National Park Service [NPS]. 2014. A New Vision for a Great Urban National Park: Gateway National Reactional Area Final General Management Plan and Environmental Impact Statement. 604 pp. + Appendices. Staten Island, New York. https://www.nps.gov/gate/learn/management/gmp-2012.htm [Accessed October 29, 2017]

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. Espoz. 2008. Status of the red knot (*Calidris canutus rufa*) in the Western Hemisphere. Studies in Avian Biology 36:1-185.

North Carolina Wildlife Resources Commission [NCWRC]. 2013. Public comments of November 27, 2013 on the proposed listing of the red knot as threatened under the ESA [Docket No. FWS–R5–ES–2013–0097; RIN AY17]. NCWRC. Raleigh, North Carolina.

Pearson, D.L., C.B. Knisley, and C.J. Kazilek. 2006. A field guide to the tiger beetles of the United States and Canada. Oxford University Press, Inc., New York, New York.

Piersma, T., R. Hoekstra, A. Dekinga, A. Koolhaas, P. Wolf, P. Battley, and P. Wiersma. 1993. Scale and intensity of intertidal habitat use by knots *Calidris canutus* in the western Wadden Sea in relation to food, friends and foes. Netherlands Journal of Sea Research 31(4):331-357.

Pover, T. 2016. Bahamas Revisited: Piping Plover Research and Conservation Five Years Later. Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. http://www.conservewildlifenj.org/blog/category/bahamas-piping-plover-project/ [Accessed October 29, 2017]

Pover, T. and C. Davis. 2012. Piping Plover Nesting Results in New Jersey: 2016. New Jersey Endangered and Nongame Species Program and Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. 8 pp. http://www.state.nj.us/dep/fgw/ensp/pdf/plover12.pdf [Accessed October 29, 2017]

Pover, T. and C. Davis. 2013. Piping Plover Nesting Results in New Jersey: 2016. New Jersey Endangered and Nongame Species Program and Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. 8 pp. http://www.state.nj.us/dep/fgw/ensp/pdf/plover13.pdf [Accessed October 29, 2017]

Pover, T. and C. Davis. 2014. Piping Plover Nesting Results in New Jersey: 2016. New Jersey Endangered and Nongame Species Program and Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. 89 pp. http://www.state.nj.us/dep/fgw/ensp/pdf/plover14.pdf [Accessed October 29, 2017]

Pover, T. and C. Davis. 2015. Piping Plover Nesting Results in New Jersey: 2016. New Jersey Endangered and Nongame Species Program and Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. 8 pp. http://www.state.nj.us/dep/fgw/ensp/pdf/plover15.pdf [Accessed October 29, 2017]

Pover, T. and C. Davis. 2016. Piping Plover Nesting Results in New Jersey: 2016. New Jersey Endangered and Nongame Species Program and Conserve Wildlife Foundation of New Jersey, Trenton, New Jersey. 9 pp. http://www.conservewildlifenj.org/downloads/cwnj_734.pdf [Accessed October 29, 2017]

Rice, T.M. 2016. Inventory of Habitat Modifications to Tidal Inlets in the U.S. Atlantic Coast Breeding Range of the Piping Plover (*Charadrius melodus*) as of 2015: Maine to North Carolina. Prepared for the North Atlantic Landscape Conservation Cooperative and U.S. Fish and Wildlife Service, Hadley, Massachusetts, 94 pp. http://northatlanticlcc.org/teams/coastal-resiliency/projects/beach-and-tidal-inlet-habitat-inventories/InventoryofHabitatModificationstotidalinletsfromMEtoNC.pdf/index_html [Accessed October 29, 2017]

Rice, T.M. 2017. Inventory of Habitat Modifications to Sandy Oceanfront Beaches in the U.S. Atlantic Coast Breeding Range of the Piping Plover (*Charadrius melodus*) as of 2015: Maine to North Carolina. Prepared for the North Atlantic Landscape Conservation Cooperative and U.S. Fish and Wildlife Service, Hadley, Massachusetts, 295 pp. http://northatlanticlcc.org/teams/coastal-resiliency/projects/beach-and-tidal-inlet-habitat-inventories/inventory-of-habitat-modifications-to-sandy-oceanfront-beaches-in-2015/index_html [Accessed October 29, 2017]

Rosen, P.S. 1980. Erosion susceptibility of the Virginia Chesapeake Bay shoreline. Marine Geology 34:45-59.

Sitters, H. 2005. Radio-tracking of red knots in Delaware Bay 2005. Unpublished report to the Endangered and Nongame Species Program, New Jersey Division of Fish and Wildlife.

U.S. Army Corps of Engineers [Corps]. 2016. New Jersey Shore Protection, Barnegat Inlet to Little Egg Inlet, (Long Beach Island, NJ) Long Beach Island Coastal Storm Risk Management. Philadelphia District, Philadelphia, Pennsylvania. http://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490783/new-jersey-shore-protection-barnegat-inlet-to-little-egg-inlet-long-beach-islan/ [Accessed October 29, 2017]

U.S. Army Corps of Engineers [Corps]. 2017a. Fact Sheet-New York Harbor, NY-Maintenance and Stewardship. New York District, New York, New York. http://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/560304/fact-sheet-new-york-harbor-ny-maintenance-and-stewardship/ [Accessed October 29, 2017]

U.S. Army Corps of Engineers [Corps]. 2017b. Post Emergency Dredging Evaluation (2015) and Biological Assessment: Maintenance Dredging, Sandy Hook, Channel, New York Harbor Federal Navigation Project. New York District, New York, New York. 48 pp.

U.S. Fish and Wildlife Service [USFWS]. 1994. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis* Say). Hadley, Massachusetts. 60 pp. https://ecos.fws.gov/docs/recovery_plan/940929b.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 1996a. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp. https://ecos.fws.gov/docs/recovery_plan/960502.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 1996b. Seabeach Amaranth (*Amaranthus pumilius*) Rafinesque Recovery Plan. Atlanta, Georgia. https://ecos.fws.gov/docs/recovery_plan/961112b.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2002. Biological Opinion on the Effects of Completion of SectionI and II of the Atlantic Coast of New Jersey Beach Erosion Control Project Sea Bright to Manasquan, Monmouth County, New Jersey on the Piping Plover (*Charadrius melodus*) and Seabeach Amaranth (*Amaranthus pumilus*). U.S. Fish and Wildlife Service, New Jersey Field Office, Pleasantville, New Jersey. 123 pp.

U.S. Fish and Wildlife Service [USFWS]. 2004. Endangered Species Management Program 2003 Year-End Report, Sea Bright to Manasquan, New Jersey. New Jersey Field Office, Pleasantville, New Jersey. 43 pp. + Appendices.

U.S. Fish and Wildlife Service [USFWS]. 2005. Biological Opinion on the Effects of Federal Beach Nourishment Activities along the Atlantic Coast of New Jersey within the U.S. Army Corps of Engineers, Philadelphia District on the Piping Plover (*Charadrius melodus*) and Seabeach Amaranth (*Amaranthus pumilus*). U.S. Fish and Wildlife Service, New Jersey Field Office, Pleasantville, New Jersey. 135 pp. + Appendices

U.S. Fish and Wildlife Service [USFWS]. 2007. Seabeach Amaranth (*Amaranthus pumilius*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Raleigh, North Carolina. 41 pp. https://ecos.fws.gov/docs/five_year_review/doc1068.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2008. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis* Say) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, Virginia. 22 pp. https://ecos.fws.gov/docs/five_year_review/doc2372.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2009. Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Northeast Region, Hadley, Massachusetts and East Lansing Field Office, Michigan. 119 pp. + Appendices. https://ecos.fws.gov/docs/five_year_review/doc3009.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2012. Programmatic Biological Opinion for Groin Projects, Multiple Counties, Virginia, Project # 05E2VA00-2012-F-0020. Gloucester, Virginia. 28 pp.

U.S. Fish and Wildlife Service [USFWS]. 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]. Pleasantville, New Jersey. 376 pp. + Appendices. https://www.fws.gov/northeast/redknot/pdf/20141125_REKN_FL_supplemental_doc_FINAL.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2016. Abundance and Productivity Estimates – 2016 Update, Atlantic Coast Piping Plover Population. Northeast Regional Office, Hadley, Massachusetts. 13 pp. https://www.fws.gov/northeast/pipingplover/pdf/Abundance_Productivity_2016_Update_final.pdf [Accessed October 29, 2017]

U.S. Fish and Wildlife Service [USFWS]. 2017. Letter from New Jersey Field Office to U.S. Army Corps of Engineers, Philadelphia regarding dredging near the Little Egg Inlet, New Jersey. Dated October 13, 2017. 15 pp. + Enclosures.

U.S. Fish and Wildlife Service and National Marine Fisheries Service [USFWS and NMFS]. 1998. Endangered Species Consultation Handbook Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. 51 pp. https://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf. [Accessed October 29, 2017]

Welp, T. Undated. Dredging and Dredged Material Disposal Overview. U.S. Army Engineer and Research Development Center, Vicksburg, Mississippi. https://www.engr.colostate.edu/~pierre/ce_old/classes/ce717/2_OverviewofDredgingandDMD_Welp.pdf [Accessed October 29, 2017]

PERSONAL COMMUNICATIONS

Gwiazdowski, R. Advanced BioConsulting, LLC. Shrewsbury, Massachusetts.

Kelly, J. 2017. New Jersey Office of Natural Lands Management, Trenton, New Jersey.

Heuser, J. 2015 and 2017. Gateway National Recreation Area; Sandy Hook Unit, Fort Hancock, New Jersey.

Suiter, D. 2017. U.S. Fish and Wildlife Service, Raleigh, North Carolina.

Wrocenski, E. 2017. U.S. Army Corps of Engineers, New York District, New York, New York.

APPENDIX A. RED KNOT MONITORING PLAN

Purpose: The purpose of this plan is to monitor and document any disturbance to red knots as a result of Sandy Hook Channel maintenance dredging involving removal of intertidal or supratidal beach and/or removal of subtidal material within 300 feet of the Mean Lower Low Water (MLLW) line and/or involving ground-based temporary structures or activity on Sandy Hook.

Disturbance Monitoring Methodology: The red knot's northbound migration season on Sandy Hook is roughly May 1 through June 15, and the southbound migration season is approximately July 15 through November 30. As per Conservation Measure 2 in the Programmatic Biological Opinion (PBO), the U.S. Army Corps of Engineers (Corps) will seasonally restrict all dredging from March 1 through August 31 of each year (restricted season). No exceptions will be made to this seasonal restriction for removal of intertidal or supratidal beach, for removal of subtidal material within 300 feet of the MLLW line, or for installation or removal of security fencing, pipeline, or any other temporary structures on the beach. Based on the red knot's migration seasons and on Conservation Measure 2, the U.S. Fish and Wildlife Service (Service) does not expect any direct disturbance of red knots between March 1 and August 31. However, red knots may be disturbed by dredging or associated activities after September 1. For any dredging scheduled to begin between September 1 and November 30 involving removal of intertidal or supratidal beach; removal of subtidal material within 300 feet of the MLLW line; and/or temporary structures or activity on Sandy Hook, a qualified avian biologist or wildlife technician will monitor any red knot response. The qualified monitor may be Corps staff, National Park Service (NPS) staff (*e.g.*, via transfer funding), or contract staff. The qualifications of the monitor must be reviewed and approved by the Service, with input from the Corps and the NPS.

Monitoring will include regular red knot surveys at three nested geographic scales (Figure 5):

- the "impact area" is intertidal and supratidal beach within 300 feet of the dredging footprint[1];
- the "sand spit" is the accreting sand spit that extends approximately 1,500 feet south from the southern limit of the Sandy Hook Channel (includes the impact area); and
- "North Beach" covers all intertidal, supratidal, tidal pool, and inter-dune habitats starting from the U.S. Coast Guard property boundary to the west and extending to the North Beach recreational area boundary to the south (includes both the impact area and the sand spit).

If the sand spit is substantially reconfigured over the life of the PBO, the Corps and the Service will revise these geographic scales as necessary and appropriate.

The monitor will coordinate with NPS before the start of the monitoring regarding recent red knot locations/observations at North Beach. Surveys will document the number, locations, and activities (*e.g.*, foraging, roosting, alert) of any red knots, as well as human activities (including but not limited to activities associated with the dredging) and any red knot reactions to human activities. All surveys will be conducted during daylight hours. Each "survey day" will consist of one two-hour period at a low-tide stage, and another two-hour period at a high-tide stage. The

[1] In addition to the sand removal area, the dredging footprint also includes all areas that will be disturbed by security fencing or other equipment or temporary structures, security or other ground-based personnel, beach driving, and potentially earth moving (*e.g.*, beach bulldozing), which may be included in the Scarping Abatement Plan (Appendix D).

low-tide period will begin at a projected low-tide time and proceed for two hours of the rising tide. The high-tide period will begin at a projected high-tide time and proceed for two hours of the falling tide. All observations will be recorded on the accompanying *Red Knot Monitoring Form*. If at any time red knots appear distressed or harassed[2] by dredging or associated activities, the monitor will notify the Service.

Monitoring will consist of baseline surveys and active project monitoring as follows:

1. Baseline Surveys: North Beach will be surveyed for three consecutive days prior to the setup/mobilization of any dredging equipment within 300 feet of the MLLW line. The monitor may require a qualified assistant to cover all of North Beach within each two-hour window. Baseline surveys will be completed no more than 7 days prior to dredge equipment setup/mobilization.

2. Mobilization Monitoring: The impact area will be monitored for red knot presence, and any reaction of the birds to project activities, during installation of security fencing as well as setup/mobilization of dredging equipment within 300 feet of the MLLW line. This monitoring event will last at least four hours—two hours before and two hours after the start of the fencing installation and the setup/mobilization of dredging equipment (regardless of tide cycle). This monitoring event may require two 4-hour periods if fencing installation and dredge mobilization do not take place concurrently.

3. Initiation of Dredging Monitoring: The impact area will be monitored for red knot presence, and any reaction of the birds to project activities upon the first initiation of dredging. This monitoring event will last at least four hours—two hours before and two hours after the start of the start of dredging (regardless of tide cycle).

4. Initial Project Monitoring: Staring the day after the initiation of dredging, the sand spit will be surveyed for 3 consecutive days. In addition, the monitor (or assistant) will document the reaction of any red knots in the impact area to the presence of the dredging equipment, particularly when dredging activity begins each day.

5. Project Monitoring: Following Initial Project Monitoring, red knot surveys will be carried out one day per week for the duration of the project, covering all of North Beach but focused on the sand spit. The monitor may require a qualified assistant to cover all of North Beach within each two-hour window.

   If at any time red knots are observed on the sand spit, then the sand spit will be surveyed for three additional, consecutive days. Also on these 3 additional days, the monitor (or assistant) will document the reaction of any birds in the impact area to the presence of the dredging equipment, particularly when dredging activity begins each day. This provision of the monitoring plan may be scaled back if red knots are persistently present on the sand spit, but consistently well away from the impact area and showing no reaction to the dredging. The Service, the Corps, and the NPS will agree on the details before scaling back this provision.

[2] Endangered Species Act regulations at 50 CFR 17.3define "harassment" as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

If dredging is to continue past November 30, surveys and monitoring can cease after that date if no red knots were observed during the previous two weekly surveys of North Beach. However, if red knots were present at North Beach during that time (second half of November), then surveys will continue past November 30 until the dredging is finished or until no red knots have been seen at North Beach for two consecutive weekly surveys.

Reporting: All monitoring forms will be submitted to the Corps, the Service, and the NPS within 5 days of each survey/monitoring date. A final report will be prepared and submitted within 60 days of completion of the dredging. The report will consist of copies of all *Red Knot Monitoring Forms*, an overall summary of the observations, and a conclusion, if possible, as to whether the project activities reached the threshold of "*harassment*." A copy of the final report will be provided to the Service, the Corps, the NPS, and the New Jersey Endangered and Nongame Species Program.

Plan Updates: This Red Knot Monitoring Plan will be re-evaluated after the first three dredging events carried out under the PBO, and the level of effort decreased, increase, or altered as may be appropriate based on the results of the plan to date.

Figure 5. Approximate red knot monitoring areas

Approximate limits of the three nested red knot monitoring areas based on 2015 aerial imagery. The size and shape of each area is likely to change for each dredging cycle.

Red Knot Monitoring Form:

Date: _____ Monitor:_____ Weather Conditions:_____

Tide Stage (low-Rising; high-falling; Other*	Start and End Time	Area Surveyed	# of Red Knots	Red Knot Location(s) (intertidal or supratidal) and Activity (foraging, roosting, or alert)	Project Activities (mobilization, inactive equipment, dredging, demobilization)	Red Knot Reaction to Project Activities (fly**, run, or alert) and distance from activity to flock/birds	Other Human Activities (e.g., pedestrians, vehicles, boats, avian predators, stationary fishermen)	Red Knot Reaction to from Other Human Activities (fly**, run, or alert) and distance from activity to flock/birds

* Other would be during dredge setup/mobilization, or upon initiation of dredging. Note tide stage during these monitoring events.
** If birds fly, note time before they return. If birds do not return within 15 minutes, the survey can continue after noting the lack of return.

Notes:

APPENDIX B. NORTHEASTERN BEACH TIGER BEETLE MONITORING PLAN

Purpose: The purpose of this plan is to monitor and document the presence/absence and number of northeastern beach tiger beetles within the footprint of each Sandy Hook Channel maintenance dredging event involving removal of material above the Mean Lower Low Water (MLLW) line and/or involving ground-based temporary structures or activity on Sandy Hook.

Background: Northeastern beach tiger beetles historically occurred on Sandy Hook, with the most recent collection made in 1940. Surveys in 1985 and 1993 found the population had been extirpated. In 1994 and 1995, a pilot effort was undertaken to reestablish a population of this beetle on Sandy Hook by translocating 571 larvae from the Chesapeake Bay region to the North Beach section of Sandy Hook. The pilot effort also included translocation of additional larvae to nearby Gunnison Beach. Following the pilot effort, an additional 1,623 larvae were translocated to North Beach from 1997 through 2000. Translocated larvae survived and reproduced, with a peak adult beetle count of 749 in 2001. However, numbers declined sharply starting in 2002 (Knielsey *et al* 2005). In 2006, 28 adults were observed, and 2 beetles were observed each year in 2007 and 2008. No beetles were observed from 2009 to 2014, but those annual surveys were conducted with limited staff. In 2015, two adult beetles were observed incidental to seabeach amaranth surveys; only a portion of North Beach was surveyed. The proposed dredge area was surveyed for adults in 2015, and none were found, but the area was not surveyed for larvae (Heuser pers. comm. 2015).

As part of this consultation, the U.S. Army Corps of Engineers (Corps) has funded a 2-year survey effort to determine presence or absence of beetles on Sandy Hook. In 2017 and again in 2018, species experts are surveying for both adults (July/August) and larvae (September / October). The 2017 surveys have been completed and no beetles were observed. However, this species often requires 2 or more years to complete its life cycle, and local resource conditions can influence the proportion of adults observed in any one year (Gwiazdowski pers. comm. 2017). Thus, a definitive conclusion of presence or absence of northeastern beach tiger beetles on Sandy Hook will not be determined until fall 2018.

Because northeastern beach tiger beetles are “sit-and-wait” predators that burrow in the intertidal beach (USFWS 1994), any larvae in the dredging footprint would be vulnerable to direct mortality. Therefore, if any beetles are observed on Sandy Hook during the 2018 survey effort, it will be necessary to conduct routine monitoring, in order to inform the Incidental Take Statement included with the Tier 2 consultation prior to each dredging event, and to evaluate if larvae should be translocated out of the dredging footprint as per the Species Contingency Plan (Appendix C).

Disturbance Monitoring Methodology: This monitoring plan will be implemented only if northeastern beach tiger beetles are observed on Sandy Hook during the 2018 presence/absence survey. If no beetles are found in 2018, then no further monitoring or surveys will be necessary unless this species is subsequently found to have recolonized North Beach.

If northeastern beach tiger beetles are documented on Sandy Hook in 2018, then subsequent monitoring will include adult and larval surveys at three nested geographic scales:

- the "impact area" is all intertidal and supratidal beach within the dredging footprint[1], adjacent intertidal areas within 300 feet, and adjacent supratidal areas within 25 feet;
- the "sand spit" is the intertidal zone and adjacent 25 feet of supratidal beach along the shoreline of the accreting sand spit that extends approximately 1,500 feet south from the southern limit of the Sandy Hook Channel, as well as the entire impact area; and
- "North Beach" covers all intertidal habitats, and approximately 25 feet of supratidal beach immediately adjacent to the intertidal zone, starting from the U.S. Coast Guard property boundary to the west and extending to the North Beach recreational area boundary to the south (includes the sand spit), as well as the entire impact area.

These geographic areas are the same as for the Red Knot Monitoring Plan (Appendix A, Figure 5), except that they are truncated 25 feet above the MHW line.

If the sand spit is substantially reconfigured over the life of the PBO, the Corps and the Service will revise these geographic scales as necessary and appropriate.

Annual Adult Surveys: Each year, whether or not dredging is planned for the following fall/winter, a qualified biologist or wildlife technician will lead a northeastern beach tiger beetle adult survey covering all of North Beach. The annual adult survey will be conducted each year between mid-July and mid-August, during sunny weather, between 9:30 am and 2:00 pm. The annual survey is expected to take one morning per year. A team of trained surveyors will form a survey line spanning from the water's edge to the wet/dry sand interface, so that the survey area covers about 10 to 25 feet of dry beach just above the intertidal zone. Depending on the tidal stage, a team of 3 to 6 trained surveyors will be needed to cover the entire survey zone, spaced with roughly 5 feet between each surveyor. The line of surveyors will walk slowly along the intertidal zone looking for tiger beetles, and coordinating their observations. Each surveyor will continuously scan an arc of beach roughly 10 feet in front of the line of surveyors, so that the scan zones of adjacent surveyors overlap. The survey team will attempt to count and photograph any beetles they encounter, and will note beetle locations using GPS as well as maps, notes, and photographs. Note that beetles may not be captured or handled by the survey team unless previously authorized by both the Service and the NPS—under no circumstances may beetles be killed or removed from the beach as part of the annual survey.

The survey team may be comprised of suitably trained staff from the Corps, the National Park Service (NPS) (*e.g.*, via transfer funds), and/or via contract. The qualifications of the team leader (a trained biologist or wildlife technician) must be reviewed and approved by Service, with input from the Corps the NPS. The team leader will be responsible for ensuring that all survey team members are adequately trained in the survey methodology, and in beetle behavior, search image, and identification. The team leader will coordinate with NPS before the start of the annual summer survey.

[1] In addition to the area of actual sand removal, the dredging footprint also includes all areas that will be disturbed by security fencing or other equipment or temporary structures, security or other ground-based personnel, beach driving, and potentially earth moving (*e.g.*, beach bulldozing), which may be included in the Scarping Abatement Plan (Appendix D).

Pre-Dredging Larval Surveys: If no beetles are observed on the sand spit during the summer survey preceding a dredge event, then no further action is necessary for that dredge event. However, if any beetles are documented on the sand spit during the summer survey preceding a dredge event, then a qualified biologist will subsequently lead a northeastern beach tiger beetle larval survey covering the impact area. The larval survey will be conducted between mid-September and mid-October, during fair weather, between 9:30 am and 5:00 pm. Each larval survey is expected to take 0.5 to 1 day. A key objective of the larval survey is to produce an estimate of the number or larvae present in the impact area. A team of biologist-lead surveyors will survey all suitable habitats within the impact area for larval burrows, using the same survey methods for adult observations, including GPS locations with notes about burrow density per GPS point. A subset of burrows will be excavated to observe larvae and confirm species identity. The methods for excavation and field identification are not harmful to larvae, but require special techniques best performed under the supervision of an expert-trained biologist. Note that larval excavation and handling by the survey team require pre-authorized by both the Service and the NPS—under no circumstances may beetles be killed or removed from the beach as part of the annual survey.

The survey team may be comprised of suitably trained staff from the Corps, NPS (*e.g.*, via transfer funding), and/or via contract. The qualifications of the team leader (an expert-trained biologist) must be reviewed and approved by Service, with input from the Corps the NPS. The team leader will be responsible for ensuring that all survey team members are adequately trained in the survey methodology, and in beetle biology, search image, excavation, handling and identification. The team leader will coordinate with NPS before the start of the larval survey.

If the Service, the Corps, and the NPS are all in agreement, then the larval survey may be combined with an effort to translocate larvae out of the dredging footprint in accordance with the Species Contingency Plan (Appendix C). Note that additional Service and NPS authorizations may be needed for translocation, compared to only conducting the larval survey.

As per the Species Contingency Plan (Appendix C), if any beetles are documented on the sand spit during the summer survey preceding a dredge event, then dredging will not commence until the larval survey and, if necessary and appropriate the translocation effort, have been completed.

Reporting: All monitoring data and photographs will be submitted to the Corps, the Service, and the NPS within 5 days of each survey date. A narrative report summarizing the methodology and results will be prepared and submitted within 60 days of each survey date. A copy of the report will be provided to the Service, the Corps, the NPS, and the New Jersey Endangered and Nongame Species Program.

Plan Updates: This Northeastern Beach Tiger Beetle Monitoring Plan will be re-evaluated after the first 3 years, and the level of effort decreased, increase, or altered as may be appropriate based on the results of the plan to date. Summer surveys may cease if no beetles are documented in North Beach after five consecutive years.

APPENDIX C. SPECIES CONTINGENCY PLAN

Purpose: The purpose of this plan is to provide additional Conservation Measures that will apply in the event that: (a) significant numbers of red knots are harassed by a dredging action; (b) northeastern beach tiger beetle larvae are present in the dredging footprint at the time of dredging; and/or (c) seabeach amaranth plants are present in the dredging footprint at the time of dredging.

Red Knot Contingency Plan

If 2 to 4 years of monitoring data (Appendix A) show substantial numbers of red knots being consistently harassed by the dredging or associated activities, the Corps, the Service, and the NPS will meet to evaluate if a change in timing would be likely to reduce the level of harassment. For example, if most of the harassment has occurred during September, the agencies will explore delaying the dredging until October or later. The agencies will also evaluate the relative contribution of project personnel on the beach (versus the dredging activity itself) in causing the harassment. As appropriate, adjustments to Conservation Measure 5 will be made if project personnel on the beach have been a significant contributor to the observed patterns of harassment.

Northeastern Beach Tiger Beetle Contingency Plan

If northeastern beach tiger beetle larvae are documented in the dredging footprint[1]—through the 2018 Corps-funded presence/absence study, the monitoring effort (Appendix B), or through any other means—the Corps, the Service, and the NPS will meet with a recognized species expert to arrange for translocation of the larvae out of the dredging footprint to the extent practicable. The Corps will fund a translocation effort no more than 1 month prior to each dredging action for which larvae have been documented in the dredging footprint.

Seabeach Amaranth Contingency Plan

In the event that the preconstruction survey (Conservation Measure 7) documents seabeach amaranth within the dredging footprint, the Corps will undertake actions aimed at salvaging and/or restoring elsewhere in North Beach a number of plants similar to those that would be destroyed by the dredging and associated activities. Specific actions to be taken will be determined following close coordination with the Service and the NPS. Actions will include one or more of the following techniques, depending on the circumstances at the time of the dredging action.

[1] In addition to the area of actual sand removal, the dredging footprint also includes all areas that will be disturbed by security fencing or other equipment or temporary structures, security or other ground-based personnel, beach driving, and potentially earth moving (*e.g.*, beach bulldozing), which may be included in the Scarping Abatement Plan (Appendix D).

1. Transplantation of Plants

Individual live plants within the dredging footprint but outside of the sand removal area will be fenced and avoided if possible (as per Conservation Measure 7). Individual live plants in the dredging footprint that would be unavoidably destroyed by dredging and/or temporary structures will be transplanted to a suitable habitat elsewhere within North Beach. Transplantation will include removal of a sufficiently large and intact volume of sand to include the full extent of the roots. Transplanting, when necessary, will occur as close as possible to the time of the dredging, and every attempt will be made to include the entire, undamaged root system. The Corps will provide for monitoring of the transplants until their deaths, and the monitoring results will be provided to the Service and the NPS.

2. Seed Collection

Seeds from plants to be translocated may be harvested prior to plants being moved. With input from the Service, the NPS, and species experts, all or a portion of the seeds may be:

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

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

3. Seasonal Timing and Sand Scraping

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

APPENDIX D. SCARPING ABATEMENT PLAN

Purpose: The purpose of this plan is to deliver potential options to minimize the scarping that may occur during dredging operations, and that may persist for some time afterward. The plan further delivers the 2017 maintenance dredging cycle slope to be constructed.

Methodology: As per Conservation Measure 9, the intent of this Scarping Abatement Plan is to minimize scarping and its effects on habitat. This plan describes various options that may reduce the effects of scarping, which is a natural occurrence of dredging upon sand material above the water line (positive elevations).

The U.S. Army Corps of Engineers' (Corps) maintenance of the Sandy Hook Channel includes dredging to establish the side slope of the channel. Dredging of the side slopes is essential to reduce excess material from collapsing into the channel, reducing navigability. Side slopes commence at the channel toe and are designed to a slope of one vertical to three horizontal (1v:3h). When dredging in the vicinity of positive elevations, temporary scarping may occur. Natural processes of wind, wave, and tide eventually eliminate scarping and allow the material to repose and smooth to a more consistent, flatter slope.

Safety within the affected zone of the dredging operations and where scarping may occur will be enhanced by the use of construction fencing, applicable signage, and security patrol personnel during the dredging period. These security officers, hired by the dredging contractor will be equipped with 4x4 vehicle(s) and will maintain appropriate communication with the National Park Service (NPS) (see Conservation Measure 5).

The fall 2017 maintenance dredging cycle is designed to create a side slope of 1v:3h. The dredging contractor will be instructed to construct a final slope that will minimize any significant scarping. The construction company will employ best methods to construct the slope. Some options may include smoothing the area above the water line mechanically with the bucket, or developing a specific type of bench cutting during excavation that would minimize the material's exposure to scarping. In addition to eliminating outright scarps, the options considered under this plan will secondarily seek to restore slopes outside the sand removal area to the range that is suitable and preferred by listed species (*e.g.*, see Maslo *et al.* 2011).

Abatement Options: For future maintenance dredging cycles, an option of allowing natural processes to reduce scarping may be deemed adequate. Natural processes have shown to be effective in the past in smoothing the slope, hence eliminating the scarp. The natural processes would include the currents in the channel as well as the tidal change. With such natural actions, the area of the side slope would develop a natural, smoother slope after constructed.
Another option could include the construction of a more gradual slope (see Figure 6). This would be subject to the availability of funds. Such methods mitigate the occurrence of a scarp by constructing a slope area with a reduced angle (more gradual slope) from the channel's toe, rather than the 1v:3h slope. Constructing a slope of smaller angles would further encroach on the land, ultimately removing more acreage. Encroachment may be lessened through development of a specific type of bench cutting during, with steeper slopes deeper transitioning to flatter slopes near the plane of MLLW.

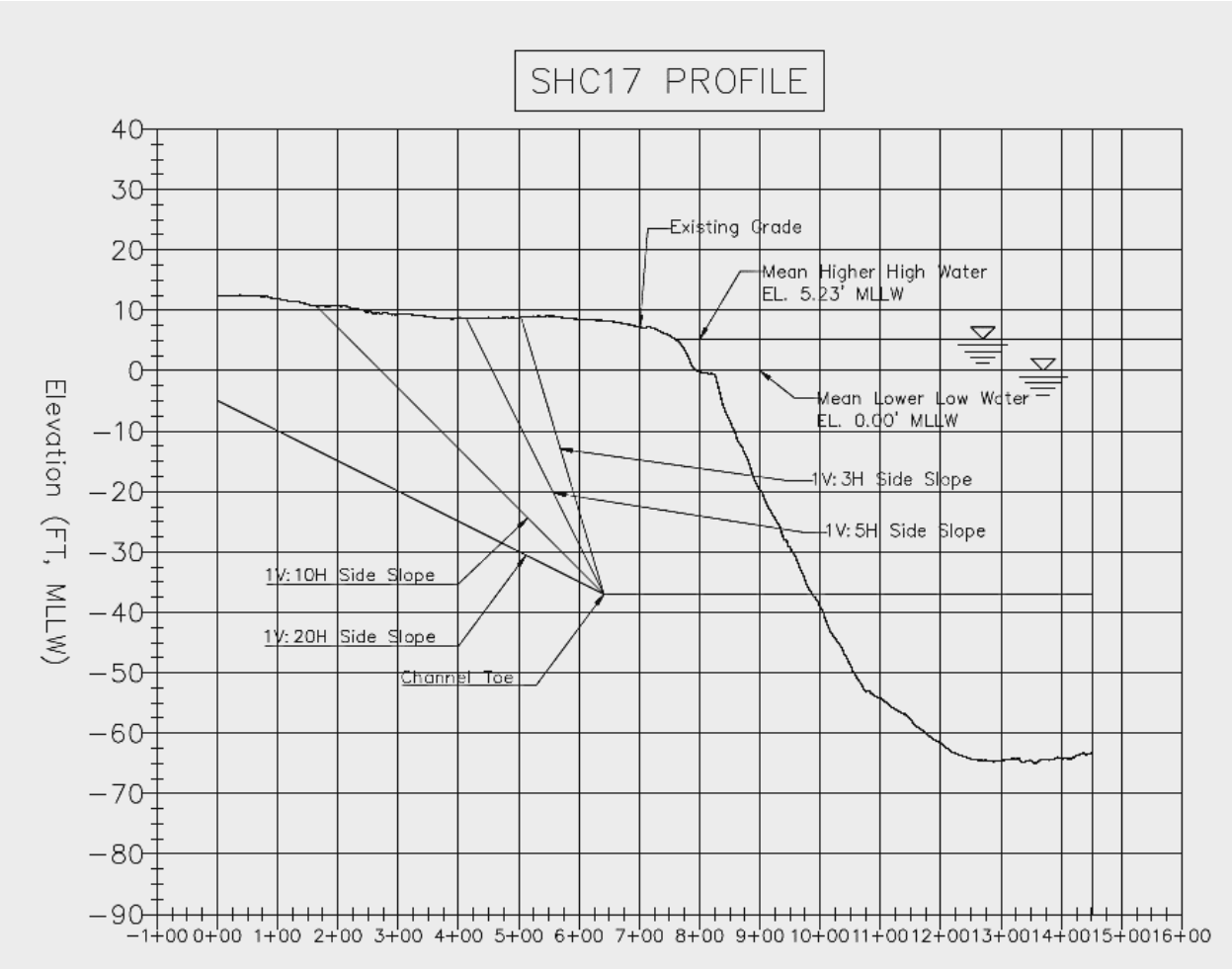

Figure 6. Typical profile of Sandy Hook Channel

Various slope options depicted. The more gradual the slope, the greater distance the terminating setback on the landward side would be.

Scarp abatement could further be accomplished utilizing land-side mechanical means. Heavy construction equipment of medium size could be used to smooth out the area where scarps (or slopes unsuitably steep for listed spices) are located. The Corps notes that the NPS has equipment available that is capable to accomplish such a task. Subject to the availability of funds, the Corps would fund NPS to hire a certified equipment operator. Funding would be extended for fuel, operating costs of equipment, operator wage, and prevailing equipment rental rates of comparable equipment in the Monmouth County, New Jersey region. A cost schedule and schedule of work would be submitted to the Corps for approval prior to the commencement of scarp reduction operations.

For the current dredging cycle, the Corps and NPS will visually monitor the development of scarping and beach slopes during and after dredging operations. Such visual analysis and use of profiles/cross-sections from After Dredge surveys will be useful in selecting the best scarping abatement plan for future cycles. The Corps anticipates natural elimination of scarping prior to piping plover season and before such the area becomes active with pedestrians. However, if the scarping persists past March 1, the Corps, the Service, and the NPS will discuss other abatement options for future years, including but not limited to those listed above. Active scarping abatement options (*e.g.*, alternate slopes, land-side mechanical means) will be implemented only following close coordination among the Corps, the Service, and the NPS.

APPENDIX E. OFFSET PLAN

Purposes: The purposes of this plan are: (1) to offset the long-term loss of intertidal and supratidal beach habitat as a result of Sandy Hook Channel maintenance dredging within 300 feet of Mean Lower Low Water (MLLW) line; (2) to offset the diversion of National Park Service (NPS) staff resources from the conservation of listed species to oversight of the dredging that occurs within 300 feet of the MLLW line; and (3) to achieve "no net loss" in the conservation of the four listed species in the action area of the Programmatic Biological Opinion (PBO).

Background and Justification: The U.S. Fish and Wildlife Service's (Service) Consultation Handbook defines "Conservation Measures" as "*actions to benefit or promote the recovery of listed species that are included by a Federal agency as an integral part of a proposed action under ESA consultation. These actions will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review*" (USFWS and NMFS 1998). This offset plan is intended to compensate for the loss of listed species habitat that is temporarily directly lost, and/or precluded from forming over the long-term, due to the recurrent dredging of the Sandy Hook Channel. This offset plan is also intended to compensate for NPS staff resources that will be diverted from natural resource management during dredging events.

The U.S. Army Corps of Engineers (Corps) conducted maintenance dredging of the Sandy Hook Channel in the autumns of 2008, 2009, 2011, 2013, and 2015, with volumes increasing consistently from 24,000 cubic yards in 2008 to 336,010 cubic yards in 2015. The dredge volume is projected to peak in 2017, at 350,000 cubic yards. From 2018 through 2020, dredge volumes are projected to decrease slightly, ranging from 225,000 to 270,000 cubic yards; however, dredge frequency is expected to increase to an annual basis over this time period. After 2020, future dredging needs are estimated at 150,000 cubic yards every year (Corps 2017b). Because the Corps intends to move to a cycle of more frequent but lower-volume dredging actions, the sand spit may not accrete to the same extent as it reached in 2015 and 2017, due to the shorter interval between dredging actions. Thus the area of intertidal and supratidal beach removed by annual dredging may be less than the 2.8 acres of intertidal and supratidal habitat that were removed in 2015.

However, direct removal of intertidal and supratidal beach is not the only mechanism of habitat loss resulting from the maintenance dredging. Repeated dredging to maintain the channel in its present (Congressionally authorized) location is precluding further growth of the sand spit. The Corps' Biological Assessment (BA) explains, "The shoreline change data indicates that after the coastal storm risk management project began in 1994, the Sandy Hook North Shore has been accreting sand rapidly. The combination of a consistent sand supply and a strong northward longshore transport mechanism is causing sand to be transported directly to the Sandy Hook North Shore and into the Federal Navigation Channel. This has created obstruction to navigation within the channel. Sediment budget calculations from 1995 to 2007 indicate the average volume change rate was 350,000 [cubic yards per year] (based on the slope of the best fit line). The average rate decreased to 80,000 [cubic yards per year] from 2007 to 2013. This indicates a volume change rate reduction of 270,000 [cubic yards per year]. This reduced rate of accretion

coincides with the spit's intersection with the channel and subsequent increased maintenance dredging actions. The decreased volume change rate may be accounted for either by less sand being transported to the spit from the south and/or sand moving off of the spit and into the channel and/or surrounding areas (which would not be visible by aerial analysis). The time period 1995 to 2013 captures the effect of Hurricane Sandy,[1] which occurred in October 2012. The shoreline appears to have recovered relatively quickly following the storm. In the case of Sandy Hook, the spit growth is impeded by the federal navigation channel. Regular dredging of the channel prevents the spit from advancing, though sand may continue accumulating on the updrift side of the channel, causing the overall area of the spit to grow over time" (Corps 2017b).

Based on the past pattern of dredging and information in the Corps' BA, we conclude that—but for the continued dredging—the spit would return to is 2015 (pre-dredging) size within a few years. This is supported by removal of a similarly sized areas in 2013 and 2015 (2.8 acres), and by the Corps' estimate that approximately 2.6 acres of habitat will be removed in fall 2017.[2] This pattern indicates that a similar area of habitat has reformed over the 2-year period following each recent dredging cycle. Absent the dredging, we would further expect the spit to continue growing beyond its 2015 size, until the channel filled in and the tip of Sandy Hook reached a new position and a new state of dynamic equilibrium influenced mainly by the volume of sand inputs coming from the updrift beach nourishment project and stochastic storm activity. However, we do not have sufficient information to estimate the equilibrium size of the spit that would form absent the dredging. Thus, we conclude that 2.8 acres is a reasonable estimate of the minimum area of habitat that will be lost and/or precluded from forming from the continued dredging to maintain the Sandy Hook Channel in its present position.

In addition, annual dredging will divert some level of staff resources from the NPS in order to coordinate with the Corps and with dredging, topographic survey, and security contractors; to ensure the safety of staff and the public during dredging; and to facilitate the implementation of the Conservation Measures included in the PBO. Natural resource staff engaged in dredging-related tasks will be diverted from their normal work of managing listed species and their habitats.

In the future, if the authorized channel is relocated such that direct and indirect habitat impacts from dredging are no longer expected, and such that NPS staff time will no longer be diverted, this Offset Plan will be terminated. The Service, the Corps, and the NPS will confirm termination in writing.

Offset Mechanisms:

Staffing Offset: To offset the diversion of staff resources within the Sandy Hook Unit (Sandy Hook) of Gateway National Recreation Area from the conservation of the four listed species to oversight of the dredging, the Corps will transfer to the NPS or its designated agent sufficient funding to cover one 3-month full-time equivalent biological monitoring position. This funding

[1] The time period of 1995 to 2013 does not capture the large extend of beach nourishment that occurred in Monmouth County in the few years following Hurricane Sandy.
2 We note that the 2015 pre-dredging projection of habitat removal was far lower (1.6) than the final post-dredging estimate of 2.8 acres. Thus, we expect that more than 2.6 acres may be removed in 2017.

will be transferred by the December 1 preceding each year in which a Corps new dredging event is scheduled. This additional staffing resource will increase (not serve as a partial replacement of) the level of NPS funds normally allocated to managing listed species under the Sandy Hook Shoreside Beach Management Plan (as amended). Within 60 days of each transfer of Corps funds, NPS will prepare a work plan for the following calendar year including costs and timeframes. The work plan will be provided to the Service and the Corps for review, and will be informed by threatened and endangered species monitoring data and dredging impacts to resources and commitment of staff time for management and oversight of the dredging program.

This Staffing Offset will apply to other agencies or entities dredging the channel within 300 feet of Sandy Hook under a Corps permit.

Habitat Offset: To achieve the goal "no net loss," it is necessary to replace the functions and values of at least 2.8 acres of beach habitat for federally listed species, considering the following factors: (1) the temporal loss[3] of the habitat; (2) uncertainty in the size of the full area of habitat that would form "but for" the dredging; (3) uncertainty in the ability of the Scarping Abatement Plan (Appendix D) to retain the suitability of additional habitat for listed species adjacent to the sand removal area; (4) the poor track record of past efforts to restore or enhance habitats for listed beach species in the Mid-Atlantic (Hecht 2016, Maslo 2009); (5) the difficulty of maintaining suitable habitat conditions even at initially successful restoration project sites; and (6) uncertainties over the long (20-year) life of the PBO including the frequency of dredging and the patterns of sand transport/deposition. Considering these factors, an offset ratio of 3:1, or 8.4 acres, is deemed necessary to prevent a net loss in conservation value.

Unlike in the wetland arena, beach restoration and enhancement projects cannot be expected to persist in perpetuity, even when the project includes a maintenance plan. All four listed beach species are adapted to early successional beach habitats that form through natural coastal processes, often storm-driven, such as dune or island overwash or breaching. Under even the best circumstances, early successional beach habitats rarely persist more than five years absent a natural (*e.g.*, storm) or human intervention to "reset the clock" on countervailing natural processes such as erosion, dune formation, and vegetative succession. Thus, a Corps offset project to replace lost habitat functions and values is reasonably expected to last a maximum of 5 years. This project life expectancy is borne out by several examples of attempted beach habitat restoration / enhancement (Hecht 2016), as well as numerous examples of storm-created habitats in New Jersey and elsewhere.

Cost information was obtained from several planned and completed beach habitat restoration or enhancement efforts in New Jersey. Averaging this cost information produced an estimate of $60,000 per acre.

The Habitat Offset Program:

The Corps will annually fund the Service's New Jersey Field Office (NJFO) to carry out a program of beach habitat restoration and enhancement to offset the functions and values of

[3] Removal of beach above the Mean Lower Low Water (MLLW) line began in 2011, and the first dredging action covered by the PBO was in 2015. In contrast, the first offset project is unlikely to be in place before 2019.

habitat lost to channel dredging. Using this funding, the NJFO will arrange for a qualified restoration practitioner to carry out the Habitat Offset Program. The practitioner will be an agency or organization with expertise in beach species and with beach habitat restoration / enhancement, and will be known as the Habitat Offset Program Manager. The NJFO will select the Habitat Offset Program Manager after considering input from the Corps and the NPS. The NJFO may elect to change the designated Habitat Offset Program Manager at any time over the life of the PBO, but will do so only after considering feedback from the Corps and the NPS.

Prior to each Corps dredging event, the Corps will transfer funding to the NJFO to carry out the Habitat Offset Program. The funding level for each Corps dredging event will be as follows:

($60,000 x 8.4 acres x 1.22 NJFO overhead x 1.22 Program Manager overhead) ÷ 5-year offset project life = $150,000 per year.

The above formula results in the level of annual funding deemed necessary to prevent a net loss of conservation value. However, the Corps and the Service have agreed that this level of funding will be provided *each dredging cycle*, not each year. Linking the funding transfers to the frequency of dredging reflects the facts that: (1) the availability of Corps funding to support the Habitat Offset Program is necessarily tied to dredging events (*e.g.*, based on Congressional appropriations); and (2) less frequent dredging would warrant less offsetting since more time between dredging events allows for the sand spit to intermittently regain some of the habitat value that is lost to the dredging (*e.g.*, more time for accretion of lost beach area, flattening of steep slopes).

Thus, <u>this plan provides that the Corps will transfer $150,000 per dredging cycle for habitat offset</u>. This funding level will be adjusted for inflation every 5 years beginning in 2022.

The NJFO will initiate and carry out the Habitat Offset Program as follows.

- Within 6 months of receiving the first Corps transfer funding, NJFO will select the Habitat Offset Program Manager after considering input from the Corps and the NPS.
- Within 1 year of receiving the first Corps transfer funding, NJFO will have arrangements in place to transfer funding to the Program Manager.
- Within 2 years of receiving the first Corps transfer funding, NJFO will require the Program Manager to submit for review and approval a proposal for the first habitat offset project, with copies to the Corps and the NPS.
- Within 4 years of receiving the first Corps transfer funding, NJFO will require the Program Manager to complete construction on the first habitat offset project.
- Over the remaining life of the PBO, as long as sufficient funds remain, NJFO will ensure that the Program Manager proposes and carries out at least one habitat offset project every 5 years.
- Any remaining habitat offset funds will be expended within 5 years of the PBO end date, or by February 28, 2043.

Each habitat offset proposal prepared and submitted by the Program Manager will include: (1) detailed project information including location, methods, timing, maintenance, and monitoring; (2) detailed budget information including planning, engineering, design, permitting, construction

/ implementation, maintenance, monitoring, and reporting; and (3) a thorough summary of best available scientific information demonstrating how the proposed project is likely to contribute to the conservation of one or more of the federally listed species covered by the PBO. In deciding whether or not to approve each project, the NJFO will consider support for the project by the NPS; the New Jersey Endangered and Nongame Species Program (ENSP); the New Jersey Office of Natural Lands Management (ONLM); the New Jersey Division of Land Use Regulation; the Corps' Regulatory Branch (if Federal permits are needed); any affected local governments or land owners; other project partners or outside conservation groups; and the Service's lead biologist for each federally listed species targeted to benefit from the proposal. Within 60 days of receiving each proposal, the NJFO will notify the Program Manager, the Corps, and the NPS if the proposal is approved as a habitat offset project under the PBO. If the Corps or the NPS have any objections, concerns, or suggestions, they will notify NJFO and Program Manager within 30 days.

In developing offset project proposals, the Program Manager will consult Table 11, below, for ranking criteria. Criteria in the "high" column are most preferred, criteria in the "low" column are minimums to be considered eligible as an offset project under the PBO. Criteria in the "medium" column are intermediate. Most projects will likely involve a mix of high, medium, and low criteria, but all projects will strive to stay on the higher end of the table.

Table 11. Offset project ranking criteria

	High	**Medium**	**Low**
Location	Sandy Hook*	Monmouth County	New Jersey
Number of Species Expected to Benefit	3 or 4 of the listed species covered by the PBO	2 of the listed species covered by the PBO	1 of the listed species covered by the PBO
Type	Restoration** of natural coastal processes that create and maintain optimal habitat	Restoration** or enhancement** of habitat where natural coastal processes remain curtailed	Long-term (5+ year) management change* to improve the ability of existing habitat to support listed species
Certainty of Success	High – proven track record of similar projects	Medium – similar projects with mixed results have provided insights used to inform the proposed project	Low – project is based on best available information about species habitat requirements, but no similar projects have been attempted
Acres of Affected Habitat	≥3:1 ratio for habitat loss resulting from channel dredging	≥2:1 ratio for habitat loss resulting from channel dredging	>1:1 ratio for habitat loss resulting from channel dredging

*Offset projects must provide additional benefits beyond those that would otherwise have occurred through routine or required practices or actions, or obligations required through legal authorities or contractual agreements. The benefits are "additional" when the project improves upon the baseline conditions of the resources and their values, services, and functions in a manner that is demonstrably new and would not have occurred without the offset project. The additional benefits may result from restoration or enhancement of habitat; preservation of existing habitat that lacks adequate protection; management actions that protect, maintain, or create habitat; or other activities (*e.g.*, an action that reduces threats from disease or predation, or captive breeding and reintroduction of individuals or populations). Demonstrating "additionality" on lands already designated for conservation purposes can be challenging, particularly when the lands under consideration are public lands. An offset project should only be sited on public lands if "additionality" is legally attainable, can demonstrated and quantified, and is supplemental to conservation the public agency is foreseeably expected to implement absent the offset project.

**Enhancement* means activities conducted in existing habitat of the species that improve one or more ecological functions or services for that species, or otherwise provide added benefit to the species and do not negatively affect other resources of concern. *Restoration* means repairing or rehabilitating habitat for the benefit of the species with the goal of returning it to its natural/historic habitat type with the same or similar functions where they have ceased to exist, or exist in a substantially degraded state.

In developing offset project proposals, the Program Manager will reflect the following guiding principles.

- Whenever possible, projects will be sited in locations that have been identified in landscape-scale conservation plans as areas that will meet conservation objectives and provide the greatest long-term benefit to listed species. The Program Manager will rely on existing conservation plans that are based upon best available scientific information, consider climate change adaptation, and contain specific objectives aimed at the biological needs of the affected species. Examples of existing conservation plans may include the Gateway National Recreation Area General Management Plan; the Sandy Hook Shoreside Beach Management Plan; the New Jersey Wildlife Action Plan; and species-specific Service documents such as a Species Status Assessment, Recovery Plan, or 5-year review.

- The Program Manager will incorporate the best available science (*e.g.*, recent habitat modeling, results from previous restoration / enhancement projects) into project site selection and design.

- Offset projects must be likely to benefit at least one federally listed species covered by the PBO (see Table 11); *i.e.*, projects must be in-kind for the impacted species. However, the in-kind requirement does not necessarily apply to the habitat type affected, as the best conservation outcome for the species may not be an offset of the same habitat type or ecological attribute of the habitat impacted by the dredging program.

- Due to the temporal loss noted above, construction dates will be early as possible, but without compromising careful project siting, design, and planning.

- Although the Service generally prefers consolidated offset projects (*e.g.*, to avoid a piecemeal approach, increase cost effectiveness), the high risk and uncertainty associated with early successional beach habitat restoration and enhancement may warrant a mix of larger and smaller projects, including pilot projects and projects with phased implementation to allow for adaptive management. Likewise, a mix is warranted between projects with higher certainty but lower or shorter-lived expected benefits (*e.g.*, invasive vegetation control) versus projects with higher risk but greater expected benefits (*e.g.*, manipulation of beach or dune profiles). If a mix of different project sizes, scales, and types is pursued, it is likely that more than one project will be carried out within each 5-year period.

Beach habitat restoration and enhancement efforts that seek to mimic the effects of natural coastal processes, but do not fully restore those processes, have often failed in the past (Hecht 2016, Maslo 2009) and remain associated with high risk and uncertainty. Due to the high risk and uncertainty, neither the Program Manager nor the Corps will be held liable for offset projects that followed the guidelines in this Offset Plan and were approved by NJFO but nonetheless fall

short in producing the expected level of benefits to listed species. In the reporting associated with all offset projects, the Program Manager will candidly, objectively, and transparently disclose the results and identify "lessons learned" that can help inform and improve future projects. Only in the unlikely event of clear and demonstrable negligence on the part of Program Manager or its agents in carrying out an offset project would Program Manager be responsible for the cost of any necessary corrective action(s).

Beginning in 2019 and continuing until all project funds are expended, the Program Manager will provide a brief annual report to NJFO, the Corps, NPS, ENSP, and ONLM. The annual reports will be transmitted by the last day of February of each year, and will summarize the previous year's activities under the Habitat Offset Program. In addition, each offset project will include its own project-specific reporting requirements. The Program Manager will transmit a final summary report no later than February 28, 2043, including lessons learned from all projects carried out under the Habitat Offset Program.

The Corps, the Service, and the NPS will periodically reassess this Offset Plan, at least every 5 years beginning no later than 2022.

This Habitat Offset will apply to other agencies or entities dredging the channel within 300 feet of Sandy Hook under a Corps permit unless: (1) the proposed non-Corps dredging involves removal of subtidal material only; AND (2) the channel has been dredged by the Corps within the previous 2 years; AND (3) the Corps expects to dredge the channel again within the next 2 years. Non-Corps subtidal dredging between regular Corps dredging cycles is exempt from the Habitat Offset because any such dredging would not directly impact beach habitat for listed species, and would not be expected to appreciably contribute to the preclusion of habitat formation beyond that already caused by the ongoing Corps' dredging program.

APPENDIX F. PHOTOS

Photos of the tip of the sand spit and the adjacent channel on July 16, 2017, by W. Walsh, USFWS.