FINDING OF NO SIGNIFICANT IMPACT

Use of Outer Continental Shelf Sand from Sandbridge Shoal in the Naval Air Station Oceana, Dam Neck Annex Shoreline Protection System (SPS) Project

Introduction

Pursuant to the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500-1508), the U.S. Department of the Navy (Navy), in coordination with the Bureau of Ocean Energy Management (BOEM), prepared an environmental assessment (EA) to determine whether authorizing use of Outer Continental Shelf (OCS) sand from Sandbridge Shoal in the Naval Air Station Oceana, Dam Neck Annex (Dam Neck Annex) Shoreline Protection System (SPS) would have a significant effect on the human environment and whether an environmental impact statement (EIS) should be prepared. Pursuant to the Department of the Interior (DOI) regulations implementing NEPA (43 CFR 46), BOEM has independently reviewed the EA and has determined that the potential impacts of the proposed action have been adequately addressed.

Proposed Action

BOEM's proposed action is the issuance of a negotiated agreement to authorize use of Sandbridge Shoal so that the project proponents, the Navy, can obtain up to 700,000 cubic yards of OCS sand from Sandbridge Shoal for a beach nourishment project at Dam Neck Annex in southeastern Virginia. The Navy's proposed action is construction of the project. This alternative includes mitigation as part of the proposed action. Initial construction of the beach nourishment project occurred in 1996. Maintenance construction occurred during 2004. This represents the third construction cycle.

The project is needed to continue to provide storm protection and reduce erosion along 9,280 feet of the SPS at the Dam Neck Annex. The purpose of BOEM's proposed action is to respond to the project sponsors' request for use of OCS sand under the authority granted to the Department of the Interior by the Outer Continental Shelf Lands Act (OCSLA). The legal authority for the issuance of negotiated noncompetitive leases for OCS sand and gravel is provided by OCSLA (43 U.S.C. 1337(k)(2)).

Alternatives to the Proposed Action

In past environmental analyses for the Dam Neck Annex SPS, a number of alternatives related to structural and non-structural alternatives were considered. The Navy has previously selected beach nourishment as the preferred alternative to address the ongoing need for erosion control and storm protection. Previous analyses have also described the affected environment and evaluated potential environmental effects resulting from the proposed action. In April 1996, the Navy completed an EA evaluating economic, engineering, and environmental concerns for the SPS. The SPS was installed in 1996 and consisted of a manmade sand dune reinforced by a buried stone seawall, with beach replenishment on the seaward side. BOEM (then MMS) completed their own EA in May 1996 evaluating potential environmental effects including threatened and endangered species, air quality and cultural resources. A supplemental EA was prepared in 2004 incorporating the alternatives and environmental analysis from the earlier EA and with supplemental analysis to specifically address the proposed 2004 beach replenishment action. The NAVY and BOEM (then MMS) both found no significant impacts for the two previous dredging cycles provided identified mitigation measures were implemented. Alternatives to beach nourishment were re-considered in scoping for this EA, but ultimately eliminated.

Two practical alternatives were considered and analyzed by BOEM (other alternatives were analyzed by the Navy which included the construction of a dune) for this project: A) authorize use of the OCS borrow area and B) the No Action alternative. The potential impacts resulting from BOEM's no action, or not issuing the negotiated agreement, would actually depend on the course of action subsequently pursued by the project proponents, which could include:

(a) re-evaluation of the project, choosing another alternative borrow location or offshore sand source,
(b) identification and use of onshore sources of comparable sand quantity and quality, or
(c) not constructing the project.

Option (a) would not minimize overall environmental effects as potential effects would be comparable, or potentially worse, depending on the borrow location. Option (b) is not considered to be viable, as upland sources of needed quality and quantity are limited in the project area. The No Action alternative would not fully meet the Project's purpose and need. In the case of the no project option, coastal erosion would continue, sea turtle and shorebird nesting habitat would deteriorate and the likelihood and frequency of property and storm damage would increase. The Navy has previously considered a range of structural and non-structural alternatives to beach fill, including other borrow areas. Beach fill using Sandbridge Shoal was chosen as the preferred alternative because of its compatibility and proximity, both important cost and environmental considerations.

Environmental Effects

This EA evaluates potential environmental effects resulting from the issuance of a negotiated agreement, and to determine if the proposed action, in light of new information, would have a significant effect on the human environment and whether an EIS must be prepared. The connected actions of conveyance and placement of the sand are also addressed.

Based on the effects analysis presented in the attached EA (Attachment 1), no significant impacts were identified. The EA and FONSI identify all mitigation and monitoring that is necessary to avoid, minimize, and/or reduce and track any foreseeable adverse impacts that may result from all phases of construction. A subset of mitigation, monitoring, and reporting requirements, specific to activities under BOEM jurisdiction, will be incorporated into the negotiated agreement to avoid, minimize, and/or reduce and track any foreseeable adverse impacts.

Significance Review

Pursuant to 40 CFR 1508.27, BOEM evaluated the significance of potential environmental effects considering both CEQ context and intensity factors. The potential significance of environmental effects has been analyzed in both spatial and temporal context. Potential effects are generally considered reversible because they will be minor to moderate, localized, and short-lived. No long-term significant or cumulatively significant adverse effects were identified. The ten intensity factors were considered in the EA and are specifically addressed below:

1. Impacts that may be both beneficial and adverse.

Potential adverse effects to the physical environment, biological resources, cultural resources, and socioeconomic resources have been considered. Adverse effects to benthic habitat and communities in the borrow area are expected to be reversible. Short-term and local effects on fish habitat and fishes are expected within the dredged area due to reduction of benthic habitat and prey, as well as changes in shoal morphology and burial of existing benthic habitat in the fill placement area. Potential effects to sea turtles, marine mammals, and cultural resources in the vicinity of operations have been reduced through tested mitigation sea turtle deflector use, marine mammal observers, and cultural resource buffers. Effects to nesting, foraging, and swimming sea turtles and marine mammals will be monitored. Temporary displacement of or behavior modification of birds near the borrow areas or beach placement could occur. Impacts would be short-term, localized and temporary and should have no lasting effects on bird populations in the area. Temporary reduction of water quality is expected due to turbidity during dredging and placement operations. Best management practices for erosion and turbidity controls will be used pursuant to the requirements of a Virginia Water Protection Permit. Small, localized, temporary increases in concentrations of air pollutant emissions are expected, but the short-term impact by emissions from the dredge or the tugs would not affect the overall air quality of the area. A temporary increase in noise level and a temporary reduction in the aesthetic value offshore during construction in the vicinity of the dredging would occur. For safety reasons, navigational and recreational resources located in the vicinity of the dredging operation would temporarily be unavailable for public use. There would also be beneficial impacts from increased storm protection and an improved recreational beach. Furthermore, over the long-term, there would be newly created shorebird and sea turtle nesting habitat.

2. The degree to which the proposed action affects public health or safety.

The proposed activities are not expected to significantly affect public health. Construction noise will temporarily increase ambient noise levels and equipment emissions would decrease air quality in the immediate vicinity of placement activities. The public is typically prevented from entering the segment of beach under construction, further this section of beach has restricted access to only military personnel and escorted guests, so recreational activities will not be occurring in close proximity to operations.

3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

No prime or unique farmland, park lands, designated Wild and Scenic reaches, or wetlands would be impacted by implementation of this project. No critical habitat for the listed species is located within the project area. Sandbridge Shoal has been designated as Essential Fish Habitat (EFH) for 22 federally managed species and is a habitat area of particular concern (HAPC) for sandbar sharks. Dredging may affect feeding success of EFH species due to turbidity, habitat perturbation, and loss of benthic prey. Impacts to EFH would occur on Sandbridge Shoal, but the limited spatial and temporal extent of dredging suggests these impacts will not adversely affect EFH on a broad scale (Attachment 1, Appendix A). There is no hardbottom within the proposed project area. Cultural resources are described in more detail below.

4. *The degree to which the effects on the quality of the human environment are likely to be highly controversial.*

No effects are expected that are scientifically controversial. Effects from beach nourishment projects, including dredging on the OCS, are generally well studied. The effects analyses in the EA has relied on the best available scientific information, including information collected from previous dredging and nourishment activities in and adjacent to the project area. Numerous studies and monitoring efforts have been undertaken in the vicinity of Sandbridge Shoal evaluating the effects of dredging and beach nourishment on shoreline change, habitat condition, benthic communities, and fish.

5. *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*

Beach nourishment is a common solution to coastal erosion problems along the mid-Atlantic coast. Beach nourishment in Virginia Beach and the surrounding areas (including Dam Neck Annex) has been ongoing for several decades. No significant adverse effects have been documented during or as a result of these past operations. The project design is typical of beach nourishment operations. Mitigation and monitoring efforts are similar to that undertaken for past projects and have been demonstrated to be effective. The effects of the proposed action are not expected to be highly uncertain, and the proposed activities do not involve any unique or unknown risks. While military munitions have been dredging during previous USACE construction cycles, the Navy has not encountered unexploded ordnances during their two previous dredging cycles. The dredge plant will not be outfitted with screening devices to exclude entrainment and placement on the beach of any military munitions although these devices are recommended by BOEM.

6. *The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*

No precedent for future action or decision in principle for future consideration is being made in BOEM's decision to authorize re-use of the Sandbridge Shoal for this construction cycle. BOEM considers each use of a borrow area on the OCS as a new federal action. The Bureau's authorization of the use of the borrow area does not dictate the outcome of future leasing decisions. Future actions will also be subject to the requirements of NEPA and other applicable environmental laws.

7. *Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.*

Significance may exist if it is reasonable to anticipate cumulatively significant impacts that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The EA identifies those actions and potential impacts related to underlying activities. The EA and previous NEPA documents conclude that the activities related to the proposed action are not reasonably anticipated to incrementally add to the effects of other activities to the extent of producing significant effects. Because the seafloor is expected to equilibrate, sand moving alongshore and will slowly accumulate offshore, the proposed project provides an incremental, but localized effect on the reduction of offshore sand resources. Although there will be a short-term and local decline in benthic habitat and populations, both are expected to recover within a few years. No significant cumulative impacts to benthic or fish habitat and associated communities are expected from the continued use of the borrow area, although NMFS Habitat Conservation Division has expressed (letter dated August 16, 2012) some concern over the repetitive use if dredging will re-occur at intervals more frequent that the expected time recovery of benthic communities (Attachment 1, Appendix A).

8. *The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.*

The proposed action is not expected to adversely affect historic resources. Bottom-disturbing activities (e.g., dredging, anchoring, pipeline emplacement and relocation) may occur during proposed construction activities. An archaeological clearance survey was performed and potential historic or cultural properties have been identified in the borrow area. Avoidance buffers have been applied to targets. A remote sensing survey will be required in advance of any construction activity to establish and use corridors for pump-out and conveyance operations. No known archaeological resources are located in the placement area. The Navy, acting as the lead agency for complying with the National Historic Preservation Act, has coordinated with the Virginia State Historic Preservation Office (SHPO) (Attachment 1, Appendix A, dated August 23, 2011). BOEM will require implementation of a chance-finds procedure which calls for immediate cessation of operations and notification in the event of an unanticipated discovery of a cultural resource. BOEM and the Navy will work with Virginia Division of Historic Resources (SHPO) should shipwreck remains be unexpectedly discovered. No significant impacts to cultural resources in the project area (borrow, pump-out, or placement areas) are anticipated with implementation of the measures to protect existing identified resources.

9. *The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.*

Nesting and swimming sea turtles, seabeach amaranth, Atlantic sturgeon, piping plovers, and roseate terns may present in the project area during and after construction operations and may be adversely affected. The Navy will comply with all requirements of biological opinions and concurrences associated with this project provided under the Endangered Species Act (ESA) from both U.S. Fish and Wildlife Service (U.S. FWS) and National Marine Fisheries Service (NMFS) (Attachment 1, Appendix A and E).

If a hopper dredge is used for the dredging operations, potential impacts to sea turtles could occur. To minimize the risk to sea turtles, standard sea turtle protection conditions will be implemented such as the use of a state-of-the-art rigid deflector draghead at all times, inflow screens, and/or monitoring of the operation.

According to the NMFS Biological Opinion (Attachment 1, Appendix E), the proposed action may adversely affect but is not likely to jeopardize the continued existence of the Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead sea turtle; Kemp's ridley sea turtles; the Gulf of Maine (GOM) DPS of Atlantic sturgeon; New York Bight (NYB) DPS of Atlantic sturgeon; Chesapeake Bay (CB) DPS of Atlantic sturgeon; Carolina DPS of Atlantic sturgeon; or South Atlantic (SA) DPS of Atlantic sturgeon, and is not likely to adversely affect leatherback or green sea turtles or right, humpback or fin whales. NMFS also concludes that the action will not affect hawksbill turtles as that species is unlikely to occur in the action area.

Because no critical habitat is designated in the action area, none will be affected by the proposed action.

The USFWS concurred with the Navy's determination of may affect, but is not likely to adversely affect for the roseate tern and seabeach amaranth. Additionally, the USFWS had a no effect determination for nesting leatherback sea turtle, hawksbill sea turtle, and Kemp's ridley sea turtle. The Service concurs with the Navy's no effect determination for these three species of sea turtle because no records of nesting attempts by these species have been documented in Virginia. The USFWS did not concur with the Navy's determination of may affect, but is not likely to adversely affect for nesting loggerhead and green sea turtles, because take of turtles may occur (Attachment 1, Appendix A). However, the USFWS amended the Loggerhead Sea Turtle Nest Monitoring and management on Back Bay NWR biological opinion issued by the Service on July 13, 2011, to add Naval Station Oceana, Dam Neck Annex. Their letter, dated May 25, 2012, will be appended to that biological opinion and maintained as part of the decision document and administrative record. The biological opinion, the amendment, and the criteria in the Navy's Integrated Natural Resource Management Plan (INRMP) together provide ESA compliance for the Navy related to monitoring of nesting sea turtles and nests, nest protection, and nest relocations for both loggerhead and green sea turtles that may occur at Naval Station Oceana, Dam Neck Annex.

The Navy included in their INRMP guidelines for migratory bird monitoring and management. The INRMP includes protocols to ensure surveys and daily observations during sea turtle nesting periods will include monitoring for both piping plover and the federal candidate red knot. There are no records of piping plovers nesting on beaches south of the Chesapeake Bay, where the species is considered to be an uncommon transient. Because it is unlikely that the piping plover will utilize this area and the monitoring protocols will be implemented, the Service concurred with the Navy's determination of may affect, but is not likely to adversely affect for piping plovers (Attachment 1, Appendix A).

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The Navy must comply with all applicable Federal, State, and local laws and requirements. BOEM and the Navy have acquired authorizations for ESA and MSA from NMFS and USFWS. A Virginia Marine Resources Commission Permit and Virginia Water Protection Permit will be obtained by the Navy. A consistency concurrence from the Virginia Department of Environmental Quality (VDEQ) has been issued for the proposed action.

The proposed action is in compliance with the Marine Mammal Protection Act. Marine mammals are not likely to be adversely affected by the project and incorporation of safeguards to protect threatened and endangered species during project construction would also protect marine mammals in the area.

Consultations and Public Involvement

The EA was subject to a public comment period. The Navy served as the lead Federal agency coordinating public involvement and comment. Pertinent correspondence with Federal and state agencies are provided in Appendix A, B and E of the EA (Attachment 1). After signature of this Finding of No Significant Impact (FONSI), a Notice of Availability of the FONSI and EA will be prepared and published by BOEM in the Federal Register or by other appropriate means. The EA and FONSI will be posted to BOEM web site [http://www.boem.gov/Non-Energy-Minerals/Marine-Minerals-Program.aspx].

Conclusion

BOEM has considered the consequences of issuing a negotiated agreement to authorize use of OCS sand from Sandbridge Shoal in the Naval Air Station Oceana, Dam Neck Annex (Dam Neck Annex) Shoreline Protection System (SPS) Project. BOEM independently reviewed the attached EA (Attachment 1) and finds that it complies with the relevant provisions of the CEQ regulations implementing NEPA, DOI regulations implementing NEPA, and other Marine Mineral Program requirements. Based on the NEPA and consultation process coordinated cooperatively by the Navy and BOEM, appropriate terms and conditions enforceable by BOEM will be incorporated into the negotiated agreement to avoid, minimize, and/or mitigate any foreseeable adverse impacts.

Based on the evaluation of potential impacts and mitigating measures discussed in the EA, BOEM finds that entering into a negotiated agreement, with the implementation of the mitigating measures, does not constitute a major Federal action significantly affecting the quality of the human environment, in the sense of NEPA Section 102(2)(C), and will not require preparation of an EIS.

James F. Bennett
Chief, Division of Environmental Assessment

Date 9/6/12

Appendix A
Mitigation, Monitoring, and Reporting Requirements

The following mitigation measures, monitoring requirements, and reporting requirements are proposed by BOEM to avoid, minimize, reduce, or eliminate environmental impacts associated with the Proposed Action (herein referred to as the "Project"). Mitigation measures, monitoring requirements, and reporting requirements in the form of terms and conditions are added to the negotiated agreement and are considered enforceable as part of the agreement.

Plans and Performance Requirements

The Navy will ensure that all operations at Sandbridge Shoal Borrow Areas A and B are conducted in accordance with the final approved "Construction Solicitation and Specifications Plan" (hereinafter referred to as the "Plan") and all terms and conditions in the MOA, as well as all applicable statutes, regulations, orders and any guidelines or directives specified or referenced herein. The Navy will provide BOEM a copy of the final Plan as soon as available.

The dredging method for removing sand from Sandbridge Shoal Borrow Areas A and B will be consistent with those analyzed or identified in the NEPA and other authorizing environmental documents, as well as any relevant project permits. Dredging depths will not exceed any specifications identified in the Plan. The Navy will allow BOEM to review and comment on modifications to the Plan that may affect the borrow area or pipeline corridors on the OCS, including the use of submerged or floated pipelines to directly convey sediment from the borrow area to the placement site. Said comments shall be delivered in a timely fashion so as to not unnecessarily delay the Navy's construction contract or schedule.

If dredging and/or conveyance methods are not wholly consistent with those evaluated in relevant NEPA documents and environmental and cultural resource consultations, and those authorized by relevant project permits, additional environmental review may be necessary. If the additional NEPA review, consultations, or permit modifications would impact or otherwise supplement the provisions of the MOA, an amendment may be required.

Prior to the commencement of construction, the Navy shall electronically provide BOEM with a summary of the construction schedule. The Navy, at the reasonable request of BOEM or the Bureau of Safety and Environmental Enforcement (BSEE), shall allow access, at the site of any operation subject to safety regulations, to any authorized Federal inspector and shall provide BOEM or BSEE any documents and records that are pertinent to occupational or public health, safety, environmental protection, conservation of natural resources, or other use of the OCS as may be requested.

Environmental Responsibilities and Environmental Compliance

The Navy is the lead agency on behalf of the Federal government to ensure the Project complies with applicable environmental laws, including but not limited to the ESA, MSFCMA, MBTA, NHPA, and CZMA. The Navy is responsible for compliance with the specific conditions of state permits, such as those administered by the Virginia Marine Resources Commission (VMRC) and Virginia Department of Environmental Quality (VDEQ).

The Navy will serve as the lead Federal agency for ESA Section 7 compliance concerning protected species under the purview of the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS). The Navy will instruct its contractor(s) to implement the mitigation terms, conditions, and measures required by the FWS, NMFS, VMRC, and BOEM pursuant to applicable federal laws and regulations. The required mitigation terms, conditions, and measures are reflected in the relevant Biological Opinions, Conservation Recommendations, Consistency Determination, and state permits.

Electronic copies of all relevant correspondence, monitoring data, and reports related to activities covered by this MOA shall be provided to BOEM within 14 days of issuance (including but not limited to observer and dredging reports and reports required by relevant project permits).

Pre-Construction Notification of Activity in or near the Borrow Area

The Navy will invite BOEM to attend a pre-construction meeting that describes the Navy's and/or its agents' plan and schedule to construct the Project.

The Navy will also notify the BOEM, electronically, of the commencement and termination of operations at Sandbridge Shoal Borrow Areas A and B within 24 hours after the USACE receives such notification from its contractor(s) for the Project. BOEM will electronically notify the Navy in a timely manner of any OCS activity within the jurisdiction of the DOI that may adversely affect the Navy's ability to use OCS sand resources from the SSBAs for the Project.

Dredge Positioning

During all phases of the Project, the Navy will ensure that the dredge and any bottom disturbing equipment is outfitted with an onboard global positioning system (GPS) capable of maintaining and recording location within an accuracy range of no more than plus or minus 3 meters. The GPS must be installed as close to the draghead, cutterhead, or other hydraulic or mechanical dredging device as practicable or use appropriate instrumentation to accurately represent the position of the draghead, cutterhead, or other hydraulic or mechanical dredging device. During dredging operations, the Navy will notify BOEM electronically if dredging occurs outside of the approved borrow area. Such notification will be made as soon as possible after the time Navy becomes aware of dredging outside of the approved borrow area.

Anchoring, spudding, or other bottom disturbing activities are not authorized outside of the approved borrow area on the OCS except for immediate concerns of safety, navigation risks or emergency situations.

The Navy will provide BOEM, electronically, with all appropriate Dredging Quality Management (DQM) data acquired during the Project using procedures jointly developed by the USACE's National Dredging Quality Management (DQM) Data Program Support Center and BOEM. The Navy will submit the DQM or other equivalent plant positioning data, including draghead, cutterhead, or other hydraulic or mechanical dredging device depth biweekly. A summary DQM dataset will be submitted within 90 days of completion of the Project. If available, the Navy will also submit Automatic Identification System (AIS) data for vessels qualifying under the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea.

Submittal of Production and Volume Information

The Navy, in cooperation with the dredge operator, shall submit to BOEM on a biweekly basis an electronic summary of the dredge track lines, outlining any deviations from the original Plan. A color-coded plot of the draghead, cutterhead, or other hydraulic or mechanical dredging device will be submitted, showing any horizontal or vertical dredge violations. The dredge track lines shall show dredge status: hotelling, dredging, transiting, or unloading. This map will be provided in PDF format.

The Navy will provide at least a biweekly update, electronically, of the construction progress including estimated volumetric production rates to BOEM.

The project completion report, as described below, will also include production and volume information, including Daily Operational Reports.

Local Notice to Mariners

The Navy shall require its contractor(s) for the Project to place a notice in the U.S. Coast Guard Local Notice to Mariners regarding the timeframe and location of dredging and construction operations in advance of commencement of dredging.

Marine Pollution Control and Contingency Plan

The Navy will require its contractor(s) and subcontractor(s) to prepare for and take all necessary precautions to prevent discharges of oil and releases of waste and hazardous materials that may impair water quality. In the event of an occurrence, notification and response will be in accordance with applicable requirements of 40 C.F.R. Part 300. All dredging and support operations shall be compliant with U.S. Coast Guard regulations and the U.S. Environmental Protection Agency's Vessel General Permit, as applicable. The Navy will notify BOEM of any occurrences and remedial actions taken and provide copies of all reports of the incident and resultant actions electronically.

Encounter of Ordnance

Remote sensing surveys and historical dredging operations suggest that the dredge contractor may encounter unexploded ordnance (UXO) in Sandbridge Shoal Borrow Areas A and B. As a safety precaution, BOEM recommends a screen be placed over the drag head to prevent any UXO from entering dredge equipment and or being placed on the beach. The screen must be designed to prevent the passage of objects greater than 1.5" in diameter. If the Navy elects not to use screening, please refer to the Responsibility clause within these stipulations and the MOA.

If any ordnance is encountered while conducting dredging activities at Sandbridge Shoal Borrow Areas A and B, the Navy will report the discovery within 24 hours to Chief, BOEM Leasing Division, at (703) 787-1215 and electronically.

Conflict Avoidance with the USACE and City of Virginia Beach Dredging Operations

Prior to commencing any operations in the vicinity of Sandbridge Shoal related to the Project, the Navy shall confirm with the USACE that there are no time or space use conflicts that may result from USACE dredging operations in the area. In the event of any time or space use conflicts between the USACE and U.S. Navy operations at Sandbridge Shoal, the Navy shall coordinate with the USACE before the Navy authorizes commencement of any operation of a dredge in the Sandbridge Shoal Borrow Areas A and B to coordinate project operations and schedules. The Navy will ensure coordination and notification among the USACE and any relevant contractors of the parties to prevent or otherwise minimize conflicts during dredging operations.

Bathymetric Surveys

The Navy will provide the BOEM with pre- and post-dredging bathymetric surveys of Sandbridge Shoal Borrow Areas A and B. The pre-dredging survey will be conducted within the area(s) intended to be dredged within 60 days prior to dredging. The post-dredging survey will be conducted within 60 days after the completion of dredging within the area(s) dredged. An additional bathymetric survey is recommended one year after completion of dredging. Hydrographic surveys will be performed in accordance with the USACE Hydrographic Surveying Manual EM 1110-2-1003. BOEM prefers one hundred percent seamless coverage using interferometric swath or multibeam bathymetry. All bathymetric data shall be roll, pitch, heave, and tide corrected using accepted practices. At a minimum, survey lines of the specific dredge area, within Sandbridge Shoal Borrow Areas A and B, will be established at intervals no greater than 50 m. Three equidistant cross-tie lines will be established parallel to the principal survey baseline. All survey lines will extend at least 100 meters beyond the edge of the dredge areas. All data shall be collected in such a manner that post-dredging bathymetry surveys are compatible with the pre-dredging bathymetric survey data to enable the latter to be subtracted from the former to calculate the volume of sand removed, the shape of the excavation, and nature of post-dredging bathymetric change.

Copies of pre-dredging and post-dredging hydrographic data will be submitted to the BOEM electronically within ninety (90) days after each survey is completed. The delivery format for data submission is an ASCII file containing corrected x, y, z data. The horizontal data will be provided in the North American Datum of 1983 (NAD ’83) Virginia State Plane South, U.S. survey feet unless otherwise specified. Vertical data will be provided in the North American Vertical Datum of 1988 (NAVD ’88), U.S. survey feet, unless otherwise specified. An 8.5x11 inch or larger plan view plot of the pre- and post-construction data will be provided showing the individual survey points, as well as contour lines at appropriate elevation intervals. These plots will be provided in PDF format. Survey metadata will also be provided.

Archaeological Resources

Onshore or Nearshore Prehistoric or Historic Resources

There are no historic properties identified within the areas of potential effect (APEs) at Dam Neck Annex. All bottom disturbing activities, including anchoring or spudding, in the vicinity of any historic resource will be avoided. If the Navy discovers any previously unknown historic or archeological remains while accomplishing the activity nearshore of or in the vicinity of Sandbridge Beach, the Navy will notify the BOEM electronically of any finding. The Navy will initiate the federal and state coordination in accordance with 36 CFR § 800.13(c) to determine if it may be adversely affected, if the site is eligible for listing in the National Register of Historic Places, and appropriate action for the resolution of adverse effects..

Offshore Prehistoric or Historic Resources
To minimize the risk of inadvertent damage to undiscovered archeological or historic resources, the Navy shall ensure that the dredge contractor does not intentionally drag equipment outside the borrow area or along the nearshore bottom during pump-out relocation procedures.

Historic Resources

Tidewater Atlantic Research completed an archaeological survey of Sandbridge Shoal Borrow Areas A and B. The remote sensing survey recorded 51 unidentified magnetic anomalies and one side-scan sonar target in Borrow Area A, and 37 unidentified magnetic anomalies and one side-scan sonar target within Borrow Area B. The side-scan sonar target recorded in Borrow Area A has been identified as a small barge. Five of the magnetic anomalies were associated with this feature. The side-scan sonar target and five associated magnetic anomalies recorded in Borrow Area B have been tentatively identified as a potentially significant historic shipwreck site. Of the remaining 46 unidentified magnetic anomalies in Area A, 29 are considered to be potentially representative of historic shipwreck sites, and of the remaining 32 unidentified magnetic anomalies in Area B, 17 are considered to be potentially representative of historic shipwreck sites. The unidentified magnetic anomalies listed in Table 1 must be avoided by all bottom-disturbing activities, including anchoring, by a minimum distance of 200 feet. Additionally, the location of the small barge in Area A and the side-scan sonar target in Area B must be avoided by a minimum distance of 500 feet. Avoidance of the two side-scan sonar targets by the specified distance will result in the avoidance of all associated magnetic anomalies.

If it is determined that the unidentified magnetic anomalies and side-scan sonar targets listed in Table 1 cannot be avoided by dredging operations, the Navy must contract a qualified marine archaeologist to conduct further investigations to assess the significance the targets, through the use of the criteria at 36 C.F.R. Parts 60 and 63, and the National Park Service's National Register Bulletin No. 20, *Nominating Historic Vessels and Shipwrecks to the National Register of Historic Places*. The proposed investigation procedures must be discussed with a BOEM archaeologist prior to commencing fieldwork.

At a minimum, this assessment must include an analysis of the age, physical composition, and structural integrity of the object (i.e. wood or metal, intact or dispersed). Measured drawings and/or underwater video or still photographs of the feature shall be made for documentation and submitted with the final "Report of Findings." The Navy shall prepare a "Report of Findings" which will include data and writing standards recommended in BOEM Notice To Lessees (NTL) 2005-G07, Enclosure No. 2. The Report of Findings must be submitted to the BOEM for approval within ten business days of the completion of fieldwork. BOEM must concur with the findings of the field archaeologist prior to the initiation of dredging operations.

Prehistoric Resources

Analysis of the subbottom profile data by Tidewater Atlantic Research indicated the presence of a paleochannel feature in the extreme southeastern corner of Borrow Area A. If proposed dredging operations in Borrow Area A will disturb the sediments to a depth that would intersect this feature, the dredging operations must avoid the outermost margins of the paleochannel feature by a minimum distance of 100 feet.

Table 1. Archaeological avoidance areas.

BORROW AREA A						
Acoustic Target	**Magnetic Anomaly**	**Amplitude (gammas)**	**Duration (feet)**	**Coordinates (Virginia State Plane South [feet])**		**Avoidance Radius (min.)**
				X	**Y**	
S1*						500 ft.
	2	3	463			200 ft.
	3	5	453			200 ft.
	4	272	546			200 ft.
	5	26	619			200 ft.
	6	2	300			200 ft.
	8	28	495			200 ft.
	9	4	252			200 ft.
	10	14	443			200 ft.
	12	11	135			200 ft.
	13	4	244			200 ft.
	14	12	307			200 ft.
	15	3	198			200 ft.
	16	4	458			200 ft.
	17	3	172			200 ft.
	19	3	222			200 ft.
	20	4	454			200 ft.
	21	2	408			200 ft.
	22	3	496			200 ft.
	23	3	646			200 ft.
	24	3	551			200 ft.
	25	4	504			200 ft.
	26	2	383			200 ft.
	27	5	296			200 ft.
	28	4	338			200 ft.
	29	4	681			200 ft.
	30	3	544			200 ft.
	31	4	575			200 ft.
	32	6	540			200 ft.
	33	5	645			200 ft.
	38	4	254			200 ft.
	39	2	203			200 ft.
	40	2	279			200 ft.
	41	3	319			200 ft.
	42	2	263			200 ft.
S1*						500 ft.
	9	8	352			200 ft.
	10	54	553			200 ft.

	11	58	569			200 ft.
	12	10	349			200 ft.
	13	3	441			200 ft.
	3	9	238			200 ft.
	4	4	185			200 ft.
	14	5	315			200 ft.
	18	10	183			200 ft.
	19	4	189			200 ft.
	20	12	285			200 ft.
	21	1	165			200 ft.
	22	5	270			200 ft.
	23	2	148			200 ft.
	24	25	312			200 ft.
	28	3	126			200 ft.
	29	2	180			200 ft.
	30	3	109			200 ft.
	31	3	87			200 ft.
	35	10	262			200 ft.
	36	2	98			200 ft.
	37	6	202			200 ft.

Unanticipated Finds Clause

In the event that the dredge operators discover any archaeological resource while conducting dredging operations in Sandbridge Shoal Borrow Areas A and B or in the vicinity of pump-out operations, the Navy shall require that dredge and/or pump-out operations be halted immediately and avoid the resource per the requirements of the Navy specifications for unanticipated finds. The Navy shall then report the discovery to the Chief, Leasing Division, BOEM electronically in a timely manner. The Navy will coordinate with BOEM on the measures needed to evaluate, avoid, protect, and, if needed, mitigate adverse impacts from an unanticipated discovery. If investigations determine that the resource is significant, the parties shall together determine how best to protect it.

Responsibilities

BOEM does not warrant that the OCS sand resources used in this project are suitable for the purpose for which they are intended by the Navy. BOEM's responsibility under this Project is limited to the authorization of access to OCS sand resources from Sandbridge Shoal Borrow Areas A and B, as described in the MOA, and therefore BOEM disclaims any and all responsibility for the physical and financial activities undertaken by other Parties in pursuit of the Project.

Project Completion Report

A project completion report will be submitted by the Navy to BOEM within 120 days following completion of the activities authorized under this MOA. This report and supporting materials should be sent in writing and electronically. The report shall contain, at a minimum, the following information:

- the names and titles of the project managers overseeing the effort (for the Navy, the engineering firm (if applicable), and the contractor), including contact information (phone numbers, mailing addresses, and email addresses);
- the location and description of the project, including the final total volume of material extracted from the borrow area and the volume of material actually placed on the beach or shoreline (including a description of the volume calculation method used to determine these volumes);
- DQM data, in ASCII files, containing the x, y, z and time stamp of the cutterhead or drag arm locations;
- a narrative describing the final, as-built features, boundaries, and acreage, including the restored beach width and length;
- a table, an example of which is illustrated below, showing the various key project cost elements;

	Cost Incurred as of Construction Completion ($)
Construction	
Engineering and Design	
Pre- and Post-Dredging Bathymetric Surveys	
Compilation of Project Completion Report	
Total	

- a table showing the various phases of the project construction, the types of construction equipment used, and the number of times and length of time each piece of construction equipment was utilized. A listing of construction and construction oversight information, including the prime and subcontractor(s), contract costs, etc.;
- a list of all major equipment used to construct the project;
- a narrative discussing the construction sequences and activities, and, if applicable, any problems encountered and solutions;
- a list and description of any construction change orders issued, if applicable;
- a list and description of any safety-related issues or accidents reported during the life of the project;
- a narrative and any appropriate tables describing any environmental surveys or efforts associated with the project and costs associated with these surveys or efforts;
- a table listing significant construction dates beginning with bid opening and ending with final acceptance of the project by the Navy;
- digital appendices containing the as-built surveys, beach-fill cross-sections, and survey data; and
- any additional pertinent comments.

Reporting Compliance

The Navy will designate in advance of construction a single point of contact (and possibly a back-up contact) responsible for facilitation of compliance with all MOA requirements. The contact information will be provided to BOEM, electronically, at least 30 days in advance of dredging and construction operations.

The parties will attempt to reasonably comply with the provisions of this MOA. Should there be an allegation of a failure to comply, the allegation shall be corrected as soon as possible and/or resolved jointly among BOEM and the Navy including through a dispute resolution process, as necessary.

Attachment 1

Final Environmental Assessment with Appendices

Environmental Assessment for Repairs to the Shoreline Protection System

at

Naval Air Station Oceana, Dam Neck Annex
Virginia Beach, Virginia

FINAL

August 2012

UNITED STATES DEPARTMENT OF THE NAVY

UNCLASSIFIED

Lead Agency: United States Department of the Navy

In accordance with Chief of Naval Operations Instructions 5090.1C, Change 1

ENVIRONMENTAL ASSESSMENT FOR REPAIRS TO THE SHORELINE PROTECTION SYSTEM AT NAVAL AIR STATION OCEANA, DAM NECK ANNEX VIRGINIA BEACH, VIRGINIA

AUGUST 2012

Abstract

The U.S. Department of the Navy is proposing to repair the shoreline protection system at Naval Air Station Oceana, Dam Neck Annex, located on the Atlantic coast in Virginia Beach, Virginia. The shoreline protection system was installed in 1996 and consists of a constructed sand dune reinforced by a buried stone seawall, with a replenished beach on the seaward side. Repair of the shoreline protection system would begin between fiscal year (FY) 2013 and FY 2016 and continue for three to six consecutive months. The Department of the Interior, Bureau of Ocean Energy Management is serving as a cooperating agency because they have jurisdiction over the borrow area and may authorize its use in the proposed project.

Under the preferred alternative, the Navy would restore the shoreline protection system to its original condition. The beach would be fully replenished and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. The restored areas of the constructed dune would be planted with native grasses. Approximately 700,000 cubic yards of sand would be required under the preferred alternative. The preferred alternative includes authorization by the Bureau of Ocean Energy Management to access the outer continental shelf borrow area known as Sandbridge Shoal, for the extent of the negotiated agreement, to dredge sand for the replenishment.

Alternative 2 would include full replenishment of the shoreline protection system and construction of a manmade dune, including a stone core, along approximately half-mile sections of dune north and south of the existing constructed dune. As required by the Council on Environmental Quality regulations, this environmental assessment also analyzes the No Action alternative.

Resource areas reviewed in the document include land use, visual setting, oceanography, the coastal zone, biological resources, water resources, noise, air quality, transportation and traffic, navigation, and cultural resources. Environmental impacts on these resource areas would be minor or negligible.

Please contact the following person with comments and questions:

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Executive Summary

ES.1 Type of Report

The U.S. Department of the Navy (Navy) is proposing to repair the shoreline protection system (SPS) on Naval Air Station Oceana, Dam Neck Annex (Dam Neck Annex) located on the Atlantic coast in Virginia Beach, Virginia. The SPS was installed in 1996 and consisted of a constructed sand dune reinforced by a buried stone seawall, with beach replenishment on the seaward side. The constructed dune extends from Building 225 south to Building 127 and measures 5,282 feet long, 20 feet high, and 50 feet wide. Sand for the beaches would be dredged from a Department of Interior, Bureau of Ocean Energy Management (BOEM)-approved borrow area within the Sandbridge Shoal, which is located approximately 3 miles offshore of the proposed project location, outside of Virginia's state territorial waters (i.e., 3 nautical miles). The anticipated implementation date of the repairs is between fiscal year (FY) 2013 and FY 2016.

This environmental assessment (EA) evaluates the reasonably foreseeable environmental consequences of the proposed SPS repairs. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969; the Council on Environmental Quality regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Navy procedures for implementing NEPA (32 CFR 775); the Chief of Naval Operations Instruction, OPNAVINST 5090.1C, Change 1 (U.S. Department of the Navy July 18, 2011), and the Department of the Interior regulations implementing NEPA (43 CFR 46). The Navy is the lead agency for the proposed action, with BOEM serving as a cooperating agency.

ES.2 Description of the Proposed Action

The proposed action is to restore the SPS at Dam Neck Annex to the level of protection from coastal flooding, currents, and wave action as it provided when first constructed in 1996. The SPS was constructed to protect Navy assets currently worth approximately $135 million. The assets include training facilities (weapons gun line), housing (bachelor enlisted quarters [BEQ]), and the Navy's Morale, Welfare, and Recreation (MWR) facilities (the Shifting Sands Beach Club, beaches, the Cottages at Dam Neck, the Navy Gateway Inn and Suites, and the Sea Mist Campground). Repairs to the SPS are expected to be required every eight to ten years to maintain design integrity and effectiveness. However, the proposed action is only a single, one-time action and does not cover any maintenance work that may be required in the future.

ES.3 Alternatives

This EA considers two action alternatives and a No Action alternative. Alternative 1 includes full replenishment of the SPS, and Alternative 2 includes full replenishment of the SPS and construction of new dunes north and south of the existing constructed dune. Alternative 1 is the preferred alternative. The approximately 1-mile-long section of the coast currently protected by the constructed sand dune is the section with critical infrastructure assets that are most in need of extra protection. The approximately half-mile-long section south of the constructed dune lacks buildings; it consists of natural sand dunes and a campground. The approximately half-mile-long section north of the constructed dune has buildings, but they are set farther back from the mean high water line and have a wider area of natural dunes protecting them. Although new manmade dunes would bolster the protection of these areas, the well-established natural dune systems provide adequate protection, provided that the Navy continues to replenish sand on the beach in front of these dunes.

ES.3.1 Alternative 1 (Preferred Alternative) – Full Replenishment

Under Alternative 1, the SPS at Dam Neck Annex would be restored to its original condition. The beach would be fully replenished, and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. The restored areas of the constructed dune would be planted with native grasses such as American beachgrass (*Ammophila breviligulata*), coastal/bitter panic grass (*Panicum amarum*), switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*). Accumulated sand would be removed from the pedestrian crossover bridges along the restored areas of the dune.

Under Alternative 1, a total of approximately 700,000 cubic yards of sand would be required. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation due to overflow of the hopper during pump-out operations and during sand placement. It is estimated that approximately 472,500 cubic yards would be placed on the beach and 52,500 cubic yards would be added to the constructed dune. This sand replaces the volume of sand eroded since 2004 by normal winds, waves, and currents as well as sand removed during storms.

Alternative 1 includes authorization by the BOEM to access outer continental shelf (OCS) sand in the borrow area known as Sandbridge Shoal, for the extent of the negotiated agreement, in order to dredge sand for the beach and dune replenishment. Sandbridge Shoal is approximately 3 miles offshore of the project location. A hopper dredge would be used to remove the sand from Sandbridge Shoal. To minimize impacts on threatened and endangered sea turtle species, dredging at Sandbridge Shoal would be conducted only from December 1 through March 31, outside of the sea turtle nesting season. The hopper dredge would remove approximately 2,800 cubic yards of sand per trip to the shoal. Once the sand is pulled from the shoal, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge onto the Dam Neck

Annex beach through a short pipeline at no more than five different pump-out stations/buoys positioned approximately 2,500 feet to 3,000 feet apart along the area to be replenished. No more than two bulldozers and two graders would then be used to shape the beach and dune to the original 1996 design. To minimize impacts on threatened and endangered sea turtle species, shaping of the beach and dune would be conducted only from December 1 through May 15. The bulldozers and graders would be operated eight hours a day. The Navy will require the contractor to use best management practices to avoid erosion during sand placement. Repairs would require three to six consecutive months to complete. Alternative 1 may need to be implemented in phases in order to complete the work during the seasons described above (i.e., December 1 through March 31 for dredging and December 1 through May 15 for onshore work).

ES.3.2 Alternative 2 - Full Replenishment and Construction of New Dunes

Under Alternative 2, as with Alternative 1, the SPS at Dam Neck Annex would be restored to its original condition: the beach would be fully replenished, and the constructed dune would be replenished with sand and reshaped to its 1996 dimensions. Alternative 2 would also include constructing new dunes, including a stone core, along the approximately half-mile sections of dune north and south of the existing constructed dune. The restored areas of the existing dune and the newly constructed dune would be planted with native grasses such as those identified above in Section ES.3.1. Accumulated sand would be removed from the pedestrian crossover bridges along the restored areas of the dune.

Alternative 2 includes authorization by BOEM to access the Sandbridge Shoal, for the extent of the negotiated agreement, in order to dredge sand for the replenishment. Sand would be acquired, transported, and distributed as described under Alternative 1. Work would be restricted to the seasons described under Alternative 1. Under Alternative 2, a total of approximately 1,100,000 cubic yards of sand would be required. Repairs of the SPS under Alternative 2 would take six to nine consecutive months to complete. Alternative 2 may need to be implemented in phases in order to complete the work within the December 1 through March 31 (dredging) and December 1 through May 15 (onshore work) time frames.

The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation due to overflow of the hopper during pump-out operations and during sand placement. Approximately 472,500 cubic yards of sand would be placed on the beach and 352,500 cubic yards of sand would be used to repair the existing SPS and to construct the new dunes. Extending the existing constructed dune from the current approximately 1-mile length to approximately 2 miles would not prevent the need for periodic beach replenishment, but its stone core would afford a greater level of protection during strong storms, giving the Navy additional time to prepare for emergency replenishment if the beach is eroded by a storm.

ES.3.3 No Action Alternative

Under CFR 40 Section 1502.14(d), an EA must analyze the No Action alternative. Under the No Action alternative, no sand would be dredged from Sandbridge Shoal to replenish/restore the SPS to its original condition; only maintenance and temporary and emergency repairs would continue. Under this alternative, the beach and dune would continue to deteriorate/erode and would be increasingly vulnerable to failure during large storms.

The SPS at Dam Neck is entering a vulnerable period where a modest winter storm season could erode the remaining beach and the sand dune down to the buried stone seawall. A single major nor'easter or hurricane is capable of eroding the SPS down to the buried stone seawall. If sand replenishment does not take place and the SPS is compromised, the cost of repairing the SPS would be substantially increased and $135 million worth of Navy real estate would be at risk of being severely damaged or destroyed. Shoreline retreat would continue, and during severe storms operations would be at risk from flooding and waves. For the purposes of this EA, the No Action alternative is used as a baseline of existing conditions against which the impacts of the other alternatives are measured.

ES.4 Summary of Potential Environmental Impacts

The potential environmental impacts of Alternative 1, Alternative 2, and the No Action alternative are summarized below.

ES.4.1 Alternative 1

Land Use

There would be no changes in current land uses within or near the project area. Alternative 1 would have a beneficial impact on existing land uses because facilities inland of the dunes would be better protected from damage during storm events. Alternative 1 would be consistent with the Dam Neck Annex master planning process and natural resources program. There would be no impact on regional land use or public use of navigable waters.

Visual Setting

Temporary, minor, direct impacts on the visual setting of the Dam Neck Annex beach would result from the presence of heavy trucks and equipment that would be visible from locations on the installation, the northern part of the beach and the northernmost houses at Sandbridge, and vessels offshore. Alternative 1 would have a long-term, beneficial impact on the visual setting because the beach and manmade dune would be replenished and would enhance the appearance of the beach landscape.

Coastal Geography and Physical Oceanography

Under Alternative 1, temporary changes in sediment transport pathways as a result of sand extraction would be expected to return to pre-extraction conditions. Sand extraction at Sandbridge Shoal would not significantly alter wave height and direction at the site of sand extraction by increasing the depth. Only minor changes in long-shore current and sediment transport would be expected. No permanent changes in offshore geology would be expected.

Coastal Zone Management

Alternative 1 would be reasonably likely to affect a land use, water use, or natural resource of Virginia's coastal zone. However, this alternative would be conducted in a manner that is either fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia's Coastal Zone Management Program (CZMP).

Terrestrial Vegetation

Adverse impacts on terrestrial vegetation would be minor and mitigated by restoring the dune with native species upon completion of the sand replenishment. Only minor impacts would result.

Terrestrial Wildlife

Minor, temporary impacts on birds would be mitigated by a nest survey and communication with the U.S. Fish and Wildlife Service (USFWS) to implement appropriate measures to protect nests if found during the breeding season. Temporary reduction of foraging habitat would occur during construction but in the long-term avian habitat would be preserved by preventing beach and dune erosion. Minor, temporary impacts on terrestrial rodents, lizards, and snakes that could be present on the dune could occur during construction. These impacts would be temporary because invertebrates that are prey for rodents and herpetofauna would re-colonize following replenishment. Overall impacts on terrestrial wildlife would be minor.

Aquatic Wildlife

Direct impacts on marine mammals and fish include temporary displacement as they avoid areas of turbidity. Fish eggs and larvae would not be able to avoid the effects of turbidity. Additional direct impacts include the potential for vessel strikes with marine mammals and potential entrainment of fish in the hopper dredge. However, it is generally thought that hopper dredges move slowly enough to minimize the risk of a strike with a marine mammal. Direct noise impacts on marine mammals would not be anticipated to occur, as marine mammals present offshore of the Dam Neck Annex (i.e., dolphins) have a hearing range above the sound generated by the hopper dredge. However, some disturbance could occur as a result of pre- and post-dredging bathymetric surveys.

Indirect, temporary impacts on both marine mammals and fish include potential reduced foraging success and prey availability. Additionally, turbidity could pose short-term impacts on adult fish (e.g., irritation, clogging of gills, impacts on demersal fish eggs) but fish would likely avoid the area. Overall, direct and adverse impacts in the form of vessel strikes or entrainment could occur; indirect impacts (reduced foraging success and prey availability, increased noise, and turbidity) would be minor.

Benthic Organisms.
Dredging would cause minor, temporary, localized impacts from entrainment and turbidity. Direct impacts on benthic organisms in the form of entrainment within the hopper dredge and from localized turbidity and bottom disturbance caused by the pump-out station/buoy anchors would be expected to occur. Indirect impacts in the form of turbidity would be minor and temporary. These direct and indirect impacts would be considered minor impacts on the regional benthic community.

Invertebrate Nekton/Macroplankton.
Direct impacts could occur from entrainment within the hopper dredge. Indirect impacts in the form of turbidity would be temporary and minor. Only minor impacts on the regional invertebrate nekton/macroplankton community would result due to the widespread distribution of these organisms and the existing dynamic nature of the surf zone.

Plankton
Direct impacts could occur from entrainment. Indirect impacts from turbidity and changes in dissolved oxygen levels could also occur. Also, re-suspended sediment in the nearshore zone could adversely impact plankton productivity. These impacts would be expected to be temporary and localized, and thus only minor impacts on the local plankton community would result.

Threatened and Endangered Species

Federally Listed Species.

- **Whales.** Alternative 1 would have no effect on the blue whale, sei whale, or sperm whale. It may affect, but is not likely to adversely affect the finback, humpback, or North Atlantic right whale. The National Marine Fisheries Service (NMFS) concurred with this determination (see Appendix E, Biological Opinion). NMFS-approved protected species observers will monitor the area for cetacean species and observations of Endangered Species Act (ESA)-protected whales within 3,280 feet of the dredging operation will result in immediate suspension of activity until the individual's protection can be assured. Dredging operations at night would be well lit to allow the observers to safely and effectively perform their task. Vessels will adhere to NMFS-established speed restrictions during transit, conform to regulations for approaching protected whales, and monitor North Atlantic right whale sighting reports. Also, operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging, and fuel spill prevention and response plans will be prepared.

- **Birds.** Alternative 1 may affect individuals, but it not likely to affect populations of the piping plover, red knot, or roseate tern. An annual shorebird monitoring program at Dam Neck Annex scheduled to begin in late FY 2012 will allow for monitoring pre- and post- replenishment to identify the presence of the piping plover. If activities associated with sand placement occur during times when sensitive avian species may be present, a qualified biologist will conduct surveys and monitor the project area for those species. If sensitive species are present, impact minimization measures such as avoidance of the area will be implemented. Also, Dam Neck Annex will coordinate with the USFWS regarding nest- protection measures in the event that any piping plover nests are discovered.

- **Fish.** Alternative 1 would have no effect on the shortnose sturgeon and would not jeopardize the federal species of concern sand tiger shark. The proposed action is likely to adversely affect the Atlantic sturgeon. The NMFS concurred with this determination in their biological opinion and provided for the incidental take of one subadult Atlantic sturgeon. To reduce impacts, mitigation measures will include NMFS-approved protected species observers on board the vessel during any dredging throughout the year to monitor for Atlantic sturgeon and attaching a state-of-the-art sea turtle deflector to the drag head, which will aid in the deflection of Atlantic sturgeon if they are present. During night-time dredging operations the work area will remain well lit to allow the observer to work safely and effectively. Mitigation measures may also include maintaining shoal morphology, leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery, and targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity. The hopper inflow will be fitted with a screen or basket to monitor the dredge material intake for Atlantic sturgeon and their remains. The drag head will also be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the action area, and the drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to prevent possible entrainment of fish. Fuel spill prevention and response plans will also be prepared.

- **Sea turtles.** Alternative 1 would have no effect on the hawksbill sea turtle. Alternative 1 may affect, but is not likely to adversely affect the green or leatherback sea turtles. Alternative 1 is likely to adversely affect the loggerhead and Kemp’s ridley sea turtles. NMFS concurred with this determination in their biological opinion and provided for the incidental take of one sea turtle, either a loggerhead or Kemp’s ridley. A state-of-the-art sea turtle deflector, designed to U.S. Army Corps of Engineers (USACE) specifications, will be installed on the drag head of the hopper dredge. The drag head would be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the action area and the drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to prevent possible entrainment of turtles. The hopper inflow will be fitted with a screen or basket to allow monitoring of the dredge material intake for sea turtles and their remains. Dredging vessels and support boats would not intentionally approach listed sea turtle species closer than 300 feet when in transit. NMFS-approved protected species observers will monitor the action area, and during night-time dredging operations the work area will be lit well enough to allow the observers to perform their task safely and effectively. Beach-quality sand with a low content of fine sediments and organic materials will be targeted to reduce the potential for increased turbidity. To avoid impacts on nesting sea turtles, the Navy will complete the work associated with Alternative 1 between December 1 and May 15. Following beach replenishment, the Sea Turtle Monitoring Protocol (Geo-Marine, Inc. November 2006) will be implemented during the nesting season (May 15 to September 15) and if nesting occurs on the north or south ends of the beach, the nests may be relocated to the USFWS Back Bay National Wildlife Refuge. Also, to the maximum extent practicable, lighting will be reduced on the beach during the sea turtle nesting season.

- **Plants.** The seabeach amaranth could occur but is unlikely to occur in the project area. Pre-construction surveys will be conducted to determine the presence or absence of seabeach amaranth within the project area. Alternative 1 may affect, but is not likely to adversely affect the seabeach amaranth.

State-Listed Species. Alternative 1 would not impact the eastern chicken turtle, canebrake rattlesnake, eastern glass lizard, Dismal Swamp southeastern shrew or Rafinesque’s eastern big-eared bat. There would be no impact on the upland sandpiper, loggerhead shrike, migrant loggerhead shrike, Henslow’s sparrow, and arctic peregrine falcon because these species would not be expected to occur on the beach. Some individual Wilson’s plovers, peregrine falcons, gull-billed terns, and bald eagles could be impacted through localized sand placement, but there would be no impact on populations. Because of mitigation, specifically, nest surveys and communication with the USFWS to implement appropriate measures to protect nests if found (if construction is undertaken during the breeding season), impacts on state-listed bird species would be reduced or eliminated. The quality of foraging habitat within the project area would be temporarily reduced; however, ample foraging areas are nearby. In the long-term, because the proposed project would help prevent the beach and dune environment at Dam Neck Annex from eroding, it would also help maintain avian foraging habitat. Therefore, only minor impacts on the Wilson’s plover, peregrine falcon, gull-billed tern, and bald eagle would result under Alternative 1.

Submerged Aquatic Vegetation

According to preliminary survey results, no submerged aquatic vegetation (SAV) occurs in the area offshore of Dam Neck Annex (Orth et al. 2012). If submerged aquatic vegetation is observed during implementation of Alternative 1, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.

Essential Fish Habitat

Direct adverse impacts on managed fish and invertebrate species due to entrainment of individual animals and mortality due to pump-out station/buoy anchor placement could occur. Indirect temporary impacts from diminished availability of bottom-dwelling food resources and an increase in turbidity could also occur. Impacts may be minimized by attaching a state-of-the-art sea turtle deflector, also useful to prevent entrainment of large fish, on the drag head of the hopper dredge, and operating the drag head in a manner that will reduce the risk of interactions with fish species that may be present in the action area; maintaining shoal morphology; leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery; targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity; attaching a screen or basket to the hopper inflow and turning off the suction in the drag head when it is lifted off the bottom to prevent possible entrainment of fish species. Fuel spill prevention and response plans will also be prepared. Conservation recommendations were also received from the NMFS to further reduce impacts on essential fish habitat (EFH) in the project area. These measures included conducting pre- and post-dredging hydrographic surveys; following existing bottom contours to maintain seafloor ridge and swale heterogeneity; limiting the dredge cut to a maximum of 2 meters; use of rotational dredging to preclude the sequential mining of the same sand ridge on successive maintenance events; minimizing the footprint and time period over which the dredge operates; use of operational techniques and best management practices during hopper dredging to reduce the size and duration of turbidity plumes and entrainment of threatened and endangered species; and developing a long-term management plan for Sandbridge Shoal prior to the Navy's next maintenance event. Implementation of these mitigation measures would minimize any impacts on EFH. As a result, only minor impacts on EFH would be expected under Alternative 1.

Water Resources

Dredging and pumping sand to shore would have minor, temporary impacts on water quality in the Atlantic Ocean, primarily due to increased turbidity. The Navy will obtain permits pursuant to Sections 401 and 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899 and through the submittal of a Joint Permit Application (JPA). Permits from the Virginia Marine Resources Commission and the Virginia Beach Wetlands Board would be obtained as appropriate. All permit conditions will be incorporated into the construction drawings and contractor specifications for Alternative 1. There would be no impacts on floodplains or wetlands. With the adherence to permit conditions, only minor impacts on surface waters would result.

Noise

In-Air Noise. Estimated exterior noise levels would be below the daylight interior sound level limits contained in the City of Virginia Beach Noise Ordinance.

In-Water Noise. Effects of in-water noise on individual species are presented in separate discussions, including Aquatic Wildlife-Marine Mammals and Fish (Section 4.2.3.1), and Threatened and Endangered Species – Whales, Fish, and Sea Turtles (Section 4.2.5.1.1).

Air Quality

Short-term, negligible impact on air quality in the region would result due to temporary construction emissions. The action would be exempt from the General Conformity Rule because the total net emissions would be below the *de minimis* levels.

Traffic and Transportation

Minor, short-term, intermittent traffic impacts would occur when construction workers access the site.

Navigation

A minimal increase in marine vessel traffic would occur during dune replenishment, which would cause minor and temporary effects on navigation in the waters surrounding Dam Neck Annex. The addition of one hopper dredge making several trips represents a very small increase over existing vessel traffic and would cause only short-term, minor impacts on navigation.

Cultural Resources

Implementation of Alternative 1 would have no effect on historic properties pursuant to Section 106 of the National Historic Preservation Act because there are no historic properties identified within the areas of potential effect (APEs) at Dam Neck Annex and because the Navy would avoid all cultural resources that are identified in the borrow area APE at Sandbridge Shoal. If the Navy discovers any previously unknown historic or archaeological remains, the Navy will notify BOEM and consult with the Virginia Department of Historical Resources (DHR) of any finding. The Navy will initiate the federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places (NRHP).

Unexploded Ordnance

Small unexploded ordnance (UXO) could be encountered during dredging operations. However, the likelihood of this occurring would be expected to be low, as UXO have not been encountered during past Navy dredging projects at Sandbridge Shoal. A screen or basket will be placed on the inflow of the hopper for the purpose of monitoring the dredge material intake for sea turtle and fish entrainment. Although not the intended purpose, the screen/basket will also help prevent any UXO from entering the hopper and being placed on the beach. Should any potential UXO pass through or become trapped on the screen, operations would cease and the Navy will call special ordnance handlers to safely remove and dispose of the ordnance. In the event that UXO is not detected as it enters the hopper, a screen could be attached to the outflow pipe on the beach to prevent the UXO from being deposited on the beach. Prior to initiating dredging, the Navy will also consider the use of a screen on the drag head specifically designed to prevent UXO from being pulled into the dredge. NEPA documentation and ESA consultations will be revised as necessary if such a device is used. Because of the low likelihood of occurrence, impacts under Alternative 1 from UXO would be minor.

ES.4.2 Alternative 2

Land Use

Construction of new manmade dunes would not result in changes in land use because natural dunes already exist in this area. Alternative 2 also would have a beneficial impact on existing land uses because facilities inland of the dunes would be better protected from damage during storm events. Alternative 2 would be consistent with the Dam Neck Annex master planning process but would not be consistent with the natural resources program goal for beaches and dunes protection. There would be no impact on regional land use or public use of navigable waters.

Visual Setting

Temporary, minor, direct impacts on visual setting would result from operation of heavy trucks and equipment which would be visible from locations on the base, the northern part of Sandbridge beach and the northernmost houses at Sandbridge, and vessels offshore. Alternative 2 would have a slightly greater long-term, beneficial impact on visual setting because the eroded natural dunes north and south of the existing manmade dune would be replaced with larger manmade dunes that would be less susceptible to erosion.

Coastal Geography and Physical Oceanography

Temporary changes in sediment transport pathways as a result of sand extraction would be expected to return to pre-extraction conditions because migration of ridge features targeted for dredging would result in infilling of the small depressions created by dredging. Sand extraction at Sandbridge Shoal would not significantly alter wave height and direction at the site of sand extraction by increasing the depth. Only minor changes in long-shore current and sediment transport would be expected. No permanent changes in offshore geology would be expected.

Coastal Zone Management

Alternative 2 would affect a land use, water use, or natural resource of Virginia’s coastal zone. However, this alternative would be conducted in a manner that is fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia’s Coastal Zone Management Plan.

Terrestrial Vegetation

Adverse impacts on vegetation would be minor and would be mitigated by restoring the dune with native species upon completion of sand replenishment.

Terrestrial Wildlife

Minor, temporary impacts on birds would be mitigated by a nest survey and communication with the USFWS to implement appropriate measures to protect any nest found if the project is implemented during the breeding season. Temporary reduction of foraging habitat would occur during construction but in the long-term avian habitat would be preserved by preventing beach and dune erosion. Minor, temporary impacts on terrestrial rodents, lizards, and snakes that could be present on the dune could occur during construction. Impacts would occur over a larger area than impacts under Alternative 1. These impacts would be considered temporary as invertebrates that are prey for rodents and herpetofauna would re-colonize following replenishment.

Aquatic Wildlife

Direct impacts on marine mammals and fish include temporary displacement as they avoid areas of turbidity. Fish eggs and larvae would not be able to avoid the effects of turbidity. Additional direct impacts include the potential for vessel strikes with marine mammals and potential entrainment of fish in the hopper dredge. As indicated under Alternative 1, it is thought that hopper dredges move slowly enough to minimize the risk of a strike with a marine mammal. There would be an increased potential for vessel strikes with marine mammals during dredging operations compared with Alternative 1 because the hopper dredge would be operating for a longer period of time and more trips to and from the shoal would be needed. Direct noise impacts on marine mammals would not be expected because marine mammals present offshore of Dam Neck Annex (i.e., bottlenose dolphins) have a hearing range above the sound generated by the hopper dredge operations. However, some disturbance could occur as a result of pre- and post-dredging bathymetric surveys.

Indirect, temporary impacts on both marine mammals and fish include potential reduced foraging success and prey availability. Additionally, turbidity could pose short-term impacts on adult fish (e.g., irritation, clogging of gills, impacts on demersal fish eggs) but fish would likely avoid the area. Impacts would occur over a longer period of time than impacts under Alternative 1, and turbidity impacts would occur over a larger area. Overall, direct and adverse impacts in the form of vessel strikes or entrainment could occur; indirect impacts (reduced foraging success and prey availability, increased noise, and turbidity) would be minor.

Benthic Organisms. Dredging would cause minor, temporary, localized impacts from entrainment and turbidity. Direct impacts on benthic organisms in the form of entrainment within the hopper dredge and from localized turbidity and bottom disturbance caused by the pump-out station/buoy anchors would be expected to occur. Direct impacts on the benthic community under Alternative 2 would be greater in extent than those under Alternative 1 because more sand would be required, resulting in lengthier periods of dredging. Indirect impacts in the form of turbidity would be minor and temporary and slightly greater than under

Alternative 1. These direct and indirect impacts would be considered minor impacts on the regional benthic community due to the widespread distribution of these organisms and the existing dynamic nature of the surf zone.

Invertebrate Nekton/Macroplankton. Direct and indirect impacts on invertebrate nekton/macroplankton under Alternative 2 would be similar to those under Alternative 1, but greater in extent due to the larger quantity of sand to be dredged under Alternative 2. Only minor impacts on the regional invertebrate nekton/macroplankton community would result.

Plankton

Direct impacts could occur from entrainment. Indirect impacts from turbidity and changes in dissolved oxygen levels could also occur. Also, re-suspended sediment in the nearshore zone could adversely impact plankton productivity. These impacts would be expected to be temporary and localized, and thus only minor impacts on local plankton community would result.

Threatened and Endangered Species

Federally Listed Species.

- **Whales.** Alternative 2 would have no effect on the blue, sei, or sperm whale. Alternative 2 may affect, but is not likely to adversely affect the finback, humpback, or North Atlantic right whale. There would be an increased potential for vessel-whale collisions and temporary impacts from noise and turbidity. NMFS-approved protected species observers will be required to monitor the area for cetacean species and observations of ESA-protected whales within 3,280 feet of the dredging operation will result in immediate suspension of activity until the individual’s protection can be assured. Vessels will adhere to NMFS-established speed restrictions during transit. All other mitigation measures would be the same as those described under Alternative 1.

- **Birds.** Alternative 2 may affect individuals but is not likely to affect populations of the piping plover, red knot, or roseate tern. If activities associated with sand placement occur during times when sensitive avian species may be present, a qualified biologist will conduct surveys and monitor the project area for those species. All minimization measures will be the same as those for Alternative 1.

- **Fish.** Alternative 2 would have no effect on the shortnose sturgeon and would not jeopardize the federal species of concern sand tiger shark. Alternative 2 is likely to adversely affect the Atlantic sturgeon. The Atlantic sturgeon and sand tiger shark would have a greater possibility of entrainment, loss of preferred benthic prey organisms at the dredge site, and length of disruption and displacement than under Alternative 1. All mitigation measures will be the same as those described under Alternative 1.

- **Sea turtles.** Alternative 2 would have no effect on the hawksbill sea turtle. Alternative 2 may affect, but is not likely to adversely affect the green or leatherback sea turtles. Alternative 2 is likely to adversely affect the loggerhead and Kemp's ridley sea turtles. There would be increased potential for entrainment and boat collisions and more underwater habitat would be disturbed under Alternative 2 than under Alternative 1. A state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge, and the drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to prevent possible entrainment of turtles. Dredging vessels and support boats will not intentionally approach listed species closer than 100 yards when in transit. All other mitigation measures will be the same as those described under Alternative 1.

- **Plants.** The seabeach amaranth could occur but is unlikely to occur in the project area. Pre-construction surveys will be conducted to determine the presence or absence of seabeach amaranth within the project area. Alternative 2 may affect, but is not likely to adversely affect the seabeach amaranth.

State-Listed Species. Alternative 2 would not impact the eastern chicken turtle, canebrake rattlesnake, eastern glass lizard, Dismal Swamp southeastern shrew, or Rafinesque's eastern big-eared bat. There would be no impact on the upland sandpiper, loggerhead shrike, migrant loggerhead shrike, Henslow's sparrow, and arctic peregrine falcon, because these species would not be expected to occur on the beach. Potential impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle under Alternative 2 would be expected to be similar to those under Alternative 1. However, the disturbance would last longer under Alternative 2 than under Alternative 1. Minor impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle would occur.

Submerged Aquatic Vegetation

According to preliminary survey results, no SAV occurs in the area offshore of Dam Neck Annex (Orth et al. 2012). If submerged aquatic vegetation is observed during implementation of Alternative 2, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.

Essential Fish Habitat

Direct adverse impacts and indirect temporary impacts on EFH (e.g., entrainment of individual animals, diminished availability of bottom-dwelling food resources, and increased turbidity) as a result of implementing Alternative 2 would be similar to Alternative 1 impacts but would occur on a larger scale because a larger quantity of dredged material from Sandbridge Shoal would be needed. Impacts may be minimized by the same mitigation measures as described under Alternative1.

Water Resources

Dredging and pumping sand to shore and constructing a manmade dune would have minor, temporary impacts on Atlantic Ocean water quality. Impacts under Alternative 2 are similar to those for Alternative 1; however, removal of the additional sand needed for Alternative 2 would be associated with higher, but still minor and temporary, turbidity impacts on water quality. The Navy would obtain all applicable federal and state permits, and the permit conditions would be incorporated into the construction drawings and contractor specifications for Alternative 2. There would be no impacts on floodplains or wetlands. With the adherence to permit conditions, there would be only minor impacts on surface waters.

Noise

In-Air Noise. Additional noise would be generated by transportation and placement of stones for the cores of the new manmade dunes. Noise generated under Alternative 2 would be below the daylight interior sound level limits noted in the City of Virginia Beach Noise Ordinance.

In-Water Noise. Effects of in-water noise on individual species are presented in separate discussions, including Aquatic Wildlife-Marine Mammals and Fish (Section 4.2.3.2), and Threatened and Endangered Species – Whales, Fish, and Sea Turtles (Section 4.2.5.2.1).

Air Quality

Short-term, negligible impact on air quality in the region would result due to temporary construction emissions. The action would be exempt from the General Conformity Rule because the total net emissions would be below the *de minimis* levels.

Traffic and Transportation

Minor, short-term, intermittent traffic impacts would occur when construction workers access the site and material is delivered.

Navigation

A minimal increase in marine vessel traffic would occur during dune replenishment would cause minor and temporary effects on navigation in the waters surrounding Dam Neck Annex. The addition of one hopper dredge making several trips represents a very small increase over existing vessel traffic and would cause only minor impacts on navigation. Impacts under Alternative 2 would occur over a longer period of time than impacts under Alternative 1.

Cultural Resources

Alternative 2 would have no effect on historic properties pursuant to Section 106 of the National Historic Preservation Act because there are no historic properties identified within the APEs at Dam Neck Annex and because the Navy would avoid all cultural resources that are identified within the APE for borrow areas at the Sandbridge Shoal. If the Navy discovers any previously unknown historic or archaeological remains, the Navy will notify BOEM of any finding. The Navy will initiate the federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the NRHP.

Unexploded Ordnance

Small UXO could be encountered during dredging operations. However, the likelihood of this occurring would be expected to be low, as UXO have not been encountered during past Navy dredging projects at Sandbridge Shoal. A screen or basket will be placed on the inflow of the hopper for the purpose of monitoring the dredge material intake for sea turtle and fish entrainment. Although not the intended purpose, the screen/basket will also help prevent any UXO from entering the hopper and being placed on the beach. Should any potential UXO pass through or become trapped on the screen, operations would cease and the Navy will call special ordnance handlers to safely remove and dispose of the ordnance. In the event that UXO is not detected as it enters the hopper, a screen could be attached to the outflow pipe on the beach to prevent the UXO from being deposited on the beach. Prior to initiating dredging, the Navy will also consider the use of a screen on the drag head specifically designed to prevent UXO from being pulled into the dredge. NEPA documentation and ESA consultations will be revised as necessary if such a device is used. Because of the low likelihood of occurrence, impacts under Alternative 2 from UXO would be minor.

ES.4.3 No Action Alternative

The No Action alternative would have moderate, indirect, adverse impacts on land use and visual setting and a long-term impact on terrestrial wildlife. The No Action alternative would not be consistent with the Dam Neck Annex master planning process or the natural resources program goals for shoreline erosion control, beaches and dunes protection, or outdoor recreation and environmental awareness. Continued erosion of the beach would have an adverse impact on the visual setting of the beach and a potential indirect impact on visual setting if facilities inland of the beach and dune are damaged during storms. Continued erosion of the beach also would reduce available wildlife habitat over the long-term.

The No Action alternative would not affect and, therefore, would not cause any changes in coastal geography and physical oceanography, coastal zone management, terrestrial vegetation, ambient noise levels, air quality, traffic and transportation, and navigation. The No Action alternative would have no impact on on-base or regional land use, aquatic wildlife, federally listed or state listed threatened or endangered species, submerged aquatic vegetation, EFH, water resources, or cultural resources.

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List of Abbreviations and Acronyms

APE	area of potential effect
AQCR	Air Quality Control Region
BA	biological assessment
BO	biological opinion
BEQ	bachelor enlisted quarters
BMP	best-management practice
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CCD	coastal consistency determination
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIDMM	Craney Island Dredged Material Management Area
CIEE	Craney Island Eastward Expansion
CNRMA	Commander, Navy Region Mid-Atlantic
CO	carbon monoxide
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
CZMP	coastal zone management program
dB	decibels
dBA	A-weighted decibels
DCR	(Virginia) Department of Conservation and Recreation

Abbreviations and Acronyms (cont.)

DEQ	(Virginia) Department of Environmental Quality
DGIF	(Virginia) Department of Game and Inland Fisheries
DHR	(Virginia) Department of Historic Resources
DMA	dynamic management area
DOD	U.S. Department of Defense
DPS	distinct population segment
EA	environmental assessment
EEZ	exclusive economic zone
EFH	essential fish habitat
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	finding of no significant impact
FY	fiscal year
GHG	greenhouse gas
HAPC	habitat area of particular concern
hp	horsepower
Hz	hertz
INRMP	Integrated Natural Resources Management Plan
ITS	Incidental Take Statement
IPT	Integrated Product Team
JEB	Joint Expeditionary Base

Abbreviations and Acronyms (cont.)

JPA	Joint Permit Application
LCAC	landing craft air cushion
L_{max}	maximum sound level
MACS	Marine Air Control Squadron
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MLW	mean low water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MOU	Memorandum of Understanding
MRC	(Virginia) Marine Resources Commission
MWR	Morale, Welfare, and Recreation (program)
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
Navy	U.S. Department of the Navy
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places

Abbreviations and Acronyms (cont.)

NWR	National Wildlife Refuge
O_3	ozone
OCS	outer continental shelf
OCSLA	Outer Continental Shelf Lands Act
ODMDS	Ocean Dredged Material Disposal Site
OPNAVINST	Chief of Naval Operations Instructions
Pb	lead
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppm	parts per million
ppt	parts per thousand
PWD	Public Works Department
RMA	resource management area
RONA	Record of Non-Applicability
RPA	resource protection area
SAS	sighting advisory system
SAV	submerged aquatic vegetation
SIP	state implementation plan
SMA	seasonal management area
SMP	stormwater management program
SO_2	sulfur dioxide
SPS	shoreline protection system
µPa	micro Pascal
USACE	U.S. Army Corps of Engineers

Abbreviations and Acronyms (cont.)

U.S.C.	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VAC	Virginia Administrative Code
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VSMP	Virginia Stormwater Management Program
VWP	Virginia Water Protection (Permit)

1 Purpose of and Need for Action

1.1 Proposed Action Summary

The U.S. Department of the Navy (Navy) is proposing to repair the shoreline protection system (SPS) on Naval Air Station (NAS) Oceana, Dam Neck Annex located on the Atlantic coast in Virginia Beach, Virginia (see Figure 1-1). The SPS was installed in 1996 and consisted of a manmade sand dune reinforced by a buried stone seawall, with beach replenishment on the seaward side. The manmade dune extends from Building 225 south to Building 127 and is 5,282 feet long, 20 feet high, and 50 feet wide. The beach replenishment portion of the SPS is 2 miles long, including the approximately 1-mile area in front of the manmade dune, with additional approximately one-half-mile portions extending north and south of the manmade dune. Sand for replenishment of the beach and repair of the constructed dune would be dredged from a Department of Interior, Bureau of Ocean Energy Management (BOEM)-approved borrow area within Sandbridge Shoal, which is located approximately 3 miles offshore of the project location, outside of Virginia's state territorial waters (i.e., 3 nautical miles [nm]). The Sandbridge Shoal area consists of two approved dredge zones (Area A and Area B) and the no dredge zone (Figure 1-2). The no dredge zone is located between Areas A and B, and is designated as such due to the presence of a submerged Navy communication cable. Implementation of the repairs is anticipated to begin between fiscal year (FY) 2013 and FY 2016.

This environmental assessment (EA) evaluates the reasonably foreseeable environmental consequences of the proposed SPS repairs. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969; the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Navy procedures for implementing NEPA (32 CFR 775); the Chief of Naval Operations Instruction, OPNAVINST 5090.1C, Change 1 (U.S. Department of the Navy July18, 2011), and the Department of the Interior regulations implementing NEPA (43 CFR 46). The Navy is the lead agency for the proposed action, with BOEM serving as a cooperating agency.

1.2 Background

Dam Neck Annex, commissioned in 1942, is a satellite installation of NAS Oceana and is home to 14 tenant commands. Dam Neck Annex is a 1,372-acre facility located along the Atlantic coast in the Hampton Roads region of Virginia, in the City of Virginia Beach, approximately 2 miles east of NAS Oceana, 5 miles

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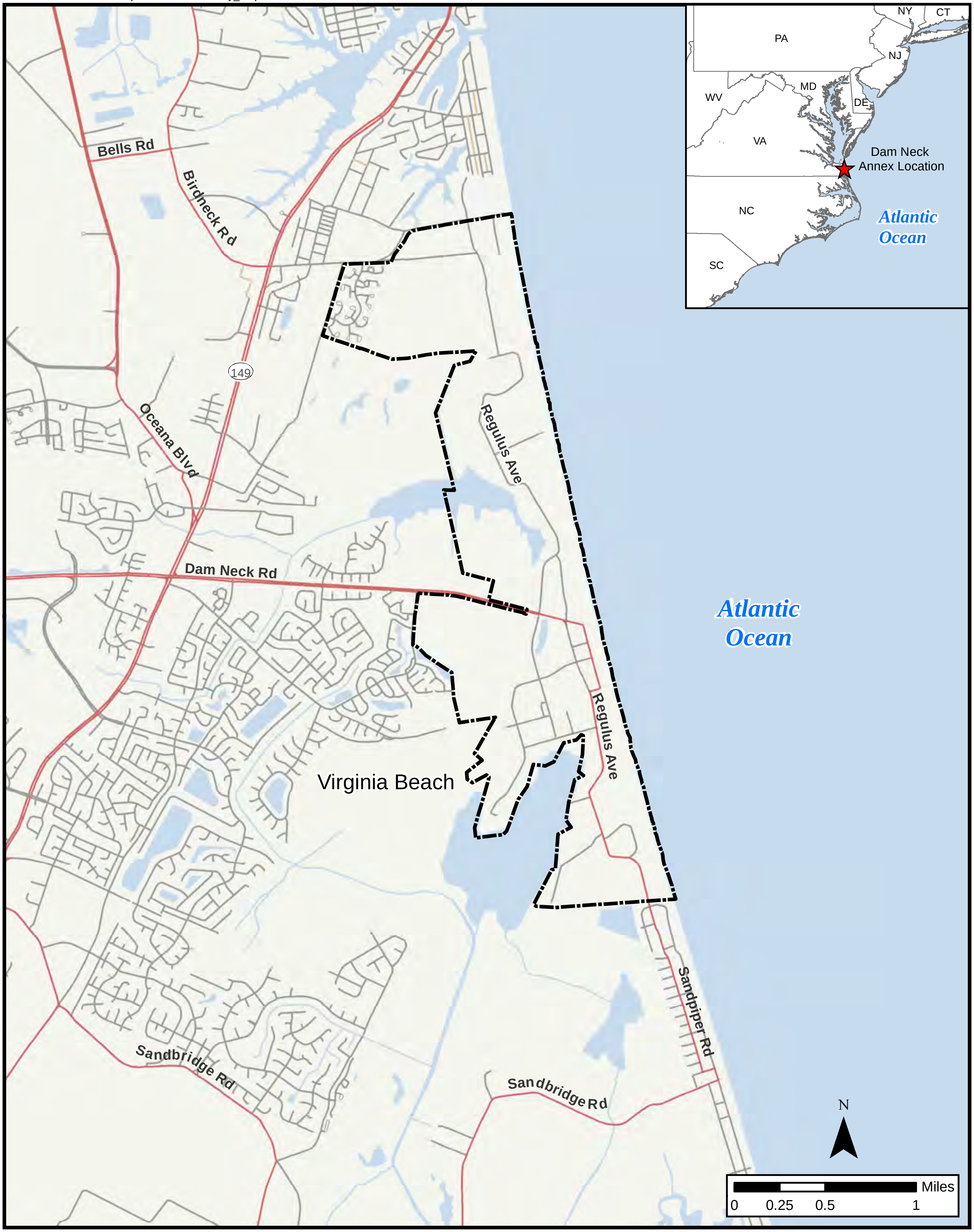
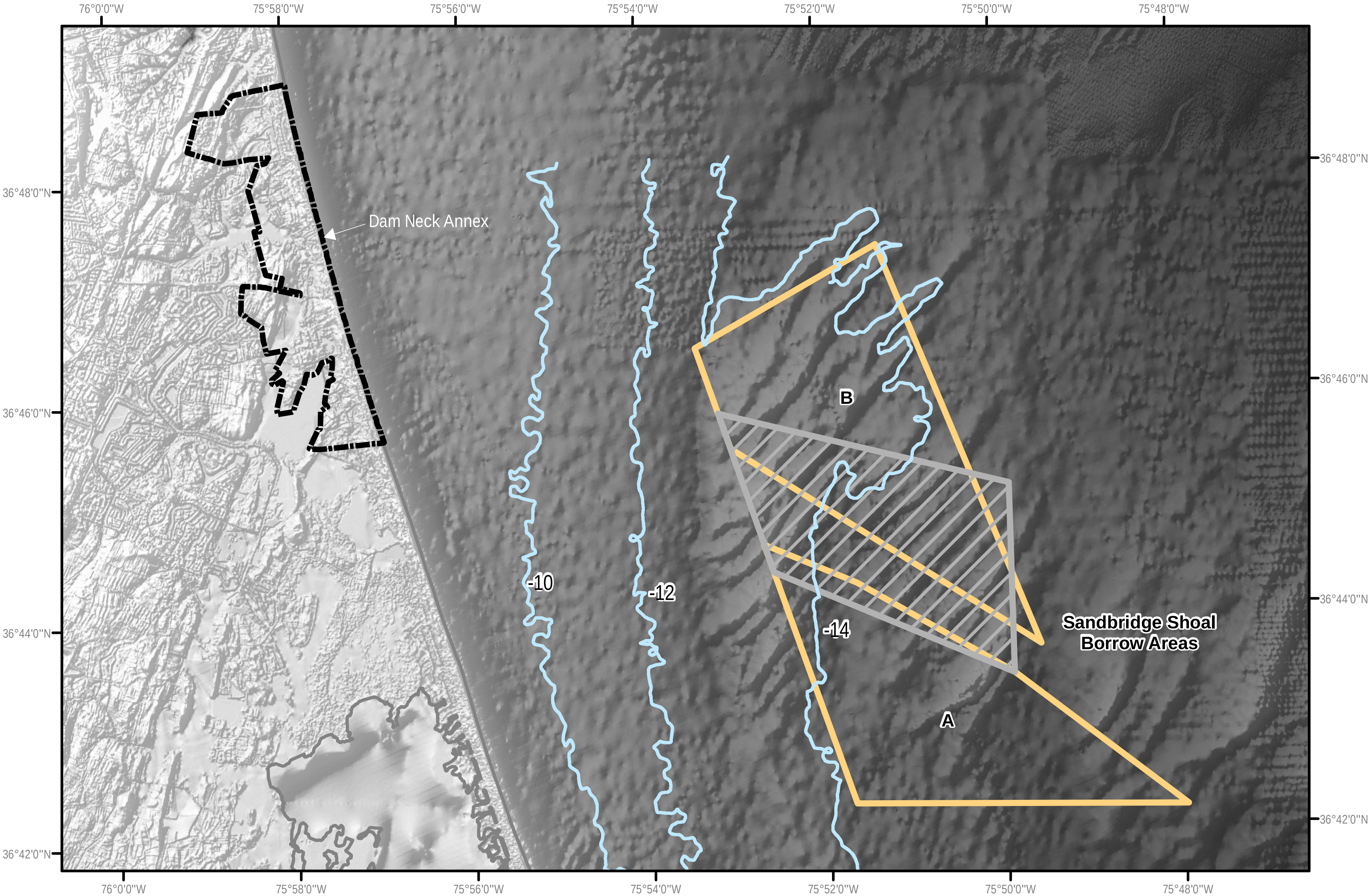


Installation Boundary

Source: ESRI, U.S. Navy

Figure 1-1 Project Vicinity
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 1-2 Dam Neck Sandbridge Shoal.mxd



Installation Boundary
Sandbridge Shoal Contours (m)
Sandbridge Shoal
No Dredge Zone

Figure 1-2 Sandbridge Shoal
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N
0 0.5 1 2 Miles

Source: 2007 NOAA; U.S. Navy

south of the main Virginia Beach resort area, and approximately 20 miles east of the City of Norfolk. Dam Neck Annex's mission is to provide the facilities and resources needed to support the land, sea, and air training and operations of tenant commands.

The beaches at Dam Neck Annex are prone to erosion from seasonal hurricanes, tropical storms, nor'easters, and winter conditions that direct wind and wave actions upon the installation's beaches. In the early 1990s the beach became so severely eroded that $124 million worth of Navy facilities, primarily the bachelor enlisted quarters (BEQ), the Shifting Sands Beach Club, the housing area, and the weapons gun line, were at risk of being severely damaged or destroyed by flooding and wave action from coastal storms. To protect these facilities, the Navy established an $8.9 million emergency military construction project (P994) in FY 1995 to construct the SPS. The project was completed in October 1996 and included constructing a reinforced sand dune and replenishing the beach on the seaward side of the dune. The constructed dune, which extends from Building 225 (the BEQ) south to Building 127, measured 5,282 feet long, 20 feet high, and 50 feet wide and covered approximately 11 acres of nearshore upland. It contained a buried stone seawall designed to provide a residual dune to protect the nearest real property until sand could be replenished (U.S. Department of Defense 1996) (Figure 1-3). However, the stone seawall was not designed to provide permanent protection for the buildings and their contents. Approximately 874,000 cubic yards (cy) of sand were required to construct the SPS, including the constructed dune and beach replenishment. Approximately 115,000 cy of the total 874,000 cy were trucked in from commercial borrow pits located approximately 10 miles from the installation to construct the sand dune on top of the stone seawall. The constructed dune was planted with American beach grass (*Ammophila breviligulata*), Atlantic coastal/bitter panic grass (*Panicum amarum*), and sea oats (*Uniola paniculata*). Six pedestrian crossover bridges were constructed over the dune to provide access to the beach. Natural sand dunes lie north and south of the constructed dune. Annual revegetation of the dunes is conducted as specified in the installation's *Integrated Natural Resources Management Plan* (INRMP).

The remaining approximately 759,000 cy of sand was placed along approximately 9,280 feet of beach in front of the constructed sand dune and extending approximately one-half mile to both the north and south of the constructed dune. The beach replenishment covered approximately 4.5 acres of nearshore upland, 8 acres of intertidal area, and 28 acres of nearshore area below the mean low water line. The beach was designed to be 200 feet wide from the dune centerline to the ocean. Sand for the beach replenishment was dredged from an ocean borrow site in Sandbridge Shoal located approximately 3 miles offshore of the project location (see Figure 1-2). The sand from the shoal was provided through a negotiated agreement with BOEM (formerly the Minerals Management Service). The sand was pumped from the dredge to the beach replenishment area.

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 1-3 Dam Neck Project_Area.mxd

Shore Protection System Location
Installation Boundary
Building
Constructed Dune

Source: ESRI, U.S. Navy

Figure 1-3 Project Area
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

It was expected that periodic replenishment of the SPS would be required to maintain its design integrity and effectiveness. The initial beach replenishment cycle was estimated to be 12 years, based upon design expectations. However, a three-year study conducted by the Navy to monitor the performance of the 1996 beach replenishment revealed that a 12-year cycle was inadequate and recommended the beach be replenished in 2003-2004 (i.e., approximately seven to eight years). In 2004, Special Project R123-01 (repairs to the SPS) replenished the sand that had eroded from the beach and dune since the SPS was constructed (U.S. Department of the Navy September 1, 2003). Approximately 700,000 cy of sand were placed along the approximately 9,280 feet of beach front replenished in 1996, covering the same acreage. The dune system needed only minor spot repair with additional sand and vegetation. Sand for the replenishment was provided through a negotiated agreement with BOEM and was dredged by hopper dredge from Sandbridge Shoal. A sand-slurry was then pumped from the hopper dredge onto the Dam Neck Annex beach through a pipeline, which was moved along the beach. Bulldozers and graders shaped the beach and constructed dune to the original 1996 configuration.

Since 2004, the combined effects of winds, wave action, and storm damage have caused the beach portion of the SPS to erode, lowering the level of protection for the Dam Neck Annex facilities. The beach portion of the SPS is integral to the proper functioning and stability of the overall SPS. Without the beach, the constructed dune would quickly erode, leaving only the buried stone seawall, which was not designed to provide permanent protection for the installation's assets. The dune, including the buried stone seawall, is currently in relatively good condition, although the sand portion has been sheared into steep slopes in several locations. Sand also covers the bottom rungs of the pedestrian crossover bridges. Erosion of the SPS has progressed to a point where a moderate winter storm season could erode the dune down to the buried seawall. The Dam Neck Annex has implemented temporary measures to reduce erosion, including installing dune fencing and using discarded Christmas trees to capture sand until the SPS can be repaired.

1.3 Purpose of and Need for the Proposed Action

The purpose of the proposed action is to protect Navy assets currently worth approximately $135 million. The assets include training facilities (weapons gun line), housing (BEQ), and the Navy's Morale, Welfare, and Recreation (MWR) facilities (the Shifting Sands Beach Club, beaches, the Cottages at Dam Neck Annex, and the Sea Mist Campground). The proposed action would also restore steep slopes to the original slope designs of the constructed dune and remove sand that covers the bottom rungs of pedestrian crossover bridges, providing easier access and improving the safety conditions of the MWR facilities.

The proposed action is needed to reconstruct the SPS, which has lost sand to erosion and coastal flooding, currents, and wave action. Repairs to the SPS are expected to be needed every eight to ten years to maintain design integrity and effectiveness.

1.4 BOEM as a Cooperating Agency

The Navy is the lead agency for the proposed action, and BOEM is serving as a cooperating agency on this EA. Pursuant to the Outer Continental Shelf Lands Act (OCSLA), BOEM has the authority to regulate mineral exploration and development of the OCS. Sandbridge Shoal is located approximately 3 miles east of Dam Neck Annex and Sandbridge Beach and contains two designated borrow areas (A and B). A no dredge zone lies between areas A and B; it is designated as such due to the presence of a submerged Navy communication cable. Sandbridge shoal is a relatively shallow feature with a minimum water depth of approximately 29.5 feet (Maa and Hobbs 1998). As such, the ridge and trough topography of the fine-grained to medium-grained sand landform is shaped predominantly by exposure to wave and current energy. The wave-current influence erodes and accretes the shoal body in bands, forcing a south-southwesterly migration. The shoal supports a variety of fishes and invertebrates (see Section 3.2.3). Dredging on the shoal between 1996 and 2007 removed approximately 6,810,000 cy of material for beach replenishment actions. The shoal remains structurally complete and exposed to the wave-current influence. However, because recovery of sand volume is relatively slight between dredging events, the total surface area of the shoal will be reduced through time with continued dredging.

The BOEM's proposed action is issuance of the negotiated agreement, and the purpose of the action is to authorize the extraction of OCS sand for use in beach replenishment. The No Action alternative for the BOEM is to not issue the negotiated agreement. BOEM must evaluate the potential impacts associated with reasonably foreseeable activities that would occur if the agreement were issued; this includes the impacts of the proposed sand dredging, transport, and placement operations.

The proposed action is a single one-time action. However, it is anticipated that replenishment would be required at some point in the future. As with previous similar projects at Dam Neck Annex, it would be anticipated that future replenishment of the beaches on a similar cycle would be required and similar volumes of sand would be needed. The Navy would initiate appropriate consultations and NEPA documentation when additional beach replenishment is required.

1.5 Scope of the Environmental Assessment

This EA identifies and analyzes the potential environmental effects of the proposed action and alternatives. It describes existing environmental conditions at Dam Neck Annex and Sandbridge Shoal, identifies reasonable alternatives to the preferred alternative, evaluates direct and indirect human and natural environmental consequences that may result from the proposed action and alternatives, identifies measures to minimize or mitigate potential adverse impacts, and addresses cumulative impacts resulting from past, present, and reasonably foreseeable projects in the region. Environmental resources/factors potentially affected by the proposed action and evaluated in this EA include the following:

- Land use, visual setting, and coastal zone
- Biological resources
- Water resources
- Noise
- Air quality
- Transportation and traffic
- Navigation
- Cultural resources.

Infrastructure and utilities, socioeconomics, soils, and environmental management are not analyzed in detail because the proposed action would not affect these resources and/or environmental issues.

Infrastructure and Utilities

Infrastructure and utilities would not be impacted because the project does not involve any changes in electrical, water, sewage, buildings, or transportation systems (roads, railroads, etc.).

Socioeconomics

The proposed action would not alter the number of personnel at Dam Neck Annex. Thus, there would be no impact on the regional population or economy, housing, or community services. Additionally, there are no hazardous waste issues or other issues that could cause environmental justice concerns.

Soils

The project area consists of medium-grained, beach-quality sand at Sandbridge Shoal and beach-grade sand at the Dam Neck Annex beach area. Underwater geology and the extraction of sand from Sandbridge Shoal are discussed in Section 3.1.3, Coastal Resources.

Environmental Management

Dam Neck Annex contained six Installation Restoration Program sites, with Sites 1, 3, and 4 located closest to the proposed project area. Sites 1 and 6 require no further action and the remaining four are inactive. All sites are located behind the dune and the closest site (Site 3) is located 0.2 miles from the project area. Given the distance of these sites from the project and their inland location beyond the dune, environmental management is not discussed further in the EA.

1.6 Regulatory Requirements

NEPA prescribes an interdisciplinary approach to environmental planning in aid of federal agency decision-making. Under NEPA, a federal agency's proposed actions can either be "categorically excluded" from further analysis or evaluated in an EA or an environmental impact statement (EIS). An EA is a concise public document intended to provide agency decision makers with sufficient information and analysis to determine whether to prepare an EIS. An EA thus results in either a finding of no significant impact (FONSI) or a decision to prepare an EIS. An EIS is required for federal actions that may significantly affect the quality of the human environment. Information documented in this EA has been derived from interviews with Navy personnel and from review of the documents listed in the reference section of this report.

The Navy is required to obtain various federal and state permits and authorizations before implementing the proposed action or alternatives. The permits and approvals expected to be required are listed in Table 1-1. In addressing environmental consequences, the Navy is guided by relevant statutes (and their implementing regulations) and Executive Orders (EOs) that establish standards and provide guidance on environmental and natural resources management and planning.

Table 1-1 Applicable Regulatory Requirements and Approvals

Regulation	Agency	Permit/Approval	Regulated Activity
National Environmental Policy Act (42 U.S. Code [U.S.C.] 4321 et seq.)	U.S. Department of the Navy	Finding of no significant impact or decision to prepare an Environmental Impact Statement	Federal action
	Bureau of Ocean Energy Management	Negotiated agreement for use of the Sandbridge Shoal	
	U.S. Army Corps of Engineers	Section 404 (Clean Water Act), Section 10 (Rivers and Harbor Act)	
Clean Water Act, 33 U.S.C. 1251, et seq.	U.S. Army Corps of Engineers	Section 404	Discharge of dredged or fill material into jurisdictional waters of the U.S.
	Virginia Department of Environmental Quality	Section 401	
Rivers and Harbors Act (33 U.S.C. 401 et seq.)	U.S. Army Corps of Engineers	Section 10	Excavation/dredging or deposition of material in any navigable water of the U.S. or any obstruction or alteration in a navigable water

Table 1-1 Applicable Regulatory Requirements and Approvals

Regulation	Agency	Permit/Approval	Regulated Activity
Endangered Species Act 16 U.S.C. 1531-1544	U.S. Fish and Wildlife Service National Marine Fisheries Service Virginia Department of Game and Inland Fisheries; Virginia Department of Conservation and Recreation, Natural Heritage Division	Agency consultation for presence of threatened or endangered species	Federal action potentially affecting threatened or endangered species
Marine Mammal Protection Act (16 U.S.C. 1361 et seq.)	National Marine Fisheries Service	Marine mammal “take” permit	“Take” of marine mammals in U.S. waters
Magnuson-Stevens Fishery Management and Conservation Act	National Marine Fisheries Service	Agency consultation to determine if an action affects or has the potential to affect essential fish habitat	All federal actions or proposed actions, permitted, funded, or undertaken by an agency that may adversely affect essential fish habitat
Clean Air Act of 1970 (42 U.S.C. 7401 et seq.)	U.S. Environmental Protection Agency	Conformity Determination	Compliance with the General Conformity Rule
National Historic Preservation Act of 1966 as amended (16 U.S.C. 470 and amendments)	Advisory Council on Historic Preservation Virginia Department of Historic Resources	Section 106	Federal undertakings that affect properties listed on or determined to be eligible for listing on the National Register of Historic Places
Coastal Zone Management Act	Virginia Department of Environmental Quality	Coastal Consistency Determination	Federal actions that potentially affect coastal resources
Virginia Stormwater Management Act (Title 10.1, Chapter 6, Article 1.1)	Soil and Water Conservation Board, Virginia Department of Conservation and Recreation	Virginia Stormwater Management Program consistency	Construction activities equal to or larger than 1 acre
Migratory Bird Treaty Act (16 U.S.C. 703-712)	U.S. Fish and Wildlife Service	Permit/Approval is not required for compliance with the MBTA	“Take” of migratory birds in U.S.

2 Description of the Proposed Action and Alternatives

2.1 Description of the Proposed Action

The proposed action is to restore the SPS at Dam Neck Annex to the same level of protection from coastal flooding, currents, and wave action as it provided when first constructed in 1996. The SPS consists of a constructed sand dune reinforced by a buried stone seawall, with beach replenishment on the seaward side. The constructed dune extends from Building 225 (BEQ) south to Building 127 and is 5,282 feet long, 20 feet high, and 50 feet wide. The beach replenishment portion of the SPS is approximately 9,280 feet long and includes the 5,282-feet area in front of the constructed dune, with additional approximately one-half-mile portions extending north and south of the constructed dune (see Figure 2-1).

2.2 Description of Alternatives

Reasonable alternatives to be evaluated in an EA are those that meet the purpose and need for the proposed action. The purpose of the proposed action is to protect Navy assets, which include training facilities, housing, and MWR facilities at Dam Neck Annex currently worth approximately $135 million. The proposed action would also restore steep slopes on the constructed dune to their original design slopes and remove sand that covers the bottom rungs of pedestrian crossover bridges, providing easier access and improving the safety conditions of the MWR facilities.

Reasonable alternatives to support the proposed action were developed based on the following objectives:

- Select shoreline stabilization methods that would be consistent with the Dam Neck Annex's mission: The beach at Dam Neck Annex serves multiple functions. These include support of specialized training commands located at the installation and the Navy's MWR program. Reasonable alternatives would include those that allow the Navy to continue training along portions of the beach without major interruptions or impediments. Portions of the beach also provide space for recreational users visiting the Dam Neck Annex Navy Gateway Inn and Suites, the Cottages at Dam Neck Annex, the Shifting Sands Beach Club, and the Sea Mist Campground.

- Avoid relocating facilities at the expense of military operating forces: Moving critical infrastructure at Dam Neck Annex farther inland to a nearby location less susceptible to storm damage would be costly and create unacceptable interruptions of ongoing training. Additionally, relocating facilities would jeopardize the benefits received from having interrelated facilities and mission support functions co-located, as they are now in the existing facility layout.

- Minimize impacts on threatened or endangered species, including marine mammals, birds, sea turtles, and fish.

- Minimize impacts on road traffic and transportation.

2.2.1 Alternative 1 (Preferred Alternative) – Full Replenishment

Under Alternative 1, the SPS at Dam Neck Annex would be restored to its original condition; the beach would be fully replenished and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. The restored areas of the constructed dune would be revegetated with native grasses such as American beachgrass, Atlantic coastal/bitter panic grass, switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*). Accumulated sand would be removed from the pedestrian crossover bridges (see Figure 2-1).

Under Alternative 1, a total of approximately 700,000 cy of sand would be required. This would require approximately 260 trips by the hopper dredge from the shoal to the beach. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation due to overflow of the hopper, during pump-out operations, and during sand placement. The majority of sand loss would be expected to come from overflow of the hopper (where the sediment would simply redeposit on the shoal) or during placement of the sand slurry on the beach (where the sand would remain in the nearshore system). The least amount of sand lost would occur during pump-out operations (where sand could potentially be lost due to seepage from the pipeline). The sand lost from seepage would be expected to settle out of the water column and onto the seafloor in the nearshore system. It is estimated that approximately 472,500 cy would be placed on the beach and 52,500 cy would be added to the constructed dune. This sand would replace the volume eroded since 2004 by normal wind, wave, and current action, as well as that removed during storms.

Alternative 1 includes authorization by the BOEM to access OCS sand in the borrow area known as Sandbridge Shoal, for the extent of the negotiated agreement, in order to dredge sand for the beach and dune replenishment. The approved Sandbridge Shoal borrow area encompasses approximately 13,500 acres in the Atlantic Ocean approximately 3 miles offshore of the project location. The Navy proposes to dredge sand from within the designated A and B borrow areas of Sandbridge Shoal; however, the exact location would be determined through discussions with BOEM. A hopper dredge would be used to remove the sand

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 2-1 Dam Neck Alternative 1.mxd

Shore Protection System Location
Installation Boundary
Building
Constructed Dune - Replenished and Reshaped
Sand Replenishment

Source: ESRI, U.S. Navy

Figure 2-1 Alternative 1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

0 125 250 500 Feet

from Sandbridge Shoal. To minimize impacts on threatened and endangered sea turtle species, dredging at Sandbridge Shoal would be conducted only from December 1 through March 31. The hopper dredge would remove approximately 2,800 cy of sand per trip to the shoal. Assumed average dredge depths of 2 feet to 6 feet would impact up to approximately 217 acres, representing up to approximately 1.6% of the approved borrow area (Table 2-1).

Table 2-1 Alternative 1 – Area of Borrow Area Impacted

	Dredge Depth		
	2 Feet	4 feet	6 feet
Acres Impacted (km^2)	217 (0.9)	108 (0.4)	72 (0.3)
Percent Impacted	1.6	0.8	0.5

Once the sand is dredged from the shoal, the dredge plant would transport the sand to a pump-out location close to shore (approximately 0.5 miles) where the sand slurry would be pumped from the hopper of the dredge onto the Dam Neck Annex beach through a short pipeline. No more than five different pump-out stations/buoys would be positioned approximately 2,500 feet to 3,000 feet apart along the area to be replenished. To avoid erosion during sand placement, the Navy will require the contractor to install a baffle plate, spreader pipes, pocket pipes, or similar apparatus to the discharge end of the pipeline that precisely controls the placement of the beach fill material and increases the settlement rate of the material to the maximum extent practicable. Temporary longitudinal control dikes will be constructed as close to the shoreline as practical and in a manner that requires the effluent water to travel a sufficient distance to minimize turbidity before returning to the ocean waters. Such longitudinal dikes and outfall devices will be used to prevent erosion at the point of deposit and the subsequent loss of material directly into the water. Once the material has been deposited, the contractor will distribute and grade the material, using no more than two bulldozers and two graders, to the designed beach fill profile. Figure 2-2 shows a cross-section of the beach replenishment design. Beach fill would be placed based on the design; however, normal nearshore physical processes would likely shape the beach following sand placement. To minimize impacts on threatened and endangered sea turtle species, shaping of the beach and dune would be conducted only from December 1 through May 15. The bulldozers and graders would be operated eight hours a day. Repairs are estimated to require three to six consecutive months to complete. Alternative 1 may need to be implemented in phases in order to complete the work during the seasons described above (i.e., December 1 through March 31 for dredging and December 1 through May 15 for onshore work).

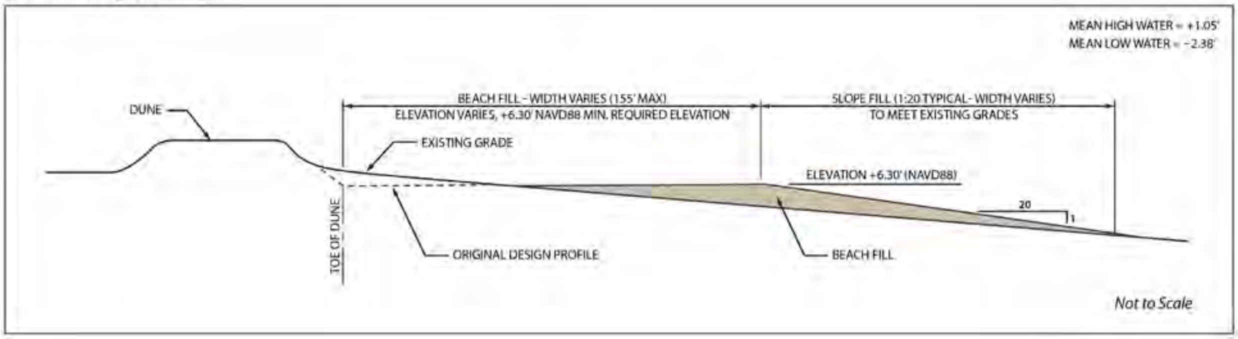


Figure 2-2 Typical Replenishment Cross-section

One hopper dredge would be used to complete the project. Dredging operations would occur 24 hours per day, with approximately 10 hours per day spent at the borrow area. The remainder of the day would be spent in transit or at the pump-out stations/buoys. It would be expected that the hopper dredge would complete approximately seven round-trips per day from the borrow area to the pump-out stations/buoys.

Based on the proposed hopper dredge capacity it was assumed that the dredge would move at a speed between 8 knots and 14 knots while transiting between the shoal and the beach (Manson Construction Co. 2008; Conoship 2011). The actual speed of the vessel would depend on the particular dredge used. While dredging, the approximate speed of the vessel would be 2 knots to 3 knots (Global Security 2011a). The dredge will comply with the United States National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) speed restrictions for vessels traveling in United States waters in the mid-Atlantic region, of no more than 10 knots between November 1 and April 30 (50 CFR 224.105). There could also be one support vessel needed to travel daily to the dredge location. The actual speed of this vessel would also depend on the particular vessel used.

2.2.2 Alternative 2 – Full Replenishment and Construction of a Dune

Under Alternative 2, as under Alternative 1, the SPS at Dam Neck Annex would be restored to the original condition; the beach would be fully replenished and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions (see Figure 2-3). Alternative 2 would also include constructing a new dune, also including a stone core, along the approximately half-mile sections of natural dune on either end of the existing constructed dune, thus extending the original constructed dune to a total length of approximately 2 miles. The restored areas of the dune and the newly constructed dune would be revegetated with native grasses such as American beachgrass, Atlantic coastal/bitter panic grass, switchgrass, and saltmeadow hay. Accumulated sand would be removed from the pedestrian crossover bridges along the restored areas of the existing constructed dune. Sand would be acquired, transported, and distributed as described under Alternative 1.

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 2-3 Dam Neck Alternative 2.mxd

Shore Protection System Location
Installation Boundary
Building
New Manmade Dune
Constructed Dune - Replenished and Reshaped
Sand Replenishment

Figure 2-3 Alternative 2
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

0 125 250 500
Feet

Source: ESRI, U.S. Navy

Under Alternative 2, a total of approximately 1,100,000 cy of sand would be required. This would require approximately 400 trips by the hopper dredge from the shoal to the beach. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation due to overflow of the hopper during pump-out operations and during sand placement. The majority of sand loss would be expected to come from overflow of the hopper (where the sediment would simply redeposit on the shoal) or during placement of the sand slurry on the beach (where the sand would remain in the nearshore system). The least amount of sand lost would occur during pump-out operations (where sand could potentially be lost due to seepage from the pipeline). The sand lost from seepage would be expected to settle out of the water column and onto the seafloor in the nearshore system. Approximately 472,500 cy of sand would be placed on the beach and 352,500 cy of sand would be used to repair the existing constructed dune and to construct the new dune. Assumed average dredge depths of 2 feet to 6 feet would impact up to approximately 341 acres, representing up to approximately 2.5% of the approved Sandbridge Shoal borrow area (Table 2-2). Extending the existing manmade dune from the current approximately 1-mile length to approximately 2 miles would not prevent the need for periodic beach replenishment, but its stone core would afford a greater level of protection during strong storms, giving the Navy additional time to prepare for emergency replenishment if the beach is eroded by a storm.

Table 2-2 Alternative 2 – Area of Borrow Area Impacted

	Dredge Depth		
	2 Feet	4 feet	6 feet
Acres Impacted (km^2)	341 (1.4)	170 (0.7)	114 (0.5)
Percent Impacted	2.5	1.3	0.8

Alternative 2 includes authorization by BOEM to access OCS sand in the borrow area known as Sandbridge Shoal, for the extent of the negotiated agreement, in order to dredge sand for the replenishment. Sandbridge Shoal is located approximately 3 miles offshore of the project location. The Navy proposes to dredge sand from within the designated A and B borrow areas of Sandbridge Shoal; however, the exact location would be determined through discussions with BOEM. A hopper dredge would be used to remove the sand from the shoal. To minimize impacts on threatened and endangered sea turtle species, dredging at Sandbridge Shoal would be conducted only from December 1 through March 31. The hopper dredge would remove approximately 2,800 cy of sand per trip to the shoal. Once the sand is dredged from the shoal, the dredge plant would transport the sand to a pump-out location close to shore (approximately 0.5 miles), where the sand slurry would be pumped from the hopper of the dredge onto the Dam Neck Annex beach through a short pipeline. No more than five different pump-out stations/buoys would be positioned approximately 2,500 feet to 3,000 feet apart along the area to be replenished. To avoid erosion during sand placement, the Navy will require the contractor to install a baffle plate, spreader pipes, pocket pipes, or similar apparatus to the discharge end of the pipeline that precisely controls the placement of the beach fill material and increases the settlement rate of the material to the maximum extent practicable. Temporary longitudinal control dikes will be constructed as close to the shoreline as practical and in a manner that requires the effluent water to travel a sufficient distance to minimize turbidity before returning to the ocean waters. Such longitudinal dikes and outfall devices will be used to prevent erosion at the point of deposit and the subsequent loss of material directly into the water. Once the material has been deposited, the contractor will distribute and grade the material, using no more than two bulldozers and two graders, to the designed beach fill profile. Figure 2-2 shows a cross-section of the beach replenishment design. Beach fill will be placed based on the design; however, normal nearshore physical processes would likely shape the beach following placement. To minimize impacts on threatened and endangered sea turtle species, shaping of the beach and dune would be conducted only from December 1 through May 15. The bulldozers and graders would be operated eight hours a day.

To construct the stone core of the extended dune, the Navy's construction contractor would order 70,000 cy of stone from a materials supplier. The supplier would quarry the rock (most likely from a location in western Virginia), load it on a train, and drop it off at a local stockyard (within 50 miles of Dam Neck Annex). The Navy's contractor would then use trucks to transport it to the project area. Approximately 2,240 truck loads would be required to transport the necessary volume of stone from the local stockyard to the installation. Repairs of the SPS under Alternative 2 are estimated to require six to nine consecutive months to complete. Alternative 2 may need to be implemented in phases in order to complete the work during the seasons described above (i.e., December 1 through March 31 for dredging and December 1 through May 15 for onshore work).

2.2.3 No Action Alternative

Under CFR 40 Section 1502.14(d), an EA must analyze the No Action alternative. Under the No Action alternative, no sand would be dredged from the Sandbridge Shoal to replenish/restore the SPS to its original condition; only maintenance and temporary and emergency repairs would continue. Under this alternative, the beach and dune would continue to deteriorate/erode and would be increasingly vulnerable to failure during large storms.

The SPS at Dam Neck Annex is entering a vulnerable period where a modest winter storm season or a single major nor'easter or hurricane could erode the remaining beach and manmade dune down to the buried stone seawall. If the sand is not replenished and the SPS is compromised, the cost of repairing the SPS would be substantially increased and $135 million worth of Navy real estate would be at risk of being severely damaged or destroyed. Shoreline retreat would continue, placing operations at risk from disruption during severe storm flooding and waves. For the purposes of this EA, the No Action alternative is used as a baseline of existing conditions against which the impacts of the other alternatives are measured.

2.3 Alternatives Considered But Eliminated

Three alternatives were considered but eliminated from further analysis: construction of groins and construction of breakwaters.

2.3.1 Construction of Groins

A groin is a long, narrow structure built out from a beach into the water perpendicular to the shore. Its purpose is to accumulate sand and reduce beach erosion. The construction of stone groins along the Dam Neck Annex beach was considered but eliminated from further consideration because it would impede the natural south-to-north littoral transport of sand, resulting in erosion on the beaches north of Dam Neck Annex. It would also be less desirable for a recreational beach than Alternatives 1 and 2.

2.3.2 Construction of Breakwaters

A breakwater is a narrow structure constructed parallel to the shore that protects the shore from the full force of wave action. By reducing the wave energy impacting the beach, the breakwater reduces beach erosion. Extensive studies would be needed before constructing breakwaters to determine whether their design would reduce the wave energy impacting the shore but would not create a tombolo effect, trapping sand between the breakwaters and the shore. If a tombolo is created, littoral sand transport would be disrupted, resulting in erosion at beaches north of Dam Neck Annex. The construction of breakwaters is also less desirable than Alternatives 1 and 2 for a recreational beach and a beach used for military training.

2.3.3 Alternate Sand Sources

Alternate sources of sand, including onshore sand mines and additional offshore borrow areas were considered. Onshore sources of sand were eliminated from further consideration because the number of trips required to deliver the necessary volumes of sand would result in greater impacts on traffic, road conditions, and air quality. For example, if a 12 cy dump truck was used, the number of trips required to deliver the 700,000 cy of sand under Alternative 1 would be more than 58,000.

Alternate offshore borrow areas considered included the Cape Henry, Thimble Shoals, and Atlantic Ocean navigation channels. All three of these channels are located north of Dam Neck Annex near the mouth of the Chesapeake Bay. These borrow areas were eliminated from further consideration because they are located farther from Dam Neck Annex than Sandbridge Shoal. Using these locations would increase the amount of time needed to complete the work. Additionally the increased travel distance for the dredge would result in greater costs and potential for vessel strikes with threatened and endangered marine animals.

2.4 Comparison of Alternatives

Table 2-3 summarizes the environmental consequences associated with the proposed action's alternatives. More detailed information on environmental consequences is found in Section 4.

2.5 Identification of the Preferred Alternative

Although Alternatives 1 and 2 each meet the objectives of the proposed action, Alternative 1 has been selected as the preferred alternative. The approximately 1-mile-long section of the coast currently protected by the constructed sand dune is the section with critical infrastructure assets (buildings) that are most in need of extra protection. The approximately half-mile-long section south of the manmade dune contains no buildings; it consists of natural sand dunes and a campground. The approximately half-mile-long section north of the constructed dune contains buildings, but they are set farther back from the mean high water line and have a wider area of natural dunes protecting them. Although a constructed dune would bolster the protection of these areas, the well-established natural dune systems provide adequate protection, provided that the Navy continues to replenish sand on these sections of beach.

The No Action alternative does not meet the purpose of and need for action and is used as a baseline of existing conditions against which the impacts of the other alternatives are measured.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
Land Use, Visual Setting, and Coastal Resources	**Land Use.** There would be no changes in current land uses within or near the project area. Alternative 1 would have a beneficial impact on existing land uses because facilities inland of the dunes would be better protected from damage during storms. Alternative 1 would be consistent with the Dam Neck Annex master planning process and natural resources program. There would be no impact on regional land use or public use of navigable waters.	**Land Use.** Construction of new dunes would not result in changes in land use because natural dunes already exist in this area. Alternative 2 would have a beneficial impact on existing land uses because facilities inland of the dunes would be better protected from damage during storms. Alternative 2 would be consistent with the Dam Neck Annex master planning process but would not be consistent with the natural resources program goal for beaches and dunes protection. There would be no impact on regional land use or public use of navigable waters.	**Land Use.** The No Action alternative would not directly impact on-base land use; however, it could indirectly impact on-base land use if facilities would have to be relocated to more inland locations or vacated due to storm damage or the risk of storm damage. Therefore, the No Action alternative could have a moderate, adverse, indirect impact on on-base land use. The No Action alternative would not be consistent with Dam Neck Annex land use controls. The No Action alternative would have no impact on regional land use.
	Visual Setting. Temporary, minor, direct impacts on the visual setting of the Dam Neck Annex beach would result from the presence of heavy trucks and equipment that would be visible from locations on the base, the northern part of the beach and the northernmost houses at Sandbridge, and vessels offshore. Alternative 1 would have a long-term, beneficial impact on the visual setting because the beach and manmade dune would be replenished and would enhance the appearance of the beach landscape.	**Visual Setting.** Temporary, minor, direct impacts on the visual setting of the Dam Neck Annex beach would result from the presence of heavy trucks and equipment which would be visible from locations on the base, the northern part of the beach and the northernmost houses at Sandbridge, and vessels offshore. Alternative 2 would have a slightly greater long-term, beneficial impact on the visual setting of the beach because the eroded natural dunes north and south of the existing manmade dune would be replaced with larger manmade dunes that are less susceptible to erosion.	**Visual Setting.** The No Action alternative would have a long-term, moderate adverse impact on visual setting due to continued erosion of the beach. This alternative could also result in an indirect, long-term adverse impact on visual setting if facilities inland of the SPS are damaged during storm events.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	Coastal Resources. **Coastal Geography and Physical Oceanography.** Temporary changes in sediment transport pathways as a result of sand extraction would be expected to return to pre-extraction conditions as migration of ridge features targeted for dredging would result in infilling of the small depressions created by dredging. Sand extraction at Sandbridge Shoal would not significantly alter wave height and direction at the site of sand extraction by increasing the depth. Only minor changes in long-shore current and sediment transport would be expected. No long-term changes in offshore geology would be expected. **Coastal Zone Management.** Alternative 1 would affect certain uses or natural resources of Virginia's coastal zone. However, this alternative would be conducted in a manner that is either fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia's Coastal Zone Management Program.	**Coastal Resources.** **Coastal Geography and Physical Oceanography.** Temporary changes in sediment transport pathways as a result of sand extraction would be expected to return to pre-extraction conditions as migration of ridge features targeted for dredging would result in infilling of the small depressions created by dredging. Sand extraction at Sandbridge Shoal would not significantly alter wave height and direction at the site of sand extraction by increasing the depth. Only minor changes in long-shore current and sediment transport would be expected. No long-term changes in offshore geology would be expected. **Coastal Zone Management.** Alternative 2 would affect certain uses or natural resources of Virginia's coastal zone. However, this alternative would be conducted in a manner that is either fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia's Coastal Zone Management Program.	**Coastal Resources.** **Coastal Geography and Physical Oceanography.** The beach and dunes would continue to erode; the erosion and natural processes affecting coastal geography and physical oceanography would continue both at Dam Neck Annex and Sandbridge Shoal. Thus, the No Action alternative would result in the continuation of natural conditions and patterns in long-shore current and sediment transport. No changes in offshore geology would be expected. **Coastal Zone Management.** Under the No Action alternative, maintenance and temporary and emergency repair of the SPS would continue. The No Action alternative represents no change from existing conditions; therefore, preparation of a coastal consistency determination would not be required for this alternative.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
Biological Resources	**Terrestrial Vegetation.** Adverse, minor impacts on vegetation would be mitigated by restoring the dune with native species upon completion of the sand replenishment phase. Impacts on terrestrial vegetation would be minor.	**Terrestrial Vegetation.** Adverse, minor impacts on vegetation would be mitigated by restoring the dune with native species upon completion of the sand replenishment phase. Impacts on terrestrial vegetation would be minor.	**Terrestrial Vegetation.** No vegetation would be damaged or removed. Periodic plantings of native grasses and installation of sand fencing would continue per the installation's dune stabilization program. As a result, there would be no change in existing conditions.
	Terrestrial Wildlife. Minor, temporary impacts on birds would be mitigated by a nest survey and communication with the USFWS to implement appropriate measures to protect any nest found if replenishment occurs during the breeding season. Temporary reduction of foraging habitat during construction but long-term preservation of avian habitat by preventing beach and dune erosion. Minor, temporary impacts on rodents, lizards, and snakes that could be present on the dune during construction.	**Terrestrial Wildlife.** Impacts on birds, terrestrial rodents, and herpetofauna would be similar to those under Alternative 1.	**Terrestrial Wildlife.** No short-term impacts on wildlife. However, the No Action alternative would have a long-term adverse impact on terrestrial wildlife because the beach would continue to erode, reducing available wildlife habitat over time.
Aquatic Wildlife	**Marine Mammals and Fish.** Temporary displacement of marine mammals and fish as they avoid areas of turbidity. Potential for vessel strikes with marine mammals during dredging operations and disturbance from pre- and post-dredging bathymetric surveys. Direct impacts on fish from potential entrainment and disturbance from	**Marine Mammals and Fish**. Potential impacts on marine mammals and fish under Alternative 2 would be similar to those under Alternative 1. However, because more sand would be needed from the borrow area to construct the manmade dune, impacts under Alternative 2 would be longer in duration than those under Alternative 1.	**Marine Mammals and Fish.** No impact on marine mammals or fish. **Benthic Organisms.** No impact on benthic organisms.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	dredging noise. Turbidity could pose short-term impacts on fish (e.g., irritation, clogging of gills, impacts on demersal fish eggs) but fish would likely avoid the area. Overall, direct and adverse impacts in the form of vessel strikes human noise, or entrainment could occur; indirect impacts (reduced foraging success and prey availability and turbidity) would be minor. **Benthic Organisms.** Dredging would cause minor, temporary, localized impacts on the regional benthic community from potential entrainment and turbidity. **Invertebrate Nekton/Macroplankton.** Dredging could cause minor, localized impacts on the regional invertebrate nekton/macroplankton community from entrainment and turbidity on individuals.	This would result in an increase in the potential for vessel-marine mammal collisions and fish entrainment as well as turbidity. Overall, direct and adverse impacts in the form of vessel strikes or entrainment could occur; indirect impacts (reduced foraging success and prey availability and turbidity) would be minor. **Benthic Organisms.** Dredging would cause minor, temporary, localized impacts on the regional benthic community from potential entrainment and turbidity. Direct impacts on the benthic community under Alternative 2 would be greater in extent than those under Alternative 1 because more sand would be required. **Invertebrate Nekton/Macroplankton.** Dredging could cause minor, localized impacts on the regional invertebrate nekton/macroplankton community from entrainment and turbidity on individuals. Direct impacts on invertebrate nekton/macroplankton under Alternative 2 would be greater in extent than those under Alternative 1 because more sand would be required.	

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
Plankton	**Plankton.** Dredging and sand placement would cause temporary, localized, and minor impacts on the regional plankton community from entrainment, turbidity, and reduced water quality.	**Plankton**. Dredging and sand placement would cause temporary, localized, and minor impacts to the regional plankton community from entrainment, turbidity and reduced water quality. Direct impacts on plankton under Alternative 2 would be greater in extent than those under Alternative 1 because more sand would be required.	**Plankton.** No impacts on plankton.
Threatened and Endangered Species	**Federally Listed Species. Whales:** Alternative 1 would have no effect on the blue whale, sei whale, or sperm whale. Alternative 1 may affect, but is not likely to adversely affect the finback, humpback, or North Atlantic right whale. NMFS-approved protected species observers will monitor the area for cetacean species and observations of ESA protected whales within 3,280 feet of the dredging operation will result in immediate suspension of activity. Dredging operations at night would be lit. Vessels will also adhere to NMFS-established speed restrictions during transit, conform to regulations for approaching ESA protected whales, and monitor North Atlantic right whale sighting reports. Operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging and fuel spill	**Federally Listed Species. Whales:** Under Alternative 2, there would be an increased potential for vessel-whale collisions and temporary impacts from noise and turbidity. However, the impacts and mitigation would be similar to that described under Alternative 1. **Birds:** The impacts and mitigation under Alternative 2 would be similar to those under Alternative 1. **Fish:** The Atlantic sturgeon would have a greater possibility of entrainment, loss of preferred benthic prey organisms at the dredge site, and length of disruption and displacement. Mitigation under Alternative 2 would be similar to that described under Alternative 1. **Sea turtles:** Sea turtles could be impacted by entrainment, loss of preferred benthic prey organisms at the dredge site, and length of disruption and displacement. Mitigation would be similar to that described under Alternative 1. **Plants:**	**Federally Listed Species.** No effect on federally listed species.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	prevention and response plans will be prepared. Reasonable and prudent measures outlined in the biological opinion will be followed. **Birds:** Alternative 1 may affect, but is not likely to adversely affect the piping plover or roseate tern. Additionally, Alternative 1 will not jeopardize the federal candidate red knot. An annual shorebird monitoring program scheduled to begin in late FY 2012 will allow for monitoring pre- and post-replenishment to identify the presence of the piping plover. If activities associated with sand placement occur during times when sensitive avian species may be present, a qualified biologist will conduct surveys and monitor the project area for those species. If sensitive species are present, impact minimization measures will be incorporated. Also, Dam Neck Annex will coordinate with the U.S. Fish and Wildlife Service (USFWS) regarding nest protection measures in the event that any piping plover nests are discovered. **Fish:** Alternative 1 would have no effect on the shortnose sturgeon and will not jeopardize the federal species of concern sand tiger shark. Alternative 1 is likely to adversely affect the	Potential impacts on the seabeach amaranth and mitigation measures that would be used under Alternative 2 would be the same as those under Alternative 1. Alternative 2 may affect, but is not likely to adversely affect the seabeach amaranth.	

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	Atlantic sturgeon. To reduce impacts, mitigation measures will include NMFS-approved protected species observers on board the vessel throughout the year to monitor for Atlantic sturgeon and attaching a state-of-the-art sea turtle deflector to the drag head, which will aid in the deflection of Atlantic sturgeon should they be present. During night-time dredging operations the work area will remain well lit to allow the observer to work safely and effectively. Mitigation measures may also include maintaining shoal morphology, leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery, and targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity. The hopper inflow will be fitted with a screen or basket. The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to prevent possible entrainment of fish species. Also, fuel spill prevention and response plans will be prepared.		

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	Reasonable and prudent measures outlined in the biological opinion will be followed. **Sea turtles:** Alternative 1 would have no effect on the hawksbill sea turtle. Alternative 1 may affect, but it not likely to adversely affect the green and leatherback sea turtles. Alternative 1 would adversely affect the loggerhead and Kemp's ridley sea turtles. A state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge and the drag head would be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the action area. The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion) and the hopper inflow will be fitted with a screen or basket to monitor for sea turtles and their remains. Dredging vessels and support boats will not intentionally approach listed species closer than 100 yards when in transit. NMFS-approved protected species observers will monitor the dredge site for sea turtles. During night-time dredging operation		

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	the work area will remain well lit to allow the observer to work safely and effectively. Beach-quality sand with a low content of fine sediments and organic materials will be targeted to reduce the potential for increased turbidity. If operations occur during the nesting season, the Sea Turtle Monitoring Protocol will be implemented, and if nesting occurs on the north or south ends of the beach the nests may be relocated to the USFWS Back Bay National Wildlife Refuge. Also, to the maximum extent practicable, lighting will be reduced on the beach during the sea turtle nesting season. Reasonable and prudent measures outlined in the biological opinion will be followed. **Plants:** The seabeach amaranth could potentially, but is unlikely to, occur in the project area. Beach replenishment projects are not believed to be detrimental to this species if they are completed between November 16 and March		

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	31, when the plant has senesced. Pre-construction surveys will be conducted to determine the presence or absence of seabeach amaranth within the project area. Alternative 1 may affect, but is not likely to adversely affect, the seabeach amaranth.		
	State-Listed Species. Alternative 1 would have no impact on the eastern chicken turtle, canebrake rattlesnake, eastern glass lizard, upland sandpiper, loggerhead shrike, migrant loggerhead shrike, Henslow's sparrow, arctic peregrine falcon, Dismal Swamp southeastern shrew, or Rafinesque's eastern big-eared bat. Alternative 1 would have minor, temporary impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle. Some individuals could be impacted through localized sand placement, but there would be no impact on populations. Because of mitigation, specifically, nest surveys and communication with the USFWS to implement appropriate measures to protect any nest found (if construction is undertaken during the breeding season) impacts on state-listed bird species would be reduced or eliminated. The quality of foraging habitat within the project area would be temporarily	**State-Listed Species.** Alternative 2 would have no impact on the eastern chicken turtle, canebrake rattlesnake, eastern glass lizard, upland sandpiper, loggerhead shrike, migrant loggerhead shrike, Henslow's sparrow, arctic peregrine falcon, Dismal Swamp southeastern shrew, or Rafinesque's eastern big-eared bat. Potential impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle under Alternative 2 would be expected to be similar to those under Alternative 1. However, the length of disturbance would be longer under Alternative 2 than under Alternative 1. Minor, temporary impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle would result.	**State-Listed Species.** No impact on state-listed species.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	reduced; however, ample foraging areas are nearby. In the long-term, because the proposed project would help prevent the beach and dune environment at Dam Neck Annex from eroding, it would also help maintain avian foraging habitat.		
Submerged Aquatic Vegetation	**Submerged Aquatic Vegetation.** Documentation of submerged aquatic vegetation offshore of the Dam Neck Annex is in progress. If submerged aquatic vegetation is observed during implementation of Alternative 1, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.	**Submerged Aquatic Vegetation.** Documentation of submerged aquatic vegetation offshore of the Dam Neck Annex is in progress. If submerged aquatic vegetation is observed during implementation of Alternative 2, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.	**Submerged Aquatic Vegetation.** No effect on submerged aquatic vegetation.
Essential Fish Habitat	**Essential Fish Habitat.** Direct adverse impact on managed fish and invertebrate species due to entrainment. Indirect temporary impacts due to diminished availability of bottom-dwelling food resources and an increase in turbidity. Mitigation measures will include installation of a state-of-the-art sea turtle deflector, also useful to prevent entrainment of large fish, on the drag head of the hopper dredge; operating the drag head in a manner that will reduce the risk of interactions with fish species that may be present in the action area; attaching a screen or basket to the hopper inflow and turning off the	**Essential Fish Habitat.** Impacts on EFH as a result of implementing Alternative 2 would be similar to those previously discussed for Alternative 1 but would occur on a larger scale because a larger quantity of dredged material would be needed from Sandbridge Shoal. Mitigation measures under Alternative 2 would be the same as those described under Alternative 1. Conservation recommendations provided by the NMFS will be followed. Impacts on EFH would be minor. Mitigation measures will further minimize impacts on EFH.	**Essential Fish Habitat.** No impact on EFH.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	suction in the drag head when it is lifted off the bottom to prevent possible entrainment of fish species; and implementing fuel spill prevention and response plans. Additional mitigation measures may include maintaining shoal morphology; leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery; and targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity. Conservation Recommendations provided by NMFS will be followed. Impacts on EFH would be minor. Mitigation measures will further minimize impacts to EFH.		
Water Resources	**Surface Waters and Water Quality.** Dredging and pumping sand to shore would have minor, temporary impacts on water quality in the Atlantic Ocean, primarily due to increased turbidity.	**Surface Waters and Water Quality.** Dredging and pumping sand to shore and constructing a manmade dune would have minor, temporary impacts on Atlantic ocean water quality. Impacts under Alternative 2 would be similar to those under Alternative 1; however, removal of the additional sand needed for Alternative 2 would be associated with higher, but still minor and temporary, turbidity impacts on water quality.	**Surface Waters and Water Quality.** No impact on surface waters or water quality.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	Floodplains. Alternative 1 would not be considered incompatible development within a floodplain and thus would not violate the stipulations of Executive Order 11988 or the National Flood Insurance Program.	**Floodplains.** The beach replenishment and dune construction proposed under Alternative 2 would not be considered incompatible development within a floodplain and therefore would not violate the stipulations of Executive Order 11988 or the National Flood Insurance Program.	**Floodplains.** No impact on floodplains.
	Wetlands. No impact on wetlands would occur because there are no wetlands in the project area.	**Wetlands.** No impact on wetlands would occur because there are no wetlands in the project area.	**Wetlands.** No impact on wetlands.
Noise	**In-Air Noise.** Estimated exterior noise levels are below the daylight interior sound level limits contained in the City of Virginia Beach Noise Ordinance. **In-Water Noise** Effects of in-water noise on individual species are presented in separate discussions, including Aquatic Wildlife-Marine Mammals and Fish (Section 4.2.3.1) and Threatened and Endangered Species – Whales, Fish, and Sea Turtles (Section 4.2.5.1.1).	**In-Air Noise.** Impacts on the acoustic environment under Alternative 2 would be similar to those described under Alternative 1. However, because this alternative would also include the construction of a dune with a stone core, additional noise would be generated by transportation and placement of stones for the core. Noise would still be below the daylight interior sound level limits contained in the City of Virginia Beach Noise Ordinance. **In-Water Noise** Effects of in-water noise to individual species are presented in separate discussions, including Aquatic Wildlife-Marine Mammals and Fish (Section 4.2.3.2), and Threatened and Endangered Species – Whales, Fish, and Sea Turtles (Section 4.2.5.2.1).	**In-Air Noise.** No change in existing ambient noise levels. **In-Water Noise** No change in existing ambient noise levels.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
Air Quality	**Air Quality.** Short-term, negligible impact on air quality in the region due to temporary construction emissions. The action would be exempt from the General Conformity Rule because the total net emissions are below the *de minimis* levels.	**Air Quality.** Short-term, negligible impact on air quality in the region due to temporary construction emissions. The action would be exempt from the General Conformity Rule because the total net emissions are below the *de minimis* levels.	**Air Quality.** No change in existing air quality.
Traffic and Transportation	**Traffic and Transportation.** Minor, short-term, intermittent traffic impacts due to construction workers accessing the site.	**Traffic and Transportation.** Minor, short-term, intermittent traffic impacts due to construction workers accessing the site and material deliveries.	**Traffic and Transportation.** No change in existing traffic and transportation.
Navigation	**Navigation.** Minimal increase in marine vessel traffic during dune replenishment, which would cause minor and temporary effects on navigation in the waters surrounding Dam Neck Annex.	**Navigation.** Impacts on navigation under Alternative 2 would be similar to those under Alternative 1 but would occur over a longer period of time.	**Navigation.** No change in navigation.
Cultural Resources	**Cultural Resources.** Alternative 1 would have no effect on historic properties pursuant to Section 106 of the National Historic Preservation Act because there are no historic properties identified within the areas of potential effect (APEs) at Dam Neck Annex and because the Navy would avoid all cultural resources that are identified within the APE for borrow areas at the Sandbridge Shoal. If the Navy discovers any previously unknown historic or archaeological remains while implementing Alternative 1, the Navy will notify BOEM of any finding. The	**Cultural Resources.** Alternative 2 would have no effect on historic properties pursuant to Section 106 of the National Historic Preservation Act because there are no historic properties identified within the APEs at Dam Neck Annex and because the Navy would avoid all cultural resources that are identified within the APE for borrow areas at the Sandbridge Shoal. Mitigation measures would be the same as those described for Alternative 1.	**Cultural Resources.** No effect on historic properties.

Table 2-3 Comparison of the Impacts Associated with Alternatives 1 and 2 and the No Action Alternative

Resource	Alternative 1	Alternative 2	No Action Alternative
	Navy will initiate the federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places NRHP.		
Unexploded Ordnance	**Unexploded Ordnance.** Because of the low likelihood of occurrence, impacts under Alternative 1 from UXO would be minor. Small UXO could be encountered during dredging operations. However, the likelihood of this occurring would be expected to be low because UXO has not been encountered during past Navy dredging projects at Sandbridge Shoal. A screen or basket will be placed on the inflow of the hopper in order to monitor the dredge material intake for sea turtle and fish entrainment, and it will also help prevent any UXO from entering the hopper and being placed on the beach. Should any potential UXO pass through or become trapped on the screen, operations would cease and the Navy will call special ordnance handlers to safely remove and dispose of the ordnance.	**Unexploded Ordnance.** Impacts under Alternative 2 would be the same as those under Alternative 1.	**Unexploded Ordnance.** No impact from unexploded ordnance.

3 Affected Environment

This chapter describes the existing environmental resources at Dam Neck Annex and in the immediate surrounding area that could be affected by the proposed action and alternatives, including the No Action alternative. Resources evaluated include land use and coastal zone management, threatened and endangered species and other biological resources, water resources, noise, air quality, and cultural resources. The resources described here provide baseline information that can be used to compare and evaluate potential impacts on the human environment that may result from implementation of the alternatives.

3.1 Land Use, Visual Setting, and Coastal Zone

3.1.1 Land Use

On-Base Land Use

Dam Neck Annex is a satellite installation of NAS Oceana, which is part of Navy Region Mid-Atlantic. Dam Neck Annex contains the Training Support Center, Hampton Roads, and 13 other tenant commands. Dam Neck Annex's mission is to anticipate, develop, and provide specialized training and support services in response to fleet requirements (Commander, Naval Installation Command n.d. [a]). It is home to the Fleet Combat Training Center Atlantic, which provides education and training in combat systems operation and maintenance for Navy personnel, training in specialized skills, and training systems support to operational and systems commands. Other major commands at Dam Neck Annex include the following (Geo-Marine, Inc. November 2006):

- Tactical Training Group, Atlantic
- Navy Marine Corps Intelligence Training Center
- The Fleet Combat Direction Systems Support Activity, Port Hueneme Division
- Naval Ocean Processing Facility
- Marine Air Control Squadron 24 (MACS 24)
- Commander Underwater Surveillance

- Commander Naval Development Group (SPECWAR)
- Fleet Composite Squadron Six (VC-6) Detachment
- Personnel Support Detachment.

Dam Neck Annex also offers a variety of training facilities:

- The small-arms firing range, located in the northern portion of the base. This includes a 50-yard outdoor pistol range, a baffle range (a range surrounded by layers of fences or buffers), and a 500-yard rifle range.
- The VC-6 Detachment provides aerial target services for the East Coast fleet. Operations include launching, tracking, and maintaining target drones. BQM-74E aerial targets are launched from the southern end of Regulus Avenue.
- 2 helicopter pads
- An 11-acre weapons compound
- Beaches and dunes training areas on the north end of the beach, which are used for amphibious landing exercises. Amphibious vehicles, including landing craft air cushions (LCAC), maneuver across the beach areas several times a month (Geo-Marine, Inc. November 2006).

Other facilities on the base include mission support, operational, administrative, personnel support, and housing facilities (Global Security 2011b). Dam Neck Annex also supports some of the last remaining tracts of undeveloped dune ecosystems along the Virginia coast (Geo-Marine, Inc. November 2006).

Regional Land Use

Dam Neck Annex is located in the Hampton Roads region of Virginia, in the City of Virginia Beach, 5 miles south of the oceanfront resort area and immediately north of the resort-residential neighborhood of Sandbridge. Immediately north of Dam Neck Annex is Camp Pendleton, which primarily contains military training and logistics facilities, MWR facilities, and open space. A portion of Camp Pendleton is leased by the City of Virginia Beach to provide overflow parking for the Virginia Aquarium and Marine Science Center. Dam Neck Annex occupies approximately 1,372 acres of highlands, marshes, coastal beaches and sand dunes, with 3.2 miles of beachfront (Geo-Marine, Inc. November 2006).

The City of Virginia Beach is bordered by the Atlantic Ocean to the east; Currituck County, North Carolina, to the south; the cities of Norfolk and Chesapeake, Virginia, to the west; and the Chesapeake Bay to the north. As noted in the *City of Virginia Beach Comprehensive Plan* (City Council & Planning Commission 2009), there are three main planned land use areas in Virginia Beach. The northern part of the city is characterized by suburban residential development and the city's major commercial centers and contains the city's planned Strategic Growth Areas and Special Economic Growth Areas for higher-density (urban) mixed-use and targeted commercial/industrial development. The southern part of the city is rural, characterized by very low-density residential, rural communities, and agricultural and recreational land uses. The rural part of the city is separated by the suburban part of the city to the north by the Princess Anne Commons and the Transition Area (Virginia Beach Department of Planning and Community Development 2009).

Land uses surrounding Dam Neck Annex consist of military land (Camp Pendleton) to the north; a built-out low-density residential and resort rental neighborhood (Sandbridge) to the south; and suburban residential, agricultural, and open space to the west. Land west of Dam Neck Annex is included in Virginia Beach's suburban area. New residential and commercial development in the suburban area is planned to be compatible with existing development. Other city planning goals for the suburban area include the creation or protection of open space and creation of transportation linkages (Virginia Beach Department of Planning and Community Development 2009).

Located approximately 5 miles to the south of Dam Neck Annex is the 9,120 acre Back Bay National Wildlife Refuge (NWR). The refuge consists of open water, barrier island beaches and sand dunes, forests, and wetlands and marshes, and it provides habitat for an assortment of wildlife, including threatened and endangered species such as piping plovers (*Charadrius melodus*), loggerhead sea turtles (*Caretta caretta*), peregrine falcons (*Falco peregrinus*), and bald eagles (*Haliaeetus leucocephalis*) (U.S. Fish and Wildlife Service September 2010).

Land Use Controls

Development on Dam Neck Annex is controlled, guided, or influenced by the following plans, programs, and policies:

- Dam Neck Annex Master Planning Process. The base master planning process measures land capacity and land use constraints (operational safety restrictions and environmental constraints such as wetlands and ecologically sensitive areas) against future operational requirements and personnel and community support requirements.

- *Integrated Natural Resources Management Plan, Naval Station Oceana, Dam Neck Annex* (Geo-Marine, Inc. November 2006). The Dam Neck Annex INRMP guides the implementation of the natural resources program for Dam Neck Annex and Camp Pendleton. The purpose of the natural resources program is to protect and enhance natural resources on the installations while ensuring support for the Navy mission and providing recreational opportunities for personnel. The beach area is located in the installation's Beaches and Dunes Management Unit. This unit contains critical areas for amphibious and land-based military training exercises as well as the vegetated dune system and several uncommon or rare natural communities (Geo-Marine, Inc. November 2006).

3.1.2 Visual Setting

Dam Neck Annex contains 3.2 miles of wide beachfront, and covers more than 1,100 acres of highlands, marshes, coastal beaches and sand dunes (Commander, Naval Installation Command n.d. [b]). Dam Neck Annex is military-owned land, and access to the beach is restricted to military personnel and escorted guests. The only structures within the beach area are six pedestrian bridges that provide access from facilities inland of the dunes to the beach and the buried stone wall that is part of the SPS. The Navy-owned facilities behind the dunes, primarily the Shifting Sands Beach Club, the BEQ, and the housing area, contain views of the dunes and, from upper floors, the beach. The SPS can also be seen from offshore. The waters off the Atlantic coast of Virginia Beach are used by recreational boaters and fishermen, commercial boat tours, and commercial ships. Although residents of Sandbridge to the south of Dam Neck Annex are prohibited from accessing the Dam Neck Annex beach, the SPS may be visible from the nearest houses at Sandbridge and from the part of the public beach closest to the installation.

3.1.3 Coastal Resources

3.1.3.1 Coastal Zone Geography and Physical Oceanography

The Virginia coastal zone comprises three broad geographic areas: the Atlantic coast of the Delmarva Peninsula, the mouth of the Chesapeake Bay, and the mainland shore of southeastern Virginia continuing into northeastern North Carolina (Hobbs et al. 2008). The Virginia coastal plain and shelf overlie the Salisbury Embayment, a sedimentary basin located between the South New Jersey Arch and Norfolk Arch. Deposition in this embayment has produced a seaward-thickening wedge of sediments beneath the coastal plain and continental slope (Hobbs et al. 2008). The entire coastal zone is composed of unconsolidated sediments (sand and silt), with no exposures of bedrock or hard, consolidated sediments (Hobbs et al. 2008). The sediments originated from the Piedmont and interior highlands of eastern North America and were carried to the coast by prehistoric rivers (Hobbs et al. 2008). The deeper sediments are the result of fluvial and deltaic deposits that were followed by inundation by the ocean and marine sediments (Hobbs et al. 2008). Dominant surface sediment along the Virginia coast south of the Chesapeake Bay consists of sands and granules, with smaller areas having slightly elevated amounts of fine-grained sediments. One of these areas is the area immediately south of the Chesapeake Bay and is likely a result of suspended-sediment transport out of the Bay (Hobbs et al. 2008). The coast of Virginia contains erosional and accretional beaches. Narrow, erosional beaches occur at Dam Neck Annex, Sandbridge, and Back Bay NWR, and wider accretional beaches occur at Fort Story and False Cape State Parks (Hobbs et al. 2008).

A "bight" is a large but often only slightly concave bay or curve in a coastline. An "arch" is an area of crystalline basement rock (i.e., a layer of igneous or metamorphic rock covered by layers of sedimentary rock) that is higher in elevation compared with the surrounding crystalline basement rock.

Sedimentary processes, including erosion, transport, and deposition, are constantly reshaping the Virginia coast (Hobbs et al. 2008). Throughout the coastal zone, gradients of energy control the net transport of sediment, producing gradual transitions in coastal geomorphology in some areas and abrupt changes in physical character in other areas (Hobbs et al. 2008). The currents of the Virginia shelf and nearshore areas surrounding the Chesapeake Bay have been described in several studies (e.g., Marmorino et al. 1999, Lentz 2008). Depth-average mean currents over the entire Mid-Atlantic Bight continental shelf, which extends from Cape Hatteras, North Carolina, in the south to Nantucket Shoals south of Cape Cod, Massachusetts, are predominantly towards the equator and approximately along isobaths (Lentz 2008). Mean currents do not vary substantially along isobaths throughout the Mid-Atlantic Bight, and inter-annual variations over the last few decades are likely small (Lentz 2008). Mean cross-shore flows are generally onshore and reflect upwelling conditions (Byrnes et al. 2003). There is a strong correlation between north-northeast winds and currents along the Mid-Atlantic Bight (Byrnes et al. 2003). Strong winds from any direction produce high seas in the area, but only storms from the north-northeast (i.e., nor'easters) produce strong alongshore current on shore faces south of the Chesapeake Bay (Xu and Wright 1998). Depth-average mean currents moving south towards the equator and along isobaths, coupled with the potential for storms from the north-northeast to enhance alongshore current to the south, likely combine to transport sediment in the along-shelf direction. Strong wind and wave events may enhance currents near the bottom and transport entrained sediment offshore while waves, their associated currents, and tidal movements reverse the direction of sediment transport in the surf zone near the beach.

The entire Mid-Atlantic Bight, including the Virginia coastline, has semi-diurnal tidal cycles. The mean tidal range along the Virginia coast is approximately 3.3 feet. The maximum spring range is less than 5 feet. Off southeastern Virginia, semi-diurnal tidal ellipses orient in a northwest-southeast direction with velocities increasing towards shore. This is in part due to the funneling effect of the Chesapeake Bay mouth (Valle-Levinson and Lwiza 1998). Tidal forcing is an important component of the flow regime on the Virginia coast, particularly near the mouth of the Chesapeake Bay. Tidal forcing becomes a less important component of along-shelf and cross-shelf processes as the distance from the mouth of the Chesapeake Bay increases (Byrnes et al. 2003). When major storms generate waves and wind, tidal currents are not a major contributor to flow. North winds drive currents to the south and south winds drive currents to the north. Smaller-amplitude signals of semi-diurnal frequency are seen to modulate the larger wind response, but these produce reversals in the flow only when the wind forcing is relatively weak (Marmorino et al. 1999). In addition, some enhancement of the flow occurs inshore near the mouth of the Chesapeake Bay (Marmorino et al. 1999). Buoyant discharge from the Chesapeake Bay, which is dominated by tidal and wind forcing, is restricted to areas near the coastline when under the influence of downwelling winds or northeasterly winds blowing onshore (Valle-Levinson and Lwiza 1998).

Waves along the Virginia coast are generally from the south-southeast. However, the largest waves are generally associated with nor'easter storms, which are primarily from the east-northeast (Dolan et al. 1988). Wave direction tends to be seasonal, with waves approaching from the southeast direction during spring and summer and from the northeast during fall and winter. Hurricanes are the biggest driver of increased wave heights during the summer.

The average water depth at Sandbridge Shoal is approximately 33 feet. The minimum water depth at Sandbridge Shoal is about 30 feet, and the ambient water depth varies from 39 to 49 feet (Maa and Hobbs 1998). Because of these depths, short-period waves are not affected by Sandbridge Shoal. Long-period waves coming from the northeast from nor'easters and the size, shape, and location of Sandbridge Shoal cause wave defraction and convergence at the shoal. This combination of factors controls the wave transformation processes and may be the reason for beach erosion immediately inshore of the shoal at Sandbridge Beach (which is located south of Dam Neck Annex) (Maa and Hobbs 1998). Immediately south of Sandbridge Beach, a nodal point or zone of divergence in long-shore sediment transport occurs (Hobbs et al. 1999). The increased wave energy in this area and the zone of divergence in long-shore sediment transport combine to cause long-term beach retreat rates of 11.5 feet per year at the southern end of Sandbridge Beach (Hobbs et al. 1999).

3.1.3.2 Coastal Zone Management

The Coastal Zone Management Act (CZMA) of 1972 (16 United States Code [U.S.C.] §1451 et seq. as amended) assists states, in cooperation with federal and local agencies, in developing land-use and water-use programs in coastal zones. Section 307 of the CZMA stipulates that, when a federal project involves reasonably foreseeable impacts on any coastal use or resource (land- or water-use or natural resource), the action must be consistent, to the maximum extent practicable, with the enforceable policies of the affected state's federally approved coastal management plan.

The Commonwealth of Virginia has developed and implemented a federally approved coastal zone management program (CZMP) describing current coastal legislation and enforceable policies (Virginia Department of Environmental Quality 2009). A network of core agencies and coastal localities in the Commonwealth of Virginia administers the enforceable policies of the Virginia CZMP. The Virginia Department of Environmental Quality (DEQ) is the lead agency for the program.

The enforceable policies of the Virginia CZMP include:

- Wetlands management
- Fisheries management
- Subaqueous lands management
- Dunes and beaches management
- Point-source air pollution control
- Point-source water pollution control
- Non-point source water pollution control
- Shoreline sanitation
- Coastal lands management.

Federal lands such as Dam Neck Annex are "lands the use of which is by law subject solely to the discretion of . . . the federal government, its officers, or agents" and are statutorily excluded from the CZMA's definition of the Commonwealth of Virginia's "coastal zone" (16 U.S.C. §1453(1)). However, because the proposed action affects coastal resources or uses beyond the boundaries of the federal property (i.e., has spillover effects), the CZMA Section 307 federal consistency requirement applies.

3.2 Biological Resources

3.2.1 Terrestrial Vegetation

Vegetation communities include beach and foredune. No large plants are in the beach community, but marine phytoplankton is present in the subtidal and intertidal portions of the beach. Vegetation in the foredune community includes Atlantic coastal/bitter panic grass, sea oats, American searocket (*Cakile edentula*), and sea ox-eye (*Borrichia frutescens*) (Geo-Marine, Inc. November 2006). The constructed dune portion of the SPS and the natural dunes north and south of the SPS have similar types of vegetation.

Because many of the dunes at Dam Neck Annex are degraded and lack vegetation, the installation's environmental department has partnered with the National Aquarium, Baltimore, to administer an installation dune stabilization program. Under this program, the Navy surveys the dunes for damage and works with community volunteers to plant native grasses and install dune fencing as needed. Four native dune grass species (American beachgrass, Atlantic coastal/bitter panic grass, switchgrass [*Panicum virgatum*], and saltmeadow hay [*Spartina patens*], and one flowering species, gray goldenrod [*Solidago nemoralis*]) are used. These species were selected for several reasons: (1) they are perennial plants native to mid-Atlantic coastal dune habitats and equipped to survive in this type of environment, (2) they complement the plants that currently thrive on the dunes, (3) they add diversity to the habitat, and (4) they are available from local nurseries (Naval Facilities Engineering Command Mid-Atlantic November 2010). Between March 2006 and November 2010, more than 220,000 plants were planted on the Dam Neck Annex dunes, with the help of 362 volunteers (Naval Facilities Engineering Command Mid-Atlantic November 2010).

3.2.2 Terrestrial Wildlife

Birds

Both migratory and most native-resident bird species are protected under the Migratory Bird Treaty Act (MBTA). The MBTA prohibits the taking, killing, or possessing of migratory birds except under the terms of a valid permit issued pursuant to federal regulations. Under 50 CFR Part 21, the armed forces are authorized to incidentally take migratory birds during military readiness activities, where incidental take refers to a take that results by the way of, but is not the purpose of, carrying out an otherwise lawful activity. However, the armed forces must confer and cooperate with the U.S. Fish and Wildlife Service (USFWS) on the development and implementation of conservation measures to minimize or mitigate adverse effects of military readiness activities if it determines that such activity may have a significant adverse effect on a population of migratory birds. Congress has defined military readiness as all training and operations of the armed forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a migratory bird population to maintain genetic diversity, reproduce, and function effectively in its native ecosystem.

Military readiness activities, for example, do not include routine operation and maintenance of aircraft at an airfield or construction of support infrastructure. These operations are considered non-military readiness activities. Migratory bird conservation relative to non-military-readiness activities is addressed separately in a Memorandum of Understanding (MOU) developed in accordance with EO 13186, signed January 10, 2001, “Responsibilities of Federal Agencies to Protect Migratory Birds.” EO 13186 directs federal agencies to incorporate bird conservation considerations into agency planning, including NEPA analyses; report annually on the level of take of migratory birds; and generally promote the conservation of migratory birds without compromising the agency mission. The MOU between the Department of Defense (DOD) and the USFWS outlines the responsibility of federal agencies to protect migratory birds and how to incorporate conservation efforts into their routine operations and construction activities. The proposed action would be considered a non-military readiness activity.

BOEM also entered into a MOU with the USFWS in 2009 to "strengthen migratory bird conservation through enhanced collaboration between the MMS and USFWS." The BOEM evaluates the effects on migratory birds and important habitats such as offshore and nearshore foraging, staging, molting, and roosting habitats. It is important to both agencies that potential impacts be thoroughly assessed and that mitigation measures be considered and implemented as appropriate.

The shoreline at Dam Neck Annex provides habitat for waterfowl, shorebirds, waterbirds, and seabirds. Waterfowl known to occur at Dam Neck Annex include several species of geese and ducks, but only four are known or likely to nest on the installation: the Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*), and American black duck (*Anas rubripes*). Other geese and ducks that breed farther north but may winter on the installation include the snow goose (*Chen caerulescens*), tundra swan (*Cygnus columbianus*), green-winged teal (*Anas crecca*), gadwall (*Anas strepera*), and bufflehead (*Bucephala albeol*a) (Geo-Marine, Inc. November 2006).

Shorebird species known to occur at Dam Neck Annex include spotted sandpiper (*Actitis macularia*), semipalmated sandpiper (*Caldris pusilla*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), dunlin (*Calidris alpina*), red knot (*Calidris canutus*), western sandpiper (*Calidris mauri*), least sandpiper (*Calidris minutilla*), willet (*Catoptrophorus semipalmatus*), semipalmated plover (*Charadrius semipalmatus*), piping plover (*Charadrius melodus*), killdeer (*Charadrius vociferous*), black-bellied plover (*Pluvialis squatarola*), American golden plover (*Pluvialis dominica*), and Wilson's plover (*Charadrius wilsonia*). Most shorebird species on the installation use it as a feeding area during migration and nest farther north. The only shorebird known to nest at Dam Neck Annex is the killdeer (*Charadrius vociferous*), which typically breeds from early March through June (Geo-Marine, Inc. November 2006; Virginia Department of Game and Inland Fisheries n.d. [a]).

Waterbird species known to occur at the installation include the great blue heron (*Ardea herodias*), little blue heron (*Florida caerulea*), green heron (*Butorides virescens*), yellow-crowned night heron (*Nyctanassa violacea*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), double-crested cormorant (*Phalacrocorax auritis*), horned grebe (*Podiceps auritus*), pied-billed grebe (*Podilymbus podiceps*), common loon (*Gavia immer*), and king rail (*Rallus elegans*). Of these, the great blue heron, little blue heron, and green heron are known or are likely to nest on the installation (Geo-Marine, Inc. November 2006).

Seabird species known to occur at the installation include the brown pelican (*Pelecanus occidentalis*), gulls (*Larus* spp.), and terns (*Sterna* spp.). Gulls and terns are known or likely to nest on the installation (Geo-Marine, Inc. November 2006). In winter, species such as black scoter (*Melanitta americana*), surf scoter (*Melanitta perspicillata*), red-throated loon (*Gavia stellata*), common loon (*Gavia immer*), and northern gannet (*Morus bassanus*) may forage in the project area.

One study found that loons and gannets, which feed on fish, were more abundant over shoal areas (Forsell and Koneff September 2002).

Several raptor species have been recorded on the installation, including the bald eagle, osprey (*Pandion haliaetus*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), sharp-shinned hawk (*Accipeter velox*), American kestrel (*Falco sparverius*), and merlin (*Falco aesalon*) (Geo-Marine, Inc. November 2006). Raptors would not be expected to frequent the beach like the waterfowl, shorebirds, waterbirds, and seabirds, but could fly over the beach while foraging. Forest-dwelling birds such as warblers and woodpeckers and birds common to urban settings such as the northern mockingbird (*Mimus polyglottos*) and mourning dove (*Zenaida macroura*) also occur at Dam Neck Annex. However, these birds are rarely found on beaches.

Mammals

Large and medium-sized terrestrial mammals occurring at Dam Neck Annex include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), Virginia opossum (*Didelphis virginianus*), eastern mole (*Scalopus aquaticus*), shrews, rabbits, and rodents (Geo-Marine, Inc. November 2006). Of these, rodent species such as the marsh rice rat (*Oryzomys palustris*) and white-footed mouse (*Peromyscus leucopus*) are the most likely to occur in the maritime dune habitat.

Herpetofauna

Fourteen amphibian species have been documented at Dam Neck Annex (Geo-Marine, Inc. November 2006). However, amphibians are generally not saltwater-tolerant and would not be expected to occur on the beach or in the maritime dune environment. Similarly, eight species of terrestrial turtle have been documented at Dam Neck Annex (Geo-Marine, Inc. November 2006) but would be unlikely to occur on the beach or in the maritime dune environment. (Sea turtles potentially occurring in the vicinity of Dam Neck Annex are described in Section 3.2.4, Threatened and Endangered Species.) Of the fifteen lizard and snake species documented at the installation (Geo-Marine, Inc. November 2006), a limited number, which are tolerant of sandy environments such as the six-lined racerunner (*Cnemidophorus sexlineatus*), eastern fence lizard (*Sceloporus undulatus*), black rat snake (*Elaphe obsolete*), eastern hognose snake (*Heterodon platyrhinos*), rough green snake (*Opheodrys aestivus*), and eastern cottonmouth (*Agkistrodon piscivorous*), may occur in the dunes.

3.2.3 Aquatic Wildlife

Marine Mammals

A wide variety of marine mammal species range throughout the Northwestern Atlantic Ocean basin from Greenland and Nova Scotia south to Florida and into the Northern Gulf of Mexico (Table 3-1). However, only one species, the bottlenose dolphin (*Tursiops truncatus*) occurs with any regularity in the shallow waters in the vicinity of Dam Neck Annex and Sandbridge Shoal. The remaining species listed in Table 3-1 are not considered further in this document because they are considered extralimital, rare occasional migrants to the coast of Virginia, or would not likely occur outside of their deep water habitats into the shallow waters of the project area. Marine mammals listed as federally threatened and endangered are discussed in Section 3.2.5.1 below.

Table 3-1 Marine Mammal Species with Ranges in the North Atlantic Ocean

Common Name	Scientific Name	Range on Eastern U.S. Coast	Season Potentially Found off Virginia	Known Depths	Likelihood in Project Area
Bottlenose Dolphin	*Tursiops truncatus*	NY to FL	Year round	<85 feet	Likely
Harbor Porpoise	*Phocoena phocoena*	Canada to NC	Winter	<492 feet	Unlikely, due to range
Short-beaked Common Dolphin	*Delphinus delphis delphis*	Greenland to NC	Winter/Spring	Continental Shelf 328 – 6,562 feet	No, due to depth
Short-finned Pilot Whale	*Globicephala macrorhynchus*	Nova Scotia to FL	Winter/Spring	Continental Shelf >328 feet	No, due to depth
Long-finned Pilot Whale	*Blobicephala melas melas*	Greenland to NC	Winter/Spring	Continental Shelf >328 feet	No, due to depth
Risso's Dolphin	*Grampus griseus*	Georges Bank to NC	Spring – Fall	Continental Shelf >328 feet	No, due to depth
Dwarf Sperm Whale	*Kogia sima*	Canada to FL	Unknown	Oceanic waters >328 feet	No, due to depth
Gray Seal	*Halichoerus grypus grypus*	Labrador to NY	Winter	Nearshore/Coastal	Unlikely, due to range
Pygmy Sperm Whale	*Kogia breviceps*	Canada to FL	Unknown	Oceanic Waters >328 feet	No, due to depth
Hooded Seal	*Cystophora cristata*	Canada to Puerto Rico	Summer – Fall	Coastal to Offshore Waters	Unlikely, due to range and depth
Spinner Dolphin	*Stenella longirostris*	Along US coast	Unknown	Oceanic Waters >6,562 feet	No, due to depth
Cuvier's Beaked Whale	*Ziphius cavirostris*	Nova Scotia to FL	Unknown	Deep Shelf Edge Waters	No, due to depth
Blainville's Beaked Whale	*Mesoplodon densirostris*	Nova Scotia to FL	Unknown	Deep Shelf Edge Waters	No, due to depth
Gervais' Beaked Whale	*Mesoplodon europaeus*	Nova Scotia to FL	Unknown	Deep Shelf Edge Waters	No, due to depth
Sowerby's Beaked Whale	*Mesoplodon bidens*	Nova Scotia to FL	Unknown	Deep Shelf Edge Waters	No, due to depth
True's Beaked Whale	*Mesoplodon mirus*	Nova Scotia to FL	Unknown	Deep Shelf Edge Waters	No, due to depth
Melon-Headed Whale	*Peponocephala electra*	Along US coast	Unknown	Deep Shelf Edge Waters	No, due to depth
Atlantic Spotted Dolphin	*Stenella frontalis*	New England to FL	Year-round	Deeper Slope Waters >656 feet	No, due to depth

Table 3-1 Marine Mammal Species with Ranges in the North Atlantic Ocean

Common Name	Scientific Name	Range on Eastern U.S. Coast	Season Potentially Found off Virginia	Known Depths	Likelihood in Project Area
Pantropical Spotted Dolphin	*Stenella attenuata*	New England to FL	Year-round	Deeper Slope Waters >656 feet	No, due to depth
Striped Dolphin	*Stenella coeruleoalba*	Georges Bank to NC	Unknown	Deeper Slope Waters	No, due to depth
Fraser's Dolphin	*Lagenodelphis hosei*	Unknown	Unknown	Deep Oceanic Waters	No, due to depth
Rough-Toothed Dolphin	*Steno bredanensis*	Nova Scotia to FL	Unknown	Deep Oceanic Waters	No, due to depth
Clymene Dolphin	*Stenella clymene*	Unknown	Unknown	Deeper Slope Waters	No, due to depth
Killer Whale	*Orcinus orca*	Uncommon in North Atlantic	Unknown	>840 feet	No, due to depth
Harbor Seal	*Phoca vitulina*	Canada to NC	Winter	Nearshore/Coastal	Unlikely, due to range
Florida Manatee **	*Trichechus manatus latirostris*	FL to MA	Summer	Shallow	Unlikely, due to range

Source: Waring et al (2011).
This chart includes all marine mammals with ranges in the North Atlantic Ocean that occur offshore of the Virginia coast. It includes animals that stay in deep water that will not occur in the project area because it is too shallow for these species.

** The Florida manatee is technically an endangered species; however, it was not included in the threatened and endangered species consultation due to its extremely rare occurrence in Virginia waters. This decision was approved by the USFWS.

There are several marine mammals that have been sighted within the project area, but they are rare in the region and, in particular, the project area either because the project area is within the extralimital extent of their geographic range or because of a lack of suitable habitat in the area. Species that have been sighted in the area yet do not occur with any regularity are the harbor seal (*Phoca vitulina*) and the harbor porpoise (*Phocoena phocoena*). Both of these species have been sighted occasionally or have been recorded in stranding data along the Virginia Coast (Swingle et al. 2010); however, because their occurrence is irregular and because it is unlikely that they would occur in the project area, they are not discussed further.

Extremely rare species such as the killer whale (*Orcinus orca*) and Florida manatee (*Trichechus manatus latirostris*) have also been sighted, but their occurrence can be considered accidental and not common. The killer whale is rare due to its habitat preference for deeper waters than the continental shelf of Virginia as well as due to its geographic range. The Florida manatee, while it is listed as an endangered species by the USFWS, is so rare in the project area that it was not considered a potentially impacted species during the Section 7 Endangered Species Act consultation process. Therefore, neither the killer whale nor the Florida manatee are discussed further.

The bottlenose dolphin is the most abundant coastal cetacean along the eastern United States coast from Long Island, New York, to the Florida peninsula (Waring et al. 2011). Bottlenose dolphins within several subgroups from the Western North Atlantic coastal stock can be found off the Virginia coast throughout the year. In the summer months, dolphins observed in waters off Dam Neck Annex are likely to be from the western North Atlantic southern migratory stock or the northern North Carolina estuarine system stock, while in the winter months, dolphins are likely from the western North Atlantic northern migratory stock (Waring et al. 2011). Animals from the coastal stock are generally limited to depths of 85 feet or less (Waring et al. 2011). This species typically occurs along the entire Atlantic coast of Virginia within 1 mile of shore and in the Chesapeake Bay and its tributaries (Blaylock July 1985). Bottlenose dolphins range in length from 6.0 feet to 12.5 feet; males have a lifespan of 40 to 45 years and females more than 50 years (National Oceanic and Atmospheric Administration Fisheries, Office of Protected Resources n.d.). Research conducted by the Virginia Marine Science Museum and James Madison University has documented the seasonal importance of the waters off of Cape Henry to the Mid-Atlantic coastal bottlenose dolphin. Their research indicates that hundreds of dolphins use the waters around Cape Henry, and evidence exists of the importance of Cape Henry waters as a nursery area for coastal bottlenose dolphins (Bell January 2010). During 2009, 34 bottlenose dolphin strandings were recorded in Virginia Beach, the majority of which occurred between May and August (Swingle et al. 2010).

Fish

A large number of marine fish species, both pelagic and demersal, occur in the coastal waters near Dam Neck Annex and Sandbridge Shoal. Because the area is located in a transition zone between temperate and subtropical regions, an extremely diverse assemblage of fish occur: up to 685 species, representing 149 families (Geo-Marine, Inc. November 2006; U.S. Department of the Navy June 2003). Of the 149 families occurring, the ten most dominant are the sea basses (*Serranidae*), jacks (*Carangidae*), gobies (*Gobiidae*), left-eyed flounders (*Bothidae*), drums and croakers (*Sciaenidae*), sea robins (*Triglidae*), wrasses (*Labridae*), requiem sharks (*Carcharhinidae*), herrings (*Clupeidae*), and snappers (*Lutjanidae*) (U.S. Department of the Navy June 2003).

Common fish species found around Sandbridge Shoal include black sea bass (*Centropristis striata*), sea robin (*Scorpaeniformes*), spotted hake (*Urophycis regia*), butterfish (Stromateidae spp.), pinfish (*Lagodon rhomboids*), smallmouth flounder (*Etropus microstomus*), and other various flounder species (*Paralichthys* spp.) (Diaz et al. 2006). Sea robins, smallmouth flounder, and pinfish had the broadest occurrence both on the shoal and surrounding the shoal and showed no significant difference in abundance across strata or between study years (Diaz et al. 2006). Habitat used by the most abundant fish species can vary from year to year and season to season. However, these fish species are most often found in sandy areas and the shoal itself (Diaz et al. 2003, 2006). Densities of the benthic organisms, often serving as prey for the fish species in the shoal area, also vary by season and substrate (Brooks et al. 2006). The availability of prey across seasons and locations of the shoal would likely influence fish species use of the shoal.

Additional fish species listed as threatened and endangered are discussed in Section 3.2.5.1 below and Appendices D and E. Fish species with designated essential fish habitat (EFH) are discussed in Section 3.2.7 and Appendix F.

From 2002 to 2005, the Virginia Institute of Marine Science (VIMS) implemented a rigorous field program that focused on possible biological impacts from ongoing dredging of Sandbridge Shoal (Diaz et al. 2006). During the field program 1,600 fishes and skates, representing 12 taxa, as well as 1,000 invertebrates, representing 12 taxa, were collected from the Sandbridge Shoal. The two most prevalent fish were sea robins (Scorpaeniformes) and spotted hake (*Urophycis regia*) (Diaz et al. 2006).

Benthic Organisms

Benthos, also referred to as the benthic zone, is the community of organisms that live in and on the seabed and occupy two areas at Dam Neck Annex: the beach and the Sandbridge Shoal.

Beaches are typically divided into four zones: upper beach, midlittoral zone, swash zone, and surf zone. The upper beach is considered the area between the high tide line and the dune base, whereas the midlittoral zone is the wet sand area below the high tide line. While the midlittoral zone is wet sand, the swash zone is the area of saturated sand where waves rush up and retreat. The surf zone is the area where waves break (Greene November 2002). Table 3-2 illustrates the types of organisms common to these beach zones on high-energy Atlantic coastal beaches.

Table 3-2 Beach Zone Organisms

Zone	Typical Resident Organisms
Upper Beach	Sand fleas; crabs; transient insects
Midlittoral Zone	Polychaete worms; isopods
Swash Zone	Coquina clams; mole crabs
Surf Zone	Shellfish; foraging fish; seabirds

Source: Greene November 2002

Sandbridge Shoal is a relatively shallow feature composed of fine to medium sand with a topography predominantly shaped by exposure to wave and current energy (Maa and Hobbs 1998). In general, species diversity and densities (including the species that are found in the benthic habitats on and in the vicinity of Sandbridge Shoal) increase as depth increases along the continental shelf (Cutter and Diaz 1998; Diaz et al. 2006). As a result, these benthic habitats become increasingly biologically diverse farther away from the shoal. Greater benthic abundance and diversity are found in the spring with both abundance and diversity beginning to decrease in the summer and reaching lowest numbers in the winter (Versar, Inc.

January 2004; Brooks et al. 2006). Slacum et al. (2010) also found that on the inner continental shelf of the mid-Atlantic Bight, flat bottom areas have greater species richness, diversity, and abundance. Slacum et al. also reported that in regions of sand shoals, there was greater abundance in areas with a steeper gradient. Species richness has also been reported to be greater in the troughs surrounding shoals than on the shoal tops themselves (Vasslides and Able 2008). Slacum et al. (2010) reported that species diversity, abundance, and richness were all lower in winter than in spring, summer, and fall.

The shoal supports a variety of invertebrates. Common invertebrate species found in Mid-Atlantic waters include the brown shrimp (*Panaeus aztecus*), pink shrimp (*P. duorarum*), white shrimp (*P. setiferus*), horseshoe crab (*Limulus polyphemus*), sea nettle (*Chrysaora quinquecirrha*), sea star (*Asterias forbesi*), and common squid (*Loligo pealei*) (Diaz et al. 2006). The benthos at Sandbridge Shoal is likely to be dominated by polychaetes, followed by lesser concentrations of amphipods, bivalves, lancelets, and much smaller concentrations of decapods, nemerteans, echinoderms, sea anemones, gastropods, phoronids, tunicates, isopods, and other crustaceans (Diaz et al. 2006). The benthic community composition at Sandbridge Shoal is typical of other shallow sandy habitats found along the Atlantic continental shelf (Diaz et al. 2006). Overall, Sandbridge Shoal and its vicinity support a food web with three trophic levels: primary producers, primary consumers (bivalves and amphipods), and secondary consumers (demersal fish). Particular invertebrates common to the shoal include hermit crabs (*Pagurus* spp.), sand shrimp (*Crangon septemspinosa*), and Atlantic brief squid (*Lolliguncula brevis*) (Diaz et al. 2006).

Invertebrate Nekton/Macro-plankton

The Atlantic Ocean waters offshore of Dam Neck Annex provide habitat for invertebrates such as a variety of squid, jellyfish, and comb jellies that live in the water column. Comb jellies and jellyfish have limited mobility and are typically carried by currents. Two species of squid are known to occur at Sandbridge Shoal: the Atlantic brief squid and Atlantic bobtail squid (*Rossia* spp.) (URS August 2010). Jellyfish species likely to occur in the area offshore of Dam Neck Annex include the sea nettle and moon jellyfish (*Aurelia aurita*).

3.2.4 Plankton

Plankton are organisms that float or drift and cannot maintain their direction against the movement of currents. Plankton includes phytoplankton and zooplankton.

Phytoplankton are single-celled organisms that are similar to plants because they contain chlorophyll and use sunlight to generate energy. Phytoplankton distribution is patchy and is influenced by several factors, the most critical being light, temperature, and nutrient conditions. Generally speaking, phytoplankton abundance is higher in nearshore waters due to an influx of nutrients from onshore sources (U.S. Department of the Navy June 2003). The distribution and diversity of phytoplankton species has been documented to differ with locally varying salinity and temperature gradients along the North Carolina and Virginia coasts where the plume waters from the Chesapeake Bay create strong frontal boundaries (U.S. Department of the Navy October 2008). Within the warmer, higher salinity waters in this region, phytoplankton includes an assortment of haptophytes, dinoflagellates, and chrysophytes (U.S. Department of the Navy October 2008).

Zooplankton are small floating animals and include species that spend their entire lives as plankton (holoplankton) and meroplankton (the eggs and larvae of many fish and invertebrates). Salps, one of the larger types of zooplankton, are found in surface and near surface waters offshore. Individual salps have a cylindrically shaped, gelatinous body between 0.4 and 11.8 inches long, with openings at either end through which they pump water to filter out of a variety of food particles (U.S. Department of the Navy October 2008). Other zooplankton found in Virginia coastal waters include copepods, chaetognaths, and larvae of several benthic groups such as barnacles, crabs, sand dollars, and starfish (URS August 2010).

3.2.5 Threatened and Endangered Species

3.2.5.1 Federally Listed Species

The ESA of 1973, as amended, provides for the conservation of threatened and endangered species of animals and plants and the habitats in which they are found. The Navy conducts consultations as required under Section 7 of the ESA for any action that “may affect” a federally listed threatened or endangered species. In accordance with the Secretary of Navy Instruction, Office of the Chief of Naval Operations Instruction 5090.1C Change 1 (U.S. Department of the Navy July 18, 2011) the protection of non-federally listed species that are listed at the state level as threatened or endangered is not legally mandated. However, the Navy encourages cooperation with states to protect such species.

The Navy contacted the NMFS, Northeast Regional Office; the USFWS, Virginia Field Office; the Virginia Department of Conservation and Recreation (DCR), Division of Natural Heritage; and the Virginia Department of Game and Inland Fisheries (DGIF) to request updated information regarding the presence of rare, threatened, or endangered species at Dam Neck Annex or in the coastal waters offshore. Written responses to the Navy’s request are provided in Appendix A. The NMFS, USFWS, and Virginia DGIF attended an interagency meeting to discuss the proposed action on June 29, 2011.

Table 3-3 lists federally listed species with the potential to occur on Dam Neck Annex or within the adjacent coastal waters, including the waters surrounding Sandbridge Shoal; none of these species have critical habitat designated within the limits of the project. State-listing status is also provided where applicable. The list was generated from the written correspondence provided by the NMFS and Virginia DCR, Division of Natural Heritage, as well as the USFWS’s Information, Planning, and Conservation (IPaC) System and the Virginia DGIF’s Fish and Wildlife Information Service website (U.S. Fish and Wildlife Service

2011a; Virginia Department of Game and Inland Fisheries 2011). The list was reviewed and approved by the NMFS, USFWS, and Virginia DGIF at the interagency meeting on June 29, 2011. (A brief summary of information about each species listed in Table 3-3 is provided here. More detailed species information can be found in Appendix D, Biological Assessment.)

Table 3-3 Federally Listed Species Potentially Occurring on Dam Neck Annex or in Adjacent Coastal Waters

Common Name	Scientific Name	Federal Status	State Status
Whales			
Blue whale	*Balaenoptera musculus*	Endangered	Endangered
Finback whale	*Balaenoptera physalus*	Endangered	Endangered
Humpback whale	*Megaptera novaengliae*	Endangered	Endangered
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Endangered
Sei whale	*Balaenoptera borealis*	Endangered	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered	Endangered
Birds			
Piping plover	*Charadrius melodus*	Threatened	Threatened
Red knot	*Calidris canutus rufa*	Candidate	--
Roseate tern	*Sterna dougallii dougallii*	Endangered	Endangered
Fish			
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered	Special Concern Species
Sand tiger shark	*Carcharias taurus*	Species of Concern	--
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	Endangered
Sea Turtles			
Loggerhead sea turtle	*Caretta caretta*	Threatened	Threatened
Green sea turtle	*Chelonia mydas*	Threatened	Threatened
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	Endangered
Plants			
Seabeach amaranth	*Amaranthus pumilus*	Threatened	Threatened

Whales

The blue whale (*Balaenoptera musculus*) is the largest animal on earth. Although the southern limit of its feeding range is unknown (National Marine Fisheries Service n.d. [a]), the Cape Cod region may represent the current southern limit. The blue whale rarely occurs in Virginia waters (National Marine Fisheries Service 1998a; Blaylock July 1985).

The finback whale (*Balaenoptera physalus*) is the second largest whale by length. It is considered common in the Atlantic Exclusive Economic Zone (EEZ) from Cape Hatteras, North Carolina, northward (Waring et al. 2011). The EEZ includes the ocean area extending from the seaward boundary of each coastal state, 3 nautical miles (3.5 miles) for most states, to 200 miles offshore. There are records of finback whales feeding off the coast of Virginia, and individuals have been found stranded in Virginia several times (National Marine Fisheries Service 2006; Blaylock July 1985).

The humpback whale (*Megaptera novaengliae*) is found in all of the world's oceans, including off the coast of Virginia. In 2009, there were two humpback whale strandings in Virginia, one in Accomack and one in Gloucester, as well as one in North Carolina (Swingle et al. 2010). In 2010, there were two humpback whale strandings in Northampton, Virginia, and one in North Carolina (Swingle et al. 2011).

The current distribution of the North Atlantic right whale (*Eubalaena glacialis*) ranges from approximately 30^{o} to 75^{o} north latitude (Crane and Scott 2002; National Marine Fisheries Service 2005). The western North Atlantic population of the North Atlantic right whale ranges from summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and the Scotian Shelf to winter calving grounds in coastal waters off the southeastern United States. Although Mid-Atlantic coastal waters north of Georgia and south of Cape Cod are not considered high use areas, North Atlantic right whales do travel frequently through these waters (National Marine Fisheries Service 2005; Waring et al. 2011). Vessel strikes have been reported off Virginia and North Carolina between 2003 and 2007, including one off Virginia Beach (Waring et al. 2011).

The sei whale (*Balaenoptera borealis)* is found in oceans worldwide; however, it is not considered common anywhere within United States Atlantic waters (Reeves et al. 1998). The species winters in temperate and subtropical waters within the United States Atlantic EEZ from the Gulf of Maine to Georges Bank (Reeves et al. 1998; Waring et al. 2011). However, the exact distribution and pattern of these seasonal movements remains unclear (National Marine Fisheries Service n.d. [b]). Sei whales are considered an open ocean-dwelling species and are not often found in inshore or coastal waters.

The sperm whale (*Physeter macrocephalus*) is the largest of the toothed whales and occurs in oceans around the world. The sperm whale is an open water- and deep water-dwelling species, and its overall distribution off the east coast of the United States is concentrated along the break of the continental shelf, over the continental slope, and into mid-ocean regions (Waring et al. 2011; National Marine Fisheries Service 2010a). Sperm whales are considered uncommon in waters less than 984 feet deep (National Marine Fisheries Service n.d. [c]).

Birds

The piping plover is a small migratory shorebird. The breeding range of the Atlantic Coast population is from Newfoundland's southern coast south to near the border between North and South Carolina (U.S. Fish and Wildlife Service 1996). In Virginia, nesting typically occurs between April 7 and June 21, although re-nesting attempts may occur past July 1 (Virginia Department of

Game and Inland Fisheries n.d. [b]). There are no records of piping plovers nesting on the mainland beaches south of the Chesapeake Bay. Piping plovers are considered uncommon transients on the southern mainland coast of Virginia and in the lower Chesapeake Bay region (Virginia Department of Game and Inland Fisheries n.d. [a]). Incidental observations of feeding piping plovers have been made on the beaches at the Dam Neck Annex. These sightings have been limited to single individuals, which typically do not stay in the area for more than a couple of days. Piping plovers are not known to nest at the installation (Geo-Marine, Inc. November 2006).

The red knot (*Calidris canutus rufa*) is a large sandpiper. It is considered a locally common to abundant transient from mid-May to early June and from mid-July to mid-September along the Virginia coast. It is considered rare west of the Chesapeake Bay and is considered uncommon to rare during the summer and winter months (Virginia Department of Game and Inland Fisheries n.d. [c]).

The roseate tern (*Sterna dougallii dougallii*) is a worldwide species that breeds in two distinct areas in North America. The northeast population includes birds that breed, or formerly bred, along the Atlantic Coast of the United States from North Carolina to Maine. The roseate tern is a rare transient and summer visitor near the coast of Virginia. Historically, it nested on the eastern shore of Virginia, but there has been no breeding activity recorded since 1927. No sightings of the species have been recorded for the installation, nor is the species included on the list of known rare, threatened and significant ecological communities list for Dam Neck Annex or Camp Pendleton (Geo-Marine, Inc. November 2006).

Fish

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a long-lived (up to 60 years) anadromous fish (i.e., it migrates from the ocean into coastal estuaries and rivers to spawn) (National Marine Fisheries Service n.d. [d]). The Atlantic sturgeon is a subtropical species occurring along the Atlantic coast and in estuaries from Labrador, Canada, to Florida and west of the Mississippi delta (Murdy et al. 1997; National Marine Fisheries Service n.d. [d]). It is a migratory species, moving southward in the winter and northward in the spring.

The sand tiger shark (*Carcharias taurus*) is a coastal species found in tropical and warm temperate waters worldwide except for the eastern Pacific (National Marine Fisheries Service 2010b). Sand tiger sharks are considered common in summer and fall in the lower Chesapeake Bay, where they inhabit shallow estuaries and coastal waters (Murdy et al. 1997). Juvenile sand tiger sharks are commonly found in estuaries along the eastern United States coastline (National Marine Fisheries Service 2010b). As a result, Virginia waters are considered important pupping grounds (MarineBio 2010).

The shortnose sturgeon (*Acipenser brevirostrum*) is an anadromous species of fish, closely related to the Atlantic sturgeon (National Marine Fisheries Service 1998b). The NMFS recognizes 19 distinct population segments inhabiting 25 river systems within this range (National Marine Fisheries Service 1998a). The distinct population segment closest to the action area is the Chesapeake Bay, which includes the Chesapeake Bay and Potomac River in Maryland and Virginia. This species is believed to have been extirpated from Virginia coastal rivers and rarely occurs in the ocean (Virginia Department of Game and Inland Fisheries n.d. [d]; National Marine Fisheries Service 1998a). The closest recent record of the species was in the Rappahannock River in 1997 (Virginia Department of Game and Inland Fisheries n.d. [d]). The mouth of the Rappahannock River is more than 50 miles from the Project.

Sea Turtles

The loggerhead sea turtle is named for its relatively large head, which supports powerful jaws (National Marine Fisheries Service n.d. [e]). In the eastern United States, the majority of loggerhead sea turtle nesting occurs from North Carolina through southwest Florida. Some nesting also occurs in southern Virginia and along the Gulf of Mexico coast westward into Texas (National Marine Fisheries Service n.d. [e]). Loggerhead sea turtles occurring off the coast of Virginia are part of the Northern Recovery Unit which includes loggerhead sea turtles originating from nesting beaches from southern Virginia to the Florida-Georgia border (National Marine Fisheries Service 2008). Loggerhead sea turtles occur in the coastal waters of Virginia primarily during late spring, summer, and early fall, typically arriving in early May and departing in early November (Colligan May 17, 2011). Because the Virginia Beach, Virginia, and the Outer Banks, North Carolina, coasts are heavily developed, it is thought that Dam Neck Annex is one of the few remaining areas for conservation of sea turtle habitat (Buhlmann et al. March 6, 1992). The loggerhead sea turtle is the only recurrent nesting species of sea turtle in southeastern Virginia (Cross et al. 2001). A loggerhead sea turtle nested on the northern portion of Dam Neck Annex beach in 1992 (Geo-Marine, Inc. November 2006). Eggs from this nest were relocated to Back Bay NWR, where they hatched successfully (Geo-Marine, Inc. November 2006). A loggerhead sea turtle also nested unsuccessfully on the southern portion of Dam Neck Annex beach in 2002 (Geo-Marine, Inc. November 2006).

The green sea turtle (*Chelonia mydas*) is the largest of the hard-shelled sea turtles and nests primarily in Florida and in smaller numbers in Georgia, South Carolina, and North Carolina (U.S. Fish and Wildlife Service 2011b; National Marine Fisheries Service 1991). Very few green sea turtles have been seen in the vicinity of Dam Neck Annex (Geo-Marine, Inc. November 2006). However, they occur seasonally, primarily from early May to November, in the coastal waters of Virginia (Colligan May 17, 2011). Although the green sea turtle does not typically nest as far north as Virginia, a nest was discovered on Sandbridge Beach, located approximately 3 miles south of the project area, in 2005 (Baker and Valentine n.d.).

The leatherback sea turtle (*Dermochelys coriacea*) is the largest sea turtle and largest living reptile in the world. The leatherback sea turtle has a global distribution and is considered the most migratory and widespread sea turtle species (National Marine Fisheries Service n.d. [f]; National Marine Fisheries Service 1992). They are primarily an open water species. The leatherback sea turtle is not known to nest as far north as Virginia. However, they have been reported to occur relatively frequently off the coast in the vicinity of Dam Neck Annex (Geo-Marine, Inc. November 2006). They are expected to occur seasonally in Virginia waters from approximately early May until November.

The hawksbill sea turtle (*Eretmochelys imbricate*) regularly occurs in southern Florida and the Gulf of Mexico, particularly Texas. Their occurrence north of Florida is rare, but sightings have been reported as far north as Massachusetts (National Marine Fisheries Service n.d. [g]; National Marine Fisheries Service 1993). Very few hawksbill sea turtles have been observed in the vicinity of Dam Neck Annex (Geo-Marine, Inc. November 2006). The hawksbill sea turtle does not nest as far north as Virginia (National Marine Fisheries Service n.d. [g], National Marine Fisheries Service 1993). They are mainly found in the tropics and are considered accidentals in Virginia (Virginia Department of Game and Inland Fisheries n.d. [e]).

The Kemp's ridley sea turtle (*Lepidochelys kempii*) is the smallest sea turtle and is a nearshore species, rarely going into waters deeper than 160 feet (National Marine Fisheries Service n.d. [h]). The Chesapeake Bay, Virginia has the largest known concentration of juvenile Kemp's ridley sea turtles, which use submerged aquatic vegetation (SAV) as their primary habitat, especially from May to November (Virginia Department of Game and Inland Fisheries n.d. [f]; Terwilliger and Musick 1995). Kemp's ridley sea turtles occur seasonally in the coastal waters of Virginia, typically from early May to November (Colligan May 17, 2011; Terwilliger and Musick 1995). They have been observed frequently off the coast of Dam Neck Annex (Geo-Marine, Inc. November 2006). Although not previously known to nest in Virginia, a Kemp's ridley sea turtle was observed laying eggs on the Dam Neck Annex beach on June 15, 2012.

Plants

The seabeach amaranth (*Amaranthus pumilus*) is an annual plant that is considered an effective sand-binder and is valued for its ability to stabilize sand dunes. Seabeach amaranth occurs on sand dunes of Atlantic Ocean beaches from New York to South Carolina. The Virginia DCR, Division of Natural Heritage conducted field surveys at Dam Neck Annex in 1990. These surveys reported no occurrence of seabeach amaranth at Dam Neck Annex (Buhlmann et al. March 6, 1992).

3.2.5.2 State-Listed Species

Virginia has two separate acts that cover endangered plant and animal species. Under the Virginia ESA (Virginia Code 29.1-563-570), the Commonwealth of Virginia is authorized to adopt the federal list and to make modifications and amendments to that list. The Virginia ESA prohibits the taking, transportation, processing, sale, or offer for sale within the Commonwealth of any threatened or endangered species of fish or wildlife. Under the Endangered Plant and Insect

Species Act (Virginia Regulations 325-01 et seq.), the taking, possession, etc. of endangered or threatened species is prohibited.

A number of species considered rare in the state have been documented at Dam Neck Annex. These species include the following state-listed rare plants: white-topped fleabane (*Erigeron vernus*), bluejack oak (*Quercus incana*), fasciculate beakrush (*Rhynchospora fascicularis* var. *fascicularis*), glossy-seeded star-grass (*Hypoxis sessilis*), and a rush (*Juncus elliotti*). Only one state-listed rare animal species, the king rail (*Rallus elegans*), has been documented at Dam Neck Annex. The king rail is considered very rare for breeding in Virginia (Geo-Marine, Inc. November 2006).

According to the Virginia DCR, Division of Natural Heritage, the beach is located within the Dam Neck Annex Middle Beach Dunes Conservation Site. Conservation sites are areas built around one or more rare plant, animal, or natural community and are designed to include the element and, where possible, its associated habitat and buffer or other adjacent land deemed necessary for the element's conservation (Baird May 18, 2011). The element of concern for the Dam Neck Annex Middle Beach Dunes Conservation Site is the loggerhead sea turtle. Conservation sites are given a biodiversity significance rating on a scale of one to five based on the rarity, quality, and number of element occurrences they contain. The Dam Neck Annex Middle Beach Dunes Conservation Site has been given a ranking of B3, which indicates a site of high significance (Baird May 18, 2011).

The Virginia DGIF's Fish and Wildlife Information Service online searchable database was used to identify state-listed species known or likely to be present within a 2-mile radius of Dam Neck Annex (Virginia Department of Game and Inland Fisheries 2011). Table 3-4 summarizes the results of the database search.

The bald eagle is known to feed at the south end of Dam Neck Annex near Lake Tecumseh but is not known to nest on the installation (Geo-Marine, Inc. November 2006).

Table 3-4 State-Listed Species Known or Likely to be Present within a 2-Mile Radius of Dam Neck Annex

Common Name	Scientific Name	State Status	Confirmed Presence within Search Area
Turtles			
Eastern chicken turtle	*Deirochelys reticularia reticularia*	Endangered	--
Reptiles			
Canebrake rattlesnake	*Crotalus horridus*	Endangered	Potential
Eastern glass lizard	*Ophisaurus ventralis*	Threatened	--
Spotted turtle	*Clemmys guttata*	Collection concerned	Yes
Northern diamond-backed terrapin	*Malaclemys terrapin terrapin*	Collection concerned	Potential

Table 3-4 State-Listed Species Known or Likely to be Present within a 2-Mile Radius of Dam Neck Annex

Common Name	Scientific Name	State Status	Confirmed Presence within Search Area
Birds			
Wilson's plover	*Charadrius wilsonia*	Endangered	--
Peregrine falcon	*Falco peregrinus*	Threatened	Potential
Upland sandpiper	*Bartramia longicauda*	Threatened	--
Loggerhead shrike	*Lanius ludovicianus*	Threatened	Potential
Henslow's sparrow	*Ammodramus henslowii*	Threatened	--
Gull-billed tern	*Sterna nilotica*	Threatened	--
Arctic peregrine falcon	*Falco peregrinus tundrius*	Threatened	--
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Yes
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	Threatened	--
Mammals			
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	Threatened	--
Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*	Endangered	--

Source: Virginia Department of Game and Inland Fisheries 2011

3.2.6 Submerged Aquatic Vegetation

SAV is the collective term given to aquatic plants that grow completely under water. The definition of SAV usually excludes algae, floating plants, and plants that grow above the water surface (U.S. Environmental Protection Agency 2006). SAV is ecologically important because it provides important habitat for young fish and other aquatic organisms, sediment stabilization, and water quality maintenance. Seventeen species of SAV have been identified in the Chesapeake Bay and its tributaries. Eelgrass (*Zostera marina*) is the only "true" seagrass species and can tolerate salinities as low as 10 parts per thousand (ppt). It is dominant in the lower reaches of the Bay (Orth et al. December 2010).

SAV habitat occurs along the entire east coast of the United States, with the exception of South Carolina and Georgia, where high freshwater input, high turbidity, and large tidal amplitude (vertical tide range) inhibit its occurrence (North Carolina Department of Environmental and Natural Resources, Division of Marine Fisheries 2010). According to preliminary survey results, no SAV occurs in the area offshore of Dam Neck Annex (Orth et al. 2012).

3.2.7 Essential Fish Habitat

Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801) require that EFH areas be identified for each species managed under a federal fishery management plan and that all federal agencies proposing actions that may adversely affect EFH consult with the NMFS. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (50 CFR 600.10). EFH for managed species has been designated by the Fishery Management Councils and were published in March 1999 by the NMFS. An EFH assessment has been prepared pursuant to Section 305(b)(2) of the Magnuson-Stevens Act and includes the following required parts: 1) identification of species of concern; 2) a description of the proposed action; 3) an analysis of the effects of the proposed action; and 4) proposed mitigation. The overall purpose of an EFH assessment is to evaluate a proposed action's effect on EFH. Subsequently, the NMFS will review and determine concurrence with the Navy's assessment of the effects of the proposed action. The following is a synopsis of the EFH assessment that is provided as Appendix F.

Sandbridge Shoal is approximately 3 miles offshore of Dam Neck Annex. Benthic species observed by Diaz et al. (2006) commonly included amphipods, bivalves and lancelets and, less commonly, decapods, nemerteans, echinoderms, anemonies, isopods, gastropods, phoronids, and tunicates. Polychaetes were the most abundant group observed. Benthic invertebrate and fish communities continue to be healthy on the shoal despite recurrent dredging. Diaz et al. (2006) monitored the area to identify biological impacts associated with dredging. Despite dredging, negative impacts on benthic macrofauna or demersal fishes have not been documented. More information concerning the benthic habitat of Sandbridge Shoal and the nearshore area can be found in Section 3.2.3, Aquatic Wildlife.

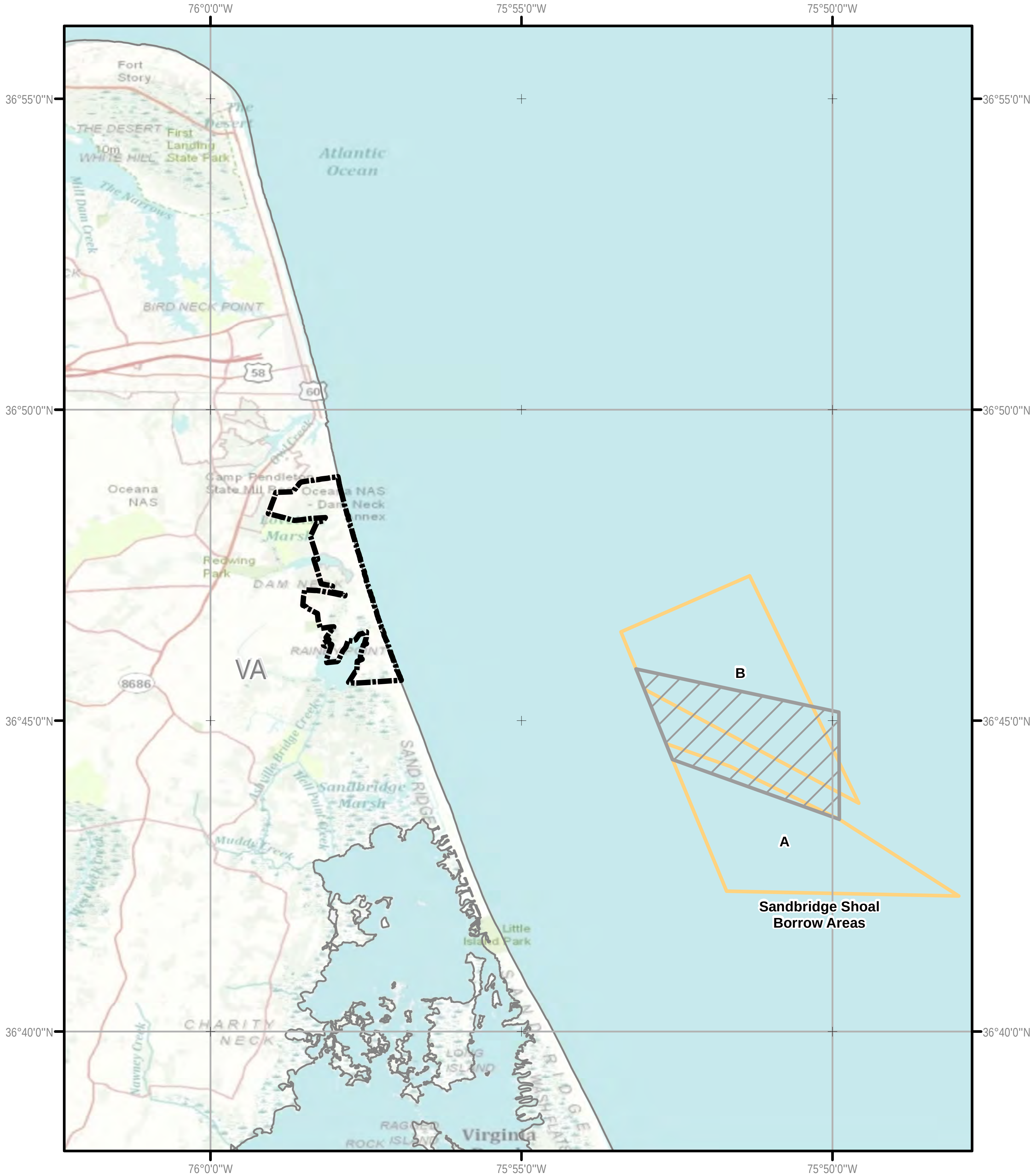
To facilitate EFH consultation, the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, and NMFS Northeast Regional Office created a *Guide to EFH Designations*. A 10' x 10' grid system was developed to isolate Atlantic coastal areas from Virginia and northward and to identify fisheries with designated EFH within each grid square. For this assessment, the Guide was used to determine the list of species to be analyzed. Sandbridge Shoal and Dam Neck Annex Beach are located within two 10' x 10' squares. Information from both of these grids (see Tables 3-5 and 3-7 and Figure 3-1) was evaluated for the assessment. Species that have designated EFH in the grids are identified in Tables 3-6 and 3-8.

Table 3-5 Square 1 EFH Designation Boundary for Dam Neck Annex and Sandbridge Shoal

Boundary	North	East	South	West
Coordinate	36°50.0'N	75°50.0'W	36°40.0'N	76°00.0'W

The coordinates above encompass the waters in the Atlantic Ocean in the project area, including Sandbridge Shoal. These waters include Muddy Creek, Porpoise Point, and northern Long Island, and Virginia Beach from Rudee Inlet on the north, south past Sandbridge Beach, Virginia, to east of halfway down Long Island just north of the Wash Flats.[1]

[1] http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407550.html



- Installation Boundary
- Sandbridge Shoal
- No Dredge Zone

Figure 3-1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia
National Marine Fisheries Service
10' x 10' Squares for EFH Designation

N

0 0.5 1 2 Miles

Table 3-6 Square 1: Designated EFH Species Associated with Dam Neck Annex and Sandbridge Shoal

Species		Eggs	Larva	Juveniles	Adult
Common Name	Scientific Name				
Red Hake	(*Urophycis chuss*)	X	X	X	
Witch Flounder	(*Glyptocephalus cynoglossus*)	X			
Windowpane Flounder	(*Scophthalmus aquosus*)	X		X	
Atlantic Sea Herring	(*Clupea harengus*)				X
Bluefish	(*Pomatomus saltatrix*)			X	X
Summer Flounder	(*Paralichthys dentatus*)			X	X
Scup	(*Stenotomus chrysops*)	N/A	N/A	X	X
Black Sea Bass	(*Centropristis striata*)	N/A		X	X
Spiny Dogfish	(*Squalus acanthias*)	N/A	N/A	X	
King Mackerel	(*Scomberomorus cavalla*)	X	X	X	X
Spanish Mackerel	(*Scomberomorus maculatus*)	X	X	X	X
Cobia	(*Rachycentron canadum*)	X	X	X	X
Red Drum	(*Sciaenops occelatus*)	X	X	X	X
Sand Tiger Shark	(*Carcharias taurus*)		X		X
Atlantic Sharpnose Shark	(*Rhizopriondon terraenovae*)				X
Dusky Shark	(*Carcharhinus obscurus*)		X	X	
Sandbar Shark	(*Carcharhinus plumbeus*)		X, HAPC	X, HAPC	X, HAPC
Scalloped Hammerhead Shark	(*Sphyrna lewini*)			X	
Tiger Shark	(*Galeocerdo cuvieri*)		X	X	X
Clearnose Skate	(*Raja eglanteria*)			X	X
Little Skate	(*Raja erinacea*)			X	X
Winter Skate	(*Leucoraja ocellata*)			X	X

Source: http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407550.html, http://www.nero.noaa.gov/hcd/skateefhmaps.htm

Key:

HAPC = Habitat Areas of Particular Concern (designated).
N/A = Either no data were available on the designated life stages, or those life stages are not present in the species' reproductive cycle.
X = Designated EFH within analyzed 10'x10' square.

Table 3-7 Square 2: EFH Designation Boundary for Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

Boundary	North	East	South	West
Coordinate	36°50.0' N	75°40.0'W	36°40.0'N	76°50.0'W

The coordinates for Square 2 include the project area and Sandbridge Shoal. These waters are one square east of the square within North Bay and Shipps Bay and southern Virginia Beach.[2]

[2] http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407540.html

Table 3-8 Square 2: Project Area Species with Designated Essential Fish Habitat

Species		Eggs	Larva	Juveniles	Adult
Common Name	Scientific Name				
Witch Flounder	(*Glyptocephalus cynoglossus*)	X			
Windowpane Flounder	(*Scophthalmus aquosus*)	X	X	X	
Atlantic Sea Herring	(*Clupea harengus*)			X	X
Monkfish	(*Lophius americanus)*	X	X		
Bluefish	(*Pomatomus saltatrix*)			X	X
Atlantic Butterfish	(*Peprilus triacanthus*)			X	
Summer Flounder	(*Paralichthys dentatus*)			X	X
Scup	(*Stenotomus chrysops*)	N/A	N/A	X	X
Black Sea Bass	(*Centropristis striata*)	N/A	X	X	X
Surf Clam	(*Spisula solidissima*)	N/A	N/A	X	
Spiny Dogfish	(*Squalus acanthias*)	N/A	N/A	X	X
King Mackerel	(*Scomberomorus cavalla*)	X	X	X	X
Spanish Mackerel	(*Scomberomorus maculatus*)	X	X	X	X
Cobia	(*Rachycentron canadum*)	X	X	X	X
Red Drum	(*Sciaenops occelatus*)	X	X	X	X
Sand Tiger Shark	(*Carcharias taurus*)		X		X
Atlantic Sharpnose Shark	(*Rhizopriondon terraenovae*)				X
Dusky Shark	(*Carcharhinus obscurus*)		X	X	
Sandbar Shark	(*Carcharhinus plumbeus*)		X	X	X
Scalloped Hammerhead Shark	(*Sphyrna lewini*)			X	
Tiger Shark	(*Galeocerdo cuvieri*)		X	X	X
Clearnose Skate	(*Raja eglanteria*)			X	X

Source: http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407540.html
http://www.nero.noaa.gov/hcd/skateefhmaps.htm

Key:
N/A = Either no data were available on the designated life stages or those life stages are not present in the species' reproductive cycle.
X = Designated EFH within analyzed 10' x 10' square.

These species are further classified by geographic area. “New England Species” include red hake, witch flounder (*Glyptocephalus cynoglossus*), windowpane flounder (*Scophthalmus aquosus*), Atlantic sea herring (*Clupea harengus*), clearnose skate (*Raja eglanteria*), little skate (*Raja erinacea*), and winter skate (*Leucoraja ocellata*). “Mid-Atlantic Species” include black sea bass (*Centropristis striata*), scup (*Stenotomus chrysops*), bluefish (*Pomatomus saltatrix*), spiny dogfish (*Squalus acanthias*), summer flounder (*Paralichthys dentatus*), and surf clam (*Spisula solidissima*). Species classified as “Highly Migratory” include sand tiger shark (*Carcharias taurus*), sandbar shark (*Carcharhinus plumbeus*), Atlantic sharpnose shark (*Rhizopriondon terraenovae*), scalloped hammerhead shark (*Sphyrna lewini*), tiger shark (*Galeocerdo cuvieri*), and dusky shark (*Carcharhinus obscurus*). “South Atlantic Species” include red drum (*Sciaenops occelatus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), and cobia (*Rachycentron canadum*) (National Oceanic and Atmospheric Administration, Northeast Regional Office n.d.).

As noted in Table 3-6 and Table 3-8, EFH within the designated grids may occur at any life stage of the noted species, and different life stages of the same species may use different habitats. EFH is designated for egg, larval, juvenile and adult life history stages of bony fish, and for egg, neonate/early juvenile, late juvenile/subadult, and adult life history stages of cartilaginous species. Species-specific information, including developmental life stages and habitat, are included in the Essential Fish Habitat Assessment (Appendix F).

3.3 Water Resources

3.3.1 Surface Waters and Water Quality

Surface Waters

Surface waters on Dam Neck Annex include a portion of Redwing Lake, Sadler Pond, and several small ponds and areas of open water, which are associated with the extensive marsh system on the installation (Geo-Marine, Inc. November 2006). The Atlantic Ocean borders the project area.

Tides

The tides at Dam Neck Annex are semi-diurnal, i.e., a tidal cycle consisting of two high tides and two low tides each lunar day, with consecutive high tides of similar height and consecutive low tides also of similar height. According to records from the Sandbridge NOAA tidal station, mean tide range is 3.35 feet and the mean tide level is 1.85 feet (National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center 2009).

Waves

Because of the exposure to the Atlantic Ocean and the Chesapeake Bay, the waves at the installation are relatively long ocean swells and shorter, locally generated waves (U.S. Army Corps of Engineers, Norfolk District May 2001). Waves reaching Dam Neck Annex primarily come from the southeast during the summer and from the northeast during the winter. The highest proportion of swells arrives from the east-northeast and range in height between 1 foot and 6 feet (U.S. Army Corps of Engineers, Norfolk District May 2001).

Water Quality Regulatory Environment

The Clean Water Act (CWA) of 1977 (33 U.S.C. §1251 et seq., which amends the Federal Water Pollution Control Act of 1972) and subsequent amendments were designed to assist in restoring and maintaining the chemical, physical, and biological integrity of waters of the United States. Water quality standards are the foundation of a water-quality-based pollution control program, which is implemented by the states for waterbodies within their jurisdiction. These standards define the goals for a waterbody by designating its uses and setting criteria to protect these uses. The CWA sets water quality standards for all contaminants in surface waters and specifies permitting requirements, delegated to individual states, for discharges of wastewater and storm water to waters of the United States under the National Pollutant Discharge Elimination System (NPDES).

Sections 305(b) and 303(d) of the CWA require states to conduct water quality assessments and report water bodies that do not meet federal water quality standards or that have impaired uses. According to the *2010 305(b)/303(d) Water Quality Assessment Integrated Report* (Virginia Department of Environmental Quality December 2010), the Atlantic Ocean next to Dam Neck Annex is not impaired.

Sandbridge Shoal is 3 nautical miles from shore and is considered a Class I Open Ocean. Numerical criteria for dissolved oxygen have been established by the Commonwealth of Virginia in the Virginia Administrative Code (9 VAC 25-260-50). The minimum for dissolved oxygen is 5.0 milligrams per liter (mg/L) for Class I Open Oceans; however, the borrow area is located outside of Virginia's state territorial waters (i.e., 3 nm).

Section 401 of the CWA requires states to review federal permit applications and certify that the permitted activities will meet state water quality standards. Section 404 of the CWA requires that the U.S. Army Corps of Engineers (USACE) regulate the discharge of dredged or fill materials into waters of the United States, including ocean areas, estuaries, and wetlands. The CWA requires any applicant for a federal license or permit for any activity that may result in a discharge into navigable waters to obtain a certification that states that the discharge will not adversely affect water quality. The Virginia DEQ is responsible for 401 Certification, called the Virginia Water Protection (VWP) permit. VWP permits contain certain conditions to protect water quality.

3.3.2 Floodplains

According to the Federal Emergency Management Act (FEMA) Flood Insurance Rate Maps for Dam Neck Annex, the shoreline is classified predominantly as Zone VE, which refers to a coastal flood zone with a velocity hazard (wave action) and defined base flood elevations. The base flood elevation ranges from 10 feet to 13 feet (Federal Emergency Management Agency 2009). There are also two small areas of Zone AE; the first is located north of the Shifting Sands Beach Club and the second is located at the northern end of the project area, next to the BEQ building (Federal Emergency Management Agency 2009). Both Zone VE and Zone AE are 100-year floodplain areas.

EO 11988 requires federal agencies to identify and consider practicable alternatives to locating incompatible facilities in areas identified as floodplains. Where practicable alternatives are not available, federal structures and facilities must be constructed in accordance with and consistent with the intent of the standards and criteria of the National Flood Insurance Program.

3.3.3 Wetlands

Approximately 522 acres of wetlands have been mapped at Dam Neck Annex (Geo-Marine, Inc. November 2006); however, none of these wetlands are in the beach area.

3.4 Noise

Noise is defined as unwanted sound. Sound is generated by the vibration of sound pressure waves in the air. Sound pressure levels are used to measure the intensity of sound and are described in terms of decibels. The decibel (dB) is a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level.

3.4.1 In-Air Noise

Sound is composed of various frequencies, but the human ear does not respond to all frequencies. Units of sound pressure adjusted to the range of human hearing are measured in A-weighted decibels (dBA). A-weighted decibels place a greater emphasis on frequencies that are detected by people with a normal auditory range by de-emphasizing the very low and very high frequency components of sound.

Existing noise sources along the Dam Neck Annex shoreline are related to the ocean, including breaking waves and the interaction of water, rocks, and sand in the surf area. Noise levels vary with the tide, height of the waves, and the sand-rock composition. In addition, commercial and recreational boating in the area generates noise. Dam Neck Annex is also an active military installation with noise sources that include vehicle traffic, small arms ranges, helicopters, vessels, and training operations.

Table 3-9 lists the typical noise levels of some common sounds in dBA and typical responses to a range of noise levels.

The communities located near the shoreline also generate noise throughout the day, primarily noise from automobile and boat traffic. Noise levels in urban/suburban areas typically range from 60 dBA to 65 dBA in the daytime and 50 dBA to 55 dBA at night (Cowan 1994). The nearest residence is 0.75 miles from the southern boundary of the project area and 1 mile from the northern boundary.

Human response to changes in sound levels depends on a number of factors, including the quality of the sound, the magnitude of the changes, the time of day at which the change takes place, whether the noise is continuous or intermittent, and the individual's ability to perceive the changes. Human ability to perceive changes in noise levels varies widely with the individual. Generally, changes in noise levels less than 3 dBA would be barely perceptible to most listeners, whereas a 10 dBA change is normally perceived as a doubling (or halving) of noise levels.

Table 3-9 Decibel Levels of Some Common Sounds

Sound Source	Noise (dBA)	Response/Perception
Carrier deck jet operation	140	
—	130	
Auto horn (3 feet)	115	
Riveting machine	110	Uncomfortable
Shout (0.5 feet)	100	
Subway station; Heavy truck (50 feet)	90	Very annoying
Pneumatic drill (50 feet)	80	Annoying
Freeway traffic (50 feet)	70	Intrusive
Air conditioning unit (20 feet)	60	Moderately loud
Light auto traffic (50 feet)	50	Moderately quiet
Living room	40	
Soft whisper (15 feet)	30	Very quiet
—	10	Just audible
—	0	Threshold of hearing

Source: AgriSafe 2009; Federal Interagency Committee on Noise August 1992; New York State Department of Environmental Conservation June 3, 2003.

Regulations

The City of Virginia Beach Noise Ordinance includes the following requirements:

Nighttime. No person shall permit, operate or cause any source of sound to create a sound level that can be heard in another person's residential dwelling during the hours between 10:00 p.m. and 7:00 a.m. in excess of 55 dBA when measured inside the residence at least four (4) feet from the wall nearest the source, with doors and windows to the receiving area closed.

Daytime. No person shall permit, operate or cause any source of sound to create a sound level in another person's residential dwelling during the hours between 7:00 a.m. and 10:00 p.m. in excess of 65 dBA when measured inside the residence at least 4 feet from the wall nearest the source, with doors and windows to the receiving area closed."

The Code of the City of Virginia Beach prohibits the operation of any bulldozer, crane, backhoe, front loader, pile driver, jackhammer, pneumatic drill, or other construction equipment between the hours of 9:00 p.m. and 7:00 a.m.

3.4.2 In-Water Noise

Sound in the water is composed of different properties than sound in the air. Sound moves 4.5 times faster in water than it does in air, making it a very effective sensory mechanism for species that spend a large part, if not all of their life underwater. Similar to in-air sound, in-water sound uses the dB scale for measurement; however, the reference pressure in-water is re 1 micro Pascal (µPa), whereas in-air it is re 20 µPa.

In-water noise is generated through natural and human-made sources. Natural sources consist of natural seismic activity (i.e., earthquakes), ice, wind, rain and waves, as well as biological sources (Richardson et al. 1995). Human-made sources include commercial shipping traffic, recreational boating, drilling, seismic exploration, and dredging activities (Richardson et al. 1995; Jasny et al. 2005). Noise generated by vessels originates from the reverberation of engine noise on the hull, operating pumps on board the vessel, and propeller cavitation, which creates sound when the bubbles produced by a moving propeller collapse (Jasny et al. 2005). Natural sources of sound have always been present in the marine system; however, manmade sound sources increase the background noise levels and exposure for marine species such as marine mammals, sea turtles, and fish.

Marine mammals use sound for all aspects of life including communication (both social and survival purposes), foraging, and navigation. They can also gather information about their surrounding environment from sounds generated underwater. Manmade sounds generated underwater can affect the way marine mammals receive sounds around them and their behaviors may change to adjust to interfering sounds. Individual reactions to sounds are highly variable across species, age classes within species, and gender (Southall et al. 2007). However, general disturbances due to sound consist of avoidance of the source, temporary habitat displacement, increase in call rate, or change in call frequency, as well as biological disturbances such as injury of the auditory system (Richardson et al. 1995).

Regulations

The Marine Mammal Protection Act (MMPA) of 1972 provides guidance for regulating underwater sound and its interaction with marine mammals. The MMPA has defined levels of harassment. Level A harassment is defined as “any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild.” Level B harassment is defined as “any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.”

NMFS has developed threshold ranges of sound exposure that are used to determine if a marine mammal has the potential to be harassed by manmade sound generated underwater. According to the NMFS, the Level A threshold for cetaceans (all species in the Order Cetacea [i.e., whales, dolphins, and porpoises]) is 180 dB for impulsive sounds only, and for pinnipeds at 190 dB for impulsive sounds only. The Level B threshold for cetaceans and pinnipeds (i.e, seals and sea lions) is 160 dB for impulsive sounds and 120 dB for continuous sounds (70 FR 1871).

3.5 Air Quality

National Ambient Air Quality Standards

The Clean Air Act (CAA) of 1970, 42 U.S.C. 7401 et seq., amended in 1977 and 1990, is the primary federal statute governing air pollution. The CAA designates six pollutants as criteria pollutants, for which National Ambient Air Quality Standards (NAAQS) have been promulgated to protect public health and welfare. The six criteria pollutants are particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). These standards are listed in Table 3-10.

Areas that do not meet NAAQSs are designated as "nonattainment" for that criteria pollutant. Nonattainment status is further defined by the extent the standard is exceeded. There are six classifications of ozone nonattainment status—transitional, marginal, moderate, serious, severe, and extreme—and two classifications of CO and PM_{10} nonattainment status—moderate and serious. The remaining criteria pollutants have designations of either attainment, nonattainment, or unclassifiable. Areas redesignated from nonattainment to attainment are commonly referred to as maintenance areas, indicating the area is in attainment but subject to a U.S. Environmental Protection Agency (EPA)-approved maintenance plan for a specific pollutant.

Dam Neck Annex is in the Norfolk-Virginia Beach-Newport News-Hampton Roads Air Quality Control Region (AQCR). This region is currently in attainment with all NAAQS, as recently designated in April 2012 (U.S. Environmental Protection Agency April 2012). The region had been designated Subpart 2 marginal nonattainment from the 8-hour ozone standard and re-designated to maintenance as of June 1, 2007.

The General Conformity Rule

The General Conformity Rule has been promulgated by the EPA to ensure that the actions of federal departments or agencies conform to the applicable state implementation plan. The General Conformity Rule applies to direct and indirect emissions of criteria pollutants or their precursors that are caused by a federal action, are reasonably foreseeable, and can be controlled practically by the federal agency through its continuing program responsibility. Conformity is demonstrated if the total net emissions expected to result from a federal action in a nonattainment or maintenance area will not:

- Cause or contribute to any new violation of any NAAQS;
- Interfere with provisions in the applicable state implementation plan for maintenance of any standard;

Table 3-10 National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm ($10\ mg/m^3$)	8 hours[1]	None	
	35 ppm ($40\ mg/m^3$)	1 hour[1]		
Lead	$0.15\ \mu g/m^3$	Rolling 3-Month Average	Same as Primary	
	$1.5\ \mu g/m^3$	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm ($100\ \mu g/m^3$)	Annual (arithmetic mean)	Same as Primary	
	0.100 ppm	1-hour[2]	None	
Particulate Matter (PM_{10})	$150\ \mu g/m^3$	24 hours[3]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	$15.0\ \mu g/m^3$	Annual[4] (arithmetic mean)	Same as Primary	
	$35\ \mu g/m^3$	24 hours[5]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8 hours[6]	Same as Primary	
	0.08 ppm (1997 std)	8 hours[7,8]	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (arithmetic mean)	0.5 ppm ($1{,}300\ \mu g/m^3$)	3 hours[1]
	0.14 ppm	24 hours[1]		
	0.075 ppm	1-hour[9]		

Source: U.S Environmental Protection Agency 2011

Notes:

1 Not to be exceeded more than once per year.
2 To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour concentrations at each monitor within an area must not exceed 0.100 ppm.
3 Not to be exceeded more than once per year on average over 3 years.
4 To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed $15.0\ \mu g/m^3$.
5 To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed $35\ \mu g/m^3$.
6 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008).
7 To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
8 The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
9 To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour at each monitor within an area must not exceed 0.075 ppm.

Key:

$\mu g/m^3$ = Micrograms per cubic meter.
mg/m^3 = Milligrams per cubic meter.
PM_{10} = Particulate matter less than 10 microns in diameter.
$PM_{2.5}$ = Particulate matter less than 2.5 microns in diameter.
ppm = Parts per million.

- Increase the frequency or severity of any existing violation; or,
- Delay the timely attainment of a standard, interim emission reduction or milestone including, where applicable, emission levels specified in the applicable state implementation plan for purposes of demonstrating reasonable further progress, attainment, or a maintenance plan.

A federal action is exempt from applying the General Conformity Rule requirements if the action's total net emissions are below the *de minimis* levels (see Table 3-11) specified in the rule or are otherwise exempt per 40 CFR 51.153. Total net emissions include direct and indirect emissions from all stationary point and area sources, construction sources, and mobile sources caused by the federal action.

Table 3-11 *De Minimis* Levels for Exemption from General Conformity Rule Requirements

Pollutant	Tons/Year
Ozone (VOCs or NO_x)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Marginal and moderate ozone nonattainment and ozone maintenance areas outside an ozone transport region	
Volatile organic compounds	100
Nitrogen oxides	100
Marginal and moderate nonattainment and ozone maintenance areas inside an ozone transport region	
Volatile organic compounds	50
Nitrogen oxides	100
CO	
All nonattainment and maintenance areas	100
SO_2 or NO_2	
All nonattainment and maintenance areas	100
Particulate Matter (PM_{10})	
Moderate nonattainment and maintenance areas	100
Serious nonattainment areas	70
Particulate Matter ($PM_{2.5}$)	
Direct Emissions	100
SO_2	100
NO_X (unless determined to not be a significant precursor)	100
VOC or ammonia (if determined to be significant precursors)	100
Lead	
All nonattainment and maintenance areas	25

Source: 40 CFR 51.

Key:
CO = Carbon monoxide.
NO_2 = Nitrogen dioxide.
NO_x = Nitrogen oxides.
PM_{10} = Particulate matter less than 10 microns in diameter.
$PM_{2.5}$ = Particulate matter less than 2.5 microns in diameter.
SO_2 = Sulfur dioxide.
VOC =Volatile organic carbon.

Climate Change and Global Warming

In June 2009, the "Global Climate Change Impacts in the United States" report (U.S. Global Change Research Program) was released. This report provides a compilation of years of scientific research produced by a consortium of experts from 13 United States government science agencies and from several major universities and research institutes (U.S. Global Change Research Program 2009). This report provides the following key findings:

- Climate changes are under way in the United States and are projected to grow.
- Crop and livestock production will be increasingly challenged.
- Threats to human health will increase.

The report notes that early and aggressive action to address climate change has the potential to reduce these impacts and notes that "choices made about emissions in the next few decades will have far-reaching consequences for climate change impacts. Over the long-term, lower emissions will lessen both the magnitude of climate change impacts and the rate at which they appear."

Federal agencies are required to address emissions of greenhouse gases (GHGs) with analysis and emission reduction planning. EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, signed in October 2009, requires federal agencies to increase energy efficiency, measure, report, and reduce GHG emissions, protect waterways with storm water management, control waste, and support sustainable technology and efficient building practices.

In October 2010, the CEQ issued *Guidance on Federal Greenhouse Gas Accounting and Reporting* to establish federal requirements for GHG reporting to comply with EO 13514 (Council on Environmental Quality October 2010). Previously, the CEQ had issued a Memorandum in February 2010 (*Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*; Council on Environmental Quality February 18, 2010). In this guidance, the CEQ affirms the requirements of NEPA and CEQ regulations and their applicability to GHGs and climate change impacts. Compliance with these CEQ guidelines requires an inventory of energy use and related GHG emissions, including the consideration of GHG emission effects of the proposed action and alternatives on EO 13514 goals and the relationship of climate change effects to the proposed action or alternatives.

3.6 Traffic and Transportation

The existing street and traffic networks surrounding Dam Neck Annex are characterized by major highways and well-maintained roads. Interstate 264 (I-264) connects the oceanfront to I-64 and downtown Norfolk. I-264 bisects the city in the east-west direction and runs north of Dam Neck Annex. Atlantic Avenue (Highway 60) changes to General Booth Boulevard south of Rudee Inlet.

Dam Neck Road leads to the only access gate; entry is restricted by military police.

The existing traffic volume is 19,700 vehicles per day on the I-264 eastbound off-ramps leading to Dam Neck Annex. The combined traffic volumes at the I-264 westbound on-ramps are 29,200 vehicles per day. With the addition of the 2012 London Bridge Road on- and off-ramps, the Virginia Department of Transportation predicts traffic volumes at the existing I-264/Lynnhaven Parkway Interchange ramps will decrease to 14,600 vehicles per day eastbound and 22,400 vehicles per day westbound, reducing 2032 traffic volumes by approximately 32%. These improvements leading to Dam Neck Road are projected to increase capacity and safety by widening the roadway from a two-lane to a four-lane divided roadway. The estimated completion date is November 2012 (Virginia Department of Transportation 2011).

Along the northeast side of the city, improvements on Oceana Boulevard have been completed from Virginia Beach Boulevard to General Booth Boulevard and will allow for increased capacity and safety for through traffic on Princess Anne Road, Dam Neck Road, and General Booth Boulevard. This will provide better connections with the base from southern Virginia Beach as well as from Chesapeake. Overall, the roads surrounding Dam Neck Annex are wide and well-maintained (Virginia Beach Department of Planning 2009).

3.7 Navigation

The U.S. Coast Guard (USCG) reports that 1,294 boats are registered in the City of Virginia Beach. Of these, 1,149 are recreational boats, 68 are passenger boats, 40 are commercial fishing boats, 35 are small vessels, and 2 are freight barges (BoatInfoWorld 2011). These numbers do not include smaller recreational and commercial vessels because the USCG typically registers only commercial boats that are used in fishing activities on navigable waters and are larger than 5 net tons. The Virginia DGIF registers any boat propelled by a motor. In 2007, 4,604 vessels were registered in the City of Norfolk and 13,502 vessels were registered in the City of Virginia Beach (Virginia Department of Game and Inland Fisheries 2007).

Rudee Inlet is located at the south end of the Virginia Beach resort area, 1 mile north of Dam Neck Annex. The inlet is a major ocean outlet for several miles of waterfront property and is the source of a large volume of boat traffic. Use of the inlet is estimated to be in excess of 148,000 round trips, primarily recreational. About 10% of trip activity is commercial fishing boats (Commonwealth of Virginia 1999).

3.8 Cultural Resources

Onshore or terrestrial cultural resources typically consist of architectural resources (buildings and structures) and archaeological resources (prehistoric and historic archaeological sites). Offshore or marine cultural resources may consist of prehistoric archaeological resources on submerged landforms, prehistoric and historic archaeological resources along the shoreline, historic shipwrecks, and offshore structures such as underwater pipelines or cables.

Cultural resources that have been included in or determined eligible for inclusion in the National Register of Historic Places (NRHP) in accordance with National Register criterion for significance are considered historic properties. Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations (36 CFR 800) require that federal agencies identify historic properties within the area of potential effects for their undertakings, in order to consider the effects of their undertakings on historic properties (i.e., NRHP-listed or eligible historic properties). The Navy consulted on the proposed action with the Virginia Department of Historic Resources (DHR) under Section 106 of the NHPA (see Appendix A, Agency Correspondence).

The area of potential effects (APE) for the proposed project includes a direct APE and an indirect APE. The direct APE at Dam Neck Annex encompasses the SPS, including the proposed beach and dune replenishment areas, and the new proposed manmade dune (see Figures 2-1 and 2-3). The direct APE also includes offshore areas including the nearshore areas off Dam Neck Annex where sand pump-out would occur, and the borrow area(s) at Sandbridge Shoal (see Figure 1-2). The indirect APE encompasses the structures that may be impacted if the proposed action is not implemented, including the BEQ (Building 225) and the gun training complex (Building 127) along Regulus Avenue, the housing area along Gunchie Street, and the Shifting Sands Beach Club at the intersection of Vanguard and Gunchie streets (see Figure 1-3).

Architectural Resources/Historic Properties

In 2009, the Navy evaluated architectural resources constructed between 1942 and 1960 at Dam Neck Annex to identify buildings, structures, or districts that were eligible for inclusion in the NRHP (Sadler & Whitehead Architects, PLC 2009). One additional architectural resource, a 19th century cemetery that is unrelated to Navy activities at Dam Neck Annex and is outside the period of significance for Dam Neck Annex was also evaluated for NRHP-eligibility (Sadler & Whitehead Architects, PLC 2009). Results of the architectural assessment indicated that none of the evaluated architectural resources constructed between 1942 and 1960 at Dam Neck Annex are eligible for listing in the NRHP (Sadler & Whitehead Architects, PLC 2009). The DHR concurred with the findings of the 2009 assessment (Sadler & Whitehead Architects, PLC 2009).

The Navy is currently preparing an evaluation of Cold War architectural resources constructed between 1948 and 1962 at Navy bases in the Hampton Roads area including Dam Neck Annex. The current evaluation effort at Dam Neck Annex is using the findings of the previous assessment and evaluating those architectural resources constructing in 1961 and 1962. The initial stage of the evaluation identified the Surface Launched Guided Missile School Study area has having potential to be eligible for the NRHP as a historic district (Dutton + Associates, LLC July 2011). At the time this EA was prepared, SHPO comments on the initial assessment were pending.

For the purposes of Section 106 of the NHPA, until further research is completed on the Surface Launched Guided Missile School Study area and a final determination on its NRHP eligibility is made, the study area is treated as a historic district. The Surface Launched Guided Missile School Study area consists of a cluster of three buildings, Building 543, 572, and 586, located on the southern portion of Dam Neck Annex along Tartar Avenue. The Surface Launched Guided Missile School study area is not located within the direct or indirect APEs for the proposed actions. Additionally, due to the existing topography, vegetation and buildings, there would be no visual effects on the study area and the three buildings.

Archaeological Resources

Onshore or terrestrial surveys have been conducted at Dam Neck Annex to identify archaeological resources that were eligible for inclusion in the NRHP. These surveys identified a total of 14 archaeological resources at Dam Neck Annex: one prehistoric archaeological site (dating to the Middle Woodland period); 11 historic archaeological sites (dating to the 19th and 20th centuries); and two historic cemeteries (dating to the 19th century) (Sadler & Whitehead, PLC 2009; Southeastern Archaeological Research, Inc. [SEARCH] 2008; Naval Facilities Engineering Command, Atlantic Division 1983).

Results of the onshore/terrestrial archaeological surveys indicated that one archaeological resource at Dam Neck Annex, Site 44VB0308, a prehistoric archaeological site dating to the Middle Woodland period, is NRHP-eligible under National Register Criterion D (Monroe and Jones 2004; SEARCH 2008; Sadler & Whitehead Architects, PLC 2009). None of the other 13 archaeological resources at Dam Neck Annex were determined or recommended NRHP-eligible (SEARCH 2008; Sadler & Whitehead Architects, PLC 2009). The Virginia DHR concurred with the Navy's determinations of significance and NRHP-eligibility for the archaeological resources at Dam Neck Annex (Holma 2007, 2009).

None of the 14 onshore or terrestrial archaeological resources at Dam Neck Annex are in the direct or indirect APEs of the proposed action.

The nearshore marine environment at Dam Neck Annex is deflationary and experiences a high rate of natural erosion. The Navy determined it is highly unlikely that any intact and significant offshore archaeological resources exist that would be eligible for inclusion in the NRHP, and that no archaeological inventory of the offshore portion is warranted. The Virginia DHR has concurred with the Navy's determination (Holma 2011).

Offshore surveys have been conducted previously at the Sandbridge Shoal, including a survey in 1996 for a beach replenishment project at Dam Neck Annex (R. Christopher Goodwin & Associates, Inc. 1996) and one in 2006 for other borrow areas at the Sandbridge Shoal (Watts 2007). The purpose of these offshore surveys was to identify archaeological resources, consisting of shipwrecks and other submerged resources such as prehistoric landforms, pipelines or cable, which may be or may contain resources that were eligible for inclusion in the NRHP. These surveys identified at least four previously recorded shipwrecks outside of, but in the general vicinity of, the Sandbridge Shoal, and records for numerous life-saving efforts for other wrecks in the general vicinity of Dam Neck Annex, suggesting that the potential for offshore cultural resources was relatively high (R. Christopher Goodwin & Associates, Inc. 1996; Watts 2007).

Results of the 1996 remote sensing survey of areas of the Sandbridge Shoal identified six magnetic anomalies; all six were evaluated as unlikely to represent potentially significant (i.e., NRHP-eligible) cultural resources, and no further offshore or marine archaeological surveys were deemed necessary for the 1996 borrow area at Sandbridge Shoal (R. Christopher Goodwin & Associates, Inc. 1996). The Minerals Management Service, forerunner to the BOEM, concurred with the findings of the 1996 survey (Minerals Management Service April 19, 1996). Results of the 2006 remote-sensing survey of additional areas of the Sandbridge Shoal identified evidence for two shipwrecks (one sunken barge and evidence of debris from another shipwreck) and anomalies or clusters of anomalies that were less definitive but could be indicative of complex deposits of cultural material that would indicate shipwreck remains (Watts 2007). Before implementing the proposed action, BOEM will provide the location of sensitive historic resources, and those areas will be avoided during dredging.

3.9 Unexploded Ordnance

The portion of the Atlantic Ocean containing Sandbridge Shoal has been used for military training and testing, including an open-ocean firing range. Because of these military activities, there is a potential for small unexploded ordnance (UXO) to occur in the dredge areas proposed for this project. A 2007 archaeological survey, which employed magnetic remote sensing, detected magnetic anomalies thought to be associated with targets and ordnance from past military activities (Watts 2007). No UXO was encountered during dredging at Sandbridge Shoal conducted by the Navy in 1996 and 2003.

4 Environmental Impacts

This chapter describes and compares the potential environmental impacts, both direct and indirect, of the proposed action and alternatives according to the resource areas described above in Chapter 3. Proposed mitigation measures to minimize or avoid adverse impacts are also discussed for each of the resources evaluated here, if applicable. A summary of all mitigation measures is provided in Chapter 6.

4.1 Land Use, Visual Setting, and Coastal Resources

4.1.1 Land Use

4.1.1.1 Alternative 1

Beach replenishment and dune revegetation under Alternative 1 would occur within the boundaries of Dam Neck Annex and adjacent offshore and nearshore waters. Following completion of Alternative 1, the dune and beach would be restored to their 1996 condition; there would be no changes to current land uses within or near the project area. The beach and dune replenishment would take place over three to six consecutive months, so replenishment activities could temporarily result in having to avoid portions of the beach because of noise and safety concerns. Because the Dam Neck Annex beach is restricted to military personnel, beach closures would not impact the general public.

Alternative 1 would have a beneficial impact on existing land uses because existing facilities inland of the dunes would be better protected from damage during storm events once replenishment is complete. Therefore, Alternative 1 would be consistent with the Dam Neck Annex master planning process.

Alternative 1 would be consistent with the Dam Neck Annex natural resources program goal (as defined in the Dam Neck Annex INRMP) for beaches and dunes protection and shoreline erosion control in the Beaches and Dunes Management Unit. Alternative 1 also would be consistent with the natural resources program goal for outdoor recreation and environmental awareness. Replenishment of the beach would create more beach area for recreation, and replanting the dunes following replenishment would complement earlier dune planting projects. Other resource management goals, or issues, for the Beaches and Dunes Management Unit include coastal zone protection, wetlands and water quality protection, threatened and endangered species protection, and marine resources (marine mammals) protection. Potential temporary impacts on these resources are discussed below. When appropriate, the Navy would employ the mitigation measures described in this section to reduce or avoid temporary, adverse impacts. The Navy would obtain appropriate federal and state permits and concurrences as identified in this EA prior to beginning the replenishment activities.

Because the project area is located on military-owned land with no public access, replenishment and revegetation activities would have no impact on regional land use. One hopper dredge would travel between the Sandbridge Shoal and nearshore waters off Dam Neck Annex. Operation of the dredge would not adversely impact public use of navigable waters.

4.1.1.2 Alternative 2

Under Alternative 2, the Navy would replenish the beach as described under Alternative 1 and would construct dunes with stone cores along approximately half-mile sections of dune on either end of the existing constructed dune. Because natural dunes already exist in these locations, construction of new dunes would not result in a change in land use. Alternative 2 would provide additional protection for a greater number of Navy facilities than Alternative 1, although these facilities are located farther from the coast than the facilities located inland of the original SPS. Beach and dune replenishment and dune construction would take place over six to nine consecutive months, and replenishment activities could result in having to avoid certain portions of the beach because of noise or safety concerns. This would not impact the general public. Like Alternative 1, Alternative 2 would be consistent with the Dam Neck Annex master planning process.

Alternative 2 would be consistent with the Dam Neck Annex natural resources program goal (as defined in the Dam Neck Annex INRMP) for shoreline erosion control in the Beaches and Dunes Management Unit. Alternative 2 would also be consistent with the goal for outdoor recreation and environmental awareness for the same reasons described under Alternative 1. However, Alternative 2 would not be consistent with the goal for beaches and dunes protection. Alternative 2 would result in the destruction of natural dunes from the outer limits of the existing manmade dune to distances of approximately half a mile north and south. The INRMP does not specifically address management of natural dunes separately from management of the manmade dune; however, one goal of the Dam Neck Annex natural resources program is protection of the coastal zone, including primary sand dunes, consistent with the CZMA. Destruction of the natural sand dunes north and south of the existing manmade dune would not be consistent with this goal. Potential temporary impacts on other resources addressed by the Dam Neck Annex INRMP (wetlands and water quality, threatened and endangered species, and marine mammals) under Alternative 2 are discussed below. When appropriate, the Navy would employ the mitigation measures described in this section to reduce or avoid temporary adverse impacts. The Navy would obtain appropriate federal and state permits and concurrences as identified in this EA before beginning the replenishment activities.

Because the project area is located on military-owned land with no public access, replenishment and revegetation activities would have no impact on regional land use. Operation of the hopper dredge between the Sandbridge Shoal and the nearshore waters off Dam Neck Annex would not adversely impact public use of navigable waters.

4.1.1.3 No Action Alternative

Under the No Action alternative, the Navy would not dredge sand from Sandbridge Shoal for beach replenishment, and only maintenance and temporary and emergency repairs would continue. The beach at Dam Neck Annex would continue to deteriorate and erode, exposing the facilities inland of the SPS to damage during storms. Implementation of the No Action alternative would not directly impact land use on the Dam Neck Annex; however, it could indirectly impact land use on the installation, for example, if facilities have to be relocated to more inland locations or vacated due to storm damage or the risk of damage. Relocating any of the coastal facilities on Dam Neck Annex would be constrained by existing environmental and operational land use; therefore, the No Action alternative could have a moderate, adverse, indirect impact on on-base land use.

The No Action alternative would not be consistent with the Dam Neck Annex master planning process because it would expose existing facilities to the risk of damage during storms. Likewise, the No Action alternative would not be consistent with the natural resources program goals for shoreline erosion control, beaches and dunes protection, or outdoor recreation and environmental awareness because this alternative would not fully address ongoing erosion of the Dam Neck Annex beach and constructed dune. Implementation of the No Action alternative would not result in impacts on wetlands and water quality, threatened and endangered species, or marine mammals and, therefore, would be consistent with the natural resources program goals for these resources.

No off-base land is located near the project area; thus, the No Action alternative would have no impact on regional land use.

4.1.2 Visual Setting

4.1.2.1 Alternative 1

Replenishment of the manmade dune and beach under Alternative 1 would have temporary impacts on the visual setting along the shoreline of Dam Neck Annex and public beaches to the south. Temporary impacts would result from the presence of trucks and heavy equipment on the beach and the presence of the hopper dredge, which at times would be close to the shoreline. Trucks and heavy equipment and the hopper dredge may be visible from the northern part of the beach at Sandbridge and the northernmost houses at Sandbridge while work is occurring on the southern part of the SPS. Equipment and vehicles would not be visible from any other non-military lands. Equipment and vehicles would be visible from vessels offshore of Dam Neck Annex. The hopper dredge would be consistent in appearance with other commercial vessels and dredges that operate regularly in the area. From vessels offshore, the view of vehicles and equipment on the beach would be inconsistent with the view of the surrounding beaches.

Visual impacts would be minor and temporary and would cease following completion of the replenishment activities. Vegetation on the dunes likely would appear sparse for a period of several months following replanting of the dunes; however, once the vegetation is established, the dunes would look nearly identical to their condition in 1996. Alternative 1 would have a long-term, beneficial impact on the visual setting because the beach and manmade dune would be replenished and would enhance the appearance of the beach landscape.

4.1.2.2 Alternative 2

Temporary impacts on the visual setting on Dam Neck Annex and the northern part of Sandbridge would be similar to as those described under Alternative 1. Alternative 2 would have a slightly greater long-term, beneficial impact on the visual setting of the beach because the eroded natural dunes north and south of the existing constructed dune would be replaced with larger manmade dunes that are less susceptible to erosion.

4.1.2.3 No Action Alternative

The No Action alternative would have a long-term, moderate adverse impact on visual setting. Continued erosion of the beach and manmade dune would result in a smaller beach area with steeply sheared dunes buffered with discarded Christmas trees and, potentially, exposure of the stone core of the constructed dune, which would diminish the natural look of the beach setting. The No Action alternative also could result in an indirect, long-term adverse impact on the visual setting if the facilities inland of the SPS are damaged during storms.

4.1.3 Coastal Resources

4.1.3.1 Coastal Geography and Physical Oceanography

4.1.3.1.1 Alternative 1

Since 1996, Sandbridge Shoal has been the source of material for replenishment at both Dam Neck Annex and Sandbridge Beach. By 2003, approximately 3,500,000 cy of sand had been removed from the shoal and placed on these two beaches (Hobbs et al. 2008). Potential impacts on the physical environment from removing sand include changes in sediment transport processes and water flow in the vicinity of Sandbridge Shoal. Byrnes et al. (2003) showed that shoals with substantial depth had decreased current velocity, sediment convergence, and infilling when compared with shoals with shallower depths. Current velocity immediately downstream of the dredged area at Sandbridge Shoal could temporarily increase, but the amount of change would be expected to be small and cover only a small area. Additionally, if infilling did not occur quickly, wave convergence at Sandbridge Shoal would produce the necessary energy to eventually infill areas where sand was removed. Temporary changes in sediment transport pathways as a result of sand extraction would be expected to return to pre-extraction conditions (Bryne et al. 2003).

Nearshore wave transformation and wave-induced long-shore sediment transport could affect the future shaping of the coastline. Maa and Hobbs (1998) modeled the physical impacts of waves along the stretch of coastline between Virginia Beach and Sandbridge, Virginia, that could be caused by dredging at Sandbridge Shoal. The water depth at Sandbridge Shoal averages 33 feet with a minimum water depth of about 30 feet, and the ambient water depth varies from 39 to 49 feet (Maa and Hobbs 1998). At this depth, only large waves with long periods would potentially be affected by dredging at Sandbridge Shoal. Shorter period waves would travel over the shoal unaffected (Maa and Hobbs 1998). Additionally, the physical impact of waves along this coastline from dredging at Sandbridge Shoal was found by Ma and Hobbes (1998) to be insignificant. Thus, sand extraction at Sandbridge Shoal would not significantly alter wave height and direction at the site of sand extraction by increasing the depth. Inshore of the shoal near Sandbridge Beach, a significant wave energy convergence, particularly for long-period waves coming from the northeast, has been demonstrated, but wave convergence in this area is considered a natural phenomenon (Maa and Hobbs 1998). Erosion from major storms in this area likely would have occurred with or without sand extraction at Sandbridge Shoal.

Wave-breaking conditions vary along the coast because of irregular bathymetry, and this varies the water surface elevation enough that long-shore current can be induced by even a normally incident wave (Maa and Hobbs 1998). This could either increase or diminish any changes in long-shore sediment transport caused by sand extraction at Sandbridge Shoal. Modeled dredging at Sandbridge Shoal has shown that changes in long-shore sediment transport would be insignificant under multiple wave conditions and from all directions (Ma and Hobbs 1998). Small local changes do occur to the north of Sandbridge Beach but there is no significant alteration of the pattern of long-shore sediment transport (Maa and Hobbs 1998).

Permanent changes in offshore geology from sand extraction at Sandbridge Shoal would not be expected. If wave patterns and sediment transport mechanisms were altered near Sandbridge Shoal following dredging, temporary physical changes to the seafloor geomorphology could take place (e.g., substrate type and composition, surface texture, water circulation, and nutrient distribution) (Greene November 2002). Changes in wave patterns and sediment transport mechanisms due to sand extraction at Sandbridge Shoal would only be expected to be minor, and therefore no permanent changes in offshore geology would result.

4.1.3.1.2 Alternative 2

Impacts associated with beach replenishment on coastal geography and physical oceanography under Alternative 2 would be similar to those described under Alternative 1.

4.1.3.1.3 No Action Alternative

Under the No Action alternative, no sand would be dredged from Sandbridge Shoal to replenish the beaches at Dam Neck Annex; only maintenance and temporary and emergency repairs would continue. Under this alternative, the beach would continue to deteriorate/erode placing the installation's infrastructure and terrestrial habitats at increased risk of damage or destruction from storm events. The erosion and the natural processes affecting coastal geography and physical oceanography would continue both at Dam Neck Annex and the Sandbridge Shoal.

4.1.3.2 Coastal Zone Management

4.1.3.2.1 Alternative 1

Alternative 1 would be reasonably likely to affect a land use, water use, or natural resource of Virginia's coastal zone. However, this alternative would be conducted in a manner that is either fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia's CZMP. The Navy's coastal consistency determination (CCD) is included in Appendix B. The Navy received concurrence on its determination from the Virginia DEQ that the proposed action is reasonably likely to affect a land use, water use, or natural resource of Virginia's coastal zone (see Appendix A, Agency Correspondence). However, the proposed action will be fully consistent or consistent to the maximum extent practicable with the enforceable policies of Virginia's coastal zone management program.

Wetlands Management

Due to the elevation and a break in contiguity, no tidal or non-tidal wetlands exist in the dune and back dune area (the project limits) and thus the proposed action would have no effect on wetlands (Rhodes January 30, 2012).

Fisheries Management

The proposed action would have no effect on Virginia's inland fisheries. Dredging at Sandbridge Shoal and beach replenishment at Dam Neck Annex would result in localized impacts on coastal fisheries but would not be expected to affect populations of individual species. The dredging area of the Sandbridge Shoal is located outside of the 3 nautical mile state territorial sea boundary, and thus outside of Virginia's coastal zone. In compliance with the Magnuson-Stevens Fishery and Conservation and Management Act, the Navy has completed an EFH assessment to assess potential impacts on managed fish with designated EFH within Sandbridge Shoal and nearshore waters in the vicinity of the project (see Appendix F, Essential Fish Habitat Assessment).

Mitigation measures will include 1) maintaining shoal morphology during dredging; 2) leaving undisturbed areas of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery; 3) targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity; and, 4) turning the suction in the drag head off when it is lifted off the bottom to prevent possible entrainment of fish species. The hopper inflow will also be fitted with a screen or basket to allow monitoring of the dredge intake. Fuel spill prevention and response plans will also be prepared. These measures would decrease adverse effects on demersal and pelagic finfish, benthic invertebrates, prey species, and supporting habitat in general.

Potential impacts on fisheries in Virginia's state territorial waters from the dispersal of sand along the beach include disturbance of benthic habitat in the surf zone, which could result in decreased availability of prey for fish that feed on benthic organisms. There would also be the potential for a temporary increase in turbidity in the nearshore during sand placement operations.

Best Management Practices (BMPs) would be used to minimize entrainment and turbidity. The turbidity generated would not likely have impacts on populations of individual fish species important to coastal fisheries. As a result, the proposed action under Alternative 1 would be fully consistent with this policy.

Subaqueous Lands Management

Potential impacts on subaqueous lands within Virginia's state territorial sea from removing sand from the Sandbridge Shoal could include changes to sediment transport processes and water flow in the nearshore areas.

Offshore sand extraction could change nearshore wave transformation and wave-induced long-shore sediment transport, thus affecting the future shaping of the coastline. The physical impact of waves along the coastline between the Virginia Beach resort area and Sandbridge due to dredging at the Sandbridge Shoal was found to be insignificant during a modeling study (Maa and Hobbs 1998). Therefore, no changes in long-shore sediment transport would be expected at Dam Neck Annex and the surrounding shoreline.

Changes in wave patterns and sediment transport mechanisms due to sand extraction at Sandbridge Shoal would be expected to be minor. During beach replenishment, Alternative 1 would require that sediment placement extend below mean low water (MLW) and on to state-owned subaqueous bottom. The Navy will submit a Joint Permit Application to obtain a Virginia Marine Resources Commission (VRMC) permit for the use of state-owned bottomlands for the placement of sand in the nearshore area during the replenishment of the beach. Therefore, the proposed action under Alternative 1 would be fully consistent with this policy.

Dunes and Beaches Management

Alternative 1 would repair and replenish the existing constructed sand dune and beach at Dam Neck Annex. The constructed dune would be replenished with sand and shaped to its 1996 dimensions in areas where sand has eroded from the dune. The replenished areas of the dune would be planted with native beach grasses. Beach grasses in the areas to be replenished would be buried by the new sand, but these plants would be replaced with similar species during re-planting. Alternative 1 would include removing sand from the six existing pedestrian crossover bridges; no new pedestrian crossover bridges would be constructed.

Therefore, Alternative 1 would be consistent to the maximum extent practicable with this policy.

Point-Source Air Pollution Control

Alternative 1 would not generate any new point sources of air pollution. Construction emissions, including vehicle and equipment emissions would not exceed *de minimis* levels under the General Conformity Rule, and no significant impact on regional air quality would result. Therefore, the proposed project would be fully consistent with this policy.

Point-Source Water Pollution Control

Alternative 1 would not generate any new point source discharges. A Virginia Pollutant Discharge Elimination System permit would not be required, and the proposed action would have no effect on point-source water pollution control.

Non-Point Source Water Pollution Control

Alternative 1 would not create any new areas of impervious surface on Dam Neck Annex.

As stipulated in 4 VAC 50-30-80, shore erosion control projects are not subject to Virginia Erosion and Sediment Control Laws and Regulations.

Under the Virginia Stormwater Management Program (SMP) Permit Regulations, “land disturbance” or “land-disturbing activity” is defined as a manmade change to the land surface—including any clearing, grading, or excavation associated with a construction activity regulated under the CWA or the Virginia Stormwater Management Program (VSMP) Permit Regulations themselves—that potentially changes its runoff characteristics. Given this definition of disturbance, the proposed action under Alternative 1 would not trigger the compliance requirement because the distribution of sand and shaping of the beach would not change the runoff characteristics of the site. Implementation of BMPs (for vehicle and equipment fueling and maintenance and spill prevention and control measures) would reduce potential impacts on surface water during beach replenishment activities. Therefore, the proposed project would be consistent with this policy to the maximum extent practicable.

Shoreline Sanitation

Alternative 1 would not involve demolition or installation of septic tanks or other wastewater infrastructure. Therefore, Alternative 1 would have no effect on shoreline sanitation.

Coastal Lands Management

The Chesapeake Bay Preservation Act and Management Regulations require localities in Tidewater Virginia to establish local protection ordinances designating Chesapeake Bay resource protection areas (RPAs) or resource management areas (RMAs). The project area on Dam Neck Annex is not in the Chesapeake Bay watershed. No RPAs or RMAs are designated in the project area. Therefore, Alternative 1 would have no effect on coastal lands management.

4.1.3.2.2 Alternative 2
Alternative 2 would not be expected to have significant short- or long-term adverse impacts on the coastal zone. Impacts would be similar to those under Alternative 1.

4.1.3.2.3 No Action Alternative
Under the No Action alternative, maintenance and temporary and emergency repair of the SPS would continue. The No Action alternative represents no change from existing conditions; therefore, preparation of a CCD would not be required for this alternative. If the No Action alternative is selected, the SPS would be vulnerable to additional major erosion during storms, which would damage the constructed dune and put the Navy real estate behind the dune at risk of being severely damaged or destroyed.

4.2 Biological Resources
4.2.1 Terrestrial Vegetation
4.2.1.1 Alternative 1
Under Alternative 1, vegetation growing on the ocean side of the constructed dune would be removed when the dune is replenished with sand and reshaped. However, the dune would be revegetated with the same native plant species used during the installation’s established revegetation program (e.g., American beachgrass, Atlantic coastal/bitter panic grass, switchgrass, saltmeadow hay, and gray goldenrod). Additional species on the Dam Neck Annex’s recommended native sand dune plant species list that could be used include American searocket, swamp rosemallow (*Hibiscus moscheutos*), seaside goldenrod (*Solidago sempervirens*), and sea oats (Naval Facilities Engineering Command Mid-Atlantic November 2010). As a result, adverse impacts on vegetation would be mitigated by restoration of the dune upon completion of the sand replenishment phase. Therefore, overall impacts on terrestrial vegetation under Alternative 1 would be minor.

4.2.1.2 Alternative 2
Under Alternative 2, vegetation growing on the ocean side of the constructed dune would be removed when the dune is replenished with sand and reshaped. Vegetation growing on the ocean side of the natural dunes north and south of the constructed dune also would be removed during construction of the new manmade dunes. Impacted areas of both dunes would be revegetated with the same native plant species used during the installation’s established revegetation program (e.g., American beachgrass, Atlantic coastal/bitter panic grass, switchgrass, saltmeadow hay, and gray goldenrod) or with additional species from the Dam Neck Annex‘s recommended native sand dune plant species list. As a result, adverse impacts on vegetation would be mitigated by restoration of the dune upon completion of the sand replenishment and dune construction phase.

Therefore, overall impacts on terrestrial vegetation under Alternative 2 would be minor.

4.2.1.3 No Action Alternative

Under the No Action Alternative, no vegetation would be removed as a result of replenishment of the constructed dune or new dune construction, as neither replenishment nor construction would occur. Periodic plantings of native grasses and installation of sand fencing would continue per the installation's dune stabilization program. These actions would help slow erosion, but without the beach and sand dune replenishment and reshaping proposed in this EA, the beach and dune would continue to deteriorate and erode at a rate faster than the native grass planting and sand fence installation could mitigate.

4.2.2 Terrestrial Wildlife

4.2.2.1 Alternative 1

Birds

The waterfowl and waterbird species that nest at Dam Neck Annex would be unlikely to nest in the project area because the dune and beach habitats do not provide proper nesting habitat. Waterfowl and waterbirds could forage in the project area and, as mobile species, would likely move to adjacent foraging areas with suitable habitat during construction.

Dam Neck Annex is within the breeding range for several shorebird and seabird species that are known to nest on sandy substrates, including the killdeer, herring gull (*Larus argentatus*), least tern (*Sterna antillarum*), Caspian tern (*Sterna caspia*), common tern (*Sterna hirundo*), royal tern (*Sterna maxima*), gull-billed tern (*Sterna nilotica*), and sandwich tern (*Sterna sandvicensis*). Several of these species are known or likely to nest at the installation. Additionally, these species may forage along the beaches in the proposed project area. Because the project would be conducted primarily in winter, impacts on nesting birds would be minimized. However, if the project is conducted in the spring or summer (i.e., the bird nesting season), a qualified biologist will survey the project area for bird nests prior to the replenishment. If a nest is found, the Navy will work with the USFWS to implement appropriate measures to protect the nest. Adult and juvenile shorebird and seabird species foraging within the project area would likely move to adjacent foraging areas with suitable habitat during construction. Some species (e.g., gulls) would likely be attracted to the dredge because the dredging operation would bring benthic organisms to the surface of the water. Foraging impacts would be temporary. Grippo et al. (2007) found no significant changes in mean waterbird and shorebird abundance following beach replenishment.

The sand dunes in the project area do not provide proper nesting habitat for raptors and forest-dwelling passerine species, although raptors could fly over the project area while foraging. Raptors and passerines would likely avoid the project area while construction activities are occurring.

In addition to potential disturbance from construction, dredging and placing sand would temporarily impact the quality of avian forage within the project area. Dredging would cause fine sediment to be temporarily suspended in the water column, which could decrease the feeding efficiency of some bird species (e.g., terns and gulls). Sand placement would impact invertebrates that some avian species (e.g., sandpipers) rely on for food. This impact would be expected to be temporary, as studies have shown that invertebrate organisms re-colonize beaches relatively quickly (two to seven months) following replenishment (Greene November 2002).

Given these considerations, Alternative 1 would be expected to have minor, temporary impacts on bird populations. Some individuals could be impacted through localized sand placement, but there would be no impact on populations. Because of mitigation, specifically, nest surveys and communication with USFWS to implement appropriate measures to protect any nest if found (if construction is undertaken during the breeding season) impacts on avian species would be reduced or eliminated. The quality of foraging habitat within the project area would be temporarily reduced; however, ample foraging areas occur nearby. In the long-term, Alternative 1 would help prevent the beach and dune environment at Dam Neck Annex from eroding, it would also help maintain avian foraging habitat.

Mammals

The marsh rice rat and white-footed mouse could potentially occur in the maritime dune habitat of the project area. Beach replenishment could impact individuals of these species that would be present during the reshaping of the constructed dune under Alternative 1. However, it would not be expected that individual mortality would affect population levels of these species. Additionally, the quality of foraging habitat and cover within the project area would be temporarily reduced. Sand placement and dune reshaping would impact invertebrates eaten by the marsh rice rat, and dune reshaping would damage vegetation eaten by both the marsh rice rat and the white-footed mouse. These impacts would be temporary, as studies have shown that invertebrate organisms re-colonize beaches relatively quickly (two to seven months) following replenishment (Greene November 2002) and the Navy would revegetate the dune with native plant species. Therefore, Alternative 1 would have a minor impact on terrestrial rodent species.

Herpetofauna

Several lizard and snake species could occur in the maritime dune habitat of the project area. Individuals of these species could be impacted during reshaping of the constructed dune under Alternative 1. However, it would not be expected that population levels of any of these species would be affected. Additionally, the quality of foraging habitat and cover within the project area would be temporarily reduced. Sand placement and dune reshaping would result in a temporary reduction in the number of insects eaten by lizards and could reduce the numbers or displace insects, lizards, mice, and rats eaten by snakes. These impacts would be temporary because the prey species would re-colonize the dunes after revegetation with native plant species. Therefore, Alternative 1 would have a minor impact on terrestrial lizards and snakes.

4.2.2.2 Alternative 2

Birds

The impacts on birds under Alternative 2 would be similar to those under Alternative 1. As with Alternative 1, if the dune work would be conducted during the breeding season, a qualified biologist would survey the project area for nests prior to replenishment. If a nest is found, the Navy will work with USFWS to implement appropriate measures to protect the nest. Alternative 2 would have a minor impact on birds.

Mammals

The impacts on terrestrial mammals under Alternative 2 would be similar to those under Alternative 1. In addition to reshaping the existing constructed dune, new manmade dunes would be constructed on the approximately half-mile sections north and south of the existing constructed dune. Therefore, the minor impacts described for Alternative 1 would occur over a larger area under Alternative 2.

Herpetofauna

The impacts on herpetofauna under Alternative 2 would be similar to those under Alternative 1. In addition to reshaping the existing constructed dune, new manmade dunes would be constructed on the approximately half-mile sections north and south of the existing constructed dune. Therefore, the minor impacts described for Alternative 1 would occur over a larger area under Alternative 2.

4.2.2.3 No Action Alternative

Under the No Action alternative, replenishment of sand on the Dam Neck Annex Beach and constructed dune would not occur, nor would construction of the new manmade dunes. As there would be no construction vehicles on the beach and no dredging or sand placement, there would be no impacts on wildlife in the short-term. However, if no action is taken, the beach and dune would continue to erode, reducing the available wildlife habitat in the long-term.

4.2.3 Aquatic Wildlife

4.2.3.1 Alternative 1

Marine Mammals

Potential direct impacts on marine mammals under Alternative 1 would include collisions with and noise generated by the hopper dredge and other vessels associated with the project. Alternative 1 would require approximately 260 trips to Sandbridge Shoal by the hopper dredge to obtain the necessary quantity of sand for beach replenishment. Hopper dredges produce low-frequency noise at typically less than 1,000 hertz (Hz), with the loudest noises emitted when loading and unloading sand (Thomsen et al. 2009). Noise levels tend to fluctuate and depend on a variety of environmental factors such as substrate and weather as well as the actions and conditions of the dredge itself. Noises from dredging operations are often continuous and can be detected above ambient noise levels many miles from the source. Other sources of underwater noise would be generated by vessels during transit as well as pre-and post-bathymetric surveys, which generally use electromechanical sources such as multi-beam depth sounders, side scan sonar, or chirp sub-bottom profilers (Continental Shelf Associates International, Inc. 2012). A multi-beam system generally operates at 240 kHz, the side-scan sonar generally operates at 100 kHz and 400 kHz, and the chirp profiler operates at 3.5, 12, and 200 kHz (Continental Shelf Associates International, Inc. 2012).

The bottlenose dolphin can be found along the entire Atlantic oceanfront within 1 mile of shore and has been documented multiple times (through stranding reports) in Virginia Beach. As a result, there could be a risk of vessel collision during dredging operations and transit. However, this risk would be low, given the slow speed of the hopper dredge during dredge operations, which would be approximately 2 knots to 4 knots (Global Security 2011a). There is a greater risk for collision while the dredge is transiting between the borrow area and the pump-out stations/buoys. The hopper dredge would likely move at greater speeds during this time, approximately 12 knots to 14 knots, based on the capacity on the proposed hopper dredge (Manson Construction Co. 2008; Conoship 2011). However, due to the mobility of the bottlenose dolphin, the risk of collision during transit is also low.

The bottlenose dolphin is considered a mid-frequency cetacean with a hearing range of 150 Hz to 160,000 Hz (Southall et al. 2007). Peak sensitivity is between approximately 20,000 Hz to 100,000 Hz at approximately 40 dB re 1 µPa to 80 dB re 1 µPa (Richardson et al. 1995). The dredge typically produces sounds at less than 1,000 Hz, so if bottlenose dolphins are present in the vicinity of the borrow area when dredging operations occur, there would be little overlap in frequency ranges between dolphin acoustics and the hopper dredge operations. There is the potential for overlap for non-echolocation calls of bottlenose dolphins with the hopper dredge noise; however, this impact would be expected to be negligible as dolphins are known to approach transiting boats and are often found in areas of heavy vessel traffic and activity with increased low-frequency underwater noise (Richardson et al. 1995).

Noise associated with pre- and post-bathymetric surveys could be within the hearing range of odontocetes (toothed whales [i.e., bottlenose dolphin) present within the project area. The operating frequency of a multi-beam depth sounder is above the hearing range of all cetaceans. The 100 KHz operating frequency of the side-scan sonar is within the hearing range of some cetaceans such as mid- and high-frequency cetaceans, but the 400 kHz frequency is above their hearing. The 3.5 and 12 kHz operating frequencies of the chirp depth sub-bottom profiler would be within the hearing range of all cetaceans, but the 220 kHz operating frequency is above all cetacean hearing ranges. If a multi-beam depth sounder were used it would not be audible to cetaceans, although certain frequencies of the side-scan sonar and the chirp sub-bottom profiler could be within the hearing frequencies of cetaceans. It would not be likely that these sound sources would result in injury (Level A harassment), but there is the potential for some disturbance (Level B harassment). Because of the amount of vessel activity that currently exists in the project area, the short duration of pre- and post-bathymetric surveys would not likely cause disturbance to marine mammals present during the survey work.

In addition to vessel collisions and noise impacts, turbidity impacts and, although unlikely, water quality impacts from fuel spills from the hopper dredge are possible. Borrow operations would result in a temporary increase in turbidity levels; however, rapid dissipation of the particles from the water column would be expected because the substrate in Sandbridge Shoal is 96% sand, with minimal amounts of smaller sized particles (see the below section on fish for more information on turbidity). It would be expected that the bottlenose dolphin could be temporarily displaced as these species would avoid turbid areas (Louis Berger Group November 1999).

Turbidity could also affect foraging success and prey availability. Sediment can irritate the gills of fish that serve as prey, causing them to leave the area. Reduced visibility in turbid waters may also decrease foraging success. However, these impacts would only be expected to be minor because the increased turbidity levels would be temporary and localized, allowing marine mammals to forage in nearby waters until the turbidity plume dissipates. Potential fuel spills would be relatively small, and adequate prevention and response plans will be prepared.

Overall, direct impacts in the form of vessel strikes could occur; however, they would be expected to be minor due to the abilities of the animals to avoid the vessels. Indirect impacts (reduced foraging success and prey availability, turbidity, and fuel spills) would also be minor due to the abilities of the animals to avoid the project area when necessary, availability of suitable habitat elsewhere throughout the coastal area, and incorporation of BMPs to reduce impacts on the water column.

Fish

Dredging activities under Alternative 1 could impact pelagic and demersal fish through increased turbidity, entrainment in the dredge, removal of benthic invertebrates, and potential behavioral changes. As indicated in Section 4.3, Water Resources, dredging increases turbidity when the sand at the borrow site is excavated and when the slurry overflows from the hopper dredge. Turbidity may alter the trophic dynamics of an area by reducing the feeding efficiency of plankton-eating fish (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Direct impacts on adult fish as a result of turbidity include irritation and clogging of gills; sediment deposition can also impact demersal eggs.

Turbidity plumes at Sandbridge Shoal would likely be limited to short duration and minimal spreading due to the dynamic nature of the offshore environment and the grain size of the material being removed. The sediment found at Sandbridge Shoal is composed primarily of medium-grained sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Turbidity created by the removal of sand at the offshore borrow site would likely be similar to sedimentation disturbance caused by natural sediment transport processes (CSA International, Inc. et al. 2009). Sediment plumes up to 6,562 feet from hopper dredges have been recorded for sediments composed of silty clay (LaSalle et al. 1991). Because the sediments found at Sandbridge Shoal are of coarser grain size it would be likely that the plumes would be much smaller. Anchor Environmental (2003) reported that turbidity plume concentrations from hopper dredges in the nearfield can range between 80 mg/L to 475 mg/L and decrease quickly with distance from the dredge. Much less information is available regarding turbidity plumes in offshore environments because disturbed sediments in this environment tend to settle faster due to coarser grain size and dynamic offshore oceanographic conditions, thus reducing the amount of time the sediments are in the water column (CSA International, Inc. et al. 2009). Fish can be entrained in dredges; larval and juvenile fish are often at the greatest risk of entrainment due to their limited mobility and swimming strength (U.S. Army Corps of Engineers and Minerals Management Service June 2009). However, because the fish within the project area are widely distributed spatially and temporally (Slacum et al. 2006), entrainment would be a localized and temporary impact and would result only in minor effects ton fish populations.

Dredging would physically remove sand from the Sandbridge Shoal; the benthic organisms found within the sand would also be removed. Thus, prey for many demersal fish would be diminished, affecting fish in the immediate vicinity of the dredging. The borrow sites could re-colonize with different benthic communities, which may result in a short-term change in the demersal fish population of the area. A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from three months to two and one-half years after the dredging event, depending on the species present, the specific details of the dredging, and environmental conditions (Brooks et al. 2006). The likelihood of re-colonization and recovery of benthic communities is increased by leaving small areas of similar habitat untouched surrounding or adjacent to the disturbed area (Diaz et al. 2004).

The area of the shoal to be dredged is small compared with the larger shoal of similar habitat. At most, approximately 220 acres of the 13,500-acre shoal would be directly impacted by the dredge. This leaves a substantial part of the shoal for displaced species to use as well as providing a source of species for re-colonization of the impacted area following dredging. While, the entire shoal itself is not completely uniform in structure, the minor variability in the shoal morphology and seasonal use of the shoal by species allows for variable distribution of species and a greater reduction of impacts on any one species from dredging.

Some fish may relocate from the area because of the dredging noise. Popper and Hastings (2009) report that various fish species have been found to abandon areas when the sound from human activities surpasses the local ambient noise levels, only to return after the sound source has been removed and ambient noise levels return to normal. Therefore, once dredging is complete, the fish would be expected to return to the area.

Potential impacts on the fish community from placing sand along the beach would include disturbing benthic habitat in the surf zone, which could decrease the availability of benthic organisms for fish who feed on them. Deposition of sand in the nearshore area would bury benthic organisms that serve as prey for pelagic fish species. However, many of the larger mobile benthic species present in the intertidal zone have the ability to burrow through the sand, reducing impacts on these species and their prey (Burlas et al. 2001). The smaller, immobile species would be affected more; however, they tend to have high reproductive rates, which would aid in recovery and re-colonization of the benthic community (Burlas et al. 2001). Burlas et al. (2001) reported recovery times of two months to six and one-half months for the intertidal benthic communities following beach replenishment. Other studies have shown that recovery within the intertidal zone has taken two months to seven months (Hackney et al. 1996) and three months to six months (Jutte et al. 1999 a,b [as cited in Burlas et al. 2001]).

Increased turbidity in the surf zone may also affect fish distribution patterns. Turbidity in the nearshore environment, similar to the offshore environment, would consist of medium-grained sand and would occur in an area of existing natural disturbance (i.e., storm activity, tidal flow, and wave activity). Wilber et al. (2006) reported that turbidity concentrations following beach replenishment (between 34 mg/L and 64 mg/L) were less than those created by storm events (between 81 mg/L and 425 mg/L). It would be expected that the turbidity concentration from Alternative 1 in the nearshore zone would be similar to those reported in Wilbur et al. (2006). A study conducted by Versar, Inc. (January 2004) indicated that turbidity plumes associated with deposition of sand during beach replenishment was short-lived and small, and did not increase local turbidity above background level (i.e., those created by natural disturbance). Elevated turbidity can negatively affect feeding behavior of some fishes and could cause the distribution patterns of fish along the shore to be temporarily changed in the short-term as the fish avoid the area.

Overall, direct and adverse impacts in the form of entrainment could occur. Indirect impacts (reduced foraging success and prey availability, fuel spills, and turbidity) would be minor due to the ability of species to relocate temporarily to acceptable habitat within the Mid-Atlantic Bight region, when necessary, and BMPS incorporated to reduce impacts on the water column.

Benthic Organisms

The primary direct effects on the benthic community under Alternative 1 would be the entrainment of infauna (organisms living within the sediment) and epifauna (organisms that live on the surface of the sediment) within the hopper dredge, and burial of both infauna and epifauna during sand placement. The benthic prey species found on the shoal and sand bottom, such as crustaceans and worms, would likely be impacted during dredging operations. Direct and localized impacts also would occur where anchors are placed for the pump-out stations/buoys and in the anchor-chain sweep areas. These activities would have only a minor impact on the regional benthic community because these types of assemblages, found on shallow, sandy shoals and the flat bottom nearshore areas, are common in Atlantic coastal areas. Similarly, the community found in the dredge area is similar to that in the broad extent of the nearshore continental shelf of the Mid-Atlantic Bight (Diaz et al. 2006).

Deposition of sand could bury the benthic species within the nearshore system; however, these impacts would be expected to be minor due to the dynamic nature of the system and the resiliency of the species found within it (see the above section on fish).

Recovery and re-colonization of the benthic communities in both the borrow area and nearshore area would be expected to occur following the completion of dredging and sand placement. A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from three months to two and a half years after the dredging event, depending on the species present, the specific details of the dredging, and environmental conditions (Brooks et al. 2006). The likelihood of re-colonization and recovery of benthic communities is increased by leaving small areas of similar habitat untouched surrounding or adjacent to the disturbed area (Diaz et al. 2004). Burlas et al. (2001) reported recovery times of two months to six and a half months for the intertidal benthic communities following beach replenishment. Other studies have shown that recovery within the intertidal zone has taken two months to seven months (Hackney et al. 1996) and 3 months to 6 months (Jutte et al. 1999 a,b [as cited in Burlas et al. 2001]).

The re-colonization may not include the same species composition as before dredging and sand placement. The benthic assemblage to re-colonize following dredging or sand placement depends on the species and abundance of animals left to re-colonize the area as well as the season in which re-colonization would occur (Diaz et al. 2004). Re-colonization could alter the benthic community structure, which could also alter the dominant predator species to re-enter the area after dredging (Brooks et al. 2006; Nairn et al. 2004).

The hopper dredge could cause an increase in turbidity that could temporarily disturb the ability of certain organisms to feed, but this effect would be temporary and limited, considering the medium grained sediment particles found in the shoal's sandy bottom environment. Increased turbidities would temporarily cause difficulty in locating prey for predatory taxa, but would not be expected to cause significant adverse effects on species in the area because they can easily migrate to another area to feed (see the previous discussion on fish for information about turbidity). Nearby shoals, and the biota that inhabit them, could also experience increased turbidity and sedimentation, but it would be expected that these impacts also would be temporary and minor.

Overall, the direct and indirect impacts under Alternative 1 would be considered minor impacts on the regional benthic community because the regional benthic community can recolonize over time and because impacts on the benthic organisms would be localized in relation to the larger regional benthic community of the Mid-Atlantic Bight.

Invertebrate Nekton/Macroplankton

Minor impacts on invertebrate nekton/macroplankton, such as squid and jellyfish, would result from implementing Alternative 1. Although squid such as the Atlantic brief squid and the Atlantic bobtail squid have been reported as occurring at the Sandbridge Shoal, these species are widely distributed throughout the offshore areas and are not concentrated within the shoal area. Thus, if entrainment occurs during dredging, no significant loss to the overall populations of these squid or the jellyfish species likely to occur in the offshore areas would result. Additionally, water quality impacts (turbidity) from dredging would be anticipated to result in only minor impacts on invertebrate nekton/macroplankton.

The dispersal and placement of sand along the beach at the Dam Neck Annex under Alternative 1 is anticipated to result in only minor impacts on invertebrate nekton/macroplankton due to the existing dynamic nature of the surf zone and the fact that any turbidity that may result from the placement of the sand would be short-term in nature and limited to the vicinity of the outfall of the pipe.

Therefore, these direct and indirect impacts under Alternative 1 would be considered minor impacts on the regional invertebrate nekton/macroplankton community.

4.2.3.2 Alternative 2

Marine Mammals

Potential impacts on marine mammals under Alternative 2 would be expected to be similar to those under Alternative 1; however, more sand would be needed from the borrow area to construct the new manmade dunes. Under Alternative 2, a larger area would be affected and dredging operations would take more time. The potential for vessel-marine mammal collisions would be increased because the hopper dredge would be operating for a longer period of time and more trips to the shoal would be needed (approximately 400 trips under Alternative 2 versus 260 trips under Alternative 1). Similarly, noise and turbidity impacts and the potential for fuel spills would be increased. These impacts would be longer in duration than under Alternative 1 but would still be temporary impacts. Overall, direct and adverse impacts in the form of vessel strikes could occur; indirect impacts under Alternative 2 (reduced foraging success and prey availability, turbidity, and fuel spills) would be minor.

Fish

The impacts on fish from dredging at the Sandbridge Shoal under Alternative 2 would be similar to those discussed above for Alternative 1 but on a greater scale due to the requirement of a larger quantity of dredged material from the Sandbridge Shoal. The impacts would be longer in duration and impact a larger area of benthic habitat but would still be temporary impacts.

The impacts on fish from the dispersal of sand along the beach under Alternative 2 would be similar to those discussed above for Alternative 1. However, Alternative 2 includes constructing new manmade dunes, which would result in increased levels of disturbance/turbidity than would occur under Alternative 1. However, the borrow substrate is largely medium-grained sand, which should allow for a short suspension time, and coupled with the dynamic nature of the surf zone, turbidity impacts would be temporary and limited to the vicinity of the outfall of the pipe. Therefore, impacts on fish under Alternative 2 would be minor.

Benthic Organisms

The impacts on the benthic community from dredging at the Sandbridge Shoal under Alternative 2 would be similar to those discussed above for Alternative 1 but on a greater scale because a larger quantity of dredged material would be needed from Sandbridge Shoal. However, overall these direct and indirect impacts would be considered minor impacts on the regional benthic community due to the ability of the regional benthic community to recolonize over time and the localized impacts on the benthic organisms in relation to the, larger regional benthic community of the Mid-Atlantic Bight.

Invertebrate Nekton/Macroplankton

The impacts on invertebrate nekton/macroplankton under Alternative 2 would be similar to those discussed under Alternative 1. However, with the greater quantity of sand to be dredged from the Sandbridge Shoal under Alternative 2, there is a slightly increased potential for entrainment of invertebrate nekton/macroplankton in the offshore areas but impacts would still be expected to be minor. Additionally, due to the construction of the new manmade dunes under Alternative 2 coupled with the greater quantity of sand to be dispersed along the beach, there is also a slightly increased potential for greater turbidity impacts under this alternative. However, these impacts would be short-term and limited to the vicinity of the outfall of the pipe. These direct and indirect impacts under Alternative 2 would be considered minor impacts on the regional invertebrate nekton/macroplankton community.

4.2.3.3 No Action

Under the No Action alternative, there would be no dredging or repair of the SPS; therefore, there would be no impacts on marine mammals, fish, benthic organisms, or invertebrate nekton/macroplankton.

4.2.4 Plankton

4.2.4.1 Alternative 1

Plankton are widely dispersed throughout the upper portions of the water column throughout the project area. Under Alternative 1, only minor entrainment of plankton in the dredge would be expected to occur. In addition to entrainment, water released from the dredge and potential decreases in water quality parameters such as turbidity and the slight potential for changes in dissolved oxygen levels could negatively impact plankton communities. However, these impacts would be temporary and localized; only minor impacts would be expected.

Placement of sand in the surf zone along the beach would result in minor temporary impacts on plankton because of the existing dynamic nature of this area. The surf zone is exposed to the open ocean and is always being reworked by waves, tidal activity, and storm activity. Sand placement would result in an increase in turbidity from the resuspension of the sand at the discharge pipe along the beach. This resuspended sediment may temporarily reduce sunlight penetration, which would adversely impact phytoplankton productivity. However, the borrow substrate is largely medium-grained sand, which should allow for a short suspension time, and, coupled with the dynamic nature of the surf zone, turbidity impacts would be temporary and limited. Minor impacts on plankton would be expected under Alternative 1.

4.2.4.2 Alternative 2

Under Alternative 2 the impacts on plankton from dredging at Sandbridge Shoal would be similar to those under Alternative 1. However, with the greater quantity of sand to be dredged from Sandbridge Shoal under Alternative 2, there would be a slightly increased potential for minor entrainment of plankton and similar, but slightly higher, turbidity impacts.

The impacts on plankton from the replenishment of sand along the beach under Alternative 2 would be similar to those under Alternative 1. However, Alternative 2 includes constructing a dune, which would increase the total time to complete the project (six to nine consecutive months under Alternative 2 versus three to six consecutive months under Alternative 1) as well as the levels of disturbance/turbidity compared with Alternative 1. However, the borrow substrate is largely medium-grained sand, which should expedite a short suspension time; this, coupled with the dynamic nature of the surf zone, indicates that turbidity impacts would be temporary and limited to the vicinity of the outfall of the pipe at the various offload locations. Minor impacts on plankton would be expected under Alternative 2.

4.2.4.3 No Action Alternative

Under the No Action alternative, there would be no dredging or in-water activities; therefore, there would be no impacts on plankton.

4.2.5 Threatened and Endangered Species

The Navy prepared a biological assessment (BA) to analyze potential impacts on the federally threatened and endangered species noted in Section 3.2.5.1, Federally Listed Species. The BA was submitted to the USFWS and NMFS. The Navy received concurrence on their effects determinations for the species under USFWS jurisdiction. Because the Navy determined that the proposed action may adversely affect individuals of the federally listed Atlantic sturgeon and non-nesting individuals of the loggerhead and Kemp's ridley sea turtles, the Navy initiated formal consultation with the NMFS. Formal consultation resulted in the NMFS issuing a biological opinion (BO) and an Incidental Take Statement (ITS), where appropriate. Findings from the BA and results of the consultations with the USFWS and NMFS are summarized below. Correspondence between the Navy and USFWS and NMFS, and the BA and BO are provided in Appendices A, D, and E, respectively.

4.2.5.1 Alternative 1

4.2.5.1.1 Federally Listed Species

Whales

Impacts on the blue whale, sei whale, and sperm whale would likely be the same as those species analyzed below. However, since these species are not likely to occur in the project area, the expected effects are considered negligible and are not discussed further.

Under Alternative 1, direct impacts on whales as a result of dredging activities would include vessel collisions and effects of low-frequency noise. Potential vessel collisions are a primary cause of injury and mortality for many whale species. Under Alternative 1, collisions of whales with the hopper dredge would be possible. According to Jensen and Silber (January 2004) there has only been one documented case of a dredge vessel colliding with a whale. On average, collisions with transiting vessels were found to occur at speeds of approximately 18 knots. Approximately 2,800 cy of sand would be removed by the hopper dredge per trip to the Sandbridge Shoal, resulting in approximately 260 trips to obtain the 700,000 cy of sand required under Alternative 1. During this time, the vessel would not be expected to exceed speeds of 12 knots to 14 knots based on the capacity of the proposed hopper dredge, therefore reducing the likelihood of a strike during transit. With only about 361 individuals, the North Atlantic right whale population could be more impacted by vessel collisions than other whale populations (Waring et al. 2011).

Low-frequency noise generated during dredging operations could also directly and negatively affect whales in the project area. Hopper dredge operations produce a low-frequency, continuous noise, typically at less than 1,000 Hz, with the loudest noise emitted during loading and unloading the sand (Thomsen et al. 2009; MALSF February 2011). Noise levels tend to fluctuate and depend on a variety of environmental factors (e.g., substrate and weather) as well as the actions and conditions of the dredge itself. Noise from dredging operations is often continuous and can be detected above ambient noise levels many miles from the source. The NMFS provided results from calculations of predicted noise levels in the vicinity of the dredge (see Appendix E, Biological Opinion). Based on those calculations, source noise levels, within one meter of the dredge, would be approximately 164 dB re 1µPa, and noise levels within 2,605 feet of the dredge could reach 120 dB re 1µPa.

According to current thresholds of harassment under the MMPA, marine mammals could be impacted by dredging noise if individuals were in the immediate vicinity (within 1 meter) of operations. This proximity is unlikely because whales would likely avoid the source of the noise. Noise levels would likely be high enough within at least approximately 2,626 feet of the operations (according to generic Level B thresholds) to disturb whales enough to disrupt their behavioral patterns (National Marine Fisheries Service July 22, 2010; Kurkul October 26, 2011). While noise generated from dredging operations may not be classified as harassment by MMPA criteria beyond 2,625 feet from the source, it is possible that species of protected whales may be affected for several kilometers beyond the source, as the sounds could still be louder than ambient levels. However, these effects would be expected to be negligible.

Baleen whales exhibit greater lower-frequency hearing than other groups of marine mammals, and they may therefore be more susceptible to low-frequency manmade noises similar to those generated during dredging operations (Southall et al. 2007; Thomsen et al. 2009). Finback whales in particular produce two types of sounds—very common 20 Hz pulses and less common sounds reaching up to 150 Hz (Richardson et al. 1995). Humpback whales in particular commonly produce two types of sounds. The first is the humpback “song,” with a range from ≤ 20 Hz to 4 kilohertz (kHz). The second type is called “winter sounds,” which range from 50 Hz to 10 kHz (Richardson et al. 1995). North Atlantic right whales in particular are known to produce moans at less than 400 Hz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species’ hearing range (Richardson et al. 1995).

Low-frequency sounds emitted during dredge operations, may cause direct impacts such as behavioral disruption, alteration of reproduction activities, and communication, and reduced predator avoidance as well as displacement, avoidance of the project area, physiological damage, or impairment (e.g., masking hearing), and even death (Southall et al. 2007). There is no evidence that sound generated during dredging operations has caused physiological damage and death for any whale species. The high-frequencies associated with pre-and post-bathymetric surveys (see Section 4.3.2.1) are above the hearing range of the baleen whales discussed here. Therefore, there would be no effect from this sound source on threatened or endangered whales. Additionally, indirect impacts such as the displacement of prey may negatively affect whales.

Indirect impacts, including the creation of turbidity plumes and the potential for fuel spills, could have temporary negative effects on whales. The size of the plumes and the time taken to settle to background levels of turbidity depend upon water and sediment characteristics as well as the nature of the dredging operations (see Section 4.2.3). Turbidity may affect foraging success and prey availability due to avoidance of the affected area by important prey species. These impacts would be expected to be minor because the increased turbidity would be temporary, and whales could forage in nearby waters until the sediment settled.

Fuel spills from the dredge would be unlikely but possible. Potential spills would be relatively small, and adequate prevention and response plans will be prepared. As a result, any impacts resulting from fuel spills would be expected to be minor.

Mitigation Measures
If dredging is conducted when ESA-protected cetaceans (i.e., the whales listed above) may be present, NMFS-approved protected species observers meeting the observer requirements outlined in Appendix B of the attached BO will be required to monitor the dredge area and the area between the dredge area and pump-out area for protected species (see Appendix E, Biological Opinion). Monitoring for whales would result in spotting individuals in the vicinity of the dredge to prevent collisions with moving vessels. Observations of ESA protected whales within 3,280 feet of the dredging operation will result in an immediate suspension of activity until the individual's protection could be assured. This will reduce the potential for Level B harassment as described above. During night-time operations, the work area will be lit well enough to allow the observer to perform their work safely, effectively, and to the extent practicable. Weekly summary reports will be submitted to the Northeast Region of NMFS by the observers.

NMFS also restricts vessels that are more than 213.2 feet long traveling in United States waters in the mid-Atlantic region from speeds greater than 10 knots between November 1 and April 30 (50 CFR 224.105). The hopper dredge operating under the Dam Neck Annex SPS replenishment project would adhere to these guidelines, reducing the potential for collisions with cetaceans. Additionally, dredge operators will conform to the regulations prohibiting approaching North Atlantic right whales closer than 1,500 feet (50 CFR 224.103(c)) and other threatened or endangered whale species no closer than 100 feet. Any vessel within these buffer zones created by a surfacing whale must depart the area immediately at a safe, slow speed. Dredge operators will also monitor the North Atlantic right whale sighting reports to remain informed on the whereabouts of right whales within the vicinity of the action area. These reports include the sighting advisory system (SAS), dynamic management areas (DMAs), and seasonal management areas (SMAs) reports.

Operational techniques and other measures would be considered in an effort to reduce the size and duration of turbidity plumes during dredging. Sediments ideal for beach replenishment (i.e., those with less silt and clay) are also best for minimizing turbidity plumes. As a result, plumes would be expected to be smaller in area and duration for this operation than for other dredging activities.

Fuel spill prevention and response plans will be prepared to reduce the likelihood of vessel fuel spills during fuel transfer or accidents and to minimize the impacts on the local environment if a spill occurs. As a result, the effects of any spills would be minor. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Table 4-1 Summary of Proposed Minimization Measures

Marine Mammals and Threatened and Endangered Whales

- NMFS-approved protected species observers, meeting the observer requirements outlined in Appendix B of the attached BO, that are on board the vessel to monitor for sea turtles and Atlantic sturgeon will also be trained to monitor the action area for ESA-protected whales
    - Observations of ESA protected whales within 3,281 feet of the dredging operation will result in an immediate suspension of activity until the individual's protection could be assured
- During night-time dredging operations, the work area would be lit well enough to ensure that observers can perform their work safely, effectively, and to the extent practicable
- Dredge operators will conform to the regulations prohibiting the approach to right whales closer than 1,500 feet (50 CFR 224.103(c)) and other threatened or endangered species of whales no closer than 100 feet
    - Any vessel within these buffer zones created by a surfacing whale must depart the area immediately at safe, slow speed
    - All dredge operators will monitor the right whale sighting reports (including SAS, DMAs, and SMAs) to remain informed on the whereabouts of right whales within the vicinity of the action area
- The hopper dredge will not exceed a speed of 10 knots between November 1 and April 30 to reduce the potential for collisions with whales
- Operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging
- Fuel spill prevention and response plans will be prepared

Threatened and Endangered Birds

- An annual shorebird monitoring program, which will include piping plovers, is scheduled to begin in late FY 2012. These surveys will allow monitoring of the beach pre- and post-replenishment to identify any presence of the piping plover.
    - If a piping plover nest is discovered before or during sand placement, impact-minimization measures such as avoidance of the nesting area will be implemented to avoid potential impacts.
- If sand is placed at a time when sensitive bird species may be present, a qualified biologist will conduct surveys and monitor the project area to ensure that no individuals are directly affected by these activities.
    - If sensitive species are present, impact-minimization measures such as avoiding the area until the birds move on will be implemented to avoid potential impacts.
    - Dam Neck Annex will coordinate with the USFWS to ensure adequate protection in the event that any piping plover nests are discovered.

Table 4-1 Summary of Proposed Minimization Measures

Threatened and Endangered Fish and Essential Fish Habitat

• NMFS-approved protected species observers meeting the observer requirements and following the observer protocol outlined in Appendix B of the attached BO will be onboard the vessel for any dredging occurring throughout the year to monitor the action area for Atlantic sturgeon
• During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable
• Sand from the dredge site will be beach quality and be approximately the same grain size as that of the existing beach area, reducing the potential for increased turbidity
• The shoal morphology will be maintained
• During dredging, sections of benthic habitat within the designated dredged area(s) will be left undisturbed to facilitate benthic re-colonization and recovery
• The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to prevent possible entrainment
• At the off-shore dredge site, a state-of-the-art sea turtle deflector, which will also aid in the deflection of Atlantic sturgeon if they are present, designed to USACE specifications, will be installed on the drag head of the hopper dredge
    o The drag head would be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the action area
    o The hopper inflow would also be fitted with a screen or basket to allow monitoring of the dredge material intake for Atlantic sturgeon and their remains
• Fuel spill prevention and response plans will be prepared
• The Navy will adhere to the following conservation recommendations provided by the NMFS (see Appendix A, Agency Correspondence):
    o Pre- and post-dredging hydrographic surveys will be conducted where dredging is planned.
    o Existing bottom contours will be followed for dredging activities to maintain seafloor ridge and swale heterogeneity.
    o The dredge cut will be limited to a maximum of 2 meters.
    o Rotational dredging will be used to preclude the sequential mining of the same sand ridge on successive maintenance events.
    o The area footprint and time period over which the dredge operates will be minimized.
    o Operational techniques and best management practices will be used during hopper dredging to reduce the size and duration of turbidity plumes and entrainment of threatened and endangered species.
    o A long-term management plan for Sandbridge Shoal will be developed with the NMFS and BOEM before the Navy's next maintenance event.

Table 4-1 Summary of Proposed Minimization Measures

Threatened and Endangered Sea Turtles

• Sand from the dredge site will be beach quality and be approximately the same grain size as that of the existing beach area, reducing the potential for increased turbidity
• During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable
• At the off-shore dredge site, a state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge
  o The drag head would be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the action area
  o The hopper inflow would also be fitted with a screen or basket to allow monitoring of the dredge material intake for sea turtles and their remains
• The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion),to prevent possible entrainment
• To minimize risks of collisions with turtles, dredging vessels and support boats will not intentionally approach within 300 feet of listed species when in transit
• If nesting occurs at the north or south ends of the beach where active military training takes place or is under threat of regular inundation due to high tides, the nests may need to be relocated. Following the monitoring protocol set out in the Dam Neck Annex INRMP, nest relocation would be the preferred action (Geo-Marine, Inc. November 2006). The USFWS and the VDGIF would be notified prior to any nest relocation and the nest relocation protocol set out in the INRMP would be followed by the monitoring personnel. Through a current agreement with the USFWS Back Bay NWR, the relocated nest would be brought to Back Bay NWR to allow for a more suitable nursery site for the nest.
  o During the nesting and hatching season beach illumination may affect nesting adult turtles and hatchlings. To the maximum extent practicable lighting will be reduced prior to the nesting and hatching season to reduce potential impacts; however, security concerns may make it not feasible to turn off some lights.

Conclusion

The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 1 would have no effect on the blue, sei, or sperm whale. Because these species are unlikely to occur within the action area of the proposed project, NMFS did not include them in their consultation (Colligan May 17, 2011). Alternative 1 may affect, but is not like to adversely affect the finback, humpback, or North Atlantic right whale. The implementation of the minimization measures outlined in Table 4-1 will reduce or eliminate potential impacts. NMFS concurred with this determination (see Appendix E, Biological Opinion).

Birds

Under Alternative 1, replenishment of sand on the beach at the Dam Neck Annex would disturb piping plovers and red knots using the beach for foraging and roosting or passing through the area. Any piping plovers or red knots would be expected to cease their normal foraging, roosting, or flight behavior and fly to adjacent areas with suitable foraging or roosting habitat or, if flying, to alter their flight paths to avoid the area where the activity is occurring. This disturbance would be expected to be temporary, with piping plovers and red knots resuming use of the beach once the sand has been placed. Following placement of the sand, beachgrass would be planted on the dune next to the new beach. This activity may result in a similar temporary disturbance of piping plovers or red knots.

Placing sand on the beach may also disrupt piping plover and red knot foraging by impacting invertebrate organisms that these species rely on for food. However, this impact would be expected to be temporary as studies have shown that invertebrate organisms re-colonize beaches relatively quickly (two months to seven months) following replenishment (Greene November 2002).

Under Alternative 1, dredging and pumping sand onto the beach could disturb roseate terns foraging offshore or passing through the area. Any roseate terns would be expected to cease their normal foraging or fly to adjacent areas with suitable forage or, if flying, to alter their flight paths to avoid the area where the activity is occurring. This disturbance would be expected to be temporary, with roseate terns resuming normal foraging behavior once construction is completed.

Mitigation Measures
The Navy began surveying for piping plover nests at Dam Neck Annex in 2010 and the surveys are expected to continue. An annual shorebird monitoring program is scheduled to begin in late FY 2012 that will allow for monitoring pre- and post- replenishment to identify the presence of the piping plover and red knot. If a piping plover nest is discovered before or during sand placement, mitigation measures such as avoidance of the nesting area would be implemented to avoid potential impacts. The Navy will coordinate with the USFWS regarding nest protection measures if any piping plover nests are discovered.

If sand placement occurs when sensitive avian species may be present, a qualified biologist will conduct surveys and monitor the project area for those species. If these species are present, mitigation measures such as avoiding the area until the birds move on will be implemented to minimize potential impacts. Proposed minimization measures for federally listed threatened and endangered bird species are summarized in Table 4-1.

Conclusion
The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 1 may affect but is not like to adversely affect the piping plover, or roseate tern and will not jeopardize the red knot. The USFWS concurred with the impact determination for the piping plover and roseate tern (Schultz November 3, 2011, May 25, 2012). Because the red knot is not currently listed as a threatened or endangered species, it was not included in the consultation with the USFWS although the USFWS encourages any management that reduces threats to the species (Schultz November 3, 2011).

Fish

The discussion below is limited to the Atlantic sturgeon and the sand tiger shark because the shortnose sturgeon is believed to have been extirpated from Virginia coastal rivers and rarely occurs in the ocean.

Under Alternative 1, impacts on fish from dredging activities at the Sandbridge Shoal could include entrainment, loss of benthic organisms serving as prey, disruption of normal feeding behaviors, and potential vessel collision. Hopper dredge entrainment is a potential impact for the juvenile Atlantic sturgeon and sand tiger sharks; adults of both species should not be susceptible to dredging entrainment because of their large size. Juvenile Atlantic sturgeon are primarily benthic feeders, placing them at greater risk of entrainment. Entrainment is thought to occur when the drag head is moving along the bottom at the same time that fish are feeding or resting near the bottom.

The preferred food sources of Atlantic sturgeon are relatively slow-moving benthic organisms; the number of these organisms would be reduced by bottom-scouring during dredging. Thus, a short-term decrease in available prey would result (see Section 4.2.3, Aquatic Wildlife, for more information on impacts on benthic prey at Sandbridge Shoal). Indirect impacts on benthic organisms adjacent to the shoal could also result from turbidity plumes during dredging. However, because resident fish are assumed to be wide-foraging or migratory, they would be expected to be in the vicinity of the shoal for a temporary period. These indirect impacts would not be anticipated for sand tiger sharks because they consume a wide range of prey species, including fish and squid, all of which have the ability to avoid bottom-scouring action and turbidity plumes generated by the hopper dredge.

The abundance of Atlantic sturgeon and sand tiger sharks at the dredge site may also be impacted by increased disruption of feeding behavior due to the noise and human activity associated with the dredging operation. These disturbances could cause individuals of these species to leave the shoal and move into adjacent habitat until the disturbance is complete (Popper and Hastings 2009).

Under Alternative 1, there is a minor potential for Atlantic sturgeon to be struck by vessels; however, there is very limited information on the likelihood of this occurring. Available information indicates that vessel strikes have occurred in spawning rivers (Brown and Murphy February 2010). These strikes may have resulted from reduced clearance between the keel of the ship and the river bottom (Atlantic sturgeon are generally bottom dwellers) and from the confinement of the riverine system. However, Alternative 1 would occur in open water. The draft between the keel of the ship and the ocean bottom would be great enough to avoid bottom interaction. Therefore, it is unlikely that Atlantic sturgeon would be struck by vessels.

Under Alternative 1, the placement of sand along the beach would impact worms, snails, aquatic insects, and crustaceans that serve as primary prey for the Atlantic sturgeon in the nearshore area. These impacts would be temporary because they are associated with the turbidity and shoreline sand mixing from operation of the dredge hose (see Section 4.2.3, Aquatic Wildlife). However, these impacts would be expected to be only minor because the Atlantic sturgeon would be expected to readily adapt to events such as beach replenishment (Hackney et al. 1996). Sand placement at the replenishment site would not affect the foraging or feeding behavior of the sand tiger shark because of the mobility of the shark and its preferred prey species.

Mitigation Measures

To minimize potential impacts on sensitive fish species NMFS-approved protected species observers meeting the observer requirements and following the observer protocol outlined in Appendix B of the attached BO will monitor the action area throughout the year. During nighttime dredging operations, the work area will be lit well enough to allow the observers to perform their work safely, effectively, and to the extent practicable. Mitigation measures may also include removing beach-quality sand from the dredge site, which is approximately the same grain size as the existing beach area, with a low content of fine sediments and organic materials. This would reduce the potential for increased turbidity because sediments that contain high levels of fine sand, silt, or clay may perform poorly and may increase the turbidity levels at the target beach (National Research Council 1995). Mitigation measures may also include maintaining shoal morphology and leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery.

Additionally, the drag head of the hopper dredge will be outfitted with a state-of-the-art sea turtle deflector, which will also aid in the deflection of Atlantic sturgeon, and will be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the action area. At the dredge site, the drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion), to further prevent possible entrainment of Atlantic sturgeon. The hopper inflow will also be fitted with a screen or basket to allow monitoring of the dredge material intake for Atlantic sturgeon and their remains.

Fuel spill prevention and response plans will be prepared to reduce the likelihood of vessel fuel spills during fuel transfer or accidents and to minimize the impacts on the local environment if a spill occurs. As a result, the effects of any spills would be minor. Proposed minimization measures for federally listed threatened and endangered fish species are summarized in Table 4-1.

Conclusion

The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. The shortnose sturgeon is unlikely to occur in the action area. Therefore, Alternative 1 would have no effect this species. Because the shortnose sturgeon is unlikely to occur within the action area of the proposed project, NMFS did not include it in their consultation (Colligan May 17, 2011). Potential impacts on the sand tiger shark and Atlantic sturgeon would include entrainment, loss of prey, disturbance, turbidity, vessel collision, and dredge noise. Due to the risk of entrainment, Alternative 1 may affect and is likely to adversely affect the Atlantic sturgeon. NMFS concurred with this determination in their BO, and provided for the incidental take of one subadult Atlantic sturgeon from any distinct population segment (DPS) due to entrainment during the dredging operation (see Appendix E, Biological Opinion). Incidental takes are those that occur incidentally to and are not the purpose of carrying out an otherwise lawful activity. NMFS determined that this anticipated level of take is not likely to result in jeopardy to any DPS of the Atlantic sturgeon. The NMFS provided reasonable and prudent measures that the Navy must implement as part of the ITS (see Table 4-2). Alternative 1 may affect but will not jeopardize the sand tiger shark. Because the sand tiger shark is not currently listed as a threatened or endangered species it was not included in the consultation with NMFS.

Table 4-2 Reasonable and Prudent Measures to Minimize and Monitor Incidental Take of Atlantic Sturgeon and Sea Turtles

Reasonable and Prudent Measures Related to Hopper Dredging Activities
• NMFS must be contacted within three days before commencement of hopper dredging and again within three days following completion of the dredging activity. Upon contacting NMFS, the Navy shall report to NMFS whether: o Hopper dredges are outfitted with state-of-the-art sea turtle deflectors on the draghead and operated in a manner that will reduce the risk of interactions with sea turtles or Atlantic sturgeon that may be present in the action area o NMFS-approved observer is present onboard the vessel for any hopper dredging occurring in the April 1to November 30 time frame o NMFS-approved observer is present onboard the vessel for any hopper dredging occurring from December 1 to March 31 for Atlantic sturgeon o All hopper dredges are equipped and operated in a manner that provides endangered/threatened species observers with a reasonable opportunity for detecting interactions with listed species and that provides for handling, collection, and resuscitation of turtles injured during project activity o Measures are taken to protect any turtles or sturgeon that survive entrainment in the hopper dredge
Reasonable and Prudent Measures for all Aspects of the Project
• All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to NMFS. • All Atlantic sturgeon that are captured during the project must be scanned for the presence of passive integrated transponder (PIT) tags. Tag numbers must be recorded and reported to NMFS. • Any dead sturgeon must be transferred to NMFS or an appropriately permitted research facility NMFS will identify so that a necropsy can be undertaken to attempt to determine the cause of death. Sturgeon should be held in cold storage. • Any dead sea turtles must be held until proper disposal procedures can be discussed with NMFS. Turtles should be held in cold storage. • All sturgeon and turtle captures, injuries, or mortalities associated with the proposed project must be reported to NMFS within 24 hours.

Sea Turtles

Under Alternative 1, direct impacts on sea turtles as a result of dredging activities include entrainment, vessel collisions, generation of low- frequency noise, and altered prey habitat. Loggerhead sea turtles are the most common sea turtle species that frequents the project area and may be adversely impacted by hopper dredge entrainment. At the dredge site, both hatchling and juvenile sea turtles could be entrained as a result of the centrifugal force of the hopper dredge's pump. The feeding behavior of loggerhead sea turtles places them at greater risk of entrainment, since they are primarily benthic (bottom) feeders. The same is true for the Kemp's ridley sea turtle, another bottom feeder, however they are less common in the area, and therefore at lower risk for entrainment. Entrainment is believed to take place primarily when the drag head is operating on the bottom sediments and individuals are feeding or resting near the bottom at the same time that the drag head is moving along the bottom.

In the North Atlantic region, loggerhead sea turtles were the most frequently entrained sea turtle species during hopper dredging, accounting for 90.5% of the total entrainment. Green and Kemp's ridley sea turtles accounted for 1.6% and 7.9% of entrainment incidents, respectively (U.S. Army Corps of Engineers 2011). Given the green sea turtle's preference for the shallow waters of reefs, bays, inlets, lagoons, and shoals that support growth of various aquatic plants, it is unlikely that they would occur in the vicinity of the shoal. The leatherback sea turtle is a deepwater species and so is also unlikely to be in the vicinity of the dredging. If an occasional leatherback sea turtle did come close to the dredging operations, the possibility of entrainment would be minimized by its large size.

Adult sea turtles may be impacted as a result of collisions with the hopper dredge. Between 200 and 300 dead sea turtles are found annually on Virginia shorelines, and most of these mortalities are attributed to boat collisions (Virginia Department of Game and Inland Fisheries n.d. [g]).

Increased noise and human activity associated with the operation of the hopper dredge could result in sea turtles leaving the shoal. Sea turtles are expected to hear low frequency sounds, in particular within the range of 100 Hz to 1,000 Hz for all species (Ketten and Bartol 2005). Captive sea turtles have been found to increase their swimming rates in the presence of increased low-frequency sounds. (Increased swimming rates serve as a proxy for avoidance behavior in the wild [McCauley et al. 2000; Lenhardt 1994]). Because sea turtles are expected to hear low-frequency sounds, exposure to those sounds from dredging operations would likely cause the animals to avoid the sound source and move into adjacent habitat until the dredging operation is complete. The high-frequencies associated with pre-and post-bathymetric surveys (see Section 4.3.2.1) are above the hearing range of the sea turtles discussed here. Therefore, there would be no effects on threatened or endangered sea turtles from this sound source.

Beach replenishment could also result in the loss of habitat for preferred prey for the loggerhead sea turtle and Kemp's ridley sea turtle, both directly through burial of nearshore habitat and indirectly through increased turbidity. Turbidity can result from suspension of the sand being discharged from the pipe and movement of the sand from the beach. Turbidity has the potential to temporarily disrupt loggerhead, green, and Kemp's ridley sea turtle feeding activities.

Indirect impacts on sea turtles from benthic scouring include loss of benthic populations that are food sources. Additionally, indirect impacts on benthos adjacent to the dredging area could result from turbidity caused by the dredging.

Alternative 1 would not result in any loss of nesting habitat, nests, eggs, or hatchlings of any sea turtle species as beach replenishment would not occur during the sea turtle nesting season.

Over the long-term, Alternative 1 may increase the availability of potential nesting habitat for the loggerhead, Kemp's ridley, and green sea turtle at Dam Neck Annex. The leatherback sea turtle does not nest along the Virginia coastline. Therefore, Alternative 1 would not affect potential nesting habitat for this species.

Mitigation Measures

To minimize potential adverse impacts on sea turtles, sand from the dredge site will be beach-quality and match as closely as possible the existing sand in grain size and have a low content of fine sediments and organic materials. Turbidity would be reduced because sediments that contain high levels of fine sand, silt, or clay may perform poorly and may increase the turbidity levels at the target beach (National Research Council 1995). Additionally, Alternative 1 would be conducted from December 1 through May 15, outside of the sea turtle nesting season.

At the off-shore dredge site, a state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge. The drag head will be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the action area. The drag head of the dredge shall remain on the bottom at all times during a pumping operation (both inside and outside the borrow area), except as outlined in the NMFS Monitoring Specifications for Hopper Dredges (Appendix E, Biological Opinion) to further prevent possible entrainment of turtles. The hopper inflow will also be fitted with a screen or basket to allow monitoring of the dredge material intake for sea turtles and their remains. To minimize risks of collisions with turtles, dredging vessels and support boats will not intentionally approach listed species closer than 300 feet when in transit.

NMFS-approved protected species observers meeting the observer requirements and following the observer protocol outlined in Appendix B of the attached BO will monitor the dredge site for sea turtles and other protected species year round.

During night-time dredging operations, the work area will be lit well enough to allow the observer to perform their work safely, effectively, and to the extent practicable. Weekly summary reports will be submitted to the NMFS Northeast Regional Office by the observers.

Following beach replenishment the Sea Turtle Monitoring Protocol (Geo-Marine, Inc. November 2006) will be implemented during the nesting season (May 15 to September 15) to assure protection of nesting turtles, laid nests, and hatchlings. If eggs are present, the nesting area(s) will be delineated and placed off-limits to vehicular and pedestrian traffic by trained Navy personnel. If nesting occurs at the north or south ends of the beach where active military training takes place or is under threat of regular inundation due to high tides, the nests may need to be relocated. Following the monitoring protocol set out in the Dam Neck INRMP, nest relocation would be the preferred action. The USFWS would be notified prior to any nest relocation and the nest relocation protocol set out in the INRMP would be followed by the monitoring personnel. Through a current agreement with the USFWS Back Bay NWR, the relocated nest would be brought to Back Bay NWR to allow for a more suitable nursery site for the nest.

Lastly, during the nesting and hatching season beach illumination may affect nesting adult turtles and hatchlings. To the maximum extent practicable, lighting will be reduced prior to the nesting and hatching seasons to reduce potential impacts; however, security concerns may make it infeasible to turn off some lights. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion

The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. The hawksbill sea turtle is unlikely to occur in the action area; therefore, Alternative 1 would have no effect on this species. Because the hawksbill sea turtle is unlikely to occur within the action area of the proposed project, NMFS did not include it in their consultation (Colligan May 17, 2011). Although measures to minimize impacts on sea turtles will be implemented, individual loggerhead and Kemp's ridley sea turtles could still be entrained. Therefore, Alternative 1 may affect and is likely to adversely affect these species. NMFS concurred with this determination in their BO and provided for the incidental take of one sea turtle, either a loggerhead or Kemp's ridley (see Appendix E, Biological Opinion). NMFS determined that this anticipated level of take is not likely to result in jeopardy to loggerhead or Kemp's ridley sea turtles. The NMFS provided reasonable and prudent measures that the Navy must implement as part of the ITS (see Table 4-2). Alternative 1 may affect but is not likely to adversely affect the leatherback sea turtle due to its large size and foraging behavior, or the green sea turtle due to its foraging behavior and low occurrence in the action area. The NMFS concurred with this determination.

When the Navy began consultation with the USFWS regarding nesting sea turtles, the USFWS concurred with the Navy's determination of no effect on nesting leatherback, hawksbill, and Kemp's ridley sea turtles because those species were not known to nest in Virginia (Schultz November 3, 2011). However, since then, a Kemp's ridley sea turtle nested at Dam Neck Annex. Therefore, to avoid impact to nesting sea turtles, the Navy will complete the work associated with Alternative 1 between December 1 and May 15. Conducting work outside of the sea turtle nesting season will also likely result in no effect on nesting green and loggerhead sea turtles. In the event that a green or loggerhead sea turtle does nest at the installation, and that nest needs to be relocated due to military activities, the USFWS has amended a BO for the Back Bay NWR to allow the movement of the nest (Schultz May 25, 2012).

Plants

The seabeach amaranth is unlikely to occur in the project area as it prefers undisturbed barrier islands; however, the potential exists for this species to occur at the Dam Neck Annex.

Beach replenishment projects are not believed to be detrimental to this species if they are completed between November 16 and March 31, when the plant has become senescent.

Mitigation Measures

A survey for seabeach amaranth at the Dam Neck Annex is scheduled for 2014. However, beach replenishment would likely occur before this date; therefore, pre-construction surveys will be conducted to determine the presence or absence of the seabeach amaranth within the project area. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion

Because of the potential for the species to occur at the Dam Neck Annex, Alternative 1 may affect, but is not likely to adversely affect, the seabeach amaranth. The USFWS concurred with this determination (Schultz November 3, 2011).

4.2.5.1.2 State-Listed Species

Turtles

The eastern chicken turtle is found in aquatic habitats associated with forests, wetlands, and floodplain forests, not along the beach or in nearshore habitats (Virginia Department of Game and Inland Fisheries n.d.[h]). Thus, this species would not be impacted by the proposed action under Alternative 1.

Reptiles

Canebrake rattlesnakes occupy hardwood and mixed hardwood-pine forests, cane fields, and the ridges and glades of swampy areas. They are more likely to occur in mature hardwood forests containing numerous logs and a layer of leaves and humus (Virginia Department of Game and Inland Fisheries n.d.[i]). The eastern glass lizard is found in dense grass cover on sandy substrates; they use pine flatwoods, mesic hammock, wet meadows, and damp grassy areas (Virginia Department of Game and Inland Fisheries n.d.[j]). Because of these habitat requirements, neither species would be found along the beach or in nearshore habitat and would not be impacted under Alternative 1.

Birds

Habitat requirements preclude the presence of the following avian species in the project area: the upland sandpiper (open pastures, grasslands [Virginia Department of Game and Inland Fisheries n.d.[k]), loggerhead shrike and migrant loggerhead shrike (grasslands [Virginia Department of Game and Inland Fisheries n.d.[l]; Virginia Department of Game and Inland Fisheries n.d.[m]]), Henslow's sparrow (weedy fields, wet meadows, saltmarsh edges [Virginia Department of Game and Inland Fisheries n.d.(n)]), and arctic peregrine falcon (nest sites near rivers, lakes, and marshes [Virginia Department of Game and Inland Fisheries n.d.(o)]).

The following species could occur in the project area based on their habitat requirements:

- Wilson's plover – Breeds near salt water and nests are found on broad sandy beaches beyond the reach of ordinary tides (Virginia Department of Game and Inland Fisheries n.d.[p]).

- Peregrine falcon – Found in terrestrial inland, aquatic, and coastal areas. They are presently nesting on artificial platforms on Virginia's barrier islands (Virginia Department of Game and Inland Fisheries n.d.[q]).

- Gull-billed tern – This species nests on the higher part of the beach but most frequently in sites above normal high tide but low enough to be washed over by surf from occasional winter storms (Virginia Department of Game and Inland Fisheries n.d.[r]).

- Bald eagle – This species prefers coasts, lakes, and rivers; most nest sites are found in the midst of large wooded areas adjacent to bodies of water (Virginia Department of Game and Inland Fisheries n.d.[s]).

Under Alternative 1, impacts on nests will be minimized by conducting most of the work in winter. However, if the project is conducted in the spring or summer (i.e., the bird nesting season), a qualified biologist will survey the project area for bird nests before replenishment. If a nest is found, the Navy will work with the USFWS to implement appropriate measures to protect the nest. Non-nesting adult and juvenile Wilson's plovers, peregrine falcons, and gull-billed terns foraging within the project area would likely move to adjacent foraging areas with suitable habitat during construction. This disturbance is expected to be temporary, with these species resuming use of the beach once the sand has been placed. Following placement of the sand, beachgrass would be planted on the dune adjacent to the new beach. This activity may result in a similar temporary disturbance of these species.

Under Alternative 1, activities associated with dredging and pumping sand onto the beach would result in disturbance to bald eagles foraging or passing through the area. Any bald eagles in the vicinity of these activities would be expected to cease their normal foraging or flight behavior and fly to adjacent areas with suitable forage or, if flying, to alter their flight paths to avoid the area where the activity is occurring. This disturbance is expected to be temporary, with bald eagles resuming normal foraging behavior once these activities are completed.

Given these considerations, Alternative 1 would be expected to have minor, temporary impacts on state-listed bird species. Some individuals could be impacted through localized sand placement, but there would be no impact on populations. Because of mitigation, specifically, nest surveys and communication with the USFWS to implement appropriate measures to protect any nest if found (if construction is undertaken during the breeding season), impacts on state-listed bird species would be reduced or eliminated. The quality of foraging habitat within the project area would be temporarily reduced; however, ample foraging areas occur nearby. In the long-term, because the proposed project would help prevent the beach and dune environment at Dam Neck Annex from eroding, it would also help maintain avian foraging habitat. Therefore, only minor impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle would result from implementing Alternative 1.

Mammals

The Dismal Swamp southeastern shrew and Rafinesque's eastern big-eared bat are inland species that are not found on beaches or in the nearshore environment. Therefore, no impacts on these species would result from implementing Alternative 1.

4.2.5.2 Alternative 2

4.2.5.2.1 Federally Listed Species

Whales

Potential impacts on whales under Alternative 2 would be expected to be similar to those under Alternative 1; however, more sand would have to be dredged to construct the new dunes. This would result in a larger area affected by the dredging and a longer duration of dredging operations compared with Alternative 1. This would increase the potential for vessel-whale collisions because the hopper dredge would be operating for a longer time period and more hopper dredge trips to the shoal would be required (approximately 400 trips under Alternative 2 versus 260 trips under Alternative 1). Similarly, noise and turbidity impacts as well as the potential for fuel spills would increase. These impacts would be longer in duration under Alternative 2 but they would remain temporary impacts.

Mitigation Measures
Mitigation measures under Alternative 2 would be the same as under Alternative 1. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion
The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 2 would have no effect on the blue, sei, or sperm whale. Alternative 2 may affect, but is not like to adversely affect the finback, humpback, or North Atlantic right whale.

Birds
Potential impacts on piping plovers, red knots, and roseate terns under Alternative 2 would be expected to be similar to those under Alternative 1. However, the length of disturbance would be longer under Alternative 2 than under Alternative 1, as the construction of the new dunes under Alternative 2 would require more time than simply placing sand and reshaping the existing dune and beaches.

Mitigation Measures
Mitigation measures under Alternative 2 would be the same as under Alternative 1. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion
The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 2 may affect but is not like to adversely affect the piping plover or roseate tern and will not jeopardize the red knot.

Fish
Potential impacts on the Atlantic sturgeon and the sand tiger shark under Alternative 2 would be similar to those under Alternative 1; however, more sand would have to be dredged to construct the new dunes. This would result in a larger area affected by the dredging and a longer duration of dredging operations compared with Alternative 1, which could increase the potential for entrainment and water quality impacts (turbidity and increased dissolved oxygen levels) as well as avoidance of the area.

Mitigation Measures
Mitigation measures under Alternative 2 would be the same as under Alternative 1. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion

The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 2 would have no effect on the shortnose sturgeon. Due to the risk of entrainment, Alternative 2 may affect and is likely to adversely affect the Atlantic sturgeon. Alternative 2 may affect but will not jeopardize the sand tiger shark.

Sea Turtles

Potential impacts on sea turtles under Alternative 2 would be expected to be similar to those under Alternative 1. However, the length of time that in-water work would occur would increase as more sand would need to be dredged under Alternative 2 than under Alternative 1. This could increase the chances of entrainment and boat collisions because the hopper dredge would be operating for a longer time period. Additionally, more underwater habitat would be disturbed under Alternative 2 than under Alternative 1 as more sand would be dredged from Sandbridge Shoal. This would also cause increased turbidity, potentially impacting surrounding benthic habitat. Finally, dredge hoses placed on the beach to disperse the sand would be in place for a longer period of time under Alternative 2 than under Alternative 1, which can create obstacles to egg-laying female loggerhead sea turtles and green sea turtles.

Mitigation Measures

Mitigation measures under Alternative 2 would be the same as under Alternative 1. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion

The determination of effects is based on the direct, indirect, and cumulative impacts on each species, mitigation measures to be implemented, and whether these effects would have the potential to reduce populations. Alternative 2 would have no effect on the hawksbill sea turtle. Alternative 2 may affect, but is not like to adversely affect the green and leatherback sea turtle. Alternative 2 may affect and is likely to adversely affect the loggerhead and Kemp’s ridley sea turtle.

Plants

Potential impacts on the seabeach amaranth under Alternative 2 would be the same as those under Alternative 1.

Mitigation Measures

Mitigation measures under Alternative 2 would be the same as under Alternative 1. Proposed minimization measures for federally listed threatened and endangered species are summarized in Table 4-1.

Conclusion
Due to the potential for the species to occur at the Dam Neck Annex, Alternative 2 may affect, but is not likely to adversely affect the seabeach amaranth.

4.2.5.2.2 State-Listed Species

Turtles
The eastern chicken turtle is found in aquatic habitats associated with forests, wetlands, and floodplain forests, not along the beach or in nearshore habitats (Virginia Department of Game and Inland Fisheries n.d[h]). Thus, no impacts on this species would result from implementing Alternative 2.

Reptiles
As indicated under Alternative 1, neither the canebrake rattlesnake nor the eastern glass lizard would be found along the beach or in nearshore habitats. Thus, no impacts on these species would result from implementing Alternative 2.

Birds
Potential impacts on Wilson's plover, peregrine falcons, gull-billed terns, and bald eagles under Alternative 2 would be expected to be similar to those under Alternative 1. However, the length of disturbance would be longer under Alternative 2 than under Alternative 1 because constructing the new dunes under Alternative 2 would require more time than simply placing sand and reshaping the existing dune and beaches. Minor, temporary impacts on the Wilson's plover, peregrine falcon, gull-billed tern, and bald eagle would result from implementing Alternative 2.

Mammals
The Dismal Swamp southeastern shrew and Rafinesque's eastern big-eared bat are inland species that are not found on beaches or in the nearshore environment. Therefore, no impacts on these species would result from implementing Alternative 2.

4.2.5.3 No Action Alternative
No beach replenishment actions would be undertaken under the No Action alternative, so there would be no effect on federally listed whales, birds, fish, sea turtles, and plants. Similarly, there would be no impacts on state-listed reptiles, birds, or mammals.

4.2.6 Submerged Aquatic Vegetation
4.2.6.1 Alternative 1
According to preliminary survey results, no SAV occurs in the area offshore of Dam Neck Annex (Orth et al. 2012). If SAV is observed during implementation of Alternative 1, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.

4.2.6.2 Alternative 2

According to preliminary survey results, no SAV occurs in the area offshore of Dam Neck Annex (Orth et al. 2012). If SAV is observed during implementation of Alternative 2, coordination would be undertaken with the appropriate agencies regarding impact minimization measures.

4.2.6.3 No Action Alternative

There would be no impacts on SAV under the No Action alternative.

4.2.7 Essential Fish Habitat

The Navy prepared an EFH assessment to analyze potential impacts on designated EFH as described in Section 3.2.7, Essential Fish Habitat. The Navy provided the assessment to NMFS as part of the EFH consultation process. Following the initial submittal, the Navy provided additional information in response to an NMFS request for clarification. The final EFH Assessment, the clarifications, and the NMFS concurrence with the findings of the assessment can be found in Appendix F, Essential Fish Habitat Assessment. Findings from the EFH assessment and conservation recommendations provided by the NMFS are summarized below.

4.2.7.1 Alternative 1

The primary impact on managed fish and invertebrate species from sand dredging under Alternative 1 would be on the local benthic community both at the borrow area and in the nearshore area. A direct effect on this community would include entrainment of infauna and epifauna that reside within and on the sandy sediment, including the managed surf clam. Similar impacts would occur where anchors are placed and within the chain-sweep areas during anchoring, primarily for pump-out stations/buoys. Placement of the pipeline within intertidal areas and onto the beach would not significantly affect these communities. These activities would have a negligible impact on the regional benthic community because these types of sandy shoal assemblages and flat nearshore bottom habitats are widespread.

The community found within the spatial extent of Sandbridge Shoal is similar to that found in shallow sandy habitats within the broad extent of the nearshore continental shelf of the Mid-Atlantic Bight (Diaz et al. 2006). The benthos at Sandbridge Shoal is likely to be dominated by polychaetes, followed by lesser concentrations of amphipods, bivalves, lancelets, and much smaller concentrations of decapods, nemerteans, echinoderms, sea anemones, gastropods, phoronids, tunicates, isopods, and other crustaceans. Dredging over a four-year period did not have negative environmental consequences on the habitat (Diaz et al. 2006).

Re-colonization of the benthic community assemblages would likely occur following the completion of dredging. A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from three months to two and one-half years after the dredging event, depending on the species present, the specific details of the dredging, and environmental conditions (Brooks et al.

2006). Also, Diaz et al. (2004) reported that the likelihood of re-colonization and recovery of benthic communities is increased by leaving small areas of similar habitat untouched surrounding or adjacent to the disturbed area. Leaving the "No Dredge Zone" of the Sandbridge Shoal untouched under Alternative 1 (see Figure 1-2) would provide a greater chance for the disturbed benthic communities to recover more rapidly and with a similar composition to the pre-dredge conditions.

In addition to direct impacts on the benthic community from dredging, indirect impacts on managed fish species would include diminished availability of bottom-dwelling food resources such as crustaceans and other invertebrates. The benthic prey species found on the shoal's sand bottom, such as crustaceans and worms, would likely be impacted during dredging operations. It is expected that operating the hopper dredge would cause an increase in turbidity that could temporarily disturb the ability of surf clams and other mollusks to feed, but this effect would be temporary and limited, considering the medium-grained sand found at the shoal (see Section 4.2.3, Aquatic Wildlife, for a discussion on turbidity during dredging operations). Finfish may have temporary difficulties finding prey because of increased turbidity, but this effect would be short-term and would be expected to result only in minor adverse effects because they can easily migrate to another area to feed. The dredging would limit feeding within the primary shoal area, but prey would still be accessible in nearby non-affected areas. Nearby shoals, and the biota that inhabit them, could also experience increased turbidity and sedimentation, but it is anticipated that these impacts also would be temporary and minor. Eggs and larvae (neonates) are the life stages that are most likely to be directly affected by a temporary increase in turbidity and potential decrease in dissolved oxygen concentrations caused by dredging. These life stages are more sensitive and are unable to emigrate from the affected area and therefore would be more susceptible to impacts, compared with juveniles and adults.

Finfish inhabiting the sandy bottom of the shoal, such as black sea bass, summer flounder, windowpane flounder, winter flounder, and witch flounder, would temporarily leave the disturbed area when dredging started but would return shortly after dredging operations cease, as has been described in other dredge projects (U.S. Army Corps of Engineers, New England District February 2011). A small number of these fish could become entrained. Juvenile and adult bony finfish found in the water column are highly motile and would likely leave the area during dredging, although a number of these fish, and some of the demersal cartilaginous species (skates), could become entrained. If an adult or juvenile managed species were in the disturbed area when dredging begins, they would likely migrate to another area, returning shortly after the dredging operations cease.

Again, it is possible, though highly unlikely, that one of the managed skates or sharks would become entrained. This is very unlikely due to their low densities in any one area at a given time, and also because of their innate ability to avoid the disturbance that would be expected during dredging operations. Cartilaginous finfish found within the project area (e.g., the clearnose skate, spiny dogfish, sand tiger shark, sandbar shark, and dusky shark) migrate seasonally, moving southward along the Atlantic Coast in search of warmer waters during the winter. They are usually found alone or in pairs when not migrating, so it is unlikely that there would be any significant concentration of these species in the project area, especially in the winter. Pups and small juveniles for these species are primarily found inshore in estuaries and in shallow coastal waters, with adults found more often in offshore areas on sand bottom, shoals, and occasionally in the water column, so impacts on these species would also be negligible. A full description of the impacts on EFH can be found in Appendix F, Essential Fish Habitat Assessment.

Mitigation Measures

The Navy will implement measures to minimize or avoid effects on EFH and managed species based on consultation with federal agencies. Alternative 1 would impact benthos and benthic habitats and managed fish and invertebrate species, some of which are important recreationally and/or commercially.

The benthic community would be expected to begin re-colonization shortly after dredging ends and would be expected to recover to background or pre-dredge conditions within a few years. Mitigation measures that could be incorporated to decrease impacts on EFH include 1) at the off-shore dredge site, a state-of-the-art sea turtle deflector, also useful to prevent entrainment of large fish, will be installed on the drag head of the hopper dredge, and the drag head will be operated in a manner that will reduce the risk of interactions with fish species that may be present in the action area; 2) maintaining shoal morphology; 3) leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery; 4) targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity; 5) attach a screen or basket to the hopper inflow and turning off the suction in the drag head when it is lifted off the bottom to prevent possible entrainment of fish species. These measures would in turn decrease adverse effects on demersal and pelagic fish, benthic invertebrates, prey species, and supporting habitat in general.

Also, fuel spill prevention and response plans will be prepared to reduce the likelihood of vessel fuel spills during fuel transfer or accidents and to minimize the impacts on the local environment should a spill occur. As a result, the effects of any spills would be minor.

The Navy will adhere to the following conservation recommendations provided by NMFS (see Appendix A, Agency Correspondence):

- Pre- and post-dredging hydrographic surveys will be conducted where dredging is planned.

- Existing bottom contours will be followed for dredging activities to maintain seafloor ridge and swale heterogeneity.
- The dredge cut will be limited to a maximum of 2 meters.
- Rotational dredging will be used to preclude the sequential mining of the same sand ridge on successive maintenance events.
- The area footprint and time period over which the dredge operates will be minimized.
- Operational techniques and best management practices will be used during hopper dredging to reduce the size and duration of turbidity plumes and entrainment of threatened and endangered species.
- A long-term management plan for Sandbridge Shoal will be developed with the NMFS and BOEM before the Navy's next maintenance event.

Minor impacts on EFH would be expected under Alternative 1. Implementation of the mitigation measures outlined above would minimize impacts on EFH.

4.2.7.2 Alternative 2

Impacts on EFH as a result of implementing Alternative 2 would be similar to those previously discussed for Alternative 1 but on a larger scale because a larger quantity of dredged material from Sandbridge Shoal is needed. A total of approximately 1,100,000 cy of sand would be required under Alternative 2, whereas approximately 700,000 cy of sand would be required under Alternative 1. Direct impacts on managed fish species and invertebrates would include entrainment of infauna and epifauna that reside within and on the sandy sediment; impacts on the sediment from pump-out station/buoy anchors and anchor-chains (therefore impacting infauna and epifauna); increased turbidity (and increased period of turbidity degradation under Alternative 2 due to a longer dredging period) during dredge operations which would affect feeding opportunities for the benthic community; and entrainment of finfish that could be located in the Sandbridge Shoal area.

Also similar to Alternative 1, there would be indirect effects of implementing Alternative 2 on managed fish species as a result of the aforementioned impacts on the benthic community. Entrainment of epifauna and infauna may result in a decrease of prey for species of finfish that may be located in the area. Similarly, increased turbidity may affect the ability of predatory finfish to locate prey. As a result, these managed fish species may temporarily leave the area during dredging activities; because Alternative 2 requires a larger quantity of sand and therefore a longer period of dredging activity, these fish species may emigrate from the shoal for a proportionally longer length of time.

Mitigation Measures
Mitigation measures under Alternative 2 would be the same as those described under Alternative 1.

Minor impacts on EFH would be expected under Alternative 2. Implementation of the mitigation measures outlined above would minimize impacts on EFH.

4.2.7.3 No Action Alternative
Under the No Action alternative, there would be no dredging or in-water activities; therefore, there would be no impacts on EFH.

4.3 Water Resources
4.3.1 Surface Waters and Water Quality
4.3.1.1 Alternative 1

Surface Waters
Dredging and pumping sand to shore would have a minor, temporary impact on water quality in the Atlantic Ocean. Impacts associated with the proposed action under Alternative 1 are discussed below.

The primary water quality impact during sand dredging operations under Alternative 1 would be increased turbidity. A hopper dredge triggers a small plume at the dredge location and a larger surface plume from the discharge of overspill water with suspended sediment as the sediment (sand) accumulates in the hopper and much of the water empties overboard (Minerals Management Service 2003).

Because the dominant substrate at the borrow site is medium-grain sand, it is expected to settle quickly, resulting in less turbidity (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Studies of the turbidity plumes from trailing hopper dredges along the coast of the United Kingdom demonstrated that coarse sediment fractions (> 2 millimeters [0.08 inches]) settled out instantaneously. Most of the remaining sediment in the plume settled out within 984 feet to 1,640 feet from the dredge over a period of approximately 20 minutes to 30 minutes (Louis Berger Group 1999). The substrate at the shoal is clean sand with a mean grain size of 0.2 millimeters (0.008 inches); thus, it would be expected to similarly settle out. In addition to the sandy substrate, the location of the borrow site in the Atlantic Ocean and the movement of the tides and currents would contribute to the rapid dissipation of the suspended solids (sand) in the water column.

BOEM solicited a project to evaluate dredging equipment and techniques, specifically hopper dredges, to identify existing and emerging dredging technologies that are focused on reducing or avoiding potential adverse effects on the offshore biological and physical environment (Baird and Associates Ltd. and Research Planning, Inc. November 2004). The report prepared as an outcome of the project indicated that it is generally viewed that elevated levels of turbidity generated from tailing suction hopper dredge operations in open ocean waters does not represent a significant ecological impact. Additionally, the findings of the industry survey and literature review completed as part of the project showed that most approaches and equipment development have focused on reducing turbidity levels associated with overflow from hopper dredges. These efforts have reduced the sedimentation footprint associated with the overflow plume to extending to a maximum of approximately 656 feet beyond the dredge area, in locations where ocean currents are not strong (Baird and Associates Ltd. and Research Planning, Inc. November 2004).

The movement of the pipe along the ocean bottom due to currents pushing the pipe would create minor and short-term scour. The amount of scour would depend upon the weight of the pipe and environmental conditions, specifically, tide speeds. Given that the mean tide range is 3.35 feet and the mean tide level is 1.85 feet off of Dam Neck Annex, a large amount of pipeline movement resulting from currents would not be anticipated. Scour impacts would be limited to the period of time that the pipeline would be maintained in the water. Turbidity impacts would not be anticipated due to the movement of the pipeline by the currents; no turbidity plume would be generated.

Additionally, sediments in the surf zone are exposed to the open ocean and are constantly reworked by waves, tidal activity, and storm activity. Previous studies have indicated that turbidity levels increase in the vicinity of the discharge point but do not have an adverse impact on the ecosystems in the surf zone (Lois Berger Group 1999). Impacts on water quality as a result of the potential discharge of hazardous substances and materials from equipment would not be anticipated.

Water Quality Regulatory Environment

The Navy will obtain the following permits and incorporate all permit conditions into the construction drawings and contractor specifications:

- **Section 401 of the CWA:** a **VWP Permit** would be obtained from the Virginia DEQ to comply with Section 401 of the CWA. This permit would ensure that water quality standards are met.

- **Section 404 of the CWA** authorizes the USACE to issue permits regulating the discharge of dredged or fill materials into waters of the United States, including wetlands.

- **Section 10 of the Rivers and Harbors Act of 1899** requires that a permit be obtained for any work in, over, or under navigable waters of the United States. This permit covers construction, excavation, or deposition of materials in, over, or under such waters, or any work that would affect the course, location, condition, or capacity of those waters. Activities requiring Section 10 permits include structures (e.g., piers), and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to navigable waters.

The Joint Permit Application (JPA) process is used by the USACE, the Virginia Marine Resources Commission (MRC), the Virginia DEQ, and local wetlands boards for permitting purposes involving water, wetlands, and dune/beach resources. The USACE regulates activities in waters of the United States under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act of 1899. The Virginia MRC regulates activities on state-owned submerged lands, tidal wetlands, and dunes/beaches under Code of Virginia Title 28.2, Chapters 12 through 14. The Virginia DEQ regulates activities in state waters and wetlands under Section 401 of the CWA; local wetland boards regulate activities in tidal wetlands and dunes/beaches under Code of Virginia Title 28.2, Chapters 13 and 14.

The JPA process includes obtaining each of the permits outlined above (VWP, Section 404, and Section 10 of the Rivers and Harbors Act of 1899, the Virginia MRC permit for encroaching on state-owned bottom land, and local wetland permitting from the Virginia Beach Wetlands Board).

As stipulated in 4VAC 50-30-80, shore erosion control projects are not subject to Virginia Erosion and Sediment Control Laws and Regulations. A shore erosion control project, as defined in the VAC, is an erosion control located on tidal waters and within nonvegetated or vegetated wetlands approved by local wetland boards, the Virginia MRC, the Virginia DEQ, or the USACE.

Under the Virginia Stormwater Management Program Permit Regulations, “land disturbance” or “land-disturbing activity” is defined as a manmade change to the land surface—including any clearing, grading, or excavation associated with a construction activity regulated under the CWA or the VSMP Permit Regulations themselves—that potentially changes its runoff characteristics. Given this definition of disturbance, it is anticipated that the proposed action under Alternative 1 would not trigger the compliance requirement, as the distribution of sand and shaping of the beach would not change the runoff characteristics of the site. With the adherence to permit conditions, only minor impacts on surface waters would result under Alternative 1.

4.3.1.2 Alternative 2

Dredging and pumping sand to shore and constructing a manmade dune would have minor, temporary impacts on Atlantic Ocean water quality. Impacts under Alternative 2 would be similar to those for Alternative 1. Removal of additional sand needed for Alternative 2 and a longer construction period would be associated with higher, but still minor and temporary, turbidity impacts on water quality.

Impacts on water quality as a result of the potential discharge of hazardous substances and materials from equipment would not be anticipated. With the adherence to permit conditions only minor impacts on surface waters under Alternative 2 would result.

4.3.1.3 No Action Alternative
Under the No Action alternative, the SPS would not be replenished. Thus, no impacts on surface waters or water quality would result.

4.3.2 Floodplains
4.3.2.1 Alternative 1
The beach replenishment proposed under Alternative 1 would not be considered incompatible development within a floodplain and thus would not violate the stipulations of EO 11988 or the National Flood Insurance Program.

4.3.2.2 Alternative 2
The beach replenishment and dune construction proposed under Alternative 2 would not be considered incompatible development within a floodplain and therefore would not violate the stipulations of EO 11988 or the National Flood Insurance Program.

4.3.2.3 No Action Alternative
Under the No Action alternative, the SPS would not be replenished. Thus, no impacts on floodplains would result.

4.3.3 Wetlands
4.3.3.1 Alternative 1
No impacts on wetlands would occur under Alternative 1 because there are no wetlands in the project area.

4.3.3.2 Alternative 2
No impacts on wetlands would occur under Alternative 2 because there are no wetlands in the project area.

4.3.3.3 No Action Alternative
Under the No Action alternative, the SPS would not be replenished. Thus, no impacts on wetlands would result.

4.4 Noise
4.4.1 In-Air Noise
4.4.1.1 Alternative 1
Under Alternative 1, the SPS at Dam Neck Annex would be restored to its original condition; the beach would be fully replenished and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions.

Sand for the replenishment would be dredged from an approved borrow area within Sandbridge Shoal, located approximately 3 miles offshore of the project location. A hopper dredge would be used to pump the sand from the Sandbridge Shoal. Once the sand is pulled from the shoal, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge onto the Dam Neck Annex beach through a short pipeline. Bulldozers and front-end loaders would then be used to shape the beach and dune to the original 1996 design.

Noise from the sand pumping operation would be steady. Noise from bulldozers and front-end loaders typically would be intermittent. Table 4-3 shows the average measured "maximum sound level" (L_{max}) associated with the types of construction equipment to be used. The L_{max} is the highest instantaneous noise level measured during a specified period.

Table 4-3 Average Measured L_{max} for Construction Equipment

Construction Category and Equipment	Average Measured L_{max} at 50 Feet (dBA)
Hydraulic Dredge	89
Bulldozer	82
Front-end Loader	79

Source: Federal Highway Administration 2006

Sound Propagation

Noise levels generated by the SPS repair activities were analyzed using a construction noise model to determine projected noise levels at various distances and receptor locations during a typical hour of construction. The algorithm in the model considered construction equipment noise specification data, usage factors, and the relative distances of the noise-sensitive receptor to the source of noise. The following logarithmic equation was used to compute projected noise levels:

$$Lp2 = Lp1 + 10_{log}(U.F.) - 20_{log}(d2/d1):$$

where:

Lp2 = the average noise level (dBA) at a noise sensitive receptor due to the operation of a unit of equipment throughout the day

Lp1 = the equipment L_{max} noise level (dBA) at a reference distance (d1)

U.F. = a usage factor that accounts for a fraction of time an equipment unit is in use throughout the day

d2 = the distance from the receiver to the unit of equipment in feet

d1 = the distance at which equipment noise level data is known (reference distance = 50 feet)

Noise levels (L_{eq}) and usage factor data for construction equipment were obtained from Table 9.1 in the Federal Highway ay Administration's *Construction Noise Handbook* (U.S. Department of Transportation August 2006).

Table 4-4 shows the predicted noise levels from the SPS repair activity at various distances for Alternative 1. Noise levels at the nearest residence to the south end of the project (0.75 miles) would be about 52 dBA and at the nearest residence to the north end of the project (1 mile) about 49 dBA. Some noise would be reduced due to shielding by buildings and atmospheric and ground attenuation depending on the noise propagation path. These estimated exterior noise levels are below the daylight interior sound level limits contained in the City of Virginia Beach Noise Ordinance even without further reduction of noise due to transmission loss through the residential structure.

It is anticipated that construction under Alternative 1 would last for three to six consecutive months and would be conducted only during daylight hours.

Table 4-4 Maximum Construction Noise Levels at Various Distances During SPS Repair under Alternative 1

Construction Equipment	Quantity	Usage Factor %	Lmax SPL @ 50 Feet (dBA)	Distance in Feet/SPL[1] (dBA)				
				50 (adj.)	250	500	1000	1500
Hydraulic Dredge	1	100	89	89	75	69	63	59
Bulldozer	2	40	82	81	67	61	55	51
Front-end Loader	2	40	79	78	64	58	52	48
Composite Noise Level				**90**	**76**	**70**	**64**	**60**

Source: Federal Highway Administration August 2006
[1] SPL = Sound Pressure Level

4.4.1.2 Alternative 2

Under Alternative 2, as with Alternative 1, the SPS at Dam Neck would be restored to its original condition; the beach would be fully replenished and the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. Alternative 2 also would include construction of new dunes, including a stone core, along the approximately half-mile sections of dune north and south of the existing constructed dune.

Impacts of sand pumping, spreading, and shaping on the acoustic environment under Alternative 2 would be similar to those described under Alternative 1. However, because this alternative would also include the construction of a man-made dune with a stone core, additional noise would be generated by transportation and placement of stones for the core.

Table 4-5 shows the predicted noise levels from the SPS repair at various distances for Alternative 2. Noise levels at the nearest residence to the south end of the project (0.75 miles) would be about 52 dBA and at the nearest residence to the north end of the project (1 mile) about 50 dBA. Some noise would be reduced due to shielding by buildings and atmospheric and ground attenuation depending on the noise propagation path. These estimated exterior noise levels are below the daylight interior sound level limits contained in the City of Virginia Beach Noise

Ordinance even without further reduction of noise due to transmission loss through the residential structure.

It is expected that construction under Alternative 2 would last for six to nine consecutive months and would be conducted only during daylight hours.

Table 4-5 Maximum Construction Noise Levels at Various Distances During SPS Repair under Alternative 2

Construction Equipment	Quantity	Usage Factor %	Lmax SPL @ 50 Feet (dBA)	Distance in Feet/SPL[1] (dBA)				
				50 (adj.)	250	500	1000	1500
Hydraulic Dredge	1	100	89	89	75	69	63	59
Bulldozer	2	40	82	81	67	61	55	51
Front-end Loader	2	40	79	78	64	58	52	48
Crane	1	16	81	73	59	53	47	43
Composite Noise Level				**90**	**76**	**70**	**64**	**60**

Source: Federal Highway Administration 2006
[1] SPL = Sound Pressure Level

4.4.1.3 No Action Alternative

Under the No Action alternative, no repairs to the SPS would occur. Existing ambient noise levels would not be affected; therefore, there would be no change to the current acoustic environment.

4.4.2 In-Water Noise

Effects of in-water noise to individual species under both Alternatives 1 and 2 are presented in separate sections, including Aquatic Wildlife-Marine Mammals and Fish (Section 4.2.3), and Threatened and Endangered Species – Whales, Fish, and Sea Turtles (Section 4.2.5).

4.5 Air Quality

Annual criteria pollutant emissions from direct and indirect sources associated with this action were considered to determine the annual impact on the region. Because the Hampton Roads air quality control region (AQCR) is designated as a maintenance area for ozone, the emissions of NO_X and VOCs were evaluated to determine General Conformity Rule applicability. Emissions from construction equipment, including dredging and vessel operations, construction materials delivery, and construction employee commute have been considered, using EPA emission factors and methods (see Appendix C). There are no projected operating emission changes resulting from this project; only temporary construction emissions have been quantified.

4.5.1 Alternative 1

Under Alternative 1, air emissions would result from the operation of equipment on the shore and from the hopper dredge removing sand from the borrow area and transferring the sand to the project site. Marine operations include using two average (1,250 horsepower [hp]) support vessels and a 5,000 hp propulsion marine vessel, equipped with a 5,000 hp dredge, 4,000 hp pump, and 2,000 hp of auxiliary generation. On shore equipment includes two front end loaders and two backhoes. These assumptions are similar to equipment assumptions stated in the June 2009 Environmental Assessment for the Sandbridge Beach Erosion Control and Hurricane Protection Project (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Particulate emissions would also result from sand being disturbed; however, this would not likely include emissions below 10 ppm and thus total particulates emissions have been calculated. These emissions would likely be minimized by the high moisture content of the sand. No other construction materials would be delivered to the site under this alternative. Construction under Alternative 1 would take approximately three to six consecutive months to complete. For on-road emissions, it is assumed that 20 workers would commute to the site for 125 days.

Table 4-6 lists the total projected annual construction emissions under Alternative 1. These projected construction emissions indicate that the proposed action would have a short-term, negligible impact on air quality in the region.

Table 4-6 Annual Emissions, Alternative 1

Emission Source	Emissions per Year (tons)						
	VOCs	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	Total PM
Construction Equipment	3.19	10.84	47.17	0.063	4.23	4.23	4.23
Labor Commute	0.10	0.97	0.07	0.001	0.02	0.22	0.22
Particulate from Sand Moving							0.45
Total	**3.30**	**11.80**	**47.24**	**0.064**	**4.25**	**4.44**	**4.89**

Totals may be different than sum of numbers in column due to rounding.

Key:
CO = Carbon monoxide.
NO_x = Nitrogen oxides.
PM_{10} = Particulate matter less than 10 microns in diameter.
$PM_{2.5}$ = Particulate matter less than 2.5 microns in diameter.
SO_2 = Sulfur dioxide.
VOCs = Volatile organic carbons.

4.5.2 Alternative 2

Construction operations under Alternative 2 would be similar to operations under Alternative 1; however, the construction of new dunes would require more sand as well as stone, which would be delivered by truck. It is assumed that the 70,000 cy of stone required under Alternative 2 would be delivered in 2,240 round trips. The large-size stone would contribute only a minimal increase in particulate emissions. Construction under Alternative 2 would take approximately six to nine consecutive months to complete. For on-road emissions, it is assumed that 20 workers would commute to the site for 200 days.

Table 4-7 lists the total projected annual construction emissions under Alternative 2. These projected construction emissions indicate that the proposed action under

Alternative 2 would have a short-term, negligible impact on air quality in the region.

Table 4-7 Annual Emissions, Alternative 2

	Emissions per Year (tons)						
Emission Source	VOCs	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	Total PM
Construction Equipment	6.60	11.73	49.66	0.065	4.38	4.38	4.38
Labor Commute	0.20	1.68	1.11	0.021	0.75	0.75	0.75
Particulate from Sand Moving							0.55
Total	**6.80**	**13.41**	**50.78**	**0.086**	**5.13**	**5.13**	**5.68**

Totals may be different than sum of numbers in column due to rounding.

Key:
CO = Carbon monoxide.
NO_x = Nitrogen oxides.
PM_{10} = Particulate matter less than 10 microns in diameter.
$PM_{2.5}$ = Particulate matter less than 2.5 microns in diameter.
SO_2 = Sulfur dioxide.
VOCs = Volatile organic carbons.

Conformity Applicability Determination

A federal action is exempt from the General Conformity Rule requirements if the action's total net emissions are below the *de minimis* levels (see Table 3-8) specified in the rule. Since the area is a maintenance area for the 8-hour ozone standard, emissions of NO_X and VOCs must be evaluated. As shown in Tables 4-5 and 4-6, emissions from Alternative 1 and Alternative 2 would be below the *de minimis* threshold of 100 tons per year for NO_X and VOCs. Therefore, a formal conformity determination is not required. A Record of Non-Applicability (RONA) has been prepared for this action (see Appendix C).

GHG Emissions and Climate Change

In February 2010, the CEQ issued *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions* (Council on Environmental Quality February 18, 2010). In this guidance, the CEQ recommends that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2-equivalent GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. Since the estimated GHG emissions from construction would be considerably less than 25,000 metric tons, and there would be no permanent increases in GHG emissions, no further analysis of GHG emissions is warranted.

Research predicts that climate change will have an impact on coastal areas, a result of sea level rise and the increased intensity of storms and storm surges (U.S. Global Change Research Program 2009). The strengthening and maintenance of coastal properties, a primary goal of this project, will be necessary to withstand these changes.

4.5.3 No Action Alternative

Under the No Action alternative, no construction for the beach improvements, repairs, or stabilization would take place. Therefore, there would be no adverse impacts on air quality in the immediate region.

4.6 Traffic and Transportation

4.6.1 Alternative 1

Alternative 1 would generate traffic from construction equipment operators accessing the site. The workforce for sand replenishment would be expected to be small with one or two equipment operators and one hopper dredge operator. Only minor, short-term and intermittent traffic increases would occur; therefore, Alternative 1 would not result in a noticeable increase in traffic given the volume of traffic on Dam Neck Road. The traffic would be consistent with the overall functioning of a military base in an urban/residential environment.

4.6.2 Alternative 2

Alternative 2 would generate traffic from construction equipment operators accessing the site and deliveries of stones for the manmade dune construction. The workforce for sand replenishment would be expected to be small with one or two equipment operators and one hopper dredge operator. Alternative 2 would result in a maximum of 4,480 round-trips within and immediately surrounding Dam Neck Annex to deliver stones for the new manmade dunes. This material would be delivered as needed during the six to nine month construction period. Only short-term and intermittent traffic increases would occur; therefore, Alternative 2 would not result in a noticeable increase in traffic given the volume of traffic on Dam Neck Road. The traffic would be consistent with the overall functioning of a military base in an urban/residential environment.

4.6.3 No Action Alternative

The No Action alternative would result in no change in existing traffic and transportation, as only ongoing maintenance and temporary and emergency repairs of the dunes would continue.

4.7 Navigation

4.7.1 Alternative 1

Under Alternative 1 there would be a minimal increase in marine vessel traffic during beach/dune replenishment, which would cause minor and temporary effects on navigation in the waters surrounding Dam Neck Annex. Although the amount of vessel traffic would increase slightly under Alternative 1, the impact would be related to the entrance and exit of one hopper dredge from Sandbridge Shoal to the beach at Dam Neck Annex. In open water, the hopper dredge would have open and free movement, with negligible, short-term effects on other boats in the area. The addition of one hopper dredge making several trips represents a very small increase that would result in only a minor impact on traffic patterns of recreational or military marine vessels. Therefore, impacts on navigation under Alternative 1 would be expected to be short-term and minor.

4.7.2 Alternative 2

Implementation of Alternative 2 would have minor impacts on navigation at Dam Neck Annex during beach replenishment and marginal impacts on navigation in the vicinity of the sand replenishment and the manmade dune construction, similar to those discussed for Alternative 1.

4.7.3 No Action Alternative

The No Action alternative would result in no impacts on navigation as no sand would be dredged from Sandbridge Shoal. Only maintenance and temporary and emergency repairs of the dunes would continue.

4.8 Cultural Resources

Section 106 of the NHPA of 1966, as amended, and its implementing regulations (36 CFR 800) require that federal agencies consider the effects of their undertakings on historic properties within the APE (i.e., NRHP-listed or eligible historic properties).

The Navy has determined that there is no potential for intact and significant cultural resources or historic properties (i.e., cultural resources included in or determined eligible for inclusion in the NRHP) to exist within the direct or indirect APEs at Dam Neck Annex. Therefore, the Navy has concluded that the proposed action at Dam Neck Annex would result in a finding of no effect on historic properties. The DHR concurred with the Navy's finding (Holma 2011; Appendix A, Agency Correspondence).

The Navy has determined that previously conducted Phase I cultural resources investigations at Sandbridge Shoal have identified some cultural resources that are or appear to be associated with shipwrecks, including some shipwrecks that may require evaluation for NRHP-eligibility and some locations that may require additional investigations to determine whether they are shipwrecks. However, BOEM only permits dredging for borrowing sand from areas of the Sandbridge Shoal that have been previously surveyed and that avoid cultural resources, including those cultural resources that may be potential historic properties. Therefore, the Navy has concluded that the proposed action at Sandbridge Shoal would result in a finding of no effect on historic properties. The DHR concurred with the Navy's finding (Holma 2011; Appendix A, Agency Correspondence).

4.8.1 Alternative 1

Alternative 1 would have no direct or indirect impacts on cultural resources or historic properties within the direct and indirect APEs at Dam Neck Annex because there are no cultural resources or historic properties present within the direct or indirect APEs. If the Navy discovers any previously unknown historic or archaeological remains while implementing Alternative 1, the Navy will notify BOEM and consult with the DHR about any finding. The Navy will initiate required federal and state coordination to determine if the remains warrant a recovery effort or if the site is eligible for listing in the NRHP. Alternative 1 would have no direct impacts on cultural resources within the APE at Sandbridge

Shoal because the Navy would dredge sand from areas that have been previously surveyed and that avoid cultural resources, including those cultural resources that may be potential historic properties. In the event that the dredge operators discover any archaeological resource while dredging at Sandbridge Shoal or during nearshore pump-out operations, the Navy will require that dredge and/or pump-out operations be halted immediately within 1,000 feet of the area of discovery. The Navy will then immediately report the discovery to BOEM. The Navy will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort. If investigations determine that the resource is significant, the parties shall together determine how best to protect it.

Implementation of Alternative 1 would have no effect on historic properties pursuant to Section 106 of the NHPA because there are no historic properties identified within the APEs at Dam Neck Annex and because the Navy would avoid all cultural resources that are identified within the APE for borrow areas at Sandbridge Shoal. Therefore, the Navy has concluded that implementation of Alternative 1 would result in a finding of no effect on historic properties, pursuant to 36 CFR 800.4.d(1). The DHR concurred with the Navy's finding (Holma 2011; Appendix A, Agency Correspondence).

4.8.2 Alternative 2

The impacts of Alternative 2 would be the same as those identified above for Alternative 1. The Section 106 effects determination for Alternative 2 is the same as that identified above for Alternative 1

4.8.3 No Action Alternative

The No Action alternative would have no impacts on cultural resources within the APEs at Dam Neck Annex or at Sandbridge Shoal. Implementation of the No Action alternative would have no effect on historic properties because none are present within the APEs at Dam Neck Annex or at Sandbridge Shoal. Therefore, the Navy has concluded that implementation of the No Action Alternative would result in a finding of no effect on historic properties, pursuant to 36 CFR 800.4.d(1).

4.9 Unexploded Ordnance

4.9.1 Alternative 1

Under Alternative 1, small UXO could be encountered during dredging operations. However, the likelihood of this occurring would be expected to be low, as UXO have not been encountered during past Navy dredging projects at Sandbridge Shoal. As described in Section 4.2.5, Threatened and Endangered Species, a screen or basket will be placed on the inflow of the hopper for the purpose of monitoring the dredge material intake for sea turtle and fish entrainment. Although not the intended purpose, the screen/basket will also help prevent any UXO from entering the hopper and being placed on the beach. Observers monitoring the screen/basket for threatened and endangered species will also monitor for potential UXO. Should any potential UXO pass through or become trapped on the screen, operations would cease and the Navy will call special ordnance handlers to safely remove and dispose of the ordnance. In the event that UXO is not detected as it enters the hopper, a screen could be attached to the outflow pipe on the beach to prevent the UXO from being deposited on the beach. Prior to initiating dredging, the Navy will also consider the use of a screen on the drag head specifically designed to prevent UXO from being pulled into the dredge. NEPA documentation and ESA consultations will be revised as necessary if such a device is used. Because of the low likelihood of occurrence, impacts from UXO would be minor.

4.9.2 Alternative 2

Impacts from UXO under Alternative 2 would be the same as those under Alternative 1.

5 Cumulative Impacts

CEQ regulations for implementing NEPA define cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what other agency (federal or non-federal) or person undertakes such other actions” (40 CFR §1508.7). Cumulative impacts can result from individually minor but collectively significant actions by various agencies (federal, state, and local) or individuals that take place over time. Accordingly, a cumulative impacts analysis must identify and define the scope of other actions and their relationship with the proposed action or its alternatives if there is an overlap in space and time.

5.1 Description of Other Agency Projects

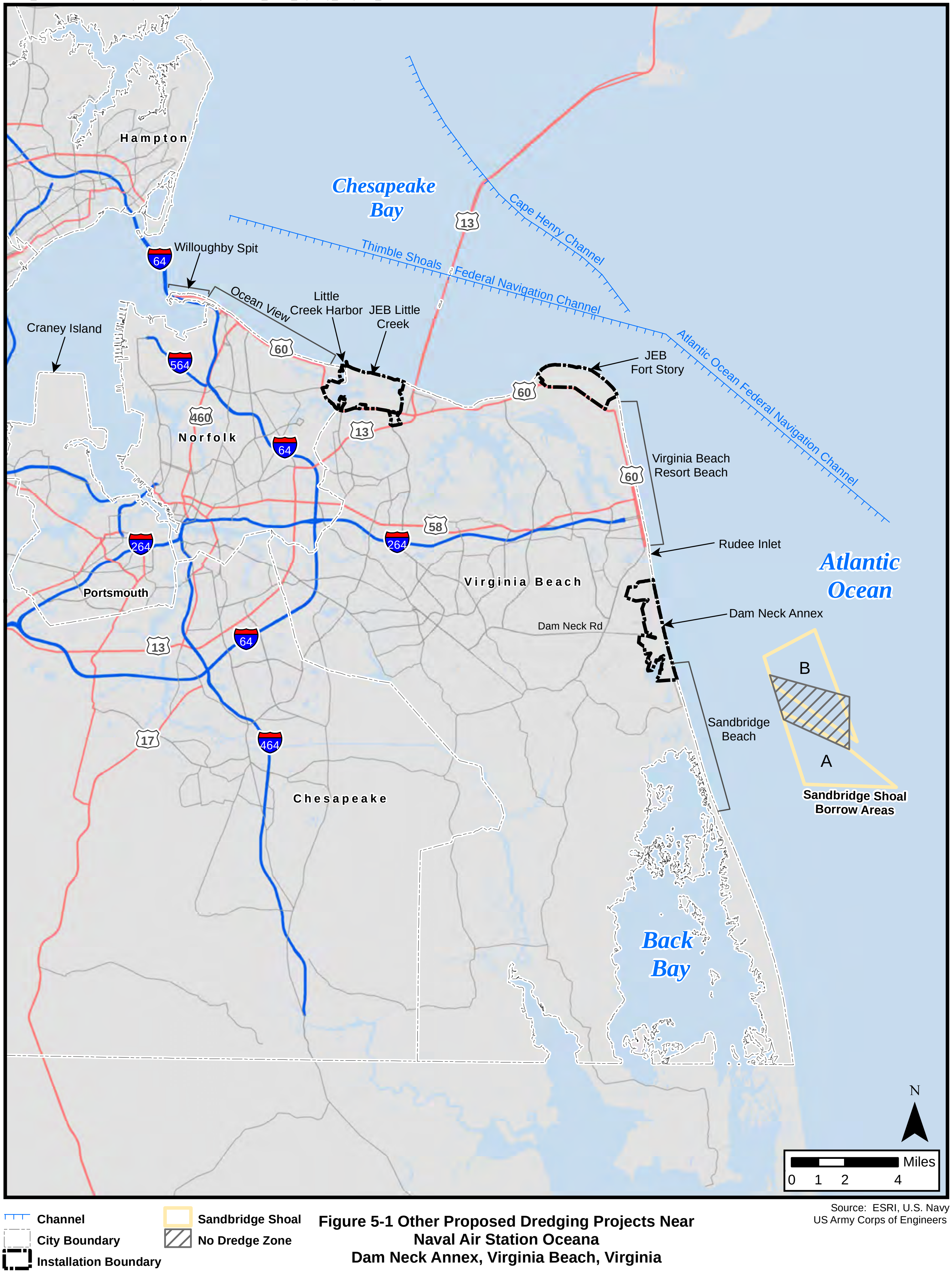
Projects by federal, state, and local agencies that could potentially generate cumulative impacts with the proposed action are described below and shown on Figure 5-1. No privately funded projects were identified that could potentially generate cumulative impacts with the proposed action.

5.1.1 Sandbridge Beach Replenishment

The USACE, Norfolk District, in cooperation with BOEM, completed an EA in 2009 assessing the impacts of continuing beach replenishment and hurricane protection measures at Sandbridge Beach in Virginia Beach, Virginia. Sandbridge is a resort and residential community located south of and adjacent to Dam Neck Annex. The 2009 EA was an update of supplemental EAs completed in 1997, 2001, and 2006 for earlier replenishment cycles at the Sandbridge oceanfront. The original EA for beach replenishment was completed by the USACE in 1992 and resulted in a FONSI. The proposed action evaluated in the 2009 EA and the previous replenishment cycles used sand dredged from the Sandbridge Shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

The beach replenishment will occur over an area 5 miles long and 125 feet wide. This area includes a 50-foot wide berm with an elevation of 6 feet North American Vertical Datum and a foreshore slope of approximately 1:20 that extends approximately 5 miles (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 5-1 Dam_Neck_Agency_Projects_Near.mxd



Source: ESRI, U.S. Navy
US Army Corps of Engineers

Figure 5-1 Other Proposed Dredging Projects Near Naval Air Station Oceana Dam Neck Annex, Virginia Beach, Virginia

A hopper dredge will be used to obtain sand from the Sandbridge Shoal. The sand will be transported to a pump-out buoy located offshore and then pumped through a discharge pipeline running along the ocean floor to discharge points on the beach. Bulldozers and graders will be used to distribute the sand on the beach. The USACE estimates 1.5 to 2.0 million cy of sand will be needed to replenish the beach. Replenishment cycles using approximately the same amount of sand are estimated to be required every three to five years at the Sandbridge oceanfront (U.S. Army Corps of Engineers and Minerals Management Service June 2009). The current replenishment cycle was expected to begin in the spring of 2012 and be completed in two to three months (Roehrs July 20, 2011). The current replenishment cycle is scheduled to occur between late 2012 and 2013 (Armstrong June 25, 2012).

5.1.2 Virginia Beach Resort Beach Replenishment

The City of Virginia Beach is planning to replenish the resort beach from Rudee Inlet to Joint Expeditionary Base (JEB) Fort Story. The resort beach is located on the city's Atlantic coast. The city plans to begin the project December 2012 at the earliest and complete it by March 31, 2013 (Armstrong June 25, 2012). The project will widen the resort beach to 300 feet along its entire length, which will require between 1.5 million and 2 million cy of sand (Applegate May 19, 2011). The source of the sand for the beach replenishment is the Thimble Shoals and Atlantic Ocean federal navigation channels and areas immediately adjacent (Roehrs July 20, 2011; U.S. Army Corps of Engineers, Norfolk District June 2006). The Thimble Shoals channel runs through the mouth of the Chesapeake Bay and over the southern tunnels of the Chesapeake Bay Bridge-Tunnel. It is located approximately 2 miles off the Chesapeake Bay shoreline of Virginia Beach. The Atlantic Ocean channel is a naturally deeper area of the continental shelf off of Virginia Beach's Atlantic shoreline. An EA for the beach replenishment has been completed and all required permits have been obtained (Roehrs July 20, 2011; U.S. Army Corps of Engineers, Norfolk District June 2006).

The last major replenishment project at the resort beach was completed in 2002. "Operation Big Beach" included depositing 4 million cy of sand on the resort beach, widening the beach to 300 feet, and constructing a boardwalk and sea wall to protect coastal infrastructure (City of Virginia Beach May 18, 2011). Sand for "Operation Big Beach" was obtained from the Thimble Shoals and Atlantic Ocean navigation channels (Roehrs July 20, 2011).

5.1.3 Rudee Inlet Dredging

The next round of maintenance dredging in Rudee Inlet is scheduled for FY 2012 (City of Virginia Beach May 18, 2011). Rudee Inlet is located south of Virginia Beach's resort beach on the Atlantic coast. Four sections of the inlet will be dredged to their permitted depths:

- The external deposition basin outside the mouth of the inlet would be dredged to 22 feet below mean lower low water (MLLW)

- The main channel of the inlet would be dredged to 12 feet below MLLW
- The internal sand trap would be dredged to 20 feet below MLLW
- The turning basin would be dredged to 9 feet below MLLW (Roehrs July 20, 2011).

The City of Virginia Beach and the USACE dredge Rudee Inlet every year. On average, 250,000 cy of sediment are removed from the inlet every year, including the four sections listed above. Some years, the amount of sediment removed can reach approximately 300,000 cy. The sediment dredged from Rudee Inlet is deposited on the resort beach to the north of the inlet, between 2nd and 9th Streets (Roehrs July 20, 2011).

5.1.4 JEB Little Creek Maintenance Dredging

The Navy plans to conduct maintenance dredging at JEB Little Creek in Virginia Beach, Virginia, beginning in late 2012 and continuing over 6 months. JEB Little Creek is located on the shoreline of the Chesapeake Bay at the city line between Virginia Beach and the City of Norfolk to the west. The installation’s harbor, Little Creek Harbor, is a tributary to the Bay. The existing slips, approaches, and basins in Little Creek Harbor would be dredged to depths ranging from -8.0 feet to -31.0 feet below mean low water; these depths have been previously authorized by the USACE. Both hydraulic and mechanical (bucket) dredging methods would be used (U.S. Army Corps of Engineers, Norfolk District Regulatory Branch 2010). Approximately 1.2 million cy of sediment would be dredged. The dredged materials would be disposed of at the Norfolk Ocean Dredged Material Disposal Site (ODMDS); the James River upland site at the Shirley Plantation in Charles City County, Virginia; or used for beach nourishment projects, as applicable (Navy Region Mid-Atlantic June 9, 2010). The James River upland site accepts contaminated materials (primarily materials contaminated by petroleum). Contaminated dredged materials are not eligible to be used for beach nourishment, so use of dredged materials from Little Creek Harbor for beach nourishment would be subject to approval by state regulatory agencies. The Norfolk ODMDS is located at 36º59' north latitude and 75º39' west longitude, outside the mouth of the Chesapeake Bay (U.S. Army Corps of Engineers and EPA Region III February 2009). The Norfolk ODMDS is circular with a radius of 4 nautical miles. It covers an area of approximately 50 square nautical miles (U.S. Army Corps of Engineers and EPA Region III February 2009).

5.1.5 Willoughby Shoreline Dune Restoration

The City of Norfolk restored 6,000 feet of dune along the shoreline of the Willoughby Spit, located on the Chesapeake Bay in the northwestern part of the City of Norfolk. Sand for the dune restoration was excavated and dredged from areas along the Ocean View shoreline, also on the northern shoreline of Norfolk (U.S. Army Corps of Engineers Norfolk District Regulatory Branch 2010). The project was completed in the spring of 2010.

5.1.6 Shoreline Restoration and Protection Project at JEB Fort Story

The Navy is proposing to conduct a shoreline restoration and protection project at JEB Fort Story, located in Virginia Beach, Virginia. The beaches and primary sand dunes at JEB Fort Story have experienced sporadic episodes of severe erosion during major storm events. Erosion is placing rare terrestrial habitats and manmade structures (including aids to navigation), military training facilities, and historic resources at risk of damage or destruction. The Navy is preparing an EA to evaluate the reasonably foreseeable environmental consequences of the proposed shoreline restoration and protection project. The EA analyzes two action alternatives, targeted replenishment of beaches and construction of breakwaters, and full replenishment of beaches. Targeted replenishment of beaches and construction of breakwaters is the preferred alternative.

Sand on the beaches at JEB Fort Story would be replenished and stone breakwaters would be constructed as follows:

- Sand would be replenished along approximately 2,500 linear feet of shoreline at the Omaha Beach training area. No breakwaters would be constructed at Omaha Beach because they would interfere with amphibious training operations.

- Sand would be replenished along approximately 1,300 linear feet of shoreline across from the installation's Department of Public Works building. Up to six stone breakwaters would be constructed parallel to the beach at this location.

- Sand would be replenished along approximately 370 linear feet of shoreline north and east of Building 734 at the northern terminus of Leyte Road. Up to three stone breakwaters would be constructed parallel to the beach at this location.

Under Alternative 1, a total of approximately 750,000 cy of sand would be required for the beach replenishment. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation due to overflow of the hopper during pump-out operations and during sand placement. This sand would replace the volume eroded by Hurricane Isabel in September 2003 and a 2009 nor'easter.

At this time the location of the sand resource for this project has not been decided. There are four options currently being discussed. These include Sandbridge Shoal, the Atlantic Ocean Channel, Thimble Shoals Channel, and the Cape Henry channel. A hopper dredge would be used to pump the sand from the chosen sand resource. Once the sand is pulled from the sand source, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge through a short pipeline and deposited at no more than five pump-out stations/buoys along the JEB Fort Story beach. Bulldozers, excavators, off-road dump trucks, and hydraulic crawler excavators would be used to shape the beach and construct the breakwaters. A temporary access road would be constructed to provide access to the beach at the Department of Public Works building. The contractor will be required to use BMPs to avoid erosion during sand placement. Beach replenishment and breakwater construction would be implemented in phases, with beach replenishment occurring first. Beach replenishment is scheduled to occur over a six-month period starting between FY 2014 to FY 2017, depending on funding. Breakwater construction would occur over a 12-month period between FY 2019 and FY 2021, depending on funding.

5.1.7 Craney Island Eastward Expansion

The Craney Island Dredged Material Management Area (CIDMMA) is a point of land in the city of Portsmouth, Virginia. The Virginia Port Authority and the USACE are constructing the Craney Island Eastward Expansion (CIEE). The CIDMMA is bordered by the Elizabeth River to the east, the James River to the north and west, and the City of Portsmouth to the south (Craney Island Eastward Expansion 2012). The CIEE's purpose is to extend the life of the CIDMMA and to provide land on which to construct the Craney Island Marine Terminal (CIMT) (Craney Island Eastward Expansion 2012, U.S. Army Corps of Engineers January 2006). Construction on the expansion started in May 2012 and is scheduled to be completed early April 2013 (Anderson June 25, 2012).

The CIEE is made up of two parts: the Stage 2A project and the pre-dredge 10-foot layer project. The Stage 2A project consists of placing the Stage 2 lift of sand for the South and Division cross dikes of the CIEE. These cross dikes would be built to an elevation of +10 feet mean lower low water (MLLW) with an estimated 1,400,000 cubic yards of sand. Three navigational channels have been identified as potential sources of sand. These include the Atlantic Ocean Federal Navigation Channel, the Cape Henry Channel, and the Thimble Shoals Channel. Completion of this portion of the project is scheduled for March 31, 2013 (Anderson June 25, 2012). The pre-dredge 10-foot layer project consists of dredging an estimated 1,500,000 cy portion of the main dike footprint to about -22 feet MLLW by cutter-head/ pipeline dredge with placement upland at Craney Island. Completion of this portion of the project is scheduled for April 10, 2013 (Anderson June 25, 2012).

5.1.8 Previous Dredging at the Sandbridge Shoal

Both the USACE and the Navy have used the Sandbridge Shoal as an offshore borrow area for sand replenishment projects at Sandbridge Beach and Dam Neck Annex. Evaluations of sand resources estimate that the borrow area may contain approximately 12 million cy of sand. Extending farther outside the borrow area it is estimated that there is approximately 181 million cy of sand in connected sand ridges (Culbertson July 16, 2012). From 1996 to 2012 (prior to implementation of the proposed action), approximately 6.81 million cy will have been dredged from the shoal for the following projects (Figure 5-2):

© Ecology & Environment, Inc. GIS Department   Project #
Path: M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 5-2 Previous Dredging.mxd

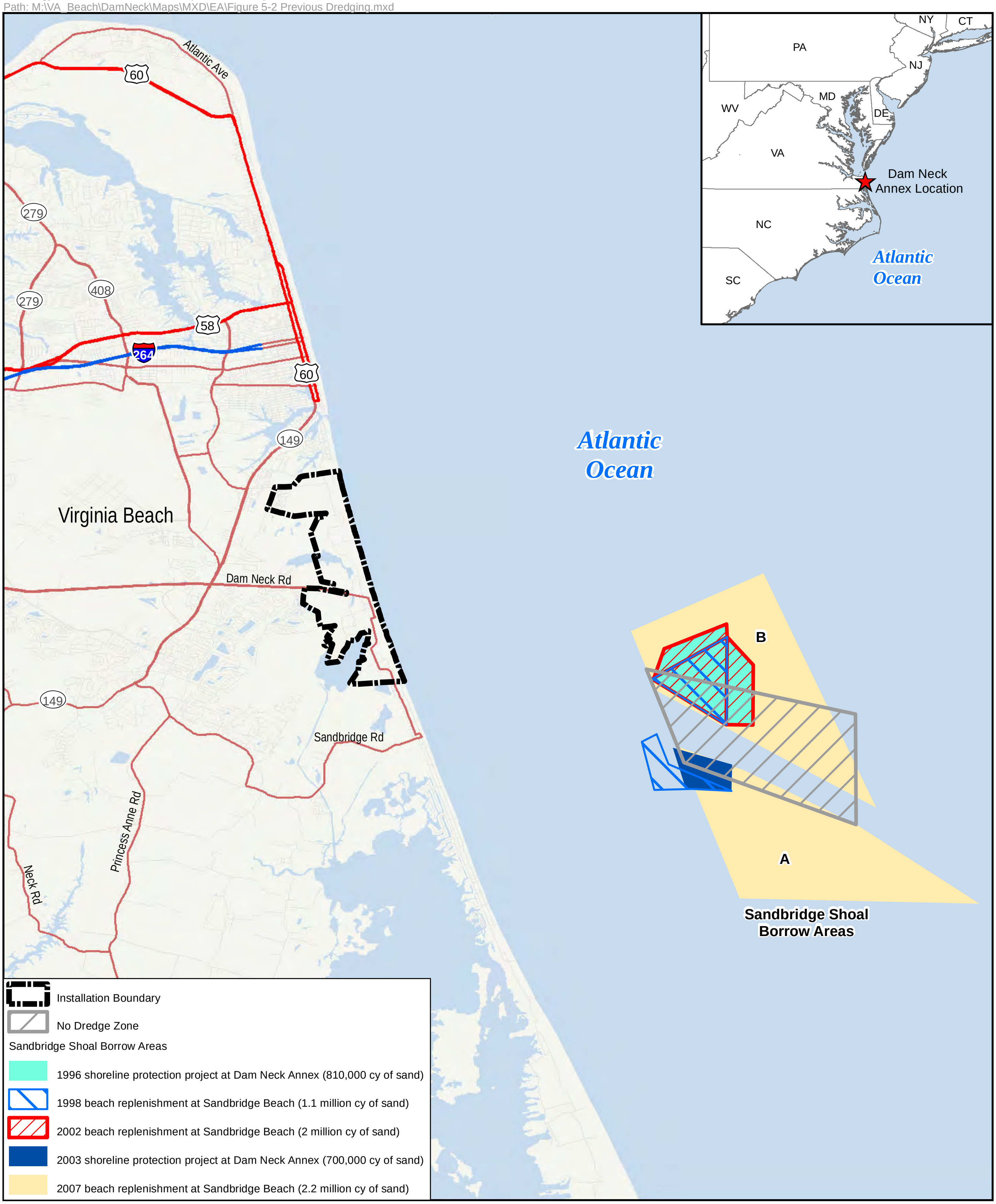
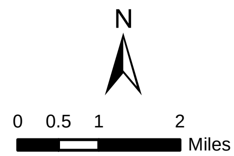


Figure 5-2
Previous Dredging at Sandbridge Shoal
Dam Neck Annex, Virginia Beach, Virginia



Source: ESRI, U.S. Navy

- 1996 shoreline protection project at Dam Neck Annex (810,000 cy of sand)
- 1998 beach replenishment at Sandbridge Beach (1.1 million cy of sand)
- 2002 beach replenishment at Sandbridge Beach (2 million cy of sand)
- 2003 shoreline protection project at Dam Neck Annex (700,000 cy of sand)
- 2007 beach replenishment at Sandbridge Beach (2.2 million cy of sand)

At least 13.2 million cy of sand will remain in the shoal following completion of these projects, based on conservative estimates of an original volume of 22 million cy of sand. This volume represents 60% of the conservative original volume of sand in the shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

5.1.9 Other In-Water Activities

The waters offshore of Virginia are very active on a daily basis. Shipping traffic into and out of the Chesapeake Bay brings large vessel shipping traffic into the area. Several commercial fisheries such as bottom trawl fisheries fishing for demersal flatfishes and pelagic trawl fisheries fishing for species such as bluefish are known to operate in the offshore area. Other state regulated fisheries such as pound net and gill net fishing also occur offshore of Virginia. In addition, the Navy operates training activities in the offshore region that may use large and small vessels. The offshore area also receives high use from recreational vessels of various sizes. Small personal vessels are common as well as tourist vessels, which are more prominent in the offshore region during the summer months.

Potential for offshore renewable energy development offshore of Virginia also exists. However, this is not expected to occur within a reasonable timeframe of the proposed action. Currently, no leases have been issued for the Virginia Wind Energy Area, which is located 23 nm off the Virginia coast. There are currently eight offshore wind companies that have expressed interested in leasing area within the wind energy area, but those companies will be entered into an auction to take place at the earliest in late 2012 or early 2013 to determine what companies could gain leases to begin wind development. As the lease process can be a timely exercise, it is not likely that any offshore wind operations would be occurring off the coast of Virginia, or anywhere close to the project area in the near future, and are therefore not discussed further.

5.2 Cumulative Impacts Analysis

Potential cumulative impacts of the proposed action with other past, ongoing, and reasonably foreseeable federal, non-federal, or private actions are discussed below. The time frame for cumulative impacts begins in 2013 and continues through 2016. The geographic area considered for cumulative impacts is determined separately for each resource listed. If the proposed action does not result in a direct or indirect impact on a resource area, then no further analysis of potential cumulative effects is necessary.

5.2.1 Marine Mammals

The geographic area assessed for cumulative impacts on non-threatened and endangered marine mammal species includes the inner continental shelf waters offshore of Virginia. The proposed action may contribute incrementally to the cumulative impacts on non-threatened and endangered marine mammals within this geographic area. These impacts may include noise, vessel collisions, turbidity impacts, and accidental spills.

The Sandbridge Beach replenishment, Virginia Beach resort beach replenishment, Rudee Inlet dredging, and the Craney Island Eastward Expansion are all expected to occur in late 2012 and early 2013, as is the proposed action. The shoreline restoration and protection project at JEB Fort Story would not be expected to occur until FY 2014 to FY 2017 for beach replenishment and FY 2019 to FY 2021 for the breakwater construction. The Sandbridge Beach replenishment and the proposed action would include dredging at the Sandbridge Shoal. The shoreline restoration and protection project at JEB Fort Story also could include dredging at Sandbridge Shoal; however, other sand sources may be chosen. Additionally, the dredging at Rudee Inlet as well as the Virginia Beach resort beach replenishment would result in dredging vessels within the coastal waters between the other projects. Thus, given the spatial and potential temporal overlap of these dredging operations at Sandbridge Shoal and within the larger area, the combined operations may contribute to cumulative impacts on marine mammals in the area from noise, vessel collisions, and turbidity impacts.

Dredging may impact marine mammals through noise generated during sand removal at the Sandbridge Shoal and the Thimble Shoals. However, similar to the proposed action, it is assumed that a hopper dredge would be utilized for the Sandbridge Beach replenishment and the shoreline restoration and protection project at JEB Fort Story at the Sandbridge Shoal as well as the Virginia Beach resort beach replenishment at the Thimble Shoals. The hopper dredge is associated with low-frequency noise at typically less than 1,000 Hz. Other vessels likely to be found within the Virginia offshore region such as commercial freight vessels or commercial and recreational fishing vessels are likely to have larger frequency ranges, approximately 6 Hz to 30,000 Hz for large and small vessels (Thomsen et al. 2009). Many of the marine mammals expected to be found off the coast have hearing ranges well above 1,000 Hz, including the bottlenose dolphin, harbor porpoise, and harbor seal. These animals are more likely to be bothered by noise associated with already existing vessel activity than the single hopper dredge associated with the proposed action. Additionally, it is assumed that noise would result in avoidance responses in many marine mammals. Although there could be cumulative impacts on marine mammals, these impacts would be minimized by implementing mitigation measures under each project, the generally short duration of the construction periods, timing of projects to occur primarily during the winter, and coordination with BOEM on use of Sandbridge Shoal. The Navy will work with BOEM and the NMFS on appropriate mitigation measures if multiple dredging operations overlap at Sandbridge Shoal.

With respect to vessel collisions, the marine mammals present in Virginia's coastal waters could be present in the vicinity of the shoal during beach replenishment. Therefore, the risk of a vessel strike does exist. However, it is generally thought that hopper dredges move slowly enough to minimize the risk of a strike with a marine mammal. Based on the current offshore traffic associated with recreational and commercial fishing vessels, Navy operations offshore, as well as the commercial vessels transiting into and out of the Chesapeake Bay, the addition of one hopper dredge vessel to the already otherwise busy offshore area of Virginia Beach would not significantly increase the potential for a vessel strike of a non - threatened or endangered marine mammal.

Lastly, cumulative impacts in the form of increased turbidity levels are possible from these combined dredging activities and bottom trawl fisheries at and around Sandbridge Shoal. Increased turbidity levels have the potential to affect foraging success and prey availability, and in high concentrations, sediment can irritate the gills of fish and affect photosynthesis in phytoplankton, both potential food sources of various marine mammals. However, increased levels of turbidity would not be expected, given that the sediment at Sandbridge Shoal is composed of approximately 96% sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009). In addition, increased turbidity levels would be short-term and spatially localized, and marine mammals would have the ability to avoid the active dredging area. Mitigation measures for each project would further reduce the potential for cumulative impacts due to marine mammal and vessel collisions.

The Willoughby Spit shoreline dune restoration was completed in the spring of 2010; therefore, this project would not have cumulative effects with the proposed action on marine mammals offshore of Virginia. JEB Little Creek maintenance dredging would take place in late 2012 and be finished by June 2013; however, it would not add to the effects of the Sandbridge beach replenishment, the Virginia Beach resort beach replenishment, the shoreline restoration and protection project at JEB Fort Story, the Craney Island Eastern Expansion, or the proposed action because those projects are largely centered around Sandbridge Shoal and that portion of the Atlantic coast from JEB Fort Story south to Sandbridge Beach. Additionally, the JEB Little Creek maintenance dredging would be limited to the JEB Little Creek harbor area.

5.2.2 Benthic Organisms

The geographic area assessed for cumulative impacts on benthos includes Sandbridge Shoal, the designated EFH grids as presented on Figure 3-1, and other proximal offshore areas near the project area. Several previous, ongoing, and future projects have been identified in the vicinity of Dam Neck Annex, including beach replenishment, dune restoration, and dredging. Impacts on benthic resources occur from a vast array of sources, including dredging projects, commercial and recreational fishing, and anchoring of various vessels. Sandbridge Shoal is used for beach replenishment projects for both the USACE and the Navy but is not the dedicated sand borrow area for all replenishment projects in the vicinity of the project area. Dredge projects impact the benthic community (i.e., entrainment of infauna and epifauna, pump-out station/buoy anchor sweep, etc.). However, studies conducted from 2002 to 2005 by the VIMS suggest that benthic invertebrate communities impacted by dredging are able to recover within a few years (Diaz et al. 2004). Similarly, research sponsored by BOEM suggests dredging will not threaten the geomorphic integrity of the Sandbridge Shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009). As such, although cumulative impacts on benthos could occur, these impacts would be expected to have only minor long-term cumulative effects on the benthos population.

It also is expected that there would be no indirect cumulative impacts on commercial and recreational fisheries as a result of dredging impacts on the benthic community. Monitoring at Sandbridge Shoal between 2002 and 2005 revealed no significant differences in macrofaunal abundance between dredged and control areas. This indicates that dredging has had little impact on habitat value (Diaz et al. 2006) and, despite the multiple dredging projects that have used Sandbridge Shoal, the shoal environment maintains a diverse, robust benthic and fish community.

5.2.3 Threatened and Endangered Species

The geographic area assessed for cumulative impacts on threatened and endangered species varies by species and is described in the discussion for each species below. The proposed action may contribute incrementally to cumulative impacts on threatened and endangered species in the project area. These impacts may result from both the offshore dredging operations and the placement of sand on the shore during Sandbridge beach replenishment, the Virginia Beach resort beach replenishment, the Rudee Inlet dredging, the shoreline restoration and protection project at JEB Fort Story, and the proposed action. The JEB Little Creek maintenance dredging would not have land-based components and would be limited to in-water impacts. Cumulative impacts could also result from other in-water activities such as recreational and commercial vessel traffic, fishing, and offshore Navy training exercises.

Whales

The geographic extent for cumulative impacts on whales includes the inner continental shelf waters offshore of Virginia. Potential cumulative impacts on whales would be the same as those described in Section 5.2.1, Marine Mammals. However, the vessel noise associated with the dredging operations would be within the hearing range of whales present in the project area. Despite this, the addition of one low frequency vessel would not cumulatively add to the already low frequency-dominated environment. It is possible that the current ambient noise levels from existing large vessel traffic could be greater than the sound emitted from the dredging operations. Therefore the existence of one vessel in the offshore environment for a four-month timeframe would not cumulatively add to the existing low-frequency environment.

Birds

The geographic extent for cumulative impacts on birds includes the coastal areas along Norfolk from Willoughby Spit to JEB Little Creek and Virginia Beach from JEB Little Creek around Cape Henry to Sandbridge Beach.

The Sandbridge beach replenishment, Virginia Beach resort beach replenishment, Rudee Inlet dredging, the shoreline restoration and protection project at JEB Fort Story, and the proposed action would all be associated with the same on-shore activities, including the dredging and pumping of sand onto the beach and the subsequent placement of sand along the areas to be replenished. With the exception of the JEB Fort Story Project, these projects would all be implemented in 2012, and would extend from Fort Story south to Sandbridge Beach. Cumulative impacts on threatened and endangered birds (including piping plovers, red knots, and roseate terns) could occur due to disturbance of any birds using the beach for foraging and roosting in the vicinity of the sand replenishment. This disturbance would be temporary, with these species resuming use of the beach once the sand has been placed. Additionally, any piping plovers or red knots using the beach in the vicinity of the beach replenishment activities would be expected to avoid the areas where activity is occurring. Placement of sand on the beaches where these activities are occurring may also disrupt piping plover and red knot foraging by covering invertebrate organisms upon which these species rely for food. However, this impact would be expected to be temporary. Dredging and pumping sand onto the beach would also disturb roseate terns foraging offshore or passing through the area. Any roseate terns in the vicinity of these activities would be expected to avoid areas where the activity is occurring. Overall, cumulative impacts on birds would be temporary and minor. Mitigation measures for each project would further reduce the potential for cumulative impacts on birds.

The JEB Little Creek maintenance dredging would be associated with in-water work and would not require any activities on land. The Willoughby Spit shoreline dune restoration was completed in 2010. The Craney Island Eastern Expansion would not be expected to impact any piping plovers as none have nested in the area since 1987. Neither the red knot nor the roseate tern have been identified in this project region (Craney Island Eastward Expansion 2012). Therefore, no cumulative impacts on these three species of threatened and endangered birds would be expected from these two projects and the proposed action.

Fish

The geographic extent for cumulative impacts on sensitive fish species, specifically the Atlantic sturgeon and the sand tiger shark, includes the inner continental shelf waters offshore of Virginia.

Direct cumulative impacts on the Atlantic sturgeon and sand tiger shark resulting from the dredging activities at the Sandbridge Shoal and the Thimble Shoals include hopper dredge entrainment for juveniles of both species. Direct cumulative impacts may also result from offshore fishing activities such as bottom trawling, which could lead to entrainment of all life stages of this species if they are present. Indirect cumulative impacts to these species may include disruption of feeding behavior due to noise and human activity associated with the dredging. Indirect impacts may also include a loss of benthic organisms serving as prey due to the scour and disturbance of the substrate. Thus, a short-term decrease in available prey would be an additive impact across all dredging locations. Indirect impacts to benthic organisms adjacent to the borrow sites may also result from turbidity plumes generated by dredging. These indirect impacts would not be expected to affect the sand tiger shark because they consume a wide range of prey species. Although cumulative impacts on sensitive fish species due to prey availability from the combined dredging operations and bottom trawling activities could occur, the extent of impacts would be minor and further minimized by the large area of habitat available to these species within the larger regional area.

Sea Turtles

The geographic extent for cumulative impacts on sea turtles includes the inner continental shelf waters offshore of Virginia for water-based impacts and the coastal shore from Willoughby Spit to JEB Little Creek in Norfolk and from JEB Little Creek around Cape Henry to Sandbridge Beach in Virginia Beach for land-based impacts.

Offshore Borrow Site Impacts. The primary direct cumulative impacts on sea turtles as a result of the dredging activities at both the Sandbridge and Thimble Shoals would be entrainment and collisions with the hopper dredge. Because loggerhead sea turtles are the most common species of sea turtle frequenting the area along the Atlantic Coast from JEB Fort Story south to Sandbridge, they are the species of sea turtle most likely to be adversely impacted by entrainment. According to the USACE's Sea Turtle Data Warehouse (U.S. Army Corps of Engineers 2011), loggerhead sea turtles had the highest numbers of takes associated with dredging between 2000 and 2009 in the Norfolk District. There were no sea turtle takes recorded for the Norfolk District in 2010 or 2011, and no takes have been recorded thus far for 2012. Table 5-1 provides a summary of sea turtle takes from 2000 to 2009 for the Norfolk District.

In addition to entrainment, adult sea turtles may be impacted as a result of vessel collisions with the hopper dredge or other large commercial vessels transiting the area.

Table 5-1 Total Sea Turtle Takes in the Norfolk District by Calendar Year

Year	Loggerhead	Kemp's Ridley	Green	Hawksbill	Leatherback	Unknown	Total
2009	3	0	0	0	0	0	**3**
2008	0	0	0	0	0	0	**0**
2007	0	1	0	0	0	0	**1**
2006	4	0	0	0	0	0	**4**
2005	0	0	0	0	0	0	**0**
2004	0	0	0	0	0	0	**0**
2003	7	1	0	0	1	0	**9**
2002	15	2	1	0	0	0	**18**
2001	7	1	0	0	0	1	**9**
2000	2	0	0	0	0	1	**3**
Total	**38**	**5**	**1**	**0**	**1**	**2**	**47**

Source: U.S. Army Corps of Engineers 2011

Cumulative impacts associated with vessel traffic and vessel noise would be the same as those described in Section 5.2.1, Marine Mammals, and the whales discussion above.

Indirect cumulative impacts on sea turtles from the various beach replenishment and dredging projects, as well as commercial and recreational fishing and boating could include loss of benthic populations that serve as food sources due to the bottom scouring and disturbance. Additionally, indirect impacts to benthos adjacent to the dredging area could result from turbidity plumes caused by the dredging and commercial bottom trawl fishing activities.

Overall, it would be expected that these cumulative impacts on the offshore borrow site would be minor and would not place the continued existence of the species in jeopardy.

Sand Placement Site Impacts. Sand placement at the replenishment sites for the Sandbridge Beach, Virginia Beach resort area, the Rudee Inlet dredging, the shoreline restoration and protection project at JEB Fort Story, and the proposed action could result in loss of habitat for prey for the loggerhead sea turtle and the Kemp's ridley sea turtle, through covering of nearshore habitat and also through increased turbidity. Loggerhead or Kemp's ridley sea turtle nests, eggs, and hatchlings could be impacted by sand placement or interaction with heavy equipment. Other potential nesting season impacts to loggerhead or Kemp's ridley sea turtles include the use of artificial lights, operational noise, and general human activity. These impacts have the potential to occur in an additive nature due to the multiple beach replenishment projects proposed along the coast. Mitigation measures for each project would further reduce the potential for cumulative impacts to sea turtles. These measures could include consulting with NMFS and USFWS, scheduling dredging during the winter, conducting pre-dredging surveys, and providing monitors. Overall, it would be expected that these cumulative impacts on the sand placement site would be minor and would not place the continued existence of the species in jeopardy.

5.2.4 Essential Fish Habitat

The geographic area assessed for cumulative impacts on EFH is Sandbridge Shoal, the designated EFH grids as presented in Figure 3-1, and other offshore areas near the project site. Impacts on local EFH resources occur from multiple sources, including other dredging projects, commercial and recreational fishing, anchoring of various vessels, non-point source pollution from storm water runoff, and natural events such as hurricanes and nor'easters. Each of these can contribute to physical and/or chemical degradation of EFH which can affect EFH species.

The primary impact on managed fish and invertebrate species from dredging would be the adverse impact on the benthic community. Multiple beach replenishment projects would pose potential cumulative impacts on EFH. The primary direct effect on this community would be the entrainment of infauna and epifauna that reside within and on the sandy sediment, including the managed surf clam. These activities would have negligible impact on the regional benthic community because these types of assemblages, found on the sandy shoals and the flat bottom nearshore areas, are ubiquitous, and the community found within the spatial extent of the dredge area is similar to that found in the broad extent of the nearshore continental shelf of the Mid-Atlantic Bight. As noted in the Diaz et al. (2004) study of offshore sand shoals of coastal Virginia, a viable benthic community was re-established within a few years after dredging.

In addition to direct impacts on the benthic community from dredging, indirect cumulative impacts on managed fish species would include diminished availability of bottom dwelling food resources such as crustaceans and other invertebrates. The benthic prey species found on the shoals and sand bottom, such as crustaceans and worms, would likely be cumulatively impacted during multiple dredging operations.

Dredging would result in a temporary increase in turbidity. The sand sediments of this region would be expected to settle quickly. However, if multiple projects were conducted at the same time, the increase in turbidity could be a cumulative, although temporary, impact. If multiple dredging projects are to occur at Sandbridge Shoal during the same time period, BOEM and the NMFS would likely recommend additional measures to minimize impacts on EFH.

Although multiple dredging projects could have a cumulative impact on EFH, impacts of each project would be reduced through agency consultation and coordination and implementation of agency-required mitigation measures.

Overall, cumulative impacts on EFH would be minor and temporary.

5.2.5 Coastal Geography and Physical Oceanography

Maintenance replenishment of Sandbridge Beach is projected for approximately every three to five years for the next 40 years. Considered in the context of past projects at Sandbridge Beach, as well as the past and future beach fill along the Virginia Beach resort area, almost the entire shoreline from Cape Henry south to the Back Bay NWR would continue to be subject to replenishment activities. Overall, the impacted area would not increase, and the nature of the impacts would not change. The intervening periods between replenishments generally allow for physical and biological recovery and equilibration of the subaerial beach and surf zones.

The shoal's function as habitat may be adversely affected, but, to date, there has been limited evidence of any sustained disturbance beyond transient and localized impacts to a wide range of benthic and pelagic biota (Diaz et al. 2006). Areas of the shoal where sediment grain-size is incompatible with the replenishment grain-size requirements, as well as other no-dredge areas such as the submarine cable zone, would remain undisturbed, thus serving as feeder zones for benthic re-colonization and natural bottom habitat. Additionally, since borrow areas are not typically dredged perfectly flat relative to the adjacent seafloor, portions of the dredged areas would remain morphologically intact.

Dredging on Sandbridge Shoal from1996 to 2007 has included removal of 6,810,000 cy of sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009). The shoal would not be expected to naturally recover the volume of the sand that is dredged (U.S. Army Corps of Engineers and Minerals Management Service June 2009). However, current research sponsored by BOEM suggests dredging will not threaten the geomorphic integrity of the shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009). To date there has been limited evidence of any sustained disturbance beyond transient and localized impacts (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

Overall, cumulative impacts on coastal geography and physical oceanography would be minor as no permanent changes in offshore geology would be expected.

6 Mitigation Matrix

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
Biological Resources						
Terrestrial Vegetation	Restored dune will be revegetated with native vegetation which may include: American beachgrass (*Ammophila breviligulata*), Atlantic coastal/bitter panic grass (*Panicum amarum*), switchgrass (*Panicum virgatum*), saltmeadow hay (*Spartina patens*), gray goldenrod (*Solidago nemoralis*), American searocket (*Cakile edentula*), swamp rosemallow (*Hibiscus moscheutos*), seaside goldenrod (*Solidago sempervirens*), and sea oats (*Uniola paniculata*).	Provide stabilization to the dune, prevent erosion and extend the time between sand replenishment events.	Effectiveness of the dune revegetation will be evaluated annually as part of the installation's dune stabilization program.	Revegetation will be conducted by contractors or by volunteers during the installation's annual dune planting.	Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic, Public Works Department (PWD)Oceana	Within 3 months of sand placement.
Birds	Nest survey and implementation of nest protection measures (if work is conducted during the breeding season).	Prevent the loss of nests, eggs, and young.	Nests will be checked periodically to determine if/when young have fledged.	A qualified biologist will survey the project area for bird nests prior to replenishment. If a nest is found, the Navy will work with the USFWS to implement appropriate measures to protect the nest.	NAVFAC Mid-Atlantic, Environmental Core	Completion of beach replenishment.
Marine Mammals	• Sand from the dredge site will be beach-quality and of similar grain size as that of the existing beach area, reducing the potential for increased turbidity. • Operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging.	Minimization of impacts from turbidity, including reduced foraging success, displacement, and prey availability.	Pre-dredge vibracore surveys will be used to identify areas of beach quality sand at the shoal. Adherence to the operational and construction techniques will mitigate any potential turbidity plumes although there are no thresholds or criteria established by the NMFS to measure against.	The contractor will be required to dredge sand from previously identified locations, and implement the described mitigation measures.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of the dredging and beach replenishment phases.
	Fuel spill prevention and response plans will be prepared.	Reduction of negative impacts on marine mammals from potential fuel spills.	Adherence to requirements of the plans to prevent spills and response to spills if they occur.	Vessel operators will be familiar with the plans and will employ them either to prevent fuel spills or respond to fuel spills if one were to occur.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of the dredging and beach replenishment phases.
Threatened and Endangered Species						
Whales	An NMFS-approved Protected Species Observer will be required to be on board the dredge to monitor the dredge area and area between the dredge area and pump-out stations for ESA protected whales.	Reduction of the potential for collisions with ESA protected whales.	Observer will be approved by NMFS and follow monitoring procedures and reporting requirements.	• NMFS-approved Protected Species Observer will monitor action area for whales. • Observations of ESA protected whales within 3,281 feet of the dredging operation will result in an immediate suspension of activity until the individual's protection could be assured.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
	During night-time dredging operations, the work area will be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable.	Reduction of the potential for collisions with ESA protected whales.	Work area is lit during dredging operations.	Vessel operators will ensure lights are turned on during night-time operations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Dredge operators will conform to the regulations prohibiting the approach of right whales closer than 1,500 feet (50 CFR 224.103(c)) and other threatened or endangered species of whales no closer than 100 feet.	Reduction of the potential for collisions with ESA protected whales.	Dredge operator does not approach right whales closer than 1,500 feet and other threatened or endangered species of whales no closer than 100 feet.	• Any vessel finding itself within these buffer zones created by a surfacing whale must depart the area immediately at safe, slow speed. • All dredge operators will monitor the right whale sighting reports (including SAS, DMAs, and SMAs) to remain informed on the whereabouts of right whales within the vicinity of the action area.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	The hopper dredge will not exceed a speed of 10 knots between November 1 and April 30.	Reduction of the potential for collisions with ESA protected whales.	Dredge operator does not exceed a speed of 10 knots between November 1 and April 30.	Vessel operators will not exceed 10 knots during this time period.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	• Sand from the dredge site will be beach-quality and of similar grain size as that of the existing beach area, reducing the potential for increased turbidity. • Operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging.	Minimization of impacts from turbidity, including reduced foraging success, displacement, and prey availability.	Pre-dredge vibracore surveys will be used to identify areas of beach- quality sand at the shoal. Adherence to the operational techniques will mitigate any potential turbidity plumes although there are no thresholds or criteria established by NMFS to measure against.	The contractor will be required to dredge sand from previously identified locations, and implement the described mitigation measures.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Fuel spill prevention and response plans will be prepared.	Reduction of negative impacts on ESA protected whales from potential fuel spills.	Adherence to requirements of the plans to prevent spills and response to spills if they occur.	Vessel operators will be familiar with the plans and will employ them either to prevent fuel spills or respond to fuel spills if one were to occur.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of the dredging and beach replenishment phases.
Birds	An annual shorebird monitoring program, which will include piping plovers, is scheduled to begin in late FY 2012. These surveys will allow monitoring of the beach pre- and post- replenishment to identify any presence of the piping plover and red knot.	Reduction of loss of nests and/or disturbance to ESA protected birds.	Survey results/reports evaluated for presence of piping plover and red knot.	If a piping plover nest is discovered prior to or during sand placement, measures such as avoidance of the nesting area will be implemented to avoid potential impacts. Dam Neck Annex will coordinate with the USFWS to ensure adequate protection in the event that any piping plover nests are discovered.	NAVFAC Mid-Atlantic, Environmental Core	Completion of beach replenishment.
	If sand placement occurs during times when sensitive bird species may be present, a qualified biologist will conduct surveys and monitor the project area to ensure that no individuals are directly affected by these activities.	Reduction of disturbance to ESA protected birds.	Surveys are conducted and ES- protected birds are not directly affected by sand placement activities.	If sensitive species are present, measures such as avoiding the area until the birds move on will be implemented to avoid potential impacts.	NAVFAC Mid-Atlantic, Environmental Core	Completion of beach replenishment.

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Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
Fish	An NMFS-approved Protected Species Observer will be on board the dredge throughout the year to monitor the action area for Atlantic sturgeon	Reduction of the potential for entrainment or collisions with the ESA protected Atlantic sturgeon.	Observer will be approved by the NMFS and follow monitoring procedures and reporting requirements.	A NMFS-approved Protected Species Observer will monitor action area for Atlantic sturgeon. NMFS will be contacted within 3 days prior to commencement of hopper dredging and again within 3 days following completion of the dredging activity to report that: 1. A NMFS-approved observer is present on board the vessel. 2. That hopper dredge is equipped and operated in a manner that provides the endangered/threatened species observer with a reasonable opportunity for detecting interactions with listed species. 3. Measures are taken to protect any Atlantic sturgeon that survive entrainment in the hopper dredge.	NAVFAC Mid-Atlantic, PWD Oceana	Within 3 days following the completion of dredging activities.
	During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable.	Reduction of the potential for entrainment or collisions with the ESA protected Atlantic sturgeon.	Work area is lit during dredging operations.	Vessel operators will ensure lights are turned on during night-time operations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Sand from the dredge site will be beach-quality and of similar grain size as that of the existing beach area, reducing the potential for increased turbidity	Minimization of impacts from turbidity, including reduced foraging success, displacement, and prey availability.	Pre-dredge vibracore surveys will be used to identify areas of beach- quality sand at the shoal.	The contractor will be required to dredge sand from previously identified locations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Shoal morphology will be maintained.	Minimization of impacts on fish, including reduced foraging success, prey availability, and loss of suitable habitat.	Pre and post-dredge bathymetric surveys.	The contractor will be required to dredge sand from previously identified locations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges.	Reduction of the potential for entrainment of the ESA protected Atlantic sturgeon.	Dredge operator turns off suction in the drag head when it is lifted off the bottom.	Vessel operators will ensure that suction in the drag head will be turned off when it is lifted off the bottom.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
	A state-of-the-art sea turtle deflector, which will also aid in the deflection of Atlantic sturgeon should they be present, designed to USACE specifications, will be installed on the drag head of the hopper dredge	Reduction of the potential for entrainment of the ESA protected Atlantic sturgeon.	Use of turtle deflector designed to USACE specifications.	• The drag head will be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the action area. • The hopper inflow will be screened to allow monitoring of the dredge material intake for Atlantic sturgeon and their remains. • NMFS will be contacted regarding use of state-of-the-art sea turtle deflector within 3 days prior to commencement of hopper dredging and again within 3 days following completion of the dredging activity.	NAVFAC Mid-Atlantic, PWD Oceana	Within 3 days following the completion of dredging activities.
Sea Turtles	An NMFS-approved Protected Species Observer will be required to be on board the dredge to monitor the dredge area and area between the dredge area and pump-out stations for ESA protected sea turtles.	Reduction of the potential for entrainment or collisions with ESA protected sea turtles.	Observer will be approved by the NMFS and follow monitoring procedures and reporting requirements.	• A NMFS-approved Protected Species Observer will monitor action area for sea turtles. • NMFS will be contacted within 3 days prior to commencement of hopper dredging and again within 3 days following completion of the dredging activity to report that: 1. A NMFS-approved observer is present on board the vessel. 2. That hopper dredge is equipped and operated in a manner that provides the endangered/threatened species observer with a reasonable opportunity for detecting interactions with listed species and that provides for handling, collection, and resuscitation of turtles injured during project activity. 3. Measures are taken to protect any sea turtles that survive entrainment in the hopper dredge.	NAVFAC Mid-Atlantic, PWD Oceana	Within 3 days following the completion of dredging activities.
	Sand from the dredge site will be beach-quality and of similar grain size as that of the existing beach area, reducing the potential for increased turbidity.	Minimization of impacts from turbidity, including reduced foraging success and prey availability.	Pre-dredge vibracore surveys will be used to identify areas of beach- quality sand at the shoal.	The contractor will be required to dredge sand from previously identified locations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable.	Reduction of the potential for entrainment or collisions with ESA protected sea turtles.	Work area is lit during dredging operations.	Vessel operators will ensure lights are turned on during night-time operations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.

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Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
	A state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge.	Reduction of the potential for entrainment of ESA protected sea turtles.	Use of turtle deflector designed to USACE specifications.	• The drag head will be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the action area. • The hopper inflow will be screened to allow monitoring of the dredge material intake for sea turtles and their remains. • NMFS will be contacted regarding use of state-of-the-art sea turtle deflector within 3 days prior to commencement of hopper dredging and again within 3 days following completion of the dredging activity	NAVFAC Mid-Atlantic, PWD Oceana	Within 3 days following the completion of dredging activities.
	The drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges.	Reduction of the potential for entrainment of ESA protected sea turtles.	Dredge operator turns off suction in the drag head when it is lifted off the bottom.	Vessel operators will ensure that suction in the drag head will be turned off when it is lifted off the bottom.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	To minimize risks of collisions with sea turtles, dredging vessels and support boats will not intentionally approach within 300 feet of listed species when in transit.	Reduction of the potential for collisions with ESA protected sea turtles.	Dredge operator does not approach within 300 feet of ESA protected sea turtles.	Observer and vessel operators will monitor area surrounding the boat for sea turtles.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	If nesting occurs at the north or south ends of the beach where active military training takes place or is under threat of regular inundation due to high tides, the nests may need to be relocated.	Reduction of the potential for loss of nests.	Nest relocations are conducted under the terms of the Dam Neck Annex INRMP monitoring protocol and the requirements of the USFWS Back Bay NWR.	Following the monitoring protocol set out in the Dam Neck Annex INRMP, nest relocation would be the preferred action (Navy 2006). The USFWS and the VDGIF will be notified prior to any nest relocation and the nest relocation protocol set out in the INRMP will be followed by the monitoring personnel. Through a current agreement with the USFWS Back Bay NWR, the relocated nest will be brought to Back Bay NWR to allow for a more suitable nursery site for the nest.	NAVFAC Mid-Atlantic, PWD Oceana	Although dredging will occur outside of nesting season, this measure will be implemented in the event that an ESA-listed sea turtle does nest at the installation, and that nest needs to be relocated due to military activities. If necessary, completion of this measure will occur at the end of beach replenishment.
	During the nesting and hatching season beach illumination may affect nesting adult turtles and hatchlings. To the maximum extent practicable lighting will be reduced prior to the nesting and hatching season to reduce potential impacts; however, security concerns may make it not feasible to turn off some lights.	Reduction of the potential for loss of nests and hatchlings.	Effect on nesting adult turtles and hatchlings is eliminated or reduced through reduction of beach illumination from adjacent artificial light sources.	Lights except those used for security purposes will be turned off prior to the nesting and hatchling season.	NAVFAC Mid-Atlantic, PWD Oceana	Although dredging will occur outside of nesting season, this measure will be implemented in the event that an ESA-listed sea turtle does nest at the installation. If necessary, completion of this measure will occur at the end of beach replenishment.

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
Plants	Pre-construction surveys will be conducted to determine the presence or absence of seabeach amaranth within the project area.	Reduction of loss of seabeach amaranth.	Survey results evaluated for presence of seabeach amaranth.	Pre-construction surveys will be conducted.	NAVFAC Mid-Atlantic, Environmental Core	Within one month prior to construction.
Essential Fish Habitat						
	A state-of-the-art sea turtle deflector, also useful to prevent entrainment of large fish, will be installed on the drag head of the hopper dredge, and the drag head will be operated in a manner that will reduce the risk of interactions with fish species that may be present in the action area.	Reduction of the potential for entrainment of large fish.	Use of turtle deflector designed to USACE specifications.	• The drag head would be operated in a manner that will reduce the risk of interactions with fish that may be present in the action area. • The hopper inflow would also be screened to allow monitoring of the dredge material intake for fish and their remains.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Existing bottom contours will be followed for dredging activities to maintain seafloor ridge and swale heterogeneity. Dredge cuts will be limited to a maximum of 2 meters.	Reduction of negative effect on fish foraging success, prey availability, and habitat requirements.	Pre and post-dredge bathymetric surveys.	Pre-dredge bathymetric surveys and consultation with BOEM will identify dredge locations. The contractor will be required to dredge sand from previously identified locations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Targeting beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity.	Minimization of impacts from turbidity, including reduced foraging success and prey availability.	Pre-dredge vibracore surveys will be used to identify areas of beach quality sand at the shoal.	The contractor will be required to dredge sand from previously identified locations.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	To prevent possible entrainment of fish species, the hopper inflow will be screened and the drag head of the dredge shall remain on the bottom at all times during a pumping operation, except as outlined in the NMFS Monitoring Specifications for Hopper Dredges..	Reduction of the potential for entrainment of fish.	Dredge operator turns off suction in the drag head when it is lifted off the bottom. Hopper inflow equipped with screen/basket.	Vessel operators will ensure that suction in the drag head will be turned off when it is lifted off the bottom.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
	Fuel spill prevention and response plans will be prepared.	Reduction of negative impacts on fish and essential fish habitat from potential fuel spills.	Adherence to requirements of the plans to prevent spills and respond to spills if they occur.	Vessel operators will be familiar with the plans and will employ them either to prevent fuel spills or respond to fuel spills if one were to occur.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of the dredging and beach replenishment phases.
	Rotational dredging will be used to preclude the sequential mining of the same sand ridge on successive maintenance events.	Reduction of negative effect on fish foraging success, prey availability, and habitat requirements.	Use of surveys from previous dredging events to determine area to dredge and confirm with post-dredge bathymetric survey.	The Navy will coordinate with BOEM to identify dredge location so as not to dredge the same sand ridge used in previous dredging projects at the shoal.	NAVFAC Mid-Atlantic, PWD Oceana in coordination with the Bureau of Ocean Energy Management (BOEM)	Completion of dredging activities.
	A long-term management plan for Sandbridge Shoal will be developed with the NMFS and BOEM prior to the Navy's next maintenance event.	Reduction of negative effect on fish foraging success, prey availability, and habitat requirements.	Development of long-term strategy and management plan for use on future beach replenishment dredging projects.	The Navy will cooperate as a partner along with BOEM, USACE, and BOEM to develop long-term plans for use of Sandbridge Shoal or other offshore sand resources that may later be identified.	NAVFAC Mid-Atlantic, Environmental Core and Hampton Roads IPT	Prior to initiation of environmental planning and consultation efforts for a subsequent beach replenishment project at Dam Neck Annex.

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
Water Quality						
	• The Navy will require the contractor to install a baffle plate, spreader pipes, pocket pipes, or similar apparatus to the discharge end of the pipeline that precisely controls the placement of the beach fill material and increases the settlement rate of the material to the maximum extent practicable. • Temporary longitudinal control dikes will be constructed as close to the shoreline as practical and in a manner that requires the effluent water to travel a sufficient distance to minimize turbidity prior to returning to the ocean waters.	Minimization of erosion during sand placement and loss of material directly into the water.	Adherence to construction techniques will mitigate any potential turbidity plumes although there are no thresholds or criteria established by NMFS to measure against.	The contractor will be required to have equipment installed on the end of the discharge pipe to control the placement of beach fill and will be required to construct temporary longitudinal control dikes.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.
Cultural Resources						
	If the Navy discovers any previously unknown historic or archeological remains, the Navy will notify BOEM and DHR of any finding.	Prevention of destruction of historic or archaeological remains.	Notification provided to BOEM and DHR.	The Navy will notify BOEM and DHR of any finding. The Navy will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the NRHP.	NAVFAC Mid-Atlantic, PWD Oceana via NAVFAC Mid-Atlantic Cultural Resource Manager	Completion of the dredging and beach replenishment phases.
	In the event that the dredge operators discover any archaeological resource while dredging at Sandbridge Shoal or during nearshore pump-out operations, the Navy will require that dredge and/or pump-out operations be halted immediately within 1,000 feet of the area of discovery. The Navy will notify BOEM and initiate the Federal and State coordination.	Prevention of destruction or burying any archaeological resources.	Notification provided to BOEM and dredging/pump-out operations are halted within 1,000 feet of the area of discovery. Navy initiates federal and state coordination.	• Vessel operators will monitor for cultural resources and will halt operations if resources are discovered. • The Navy will then immediately report the discovery to BOEM. The Navy will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort. If investigations determine that the resource is significant, the parties shall together determine how best to protect it.	NAVFAC Mid-Atlantic, PWD Oceana via NAVFAC Mid-Atlantic Cultural Resource Manager	Completion of dredging activities.
Unexploded Ordnance						
	A screen or basket will be placed on the inflow of the hopper for the purpose of monitoring the dredge material intake for sea turtles and fish entrainment. Although not the intended purpose, the screen/basket will also help prevent any UXO from entering the hopper and being placed on the beach. A screen can also be installed on the outflow pipe to prevent any undetected UXO from being placed on the beach. Prior to initiating dredging, the Navy will also consider the use of a screen specifically designed to prevent UXO from being pulled into the dredge.	Prevention of UXO entering the hopper or being placed on the beach.	UXO is not placed on the beach.	Contractor will be required to install screens on the hopper intake. Screens may also be required on the outflow pipe and drag head.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.

Mitigation Matrix

Resource	Description of Mitigation Measures	Anticipated Benefit	Criteria for Evaluating Efficacy	Description of How Mitigation Measures will be Implemented	Assignment of Command Responsibility for Implementation	Estimated Completion Date
	Should any UXO pass through, or become trapped on the screen, operations would cease and the Navy would call special ordnance handlers to safely remove and dispose of the ordnance.	Prevention of potential injuries or safety concerns.	Procedure is followed and UXO is safely removed and properly disposed.	• Contractors will monitor for UXO and would cease operations if UXO pass through, or become trapped on, the screen. • The Navy would call ordnance handlers to remove and dispose the ordnance.	NAVFAC Mid-Atlantic, PWD Oceana	Completion of dredging activities.

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A Agency Correspondence

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
WASHINGTON, DC 20240-0001

Mr. W. David Noble
Director, Environmental Planning and Conservation
Department of the Navy
Navy Region, Mid-Atlantic
1510 Gilbert Street
Norfolk, Virginia 23511-2737

JAN 2 6 2012

Dear Mr. Noble:

Thank you for your November 17, 2011, letter requesting that the Bureau of Ocean Energy, Management (BOEM) cooperate with the Department of the Navy during the environmental review for the shoreline protection systems located at both the Naval Air Station (NAS) Oceana, Dam Neck Annex in Virginia Beach, Virginia and at the Joint Expeditionary Base Little Creek/Fort Story (JEBLCFS) in Virginia Beach, Virginia. The proposed action would involve beach re-nourishment using sand from Sandbridge Shoal located approximately 3 nautical miles offshore of the NAS Oceana, Dam Neck Annex shoreline.

The BOEM welcomes the opportunity to participate in this effort and agrees to serve as a cooperating agency since the BOEM has jurisdiction over mineral leasing on the Outer Continental Shelf (OCS). As a cooperating agency, the BOEM expects to: participate and provide input in the National Environmental Policy Act (NEPA) process at the earliest possible time; assume, on the request of the Navy, responsibility for developing information and preparing environmental analyses for which the BOEM has special expertise; make available staff support, at the lead agency's request, to enhance the interdisciplinary capability of the Navy; provide comment on draft versions of the EA when requested; and use our own funds to accomplish these responsibilities to the greatest extent practicable.

The BOEM also recognizes the importance of initiating and agrees to participate in the required Endangered Species Act (ESA) Section 7 consultation; the Magnuson-Stevens Fishery and Conservation Management Act Essential Fish Habitat (EFH) consultation (Section 305); the National Historic Preservation Act (NHPA) Section 106 process; and the Coastal Zone Management Act (CZMA) Section 307 consistency process. As the lead federal agency for ESA Section 7 and the EFH consultations, the Navy must notify the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) of its lead role and BOEM's cooperating role. BOEM would expect the Navy, as lead agency, to jointly submit the ESA Section 7 and EFH assessments to FWS and NMFS. The BOEM expects the Navy to be the lead federal agency for NHPA Section 106 and CZMA Section 307 compliance with the BOEM acting in a consulting role. In addition, BOEM requests to be copied on all pertinent correspondence related to these consultations for both projects.

The BOEM looks forward to working with the Navy during this process. If you would like to discuss any of these items further, please contact Dr. Jennifer Culbertson at (703) 787-1742 or by e-mail at Jennifer.Culbertson@boem.gov.

Sincerely,

James F. Bennett
Chief, Division of Environmental Assessment
Bureau of Ocean Energy Management

cc: Mr. Benjamin McGinnis
Department of the Navy

Ms. Karen P. Lienemann, P.E.
Department of the Navy

Mr. K. Dean Wright,
Department of the Navy

Mr. Steve Textoris,
Leasing Division
Bureau of Ocean Energy Management

Douglas W. Domenech
Secretary of Natural Resources

David A. Johnson
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Division of Natural Heritage
217 Governor Street
Richmond, Virginia 23219-2010
(804) 786-7951

May 18, 2011

Jessica Barker
Department of the Navy
Navy Region, Mid-Atlantic
1510 Gilbert St.
Norfolk, VA 23511-2737

Re: 5090 EV22/22/270, Repair Shore Protection System at Naval Air Station Oceana, Dam Neck Annex

Dear Ms. Barker:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, this site is located within the Dam Neck Middle Beach Dunes Conservation Site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Dam Neck Middle Beach Dunes Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at this site is:

Caretta caretta,	Loggerhead	G3/S1B,S1N/LT,PE/LT

The Loggerhead sea turtle is a cosmopolitan sea turtle which nests regularly in small numbers in Virginia. Loggerheads mate from late March to early June. From late April to early September, females make their way to shore to dig nests on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. Though thousands of eggs may be laid, only a few individuals are believed to survive to adulthood. Please note this species is classified as threatened by both the United States Fish and Wildlife Service (USFWS) and the Virginia Department of Game and Inland Fisheries (DGIF)

Loggerheads face threats both in the marine environment and on nesting beaches. The greatest cause of decline and the continuing primary threat to Loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges (USFWS, 2005). On land, Loggerheads face threats from habitat loss and alteration (primarily development of beaches, dredging, riprap, groins and jetties etc), increased nest predation by raccoons and feral animals, trampling by foot and vehicle traffic, and beachfront lighting which may affect hatchlings from reaching the ocean (NatureServe, 2009).

DCR recommends avoiding impacts to nesting Loggerhead sea turtles through monitoring and/or time-of-year restrictions. Due to the legal status of the Loggerhead sea turtle, DCR also recommends coordination with USFWS and VDGIF to ensure compliance with protected species legislation.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Shirl Dressler at (804) 367-6913.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Tylan Dean, USFWS
Amy Ewing, VDGIF

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

MAY 17 2011

W. David Noble
Department of the Navy
Commander
Navy Region, Mid-Atlantic
1510 Gilbert Street
Norfolk, Virginia 23511-2737

Re: Repair of Shore Protection System at Naval Air Station Oceana

Dear Mr. Noble,

This is in response to your letter dated May 2, 2011, informing NOAA's National Marine Fisheries Service (NMFS) that the Navy is preparing an Environmental Assessment, an endangered species consultation package, and an essential fish habitat assessment on the proposed repair of the shore protection system (SPS) at the Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia. Repair of the SPS will require approximately 827,000 cubic yards of sand, which will be dredged from a Bureau of Ocean Energy, Management, Regulation, and Enforcement (BOEMRE) approved borrow area within the Sandbridge Shoal, located approximately three miles offshore of the project location. The Navy seeks technical assistance regarding the presence of species listed as threatened or endangered by NMFS within the proposed project site.

NMFS Listed Species

Sea Turtle Species

Four species of federally threatened or endangered sea turtles under the jurisdiction of NMFS can be found seasonally in the coastal waters of Virginia from early May –November of each year. Loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), and green sea turtles (*Chelonia mydas*) are present in these waters mainly during late spring, summer and early fall when water temperatures are relatively warm. While federally endangered leatherback sea turtles (*Dermochelys coriacea*) may be found in the waters off Virginia during the same time frame as well, this species is unlikely to occur in the action area as it is typically found in deeper, more offshore waters.

Several studies have examined the seasonal distribution of sea turtles in the mid-Atlantic, including Virginia. Sea turtles begin appearing in nearshore habitats of the mid-Atlantic as water temperatures rise in the spring and remain throughout the warmer months. Sea turtles are typically found in Virginia when water temperatures are greater than 11°C. In early May, as water temperatures continue to rise farther northward, Kemp's ridleys and loggerheads begin to appear in Virginia (Morrealle and Standora 2005). As temperatures decline in the fall, sea turtles leave their coastal habitats and join a larger contingent of other turtles migrating southward to overwinter (Morrealle and Standora 2005, Musick and Limpus 1997). Studies summarized in Morreale and Standora (2005) indicate that loggerhead and Kemp's ridley sea turtles begin to appear in Virginia waters in May and begin leaving Virginia waters by the first week of November. Similar migratory patterns are expected for green and leatherback sea turtles (Shoop and Kenney 1992; Morreale 1999).

Whale Species
~~Federally listed species of whales may be found seasonally off the Atlantic coast of Virginia.~~
Federally endangered North Atlantic right whales have been found off the coast of Virginia from November 1 – May 31, approximately 30 nautical miles from shore. Humpback whales feed during the spring, summer, and fall over a range that encompasses the eastern coast of the United States and may be found in Virginia waters from September 1 – April 30. Fin (*Balaenoptera physalus*) whales are also seasonally present in the waters off of Virginia, but are typically found in deeper offshore waters. Fin whales are likely to be present off the coast of Virginia from October – January.

As listed species are likely to be present in the action area of this project, a consultation, pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, may be necessary. The Navy will be responsible for determining whether the proposed action is likely to affect listed species. When project plans are complete, the Navy should submit their determination of effects, along with justification for the determination, and a request for concurrence to the attention of the Section 7 Coordinator, NMFS, Northeast Regional Office, Protected Resources Division (PRD), 55 Great Republic Drive, Gloucester, MA 01930. After reviewing this information, NMFS would then be able to conduct a consultation under section 7 of the ESA.

Technical Assistance for Proposed Species
On March 16, 2010, NMFS published a proposed rule to list two distinct population segments (DPS) of loggerhead sea turtles as threatened and seven distinct population segments of loggerhead sea turtles as endangered, including the Northwest Atlantic DPS. This rule, when finalized, would replace the existing listing for loggerhead sea turtles. Currently, the species is listed as threatened range-wide.

On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS) (75 FR 61872; 75 FR 61904). As you know, once a species is proposed for listing, as either endangered or threatened, the conference provisions of the ESA apply (see 50 CFR 402.10). As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat."

Please note that once a species is proposed for listing the conference provisions of the ESA apply (see 50 CFR 402.10). As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. The conference is designed to assist the Federal agency and any applicant in identifying and resolving potential conflicts at an early stage in the planning process." Based on the information on the proposed project provided to NMFS to date, NMFS encourages the Navy to consider effects of the proposed action on Atlantic sturgeon and loggerhead sea turtles and work with NMFS to determine if a conference is required. As the listing status for these species may change, NMFS recommends that the project proponent obtain updated status information from NMFS prior to the submittal of any applications or requests for consultation.

Should you have any questions about these comments or about the section 7 consultation process in general, please contact Danielle Palmer at (978)282-8468 or by e-mail (Danielle.Palmer@noaa.gov). Additionally, Julie Crocker, from NMFS PRD will attend the interagency meeting being scheduled by the Navy in regards to the proposed action. Julie Crocker can be contacted at (978)-282-8480 or by email at Julie.Crocker@noaa.gov.

Sincerely,

for Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

EC: Palmer

File Code: Sec 7 Technical Assistance 2011
PCTS: T/NER/2011/01988

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
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OCT 2 6 2011

W. David Noble
Department of the Navy
Director, Environmental Planning and Conservation
Navy Region, Mid-Atlantic
1510 Gilbert Street
Norfolk, Virginia 23511-2737

Re: JEB Fort Story and Dam Neck Annex

Dear Mr. Noble,

On September 9, 2011, we received your letters, dated September 8, 2011, requesting informal consultation, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, on the Shoreline and Restoration Project at the Joint Expeditionary Base Little Creek-Fort Story (JEB Fort Story) and on the repairs to the Shore Protection System at Naval Air Station Oceana, Dam Neck Annex (Dam Neck Annex), Virginia Beach, Virginia. As the lead federal agency[1], you provided us a Biological Assessment for each project and requested our concurrence with the preliminary determination that the project is not likely to adversely affect any species listed as threatened or endangered under the ESA. Listed species likely to occur within both project areas include: Fin, humpback and North Atlantic right whales; and, leatherback, green, Kemp's ridley and loggerhead (i.e., the Northwest Atlantic distinct population segment) sea turtles. Proposed species likely to occur in the action area include Atlantic sturgeon.

After review of the Biological Assessment, we are not able at this time to concur with your effects determination, specifically due to the risk of sea turtle entrainment. Both projects will require dredging, via a hopper dredge, of the Sandbridge Shoal for the purposes of replenishing the beaches at Dam Neck Annex and at JEB Fort Story. If dredging operations occur at a time of year sea turtles are known to present in the waters off Virginia (i.e., April-November), there is a risk of sea turtle entrainment for both projects, and thus, the potential to adversely affect sea turtle species.

Additionally, we request that you revise your Biological Assessment in light of the following changes to the loggerhead listing:

[1] The Navy has designated itself as the lead federal agency for the proposed actions and consultations; however, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEM) will have permitting authority over the sand lease site at Sandbridge Shoal. It is also NMFS understanding that the U.S. Army Corps of Engineers (ACOE) will have permitting authority over those actions impacting waters of the United States. As such the ACOE and BOEM will serve as cooperating agencies for both consultations.

- On March 16, 2010, we published a proposed rule to list two distinct population segments (DPS) of loggerhead sea turtles as threatened and seven distinct population segments of loggerhead sea turtles as endangered (75 FR 12598). On September 16, 2011, a final listing determination was made designating the Northwest Atlantic Ocean DPS, South Atlantic Ocean DPS, Southeast Indo-Pacific Ocean DPS, and the Southwest Indian Ocean DPS as threatened. The Northeast Atlantic Ocean DPS, Mediterranean Sea DPS, North Indian Ocean DPS, North Pacific Ocean DPS, and South Pacific Ocean DPS have been designated as endangered (76 FR 58868). The effective date of listing is October 24, 2011. The species of loggerhead likely to be present in the action area is the threatened Northwest Atlantic DPS of loggerhead sea turtle. After the effective date of listing (October 24, 2011) loggerhead sea turtles will be identified by their respective DPS.

Technical Assistance for Proposed Species

On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS) (75 FR 61872; 75 FR 61904). Once a species is proposed for listing, as either endangered or threatened, the conference provisions of the ESA may apply (see ESA section 7(a)(4) and 50 CFR 402.10). As stated at 50 CFR 402.10, "Federal agencies are required to confer with NMFS on any action which is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat."

Based on the information provided to us, we are concerned with the risk of entrainment of Atlantic sturgeon in the hopper dredge[2]. As such, we encourage the Navy to consider effects of the proposed actions on Atlantic sturgeon and work with us to determine if a conference is required. As the listing status for Atlantic sturgeon may change, we recommend that you obtain updated status information from us prior to the submittal of any applications or further requests for consultation.

In addition to your consideration of the above noted topics, we have also provided additional comments on the Biological Assessments (see Enclosure) and seek additional information. Please note, the comments provided are based on the JEB-Fort story project; however, the same comments, minus the breakwater installation, apply to the Dam Neck Annex project.

---

[2] U.S. Army Corps of Engineers records from dredging operations between the years of 1990-2011 indicate that of the approximately 30 reported sturgeon entrainments, at least 17 were Atlantic sturgeon, and of those 17, approximately 15 were taken with hopper dredges

Should you have any question on our comments, the Section 7 process, or wish to discuss this further please contact Danielle Palmer at 978-282-8468 or by e-mail (Danielle.Palmer@Noaa.gov).

Sincerely,

Harold C Mears

for Patricia A. Kurkul
Regional Administrator

Enclosure

EC: Palmer, NMFS/PRD
McGinnis, Navy

File Code: Navy-JEB and Dam Neck Annex: need for Formal Consultation and 2011 BA comments
H:\H2.0\personal\Danielle Palmer\Section 7\Formal Consultation\ Navy-Dam Neck and JEB Fort Story\ NAVY-DAM NECK and JEB Fort Story BA comments

Comments on Biological Assessment

A Biological Assessment (BA) must provide NMFS with sufficient information to allow us to carry out a section 7 consultation for each action identified above. NMFS anticipates that if formal consultation is completed, any Biological Opinion produced by NMFS will assess the direct and indirect effects of the action NMFS listed species and determine whether the proposed action is likely to jeopardize the continued existence of any species. In order to make such determinations, we will need to consider impacts of the action on individuals (e.g., dredge entrainment, acoustic harassment, vessel strikes) and the habitat (e.g., loss of benthic resources, elevated levels of turbidity). The following information is necessary for NMFS to complete our analysis.

<u>Section 2.1.1</u>

Beach Replenishment and Dredging Operations

The following additional information is needed on the operation and schedule of dredge operations:

a.) In regards to the JEB Fort story Project, it states on page 2-5 that the Omaha Beach replenishment will be scheduled over a six-month period starting between fiscal year 2012 and 2014 and that there are two Phases of replenishment proposed.

> 1. Does the six month period encompass both Phases of the replenishment? If so, approximately when will Phase 1and Phase 2 be initiated and approximately how many months will it take to complete each Phase? As sea turtles are only likely to occur in the action area seasonally, the timing of the dredging is important to understanding effects of the action on these species.

b.) How many dredges will be used? If more than one is expected, will they be operating at the same time?

c.) How many hours will the dredge(s) operate (e.g., 12 hour shifts, 24 hours)? What portion of these hours will be spent at the shoal vs. transiting to the pump-out station/buoy?

d.) How many trips per day will be taken from the shoal to the pump-out station/buoy near the shoreline?

e.) How far from shore is the pump-out station/buoy? How far apart are the buoys?

f.) Are any renourishment cycles proposed? If so, how many; how often will they occur; and how much material will be removed per cycle?

g.) Dredged material will be placed on shore to replenish the beach. Approximately how far from shore will this material extend into the water?

Sandbridge Shoal

The following additional information is needed on the benthic environment of Sandbridge Shoal:

a.) How many acres is Sandbridge Shoal?

b.) Approximately what percentage of the shoal will be removed by the proposed dredging operations?

Stone Breakwater Installation

The following additional information is needed in regards to the installation of the stone breakwaters:

a.) It is stated on page 2-5, that a total of 58,000 tons of stone will be used to construct the breakwaters:

1. How many tons of stone will be used per breakwater?

2. Approximately how many acres of benthic habitat will be lost per breakwater? This information will be considered in our assessment of habitat alteration as a result of the proposed actions on Atlantic sturgeon and listed species.

b.) It is stated on page 5-16 that breakwater installation may require excavation:

1. Will excavation occur during low tide?

2. How much material will be removed?

3. Explain the purpose of the excavation.

c.) It is stated that a hydraulic excavator will be used to place the stone, seaward of the high water line. Will stone placement be undertaken during periods of low tide or will work be conducted in-water?

d.) Can you please provide depth profiles from the shoreline out past the stone breakwaters (e.g., depths near shoreline; depths where breakwaters will be placed; depths a few meters past breakwaters)?

e.) Approximately how far from shore will the breakwaters be placed?

f.) It is stated on page 2-5, that breakwater construction will occur over a 12 month period between FY2017 and FY 2019. Please explain further the proposed schedule of installation.

How will the 12 months be divided between FY2017 and FY2019? Are there certain times of year that work will or will not occur?

Section 3.2 Species Present in Action Area

a.) Please include the following information regarding Atlantic sturgeon in Table 3-1:

"On October 6, 2010, NMFS published two proposed rules to list five distinct population segments (DPS) of Atlantic sturgeon under the ESA. NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic) and one DPS of Atlantic sturgeon as threatened (Gulf of Maine DPS) (75 FR 61872; 75 FR 61904).

b.) Please note, the listing status of loggerhead sea turtles has changed and the following information should be updated in Table 3-1.

"On March 16, 2010, we published a proposed rule to list two distinct population segments (DPS) of loggerhead sea turtles as threatened and seven distinct population segments of loggerhead sea turtles as endangered (75 FR 12598). On September 16, 2011, a final listing determination was made designating the Northwest Atlantic Ocean DPS, South Atlantic Ocean DPS, Southeast Indo-Pacific Ocean DPS, and the Southwest Indian Ocean DPS as threatened. The Northeast Atlantic Ocean DPS, Mediterranean Sea DPS, North Indian Ocean DPS, North Pacific Ocean DPS, and South Pacific Ocean DPS have been designated as endangered (76 FR 58868). The effective date of listing is October 24, 2011. The species of loggerhead likely to present in the action area is the threatened Northwest Atlantic distinct population segment of loggerhead."

Section 4.3; 4.3.1 Atlantic Sturgeon

a.) You may want to refer to the information provided above (Section 3.2 (a)) in this section as well for Atlantic sturgeon.

Section 4.4; 4.4.1 Loggerhead Sea Turtles

a.) Please include the information provided above (Section 3.2 (b)) in this section.

Section 5

In general, Atlantic sturgeon and/or listed species of whales and sea turtles may be impacted, directly or indirectly, by one or more of the following:

a.) Increase levels of turbidity
b.) Increased levels of underwater noise levels as a result of dredging
c.) Vessel collision/strikes.

With the exception of whales, sea turtles and Atlantic sturgeon may also be directly or indirectly impacted by the following:

a.) Dredge entrainment
b.) Alteration of the benthic environment (e.g., removal of foraging items).

Although some of these impacts were addressed for each species within Section 5, additional analyses and information should be provided in the BA as follows:

a.) Increased levels of turbidity:

1. Please provide information on the turbidity levels expected to result from dredging operations, beach renourishment, and the installation of breakwaters. Information on the extent the sediment plume will be experienced, the concentration levels of suspended sediment, and, the length of time elevated levels of suspended sediment will be experienced, should be provided. This information should then be used to assess the impacts of turbidity on listed species and Atlantic sturgeon.

b.) Benthic environment of the action area. Information is needed on the habitat characteristics in the area where stone breakwaters will be placed and along the shoreline where beach replenishment will take place (e.g., What are the depths in these areas?; What types of benthic organisms comprise each of these areas?; and Is any submerged aquatic vegetation present in these areas?).

Based on this information, impacts on the benthic environment needs to be assessed and a conclusion made on how these impacts will effect listed species of sea turtles and Atlantic sturgeon (e.g., Do these areas support foraging habitat for these species? If so, will a significant percentage of foraging habitat be removed?). In general, you need to provide:

1. A description of the baseline habitat;
2. How the action will change the baseline, for how long and what the recovery rate is expected to be; and,
3. Whether these changes will adversely affect sea turtles and Atlantic sturgeon by affecting forage availability.

Specific Comments for Section 5

Section 5.1 Whales

a.) On page 5-2, as well as within other sections of the BA, it states that dredge speeds will not exceed 10 knots between the months of November 1-April 30.

1. Is this the only period of time dredging will occur? If not, what will dredge speeds be outside of this timeframe? NMFS would recommend that all vessels operate at 10 knots or less at all times.

2. NMFS recommends a lookout/bridge watch be onboard all dredges. The lookout/bridge watch should be knowledgeable in the identification of listed species.

b.) In regards to dredge noise, although the specific dredge to be used may not be known at this time, an estimate of the source level, at 1 meter, of the dredge, and the distance in which the 120 dB re 1 μPa threshold will extend, is needed. As noted in the BA, 120 dB threshold, as defined by NMFS, is the underwater noise level believed to result in Level B behavioral disturbance/harassment of marine mammals from a continuous noise source. As dredge noise is considered a continuous noise, estimates of the extent in which the 120 dB will be experienced needs to be provided in order to define a zone of influence. Please review the 2010 NASA Biological Opinion (emailed September 28, 2011, to Ben McGinnis, Navy) to obtain information in this matter.

Additionally, it is stated on page 5-3, that "noise levels would likely be high enough within at least 100 m of the operations to disturb whales enough to disrupt their behavioral patterns." Based on NMFS review of dredge noise in the 2010 NASA Biological Opinion, within 794 meters from the dredge, noise levels could reach 120 dB, and as such, disruption of behavioral patterns in likely larger than 100 meters.

Section 5.3.1 Atlantic Sturgeon

a.) Atlantic sturgeon are known to be struck by vessels. As such, the BA should consider the potential for vessel interactions with Atlantic sturgeon.

b.) This section also describes, in general, how dredging and the placement of sand for beach nourishment can remove prey resources for Atlantic sturgeon. However, as noted above, this analysis should be specific to the habitats in the action area (i.e., shoal, nearshore where sand will be placed, and breakwater area). That is, as noted above:

1. What are the benthic organisms comprising the habitats of the action area;

2. Are these habitats currently comprised of the preferred prey items of Atlantic sturgeon? If so, what will this impact be on the prey resources and thus, on Atlantic sturgeon. Recovery times and percent of prey removal should be included in this analysis as well; or,

3. Do certain portions of the action area consist of poor foraging habitat for Atlantic sturgeon? If so, what will this impact be on the prey resources and thus, on Atlantic sturgeon.

Additionally, it states on page 5-10, that "these disturbances would cause Atlantic sturgeon to leave its preferred habitat..." Can you provide information that would support the Navy's conclusion that underwater noise levels would cause Atlantic sturgeon to leave the affected area (pg. 5-10)? Additionally, what is the Atlantic sturgeon's preferred habitat in the action area? Is the BA stating that the shoal area is a preferred habitat of Atlantic sturgeon? If so, as noted previously, information supporting this needs to be provided.

Section 5.4: Turtles

a.) See comment (b) for Atlantic sturgeon above. A similar analysis needs to be done for sea turtles.

Section 7

a.) On page 7-2, third paragraph regarding fish species, it states that "....potential impacts would include entrainment, loss of prey, disturbance, and turbidity." Impacts should also include vessel collision and dredge noise.

b.) On page 7-3, first paragraph, it states that "....impact sea turtles through entrainment, vessel collision, disruption of food sources, and turbidity." Impacts should also include dredge noise.

Mitigation Measures

After reviewing the BA, we noticed several mitigation measures the Navy plans to implement throughout the proposed action. The BA should include a comprehensive list of all the mitigation measures the Navy proposes to implement for this action. We would like to review these measures and work with you to provide, if necessary, additional measures that may be appropriate to reduce impacts to listed species.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUN - 7 2012

David Noble
Department of the Navy
Commander
Navy Region, Mid-Atlantic
1510 Gilbert Street
Norfolk, VA 23511-2737

RE: Initiation of ESA Formal Consultation – Dam Neck Annex

Dear Mr. Noble,

The Navy has requested the initiation of formal consultation for the repairs to the Shoreline Protection System at the Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia. You requested informal consultation and submitted a Biological Assessment (BA) on September 8, 2011. In a letter dated October 26, 2011, we informed the Navy that we were not able to proceed with an informal consultation, as we did not concur with its not likely to adversely affect determination, and we requested additional information and revisions be made to the BA. We received a revised BA on April 20, 2012, and responded with additional comments on May 16, 2012, via email. We received the final BA via e-mail on May 21, 2012, and in an email dated May 24, 2012, the Navy confirmed that the final BA served as their formal request for formal consultation.

The BA includes the information we requested and we are initiating a formal consultation. We received the final revised BA on May 21, 2012. It will mark the beginning of formal consultation. The ESA and the section 7 regulations (50 CFR 402.14) require we conclude formal consultation within 90 calendar days of initiation, and that we deliver the biological opinion to the action agency within 45 days after the conclusion of formal consultation (i.e., October 3, 2012), unless extended. In the meantime, pursuant to section 7(d) of the ESA, the Navy must not make any irreversible or irretrievable commitment of resources that would foreclose the formulation or implementation of any reasonable and prudent alternatives to avoid jeopardizing endangered or threatened species.

I look forward to continuing to work with you and your staff during the consultation process. If you have any questions or concerns about this letter, or about the consultation process in general, please contact Danielle Palmer at (978) 282-8468 or by e-mail (Danielle.Palmer@noaa.gov).

Sincerely,

Daniel S. Morris
Acting Regional Administrator

EC: Palmer, F/NER3
O'Brien, F/NER4
McGinnis, Navy
Wikel, Culberston, BOEM
Woodward, ACOE/Norfolk

File Code: Sec 7 NAVY-JEB Fort Story
PCTS: F/NER/2012/02021

Czapka, Stephen J.

From: McGinnis, Benjamin A CIV NAVFAC MIDLANT, EV <benjamin.mcginnis@navy.mil>
Sent: Thursday, July 19, 2012 5:24 PM
To: David O'Brien
Cc: Culbertson, Jennifer; Wikel, Geoffrey L; Barker, Jessica D CIV NAVFAC MIDLANT, EV; Shurling, Cynthia; Czapka, Stephen J.; Budzynkiewicz, Jaime; Danielle Palmer
Subject: Response to Questions - EFH assessment for Repairs to Shoreline Protection System (SPS) at NAS Oceana, Dam Neck Annex
Attachments: Attachment 1.pdf; Attachment 2.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dave,

In response to your e-mail of May 30, 2012, the Department of the Navy (Navy) and the Bureau of Ocean Energy Management (BOEM) offer the responses below as a supplement to our previously requested Essential Fish Habitat (EFH) consultation with NMFS for the NAS Oceana, Dam Neck Annex Repairs to the Shoreline Protection System (SPS) project. As previously discussed, your e-mail was written in regards to the proposed Shoreline Protection and Restoration Project at Joint Expeditionary Base (JEB) Fort Story but you have confirmed that questions not addressed specifically toward the JEB Fort Story project would also apply to our similar efforts at the NAS Oceana, Dam Neck Annex. Questions specific to the JEB Fort Story project are not addressed here and will be handled at a later date for that project specifically.

Please note that page references to the JEB Fort Story EFH Assessment may differ from those of the Dam Neck Annex EFH Assessment. We have modified the page references in the questions posed in your e-mail to correctly identify the same discussion in our Dam Neck Annex EFH Assessment.

2-2 DISCUSSES EMPLOYING "BMP'S" DURING SAND PLACEMENT ALONG THE BEACH. WILL THIS INCLUDE TURBIDITY CURTAINS, OR CAN YOU BETTER DEFINE THE E&S MEASURES TO BE EMPLOYED?

The Navy will require the contractor to install a baffle plate, spreader pipes, pocket pipes, or similar apparatus to the discharge end of the pipeline that precisely controls the placement of the beach fill material and increases the settlement rate of the material to the maximum extent practicable. Temporary longitudinal control dikes will be constructed as close to the shoreline as practical and in a manner that requires the effluent water to travel a sufficient distance to minimize turbidity prior to returning to the ocean waters. Such longitudinal dikes and outfall devices shall be used to prevent erosion at the point of deposit and the subsequent loss of material directly into the water. Once the material has been deposited, the contractor shall distribute and grade the material to the designed beach fill profile.

Use of turbidity curtains is not a practical option or alternative due the dynamic current and wave climate in the adjacent nearshore area.

4-1 IS IT POSSIBLE TO SCHEDULE THE DREDGING DURING THE WINTER MONTHS WHEN BENTHIC PRODUCTIVITY, FISH UTILIZATION, AND THE PRESENCE OF SEA TURTLES IS LOWEST?

The Navy plans to limit the dredging schedule to the winter months. We anticipate that dredging at Sandbridge Shoal would occur sometime between December 1 and March 31.

4-1 VOLUME OF SAND HARVESTED BETWEEN 1996 AND 2007 IS PROVIDED AS 6.8 MCY WHICH IS INCONSISTENT WITH VOLUME FIGURE OF 4 MCY PROVIDED ON 7-5.

Approximately 6,810,000 cubic yards (cy) of sand were removed from Sandbridge Shoal between 1996 and 2007. The four (4) million cubic yard (mcy) volume cited on page 7-5 of the Dam Neck EFH Assessment is incorrect.

4-2 CAN YOU QUANTIFY "RELATIVELY SLIGHT" ACCRETION OR RECOVERY OF THE SHOAL? IS THE CONTINUED MINING OF SANDBRIDGE SHOAL SUSTAINABLE?

BOEM is not aware of any studies specifically quantifying the accretion on Sandbridge Shoal but as was discussed during our WebEx/teleconference with you on July 12, 2012, it is quite small and more often you see movement of sand within the shoal complex and not as much accretion with sand from outside the complex. However, within the longer term management time frame that the USACE and the Navy look at (25-50 years) for renourishment plans, BOEM does believe that the continued use of the shoal is sustainable. With proper management of the shoal the sand can be accessed without long term, broad scale changes to the shoal complex. By looking at the Sandbridge 3D figure (Attachment 1) the areas in green are locations of loss either due to dredging or the movement of the shoal itself. Areas of red are areas of gain due to accretion or movement within the shoal. The areas of impact due to dredging are primarily located on the northwest portion of the shoal with one additional !
area directly in the southern portion of the shoal. By looking at these areas of loss in context of the total shoal area (this figure includes Borrow Areas A, B and the no dredge zone that extends between the two), you can see that the continued mining in the current management plan timeframe would not alter the greater shoal area.

5-5 WHAT IS THE RATIONALE FOR THE "NO DREDGE ZONE" DEPICTED ON BORROW AREAS A AND B?

The "no dredge zone" depicted in Figure 5-1 encompasses an approximate area containing Navy submarine data cables. There is no known regulatory requirement that prevents dredging within the area depicted in the figure, only self-imposed restrictions by the U.S. Army Corps of Engineers for their own projects. It is the Navy's intent to limit dredging outside of the cable area to avoid interaction or damage to any of its own cables.

7-8 WHY IS THE ESTIMATED SAND VOLUME OF SANDBRIDGE SHOAL SO VARIABLE (BETWEEN 22-105 MCY)?

As you can see in Attachment 2, the definition of the footprint of the shoal is variable depending on who is studying it. The shoal body itself, outlined in black is much smaller than the entire shoal complex. Also, the borrow areas A and B (bold black polygons) only cover a percentage of the main shoal body itself. So depending on what footprint is defined in the study that is being referenced the actual shoal volume can be highly variable.

8-1 DO YOU FEEL THE CONTINUED MINING OF SANDBRIDGE SHOAL IS SUSTAINABLE WHEN APPROXIMATELY 44% OF THE CONSERVATIVE ESTIMATED SAND RESOURCE HAS BEEN MINED OVER THE LAST 17 YEARS?

BOEM does not believe that the 44% estimate is correct. As BOEM has previously mentioned, the volume of the shoal depends upon the identified footprint. As you can see in Attachment 2 there are various areas defined as the shoal and borrow areas. If you look at the main shoal area that is outlined in the thin black line and only within the defined borrow areas (the thick black polygons) BOEM has estimated there to be approximately 12,000,000 cy of sand. However, this does not include any of the sand rich areas located within the borrow areas that are not defined on the main shoal body itself. BOEM estimates that the entire shoal body itself (within the thin black line) contains approximately 28,300,000 cubic yards of sand. Looking at the entire shoal complex which would include the areas highlighted in yellow, the shoal body (thin black line) and the connected sand ridges that extend outside of the borrow sites BOEM has approximated a sand volume of 181,000,000 cy of sand. !

The total use of the shoal since the mid-1990's has led to the loss of approximately 6,810,000 cubic yards which is a small percentage when compared to the total estimated volume of the entire shoal complex.

8-1 WHAT SIZE SCREEN (MESH SIZE) WILL BE USED TO MINIMIZE ENTRAINMENT OF FINFISH? IS THIS PRACTICABLE? SCREENING OF THE CUTTERHEAD MAY BE A MORE APPROPRIATE BMP FOR EXCLUSION OF SEA TURTLES.

The Navy does not intend to use a screen on the drag head. Although a screen could be used to minimize entrainment of finfish, it would allow for impingement of these animals including to Atlantic sturgeon and sea turtles. The Navy has previously discussed the use of a screen on the drag head with Ms. Danielle Palmer of the NMFS Protected Resources Division, and it is her programs preference that a screen not be utilized since it would prevent identification of takes of protected sea turtles and Atlantic sturgeon, which could still occur by way of impingement upon the screen. The Navy confirmed this position again with Ms. Palmer by telephone on July 17, 2012.

The Navy's contractor will be required to operate the drag head in a manner that minimizes the possible entrainment of sea turtles and Atlantic sturgeon. The anticipated Biological Opinion (BO) to be provided by NFMS Protected Resources Division will require the suction in the drag head to be turned off when it is lifted off the bottom, as was proffered by the Navy in our Biological Assessment previously submitted to NMFS.

8-1 CAN YOU DEFINE THE "OPERATIONAL TECHNIQUES" TO BE EMPLOYED DURING DREDGING TO MINIMIZE TURBIDITY PLUMES?

As stated above, the Navy's contractor will be required to operate the drag head in a manner that minimizes the possible entrainment of sea turtles and Atlantic sturgeon. These "operational techniques" would include placing the drag head as close to the bottom as practical and turning off the section in the drag head before it is lifted from the bottom, which would in turn help to minimize the resuspension of adjacent sediment and the resulting turbidity plumes. However, a temporary localized increase in turbidity could still occur during dredging operations. Since the target sediment is primarily coarse-grained sand, this impact is not expected to be significant and would not result in long-term negative impacts. Geotechnical information which characterizes the sediment at the shoal will be utilized to select areas for dredging that contain beach quality sand and avoid areas with finer grained material that would be more likely to produce turbidity issues.

We hope our responses and the information shared with you during our WebEx/teleconference last week sufficiently answer your questions. As you are already aware of our current time constraints, the Navy would appreciate your expeditious review of this matter. Should you have any questions, please feel free to contact us at any time.

v/r,

Ben McGinnis
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-----Original Message-----
From: David O'Brien [mailto:david.l.o'brien@noaa.gov]
Sent: Wednesday, May 30, 2012 11:43
To: Barker, Jessica D CIV NAVFAC MIDLANT, EV
Subject: EFH assessment for Shoreline Restoration at JEB Little Creek/Fort Story

Hello Jessica,

I hope you are doing well. I have reviewed the EFH assessment for the beach nourishment and breakwater project at JEB Little Creek/Fort Story and have a few questions that I hope either you or the consultant can answer before I provide a formal response to your request for EFH consultation. To make it easier for you to respond, I have referenced each of my questions with a page number from the EFH assessment.

2-2 Discusses employing "BMP's"during sand placement along the beach. Will this include turbidity curtains, or can you better define the E&S measures to be employed?

2-5 Can you estimate the anticipated replenishment cycle for JEB Little Creek/Ft. Story?

3-1 Is it possible to schedule the dredging during the winter months when benthic productivity, fish utilization,and the presence of sea turtles is lowest?

3-1 Volume of sand harvested between 1996 and 2007 is provided as 6.8 mcy which is inconsistent with volume figure of 4 mcy provided on 6-5.

3-2 Can you quantify "relatively slight" accretion or recovery of the shoal? Is the continued mining of Sandbridge Shoal sustainable?

4-7 What is the rationale for the "no dredge zone" depicted on borrow areas A and B?

6-1 Are the breakwaters to be place in the intertidal zone? A depth of -2 to -7 ft. MLLW is provided on 2-5.

6-8 Why is the estimated sand volume of Sandbridge Shoal so variable (between 22-105 mcy)?

7-1 Do you feel the continued mining of Sandbridge Shoal is sustainable when approximately 44% of the conservative estimated sand resource has been mined over the last 17 years?

7-1 What size screen (mesh size) will be used to minimize entrainment of finfish? Is this practicable? Screening of the cutterhead may be a more appropriate BMP for exclusion of sea turtles.

7-1 Can you define the "operational techniques" to be employed during dredging to minimize turbidity plumes?

Please feel free to give me a call to discuss any of the questions I have outlined above. I am certainly interested in helping the Navy and BOEM develop a sand management plan for Sandbridge Shoal. I look forward to talking with you soon.

Best regards,

Dave

--

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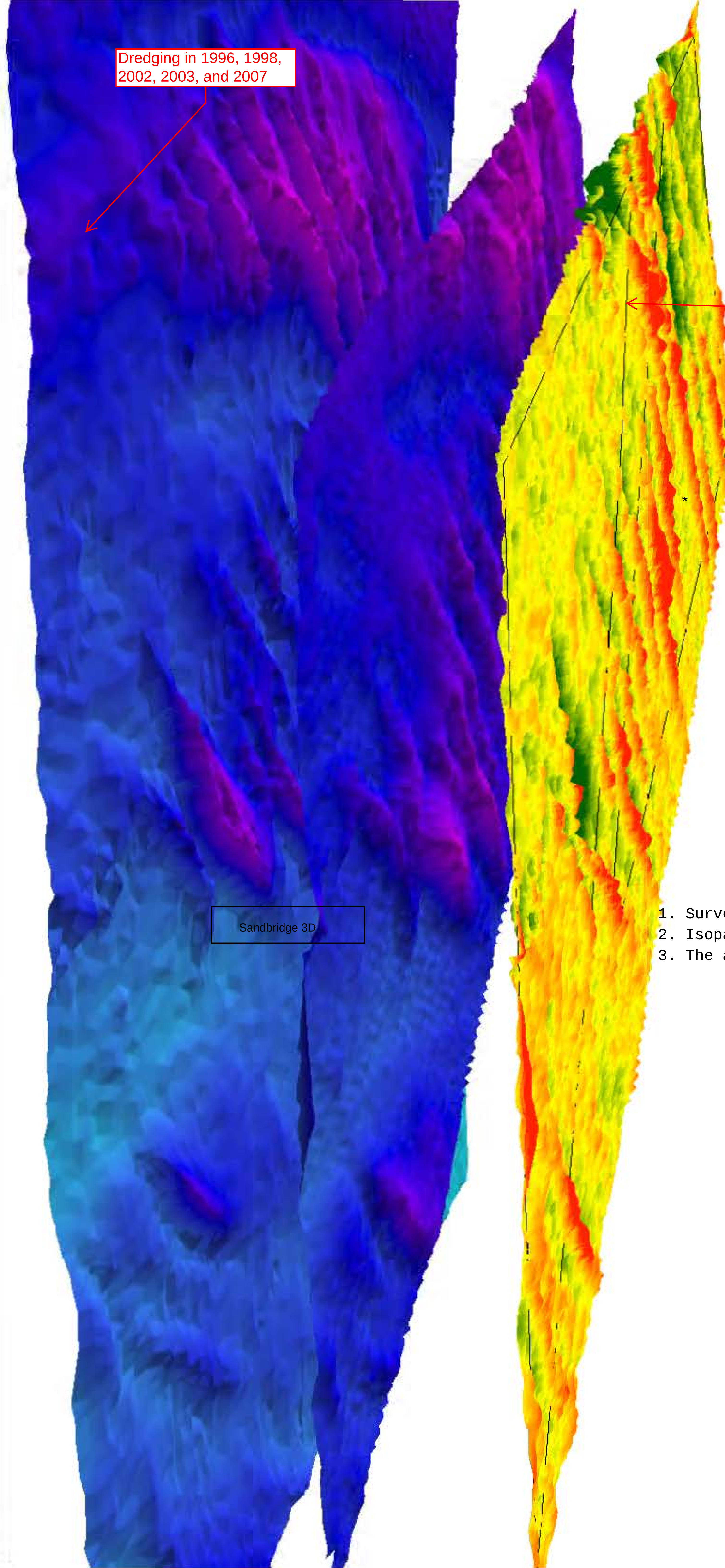
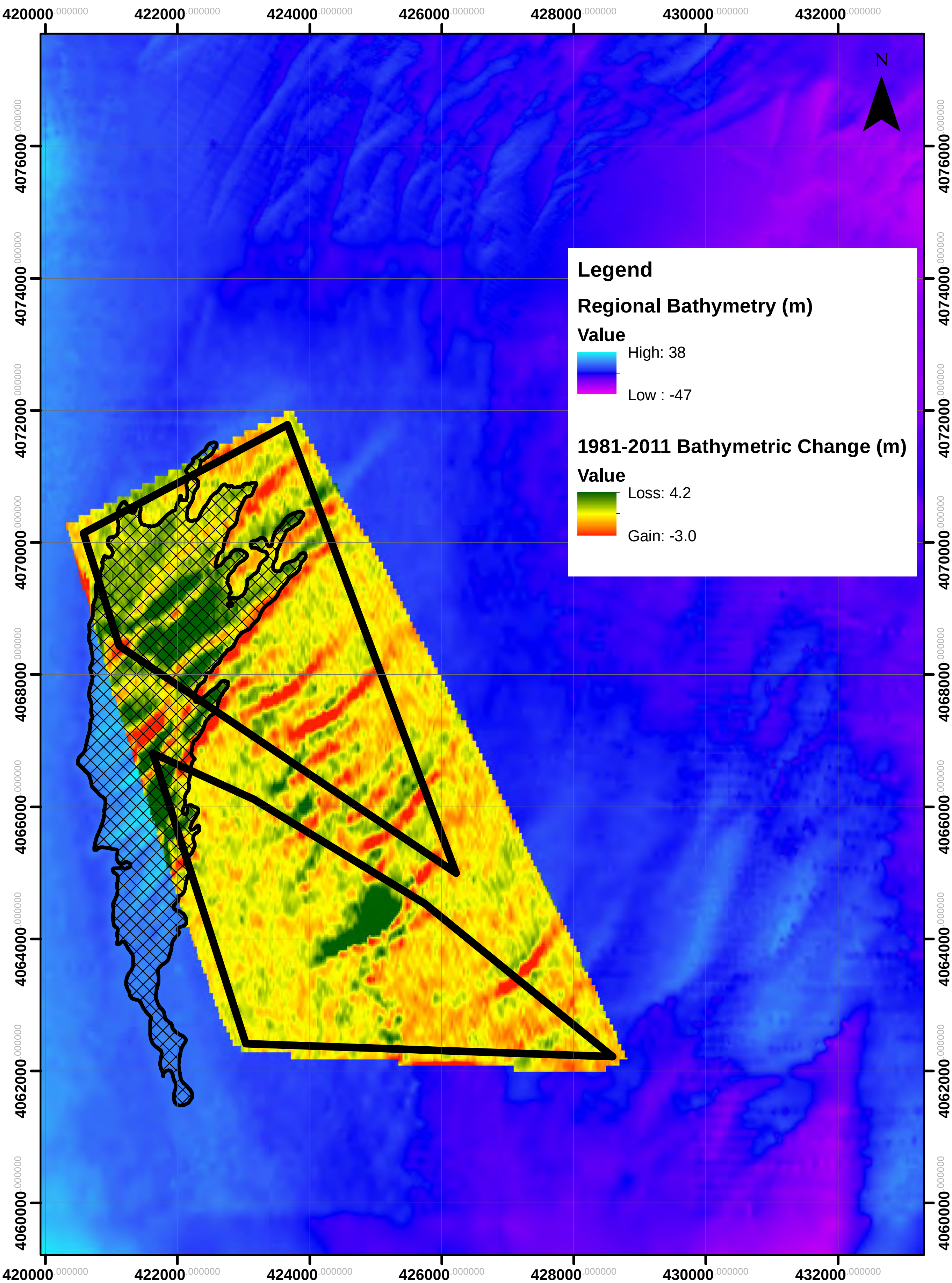


Isopac

Dredgin

1. Surveys were converted
2. Isopach data has not b
3. The areal footprint of

Attachment 1



Attachment 2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

AUG 16 2012

Mr. Ben McGinnis
Environmental Planning & Conservation
NAVFAC MIDLANT EV Core
Naval Station Norfolk
Bldg. Z-144, 2nd Floor
9742 Maryland Avenue
Norfolk, VA 23511-3095

Re: NAS Oceana, Dam Neck Annex, repairs to shoreline protection system; Essential Fish Habitat Assessment

Dear Mr. McGinnis,

We have reviewed the essential fish habitat (EFH) assessment prepared for repairs to the shoreline protection system (SPS) at the Navy's NAS Oceana, Dam Neck Annex, located in the City of Virginia Beach, Virginia. The SPS, completed in October 1996, consists of a buried stone seawall core covered with sand to create an artificial dune and associated beach nourishment. The SPS beach was nourished a second time between October 2003 and April 2004. Since 2004, erosion and storm damage have reduced the level of protection afforded Dam Neck Annex facilities by the beach component of the SPS. Based on the current 7-9 year maintenance cycle, the Navy is proposing to nourish the SPS beach between FY 2012 and FY 2014 depending on funding.

In order to return to the level of protection as originally designed, the Navy has evaluated two alternatives for the proposed SPS repair project. Alternative 1, the preferred alternative, involves the full replenishment of the approximately 1 mi. long SPS with additional nourishment approximately 0.5 mi. north and 0.5 mi. south of the SPS dune. This alternative would require approximately 700,000 cu. yds. of sand from the outer continental shelf in the borrow area known as Sandbridge Shoal. The shoal would be excavated using a hopper dredge and the sandy material would be transported by to an offshore pump-out buoy, and conveyed to the beach via pipeline and then distributed using no more than two bulldozers and two graders to produce the designed beach profile. Repairs to the SPS under Alternative 1 are expected to require three to six consecutive months to complete.

Alternative 2 includes the full replenishment of the SPS as to be completed in Alternative 1, with the additional construction of a man-made, stone core dune extending 0.5 mi. north and 0.5 mi. south of the existing SPS dune. Under Alternative 2, approximately 1.1 million cu. yds. of sand would be required from Sandbridge Shoal. The beach replenishment and dune construction under Alternative 2 would take approximately 6 to 9 months to complete.

Sandbridge Shoal is an area of approximately 13,500 acres (55 km^2) located approximately 3 nautical miles (4.8 km) east of the proposed project location. The mining of beach quality sand for this project will target approximately 0.7-1.1 million cubic yards of material from the main shoal body in borrow areas "A" and "B" utilizing a trailing suction hopper dredge.

General Comments

Sandbridge Shoal has been the source of material for numerous City of Virginia Beach's Sandbridge Beach nourishment projects and the nourishment of Dam Neck Annex in 1996 and 2003. The EFH assessment indicates that Sandbridge Shoal exhibits relatively little volumetric recovery between dredging events, leading to the long-term reduction in the surface area of bottom habitat. As presented in the EFH assessment, previous sand mining and beach nourishment projects have cumulatively extracted approximately 44% of the sand volume conservatively estimated by the Corps of Engineers at Sandbridge Shoal (22 million cu. yds.). However, recent sampling and benthic mapping of Sandbridge Shoal by the Bureau of Ocean Energy Management (BOEM) appears to suggest a significantly larger sand resource (Wikel and Culbertson, BOEM, personal communication) than previously reported by the Corps of Engineers. Therefore, if managed appropriately, it is the opinion of BOEM that the sand resources of Sandbridge Shoal may be available throughout the 50-year project life of both the Dam Neck Annex shoreline protection system and City of Virginia Beach's Sandbridge Beach hurricane protection projects.

The EFH assessment states that despite previous dredging events, "negative impacts on macrobenthos or demersal fishes have not been documented" and that monitoring between dredged and non-dredged control areas has revealed no significant differences in macrofauna abundance. However, the assessment indicates that recent dredging projects have the potential to result in direct and indirect impacts including "habitat alterations, loss of benthic invertebrates, and changes in local bathymetry". In addition, continued mining of Sandbridge Shoal may result in "increased coastal erosion at beaches landward and adjacent to the mining site resulting in alteration of the littoral sediment budget..." and may affect "a shoal's function as fishery habitat". In our view, the fisheries data collected to date on and adjacent to Sandbridge Shoal (Cutter and Diaz, 1998; Diaz et al., 2006) is insufficient to conclude that the cumulative, long-term impacts of sand mining on EFH and managed species are discountable. In a study that analyzed two trawl survey time series totaling 14 years of data off the coast of New Jersey, Vasslides and Able (2008) concluded that sand ridges are important features of the inner continental shelf, influencing fish assemblages and abundance. We believe this important function of the Mid-Atlantic sand ridge complex includes Sandbridge Shoal.

The EFH assessment states that recovery of the benthos within the borrow sites is anticipated to occur between 3 months to 2.5 years. However, based on the projected needs of the Navy and the City of Virginia Beach, sand mining at Sandbridge Shoal and the removal of the benthic epifauna and infauna communities every 3 to 5 years may limit the extent to which the benthos recover, thus affecting EFH and higher trophic levels including managed species.

Essential Fish Habitat Conservation Recommendations

As identified in the EFH assessment, the general project area including Dam Neck Annex and Sandbridge Shoal has been designated as EFH for 22 federally managed species and is a habitat area of particular concern (HAPC) for sandbar sharks. While we concur with the Navy's determination that the proposed 2012 maintenance cycle of the Dam Neck Annex shoreline protection project will not have a substantial adverse effect on EFH or HAPC for sandbar shark, we are concerned that long-term cumulative impacts to EFH and managed species may result from the continued, future mining of Sandbridge Shoal. Therefore, given the project's 7-9 yr. maintenance cycle for beach nourishment across the projected 50-yr. project life of the Dam Neck Annex SPS, we provide the following conservation recommendations pursuant to Section 305 (b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to help avoid and minimize individual and cumulative adverse impacts to EFH, managed species and their prey.

1) Pre- and post-dredge hydrographic surveys should be conducted where dredging is planned.

2) Existing bottom contours should be followed for dredging activities to maintain seafloor ridge and swale heterogeneity.

3) The dredge cut should be limited to a maximum of 2 meters

4) Rotational dredging should be used to preclude the sequential mining of the same sand ridge on successive maintenance events.

5) The area footprint and time period over which the dredge operates should be minimized

6) Operational techniques and best management practices should be used during hopper dredging to reduce the size and duration of turbidity plumes and entrainment of threatened and endangered species.

7) A long-term management plan for Sandbridge Shoal should be developed, in coordination with us, prior to the Navy's next maintenance event.

Section 305(b)(4)(B) of the MSA requires the Navy to respond to us regarding the EFH conservation recommendations provided here. In the case where your response is inconsistent with our recommendations, the Navy must substantiate its reasons for not accepting the recommendations pursuant to 50 CFR 600.920(k).

Please note that if new information becomes available or the project is substantially revised in such a manner that affects the basis for the above recommendations, EFH consultation must be reinitiated.

Conclusions

The proposed sand mining of Sandbridge Shoal and beach nourishment of the Navy's Dam Neck Annex will affect EFH and sandbar shark HAPC. However, we concur with your determination that the 2012 project alone will not significantly adversely affect EFH or HAPC. However, we have concerns regarding long-term, cumulative impacts to Sandbridge Shoal, EFH, managed species and their prey species based on the historic and projected continued use of Sandbridge Shoal as a source of beach quality sand by both the Navy and the City of Virginia Beach. The conservation recommendations provided above are intended to avoid and minimize the cumulative adverse effects of sand mining and beach nourishment on EFH, managed species, their prey species and other aquatic resources. Additional mitigative measures may be identified in the future through the efforts of BOEM, the Navy and NOAA Fisheries Service in developing a long-term management plan for Sandbridge Shoal.

Thank you for the opportunity to review and provide comment on the EFH assessment for the Sandbridge Beach erosion control and hurricane protection project. We look forward to your response to our recommendations. Please feel free to contact Mr. David O'Brien of our Gloucester Point, VA field office at 804-684-7828 (David.L.O'Brien@noaa.gov) if you have any questions regarding these recommendations.

Sincerely,

for Louis A. Chiarella
Acting Assistant Regional Administrator
For Habitat Conservation

Literature Cited

Cutter, G.G. Jr. and R.J. Diaz. 1998. Benthic Habitats and Biological Resources off the Virginia Coast 1996 and 1997. In *Environmental Studies Relative to Potential Sand Mining in the Vicinity of the City of Virginia Beach, Virginia* (C.H. Hobbs, ed.) U.S. Department of the Interior, Minerals Management Service, OCS Study 2000-055.

Diaz, R.J., C.O.Tallent and J.A. Nestlerode. 2006. Benthic resources and habitats at the Sandbridge borrow area: A test of monitoring protocols. In *Field testing of a physical/biological monitoring methodology for offshore dredging and mining operations.* (C.H. Hobbs, ed.) U.S. Department of the Interior, Minerals Management Service. MMS OCS Study 2005-056.

Vasslides, J.M. and K.W. Able. 2008. Importance of shoreface sand ridges as habitat for fishes off the northeast coast of the United States. *Fisheries Bulletin.* No. 106, pp. 93-107.

DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
1510 GILBERT ST.
NORFOLK, VA 23511-2737

IN REPLY REFER TO:
5090
EV22/22/487
AUG 23 2011

Mr. Marc Holma
Department of Historic Resources
Review and Compliance
2801 Kensington Avenue
Richmond, Virginia 23221

Dear Mr. Holma:

SUBJECT: REPAIRS TO THE SHORELINE PROTECTION SYSTEM AT NAVAL AIR STATION OCEANA, DAM NECK ANNEX, VIRGINIA BEACH, VIRGINIA RHPO #11-63

The intent of this letter is to initiate Section 106 consultation regarding the proposed repairs to the shoreline protection system (SPS) at Naval Air Station Oceana, Dam Neck Annex (DNA) in Virginia Beach, Virginia. The SPS was constructed to protect Navy assets currently worth approximately $135 million. The SPS on the Annex consists of a constructed sand dune reinforced by a buried stone core, and associated beach on the seaward side. The constructed sand dune is one mile long, 20 feet high and 50 feet wide at its base. The beach portion of the SPS is approximately two miles long, including the one-mile area in front of the constructed sand dune, with approximately one-half-mile portions extending north and south of the constructed sand dune. The beaches at DNA have been affected by heavy erosion in recent years. To ensure the continued stability of the shoreline, provide for the ongoing military mission, and to protect Department of Defense infrastructure worth approximately $135 million, the Navy proposes the following undertaking: to replenish approximately 472,500 yd^3 of lost beach sand and restore 52,500 yd^3 of sand to the artificial dune. An Environmental Assessment is being prepared to determine the potential impacts of this undertaking and to assess alternatives. The Area of Potential Effect (APE) for this undertaking is shown on enclosure (1).

The proposed action includes authorization by the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) to access outer continental shelf sand in the borrow area known as Sandbridge Shoal, for the extent of the lease agreement, in order to dredge sand for the beach and dune replenishment. Sandbridge Shoal is approximately 3 miles offshore of the project location. A hopper dredge would be used to pump the sand from Sandbridge Shoal. The hopper dredge would remove approximately 2,800 yd^3 of sand per trip to the shoal. Once the sand is pulled from the shoal, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge onto the Annex beach through a short pipeline at approximately 18 different offload locations, spaced approximately 500 feet apart, along the shoreline. No more than two bulldozers and two graders would then be used to shape the beach and dune to the original 1996 design. The anticipated implementation date of the repairs is fiscal year (FY) 2012. Repairs are proposed to require nine months to complete.

The APE has undergone beach replenishment twice previously, in 1996 and 2004. The APE for the 2012 undertaking will not exceed the APEs for the prior replenishments. The constructed dune portion of the SPS will not be expanded in any way, and all actions would be restricted to the 1996 APE.

All sand would be dredged from approved borrow areas. BOEMRE has previously inventoried the Sandbridge Shoal for historic resources. BOEMRE prohibits dredging from areas determined to contain significant or potentially significant historic resources. The Army Corps of Engineers, Norfolk District have previously consulted with the Virginia Department of Historic Resources (VA DHR) on similar projects where sand was dredged from the Sandbridge Shoal (VA DHR #2007-0458). For these reasons, the Navy has determined that no significant resources at the Sandbridge Shoal will be affected by this action.

The soils of the APE have been extensively impacted by prior dune construction and replenishment activities, and erosion had also severely impacted the area. There are no known archaeological sites in within the APE. The area has previously been assessed as having no potential to contain intact and significant archaeological resources. Because of this prior erosion and disturbance, the Navy has determined that this action has no potential to impact intact and significant archaeological resources. The VA DHR has recently reviewed a similar undertaking (RHPO #11-25, VA DHR #2011-0615) for dune stabilization at the artificial dune line at DNA. VA DHR concurred with the Navy's determination this previous undertaking would have no potential to impact intact and significant archaeological resources.

There are no historic structures or districts that will be impacted by this undertaking. The Navy has recently identified a potential historic district and three potential historically significant structures at DNA and is currently consulting with the VA DHR regarding these properties (initial survey findings have been forwarded to VA DHR in AUG 2011 for review and comment). These include buildings 543, 572, and 586, which may contribute to a tentatively-identified Surface-Launched Guided Missile School Historic District at DNA. These properties are completely out of view from this APE due to intervening structures, vegetation, and topography. Thus there is no potential for impacts to significant or potentially-significant districts or structures.

For these reasons, the Navy has determined that there will be no effect upon historic properties as a result of this undertaking. This letter is to provide documentation of this finding in accordance with 36 CFR 800.4(d)(1). Per Section 106 of the National Historic Preservation Act, we request that within 30 days you provide your views and comments on the Navy's finding of no effect.

For your convenience, a concurrence block has been provided. If you have any questions, please contact K. Dean Wright at (757) 341-0373 or Pam Anderson (757) 341-0372.

Sincerely,

Mike Jones

MICHAEL H. JONES
Director
Environmental Planning
By direction of the Commander

Enclosure: 1. Map of Area of Potential Effect

5090
EV22/22/487
AUG 23 2011

IF YOU CONCUR WITH THE NAVY'S DETERMINATION THAT THE PROPOSED REPAIRS TO THE SHORELINE PROTECTION SYSTEM AT NAVAL AIR STATION OCEANA, DAM NECK ANNEX, VIRGINIA BEACH, VIRGINIA, WILL HAVE "NO EFFECT" UPON HISTORIC RESOURCES, PLEASE SIGN BELOW AND RETURN THIS LETTER TO OUR OFFICE.

MR. MARC HOLMA
Architectural Historian
Review and Compliance

8 Sept 11
DATE

DHR# 2011-1478


Dam Neck Annex
Shoreline Protection System
Area of Potential Effect
Enclosure 1
Scale 1 : 15,000
0
750
1,500
3,000
Feet
map created by K. Dean Wright, EV22, Environmental, NAVFAC MIDLANT, 2011 AUG 19
N
W
E
S
44VB0082
44VB0091
BATT STREET
44VB0085
44VB0308
44VB0309
44VB0087
TERRIER AVENUE
DAM NECK RD
Dam Neck
Dam Neck
44VB0346
44VB0083
VIKING AVENUE
TALOS STREET
44VB0345
44VB0084
Building 572
TARTAR AVENUE
Building 543
Building 586
POLARIS STREET
44VB0086
LOON CT
44VB0344
Livorno
Atlantic Shores
San Remo
Taranto
Alliance
Malta
Toulon
Naples
Casual
Ocean Lakes
Ocean Bay
Bold Ruler
Norton
Daimler
Bunsen
Kelvin
Hecate
Doppler
Quesnel
Aldrich
Kittmal
Lake
020
0017
B0018
Legend
Artificial Dune Line
Shoreline Protection System APE
Historic District
Archaeology Sites
eligibility
eligible
potentially eligible
not eligible
undetermined
other

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

NOV 03 2011

Mr. W. David Noble
Director, Environmental Planning and Conservation
Department of the Navy
Navy Region Mid-Atlantic
1510 Gilbert Street
Norfolk, Virginia 23511-2737

Attn: Ben McGinnis, Environmental Planning and Conservation

Re: Section 7 Consultation on Repairs to the Shore Protection System at Naval Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

Dear Mr. Noble:

The U.S. Fish and Wildlife Service (Service) received your request for concurrence with your determinations regarding the referenced project and its effects on federally listed threatened and endangered species. The following comments are provided under provisions of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).

The proposed action involves dredging 700,000 cubic yards of sand from Sandbridge shoal using a hopper dredge and placing the dredged material on a 2-mile stretch of beach and dune in the referenced project area. Sand will be placed to renourish the beach and replace sand along the seaward side of the armored dune that serves as the primary protection from wave action, aiding in infrastructure protection at the facility.

In the biological assessment, the Navy made determinations that the proposed project may affect, but is not likely to adversely affect the federally listed endangered roseate tern (*Sterna dougallii dougallii*) and the threatened Atlantic piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and seabeach amaranth (*Amaranthus punilus*). The Navy also made determinations regarding threatened and endangered species that fall solely under the jurisdiction of the National Oceanic and Atmospheric Administration (NOAA) Fisheries Office of Protected Resources, and these species, which include fish, whales, and sea turtles, are not considered further herein. Consultation on these species should be completed with NOAA Fisheries.

Based on our evaluation of the project and information provided, we concur with your determinations for the roseate tern and seabeach amaranth. However, we do not concur with your determination for the loggerhead and green sea turtles and the piping plover. Your biological assessment identifies that loggerhead sea turtles have nested on the beach at Dam Neck shortly after the beach was last renourished, and nests were relocated to the turtle hatchery at Back Bay National Wildlife Refuge. Once the renourishment has been completed, the beach may provide conditions suitable for sea turtle nesting, and sea turtles may again attempt to nest. If the beach habitat is suitable but the management of the beach and surrounding area is not suitable for successful turtle nesting, which may result if extensive activity on the beach occurs and cannot be prevented, if the beach remains illuminated during the nesting season, or other similar situations occur, the renourishment may create an attractive nuisance by attracting nesting turtles to a location that would not allow for successful hatching.

Similarly, while we do not expect piping plovers to nest within the action area, plovers may frequent the area after nesting and during migration. Renourishment may result in creation of suitable plover roosting and foraging habitat in a setting that would cause frequent disturbance to plovers similar to that discussed above for sea turtles.

To determine if formal consultation under section 7 of the ESA will be necessary, we request additional information about the proposed management of the beach and the surrounding area following renourishment to determine whether sea turtle nests that are laid on the beach within the project area can be protected and managed in situ to allow for successful hatching, emergence of hatchlings, and movement of hatchlings to the sea unassisted. We also request additional information about how sea turtle nest monitoring will be conducted and proposed measures to avoid potential adverse effects to piping plovers using the beaches following renourishment within the action area.

While the candidate red knot (*Calidris canutus rufa*) is not currently protected under the ESA, we encourage any management that reduces threats to this species. The biological assessment considers the potential effects of the project on the red knot and other shorebirds. The Service encourages consideration of the red knot and other candidate species in the environmental review process by avoiding adverse impacts to these species.

If you have any questions, please contact Tylan Dean of this office at (804) 693-6694, extension 166, or via email at tylan_dean@fws.gov.

Sincerely,

Cynthia A. Schulz

Cindy Schulz
Supervisor
Virginia Field Office

cc: Back Bay NWR, Virginia Beach, VA (Jared Brandwein)
VDGIF, Richmond, VA (Amy Ewing)
VDCR, Richmond, VA (Rene Hypes)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

MAY 2 5 2012

Mr. W. David Noble
Director, Environmental Planning and Conservation
Department of the Navy
Navy Region Mid-Atlantic
1510 Gilbert Street
Norfolk, Virginia 23511-2737

Attn: Ben McGinnis, Environmental Planning and Conservation

Re: Section 7 Consultation on Repairs to the Shoreline Protection System at Naval Station Oceana, Dam Neck Annex, Virginia Beach

Dear Mr. Noble:

On November 3, 2012, the U.S. Fish and Wildlife Service (Service) delivered our response to the Biological Assessment (BA) prepared by the Navy for the referenced project and its effects on the federally listed endangered roseate tern (*Sterna dougallii dougallii*) and the federally listed threatened Atlantic piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), and seabeach amaranth (*Amaranthus punilus*) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). In our November 3, 2012 response, the Service concurred with the Navy's determination of may affect, but is not likely to adversely affect for the roseate tern and seabeach amaranth. The Service requested that the Navy address concerns regarding proposed management for loggerhead sea turtles, green sea turtles, and piping plovers.

In a letter dated April 20, 2012, the Navy requested the Service's concurrence with the determination of may affect, but is not likely to adversely affect for the loggerhead sea turtle, green sea turtle, and piping plover based on modifications made by the Navy to their Integrated Natural Resource Management Plan (INRMP). Additionally, the Navy requested the Service's concurrence with a no effect determination for nesting federally listed endangered leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricate*), and Kemp's ridley sea turtle (*Lepidochelys kempii*). The Service concurs with the Navy's no effect determination for these three species of sea turtle because no records of nesting attempts by these species have been documented in Virginia.

Regarding loggerhead and green sea turtles, the Navy's INRMP includes a Sea Turtle Monitoring Protocol section, which sets criteria for daily monitoring of nesting sea turtles and nests, nest protection, and nest relocations. The Navy has agreed to leave nests in situ rather than relocating nests, only moving nests when operational uses of the beach would result in the take of a nest. In such cases, the Navy will coordinate with the Service's Back Bay National Wildlife Refuge (NWR). All nest relocations by the Navy will be conducted in accordance with the methods outlined in the July 13, 2011, biological opinion issued to Back Bay NWR (copy enclosed) that provides ESA compliance for such activities at False Cape State Park, Back Bay NWR, Sandbridge Beach, Virginia Beach Resort Area, and Fort Story.

The Service does not concur with the Navy's determination of may affect, but is not likely to adversely affect for nesting loggerhead and green sea turtles, because take of turtles may occur. However, this letter amends the Loggerhead Sea Turtle Nest Monitoring and Management on Back Bay NWR biological opinion issued by the Service on July 13, 2011, to add Naval Station Oceana, Dam Neck Annex. This letter will be appended to that biological opinion and maintained as part of the decision document and administrative record. The biological opinion, this amendment, and the criteria in the INRMP together provide ESA compliance for the Navy related to monitoring of nesting sea turtles and nests, nest protection, and nest relocations for both loggerhead and green sea turtles that may occur at Naval Station Oceana, Dam Neck Annex.

The Navy has included in their INRMP guidelines for migratory bird monitoring and management. The INRMP includes protocols to ensure surveys and daily observations during sea turtle nesting periods will include monitoring for both piping plover and the federal candidate red knot (*Calidris canutus rufa*). There are no records of piping plovers nesting on beaches south of the Chesapeake Bay, where the species is considered to be an uncommon transient. Because it is unlikely that the piping plover will utilize this area and the monitoring protocols will be implemented, the Service concurs with the Navy's determination of may affect, but is not likely to adversely affect for piping plovers.

If you have any questions, please contact Mike Drummond of this office at (804) 693-6694, extension 122, or via email at mike_drummond@fws.gov.

Sincerely,

Cynthia A. Schulz

Cindy Schulz
Field Supervisor
Virginia Ecological Services

Enclosure

cc: Back Bay NWR, Virginia Beach, VA (Attn: Kathy Owen)
VDGIF, Richmond, VA (Attn: Amy Ewing)

VDGIF, Wachapreague, VA (Attn: Ruth Boettcher)
VDCR, DNH, Richmond, VA (Attn: René Hypes)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

JUL 13 2011

Memorandum

To: Project Leader, Back Bay National Wildlife Refuge
(Attn: Geralyn Mireles, Wildlife Biologist)

From: Supervisor, Virginia Ecological Services Cynthia A. Schulz

Subject: Biological Opinion on the Back Bay National Wildlife Refuge Sea Turtle Management Program, Virginia Beach, Virginia

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the subject project and its effects on the federally listed threatened loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*). The Service's Back Bay National Wildlife Refuge (BBNWR) proposes to conduct sea turtle nest management activities on BBNWR and adjacent properties along the Atlantic coast beaches extending from the Virginia/North Carolina border to the mouth of the Chesapeake Bay. This biological opinion is submitted in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Formal consultation was initiated on January 27, 2011.

This biological opinion is based on the BBNWR Comprehensive Conservation Plan (CCP) (Service 2010), emails, telephone conversations, a sea turtle management meeting, and other information provided by the Service, Virginia Department of Game and Inland Fisheries, and others. A complete administrative record of this consultation is on file in this office.

CONSULTATION HISTORY

08-03-10 BBNWR requested section 7 consultation on their revised CCP.

08-03-10 to 9-13-10 The Virginia Field Office (VAFO) and BBNWR coordinated on a management plan to review and revise sea turtle and beach management on BBNWR.

09-13-10 VAFO and BBNWR completed review of BBNWR CCP and completed informal consultation. BBNWR and VAFO committed to conducting a meeting and evaluation of sea turtle management prior to the 2011 sea turtle nesting season to review and revise sea turtle management and complete formal section 7 consultation, if necessary.

01-19-11	VAFO held a sea turtle management meeting which included BBNWR and other agencies conducting sea turtle nest management and beach management in Virginia.
02-02-11	VAFO received draft intra-Service section 7 consultation form on BBNWR sea turtle management.
02-02-11 to 06-15-11	VAFO and BBNWR reviewed and revised sea turtle nest management protocol and intra-Service consultation form.
06-15-11	VAFO received final revisions of the nest management protocol and intra-Service consultation from BBNWR.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed activity is to continue monitoring and managing loggerhead sea turtle nests within all sea turtle nesting areas including the beaches of BBNWR, the Virginia Beach resort area, Fort Story, the City of Sandbridge, and False Cape State Park (FCSP). These management practices will continue until the loggerhead sea turtle is no longer listed. If nests of other sea turtle species are found, including the green sea turtle, the same protocol will be followed. Activities within sea turtle nesting habitat include crawl and nest searches as well as nest relocations.

A limited number of permit holders drive vehicles on the beach at BBNWR. Permits are issued to continue traditional ingress and egress along the BBNWR beach between the permittee's residence and their full-time employment in the Norfolk-Virginia Beach area. These permits are not transferrable and will be terminated when the current permit holder is no longer able to drive, or when alternate access becomes available during the permit period. Permittee access on BBNWR beach is prohibited between 12:00 am and 5:00 am from May 1 – September 30, to reduce negative impacts on sea turtles.

Monitoring Methods -
Turtle crawl and nest searches - Morning patrols for turtle crawls and nests are conducted from about June 1 through August 31. FCSP employees patrol BBNWR and FCSP, while BBNWR staff and volunteers are responsible for the north mile of BBNWR and Sandbridge Beach. A BBNWR volunteer patrols the Fort Story and Virginia Beach resort area beaches. Personnel use ATVs for the surveys, but vehicles may be used on the beaches where permitted beach driving is allowed.

When a turtle crawl is found, BBNWR staff determine whether the crawl resulted in a nest. The presence of a "body pit" in a sea turtle crawl usually indicates the turtle attempted to lay eggs. BBNWR biologists closely examine the body pit for indented impressions and/or mounded areas that indicate the location of the female's front flippers. This dictates her position when the eggs were deposited. If flipper impressions are found, the area directly to the rear is targeted as the most probable nest location and is carefully excavated by hand first. The fingertips are used to probe the sand for a small, soft spot, unlike the surrounding more densely packed sand. This indicates the nest location. If flipper impressions are not found, the flattened circular area at either end of the tracks is targeted. Eggs are usually a few inches below this soft, 2-3 inch opening, so extreme care is taken. The biologist gently digs by hand into the body pit to locate the egg chamber and determine if eggs are present (Service 2007). The location and date of the crawl will be recorded, whether a nest is found or not.

Nest relocation - The construction of dunes on FCSP and BBNWR beaches in the 1930s resulted in blockage of overwash and dune blowout areas which otherwise would have allowed nesting sea turtles access to higher beach elevations. Current turtle nesting is limited to lower elevation sections of the beach which are susceptible to extensive saltwater inundation, beach erosion and complete nest loss during monthly high tides, "northeaster" storms, and hurricane activity in the mid-Atlantic. Other potential threats including vehicular beach traffic and public use activity also exist on these beaches.

The following risk analysis is performed by BBNWR biologists to determine if a nest needs to be relocated. If the answer to either of the two questions below is affirmative, the nest is relocated:

- Is the nest/body pit located below the estimated mean high tide lines – as evidenced by the wrack lines and reference to tidal conditions when personnel survey the beach?
- Is the nest in an area where there is a likelihood that vehicles will run over the nest with signage and markers installed, or that there is a likelihood that intense artificial lighting will result in hatchling disorientation?

Once nests are determined to be present, biologists wear nitrile gloves prior to handling any eggs. This minimizes potential harm to the handlers (i.e., salmonella) and to the eggs (human carried bacteria, temperature change, etc.).

Before eggs are removed, the depth from beach surface to the top of eggs is measured. Using excavated sand from the original nest, a 2 inch layer of moist sand is placed in the bottom of a cooler (Sill et al. 2000). Keeping exposed eggs shaded with an umbrella, BBNWR staff remove eggs individually from the nest, being careful not to rotate them in the process. Eggs are placed into the cooler with a 1 inch border of sand between the eggs and the sides of the cooler. The eggs are placed in the cooler in a consistent and methodical manner with note taken of the order. The number of eggs in each layer are counted and recorded. Eggs are packed in such a manner that they are not touching and with 2 inches of sand between each layer of eggs. Usually two coolers are used. After all eggs are removed, the distance from the beach surface to the bottom of the nest depth is measured (Boulon 1999, Service 2007). The length and width of the nest cavity at the widest and longest points is also measured. Once all eggs are placed in the cooler, extra sand from the nest is placed over them and into a separate container. This sand is used to surround the reburied eggs at the nursery site located on BBNWR behind the primary dune. Once all the data has been recorded, the nest cavity is refilled and the crawl brushed out with rakes and shovels. Eggs are kept out of direct sunlight; jolting or shifting is avoided during the trip to the nursery (Mortimer 1999).

At the designated nursery site a vertical shaft large enough for the predator-proof cage is dug with a spade/shovel. The predator-proof cage is placed in the hole with the middle rib of cage at least an inch above the sand as long as bottom and top nest depths are near the original nest's depths (Service 2007). The same person who removed the eggs from the original nest transfers the eggs from the coolers to the nest cage. The eggs are not rotated or packed tightly (Jones and Musick 1988, Mortimer 1999). Eggs are placed into the nest cage in the reverse order in which they were removed from the original nest (i.e., the first egg put in the cooler will be the last one to go into the cage). The bottom and sides of the cage are filled with sand from the original nest. Dry sand is not allowed to enter the cage through the mesh while the shape and size of the original nest is recreated as closely as possible. The remainder of the relocated nest cavity is filled with the extra sand brought from the original nest. The top of the predator-proof cage is secured with three 6-inch pieces of aluminum wire, and the nest number is written on the top. For any eggs that are broken, the cause of break is recorded on a copy of the nest data sheet. The sheet is then bagged with the specimen and placed in the biology freezer at BBNWR. The Nest and Crawl Data Sheet is completed and filed at BBNWR. Digital photos of the nest and crawl are downloaded and catalogued. This information and more is included in the 2007 "Back Bay NWR Sea Turtle Nest Standard Operating Procedures."

In situ nest management - Nests that are identified and left in situ are market with reflectors, signs identifying the site as a sea turtle nest, and flagging tape placed in the immediate vicinity of the nest (within 9.8 feet [ft]) to help prevent nests from being run over by vehicles or inadvertently disturbed. A predator guard, constructed of galvanized fence wire with a rectangular mesh size of approximately 2 inches by 4 inches is used. A trench is excavated around the nest, and the fence material is placed over the nest with flaps placed in the trenches and re-buried to prevent excavation by predators. In situ nests are monitored daily near the hatch window to determine if they are successful, and after all hatching is anticipated to be completed, the nests are excavated and the number and condition of hatched eggs, unhatched eggs, and young turtles are counted.

Action Area - The "action area" is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project consists of the beaches of BBNWR, FCSP, the Virginia Beach resort area, Fort Story, and Sandbridge.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

The loggerhead sea turtle was listed as threatened in the U.S. in 1978 (NMFS and Service 1991a) and the green sea turtle was listed as endangered in 1978 (NMFS and Service 1991b). In March 2010, the Service and NMFS published a proposed rule in the Federal Register to recognize nine distinct populations of loggerhead sea turtles worldwide. Under this proposed rule, the loggerhead sea turtle population that would be affected by the proposed actions is the north

Atlantic population and it is proposed to be listed as endangered (72 FR 12598). There is designated critical habitat outside of Virginia for the green sea turtles, but none has been designated for the loggerhead sea turtle.

Species/Critical Habitat Description and Life History – This account emphasizes loggerhead and green sea turtle nesting and breeding biology, which is the subject of this biological opinion. Additional information about the life history of these sea turtle species and their habitat use, behavior, and survival at sea can be found in other documents, including the loggerhead and green sea turtle recovery plans (National Marine Fisheries Service [NMFS] and Service 1991a, b, respectively), loggerhead and green sea turtle five-year statues reviews (NMFS and Service 2007a, b, respectively), and other sources (National Research Council 1990).

The loggerhead is smaller, with a mean carapace length of 3 ft and a mean mass of 293 pounds (NMFS and Service 2008), compared to 3.35 ft and 300 pounds for the green sea turtle (National Research Council 1990). Green sea turtles nest primarily in the tropics and are rarer nesters at higher latitudes, while loggerheads have significant nesting populations outside the tropics (National Research Council 1990).

Life History and Population Dynamics - Loggerhead females are believed to reach sexual maturity at a minimum age of 30 years (Snover 2002). At the start of the breeding season, they migrate from foraging areas on the continental shelf to mating areas in the waters near their nesting beaches (Schroeder et al. 2003). Reproductive females exhibit the desire to return to their birthplace to lay their eggs (Miller et al. 2003). Females may be inseminated by multiple males (Bollmer et al. 1999). After mating, males return to their foraging areas while females remain in the waters near their natal beaches to emerge onto their nesting beaches to lay eggs. The following account of nesting biology is a synopsis of Miller et al. (2003).

Loggerhead females tend to nest on high wave energy, sandy ocean beaches. Gravid females emerge from the wash zone and crawl toward the dune line until they encounter a suitable nest site, typically on open sand at the seaward base of a dune, but sometimes in vegetation. The female clears away surface debris with the front flippers, creating a "body pit," then excavates a flask shaped nest cavity with her hind flippers. Loggerheads lay an average of 112 eggs per nest. After laying, the female covers the nest with sand using all four flippers. Once the nest covering phase is complete, she crawls back into the sea. Individual females may nest 1 to 6 times per nesting season, at intervals of 12-16 days, during the late spring to late summer. Intervals between nesting shorter than 10 days indicate that the previous nest attempt was likely aborted due to disturbance. Mature loggerheads nest every two to three years, on average (Schroeder et al. 2003). Nest incubation period (from laying to hatching) depends on temperature and ranges from 48 to 90 days at the extremes. Emergence of hatchlings from the nest cavity usually occurs within four days of hatch, but may take up to two weeks longer. Hatchling emergence from nests usually occurs at night when temperatures are lower and diurnal predators are inactive. Hatching success typically approaches 80 percent; after hatchlings leave the beaches, they typically fall prey to a variety of predators, including birds, fish, and sharks (National Research Council 1990).

Within the Northwest Atlantic, the majority of loggerhead sea turtle nesting activity occurs from April through September, with a peak in June and July (Williams-Walls et al. 1983, Dodd 1988, Weishampel et al. 2006). Nesting occurs within the Northwest Atlantic along the coasts of North America, Central America, northern South America, the Antilles, Bahamas, and Bermuda, but is concentrated in the southeastern U.S. and on the Yucatán Peninsula in Mexico on open beaches or along narrow bays having suitable sand (Sternberg 1981, Ehrhart 1989, Ehrhart et al. 2003, NMFS and Service 2008).

Sex ratio of hatchlings depends on temperature during incubation. Below 84° Fahrenheit (29° Celsius), more males are produced than females and above that temperature more females are produced (Carthy et al. 2003). Furthermore, fluctuating incubation temperatures often produce more females than stable temperatures, and temperature, hydration, and gas exchange during incubation can determine hatchling size, early swimming behavior, growth rate, and hatchling robustness (Carthy et al. 2003). Newly emerged hatchlings immediately head for the sea, most likely orienting toward the water by moving toward the brightest horizon and away from dark silhouettes (Lohmann and Lohmann 2003). Sea turtles are most negatively sensitive to blue and green light and loggerheads in particular are averse to yellow light (Witherington and Martin 1996). Once in the sea, hatchling loggerheads swim into the waves and eventually enter the open ocean, where they will spend the first 6.5 to 11.5 years of their lives primarily at the top of the water column, until finally moving to foraging areas on the continental shelf (Bolten 2003).

Green sea turtles nest in two, three, or four year intervals, and may lay as many as nine clutches within a nesting season (NMFS and Service 1991b). Clutch size varies from 75-200 eggs, and incubation ranges from about 45-75 days (NMFS and Service 1991b).

Nesting habitat - Less is known about factors that cue nest site selection than about anthropogenic disturbances that discourage nesting (Miller et al. 2003). Typical nesting areas are sandy, wide, open beaches backed by low dunes, with a flat, sandy approach from the sea (Miller et al. 2003). Nesting is nonrandom along the shoreline, but studies of the physical characteristics associated with nests versus random or non-nesting sites on the beach have produced varying results. Some factors found to determine nest selection are beach slope (3 of 3 studies), temperature (2 of 3 studies), distance to ocean (1 of 3 studies), sand type (2 of 2 studies), and moisture (1 of 3 studies), although the results were occasionally contradictory (Miller et al. 2003). Other factors examined but not found to be significant were sand compaction, erosion, pH, and salinity. Although the process of nest site selection is not well understood, a successful nest must be laid in a low salinity, high humidity, and well-ventilated substrate that is not prone to flooding or burying due to tides and storms and where temperature is optimal for development (Miller et al. 2003).

Status and Distribution – Approximately 58,000 loggerhead nests were estimated in the U.S. Atlantic in 1983 (NMFS and Service 1991a) and between 53,000 and 92,000 nests from 1989 to 1998 (Turtle Expert Working Group 2000). Within the northern subpopulation (north Florida to Virginia), studies in South Carolina and Georgia have documented a decline in number of nests

(Ehrhart et al. 2003). Based on genetic evidence, male loggerheads disperse freely among sites within the U.S. Atlantic population, while females are faithful to their natal sites (Bowen et al. 2005). Because sex ratio is determined by temperature during incubation (Miller et al. 2003), the northern part of the U.S. Atlantic population, apparently provides a disproportionate number of males to the larger population (Mrosovsky et al. 1984a, Hanson et al. 1998, Hawkes et al. 2007).

"Analyses of historic and recent abundance information by the Marine Turtle Specialist Group (MTSG) indicate that extensive population declines for the green sea turtle have occurred in all major ocean basins. The MTSG analyzed population trends at 32 index nesting sites around the world and found a 48-65 percent decline in the number of mature females nesting annually over the past 100-150 years. The two largest nesting populations of green turtles are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia, where an annual average of 22,500 and 18,000 females nest per season, respectively. In the U.S., green turtles nest primarily along the central and southeast coast of Florida; present estimates range from 200 - 1,100 females nesting annually" (NMFS 2008). In the southeast U.S., the majority of green turtle nesting occurs in Florida. The green turtle nesting population of Florida appears to be increasing based on 19 years (1989-2007) of index nesting data from throughout the state (http://research.myfwc.com/features/view_article.asp?id=27537).

Factors Affecting the Species – Numerous factors affect sea turtle growth, survival, and behavior while at sea from when they leave natal beaches as hatchlings until they mature and return to beaches to breed. These factors are discussed in detail in the 5-year status reviews for the two turtle species (NMFS and Service 2007a, b). The discussion herein is limited to factors affecting turtle nesting. Threats to loggerhead sea turtles on the nesting grounds are similar to those faced by green sea turtles. The following threats affect both species, though there may be some differences in susceptibility between the species.

Weather and tides - Storm events may erode beaches and destroy nests or cause nest failure due to flooding or piling of eroded sand on the nest site. Beach erosion due to wave action may also decrease the availability of suitable nesting habitat (Steinetz et al. 1998), leading to a decline in nesting rate on a particular beach. Sea level rise, often in combination with human development along beaches, is contributing to erosion, changes in beach characteristics, and more intensive management of many beaches.

Predation - Predation of eggs and young by mammals, birds, and ghost crabs may eliminate up to 100 percent of the nests and any hatchlings that emerge on beaches where predation is not managed (National Research Council 1990). This is a natural phenomenon that has always affected sea turtle populations, but due to reduced turtle population sizes, reduced turtle habitat availability, and unnatural population increases of nest predators in some areas, predation is a significant threat to remaining breeding populations and is actively controlled through predator exclusion and predator control on most beaches where turtles nest.

Human activities - Crowding of nesting beaches by pedestrians can disturb nesting females and prevent laying (NMFS and Service 2008). Furthermore, the use of flashlights and campfires may interfere with sea-finding behavior by hatchlings. Beach driving, including pedestrian traffic and vehicle use, and beach cleaning pose a risk of injury to females and live stranded turtles, can leave ruts that trap hatchlings attempting to reach the ocean (Hosier et al. 1981, Cox et al. 1994), can disturb adult females and cause them to abort nesting attempts, and can interfere with sea-finding behavior if headlights are used at night (NMFS and Service 2008). Driving directly over incubating egg clutches can cause sand compaction, which may decrease hatching and emergence success and directly kill pre-emergent hatchlings (NMFS and Service 2007a). Artificial lighting on structures may affect turtle behavior in a similar manner (Witherington and Martin 1996). Beach cleaning can directly destroy nests. Poaching is a problem in some countries and occurs at a low level in the U.S. (NMFS and Service 2007a). An increased human presence may also lead to an increase in the presence of domestic pets that can depredate nests and an increase in litter that may attract wild predators (National Research Council 1990).

The rate of habitat loss due to erosion and escarpment formation may be increased during shoreline stabilization efforts, either through renourishment (Dolan et al. 1973) or placement of hard structures such as sea walls or pilings (Bouchard et al. 1998). Vehicle traffic may alter the beach profile leading to steeper foredunes (Anders and Leatherman 1987), which may be unsuitable for nesting. Improperly placed erosion control structures such as drift fencing can act as a barrier to nesting females. Non-native and/or invasive vegetation may be introduced in conjunction with beach development, which can overrun nesting habitat, make the substrate unsuitable for digging nest cavities, invade nests and desiccate nests, or trap hatchlings.

Reduced nesting success on constructed/augmented beaches could result due to sand compaction, escarpment formation, and changes in the beach profile. Sand compaction has been shown to negatively impact sea turtles, particularly concerning beach nourishment projects. Placement of very fine sand and/or the use of heavy machinery can cause sand compaction on nourished beaches (Nelson et al. 1987, Nelson and Dickerson 1988). Significant reductions in nesting success (i.e., false crawls occurred more frequently) have been documented on severely compacted nourished beaches (Nelson and Dickerson 1987, Nelson et al. 1987), and increased false crawls may result in increased physiological stress to nesting females. Sand compaction may also increase the length of time required to excavate nests and result in increased physiological stress (Nelson and Dickerson 1988).

ENVIRONMENTAL BASELINE

Status of the Species/Habitat Within the Action Area – Sea turtle nesting has regularly occurred within the action area since the 1970s. Since 1970, 93 nests have been recorded, ranging from 0-7 nests per year. The majority of nests have occurred on BBNWR and FCSP (49 and 28, respectively, BBNWR 2011). Up to 8 false crawls have also been recorded among all the sites within a year (2002; BBNWR 2011), and a total of 45 false crawls have been recorded.

Since monitoring began, 9 nests have been left in situ, and most of these occurred from 2003 to 2005, when BBNWR staff tested and evaluated in situ hatch success of nests. The majority of nests left in situ failed to hatch, presumably as a result of tropical storms causing prolonged inundation and beach erosion, but at least one nest left in situ hatched successfully at a rate comparable to nests placed in the hatchery. Most nests have been relocated to a sea turtle hatchery on BBNWR, located behind the primary dune. Hatch success of the hatchery-produced young is high, generally ranging from 80 to 95 percent.

In 2010, preliminary genetic analysis of 9 sea turtle nests in Virginia was conducted in conjunction with a larger study of the population genetics of the northern recovery unit of loggerhead sea turtles. The 9 nests were laid by 4 different females, 2 of which also nested in North and South Carolina within the same year, as well as individuals that had not been recorded nesting outside of Virginia (Nairn and Shamblin 2011).

At BBNWR there is an artificial dune system that creates a narrow beach with a high primary dune. This combination creates poor quality nesting habitat due to the high probability of erosive washovers, egg exposure to saltwater and air, or entombment. Beaches in Sandbridge, Virginia Beach oceanfront, and other sites are generally larger, but are also subject to high levels of human activity, extensive illumination, and human traffic. Beaches at several sites are periodically renourished to maintain them in a condition to support public recreation.

<u>Factors Affecting Species Environment Within the Action Area</u> – The artificial dunes on BBNWR and FCSP result in narrow beaches that lack the upper beach zones and at high tides water is generally at or near the base of the dunes. The upper beach berm to dune transitional habitat, and all associated plants and animals, are generally lacking.

Beach driving results in ruts, compaction of sand, and disturbance of beach flora and fauna, and further contributes to the degraded condition of upper beach habitat. Vehicle operation on the beach may also reduce beach stability and result in increased levels of sand transport both on and off of the beaches of BBNWR and FCSP.

Human recreational use of the beaches, including grooming of the most heavily used recreational beaches in the City of Virginia Beach, result in highly disturbed beaches that lack natural beach contours, and may be more compacted than natural beaches. These areas also generally lack vegetation, and the beaches lie immediately in front of heavily developed hotel/resort areas. These areas are generally illuminated, and lack most characteristics of suitable sea turtle nesting beaches, with the exception of a broad beach profile that is maintained through periodic beach renourishing. Direct disturbance of sea turtles is also likely to occur on beaches that have high levels of human use or vehicle operation.

Beach renourishment may result in unsuitable beach conditions, including unnatural profiles, beach sand composition that is different from natural beaches in color, density, compaction, drainage, and other characteristics. These beaches may be suitable for sea turtle nesting, but may result in differences in nest success, hatchling gender, and hatchling fitness.

EFFECTS OF THE ACTION

Adverse Effects – The effects to sea turtles from nest relocation are not well studied, and vary depending on the specific practices involved in relocation. Because it is not practical to monitor the long-term survival or success of hatchling turtles, the specific effects of nest management action on BBNWR on hatchling turtles are not known.

Many studies indicate reduced hatch success of relocated sea turtle nests. Handling alone can result in damage to embryos by disrupting membrane attachment and result in reduced hatch success (Limpus et al. 1979, Parmenter 1980). Differences in the moisture regime, temperature regime, and gas exchange between nest sites selected by turtles and sites where nests are relocated also have the potential to affect hatch success (Ackerman 1980, McGehee 1990).

Movement of sea turtle nests to a hatchery site alters sex ratios of sea turtles compared to those that would occur in natural nests as a result of different incubation temperatures (Harvey and Slatkin 1982; Limpus et al. 1982; Mrosovsky et al. 1984a, b; Dalrymple et al. 1985; Dutton et al. 1985; Standora and Spotila 1985). The use of a hatchery site that is more far-removed from the beach likely generally results in warmer incubation temperatures than those which would occur at natural nest sites, and this would tend to increase the proportion of female hatchlings (Mrosovsky et al. 1984a, b). However, because the sex ratios that would naturally occur are expected to vary among years and sites depending on weather conditions, date that the nest is laid, nest depth, soil conditions, and other factors, it is not possible to determine how the sex ratio at the hatchery site would differ from what would occur naturally. Additionally, it is not possible to determine what biological, demographic, or genetic effects to the population may result from altered sex ratios, except that differences should be expected, and we presume that the naturally occurring sex ratios and the variation in those ratios over time, are appropriate to maintain the sea turtle populations.

As a result of the refinement of methods and implementation of a detailed protocol to excavate, transport, and re-bury turtle nests that are relocated by BBNWR personnel, hatch success rates are generally comparable to those that may occur naturally. Similarly, the identification and routine use of a carefully selected hatchery site at BBNWR has apparently reduced the adverse effects to turtle embryos and hatching success.

Emerging research on the homing abilities of sea turtles continues to indicate a strong tendency for sea turtles to return to their natal beaches to nest. However, to date, the cues that sea turtle hatchlings use to allow them to return to natal beaches are unknown. Irwin et al. (2004) have measured distorted magnetic fields within sea turtle egg enclosures similar to those used by BBNWR. Based on evidence that sea turtles navigate at sea using magnetic fields Lohmann et al. (1999) and Irwin et al. (2004) speculate that magnetic fields may be an important mechanism for imprinting on natal beaches, and distortion in magnetic fields may affect homing behavior and the ability to return to natal beaches.

Condition of hatchling turtles may be more important than hatch success in terms of the likelihood of survival and recruitment of young turtles. Hatchling size in some turtle species is related to the water balance of eggs while in the nest, with larger young generally resulting from eggs that occurred in wetter conditions (Janzen et al. 1995). While the relationship of hatchling size to nest environment during development has not been well studied in sea turtles, larger young may be more likely to survive (Janzen et al. 1995).

Manual release of hatchlings from the enclosed egg chamber used at the BBNWR hatchery may result in higher than normal susceptibility to predation. Release of hatchlings during daytime hours can result in higher predation, and release of hatchlings en masse may also increase predation vulnerability by attracting predators to the group of young being released. Under natural conditions, night-time emergence and emergence of relatively small numbers of individuals over time (particularly at more northerly latitudes) may result in reduced risk of loss of all young.

Additionally, holding hatchlings after emergence may result in expenditure of energy attempting to escape, interference with normal behaviors, and elevated levels of stress that may detrimentally affect the physiological condition of hatchlings. After release into the ocean, this may result in reduced likelihood of survival and reduced probability of reaching nursery areas.

While the risk of catastrophic loss of clutches cannot be estimated, relocating turtle nests to a common hatchery area increases the likelihood of catastrophic loss resulting from accidents, adverse environmental conditions, and disease and predation.

It is uncertain whether the effects of intensive nest management discussed above occur, and to what degree they affect hatchling survival. The types of effects may vary depending on the environmental conditions within the specific nesting season, and the specific conditions that each nest is subjected to during management activities and relocation. The combination of these factors results in highly uncertain effects to the sea turtle population. While hatch success has often been used as a proxy to assess reproductive success, the factors discussed above may reduce recruitment, affect population demography, and affect future use of turtle nesting beaches in the action area. For the purposes of this analysis and in the absence of specific information that would allow us to consider the expected magnitude and severity of effects that may result, we make the conservative assumption that all of these factors affect hatchling sea turtles to a degree that cumulatively results in significantly reduced survival and recruitment probability.

Beneficial Effects – Monitoring and in situ nest protection provides good information on the sea turtle nesting effort within the action area. Nest marking and predator protection reduce the potential for anthropogenic impacts including disruption of nests and predation that may result from artificially abundant predators. The educational component of the monitoring aids in improving beach visitor consideration of sea turtle nesting in the vicinity of recreational areas. While unknown, the controlled conditions of the turtle hatchery likely result in higher nest success rates than would occur if turtle nests were left in the wild, but it remains unclear whether the greater productivity results in improved recruitment of juvenile sea turtles.

Interrelated and Interdependent Actions - An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Service is not aware of any such actions associated with this project.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects likely to adversely impact nesting sea turtles include management of beaches by private individuals and municipalities, and use of beaches for recreational purposes. Management and use of beaches degrades the habitat quality for nesting sea turtles and minimizes the likelihood of successful nesting and hatching of young. Shoreline development adjacent to beaches, primarily along the developed Virginia Beach oceanfront and Sandbridge, results in disturbance of adult female sea turtles attempting to nest, minimizing the likelihood of successful nesting.

CONCLUSION

After reviewing the status of the loggerhead and green sea turtle, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed BBNWR sea turtle nest management program is not likely to jeopardize the continued existence of the loggerhead and green sea turtles. No critical habitat has been designated for this species within the action area; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in 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 listed species 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, the 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 to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of all sea turtle nests that are relocated within the action area. While there is potential for some individual hatchlings to survive and recruit into the breeding population, the degree of uncertainty in the expected effects that relocation has on sea turtles requires expectation of loss of all relocated nests. Because the decision to relocate nests is dependent on the specific location, setting of the nest, and determination of BBNWR personnel, all nests that occur in any year may be relocated.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or adverse modification or destruction of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of nesting sea turtles.

- Conduct sea turtle monitoring and management to minimize anthropogenic intervention and maximize protection of nests.

TERMS AND CONDITIONS

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

The proposed action includes appropriate measures to avoid and minimize adverse effects to sea turtles, and no additional terms and conditions are needed to implement the reasonable and prudent measures.

The following relates to reporting requirements:

- Care must be taken in handling any dead specimens of proposed or listed species that are found to preserve biological material in the best possible state. In conjunction with the preservation of any dead 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 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. Upon locating a dead specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883, 5721 South Laburnum Avenue, Richmond, Virginia 23231, and the Service's Virginia Field Office at 804-693-6694 at the address provided above.

CONSERVATION RECOMMENDATIONS

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

BBNWR should work with other beach owners and managers in the region to implement beach management programs for sea turtles that include efforts to minimize threats to sea turtle nesting such as artificial lighting, beach grooming, and vehicle operation on beaches.

BBNWR should develop a beach management plan that allows for overwash and natural beach processes in at least limited areas of BBNWR that will allow for sea turtle nesting. If sea turtle nest relocation continues, identify an alternate hatchery location on the beach that will allow for natural and unassisted emergence.

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

REINITIATION NOTICE

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

If you have any questions, please contact Tylan Dean of this office at (804) 693-6694, extension 166, or via email at tylan_dean@fws.gov.

cc: VDGIF, Wachapreague, VA (Attn: Ruth Boettcher)
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VDCR, DNH, Richmond, VA (Attn: René Hypes)

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B

Coastal Consistency Determination

DEPARTMENT OF THE NAVY
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NORFOLK, VA 23511-2737

IN REPLY REFER TO:
5090
EV22/22/RE281
APR 26 2012

Ms. Ellie Irons
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Room 631
Richmond, Virginia 23219

Dear Ms. Irons:

SUBJECT: FEDERAL COASTAL CONSISTENCY DETERMINATION FOR PROPOSED REPAIRS TO THE SHORELINE PROTECTION SYSTEM AT NAVAL AIR STATION OCEANA, DAM NECK ANNEX, VIRGINIA BEACH, VIRGINIA

The Navy proposes to repair the existing Shoreline Protection System (SPS) through a proposed beach renourishment project at Naval Air Station Oceana, Dam Neck Annex in Virginia Beach, Virginia.

The enclosed Federal Coastal Consistency Determination (CCD) and associated drawings are being submitted in accordance with Section 307 (c) (1) of the Federal Coastal Zone Management Act (CZMA) of 1972 as amended.

The Department of the Navy has determined that the proposed federal agency action is reasonably likely to affect a land use, water use or natural resource of the Commonwealth of Virginia's coastal zone. However, the Navy will conduct the proposed activity in a manner that will be either fully consistent, or consistent to the maximum extent practicable with the applicable enforceable policies of the Virginia Coastal Zone Management Program.

The Navy has consulted with the Virginia Department of Historic Resources on this project.

Please note that the Navy is the lead agency for this proposed action, with the Bureau of Ocean Energy Management (BOEM) serving as a cooperating agency for the National Environmental Policy Act process and during this CZMA consultation.

To aid in your review, an electronic copy of this document will be provided to your office separately through electronic mail. Our point of contact is Mr. Ben McGinnis, Physical Scientist, Environmental Planning and Conservation, NAVFAC MIDLANT at (757) 341-0486 or e-mail at benjamin.mcginnis@navy.mil.

Sincerely,

W. DAVID NOBLE

W. DAVID NOBLE
Director
Environmental Planning and
Conservation
By direction of the Commander

Enclosures: 1. Coastal Consistency Determination (CCD) and Associated Drawings

Department of the Navy

Commander, Navy Region, Mid-Atlantic

Coastal Zone Management Act of 1972
COASTAL CONSISTENCY DETERMINATION
Proposed Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex Virginia Beach, Virginia

Proposed Federal Agency Action

The U.S. Department of the Navy (Navy) is proposing to repair the shoreline protection system (SPS) on Naval Air Station (NAS) Oceana, Dam Neck Annex (or Dam Neck) located along the Atlantic Ocean in Virginia Beach, Virginia (see Enclosure 1). Implementation of the proposed action is expected to begin between fiscal year (FY) 2012 and (FY) 2014. The Bureau of Ocean Energy Management (BOEM) is a cooperating agency during the National Environmental Policy Act (NEPA) process for this project and is coordinating with the Navy during this CZMA consultation. The Navy will serve as the lead agency.

Dam Neck, commissioned in 1942, is a satellite installation of NAS Oceana and is home to 14 tenant commands. Dam Neck is situated approximately two miles east of NAS Oceana, five miles south of the Virginia Beach resort area, and approximately 20 miles east of the City of Norfolk. Dam Neck's mission is to provide facilities and resources necessary to support the land, sea, and air training and operations of tenant commands.

The beaches at Dam Neck are prone to erosion from seasonal hurricanes, tropical storms, nor'easters, and winter conditions that direct wind and wave actions upon the installation's beaches. The SPS was originally constructed to protect $124 million worth of Navy facilities on Dam Neck, including the bachelor enlisted quarters (BEQ), Shifting Sands Beach Club, housing area, and the weapons gun line, from being damaged or destroyed by flooding and wave action during coastal storms. The SPS was installed in 1996 and consists of a constructed sand dune reinforced by a buried stone core, with beach replenishment on the seaward side. Sand for the constructed dune was trucked in from commercial borrow pits located approximately 10 miles from Dam Neck. The constructed dune extends from Building 225 (BEQ) south to Building 127 and measures approximately 5,282 feet long (1 mile), 20 feet high, and 50 feet wide. The constructed dune was planted with American beach grass (*Ammophila breviligulata*), Atlantic coastal/bitter panic grass

(*Panicum amarum*), and sea oats (*Uniola paniculata*). Six pedestrian crossover bridges were constructed over the dune to provide pedestrian access to the beach. Natural sand dunes exist to the north and south of the constructed dune. Annual revegetation of the dunes is conducted as specified in the installation's Integrated Natural Resources Management Plan.

The beach replenishment covered 9,280 feet of the beach in front of the constructed sand dune and extending approximately one-half-mile to the north and south of the constructed dune. The beach was designed to be 200 feet wide from the dune centerline to the ocean. Sand for the beach replenishment was dredged from Sandbridge Shoal, an approved U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM; formerly the Minerals Management Service) dredge site. Sandbridge Shoal is located approximately three miles offshore of the project location (see Enclosure 2).

Since its construction, the SPS has been replenished once, in 2004. At that time, the 9,280-feet beach front was replenished, and minor spot repair with additional sand and vegetation was completed on the constructed dune. Sand for the replenishment and repairs was provided through a negotiated agreement with BOEM and was dredged by hopper dredge from Sandbridge Shoal. Since 2004, the combined effects of winds, wave action, and storm damage have caused the beach portion of the SPS to lose a major amount of sand, lowering the level of protection for the Dam Neck facilities. The beach portion of the SPS is integral to the proper functioning and stability of the overall SPS. Without the beach, the constructed dune would quickly erode, leaving only the buried stone core, which was not designed to provide permanent protection for the buildings. The dune, including the buried stone core, is currently in relatively good condition, although the sand portion has been sheared into steep slopes in several locations. Erosion of the SPS has progressed to a point where a moderate winter storm season could erode the dune down to the buried stone core. The proposed action is needed to reconstruct the SPS and mitigate this major sand loss.

The Navy is currently in the process of preparing an Environmental Assessment (EA) that evaluates alternatives for repairing the SPS. The EA for the proposed action evaluates two action alternatives: Alternative 1 - full replenishment of the SPS to the original condition, and Alternative 2 - full replenishment of the SPS, as well as construction of an armored dune with a stone core extending approximately one-half mile from both the north and south ends of the existing man-made dune. Alternative 1 is the preferred alternative.

Under Alternative 1, the SPS at Dam Neck would be restored to its original condition (see Enclosure 3). The beach would be fully replenished, and the seaward side of the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. The restored areas of the constructed dune would be planted with native grasses such as American beach grass, Atlantic coastal/bitter panic grass, switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*).

A total of approximately 700,000 cubic yards (cy) of sand would be required. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation. It is estimated that approximately 472,500 cy of sand would be placed on the beach and 52,500 cy of sand would be added to the constructed dune. This sand would replace the volume eroded since 2004 by normal wind, wave, and current action, as well as that removed during storm events.

Alternative 1 will include authorization by BOEM to access the Sandbridge Shoal in order to dredge sand for the replenishment. A hopper dredge would be used to pump the sand from the Sandbridge Shoal. Once the sand is dredged from the shoal, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge onto the Dam Neck beach through a short pipeline at offload sites spaced along the shoreline. No more than two bulldozers and two graders would then be used to shape the beach and dune to the original 1996 design. The bulldozers and graders would be operated eight hours a day. The Navy contractor will be required to use best management practices (BMPs) to avoid erosion during sand placement. Repairs are estimated to require three to six consecutive months to complete.

Under Alternative 2 (see Enclosure 4), the SPS would be restored to its original condition, similar to Alternative 1. The beach would be fully replenished, and the seaward side of the already existing man-made dune would be replenished with sand and reshaped to the 1996 dimensions. In addition to the full replenishment of the SPS, Alternative 2 would also include construction of a new dune (including a stone core), extending the existing man-made dune to both the north and south by approximately one half-mile at each end. Also, similar to Alternative 1, the restored, and the newly constructed areas of the dune would be revegetated with native grasses.

A total of approximately 1,000,000 cy of sand would be required. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation. Approximately 472,500 cy of sand would be placed on the beach and 352,000 cy of sand would be used to repair the existing man-made dune and construct the new enforced dune.

Alternative 2 will include authorization by BOEM to access the Sandbridge Shoal in order to dredge sand for the replenishment. Similar to Alternative 1, once the sand is pulled from the shoal, the dredge would be transported close to shore where the sand slurry would be pumped from the dredge onto the Dam Neck beach through a short pipeline at offload sites spaced along the shoreline. No more than two bulldozers and two graders would then be used to shape the beach and dune to the original 1996 design, and construct the new armored dune. The bulldozers and graders would be operated eight hours a day. The Navy contractor will be required to use best management practices (BMPs) to avoid erosion during sand placement.

To construct the stone core of the newly extended man-made dune, the Navy's construction contractor would order approximately 70,000 cy of stone from a material supplier. Approximately 2,240 truckloads would be required to transport the necessary stone to the project area from a local stockyard. Repairs are estimated to require six to nine consecutive months to complete Alternative 2.

Background

The Coastal Zone Management Act of 1972 (CZMA), codified in 16 U.S. Code section 1451 *et seq.*, and administered by the Secretary of Commerce through the Office of Coastal Resources Management of the National Oceanic and Atmospheric Administration, established a comprehensive regulatory scheme for effective management, beneficial use, protection, and development of the coastal zone and its natural resources. CZMA encourages coastal states and provides a mechanism for them to develop, obtain federal approval for, and implement a broad-based coastal management program (CMP).

Federal approval of a state CMP triggers for federal executive agencies an obligation, under CZMA Section 307, to make coastal consistency determinations for their activities. Section 307 applies to federal agency activity in a state's coastal zone and also to federal agency activity outside the coastal zone, if the activity affects a land or water use in or natural resources of the coastal zone. Federal agency activity includes activity performed by a federal agency, approved by a federal agency, or for which a federal agency provides financial assistance. Such activity, whether direct, indirect, or cumulative, must be demonstrated to be consistent with the enforceable policies of the state's CMP, that is, fully consistent with those policies, unless full consistency is otherwise prohibited by federal law. There are no categorical exemptions to or exclusions from Section 307.

The Commonwealth of Virginia has developed and implemented a federally approved Coastal Zone Management Program (CZMP). The nine enforceable policies of the Virginia CZMP address: (1) wetlands management; (2) fisheries management; (3) subaqueous lands management; (4) dunes and beaches management; (5) point source air pollution control; (6) point source water pollution control; (7) non-point source water pollution control; (8) shoreline sanitation; (9) coastal lands management.

Analysis of Enforceable Policies

Wetlands Management

Due to the elevation and a break in contiguity, no tidal wetlands exist in the dune and back dune area (the project limits for Alternative 1). The Navy is not aware of any wetland resources that would be affected by the construction of the man-made armored dune as part of Alternative 2.

The Navy is currently performing a wetland delineation that will be submitted to the United States Army Corps of Engineers (USACE) for a jurisdictional determination in the near future. If wetlands are found to be present within the project limits of Alternative 2, all minimization and mitigative measures necessary would be employed into the design. Also a Joint Permit Application (JPA) will be submitted for the project, and a permit for non-tidal wetland impacts would be obtained, if necessary, along with all other applicable permits. Therefore, either Alternative 1 or 2 will be fully consistent with this policy.

Fisheries Management

The proposed action would have no effect on Virginia's inland fisheries. Dredging at Sandbridge Shoal and beach replenishment at Dam Neck would result in localized impacts on coastal fisheries but would not be expected to affect populations of individual species. The dredging area of the Sandbridge Shoal is located outside of the three nautical mile territorial sea boundary, and thus outside of Virginia's coastal zone. In compliance with the Magnuson-Stevens Fishery Conservation and Management Act, the Navy is completing an Essential Fish Habitat (EFH) Assessment to assess potential impacts on managed fish with designated EFH within Sandbridge Shoal and nearshore waters in the vicinity of the project.

Mitigation measures to reduce impacts on managed species will be developed in consultation with federal and state agencies, as necessary. Mitigation measures could include 1) maintaining shoal morphology during dredging; 2) leaving undisturbed areas of benthic habitat within the designated dredge area(s) to facilitate benthic recolonization and recovery; and 3) scheduling dredging to avoid egg and larvae periods. These measures would decrease adverse effects on demersal and pelagic finfish, benthic invertebrates, prey species, and supporting habitat in general at the Shoal, which could have spillover effects in the nearshore area.

Potential impacts to fisheries in Virginia's territorial sea from the dispersal of sand along the beach include disturbance to benthic habitat in the surf zone, which could result in decreased availability of prey for fish who feed on benthic organisms. There would also be the potential for a temporary increase in turbidity in the nearshore during sand placement operations.

Best management practices (BMP) would be used to minimize turbidity in the nearshore area. Because Alternative 1 or 2 will require the same amount of sand placement within the nearshore area, impacts on turbidity would be similar. The turbidity generated is not likely to have impacts on populations of individual fish species important to coastal fisheries. As a result, either Alternative 1 or 2 would be fully consistent with this policy.

Subaqueous Lands Management

Potential impacts to subaqueous lands within Virginia's territorial sea from removing sand from the Sandbridge Shoal could include changes to sediment transport processes and water flow in the nearshore areas.

Offshore sand extraction could change nearshore wave transformation and wave-induced long-shore sediment transport, thus affecting the future shaping of the coastline. The physical impact of waves along the coastline between the Virginia Beach resort area and Sandbridge due to dredging at the Sandbridge Shoal was found to be insignificant during a modeling study (Maa and Hobbs 1998). Therefore, no changes in long-shore sediment transport would be expected at Dam Neck and the surrounding shoreline.

Changes in wave patterns and sediment transport mechanisms due to sand extraction at Sandbridge Shoal would be expected to be minor. Alternative 2 would create a greater disturbance at the Shoal due to the increased amount of sand required to complete the project. However, it is expected that the volume of sand to be removed for Alternative 2 would have similar effects on wave patterns and sediment transport compared to Alternative 1.

During the beach replenishment activities, either Alternative 1 or 2 would require that sediment placement extends beyond mean low water (MLW) and onto state-owned subaqueous bottomland. The Navy will submit a Joint Permit Application (JPA) to obtain a Virginia Marine Resources Commission (VMRC) permit for the use of state-owned bottomlands for the placement of sand in the nearshore area during the replenishment of the beach. Therefore, either Alternative 1 or 2 would be fully consistent with this policy.

Dunes and Beaches Management

Either Alternative 1 or 2 would repair and replenish the existing constructed sand dune and beach at Dam Neck. The seaward side of the constructed dune would be replenished with sand and shaped to its 1996 dimensions in areas where sand has eroded from the dune. The replenished areas of the dune would be planted with native beach grasses. Beach grasses in the areas that would be replenished would be buried by the new sand, but these plants would be replaced with similar species during re-planting. Either Alternative 1 or 2 would include removing sand from the six existing pedestrian crossover bridges; no new pedestrian crossover bridges would be constructed.

Alternative 2 would also include the construction of armored dunes as extensions of the already existing man-made dunes within the project area. Under both alternatives restoration of the coastal primary sand dune and beach would occur. Therefore, either Alternative 1 or 2 would be consistent to the maximum extent practicable with the applicable enforceable policy.

Point Source Air Pollution Control

Neither Alternative 1 nor 2 would generate any new point sources of air pollution. Construction emissions, including vehicle and equipment emissions, would not exceed *de minimis* levels under the General Conformity Rule, and no significant impact on regional air quality would result. Therefore, implementation of either Alternative 1 or 2 would be fully consistent with this policy.

Point Source Water Pollution Control

Neither Alternative 1 nor 2 would generate any new point source discharges. A Virginia Pollutant Discharge Elimination System permit would not be required, and neither alternative would have an effect on point-source water pollution control.

Non-Point Source Water Pollution Control

Neither Alternative 1 nor 2 would create any new areas of impervious surface on Dam Neck.

As stipulated in 4 VAC 50-30-80, shore erosion control projects are not subject to Virginia Erosion and Sediment Control Laws and Regulations.

Under the Virginia Stormwater Management Program (SMP) Permit Regulations, "land disturbance" or "land-disturbing activity" is defined as a manmade change to the land surface—including any clearing, grading, or excavation associated with a construction activity regulated under the Clean Water Act or the Virginia SMP Permit Regulations themselves—that potentially changes its runoff characteristics. Given this definition of disturbance, neither Alternative 1 nor 2 would trigger the compliance requirement because the distribution of sand and shaping of the beach would not change the runoff characteristics of the site. Implementation of best management practices (for vehicle and equipment fueling and maintenance and spill prevention and control measures) would reduce potential impacts on surface water during beach replenishment activities. Therefore, the proposed project would be consistent with this policy to the maximum extent practicable.

Shoreline Sanitation

Neither Alternative 1 nor 2 would involve demolition or installation of septic tanks or other wastewater infrastructure. Therefore, neither alternative would have an effect on shoreline sanitation.

Coastal Lands Management

The Chesapeake Bay Preservation Act and Management Regulations require localities in Tidewater Virginia to establish local protection ordinances designating Chesapeake Bay Resource Protection Areas (RPAs) or Resource Management Areas (RMAs). The project area on Dam Neck is not within the Chesapeake Bay watershed. No RPAs or RMAs are designated within the project area. Therefore, neither Alternative 1 nor 2 would have an effect on coastal lands management.

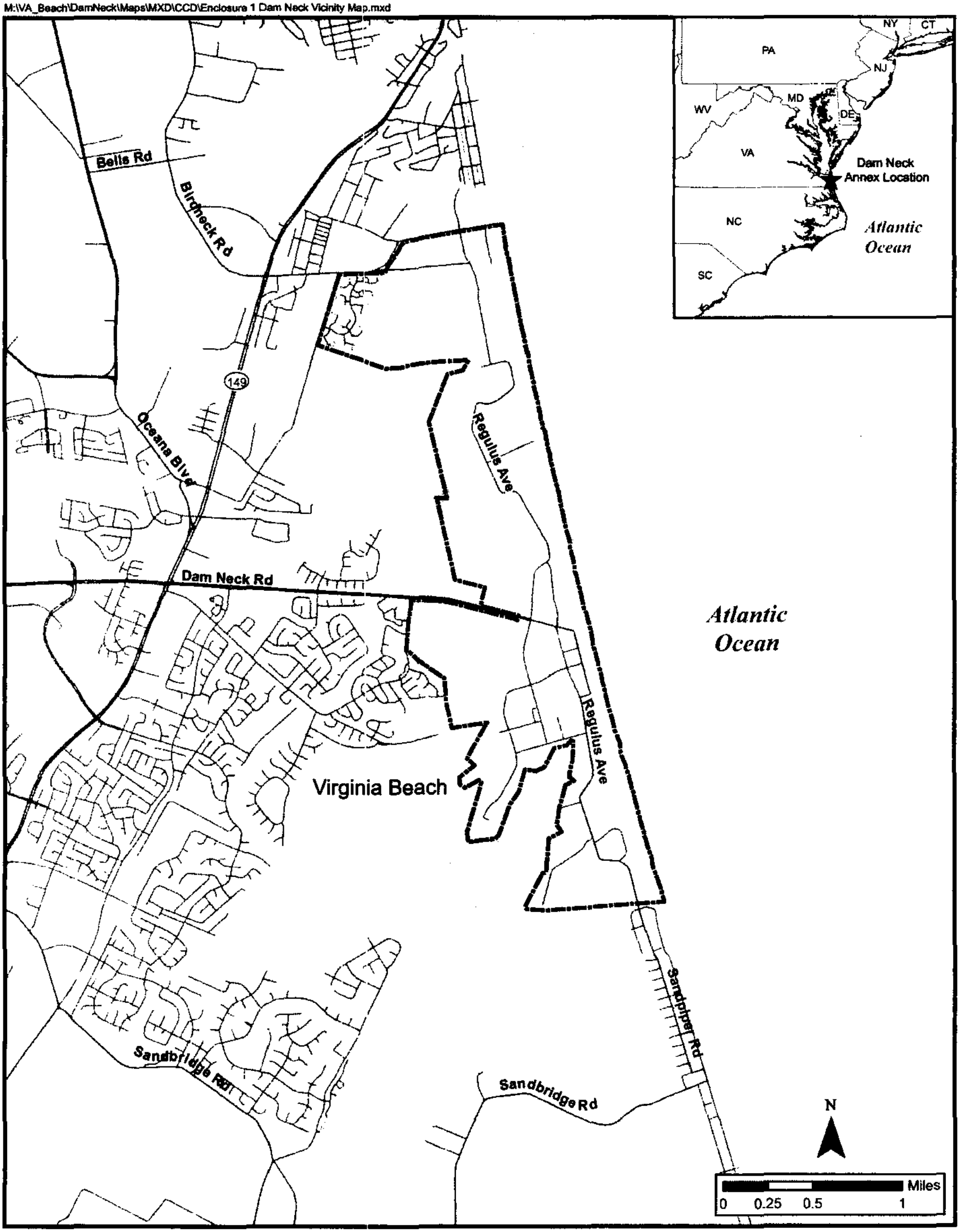
Conclusion

After careful consideration, the Navy has determined that implementation of either Alternative 1 or 2 would reasonably likely affect a land use, water use, or natural resource of the Commonwealth of Virginia. However, the Navy would conduct either Alternative 1 or 2 in a manner that would either be fully consistent, or consistent to the maximum extent practicable with the applicable enforceable policies of the CZMP. Additionally, the Navy would obtain permits or approvals for the proposed work as required under Section 10 of the Rivers and Harbors Act, Sections 401 and 404 of the Clean Water Act, and applicable laws of the Commonwealth of Virginia.

W. David Noble
Director
Environmental Planning and Conservation

4/26/2012
Date

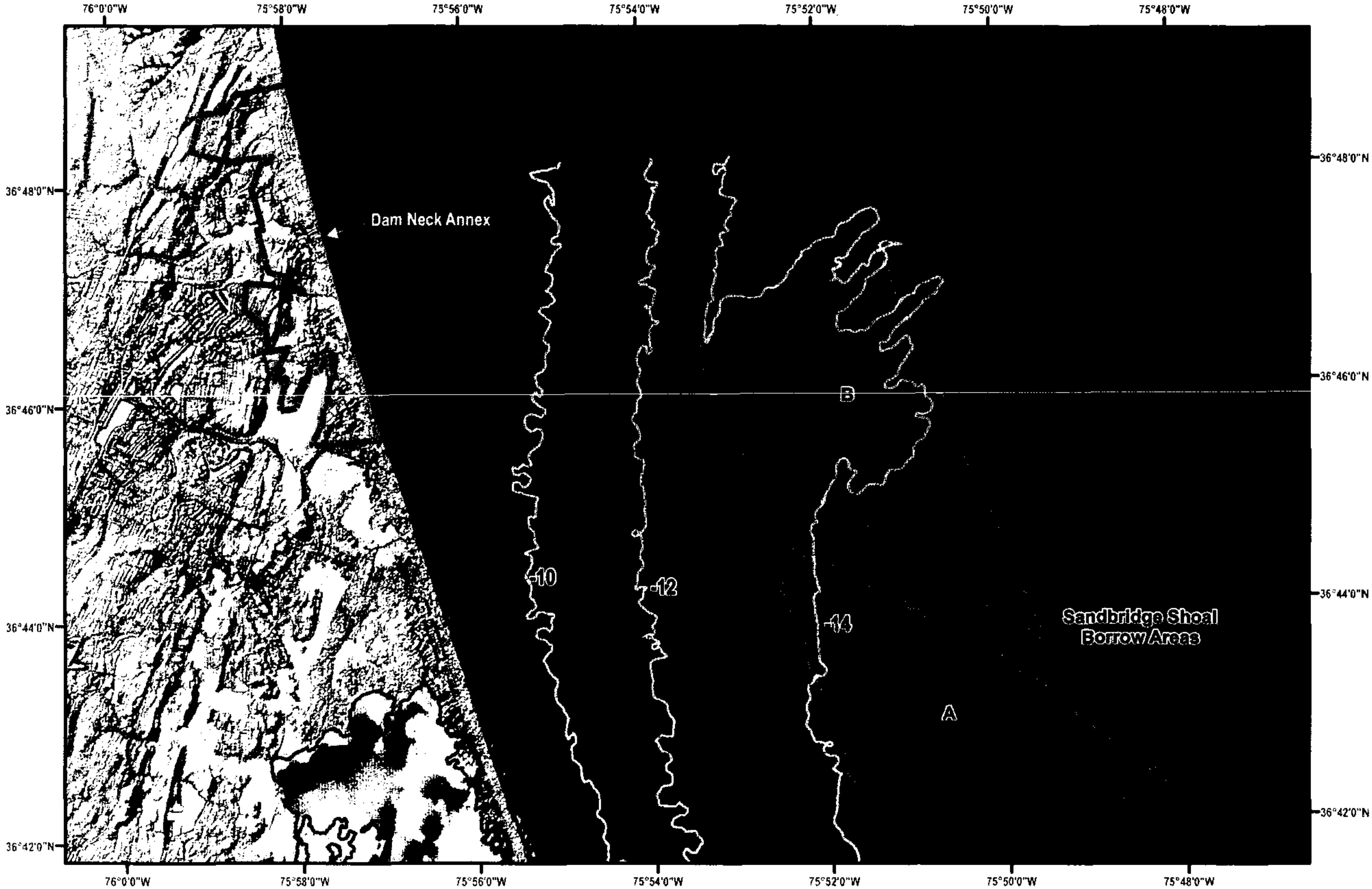
M:\VA_Beach\DamNeck\Maps\MXD\CCD\Enclosure 1 Dam Neck Vicinity Map.mxd



Installation Boundary

Enclosure 1 Project Vicinity
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy



Installation Boundary **Sandbridge Shoal Contours (m)**

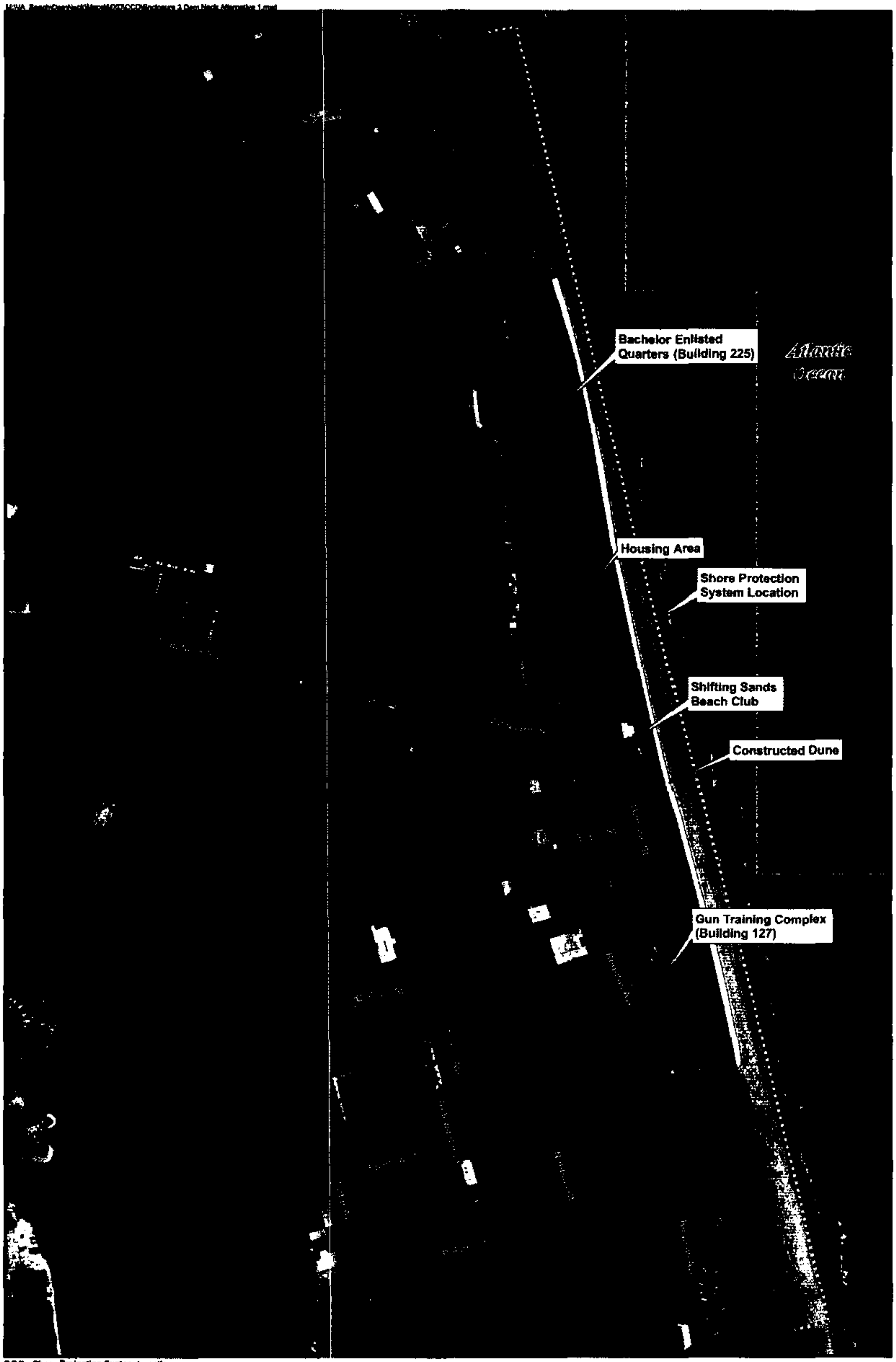
Sandbridge Shoal **No Dredge Zone**

Source: 2007 NOAA; U.S. Navy

Enclosure 2 Sandbridge Shoal
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

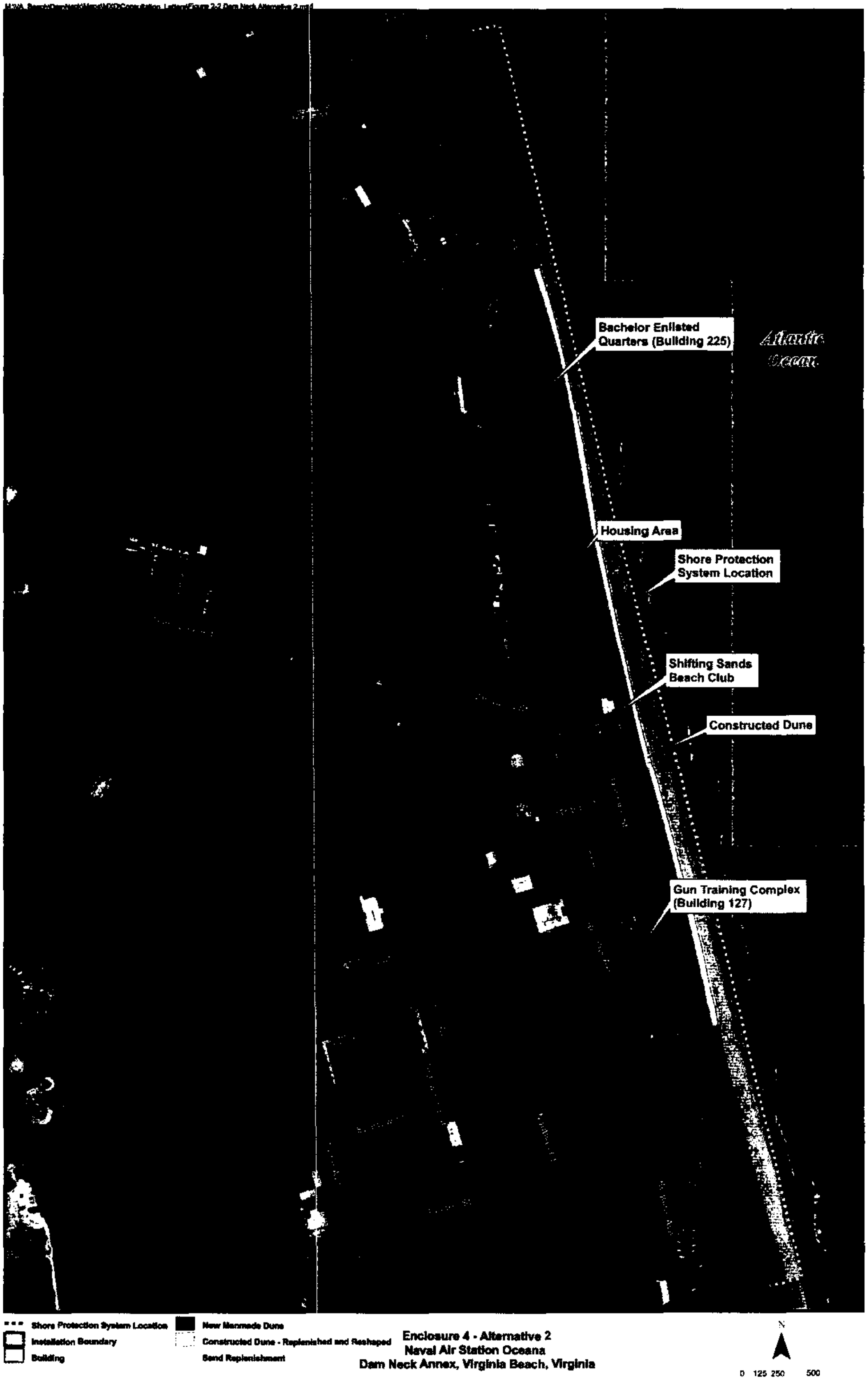
0 0.5 1 2 Miles



Shore Protection System Location
Installation Boundary
Building
Constructed Dune - Replenished and Reshaped
Sand Replenishment
Source: ESRI, U.S. Navy

Enclosure 3 Alternative 1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N
0 125 250 500 Feet



Enclosure 4 - Alternative 2
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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June 27, 2012

Mr. W. David Noble
Environmental Planning and Conservation
Navy Region, Mid-Atlantic
1510 Gilbert St.
Norfolk, VA 23511-2737

RE: Federal Consistency Determination for Proposed Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex, Virginia Beach (DEQ 12-092F, 5090 EV22/22/RE281)

Dear Mr. Noble:

The Commonwealth of Virginia has completed its review of the federal consistency determination (FCD) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of FCDs and responding on behalf of the Commonwealth. This letter is in response to the FCD dated April 26, 2012, (received May 2, 2012) that was submitted by the Navy. The following agencies participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Department of Health
Department of Historic Resources
Marine Resources Commission

The Department of Game and Inland Fisheries, Virginia Institute of Marine Science, Hampton Roads Planning District Commission and the City of Virginia Beach also were invited to comment on the project.

PROJECT DESCRIPTION

The Department of the Navy submitted a FCD for repairs to an existing shoreline protection system at Naval Air Station Oceana, Dam Neck, in the City of Virginia Beach. The shoreline protection system was installed in 1996 and consists of a constructed sand dune reinforced by a buried stone core with beach replenishment on the seaward side. Winds and storm damage have caused the beach portion of the shoreline protection system to lose a significant amount of sand. The action proposed in the FCD is necessary to reconstruct the shoreline protection system and mitigate the sand loss.

The Navy is preparing an environmental assessment (EA) that evaluates two action alternatives. Alternative 1, the Preferred Alternative, is the full replenishment of the shoreline protection system to its original condition. Alternative 2 is the full replenishment of the shoreline protection system as well as the construction of an armored dune with a stone core extending approximately one-half mile from both the north and south ends of the existing dune. Either alternative would require authorization by the Bureau of Ocean Energy Management (BOEM) to access the Sandbridge Shoal (which is located outside of the 3 nautical mile territorial sea boundary) to dredge sand for the replenishment. The FCD states that the implementation of either Alternative 1 or 2 would be consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program (VCP) (previously called the Virginia Coastal Resources Management Program).

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities located inside or outside of Virginia's designated coastal management area that can have reasonably foreseeable effects on coastal resources or coastal uses must, to the maximum extent practicable, be implemented in a manner consistent with the VCP. The VCP consists of a network of programs administered by several agencies. In order to be consistent with the VCP, the project activities must be consistent with the enforceable policies of the VCP and all the applicable permits and approvals listed under the enforceable policies of the VCP must be obtained prior to commencing the project. DEQ coordinates the review of FCDs with agencies administering the enforceable and advisory policies of the VCP.

PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, a public notice of this proposed action was published on the DEQ website from May 8, 2012 to June 1, 2012. No public comments were received in response to the notice.

FEDERAL CONSISTENCY CONCURRENCE

The Navy finds the project consistent with the enforceable policies of the VCP. The reviewing agencies that are responsible for the administration of the enforceable policies generally agree with the FCD. Based on the review of the FCD and the comments submitted by agencies administering the enforceable policies of the VCP, DEQ concurs that the proposed project is consistent with the VCP provided all applicable permits and approvals are obtained as described below. However, other state approvals which may apply to this project are not included in this FCD. Therefore, the Navy must also ensure that this project is constructed and operated in accordance with all applicable federal, state and local laws and regulations. The analysis which follows responds to the discussion of the enforceable policies of the VCP that apply to this project.

ANALYSIS OF ENFORCEABLE POLICIES

1. Fisheries Management. The FCD (page 6) states that dredging at Sandbridge Shoal and beach replenishment at Dam Neck would result in local impacts on coastal fisheries and mitigation measures will be implemented in consultation with federal and state agencies. In addition, the Navy is completing an Essential Fish Habitat Assessment.

1(a) Agency Jurisdiction.

(i) Department of Game and Inland Fisheries

The Department of Game and Inland Fisheries (DGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state- or federally-listed endangered or threatened species, but excluding listed insects (Virginia Code Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce or compensate for those impacts. For more information, see the DGIF website at *www.dgif.virginia.gov.*

(ii) Virginia Marine Resources Commission

The Virginia Marine Resources Commission (Virginia Code 28.2-200 to 28.2-713) and DGIF (Virginia Code 29.1-100 to 29.1-570) have management authority for the conservation and enhancement of finfish and shellfish resources in the Commonwealth.

(iii) Virginia Department of Health

The Virginia Department of Health's (VDH) Division of Shellfish Sanitation (DSS) is responsible for protecting the health of the consumers of molluscan shellfish and crustacea by ensuring that shellfish growing waters are properly classified for harvesting, and that molluscan shellfish and crustacea processing facilities meet sanitation standards. The mission of this Division is to minimize the risk of disease from molluscan shellfish and crustacea products at the wholesale level by classifying shellfish waters for safe commercial and recreational harvest; by implementing a statewide regulatory inspection program for commercial processors and shippers; and by providing technical guidance and assistance to the shellfish and crustacea industries regarding technical and public health issues.

1(b) Agency Findings.

(i) Department of Game and Inland Fisheries

DGIF did not respond to DEQ's request for comments.

(ii) Virginia Marine Resources Commission

VMRC states that it does not have any concerns regarding shellfish impacts.

(iii) Virginia Department of Health

VDH DSS states that it has no comments.

2. Wetlands Management. The FCD (page 5) states the Navy is performing a wetland delineation and a JPA will be submitted for the project.

2(a) Agency Jurisdiction.

(i) Department of Environmental Quality

The State Water Control Board promulgates Virginia's water regulations, covering a variety of permits to include Virginia Pollutant Discharge Elimination System Permit, Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection Permit (VWPP). The VWPP is a state permit which governs wetlands, surface water, and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal *Clean Water Act* § 404 permits for dredge and fill activities in waters of the U.S. The VWPP Program is under the Office of Wetlands and Stream Protection (OWSP), within the DEQ Division of Water Quality Programs.

(ii) Virginia Marine Resources Commission

Tidal wetlands are administered by the Virginia Marine Resources Commission under the authority of Virginia Code 28.2-1301 through 28.2-1320.

2(b) Agency Comments.

(i) Department of Environmental Quality

The DEQ Tidewater Regional Office (TRO) states that according to the FCD the Navy will submit a JPA for all proposed surface water impacts.

(ii) Virginia Marine Resources Commission

A JPA should be completed and submitted to VMRC for review and permitting.

2(c) Recommendations. In general, DEQ recommends that stream and wetland impacts be avoided to the maximum extent practicable. To minimize unavoidable impacts to wetlands and waterways, DEQ recommends the following practices:

- Operate machinery and construction vehicles outside of stream-beds and wetlands; use synthetic mats when in-stream work is unavoidable.
- Preserve the top 12 inches of material removed from wetlands for use as wetland seed and root-stock in the excavated area.
- Erosion and sedimentation controls should be designed in accordance with the most current edition of the *Virginia Erosion and Sediment Control Handbook*. These controls should be in place prior to clearing and grading, and maintained in good working order to minimize impacts to state waters. The controls should remain in place until the area is stabilized.
- Place heavy equipment, located in temporarily impacted wetland areas, on mats, geotextile fabric, or use other suitable measures to minimize soil disturbance, to the maximum extent practicable.
- Restore all temporarily disturbed wetland areas to pre-construction conditions and plant or seed with appropriate wetlands vegetation in accordance with the

cover type (emergent, scrub-shrub or forested). The applicant should take all appropriate measures to promote revegetation of these areas. Stabilization and restoration efforts should occur immediately after the temporary disturbance of each wetland area instead of waiting until the entire project has been completed.
- Place all materials which are temporarily stockpiled in wetlands, designated for use for the immediate stabilization of wetlands, on mats or geotextile fabric in order to prevent entry in state waters. These materials should be managed in a manner that prevents leachates from entering state waters and must be entirely removed within thirty days following completion of that construction activity. The disturbed areas should be returned to their original contours, stabilized within thirty days following removal of the stockpile, and restored to the original vegetated state.
- All non-impacted surface waters within the project or right-of-way limits that are within 50 feet of any clearing, grading or filling activities should be clearly flagged or marked for the life of the construction activity within that area. The project proponent should notify all contractors that these marked areas are surface waters where no activities are to occur.
- Measures should be employed to prevent spills of fuels or lubricants into state waters.

2(d) Requirement. Any proposed surface water impacts should comply with the requirements of the VWP Program (see Item 3 in the Analysis of Enforceable Policies Section for information on submitting a JPA).

2(e) Conclusion. Provided a JPA is submitted and that all necessary VWP permits or authorizations are obtained and complied with, this project will be consistent with wetlands management enforceable policy.

3. Subaqueous Lands. The FCD (page 7) states that beach replenishment activities for both alternatives would require that sediment placement extends beyond low mean water and onto state-owned subaqueous bottomland.

3(a) Agency Jurisdiction. In accordance with the Coastal Zone Management Act of 1972 (§1456(c)) and federal consistency regulations (15 CFR, Part 930, Subpart C, §930.30 et seq.), the Navy's actions must be consistent with the enforceable policies of the VCP, including the subaqueous lands management enforceable policy. VMRC, pursuant to Section 28.2-1200 et seq. of the Code of Virginia, has jurisdiction over any encroachments in, on, or over any state-owned rivers, streams, or creeks in the Commonwealth.

The VMRC serves as the clearinghouse for the JPA used by the:

- Corps for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a VWP permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

The VMRC will distribute the completed JPA to the appropriate agencies. Each agency will conduct its review and respond.

3(b) Agency Finding. A JPA should be completed and submitted to VMRC for review and permitting.

3(c) Agency Recommendation. Coordinate with VMRC regarding the submittal of a JPA.

3(d) Requirement. The proposal to hydraulically nourish the beach will require a permit from VMRC.

4. Dunes Management. The FCD (pages 7 and 8) states that either Alternative 1 or 2 would repair and replenish the existing constructed sand dune and beach at Dam Neck. Alternative 2 would also include the construction of armored dunes as extensions of the existing dune. Under both alternatives, restoration of the coastal primary sand dune and beach would occur.

4(a) Agency Jurisdiction. Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the VMRC (Virginia Code §28.2-1400 through §28.2-1420).

4(b) Agency Comments. VMRC states that in accordance with Chapter 14, Coastal Primary Sand Dunes and Beaches, of the Code of Virginia, sand nourishment or replenishment activities on jurisdictional beaches or coastal primary dunes does not require further authorization from the City of Virginia Beach Wetlands Board. However, the placement of materials on or along the dunes other than beach-quality sand or vegetation sprigs, i.e. "armoring the dunes," may require a permit from the Local Wetlands Board. This kind of request would need to be processed and heard by the city's Local Wetlands Board for a permit to legally impact the beach / coastal primary sand dune.

If the referenced dune to be impacted is definitely manmade, then by legal definition, it cannot be considered as a jurisdictional coastal primary sand dune. The beach and dune jurisdiction for the locality would then typically shift landward to the nearest manmade structure or adjacent natural dune. Classifying natural dunes versus manmade dunes can be very difficult and controversial, especially along nourished shorelines.

4(c) Agency Recommendation. VMRC recommends that the locality review the portions of the project within its jurisdiction.

5. Air Pollution Control. The FCD (page 4) states that construction emissions, including vehicles and equipment, would not exceed *de minimis* levels under the General Conformity Rule.

5(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the Air Pollution Control Board, is responsible for developing regulations that become Virginia's Air Pollution Control Law. DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issue of necessary permits to construct and operate all stationary sources in the region as well as to monitor emissions from these sources for compliance. As a part of this mandate, the environmental documents of new projects to be undertaken in the state are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

5(b) Ozone Maintenance Area. According to the DEQ Air Division, the project site is located in an ozone maintenance area and an emission control area for volatile organic compounds (VOCs) and oxides of nitrogen (NO_X), which are contributors to ozone pollution.

5(c) Agency Recommendation. All precautions are to be taken to restrict the emissions of VOCs and NO_X during construction.

5(d) Requirements.

(i) Fugitive Dust

During land-disturbing activities, fugitive dust must be kept to a minimum by using control methods outlined in 9VAC5-50-60 *et seq.* of the Regulations for the Control and

Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or suitable chemicals for dust control during the proposed demolition and construction operations and from material stockpiles;
- Installation and use of hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

(ii) Open Burning

If project activities include the burning of vegetative debris, this activity must meet the requirements under 9VAC5-130 *et seq.* of the regulations for open burning, and it may require a permit. The regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. The Navy should contact officials with the appropriate locality to determine what local requirements, if any, exist.

5(e) Conclusion. Provided the project complies with applicable requirements, it would be consistent with the air pollution control enforceable policy of the VCP.

6. Coastal Lands Management. The FCD (page 3) states that the project area is not within the Chesapeake Bay watershed.

6(a) Agency Jurisdiction. The Department of Conservation and Recreation (DCR) Division of Stormwater Management – Local Implementation (DSM –LI) administers the coastal lands management enforceable policy of the VCP, which is governed by the Chesapeake Bay Preservation Act (Virginia Code §10.1-2100-10.1-2114) and Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC10-20 *et seq.*).

6(b) Agency Comments. DCR DSM –LI states that Dam Neck Annex lies outside of the Chesapeake Bay Preservation Area and Chesapeake Bay watershed as depicted on the City of Virginia Beach's Chesapeake Bay Preservation Area map as it is located in the Atlantic Ocean drainage basin. As there are no requirements under the Bay Act due to the location outside of the Chesapeake Bay watershed, this project is consistent with the Chesapeake Bay Preservation Act.

7. Non-point Source Pollution Control. The FCD (page 8) states that as stipulated in 4VAC50-30-80, shore erosion control projects are not subject to Virginia Erosion and Sediment Control Laws and Regulations. Under the Virginia Stormwater Management

Program (SMP) Permit Regulations, land disturbance is defined as a manmade change to the land surface—including any clearing, grading, or excavation associated with a construction activity regulated under the Clean Water Act or the Virginia SMP Permit Regulations themselves—that potentially changes its runoff characteristics. Given this definition of disturbance, neither Alternative 1 nor 2 would trigger the compliance requirement because the distribution of sand and shaping of the beach would not change the runoff characteristics of the site. However, the FCD (pages 8 and 9) states that the implementation of best management practices (for vehicle and equipment fueling and maintenance and spill prevention and control measures) would reduce potential impacts on surface water during beach replenishment activities.

7(a) Agency Jurisdiction. The DCR Division of Stormwater Management (DSM) administers the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R) and the Virginia Stormwater Management Law and Regulations (VSWML&R).

7(b) Erosion and Sediment Control and Stormwater Management Project-Specific Plans. According to DCR pursuant to Executive Order 12008, all federal projects shall comply with state and local regulations. The Navy and their authorized agents conducting regulated land-disturbing activities on private and public lands in the state must comply with the VESCL&R and VSWML&R including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, Federal Consistency under the Coastal Zone Management Act).

- Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbance activities that result in the land-disturbance of equal to or greater than 10,000 square feet would be regulated by VESCL&R.
- Shoreline erosion projects are not included in the definition of "land-disturbing activity" under the VESCL and hence not regulated, except for the portion of the work that occurs away from the shore itself, such as access roads, staging areas, waste and borrow areas etc.

Accordingly, DCR recommends that the Navy prepare and implement an erosion and sediment control (ESC) plan to ensure compliance with state law and regulations. The ESC plan can be submitted to the DCR regional office that serves the area where the project is located for review for compliance. The Navy is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy.

7(c) VSMP General Permit for Construction Activities. The operator or owner of construction activities involving land-disturbing activities equal to or greater than 1 acre are required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the Virginia Stormwater Management Program (VSMP) Permit Regulations. General information and forms are available at *www.dcr.virginia.gov/soil_and_water/index.shtml.*

7(d) Conclusion. For consistency with the nonpoint source pollution control enforceable policy of the VCP, the project must be consistent with the erosion and sediment control and the stormwater management laws and regulations.

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

In addition to the enforceable policies of the VCP, comments also were provided with respect to applicable requirements and recommendations of the following programs:

1. Solid and Hazardous Waste Management.

1(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by DEQ, the Virginia Waste Management Board and the U.S. Environmental Protection Agency. They administer programs created by the federal Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the Virginia Waste Management Board and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use and alternative programs such as materials recycling and composting.

1(b) Database and Data File Searches. The DEQ Division of Land Protection and Revitalization (DLPR) conducted a cursory review of its database files, including a Geographic Information System database search, and determined that facility waste sites of concern were located within the same zip code of the proposed project under 23461 and/or within a 0.2 mile-radius.

Hazardous Waste Facilities

The search of the RCRAInfo database found two facilities but their proximities to the work site were not determined:

- Amoco #60086 –Tanks, 1101 Virginia Beach Blvd., Virginia Beach, VA 23461. ID # VAD988198768 Contact: Toni Dougherty at 301-625-7858.
- Naval Air Station, Dam Neck Annex, Tarter Avenue, Virginia Beach, VA 23461. ID# VA5170022938. Contact: Crystal G. St. Clair-Canaii at 757-754-6775.

CERCLA

The following CERCLA facility site was found in or near zip code 22134 and/or within 500 feet of the project site:

- USN Fleet Combat Training Center, 1912 Regulus Avenue, Virginia Beach, VA 23461. NPL Status: Not on the NPL. EPA ID# VA5170022938. Proximity to the work sites was not determined.

The following websites may prove helpful in locating additional information for this identification number:

- *www.epa.gov/superfund/sites/cursites/index.htm*
- *www.epa.gov/enviro/html/rcris/rcris_query_java.html*

Petroleum Release Sites

The following petroleum release site was found in the DEQ's inventory under zip code 23461 and/or within 0.2 mile of the project site:

- Combat Training Center, 1912 Regulus Avenue, Virginia Beach, VA 23461. ID# 19972320.

1(c) Requirement. DEQ TRO states that the installation or use of any portable aboveground petroleum storage tank (>660 gallons – 9VAC 5-91-10 *et seq.*) *for more than 120 days* must be reported to DEQ.

1(d) Agency Recommendations.

- DEQ encourages all projects, including installation activities, to implement pollution prevention principles, including:

  - o the reduction, reuse and recycling of all solid wastes generated; and
  - o the minimization and proper handling of generated hazardous wastes.

- Evaluate the proximities of the identified waste sites, including the location, nature and extent of the petroleum release, to the project site and the potential impact to the project.

1(e) Requirement. Any soil/sediment that is suspected of contamination or wastes that are generated during construction-related activities must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations.

2. Wildlife Resources.

2(a) Agency Jurisdiction. DGIF, as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state- or federally-listed endangered or threatened species, but excluding listed insects (Virginia Code Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce or compensate for those impacts.

2(b) Agency Comment. DGIF did not respond to DEQ's request for comments.

2(c) Additional Information. DGIF maintains a database (*http://vafwis.org/fwis/*) of wildlife locations, including threatened and endangered species, trout streams and anadromous fish waters.

3. Historic Structures and Architectural Resources.

3(a) Agency Jurisdiction. The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. DHR, as the designated Historic Preservation Office for the Commonwealth, ensures that federal actions comply with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulation at 36 Code of Federal Regulations Part 800. The NHPA requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding. DHR also provides comments to DEQ through the state environmental impact report review process.

3(b) Requirement. Coordinate the project with DHR to ensure compliance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36 CFR 800.

4. Natural Heritage Resources.

4(a) Agency Jurisdiction. The mission of the DCR is to conserve Virginia's natural and recreational resources. DCR supports a variety of environmental programs organized within seven divisions including the Division of Natural Heritage (DNH). DNH's mission is conserving Virginia's biodiversity through inventory, protection, and stewardship. The Virginia Natural Area Preserves Act, 10.1-209 through 217 of the *Code of Virginia*, was passed in 1989 and codified DCR's powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

4(b) Agency Finding. According to the information currently in DCR's files, the Dam Neck Middle Beach Dunes Conservation Site is within the project area. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality and number of element occurrences they contain on a scale of 1 to 5 with 1 being the most significant. Dam Neck Middle Beach Dunes Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at this site is the Loggerhead sea turtle (*Caretta caretta,* G3/S1B,S1N/LE/LT).

The Loggerhead is a cosmopolitan sea turtle which nests regularly in small numbers in Virginia. Loggerheads mate from late March to early June. From late April to early September, females make their way to shore to dig nests on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. Though thousands of eggs may be laid, only a few individuals are believed to survive to adulthood. This species is classified as endangered by the U.S. Fish and Wildlife Service (FWS) and threatened by the Department of Game and Inland Fisheries (DGIF).

Loggerheads face threats both in the marine environment and on nesting beaches. The greatest cause of decline and the continuing primary threat to Loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges (FWS, 2005). On land, Loggerheads face threats from habitat loss and alteration (primarily development of beaches, dredging, riprap, groins and jetties etc), increased nest predation by raccoons and feral animals, trampling by foot and vehicle traffic, and beachfront lighting which may affect hatchlings from reaching the ocean (NatureServe, 2009).

4(c) Threatened and Endangered Plant and Insect Species. The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the *Code of Virginia*, as amended, authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to conserve, protect and manage endangered species of plants and insects. VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the U.S. Fish and Wildlife Service (FWS), DCR DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by FWS, are available, adherence to the order and tasks outlined in the plans should be followed to the extent possible.

VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between the VDACS and DCR, DCR has the authority to report for VDACS on state-listed plant and insect species. DCR states that the current activity will not affect any documented state-listed plant and insect species.

4(d) Natural Area Preserves. DCR states that there are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

4(e) Agency Recommendations.

- Contact DCR DNH for updated information if a significant amount of time passes before the project is implemented, since new information is continually added to the Biotics Data System.
- Coordinate with the FWS and DGIF to ensure compliance with the Federal Endangered Species Act (16 U.S.C. sections 1531 *et seq.*) and Virginia Endangered Species Act (Virginia Code §§ 29.1-563 – 570) due to the legal status of the Loggerhead sea turtle.
- Implement Alternative 1 in order to retain a more natural dune at the termini of the project, especially at the southern end.

5. Water Supply.

5(a) Agency Jurisdiction. The Virginia Department of Health (VDH) Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water sources (groundwater wells, springs and surface water intakes).

5(b) Agency Finding. VDH ODW states that it reviewed the project and has no comments.

Contact VDH (Barry E. Matthews at 804-864-7515) for additional information if necessary.

6. Local and Regional Comments. As customary, DEQ invited the City of Virginia Beach and the Hampton Roads Planning District Commission to comment on the project.

6(a) Jurisdiction. In accordance with the Code of Virginia, Section 15.2-4207, planning district commissions encourage and facilitate local government cooperation and state-local cooperation in addressing, on a regional basis, problems of greater than local significance. The cooperation resulting from this is intended to facilitate the recognition and analysis of regional opportunities and take account of regional influences in planning and implementing public policies and services. Planning district commissions promote the orderly and efficient development of the physical, social and economic elements of the districts by planning, and encouraging and assisting localities to plan for the future.

6(c) Comments. The City of Virginia Beach and the Hampton Roads Planning District Commission did not respond to DEQ's request for comments.

REGULATORY AND COORDINATION NEEDS

1. Water Quality and Wetlands. The Navy should ensure compliance with the VWP Program. If applicable, permitting action commences with the receipt of a complete Joint Permit Application (JPA). Questions on the applicability and fulfillment of VWP Program requirements may be addressed to the DEQ TRO (Bert Parolari at 757-518-2166 or *Bert.Parolari@deq.virginia.gov*).

2. Subaqueous Lands Impacts. Pursuant to section 28.2-1204 of the Code of Virginia, the VMRC has jurisdiction over any encroachments in, on or over any state-owned rivers, streams or creeks in the Commonwealth. Contact VMRC (Justin Worrell at 757-247-8027 or *Justin.Worrell@mrc.virginia.gov*) regarding the submittal of a JPA.

3. Nonpoint Source Pollution Control.

3(a) Erosion and Sediment Control and Stormwater Management Plans. The Navy must ensure that it is in compliance with Virginia's Erosion and Sediment Control Law (Virginia Code 10.1-567) and Regulations (4VAC50-30-30 *et seq.*) and Stormwater Management Law (Virginia Code 10.1-603.5) and Regulations (4VAC3-20-210 *et seq.*). Land-disturbing activities immediately outside the limits of the shore erosion project are subject to the Act and Regulations (4VAC50-30-80 C). Accordingly, project activities outside the limits of the shore erosion project that disturb 10,000 square feet or more would be regulated by VESCL&R and VSWML&R. The Navy is encouraged to contact DCR's Suffolk Regional Office (757-925-2468) for assistance with developing or implementing erosion and sediment control and stormwater management plans to ensure project conformance.

3(b) Virginia Stormwater Management Program General Permit for Stormwater Discharges from Construction Activities. For projects involving land-disturbing activities of equal to or greater than 1 arce, the Navy is required to develop a project-specific stormwater pollution prevention plan and apply for registration coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities (VSMP Permit Regulations 4VAC-50 *et seq.*). Specific questions regarding the Stormwater Management Program requirements should be directed to DCR (Holly Sepety at 804-225-2613).

4. Air Quality Regulations. Guidance on minimizing the emission of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) during construction may be obtained from DEQ TRO. The following regulations may apply during construction:

- fugitive dust and emissions control (9VAC5-50-60 *et seq.*); and
- open burning restrictions (9VAC5-130 *et seq.*).

For information on any local requirements pertaining to open burning, contact officials with the City of Virginia Beach.

Contact the DEQ TRO (Troy Breathwaite at 757-518-2006*)* for additional information.

5. Solid and Hazardous Wastes. All solid waste, hazardous waste and hazardous materials must be managed in accordance with all applicable federal, state and local environmental regulations.

These state laws and regulations may apply:

- Virginia Waste Management Act (*Code of Virginia* Section 10.1-1400 *et seq.*);
- Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC20-60);
- Virginia Solid Waste Management Regulations (VSWMR) (9VAC20-81); and
- Virginia Regulations for the Transportation of Hazardous Materials (9VAC20-110).

These federal laws and regulations may apply:

- Resource Conservation and Recovery Act (RCRA) (42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations); and
- U.S. Department of Transportation Rules for Transportation of Hazardous materials (49 Code of Federal Regulations Part 107).

5(a) Storage Tank. Report the installation or use of any portable aboveground petroleum storage tank (>660 gallons – 9VAC 5-91-10 *et seq.*) <u>for more than 120 days</u> to DEQ (DEQ Tidewater Regional Office, Petroleum Storage Tank Program, Attn: Tom Madigan, 5636 Southern Blvd., Virginia Beach, VA 23462. Phone 757-518-2115).

Contact DEQ TRO (Milt Johnston at 757-518-2151) for additional information on waste management.

6. Natural Heritage Resources. Contact the DCR DNH at (804) 371-2708 for an update on natural heritage information if a significant amount of time passes before the project is implemented.

7. Protected Species and Wildlife Resources.

- DGIF's database may be accessed at *http://vafwis.org/fwis/* or by contacting DGIF (Shirl Dressler at 804-367-6913).
- Coordinate with the FWS (Cindy Schulz at 804-693-6694, extension 164) and DGIF (Amy Ewing at *Amy.Ewing@dgif.virginia.gov*) to ensure compliance with the Federal Endangered Species Act (16 U.S.C. sections 1531 *et seq.*) and Virginia Endangered Species Act (Virginia Code §§ 29.1-563 – 570) due to the legal status of the Loggerhead sea turtle.

8. Historic Resources. Coordinate the project with DHR (Roger Kirchen at *Roger.Kirchen@dhr.virginia*.gov or 804-482-6091) to ensure compliance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations at 36 CFR 800.

Thank you for the opportunity to comment on this FCD. The detailed comments of reviewers are attached. If you have questions, please do not hesitate to call me at (804) 698-4325 or Julia Wellman at (804) 698-4326.

Sincerely,

Ellie Irons, Program Manager
Environmental Impact Review

Enclosures

ec: Amy Ewing, DGIF
Robbie Rhur, DCR
Barry Matthews, VDH
Keith Skiles, VDH
Steve Coe, DEQ DLPR
Kotur Narasimhan, DEQ DAPC
Cindy Keltner, DEQ TRO
Roger Kirchen, DHR
Justin Worrell, VMRC
Pam Mason, VIMS
Clay Bernick, City of Virginia Beach
John Carlock, Hampton Roads PDC
Ben McGinnis, Navy

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

June 5, 2012

PROJECT NUMBER: 12-092F

PROJECT TITLE: Repairs to the Shoreline Protection System at Naval Air Station Oceana-Dam Neck Annex

As Requested, TRO staff has reviewed the supplied information and has the following comments:

Petroleum Storage Tank Cleanups:
No comments.

Petroleum Storage Tank Compliance/Inspections:
The installation or use of any portable aboveground petroleum storage tank (>660 gallons – 9 VAC 25-91-10 et seq.) for more than 120 days for this project must be reported to the DEQ Tidewater Regional Office Petroleum Storage Tank Program attn: Tom Madigan – DEQ Tidewater Regional Office – 5636 Southern Blvd., Virginia Beach, VA 23462. Phone (757) 518-2115.

Virginia Water Protection Permit Program (VWPP):
You indicate that you will submit a Joint Permit Application (JPA) for all proposed surface water impacts. Provided a JPA is submitted and that all necessary VWP permits or authorizations are obtained and complied with, this project will be consistent with the requirements of our program.

Air Permit Program :
No comments.

Water Permit Program :
Water permits – no comments

Ground Water – No comments

Waste Permit Program :
No comments

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

June 5, 2012

PROJECT NUMBER: 12-092F

PROJECT TITLE: Repairs to the Shoreline Protection System at Naval Air Station Oceana-Dam Neck Annex

The staff from the Tidewater Regional Office thanks you for the opportunity to provide comments.

Sincerely,

Cindy Keltner
Environmental Specialist II
5636 Southern Blvd.
VA Beach, VA 23462
(757) 518-2167
Cindy.Keltner@deq.virginia.gov

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY

TO: Julia H. Wellman **DEQ - OEIA PROJECT NUMBER: 12 – 092F**

PROJECT TYPE: ☐ STATE EA / EIR **X FEDERAL EA / EIS** ☐ SCC

X CONSISTENCY DETERMINATION

PROJECT TITLE: REPAIRS TO SHORELINE PROTECTION SYSTEM AT NAVAL AIR STATION OCEANA, DAM NECK ANNEX

PROJECT SPONSOR: DOD / DEPARTMENT OF THE NAVY

PROJECT LOCATION: **X OZONE MAINTENANCE AND EMISSION CONTROL AREA FOR NOX & VOC**

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: **X CONSTRUCTION**
☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 F – STAGE II Vapor Recovery
3. ☐ 9 VAC 5-40-5490 et seq. – Asphalt Paving operations
4. **X 9 VAC 5-130 et seq. – Open Burning**
5. **X 9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
6. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to__________________
7. ☐ 9 VAC 5-50-160 et seq. – Standards of Performance for Toxic Pollutants
8. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the____________________________
9. ☐ 9 VAC 5-80-1100 et seq. of the regulations – Permits for Stationary Sources
10. ☐ 9 VAC 5-80-1700 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the ____________________________
11. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
12. ☐ 9 VAC 5-80-800 et seq. Of the regulations – Operating Permits and exemptions. This rule may be applicable to ____

COMMENTS SPECIFIC TO THE PROJECT:

All precautions are necessary to restrict the emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_X).

K. S. Narasimhan

(Kotur S. Narasimhan)
Office of Air Data Analysis **DATE: May 11, 2012**

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Julia Wellman, DEQ/EIR Environmental Program Planner

FROM: Steve Coe, DLPR Review Coordinator

DATE: May 29, 2012

COPIES: Sanjay Thirunagari, DLP&R Review Manager
EIR File

SUBJECT: EIR Project No. 12-092F- Repairs to the Shoreline Protection System, Oceana Dam Neck Annex, Va Beach – Review Comments

The Division of Land Protection & Revitalization has completed its review of the Environmental Impact Report regarding the Repairs to the Shoreline Protection System, Oceana Dam Neck Annex project, Virginia Beach, VA 23461. The project scope includes the proposed beach renourishment at the site.

We have provided comments below concerning potential waste issues and environmental resources that could be affected and which may be impacted by this proposed project. The submittal did not address potential solid and/or hazardous waste issues. The submittal did not include a search of waste-related databases. The DLPR staff has conducted a cursory review of its database files under zip code 23461, including a GIS database search (.2 mile radius) of the project site and determined the information below.

Facility waste sites of concern were located within the same zip code of the proposed project under zip code 23461, and/or within the .2 mile radius from the project site. However, the proximity of identified waste sites to the project site and/or potential impact to the project should be further evaluated.

The staff's summary comments are as follows:

Hazardous Waste Facilities - two

The search of the RCRAInfo database under zip code 23461 and/or within .2 mile radius of the project site found two (2) facilities, but proximity to the work sites was not determined:

1) Amoco #60086 –Tanks, 1101 Virginia Beach Blvd., Virginia Beach, VA 23461. ID # VAD988198768 Contact: Toni Dougherty at 301-625-7858.
2) Naval Air Station, Dam Neck Annex, Tarter Avenue, Virginia Beach, VA 23461. ID# VA5170022938. Contact: Crystal G. St. Clair-Canaii at 757-754-6775.

CERCLA Sites – one

The following CERCLA facility site was found on the CERCLIS database under or near zip code 22134 and/or within 500 feet of the project site found the following facilities:

USN Fleet Combat Training Center, 1912 Regulus Avenue, Virginia Beach, VA 23461. NPL Status: Not on the NPL. EPA ID# VA5170022938. Proximity to the work sites was not determined.

The following websites may prove helpful in locating additional information for these identification numbers: http://www.epa.gov/superfund/sites/cursites/index.htm or http://www.epa.gov/enviro/html/rcris/rcris_query_java.html.

FUDs Sites – none

Solid Waste Facilities – None

VRP Sites - None

Petroleum Release Sites - one

The following petroleum release site was found on the DEQ's Inventory under zip code 23461 and/or within .2 mile of the project site:

Combat Training Center, 1912 Regulus Avenue, Virginia Beach, VA 23461. ID# 19972320.

(Note: Dates above are the latest PC Database edit dates of the specific PC Case Nos.)

Please note that the DEQ's PC case files of the PC Case Nos., within .2 mile of the proposed project are identified above and these petroleum releases should be evaluated by the project engineer or manager to establish the exact location of the release and the nature and extent of the petroleum release and the potential to impact the proposed project. The facility representative should contact the DEQ's Tidewater Regional Office for further information and the administrative records of the PC cases which are in close proximity to the proposed project.

GENERAL COMMENTS

Soil, Sediment, and Waste Management

Any soil that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous materials, 49 CFR Part 107.

Asbestos and/or Lead-based Paint

All structures being demolished/renovated/ removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed. Questions may be directed to Ms. Lisa Silvia at the Tidewater Regional Office (757-518-2175).

Pollution Prevention – Reuse - Recycling

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Steve Coe, Environmental Specialist, at (804) 698-4029.

Wellman, Julia (DEQ)

From: Worrell, Justin (MRC)
Sent: Friday, May 18, 2012 8:17 AM
To: Wellman, Julia (DEQ)
Subject: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Ms. Wellman,

I have reviewed the Consistency Determination submitted for this proposal. As detailed in the submittal, the proposal to hydraulically nourish the beach will require a permit from our agency. A Joint Permit Application should be completed and submitted to our office for review / permitting.

Thank you for the opportunity to comment on this proposal. Feel free to contact me if there are further questions.

Justin D. Worrell
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

Wellman, Julia (DEQ)

From: Worrell, Justin (MRC)
Sent: Wednesday, June 13, 2012 12:19 PM
To: Wellman, Julia (DEQ)
Cc: Clay Bernick
Subject: RE: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Ms. Wellman,

Thanks for taking the time this morning to further explain the need for the Commission to comment on the 'consistency' of the proposal to nourish and protect the beach at Oceana, Dam Neck Annex. Overall, I think the proposal is consistent with dunes management policy, but let me further clarify the State and Local process of reviewing beach nourishment proposals.

In accordance with Chapter 14, Coastal Primary Sand Dunes and Beaches, of the Code of Virginia, sand nourishment or replenishment activities on jurisdictional beaches or coastal primary dunes does not require further authorization from the City of Virginia Beach Wetlands Board, and is therefore deemed consistent with the management policy. However, the placement of materials on or along the dunes other than beach-quality sand or vegetation sprigs, i.e. "armoring the dunes," may require a permit from the local Board. I would not state that such an armoring approach is 'inconsistent' with the management policy, but that such a request would need to be processed and heard by the City's Local Wetlands Board for a permit to legally impact the beach / coastal primary sand dune.

Now, if the referenced dune to be impacted is definitely manmade, then by legal definition, it cannot be considered the jurisdictional coastal primary sand dune. The beach and dune jurisdiction for the locality would then typically shift landward to the nearest manmade structure or adjacent natural dune. Classifying natural dunes vs. manmade dunes can be very difficult and controversial, especially along nourished shorelines. For the purposes of this review, it's best to just identify the dune directly adjacent to the shoreline as within the Board's jurisdiction, and then have the locality determine if the proposed activities are exempt or need permits.

I hope this helps. Feel free to call me if there are further questions.

Justin D. Worrell
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

From: Wellman, Julia (DEQ)
Sent: Wednesday, June 13, 2012 10:56 AM
To: Worrell, Justin (MRC)
Subject: RE: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Hi Justin,

Thank you for the additional information. However, I need to resolve the issue of whether it is consistent with the dunes management enforceable policy for the Virginia Coastal Zone Management Program:

- http://www.deq.virginia.gov/Programs/EnvironmentalImpactReview/FederalConsistencyReviews.aspx

- *Dunes Management* - Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Virginia Code §28.2-1400 through §28.2-1420).

I have attached the FCD for your reference and copied the information regarding the enforceable policy below.

Is the sand dune that will be affected by the proposed project considered a primary sand dune?

Dunes and Beaches Management

Either Alternative 1 or 2 would repair and replenish the existing constructed sand dune and beach at Dam Neck. The seaward side of the constructed dune would be replenished with sand and shaped to its 1996 dimensions in areas where sand has eroded from the dune. The replenished areas of the dune would be planted with native beach grasses. Beach grasses in the areas that would be replenished would be buried by the new sand

but these plants would be replaced with similar species during re-planting. Either Alternative 1 or 2 would include removing sand from the six existing pedestrian crossover bridges; no new pedestrian crossover bridges would be constructed.

Alternative 2 would also include the construction of armorec dunes as extensions of the already existing man-made dunes within the project area. Under both alternatives restoration oi the coastal primary sand dune and beach would occur. Therefore, either Alternative 1 or 2 would be consistent to the maximum extent practicable with the applicable enforceable policy.

Julia Wellman
Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Office of Environmental Impact Review
PO Box 1105
Richmond, VA 23218
Phone: (804) 698-4326
Fax: (804) 698-4319
E-mail: Julia.Wellman@deq.virginia.gov

From: Worrell, Justin (MRC)
Sent: Tuesday, June 12, 2012 8:35 AM
To: Wellman, Julia (DEQ)
Cc: Rick Scarper; Clay Bernick
Subject: RE: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Ms. Wellman,

Any impacts to the existing coastal primary sand dunes in this beach area would need to be reviewed by the City of Virginia Beach Waterfront / Wetlands staff. Without recalling the specific details of the proposal, unless the proposed nourishment would somehow adversely impact the existing sand dune system, I don't think the City will need to hear this project or issue a Wetlands Board Permit. But, that decision will be made by the City after the Joint Permit Application is submitted and reviewed.

The Commission's jurisdiction is specifically tied to the hydraulic nourishment – the sand coming from the water and being distributed along the shore, altering / expanding the mlw shoreline.

I hope this answers your questions. Feel free to call me if you have further questions.

Justin D. Worrell
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

From: Wellman, Julia (DEQ)
Sent: Monday, June 11, 2012 4:33 PM
To: Worrell, Justin (MRC)
Subject: RE: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Hi Justin, I am emailing regarding the above-referenced project, specifically as it relates to the dunes management enforceable policy administered by VMRC. Since this project affect dunes, would it be consistent with the dunes management enforceable policy?

Julia Wellman
Office of Environmental Impact Review
Department of Environmental Quality
Richmond, Virginia
804-698-4326
Julia.Wellman@deq.virginia.gov

From: Worrell, Justin (MRC)
Sent: Friday, May 18, 2012 8:16 AM
To: Wellman, Julia (DEQ)
Subject: Federal #12-092F, Repairs to Shoreline Protection System at Oceana, Dam Neck Annex

Ms. Wellman,

I have reviewed the Consistency Determination submitted for this proposal. As detailed in the submittal, the proposal to hydraulically nourish the beach will require a permit from our agency. A Joint Permit Application should be completed and submitted to our office for review / permitting.

Thank you for the opportunity to comment on this proposal. Feel free to contact me if there are further questions.

Justin D. Worrell
Environmental Engineer

Wellman, Julia (DEQ)

From: Wesson, Jim (MRC)
Sent: Tuesday, June 26, 2012 1:44 PM
To: Worrell, Justin (MRC); Wellman, Julia (DEQ)
Subject: RE: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

We do not have any shellfish concerns with this project. Jim

James Wesson
Dept Head Conservation and Replenishment
Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
757 247-2121

From: Worrell, Justin (MRC)
Sent: Tuesday, June 26, 2012 1:40 PM
To: Wellman, Julia (DEQ)
Cc: Wesson, Jim (MRC)
Subject: RE: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

Julia,

I doubt we would have concerns, given that this is out along the ocean shoreline, but I'll forward your e-mail to Dr. Jim Wesson with our oyster replenishment program.

Justin D. Worrell
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

From: Wellman, Julia (DEQ)
Sent: Tuesday, June 26, 2012 1:24 PM
To: Worrell, Justin (MRC)
Subject: FW: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

Hi Justin,

Does VMRC have any comments (in addition to the ones you have provided regarding dunes and hydraulic beach nourishment) regarding shellfish resources? Please see VDH's comments below.

Julia Wellman
Environmental Impact Review Coordinator
Virginia Department of Environmental Quality
Office of Environmental Impact Review
PO Box 1105
Richmond, VA 23218
Phone: (804) 698-4326
Fax: (804) 698-4319
E-mail: Julia.Wellman@deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David A. Johnson
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
(804) 786-1712

RECEIVED
JUN 26 2012
DEQ-Office of Environmental Impact Review

MEMORANDUM

DATE: June 1, 2012

TO: Julia Wellman, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 12-092F, Dam Neck Shoreline Repairs, City of Virginia Beach

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Dam Neck Middle Beach Dunes Conservation Site is within the project area. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Dam Neck Middle Beach Dunes Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at this site is:

Caretta caretta	Loggerhead sea turtle	G3/S1B,S1N/LE/LT

The Loggerhead is a cosmopolitan sea turtle which nests regularly in small numbers in Virginia. Loggerheads mate from late March to early June. From late April to early September, females make their way to shore to dig nests on ocean beaches, generally preferring high energy, relatively narrow, steeply sloped, coarse-grained beaches. Though thousands of eggs may be laid, only a few individuals are believed to survive to adulthood. Please note this species is classified as endangered by the United States Fish and Wildlife Service (USFWS) and threatened by the Virginia Department of Game and Inland Fisheries (DGIF).

Loggerheads face threats both in the marine environment and on nesting beaches. The greatest cause of decline and the continuing primary threat to Loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges (USFWS, 2005). On land, Loggerheads face threats from habitat loss and alteration (primarily development of beaches, dredging, riprap, groins and jetties etc), increased nest predation by raccoons and feral animals, trampling by foot and vehicle traffic, and beachfront lighting which may affect hatchlings from reaching the ocean (NatureServe, 2009).

DCR prefers Alternative #1 over Alternative #2, thus retaining a more natural dune at the termini of the project , especially at the southern end.. Due to the legal status of the Loggerhead sea turtle, DCR recommends coordination with the U.S. Fish and Wildlife Service (USFWS) and Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Gladys Cason (804-367-0909 or Gladys.Cason@dgif.virginia.gov).

Division of Stormwater Management

Chesapeake Bay Local Assistance:
The Dam Neck Annex lies outside of the Chesapeake Bay Preservation Area and Chesapeake Bay watershed as depicted on the City of Virginia Beach's Chesapeake Bay Preservation Area map as it is located in the Atlantic Ocean drainage basin. As there are no requirements under the Bay Act due to the location outside of the Chesapeake Bay watershed, this project is consistent with the Chesapeake Bay Preservation Act.

Stormwater Management:
By executive order 12008, all federal projects shall comply with state and local regulations. The applicant and their authorized agents conducting regulated land disturbing activities on private and public lands in the state must comply with the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R), Virginia Stormwater Management Law and Regulations including coverage under the general permit for stormwater discharge from construction activities, and other applicable federal nonpoint source pollution mandates (e.g. Clean Water Act-Section 313, Federal Consistency under the Coastal Zone Management Act). Clearing and grading activities, installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, soil stockpiles, and related land-disturbance activities that result in the land-disturbance of equal to or greater than 10,000 square feet would be regulated by VESCL&R.

Shoreline erosion projects are not included in the definition of "land-disturbing activity" under the E&S law and hence not regulated, except for the portion of the work that occurs away from the shore itself, such as access roads, staging areas, waste and borrow areas etc. Accordingly, DCR recommends that the applicant prepare and implement a erosion and sediment control (ESC) plan to ensure compliance with state law and regulations. The ESC plan can be submitted to the DCR Regional Office that serves the area where the project is located for review for compliance. The applicant is ultimately responsible for achieving project compliance through oversight of on-site contractors, regular field inspection, prompt action against non-compliant sites, and other mechanisms consistent with agency policy. [Reference: VESCL §10.1-567;].

The operator or owner of construction activities involving land disturbing activities equal to or greater than one acre are required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). Construction activities requiring registration also includes the land-disturbance of less than one acre of total land area that is part of a larger common plan of development or sale if the larger common plan of development will ultimately disturb equal to or greater than one acre. The SWPPP must be prepared prior to submission of the registration statement for coverage under the general permit and the SWPPP must address water quality and quantity in accordance with the Virginia Stormwater Management Program (VSMP) Permit Regulations. General information and registration forms for the General Permit are available on DCR's website at
http://www.dcr.virginia.gov/soil_and_water/index.shtml
[Reference: Virginia Stormwater Management Law Act §10.1-603.1 et seq.; VSMP Permit Regulations §4VAC-50 et seq.]

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

Cc: Amy Ewing, VDGIF

Kim Smith, USFWS

Fisher, John (DEQ)

From: Forsgren, Diedre (VDH)
Sent: Thursday, May 31, 2012 3:55 PM
To: Fisher, John (DEQ)
Cc: Matthews, Barry (VDH); Skiles, Keith (VDH)
Subject: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

DEQ Project #:	12-092F
Name:	Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex
Sponsor:	DOD/Department of the Navy
Location:	Virginia Beach

The Department of Health has reviewed the above captioned project and the information provided, and has no comment.

Diedre Forsgren
Office Services Specialist
VIRGINIA DEPARTMENT OF HEALTH
Office of Drinking Water, Room 622-A
109 Governor Street
Richmond, VA 23219
Phone: (804) 864-7241
email: diedre.forsgren@vdh.virginia.gov

Wellman, Julia (DEQ)

From: Skiles, Keith (VDH)
Sent: Monday, June 04, 2012 2:04 PM
To: Wellman, Julia (DEQ); Forsgren, Diedre (VDH)
Subject: RE: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

Julia,
I reviewed the application for Shellfish Sanitation, and from a public health standpoint we have no comments. The Marine Resources Commission may want to comment on impacts to the shellfish resource in the area to the extent that one exists. If you have any specific questions let me know.
Keith

804-864-7479

From: Wellman, Julia (DEQ)
Sent: Monday, June 04, 2012 1:16 PM
To: Skiles, Keith (VDH); Forsgren, Diedre (VDH)
Subject: FW: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

Do you anticipate the VDH shellfish group to comment? I was hoping to receive comments.

Julia Wellman
Office of Environmental Impact Review
Department of Environmental Quality
Richmond, Virginia
804-698-4326
Julia.Wellman@deq.virginia.gov

From: Fisher, John (DEQ)
Sent: Friday, June 01, 2012 10:16 AM
To: Wellman, Julia (DEQ)
Subject: FW: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

From: Forsgren, Diedre (VDH)
Sent: Thursday, May 31, 2012 3:55 PM
To: Fisher, John (DEQ)
Cc: Matthews, Barry (VDH); Skiles, Keith (VDH)
Subject: (12-092F) CD: Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex

DEQ Project #: 12-092F
o the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex
D/Department of the Navy
ginia Beach

The Department of Health has reviewed the above captioned project and the information provided, and has no comment.

Fisher, John (DEQ)

From: Kirchen, Roger (DHR)
Sent: Wednesday, May 23, 2012 4:59 PM
To: Fisher, John (DEQ)
Subject: Repairs to the Shoreline Protection System at NAS-Oceana, Dam Neck Annex (DEQ # 12-092F; DHR File No. 2012-0819)

We request that the Navy or its agents consult directly with DHR, as necessary, pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations codified at 36 CFR Part 800 which require Federal agencies to consider the effects of their undertakings on historic properties.

Roger

Roger W. Kirchen, Archaeologist
Office of Review and Compliance
Division of Resource Services and Review
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
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fax: 804-367-2391
roger.kirchen@dhr.virginia.gov

C

Air Emissions Calculations and RONA

Construction Equipment Exhaust Emission Factors, Based on EPA NONROAD emission rates

Equipment Type	Fuel Type	SCC	Avg Size[1] (hp)	Load[2]	Engine Size Range	Emission Factor[3] (g/hp-hr)					Equipment Emission Rate[4] (lbs-hr)				
						VOC	CO	NO_x	SO_2	PM_{10}	VOC	CO	NO_x	SO_2	PM_{10}
Asphalt Paving Machine	Diesel	2270002003	91	0.59	75<hp≤100	0.27	2.83	2.63	0.01	0.38	0.03	0.33	0.31	0.001	0.04
Vibratory Compactor	Diesel	2270002009	8	0.43	6<hp≤11	0.68	4.49	4.95	0.01	0.50	0.01	0.03	0.04	0.000	0.00
Generators	Diesel	2270006005	22	0.43	16<hp≤25	0.74	3.03	5.36	0.01	0.49	0.02	0.06	0.11	0.000	0.01
Air Compressors	Diesel	2270006015	37	0.43	25<hp≤40	0.25	1.28	4.28	0.01	0.23	0.01	0.04	0.15	0.000	0.01
Excavator/Loaders/Backhoes	Diesel	2270002066	77	0.21	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.04	0.22	0.18	0.000	0.03
Aerial Lifts (Cherry Pickers)	Diesel	2270003010	43	0.21	40<hp≤50	1.81	6.78	5.88	0.01	0.98	0.04	0.13	0.12	0.000	0.02
Crawler Tractor/Dozers	Diesel	2270002069	157	0.59	100<hp≤175	0.21	1.00	2.44	0.01	0.24	0.04	0.20	0.50	0.001	0.05
Off-Highway Trucks	Diesel	2270002051	489	0.59	300<hp≤600	0.15	0.78	1.97	0.01	0.13	0.10	0.50	1.25	0.004	0.08
Marine Equipment	Diesel	2282005010	1250	0.51	hp>750	0.30	1.00	4.50	0.01	0.40	0.42	1.41	6.32	0.008	0.56
Marine Equipment[5]	Diesel	2282005010	5000	0.51	hp>750	0.30	1.00	4.50	0.01	0.40	1.69	5.62	25.30	0.034	2.25
Marine Equipment[5]	Diesel	2282005010	4000	0.51	hp>750	0.30	1.00	4.50	0.01	0.40	1.35	4.50	20.24	0.027	1.80
Marine Equipment[5]	Diesel	2282005010	2000	0.51	hp>750	0.30	1.00	4.50	0.01	0.40	0.67	2.25	10.12	0.013	0.90
Misc. Light Pumps	Diesel	2270006010	20	0.74	16<hp≤25	0.74	3.03	5.36	0.01	0.49	0.02	0.10	0.17	0.000	0.02
Commercial Welder	Diesel	2270006025	35	0.45	25<hp≤40	0.25	1.28	4.28	0.01	0.23	0.01	0.04	0.15	0.000	0.01
Pressure Washers	Diesel	2270006030	9	0.3	6<hp≤11	0.68	4.49	4.95	0.01	0.50	0.00	0.03	0.03	0.000	0.00
Roller	Diesel	2270002015	95	0.61	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.13	0.78	0.66	0.001	0.12
Crane (Hydraulic Truck)	Diesel	2270002045	194	0.47	175<hp≤300	0.20	1.00	2.80	0.01	0.40	0.04	0.20	0.56	0.001	0.08
Crane (Crawler)	Diesel	2270002045	489	0.47	200<hp≤500	0.68	2.70	8.38	0.01	0.40	0.34	1.37	4.25	0.003	0.20
Scraper	Diesel	2270002018	311	0.7	300<hp≤600	0.15	0.78	1.97	0.01	0.13	0.07	0.38	0.95	0.003	0.06
Surfacing Equipment	Diesel	2270002024	183	0.49	150<hp≤250	0.20	1.00	2.80	0.01	0.40	0.04	0.20	0.55	0.001	0.08
Trencher	Diesel	2270002030	77	0.66	50<hp≤100	0.99	3.49	8.30	0.01	0.72	0.11	0.39	0.93	0.001	0.08
Concrete Saw	Diesel	2270002039	79	0.78	75<hp≤100	1.03	6.13	5.14	0.01	0.91	0.14	0.83	0.70	0.001	0.12
Cement Mixer	Diesel	2270002042	11	0.59	6<hp≤20	0.70	2.00	5.20	0.01	0.60	0.01	0.03	0.07	0.000	0.01
Drill Rig	Diesel	2270002033	209	0.79	100<hp≤250	0.68	2.70	8.38	0.01	0.40	0.25	0.98	3.05	0.002	0.15
Grader	Diesel	2270002048	172	0.64	150<hp≤250	0.40	1.00	4.50	0.01	0.40	0.10	0.24	1.09	0.001	0.10
Skid Steer	Diesel	2270002072	131	0.58	50<hp≤250	0.20	1.00	3.30	0.01	0.72	0.03	0.17	0.55	0.001	0.12
Telehandler	Diesel	2270003020	111	0.3	100<hp≤125	0.20	1.00	6.90	0.01	0.40	0.01	0.07	0.51	0.000	0.03

Notes:

1. Avg hp from "Nonroad Engine and Vehicle Emissions Study Report" EPA 460/3-91-02. Nov 1991, unless noted.
2. Load from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling" EPA420-P-04-005. April 2004.
3. Emission factors from EPA's NONROAD model (Year 2014) and NR-009A, June 15, 1998.
4. Equipment Emission Rate = Average HP x Load x Emission Factor x 453.6 g/lb.
5. Marine Equipment hp based on assumptions from EA for the Sandbridge Beach Erosion Control and Hurricane Protection Project, Virginia Beach, Virginia, USCorp, June 2009

Equipment Exhaust Emissions, Off-Road Construction Equipment and Vehicles

Activity	Equipment List	Eqpt qty	hp[2]	Days Used	Emission Factors (lb/day/unit)[1] VOC	CO	NO_X	SO_2	PM_{10}	Emissions (TPY) VOC	CO	NO_X	SO_2	$PM_{2.5}$	PM_{10}
Sand placement (Alternative 1 and 2)	Loader	2	77	125	0.29	1.75	1.47	0.002	0.26	0.04	0.2	0.18	0.000	0.03	0.03
	Backhoe	2	77	125	0.29	1.75	1.47	0.002	0.26	0.04	0.22	0.18	0.000	0.03	0.03
Man-made dune (Alternative 2 only)	Loader	1	77	125	0.29	1.75	1.47	0.002	0.26	0.02	0.11	0.09	0.000	0.02	0.02
	Crane (Crawler)	1	489	125	2.76	10.94	33.97	0.024	1.62	0.17	0.68	2.12	0.002	0.10	0.10
	Crane (Hydraulic Truck)	1	194	125	0.32	1.61	4.50	0.010	0.64	0.02	0.10	0.28	0.001	0.04	0.04
Hopper Barge Operations (Alternative 1 and 2)[3]	Marine Equipment (Propulsion)	1	5000	125	13.49	44.97	202.38	0.270	17.99	0.84	2.81	12.65	0.017	1.12	1.12
	Marine Equipment (Dredge)	1	5000	125	13.49	44.97	202.38	0.270	17.99	0.84	2.81	12.65	0.017	1.12	1.12
	Marine Equipment (Pump)	1	4000	125	10.79	35.98	161.90	0.216	14.39	0.67	2.25	10.12	0.013	0.90	0.90
	Marine (Auxillary Generation)	1	2000	125	5.40	17.99	80.95	0.108	7.20	0.34	1.12	5.06	0.007	0.45	0.45
Support Vessels(Alternative 1 and 2)	Marine Equipment	2	1250	125	3.37	11.24	50.60	0.067	4.50	0.42	1.41	6.32	0.008	0.56	0.56
Total Emissions, Alternative 1 (TPY):										**3.2**	**10.8**	**47.2**	**0.063**	**4.2**	**4.2**
Total Emissions, Alternative 2 (TPY):										**6.6**	**11.7**	**49.7**	**0.065**	**4.4**	**4.4**

Notes

1. Calculated using EPA NONROAD equipment emission rates (see Previous Table), assuming operation for 8 hours per day.

2. Avg hp from "Nonroad Engine and Vehicle Emissions Study Report" EPA 460/3-91-02. Nov 1991, unless noted.

3. Marine Equipment hp based on assumptions from EA for the Sandbridge Beach Erosion Control and Hurricane Protection Project, Virginia Beach, Virginia, USCorp, June 2009

PM2.5 totals assumed to be the same as PM10

Emissions from On Road Vehicle Activity During Construction

Description	Emission Factors (g/mi)[1] VOC	CO	NOx	CO_2	PM2.5	PM10	SO_2
Worker Commuting Vehicles	1.49	14.05	1.09	440.0	0.347	3.130	0.012
Diesel Delivery Vehicles	0.28	1.1	8.06	1400.0	0.511	3.300	0.156

Notes:

a. Emission factors for gasoline worker vehicles from "Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks (EPA420-F-05-22, EPA 2005). It was assumed that the vehicle make-up included 50% cars and 50% light-duty trucks/SUVs. SO2 emission factor calculated from gasoline consumption rate and a sulfur content of 80 ppm.

b. Emission factors for diesel worker and delivery vehicles (except SO2 and CO2) from "Assessing the Effects of Freight Movement on Air Quality at the National and Regional Level- Final Report" (U.S. Federal Highway Administration 2005).

c. CO_2 and SO_2 emission factors for diesel worker and delivery vehicles from "Greenhouse Gas Protocol - Corporate Accounting and Reporting Standard / Mobile Guide" (World Resources Institute/World Business Council for Sustainable Development 2005). SO2 emission factor calculated from diesel consumption rate and a sulfur content of 348 ppm.

d. PM10 and PM2.5 factors are the sum of exhaust and road dust emission factors.

Source	Number of round trips	Average trip distance (miles)	Total Annual Miles	Emission TPY VOC	CO	NOx	CO_2	PM2.5	PM10	SO_2
Alternative 1										
Labor Commute[1]	2500	25	62,500	0.102	0.966	0.075	30.250	0.024	0.215	0.0008
Total Alternative 1 Mobile Emissions, TPY				**0.102**	**0.966**	**0.075**	**30.250**	**0.024**	**0.215**	**0.0008**
Alternative 2										
Labor Commute[2]	4000	25	100,000	0.164	1.546	0.120	48.400	0.038	0.344	0.0013
Delivery Truck Traffic[3]	2240	50	112,000	0.034	0.136	0.993	172.480	0.063	0.407	0.0192
Total Alternative 2 Mobile Emissions, TPY				**0.198**	**1.681**	**1.113**	**220.880**	**0.101**	**0.751**	**0.0205**

Notes

1. Alternative 1 total worker commute round trips assume 20 workers, 125 work days
2. Alternative 2 total worker commute round trips assume 20 workers, 200 work days
3. Alternative 2 deliveries associated with 70,000 CY stone for man-made dune, delivered in 2240 round trips

Aggregate Handling of Storage Piles- Emission Factor Derivation Table

$E = k(0.0016)((U/5)^{1.3/}(M/2)^{1.4})$ AP-42 Section 13.2.4 (11/06 version)

where:

E = particulate emission factor (lb/tons of material)

k = particle size multiplier

U = wind speed (miles per hour)

M = Moisture content (%)

Parameter	Units	Particulates	Reference
k factor	g/VMT	0.74	for <30 um (sand is <125 um), 13.2.4-4
Wind Speed, U	mph	15	Highest Range of Source conditions, 13.2.4-4
Moisture content, M	%	7.4	Table 13.2.4-1
Emission factor, E	lbs/ton	0.0008	

	Alternative 1		Alternative 2	
Total CY of sand	700000	CY	860000	CY
weight (wet) of sand	3240	lbs/CY	3240	lbs/CY
Total weight of sand	1134000	tons	1393200	tons
Particulate emissions	0.4484458	tons	0.55095	tons

GENERAL CONFORMITY — RECORD OF NON-APPLICABILITY (RONA)

for

Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex Virginia Beach, Virginia

An applicability analysis for General Conformity under the Clean Air Act, Section 176 has been completed for this project according to the requirements of 40 Code of Federal Regulations (CFR) 51 and 93. The requirements of this rule are not applicable to this project/action because total direct and indirect emissions from this project will be below the *de minimis* conformity threshold value for ozone of 100 tons per year for volatile organic compounds (VOCs) and nitrogen oxides (NO_X) for "other" (marginal or moderate) nonattainment areas or maintenance attainment areas not within an Ozone Transport Region. Annual NOX and VOC emissions from the action are show in Table C-1.

Table C-1 Projected Emissions and General Conformity *de minimis* Thresholds

	Emissions (tons per year)	
	NO_X	VOCs
Projected emissions from construction under Alternative 1	47.24	3.30
Projected emissions from construction under Alternative 2	50.78	6.80
General Conformity *de minimis* thresholds for ozone non-attainment or maintenance not in an ozone transport region.	100	100

Key:
NOx = Nitrogen oxides.
VOCs = Volatile organic compounds.

SIGNED:

[signature] 13 Aug 12

Date

RAFAEL A. MIRANDA, CDR (sel), CEC, USN
PWO, PWD Oceana

D Biological Assessment

Biological Assessment for Repairs to the Shoreline Protection System, Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

May 2012

Prepared for

UNITED STATES DEPARTMENT OF THE NAVY

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
348 Southport Circle, Suite 101
Virginia Beach, Virginia 23452

UNCLASSIFIED

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List of Abbreviations and Acronyms

ACS	American Cetacean Society
ASMFC	Atlantic State Marine Fisheries Commission
BA	Biological Assessment
BEQ	bachelor enlisted quarters
BOEM	Bureau of Ocean Energy Management
°C	degrees Celsius
cm	centimeter
cy	cubic yard
dB	decibel
DMA	Dynamic Management Area
EEZ	Exclusive Economic Zone
EPA	Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
FMP	Fisheries Management Plan
ft	feet
FY	fiscal year
g	gram
ha	hectare
Hz	hertz
in	inch
INRMP	Integrated Natural Resources Management Plan
IPaC	Information, Planning, and Conservation
IWC	International Whaling Commission
kg	kilogram
kHz	kilohertz
kn	knot
lbs	pounds

List of Abbreviations and Acronyms (cont.)

m	meter
m^3	cubic meter
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MTSG	Marine Turtle Specialist Group
NAS	Naval Air Station
Navy	United States Department of the Navy
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
SAS	Sighting Advisory System
SAV	submerged aquatic vegetation
SOC	Species of Concern
SMA	Seasonal Management Area
SPS	shoreline protection system
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VAQS	Virginia Aquarium and Marine Science Center Foundation Stranding Response Program
VASC	Virginia Aquarium Stranding Center
VDGIF	Virginia Department of Game and Inland Fisheries

1 Introduction

Dam Neck Annex, commissioned in 1942, is a satellite installation of Naval Air Station (NAS) Oceana and is home to 14 tenant commands. Dam Neck Annex is a 1,372-acre (555-hectare [ha]) facility situated on the Atlantic coast in the Hampton Roads region of Virginia, within the City of Virginia Beach (Figure 1-1). The Annex is situated approximately 2 miles (3.2 kilometers [km]) east of NAS Oceana, 5 miles (8 km) south of the primary Virginia Beach resort area, and approximately 20 miles (32 km) east of the City of Norfolk. Dam Neck Annex's mission is to provide the facilities and resources needed to support the land, sea, and air training and operations of tenant commands, as well as to provide the highest quality services to service personnel and their families.

The beaches at Dam Neck Annex are prone to erosion from seasonal hurricanes, tropical storms, nor'easters, and winter conditions that force powerful wind and wave actions upon the installation's beaches. In the early 1990s, the beach became so severely eroded that $124 million worth of Navy facilities, primarily the bachelor enlisted quarters (BEQ), Shifting Sands Beach Club, housing area, and the weapons gun line, were at risk of being damaged or destroyed by flooding and wave action caused by coastal storms. To protect these facilities, the Navy established an $8.9 million emergency military construction project (P994) in fiscal year (FY) 1995 to construct the shoreline protection system (SPS) (see Figure 1-2).

The SPS project was completed in October 1996 and included constructing a reinforced sand dune and replenishing the beach on the seaward side of the dune. The constructed dune, which extends from Building 225 (the BEQ) south to Building 127, measured 5,282 feet (ft) (1 mile [1,610 meters (m)]) in length, 20 ft (6 m) in height, and 50 ft (15 m) in width; covered approximately 11 acres (4.5 ha) of nearshore upland. It contained a buried stone seawall designed to provide a residual dune to protect the nearest real property until sand could be replenished (United States Department of Defense 1996) (see Figure 1-2). However, the stone seawall was not designed to provide permanent protection of the buildings and their contents. Approximately 874,000 cubic yards (cy) (668,000 cubic meters [m^3]) of sand was required to construct the SPS, including the constructed dune and beach replenishment. Approximately 115,000 cy (88,000 m^3) of the total 874,000 cy was trucked in from commercial borrow pits located approximately 10 miles (16 km) from Dam Neck Annex to construct the sand dune on top of the stone seawall. The constructed dune was planted with American beach grass

(*Ammophila breviligulata*), Atlantic coastal/bitter panic grass (*Panicum amarum*), and sea oats (*Uniola paniculata*). Six pedestrian crossover bridges were constructed over the dune to provide pedestrian access to the beach. Natural sand dunes occur north and south of the constructed dune. Annual revegetation of the dunes is conducted as specified in the installation's Integrated Natural Resources Management Plan (INRMP) (United States Department of Defense 1996).

The remaining approximately 759,000 cy (580,000 m^3) of sand was placed along approximately 9,280 ft (2 miles [2,800 m]) of beach in front of the constructed sand dune and extending approximately one-half mile (0.8 km) to both the north and south of the constructed dune. The beach replenishment covered approximately 4.5 acres (1.8 ha) of nearshore upland, 8 acres (3.2 ha) of intertidal area, and 28 acres (11.3 ha) of nearshore area below the mean low water line. The beach was designed to be 200 ft (61 m) wide from the dune centerline to the ocean.

Sand for the beach replenishment was dredged from an ocean borrow site in the Sandbridge Shoal, located approximately 3 miles (4.8 km) offshore of the project location, outside of Virginia's territorial sea. Ocean depth in the vicinity of the Sandbridge Shoal ranges from approximately 30 to 65 ft (9.1 to 19.8 m) (United States Army Corps of Engineers [USACE] June 2009). Estimated sand reserves are 40 million cy (30,582,194 m^3) (Hardaway et al. 1998). In places, the shoal is approximately 20 ft (6.1 m) thick. The principal sediment is fine to medium sand. The sand dredged from the shoal was provided through a negotiated agreement with the United States Department of Interior, Bureau of Ocean Energy Management (BOEM), formerly the Minerals Management Service. The dredged sand was pumped from the shoal to the beach replenishment area.

It was anticipated that periodic replenishment of the SPS would be required to maintain its design integrity and effectiveness. The initial beach replenishment cycle was estimated to be 12 years based upon design expectations. However, a three-year study conducted by the Navy to monitor the performance of the 1996 beach replenishment revealed that a 12-year cycle was inadequate and recommended the beach be replenished in 2003-2004 (i.e., approximately every 7 to 8 years). In 2004, Special Project R123-01 (Repairs to SPS) replenished the sand that had eroded from the beach and dune since the SPS was constructed (United States Department of the Navy, September 1, 2003). The project placed approximately 700,000 cy (535,000 m^3) of sand along the approximately 2 miles (9,280 ft [2,829 m]) of beach front replenished in 1996, covering the same acreage. The dune system needed only minor spot repair with additional sand and vegetation. Sand for the replenishment was provided through a negotiated agreement with BOEM and was dredged by hopper dredge from Sandbridge Shoal. A sand-slurry was then pumped from the hopper dredge onto the Dam Neck Annex beach through a pipeline, which was moved along the beach. Bulldozers and graders shaped the beach and dune to the original 1996 configuration.

M:\VABeach\DamNeck\Maps\MXD\DEIS\Vicinity_Map.mxd

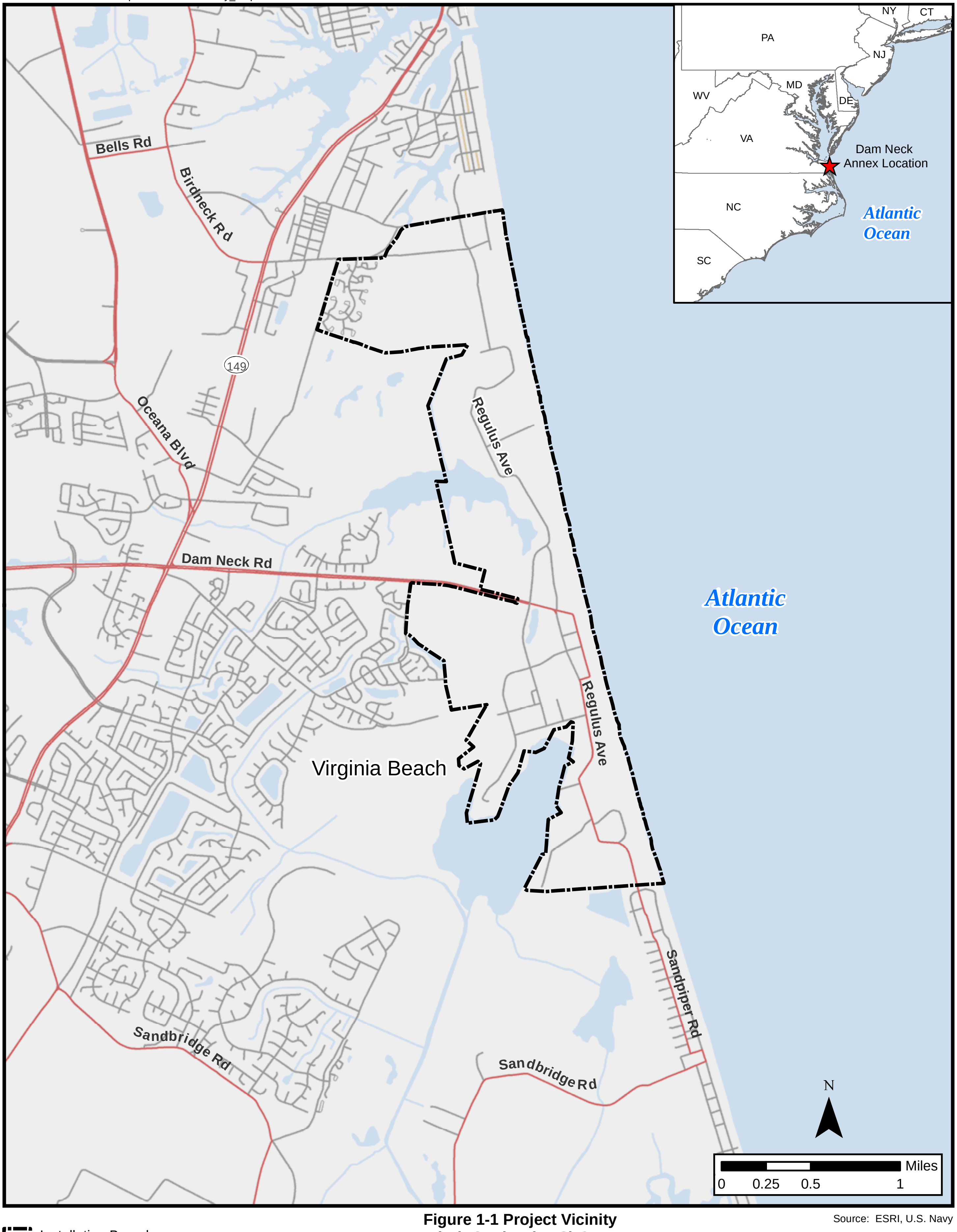

Figure 1-1 Project Vicinity
Naval Air Station (NAS) Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

M:\VABeach\DamNeck\Maps\MXD\DEIS\Figure 1-2 Dam Neck Project_Area.mxd

Source: ESRI, U.S. Navy

Figure 1-2 Project Area
Naval Air Station (NAS) Oceana
Dam Neck Annex, Virginia Beach, Virginia

Since 2004, the combined effects of wind, wave action, and storm damage have caused the beach portion of the SPS to lose a major amount of sand, lowering the level of protection for Dam Neck Annex facilities. The beach portion of the SPS is integral to the proper functioning and stability of the overall SPS. Without the beach, the manmade dune would quickly erode, leaving only the buried stone seawall, which was not designed to provide permanent protection for the buildings. The dune, including the buried stone seawall, is currently in relatively good condition, although the sand portion has been sheared into steep slopes in several locations. Sand also covers the bottom rungs of the pedestrian crossover bridges. Erosion of the SPS has progressed to a point where a moderate winter storm season could erode the dune down to the buried seawall. Dam Neck Annex has implemented temporary measures to reduce erosion, including installing dune fencing and using discarded Christmas trees to capture sand until the SPS can be repaired.

2 Description of the Proposed Action and Action Area

2.1 Proposed Action and Alternatives

The United States Department of the Navy (the Navy) is proposing to repair the SPS on NAS Oceana, Dam Neck Annex, located on the Atlantic coast in Virginia Beach, Virginia. The portion of the SPS that would be repaired (replenished) is approximately 2 miles (3.2 km) long, including the 1-mile (1.6 km) area in front of the manmade dune, with additional approximately one-half-mile (0.8 km) portions extending north and south of the manmade dune. Sand for the beaches would be dredged from a BOEM-approved borrow area within the Sandbridge Shoal (Figure 2-1), which is located approximately 3 miles (4.8 km) offshore of the proposed project location. Implementation of the repairs is anticipated to begin between FY 2012 and FY 2014.

The Navy is preparing an environmental assessment (EA) to evaluate the reasonably foreseeable environmental consequences of the proposed SPS repairs. The EA will evaluate two action alternatives: Alternative 1, Full Replenishment of the SPS (Preferred Alternative); and Alternative 2, Full Replenishment of the SPS and Construction of a Manmade Dune. Both alternatives are described briefly below.

The Navy is the lead agency for this proposed action, with the BOEM serving as a cooperating agency for the National Environmental Policy Act process and coordinating with the Navy during Section 7 consultation under the federal Endangered Species Act (ESA).

2.1.1 Alternative 1 (Preferred Alternative): Full Replenishment

Under Alternative 1, the SPS at Dam Neck Annex would be restored to its original condition (Figure 2-2). The beach would be fully replenished, and the seaward side of the existing manmade dune would be replenished with sand and reshaped to its 1996 dimensions. The restored areas of the manmade dune would be revegetated with native grasses such as American beach grass, Atlantic coastal/bitter panic grass, switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*). Accumulated sand would be removed from the pedestrian crossover bridges.

Under Alternative 1, a total of approximately 700,000 cy (535,000 m^3) of sand would be required. This would require approximately 260 trips by the hopper dredge from the shoal to the beach. The volume of sand required includes an extra 25 percent contingency for sand that escapes into the water column during the replenishment operation. It is estimated that approximately 472,500 cy (361,300 m^3) would be placed on the beach, and 52,500 cy (40,100 m^3) would be added to the manmade dune. This sand would replace the volume eroded since 2004 by normal wind, wave, and current action, as well as that removed during storm events.

Alternative 1 includes authorization by BOEM to access outer continental shelf (OCS) sand in the borrow area known as Sandbridge Shoal for the extent of the lease agreement in order to dredge sand for the replenishment. The approved Sandbridge Shoal borrow area encompasses approximately 13,500 acres (55 km^2) in the Atlantic Ocean approximately 3 miles (4.8 km) east of the proposed project location (see Figure 2-1). Substrates within the shoal are primarily medium - grained sand appropriate for beach restoration projects (U.S. Army Corps of Engineers and Minerals Management Service June 2009). A hopper dredge would be used to pump the sand from Sandbridge Shoal, removing approximately 2,800 cy (2,141 m^3) of sand per trip. Pumping is the safest and most efficient way to move the sand (Ecology and Environment, Inc. April 28, 2011). Assumed average dredge depths of 2 to 6 ft (0.6 to 1.8 m) would impact up to approximately 217 acres (0.9 km^2), representing up to approximately 1.6 percent of the approved borrow area (Table 2-1). Once the sand is removed from the shoal, the dredge would be transported to pump-out stations/buoys located close to shore (approximately 0.5 miles [0.8 km]) where the sand slurry would be pumped from the dredge onto the Dam Neck Annex beach through a pipeline at no more than five different pump-out stations/buoys positioned approximately 2,500 to 3,000 ft (762 to 914 m) apart along the area to be replenished. No more than two bulldozers and two graders would then be used to shape the beach and dune to its original 1996 design. The bulldozers and graders would be operated 8 hours per day. The maximum distance the deposited sand would extend into the water from the shore would be 300 ft (91.4 m). The Navy will ensure that the contractor uses best management practices to avoid erosion during sand placement. Repairs are estimated to require approximately three to six consecutive months to complete.

Table 2-1 Alternative 1 – Area of Borrow Area Impacted

	Dredge Depth		
	2 Feet	4 feet	6 feet
Acres Impacted (km^2)	217 (0.9)	108 (0.4)	72 (0.3)
Percent Impacted	1.6	0.8	0.5

One hopper dredge would be used to complete the project. Dredging operations would occur 24 hours per day, with approximately 9.8 hours per day spent at the borrow area. The remainder of the day would be spent in transit or at the pump-out stations/buoys. It would be expected that the hopper dredge would complete approximately seven round-trips per day from the borrow area to the pump-out stations/buoys.

M:\VA_Beach\DamNeck\Maps\MXD\Biological Assessments\Figure 2-1 Dam Neck Sandbridge Shoal.mxd

Figure 2-1 Sandbridge Shoal
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

M:\VA_Beach\DamNeck\Maps\MXD\Biological Assessments\Figure 2-2 Dam Neck Alternative 1.mxd

Shore Protection System Location
Installation Boundary
Building
Constructed Dune - Replenished and Reshaped
Sand Replenishment
Source: ESRI, U.S. Navy

Figure 2-2 Alternative 1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

0 125 250 500 Feet

Based on the proposed hopper dredge capacity it was assumed that the dredge would move at a speed between 8 and 14 knots (kn) while transiting between the Shoal and the beach (Manson Construction Co. 2008; Conoship 2011). The actual speed of the vessel would depend on the particular dredge used. While dredging, the approximate speed of the vessel would be 2 to 3 kn (Global Security 2011). The dredge will comply with the United States National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) speed restrictions for vessels traveling in United States waters in the mid-Atlantic region, of no greater than 10 kn between November 1 and April 30 (50 CFR 224.105). There could also be one support vessel needed to travel daily to the dredge location. The actual speed of this vessel would also depend on the particular vessel used.

Sandbridge Shoal is a relatively shallow feature (Maa and Hobbs 1998). As such, the ridge and trough topography of the fine- to medium-grained sand landform is predominantly shaped by exposure to wave and current energy. The wave-current influence erodes and accretes the shoal body in bands, forcing a south-southwesterly migration. In general, research has shown that species diversity and densities (including the species that are found in the benthic habitats on and in the vicinity of Sandbridge Shoal) increase as depth increases along the Continental Shelf (Cutter and Diaz 1998; Diaz et al. 2006). As a result, these benthic habitats become more biologically diverse farther from the shoal.

Alternative 1 would be a single one-time action. However, it is anticipated that future replenishment of the beaches would be necessary and would be on a similar cycle and require similar volumes of sand as past similar projects at Dam Neck Annex. Catastrophic storm events may require shorter cycles and larger volumes of sand. The Navy will initiate appropriate consultations when additional beach replenishment is required.

2.1.2 Alternative 2: Full Replenishment and Construction of a Manmade Dune

Under Alternative 2, as with Alternative 1, the SPS at Dam Neck would be restored to its original condition: the beach would be fully replenished, and the seaward side of the constructed dune would be replenished with sand and reshaped to its 1996 dimensions. Alternative 2 would also include construction of a manmade dune, including a stone core, along the approximately half-mile (0.8 km) sections of dune north and south of the SPS (Figure 2-3). The restored areas of the existing dune and the newly constructed dune would be planted with the native grasses identified in Section 2.1.1. Accumulated sand would be removed from the pedestrian crossover bridges along the restored areas of the dune.

Alternative 2 includes authorization by the BOEM to access OCS sand in the Sandbridge Shoal, for the extent of the lease agreement, in order to dredge sand for the replenishment. Sand would be acquired, transported, and distributed as described under Alternative 1. Repairs are estimated to require six to nine consecutive months to complete but could take longer if additional sand is required.

Under Alternative 2, a total of approximately 1.1 million cy (841,060 m^3) of sand would be required. This would require approximately 400 trips by the hopper dredge from the shoal to the beach. The volume of sand required includes an extra 25 percent contingency for sand that escapes into the water column during the replenishment operation. Approximately 472,500 cy (361,252 m^3) would be placed on the beach, and 352,500 cy (269,506 m^3) would be added to the constructed dune. Assumed average dredge depths of 2 to 6 ft (0.6 to 1.8 m) would impact up to approximately 341 acres (1.4 km^2), representing up to approximately 2.5% of the approved Sandbridge Shoal borrow area (Table 2-2). Extension of the manmade dune would not prevent the need for periodic beach replenishment, but its stone core would afford a greater level of protection during strong storms, thereby providing the Navy additional time to prepare for emergency replenishment if the beach were to be eroded by a storm.

Table 2-2 Alternative 2 – Area of Borrow Area Impacted

	Dredge Depth		
	2 feet	4 feet	6 feet
Acres Impacted (km^2)	341 (1.4)	170 (0.7)	114 (0.5)
Percent Impacted	2.5	1.3	0.8

2.2 Definition of Action Area

The Action Area includes the spatial extent of impact on individuals of listed species that may be directly or indirectly affected by the proposed action. The Action Area extends beyond the immediate project area where sand placement and dredging would occur. The Action Area of the proposed action includes the area immediately surrounding the project boundary on the Dam Neck Annex beach, Sandbridge Shoal, and the transit area between the shoal and the offload area off the shoreline of Dam Neck Annex.

M:\VA_Beach\DamNeck\Maps\MXD\Biological Assessments\Figure 2-3 Dam Neck Alternative 2.mxd

Figure 2-3 Alternative 2
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

3 Regulatory Environment and Need for the Biological Assessment

3.1 Regulatory Environment

This Biological Assessment (BA) was prepared in accordance with the ESA. The ESA was passed in 1973 and provides a program for the conservation and protection of threatened and endangered species and their habitats. The lead federal agencies responsible for the implementation of the ESA are the United States Fish and Wildlife Service (USFWS) and the NMFS. Under Section 7 of the ESA, federal agencies are required to consult with USFWS and/or NMFS to ensure that actions they authorize, fund, or implement are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of listed species (United States Environmental Protection Agency [EPA] 2011). The act also prohibits the "taking" of any listed species.

3.2 Need for the BA and Identification of Species for Inclusion

A BA is prepared if listed species or critical habitat may be present in the Action Area of a federal action, such as the proposed action. Table 3-1 provides a list of those federally listed species potentially occurring within the Action Area for the proposed action. Thus, this BA has been prepared for the Section 7 process to determine whether the proposed action would be likely to adversely affect these identified listed species, or designated critical habitat.

The list of species included in Table 3-1 was developed through the use of the following online tools that allowed for the identification of those species and their habitats in proximity to the Action Area:

- **USFWS's Information, Planning, and Conservation (IPaC) System.** This is an online tool that provides information about sensitive resources within the vicinity of a proposed project. The IPaC system provides information regarding federally designated and proposed candidate, threatened, and endangered species; final critical habitats; and USFWS refuges that may occur in the identified areas or may be affected by the proposed action (USFWS 2011a).

- **Virginia Department of Game and Inland Fisheries, Fish, and Wildlife Information Service Website.** The geographic search function on this website allows for the creation of a report on wildlife resources located within a selected geographic area (Virginia Department of Game and Inland Fisheries [VDGIF] 2011).

The list was reviewed and approved by the NMFS and USFWS at an interagency meeting on June 29, 2011.

Table 3-1 Federally Listed Species Potentially Occurring in the Action Area

Common Name	Scientific Name	Federal Status	Critical Habitat in the Action Area
Whales			
Blue whale	*Balaenoptera musculus*	Endangered	N/A[1]
Finback whale	*Balaenoptera physalus*	Endangered	N/A
Humpback whale	*Megaptera novaengliae*	Endangered	N/A
North Atlantic right whale	*Eubalaena glacialis*	Endangered	No
Sei whale	*Balaenoptera borealis*	Endangered	N/A
Sperm whale	*Physeter macrocephalus*	Endangered	N/A
Birds			
Piping plover	*Charadrius melodus*	Threatened	No
Red knot	*Calidris canutus rufa*	Candidate	N/A[2]
Roseate tern	*Sterna dougallii dougallii*	Endangered	N/A
Fish			
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered[3]	N/A[2]
Sand tiger shark	*Carcharias taurus*	Species of Concern	N/A[2]
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	N/A
Sea Turtles			
Loggerhead sea turtle	*Caretta caretta*	Threatened[4]	N/A
Green sea turtle	*Chelonia mydas*	Threatened	No
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	No
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	No
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	No
Plants			
Seabeach amaranth	*Amaranthus pumilus*	Threatened	N/A

[1] Species listed before 1978 are not required to have designated critical habitat.
[2] Species not listed as endangered or threatened under the ESA are not required to have designated critical habitat under the ESA
[3] See Section 4.3.1 for clarification on the Atlantic sturgeon's status.
[4] See Section 4.4.1 for clarification on the loggerhead sea turtle's status.

4 Listed Species and Critical Habitat in the Action Area

4.1 Whales

4.1.1 Blue Whale

4.1.1.1 Status

The blue whale (*Balaenoptera musculus*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.1.2 Species Biology

Description

Blue whales are the largest animal on earth (NMFS 1998a). In the Northern Hemisphere, the largest blue whale recorded had a body length of 92 ft (28.1 m). They can weigh more than 150 tons (NMFS 1998a).

Blue whales are a species of baleen whale, which are filter feeders. In the North Atlantic, their diet consists entirely of krill (relatively large *euphausiid* crustaceans) (NMFS 1998a). In summer feeding areas, they may eat up to 7,937 pounds (lbs; 3,600 kilograms [kg]) of krill per day (MarineBio 2010a). Blue whales, as with other baleen whale species, produce low-frequency sounds. Blue whales in particular produce sounds within the range of ~12 to 390 hertz (Hz) (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

Blue whales are found in all of the world's oceans (MarineBio 2010a). In the North Atlantic, the northern extent of their range extends into Baffin Bay and the Greenland Sea (NMFS 1998a). They are most frequently sighted in waters off of eastern Canada, primarily in the Gulf of St. Lawrence (NMFS n.d. [a]). Blue whales are considered rare in the shelf waters of the eastern United States, but occasional sightings have been made off of Cape Cod, Massachusetts (NMFS 1998a). It is believed that the Cape Cod region may represent the current southern limit of the blue whale's feeding range, although the exact southern limit of their range is unknown (NMFS n.d. [a]). Some records suggest that North Atlantic blue whales may occur as far south as Florida and the Gulf of Mexico (Waring et al. 2009). They rarely occur in Virginia waters (Blaylock 1985).

Status

Blue whale populations around the world were severely depleted during the first half of the 20th century due to intensive hunting (NMFS 1998a). At least 11,000 blue whales were killed in the North Atlantic alone (NMFS 1998a; NMFS n.d. [a]). In 1955, hunting of blue whales in the North Atlantic was banned by the International Whaling Commission (IWC) for the Regulation of Whaling, although Iceland did not recognize this protection status until 1960 (NMFS 1998a). Little information is available on the current population size of blue whales in the North Atlantic (Waring et al. 2009). Most of the available information comes from data collected from the Gulf of St. Lawrence, where 440 individuals have been catalogued. This number is considered to be a minimum population estimate for the western North Atlantic stock (Waring et al. 2009). Some studies have suggested that blue whale numbers have been slowly increasing (Waring et al. 2009).

Threats

Threats to blue whales in the Atlantic include vessel collisions and entanglement in fishing gear (NMFS 1998a). Disturbance from vessels, particularly from whale watching in the Gulf of St. Lawrence; degradation of habitat from acoustic and chemical pollution; and military operations are also concerns; however, no clear evidence is available to describe or quantify the impacts of these activities on blue whale populations (NMFS 1998a).

4.1.1.3 Occurrence in the Action Area

The blue whale is unlikely to occur in the Action Area (Palmer 2011).

4.1.1.4 Critical Habitat

Critical habitat has not been designated for the blue whale (NMFS 2011).

4.1.2 Finback Whale

4.1.2.1 Status

The Finback whale (*Balaenoptera physalus*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.2.2 Species Biology

Description

Finback whales are the second largest whale by length to the blue whale, measuring up to 78 ft (24 m) in length in the northern hemisphere and 88 ft (26.8 m) in the southern hemisphere (NMFS 2006b; American Cetacean Society [ACS] 2004a). Males and females can both weigh between 50 and 70 tons (ACS 2004a).

Finback whales are a species of baleen whale and consume large amounts of krill, capelin (*Mallotus villosus*), squid, herring (*Clupea* spp.), and lanternfish (*Myctophidae* spp.) (Blaylock 1985). Finback whales, like other baleen whale species, produce low-frequency sounds. Finback whales in particular produce two types of sounds—very common 20-Hz pulses and less common sounds reaching up to 150 Hz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

Finback whales occur in all the world's oceans (NYSDEC n.d. [a]). They primarily occur offshore, diving to depths up to 755 ft (230.1 m) (Blaylock 1985). Finback whales are widely distributed in the North Atlantic, occurring from the edge of Arctic pack ice south to the Gulf of Mexico and east to the Mediterranean Sea (NMFS 2006b). Mass migratory movements along a defined migratory corridor have not been supported by sightings (NMFS 2006b). However, acoustic data have indicated a "southward flow pattern" occurring in the fall from the Labrador/Newfoundland area, past Bermuda, and to the West Indies (NMFS 2006b). It is thought that aggregate movements of the majority of the whales is southward in winter/fall and northward in spring/summer (Blaylock 1985). During winter, they can be distributed offshore from Cape Cod to Florida (Blaylock 1985). Other populations of finback whales in northern latitudes tend to move further offshore, as opposed to southward, in the fall (NMFS 2006b).

Off the coast of the eastern United States, finback whales are generally centered over the 100 m isobath but have been sighted in shallower and deeper water, including submarine canyons off the continental shelf (NMFS 2006b). Within the Atlantic Ocean, they are considered common within 200 miles (321.9 km) of shore, from Cape Hatteras, North Carolina, northward (Waring et al. 2009). Calving takes place from the months of October to January in the mid-Atlantic region (Waring et al. 2009). Records exist of finback whales feeding off the coast of Virginia, and individuals have been found stranded on Virginia beaches several times (NMFS 2006b; Blaylock 1985).

Status

Finback whales have suffered from decades of hunting pressure. The historical, pre-hunting population in the North Atlantic is estimated to have been between 30,000 and 50,000 (NYSDEC n.d. [a]). The current minimum population estimate for this species is 3,269, with a best population estimate of 3,985 (Waring et al. 2009). This was determined from combined 2006 and 2007 studies in the Gulf of Maine and Northern Labrador regions. Worldwide, it is thought that current population estimates are approximately 40,000 individuals in the northern hemisphere and 15,000 to 20,000 individuals in the southern hemisphere (ACS 2004a).

Threats

Although commercial harvesting of finback whales was halted in the North Atlantic in 1987, hunting, subject to catch limits, continues in the waters of Greenland. Other threats include vessel collisions, reduced prey as a result of overfishing, entanglement in fishing gear, habitat degradation, and disturbance from low frequency noise. Finback whales are reported to be more susceptible to vessel collisions than other large whales, most likely due to their behavior of sleeping on the surface at night (NMFS n.d. [b]; Blaylock 1985).

4.1.2.3 Occurrence in the Action Area

The finback whale has the potential to occasionally occur in the deeper portions of the Action Area. Mortalities caused by vessel strikes were reported on March 26, 2005, off Virginia Beach, Virginia, and March 25, 2007 in Norfolk Harbor, Virginia (Waring et al. 2009).

4.1.2.4 Critical Habitat

Critical habitat has not been designated for the finback whale (NMFS 2011).

4.1.3 Humpback Whale

4.1.3.1 Status

The humpback whale (*Megaptera novaengliae*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.3.2 Species Biology

Description

Adult male and female humpback whales measure between 40 and 48 ft (12.2 and 14.6 m) and 25 and 50 ft (13.7 and 15.2 m) in length, respectively. Both sexes weigh between 25 and 40 tons (ACS 2004b).

As a baleen whale, the humpback consumes large amounts of krill and small fish (up to 3,000 lbs [1,361 kg] per day) (MarineBio 2010b). Important prey fish for the humpback whale include sand lance (*Ammodytes americanus*), herring (*Clupea harengus*), and capelin. *Meganyctiphanes norvegica* is the primary krill species they consume (NMFS 1991a). Humpback whales, like other baleen whale species, produce low-frequency sounds. Humpback whales in particular commonly produce two types of sounds. The first is the humpback "song," with a range from ≤ 20 Hz to 4 kilohertz (kHz). The second type is called "winter sounds," which range from 50 Hz to 10 kHz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

Humpback whales occur in all the world's oceans. In the North Atlantic, they range from Northern Ireland and Western Greenland to the West Indies and Gulf of Mexico. They primarily occur within nearshore habitats, such as over shallow banks and in shelf waters, while feeding or breeding but may venture into open ocean habitat during migration (Cupka and Murphy n.d.; MarineBio 2010b). It is thought that humpback whales rarely dive deeper than 135 to 197 ft (41 to 60 m), as diving any deeper would put them into oxygen debt (NMFS 1991a). Despite this, there have been records of humpback whales diving up to 656 ft (200 m) (NMFS 1991a).

In the western North Atlantic, humpback whales feed during the spring, summer, and fall over a spatial range that encompasses the entire eastern coast of the United States (including the Gulf of Maine), as well as the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (NMFS n.d. [c]; Waring et al. 2009). There are also documented feeding grounds off Iceland and northern Norway (Waring et al. 2009). Genetic evidence suggests that these six regions represent separate feeding stocks in the North Atlantic (Waring et al. 2009). Studies revealed that humpback whales off the southeastern and mid-Atlantic are composed of 42.9 percent Gulf of Maine stock, 19.0 percent Newfoundland stock, and 4.8 percent Gulf of St. Lawrence stock (Cupka and Murphy n.d.; Waring et al. 2009). It has also been suggested that the mid-Atlantic region serves as a supplemental winter feeding ground (Waring et al. 2009). The majority of all these stocks migrate southward for the winter, mating and calving in the West Indies (Cupka and Murphy n.d.; Waring et al. 2009).

Status

The humpback whale's tendency to follow predictable migration pathways and to frequent nearshore habitats made the species an easy target for commercial whaling. Their numbers declined drastically in the early 19th century, leaving only 5 percent to 10 percent of their original stock intact. The humpback whale has been legally protected from commercial whaling since 1966 by the IWC. It is believed that humpback whales are making a slow recovery from their record low numbers of less than 1,000 individuals (MarineBio 2010b).

Tagging data indicate that the overall North Atlantic population is estimated to be 4,894 males and 2,804 females. This population estimate is thought to be an underestimate of the total population size because the sex ratio of this species is known to be even (Waring et al. 2009). The Gulf of Maine stock's most recent population estimate, derived from a line-transect survey, was 847 individuals, with a minimum population estimate of 549 individuals (Waring et al. 2009). A series of population estimates indicate that the Gulf of Maine humpback whale stock is increasing in size (Waring et al. 2009).

Threats

Threats to humpback whales include vessel collisions, entanglement in fishing gear, disturbance from anthropogenic noise, pollutants and contaminants, habitat degradation, and overfishing of the whales' prey base (Cupka and Murphy n.d.; NMFS 1991a; Wiley et al. 1995). However, vessel collisions and entanglement in fishing gear are likely the main causes of humpback mortality (Wiley et al. 1995; Waring et al. 2009).

4.1.3.3 Occurrence in the Action Area

The humpback whale has the potential to occur in the Action Area year-round. If present, they would likely be migrating through the area en route to Caribbean waters or feeding in the area.

There was a noted increase in humpback whale sightings in the vicinity of the Chesapeake and Delaware bays in 1992 (Wiley et al. 1995; Waring et al. 2009).

On the United States southeastern and mid-Atlantic coast, 38 humpback whale strandings were reported between the years of 1985 and 1992. This count noted an increase in humpback whale strandings concentrated along the Virginia and North Carolina coastlines in the fall, winter, and spring. Most of the individuals stranded were sexually immature, leading researchers to conclude that these areas were becoming an increasingly important habitat for juvenile humpback whales (Wiley et al. 1995; Waring et al. 2009).

Five cases of severe injury or mortality of humpback whales were recorded off the coast of Virginia and North Carolina between January 2003 and December 2007 (Waring et al. 2009). Mortalities caused by vessel strikes were reported on June 6, 2003, in the mouth of the Chesapeake Bay, Virginia; March 17, 2006, off Virginia Beach, Virginia; May 10, 2007 off Wachapreague, Virginia; and December 21, 2007, off Ocean Sands, North Carolina (Waring et al. 2009). One case of serious injury caused by entanglement in fishing gear was reported on July 12, 2003, in the Oregon Inlet, North Carolina (Waring et al. 2009). No humpback whale strandings were reported in Virginia in 2008. In 2009, three humpback whale strandings occurred: one in Accomack, Virginia, on March 25 and Gloucester, Virginia, on September 26 and one in North Carolina (Swingle et al. 2010). In 2010, two humpback whale strandings occurred: one in Northampton, Virginia, on May 5 and one in North Carolina (Swingle et al. 2011).

4.1.3.4 Critical Habitat

Critical habitat has not been designated for the humpback whale (NMFS 2011).

4.1.4 North Atlantic Right Whale

4.1.4.1 Status

The North Atlantic right whale (*Eubalaena glacialis*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.4.2 Species Biology

Description

Adult North Atlantic right whales measure between 45 and 55 ft (14 and 17 m) long and can weigh up to 70 tons, with females generally larger than males (NMFS 2005a).

North Atlantic right whales are a species of baleen whale and consume krill and small fish just below the water's surface (VDGIF n.d.[a]). The majority of their prey base is likely composed of calanoid copepods, primarily *Calanus finmarchicus* (ACS 2004c; NMFS 2005a; Waring et al. 2009). North Atlantic right whales, like other baleen whale species, produce low-frequency sounds. North Atlantic right whales in particular are known to produce moans at less than 400 Hz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

The current distribution of the North Atlantic right whale, which ranges from approximately 30° to 75° north latitude in the North Atlantic, is thought to be strongly influenced by the location of its prey (Crane and Scott 2002; NMFS 2005a). For feeding, North Atlantic right whales generally prefer depths of 328 to 656 ft (100 to 200 m) adjacent to steeply sloping bottom topography, but they have been known to dive to depths of 1,000 ft (305 m) (ACS 2004c; NMFS 2005a). As a result, they are most often found in coastal or continental shelf waters but may venture further offshore (NMFS n.d. [d]; NMFS 2005a). In winter, North Atlantic right whales have been reported in coastal waters in the lower latitudes of their range. Reports suggest that all reproductively active females return to these areas each year to calve (NMFS 2005a). Further distribution details of most of the population during the winter are largely unknown. During the spring and summer, North Atlantic right whales migrate to the higher latitudes of their range (NMFS 2005a).

The western North Atlantic population of the North Atlantic right whale ranges from summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and the Scotian Shelf to winter calving grounds in coastal waters off the southeastern United States. High-use areas for the species include coastal Florida and Georgia from Sebastian Inlet, Florida, to the Altamaha River, Georgia; the Great South Channel east of Cape Cod; Massachusetts Bay and Cape Cod Bay; the Bay of Fundy; and the Scotian Shelf, including Brown's and Baccaro banks, Roseway Basin, and the area to the east (NMFS n.d. [d]; NMFS 2005a; Waring et al. 2009).

Peak numbers of North Atlantic right whales occur off of New England and in the Great South Channel in winter and spring. In the summer and fall, a large portion of the population occurs in the Bay of Fundy and on the Scotian Shelf. Calving takes place from December to March along the southeastern United States' coastline and from mid-January to mid-May in Cape Cod Bay (NMFS 2005a). Despite the knowledge of their winter range, a majority of the whales are unaccounted for in winter. Sparse data suggest that the Gulf of St. Lawrence, Newfoundland, New York and New Jersey coastal waters, the Gulf of Mexico, and Bermuda may be additional wintering areas (NMFS 2005a).

Although Mid-Atlantic coastal waters north of Georgia and south of Cape Cod are not considered high-use areas, North Atlantic right whales do travel frequently through these waters (NMFS 2005a; Waring et al. 2009). Satellite tags have shown North Atlantic right whales to make round-trip migrations to the area off the southeastern United States and back to Cape Cod Bay at least twice during the winter (Waring et al. 2009). Recent surveys also suggest that the area from Cape Fear, North Carolina, to South Carolina may also be used as a wintering/calving area (NMFS 2005a).

Status

Right whales were hunted heavily from the 12th century into the early 20th century due to their slow swimming speed, high yield of oil and baleen per whale, and the fact they floated after they were killed (Knowlton and Kraus 2001). They were protected from commercial whaling in 1949 by the IWC for the regulation of Whaling. The North Atlantic right whale population was estimated at approximately 361 individuals in 2005, making the species the rarest marine mammal (NMFS n.d. [d]; Waring et al. 2009). Population data indicate that their numbers may be increasing slightly (Waring et al. 2009).

Threats

Vessel collisions and entanglement in fishing gear cause approximately 40 percent of North Atlantic right whale deaths (Knowlton and Kraus 2001; Woods Hole Oceanographic Institution 2007; Waring et al. 2009). Other threats may include habitat degradation, contaminants and pollutants, climate and ecosystem change, anthropogenic disturbance, predators such as large sharks or killer whales, and increasing anthropogenic sound (ACS 2004c; NMFS n.d. [d]; Parks et al. 2007; Parks et al. 2011).

4.1.4.3 Occurrence in the Action Area

North Atlantic right whales may occur within the Action Area in fall, winter, and spring. Most individuals occurring in the region during these seasons are expected to be transient, traveling between the New England region and areas south of Virginia.

Five North Atlantic right whale mortalities occurred off the southeastern United States between January and March 1996, which was considered an unusually high number. One death was attributed to a vessel strike. Causes of death for the remaining four were undetermined (NMFS 2005a).

Other mortalities attributed to vessel strikes have been reported in the region, including two off Virginia and North Carolina between January 2003 and December 2007; one off Virginia Beach, Virginia, on March 7, 2004; and one off Ocean Sands, North Carolina, on November 24, 2004. A mortality attributed to fishing gear entanglement was reported on March 31, 2007, off the Outer Banks, North Carolina (Waring et al. 2009).

No North Atlantic right whale strandings were reported in Virginia or North Carolina in 2008 or 2010 (Swingle et al. 2010; Swingle et al. 2011). In 2009, one stranding was reported in North Carolina (Swingle et al. 2010).

4.1.4.4 Critical Habitat

There is no designated critical habitat for the North Atlantic right whale in the Action Area. Critical habitat for the North Atlantic right whale is designated in coastal Florida and Georgia from the Sebastian Inlet, Florida, to the Altamaha River, Georgia; the Great South Channel east of Cape Cod; and Massachusetts Bay and Cape Cod Bay (NMFS n.d. [d]; NMFS 2005a).

4.1.5 Sei Whale

4.1.5.1 Status

The sei whale (*Balaenoptera borealis*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.5.2 Species Biology

Description

Adult male sei whales can measure between 45 and 65 ft (13.7 and 19.8 m) in length and weigh between 14 and 17 tons. Females are generally slightly larger than males (ACS 2004d).

Sei whales are a species of baleen whale and are opportunistic feeders, feeding on whatever is locally abundant, including plankton, krill, small fish, or squid. On average, a sei whale eats about 900 kg (1,984 lbs) of zooplankton, krill, and small fish per day (MarineBio 2010c). Mating occurs between November and February in the southern parts of their range (MarineBio 2010c; Reeves et al. 1998; Waring et al. 2009). Sei whales, like other baleen whale species, produce low-frequency sounds; however, recordings of this species have detected sounds in higher frequency ranges. Sei whales are not a commonly recorded large whale species. Of the recordings that exist, the sound production range for this species has been identified as 1.5 to 3.5 kHz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

Sei whales are found in oceans around the world, but they tend to avoid the more extreme cold temperatures present at the poles (MarineBio 2010c). In the North Atlantic, sei whales range from southern Europe or northwestern Africa to Norway in the east and from the southeastern United States to Greenland in the west (Reeves et al. 1998).

Sei whales are not considered common anywhere within United States Atlantic waters (Reeves et al. 1998). Individuals present in the western Atlantic complete a feeding migration toward the poles in the summer, possibly to areas on the Scotian Shelf (Reeves et al. 1998; Waring et al. 2009). The species winters in temperate and subtropical waters of the Atlantic within 200 miles (321.9 km) of the United States, from the Gulf of Maine to Georges Bank (Reeves et al. 1998; Waring et al. 2009). However, the exact distribution and pattern of these seasonal movements remains unclear (NMFS n.d. [e]). Despite most individuals' southernmost extent being from the Gulf of Maine to George's Bank, the species has been sighted as far south as North Carolina (Reeves et al. 1998).

Sei whales are considered an open-ocean-dwelling species and are not often found in inshore or coastal waters. They most often travel in groups of two to five at depth less than 984 ft (300 m), following shelf contours and plankton/krill gatherings (MarineBio 2010c). Occasionally, they congregate in larger groups in feeding areas (VDGIF n.d. [b]).

Status

The sei whale became a target of commercial whaling when other more desirable species, such as the finback and blue whale, began to decline and then became protected. They were overharvested by the mid-1970s, and the IWC banned hunting of the species in 1979 (MarineBio 2010c). The current population estimate for the sei whale Nova Scotia stock is 386 individuals, with a minimum population estimate of 208 individuals (Waring et al. 2009). This estimate is considered conservative as the known range of this stock is the entire western North Atlantic. The global population is estimated at 54,000, one-fifth of historical population levels (ACS 2004d).

Threats

Threats currently endangering the sei whale include vessel strikes and entanglement in fishing gear (NMFS n.d. [e]; Waring et al. 2009).

4.1.5.3 Occurrence in the Action Area

Sei whales are unlikely to occur in the Action Area. They are an open-water-dwelling species, unlikely to occur in shallower waters near the shoal or coast. However, a mortality attributed to a vessel strike was reported on February 19, 2003, in Norfolk, Virginia (Waring et al. 2009). This was the only reported mortality of a sei whale in Virginia between 2003 and 2007.

4.1.5.4 Critical Habitat

Critical habitat has not been designated for the sei whale (NMFS 2011).

4.1.6 Sperm Whale

4.1.6.1 Status

The sperm whale (*Physeter macrocephalus*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.1.6.2 Species Biology

Description

Male sperm whales can have a body length up to 59 ft (18 m) and weigh up to 57 tons. Females can reach up to 41 ft (12.5 m) in length and weigh up to 24 tons (NMFS 2010a).

Sperm whales, the largest of the toothed whales, feed mainly on large squid (including colossal squid (*Mesonychoteuthis hamiltoni*) and giant squid (*Architeuthis* spp.) but will also feed on octopus, large demersal and mesopelagic sharks, skates, and deepwater fishes (Reeves et al. 2002; ACS 2004e; MarineBio 2010d; NMFS 2010a). Sperm whales have a complex sound production range. Sperm whales produce both low- and high-frequency sounds in the forms of buzzes and clicks. The known sound production range for this toothed whale species is 100 Hz to 30 kHz (Richardson et al. 1995). Because of the obstacles in determining the hearing ranges of large open ocean whales, it is assumed that the sound production range of the species is an indicator of the species' hearing range (Richardson et al. 1995).

Distribution

Sperm whales occur in oceans around the world. They range from 60°N to 70°S but are most common in temperate and tropical latitudes, rarely approaching polar ice fields (MarineBio 2010d; NMFS 2010a). Adult males tend to migrate further toward the poles (ACS 2004e; NMFS 2010a).

There are two stocks of sperm whales in the North Atlantic: a western North Atlantic stock and a northern Gulf of Mexico stock (NMFS 2010a; NMFS n.d. [f]). Surveys conducted in 1972 across much of the western and central North Atlantic reported that the highest densities of sperm whales occurred in two regions. These regions were the "North Sargasso Sea Region" (30° to 40° N and 50° to 70° W) and the "Gulf Stream Region," which describes two offshore areas between 40°N and 50°N, one over the Grand Banks of Newfoundland and the other over the North Atlantic Ridge (NMFS 2010a). Off Nova Scotia, sperm whales were reported by whalers to be primarily in continental slope waters at depths between 295 and 6,004 ft (90 and 1,830 m), most often around the edges of banks and in submarine canyons (NMFS 2010a). The overall distribution off the east coast of the United States is similarly concentrated along the break of the continental shelf, over the continental slope, and into mid-ocean regions (Waring et al. 2009; NMFS 2010a). High densities have been reported in inner slope waters north of Cape Hatteras, North Carolina, seaward of the 3,281-ft (1,000 m) isobath during the summer. During the late spring and fall, individuals have been recorded on the southern Scotian Shelf and south of New England on the continental shelf in waters less than 328 ft (100 m) deep (NMFS 2010a). Despite this, they are considered uncommon in waters less than 984 ft (300 m) deep (NMFS n.d. [f]).

Sperm whales are considered deep and prolonged divers and have been known to dive down to depths of 10,561 ft (3,219 m) (MarineBio 2010d; NMFS 2010a). The species is highly gregarious and is most commonly found in groups of approximately 30 individuals, although groups of 100 or more have been recorded (MarineBio 2010d).

Status

Sperm whale populations are considered more stable than those of many other whale species. This is likely because they were historically hunted less intensely than baleen whales. Their worldwide population is estimated at between 200,000 and 1.5 million individuals (ACS 2004e; MarineBio 2010d; NMFS 2010a). The best population estimate for sperm whales off the east coast of the United States is 4,804 individuals; 2,607 individuals from Maryland to the Bay of Fundy; and 2,197 individuals from Florida to Maryland (Waring et al. 2009; NMFS 2010a). The minimum population estimate for this western North Atlantic stock is 3,359 individuals (Waring et al. 2009).

Threats

Threats to sperm whales include vessel collisions, entanglement in fishing gear, contaminants and pollutants, habitat degradation, reduced prey abundance due to climate change or overfishing, and possibly effects of anthropogenic ocean noise (NMFS n.d. [f]; NMFS 2010a).

4.1.6.3 Occurrence in the Action Area

The sperm whale is unlikely to occur in the Action Area (Palmer 2011). They are an open-water- and deep-water-dwelling species and are unlikely to be in shallower waters near the shoal or coast. No reported mortalities or strandings were reported along the Virginia coast between 2001 and 2005 (Waring et al. 2009).

4.1.6.4 Critical Habitat

Critical habitat has not been designated for the sperm whale (NMFS 2011).

4.2 Birds

4.2.1 Piping Plover

4.2.1.1 Status

The piping plover (*Charadrius melodus*) was listed under the ESA in 1986 (USFWS 1996). The Great Lakes population is listed as endangered, and the Atlantic coast, including Virginia and the Northern Great Plains, populations are listed as threatened.

4.2.1.2 Species Biology

Description

The piping plover is a small migratory shorebird. Adults have an average body length of 6.7 inches (in) (17 centimeters [cm]) and weigh between 1.6 and 2.3 ounces (46 and 64 grams [g]) (USFWS 1996). During the breeding season, piping plovers have a light beige back and crown, white under parts and rump, black on the upper tail with white on the edges, and single black bands across the breast and forehead. A single white wing stripe with black highlights at the wrist joints and along the trailing edge of the wing is visible when the birds are in flight (USFWS 1996). During the breeding season, the legs and bill of a piping plover are orange, with a black tip on the bill. In winter, piping plovers lack the black bands on the breast and forehead, their legs are pale yellow, and their bills are black (USFWS 1996).

Piping plovers build nests above the high tide line on coastal beaches, sandflats at the ends of sandspits and barrier islands, gently sloping foredunes, and in blowout and washover areas in dunes. They may also nest in areas where suitable dredge material has been deposited (USFWS 1996). Piping plover nests are shallow depressions scraped into fine-grained sand or mixtures of sand and pebbles, shells, or cobble (USFWS 1996). On Virginia's barrier islands, nests are typically placed in drier areas where the surface becomes more diversified with pebbles and broken shells cut into or between dunes and often close to backside marshes, mudflats, or vegetation barriers (VDGIF n.d. [c]). Females typically lay four eggs per clutch, and a pair generally fledges one brood per season. In Virginia, piping plovers lay eggs from mid-April to early July, and young may be evident through August (VDGIF n.d. [c]).

In winter, piping plovers generally occur in small groups at accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets (USFWS 1996).

Piping plovers feed on invertebrates, including marine worms, fly larvae, beetles, crustaceans, and mollusks. Feeding habitats include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS 1996).

Distribution

In summer, piping plovers breed in three regions: the Northern Great Plains, the Great Lakes, and the Atlantic coast (Elliott-Smith and Haig 2004). The Atlantic coast population's breeding range is from Newfoundland's southern coast south to near the border between North and South Carolina; while the extent of this current range is similar to the piping plover's historic range, the species is absent from many beaches where it once nested (USFWS 1996). In Virginia, nesting typically occurs between April 7 and June 21, although renesting attempts may occur past July 1 (VDGIF n.d. [c]).

In the United States, piping plovers from all three breeding populations winter along the Atlantic coast from North Carolina south and across the entire Gulf coast (Elliott-Smith and Haig 2004). The highest winter populations are typically observed along the Gulf coast in Texas. The distribution of wintering piping plovers outside the United States is poorly understood (Elliott-Smith and Haig 2004).

During migratory periods, most piping plovers that breed in the Northern Plains and Great Lakes regions fly non-stop between their wintering and breeding grounds (Elliott-Smith and Haig 2004). Birds from the Atlantic coast population are believed to migrate within a narrow strip along the coast in both spring and fall (USFWS 1996). In fall, piping plovers may congregate in large concentrations at sites along the Atlantic coast, indicating that some birds stop to refuel during migration (Elliott-Smith and Haig 2004). Similar stopover use has not been well documented during spring migration, although it is believed the same migratory pathway is used in both spring and fall (Elliott-Smith and Haig 2004). The piping plover migrates northward from February to early April and southward in late July to September (VDGIF n.d. [c]).

Status

Initial population declines of piping plovers were caused by uncontrolled commercial and recreational hunting and egg collecting in the early 1900s. Following the passage of the Migratory Bird Treaty Act (MBTA) in 1918, their population numbers recovered slightly. More recently, piping plover breeding habitat has been lost due to dune stabilization efforts and beachfront development (VDGIF n.d. [c]). Habitat loss combined with increased use of beaches for recreation has resulted in breeding population declines in coastal regions. Since the species' listing under the ESA, the Atlantic coast population estimate has increased 234 percent, from 790 breeding pairs in 1986 to 1,849 breeding pairs in 2009. In Virginia, the population estimate increased from 100 to 193 breeding pairs over the same time period (USFWS 2011b).

4.2.1.3 Occurrence in the Action Area

There are no records of piping plovers nesting on mainland beaches south of the Chesapeake Bay. They are considered uncommon transients on the southern mainland coast of Virginia and in the lower Chesapeake Bay region (VDGIF n.d. [c]). Piping plover sightings at the nearby Back Bay National Wildlife Refuge (NWR) typically occur during spring and fall migrations. Numbers of annual sightings at the refuge from 1976 through 2005 ranged from zero to 18; the number of sighting remained relatively low between 1994 and 2005 with a maximum of five sightings in any given year (Backer and Valentine n.d.). As recently as July 2009, no nests have been documented at Back Bay NWR (USFWS 2010). Incidental observations of feeding piping plovers have been made on the beaches at Dam Neck. These sightings have been limited to single individuals, which typically do not stay in the area for more than a couple of days. Piping plovers are not known to nest at the installation (Navy 2006). In general, the beaches at Dam Neck are too narrow to provide ideal nesting habitat for piping plovers. However, the Navy has been conducting nesting surveys in two areas at the north end of Dam Neck since 2010 to ensure there are no conflicts with training activities. The areas where nest surveys are conducted are not within the Action Area. VDGIF reports that piping plovers are most likely to occur in Virginia Beach during winter and spring (VDGIF n.d. [c]).

4.2.1.4 Critical Habitat

No critical habitat for the piping plover is designated in the Commonwealth of Virginia; therefore, no critical habitat is designated within the Action Area. Critical habitat has not been designated for the Atlantic breeding population. Critical habitat for wintering piping plovers has been designated along portions of the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas (USFWS 2009).

4.2.2 Red Knot

4.2.2.1 Status

The red knot (*Calidris canutus rufa*) was designated as a candidate species for listing under the ESA on September 12, 2006 (USFWS 2006).

4.2.2.2 Species Biology

Description

The red knot is a large sandpiper. Adults have a total body length of 9.1 to 9.8 in (23 to 25 cm) and weigh about 4.8 ounces (135 g) (Harrington 2001). Their basic plumage is gray above, with off-white under parts that have faint, dark vertical streaking on the upper breast that may extend laterally to the flanks (Harrington 2001). The bill, which is slightly longer than the head, is black and tapers steadily from a relatively thick base to a fine tip (Harrington 2001). The legs are typically dark gray to black but may be greenish in juvenile and elderly birds (Harrington 2001). During the breeding season, the breast and belly are salmon-red to brick-red, with a light coloration on the lower belly and under the tail coverts (Harrington 2001).

The red knot winters on tidal and intertidal flats, marshes, and sandy or muddy beaches and shorelines, and forages in these areas during migration (VDGIF n.d. [d]). Prey includes crustaceans (including crayfish), mollusks, insects (including grasshoppers, caterpillars, bees, diving beetles, and cutworm larvae), horseshoe crab (*Limulus polyphemus*) eggs, marine worms, algae, buds, and seeds (grasses, sedges, horsetails) (VDGIF n.d. [d]). Red knots may wade breast deep to feed, but rarely swim and are not known to dive (VDGIF n.d. [d], Harrington 2001).

Red knots breed on the arctic tundra, with males arriving before females in order to prepare nest scrapes on the ground (Harrington 2001). The mean clutch size is four eggs, and both sexes participate equally to incubate the eggs (Harrington 2001). After hatching, the young leave the nest as soon as they are dry and move to a lower, wetland habitat with one parent, typically the male (VDGIF n.d. [d]; Harrington 2001).

Distribution

Six subspecies of red knot have been recognized, all of which breed on the high arctic tundra (Niles et al. 2008). The *rufa* subspecies is the only one likely to occur on the United States Atlantic coast (Niles et al. 2008), typically during spring (mid-April to May) and fall (July to mid-October) migrations (VDGIF n.d. [d]; Niles et al. 2008). Red knots winter in southern Patagonia and Tierra del Fuego and migrate up the Atlantic coast to breed in the central Canadian Arctic during June and July, although non-breeding adults occasionally remain on the Atlantic coast through summer and may overwinter from Massachusetts southward through Central and South America (Niles et al. 2008; VDGIF n.d. [d]). Red knots that overwinter in the United States typically do so in Florida, Georgia, South Carolina, or Texas (Niles et al. 2008).

Status

The primary factor threatening the red knot is a reduction of horseshoe crab eggs in the Delaware Bay area, resulting from overharvest for bait and use in the biomedical industry (USFWS 2006). The Delaware Bay area is the largest known spring migration stopover area for the red knot, with the highest concentrations corresponding with the horseshoe crab spawning season from mid-May to early June (USFWS 2006). The red knot feeds on horseshoe crab eggs to rebuild body mass needed to arrive in the Arctic healthy. With fewer horseshoe crab eggs to feed on, the red knot fails to achieve the body mass needed to survive the initial few days of snow cover on the tundra, leading to reduced annual survival rates (USFWS 2006). A trawl survey conducted in the Delaware Bay by the Delaware Division of Fish and Wildlife shows that, since 1990, a highly significant decline has occurred in the number of adult horseshoe crabs in the Delaware Bay. Egg density surveys started by the New Jersey Division of Fish and Wildlife and continued by Rutgers University indicate that a highly significant decrease has occurred in the density of eggs in the upper 2 in (5 cm) of sand in New Jersey (Niles et al. 2008). In the first decade of 2000, new restrictions have been set on the horseshoe crab fishing industry, which are expected to allow the horseshoe crab population, and subsequently the red knot population, to recover (USFWS 2006).

4.2.2.3 Occurrence in the Action Area

The red knot is considered a locally common to abundant transient from mid-May to early June and from mid-July to mid-September along the Virginia coast. It is considered rare west of the Chesapeake Bay and is considered uncommon to rare during the summer and winter months (VDGIF n.d. [d]). It is known to stopover during migration on Metompkin, Parramore, and Fisherman islands on Virginia's Eastern Shore, where it feeds on invertebrate species, particularly the blue mussel (*Mytilus edulis*) (Niles et al. 2008).

Most shorebird species use Dam Neck Annex beaches as a feeding area during migration. The killdeer (*Charadrius vociferous*) is the only shorebird species known to nest on the installation (Navy 2006). Therefore, the red knot may occur at the installation during spring and fall migration.

4.2.2.4 Critical Habitat

No critical habitat is currently designated for the red knot, as it is a candidate species. Weekly aerial shorebird surveys have been carried out along the Delaware Bay shore during the spring stopover period in May and early June, and these data have been reviewed to determine which Delaware Bay beaches are used by the greatest number of red knots (Niles et al. 2008). Additionally, horseshoe crab spawning habitat has been mapped and correlated with red knot use (Niles et al. 2008). Based on such studies, the New Jersey Department of Environmental Protection (NJDEP) has recommended to the USFWS that the Delaware Bay shore in New Jersey from Norbury's Landing to Dennis Creek should be considered critical red knot habitat, as should stretches of New Jersey shoreline in the Fortescue and Gandy's Beach areas, the Hereford Inlet area between Stone Harbor and Wildwood, and Stone Harbor Point (Niles et al. 2008). NJDEP has also recommended that the Delaware shores in the vicinity of Bower's Beach and Slaughter Beach-Mispillion Harbor be classified as critical habitat (Niles et al. 2008).

4.2.3 Roseate Tern

4.2.3.1 Status

The northeastern breeding population of the roseate tern (*Sterna dougallii dougallii*) was listed as endangered under the ESA in 1987 (USFWS 1998).

4.2.3.2 Species Biology

Description

The roseate tern is a worldwide species that breeds in two distinct areas in North America. The northeast population includes birds that breed, or formerly bred, along the Atlantic coast of the United States from North Carolina to Maine. Small numbers of roseate terns also nest in the Maritime Provinces of Canada

(USFWS 1998). The second North American population nests on islands around the Caribbean Sea.

The roseate tern is a medium-sized seabird measuring approximately 13.8 to 15.8 in (35 to 40 cm), including a deeply forked tail, and weighing approximately 3.5 to 4.2 ounces (100 to 120 g) (USFWS 1998). They have light-gray wings with the first three or four primary feathers being black. Their back is light gray, their cap is black, and the remainder of their body is white. During the breeding season, the chest and belly are characterized by a rosy tinge, and the basal three-fourths of the otherwise entirely black bill and legs become orange-red (USFWS 2011c).

The roseate tern is exclusively a marine species and typically breeds on small islands and occasionally on sand dunes at the ends of barrier beaches (USFWS 1998). They typically nest under or adjacent to objects that provide cover or shelter, including rocks, driftwood, or manmade objects (USFWS 1998). The majority of roseate tern eggs are laid between May and June in a shallow scrape on bare sand, soil, or stones. Roseate tern clutches typically contain one or two eggs (USFWS 1998).

Roseate terns feed on small schooling marine fish, which they catch by plunge-diving vertically into the water and catching the fish in their beaks. They feed primarily on American sand lance but also feed on other small fish such as Atlantic herring, blueback herring (*Alosa aestivalis*), juvenile mackerel, and juvenile bluefish (*Pomatomus saltatrix*), as well as mollusks. Roseate terns typically feed over open water, often in tidal channels or over sandbanks where fish are brought into shallower water (USFWS 1998).

Distribution

The roseate tern is a rare transient and summer visitor near the coast of Virginia. Historically, it nested on the Eastern Shore of Virginia, but no breeding activity has been recorded since 1927. Roseate terns formerly bred from Sable Island, Nova Scotia, to Virginia but no longer breed south of Long Island, New York (Center for Biological Diversity 2011). Current nesting range on the United States Atlantic coast is from Quebec to New York (USFWS 1998).

Approximately 80 percent of the population breeds at two large colonies located on Great Gull Island, New York, and Bird Island, Massachusetts (Gochfeld et al. 1998). They nest in large colonies on the higher part of the beach (dunes, ridges), primarily where there is vegetation available to shade and conceal the nest. Colony sites used by roseate terns in the northeastern United States have been grouped into six areas: 1) Northern United States, Gulf of Maine, 2) Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts, 3) Buzzards Bay, Massachusetts, 4) the Central Connecticut Coast, 5) Eastern Connecticut and New York--Eastern Long Island Sound and Gardiners Bay, and 6) Southern Long Island from Shinnecock Bay west to Great South Bay (USFWS 1998).

Roseate terns migrate south in late August and early September. Banded bird studies indicate that the West Indies are utilized in September and October (USFWS 1998). Roseate terns have rarely been observed in winter; however, data from banding recoveries indicated that roseate terns were found to winter in South America from January through March, specifically in Brazil (USFWS 1998).

Status

Prior to the 20th century, population declines of the northeastern roseate tern population were attributable to hunting to supply feathers for the hat-making industry. In 1890, the northeastern roseate tern population was estimated at approximately 2,000 pairs. Population numbers increased to approximately 8,500 pairs by the 1930s, but then declined to approximately 4,800 pairs estimated in 1952 and approximately 2,500 pairs estimated in 1977. The later declines were attributed to encroachment by gulls and habitat loss (USFWS 1998). Their numbers continued to fluctuate between approximately 2,500 and 3,500 pairs from 1978 to 1988. In 1997, the northeastern nesting population of the roseate tern was estimated at 3,382 pairs (USFWS 1998). The population increased to a high of approximately 4,310 pairs in 2000 (Center for Biological Diversity 2011). Loss of suitable nesting habitat (to humans, gulls, erosion), a decrease in food supply, and predation are the primary factors in this species' decline.

4.2.3.3 Occurrence in the Action Area

The roseate tern is considered a rare transient and summer visitor to Virginia, primarily during migration. It has been extirpated from Virginia as a breeding species, with no recorded breeding since 1927 (VDGIF n.d. [e]). No sightings of the species have been recorded for the installation, and the species is not included on the list of known rare, threatened, and significant ecological communities for Dam Neck Annex or Camp Pendleton (Navy 2006).

4.2.3.4 Critical Habitat

Critical habitat has not been designated for the roseate tern (USFWS 2011c).

4.3 Fish

4.3.1 Atlantic Sturgeon

4.3.1.1 Status

On October 6, 2010, the NMFS published two proposed rules to list five distinct population segments (DPSs) of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) under the ESA. The NMFS is proposing to list four DPSs as endangered (New York Bight, Chesapeake Bay, Carolina, and South Atlantic) and one DPS of the Atlantic sturgeon as threatened (Gulf of Maine DPS) (75 FR 61872; 75 FR 61904). On January 31, 2012, the NMFS announced the final decision to list the DPS as proposed (NMFS January 31, 2012). The final rule was published in the Federal Register on February 6, 2012 and became effective on April 6, 2012 (77 FR 5914; 77 FR 5880).

4.3.1.2 Species Biology

Description

The Atlantic sturgeon is a long-lived (up to 60 years), estuarine-dependent, anadromous (migrates from the ocean into coastal estuaries and rivers to spawn) species of fish (NMFS n.d. [g]). Adult Atlantic sturgeon, which reach sexual maturity between years 5 and 34, have five rows of bony plates, called scutes, covering the head and body; a long, hard snout that turns upward at the tip; and a soft, toothless mouth with four sensory barbels on the underside of the snout. They typically have a brown, tan, or bluish-black body and a grayish-white belly (Chesapeake Bay Program n.d.). Adults can reach 14 ft (4.3 m) in length and weigh more than 600 lbs (270 kg) (Murdy et al. 1997).

Atlantic sturgeon are opportunistic benthic feeders, consuming worms, snails, aquatic insects, crustaceans, and sand lances (VDGIF n.d. [f]).

Distribution

The Atlantic sturgeon is a subtropical species occurring along the Atlantic coast and in estuaries from Labrador, Canada, to Florida and west of the Mississippi delta (Murdy et al. 1997; NMFS n.d. [g]). It is currently known to occur in 35 rivers, of which spawning is known to occur in 20 (NMFS 2010b). Atlantic sturgeon occupy coastal waters and estuaries when not spawning--generally, in shallow nearshore areas dominated by sand or gravel substrate at depths between 33 and 164 ft (10 and 50 m) (NMFS n.d. [g]).

The Atlantic sturgeon is a migratory species, moving southward in the winter and northward in the spring. Fish documented off the coast of North Carolina in November have been found off Long Island in early spring (VDGIF n.d. [f]). The Atlantic sturgeon is anadromous, traveling up large rivers to spawn in April and May within Chesapeake Bay tributaries (Murdy et al. 1997; VDGIF n.d. [f]). Atlantic sturgeon might have historically spawned in most tributaries of the Chesapeake Bay, but today limited spawning occurs in the James and York rivers (Atlantic States Marine Fisheries Commission 1998). Spawning occurs over solid substrates at temperatures between 55.9 and 68.9 degrees Fahrenheit [°F] (13.3 and 20.5 degrees Celsius [°C]). After spawning, adults return to the sea and remain there until the next spawning period. Females usually exit rivers within a span of four to six weeks, and males may remain in the river or lower estuary until the fall (Murdy et al. 1997; NMFS 2010b). Juveniles move between estuaries and the ocean (VDGIF n.d. [f]).

Status

Landings of Atlantic sturgeon in the Chesapeake Bay peaked in 1890 and were followed by a steady decline. In 1938, Virginia passed a law prohibiting the removal of sturgeons less than 4 ft (1.2 m) in length from the commonwealth's waters. In 1974, it was prohibited "to take or catch and retain possession of any sturgeon fish" in Virginia (Murdy et al. 1997). In 1998, the Atlantic States Marine Fisheries Commission (ASMFC) instituted a moratorium on the harvest of Atlantic sturgeon for the entire United States Atlantic coast. This moratorium is to remain in effect until there are at least 20 protected age classes, a state predicted to take 40 or more years to attain (NMFS n.d. [g]).

Estimates of the population size in Virginia are unavailable, but, from analysis of populations in the Hudson River in New York and the Altamaha River in Georgia, the population is thought to be stable (NMFS n.d. [g]; NMFS 2010b). Atlantic sturgeon stocks in Virginia have the potential to be rehabilitated by prohibiting landings from coastal fisheries (particularly in North Carolina) and by hatchery culture and stocking (VDGIF n.d. [f]).

Threats

Atlantic sturgeon populations have been most negatively impacted by overfishing, pollution, and locks and dams. Their populations are also limited by habitat degradation, dredging/gravel and stone removal, water withdrawals, ship strikes, channelization, and flow changes (VDGIF n.d. [f]; NMFS n.d. [g]).

4.3.1.3 Occurrence in the Action Area

Atlantic sturgeon are likely to occur in the Action Area. This species prefers shallow coastal waters between 33 and 164 ft (10 and 50 m) deep, habitat similar to that where the sand dredging and placement would be taking place under the proposed action.

4.3.1.4 Critical Habitat

Critical habitat has not been designated for the Atlantic sturgeon because candidate species are not required to have designated critical habitat.

4.3.2 Sand Tiger Shark

4.3.2.1 Status

The sand tiger shark (*Carcharias taurus*) is designated as a federal Species of Concern (SOC) throughout the western Atlantic, south Atlantic, Caribbean, and northern Gulf of Mexico portions of its range (NMFS 2010c). A SOC is a designation for a species for which there is some concern regarding status and threats but for which insufficient information is available to indicate a need to list it under the ESA (NMFS 2010c). The sand tiger shark is listed as a SOC primarily due to the species' low productivity and the high uncertainty in its abundance trends. It is managed by the Highly Migratory Species Fishery Management Plan (NMFS 2006a). Beginning in 1997, this plan made it illegal to land this species or any parts (fins, meat, jaws, etc.) on the Atlantic coast of the United States. Since 2010, under the Shark Interstate Fisheries Management Plan for State waters, the retention or possession of any sand tiger shark from Florida to Maine has been prohibited (NMFS 2010c).

4.3.2.2 Species Biology

Description

The sand tiger shark is characterized by two dorsal fins of similar size; a short, asymmetric caudal fin; five medium gill slits in front of pectoral-fin bases; a lack of gill-rakers; a very short snout; and small eyes without nicitating membranes

(NMFS 2010c). Their bodies are light grey-brown above and lighter below with yellowish blotches. Their teeth are long and pointed, with a small spine-like cusp on either side. Sand tiger sharks can grow to approximately 10.4 feet (3.2 m) in length (Murdy et al. 1997; NMFS 2010c).

Sand tiger sharks prey on a large variety of bony fishes, rays, squids, small sharks, crabs, and lobsters, hunting singly or in groups (Murdy et al. 1997; MarineBio 2010e; NMFS 2010c).

Distribution

The sand tiger shark is a coastal species found in tropical and warm temperate waters worldwide, except in the eastern Pacific (NMFS 2010c). In the western Atlantic, the species ranges from the Gulf of Maine to coastal waters off Argentina (MarineBio 2010e). Sand tiger sharks are migratory, moving toward the poles in the summer and toward the equator in the fall and winter (NMFS 2010c).

Sand tiger sharks are usually solitary but can also occur in small to large schools (NMFS 2010c). They can occur at depths of 0 to 625 ft (190 m) but are usually found at depths of less than 230 ft (70 m) (MarineBio 2010e; NMFS 2010c).

Sand tiger sharks are considered common in summer and fall in the lower Chesapeake Bay, where they inhabit shallow estuaries and coastal waters (Murdy et al. 1997). Juvenile sand tiger sharks are commonly found in estuaries along the eastern United States coastline (NMFS 2010c). As a result, Virginia waters are considered important pupping grounds (MarineBio 2010e).

Status

The sand tiger shark is extremely vulnerable due to past overfishing and because adults congregate in large numbers in coastal areas during the mating season, which in North America is thought to occur on alternate years from late March to April. Because of a severe population decline in the 1990s, the NMFS prohibited possession of this species in United States waters in 1997 (Martin 2003). In 2007, it was determined that the population was still declining, with juveniles being the most vulnerable life history stage (NMFS 2010c). Subsequently, in 2009, it was determined that the population was still declining, and it was decided that the species should be retained as a SOC due to its low fecundity (NMFS 2010c).

Threats

Threats to the sand tiger shark include entanglement in fishing gear, risk of being caught as bycatch, and pollution and contamination (Carlson et al. 2009; NMFS 2010c).

4.3.2.3 Occurrence in the Action Area

The sand tiger shark may be present in the vicinity of the borrow and offload areas of the dredging operations as they are a coastal species found close to shore and in the region of Sandbridge Shoal.

4.3.2.4 Critical Habitat

Critical habitat has not been designated for the sand tiger shark because it has not been listed under the ESA.

4.3.3 Shortnose Sturgeon

4.3.3.1 Status

The shortnose sturgeon (*Acipenser brevirostrum*) was listed as federally endangered in 1967 under the Endangered Species Preservation Act, a precursor to the ESA (NMFS 2011).

4.3.3.2 Species Biology

Description

The shortnose sturgeon is an anadromous species of fish, closely related to the Atlantic sturgeon (NMFS 1998b). The shortnose is one of the smallest species of sturgeon, rarely exceeding 3 ft (1 m) in length, but it has been known to reach a length of approximately 4.7 ft (1.4 m) (Massachusetts Division of Fisheries and Wildlife, Natural Heritage Endangered Species Program 2008; Murdy et al.1997; NMFS n.d. [h]). Adults have a short, blunt, rounded snout with their mouth on the ventral side. They have four rows of scutes along their body, and modified armored scales on their head give it a skull-like appearance. The shortnose sturgeon has a yellow-brown to black-olive dorsal surface, pale-colored scutes, and a white underside (Massachusetts Division of Fisheries and Wildlife, Natural Heritage Endangered Species Program 2008). They are generally distinguishable from the Atlantic sturgeon by their smaller size and shorter snout.

Shortnose sturgeons are nocturnal feeders, preying on benthic organisms such as mollusks, crustaceans, and insects (NMFS n.d. [h]).

Distribution

The shortnose sturgeon occurs in rivers, estuaries, and the Atlantic Ocean along the East Coast of North America (NMFS 1998b). Although the species may occasionally enter the marine environment, their populations are believed to be typically confined to their natal rivers and estuaries. When shortnose sturgeons have been captured in the ocean, they were taken close to shore in full salinity. Shortnose sturgeons are known to occur as far north as Saint John River, New Brunswick, Canada, and as far south as Indian River, Florida (NMFS 1998b). The NMFS recognizes 19 distinct population segments inhabiting 25 river systems within this range (NMFS 1998b). The closest distinct population segment to the Action Area is the Chesapeake Bay, which includes the Chesapeake Bay and Potomac River in Maryland and Virginia.

Shortnose sturgeons are a migratory species influenced by temperature and salinity, tending to prefer warmer temperatures and lower salinity, and regularly migrating between freshwater and mesohaline river reaches (NMFS 1998b). In the northern part of their range, they spend the summer in the upper estuary and the winter in deep water, while in the southern part of their range, they spend the winter in the upper estuary and the summer at the mouth of the river. Throughout their range, they migrate upstream in the spring (VDGIF n.d. [g]).

Shortnose sturgeons travel up rivers to spawn. Their breeding season is from April to June when water temperatures reach approximately 46.4 to 53.6°F (8 to 12°C) (NMFS 1998b; VDGIF n.d. [g]). Little information on spawning behavior is available, but evidence suggests that shortnose sturgeon spawn in groups and form pair bonds (VDGIF n.d. [g]).

Status

No estimate of the historical shortnose sturgeon population size is available (NMFS n.d. [h]). The lack of shortnose sturgeon catches in the 1950s led the USFWS to conclude that the species had been eliminated from rivers in its historical range (except the Hudson River) (NMFS n.d. [h]). Current population estimates have been made for some river systems, and the total estimated adult population size for the best known rivers is approximately 10,000 individuals (VDGIF n.d. [g]). Historical trends for abundance have not been conclusive, but there is evidence to suggest a population decline (NMFS n.d. [h]). It is thought that restoration of the species may be achieved through the installation of fish ladders or the elimination of old dams, as well as hatchery culture and restocking (Murdy et al. 1997; VDGIF n.d. [g]).

Until recently in Virginia, the shortnose sturgeon was believed to have been extirpated from Virginia coastal rivers. However, a fish was collected from the Rappahannock River, the mouth of which is more than 50 miles (80.5 km) from the project area, in 1997 through the USFWS Sturgeon Reward Program. The species has also reappeared in the lower Susquehanna drainage. Prior to this, the last reported specimen of this species for the entire Chesapeake Bay basin was in 1876 in the Potomac River at Washington, D.C. The species is considered extremely rare in Virginia and is believed to have been extirpated from the coastal rivers (VDGIF n.d. [g]).

Threats

Threats endangering the shortnose sturgeon include construction of dams; pollution; bycatch; habitat alterations from discharges, dredging, or disposal of material into rivers; and development involving estuaries, rivers, and marshes (NMFS n.d. [h]; NMFS 1998b).

4.3.3.3 Occurrence in the Action Area

The shortnose sturgeon is unlikely to occur in the Action Area (Palmer 2011). This species is believed to have been extirpated from Virginia coastal rivers and rarely occurs in the ocean (VDGIF n.d. [g], NMFS 1998b). The closest recent record of the species was in the Rappahannock River in 1997 (VDGIF n.d. [g]). The mouth of the Rappahannock River is over 50 miles (80.5 km) from the Action Area.

4.3.3.4 Critical Habitat

Critical habitat has not been designated for the shortnose sturgeon (NMFS 2011).

4.4 Sea Turtles

4.4.1 Loggerhead Sea Turtle

4.4.1.1 Status

On March 16, 2010, NMFS published a proposed rule to list two DPSs of loggerhead sea turtles (*Caretta caretta*) as threatened and seven DPSs of loggerhead sea turtles as endangered (75 FR 12598). On September 16, 2011, a final listing determination was made designating the Northwest Atlantic Ocean DPS, South Atlantic Ocean DPS, Southeast Indo-Pacific Ocean DPS, and the Southwest Indian Ocean DPS as threatened. The Northeast Atlantic Ocean DPS, Mediterranean Sea DPS, North Indian Ocean DPS, North Pacific Ocean DPS, and South Pacific Ocean DPS have been designated as endangered (76 FR 58868). The effective date of listing is October 24, 2011. The species of loggerhead sea turtle likely to be present in the Action Area is the threatened Northwest Atlantic DPS.

4.4.1.2 Species Biology

Description

The loggerhead sea turtle is named for its relatively large head, which supports powerful jaws (NMFS n.d. [i]). Its powerful jaws are well suited to eating hard-shelled prey. The horseshoe crab is an important benthic food species of the loggerhead sea turtle. The horseshoe crab favors water that is 13 to 67 ft (4.0 to 20.4 m) deep. The loggerhead sea turtle also feeds on other crustaceans, mollusks, jellyfish, and sometimes fish and eelgrass (NYSDEC n.d. [b]). The straight carapace length of adults in the southeastern United States averages approximately 3 ft (0.9 m), with a corresponding weight of approximately 250 lbs (113 kg) (NMFS n.d. [i]). The carapace is brown to reddish brown and can be tinged with olive (VDGIF n.d. [h]).

Loggerhead sea turtles reach sexual maturity at about 35 years of age (NMFS n.d. [i]). Females lay eggs in three to five nests during a single nesting season, with each nest containing 87 to 147 eggs (NMFS n.d. [i]; VDGIF n.d. [h]). Nests are typically on a high beach that is not inundated by high tides or groundwater. Females can nest every year, but most nest every second or third year (VDGIF n.d. [h]). With a hearing threshold of 100 to 1,000 Hz (Ketten and Bartol 2005), loggerhead sea turtles (as with other sea turtle species) are sensitive to low-frequency sounds).

Distribution

Loggerhead sea turtles occur in temperate and tropical waters of the Atlantic, Pacific, and Indian Oceans (NMFS 2008). In the Atlantic, their range extends from Newfoundland, Canada, to Argentina (NMFS n.d. [i]). Nesting occurs from April to August, primarily in the subtropics (VDGIF n.d. [h]). In the eastern United States, the majority of loggerhead sea turtle nesting occurs from North Carolina through southwest Florida. Some nesting also occurs in southern Virginia and along the Gulf of Mexico coast westward into Texas (NMFS n.d. [i]).

As part of the loggerhead sea turtle recovery effort, the NMFS and USFWS have divided the Northwestern Atlantic population into five recovery units. Four of the five recovery units represent nesting assemblages in the southeastern United States; the fifth recovery unit includes all other nesting assemblages within the Northwest Atlantic. Loggerhead sea turtles occurring off of Virginia are part of the Northern Recovery Unit, which includes loggerheads originating from nesting beaches from southern Virginia to the Florida-Georgia border (NMFS 2008). This unit makes up the second-largest aggregation of loggerhead sea turtles in the Northwest Atlantic (NMFS 2008).

The loggerhead sea turtle is the most common sea turtle in Virginia waters and occurs within the Chesapeake Bay from Baltimore southward; in the estuaries of all the major rivers; along Virginia's entire Atlantic coast; and into the lagoons and channels between and landward of barrier islands (Terwilliger and Musick 1995). The lower Chesapeake Bay estuary and the Atlantic coastline provide important developmental habitat for immature loggerhead sea turtles because of the submerged aquatic vegetation (SAV) beds and a rich diversity of bottom-dwelling fauna that provide them with both cover and forage. They begin occurring in nearshore habitats in the mid-Atlantic when water temperatures rise in the spring and remain until early fall. In Virginia, they typically occur when water temperatures rise above 51.8°F (11°C), usually in early May (Colligan 2011). When water temperatures begin to decrease in the fall, loggerhead sea turtles begin to migrate south, leaving Virginia's waters. This typically occurs by the first week of November (Colligan 2011).

Status

The loggerhead sea turtle is the most abundant species of sea turtle found in United States' coastal waters (NMFS n.d. [i]). Average annual nest totals for the Northern Recovery Unit averaged 5,215 nests from 1989 through 2008. The nesting trend has declined by 1.3 percent since 1983, and strong statistical evidence suggests the population has experienced a long-term decline (NMFS 2008).

Aerial surveys conducted from 2001 through 2004 showed that there has been a 65 percent to 75 percent decline in sea turtle populations in the Chesapeake Bay since the 1980s (NMFS 2008).

Threats

Threats endangering loggerhead sea turtles include beach development, bulkheading, and vehicular use of beaches that destroys nesting habitat. Beach lighting is another potential threat as it may discourage turtles from nesting and disorient hatchling turtles (Buhlman et al. 1992). Other threats include bottom trawl, pelagic longline, demersal longline, and demersal large-mesh gillnet fisheries; beach armoring; marine debris ingestion; beach erosion; vessel strikes; legal and illegal harvest; oil pollution; and predation by native and exotic species (NMFS 2008).

4.4.1.3 Occurrence in the Action Area

Loggerhead sea turtles occur in the coastal waters of Virginia primarily during late spring, summer, and early fall, typically arriving in early May and departing in early November (Colligan 2011). Up to 9,000 loggerheads may inhabit the Chesapeake Bay during the summer months (Terwilliger and Musick 1995).

Nesting Records

The loggerhead sea turtle is the only recurrent nesting species of sea turtle in southeastern Virginia, with most nests occurring at Back Bay NWR. However, nests are occasionally documented outside of the NWR. A loggerhead sea turtle nested on the northern portion of the Dam Neck Annex beach in 1992 (Navy 2006). Eggs from this nest were relocated to Back Bay NWR, where they hatched successfully (Navy 2006). A loggerhead sea turtle also nested unsuccessfully on the southern portion of the Dam Neck Annex beach in 2002 (Navy 2006).

Stranding Records

In Virginia, sea turtle strandings primarily occur in late spring, summer, and fall. In Virginia during the 1990s, an average of 83 sea turtle strandings occurred per year. Since 2001, the average annual number of sea turtle strandings in Virginia has increased to 292, and these included a high of 531 in 2003 and a low of 184 in 2010 (Swingle et al. 2011). In 2003, 13 loggerhead sea turtle strandings were reported on the Dam Neck Annex beach (Navy 2006).

In 2009, sea turtle strandings in Virginia Beach and Norfolk comprised approximately 53 percent of all strandings reported by the Virginia Aquarium and Marine Science Center Foundation Stranding Response Program (VAQS) and stranding network cooperators trained by the Virginia Aquarium Stranding Center (VASC) (Swingle et al. 2010). Of the commonwealth's strandings, the loggerhead sea turtle was the most common, comprising 165 (seven of which were live) of the 227 (73 percent) reported strandings (Swingle et al. 2010).

In 2010, sea turtle strandings in Virginia Beach, Norfolk, and other southside Virginia cities comprised approximately 45 percent of the strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2011). Of the commonwealth's strandings, the loggerhead sea turtle was the most common, comprising 128 (six of which were live) of the 184 (70 percent) reported strandings (Swingle et al. 2011).

4.4.1.4 Critical Habitat

Critical habitat has not been designated for the loggerhead sea turtle (NMFS 2011).

4.4.2 Green Sea Turtle

4.4.2.1 Status

The green sea turtle (*Chelonia mydas*) was listed under the ESA in 1978. The breeding populations in Florida and along the Pacific coast of Mexico are listed as endangered, while the species is listed as threatened throughout the rest of its range, including Virginia (NMFS 2011).

4.4.2.2 Species Biology

Description

The green sea turtle is the largest of the hard-shelled sea turtles, growing to a maximum length of approximately 4 ft (1.2 m) and weighing up to 440 lbs (200 kg) (USFWS 2011d). Adult green sea turtles are herbivorous, feeding on seagrasses, sea lettuce, and algae. Their diet is thought to give them their greenish body fat, for which they are named (NMFS n.d. [j]; NMFS 1991b). Their carapace can be black, gray, green, brown, or yellow (NMFS n.d. [j]).

Females can nest every year but generally nest every second, third, or fourth year (USFWS 2011d). A female may lay as many as nine clutches of eggs within a single nesting season. In Florida, female green sea turtles average 3.3 nests per season, with an average clutch size of 136 eggs (USFWS 2011d). The hearing threshold of the green sea turtle is the same as the loggerhead sea turtle (Ketten and Bartol 2005).

Distribution

The green sea turtle is globally distributed and most often found in tropical and subtropical waters along the continental coasts and islands between 30°N and 30°S (NMFS n.d. [j]). On the United States Atlantic and Gulf coasts, it is found in inshore and nearshore waters from Texas to Massachusetts (NMFS n.d. [j]; NMFS 1991b). Within the continental United States, the green sea turtle nests primarily in Florida and in smaller numbers in Georgia, South Carolina, and North Carolina (USFWS 2011d; NMFS 1991b). Their nesting season ranges from June through September.

Green sea turtles are generally found feeding in shallow waters of reefs, bays, inlets, lagoons, and shoals with an abundance of marine grass and algae. In addition to using coastal areas for feeding, they are also present in open ocean convergence zones and on beaches for nesting (NMFS n.d. [j]).

Several juvenile turtles, with an average length of approximately 12 in (30 cm), are typically seen in the Chesapeake Bay during the late summer and early fall (Virginia Institute of Marine Science 2011).

Status

Recent analyses by the Marine Turtle Specialist Group (MTSG) indicate that population declines have occurred to the species in all major ocean basins over the past 100 to 150 years. One particular study showed a 48 percent to 65 percent decline in the number of mature nesting females in the past 100 to 150 years (NMFS n.d. [j]).

The NMFS and USFWS completed a five-year review of the green sea turtle in 2007, gathering and synthesizing information regarding the status of the species' threatened breeding populations around the world. As part of this review, current nesting abundance was estimated for 46 threatened and endangered nesting concentrations around the world; the closest one to Dam Neck Annex on the Atlantic coast is located in Florida, and it is the only one included for the southeastern states. At that site, a nesting abundance of 5,055 was estimated, based on assessments from 2001 through 2005. The results indicated an increasing trend in that site's nesting abundance (NMFS and USFWS 2007).

Gaps in the understanding of green sea turtle biology, such as growth and age to maturity, annual reproduction output, and the oceanic phase of juveniles, serve as limiting factors in the effective modeling of populations and a full understanding of which nesting concentrations are at most risk (NMFS and USFWS 2007). To build upon previous efforts, such as those undertaken by the MTSG and those included as part of the NMFS and USFWS study and to achieve a fuller understanding of green sea turtle biology and its implications on population trends, tagging programs and other studies will be needed (NMFS and USFWS 2007).

Threats

The principal cause of the decline of the green sea turtle can be attributed to the long-term harvesting of eggs, as well as harvesting of juveniles and adults on their feeding grounds. Such harvesting still occurs in parts of the world (NMFS n.d. [j]). Other threats endangering green sea turtles include beach development, bulkheading, and vehicular use of beaches that can destroy nesting habitat. Beach lighting is also a potential threat as it may discourage turtles from nesting and disorient hatchling turtles. Entanglement in longline, pound net, gillnet, and trap/pot fishing gear; entrapment in bottom trawls and fishing dredges; beach armoring; marine debris ingestion; beach erosion; vessel strikes; legal and illegal harvest; pollution; and predation by native and exotic species also pose threats to green sea turtles (NMFS n.d. [j]; NMFS n.d. [k]; NMFS 1991b). Green sea turtles are also prone to the disease *fibropapillomatosis* (NMFS n.d. [j]).

4.4.2.3 Occurrence in the Action Area

Very few green sea turtles have been seen in the vicinity of Dam Neck Annex (Navy 2006). However, they occur seasonally, primarily from early May to November, in the coastal waters of Virginia (Colligan 2011). The green sea turtle does not typically nest as far north as Virginia; however, a nest was discovered on Sandbridge Beach, located approximately three miles south of the project area, in 2005 (Baker and Valentine n.d.).

Local Stranding Records

Sea turtle strandings in Virginia primarily occur in late spring, summer, and fall (Navy 2006).

In 2009, sea turtle strandings in Virginia Beach and Norfolk comprised approximately 53 percent of the strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2010). Of the commonwealth's strandings, green sea turtles comprised 10 of the 227 (4 percent) reported strandings (Swingle et al. 2010).

In 2010, sea turtle strandings in Virginia Beach, Norfolk, and other southside Virginia cities comprised approximately 45 percent of the strandings reported by

VAQS and stranding network cooperators trained by VASC (Swingle et al. 2011). Of the commonwealth's strandings, green sea turtles comprised 16 of the 184 (9 percent) reported strandings (Swingle et al. 2011).

4.4.2.4 Critical Habitat

No critical habitat is designated for the green sea turtle within the Action Area (NMFS 2011). Critical habitat has been designated for green sea turtles within coastal waters around Culebra Island, Puerto Rico (NMFS n.d. [j]).

4.4.3 Leatherback Sea Turtle

4.4.3.1 Status

The leatherback sea turtle (*Dermochelys coriacea*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.4.3.2 Species Biology

Description

The leatherback sea turtle is the largest sea turtle and largest living reptile in the world, with a maximum length of approximately 6.5 ft (2.0 m) and corresponding weight of approximately 2,000 lbs (907 kg) (NMFS n.d. [l]; NMFS 1992a). It is the only sea turtle species with a carapace that lacks hard, bony scutes (NMFS n.d. [l]; NMFS 1992a). Instead, the carapace of the leatherback sea turtle is covered by thick, leathery, oil-saturated connective tissue overlaying interlocking dermal bones (NMFS n.d. [l]; NMFS 1992a).

Leatherback sea turtles primarily eat jellyfish (VDGIF n.d. [i]). As such, their jaw, mouth, and throat have special adaptations for consumption of soft gelatinous prey (NMFS n.d. [l]; NMFS 1992a).

Female leatherback sea turtles nest every two to three years, averaging approximately six clutches per season, but can have up to nine clutches per season (VDGIF n.d. [i]). Each clutch averages approximately 100 eggs (NMFS n.d. [l]). The hearing threshold of the leatherback sea turtle is the same as the loggerhead sea turtle (Ketten and Bartol 2005).

Distribution

The leatherback sea turtle has a global distribution and is considered the most migratory and widespread sea turtle species (NMFS n.d. [l]; NMFS 1992a). They are primarily a pelagic (open water) species but are occasionally reported in coastal waters (NMFS n.d. [l]). They have been sighted along the entire coast of the eastern United States from the Gulf of Maine in the north to Puerto Rico, the Gulf of Mexico, and the United States Virgin Islands in the south (NMFS n.d. [l]; NMFS 1992a).

Canada's Atlantic coast supports one of the largest seasonal foraging populations of the leatherback sea turtle. In the eastern continental United States, minor nesting colonies occur in southeastern Florida (NMFS n.d. [l]; NMFS 1992a). Eggs are laid on sandy, tropical beaches from approximately March to July (NMFS n.d.

[l]; USFWS 2011e). Leatherback sea turtles mate in waters adjacent to nesting beaches and along migratory pathways. After nesting, females travel from tropical waters to more temperate latitudes to feed.

Adult leatherback sea turtles have thermoregulatory adaptations that allow them to tolerate colder water temperatures than other sea turtles, allowing them to seasonally forage as far north as Newfoundland (NMFS n.d. [l]). They migrate to more temperate latitudes in the summer to feed on high concentrations of jellyfish (NMFS n.d. [l], NMFS 1992a).

Status

In the Pacific, nesting populations of the leatherback sea turtle have declined by as much as 80 percent. The population trend in the Atlantic is less clear. Some populations in the Caribbean appear to be increasing but are substantially smaller than historical levels (NMFS n.d. [l]). Overall, studies of the population since 1981 show annual fluctuations but do not project a long-term decline (NMFS 1992a).

Threats

The primary threat to the leatherback sea turtle is legal and illegal harvesting of eggs and nesting females. Other threats include beach development, bulkheading, and vehicular use of beaches that can destroy nesting habitat. Beach lighting is also a potential threat as it may discourage turtles from nesting and disorient hatchling turtles. Entanglement in longline, pound net, gillnet, and trap/pot fishing gear; entrapment in bottom trawls and fishing dredges; beach armoring; marine debris ingestion; beach erosion; vessel strikes; pollution; and predation by native and exotic species also pose threats to leatherback sea turtles (NMFS n.d. [m]; NMFS n.d. [k]; NMFS 1992a).

4.4.3.3 Occurrence in the Action Area

The leatherback sea turtle is not known to nest as far north as Virginia. However, leatherbacks have been reported to occur relatively frequently off the coast in the vicinity of Dam Neck Annex (Navy 2006). They are expected to occur seasonally in Virginia waters from approximately early May until November. However, leatherback sea turtles are unlikely to occur in the Action Area because they are typically found in deeper, more offshore waters (Colligan 2011).

Local Stranding Records

Sea turtle strandings primarily occur in late spring, summer, and fall in Virginia (Navy 2006).

In 2009, sea turtle strandings in Virginia Beach and Norfolk comprised approximately 53 percent of all strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2010). Of the commonwealth's strandings, leatherback sea turtles comprised four of the 227 (1.7 percent) reported strandings (Swingle et al. 2010).

In 2010, sea turtle strandings in Virginia Beach, Norfolk, and other southside Virginia cities comprised approximately 45 percent of the strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2011). Of the commonwealth's strandings, leatherback sea turtles comprised four of the 184 (2.1 percent) reported strandings (Swingle et al. 2011).

4.4.3.4 Critical Habitat

No critical habitat is designated for the leatherback sea turtle within the Action Area (NMFS 2011). Critical habitat has been designated since 1979 in the coastal waters adjacent to Sandy Point, St. Croix, and the United States Virgin Islands (NMFS n.d. [l]). On November 2, 2010, the Sierra Club petitioned to revise critical habitat for the leatherback sea turtle to include coastal waters of Puerto Rico (NMFS n.d. [l]).

4.4.4 Hawksbill Sea Turtle

4.4.4.1 Status

The hawksbill sea turtle (*Eretmochelys imbricate*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.4.4.2 Species Biology

Description

The hawksbill sea turtle grows to a length of 25 to 35 in (0.6 to 0.9 m), with a corresponding weight of 100 to 150 lbs (45 to 68 kg) (NMFS n.d. [m]). The carapace has "tortoiseshell" coloration, ranging from dark to golden brown, with streaks of orange, red, or black (NMFS n.d. [m]). The head of the hawksbill sea turtle is elongated and tapers to a beak-like mouth, from which the species gets its name (NMFS n.d. [m]). The shape of the mouth allows it to reach into holes and crevasses of coral reefs to find sponges, which are the primary food source for adults (NMFS n.d. [m]).

Female hawksbill sea turtles nest every two to three years. In years when they nest, they lay eggs in three to five nests with each containing approximately 130 eggs (NMFS n.d. [m]). The hearing threshold of the hawksbill sea turtle is the same as the loggerhead sea turtle (Ketten and Bartol 2005).

Distribution

The hawksbill sea turtle is found in tropical and subtropical areas around the world, usually between the latitudes of 30° North and 30° South (NMFS n.d. [m]; NMFS 1993). They are most commonly associated with healthy coral reefs and can often be found around rocky outcrops and high-energy shoals where sponges are especially abundant. The species may also inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (NMFS n.d. [m])

In the continental United States, hawksbill sea turtles regularly occur in southern Florida and the Gulf of Mexico, particularly Texas. Their occurrence north of Florida is rare, but sightings have been reported as far north as Massachusetts

(NMFS n.d. [m]; NMFS 1993). In Florida, sightings have been reported in the reefs off Palm Beach, Broward, Miami-Dade, and Monroe counties (NMFS n.d. [m]).

Hawksbill sea turtles nest on sandy tropical beaches (VDGIF n.d. [j]). In the continental United States, nesting is restricted to the southeast coast of Florida and the Florida Keys (NMFS n.d. [m]; NMFS 1993).

Status

Hawksbill sea turtles are solitary nesters, making the development of a population estimate or trend from nesting beaches difficult. Despite this, it is known that the largest population in the Western Atlantic occurs in the Caribbean. All countries in the Caribbean, with a few exceptions, report fewer than 100 nesting females annually (NMFS 1993). Hawksbill sea turtle nests in Florida between 1979 and 1990 ranged from zero to two nests per year (NMFS 1993). Studies conducted in 1989 suggest that hawksbill sea turtle populations in the Western Atlantic and Caribbean region are experiencing severe declines.

Threats

Threats endangering hawksbill sea turtles include beach development, bulkheading, and vehicular use of beaches that can destroy nesting habitat. Beach lighting is another potential threat because it may discourage turtles from nesting and disorient hatchling turtles. Other threats include entanglement in longline, pound net, gillnet, and trap/pot fishing gear; entrapment in bottom trawls and fishing dredges; beach armoring; marine debris ingestion; beach erosion; vessel strikes; legal and illegal harvest; pollution; and predation by native and exotic species (NMFS n.d. [m]; NMFS n.d. [k]; NMFS 1993).

4.4.4.3 Occurrence in the Action Area

Very few hawksbill sea turtles have been observed in the vicinity of Dam Neck Annex (Navy 2006). The hawksbill sea turtle does not nest as far north as Virginia (NMFS n.d. [m]; NMFS 1993). The species is mainly isolated to the tropics and only occurs accidentally in Virginia (VDGIF n.d. [j]). The first documented occurrence of this species in Virginia was made in November 1990, when an individual was sighted in the lower Chesapeake Bay near Ocean View, Norfolk (VDGIF n.d. [j]). Because of this scarcity, the hawksbill sea turtle is unlikely to occur in the Action Area (Palmer 2011).

Local Stranding Records

No hawksbill sea turtle strandings were reported in 2009 or 2010 in the vicinity of Virginia Beach and Norfolk (Swingle et al. 2010; Swingle et al. 2011).

4.4.4.4 Critical Habitat

No critical habitat is designated for the hawksbill sea turtle within the Action Area (NMFS 2011). Critical habitat has been designated for hawksbill sea turtles within the coastal waters surrounding the Puerto Rican islands of Mona and Monito (NMFS n.d. [m]).

4.4.5 Kemp's Ridley Sea Turtle

4.4.5.1 Status

The Kemp's ridley sea turtle (*Lepidochelys kempii*) was listed as federally endangered under the ESA in 1970 (NMFS 2011).

4.4.5.2 Species Biology

Description

The Kemp's ridley sea turtle is the smallest sea turtle, growing to a length of 24 to 28 in (0.6 to 0.7 m) in length, with an average weight of 100 lbs (45 kg) (NMFS n.d. [n]). The carapace of the Kemp's ridley sea turtle is grayish green, and its preferred diet is crabs, although it may also eat fish, jellyfish, and mollusks (NMFS n.d. [n]).

Nesting occurs from May to July, with females laying two to three clutches of approximately 100 eggs each (USFWS 2011f). The hearing threshold of the Kemp's ridley sea turtle is the same as the loggerhead sea turtle (Ketten and Bartol 2005).

Distribution

The Kemp's ridley sea turtle is found only in the Gulf of Mexico and along the Atlantic coast of the United States. It is a nearshore species, rarely going into waters deeper than 160 ft (50 m) (NMFS n.d. [n]). The species usually inhabits neritic zones containing muddy or sandy bottoms where much of their prey can be found (NMFS n.d. [n]; NMFS 1992b).

Ninety-five percent of Kemp's ridley sea turtle nesting occurs in the state of Tamaulipas, Mexico, where females arrive onshore to nest in a large group; this is called an "*arribada*," which means "arrival" in Spanish (NMFS n.d. [n]). *Arribada* nesting behavior is only exhibited by the genus *Lepidochelys*, which contains the Kemp's ridley sea turtle and one other species, the olive ridley sea turtle (*L. olivacea*) (NMFS n.d. [n]). In addition to Tamaulipas, nesting occurs consistently, on a smaller scale, in Veracruz, Mexico, and Padre Island National Seashore, Texas (NMFS n.d. [n]; USFWS 2011f). Occasional nesting has been documented in North Carolina, South Carolina, and the Gulf and Atlantic coasts of Florida (NMFS n.d. [n]).

The nearshore and inshore waters of the northern Gulf of Mexico, particularly salt marshes in Louisiana, are important foraging habitat for the Kemp's ridley sea turtle (USFWS 2011f). However, the species may forage as far north as Nova Scotia, Canada (NMFS n.d. [n]). The Chesapeake Bay, Virginia, has the largest known concentration of juvenile Kemp's ridley sea turtles, which use SAV as their primary habitat, especially from May to November (VDGIF n.d. [k]; Terwilliger and Musick 1995). Their preferred food source in the Chesapeake Bay is the blue crab (*Callinectes sapidus*) (VDGIF n.d. [k]).

Status

The Kemp's ridley sea turtle is the most seriously endangered sea turtle (USFWS 2011f). There has been a historical, dramatic decrease in *arribada* size. In 1947, it was estimated that 42,000 turtles nested in a single day at Rancho Nuevo, Tamaulipa, Mexico, but between 1978 and 1991 only 200 Kemp's ridley sea turtles nested annually at this location (NMFS n.d. [n]). The species appears to be recovering from these low numbers, with 7,866 nests documented at Rancho Nuevo in 2006.

Threats

Threats endangering the Kemp's ridley sea turtle include beach development, bulkheading, and vehicular use of beaches that can destroy nesting habitat. Beach lighting is another potential threat because it may discourage turtles from nesting and disorient hatchling turtles. Additional threats include entanglement in longline, pound net, gillnet, and trap/pot fishing gear; entrapment in bottom trawls and fishing dredges; beach armoring; marine debris ingestion; beach erosion; vessel strikes; legal and illegal harvest; pollution; and predation by native and exotic species (NMFS n.d. [n]; NMFS n.d. [k]; NMFS 1992b).

4.4.5.3 Occurrence in the Action Area

The Kemp's ridley sea turtle occurs seasonally in the coastal waters of Virginia, typically from early May to November (Colligan 2011; Terwilliger and Musick 1995). They have been observed frequently off the coast at Dam Neck (Navy 2006). Kemp's ridley sea turtles do not nest in Virginia.

Local Stranding Records

Sea turtle strandings primarily occur in late spring, summer, and fall in Virginia (Navy 2006).

In 2009, sea turtle strandings in Virginia Beach and Norfolk comprised approximately 53 percent of the strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2010). Of the commonwealth's strandings, Kemp's ridley sea turtles comprised 48 of the 227 (21 percent) reported strandings (Swingle et al. 2010). This species was second only to the loggerhead sea turtle for the highest number of sea turtle strandings in 2009 (Swingle et al. 2010).

In 2010, sea turtle strandings in Virginia Beach, Norfolk, and other southside Virginia cities comprised approximately 45 percent of the strandings reported by VAQS and stranding network cooperators trained by VASC (Swingle et al. 2011). Of the commonwealth's strandings, Kemp's ridley sea turtles comprised 33 of the 184 (18 percent) reported strandings (Swingle et al. 2011). As in 2009, this species was second only to the loggerhead sea turtle for the highest number of sea turtle strandings in 2010 (Swingle et al. 2011).

4.4.5.4 Critical Habitat

No critical habitat is designated for the Kemp's ridley sea turtle within the Action Area (NMFS 2011). The NMFS and USFWS were petitioned on February 17, 2010, to designate critical habitat for nesting beaches on the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean. The petition is currently being reviewed (NMFS n.d. [n]).

4.5 Plants

4.5.1 Seabeach Amaranth

4.5.1.1 Status

The seabeach amaranth (*Amaranthus pumilus*) was listed as federally threatened under the ESA in 1993 (USFWS n.d.).

4.5.1.2 Species Biology

Description

Seabeach amaranth is an annual plant that is considered an effective sand-binder and is valued for its ability to stabilize sand dunes. It grows in clumps often reaching 11.8 in (30 cm) in diameter with five to 20 branches, but it can occasionally grow to over 3.3 ft (1 m) across with more than 100 branches (USFWS n.d.).

Germination generally occurs from April to July. Flowering can begin as early as June and continues until the death of the plant in the late fall. Seed production begins in July and peaks in September (USFWS n.d.).

Distribution

Seabeach amaranth occurs on sand dunes of Atlantic Ocean beaches from New York to South Carolina. Historically, this species was distributed from Massachusetts to South Carolina.

It grows on barrier island beaches, primarily on overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches. There are records of occasional temporary populations occurring in other habitats, such as on blowouts in foredunes, sound-side beaches, and shell/sand material or dredge soil placed as beach replenishment. Despite these occasional occurrences, it appears to need extensive areas of barrier islands and inlets to establish regular populations. It is intolerant of competition and, as a result, does not grow on well-vegetated sites (USFWS n.d.).

Status

Total seabeach amaranth numbers reported in 2005 rangewide were the lowest reported since 1999 (USFWS 2005). The Maryland and Virginia populations have been declining steadily since 2002 (USFWS 2005). Annual surveys conducted in Maryland and Virginia since 1987 showed no presence of seabeach amaranth until 1998. Since 1998, numbers have reached a low of one to a high of 878 individuals. These counts were conducted on Assateague Island (Maryland side) and the Chincoteague NWR (Virginia side). The opportunistic growth behavior of the species and its constantly changing habitat makes it difficult to make accurate estimates of population size based on the annual surveys described above (USFWS 2005). This also may be the reason that population count numbers fluctuate so widely.

Threats

The seabeach amaranth is most threatened by the construction of beach stabilization structures, beach erosion, tidal inundation, invasive species, beach grooming, herbivory by insects (primarily webworm [*Pyralidae*]) and feral animals, and disturbance by off-road vehicles (USFWS n.d.; USFWS 2005). Beach replenishment projects are not believed to be detrimental to the species if they are completed between November 16 and March 31, when seabeach amaranth has senesced. If completed outside this window, these projects run the risk of burying live plants, which would be an additional threat to the species' survival (USFWS 2005).

4.5.1.3 Occurrence in the Action Area

Seabeach amaranth is unlikely to occur in the Action Area. This species prefers undisturbed barrier island habitat. The Division of Natural Heritage conducted field surveys at Dam Neck Annex in 1990. These surveys reported no occurrence of seabeach amaranth within the Action Area or elsewhere at Dam Neck Annex (Buhlmann et al. 1992). Regardless, according to consultations with USFWS, there is a potential that the species could occur.

In Virginia, extant populations of seabeach amaranth exist at Chincoteague NWR. Hog Island, False Cape State Park, Cape Henry/Fort Story, and Fisherman's Island in Virginia have been surveyed various times, and no plants have been found (USFWS 2005).

4.5.1.4 Critical Habitat

Critical habitat has not been designated for the seabeach amaranth (USFWS n.d.).

5 Analysis of Effects of the Proposed Action

5.1 Whales

5.1.1 Blue Whale

Determination of Effects

The blue whale is unlikely to occur in the Action Area. Therefore, the proposed action would have no effect on the species.

5.1.2 Finback Whale

The finback whale is the most commonly observed large cetacean species in all seasons in the United States Atlantic Exclusive Economic Zone (EEZ), which includes waters off Virginia (Waring et al. 2009). Northerly migration occurs in spring and summer, while southerly migration occurs in winter (Blaylock 1985). Finback whales calve in the mid-Atlantic region between October and January, and they typically move farther offshore in winter (Blaylock 1985; Waring et al. 2009). There are records of finback whales feeding off the coast of Virginia, and individuals have been found stranded in Virginia several times (Blaylock 1985; NMFS 2006b).

5.1.2.1 Potential Direct and Indirect Effects of Alternative 1

Vessel collisions are a prominent anthropogenic cause of injury and mortality in many whale species, particularly finback whales, which are the most frequently struck (Laist et al. 2001). Finback whales may be particularly vulnerable to vessel collisions due to their habit of sleeping on the surface at night (Blaylock 1985). Larger (greater than 262 feet [80 m]) in length and faster-moving (greater than 14 kn) vessels are responsible for more known whale strikes than smaller or slower ships (Laist et al. 2001). A recent study examining the influence of vessel speed in contributing to either a lethal injury (killed or severely injured) or a non-lethal injury (minor or no injury) to large whales when struck found that the probability of lethal injury increased as vessel speed increased (Vanderlaan and Taggart 2007). At vessel speeds of 8.6 kn the probability of lethal injury from a vessel strike was approximately 20 percent; the probability of lethal injury at 15 kn was approximately 80 percent (Vanderlaan and Taggart 2007). The probability of lethal injury at vessel speeds less than 4 kn is close to zero, while above 15 kn it is close to 100 percent (Vanderlaan and Taggart 2007). Mortalities caused by vessel strikes have been reported in recent years in Virginia waters, including one on

March 26, 2005, off Virginia Beach and on March 25, 2007, in Norfolk Harbor (Waring et al. 2009). As described in Section 2.1.1, the hopper dredge would travel at approximately 2 to 3 kn while dredging, and during transit to and from the shoal from November 1 through April 30 the dredge would not exceed 10 kn. If a collision were to occur, based on the study by Vanderlaan and Taggart (2007), the probability of a lethal injury to a whale at the speeds the hopper dredge would be moving would be relatively low; close to zero while dredging, and less than 30 percent when moving at 10 kn. The use of NMFS-approved observers on the vessels would further reduce the probability of collisions (see Section 5.1.2.3).

Under Alternative 1, collisions of the hopper dredge with finback whales in the Action Area would be possible. Finback whale calves and their mothers could be at risk of collisions if dredging operations occur during winter months.

Emissions of low frequency noise during dredging operations also may directly and negatively affect finback whales in the Action Area. Hopper dredges produce continuous low-frequency noise, typically at less than 1,000 Hz, with the loudest noise emitted during loading and unloading of sand (Thomsen et al. 2009). Noise levels tend to fluctuate and depend on a variety of environmental factors (e.g., substrate, weather) as well as the actions and conditions of the dredge itself. Ambient noise levels of an active military installation and an area used for recreational and commercial boating would be variable but above typical background levels. Noise from dredging operations is continuous and may be above ambient noise levels many kilometers from the source. Calculations by the NMFS for a similar dredge project in Virginia reported noise levels of 164 dB re 1µPa at 1 m (3.3 ft) from the source (NMFS July 22, 2010; Kurkul October 26, 2011). For the same project, NMFS calculated noise levels of 120 dB re 1µPa within 794 m (2,605 ft) of the dredge (NMFS July 22, 2010; Kurkul October 26, 2011).

Finback whales, as with all baleen whales, exhibit lower frequency hearing than do other groups of marine mammals and may be more susceptible to low frequency anthropogenic noises similar to those created during dredging operations (Southall et al. 2007; Thomsen et al. 2009). The Marine Mammal Protection Act (MMPA) began employing generic noise thresholds in 1997 to determine whether activities producing sound resulted in a "take" of marine mammals by way of harassment (NMFS 2005b). The MMPA defines harassment on two levels: Level A harassment is associated with any activity with the potential to injure or kill wild marine mammals, and Level B harassment is associated with any activity that disrupts behavioral patterns of wild marine mammals. The generic thresholds consider 180 dB re 1µPa to be Level A harassment, and 120 dB re 1µPa (continuous sound) to be Level B harassment (160 dB re 1µPa for impulse sounds). The NMFS is currently in the process of developing new thresholds that consider multiple variables, including hearing function of species, noise type, and other factors; however, these criteria have not been finalized. Recommendations for these guidelines are presented by Southall et al. (2007) and indicate that noise thresholds for low-frequency cetaceans during continuous sound (like dredging) activities could be increased with the approval of the new criteria.

Relatively little is known about the effects of most anthropogenic ocean noise on marine mammals (The National Academies 2003). Direct effects may include behavioral disruption, such as altering reproduction, communication, and reduced predator avoidance, as well as displacement, avoidance of the area, physiological damage, or impairment (e.g., masking hearing), and even death (Southall et al. 2007). While physiological damage and death are potential direct impacts of acoustic disturbance of whales, there is no evidence that sound produced during dredging operations has caused these impacts to any whale species. Furthermore, indirect effects like displacement of prey may negatively impact marine mammals.

According to current thresholds of harassment under the MMPA, marine mammals (i.e., finback whales) could be impacted by dredging noise if individuals were to be in the immediate vicinity (within 1 m) of operations. This is unlikely, as whales would likely avoid the source of the noise. In addition, as discussed in Section 5.1.2.3 below, NMFS-approved observers will monitor the area for finback whales and other protected species to prevent the dredge from approaching too close to them. Noise levels would likely be high enough within at least approximately 800 m (2,625 ft) of the operations (according to generic Level B thresholds) to disturb whales enough to disrupt behavioral patterns (NMFS July 22, 2010; Kurkul October 26, 2011). While noise produced from dredging operations may not be classified as harassment by MMPA criteria beyond 800 m (2,625 ft) from the source, it is possible that finback whales or other species may be affected for several kilometers beyond the source, as the sounds could still be louder than ambient levels. The effects of dredging noise on finback whales, as well as their response to it, are not well known and likely vary by individual, but they could include temporary displacement from the Action Area during operations.

The dredging of offshore sand under Alternative 1 could generate some turbidity plumes that may have temporary negative effects on marine mammals in the Action Area. Turbidity plumes at Sandbridge Shoal would likely be limited to short durations and minimal spreading due to the dynamic nature of the offshore environment and the grain size of the material being removed. The sediment found at Sandbridge Shoal is composed primarily of medium-grained sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Turbidity created by the removal of sand at the offshore borrow site would likely be similar to sedimentation disturbance caused by natural sediment transport processes (CSA International, Inc., et al. 2009). Sediment plumes up to 2,000 m (6,562 ft) from hopper dredges have been recorded for sediments composed of silty clay (LaSalle et al. 1991). Because the sediments found at Sandbridge Shoal are of a coarser grain size it is likely that the plumes would be much smaller. Anchor Environmental (2003) reported that turbidity plume concentrations from hopper dredges in the nearfield can range between 80 to 475 mg/L and decrease quickly with distance from the dredge. Much less information is available regarding turbidity plumes in offshore environments because of the tendency for offshore sands to be coarser and the more dynamic oceanographic conditions that are found in the open ocean environment, which minimize settling effects and reduce the time in the water column (CSA International, Inc. et al. 2009).

Turbidity may affect foraging success and prey availability due to avoidance of the affected area by important prey species. However under Alternative 1, the primary effects of turbidity on whales would not be expected to be significant because the increased turbidity would be short-lived, and whales could forage in nearby waters until the sediment settled.

Fuel spills from the dredge are unlikely but possible. Potential spills would be relatively small, and adequate prevention and response plans would be in place. As a result, any impacts resulting from fuel spills would be expected to be minor.

5.1.2.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on finback whales under Alternative 2 are expected to be similar to those under Alternative 1; however, more sand would need to be dredged to build new dunes under Alternative 2. This would result in a greater area affected and a longer duration of dredging operations compared to Alternative 1. Alternative 2 would also increase the potential for vessel-whale collisions, as the hopper dredge would be operating for a longer time period. Similarly, noise and turbidity impacts, and the potential for fuel spills, would each increase. Although these impacts would be longer in duration under Alternative 2 than under Alternative 1, they would remain temporary impacts.

5.1.2.3 Actions to Reduce Adverse Effects

NMFS-approved observers meeting the Observer Requirements outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) will be required to monitor the Action Area for finback whales and other protected species. The primary concern in monitoring for whales would be spotting individuals in the vicinity of the dredge to prevent their collisions with moving vessels. Observations of whales within 3,280 ft (1,000 m) of the dredging operation would result in an immediate suspension of activity until the individual's protection could be assured. During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable. Weekly summary reports would be submitted to the Northeast Region of NMFS by the observers.

NMFS also restricts vessels more than 213 ft (65 m) long traveling in United States waters in the mid-Atlantic region from speeds greater than 10 kn between November 1 and April 30 (50 CFR 224.105). The protections are in place primarily to reduce collisions with North Atlantic right whales but are also effective for all whale species as most collisions occur at speeds greater than 14 kn (Laist et al. 2001). The hopper dredge operating under the Dam Neck Annex SPS replenishment project would adhere to these guidelines, reducing the potential for collisions with finback whales and other cetaceans. Additionally, dredge operators will conform to the regulations prohibiting the approach of North Atlantic right whales closer than 500 yards (1500 ft) (50 CFR 224.103(c)) and other threatened or endangered species of whales no closer than 100 ft. Any vessel finding itself within these buffer zones created by a surfacing whale must depart the area immediately at safe, slow speed. Dredge operators will also monitor the North Atlantic right whale sighting reports to remain informed on the whereabouts of right whales within the vicinity of the Action Area. These include the Sighting Advisory System (SAS), Dynamic Management Areas (DMAs), and Seasonal Management Areas (SMAs).

Overflow of hoppers during loading is the largest contributor to turbidity in dredging operations (MMS 1999). Operational techniques and other measures would be considered in an effort to reduce the size and duration of turbidity plumes during dredging. Sediments ideal for beach replenishment (i.e., those with less silt and clay) are also best for minimizing turbidity plumes. As a result, plumes are expected to be smaller in area and duration for this operation than for other dredging activities.

Fuel spill prevention and response plans would be implemented to reduce the likelihood of vessel fuel spills during fuel transfer or accidents and to minimize the impacts on the local environment should a spill occur. As a result, the effects of any spills would be minor.

5.1.2.4 Determination of Effects

The finback whale may occur in the Action Area throughout the year. Impacts on this species would be minimized by the actions discussed in Section 5.1.2.3, and all impacts would be temporary. Therefore, the Navy has determined that activities under both Alternatives 1 and 2 may affect but are not likely to adversely affect the finback whale.

5.1.3 Humpback Whale

Humpback whales may be found in the waters off the coast of Virginia year-round. Many are migrating to or from their breeding and calving grounds in the West Indies; however, it has also been suggested that the mid-Atlantic region serves as a supplemental winter feeding ground for the species (Waring et al. 2009). In recent years, humpback whale strandings along the mid-Atlantic coastline have revealed that these areas may be important habitat for juveniles, particularly during the fall, winter, and spring (Wiley et al. 1995; Waring et al. 2009).

5.1.3.1 Potential Direct and Indirect Effects of Alternative 1

Under Alternative 1, collisions between humpback whales and the hopper dredge used to transport sand in the Action area could be possible. Immature humpback whales may be at greater risk of collisions if dredging operations occur during the winter months because the Action Area may be an important winter foraging area. A discussion of vessel collisions with whales is presented in Section 5.1.2.1. As described in Section 2.1.1, the hopper dredge would travel at approximately 2 to 3 kn while dredging. From November 1 through April 30, during transit to and from the shoal, the dredge would not exceed 10 kn. A study by Vanderlaan and Taggart (2007) indicates that if a collision were to occur the probability of a lethal injury of a whale at the speeds the hopper dredge would be moving would be relatively low—close to zero while dredging and less than 30 percent when moving at

10 kn. The use of NMFS-approved observers on the vessel would further reduce the probability of collisions (see Section 5.1.2.3).

Humpback whales, like finback whales, exhibit greater lower-frequency hearing than other groups of marine mammals (Southall et al. 2007; Thomsen et al. 2009). As a result, noise created from dredging operations (described in Section 5.1.2.1) may have similar negative effects on humpback whales. The primary effect would be avoidance of the Action Area during dredging operations; however, other behavioral disruptions, displacement of prey, and injury would be possible (The National Academies 2003).

Dredging offshore sand under Alternative 1 could generate some turbidity plumes that may have temporary negative effects on marine mammals in the Action Area (see Section 5.1.2.1). Under Alternative 1, the primary effects of turbidity on humpback whales would not be expected to be significant because the turbidity would be short-lived, and whales could forage in nearby waters until the sediment settled.

Fuel spills from the dredge are unlikely but possible. Potential spills would be relatively small, and adequate prevention and response plans would be in place. As a result, any impacts resulting from fuel spills would be expected to be minor.

5.1.3.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on humpback whales under Alternative 2 are expected to be similar to those under Alternative 1; however, more sand would need to be dredged to build new dunes under Alternative 2, which would result in a greater area affected and a longer duration of dredging operations compared to Alternative 1. Alternative 2 would increase the potential for vessel-whale collisions, as the hopper dredge would be operating for a longer time period. Similarly, noise and turbidity impacts and the potential for fuel spills would increase under this alternative. Although these impacts would be longer in duration under Alternative 2 than under Alternative 1, they would remain temporary impacts.

5.1.3.3 Actions to Reduce Adverse Effects

Actions to reduce impacts on the humpback whale under Alternatives 1 or 2 would be the same as those described for the finback whale (see Section 5.1.2.3).

5.1.3.4 Determination of Effects

The humpback whale may occur in the Action Area throughout the year. Impacts on this species would be minimized by the actions discussed in Section 5.1.2.3 and all impacts would be temporary. Therefore, the Navy has determined that activities under both Alternatives 1 and 2 may affect but are not likely to adversely affect the humpback whale.

5.1.4 North Atlantic Right Whale

North Atlantic right whales may occur off the Virginia coast in fall, winter, and spring. Most individuals occurring in the region during these seasons are expected to be transient, traveling between the New England region and areas south of Virginia.

5.1.4.1 Potential Direct and Indirect Effects of Alternative 1
Potential impacts on the North Atlantic right whale would be similar to those described for the finback whale (see Section 5.1.2.1).

5.1.4.2 Potential Direct and Indirect Effects of Alternative 2
Potential impacts on North Atlantic right whales under Alternative 2 are expected to be similar to those described for the finback whale (see Section 5.1.2.2).

5.1.4.3 Actions to Reduce Adverse Effects
Actions to reduce impacts on the North Atlantic right whale under Alternative 1 or 2 would be the same as described for the finback whale (see Section 5.1.2.3).

5.1.4.4 Determination of Effects
The North Atlantic right whale may occur in the Action Area in fall, winter, and spring. Impacts on this species would be minimized by the actions discussed in Section 5.1.2.3 and all impacts would be temporary. Therefore, the Navy has determined that activities under both Alternatives 1 and 2 may affect but are not likely to adversely affect the North Atlantic right whale.

5.1.5 Sei Whale

Determination of Effects
The sei whale is unlikely to occur in the Action Area. Therefore, the proposed action would have no effect on this species.

5.1.6 Sperm Whale

Determination of Effects
The sperm whale is unlikely to occur in the Action Area. Therefore, the proposed action would have no effect on this species.

5.2 Birds
5.2.1 Piping Plover
The piping plover is an uncommon transient on the southern mainland coast of Virginia and is most likely to occur during spring and fall migration. Individuals are occasionally observed foraging along the Dam Neck Annex beach, but no nests have been documented at the installation.

5.2.1.1 Potential Direct and Indirect Effects of Alternative 1
Under Alternative 1, the operation of heavy equipment and the presence of personnel associated with the placement of sand on the beach at Dam Neck Annex would result in disturbance to any piping plovers using the beach for foraging and roosting or passing through the area. Any piping plovers using the beach in the vicinity of the sand placement would be expected to cease their normal foraging, roosting, or flight behavior and fly to adjacent areas with suitable foraging or

roosting habitat. If piping plovers were flying over the sand placement area, they would be expected to alter their flight paths to avoid the area where the activity is occurring. This disturbance would be expected to be temporary, with piping plovers resuming use of the beach once the sand has been placed. Following placement of the sand, beachgrass planting will occur on the seaward side of the dune adjacent to the new beach. This activity may result in a similar temporary disturbance to piping plovers.

Placement of sand on the beach at Dam Neck Annex under Alternative 1 may also disrupt piping plover foraging by covering invertebrate organisms that the species relies on for food. However, this impact would be expected to be temporary as studies have shown that invertebrate organisms recolonize beaches relatively quickly (two to seven months) following replenishment (Greene 2002).

5.2.1.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on piping plovers under Alternative 2 are expected to be similar to those described under Alternative 1. However, the length of disturbance would likely be longer under Alternative 2 than under Alternative 1 because the construction of the manmade dune under Alternative 2 would require more time than simply placing sand and reshaping the existing dune and beaches under Alternative 1.

5.2.1.3 Actions to Reduce Adverse Effects

Piping plovers are not expected to nest at Dam Neck Annex; however, the Navy conducts nesting surveys (started in 2010) that are expected to continue. If a nest is discovered prior to or during sand placement, impact minimization measures such as avoidance of the nesting area would be implemented to avoid potential impacts. Dam Neck Annex will coordinate with the USFWS to ensure adequate protection in the event that any piping plover nests are discovered.

An annual migratory bird survey program, which will include piping plovers, is scheduled to begin in late FY 2012. These surveys will cover each of the fall and spring migration periods, the breeding season, and winter and summer resident periods. These surveys will allow the beach to be monitored before and after replenishment to identify any presence of the piping plover and will be repeated annually. In addition the Navy will modify existing monitoring procedures so that trained personnel will monitor the Dam Neck beach for the presence of piping plovers while conducting sea turtle monitoring, which is being carried out under the existing Sea Turtle Monitoring Protocol (Navy 2006), and during routine patrols of the beach throughout the year. The Navy will share information and coordinate with the USFWS if the survey and monitoring programs identify the presence of the piping plover.

If activities associated with sand placement occur during times when piping plovers may be present, a qualified biologist would conduct surveys and monitor the project area to ensure that no piping plovers are directly affected by these activities. If piping plovers are present, impact minimization measures such as avoiding the area until the birds move on would be implemented to avoid potential impacts.

5.2.1.4 Determination of Effects

The piping plover is not expected to nest in or near the vicinity of the Action Area. Based on previous observations, only individuals are likely to occasionally occur during spring and fall migration. Additionally, any potential impacts on the species under both Alternatives 1 and 2 would be temporary. Therefore, the Navy has determined that Alternatives 1 and 2 may affect but are not likely to adversely affect the piping plover.

5.2.2 Red Knot

The red knot is considered a locally common to abundant transient along the Virginia coast during spring migration from mid-May to early June and fall migration from mid-July to mid-September. It is considered uncommon to rare during the summer and winter months (VDGIF n.d. [d]). The red knot is most likely to use the Dam Neck Annex beach as a feeding area during migration; the species does not breed in the area.

5.2.2.1 Potential Direct and Indirect Effects of Alternative 1

Under Alternative 1, the operation of heavy equipment and the presence of personnel associated with the placement of sand on the beach at Dam Neck Annex would result in disturbance to red knots using the beach for foraging and roosting or passing through the area. Any red knots using the beach in the vicinity of the sand placement activity would be expected to cease their normal foraging, roosting, or flight behavior and fly to adjacent areas with suitable foraging or roosting habitat. If flying through the area, red knots would be expected to alter their flight paths to avoid the area where the activity is occurring. This disturbance is expected to be temporary, with red knots resuming use of the beach once the sand has been placed. Following placement of the sand, beachgrass planting will occur on the seaward side of the dune adjacent to the new beach. This activity may result in a similar temporary disturbance to red knots.

Placement of sand on the beach at Dam Neck Annex under Alternative 1 may also disrupt red knot foraging by covering invertebrate organisms that red knots rely on for food. However, this impact is expected to be temporary as studies have shown that invertebrate organisms recolonize beaches relatively quickly (two to seven months) following replenishment (Greene 2002).

5.2.2.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on red knots under Alternative 2 are expected to be similar to those described under Alternative 1. However, the length of disturbance would likely be longer under Alternative 2 than under Alternative 1 because the construction of the manmade dune under Alternative 2 would require more time than simply placing sand and reshaping the existing dune and beaches under Alternative 1.

5.2.2.3 Actions to Reduce Adverse Effects

An annual migratory bird survey program, which will include red knots, is scheduled to begin in late FY 2012. These surveys will cover each of the fall and spring migration periods, the breeding season, and winter and summer resident periods. These surveys will allow the beach to be monitored before and after replenishment to identify any presence of the red knot and will be repeated annually. If necessary the Navy will modify existing monitoring procedures so that trained personnel will monitor the Dam Neck beach for the presence of red knot while conducting sea turtle monitoring, which is being carried out under the existing Sea Turtle Monitoring Protocol (Navy 2006), and during routine patrols of the beach throughout the year. The Navy will share information and coordinate with the USFWS if the survey and monitoring programs identify the presence of the red knot.

If activities associated with the repairs of the SPS are conducted during times when the red knot may be present, a qualified biologist would conduct surveys and monitor the project area to ensure no birds are directly affected during construction. If red knots are present, impact minimization measures such as avoiding the area until the birds move on would be implemented to avoid potential impacts.

5.2.2.4 Determination of Effects

The red knot is only likely to occur on the Dam Neck Annex beach during spring and fall migration. Additionally, any potential impacts on the species under both Alternatives 1 and 2 would be temporary. Therefore, the Navy has determined that Alternatives 1 and 2 may affect but will not jeopardize the red knot.

5.2.3 Roseate Tern

The roseate tern no longer breeds south of Long Island, New York (USACE June 2009). In Virginia, it is a rare transient during migration in late summer (USFWS 2011).

5.2.3.1 Potential Direct and Indirect Effects of Alternative 1

Under Alternative 1, activities associated with dredging and pumping sand onto the beach at Dam Neck Annex would result in disturbance to roseate terns foraging offshore or passing through the area. Any roseate terns in the vicinity of these activities would be expected to cease their normal foraging or flight behavior and fly to adjacent areas with suitable forage. If flying, they would be expected to alter their flight paths to avoid the area where the activity is occurring. This disturbance would be expected to be temporary in nature, with roseate terns resuming normal foraging or flight behavior once these activities are completed.

5.2.3.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on roseate terns under Alternative 2 are expected to be similar to those described under Alternative 1.

5.2.3.3 Actions to Reduce Adverse Effects

If work were conducted in late summer, when roseate terns could potentially occur, the qualified biologist surveying for red knot would also be able to survey for roseate terns utilizing the beach and nearshore areas. If roseate terns are present, impact minimization measures such as avoiding the area until the birds move on would be implemented to avoid potential impacts.

5.2.3.4 Determination of Effects

The roseate tern may occur within the Action Area as a rare transient in late summer. If work is conducted during this time of year, any potential impacts on the species under both Alternatives 1 and 2 would be temporary. Therefore, the Navy has determined that Alternatives 1 and 2 may affect but are not likely to adversely affect the roseate tern.

5.3 Fish

5.3.1 Atlantic Sturgeon

The Atlantic sturgeon prefers shallow coastal waters between 33 and 164 ft (10 and 50 m) deep and is therefore likely to occur in the Action Area.

5.3.1.1 Potential Direct and Indirect Effects of Alternative 1

Under Alternative 1, juvenile Atlantic sturgeon could be adversely impacted by hopper dredge entrainment. Adult Atlantic sturgeon should not be susceptible to dredging entrainment because of their large size, up to 14 ft (4.3 m) in length and 600 lbs (272 kg) in weight. At the dredge site, entrained fish typically perish as a result of the centrifugal force of the hopper dredge's pump.

In addition to their small size, Atlantic sturgeon are primarily benthic feeders, resulting in a greater risk of entrainment. Entrainment is believed to take place primarily when the drag head is moving along the bottom at the same time that fish are feeding or resting near the bottom.

The preferred food sources of Atlantic sturgeon are relatively slow-moving benthic organisms such as worms, snails, aquatic insects, and crustaceans. The benthos at Sandbridge Shoal is likely to be dominated by polychaetes, followed by lesser concentrations of amphipods, bivalves, lancelets, and much smaller concentrations of decapods, nemerteans, echinoderms, sea anemones, gastropods, phoronids, tunicates, isopods, and other crustaceans (Diaz et al. 2006). The benthic community composition at Sandbridge Shoal is typical of other shallow sandy habitats found along the Atlantic continental shelf, and dredging over a four-year period did not have negative environmental consequences on the habitat (Diaz et al. 2006). Sandbridge Shoal is likely to contain food resources for the Atlantic sturgeon; however, habitat within the shoal is not distinct from other sandy shoal areas along the Atlantic coast migratory route of the species. It is not known if there are areas of better or poorer foraging habitat for the Atlantic sturgeon within Sandbridge Shoal.

Because dredging causes bottom-scouring and potential uptake of benthic organisms, the Atlantic sturgeon could be indirectly impacted by this activity due to the immediate loss of prey items on the shoal. A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from 3 months to 2.5 years after the dredging event, dependent on the species present, the specific details of the dredging, and environmental conditions (Brooks et al. 2006). The likelihood of re-colonization and recovery of benthic communities is increased by leaving small areas of similar habitat untouched surrounding or adjacent to the disturbed area. Leaving the “No Dredge Zone” untouched during the proposed action (Figure 2-1) would provide a greater chance for the disturbed benthic communities to recover more rapidly and with a similar composition to the pre-dredge conditions (Diaz et al. 2004). Indirect impacts on benthic organisms adjacent to the borrow area could also result from turbidity plumes created by the dredging operation. However, the effects of dredging would likely be minimal because Atlantic sturgeon are wide-foraging and migratory. They would likely spend only a portion of their lifecycle at the dredging site, and because the benthic habitat on Sandbridge Shoal is not unique, short-term loss of this habitat for feeding purposes would not inhibit Atlantic sturgeon from finding similar food resources within their migratory pathway or after the benthic community recovery.

Atlantic sturgeon abundance at the dredge site may also be affected by increased disruption of feeding behavior due to the noise and human activity associated with the dredging operation. Popper and Hastings (2009) report that various fish species have been found to abandon areas when the sound from human activities surpasses the local ambient noise levels, only to return after the sound source has been removed and ambient noise levels return to normal. Acoustic and anthropogenic disturbances could cause the Atlantic sturgeon to leave the shoal and move into adjacent habitat until the dredging operation is complete. The mobility of the species and its ability to move into adjacent nearshore foraging and feeding areas until the dredging operation is complete and the availability of other potential foraging areas of similar prey composition would minimize potential impacts on the Atlantic sturgeon.

Under Alternative 1, there is a minor potential for Atlantic sturgeon to be struck by vessels; however, there is very limited information on the likelihood of this occurring. Available information indicates that vessel strikes have occurred in spawning rivers (Brown and Murphy 2010). Between 2005 and 2008, 14 of 28 Atlantic sturgeon mortalities in the Delaware River were attributed to vessel strikes (Brown and Murphy 2010). These strikes may have resulted from reduced clearance between the keel of the ship and the river bottom (Atlantic sturgeon are generally bottom dwellers) and from the confinement of the riverine system. The proposed action would occur in open water, and the draft between the keel of the ship and the ocean bottom would be great enough to avoid bottom interaction. Therefore, it is unlikely that Atlantic sturgeon would be struck by vessels under Alternative 1.

Under Alternative 1, the placement of sand along the beach at Dam Neck Annex would impact worms, snails, aquatic insects, and crustaceans that serve as primary prey for the Atlantic sturgeon within the nearshore area. These impacts would be temporary because they are associated with the turbidity and shoreline sand mixing from operation of the dredge hose. Hackney et al. (1996) suggest that fish that exhibit opportunistic behavior and live in a dynamic environment such as the surf zone may be able to readily adapt to events like beach replenishment. Based on this, the proposed action should not significantly affect the nearshore foraging and feeding behavior or prey species of the Atlantic sturgeon.

Deposition of sand in the nearshore area would bury benthic organisms that serve as prey for the Atlantic sturgeon. However, many of the larger mobile benthic species present in the intertidal zone have the ability to burrow through the sand, reducing impacts on these species (Burlas et al. 2001). The smaller, immobile species would be more impacted; however, they tend to have high reproductive rates, which would aid in recovery and re-colonization of the benthic community (Burlas et al. 2001). No SAV occurs within the nearshore Action Area at Dam Neck Annex. Burlas et al. (2001) reported recovery times of 2 to 6.5 months for the intertidal benthic communities following beach replenishment. Other studies have shown that recovery within the intertidal zone has taken 2 to 7 months (Hackney et al. 1996) and 3 to 6 months (Jutte et al. 1999 a,b [as cited in Burlas et al. 2001]).

Turbidity increases caused by removal of sand from the shoal, overflow of sand from the dredge at the borrow site, and nearshore sand deposition could reduce the level of oxygen in the water column and clog the gills of the Atlantic sturgeon. Turbidity plumes at Sandbridge Shoal are likely to be limited to short durations and minimal spreading due to the dynamic nature of the offshore environment and the grain size of the material being removed. The sediment found at Sandbridge Shoal is composed primarily of medium -grained sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Turbidity created by removing sand at the offshore borrow site is likely to be similar to sedimentation disturbance caused by natural sediment transport processes (CSA International, Inc. et al. 2009). Sediment plumes up to 2,000 m (6,562 ft) from hopper dredges have been recorded for sediments composed of silty clay (LaSalle et al. 1991). Because the sediments found at Sandbridge Shoal are of coarser grain size it is likely that the plumes would be much smaller. Anchor Environmental (June 2003) reported that turbidity plume concentrations from hopper dredges in the near field can range between 80 to 475 mg/L and decrease quickly with distance from the dredge. Much less information is available regarding turbidity plumes in offshore environments because offshore sands tend to be coarser and oceanographic conditions in the open ocean environment are more dynamic, minimizing settling and reducing time in the water column (CSA International, Inc. et al. 2009).

Turbidity in the nearshore environment, similar to the offshore environment, would consist of primarily medium-grained sand and would occur in an area of existing natural disturbance (i.e., storm activity, tidal flow, and wave activity). Wilbur et al. (2006) reported that turbidity concentrations following beach replenishment (between 34 mg/L and 64 mg/L) were less than those created by storm events (between 81 mg/L and 425 mg/L). It would be expected that the turbidity concentration from the proposed action in the nearshore zone would be similar to those reported in Wilbur et al. (2006). A study conducted by Versar, Inc. (2004) indicated that turbidity plumes associated with deposition of sand during beach replenishment were short-lived and small and did not increase local turbidity above background levels (i.e., those created by natural disturbance). Therefore, impacts on Atlantic sturgeon due to offshore or nearshore turbidity would be minor. Due to its mobility, the Atlantic sturgeon would be expected to avoid these turbidity impacts by moving out of both areas until the beach replenishment is complete.

The placement of sand at the replenishment site typically converts shallow ocean water surf-zone habitat to inter-tidal and supra-tidal beach habitat. However, this seaward transfer of habitat would not be significant for the Atlantic sturgeon because of the vast extent of ocean habitat adjacent to and in the vicinity of the Dam Neck Annex beach.

As previously documented, Atlantic sturgeon travel from the ocean up into large rivers to spawn. Because of this, the proposed action would not affect reproduction or population recruitment of the Atlantic sturgeon.

5.3.1.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on the Atlantic sturgeon under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment and vessel collision during transit because the hopper dredge would be operating for a longer time period. Additionally, more underwater habitat would be disturbed under Alternative 2 than under Alternative 1 because more sand would be dredged from the Sandbridge Shoal. This would also cause short-term increased turbidity, potentially impacting surrounding benthic habitat.

5.3.1.3 Actions to Reduce Adverse Effects

To minimize potential impacts on the Atlantic sturgeon, NMFS-approved observers meeting the Observer Requirements and following the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) will monitor the Action Area throughout the year. During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable. Sand from the dredge site would be beach-quality and would be approximately the same grain size as the existing beach area, with a low content of fine sediments and organic materials. This would reduce the potential for increased turbidity since sediments that contain high levels of fine sand, silt, or clay may perform poorly and may increase the turbidity levels at the target beach (National Research Council [NRC] 1995).

Additionally, the drag head of the hopper dredge will be outfitted with a state-of-the-art sea turtle deflector and will be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the Action Area. At the dredge site, the suction in the drag head will be turned off when it is lifted off the bottom to further prevent possible entrainment of Atlantic sturgeon. The hopper inflow will also be screened to allow monitoring of the dredge material intake for Atlantic sturgeon and their remains.

5.3.1.4 Determination of Effects

While some individual Atlantic sturgeon may become entrained in the hopper dredge, the number would not be expected to be significant due to the mobility of Atlantic sturgeon and their ability to move away from the drag head while it is operating. Also, impacts on the Atlantic sturgeon's benthic prey supply and feeding behavior both at the Sandbridge Shoal dredge area and in the Dam Neck Annex replenishment area should be temporary because the species would be able to find adjacent feeding areas during the dredging operation. Although a state-of-the-art sea turtle deflector would be attached to the drag head and the suction in the drag head would be turned off when lifted from the bottom, entrainment of individual sturgeon could still occur. Because of the possibility of entrainment, the Navy has determined that Alternatives 1 and 2 may affect and is likely to adversely affect the Atlantic sturgeon.

5.3.2 Sand Tiger Shark

In the western Atlantic, sand tiger sharks range from the Gulf of Maine to coastal waters off Argentina (MarineBio 2010e). They are considered common in summer and fall in the lower Chesapeake Bay, where they inhabit shallow estuaries and coastal waters (Murdy et al. 1997). Juvenile sand tiger sharks are commonly found in estuaries along the eastern United States coastline (NMFS 2010c). As a result, Virginia waters are considered important pupping grounds (MarineBio 2010e). Therefore, the sand tiger shark may be present in the vicinity of the dredging borrow and offload areas

5.3.2.1 Potential Direct and Indirect Effects of Alternative 1

Under Alternative 1, juvenile sand tiger sharks could be adversely impacted by hopper dredge entrainment. Adult sand tiger sharks would not be susceptible to dredging entrainment because of their relatively large size, up to 10 ft (3 m) in length. At the dredge site, entrained fish typically perish as a result of the centrifugal force of the hopper dredge's pump drawing them into the dredge.

Sand tiger sharks are unlikely to be indirectly impacted at the dredge site because they consume a wide range of prey species, including bony fishes, other sharks, rays, and squid, all of which have the mobility to avoid the bottom-scouring action and temporary turbidity plumes generated by operation of the hopper dredge. Turbidity plumes at Sandbridge Shoal would likely be limited to short durations and minimal spreading due to the dynamic nature of the offshore environment and the grain size of the material being removed. The sediment found at Sandbridge Shoal is composed primarily of medium-grained sand (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

Sand tiger shark abundance at the dredge site may also be affected by noise and human activity associated with the dredging operation. These operations could result in disruption of feeding behavior and leaving the shoal to move into adjacent habitat until the dredging operation is complete. However, this impact would be temporary given the mobility and typically wide-ranging feeding territories of sand tiger sharks. Popper and Hastings (2009) report that various fish species have been found to abandon areas when the sounds of human surpass the local ambient noise levels, only to return after the sound source has been removed and ambient noise levels return to normal. The mobility of the species and its ability to move into adjacent nearshore foraging and feeding areas until the dredging operation is complete and the availability of other potential foraging areas of similar prey composition would minimize potential impacts on the sand tiger shark.

Sand placement at the replenishment site would not affect either the foraging or feeding behavior of the sand tiger shark because of the mobility of both the shark and its preferred prey species.

Turbidity increases caused by nearshore sand deposition could reduce the level of oxygen in the water column and clog the gills of the sand tiger shark. Turbidity in the nearshore environment, similar to the offshore environment, would consist of primarily medium-grained sand and occur in an area of existing natural disturbance (i.e., storm activity, tidal flow, and wave activity). Wilbur et al. (2006) reported that turbidity concentrations following beach replenishment (between 34 mg/L and 64 mg/L) were less than those created by storm events (between 81 mg/L and 425 mg/L). It would be expected that the turbidity concentration from the proposed action in the nearshore zone would be similar to those reported in Wilbur et al. (2006). A study conducted by Versar, Inc. (2004) indicated that turbidity plumes associated with deposition of sand during beach replenishment were short-lived and small and did not increase local turbidity above background levels (i.e., those created by natural disturbance). Due to its mobility, sand tiger sharks would be expected to avoid these impacts by temporarily moving out of the affected area until after beach replenishment is complete.

The placement of sand at the replenishment site typically converts shallow ocean water surf-zone habitat to inter-tidal and supra-tidal beach habitat. However, this seaward transfer of habitat would not be significant for the sand tiger shark because of the vast extent of ocean habitat adjacent to and in the vicinity of the Dam Neck Annex beach.

5.3.2.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on the sand tiger shark under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment as the hopper dredge would be operating for a longer time period. As with Alternative 1, the mobility of sand tiger sharks should limit indirect impacts from temporary turbidity created by the dredging operations under Alternative 2.

5.3.2.3 Actions to Reduce Adverse Effects

To minimize potential impacts on the sand tiger shark, sand from the dredge site would be beach-quality and be of similar grain size, with a low content of fine sediments and organic materials. This would reduce the potential for turbidity plumes since sediments that contain high levels of fine sand, silt, or clay may perform poorly and may increase the turbidity levels at the target beach (NRC 1995).

At the dredge site, a state-of-the-art sea turtle deflector would be attached to the drag head which would minimize the potential for entrainment of sand tiger sharks. The suction in the drag head would be turned off when it is lifted off the bottom to prevent possible entrainment of sand tiger sharks.

5.3.2.4 Determination of Effects

While some individual sand tiger sharks may become entrained in the hopper dredge, the number would not be expected to be significant due to the mobility of sand tiger sharks and their ability to move away from the drag head while it is operating. Also impacts on the sand tiger shark's foraging success and feeding behavior both at the dredge site and in the Dam Neck Annex replenishment area should be temporary because of the mobility of both the shark and its primary prey species (bony fishes, other sharks, rays, and squid). Based on this, the Navy has determined that Alternatives 1 and 2 may affect but will not jeopardize the sand tiger shark.

5.3.3 Shortnose Sturgeon

Determination of Effects

The shortnose sturgeon is unlikely to occur in the Action Area (Palmer 2011). This species is believed to have been extirpated from Virginia coastal rivers and rarely occurs in the ocean (VDGIF n.d.[g], NMFS 1998b). Therefore, the proposed action would have no effect on the shortnose sturgeon.

5.4 Sea Turtles

5.4.1 Loggerhead Sea Turtle

Loggerhead sea turtles are the only marine turtles known to recurrently nest on beaches in the vicinity of the proposed action. They occur in the coastal waters of Virginia primarily during late spring, summer, and early fall, typically arriving in early May and departing in early November (Colligan 2011). A loggerhead sea turtle nested on the northern portion of the Dam Neck Annex beach in 1992 (Navy 2006). Eggs from this nest were relocated to Back Bay NWR, where they completed successfully (Navy 2006). A loggerhead sea turtle also nested unsuccessfully on the southern portion of the Dam Neck Annex beach in 2002 (Navy 2006).

5.4.1.1 Potential Direct and Indirect Effects of Alternative 1

Loggerhead sea turtles may be directly affected under Alternative 1. Since they are the most common species of sea turtle frequenting the Action Area, they are the species of sea turtle most likely to be adversely impacted by hopper dredge entrainment. At the dredge site, both hatchling and juvenile loggerhead sea turtles could be entrained by the centrifugal force of the hopper dredge's pump. The feeding behavior of loggerhead sea turtles places them at greater risk of entrainment, since they are primarily benthic (bottom) feeders. Entrainment is believed to take place primarily when the drag head is operating on the bottom sediments, with affected individuals feeding or resting near the bottom at the same time that the drag head is moving along the bottom.

Sea turtle mortalities due to entrainment during hopper dredging operations have been documented on the East Coast of the United States (USACE 2006). In the North Atlantic Region, loggerhead sea turtles were the most frequently entrained sea turtle species during hopper dredging, accounting for 90.5 percent of the total entrainment for turtles identified by species. Green and Kemp's ridley sea turtles accounted for 1.6 percent and 7.9 percent of entrainment incidents, respectively (USACE 2006).

To minimize entrainment, a hopper dredge must now be equipped with a rigid state-of-the-art sea turtle deflector attached to its drag head. The deflector would be checked throughout every load to ensure that proper installation is maintained (USACE n.d.). USACE field tests demonstrated that a rigid turtle deflector, properly installed and operated, blocked 95 percent of mock turtles from entrainment in the dredge (USACE 1997).

Between 200 and 300 dead sea turtles are found annually on Virginia shorelines, and most of these mortalities are attributed to boat collisions (VDGIF n.d. [l]). Adult loggerhead sea turtles could be impacted as a result of collisions with the hopper dredge.

Since dredging causes impacts on benthic populations in the dredged area, loggerhead sea turtles may be indirectly impacted by the reduction of their food resources, which are relatively slow-moving horseshoe crabs and other crustaceans as well as non-motile prey such as mollusks. The benthos at Sandbridge Shoal is likely to be dominated by polychaetes, followed by lesser concentrations of amphipods, bivalves, lancelets, and much smaller concentrations of decapods, nemerteans, echinoderms, sea anemones, gastropods, phoronids, tunicates, isopods, and other crustaceans (Diaz et al. 2006). The benthic community composition at Sandbridge Shoal is typical of other shallow sandy habitats found along the Atlantic continental shelf, and dredging over a four-year period did not have negative environmental consequences on the habitat (Diaz et al. 2006). Sandbridge Shoal is likely to contain food resources for the loggerhead sea turtle; however, habitat within the shoal is not distinct from other sandy shoal areas along the Atlantic coast continental shelf. It is not known if areas of better or poorer foraging habitat for the loggerhead sea turtle are within Sandbridge Shoal. Sea turtle abundance at the dredging site may also be affected by interference with underwater resting areas.

Indirect impacts on benthos adjacent to the dredging area could also result from temporary turbidity plumes caused by the dredging operation (see Section 5.3.1.1). Turbidity at the dredge site may cause minor impacts on loggerhead sea turtles located within the area; however, they would be able to move away from the disturbance. Additionally, research has shown that offshore turbidity plumes tend to be localized and temporary and would likely have minimal and short-term impacts on the immediate substrate and water column (CSA International, Inc. et al. 2009). A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from 3 months to 2.5 years after dredging, depending on the species present, the specific details of the dredging, and environmental conditions (Brooks et al. 2006). The likelihood of re-colonization and recovery of benthic communities is increased by leaving small areas of similar habitat untouched surrounding or adjacent to the disturbed area. Leaving the "No Dredge Zone" untouched during the proposed action (Figure 1-1) would provide a greater chance for the disturbed benthic communities to recover more rapidly and with a composition similar to the pre-dredge conditions (Diaz et al. 2004). Because the benthic habitat on Sandbridge Shoal is not unique, short-term loss of this habitat for feeding purposes would not inhibit loggerhead sea turtles from finding similar food resources within the area, or after the benthic community recovers.

Increased noise and human activity associated with the operation of the hopper dredge could result in sea turtles leaving the shoal. Captive sea turtles have been found to increase their swimming rates in the presence of increased low-frequency sounds. Increased swimming rates serve as a proxy for avoidance behavior in the wild (McCauley et al. 2000; Lenhardt 1994). Sea turtles exposed to low-frequency sounds from dredging operations would likely avoid the sound source and move into adjacent habitat until the dredging operation is complete.

Sand placement on the Dam Neck Annex beach could result in the loss of loggerhead prey (crustaceans and mollusks) as a result of the burial of benthos in the nearshore and surf zones. Many of the larger mobile benthic species present in the intertidal zone have the ability to burrow through the sand, reducing impacts on these species (Burlas et al. 2001). Burlas et al. (2001) reported recovery times for the intertidal benthic communities of 2 to 6.5 months following beach replenishment. Other studies have shown that recovery within the intertidal zone has taken 2 to 7 months (Hackney et al. 1996) and 3 to 6 months (Jutte et al. 1999a,b as cited in Burlas et al. 2001).

Turbidity at the target beach can result from resuspension of sediment at the discharge pipe and from sediment winnowing from the replenished beach into the surf zone, which can be carried in the long-shore drift direction or seaward with waves and currents (Van Dolah et al. 1992). Turbidity can also occur between the dredge site and target beach by sand being lost during hopper loading, leaks occurring in the transport pipes, sand being lost during movement between sites, and from routine drainage of water containing fine sediment. This turbidity has the potential to temporarily disrupt loggerhead feeding.

Turbidity in the nearshore environment, similar to the offshore environment, would consist of primarily medium-grained sand and would occur in an area of existing natural disturbance (i.e., storm activity, tidal flow, and wave activity). Wilbur et al. (2006) reported that turbidity concentrations following beach replenishment (between 34 mg/L and 64 mg/L) were less than those created by storm events (between 81 mg/L and 425 mg/L). It would be expected that the turbidity concentration from the proposed action in the nearshore zone would be similar to those reported in Wilbur et al. (2006). A study conducted by Versar, Inc. (2004) indicated that turbidity plumes associated with deposition of sand during beach replenishment were short-lived and small and did not increase local turbidity above background level (i.e., those created by natural disturbance). Therefore, impacts on loggerhead sea turtles due to offshore or nearshore turbidity would be minor. Due to its mobility, the loggerhead sea turtle would be expected to avoid these turbidity impacts by moving out of both areas until the beach replenishment is complete.

At the replenishment site, turtle nests, eggs, and hatchlings may be buried by multiple layers of sand from the dredge hose. They could also be crushed by heavy equipment moving the sand into place following deposition.

Beach replenishment may also create obstacles to egg-laying female loggerhead sea turtles that are trying to reach nesting habitat above the high tide line. Physical changes along replenished beaches include formation of steep berms, or scarps (Nelson et al. 1987), which can prevent females from reaching preferred nesting sites along the beach, resulting in "false crawls." As a result, eggs may be laid closer to the water, where they are more likely to be swept away by incoming tides (Steinitz et al. 1998).

Dredge hoses placed on the beach to disperse the sand can create obstacles to egg-laying female loggerhead sea turtles, resulting in false crawls and an unnecessary expenditure of energy. Additionally, replenished beaches are often harder than natural beaches, sometimes causing female loggerheads to abandon attempts at digging nests to lay their eggs (Nelson and Dickerson 1987; Steinitz et al. 1998).

The success of incubating loggerhead sea turtle eggs can be reduced when the sand grain size, shear resistance, color, gas diffusion rates, organic composition, and moisture content of the nourished sand are different from the natural beach sand (Nelson and Dickerson 1988; Nelson 1991). Sand temperature changes can alter the egg incubation time, leading to increased predation risks and altering the sex ratio of hatchlings (Schulman et al. 1994). Altered beach conditions may also hamper embryonic development (Ackerman 1996).

In some cases, beach replenishment can benefit sea turtles by restoring habitat along eroded beaches. An engineered beach can be more stable than an eroding beach. Studies have found no significant difference between replenished and non-replenished beaches in the number of eggs per nest and the hatching and emergence success (Nelson et al. 1987).

5.4.1.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on loggerhead sea turtles under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment and boat collisions as the hopper dredge would be operating for a longer time period. Additionally, more underwater habitat would be disturbed under Alternative 2 than under Alternative 1 because more sand would be dredged from the Sandbridge Shoal. This would also cause increased turbidity, potentially impacting surrounding benthic habitat. Finally, dredge hoses placed on the beach to disperse the sand would be in place for a longer period of time under Alternative 2 than under Alternative 1. As described above, these hoses can create obstacles to egg-laying female loggerhead sea turtles.

5.4.1.3 Actions to Reduce Adverse Effects

To minimize potential adverse impacts on loggerhead sea turtles, sand from the dredge site would be beach-quality and match as closely as possible the existing sand in grain size and have a low content of fine sediments and organic materials. Turbidity would be reduced since sediments that contain high levels of fine sand, silt, or clay may perform poorly and may increase the turbidity levels at the target beach (NRC 1995).

At the off-shore dredge site, a state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge. The drag head will be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the Action Area. The suction in the drag head will be turned off when it is lifted off the bottom to further prevent possible entrainment of turtles. The hopper inflow will also be screened to allow monitoring of the dredge material intake for sea turtles and their remains. To minimize risks of collisions with turtles, dredging vessels and support boats would not intentionally approach within 100 yards (91.4 m) of listed species when in transit.

The off-shore dredging and pumping operations would be staffed by NMFS-approved observers meeting the Observer Requirements and following the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) to monitor the dredge site for sea turtles and other protected species year round. During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable. Weekly summary reports would be submitted to the Northeast Region of NMFS by the observers.

If operations occur during the nesting season (May 15 to September 15), the Sea Turtle Monitoring Protocol (Navy 2006) would be implemented to ensure protection of nesting turtles, laid nests, and hatchlings. Personnel trained by the VDGIF would monitor the target beach throughout the replenishment construction period and following replenishment. Trained personnel would be responsible for locating nesting turtles; identifying turtle species, nesting tracks vs. false crawl tracks, and laid nests; and protecting laid nests. These surveys would be conducted before sunrise each morning. The target beach would be surveyed along the high-tide line in both directions and through visual inspection in the beach-fill area for the duration of the nesting period. If crawls are not detected, sand replenishment operations can proceed for the day. If crawls are noted, Navy Natural Resources would be notified, and the nest(s) would be marked. If crawls are later determined to be false crawls, work within the project area can proceed. If eggs are present, the nesting area(s) would be delineated and placed off-limits to vehicular and pedestrian traffic by trained Dam Neck Annex personnel.

In addition, the following onshore impact avoidance/minimization measures would be implemented during the loggerhead sea turtle nesting season:

- The beach would be inspected by properly trained personnel before daytime operations could begin;
- Reports of sea turtle activity would be reported to the USFWS the day the activity is discovered; and
- A final report summarizing the results of the dredging and any sea turtle takes would be submitted to the Navy, USACE, and the NMFS within 20 working days of completion of each cycle of the project.

If nesting occurs at the north or south ends of the beach where active military training takes place or where the beach is under threat of regular inundation by high tides, the nests may need to be relocated. The USFWS and the VDGIF would be consulted on a case-by-case basis to determine the appropriate action in these instances as to whether to allow the nest to remain in situ or to relocate it under the current nest relocation protocol set out in the INRMP. Through a current agreement with the USFWS Back Bay NWR, the relocated nest would be brought to Back Bay NWR to allow for a more suitable nursery site for the nest, unless a reasonable alternative relocation plan is preferred by the USFWS at that time.

During the nesting and hatching season, beach illumination may affect nesting adult turtles and hatchlings. To the maximum extent practicable, lighting will be reduced prior to the nesting and hatching season to reduce potential impacts; however, security concerns may make it not feasible to turn off some lights.

5.4.1.4 Determination of Effects

Dredging under Alternatives 1 and 2 could result in entrainment of individual loggerhead sea turtles; however, the number would not be expected to be significant due to the use of a deflector on the drag head and the loggerhead sea turtle's ability to move away from the drag head while it is operating. According to observer data collected by the USACE from 1994 to 2011, 54 takes of loggerhead sea turtles have been recorded during dredging projects using hopper dredges in the Norfolk District. Of those 54 takes, only six were observed during an open-ocean beach-nourishment project; however, no takes were associated with dredging projects at Sandbridge Shoal (USACE 2006). In addition, impacts on the loggerhead sea turtle's prey supply and feeding behavior, both at the Sandbridge Shoal and the Dam Neck Annex beach replenishment area, would be temporary, and this species would be able to successfully locate adjacent feeding areas during the dredging period.

Because loggerhead sea turtle nesting at Dam Neck Annex is rare and the target area for replenishment would be monitored throughout the nesting season, the potential for nest destruction would be low. Also, considering the close match of sand from the Sandbridge Shoal with the existing sand in the Dam Neck Annex beach replenishment area, the proposed action could result in a long-term beneficial increase in potential loggerhead sea turtle nesting habitat. Although the impact minimization measures described in Section 5.4.1.3 would be implemented, entrainment of individual loggerhead sea turtles could still occur. Because of the possibility of entrainment, the Navy has determined that Alternatives 1 and 2 may affect and is likely to adversely affect the loggerhead sea turtle.

5.4.2 Green Sea Turtle

Very few green sea turtles have been observed in the vicinity of Dam Neck Annex (Navy 2006). However, they occur seasonally, primarily from early May to November, in the coastal waters of Virginia (Colligan 2011). The green sea turtle does not typically nest as far north as Virginia; however, a nest was discovered on Sandbridge Beach, located approximately three miles (4.8 km) south of the project area, in 2005 (Baker and Valentine n.d.).

5.4.2.1 Potential Direct and Indirect Effects of Alternative 1

Given the green sea turtle's preference for the shallow waters of reefs, bays, inlets, lagoons, and shoals that support growth of sea grasses, sea lettuce, and algae, their preferred foods, it is unlikely they would occur in the vicinity of the dredge site. The Sandbridge Shoal is sufficiently offshore and deep as to not provide habitats for the SAV typically eaten by green sea turtles. Therefore, green sea turtles would not be expected to use this area as foraging habitat.

Sand placement on the Dam Neck Annex beach would not likely result in the loss of green sea turtle prey (i.e., algae, seaweed, and sea grass) as a result of the burial of benthos in the nearshore and surf zones. Similarly, no SAV beds have been mapped in the nearshore area of Dam Neck and so no disruption of green sea turtle feeding habitat would be expected (Virginia Institute of Marine Science 2010).

Because the green sea turtle has nested only once in the vicinity of Dam Neck, the potential for the sand placement associated with beach replenishment to impact egg-laying adult females or their nests, eggs, or hatchlings would be minimal. On the remote chance that a green sea turtle does nest in the replenishment area, the full-time monitoring that would take place throughout the sea turtle nesting period, as described for loggerhead sea turtles (Section 5.4.1.1), would prevent any harm to the eggs and hatchlings.

Potential green sea turtle impacts associated with collisions, entrainment, noise, and turbidity would be similar to those described for the loggerhead sea turtle.

5.4.2.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on green sea turtles under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment and boat collisions because the hopper dredge would be operating for a longer time period. Additionally, as more sand would be required under Alternative 2, more turbidity would be expected to occur between the dredge site and target beach by sand being lost during hopper loading, leaks occurring in the transport pipes, sand being lost during movement between sites, and from routine drainage of water containing high quantities of fine sediment, all of which could temporarily disrupt green sea turtle feeding activity.

5.4.2.3 Actions to Reduce Adverse Effects

Actions to reduce adverse effects on the green sea turtle would be the same as those described for the loggerhead sea turtle in Section 5.4.1.3.

5.4.2.4 Determination of Effects

Dredging under Alternatives 1 and 2 could result in entrainment of individual green sea turtles; however, this is unlikely due to the use of deflectors on the drag heads, the green sea turtle's ability to move away from the drag head while it is in use, and the unlikely occurrence of the species in the Action Area due to a lack of suitable forage. In addition, operation of the hopper dredge at Sandbridge Shoal would not impact the green sea turtle's feeding habitat or food base because the species is herbaceous and feeds only on SAV in shallow waters. No SAV beds have been mapped in the nearshore area of the Dam Neck Annex, and thus no disruption of green sea turtle feeding habitat would be expected (Virginia Institute of Marine Science 2010). According to observer data collected by the USACE from 1994 to 2011, one take of a green sea turtle has been recorded during dredging projects using hopper dredges in the Norfolk District. However, the take was not associated with an open-ocean beach-nourishment project (USACE 2006). Also, since the green sea turtle has been documented as nesting in the vicinity of Dam Neck Annex only once, the proposed action is unlikely to impact nesting females or their nests, eggs, and hatchlings. Based on this analysis and through the implementation of the impact minimization measures described in Section 5.4.1.3, the Navy has determined that Alternatives 1 and 2 may affect but are not likely to adversely affect the green sea turtle.

5.4.3 Leatherback Sea Turtle

The leatherback sea turtle is not known to nest as far north as Virginia. However, the species has been reported to occur relatively frequently off the coast in the vicinity of Dam Neck Annex (Navy 2006) and is expected to occur seasonally in Virginia waters from approximately early May until November. However, leatherback sea turtles are unlikely to occur in the Action Area as they are typically found in deeper, more offshore waters (Colligan 2011).

5.4.3.1 Potential Direct and Indirect Effects of Alternative 1

It is unlikely that the leatherback sea turtle would be significantly impacted by the proposed action because it is typically found in deepwater, pelagic areas of the open ocean. If an occasional leatherback sea turtle did come in proximity to the dredging operation, the possibility of entrainment would be minimized by its large size (adults weigh up to 2,000 lbs [907.2 kg]). Leatherback sea turtles may be impacted as a result of collisions with the hopper dredge, or noise attributed to dredging operations (as described in Section 5.4.1.1).

Because leatherback sea turtles eat exclusively jellyfish, the operation of the hopper dredge both at the dredge site and the Dam Neck Annex replenishment site would not affect its prey availability, feeding habitat, or feeding behavior. Jellyfish are more likely to be located in the middle of the water column rather than on the bottom, where turbidity is most likely to occur.

Because the leatherback sea turtle does not nest along the Virginia coastline, the proposed action would not result in any loss of nesting habitat, nests, eggs, or hatchlings for this species.

5.4.3.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on leatherback sea turtles under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment and boat collisions as the hopper dredge would be operating for a longer time period.

5.4.3.3 Actions to Reduce Adverse Effects

To minimize impacts on leatherback sea turtles, the measures described in Section 5.4.1.3 for loggerhead sea turtles would also be implemented for leatherback sea turtles.

5.4.3.4 Determination of Effects

Dredging activities under Alternatives 1 and 2 could result in entrainment of individual leatherback sea turtles; however, this is unlikely due to the leatherback sea turtles large size and use of a deflector on the drag head, and the unlikelihood of their occurrence in the Action Area. According to observer data collected by the USACE from 1994 to 2011, no takes of leatherback sea turtles have been recorded during dredging projects using hopper dredges in the Norfolk District (USACE 2006). In addition, no impacts on the leatherback sea turtle's feeding and resting habitat would be expected because this species eats only jellyfish and primarily lives in the open ocean. Finally, the proposed action would not result in any loss of nesting habitat, nests, eggs, or hatchlings because this species does not nest on the Virginia coastline. Based on this analysis, the Navy has determined that Alternatives 1 and 2 may affect but are not likely to adversely affect the leatherback sea turtle.

5.4.4 Hawksbill Sea Turtle

Determination of Effects

The hawksbill sea turtle does not nest as far north as Virginia (NMFS n.d. [m]; NMFS 1993). They are mainly isolated to the tropics and are only accidentals in Virginia (VDGIF n.d. [j]). Because of this, the hawksbill sea turtle is unlikely to occur in the Action Area (Palmer 2011). Therefore, the proposed action would have no effect on the species.

5.4.5 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle occurs seasonally in the coastal waters of Virginia, typically from early May to November (Colligan 2011; Terwilliger and Musick 1995). They have been observed frequently off the coast at Dam Neck Annex (Navy 2006). Kemp's ridley sea turtles do not nest in Virginia.

5.4.5.1 Potential Direct and Indirect Effects of Alternative 1

As Kemp's ridley sea turtles are commonly seen off the coast of Dam Neck Annex, they may be adversely impacted by hopper dredge entrainment. Also, because they are the smallest of the sea turtles, with a maximum weight of 100 lbs (45.4 kg), they are likely more vulnerable to entrainment than other sea turtle species.

The feeding behavior of the Kemp's ridley sea turtle also places it at greater risk of entrainment because they are primarily bottom feeders, with blue crabs as their local preferred prey. To minimize entrainment, the hopper dredge will be equipped with a rigid state-of-the-art sea turtle deflector attached to the drag head. The deflector would be checked throughout every load to ensure that proper installation is maintained (USACE n.d.). Impacts on the Kemp's ridley sea turtle associated with the potential for collision would be similar to those described for loggerhead sea turtles.

Kemp's ridley sea turtle abundance at the dredge site may also be affected by increased disruption of feeding behavior and interference with underwater resting areas. Impacts on the habitat of the blue crab, the preferred prey of the Kemp's ridley sea turtle, adjacent to the dredging area could result both directly from bottom scouring and indirectly from turbidity plumes caused by the dredging operation (see Section 5.4.1.1 for more details). Increased noise and human activity associated with the operation of the hopper dredge could result in impacts on Kemp's ridley sea turtles similar to those described for loggerhead sea turtles.

Sand placement at the replenishment site could also result in the loss of habitat for the preferred prey (blue crabs) of the Kemp's ridley sea turtle, both directly through burial of nearshore habitat and indirectly through temporarily increased turbidity (see Section 5.4.1.1 for more details).

The proposed action would not result in any loss of nesting habitat, nests, eggs, or hatchlings of the Kemp's ridley sea turtle because the species does not nest along the Virginia coastline.

5.4.5.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on Kemp's ridley sea turtles under Alternative 2 are expected to be similar to those described under Alternative 1. However, the duration of in-water work would be greater under Alternative 2 than under Alternative 1 because more sand would need to be dredged. This could increase the chances of entrainment and boat collisions as the hopper dredge would be operating for a longer time period. Additionally, more underwater habitat would be disturbed under Alternative 2 than under Alternative 1 because more sand would be dredged from the Sandbridge Shoal. This would also cause increased turbidity, potentially impacting surrounding benthic habitat.

5.4.5.3 Actions to Reduce Adverse Effects

Measures to reduce adverse effects described in Section 5.4.1.3 for loggerhead sea turtles would also be implemented for Kemp's ridley sea turtles.

5.4.5.4 Determination of Effects

Dredging activities under Alternatives 1 and 2 could result in entrainment of individual Kemp's ridley sea turtles; however, the number would not be expected to be significant due to the use of a state-of-the-art sea turtle deflector on the drag head and the Kemp's ridley sea turtle's ability to move away from the drag head while it is operating. According to observer data collected by the USACE from 1994 to 2011, five Kemp's ridley sea turtle takes have been documented during dredging projects using hopper dredges in the Norfolk District. None of the five takes were associated with an open-ocean, beach-nourishment project (USACE 2006). In addition, impacts on the Kemp's ridley sea turtle's preferred prey (blue crabs) and feeding behavior, both at the Sandbridge Shoal and the Dam Neck Annex beach replenishment area, would be temporary, and this species would be able to successfully locate adjacent feeding areas during the period of dredging. Finally, the proposed action would not result in any loss of nesting habitat, nests, eggs, or hatchlings for this species because it does not nest on the Virginia coastline. Although the impact minimization measures described in Section 5.4.1.3 would be implemented, entrainment of individual Kemp's ridley sea turtles could still occur. Because of the possibility of entrainment, the Navy has determined that Alternatives 1 and 2 may affect and are likely to adversely affect the Kemp's ridley sea turtle.

5.5 Plants

5.5.1 Seabeach Amaranth

Seabeach amaranth is unlikely to occur in the Action Area as it prefers undisturbed barrier island habitat. However, past consultations with the USFWS have indicated that the species could potentially occur at Dam Neck Annex.

5.5.1.1 Potential Direct and Indirect Effects of Alternative 1

To date, the seabeach amaranth has not been recorded at Dam Neck Annex, but past consultations with the USFWS have indicated that the species could potentially occur there.

5.5.1.2 Potential Direct and Indirect Effects of Alternative 2

Potential impacts on seabeach amaranth under Alternative 2 would be the same as those described under Alternative 1.

5.5.1.3 Actions to Reduce Adverse Effects

A survey for this species is scheduled for 2014 (Wright, personal communication, 2011). However, dredging would likely occur before this date; therefore, pre-construction surveys would be conducted to determine the presence or absence of seabeach amaranth.

5.5.1.4 Determination of Effects

Although it has not been documented at Dam Neck Annex, the Navy has determined that Alternatives 1 and 2 may affect but are not likely to adversely affect seabeach amaranth.

6 Cumulative Impacts

6.1 Introduction

Cumulative effects are defined by the USFWS and NMFS as the "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 Code of Federal Regulations § 402.02). As specified in the USFWS and NMFS *ESA Section 7 Consultation Handbook* (March 1998), this definition "is specific to Section 7 analyses; it should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws."

6.2 Identification of Other Activities in the Action Area

The Sandbridge Shoal is expected to be utilized for other beach replenishment projects near Dam Neck Annex in coming years. The City of Virginia Beach had planned to replenish the sand on the public beaches at Sandbridge and the oceanfront resort area in the spring of 2012. The oceanfront resort area sand replenishment has been delayed to until December 2012 at the earliest for funding reasons.

State-regulated commercial fishing activities, including pound net, trawl, and gill net fishing, occur in the Action Area. These activities could result in bycatch of sea turtle and fish species evaluated in this BA. In addition, fishing vessels and other boat traffic could impact sea turtles and whales through vessel collisions. It is expected that Virginia will continue to license commercial fishing activities within the Action Area. The species evaluated in this BA may also be negatively affected by ingestion of plastics, petroleum products, and marine vessel-generated debris.

6.3 Cumulative Impacts

Maintenance replenishment of Sandbridge Beach is projected for approximately every three to five years for the next 40 years. Considered in the context of past projects at Sandbridge Beach and the adjacent Dam Neck Annex (7- to 10-year replenishment frequency), as well as the past and future beach fill along the Virginia Beach resort area, almost the entire shoreline from Cape Henry south to the Back Bay NWR will continue to be subject to the stresses of such replenishment activities. Overall, the impacted area would not increase, and the nature of the impacts would not change. The intervening periods between replenishments generally allow for physical and biological recovery and equilibration of the subaerial beach and surf zone. Also, most sandy-beach species are adapted to severe physical disturbances because storms are frequent along the mid-Atlantic coast.

Considered in combination with past dredging operations, the cumulative volume of sand removed from the Sandbridge Shoal through 2010 would represent less than 25 percent of fairly conservative volume estimates. The shoal's function as habitat may be adversely affected, but to date, there has been limited evidence of any sustained disturbance beyond transient and localized impacts on a wide range of benthic and pelagic biota (Diaz et al. 2006). Areas of the shoal where sediment grain-size is incompatible with the replenishment grain-size requirements, as well as other no-dredge areas such as the submarine cable zone, would remain undisturbed, serving as feeder zones for benthic recolonization and natural bottom habitat. Additionally, since borrow areas are not typically dredged perfectly flat relative to the adjacent seafloor, portions of the dredge areas would remain morphologically intact.

The proposed action would create a temporary increase in vessel traffic in the Action Area that could increase the likelihood of collisions with whales and sea turtles. However, the hopper dredge, like other vessels in the area, will abide by NMFS guidelines for speed to reduce collisions. As such, whale or sea turtle collisions with the dredge are not likely to occur, making cumulative impacts possible but not likely.

Additionally, the increased vessel traffic from the proposed action has the potential to add debris, contaminants, and pollutants to the local environment. Operation of the hopper dredge could result in accidental discharges of fuel and debris. The implementation of approved management and prevention plans would minimize potential impacts from these accidents, resulting in minimal cumulative effects in conjunction with the normal vessel traffic in the area.

Dredging would create a temporary increase in anthropogenic noise generated by the hopper dredge within the Action Area. It is expected that the increase in noise could cause some displacement of wildlife. However, since the dredging would occur over a relatively short duration and the area typically contains background noise associated with commercial and recreational vessels and an active military installation, cumulative noise impacts could occur. If multiple dredging projects were to occur at the Sandbridge Shoal during the same time period, BOEM would recommend additional measures to minimize impacts on listed species, as requested by NMFS.

Dredging would result in a temporary increase in turbidity within the Action Area. The sand sediments of this region would be expected to settle quickly. However, as with noise, if multiple projects were conducted at the same time, the increase in turbidity would be a cumulative, although temporary, impact. If multiple dredging projects are to occur at the Sandbridge Shoal during the same time period, BOEM would recommend additional measures to minimize impacts on listed species, as requested by NMFS.

Commercial fishery bycatch data for the Atlantic fisheries are limited and fragmentary, making it difficult to obtain cumulative bycatch estimates (Moore et al. 2009). Between 1992 and 2006, the Atlantic pelagic longline fleet hooked an estimated 727 loggerhead sea turtles annually, of which approximately 38 per year died (Moore et al. 2009). The Atlantic pelagic longline fleet also caught an estimated 753 leatherback sea turtles annually, with an estimated mortality rate of 0.027 (Moore et al. 2009). The Mid-Atlantic bottom trawl fleet for fishes between 1996 and 2004 took an average of 616 loggerhead sea turtles annually, with a mortality rate of 0.43 (Moore et al. 2009). Loggerhead sea turtle bycatch estimates in the scallop dredge fishery are very limited and range from 749 in 2003 to zero in 2005 (Moore et al. 2009). Sea turtles are also captured in Mid-Atlantic coastal and inshore gillnets and inshore pound nets, but there are currently no published bycatch estimates for these fisheries (Moore et al. 2009). Although multiple dredging projects could have a cumulative impact on sea turtles and fishes, impacts of each project would be reduced through agency consultation and coordination and implementation of agency-required impact minimization measures.

7 Conclusions

The purpose of this BA is to evaluate the potential for the repairs to the SPS at Dam Neck Annex to impact federally listed species with the potential to occur in the Action Area. Six whale species, three bird species, three fish species, five turtle species, and one plant species were evaluated, and the effects determination is presented in Table 7-1. The determination of effects is based on the direct, indirect, and cumulative impacts on each species and whether these effects would have the potential to reduce populations. Effects of actions on federally listed threatened and endangered species are classified as either no effect, may affect but not likely to adversely affect, or likely to adversely affect.

Table 7-1 Determination of Effects

Common Name	Scientific Name	Federal Status	Determination
Blue whale	*Balaenoptera musculus*	Endangered	No effect
Finback whale	*Balaenoptera physalus*	Endangered	Not likely to adversely affect
Humpback whale	*Megaptera novaengliae*	Endangered	Not likely to adversely affect
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Not likely to adversely affect
Sei whale	*Balaenoptera borealis*	Endangered	No effect
Sperm whale	*Physeter macrocephalus*	Endangered	No effect
Piping plover	*Charadrius melodus*	Threatened	Not likely to adversely affect
Red knot	*Calidris canutus*	Candidate	Will not jeopardize
Roseate tern	*Sterna dougallii dougallii*	Endangered	Not likely to adversely affect
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Endangered	Likely to adversely affect
Sand tiger shark	*Carcharias taurus*	Species of Concern	Will not jeopardize
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	No effect
Loggerhead sea turtle	*Caretta caretta*	Threatened	Likely to adversely affect
Green sea turtle	*Chelonia mydas*	Threatened	Not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Not likely to adversely affect
Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered	No effect

Table 7-1 Determination of Effects

Common Name	Scientific Name	Federal Status	Determination
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	Likely to adversely affect
Seabeach amaranth	*Amaranthus pumilus*	Threatened	Not likely to adversely affect

Of the six whale species evaluated in this BA, three federally endangered species are likely to occur in the Action Area: the finback whale, humpback whale, and North Atlantic right whale. The proposed action could potentially have a negative effect on these three species through vessel collisions, noise, and turbidity. Measures to minimize these impacts would include:

- Provide NMFS-approved observers that meet the Observer Requirements and follow the Observer Protocol as outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) to monitor the Action Area for these protected species;
- Maintain low speed while transiting between the Sandbridge Shoal and the offload area; and
- Minimize overflow of the hopper to reduce turbidity plumes (Table 7-2).

Through implementation of these minimization measures, impacts from the proposed action on the federally endangered whale species should be minimized. Therefore, the proposed action may affect but is not likely to adversely affect the finback whale, humpback whale, and North Atlantic right whale. There would be no effect on the blue whale, sei whale, or sperm whale as they are unlikely to occur in the Action Area.

The three listed bird species with the potential to occur at Dam Neck Annex (piping plover, red knot, and roseate tern) are most likely to occur as transient individuals during their spring and fall migrations. None of the three species are known to breed at Dam Neck Annex, although the piping plover could potentially breed there in the future. Potential impacts on these species include disturbance from the beach replenishment activities and burial of prey items. It is expected that these species, if present, would move to adjacent beaches until the work is completed. Therefore, the proposed action may affect but is not likely to adversely affect the piping plover and roseate tern, and may affect but will not jeopardize the red knot.

Of the three fish species evaluated, two, the Atlantic sturgeon and sand tiger shark, could potentially occur in the Action Area. The third species, the shortnose sturgeon, is unlikely to occur; therefore, the proposed action would have no effect on this species. For the remaining two species, potential impacts would include entrainment, loss of prey, disturbance, turbidity, vessel collision, and dredge noise. Impacts from entrainment and turbidity would be minimized by screening the hopper inflow and reducing the overflow of the hopper, respectively. NMFS-approved observers that meet the Observer Requirements and follow the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) would also be on board during dredging operations to monitor the dredge site throughout the year (Table 7-2). It is expected that impacts from disruption of food sources and disturbance would be minimal because the two fish species are highly mobile and could move to adjacent areas to forage until the dredging operations are completed. Due to the risk of entrainment the proposed action may affect and is likely to adversely affect the Atlantic sturgeon. The proposed action may affect but will not jeopardize the sand tiger shark.

Five sea turtle species were evaluated in the BA. One species, the hawksbill sea turtle, is unlikely to occur in the Action Area; therefore, the proposed action would have no effect on this species. The remaining four sea turtle species (loggerhead sea turtle, green sea turtle, leatherback sea turtle, and Kemp's ridley sea turtle) could occur in the waters off of Dam Neck Annex from approximately early May to November. Only one species, the loggerhead sea turtle, is likely to nest on Virginia beaches. The proposed action could impact sea turtles through entrainment, vessel collisions, disruption of food sources, turbidity, and dredge noise. These potential impacts would be reduced by:

- The use of a state-of-the-art sea turtle deflector on the drag head;
- Having NMFS-approved observers that meet the Observer Requirements and follow the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (NMFS July 22, 2010) on the dredge vessel between April 1 and November 30; and
- Minimizing overflow of the hopper (Table 7-2).

The mobility of sea turtles should also allow them to avoid the area during the dredging operations. Additional impacts on nesting loggerhead sea turtles could include obstacles to egg-laying females; burying of nests, eggs, and hatchlings; and reduction of hatching success. Impacts on nesting sea turtles would be minimized by monitoring the beach for sea turtles and their drags, nests, and nesting activity.

Although measures to minimize impacts on sea turtles would be implemented, individual loggerhead and Kemp's ridley sea turtles could still be entrained. Therefore, the proposed action may affect and is likely to adversely affect these species. The proposed action may affect but is not likely to adversely affect the leatherback sea turtle due to its large size and foraging behavior, or the green sea turtle due to its foraging behavior and low occurrence in the Action Area.

Finally, the seabeach amaranth has not been documented at Dam Neck Annex. However, previous consultations with the USFWS have indicated that the plant could potentially occur. To minimize impacts on this species, pre-construction surveys would be conducted to determine the presence or absence of seabeach amaranth. Due to the potential occurrence of the species, it was determined that the proposed action may affect but is not likely to adversely affect the seabeach amaranth.

Table 7-2 Summary of Proposed Minimization Measures

Whales

- NMFS-approved observers meeting the Observer Requirements outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program, that are on board the vessel to monitor for sea turtles and Atlantic sturgeon will also be trained to monitor the Action Area for whales throughout the year
  - Observations of whales within 3,280.8 ft (1,000 m) of the dredging operation will result in an immediate suspension of activity until the individual's protection could be assured
- During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable
- Dredge operators will conform to the regulations prohibiting the approach of right whales closer than 500 yards (1,500 ft) (50 CFR 224.103(c)) and other threatened or endangered species of whales no closer than 100ft
  - Any vessel finding itself within these buffer zones created by a surfacing whale must depart the area immediately at safe, slow speed
- All dredge operators will monitor the right whale sighting reports (including SAS, DMAs, and SMAs) to remain informed on the whereabouts of right whales within the vicinity of the Action Area
- The hopper dredge will not exceed a speed of 10 kn between November 1 and April 30 to reduce the potential for collisions with whales
- Operational techniques and other measures will be considered in an effort to reduce the size and duration of turbidity plumes during dredging
- Fuel spill prevention and response plans will be implemented

Birds

- Piping plover nesting surveys will be conducted at Dam Neck Annex.
  - If a nest is discovered prior to or during sand placement, impact minimization measures such as avoidance of the nesting area will be implemented to avoid potential impacts.
  - Dam Neck Annex will coordinate with the USFWS to ensure adequate protection in the event that any piping plover nests are discovered.
- An annual migratory bird survey program, which will include piping plovers and red knots, is scheduled to begin in late FY 2012. These surveys will cover each of the fall and spring migration periods, the breeding season, and winter and summer resident periods. These surveys will allow monitoring of the beach pre- and post- replenishment to identify any presence of the piping plover or red knot and will be repeated annually.
- Existing procedures will be modified so that trained personnel will monitor the beach for the presence of protected bird species while conducting monitoring being carried out under the existing Sea Turtle Monitoring Protocol (Navy 2006) and during routine patrols of the beach throughout the year. The Navy will share information and coordinate with the USFWS if the survey and monitoring programs identify the presence of protected bird species.
- If sand placement occurs during times when sensitive bird species may be present, a qualified biologist will conduct surveys and monitor the project area to ensure that no individuals are directly affected by these activities.
  - If sensitive species are present, impact minimization measures such as avoiding the area until the birds move on will be implemented to avoid potential impacts.

Table 7-2 Summary of Proposed Minimization Measures

Fish

- NMFS-approved observers meeting the Observer Requirements and following the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program will be on board the vessel for any dredging occurring throughout the year to monitor the Action Area for Atlantic sturgeon
- During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable
- Sand from the dredge site will be beach-quality and be approximately the same grain size as that of the existing beach area, reducing the potential for increased turbidity
- The suction in the drag head will be turned off when it is lifted off the bottom to prevent possible entrainment
- At the off-shore dredge site, a state-of-the-art sea turtle deflector, which will also aid in the deflection of Atlantic sturgeon should they be present, designed to USACE specifications, will be installed on the drag head of the hopper dredge
  - The drag head would be operated in a manner that will reduce the risk of interactions with Atlantic sturgeon that may be present in the Action Area
  - The hopper inflow would also be screened to allow monitoring of the dredge material intake for Atlantic sturgeon and their remains
- Fuel spill prevention and response plans would be implemented

Sea Turtles

- Sand from the dredge site will be beach-quality and be approximately the same grain size as that of the existing beach area, reducing the potential for increased turbidity
- NMFS-approved observers meeting the Observer Requirements and following the Observer Protocol outlined in the Biological Opinion for the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program will be on board the vessel for any dredging occurring between April 1 and November 30 to monitor the Action Area for sea turtles
- During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable
- At the off-shore dredge site, a state-of-the-art sea turtle deflector, designed to USACE specifications, will be installed on the drag head of the hopper dredge
  - The drag head would be operated in a manner that will reduce the risk of interactions with sea turtles that may be present in the Action Area
  - The hopper inflow would also be screened to allow monitoring of the dredge material intake for sea turtles and their remains
- The suction in the drag head will be turned off when it is lifted off the bottom to prevent possible entrainment
- To minimize risks of collisions with turtles, dredging vessels and support boats will not intentionally approach within 100 yards (91.4 m) of listed species when in transit

Table 7-2 Summary of Proposed Minimization Measures

- If operations occur during the nesting season (May 15 to September 15), the Sea Turtle Monitoring Protocol (Navy 2006) will be implemented to assure protection of nesting turtles, laid nests and hatchlings
    - If nesting occurs at the north or south ends of the beach where active military training takes place or is under threat of regular inundation due to high tides, the nests may need to be relocated. The USFWS and the VDGIF would be consulted on a case-by-case basis to determine the appropriate action in these instances as to whether to allow the nest to remain in situ or to relocate it under the current nest relocation protocol set out in the INRMP. Through a current agreement with the USFWS Back Bay NWR, the relocated nest would be brought to the Back Bay NWR to allow for a more suitable nursery site for the nest unless a reasonable alternative relocation plan is preferred by the USFWS at that time.
    - During the nesting and hatching season beach illumination may affect nesting adult turtles and hatchlings. To the maximum extent practicable lighting will be reduced prior to the nesting and hatching season to reduce potential impacts; however, security concerns may make in not feasible to turn off some lights.

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E Biological Opinion

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

JUL 20 2012

W. David Noble
Department of the Navy
Director, Environmental Planning and Conservation
Navy Region, Mid-Atlantic
1510 Gilbert Street
Norfolk, VA 23511-2737

Dear Mr. Noble,

I have enclosed the biological opinion (Opinion), issued under Section 7(a)(2) of the Endangered Species Act (ESA), regarding the Navy's proposal for repairs to the Shoreline Protection System (SPS) at Naval Air Station (NAS) Oceana, Dam Neck Annex, Virginia Beach, Virginia. The Navy is identified as the lead agency for this action, with the U.S. Army Corps of Engineers (ACOE) and the Bureau of Ocean Energy Management (BOEM) serving as cooperating agencies. The Navy will obtain the appropriate permits from the ACOE and BOEM for this activity. In this Opinion, we have analyzed the entire action and independently evaluated the 2012 Biological Assessment (BA). correspondence with the Navy. and other sources of information. We conclude that the proposed project may adversely affect but is not likely to jeopardize the continued existence of the Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead sea turtle; Kemp's ridley sea turtles; the Gulf of Maine (GOM) DPS of Atlantic sturgeon; New York Bight (NYB) DPS of Atlantic sturgeon; Chesapeake Bay (CB) DPS of Atlantic sturgeon; Carolina DPS of Atlantic sturgeon; or South Atlantic (SA) DPS of Atlantic sturgeon, and is not likely to adversely affect leatherback or green sea turtles or right, humpback or fin whales. We also conclude that the action will not affect hawksbill turtles as that species is unlikely to occur in the action area. We have assessed the project's impacts on listed species over the project's proposed lifetime (i.e., through approximately 2015).

Incidental takes are those that occur incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, incidental takes are not considered to be prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. The Incidental Take Statement (ITS) accompanying this Biological Opinion, pursuant to Section 7 (b)(4) of the ESA, exempts the incidental taking of no more than 1 sea turtle for approximately every 1.8 million cubic yards (cy) of material removed from the borrow areas. Over the course of the project life, we expect that one sea turtle, either a loggerhead or Kemp's ridley, may be entrained in a hopper dredge. No take of any other species of sea turtle is exempted. In regards to Atlantic sturgeon, it is reasonable to expect that one Atlantic sturgeon may be entrained in a hopper dredge for approximately every 10.2 million cy of material removed from the borrow areas.

Over the course of the project life, we expect that one subadult Atlantic sturgeon from any of the 5 DPSs may be entrained during hopper dredging operations,.

We anticipate the dredging may collect an additional unquantifiable number of previously dead sturgeon or sea turtles or sturgeon or sea turtle parts. Provided that we concur with the Navy's determination regarding the state of decomposition, condition of the specimen, and likely cause of mortality, the collection of previously dead sea turtle parts will also be exempted.

The ITS specifies six reasonable and prudent measures (RPMs) and 18 Terms and Conditions necessary to minimize and monitor take of listed species. The RPMs outlined in the ITS are non-discretionary, and must be undertaken so that they become binding conditions for the exemption in section 7(o)(2) to apply. Failure to implement the terms and conditions through enforceable measures may result in a lapse of the protective coverage of section 7(o)(2). Monitoring that is required by the ITS will continue to supply information on the level of take resulting from the proposed action.

With this Opinion, we conclude consultation for the proposed repair of the Dam Neck Annex SPS, Virginia. Reinitiation of this consultation is required if: (1) the amount of taking specified in the ITS is exceeded; (2) new information reveals effects of these actions that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) project activities are subsequently modified in a manner that causes an effect to the listed species that was not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified actions.

We look forward to continuing to work cooperatively with your office to minimize the effect of dredging projects on listed species. For further information regarding any consultation requirements, please contact Danielle Palmer at (978) 282-8468 or by e-mail (danielle.palmer@noaa.gov). Thank you for working cooperatively with my staff throughout this consultation process.

Sincerely,

Daniel S. Morris
Acting Regional Administrator

EC: McGinnis, Navy/Mid-Atlantic
Wikel, BOEM
Culbertson, BOEM
Steffey, ACOE/Norfolk
Palmer, NMFS/NER
O'Brien, NMFS/HCD
Murray-Brown, NMFS/NER

File Code: Section 7 - 2012 Navy Dam Neck Annex
PCTS: F/NER/2012/02021

NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Agency: United States Department of the Navy

Activity: Shoreline Protection System Repairs, Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

Conducted by: National Marine Fisheries Service
Northeast Regional Office

Date Issued: 7.20.2012

Approved by: ______________

1.0 INTRODUCTION

This constitutes the biological opinion (Opinion) of NOAA's National Marine Fisheries Service (NMFS) on the effects of the United States Department of the Navy's (Navy) proposed repairs to the Shoreline Protection System (SPS), Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia on threatened and endangered species in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). As the Navy is funding and carrying out the proposed action, the Navy will serve as the lead Federal agency for purposes of this consultation. Other Federal agencies involved in authorizing, funding or carrying out the proposed action include the U.S. Army Corps of Engineers (USACE) and the Bureau of Ocean Energy Management (BOEM). The USACE will be issuing a permit to the Navy pursuant to section 10 of the Rivers and Harbors Act. The BOEM will be issuing a non-competitive lease to the Navy pursuant to the Outer Continental Shelf Lands Act. These actions will be considered in this consultation.

This Opinion is based on information provided in the 2012 Biological Assessment (BA) for repairs to the Shoreline Protection System, Dam Neck Annex; correspondence with the Navy; and other sources of information. A complete administrative record of this consultation will be kept on file at the NMFS Northeast Regional Office. The date May 21, 2012, will be used to mark the start of formal consultation.

2.0 CONSULTATION HISTORY

In 1995, the Navy submitted an Environmental Assessment to NMFS regarding a beach erosion control project at Dam Neck Annex, Virginia Beach, Virginia. The project consisted of the construction of a buried seawall and periodic beach nourishment. NMFS informed the Navy that formal consultation, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, was necessary, and the Navy initiated consultation in July 1995.

NMFS issued a Biological Opinion in January 1996, concluding that the initial and subsequent dredging by hopper dredge on a 12-year cycle could lethally take threatened loggerhead sea turtles, but was not likely to jeopardize the continued existence of the loggerhead population. NMFS also concluded that endangered Kemp's ridley, green, hawksbill, and leatherback sea turtles, and humpback and fin whales were not likely to be adversely affected by the project. NMFS issued an Incidental Take Statement (ITS) exempting the take of one documented Kemp's ridley or green sea turtle by injury or mortality, and 10 loggerhead sea turtle mortalities.

The dredging took place between August 1996 and November 1996. No incidents of sea turtle mortality were detected, and although three dead loggerheads were spotted either floating in the water or washed up on the beach south of Dam Neck, the mortalities were not linked to the dredging activity. No whales were spotted by observers throughout the dredge cycle.

In March 2003, following a Navy study on the performance of the beach erosion control project, which indicated the need to re-nourish the beach with additional sand in 2003-2004, the Navy requested affirmation from NMFS that the proposed 2003-2004 dredge cycle could be conducted under the same ITS and Terms and Conditions specified in the 1996 Biological Opinion. NMFS informed the Navy in April 2003 that formal consultation would be required, as the cycle was more frequent and had been condensed from 12 years to eight, and the volume of dredged material had increased from 635,000 cubic yards (cy) to 700,000 cy. Additionally, new information regarding loggerhead sea turtles had become available, indicating the need for reinitiation. Formal consultation was re-initiated in July 2003.

NMFS issued a Biological Opinion in December 2003, concluding that the dredging operations at the Sandbridge Shoal borrow site and beach nourishment activities at the Dam Neck Annex Beach may adversely affect but are not likely to jeopardize the continued existence of the loggerhead, leatherback, Kemp's ridley, green, or hawksbill sea turtles. In addition, NOAA Fisheries concluded that this action is not likely to adversely affect North Atlantic right, humpback, and fin whales. NMFS issued an Incidental Take Statement (ITS) exempting the take of up to four loggerheads and one Kemp's ridley or green sea turtle by mortality. Additionally, NMFS stated that relocation trawling, a requirement under the reasonable and prudent measures and terms and conditions under certain circumstances, could result in the annual take of an additional 120 sea turtles (either loggerheads, Kemp's ridleys, leatherbacks, or greens, or a combination thereof) without causing injury or death, and the injury or death of one sea turtle (of any of the aforementioned species). No incidental take of any listed marine mammal was anticipated or exempted.

In September 2011, the Navy requested informal consultation on their proposal to conduct repairs to the Shore Protection System at Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia. The Navy provided NMFS with a Biological Assessment for the project and requested concurrence with the preliminary determination that the project was not likely to adversely affect any species listed as threatened or endangered under the ESA.

In a letter dated October 26, 2011, NMFS informed the Navy that it was not able to concur with the Navy's not likely to adversely affect determination, due to the risk of sea turtle and Atlantic sturgeon entrainment, and requested additional information and revisions to be made to the BA. A revised BA for the purposes of formal consultation was received on April 20, 2012. NMFS provided additional comments to the Navy on May 16, 2012, via email. The final BA was submitted to NMFS by e-mail on May 21, 2012, and this date marks the beginning of formal consultation. In an email dated May 24, 2012, the Navy confirmed that the final BA served as their formal request for formal consultation.

3.0 DESCRIPTION OF THE PROPOSED ACTION

The United States Department of the Navy is proposing to repair the Shoreline Protection System (SPS) on Naval Air Station Oceana, Dam Neck Annex, located on the Atlantic coast in Virginia Beach, Virginia. The portion of the SPS that would be repaired (replenished) is approximately 2 miles (3.2 km) long, including the 1-mile (1.6-km) area in front of manmade dune, with additional approximately one-half-mile (0.8-km) portions extending north and south of the manmade dune. Sand for the beaches would be dredged from a Bureau of Ocean Energy Management-approved borrow area within the Sandbridge Shoal, located approximately 3 miles (4.8 km) offshore of the proposed project area. Implementation of the replenishment is anticipated to begin between FY 2012 and FY 2014, based on funding and training schedules, and is estimated to take three to six consecutive months to complete.

3.1 Original Shoreline Protection System

Dam Neck Annex is a satellite installation of Naval Air Station Oceana, situated on the Atlantic coast in the Hampton Roads region of Virginia, within the City of Virginia Beach. The beaches at Dam Neck Annex are prone to erosion from seasonal hurricanes, tropical storms, nor'easters, and winter conditions that force powerful wind and wave actions upon the installation beaches. In the early 1990s, the beach became so severely eroded that Navy facilities were at risk of being damaged or destroyed by flooding and wave action caused by coastal storms. To protect these facilities, the Navy established an emergency military construction project (P994) in fiscal year 1995 to construct the Shoreline Protection System.

The SPS project was completed in October 1996 and included constructing a reinforced sand dune and replenishing the beach on the seaward side of the dune. The constructed dune measured 5,282 feet (1 mile [1,610 meters (m)]) in length, 20 feet (6 m) in height, and 50 feet (15 m) in width; covered approximately 11 acres (4.5 ha) of nearshore upland. It contained a buried stone seawall designed to provide a residual dune to protect the nearest real property until sand could be replenished. However, the stone seawall was not designed to provide permanent protection of the buildings and their contents. Approximately 874,000 cubic yards (cy; 668,000 cubic meters [m^3]) of sand was required to construct the SPS, including the constructed dune and beach replenishment. Approximately 115,000 cy (88,000 m^3) of the total sand was trucked in from commercial borrow pits located approximately 10 miles (16 km) from Dam Neck Annex to construct the sand dune on top of the stone seawall. The constructed dune was planted with American beach grass (*Ammophila breviligulata*), Atlantic coastal/bitter panic grass (*Panicum amarum*), and sea oats (*Uniola paniculata*). Six pedestrian crossover bridges were constructed over the dune to provide pedestrian access to the beach. Natural sand dunes occur north and south of the constructed dune. Annual revegetation of the dunes is conducted as specified in the installation's Integrated Natural Resources Management Plan (INRMP).

The remaining approximately 759,000 cy (580,000 m^3) of sand was placed along approximately 9,280 feet (2 miles [2,800 m]) of beach in front of the constructed sand dune and extending approximately one-half mile (0.8 km) to both the north and south of the constructed dune. The beach replenishment covered approximately 4.5 acres (1.8 ha) of nearshore upland, 8 acres (3.2 ha) of intertidal area, and 28 acres (11.3 ha) of nearshore area below the mean low water line. The beach was designed to be 200 feet (61 m) wide from the dune centerline to the ocean.

Sand for the beach replenishment was dredged from an ocean borrow site in the Sandbridge Shoal, located approximately 3 miles (4.8 km) offshore of the project location, outside of Virginia's territorial sea. Ocean depth in the vicinity of the Sandbridge Shoal ranges from approximately 30 to 65 feet (9.1 to 19.8 m). Estimated sand reserves are 40 million cy (30,582,194 m^3). In places, the shoal is approximately 20 feet (6.1 m) thick. The principal sediment is fine to medium sand. The sand dredged from the shoal was provided through a negotiated agreement with the United States Department of Interior, Bureau of Ocean Energy Management (BOEM), formerly the Minerals Management Service. The dredged sand was pumped from the shoal to the beach replenishment area.

The Navy anticipated that periodic replenishment of the SPS would be required to maintain its design integrity and effectiveness. The initial beach replenishment cycle was estimated to be 12 years based upon design expectations. However, a three-year study conducted by the Navy to monitor the performance of the 1996 beach replenishment revealed that a 12-year cycle was inadequate and recommended the beach be replenished in 2003-2004 (i.e., approximately every 7 to 8 years). In 2004, Special Project R123-01 (Repairs to Shoreline Protection System) replenished the sand that had eroded from the beach and dune since the SPS was constructed. The project placed approximately 700,000 cy (535,000 m^3) of sand along the approximately 2 miles (9,280 feet [2,829 m]) of beach front replenished in 1996, covering the same acreage. The dune system needed only minor spot repair with additional sand and vegetation. Sand for the replenishment was provided through a negotiated agreement with BOEM and was dredged by hopper dredge from Sandbridge Shoal. A sand-slurry was then pumped from the hopper dredge onto the Dam Neck Annex beach through a pipeline, which was moved along the beach. Bulldozers and graders shaped the beach and dune to the original 1996 configuration.

3.2 Restoration of Shoreline Protection System to Original Condition

The Navy proposes to restore the SPS at Dam Neck Annex to its original condition. The beach would be fully replenished, and the seaward side of the existing manmade dune would be replenished with sand and reshaped to its 1996 dimensions. The restored areas of the manmade dune would be revegetated with native grasses such as American beach grass, Atlantic coastal/bitter panic grass, switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*). Accumulated sand would be removed from the pedestrian crossover bridges.

A total of approximately 700,000 cy (535,000 m^3) of sand would be required. This would require approximately 260 trips by the hopper dredge from the shoal to the beach. The volume of sand required includes an extra 25 percent contingency for sand that escapes into the water column during the replenishment operation. It is estimated that approximately 472,500 cy (361,300 m^3) would be placed on the beach, and 52,500 cy (40,100 m^3) would be added to the manmade dune. This sand would replace the volume eroded since 2004 by normal wind, wave, and current action, as well as that removed during storm events.

The Navy would require authorization from BOEM to access outer continental shelf sand in the borrow area known as Sandbridge Shoal for the extent of the lease agreement in order to dredge sand for the replenishment. The approved Sandbridge Shoal borrow area encompasses approximately 13,500 acres (55 km^2) in the Atlantic Ocean approximately 3 miles (4.8 km) east of the proposed project location.

Substrates within the shoal are primarily medium-grained sand appropriate for beach restoration projects. A hopper dredge would be used to pump the sand from Sandbridge Shoal, removing approximately 2,800 cy (2,141 m^3) of sand per trip. Assumed average dredge depths of 2 to 6 feet (0.6 to 1.8 m) would affect up to approximately 217 acres (0.9 km^2), representing up to approximately 1.6 percent of the approved borrow area. Once the sand is removed from the shoal, the dredge would be transported to pump-out stations/buoys located close to shore (approximately 0.5 miles [0.8 km])) where the sand slurry would be pumped from the dredge onto the Dam Neck Annex beach through a pipeline at no more than five different pump-out stations/buoys positioned approximately 2,500 to 3,000 feet [762 to 914 m]) apart along the area to be replenished. No more than two bulldozers and two graders would then be used to shape the beach and dune to its original 1996 design. The bulldozers and graders would be operated 8 hours per day. The maximum distance the deposited sand would extend into the water from the shore would be 300 feet (91.4 m). The Navy will ensure that the contractor uses best management practices to avoid erosion during sand placement.

Repairs are estimated to require approximately three to six consecutive months to complete. One hopper dredge would be used to complete the project. Dredging operations would occur 24 hours per day, with approximately 9.8 hours per day spent at the borrow area. The remainder of the day would be spent in transit or at the pump-out stations/buoys. It would be expected that the hopper dredge would complete approximately seven round-trips per day from the borrow area to the pump-out stations/buoys.

Based on the proposed hopper dredge capacity it was assumed that the dredge would move at a speed between 8 and 14 knots while transiting between the Shoal and the beach (Navy 2012a). The actual speed of the vessel would depend on the particular dredge used. While dredging, the approximate speed of the vessel would be 2 to 3 knots (Navy 2012a). The dredge will comply with the NMFS speed restrictions for vessels traveling in United States waters in the mid-

Atlantic region, of no greater than 10 knots between November 1 and April 30 (50 CFR 224.105). There could also be one support vessel needed to travel daily to the dredge location. The actual speed of this vessel would also depend on the particular vessel used.

The proposed action would be a single one-time action. However, it is anticipated that future replenishment of the beaches would be necessary and would be on a similar cycle and require similar volumes of sand as past similar projects at Dam Neck Annex. Catastrophic storm events may require shorter cycles and larger volumes of sand. The Navy would initiate appropriate consultations when additional beach replenishment is required.

3.3 Mitigation Measures

Observers will be required to monitor the action area for protected species to prevent collisions with moving vessels. Observations of whales within 3,280 feet (1,000 m) of the dredging operation would result in an immediate suspension of activity until the individual's protection could be assured. During night-time dredging operations, the work area would be lit well enough to ensure that the observer can perform their work safely, effectively, and to the extent practicable. Weekly summary reports would be submitted to the NMFS Northeast Region by the observers.

Dredge operators would conform to the regulations prohibiting the approach of North Atlantic right whales closer than 500 yards (457 m) (50 CFR 224.103(c)) and other threatened or endangered species of whale no closer than 100 feet (30 m). Any vessel within these buffer zones created by a surfacing whale would depart the area immediately at safe, slow speed. To reduce risk of collisions with turtles, dredging vessels and support boats would not intentionally approach within 100 yards (91 m) of listed species when in transit.

The hopper dredge would comply with the NMFS speed restrictions for vessels traveling in United States waters in the mid-Atlantic region, of no greater than 10 knots between November 1 and April 30 (50 CFR 224.105). If operations occur during sea turtle nesting season (May 15 to September 15), the Sea Turtle Monitoring Protocol under the Navy's Integrated Natural Resources Management Plan for Dam Neck Annex, would be implemented to ensure protection of nesting turtles, laid nests, and hatchlings. Trained personnel would monitor the target beach throughout and following replenishment. They would be responsible for locating nesting turtles, and identifying species, nesting tracks vs. false crawl tracks, and laid nests. Surveys would be conducted before sunrise each morning. The target beach would be surveyed along the high-tide line in both directions and through visual inspection in the beach-fill area for the duration of the nesting period.

If crawls are not detected, sand replenishment operations would proceed for the day. If crawls are noted, personnel would notify Navy Natural Resources and the nest(s) would be marked. If crawls are later determined to be false crawls, work within the project area can proceed. If eggs are present, the nesting area(s) would be delineated and placed off-limits to vehicular and pedestrian traffic.

Reports of sea turtle activity would be reported to the U.S. Fish and Wildlife the day the activity is discovered, and a final report summarizing the results of the dredging and any sea turtle takes would be submitted to the Navy, USACE, and NMFS within 20 working days of completion of each cycle of the project.

To the maximum extent practicable, lighting would be reduced prior to nesting and hatching season, although due to security reasons, some lights could be left lit.

Sand from the dredge site would be beach-quality and would be approximately the same grain size as the existing beach area, with a low content of fine sediments and organic materials.

The drag head of the hopper dredge would be outfitted with a sea turtle deflector. At the dredge site, the suction in the drag head would be turned off when it is lifted off the bottom. The hopper inflow would be screened to allow monitoring of the dredge material intake for listed species and their remains.

3.4 Action Area

The action area is defined in 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 action area for this consultation includes the Dam Neck Annex, the Sandbridge Shoal Borrow Areas, the waters between and immediate adjacent to these areas where the project vessels will travel and dredged material will be transported (see Appendix A for an map of the action area), as well as an area extending 4,000 feet (1,220 m) in all directions from the area to be dredged to account for the sediment plume generated during dredging activities. As dredging operations would also produce underwater noise levels that range from 120-160 dB re 1μPa, the action area would also include the area around the dredge where effects of increased underwater noise levels would be experienced. Based on the analysis of dredge noise and transmission loss calculators, effects of dredge noise will be experienced within 794 meters from the dredge during loading and pumping.

4.0 LISTED SPECIES IN THE ACTION AREA

NMFS has determined that the action being considered in this biological opinion may affect the following endangered or threatened species under NMFS' jurisdiction:

Sea Turtles

Green sea turtle	*Chelonia mydas*	Threatened/Endangered[1]
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelyts coriacea*	Endangered

[1] Pursuant to NMFS regulations at 50 CFR 223.205, the prohibitions of Section 9 of the Endangered Species Act apply to all green turtles, whether endangered or threatened.

Loggerhead sea turtle	*Caretta caretta*	Threatened
Northwest Atlantic Ocean DPS		
Cetaceans		
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
North Atlantic right whale	*Eubalaena glacialis*	Endangered
Fish		
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	
Gulf of Maine DPS		Threatened
New York Bight DPS		Endangered
Chesapeake Bay DPS		Endangered
Carolina DPS		Endangered
South Atlantic DPS		Endangered

This section presents biological and ecological information relevant to formulating the Biological Opinion. Information on species' life history, its habitat and distribution, and other factors necessary for its survival are included to provide background for analyses in later sections of this opinion.

4.1 Status of Sea Turtles

Sea turtles continue to be affected by many factors occurring on the nesting beaches and in the water. Poaching, habitat loss, and nesting predation by introduced species affect hatchlings and nesting females while on land. Fishery interactions, vessel interactions, and channel dredging operations, for example, affect sea turtles in the neritic zone (defined as the marine environment extending from mean low water down to 200 m (660 foot) depths, generally corresponding to the continental shelf (Lalli and Parsons 1997; Encyclopedia Britannica 2011)). Fishery interactions also affect sea turtles when these species and the fisheries co-occur in the oceanic zone (defined as the open ocean environment where bottom depths are greater than 200 m (Lalli and Parsons 1997). As a result, sea turtles still face many of the original threats that were the cause of their listing under the ESA.

With the exception of loggerheads, sea turtles are listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS). Therefore, information on the range-wide status of Kemp's ridley and green sea turtles is included to provide the status of each species, overall. Information on the status of loggerheads will only be presented for the DPS affected by this action. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d; Conant *et al.* 2009), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 2008), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991b, 1998b).

The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of

Mexico. There is an on-going assessment of the long-term effects of the spill on Gulf of Mexico marine life, including sea turtle populations. Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. Approximately 536 live adult and juvenile sea turtles were recovered from the Gulf and brought into rehabilitation centers; of these, 456 were visibly oiled (these and the following numbers were obtained from http://www.nmfs.noaa.gov/pr/health/oilspill/). To date, 469 of the live recovered sea turtles have been successfully returned to the wild, 25 died during rehabilitation, and 42 are still in care but will hopefully be returned to the wild eventually. During the clean-up period, 613 dead sea turtles were recovered in coastal waters or on beaches in Mississippi, Alabama, Louisiana, and the Florida Panhandle. As of February 2011, 478 of these dead turtles had been examined. Many of the examined sea turtles showed indications that they had died as a result of interactions with trawl gear, most likely used in the shrimp fishery, and not as a result of exposure to or ingestion of oil.

During the spring and summer of 2010, nearly 300 sea turtle nests were relocated from the northern Gulf to the east coast of Florida with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. From these relocated nests, 14,676 sea turtles, including 14,235 loggerheads, 125 Kemp's ridleys, and 316 greens, were ultimately released from Florida beaches.

As noted above, a thorough assessment of the long-term effects of the spill on sea turtles has not yet been completed. However, the spill resulted in the direct mortality of many sea turtles and may have had sub lethal effects or caused environmental damage that will affect other sea turtles into the future. The population level effects of the spill and associated response activity are likely to remain unknown for some period into the future.

4.1.1 Northwest Atlantic DPS of loggerhead sea turtle

The loggerhead is the most abundant species of sea turtle in U.S. waters. Loggerhead sea turtles are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. They are also exposed to a variety of natural and anthropogenic threats in the terrestrial and marine environment.

Listing History

Loggerhead sea turtles were listed as threatened throughout their global range on July 28, 1978. Since that time, several status reviews have been conducted to review the status of the species and make recommendations regarding its ESA listing status. Based on a 2007 five-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and FWS determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified for the loggerhead (NMFS and USFWS 2007a). Genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007; TEWG 2009; NMFS and USFWS 2008). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003).

In part to evaluate those genetic differences, in 2008, NMFS and FWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT evaluated genetic data, tagging and telemetry data, demographic information, oceanographic features, and geographic barriers to determine whether population segments exist. The BRT report was completed in August 2009 (Conant *et al.* 2009). In this report, the BRT identified the following nine DPSs as being discrete from other conspecific population segments and significant to the species: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean.

The BRT concluded that although some DPSs are indicating increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to an analysis using expert opinion in a matrix model framework, the BRT report stated that all loggerhead DPSs have the potential to decline in the foreseeable future. Based on the threat matrix analysis, the potential for future decline was reported as greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al.* 2009). The BRT concluded that the North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Southeast Indo-Pacific Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs were at risk of extinction. The BRT concluded that although the Southwest Indian Ocean and South Atlantic Ocean DPSs were likely not currently at immediate risk of extinction, the extinction risk was likely to increase in the foreseeable future.

On March 16, 2010, NMFS and USFWS published a proposed rule (75 FR 12598) to divide the worldwide population of loggerhead sea turtles into nine DPSs, as described in the 2009 Status Review. Two of the DPSs were proposed to be listed as threatened and seven of the DPSs, including the Northwest Atlantic Ocean DPS, were proposed to be listed as endangered. NMFS and the USFWS accepted comments on the proposed rule through September 13, 2010 (75 FR 30769, June 2, 2010). On March 22, 2011 (76 FR 15932), NMFS and USFWS extended the date by which a final determination on the listing action will be made to no later than September 16, 2011. This action was taken to address the interpretation of the existing data on status and trends and its relevance to the assessment of risk of extinction for the Northwest Atlantic Ocean DPS, as well as the magnitude and immediacy of the fisheries bycatch threat and measures to reduce this threat. New information or analyses to help clarify these issues were requested by April 11, 2011.

On September 22, 2011, NMFS and USFWS issued a final rule (76 FR 58868), determining that the loggerhead sea turtle is composed of nine DPSs (as defined in Conant *et al.*, 2009) that constitute species that may be listed as threatened or endangered under the ESA. Five DPSs were listed as endangered (North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea), and four DPSs were listed as threatened (Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean). Note that the Northwest Atlantic Ocean (NWA) DPS and the Southeast Indo-Pacific Ocean DPS were originally proposed as endangered. The NWA DPS was determined to be threatened based on review of nesting data available after the proposed rule was published, information provided in public comments on the proposed rule, and further discussions within the agencies. The two primary factors considered were population abundance and population trend. NMFS and USFWS found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats. This final listing rule became effective on October 24, 2011.

The September 2011 final rule also noted that critical habitat for the two DPSs occurring within the U.S. (NWA DPS and North Pacific DPS) will be designated in a future rulemaking. Information from the public related to the identification of critical habitat, physical or biological habitat features essential to the conservation of the species, and relevant impacts of a critical habitat designation was solicited. Currently, no critical habitat is designated for any DPS of loggerhead sea turtles, and therefore, no critical habitat for any DPS occurs in the action area.

Presence of Loggerhead Sea Turtles in the Action Area

The effects of this proposed action are only experienced within the Atlantic Ocean. NMFS has considered the available information on the distribution of the 9 DPSs to determine the origin of any loggerhead sea turtles that may occur in the action area. As noted in Conant *et al.* (2009), the range of the four DPSs occurring in the Atlantic Ocean are as follows: NWA DPS – north of the equator, south of 60° N latitude, and west of 40° W longitude; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60° N latitude, east of 40° W longitude, and west of 5° 36' W longitude; South Atlantic DPS – south of the equator, north of 60° S latitude, west of 20° E longitude, and east of 60° W longitude; Mediterranean DPS – the Mediterranean Sea east of 5° 36' W longitude. These boundaries were determined based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. While adults are highly structured with no overlap, there may be some degree of overlap by juveniles of the NWA, NEA, and Mediterranean DPSs on oceanic foraging grounds (Laurent *et al.* 1993, 1998; Bolten *et al.* 1998; LaCasella *et al.* 2005; Carreras *et al.* 2006, Monzón-Argüello *et al.* 2006; Revelles *et al.* 2007). Previous literature (Bowen *et al.* 2004) has suggested that there is the potential, albeit small, for some juveniles from the Mediterranean DPS to be present in U.S. Atlantic coastal foraging grounds. These conclusions must be interpreted with caution however, as they may be representing a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in US Atlantic coastal waters. A re-analysis of the data by the Atlantic loggerhead Turtle Expert Working Group has found that that it is unlikely that U.S. fishing fleets are interacting with either the Northeast Atlantic loggerhead DPS or the Mediterranean loggerhead DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011).

Given that the action area is a subset of the area fished by US fleets, it is reasonable to assume that based on this new analysis, no individuals from the Mediterranean DPS or Northeast Atlantic DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al.* 2009). As such, the remainder of this consultation will only focus on the NWA DPS, listed as threatened.

Distribution and Life History

Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the 5-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG report (2009), and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which is a second revision to the original recovery plan that was approved in 1984 and subsequently revised in 1991.

In the western Atlantic, waters as far north as 41° N to 42° N latitude are used for foraging by juveniles, as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003). In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Braun-McNeill *et al.* 2008; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures ≥11°C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 m to 49 m deep (Shoop and Kenney 1992). However, more recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Mansfield 2006; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield et al. 2009).

Loggerhead sea turtles occur year round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the Southeast United States (*e.g.*, Pamlico and Core Sounds) and also move up the U.S. Atlantic Coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2004), occurring in Virginia foraging areas as early as April/May and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some turtles may remain in Mid-Atlantic and Northeast areas until late fall. By December, loggerheads have migrated from inshore and more northern coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Shoop and Kenney 1992; Epperly *et al.* 1995b).

Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988; NMFS and USFWS 2008). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats (NMFS and USFWS 2008).

As presented below, Table 3 from the 2008 loggerhead recovery plan highlights the key life history parameters for loggerheads nesting in the United States.

Population Dynamics and Status

By far, the majority of Atlantic nesting occurs on beaches of the southeastern United States (NMFS and USFWS 2007a). For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29° N latitude; (2) a south Florida group of nesting females that nest from 29° N latitude on the East Coast to Sarasota on the West Coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico; and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, Florida and on Cal Sal Bank (TEWG 2009). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the five identified nesting groups of females (TEWG 2009). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

Table 3. Typical values of life history parameters for loggerheads nesting in the U.S.

Life History Parameter	**Data**
Clutch size	100-126 eggs[1]
Egg incubation duration (varies depending on time of year and latitude)	42-75 days[2,3]
Pivotal temperature (incubation temperature that produces an equal number of males and females)	29.0°C[5]
Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors)	45-70%[2,6]
Clutch frequency (number of nests/female/season)	3-5.5 nests[7]
Internesting interval (number of days between successive nests within a season)	12-15 days[8]
Juvenile (<87 cm CCL) sex ratio	65-70% female[4]
Remigration interval (number of years between successive nesting migrations)	2.5-3.7 years[9]
Nesting season	late April-early September
Hatching season	late June-early November
Age at sexual maturity	32-35 years[10]
Life span	>57 years[11]

1 Dodd 1988.
2 Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).
3 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).
4 National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication, 2005.
5 Mrosovsky (1988).
6 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=1,680).
7 Murphy and Hopkins (1984); Frazer and Richardson (1985); Ehrhart, unpublished data; Hawkes *et al.* 2005; Scott 2006; Tony Tucker, Mote Marine Laboratory, personal communication, 2008.
8 Caldwell (1962), Dodd (1988).
9 Richardson *et al.* (1978); Bjorndal *et al.* (1983); Ehrhart, unpublished data.
10 Melissa Snover, NMFS, personal communication, 2005; see Table A1-6.
11 Dahlen *et al.* (2000).

The lack of genetic structure makes it difficult to designate specific boundaries for the nesting subpopulations based on genetic differences alone. Therefore, the Loggerhead Recovery Team recently used a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to reassess the designation of these subpopulations to identify recovery units in the 2008 recovery plan.

In the 2008 recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the Southeast United States. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the United States, but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

The Loggerhead Recovery Team evaluated the status and trends of the Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008). The level and consistency of nesting coverage varies among recovery units, with coverage in Florida generally being the most consistent and thorough over time. Since 1989, nest count surveys in Florida have occurred in the form of statewide surveys (a near complete census of entire Florida nesting) and index beach surveys (Witherington *et al.* 2009). Index beaches were established to standardize data collection methods and maintain a constant level of effort on key nesting beaches over time.

Note that NMFS and USFWS (2008), Witherington *et al.* (2009), and TEWG (2009) analyzed the status of the nesting assemblages within the NWA DPS using standardized data collected over periods ranging from 10-23 years. These analyses used different analytical approaches, but found the same finding that there had been a significant, overall nesting decline within the NWA DPS. However, with the addition of nesting data from 2008-2010, the trend line changes showing a very slight negative trend, but the rate of decline is not statistically different from zero (76 FR 58868, September 22, 2011). The nesting data presented in the Recovery Plan (through 2008) is described below, with updated trend information through 2010 for two recovery units.

From the beginning of standardized index surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2008, there was a 41% decrease in annual nest counts from index beaches, which represent an average of 70% of the statewide nesting activity (NMFS and USFWS 2008). From 1989-2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and USFWS 2008). With the addition of nesting data through 2010, the nesting trend for the PFRU does not show a nesting decline statistically different from zero (76 FR 58868, September 22, 2011). The NRU, the second largest nesting assemblage of loggerheads in the United States, has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The NRU dataset included 11 beaches with an uninterrupted time series of coverage of at least 20 years; these beaches represent approximately 27% of NRU nesting (in 2008). Through 2008, there was strong statistical data to suggest the NRU has experienced a long-term decline, but with the inclusion of nesting data through 2010, nesting for the NRU is showing possible signs of stabilizing (76 FR 58868, September 22, 2011). Evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. However, the NGMRU has shown a significant declining trend of 4.7% annually since index nesting beach surveys were initiated in 1997 (NMFS and USFWS 2008). No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 2008 recovery plan compiled information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (*i.e.*, nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year (from 1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (from 1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (from 1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (from 1995-2007) with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. Note that the above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

Genetic studies of juvenile and a few adult loggerhead sea turtles collected from Northwest Atlantic foraging areas (beach strandings, a power plant in Florida, and North Carolina fisheries) show that the loggerheads that occupy East Coast U.S. waters originate from these Northwest Atlantic nesting groups; primarily from the nearby nesting beaches of southern Florida, as well as the northern Florida to North Carolina beaches, and finally from the beaches of the Yucatán Peninsula, Mexico (Rankin-Baransky *et al.* 2001; Witzell *et al.* 2002; Bass *et al.* 2004; Bowen *et al.* 2004). The contribution of these three nesting assemblages varies somewhat among the foraging habitats and age classes surveyed along the east coast. The distribution is not random and bears a significant relationship to the proximity and size of adjacent nesting colonies (Bowen *et al.* 2004). Bass *et al.* (2004) attribute the variety in the proportions of sea turtles from loggerhead turtle nesting assemblages documented in different East Coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches.

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies have been conducted in some areas of the Northwest Atlantic and provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). The TEWG (2009) used raw data from six in-water study sites to conduct trend analyses. They identified an increasing trend in the abundance of loggerheads from three of the four sites located in the Southeast United States, one site showed no discernible trend, and the two sites located in the northeast United States showed a decreasing trend in abundance of loggerheads. The 2008 loggerhead recovery plan also includes a full discussion of in-water population studies for which trend data have been reported, and a brief summary will be provided here.

Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the Southeast Coast of the U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last four years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977-2004 show an increasing trend of loggerheads at the power plant intake structures (FPL and Quantum Resources 2005).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 in comparison to the period 1987-1992, with only two loggerheads (of a total 54 turtles) observed captured in pound net gear during the period 2002-2004. This is in contrast to the previous decade's study where numbers of individual loggerheads ranged from 11 to 28 per year (Morreale *et al.* 2005). No additional loggerheads were reported captured in pound net gear in New York through 2007, although two were found cold-stunned on Long Island Bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ($p<0.05$) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in

Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue crabs, with loggerheads redistributing outside of Bay waters (NMFS and USFWS 2008).

As with other turtle species, population estimates for loggerhead sea turtles are difficult to determine, largely due to their life history characteristics. However, a recent loggerhead assessment using a demographic matrix model estimated that the loggerhead adult female population in the western North Atlantic ranges from 16,847 to 89,649, with a median size of 30,050 (NMFS SEFSC 2009). The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. The pelagic stage survival parameter had the largest effect on the model results. As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. It should also be noted that additional analyses are underway which will incorporate any newly available information.

As part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), line transect aerial abundance surveys and turtle telemetry studies were conducted along the Atlantic Coast in the summer of 2010. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. Aerial surveys were conducted from Cape Canaveral, Florida to the Gulf of St. Lawrence, Canada. Satellite tags on juvenile loggerheads were deployed in two locations – off the coasts of northern Florida to South Carolina (n=30) and off the New Jersey and Delaware coasts (n=14). As presented in NMFS NEFSC (2011), the 2010 survey found a preliminary total surface abundance estimate within the entire study area of about 60,000 loggerheads (CV=0.13) or 85,000 if a portion of unidentified hard-shelled sea turtles were included (CV=0.10). Surfacing times were generated from the satellite tag data collected during the aerial survey period, resulting in a 7% (5%-11% inter-quartile range) median surface time in the South Atlantic area and a 67% (57%-77% inter-quartile range) median surface time to the north. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS NEFSC 2011). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. The density of loggerheads was generally lower in the north than the south; based on number of turtle groups detected, 64% were seen south of Cape Hatteras, North Carolina, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. Although they have been seen farther north in previous studies (*e.g.*, Shoop and Kenney 1992), no loggerheads were observed during the aerial surveys conducted in the summer of 2010 in the more northern zone encompassing Georges Bank, Cape Cod Bay, and the Gulf of Maine. These estimates of loggerhead abundance over the U.S. Atlantic continental shelf are considered very preliminary. A more thorough analysis will be completed pending the results of further studies related to improving estimates of regional and seasonal variation in loggerhead surface time (by increasing the sample size and geographical area of tagging) and other information needed to improve the biases inherent in aerial surveys of sea turtles (*e.g.*, research on depth of detection and species misidentification rate). This survey effort represents the most comprehensive assessment of sea turtle abundance and distribution in many years. Additional aerial surveys and research to improve the abundance estimates are anticipated in 2011-2014, depending on available funds.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The 5-year status review and 2008 recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007a, 2008). Amongst those of natural origin, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold-stunning, biotoxin exposure, and native species predation.

Anthropogenic factors that affect hatchlings and adult females on land, or the success of nesting and hatching include: beach erosion, beach armoring, and nourishment; artificial lighting; beach cleaning; beach pollution; increased human presence; recreational beach equipment; vehicular and pedestrian traffic; coastal development/construction; exotic dune and beach vegetation; removal of native vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (*e.g.*, raccoons, armadillos, and opossums), which raid nests and feed on turtle eggs (NMFS and USFWS 2007a, 2008). Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic Coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density East Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerheads are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation; marine pollution; underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions.

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeders in coastal waters, the most important source of human caused mortality in U.S. Atlantic waters was fishery interactions. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles (Wallace *et al.* 2008). The Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant *et al.* 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity of sea turtle bycatch across all fisheries is of great importance.

Finkbeiner et al. (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

Of the many fisheries known to adversely affect loggerheads, the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest threat of mortality to neritic juvenile and adult age classes of loggerheads (NRC 1990, Finkbeiner et al. 2011). Significant changes to the South Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultations. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002a; Lewison *et al.* 2003). A section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries completed in 2002 estimated the total annual level of take for loggerhead sea turtles to be 163,160 interactions (the total number of turtles that enter a shrimp trawl, which may then escape through the TED or fail to escape and be captured) with 3,948 of those takes being lethal (NMFS 2002a).

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates were based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all affected the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico have been substantially less than were projected in the 2002 Opinion. In 2008, the NMFS Southeast Fisheries Science Center (SEFSC) estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery to be 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center to Dr. R. Crabtree, Southeast Region, December 2008). However, the most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of take for loggerheads at present. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least thousands and possibly tens of thousands of interactions annually, of which at least hundreds and possibly thousands are expected to be lethal (NMFS 2012).

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. The reduction of sea turtle captures in fishing operations is identified in recovery plans and 5-year status reviews as a priority for the recovery of all sea turtle species. In the threats analysis of the loggerhead recovery plan, trawl bycatch is identified as the greatest source of mortality. While loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear was previously estimated for the period 1996-2004 (Murray 2006, 2008), a recent bycatch analysis estimated the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2005-2008 (Warden 2011a). Northeast Fisheries Observer Program data from 1994-2008 were used to develop a model of interaction rates and those predicted rates were applied to 2005-2008 commercial fishing data to estimate the number of interactions for the trawl fleet. The number of predicted average annual loggerhead interactions for 2005-2008 was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls but being released through a TED. Of the 292 average annual observable loggerhead interactions, approximately 44 of those were adult equivalents. Warden (2011b) found that latitude, depth and SST were associated with the interaction rate, with the rates being highest south of 37°N latitude in waters < 50 m deep and SST > 15°C. This estimate is a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, estimated to be 616 sea turtles (CV=0.23, 95% CI over the 9-year period: 367-890) (Murray 2006, 2008).

There have been several published estimates of the number of loggerheads taken annually as a result of the dredge fishery for Atlantic sea scallops, ranging from a low of zero in 2005 (Murray 2007) to a high of 749 in 2003 (Murray 2004). Murray (2011) recently re-evaluated loggerhead sea turtle interactions in scallop dredge gear from 2001-2008. In that paper, the average number of annual observable interactions of hard-shelled sea turtles in the Mid-Atlantic scallop dredge fishery prior to the implementation of chain mats (January 1, 2001 through September 25, 2006) was estimated to be 288 turtles (CV = 0.14, 95% CI: 209-363) [equivalent to 49 adults], 218 of which were loggerheads [equivalent to 37 adults]. After the implementation of chain mats, the average annual number of observable interactions was estimated to be 20 hard-shelled sea turtles (CV = 0.48, 95% CI: 3-42), 19 of which were loggerheads. If the rate of observable interactions from dredges without chain mats had been applied to trips with chain mats, the estimated number of observable and inferred interactions of hard-shelled sea turtles after chain mats were implemented would have been 125 turtles per year (CV = 0.15, 95% CI: 88-163) [equivalent to 22 adults], 95 of which were loggerheads [equivalent to 16 adults]. Interaction rates of hard-shelled turtles were correlated with sea surface temperature, depth, and use of a chain mat. Results from this recent analysis suggest that chain mats and fishing effort reductions have contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011).

An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, b). From 1995-2006, the annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to average 350 turtles (CV=0.20, 95% CI over the 12-year period: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009a).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) FMP are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those incidental takes that would still occur (Garrison and Stokes 2010). In 2010, there were 40 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2011a, 2011b). All of the loggerheads were released alive, with the vast majority released with all gear removed. While 2010 total estimates are not yet available, in 2009, 242.9 (95% CI: 167.9-351.2) loggerhead sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP based on the observed takes (Garrison and Stokes 2010). The 2009 estimate is considerably lower than those in 2006 and 2007 and is consistent with historical averages since 2001 (Garrison and Stokes 2010). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Documented takes also occur in other fishery gear types and by non-fishery mortality sources (*e.g.*, hopper dredges, power plants, vessel collisions), but quantitative estimates are unavailable.

As highly migratory, wide-ranging organisms that are biologically tied to temperature regimes, loggerhead sea turtles are vulnerable to effects of climate change in aspects of their physiology and behavior (Van Houtan 2011; 2009 Loggerhead Status Review Report). Analysis on potential effects of climate change on loggerhead sea turtles in the action area is included below in section 6.0.

Summary of Status for Loggerhead Sea Turtles

Loggerheads are a long-lived species and reach sexual maturity relatively late at around 32-35 years in the Northwest Atlantic (NMFS and USFWS 2008). The species continues to be affected by many factors occurring on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation that affects eggs, hatchlings, and nesting females on land, as well as fishery interactions, vessel interactions, marine pollution, and non-fishery (*e.g.*, dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007a, 2008). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA.

As mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was recently published by NMFS and FWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit. The recovery plan noted a decline in annual nest counts for three of the five recovery units for loggerheads in the Northwest Atlantic, including the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. The nesting trends for the other two recovery units could not be determined due to an absence of long term data.

NMFS convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to evaluate the status of this species in the Atlantic. A final report from the Loggerhead TEWG was published in July 2009. In this report, the TEWG indicated that it could not determine whether the decreasing annual numbers of nests among the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of adult females, decreasing numbers of adult females, or a combination of these factors. Many factors are responsible for past or present loggerhead mortality that could affect current nest numbers; however, no single mortality factor stands out as a likely primary factor. It is likely that several factors compound to create the current decline, including incidental capture (in fisheries, power plant intakes, and dredging operations), lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. Regardless, the TEWG stated that "it is clear that the current levels of hatchling output will result in depressed recruitment to subsequent life stages over the coming decades" (TEWG 2009). However, the report does not provide information on the rate or amount of expected decrease in recruitment but goes on to state that the ability to assess the current status of loggerhead subpopulations is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and USFWS 2008, TEWG 2009), when nest counts through 2010 are analyzed, the nesting trends from 1989-2010 are not significantly different than zero (i.e., stable) for all recovery units within the NWA DPS for which there are enough data to analyze (76 FR 58868, September 22, 2011). The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

Based on this and the current best available information, we believe that the NWA DPS of loggerheads is currently stable; as protective measures for sea turtles are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years. Please note, this stable trend is based solely on information we have on nesting trends. The number of sea turtles comprising the neritic and oceanic life stages of the population is currently unknown and as such, the overall status and future trend of the population remains unclear and can only be speculated based on the available data we currently have on nesting trends. Therefore, until information and data becomes available on the numbers of individuals comprising the neritic and oceanic life stages, nesting trends represent the best available information and serve as the best representative of the population's trend.

4.1.2 Kemp's ridley sea turtles

Distribution and Life History

The Kemp's ridley is one of the least abundant of the world's sea turtle species. In contrast to loggerhead, leatherback, and green sea turtles, which are found in multiple oceans of the world, Kemp's ridleys typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (NMFS et al. 2011).

Kemp's ridleys mature at 10-17 years (Caillouet *et al.* 1995; Schmid and Witzell 1997; Snover *et al.* 2007; NMFS and USFWS 2007c). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (NMFS *et al.* 2011). Females lay an average of 2.5 clutches within a season (TEWG 1998, 2000) and the mean remigration interval for adult females is 2 years (Marquez *et al.* 1982; TEWG 1998, 2000).

Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available S*argassum* and associated infauna or other epipelagic species (NMFS et al. 2011). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the STSSN suggest that benthic immature developmental areas occur along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 m (NMFS and USFWS 2007b). The suitability of these habitats depends on resource availability, with optimal environments providing rich sources of crabs and other invertebrates. Kemp's ridleys consume a variety of crab species, including *Callinectes*, *Ovalipes*, *Libinia*, and *Cancer* species. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). A wide variety of substrates have been documented to provide good foraging habitat, including seagrass beds, oyster reefs, sandy and mud bottoms, and rock outcroppings (NMFS and USFWS 2007b).

Foraging areas documented along the U.S. Atlantic coast include Charleston Harbor, Pamlico Sound (Epperly *et al.* 1995c), Chesapeake Bay (Musick and Limpus 1997), Delaware Bay (Stetzar 2002), and Long Island Sound (Morreale and Standora 1993; Morreale *et al.* 2005). For instance, in the Chesapeake Bay, Kemp's ridleys frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

Adult Kemp's ridleys are found in the coastal regions of the Gulf of Mexico and southeastern United States, but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG

2000). Adults are primarily found in nearshore waters of 37 m or less that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2007b).

Population Dynamics and Status

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007b; NMFS *et al.* 2011). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007b). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, corresponding to fewer than 300 adult females nesting in that season (TEWG 2000; NMFS and USFWS 2007b; NMFS *et al.* 2011). Conservation efforts by Mexican and U.S. agencies have aided this species by eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations (TEWG 2000). Since the mid-1980s, the number of nests observed at Rancho Nuevo and nearby beaches has increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population is on its way to recovery. An estimated 5,500 females nested in the State of Tamaulipas over a 3-day period in May 2007 and over 4,000 of those nested at Rancho Nuevo (NMFS and USFWS 2007b). In 2008, 17,882 nests were documented on Mexican nesting beaches (NMFS 2011). There is limited nesting in the United States, most of which is located in South Texas. While six nests were documented in 1996, a record 195 nests were found in 2008 (NMFS 2011).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, predators, and oceanographic-related events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. In the last five years (2006-2010), the number of cold-stunned turtles on Cape Cod beaches averaged 115 Kemp's ridleys, 7 loggerheads, and 7 greens (NMFS unpublished data). The numbers ranged from a low in 2007 of 27 Kemp's ridleys, 5 loggerheads, and 5 greens to a high in 2010 of 213 Kemp's ridleys, 4 loggerheads, and 14 greens. Annual cold stun events vary in magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast U.S. waters in a given year, oceanographic conditions, and/or the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if they are found early enough, these events represent a significant source of natural mortality for Kemp's ridleys.

Like other sea turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940s through the early 1960s, nests from Ranch Nuevo were heavily exploited, but beach protection in 1967 helped to curtail this activity (NMFS *et al.* 2011). Following World War II, there was a substantial increase in the number of trawl vessels, particularly shrimp trawlers, in the Gulf of Mexico where adult Kemp's ridley sea turtles occur. Information from fisheries observers helped to demonstrate the high number of turtles taken in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle takes in shrimp trawls and other trawl fisheries, including the development and use of turtle excluder devices (TEDs). As described above, there is lengthy regulatory history with regard to the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002b; Epperly 2003; Lewison *et al.* 2003). The 2002 Biological Opinion on shrimp trawling in the southeastern United States concluded that 155,503 Kemp's ridley sea turtles would be taken annually in the fishery with 4,208 of the takes resulting in mortality (NMFS 2002b).

Although modifications to shrimp trawls have helped to reduce mortality of Kemp's ridleys, a recent assessment found that the Southeast/Gulf of Mexico shrimp trawl fishery remained responsible for the vast majority of U.S. fishery interactions (up to 98%) and mortalities (more than 80%). Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

This species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. Three Kemp's ridley captures in Mid-Atlantic trawl fisheries were documented by NMFS observers between 1994 and 2008 (Warden and Bisack 2010), and eight Kemp's ridleys were documented by NMFS observers in mid-Atlantic sink gillnet fisheries between 1995 and 2006 (Murray 2009a). Additionally, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected by NMFS to have been from a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002). The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore. The NMFS Northeast Fisheries Science Center also documented 14 Kemp's ridleys entangled in or impinged on Virginia pound net leaders from 2002-2005. Note that bycatch estimates for Kemp's ridleys in various fishing gear types (*e.g.*, trawl, gillnet, dredge) are not available at this time, largely due to the low number of observed interactions precluding a robust estimate. Kemp's ridley interactions in non-fisheries have also been observed; for example, the Oyster Creek Nuclear Generating Station in Barnegat Bay, New Jersey, recorded a total of 27 Kemp's ridleys (15 of which were found alive) impinged or captured on their intake screens from 1992-2006 (NMFS 2006).

As highly migratory, wide-ranging organisms that are biologically tied to temperature regimes, Kemp's ridley sea turtles are vulnerable to effects of climate change in aspects of their physiology and behavior (Van Houtan 2011). Analysis on potential effects of climate change on Kemp's ridley sea turtles in the action area is included below in section 6.0.

Summary of Status for Kemp's Ridley Sea Turtles

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007b; NMFS *et al.* 2011). The number of nesting females in the Kemp's ridley population declined dramatically from the late 1940s through the mid-1980s, with an estimated 40,000 nesting females in a single *arribada* in 1947 and fewer than 300 nesting females in the entire 1985 nesting season (TEWG 2000; NMFS *et al.* 2011). However, the total annual number of nests at Rancho Nuevo gradually began to increase in the 1990s (NMFS and USFWS 2007b). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles (1.8-2 years), there were an estimated 7,000-8,000 adult female Kemp's ridley sea turtles in 2006 (NMFS and USFWS 2007b). The number of adult males in the population is unknown, but sex ratios of hatchlings and immature Kemp's ridleys suggest that the population is female-biased, suggesting that the number of adult males is less than the number of adult females (NMFS and USFWS 2007b). While there is cautious optimism for recovery, events such as the Deepwater Horizon oil release, and stranding events associated increased skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may dampen recent population growth.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Based on their 5-year status review of the species, NMFS and USFWS (2007b) determined that Kemp's ridley sea turtles should not be reclassified as threatened under the ESA. A revised bi-national recovery plan was published for public comment in 2010, and in September 2011, NMFS, USFWS, and the Services and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) released the second revision to the Kemp's ridley recovery plan.

Based on this and the current best available information, we believe that the Kemp's ridley sea turtle population is currently stable; as protective measures for sea turtles are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years. Please note, this stable trend is based solely on information we have on nesting trends. The number of sea turtles comprising the neritic and oceanic life stages of the population is currently unknown and as such, the overall status and future trend of the population remains unclear and can only be speculated based on the available data we currently have on nesting trends. Therefore, until information and data becomes available on the numbers of individuals comprising the neritic and oceanic life stages, nesting trends represent the best available information and serve as the best representative of the population's trend.

4.1.3 Leatherback sea turtle

Leatherback sea turtles are widely distributed throughout the oceans of the world, including the Atlantic, Pacific, and Indian Oceans, and the Mediterranean Sea (Ernst and Barbour 1972).

Leatherbacks are the largest living turtles and range farther than any other sea turtle species. Their large size and tolerance of relatively low water temperatures allows them to occur in boreal waters such as those off Labrador and in the Barents Sea (NMFS and USFWS 1995).

In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). By 1995, this global population of adult females was estimated to have declined to 34,500 (Spotila *et al.* 1996). The most recent population size estimate for the North Atlantic alone is a range of 34,000-94,000 adult leatherbacks (TEWG 2007). Thus, there is substantial uncertainty with respect to global population estimates of leatherback sea turtles.

4.1.3.1 Pacific Ocean

Leatherback nesting has been declining at all major Pacific basin nesting beaches for the last two decades (Spotila *et al.* 1996, 2000; NMFS and USFWS 1998a, 2007b; Sarti *et al.* 2000). In the western Pacific, major nesting beaches occur in Papua New Guinea, Indonesia, Solomon Islands, and Vanuatu, with an approximate 2,700-4,500 total breeding females, estimated from nest counts (Dutton *et al.* 2007). While there appears to be overall long term population decline, the Indonesian nesting aggregation at Jamursba-Medi is currently stable (since 1999), although there is evidence to suggest a significant and continued decline in leatherback nesting in Papua New Guinea and Solomon Islands over the past 30 years (NMFS 2011). Leatherback sea turtles disappeared from India before 1930; have been virtually extinct in Sri Lanka since 1994; and, appear to be approaching extinction in Malaysia (Spotila *et al.* 2000). In Fiji, Thailand, and Australia, leatherback sea turtles have only been known to nest in low densities and scattered sites.

The largest, extant leatherback nesting group in the Indo-Pacific lies on the North Vogelkop coast of West Papua, Indonesia, with 3,000-5,000 nests reported annually in the 1990s (Suárez *et al.* 2000). However, in 1999, local villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been reported throughout the western Pacific region where observers report that nesting groups are well below abundance levels that were observed several decades ago (*e.g.*, Suárez 1999).

Leatherback sea turtles in the western Pacific are threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, major leatherback nesting beaches are located in Mexico and Costa Rica, where nest numbers have been declining. According to reports from the late 1970s and early 1980s, beaches located on the Mexican Pacific coasts of Michoacán, Guerrero, and Oaxaca sustained a large portion, perhaps 50%, of all global nesting by leatherbacks (Sarti *et al.* 1996). A dramatic decline has been seen on nesting beaches in Pacific Mexico, where aerial survey data was used to estimate that tens of thousands of leatherback nests were laid on the beaches in the 1980s (Pritchard 1982), but a total of only 120 nests on the four primary index beaches (combined) were counted in the 2003-2004 season (Sarti Martinez *et al.* 2007). Since the early 1980s, the Mexican Pacific population of adult female leatherback turtles has declined to slightly more than 200 during 1998-1999 and 1999-2000 (Sarti *et al.* 2000). Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world and the most important nesting beach in the Pacific. Between 1988 and 1999, the nesting group declined from 1,367 to 117 female leatherback sea turtles. Based on their models, Spotila *et al.* (2000) estimated that the group could fall to less than 50 females by 2003-2004. Another, more recent, analysis of the Costa Rican nesting beaches indicates a decline in nesting during 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and USFWS 2007d), indicating that the reductions in nesting females were not as extreme as the reductions predicted by Spotila *et al.* (2000).

On September 26, 2007, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters along the U.S. West Coast. On December 28, 2007, NMFS published a positive 90-day finding on the petition and convened a critical habitat review team. On January 26, 2012, NMFS published a final rule to revise the critical habitat designation to include three particular areas of marine habitat. The designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour, and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. The designated critical habitat areas contain the physical or biological feature essential to the conservation of the species that may require special management conservation or protection. In particular, the team identified one Primary Constituent Element: the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae, of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Leatherbacks in the eastern Pacific face a number of threats to their survival. For example, commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries are known to capture, injure, or kill leatherbacks in the eastern Pacific Ocean. Given the declines in leatherback nesting in the Pacific, some researchers have concluded that the leatherback is on the verge of extinction in the Pacific Ocean (*e.g.*, Spotila *et al.* 1996, 2000).

4.1.3.2 Indian Ocean

Leatherbacks nest in several areas around the Indian Ocean. These sites include Tongaland, South Africa (Pritchard 2002) and the Andaman and Nicobar Islands (Andrews *et al.* 2002). Intensive survey and tagging work in 2001 provided new information on the level of nesting in the Andaman and Nicobar Islands (Andrews *et al.* 2002). Based on the survey and tagging work, it was estimated that 400-500 female leatherbacks nest annually on Great Nicobar Island (Andrews *et al.* 2002). The number of nesting females using the Andaman and Nicobar Islands combined was estimated around 1,000 (Andrews and Shanker 2002). Some nesting also occurs along the coast of Sri Lanka, although in much smaller numbers than in the past (Pritchard

2002).

4.1.3.3 *Mediterranean Sea*

Casale *et al.* (2003) reviewed the distribution of leatherback sea turtles in the Mediterranean. Among the 411 individual records of leatherback sightings in the Mediterranean, there were no nesting records. Nesting in the Mediterranean is believed to be extremely rare if it occurs at all. Leatherbacks found in Mediterranean waters originate from the Atlantic Ocean (P. Dutton, NMFS, unpublished data).

4.1.3.4 *Atlantic Ocean*

Distribution and Life History

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992). Leatherbacks are frequently thought of as a pelagic species that feed on jellyfish (*e.g.*, *Stomolophus, Chryaora*, and *Aurelia* species) and tunicates (*e.g.*, salps, pyrosomas) (Rebel 1974; Davenport and Balazs 1991). However, leatherbacks are also known to use coastal waters of the U.S. continental shelf (James *et al.* 2005a; Eckert *et al.* 2006; Murphy *et al.* 2006), as well as the European continental shelf on a seasonal basis (Witt *et al.* 2007).

Tagging and satellite telemetry data indicate that leatherbacks from the western North Atlantic nesting beaches use the entire North Atlantic Ocean (TEWG 2007). For example, leatherbacks tagged at nesting beaches in Costa Rica have been found in Texas, Florida, South Carolina, Delaware, and New York (STSSN database). Leatherback sea turtles tagged in Puerto Rico, Trinidad, and the Virgin Islands have also been subsequently found on U.S. beaches of southern, Mid-Atlantic, and northern states (STSSN database). Leatherbacks from the South Atlantic nesting assemblages (West Africa, South Africa, and Brazil) have not been re-sighted in the western North Atlantic (TEWG 2007).

The CETAP aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia conducted between 1978 and 1982 showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in water depths ranging from 1 to 4,151 m, but 84.4% of sightings were in waters less than 180 m (Shoop and Kenney 1992). Leatherbacks were sighted in waters within a sea surface temperature range similar to that observed for loggerheads; from 7°-27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters in comparison to loggerhead sea turtles since more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). Studies of satellite tagged leatherbacks suggest that they spend 10%-41% of their time at the surface, depending on the phase of their migratory cycle (James *et al.* 2005b). The greatest amount of surface time (up to 41%) was recorded when leatherbacks occurred in continental shelf and slope waters north of 38°N (James *et al.* 2005b).

In 1979, the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands were designated as critical habitat for the leatherback sea turtle. On February 2, 2010, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters adjacent to a major nesting beach in Puerto Rico. NMFS published a 90-day finding on the petition on July 16, 2010, which found that the petition did not present substantial scientific information indicating that the petitioned revision was warranted. The original petitioners submitted a second petition on November 2, 2010 to revise the critical habitat designation to again include waters adjacent to a major nesting beach in Puerto Rico, including additional information on the usage of the waters. NMFS determined on May 5, 2011, that a revision to critical habitat off Puerto Rico may be warranted, and an analysis is underway. Note that on August 4, 2011, FWS issued a determination that revision to critical habitat along Puerto Rico should be made and will be addressed during the future planned status review.

Leatherbacks are a long lived species (>30 years). They were originally believed to mature at a younger age than loggerhead sea turtles, with a previous estimated age at sexual maturity of about 13-14 years for females with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). However, new sophisticated analyses suggest that leatherbacks in the Northwest Atlantic may reach maturity at 24.5-29 years of age (Avens *et al.* 2009). In the United States and Caribbean, female leatherbacks nest from March through July. In the Atlantic, most nesting females average between 150-160 cm curved carapace length (CCL), although smaller (<145 cm CCL) and larger nesters are observed (Stewart *et al.* 2007, TEWG 2007). They nest frequently (up to seven nests per year) during a nesting season and nest about every 2-3 years. They produce 100 eggs or more in each clutch and can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Therefore, the actual proportion of eggs that can result in hatchlings is less than the total number of eggs produced per season. As is the case with other sea turtle species, leatherback hatchlings enter the water soon after hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm CCL, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm CCL.

Population Dynamics and Status

As described earlier, sea turtle nesting survey data is important in that it provides information on the relative abundance of nesting, and the contribution of each population/subpopulation to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually, and as an indicator of the trend in the number of nesting females in the nesting group. The 5-year review for leatherback sea turtles (NMFS and USFWS 2007d) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007).

In the United States, the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007d). Stewart *et al.* (2011) evaluated nest counts from 68

Florida beaches over 30 years (1979-2008) and found that nesting increased at all beaches with trends ranging from 3.1%-16.3% per year, with an overall increase of 10.2% per year. An analysis of Florida's index nesting beach sites from 1989-2006 shows a substantial increase in leatherback nesting in Florida during this time, with an annual growth rate of approximately 1.17 (TEWG 2007). The TEWG reports an increasing or stable nesting trend for all of the seven populations or groups of populations with the exception of the Western Caribbean and West Africa. The leatherback rookery along the northern coast of South America in French Guiana and Suriname supports the majority of leatherback nesting in the western Atlantic (TEWG 2007), and represents more than half of total nesting by leatherback sea turtles worldwide (Hilterman and Goverse 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). The TEWG (2007) report indicates that using nest numbers from 1967-2005, a positive population growth rate was found over the 39-year period for French Guinea and Suriname, with a 95% probability that the population was growing. Given the magnitude of leatherback nesting in this area compared to other nest sites, negative impacts in leatherback sea turtles in this area could have profound impacts on the entire species.

The CETAP aerial survey conducted from 1978-1982 estimated the summer leatherback population for the northeastern United States at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina) (Shoop and Kenney 1992). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimated the leatherback population for the northeastern United States at the time of the survey. Estimates of leatherback abundance of 1,052 turtles (C.V. = 0.38) and 1,174 turtles (C.V. = 0.52) were obtained from surveys conducted from Virginia to the Gulf of St. Lawrence in 1995 and 1998, respectively (Palka 2000). However, since these estimates were also based on sightings of leatherbacks at the surface, the author considered the estimates to be negatively biased and the true abundance of leatherbacks may be 4.27 times higher (Palka 2000).

Threats

The 5-year status review (NMFS and USFWS 2007d) and TEWG (2007) report provide summaries of natural as well as anthropogenic threats to leatherback sea turtles. Of the Atlantic sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, trap/pot gear in particular. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their diving and foraging behavior, their distributional overlap with the gear, their possible attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, and perhaps to the lightsticks used to attract target species in longline fisheries. Leatherbacks entangled in fishing gear generally have a reduced ability to feed, dive, surface to breathe, or perform any other behavior essential to survival (Balazs 1985). In addition to drowning from forced submergence, they may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in tissue necrosis. The long-term impacts of entanglement on leatherback health remain unclear. Innis *et al.* (2010) conducted a health evaluation of leatherback sea turtles during direct capture (n=12) and disentanglement (n=7). They found no significant difference in many of the measured health parameters between entangled and directly captured turtles. However, blood parameters, including but not limited to sodium, chloride, and blood urea nitrogen, for entangled turtles showed several key differences that were most likely due to reduced foraging and associated seawater ingestion, as well as a general stress response.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

Leatherbacks have been documented interacting with longline, trap/pot, trawl, and gillnet fishing gear. For instance, between 1992 and 1999 an estimated 6,363 leatherback sea turtles were documented as caught by the U.S. Atlantic tuna and swordfish longline fisheries (NMFS SEFSC 2001). Currently, the U.S. tuna and swordfish longline fisheries managed under the HMS FMP are estimated to capture 1,764 leatherbacks (no more than 252 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). In 2010, there were 26 observed interactions between leatherback sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2011a, 2011b). All leatherbacks were released alive, with all gear removed for the majority of captures. While 2010 total estimates are not yet available, in 2009, 285.8 (95% CI: 209.6-389.7) leatherback sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP based on the observed takes (Garrison and Stokes 2010). The 2009 estimate continues a downward trend since 2007 and remains well below the average prior to implementation of gear regulations (Garrison and Stokes 2010). Since the U.S. fleet accounts for only 5%-8% of the longline hooks fished in the Atlantic Ocean, adding up the under-represented observed takes of the other 23 countries actively fishing in the area would likely result in annual take estimates of thousands of leatherbacks over different life stages (NMFS SEFSC 2001). Lewison *et al.* (2004) estimated that 30,000-60,000 leatherbacks were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries, as well as others).

Leatherbacks are susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer *et al.* 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer *et al.* 2002). More recently, from 2002 to 2010, NMFS received 137 reports of sea turtles entangled in vertical lines from Maine to Virginia, with 128 events confirmed (verified by photo documentation or response by a trained responder; NMFS 2008a). Of the 128 confirmed events during this period, 117 events involved leatherbacks. NMFS identified the gear type and fishery for 72 of the 117 confirmed events, which included lobster (42[2]), whelk/conch (15), black sea bass (10), crab (2), and research pot gear (1). A review of leatherback mortality documented by the STSSN in Massachusetts suggests that vessel strikes and entanglement in fixed gear (primarily lobster pots and whelk pots) are the principal sources of this mortality (Dwyer *et al.* 2002).

Leatherback interactions with the U.S. South Atlantic and Gulf of Mexico shrimp fisheries are also known to occur (NMFS 2002b). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, Florida through North Carolina) as they make their annual spring migration north. For many years, TEDs that were required for use in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species, because the TED openings were too small to allow leatherbacks to escape. To address this problem, NMFS issued a final rule on February 21, 2003, to amend the TED regulations (68 FR 8456, February 21, 2003). Modifications to the design of TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles. Given those modifications, Epperly *et al.* (2002) anticipated an average of 80 leatherback mortalities a year in shrimp gear interactions, dropping to an estimate of 26 leatherback mortalities in 2009 due to effort reduction in the Southeast shrimp fishery (Memo from Dr. B. Ponwith, SEFSC, to Dr. R. Crabtree, SERO, January 5, 2011).

Other trawl fisheries are also known to interact with leatherback sea turtles although on a much smaller scale. In October 2001, for example, a NMFS fisheries observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware. TEDs are not currently required in this fishery. In November 2007, fisheries observers reported the capture of a leatherback sea turtle in bottom otter trawl gear fishing for summer flounder.

Gillnet fisheries operating in the waters of the Mid-Atlantic States are also known to capture, injure, and/or kill leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994-1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54%-92%. In North Carolina, six additional leatherbacks were reported captured in gillnet sets in the spring (NMFS SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-cm) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in NMFS SEFSC 2001). Lastly, Murray (2009a) reports five observed leatherback captures in Mid-Atlantic sink gillnet fisheries between 1994 and 2008.

Fishing gear interactions can occur throughout the range of leatherbacks. Entanglements occur in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line, and crab pot line. Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo *et al.* 1994; Graff 1995). Gillnets

2 One case involved both lobster and whelk/conch gear.

are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier *et al.* 1999), and gillnets targeting green and hawksbill sea turtles in the waters of coastal Nicaragua also incidentally catch leatherback sea turtles (Lagueux *et al.* 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50%-95% (Eckert and Lien 1999). Many of the sea turtles do not die as a result of drowning, but rather because the fishermen cut them out of their nets (NMFS SEFSC 2001).

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the necropsy results of leatherback sea turtles revealed that a substantial percentage (34% of the 408 leatherback necropsies' recorded between 1885 and 2007) reported plastic within the turtles' stomach contents, and in some cases (8.7% of those cases in which plastic was reported), blockage of the gut was found in a manner that may have caused the mortality (Mrosovsky *et al.* 2009). An increase in reports of plastic ingestion was evident in leatherback necropsies conducted after the late 1960s (Mrosovsky *et al.* 2009). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items (*e.g.*, jellyfish) and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that plastic objects may resemble food items by their shape, color, size, or even movements as they drift about, and induce a feeding response in leatherbacks.

Although leatherbacks are probably already beginning to be affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to leatherback turtle populations have been observed to date (PIRO BO 2012). However, over the long term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Analysis on potential effects of climate change on leatherback sea turtles in the action area is included below in section 6.0.

4.1.3.5 Summary of Status for Leatherback Sea Turtles

In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically over the past 10 to 20 years. Nesting groups throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (for example, egg poaching) (NMFS and USFWS 2007d). No reliable long term trend data for the Indian Ocean populations are currently available. While leatherbacks are known to occur in the Mediterranean Sea, nesting in this region is not known to occur (NMFS and USFWS 2007d).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in

Suriname and French Guiana which support the majority of leatherback nesting (NMFS and USFWS 2007d). The species as a whole continues to face numerous threats in nesting and marine habitats. As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like pollution and habitat destruction account for an unknown level of other mortality. The long term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups like French Guiana and Suriname (NMFS and USFWS 2007d).

Based on its 5-year status review of the species, NMFS and USFWS (2007d) determined that endangered leatherback sea turtles should not be delisted or reclassified. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified (NMFS and USFWS 2007d).

Based on this and the current best available information, we believe that the leatherback population is currently stable; as protective measures for sea turtles are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years. Please note, this stable trend is based solely on information we have on nesting trends. The number of sea turtles comprising the neritic and oceanic life stages of the population is currently unknown and as such, the overall status and future trend of the population remains unclear and can only be speculated based on the available data we currently have on nesting trends. Therefore, until information and data becomes available on the numbers of individuals comprising the neritic and oceanic life stages, nesting trends represent the best available information and serve as the best representative of the population's trend.

4.1.4 Green sea turtles

Green sea turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991, 2007c; Seminoff 2004). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered. As it is difficult to differentiate between breeding populations away from the nesting beaches, all green sea turtles in the water are considered endangered.

4.1.4.1 Pacific Ocean

Green sea turtles occur in the western, central, and eastern Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998b). In the western Pacific, major nesting rookeries at four sites including Heron Island (Australia), Raine Island (Australia), Guam, and Japan were evaluated and determined to be increasing in abundance, with the exception of Guam which appears stable (NMFS and USFWS 2007c). In the central Pacific, nesting occurs on French Frigate Shoals, Hawaii, which has also been reported as increasing with a mean of 400 nesting females annually from 2002-2006 (NMFS and USFWS 2007c). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacan, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007c). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007c). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007c). The Pacific Mexico green turtle nesting population (also called the black turtle) is considered endangered.

Historically, green sea turtles were used in many areas of the Pacific for food. They were also commercially exploited, which, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998b). Green sea turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis, which is a viral disease that causes tumors in affected turtles (NMFS and USFWS 1998b; NMFS 2004).

4.1.4.2 Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997; Ferreira *et al.* 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green sea turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island Index Site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

4.1.4.3 Mediterranean Sea

There are four nesting concentrations of green sea turtles in the Mediterranean from which data are available – Turkey, Cyprus, Israel, and Syria. Currently, approximately 300-400 females nest each year, about two-thirds of which nest in Turkey and one-third in Cyprus. Although green sea turtles are depleted from historic levels in the Mediterranean Sea (Kasparek *et al.* 2001), nesting data gathered since the early 1990s in Turkey, Cyprus, and Israel show no apparent trend in any direction. However, a declining trend is apparent along the coast of Palestine/Israel, where 300-350 nests were deposited each year in the 1950s (Sella 1982) compared to a mean of 6 nests per year from 1993-2004 (Kuller 1999; Y. Levy, Israeli Sea Turtle Rescue Center, unpublished data). A recent discovery of green sea turtle nesting in Syria adds roughly 100 nests per year to green sea turtle nesting activity in the Mediterranean (Rees *et al.* 2005). That such a major nesting concentration could have gone unnoticed until recently (the Syria coast was surveyed in 1991, but nesting activity was attributed to loggerheads) bodes well for the ongoing speculation that the unsurveyed coast of Libya may also host substantial nesting.

4.1.4.4 Atlantic Ocean

Distribution and Life History

As has occurred in other oceans of its range, green sea turtles were once the target of directed fisheries in the United States and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were taken in a directed fishery in the Gulf of Mexico (Doughty 1984). Declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty

1984).

In the western Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in Mid-Atlantic and Northeast waters such as Chesapeake Bay and Long Island Sound (Musick and Limpus 1997; Morreale and Standora 1998; Morreale *et al.* 2005), which serve as foraging and developmental habitats.

Some of the principal feeding areas in the western Atlantic Ocean include the upper west coast of Florida, the Florida Keys, and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The waters surrounding the island of Culebra, Puerto Rico, and its outlying keys are designated critical habitat for the green sea turtle.

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). As is the case with the other sea turtle species described above, adult females may nest multiple times in a season (average 3 nests/season with approximately 100 eggs/nest) and typically do not nest in successive years (NMFS and USFWS 1991b; Hirth 1997).

Population Dynamics and Status

Like other sea turtle species, nest count information for green sea turtles provides information on the relative abundance of nesting, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for threatened green sea turtle nesting in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007c). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Archipelago, Guinea-Bissau (NMFS and USFWS 2007d). Nesting at all of these sites is considered to be stable or increasing with the exception of Bioko Island, which may be declining. However, the lack of sufficient data precludes a meaningful trend assessment for this site (NMFS and USFWS 2007c).

Seminoff (2004) reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above threatened nesting sites with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. He concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic Ocean. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007c).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007c). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007c). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007c).

The status of the endangered Florida breeding population was also evaluated in the 5-year review (NMFS and USFWS 2007d). The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend since establishment of the Florida index beach surveys in 1989. This trend is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995), as well as protections in Florida and throughout the United States (NMFS and USFWS 2007c).

The statewide Florida surveys (2000-2006) have shown that a mean of approximately 5,600 nests are laid annually in Florida, with a low of 581 in 2001 to a high of 9,644 in 2005 (NMFS and USFWS 2007c). Most nesting occurs along the east coast of Florida, but occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches in the Florida Panhandle (Meylan *et al.* 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina (just east of the mouth of the Cape Fear River), Onslow Island, and Cape Hatteras National Seashore. One green sea turtle nested on a beach in Delaware in 2011, although its occurrence was considered very rare.

Threats

Green sea turtles face many of the same natural threats as loggerhead and Kemp's ridley sea turtles. In addition, green sea turtles appear to be particularly susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body. Juveniles appear to be most affected in that they have the highest incidence of disease and the most extensive lesions, whereas lesions in nesting adults are rare. Also, green sea turtles frequenting nearshore waters, areas adjacent to large human populations, and areas with low water turnover, such as lagoons, have a higher incidence of the disease than individuals in deeper, more remote waters. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, leading potentially to death (George 1997).

As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observes that because green sea turtles spend a shorter time in oceanic waters and as older juveniles occur on shallow seagrass pastures (where benthic trawling is unlikely), they avoid high mortalities in pelagic longline and benthic trawl fisheries. Although the relatively low number of observed green sea turtle captures makes it difficult to estimate bycatch rates and annual take levels, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and mid-Atlantic trawl and gillnet fisheries. Murray (2009a) also lists five observed captures of green turtle in Mid-Atlantic sink gillnet gear between 1995 and 2006.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

Other activities like channel dredging, marine debris, pollution, vessel strikes, power plant impingement, and habitat destruction account for an unquantifiable level of other mortality. Stranding reports indicate that between 200-400 green sea turtles strand annually along the eastern U.S. coast from a variety of causes most of which are unknown (STSSN database).

As highly migratory, wide-ranging organisms that are biologically tied to temperature regimes, green sea turtles are vulnerable to effects of climate change in aspects of their physiology and behavior (Van Houtan 2011). Analysis on potential effects of climate change on green sea turtles in the action area is included below in section 6.0.

4.1.4.5 Summary of Status of Green Sea Turtles

A review of 32 Index Sites[3] distributed globally revealed a 48-67% decline in the number of mature females nesting annually over the last three generations[4] (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the 5-year status review of the species (NMFS and USFWS 2007c). Of the 23 threatened nesting groups assessed in that report for which nesting abundance trends could be determined, ten were considered to be increasing, nine were considered stable, and four were considered to be decreasing (NMFS and USFWS 2007d). Nesting groups were considered to be doing relatively well (the number of sites with increasing nesting were greater than the number of sites with decreasing nesting) in the Pacific, western Atlantic, and central Atlantic (NMFS and USFWS 2007c). However, nesting populations were determined to be doing relatively poorly in Southeast Asia, eastern Indian Ocean, and perhaps the Mediterranean. Overall, based on mean annual reproductive effort, the report estimated that 108,761 to 150,521 females nest each year among the 46 threatened and endangered nesting sites included in the evaluation (NMFS and USFWS 2007c). However, given the late age to maturity for green sea turtles, caution is urged regarding the status for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation

[3] The 32 Index Sites include all of the major known nesting areas as well as many of the lesser nesting areas for which quantitative data are available.

[4] Generation times ranged from 35.5 years to 49.5 years for the assessment depending on the Index Beach site

(NMFS and USFWS 2007c).

Seminoff (2004) and NMFS and USFWS (2007c) made comparable conclusions with regard to nesting for four nesting sites in the western Atlantic that indicate sea turtle abundance is increasing in the Atlantic Ocean. Each also concluded that nesting at Tortuguero, Costa Rica represented the most important nesting area for green sea turtles in the western Atlantic and that nesting had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007c).

However, the 5-year review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed take at their primary foraging area in Nicaragua (NMFS and USFWS 2007c). The endangered breeding population in Florida appears to be increasing based upon index nesting data from 1989-2010 (NMFS 2011).

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like hopper dredging, pollution, and habitat destruction account for an unknown level of other mortality. Based on its 5-year status review of the species, NMFS and USFWS (2007c) determined that the listing classification for green sea turtles should not be changed. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified (NMFS and USFWS 2007c).

Based on this and the current best available information, we believe that the green sea turtle population is currently stable; as protective measures for sea turtles are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years. Please note, this stable trend is based solely on information we have on nesting trends. The number of sea turtles comprising the neritic and oceanic life stages of the population is currently unknown and as such, the overall status and future trend of the population remains unclear and can only be speculated based on the available data we currently have on nesting trends. Therefore, until information and data becomes available on the numbers of individuals comprising the neritic and oceanic life stages, nesting trends represent the best available information and serve as the best representative of the population's trend.

4.2 North Atlantic Right whales

Historically, right whales have occurred in all the world's oceans from temperate to subarctic latitudes (Perry *et al.* 1999). In both hemispheres, they are observed at low latitudes and in nearshore waters where calving takes place in the winter months, and in higher latitude foraging grounds in the summer (Clapham *et al.* 1999; Perry *et al.* 1999). The species is designated as depleted under the Marine Mammal Protection Act (MMPA).

Right whales have been listed as endangered under the Endangered Species Act (ESA) since 1973. In December 2006, NMFS completed a comprehensive review of the status of right whales in the North Atlantic and North Pacific Oceans, which at the time were listed as a single species, *Eubalaena glacialis*, or "northern right whale. Based on the findings from the status review, NMFS concluded that right whales in the Northern Hemisphere exist as two species:

North Atlantic right whale (*Eubalaena glacialis*) and the North Pacific right whale (*Eubalaena japonica*). NMFS determined that each of the species is in danger of extinction throughout its range. In 2008, based on the status review, NMFS listed right whales in the Northern Hemisphere as two separate endangered species: the North Atlantic right whale (*E. glacialis*) and North Pacific right whale (*E. japonica*) (73 FR 12024; March 6, 2008). Right whales in the Southern Hemisphere (*E. australis*) remained listed as endangered as well.

The International Whaling Commission (IWC) recognizes two right whale populations in the North Atlantic: a western and eastern population (IWC, 1986). It is thought that the eastern population migrated along the coast from northern Europe to northwest Africa. The current distribution and migration patterns of the eastern North Atlantic right whale population, if extant, are unknown. Sighting surveys from the eastern Atlantic Ocean suggest that right whales present in this region are rare (Best *et al.*, 2001) and it is unclear whether a viable population in the eastern North Atlantic still exists (Brown 1986, NMFS 1991b). Photo-identification work has shown that some of the whales observed in the eastern Atlantic were previously identified as western Atlantic right whales (Kenney 2002). This Opinion will focus on the North Atlantic right whale (*Eubalaena glacialis*) which occurs in the action area.

Habitat and Distribution

Western North Atlantic right whales generally occur from the southeast U.S. to Canada (*e.g.*, Bay of Fundy and Scotian Shelf) (Kenney 2002; Waring *et al.* 2010). Like other right whale species, they follow an annual pattern of migration between low latitude winter calving grounds and high latitude summer foraging grounds (Perry *et al.* 1999; Kenney 2002).

The distribution of right whales seems linked to the distribution of their principal zooplankton prey, calanoid copepods (Winn *et al.* 1986; NMFS 2005; Baumgartner and Mate 2005; Waring *et al.* 2010). Right whales are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990; Schevill *et al.* 1986; Watkins and Schevill 1982) and in the Great South Channel in May and June (Kenney *et al.* 1986; Payne *et al.* 1990; Kenney *et al.* 1995; Kenney 2001) where they have been observed feeding predominantly on copepods of the genera *Calanus* and *Pseudocalanus* (Baumgartner and Mate 2005; Waring *et al.* 2010). Right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks in the summer through fall (Mitchell *et al.* 1986; Winn *et al.* 1986; Stone *et al.* 1990). The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats. Calving is known to occur in the winter months in coastal waters off of Georgia and Florida (Kraus *et al.* 1988). Calves have also been sighted off the coast of North Carolina during winter months suggesting the calving grounds may extend as far north as Cape Fear. In the North Atlantic it appears that not all reproductively active females return to the calving grounds each year (Kraus *et al.*, 1986; Payne 1986). Patrician *et al.* (2009) analyzed photographs of a right whale calf sighted in the Great South Channel in June of 2007 and determined the calf appeared too young to have been born in the known southern calving area. In addition, the location of some portion of the population during the winter months remains unknown (NMFS 2005). However, recent aerial surveys conducted under the North Atlantic Right Whale Sighting Survey (NARWSS) program have indicated that some individuals may reside in the northern Gulf of Maine during the winter. In 2008, 2009, and 2010, right whales were sighted on Jeffrey's and Cashes Ledge, Stellwagen Bank, and Jordan Basin during December to February (Khan *et al.* 2009, 2010, 2011).

While right whales are known to congregate in the aforementioned areas, much is still not understood about their seasonal distribution and movements within and between these areas are extensive (Waring *et al.* 2010). In the winter, only a portion of the known right whale population is seen on the calving grounds. The winter distribution of the remaining right whales remains uncertain (NMFS 2005, Waring *et al.* 2010). Results from winter surveys and passive acoustic studies suggest that animals may be dispersed in several areas including Cape Cod Bay (Brown *et al.* 2002) and offshore waters of the southeastern U.S. (Waring *et al.* 2010). On multiple days in December 2008, congregations of more than forty individual right whales were observed in the Jordan Basin area of the Gulf of Maine, leading researchers to believe this may be a wintering ground (NOAA 2008). Telemetry data have shown lengthy and somewhat distant excursions into deep water off of the continental shelf (Mate *et al.* 1997) as well as extensive movements over the continental shelf during the summer foraging period (Mate *et al.* 1992; Mate *et al.* 1997; Bowman et al. 2003; Baumgartner and Mate 2005). Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland; in addition, resightings of photographically identified individuals have been made off Iceland, arctic Norway, and in the old Cape Farewell whaling ground east of Greenland. The Norwegian sighting (September 1999) represents one of only two sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. Similarly, records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al.* 1972) represent either geographic anomalies or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. The frequency with which right whales occur in offshore waters in the southeastern U.S. remains unclear (Waring *et al.*, 2010).

Abundance estimates and trends

An estimate of the pre-exploitation population size for the North Atlantic right whale is not available. As is the case with most wild animals, an exact count of North Atlantic right whales cannot be obtained. However, abundance can be reasonably estimated as a result of the extensive study of western North Atlantic right whale population. IWC participants from a 1999 workshop agreed to a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be greater than this estimate (Best *et al.* 2001). Based on a census of individual whales using photo-identification techniques and an assumption of mortality for those whales not seen in seven years, a total 299 right whales was estimated in 1998 (Kraus *et al.* 2001), and a review of the photo-ID recapture database on June 24, 2009, indicated that 361 individually recognized whales were known to be alive during 2005 (Waring *et al.* 2010). Because this 2009 review was a nearly complete census, it is assumed this estimate represents a minimum population size. The minimum number alive population index for the years 1990-2005 suggests a positive trend in numbers. These data reveal a significant increase in the number of catalogued whales alive during this period, but with significant variation due to apparent losses exceeding gains during 1998-1999. Mean growth rate for the period was 2.1% (Waring *et al.* 2010).

A total of 297 right whale calves have been born from 1993-2009 (Waring *et al.* 2010). The mean calf production for the 15-year period from 1993-2009 is estimated to be 17.2/year (Waring *et al.* 2010). Calving numbers have been sporadic, with large differences among years, including a second largest calving season in 2000/2001 with 31 right whale births (Waring *et al.* 2010). The three calving years (97/98; 98/99; 99/00) prior to this record year provided low recruitment levels with only 11 calves born. The last nine calving seasons (2000-2009) have been remarkably better with 31, 21, 19, 17, 28, 19, 23, 23, and 39 births, respectively (Waring *et al.* 2010). However, the western North Atlantic stock has also continued to experience losses of calves, juveniles and adults.

As is the case with other mammalian species, there is an interest in monitoring the number of females in this western North Atlantic right whale population since their numbers will affect the population trend (whether declining, increasing or stable). Kraus *et al.* (2007) reported that as of 2005, 92 reproductively-active females had been identified and Schick *et al.* (2009) estimated 97 breeding females. From 1983-2005, the number of new mothers recruited to the population (with an estimated age of 10 for the age of first calving), varied from 0-11 each year with no significant increase or decline over the period (Kraus *et al.* 2007). By 2005, 16 right whales had produced at least 6 calves each, and 4 cows had at least seven calves. Two of these cows were at an age which indicated a reproductive life span of at least 31 years (Kraus *et al.* 2007). As described above, the 2000/2001 - 2006/2007 calving seasons had relatively high calf production and included additional first time mothers (*e.g.*, eight new mothers in 2000/2001). However, over the same time period there have been continued losses to the western North Atlantic right whale population including the death of mature females as a result of anthropogenic mortality (like that described in Glass *et al.* 2009, below). Of the 15 serious injuries and mortalities between 2003 and 2007, at least 9 were adult females, three of which were carrying near-term fetuses and 4 of which were just starting to bear calves (Waring *et al.* 2009). Since the average lifetime calf production is 5.25 calves (Fujiwara and Caswell 2001), the deaths of these 9 females represent a loss of reproductive potential of as many as 47 animals. However, it is important to note that not all right whale mothers are equal with regards to calf production. Right whale #1158 had only one calf over a 25-year period (Kraus *et al.* 2007). In contrast, one of the largest right whales on record was a female nicknamed "Stumpy," who was killed in February 2004 of an apparent ship strike (NMFS 2006). She was first sighted in 1975 and known to be a prolific breeder, successfully rearing calves in 1980, 1987, 1990, 1993, and 1996 (Moore *et al.* 2007). At the time of her death, she was estimated to be 30 years of age and carrying her sixth calf; the near-term fetus also died (NMFS 2006).

Abundance estimates are an important part of assessing the status of the species. However, for Section 7 purposes, the population trend (*i.e.*, whether increasing or declining) provides better information for assessing the effects of a proposed action on the species. As described in previous Opinions, data collected in the 1990s suggested that right whales were experiencing a slow but steady recovery (Knowlton *et al.* 1994). However, Caswell *et al.* (1999) used photo-identification data and modeling to estimate survival and concluded that right whale survival decreased from 1980 to 1994. Modified versions of the Caswell *et al.* (1999) model as well as several other models were reviewed at the 1999 IWC workshop (Best *et al.* 2001). Despite differences in approach, all of the models indicated a decline in right whale survival in the 1990s relative to the 1980s with female survival, in particular, apparently affected (Best *et al.* 2001). In 2002, NMFS' NEFSC hosted a workshop to review right whale population models to examine: (1) potential bias in the models and (2) changes in the subpopulation trend based on new information collected in the late 1990s (Clapham *et al.* 2002). Three different models were used to explore right whale survivability and to address potential sources of bias. Although biases were identified that could negatively affect the results, all three modeling techniques resulted in the same conclusion; survival has continued to decline and seems to be focused on females (Clapham *et al.* 2002). Increased mortalities in 2004 and 2005 were cause for serious concern (Kraus *et. al* 2005). Calculations indicate that this increased mortality rate would reduce population growth by approximately 10% per year (Kraus *et. al* 2005). Despite the preceding, examination of the minimum number alive population index calculated from the individual sightings database, as it existed on 24 June 2009, for the years 1990-2005 suggest a positive trend in numbers (Waring *et al.* 2010). These data reveal a significant increase in the number of catalogued whales alive during this period, but with significant variation due to apparent losses exceeding gains during 1998-1999 (Waring *et al.* 2010). Recently, NMFS NEFSC developed a population viability analysis (PVA) to examine the influence of anthropogenic mortality reduction on the recovery prospects for the species (Pace, in review). The PVA evaluated several scenarios on how the populations would fare without entanglement mortalities compared to the status quo. Only 2 of 1000 projections (with the status quo simulation) ended with a smaller total population size than they started and zero projections resulted in extinction. As described above, the mean growth rate estimated in the latest stock assessment report, for the period 1990-2005, was 2.1% (Waring *et al.* 2010).

Reproductive Fitness

Healthy reproduction is critical for the recovery of the North Atlantic right whale (Kraus *et al.* 2007). Researchers have suggested that the population has been affected by a decreased reproductive rate (Best *et al.* 2001; Kraus *et al.* 2001). Kraus *et al.* (2007) reviewed reproductive parameters for the period 1983-2005, and estimated calving intervals to have changed from 3.5 years in 1990 to over five years between 1998-2003, and then decreased to just over 3 years in 2004 and 2005.

Factors that have been suggested as affecting the right whale reproductive rate include reduced genetic diversity (and/or inbreeding), contaminants, biotoxins, disease, and nutritional stress. Although it is believed that a combination of these factors is likely causing an effect on right whales (Kraus *et al.* 2007), there is currently no evidence available to determine their actual effect, if any. The dramatic reduction in the North Atlantic right whale population believed to have occurred due to commercial whaling may have resulted in a loss of genetic diversity which could affect the ability of the current population to successfully reproduce (*i.e.*, decreased conceptions, increased abortions, and increased neonate mortality). One hypothesis is that the low level of genetic variability in this species produces a high rate of mate incompatibility and unsuccessful pregnancies (Frasier *et al.* 2007). Analyses are currently under way to assess this relationship further as well as the influence of genetic characteristics on the potential for species recovery (Frasier *et al.* 2007). Studies by Schaeff *et al.* (1997) and Malik *et al.* (2000) indicate that western North Atlantic right whales are less genetically diverse than southern right whales. However, several apparently healthy populations of cetaceans, such as sperm whales and pilot whales, have even lower genetic diversity than observed for western North Atlantic right whales (IWC 2001a). Similarly, while contaminant studies have confirmed that right whales are exposed to and accumulate contaminants, researchers could not conclude that these contaminant loads were negatively affecting right whale reproductive success since concentrations were lower than those found in marine mammals proven to be affected by PCBs and DDT (Weisbrod *et al.* 2000). Another suite of contaminants (i.e. antifouling agents and flame retardants) that have been proven to disrupt reproductive patterns and have been found in other marine animals, have raised new concerns (Kraus *et al.* 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the North Atlantic right whales and that inhalation may be an important exposure route (Wise *et al.* 2008). A number of diseases could be also affecting reproduction, however tools for assessing disease factors in free-swimming large whales currently do not exist (Kraus *et al.* 2007). Once developed, such methods may allow for the evaluation of disease effects on right whales. Impacts of biotoxins on marine mammals are also poorly understood, yet data is showing that marine algal toxins may play significant roles in mass mortalities of large whales (Rolland *et al.* 2007). Although there are no published data concerning the effects of biotoxins on right whales, researchers are now certain that right whales are being exposed to measurable quantities of paralytic shellfish poisoning (PSP) toxins and domoic acid via trophic transfer through the presence of these biotoxins in prey upon which they feed (Durbin *et al.* 2002, Rolland *et al.* 2007).

Data indicating whether right whales are food-limited are difficult to evaluate (Kraus *et al.* 2007). North Atlantic right whales seem to have thinner blubber than right whales from the South Atlantic (Kenney 2002; Miller *et al.* (*in press*)). Miller *et al.* (*in press*) suggests that lipids in the blubber are used as energetic support for reproduction in female right whales. In the same study, blubber thickness was also compared among years of differing prey abundances. During a year of low prey abundances, right whales had significantly thinner blubber than during years of greater prey abundances. The results suggest that blubber thickness is indicative of right whale energy balance and that the marked fluctuations in the North Atlantic right whale reproduction have a nutritional component (Miller *et al.* (*in press*)).

Threats

There is general agreement that right whale recovery is negatively affected by anthropogenic mortality. From 2004-2008, right whales had the highest proportion of entanglement and ship strike events relative to the number of reports for a species (Glass *et al.* 2010). Given the small population size and low annual reproductive rate of right whales, human sources of mortality may have a greater effect to relative population growth rate than for other large whale species (Waring *et al.* 2010). For the period 2004-2008, the annual human-caused mortality and serious injury rate for the North Atlantic right whale averaged 2.8 per year (2.2 in U.S. waters; 0.6 in Canadian waters) (Glass *et al.* 2010). Twenty-one confirmed right whale mortalities were reported along the U.S. east coast and adjacent Canadian Maritimes from 2004-2008 (Glass *et al.* 2010). These numbers represent the minimum values for serious injury and mortality for this period. Given the range and distribution of right whales in the North Atlantic, and the fact that positively buoyant species like right whales may become negatively buoyant if injury prohibits effective feeding for prolonged periods, it is highly unlikely that all carcasses will be observed (Moore *et al.* 2004, Glass *et al.* 2009). Moreover, carcasses floating at sea often cannot be examined sufficiently and may generate false negatives if they are not towed to shore for further necropsy (Glass *et al.* 2009). Decomposed and/or unexamined animals represent lost data, some of which may relate to human impacts (Waring *et al.* 2010).

Considerable effort has been made to examine right whale carcasses for the cause of death (Moore *et al.* 2004). Because they live in an ocean environment, examining right whale carcasses is often very difficult. Some carcasses are discovered floating at sea and cannot be retrieved. Others are in such an advanced stage of decomposition when discovered that a complete examination is not possible. Wave action and post-mortem predation by sharks can also damage carcasses, and preclude a thorough examination of all body parts. It should also be noted that mortality and serious injury event judgments are based upon the best available data and additional information may result in revisions (Glass *et al.* 2010). Of the 21 total, confirmed right whale mortalities (2004-2008) described in Glass *et al.* (2010), 3 were confirmed to be entanglement mortalities (1 adult female, 1 female calf, 1 male calf) and 8 were confirmed to be ship strike mortalities (5 adult females, 1 female of unknown age, 1 male calf, and 1 yearling male). Serious injury involving right whales was documented for 1 entanglement event (adult male) and 2 ship strike events (1 adult female and 1 yearling male).

Although disentanglement is either unsuccessful or not possible for the majority of cases, during the period of 2004-2008, there were at least 4 documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious injury (Waring *et al.* 2010). Even when entanglement or vessel collision does not cause direct mortality, it may weaken or otherwise affect individuals so that further injury or death is likely (Waring *et. al* 2010). Some right whales that have been entangled were subsequently involved in ship strikes (Hamilton *et al.* 1998) suggesting that the animal may have become debilitated by the entanglement to such an extent that it was less able to avoid a ship. Similarly, skeletal fractures and/or broken jaws sustained during a vessel collision may heal, but then compromise a whale's ability to efficiently filter feed (Moore *et al.* 2007). A necropsy of right whale #2143 ("Lucky") found dead in January 2005 suggested the animal (and her near-term fetus) died after healed propeller wounds from a previous ship strike re-opened and became infected as a result of pregnancy (Moore *et al.* 2007, Glass *et al.* 2008). Sometimes, even with a successful disentanglement, an animal may die of injuries sustained by fishing gear (e.g. RW #3107) (Waring *et al.* 2010).

Entanglement records from 1990-2008 maintained by NMFS include 47 confirmed right whale entanglement events (Waring *et al.* 2010). Because whales often free themselves of gear following an entanglement event, scarification analysis of living animals may provide better indications of fisheries interactions rather than entanglement records (Waring *et al.* 2010). Data presented in Knowlton *et al.* 2008 indicate the annual rate of entanglement interaction remains at high levels. Four hundred and ninety-three individual, catalogued right whales were reviewed and 625 separate entanglement interactions were documented between 1980 and 2004. Approximately 358 out of 493 animals (72.6% of the population) were entangled at least once; 185 animals bore scars from a single entanglement; however one animal showed scars from 6 different entanglement events. The number of male and female right whales bearing entanglement scars was nearly equivalent (142/202 females, 71.8%; 182/224 males, 81.3%), indicating that right whales of both sexes are equally vulnerable to entanglement. However, juveniles appear to become entangled at a higher rate than expected if all age groups were equally vulnerable. For all years but one (1998), the proportion of juvenile, entangled right whales exceeded their proportion within the population. Based on photographs of catalogued animals from 1935 through 1995, Hamilton *et al.* (1998) estimated that 6.4 percent of the North Atlantic right whale population exhibit signs of injury from vessel strikes. Reports received from 2004-2008 indicate that right whales had the greatest number of ship strike mortalities (n=8) and serious injuries (n=2) compared to other large whales in the Northwest Atlantic (Glass *et al.* 2010). In 2006 alone, four reported mortalities and one serious injury resulted from right whale ship strikes (Glass *et al.* 2010).

As highly migratory, wide-ranging organisms, effects of climate change on cetaceans are possible. Analysis on potential effects of climate change on North Atlantic right whales in the action area is included below in section 6.0.

Summary of Right Whale Status

In March 2008, NMFS listed the North Atlantic right whale as a separate, endangered species (*Eubalaena glacialis*) under the ESA. This decision was based on an analysis of the best scientific and commercial data available. The decision took into consideration current population trends and abundance, demographic risk factors affecting the continued survival of the species, and ongoing conservation efforts. NMFS determined that the North Atlantic right whale is in danger of extinction throughout its range because of: (1) overutilization for commercial, recreational, scientific or educational purposes; (2) the inadequacy of existing regulatory mechanisms; and (3) other natural and manmade factors affecting its continued existence.

Previous models estimated that the right whale population in the Atlantic numbered 300 (+/- 10%) (Best *et al.* 2001). However, a review of the photo-ID recapture database on July 24, 2009 indicated that 361 individually recognized right whales were known to be alive in 2005 (Waring *et al.* 2010). The 2000/2001 - 2008/2009 calving seasons have had relatively high calf production (31, 21, 19, 17, 28,19, 23, 23, and 39 calves, respectively) and have included additional first time mothers (*e.g.*, eight new mothers in 2000/2001) (Waring *et al.* 2009, 2010). There are some indications that climate-driven ocean changes affecting the plankton ecology of the Gulf of Maine, may, in some manner, be affecting right whale fitness and reproduction.

However, there is also general agreement that right whale recovery is negatively affected by human sources of mortality. This mortality appears to, have a greater impact on the population growth rate of right whales, compared to other baleen whales in the western North Atlantic, given the small population size and low annual reproductive rate of right whales (Waring *et al.* 2010).

Over the five-year period 2004-2008, right whales had the highest proportion of entanglements and ship strikes relative to the number of reports for a species: of 64 reports involving right whales, 24 were confirmed entanglements and 17 were confirmed ship strikes. There were 21 verified right whale mortalities, three due to entanglements, and eight due to ship strikes (Glass *et al.* 2010). This represents an absolute minimum number of the right whale mortalities for this period. Given the range and distribution of right whales in the North Atlantic, it is highly unlikely that all carcasses will be observed. Scarification analysis indicates that some whales do survive encounters with ships and fishing gear. However, the long-term consequences of these interactions are unknown.

A variety of modeling exercises and analyses indicate that survival probability declined in the 1990s (Best *et al.* 2001), and mortalities in 2004-2005, including a number of adult females, also suggested an increase in the annual mortality rate (Kraus *et al.* 2005). Nonetheless, a census of the minimum number alive population index calculated from the individual sightings database, as it existed on 24 June 2009, for the years 1990-2005 suggest a positive trend in numbers of right whales (Waring *et al.* 2010). In addition, calving intervals appear to have declined to 3 years in recent years (Kraus *et al.* 2007), and calf production has been relatively high over the past several seasons.

Based on the information currently available, for the purposes of this Opinion, NMFS believes that the western North Atlantic right whale subpopulation is increasing; as protective measures for large whales are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years.

4.3 Humpback Whales

Humpback whales inhabit all major ocean basins from the equator to subpolar latitudes. With the exception of the northern Indian Ocean population, they generally follow a predictable migratory pattern in both hemispheres, feeding during the summer in the higher near-polar latitudes and migrating to lower latitudes in the winter where calving and breeding takes place (Perry *et al.* 1999). Humpbacks are listed as endangered under the ESA at the species level and are considered depleted under the MMPA. Therefore, information is presented below regarding the status of humpback whales throughout their range.

4.3.1 North Pacific, Northern Indian Ocean and Southern Hemisphere

Humpback whales in the North Pacific feed in coastal waters from California to Russia and in the Bering Sea. They migrate south to wintering destinations off Mexico, Central America, Hawaii, southern Japan, and the Philippines (Carretta *et al.* 2011). Although the IWC only considered one stock (Donovan 1991) there is evidence to indicate multiple populations migrating between their respective summer/fall feeding areas to winter/spring calving and mating areas within the North Pacific Basin (Angliss and Outlaw 2007, Carretta *et al.* 2011). Within the Pacific Ocean, NMFS recognizes three management units within the U.S. EEZ for the purposes of managing this species under the MMPA. These are: the California-Oregon-Washington stock (feeding areas off the US west coast), the central North Pacific stock (feeding areas from Southeast Alaska to the Alaska Peninsula) and the western North Pacific stock (feeding areas from the Aleutian Islands, the Bering Sea, and Russia) (Carretta *et al.* 2011).

Because fidelity appears to be greater in feeding areas than in breeding areas, the stock structure of humpback whales is defined based on feeding areas (Carretta *et al.* 2011). Recent research efforts via the Structure of Populations, Levels of Abundance, and Status of Humpback Whales (SPLASH) Project estimate the abundance of humpback whales to be just under 20,000 whales for the entire North Pacific, a number which doubles previous population predictions (Calambokidis *et al.* 2008). There are indications that the California-Oregon-Washington stock was growing in the 1980's and early 1990's with a best estimate of 8% growth per year (Carretta *et al.* 2011). The best available estimate for the California-Oregon-Washington stock is 2,043 whales (Carretta *et al.* 2011). The central North Pacific stock is estimated at 4,005 (Allen and Angliss 2011), and various studies report that it appears to have increased in abundance at rates between 6.6%-10% per year (Allen and Angliss 2011). Although there is no reliable population trend data for the western North Pacific stock, as surveys of the known feeding areas are incomplete and many feeding areas remain unknown, minimum population size is currently estimated at 732 whales (Allen and Angliss 2011).

The Northern Indian Ocean population of humpback whales consists of a resident stock in the Arabian Sea, which apparently does not migrate (Minton *et al.* 2008). The lack of photographic matches with other areas suggests this is an isolated subpopulation. The Arabian Sea subpopulation of humpback whales is geographically, demographically and genetically isolated, residing year round in sub-tropical waters of the Arabian Sea (Minton *et al.* 2008). Although potentially an underestimate due to small sample sizes and insufficient spatial and temporal coverage of the population's suspected range, based on photo-identification, the abundance estimate off the coast of Oman is 82 animals [60-111 95% confidence interval (CI)](Minton *et al.* 2008).

The Southern Hemisphere population of humpback whales is known to feed mainly in the Antarctic, although some have been observed feeding in the Benguela Current ecosystem on the migration route west of South Africa (Reilly *et al.* 2008a). The IWC Scientific Committee recognizes seven major breeding stocks, some of which are tentatively further subdivided into substocks. The seven major breeding stocks, with their respective breeding ground estimates in parenthesis, include Southwest Atlantic (6,251), Southeast Atlantic (1,594), southwestern Indian Ocean (5,965), southeastern Indian Ocean (10,032), Southwest Pacific (7,472), central South Pacific (not available), and southeast Pacific (2,917) (Reilly *et al.* 2008a). The total abundance estimate of 36,600 humpback whales for the Southern Hemisphere is negatively biased due to no available abundance estimate for the central South Pacific subpopulation and only a partial estimate for the Southeast Atlantic subpopulation. Additionally, these abundance estimates have been obtained on each subpopulation's wintering grounds, and the possibility exists that the entire population does not migrate to the wintering grounds (Reilly *et al.* 2008a).

Like other whales, southern hemisphere humpback whales were heavily exploited for commercial whaling. Although they were given protection by the IWC in 1963, Soviet whaling data made available in the 1990's revealed that 48,477 southern hemisphere humpback whales were taken from 1947-1980, contrary to the original reports to the IWC which accounted for the take of only 2,710 humpbacks (Zemsky *et al.* 1995, IWC 1995, Perry *et al.* 1999).

4.3.2 Gulf of Maine (North Atlantic)

Humpback whales from most Atlantic feeding areas calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Previously, the North Atlantic humpback whale population was treated as a single stock for management purposes, however due to the strong fidelity to the region displayed by many whales, the Gulf of Maine stock was reclassified as a separate feeding stock (Waring *et al.* 2010). The Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland and northern Norway are the other regions that represent relatively discrete subpopulations. Sightings are most frequent from mid-March through November between 41°N and 43°N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffrey's Ledge (CeTAP 1982) and peak in May and August. Small numbers of individuals may be present in this area year-round, including the waters of Stellwagen Bank. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, targeting fish schools and filtering large amounts of water for their associated prey. It is hypothesized humpback whales may also feed on euphausiids (krill) as well as capelin (Waring *et al.* 2010, Stevick *et al.* 2006).

In winter, whales from waters off New England, Canada, Greenland, Iceland, and Norway, migrate to mate and calve primarily in the West Indies where spatial and genetic mixing among these groups does occur (Waring *et al.* 2010). Various papers (Clapham and Mayo 1990; Clapham 1992; Barlow and Clapham 1997; Clapham *et al.* 1999) summarize information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (NMFS 1991a).

Humpback whales use the Mid-Atlantic as a migratory pathway to and from the calving/mating grounds, but it may also be an important winter feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle *et al.* 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle *et al.* (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Identified whales using the Mid-Atlantic area were found to be residents of the Gulf of Maine and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding populations in the Mid-Atlantic region. Strandings of humpback whales have increased between New Jersey and Florida since 1985 consistent with the increase in Mid-Atlantic whale sightings. Strandings were most frequent during September through April in North Carolina and Virginia waters, and were composed primarily of juvenile humpback whales of no more than 11 meters in length (Wiley *et al.* 1995).

Abundance Estimates and Trends

Photographic mark-recapture analyses from the Years of the North Atlantic Humpback (YONAH) project gave an ocean-basin-wide estimate of 11,570 animals during 1992/1993 and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (95% c.i. = 8,000 - 13,600) (Waring *et al.* 2010). For management purposes under the MMPA, the estimate of 11,570 individuals is regarded as the best available estimate for the North Atlantic population (Waring *et al.* 2010). The best, recent estimate for the Gulf of Maine stock is 847 whales, derived from a 2006 line-transect aerial sighting survey (Waring *et al.* 2010).

Population modeling, using data obtained from photographic mark-recapture studies, estimates the growth rate of the Gulf of Maine stock to be at 6.5% for the period 1979-1991 (Barlow and Clapham 1997). More recent analysis for the period 1992-2000 estimated lower population growth rates ranging from 0% to 4.0%, depending on calf survival rate (Clapham *et al.* 2003 in Waring *et al.* 2010). However, it is unclear whether the apparent decline in growth rate is a bias result due to a shift in distribution documented for the period 1992-1995, or whether the population growth rates truly declined due to high mortality of young-of-the-year whales in US Mid-Atlantic waters (Waring *et al.* 2010). Regardless, calf survival appears to have increased since 1996, presumably accompanied by an increase in population growth (Waring *et al.* 2010). Stevick *et al.* (2003) calculated an average population growth rate of 3.1% in the North Atlantic population overall for the period 1979-1993.

Threats

As is the case with other large whales, like North Atlantic right whales, the major known sources of anthropogenic mortality and injury of humpback whales occur from fishing gear entanglements and ship strikes. For the period 2004 through 2008, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged 4.6 animals per year (U.S. waters, 4.4; Canadian waters, 0.2) (Waring *et al.* 2010). Between 2004 and 2008 humpback whales were involved in 81 confirmed entanglement events and 14 confirmed ship strike events (Glass *et al.* 2010). Over the five-year period, humpback whales were the most commonly observed entangled whale species; entanglements accounted for 5 mortalities and 11 serious injuries (Glass *et al.* 2010). Of the 14 confirmed ship strikes, 8 of the events were fatal (Glass *et al.* 2010). It was assumed that all of these events involved members of the Gulf of Maine stock of humpback whales unless a whale was confirmed to be from another stock; in reports prior to 2007, only events involving whales confirmed to be members of the Gulf of Maine stock were included. There were also many carcasses that washed ashore or were spotted floating at sea for which the cause of death could not be determined. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data' some of which may relate to human impacts (Glass *et al.* 2009, Waring *et al.* 2010).

Based on photographs taken between 2000-2002 of the caudal peduncle and fluke of humpback whales, Robbins and Mattila (2004) estimated that at least half (48-57%) of the sample (187 individuals) was coded as having a high likelihood of prior entanglement. Evidence suggests that entanglements have occurred at a minimum rate of 8-10% per year. Scars acquired by Gulf of Maine stock humpback whales between 2000 and 2002 suggest a minimum of 49 interactions with gear took place. Based on composite scar patterns, it was believed that male humpback whales were more vulnerable to entanglement than females. Males may be subject to other sources of injury that could affect scar pattern interpretation. Images were obtained from a humpback whale breeding ground; 24% exhibited raw injuries, presumably a result from agonistic interactions. However, current evidence suggests that breeding ground interactions alone cannot explain the higher frequency of healed scar patterns among Gulf of Maine stock male humpback whales (Robbins and Mattila 2004).

Humpback whales, like other baleen whales, may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including fisheries operations, vessel traffic, and coastal development. Currently, there is no evidence that these types of activities are affecting humpback whales. However, Geraci *et al.* (1989) provide strong evidence that a mass mortality of humpback whales from 1987-1988 resulted from the consumption of mackerel whose livers contained high levels of saxitoxin, a naturally occurring red tide toxin, the origin of which remains unknown. It has been suggested that the occurrence of a red tide event is related to an increase in freshwater runoff from coastal development, leading some observers to suggest that such events may become more common among marine mammals as coastal development continues (Clapham *et al.* 1999). There have been three additional known cases of a mass mortality involving large whale species along the East coast between 1998 and 2008. In the 2006 mass mortality event, 21 dead humpback whales were found between July 10 and December 31, 2006, triggering NMFS to declare an unusual mortality event (UME) for humpback whales in the Northeast United States. The UME was officially closed on December 31, 2007 after a review of 2007 humpback whale strandings and mortality showed that the elevated numbers were no longer being observed. The cause of the 2006 UME has not been determined to date, although investigations are ongoing.

Changes in humpback whale distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Stevick *et al.* 2006, Waring *et al.* 2010). Shifts in relative finfish species abundance correspond to changes in observed humpback whale movements (Stevick *et al.* 2006). However, there is no evidence that humpback whales were adversely affected by these trophic changes.

As highly migratory, wide-ranging organisms, effects of climate change on cetaceans are possible. Analysis on potential effects of climate change on humpback whales in the action area is included below in section 6.0.

4.3.3 Summary of Humpback Whale Status

The best available population estimate for humpback whales in the North Atlantic Ocean is 11,570 animals, and the best, recent estimate for the Gulf of Maine stock is 847 whales (Waring *et al.* 2010). Anthropogenic mortality associated with fishing gear entanglements and ship strikes remains significant. In the winter, mating and calving occurs in areas located outside of the United States where the species is afforded less protection. Despite all of these factors, current data suggest that the Gulf of Maine humpback stock is steadily increasing in size (Waring *et al.* 2010). This is consistent with an estimated average trend of 3.1% in the North Atlantic population overall for the period 1979-1993 (Stevick *et al.* 2003). With respect to the species overall, there are also indications of increasing abundance for the California-Oregon-Washington, central North Pacific, and Southern Hemisphere stocks: Southwest Atlantic, Southeast Atlantic, Southwest Indian Ocean, Southeast Indian Ocean, and Southwest Pacific. Trend data is lacking for the western North Pacific stock, the central South Pacific and Southeast Pacific subpopulations of the southern hemisphere humpback whales, and the northern Indian Ocean humpbacks.

Therefore, given the best available information, for the purposes of this biological opinion, NMFS believes the globally, most humpback whale populations are increasing; as protective measures for large whales are currently in place and continue to be developed, we expect this trend to continue or possibly improve over the next 50 years.

4.4 Fin Whale

The fin whale (*Balaenoptera physalus*) has been listed as endangered under the ESA and is also designated as depleted under the MMPA. Fin whales inhabit a wide range of latitudes between 20-75° N and 20-75° S (Perry *et al.* 1999). The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the Arctic ice pack (NMFS 1998a). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays Clark (1995) reported a general southward flow pattern of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability as this species preys opportunistically on both invertebrates and fish (Watkins *et al.* 1984). Fin whales feed by gulping prey concentrations and filtering the water for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments.

4.4.1 Pacific Ocean

Within US waters of the Pacific, fin whales are found seasonally off the coast of North America and Hawaii and in the Bering Sea during the summer (Allen and Angliss 2010). Although stock structure in the Pacific is not fully understood, NMFS recognizes three fin whale stocks in the US Pacific waters for the purposes of managing this species under the MMPA. These are: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii (Carretta *et al.* 2011). Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available (Allen and Angliss 2010). A provisional population estimate of 5,700 was calculated for the Alaska stock west of the Kenai Peninsula by adding estimates from multiple surveys (Allen and Angliss 2010). This can be considered a minimum estimate for the entire stock because it was estimated from surveys that covered only a portion of the range of the species (Allen and Angliss 2010). An annual population increase of 4.8% between 1987 and 2003 was estimated for fin whales in coastal waters south of the Alaska Peninsula (Allen and Angliss 2010). This is the first estimate of population trend for North Pacific fin whales; however, it must be interpreted cautiously due to the uncertainty in the initial population estimate and the population structure (Allen and Angliss 2010). The best available estimate for the California/Washington/Oregon stock is 3,044, which is likely an underestimate (Carretta *et al.* 2011). The best available estimate for the Hawaii stock is 174, based on a 2002 line-transect survey (Carretta *et al.* 2011).

Stock structure for fin whales in the southern hemisphere is unknown. Prior to commercial exploitation, the abundance of southern hemisphere fin whales is estimated to have been at 400,000 (IWC 1979, Perry *et al.* 1999). There are no current estimates of abundance for southern hemisphere fin whales. Since these fin whales do not occur in US waters, there is no recovery plan or stock assessment report for the southern hemisphere fin whales.

4.4.2 North Atlantic

NMFS has designated one population of fin whales in US waters of the North Atlantic (Waring *et al.* 2010). This species is commonly found from Cape Hatteras northward. A number of researchers have suggested the existence of fin whale subpopulations in the North Atlantic based on local depletions resulting from commercial overharvesting (Mizroch and York 1984) or genetics data (Bérubé *et al.* 1998). Photo-identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years (Seipt *et al.* 1990) suggesting some level of site fidelity. The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia and southeastern coast of Newfoundland are believed to constitute a single stock of fin whales under the present IWC scheme (Donovan 1991). However, it is uncertain whether the proposed boundaries define biologically isolated units (Waring *et al.* 2010).

During 1978-1982 aerial surveys, fin whales accounted for 24% of all cetaceans and 46% of all large cetaceans sighted over the continental shelf between Cape Hatteras and Nova Scotia (Waring *et al.* 2010). Underwater listening systems have also demonstrated that the fin whale is the most acoustically common whale species heard in the North Atlantic (Clark 1995). The single most important area for this species appeared to be from the Great South Channel, along the 50m isobath past Cape Cod, over Stellwagen Bank, and past Cape Ann to Jeffrey's Ledge (Hain *et al.* 1992).

Like right and humpback whales, fin whales are believed to use North Atlantic waters primarily for feeding, and more southern waters for calving. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce. Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda and into the West Indies, but neonate strandings along the US Mid-Atlantic coast from October through January suggest the possibility of an offshore calving area (Hain *et al.* 1992).

Fin whales achieve sexual maturity at 6-10 years of age in males and 7-12 years in females (Jefferson *et al.* 2008), although physical maturity may not be reached until 20-30 years (Aguilar and Lockyer 1987). Conception is believed to occur in tropical and subtropical areas during the winter with birth of a single calf after an 11-12 month gestation (Jefferson *et al.* 2008). The calf is weaned 6-11 months after birth (Perry *et al.* 1999). The mean calving interval is 2.7 years (Agler *et al.* 1993).

The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available (IWC 1992). In the western North Atlantic, fin whales feed on a variety of small schooling fish (*i.e.*, herring, capelin, sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999).

Population Trends and Status

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. One method used the catch history and trends in Catch Per Unit Effort to obtain an estimate of 3,590 to 6,300 fin whales for the entire western North Atlantic (Perry *et al.* 1999). Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the Northeastern US continental shelf waters. The 2010 Stock Assessment Report (SAR) gives a best estimate of abundance for fin whales in the western North Atlantic of 3,985 (CV = 0.24). However, this estimate must be considered extremely conservative in view of the incomplete coverage of the known habitat of the stock and the uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas (Waring *et al.* 2010). The minimum population estimate for the western North Atlantic fin whale is 3,269 (Waring *et al.* 2010). However, there are insufficient data at this time to determine population trends for the fin whale (Waring *et al.* 2010).

Other estimates of the abundance of fin in the North Atlantic are presented in Pike *et al.* (2008) and Hammond *et al.* (2011). Pike *et al.* (2008) estimates the abundance of fin whales to be 27,493 (CV 0.2) in waters around Iceland and the Denmark Strait. Hammond *et al.* (2008) estimates the abundance of 19,354 (CV 0.24) fin whales in the eastern North Atlantic.

Threats

The major known sources of anthropogenic mortality and injury of fin whales include entanglement in commercial fishing gear and ship strikes. The minimum annual rate of confirmed human-caused serious injury and mortality to North Atlantic fin whales from 2004-2008 was 3.2 (Glass *et al.* 2010). During this five year period, there were 14 confirmed entanglements (3 fatal; 3 serious injuries) and 13 ship strikes (10 fatal) (Glass *et al.* 2010). Fin whales are believed to be the cetacean most commonly struck by large vessels (Laist *et al.* 2001). In addition, hunting of fin whales continued well into the 20th century. Fin whales were given total protection in the North Atlantic in 1987 with the exception of an aboriginal subsistence whaling hunt for Greenland (Gambell 1993, Caulfield 1993). However, Iceland has increased its whaling activities in recent years and reported a catch of 136 whales in the 1988/89 and 1989/90 seasons (Perry *et al.* 1999), 7 in 2006/07, and 273 in 2009/2010. Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities.

As highly migratory, wide-ranging organisms, effects of climate change on cetaceans are possible. Analysis on potential effects of climate change on fin whales in the action area is included below in section 6.0.

4.4.3 Summary of Fin Whale Status

Information on the abundance and population structure of fin whales worldwide is limited. NMFS recognizes three fin whale stocks in the Pacific for the purposes of managing this species under the MMPA. Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available (Angliss *et al.* 2001). Stock structure for fin whales in the southern hemisphere is unknown and there are no current estimates of abundance for southern hemisphere fin whales. As noted above, the best population estimate for the western North Atlantic fin whale is 3,985 and the minimum population estimate is 3,269. The 2010 SAR indicates that there are insufficient data at this time to determine population trends for the fin whale. Fishing gear appears to pose less of a threat to fin whales in the North Atlantic Ocean than to North Atlantic right or humpback whales. However, commercial whaling for fin whales in the North Atlantic has restarted and fin whales continue to be struck by large vessels.

Based on the information currently available, for the purposes of this Opinion, NMFS considers the population trend for fin whales to be undetermined. Without sufficient data to determine current fin whale population trends, we are unable to predict the potential trend of fin whales over the next 50 years as well.

4.5 Atlantic Sturgeon

The section below describes the Atlantic sturgeon listing, provides life history information that is relevant to all DPSs of Atlantic sturgeon and then provides information specific to the status of each DPS of Atlantic sturgeon. Below, we also provide a description of which Atlantic sturgeon DPSs likely occur in the action area and provide information on the use of the action area by Atlantic sturgeon.

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a subspecies of sturgeon distributed along the eastern coast of North America from Hamilton Inlet, Labrador, Canada to Cape Canaveral, Florida, USA (Scott and Scott 1988; ASSRT 2007; T. Savoy, CT DEP, pers. comm.). NMFS has delineated U.S. populations of Atlantic sturgeon into five DPSs[5] (77 FR 5880 and 77 FR 5914). These are: the Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (SA) DPSs. The results of genetic studies suggest that natal origin influences the distribution of Atlantic sturgeon in the marine environment (Wirgin and King, 2011). However, genetic data as well as tracking and tagging data demonstrate sturgeon from each DPS and Canada occur throughout the full range of the subspecies. Therefore, sturgeon originating from any of the 5 DPSs can be affected by threats in the marine, estuarine and riverine environment that occur far from natal spawning rivers.

On February 6, 2012, we published notice in the *Federal Register* that we were listing the NYB, CB, Carolina, and SA DPSs as endangered, and the GOM DPS as threatened (77 FR 5880 and 77

[5] To be considered for listing under the ESA, a group of organisms must constitute a "species." A "species" is defined in section three of the ESA to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.

FR 5914). The effective date of the listings was April 6, 2012. The DPSs do not include Atlantic sturgeon that are spawned in Canadian rivers. Therefore, Canadian spawned fish are not included in the listings.

As described below, individuals originating from all of the 5 listed DPSs may occur in the action area. Information general to all Atlantic sturgeon as well as information specific to each of the relevant DPSs is provided below.

4.5.1 Atlantic sturgeon life history

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[6] fish (Bigelow and Schroeder 1953; Vladykov and Greeley 1963; Mangin 1964; Pikitch *et al.* 2005; Dadswell 2006; ASSRT 2007). They are a relatively large fish, even amongst sturgeon species (Pikitch *et al.*, 2005). Atlantic sturgeons are bottom feeders that suck food into a ventrally-located protruding mouth (Bigelow and Schroeder 1953). Four barbels in front of the mouth assist the sturgeon in locating prey (Bigelow and Schroeder 1953). Diets of adult and migrant subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007).

Rate of maturation is affected by water temperature and gender. In general: (1) Atlantic sturgeon that originate from southern systems grow faster and mature sooner than Atlantic sturgeon that originate from more northern systems; (2) males grow faster than females; (3) fully mature females attain a larger size (i.e. length) than fully mature males; and (4) the length of Atlantic sturgeon caught since the mid-late 20th century have typically been less than 3 meters (m) (Smith *et al.* 1982; Smith *et al.* 1984; Smith 1985; Scott and Scott 1988; Young *et al.* 1998; Collins *et al.* 2000; Caron *et al.* 2002; Dadswell 2006; ASSRT 2007; Kahnle *et al.* 2007; DFO, 2011). The largest recorded Atlantic sturgeon was a female captured in 1924 that measured approximately 4.26 m (Vladykov and Greeley 1963). Dadswell (2006) reported seeing seven fish of comparable size in the St. John River estuary from 1973 to 1995. Observations of large sized sturgeon are particularly important given that egg production is correlated with age and body size (Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Dadswell 2006). However, while females are prolific with egg production ranging from 400,000 to 4 million eggs per spawning year, females spawn at intervals of 2-5 years (Vladykov and Greeley 1963; Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Stevenson and Secor 1999; Dadswell 2006). Given spawning periodicity and a female's relatively late age to maturity, the age at which 50 percent of the maximum lifetime egg production is achieved is estimated to be 29 years (Boreman 1997). Males exhibit spawning periodicity of 1-5 years (Smith 1985; Collins *et al.* 2000; Caron *et al.* 2002). While long-lived, Atlantic sturgeon are exposed to a multitude of threats prior to achieving maturation and have a limited number of spawning opportunities once mature.

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6 Anadromous refers to a fish that is born in freshwater, spends most of its life in the sea, and returns to freshwater to spawn (NEFSC FAQ's, available at http://www.nefsc.noaa.gov/faq/fishfaq1a.html, modified June 16, 2011).

Water temperature plays a primary role in triggering the timing of spawning migrations (ASMFC, 2009). Spawning migrations generally occur during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clugston 1997; Caron *et al.* 2002). Male sturgeon begin upstream spawning migrations when waters reach approximately 6° C (43° F) (Smith *et al.* 1982; Dovel and Berggren 1983; Smith 1985; ASMFC 2009), and remain on the spawning grounds throughout the spawning season (Bain 1997). Females begin spawning migrations when temperatures are closer to 12° C to 13° C (54° to 55° F) (Dovel and Berggren, 1983; Smith, 1985; Collins *et al.*, 2000), make rapid spawning migrations upstream, and quickly depart following spawning (Bain 1997).

The spawning areas in most U.S. rivers have not been well defined. However, the habitat characteristics of spawning areas have been identified based on historical accounts of where fisheries occurred, tracking and tagging studies of spawning sturgeon, and physiological needs of early life stages. Spawning is believed to occur in flowing water between the salt front of estuaries and the fall line of large rivers, when and where optimal flows are 46-76 cm/s and depths are 3-27 m (Borodin 1925; Dees 1961; Leland,1968; Scott and Crossman, 1973; Crance 1987; Shirey *et al.* 1999; Bain *et al.* 2000; Collins *et al.*, 2000; Caron *et al.* 2002; Hatin *et al.* 2002; ASMFC, 2009). Sturgeon eggs are deposited on hard bottom substrate such as cobble, coarse sand, and bedrock (Dees 1961; Scott and Crossman 1973; Gilbert 1989; Smith and Clugston 1997; Bain *et al.* 2000; Collins *et al.* 2000; Caron *et al.* 2002; Hatin *et al.* 2002; Mohler 2003; ASMFC 2009), and become adhesive shortly after fertilization (Murawski and Pacheco 1977; Van den Avyle 1983; Mohler, 2003). Incubation time for the eggs increases as water temperature decreases (Mohler 2003). At temperatures of 20° and 18° C, hatching occurs approximately 94 and 140 hours, respectively, after egg deposition (ASSRT 2007).

Larval Atlantic sturgeon (i.e. less than 4 weeks old, with total lengths (TL) less than 30 mm; Van Eenennaam *et al.* 1996) are assumed to undertake a demersal existence and inhabit the same riverine or estuarine areas where they were spawned (Smith *et al.* 1980; Bain *et al.* 2000; Kynard and Horgan 2002; ASMFC 2009). Studies suggest that age-0 (i.e., young-of-year), age- 1, and age-2 juvenile Atlantic sturgeon occur in low salinity waters of the natal estuary (Haley 1999; Hatin *et al.* 2007; McCord *et al.* 2007; Munro *et al.* 2007) while older fish are more salt tolerant and occur in higher salinity waters as well as low salinity waters (Collins *et al.* 2000). Atlantic sturgeon remain in the natal estuary for months to years before emigrating to open ocean as subadults (Holland and Yelverton 1973; Dovel and Berggen 1983; Waldman *et al.* 1996; Dadswell 2006; ASSRT 2007).

After emigration from the natal estuary, subadults and adults travel within the marine environment, typically in waters less than 50 m in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh *et al.* 2002; Savoy and Pacileo 2003; Stein *et al.* 2004; USFWS 2004; Laney *et al.* 2007; Dunton *et al.* 2010; Erickson *et al.* 2011; Wirgin and King 2011). Tracking and tagging studies reveal seasonal movements of Atlantic sturgeon along the coast. Satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight at depths greater than 20 m during winter and spring, and in the northern portion of the Mid-Atlantic Bight at depths less than 20 m in summer and fall (Erickson *et al.*, 2011). Shirey (Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC 2009) found a similar movement pattern for juvenile Atlantic sturgeon based on recaptures of fish originally tagged in the Delaware River. After leaving the Delaware River estuary during the fall, juvenile Atlantic sturgeon were recaptured by commercial fishermen in nearshore waters along the Atlantic coast as far south as Cape Hatteras, North Carolina from November through early March. In the spring, a portion of the tagged fish reentered the Delaware River estuary. However, many fish continued a northerly coastal migration through the Mid-Atlantic as well as into southern New England waters where they were recovered throughout the summer months. Movements as far north as Maine were documented. A southerly coastal migration was apparent from tag returns reported in the fall. The majority of these tag returns were reported from relatively shallow near shore fisheries with few fish reported from waters in excess of 25 m (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC, 2009). Areas where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy (e.g., Minas and Cumberland Basins), Massachusetts Bay, Connecticut River estuary, Long Island Sound, New York Bight, Delaware Bay, Chesapeake Bay, and waters off of North Carolina from the Virginia/North Carolina border to Cape Hatteras at depths up to 24 m (Dovel and Berggren, 1983; Dadswell *et al.*, 1984; Johnson *et al.*, 1997; Rochard *et al.*, 1997; Kynard *et al.* 2000; Eyler *et al.* 2004; Stein *et al.* 2004; Wehrell 2005; Dadswell 2006; ASSRT 2007; Laney *et al.* 2007). These sites may be used as foraging sites and/or thermal refuge.

4.5.2 Determination of DPS Composition in the Action Area

As explained above, the range of all 5 DPSs overlaps and extends from Canada through Cape Canaveral, Florida. We have considered the best available information to determine from which DPSs individuals in the action area are likely to have originated. We have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 49%; South Atlantic 20%; Chesapeake Bay 14%; Gulf of Maine 11%; and Carolina 4.0%. These percentages are largely based on genetic sampling of individuals (n=173) sampled in commercial fisheries by the Northeast Fisheries Observers Program (NEFOP). This covers captures from the Gulf of Maine to Cape Hatteras and is generally aligned with the action area for this consultation. Therefore, this represents the best available information on the likely genetic makeup of individuals occurring in the action area. The genetic assignments have a plus/minus 5% confidence interval; however, for purposes of section 7 consultation we have selected the reported values above, which approximate the mid-point of the range, as a reasonable indication of the likely genetic makeup of Atlantic sturgeon in the action area. These assignments and the data from which they are derived are described in detail in Damon-Randall *et al.* (2012a).

Distribution and Abundance

Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the mid to late 19th century when a caviar market was established (Scott and Crossman, 1973; Taub, 1990; Kennebec River Resource Management Plan, 1993; Smith and Clugston, 1997; Dadswell, 2006; ASSRT, 2007). Abundance of spawning-aged females prior to this period of exploitation was predicted to be greater than 100,000 for the Delaware, and at least 10,000 females for other spawning stocks (Secor and Waldman, 1999; Secor, 2002). Historical records suggest that Atlantic sturgeon spawned in at least 35 rivers prior to this period. Currently, only 16 U.S. rivers are known to support spawning based on available evidence (i.e., presence of young-of-year or gravid Atlantic sturgeon documented within the past 15 years) (ASSRT, 2007). While there may be other rivers supporting spawning for which definitive evidence has not been obtained (e.g., in the Penobscot and York Rivers), the number of rivers supporting spawning of Atlantic sturgeon are approximately half of what they were historically. In addition, only four rivers (Kennebec, Hudson, Delaware, James) are known to currently support spawning from Maine through Virginia where historical records support there used to be fifteen spawning rivers (ASSRT, 2007). Thus, there are substantial gaps in the range between Atlantic sturgeon spawning rivers amongst northern and mid-Atlantic states which could make recolonization of extirpated populations more difficult.

There are no current, published population abundance estimates for any of the currently known spawning stocks. Therefore, there are no published abundance estimates for any of the five DPSs of Atlantic sturgeon. An estimate of 863 mature adults per year (596 males and 267 females) was calculated for the Hudson River based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.*, 2007). An estimate of 343 spawning adults per year is available for the Altamaha River, GA, based on fishery-independent data collected in 2004 and 2005 (Schueller and Peterson, 2006). Using the data collected from the Hudson River and Altamaha River to estimate the total number of Atlantic sturgeon in either subpopulation is not possible, since mature Atlantic sturgeon may not spawn every year (Vladykov and Greeley, 1963; Smith, 1985; Van Eenennaam *et al.*, 1996; Stevenson and Secor, 1999; Collins *et al.* 2000; Caron *et al.*, 2002), the age structure of these populations is not well understood, and stage to stage survival is unknown. In other words, the information that would allow us to take an estimate of annual spawning adults and expand that estimate to an estimate of the total number of individuals (e.g., yearlings, subadults, and adults) in a population is lacking. The ASSRT presumed that the Hudson and Altamaha rivers had the most robust of the remaining U.S. Atlantic sturgeon spawning populations and concluded that the other U.S. spawning populations were likely less than 300 spawning adults per year (ASSRT, 2007).

It is possible, however, to estimate the total number of adults in some other rivers based on the number of mature adults in the Hudson River. We have calculated an estimate of total mature adults and a proportion of subadults for four of the five DPSs. The technique used to obtain these estimates is explained fully in Damon-Randall 2012(b) and is summarized briefly below. We used this method because for these four DPSs, there are: (1) no total population estimates available; (2) with the exception of the Hudson River, no estimates of the number of mature adults; and, (3) no information from directed population surveys which could be used to generate an estimate of the number of spawning adults, total adult population or total DPS population.

Kahnle *et al.* (2007) estimated the number of total mature adults per year in the Hudson River using data from surveys in the 1980s to mid-1990s and based on mean harvest by sex divided by sex specific exploitation rate. While this data is over 20 years old, it is currently the best available data on the abundance of Hudson River origin Atlantic sturgeon. The sex ratio of spawners is estimated to be approximately 70% males and 30% females. As noted above, Kahnle *et al.* (2007) estimated a mean annual number of mature adults at 596 males and 267 females.

We were able to use this estimate of the adult population in the Hudson River and the rate at which Atlantic sturgeon from the Hudson River are intercepted in certain Northeast commercial fisheries[7] to estimate the number of adults in other spawning rivers. As noted above, the method used is summarized below and explained fully in Damon-Randall 2012(b).

Given the geographic scope of commercial fisheries as well as the extensive marine migrations of Atlantic sturgeon, fish originating from nearly all spawning rivers are believed to be intercepted by commercial fisheries. An estimate of the number of Atlantic sturgeon captured in certain fisheries authorized by NMFS under Federal FMPs in the Northeast is available (NEFSC 2011). This report indicates that based on observed interactions with Atlantic sturgeon in sink gillnet and otter trawl fisheries from 2006-2010, on average 3,118 Atlantic sturgeon are captured in these fisheries each year. Information in the NEFOP database, indicates that 25% of captured Atlantic sturgeon are adults (determined as length greater than 150 cm) and 75% are subadults (determined as length less than 150cm). By applying the mixed stock genetic analysis of individuals[8] sampled by the NEFOP and At Sea Monitoring Program (see Damon-Randall *et al.* 2012a) to the bycatch estimate, we can determine an estimate of the number of Hudson River Atlantic sturgeon that are intercepted by these fisheries on an annual basis.

Given the number of observed Hudson River origin Atlantic sturgeon adults taken as bycatch, we can calculate what percentage of Hudson River origin Atlantic sturgeon mature adults these represent. This provides an interception rate. We assume that fish originating in any river in any DPS are equally likely to be intercepted by the observed commercial fisheries; therefore, we can use this interception rate to estimate the number of Atlantic sturgeon in the other rivers of origin. This type of back calculation allows us to use the information we have for the Hudson River and fill in significant data gaps present for the other rivers. Using this method, for the purposes of this consultation, we have estimated the total adult populations for three DPSs (Gulf of Maine, Chesapeake Bay, and South Atlantic) as follows. It is important to note that this method likely underestimates the total number of adults in the SA DPS because genetic analysis of individuals observed through the NEFOP program indicate that only individuals from the Savannah and Ogeechee are being captured in Northeast fisheries considered in the NEFSC bycatch report. Spawning is known to occur in other rivers in the SA DPS, including the Altamaha (estimate of 343 adult spawners per year).

Given the proportion of adults to subadults in the observer database (ratio of 1:3), we can also estimate a number of subadults originating from each DPS. However, this cannot be considered an estimate of the total number of subadults because it would only consider those subadults that are of a size vulnerable to captured in commercial sink gillnet and otter trawl gear in the marine

[7] Bycatch information was obtained from a report prepared by NMFS' Northeast Fisheries Science Center (NEFSC 2012).

[8] Based on the best available information, we expect that 46% of Atlantic sturgeon captured in Northeast commercial fisheries originate from the New York Bight DPS and that 91% of those individuals originate from the Hudson River (see Damon-Randall *et al.* 2012a and Wirgin and King 2011).

environment and are present in the marine environment.

Currently, there are an estimated 343 spawning adults in the Altamaha and there are estimated to be less than 300 spawning adults (total of both sexes) in each of the other major river systems occupied by the South Atlantic DPS. Spawning is thought to occur in six rivers in the SA DPS. Adding these estimates together results in a total adult population estimated of less than 1,843 mature adults. Our fishery dependent estimate is 390. This is likely an underestimate of the total number of adults in the SA DPS because genetic analysis of individuals observed through the NEFOP program indicate that only individuals from the Savannah and Ogeechee are being captured in Northeast fisheries considered in the NEFSC bycatch report. Because of this, it is difficult to compare these two estimates. It may be reasonable to consider the estimate of 390 adults to be an estimate of the number of adults in the Savannah and Ogeechee rivers only. This would be consistent with the assumption that there are fewer than 300 adults in each of these two rivers.

We are not able to use this method to calculate an adult population estimate for the Carolina DPS. Based on the results of the genetic mixed stock analysis, fish originating from the Carolina DPS appear rarely in the Northeast Fisheries Observer Program (NEFOP) observer dataset (e.g., 4% of the 173 fish observed). While we are unable to calculate a population estimate using the above methodology, we do have an estimate of 1500 adult spawners/year (5 spawning rivers x 300 spawning adults per river) described in the Atlantic sturgeon status review report. For the South Atlantic DPS, using this method, the estimated number of fish in the South Atlantic DPS would be 1800 spawning adults (6 spawning rivers x 300 spawning adults per river). Therefore, the Carolina DPS has approximately 17% less fish than the South Atlantic DPS. Based on the methodology described above, the estimated number of mean annual mature adults for the South Atlantic DPS is 390 fish. Using the proportion of Carolina DPS fish to South Atlantic DPS fish, we estimate that the mean number of annual mature adults in the Carolina DPS is 324 (17% less than 390).

Table 1: Summary of Calculated Population Estimates from NER Fisheries Dependent Data

DPS	Estimated Adult Population	Estimated Subadults of Size vulnerable to capture in commercial fisheries
GOM	215	645
NYB (Hudson River and Delaware River)	951	2,853
CB	273	819
SA*	390	1,170
Carolina*	324	972

*see note re. South Atlantic and Carolina population sizes in paragraphs above.

Threats faced by Atlantic sturgeon throughout their range

Atlantic sturgeon are susceptible to over exploitation given their life history characteristics (e.g., late maturity, dependence on a wide-variety of habitats). Similar to other sturgeon species

(Vladykov and Greeley, 1963; Pikitch *et al.*, 2005), Atlantic sturgeon experienced range-wide declines from historical abundance levels due to overfishing (for caviar and meat) and impacts to habitat in the 19th and 20th centuries (Taub, 1990; Smith and Clugston, 1997; Secor and Waldman, 1999).

Based on the best available information, NMFS has concluded that unintended catch of Atlantic sturgeon in fisheries, vessel strikes, poor water quality, water availability, dams, lack of regulatory mechanisms for protecting the fish, and dredging are the most significant threats to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). While all of the threats are not necessarily present in the same area at the same time, given that Atlantic sturgeon subadults and adults use ocean waters from the Labrador, Canada to Cape Canaveral, FL, as well as estuaries of large rivers along the U.S. East Coast, activities affecting these water bodies are likely to affect more than one Atlantic sturgeon DPS. In addition, given that Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

An ASMFC interstate fishery management plan for sturgeon (Sturgeon FMP) was developed and implemented in 1990 (Taub, 1990). In 1998, the remaining Atlantic sturgeon fisheries in U.S. state waters were closed per Amendment 1 to the Sturgeon FMP. Complementary regulations were implemented by NMFS in 1999 that prohibit fishing for, harvesting, possessing or retaining Atlantic sturgeon or its parts in or from the Exclusive Economic Zone in the course of a commercial fishing activity.

Commercial fisheries for Atlantic sturgeon still exist in Canadian waters (DFO, 2011). Sturgeon belonging to one or more of the DPSs may be harvested in the Canadian fisheries. In particular, the Bay of Fundy fishery in the Saint John estuary may capture sturgeon of U.S. origin given that sturgeon from the Gulf of Maine and the New York Bight DPSs have been incidentally captured in other Bay of Fundy fisheries (DFO, 2010; Wirgin and King, 2011). Because Atlantic sturgeon are listed under Appendix II of the Convention on International Trade in Endangered Species (CITES), the U.S. and Canada are currently working on a conservation strategy to address the potential for captures of U.S. fish in Canadian directed Atlantic sturgeon fisheries and of Canadian fish incidentally in U.S. commercial fisheries. At this time, there are no estimates of the number of individuals from any of the DPSs that are captured or killed in Canadian fisheries each year. Based on geographic distribution, most U.S. Atlantic sturgeon that are intercepted in Canadian fisheries are likely to originate from the Gulf of Maine DPS, with a smaller percentage from the New York Bight DPS.

Fisheries bycatch in U.S. waters is one of the primary threats faced by all 5 DPSs. At this time, we have an estimate of the number of Atlantic sturgeon captured and killed in sink gillnet and otter trawl fisheries authorized by Federal FMPs (NMFS NEFSC 2011) in the Northeast Region, as well as estimates for the shrimp and Highly Migratory Species fisheries in the Southeast Region (NMFS 2012; A. Herndon, pers. comm.). We do not have an estimate of the number of Atlantic sturgeon captured or killed in state fisheries. At this time, we are not able to quantify the effects of other significant threats (e.g., vessel strikes, poor water quality, water availability, dams, and dredging) in terms of habitat impacts or loss of individuals. While we have some information on the number of mortalities that have occurred in the past in association with certain activities (e.g., mortalities in the Delaware and James Rivers that are thought to be due to vessel strikes), we are not able to use those numbers to extrapolate effects throughout one or more DPS. This is because of (1) the small number of data points and, (2) lack of information on the percent of incidences that the observed mortalities represent.

As noted above, the NEFSC prepared an estimate of the number of encounters of Atlantic sturgeon in fisheries authorized by Northeast FMPs (NEFSC 2011). The analysis prepared by the NEFSC estimates that from 2006 through 2010 there were 2,250 to 3,862 encounters per year in observed gillnet and trawl fisheries, with an average of 3,118 encounters. Mortality rates in gillnet gear are approximately 20%. Mortality rates in otter trawl gear are believed to be lower at approximately 5%.

Global climate change may affect all DPSs of Atlantic. Further analysis on potential effects of climate change on Atlantic sturgeon in the action area is included in section 6.0 below.

Information specific to each DPS is presented in the sections below.

4.5.2.1 Gulf of Maine (GOM) DPS

The GOM DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, MA. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and it is possible that it still occurs in the Penobscot River as well. Spawning in the Androscoggin River may also be occurring. Maine Department of Marine Resources reported the capture of a larval Atlantic sturgeon during the 2011 spawning season below the Brunswick Dam; this suggests that spawning may be occurring in this area. There is no evidence of recent spawning in the remaining rivers. In the 1800s, construction of the Essex Dam on the Merrimack River at river kilometer (rkm) 49 blocked access to 58 percent of Atlantic sturgeon habitat in the river (Oakley 2003; ASSRT 2007).However, the accessible portions of the Merrimack seem to be suitable habitat for Atlantic sturgeon spawning and rearing (i.e., nursery habitat) (Keiffer and Kynard 1993). Therefore, the availability of spawning habitat does not appear to be the reason for the lack of observed spawning in the Merrimack River. Studies are on-going to determine whether Atlantic sturgeon are spawning in these rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are key elements of Atlantic sturgeon life history for the GOM DPS as well as likely throughout the entire range (ASSRT 2007; Fernandes *et al.* 2010).

Several threats play a role in shaping the current status of GOM DPS Atlantic sturgeon. Historical records provide evidence of commercial fisheries for Atlantic sturgeon in the Kennebec and Androscoggin Rivers dating back to the 17th century (Squiers *et al.* 1979). In 1849, 160 tons of sturgeon was caught in the Kennebec River by local fishermen (Squiers *et al.*

1979). Following the 1880's, the sturgeon fishery was almost non-existent due to a collapse of the sturgeon stocks. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon by catch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries occurring in state and federal waters still occurs. In the marine range, GOM DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004; ASMFC 2007).
As explained above, we have estimates of the number of subadults and adults that are killed as a result of bycatch in fisheries authorized under Northeast FMPs. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats. Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Riverine habitat may be affected by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. Many rivers in the GOM DPS have navigation channels that are maintained by dredging. Dredging outside of Federal channels and in-water construction occurs throughout the GOM DPS. While some dredging projects operate with observers present to document fish mortalities, many do not. To date we have not received any reports of Atlantic sturgeon killed during dredging projects in the Gulf of Maine region; however, as noted above, not all projects are monitored for interactions with fish. At this time, we do not have any information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects are also not able to quantify any effects to habitat.

Connectivity is disrupted by the presence of dams on several rivers in the Gulf of Maine region, including the Penobscot and Merrimack Rivers. While there are also dams on the Kennebec, Androscoggin and Saco Rivers, these dams are near the site of natural falls and likely represent the maximum upstream extent of sturgeon occurrence even if the dams were not present. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the Gulf of Maine region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the Gulf of Maine region is currently unknown; however, the documentation of an Atlantic sturgeon larvae downstream of the Brunswick Dam in the Androscoggin River suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least that project and therefore, may be affected by project operations. The range of Atlantic sturgeon in the Penobscot River is limited by the presence of the Veazie and Great Works Dams. Together these dams prevent Atlantic sturgeon from accessing approximately 29 km of habitat, including the presumed historical spawning habitat located downstream of Milford Falls, the site of the Milford Dam. While removal of the Veazie and Great Works Dams is anticipated to occur in the near future, the presence of these dams is currently preventing access to significant habitats within the Penobscot River. While Atlantic sturgeon are known to occur in the Penobscot River, it is unknown if spawning is currently occurring or whether the presence of the Veazie and Great Works Dams affects the likelihood of spawning occurring in this river. The Essex Dam on the Merrimack River blocks access to approximately 58% of historically accessible habitat in this river. Atlantic sturgeon occur in the Merrimack River but spawning has not been documented.

Like the Penobscot, it is unknown how the Essex Dam affects the likelihood of spawning occurring in this river.

GOM DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Gulf of Maine over the past decades (Lichter *et al.* 2006; EPA 2008). Many rivers in Maine, including the Androscoggin River, were heavily polluted in the past from industrial discharges from pulp and paper mills. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

There are no empirical abundance estimates for the GOM DPS. The Atlantic sturgeon SRT (2007) presumed that the GOM DPS was comprised of less than 300 spawning adults per year, based on abundance estimates for the Hudson and Altamaha River riverine populations of Atlantic sturgeon. Surveys of the Kennebec River over two time periods, 1977-1981 and 1998-2000, resulted in the capture of nine adult Atlantic sturgeon (Squiers 2004). However, since the surveys were primarily directed at capture of shortnose sturgeon, the capture gear used may not have been selective for the larger-sized, adult Atlantic sturgeon; several hundred subadult Atlantic sturgeon were caught in the Kennebec River during these studies. As explained above, we have estimated that there is an annual mean of 166 mature adult Atlantic sturgeon in the GOM DPS.

Summary of the Gulf of Maine DPS

Spawning for the GOM DPS is known to occur in two rivers (Kennebec and Androscoggin) and possibly in a third. Spawning may be occurring in other rivers, such as the Sheepscot or Penobscot, but has not been confirmed. There are indications of increasing abundance of Atlantic sturgeon belonging to the GOM DPS. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River, and are observed in rivers where they were unknown to occur or had not been observed to occur for many years (e.g., the Saco, Presumpscot, and Charles rivers). These observations suggest that abundance of the GOM DPS of Atlantic sturgeon is sufficient such that recolonization to rivers historically suitable for spawning may be occurring. However, despite some positive signs, there is not enough information to establish a trend for this DPS.

Some of the impacts from the threats that contributed to the decline of the GOM DPS have been removed (e.g., directed fishing), or reduced as a result of improvements in water quality and removal of dams (e.g., the Edwards Dam on the Kennebec River in 1999). There are strict regulations on the use of fishing gear in Maine state waters that incidentally catch sturgeon. In addition, there have been reductions in fishing effort in state and federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, MA, with only 8 percent (e.g., 7 of the 84 fish) of interactions observed in the Mid Atlantic/Carolina region being assigned to the Gulf of Maine DPS (Wirgin and King

2011). Tagging results also indicate that GOM DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south. However, data on Atlantic sturgeon incidentally caught in trawls and intertidal fish weirs fished in the Minas Basin area of the Bay of Fundy (Canada) indicate that approximately 35 percent originated from the GOM DPS (Wirgin *et al.*, in draft).

As noted previously, studies have shown that in order to rebuild, Atlantic sturgeon can only sustain low levels of bycatch and other anthropogenic mortality (Boreman 1997; ASMFC 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). NMFS has determined that the GOM DPS is at risk of becoming endangered in the foreseeable future throughout all of its range (i.e., is a threatened species) based on the following: (1) significant declines in population sizes and the protracted period during which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect recovery.

4.5.2.2 New York Bight (NYB) DPS

The NYB DPS includes the following: all anadromous Atlantic sturgeon spawned in the watersheds that drain into coastal waters from Chatham, MA to the Delaware-Maryland border on Fenwick Island. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco 1977; Secor 2002; ASSRT 2007). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

The abundance of the Hudson River Atlantic sturgeon riverine population prior to the onset of expanded exploitation in the 1800's is unknown but, has been conservatively estimated at 10,000 adult females (Secor, 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor, 2002; ASSRT, 2007; Kahnle *et al.* 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson River riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). Kahnle *et al.* (1998; 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid 1970's (Kahnle *et al.*, 1998). A decline appeared to occur in the mid to late 1970's followed by a secondary drop in the late 1980's (Kahnle *et al.* 1998; Sweka *et al.* 2007; ASMFC 2010). Catch-per-unit-effort data suggests that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980's (Sweka *et al.* 2007; ASMFC, 2010). In examining the CPUE data from 1985-2007, there are significant fluctuations during this time. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s and while the CPUE is generally higher in the 2000s as compared to the 1990s, given the significant annual fluctuation it is difficult to discern any trend. Despite the CPUEs from 2000-2007 being generally higher than those from 1990-1999, they are low compared to the late 1980s. There is currently not enough information regarding any life stage to establish a trend for the Hudson River population.

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800's indicate that this was historically a large population with an estimated 180,000 adult females prior to 1890 (Secor and Waldman, 1999; Secor, 2002). Sampling in 2009 to target young-of- the year (YOY) Atlantic sturgeon in the Delaware River (i.e., natal sturgeon) resulted in the capture of 34 YOY, ranging in size from 178 to 349 mm TL (Fisher, 2009) and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron in Calvo *et al.* 2010). Genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class (Fisher 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning is still occurring in the Delaware River, the relatively low numbers suggest the existing riverine population is limited in size.

Several threats play a role in shaping the current status and trends observed in the Delaware River and Estuary. In-river threats include habitat disturbance from dredging, and impacts from historical pollution and impaired water quality. A dredged navigation channel extends from Trenton seaward through the tidal river (Brundage and O'Herron 2009), and the river receives significant shipping traffic. Vessel strikes have been identified as a threat in the Delaware River; however, at this time we do not have information to quantify this threat or its impact to the population or the New York Bight DPS. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population.

Summary of the New York Bight DPS

Atlantic sturgeon originating from the NYB DPS spawn in the Hudson and Delaware Rivers. While genetic testing can differentiate between individuals originating from the Hudson or Delaware River the available information suggests that the straying rate is high between these rivers. There are no indications of increasing abundance for the NYB DPS (ASSRT 2009; 2010). Some of the impact from the threats that contributed to the decline of the NYB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in state and federally-managed fisheries, and vessel strikes remain significant threats to the NYB DPS.

In the marine range, NYB DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004; ASMFC 2007). As explained above, currently available estimates indicate that at least 4% of adults may be killed as a result of bycatch in fisheries authorized under Northeast FMPs. Based on mixed stock analysis results presented by Wirgin and King (2011), over 40 percent of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the NYB DPS. Individual-based assignment and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1-2% were from the NYB DPS. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats.

Riverine habitat may be affected by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. Both the Hudson and Delaware rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Dredging outside of Federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects operate with observers present to document fish mortalities many do not. We have reports of one Atlantic sturgeon entrained during hopper dredging operations in Ambrose Channel, New Jersey. At this time, we do not have any information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects are also not able to quantify any effects to habitat.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown.

NYB DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter *et al.* 2006; EPA 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds as developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes occur in the Delaware River. Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004 to 2008, and at least 13 of these fish were large adults. Given the time of year in which the fish were observed (predominantly May through July, with two in August), it is likely that many of the adults were migrating through the river to the spawning grounds. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the NYB DPS.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman 1997; ASMFC, 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the

NYB DPS. As explained above, we have estimated that there are an annual mean total of 950 mature adult Atlantic sturgeon in the NYB DPS. NMFS has determined that the NYB DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

4.5.2.3 Chesapeake Bay (CB) DPS

The CB DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, VA. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100 percent of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (i.e. dams) are located upriver of where spawning is expected to have historically occurred (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well (Musick *et al.*, 1994; ASSRT 2007; Greene, 2009). However, conclusive evidence of current spawning is only available for the James River. Atlantic sturgeon that are spawned elsewhere are known to use the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat prior to entering the marine system as subadults (Vladykov and Greeley 1963; ASSRT 2007; Wirgin *et al.* 2007; Grunwald *et al.* 2008).

Several threats play a role in shaping the current status of CB DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 19th century (Hildebrand and Schroeder 1928; Vladykov and Greeley 1963; ASMFC 1998; Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17th century (Secor 2002; Bushnoe *et al.* 2005; ASSRT, 2007; Balazik *et al.* 2010). Habitat disturbance caused by in-river work such as dredging for navigational purposes is thought to have reduced available spawning habitat in the James River (Holton and Walsh, 1995; Bushnoe *et al.*, 2005; ASSRT 2007). At this time, we do not have information to quantify this loss of spawning habitat.

Decreased water quality also threatens Atlantic sturgeon of the CB DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface to volume ratio, and strong stratification during the spring and summer months (Pyzik *et al.* 2004; ASMFC 1998; ASSRT 2007; EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005; 2010). At this time we do not have sufficient information to quantify the extent that degraded water quality effects habitat or individuals in the James River or throughout the Chesapeake Bay.

Vessel strikes have been observed in the James River (ASSRT 2007). Eleven Atlantic sturgeon were reported to have been struck by vessels from 2005 through 2007. Several of these were mature individuals. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the CB DPS.

In the marine and coastal range of the CB DPS from Canada to Florida, fisheries bycatch in federally and state managed fisheries poses a threat to the DPS, reducing survivorship of subadults and adults and potentially causing an overall reduction in the spawning population (Stein *et al.* 2004; ASMFC 2007; ASSRT 2007).

Summary of the Chesapeake Bay DPS

Spawning for the CB DPS is known to occur in only the James River. Spawning may be occurring in other rivers, such as the York, but has not been confirmed. There are anecdotal reports of increased sightings and captures of Atlantic sturgeon in the James River. However, this information has not been comprehensive enough to develop a population estimate for the James River or to provide sufficient evidence to confirm increased abundance. Some of the impact from the threats that facilitated the decline of the CB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). As explained above, we have estimated that there is an annual mean of 329 mature adult Atlantic sturgeon in the CB DPS. We do not currently have enough information about any life stage to establish a trend for this DPS. Areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in U.S. state and federally-managed fisheries, Canadian fisheries and vessel strikes remain significant threats to the CB DPS of Atlantic sturgeon. Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC 2007; Kahnle *et al.* 2007). The CB DPS is currently at risk of extinction given (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect the potential for population recovery.

4.5.2.4 The South Atlantic (SA) DPS

Distribution and Abundance

The SA DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the South Atlantic DPS and the adjacent portion of the marine range are shown in Figure 3. Sturgeon are commonly captured 40 miles offshore (D. Fox, DSU, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004, ASMFC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms.

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system (Table 2). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population present in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the SA DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the SA DPS likely use other river systems than those listed here for their specific life functions.

Table 2. Major rivers, tributaries, and sounds within the range of the South Atlantic DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

River/Estuary	Spawning Population	Data
ACE (Ashepoo, Combahee, and Edisto Rivers) Basin, SC; St. Helena Sound	Yes	1,331 YOY (1994-2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998)
Broad-Coosawhatchie Rivers, SC; Port Royal Sound	Unknown	
Savannah River, SC/GA	Yes	22 YOY (1999-2006); running ripe male (1997)
Ogeechee River, GA	Yes	age-1 captures, but high inter-annual variability (1991-1998); 17 YOY (2003); 9 YOY (2004)
Altamaha River, GA	Yes	74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005)
Satilla River, GA	Yes	4 YOY and spawning adults (1995-1996)
St. Marys River, GA/FL	Extirpated	
St. Johns River, FL	Extirpated	

The riverine spawning habitat of the SA DPS occurs within the South Atlantic Coastal Plain ecoregion (TNC 2002), which includes fall-line sandhills, rolling longleaf pine uplands, wet pine flatwoods, isolated depression wetlands, small streams, large river systems, and estuaries. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. The primary threats to biological diversity in the South Atlantic Coastal Plain listed by TNC are intensive silvicultural practices, including conversion of natural forests to highly managed pine monocultures and the clear-cutting of bottomland hardwood forests. Changes in water quality and quantity, caused by hydrologic alterations (impoundments, groundwater withdrawal, and ditching), and point and nonpoint pollution, are threatening the aquatic systems. Development is a growing threat, especially in coastal areas. Agricultural conversion, fire regime alteration, and the introduction of nonnative species are additional threats to the ecoregion's diversity. The South Atlantic DPS' spawning rivers, located in the South Atlantic Coastal Plain, are primarily of two types: brownwater (with headwaters north of the Fall Line, silt-laden) and blackwater (with headwaters in the coastal plain, stained by tannic acids).

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the SA DPS. Currently, the Atlantic sturgeon spawning population in at least two river systems within the SA DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 1 percent of what they were historically (ASSRT 2007).

Threats

The South Atlantic DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the SA DPS. Dredging is a present threat to the SA DPS and is contributing to their status by modifying the quality and availability of Atlantic sturgeon habitat. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced DO and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns Rivers. Reductions in water quality from terrestrial activities have modified habitat utilized by the SA DPS. Low DO is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more highly sensitive to low DO and the negative (metabolic, growth, and feeding) effects caused by low DO increase when water temperatures are concurrently high, as they are within the range of the South Atlantic DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the South Atlantic DPS. Known large water withdrawals of over 240 million gallons per day (mgd) of water may be removed from the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the SA DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the SA DPS and will likely be compounded in the future by population growth and potentially by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the SA DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the SA DPS. Atlantic sturgeon are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5 percent of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets, therefore fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the SA DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no permit requirements for water withdrawals under 100,000 gpd in Georgia, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution.)

The recovery of Atlantic sturgeon along the Atlantic Coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and, (4) mitigation of water quality parameters that are restricting sturgeon use of a river (i.e., DO). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

Viability of the South Atlantic DPS

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers of every river population in the SA DPS put them in danger of extinction throughout their range; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population sizes within the SA DPS have remained relatively constant at greatly reduced levels (approximately 6 percent of historical population sizes in the Altamaha River, and 1 percent of historical population sizes in the remainder of the DPS) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry, 1971; Shaffer, 1981; Soulé, 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, it also results increases the timeframe over which exposure to the multitude of threats facing the SA DPS can occur.

The viability of the SA DPS depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (i.e., spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively affect the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Secor and Waldman 1999). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Summary of the Status of the SA DPS of Atlantic Sturgeon

The SA DPS is estimated to number fewer than 6 percent of its historical population size, with all river populations except the Altamaha estimated to be less than 1 percent of historical abundance. There are an estimated 343 spawning adults per year in the Altamaha and less than 300 spawning adults per year (total of both sexes) in each of the other major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs in the watersheds (including all rivers and tributaries) of the ACE Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the South Atlantic DPS by habitat alteration, bycatch, and from the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch.

Dredging is contributing to the status of the SA DPS by modifying spawning, nursery, and foraging habitat. Habitat modifications through reductions in water quality are also contributing to the status of the SA DPS through reductions in DO, particularly during times of high water temperatures, which increase the detrimental effects on Atlantic sturgeon habitat. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch is also a current impact to the SA DPS that is contributing to its status. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may utilize multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the SA DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS' authority under the Federal Power Act to recommend fish passage and existing controls on some pollution sources. There is a lack of regulation for some large water withdrawals, which threatens sturgeon habitat. Current regulatory regimes do not require a permit for water withdrawals under 100,000 gpd in Georgia and there are no restrictions on interbasin water transfers in South Carolina. Data required to evaluate water allocation issues are either very weak, in terms of determining the precise amounts of water currently being used, or non-existent, in terms of our knowledge of water supplies available for use under historical hydrologic conditions in the region. Existing water allocation issues will likely be compounded by population growth, drought, and potentially climate change. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the SA DPS.

4.5.2.5 Carolina DPS

Distribution and Abundance

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. Sturgeon are commonly captured 40 miles offshore (D. Fox, DSU, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004, ASMFC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms.

Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. We determined spawning was occurring if young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system (Table 3). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Table 3. Major rivers, tributaries, and sounds within the range of the Carolina DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

River/Estuary	Spawning Population	Data
Roanoke River, VA/NC; Albemarle Sound, NC	Yes	collection of 15 YOY (1997-1998); single YOY (2005)
Tar-Pamlico River, NC;	Yes	one YOY (2005)

Pamlico Sound		
Neuse River, NC; Pamlico Sound	Unknown	
Cape Fear River, NC	Yes	upstream migration of adults in the fall, carcass of a ripe female upstream in mid-September (2006)
Waccamaw River, SC; Winyah Bay	Yes	age-1, potentially YOY (1980s)
Pee Dee River, SC; Winyah Bay	Yes	running ripe male in Great Pee Dee River (2003)
Sampit, SC; Winyah Bay	Extirpated	
Santee River, SC	Unknown	
Cooper River, SC	Unknown	
Ashley River, SC	Unknown	

The riverine spawning habitat of the Carolina DPS occurs within the Mid-Atlantic Coastal Plain ecoregion (TNC 2002), which includes bottomland hardwood forests, swamps, and some of the world's most active coastal dunes, sounds, and estuaries. Natural fires, floods, and storms are so dominant in this region that the landscape changes very quickly. Rivers routinely change their courses and emerge from their banks. The primary threats to biological diversity in the Mid-Atlantic Coastal Plain, as listed by TNC are: global climate change and rising sea level; altered surface hydrology and landform alteration (e.g., flood-control and hydroelectric dams, inter-basin transfers of water, drainage ditches, breached levees, artificial levees, dredged inlets and river channels, beach renourishment, and spoil deposition banks and piles); a regionally receding water table, probably resulting from both over-use and inadequate recharge; fire suppression; land fragmentation, mainly by highway development; land-use conversion (e.g., from forests to timber plantations, farms, golf courses, housing developments, and resorts); the invasion of exotic plants and animals; air and water pollution, mainly from agricultural activities including concentrated animal feed operations; and over-harvesting and poaching of species. Many of the Carolina DPS' spawning rivers, located in the Mid-Coastal Plain, originate in areas of marl. Waters draining calcareous, impervious surface materials such as marl are: (1) likely to be alkaline; (2) dominated by surface run-off; (3) have little groundwater connection; and, (4) are seasonally ephemeral.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002, Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time-frame. Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with a potential extirpation in an additional system. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 3 percent of what they were historically (ASSRT 2007).

Threats

The Carolina DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the Carolina DPS. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking over 60 percent of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and dissolved oxygen (DO)) downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and curtails the extent of spawning and nursery habitat for the Carolina DPS. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams. Reductions in water quality from terrestrial activities have modified habitat utilized by the Carolina DPS. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee rivers have been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the Carolina DPS. Twenty interbasin water transfers in existence prior to 1993, averaging 66.5 million gallons per day (mgd), were authorized at their maximum levels without being subjected to an evaluation for certification by North Carolina Department of Environmental and Natural Resources or other resource agencies. Since the 1993 legislation requiring certificates for transfers, almost 170 mgd of interbasin water withdrawals have been authorized, with an additional 60 mgd pending certification. The removal of large amounts of water from the system will alter flows, temperature, and DO. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current stressors to the Carolina DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. Atlantic sturgeon are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5 percent of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets, therefore fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution, etc.)

The recovery of Atlantic sturgeon along the Atlantic Coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and, (4) mitigation of water quality parameters that are restricting sturgeon use of a river (i.e., DO). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers of every river population in the Carolina DPS put them in danger of extinction throughout their range; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population sizes within the Carolina DPS have remained relatively constant at greatly reduced levels (approximately 3 percent of historical population sizes) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry, 1971; Shaffer, 1981; Soulé, 1980). Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, it also results increases the timeframe over which exposure to the multitude of threats facing the Carolina DPS can occur.

The viability of the Carolina DPS depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively affect the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Secor and Waldman 1999). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Summary of the Status of the Carolina DPS of Atlantic Sturgeon

In summary, the Carolina DPS is estimated to number less than 3 percent of its historic population size. There are estimated to be less than 300 spawning adults per year (total of both sexes) in each of the major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the Carolina DPS by habitat alteration and bycatch. This DPS was severely depleted by past directed commercial fishing, and faces ongoing impacts and threats from habitat alteration or inaccessibility, bycatch, and the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch that have prevented river populations from rebounding and will prevent their recovery.

The presence of dams has resulted in the loss of over 60 percent of the historical sturgeon habitat on the Cape Fear River and in the Santee-Cooper system. Dams are contributing to the status of the Carolina DPS by curtailing the extent of available spawning habitat and further modifying the remaining habitat downstream by affecting water quality parameters (such as depth, temperature, velocity, and DO) that are important to sturgeon. Dredging is also contributing to the status of the Carolina DPS by modifying Atlantic sturgeon spawning and nursery habitat. Habitat modifications through reductions in water quality are contributing to the status of the

Carolina DPS due to nutrient-loading, seasonal anoxia, and contaminated sediments. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch is also a current threat to the Carolina DPS that is contributing to its status. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may utilize multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the Carolina DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS' authority under the Federal Power Act to recommend fish passage and existing controls on some pollution sources. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the Carolina DPS.

5.0 ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of the listed species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include: vessel and fishery operations, water quality/pollution, and recovery activities associated with reducing those impacts.

5.1 Federal Actions that have Undergone Formal or Early Section 7 Consultation

NMFS has undertaken several ESA section 7 consultations to address the effects of vessel operations and gear associated with federally-permitted fisheries on threatened and endangered species in the action area. Each of those consultations sought to develop ways of reducing the probability of adverse impacts of the action on listed species. Formal consultations completed in the action area are summarized below.

Dredging

Whole sea turtles and sea turtle parts have been taken in hopper dredging operations in the action area. Dredging operations have been undertaken in offshore borrow areas to assist in beach erosion and hurricane protection programs in the areas of Virginia Beach (Sandbridge Beach Erosion and Hurricane Protection Project, NMFS NER 1993 and 2001;Virginia Beach Hurricane Protection Project, NMFS NER 2005; Shoreline Restoration and Protection Project-Joint Expeditionary Base Little Creek/Fort Story, Virginia Beach, Virginia , NMFS NER 2012 (to be issued)), as well as in areas such as Cape Henry Channel, the Atlantic Ocean Channel, and Thimble Shoals. These dredging operations have, or had the potential to, incidentally taken sea turtles. The impacts of hopper dredging in these channels on listed species were previously considered via formal section 7 consultations (NMFS NER 2002, NMFS NER 2003). Incidental take statements were issued for each of these consultations. Since 1994, 63 sea turtles have been taken by Virginia dredge operations. Some of the incidents involved decomposed turtle flippers and/or carapace parts, but most of these takes were fresh dead turtles. As such, hopper dredging in the action area has resulted in the mortality of a number of sea turtles, most of which were loggerheads. There have also been several strandings (e.g., 13 in 2002, 3 turtles in 2003) with injuries consistent with dredge interactions. Dredging in the surrounding area could have influenced the distribution of sea turtles and/or disrupted potential foraging habitat.

Federal Vessel Operations

Potential adverse effects on listed species from federal vessel operations in the action area of this consultation include operations of the US Navy (USN) and the US Coast Guard (USCG), which maintain the largest federal vessel fleets, the EPA, the National Oceanic and Atmospheric Administration (NOAA), and the USACE. NMFS has conducted formal consultations with the USCG, the USN, EPA and NOAA on their vessel operations. In addition to operation of USACE vessels, NMFS has consulted with the USACE to provide recommended permit restrictions for operations of contract or private vessels around whales. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid adverse effects to listed species. Refer to the biological opinions for the USCG (September 15, 1995; July 22, 1996; and June 8, 1998) and the USN (May 15, 1997) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

Federal Fishery Operations

NMFS authorizes the operation of several fisheries in the action area under the authority of the Magnuson-Stevens Fishery Conservation Act and through Fishery Management Plans and their implementing regulations. Commercial and recreational fisheries in the action area employ gear that is known to harass, injure, and/or kill sea turtles and Atlantic sturgeon. In the Northeast Region (Maine through Virginia), formal ESA section 7 consultations have been conducted on the American lobster, Atlantic bluefish, Atlantic mackerel/squid/ butterfish, Atlantic sea scallop, monkfish, northeast multispecies, skate, red crab, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. Of those consultations, only portions of the Atlantic bluefish, Atlantic mackerel/squid/ butterfish, skate, monkfish, northeast multispecies, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries occur within the action area. These consultations have considered effects to loggerhead, green, Kemp's ridley and leatherback sea turtles. We have completed Biological Opinions on the operations of these fisheries. In each of these Opinions, we concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of any sea turtle species. Each of these Opinions included an incidental take statement exempting a certain amount of lethal and/or non-lethal take resulting from interactions with the fishery. These ITSs are summarized in the table below. Further, in each Opinion, we concluded that the potential for interactions (i.e., vessel strikes) between sea turtles and fishing vessels was extremely low and similarly that any effects to sea turtle prey and/or habitat would be insignificant and discountable. We have also determined that the Atlantic herring and surf clam/ocean quahog fisheries do not adversely affect any species of listed sea turtles.

In addition to these consultations, NMFS has conducted a formal consultation on the pelagic longline component of the Atlantic highly migratory species FMP. Portions of this fishery occur within the action area. In a June 1, 2004 Opinion, NMFS concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of loggerhead, Kemp's ridley or green sea turtles but was likely to jeopardize the continued existence of leatherback sea turtles. This Opinion included a Reasonable and Prudent Alternative that when implemented would modify operations of the fishery in a way that would remove jeopardy. This fishery is currently operated in a manner that is consistent with the RPA. The RPA included an ITS which is reflected in the table below. Unless specifically noted, all numbers denote an annual number of captures that may be lethal or non-lethal.

FMP	**Date of Most Recent Opinion**	**Loggerhead**	**Kemp's ridley**	**Green**	**Leatherback**
Atlantic bluefish	October 29, 2010	82 (34 lethal)	4	5	4
Monkfish	October 29, 2010	173 (70 lethal)	4	5	4
Multispecies	October 29, 2010	46 in trawls (21 lethal)	4	5	4
Skate	October 29, 2010	39 (17 lethal)	4	5	4
Spiny dogfish	October 29, 2010	2	4	5	4
Mackerel/squid/butterfish	October 29, 2010	62 (25 lethal)	2	2	2
Summer flounder/scup/black sea bass	October 29, 2010	205 (85 lethal)	4	5	6
Pelagic longline under the HMS FMP (per the RPA)	June 1, 2004	1,905 (339 lethal) every 3 years	*105 (18 lethal) every 3 years	*105 (18 lethal) every 3 years	1764 (252 lethal) every 3 years
Tilefish	March 13, 2001	6 (3 lethal)			1

**combination of 105 (18 lethal) Kemp's ridley, green, hawksbill, or Olive ridley*
***combination of 16 turtles total every 3 years with 2 lethal (Kemp's ridley, green, hawksbill, leatherback)*
**** this consultation has been reinitiated and a new Opinion is expected in 2012*

We are in the process of reinitiating consultations that consider fisheries actions that may affect Atlantic sturgeon. Sturgeon originating from the four DPSs considered in this consultation are known to be captured and killed in fisheries operated in the action area. At the time of this writing, no Opinions considering effects of federally authorized fisheries on any DPS of Atlantic sturgeon have been completed. As noted in the Status of the Species section above, the NEFSC prepared a bycatch estimate for Atlantic sturgeon captured in sink gillnet and otter trawl fisheries operated from Maine through Virginia. This estimate indicates that, based on data from 2006-2010, annually, an average of 3,118 Atlantic sturgeon are captured in these fisheries with 1,569 in sink gillnet and 1,548 in otter trawls. The mortality rate in sink gillnets is estimated at approximately 20% and the mortality rate in otter trawls is estimated at 5%. Based on this estimate, a total of 391 Atlantic sturgeon are estimated to be killed annually in these fisheries that are prosecuted in the action area. We are currently in the process of determining the effects of this annual loss to each of the DPSs. Any of these fisheries that operate with sink gillnets or otter trawls are likely to interact with Atlantic sturgeon and be an additional source of mortality in the action area.

5.2 Non-Federally Regulated Actions

Private and Commercial Vessel Operations

Private and commercial vessels, including fishing vessels, operating in the action area of this
Private and commercial vessels, including fishing vessels, operating in the action area of this
consultation also have the potential to interact with listed species. Ship strikes have been identified as a significant source of mortality to the North Atlantic right whale population (Kraus 1990) and are also known to affect all other endangered whales. Data also shows that vessel traffic is a substantial cause of sea turtle mortality. Fifty to 500 loggerheads and 5 to 50 Kemp's ridley turtles are estimated to be killed by vessel traffic per year in the U.S. (National Research Council 1990). In certain geographic areas, vessel strikes have also been identified as a threat to Atlantic sturgeon. Although the exact number of Atlantic sturgeon killed as a result of being stuck by vessels is unknown, records of these interactions have been documented (e.g., Brown and Murphy 2010). These commercial and private activities therefore, have the potential to result in lethal (boat strike) or non-lethal (through harassment) takes of listed species that could prevent or slow a species' recovery. As whales, Atlantic sturgeon, and turtles may be in the area where high vessel traffic occurs, the potential exists for collisions with vessels transiting from within and out of the action area.

An unknown number of private recreational boaters frequent coastal waters; some of these are engaged in whale watching or sport fishing activities. These activities have the potential to result in lethal (through entanglement or boat strike) or non-lethal (through harassment) takes of listed species. Effects of harassment or disturbance which may be caused by such vessel activities are currently unknown; however, no conclusive detrimental effects have been demonstrated. Recent federal efforts regarding mitigating impacts of the whale watch and shipping industries on endangered whales are discussed below.

Non-Federally Regulated Fishery Operations

State fisheries do operate in the state waters of Virginia; however, very little is known about the level of interactions with listed species in fisheries that operate strictly in state waters, although impacts on Atlantic sturgeon and sea turtles from state fisheries may be greater than those from federal activities in certain areas due to the distribution of these species in these waters. However, depending on the fishery in question, many state permit holders also hold federal licenses; therefore, section 7 consultations on federal actions in those fisheries address some state-water activity. Impacts of state fisheries on endangered whales are addressed as appropriate through the MMPA take reduction planning process. NMFS is actively participating in a cooperative effort with the Atlantic States Marine Fisheries Commission (ASMFC) and member states to standardize and/or implement programs to collect information on level of effort and bycatch of protected species in state fisheries. When this information becomes available, it can be used to refine take reduction plan measures in state waters.

5.3 Other Potential Sources of Impacts to Listed Species

Excessive turbidity due to coastal development and/or construction sites could influence Atlantic sturgeon, sea turtle, and whale foraging ability; however, based on the best available information, whales, Atlantic sturgeon, and turtles are not very easily affected by changes in water quality or increased suspended sediments unless these alterations make habitat less suitable for listed species and hinder their capability to forage and/or for their foraging items to exist. If the latter occurs, eventually these species will tend to leave or avoid these less desirable areas (Ruben and Morreale 1999).

Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle Atlantic sturgeon, turtles, and whales causing serious injuries or mortalities to these species. Turtles commonly ingest plastic or mistake debris for food (Magnuson et al. 1990). Sources of contamination in the action area also include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, industrial development, and debris and materials from launch activities occurring at WFF (i.e., spent rockets, payloads, and rocket-boosted projectiles, as well as non-hazardous expended material such as steel, aluminum, rubber, vinyl, glass, and plastics). While the effects of contaminants on Atlantic sturgeon, whales, and turtles are relatively unclear, pollutants may make Atlantic sturgeon, sea turtles and whales more susceptible to disease by weakening their immune systems or may have an effect on Atlantic sturgeon, sea turtle, and whale reproduction and survival. For instance, pollution may be linked to the fibropapilloma virus that kills many turtles each year (NMFS 1997).

Noise pollution has been raised primarily as a concern for marine mammals. The potential effects of noise pollution on marine mammals range from minor behavioral disturbance to injury to death. The noise level in the ocean is thought to be increasing at a substantial rate due to increases in shipping and other activities, including seismic exploration, offshore drilling and sonar used by military and research vessels (NMFS 2007). Because under some conditions low frequency sound travels very well through water, few oceans are free of the threat of human noise. While there is no hard evidence of a whale population being adversely affected by noise, scientists think it is possible that masking, the covering up of one sound by another, could interfere with marine mammals' abilities to feed and to communicate for mating (NMFS 2007). Masking is a major concern about shipping, but only a few species of marine mammals have been observed to demonstrate behavioral changes to low level sounds. Concerns about noise in the action area of this consultation include increasing noise due to increasing commercial shipping and recreational vessels. Although noise pollution has been identified as a concern for marine mammals, these elevated levels of underwater noise may also be of concern for sea turtles and Atlantic sturgeon. Until additional studies are undertaken, it is difficult to determine the effects these elevated levels of noise will have on sea turtles and Atlantic sturgeon and to what degree these levels of noise may be altering the behavior or physiology of these species.

It should be noted, NMFS and the US Navy have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment. Acoustic impacts can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns. It is expected that the policy on managing anthropogenic sound in the oceans will provide guidance for programs such as the use of acoustic deterrent devices in reducing marine mammal-fishery interactions and review of federal activities and permits for research involving acoustic activities.

As noted above, private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with sea turtles. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. It is important to note that minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements. Listed species may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events. However, these spills typically involve small amounts of material that are unlikely to adversely affect listed species. Larger oil spills may result from accidents, although these events would be rare and involve small areas. No direct adverse effects on listed sea turtles resulting from fishing vessel fuel spills have been documented.

5.4 Conservation and Recovery Actions Reducing Threats to Listed Species

A number of activities are in progress that may ameliorate some of the threat that activities summarized in the *Environmental Baseline* pose to threatened and endangered species in the action area of this consultation. These include education/outreach activities; specific measures to reduce the adverse effects of entanglement in fishing gear, including gear modifications, fishing gear time-area closures, and whale disentanglement; and, measures to reduce ship and other vessel impacts to protected species. Many of these measures have been implemented to reduce risk to critically endangered right whales. Despite the focus on right whales, other cetaceans and some sea turtles will likely benefit from the measures as well.

5.4.1 Reducing Threats to Listed Whales

5.4.1.1 Atlantic Large Whale Take Reduction Plan

The Atlantic Large Whale Take Reduction Plan (ALWTRP) reduces the risk of serious injury to or mortality of large whales due to incidental entanglement in U.S. commercial trap/pot and gillnet fishing gear. The ALWTRP focuses on the critically endangered North Atlantic right whale, but is also intended to reduce entanglement of endangered humpback and fin whales. The plan is required by the Marine Mammal Protection Act (MMPA) and has been developed by NOAA's National Marine Fisheries Service (NMFS). The ALWTRP covers the U.S. Atlantic Exclusive Economic Zone (EEZ) from Maine through Florida (26°46.5'N lat.). The requirements are year-round in the Northeast, and seasonal in the Mid and South Atlantic.

The plan has been developed in collaboration with the Atlantic Large Whale Take Reduction Team (ALWTRT), which consists of fishing industry representatives, environmentalists, state and federal officials, and other interested parties. The ALWTRP is an evolving plan that changes as NMFS and the ALWTRT learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. Regulatory actions are directed at reducing serious entanglement injuries and mortality of right, humpback and fin whales from fixed gear fisheries (*i.e.*, trap and gillnet fisheries). The non-regulatory component of the ALWTRP is composed of four principal parts: (1) gear research and development, (2) disentanglement, (3) the Sighting Advisory System (SAS), and (4) education/outreach. These components will be discussed in more detail below. The first ALWTRP went into effect in 1997.

5.4.1.1.1 ALWTRP Regulatory Measures to Reduce the Threat of Entanglement on Whales

The regulatory component of the ALWTRP includes a combination of broad fishing gear modifications and time-area restrictions supplemented by progressive gear research to reduce the chance that entanglements will occur, or that whales will be seriously injured or die as a result of an entanglement. The long-term goal, established by the 1994 Amendments to the MMPA, is to reduce entanglement related serious injuries and mortality of right, humpback and fin whales to insignificant levels approaching zero within five years of its implementation. Despite these measures, entanglements, some of which resulted in serious injuries or mortalities, continued to occur. Data on whale distribution, gear distribution and configuration, and all gear observed on or taken off whales was examined. The ALWTRP is an evolving plan, and revisions are made to the regulations as new information and technology becomes available. Because serious injury and mortality of right, humpback and fin whales have continued to occur due to gear entanglements, new and revised regulatory measures have been issued since the original plan was developed.

5.4.1.1.2 Non-regulatory components of the ALWTRP

Gear Research and Development

Gear research and development is a critical component of the ALWTRP, with the aim of finding new ways of reducing the number and severity of protected species-gear interactions while still allowing for fishing activities. At the outset, the gear research and development program followed two approaches: (a) reducing the number of lines in the water while still allowing fishing, and (b) devising lines that are weak enough to allow whales to break free and at the same time strong enough to allow continued fishing. Development of gear modifications are ongoing and are primarily used to minimize risk of large whale entanglement. The ALWTRT has now moved into the next phase with the focus and priority being research to reduce risk associated with vertical lines. This aspect of the ALWTRP is important, in that it incorporates the knowledge and encourages the participation of industry in the development and testing of modified and experimental gear. Currently, NMFS is developing a co-occurrence risk model that will allow us to examine the density of whale and density of vertical lines in time and space to identify those areas and times that appear to pose the greatest vertical line risk and prioritize those areas for management. The current schedule would result in a proposed rule for additional vertical line risk reduction to be published in 2013.

The NMFS, in consultation with the ALWTRT, is currently developing a monitoring plan for the ALWTRP. While the number of serious injuries and mortalities caused by entanglements is higher than our goals, it is still a relatively small number which makes monitoring difficult. Specifically, we want to know if the most recent management measures, which became fully effective April 2009, have resulted in a reduction in entanglement related serious injuries and mortalities of right, humpback and fin whales. Because these are relatively rare events and the data obtained from each event is sparse, this is a difficult question to answer. The NEFSC has identified proposed metrics that will be used to monitor progress and they project that five years of data would be required before a change may be able to be detected. Therefore, data from 2010-2014 may be required and the analysis of that data would not be able to occur until 2016.

Large Whale Disentanglement Program

Entanglement of marine mammals in fishing gear and/or marine debris is a significant problem throughout the world's oceans. NMFS created and manages a Whale Disentanglement Network, purchasing equipment caches to be located at strategic spots along the Atlantic coastline, supporting training for fishers and biologists, purchasing telemetry equipment, etc. This has resulted in an expanded capacity for disentanglement along the Atlantic seaboard including offshore areas. Along the eastern seaboard of the United States, large whale entanglement reports have been received of humpback whales and North Atlantic right whales and to a lesser extent fin whales and sei whales. In 1984 the Provincetown Center for Coastal Studies (PCCS) in partnership with NMFS developed a technique for disentangling free-swimming large whales from life threatening entanglements. Over the next decade PCCS and NMFS continued working on the development of the technique to safely disentangle both anchored and free swimming large whales. In 1995 NMFS issued a permit to PCCS to disentangle large whales. Additionally, NMFS and PCCS have established a large whale disentanglement program, also referred to as the Atlantic Large Whale Disentanglement Network (ALWDN), based on successful disentanglement efforts by many researchers and partners. Memorandums of Agreement were also issued between NMFS and other Federal Government agencies to increase the resources available to respond to reports of entangled large whales anywhere along the eastern seaboard of the United States. NMFS has established agreements with many coastal states to collaboratively monitor and respond to entangled whales. As a result of the success of the disentanglement network, NMFS believes whales that may otherwise have succumbed to complications from entangling gear have been freed and survived.

Sighting Advisory System (SAS)

Although the Sighting Advisory System (SAS) was developed primarily as a method of locating right whales and alerting mariners to right whale sighting locations in a real time manner, the SAS also addresses entanglement threats. Fishermen can obtain SAS sighting reports and make necessary adjustments in operations to decrease the potential for interactions with right whales. Some of these sighting efforts have resulted in successful disentanglement of right whales. The SAS is discussed below.

Educational Outreach

Education and outreach activities are considered one of the primary tools to reduce the threats to all protected species from human activities, including fishing activities. Outreach efforts for fishermen under the ALWTRP are fostering a more cooperative relationship between all parties interested in the conservation of threatened and endangered species. NMFS has also been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques. NMFS has conducted workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

5.4.1.2 Ship Strike Reduction Program

The Ship Strike Reduction Program is currently focused on protecting the North Atlantic right whale, but the operational measures are expected to reduce the incidence of ship strike on other large whales to some degree. The program consists of five basic elements and includes both regulatory and non-regulatory components: 1) operational measures for the shipping industry, including speed restrictions and routing measures, 2) section 7 consultations with Federal agencies that maintain vessel fleets, 3) education and outreach programs, 4) a bilateral conservation agreement with Canada, and 5) continuation of ongoing measures to reduce ship strikes of right whales (*e.g.*, SAS, ongoing research into the factors that contribute to ship strikes, and research to identify new technologies that can help mariners and whales avoid each other).

5.4.1.3 Regulatory Measures to Reduce Vessel Strikes to Large Whales

Restricting vessel approach to right whales

In one (1) recovery action aimed at reducing vessel-related impacts, including disturbance, NMFS published a proposed rule in August 1996 restricting vessel approach to right whales (61 FR 41116, August 7, 1996) to a distance of 500 yards. The Recovery Plan for the North Atlantic right whale identified anthropogenic disturbance as one (1) of many factors which had some potential to impede right whale recovery (NMFS 2005a). Following public comment, NMFS published an interim final rule in February 1997 codifying the regulations. With certain exceptions, the rule prohibits both boats and aircraft from approaching any right whale closer than 500 yds. Exceptions for closer approach are provided for the following situations, when: (a) compliance would create an imminent and serious threat to a person, vessel, or aircraft; (b) a vessel is restricted in its ability to maneuver around the 500-yard perimeter of a whale; (c) a vessel is investigating or involved in the rescue of an entangled or injured right whale; or (d) the vessel is participating in a permitted activity, such as a research project. If a vessel operator finds that he or she has unknowingly approached closer than 500 yds, the rule requires that a course be steered away from the whale at slow, safe speed. In addition, all aircraft, except those involved in whale watching activities, are exempted from these approach regulations. This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the environmental baseline.

Mandatory Ship Reporting System (MSR)

In April 1998, the USCG submitted, on behalf of the US, a proposal to the International Maritime Organization (IMO) requesting approval of a mandatory ship reporting system (MSR) in two areas off the east coast of the US, the right whale feeding grounds in the Northeast, and the right whale calving grounds in the Southeast. The USCG worked closely with NMFS and other agencies on technical aspects of the proposal. The package was submitted to the IMO's Subcommittee on Safety and Navigation for consideration and submission to the Marine Safety Committee at IMO and approved in December 1998. The USCG and NOAA play important roles in helping to operate the MSR system, which was implemented on July 1, 1999. Ships entering the northeast and southeast MSR boundaries are required to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent right whale sightings or management areas in the area and information on precautionary measures to take while in the vicinity of right whales.

Vessel Speed Restrictions

A key component of NOAA's right whale ship strike reduction program is the implementation of speed restrictions for vessels transiting the US Atlantic in areas and seasons where right whales predictably occur in high concentrations. The Northeast Implementation Team (NEIT)-funded "Recommended Measures to Reduce Ship Strikes of North Atlantic Right Whales" found that seasonal speed and routing measures could be an effective means of reducing the risk of ship strike along the US east coast. Based on these recommendations, NMFS published an Advance Notice of Proposed Rulemaking (ANPR) in June 2004 (69 FR 30857; June 1, 2004), and subsequently published a proposed rule on June 26, 2006 (71 FR 36299; June 26, 2006). NMFS published regulations on October 10, 2008 to implement a 10-knot speed restriction for all vessels 65 ft (19.8 m) or longer in Seasonal Management Areas (SMAs) along the east coast of the U.S. Atlantic seaboard at certain times of the year (73 FR 60173; October 10, 2008).

SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15 day periods in areas in which right whales are sighted outside of SMA boundaries. When NOAA aerial surveys or other reliable sources report aggregations of 3 or more right whales in a density that indicates the whales are likely to persist in the area, NOAA calculates a buffer zone around the aggregation and announces the boundaries of the zone to mariners via various mariner communication outlets, including NOAA Weather Radio, USCG Broadcast Notice to Mariners, MSR return messages, email distribution lists, and the Right Whale Sighting Advisory System (SAS). NOAA requests mariners to route around these zones or transit through them at 10 knots or less. Compliance with these zones is voluntary.

The rule will expire five years from the date of effectiveness. NOAA is currently analyzing data on compliance with the rule and the effectiveness of the rule since its implementation to determine the next steps as its expiration in December 2013 approaches.

Vessel Routing Measures to Reduce the Co-occurrence of Ships and Whales

Another critical, non-regulatory component of NOAA's right whale ship strike reduction program involves the development and implementation of routing measures that reduce the co-occurrence of vessels and right whales, thus reducing the risk of vessel collisions. Recommended routes were developed for the Cape Cod Bay feeding grounds and Southeast calving grounds by overlaying right whale sightings data on existing vessel tracks, and plotting alternative routes where vessels could expect to encounter fewer right whales. Full implementation of these routes was completed at the end of November 2006. The routes are now charted on all NOAA electronic and printed charts, published in US Coast Pilots, and mariners have been notified through USCG Notices to Mariners.

Through a joint effort between NOAA and the USCG, the US also submitted a proposal to the IMO to shift the northern leg of the existing Boston Traffic Separation Scheme (TSS) 12 degrees to the north. Overlaying sightings of right whales and all baleen whales on the existing TSS revealed that the existing TSS directly overlaps with areas of high whale densities, while an area slightly to the north showed a considerable decrease in sightings. Separate analyses by the SBNMS and the NEFSC both indicated that the proposed TSS would overlap with 58% fewer right whale sightings and 81% fewer sightings of all large whales, thus considerably reducing the risk of collisions between ships and whales. The proposal was submitted to the IMO in April 2006, and was adopted by the Maritime Safety Committee in December 2006. The shift took effect on July 1, 2007. In 2009 this TSS was modified by narrowing the width of the north-south portion by one (1) mile to reduce the threat of ship collisions with endangered right whales and other whale species.

In 2009 NOAA and the USCG established the Great South Channel as an Area to be Avoided (ATBA). This is a voluntary seasonal ATBA for ships weighing 300 gross tons or more. The ABTA will be in effect each year from April 1 to July 31, when right whales are known to congregate around the Great South Channel. Implementing this ATBA coupled with narrowing the TSS by one (1) nautical mile will reduce the relative risk of right whale ship strikes by an estimated 74% during April-July (63% from the ATBA and 11% from the narrowing of the TSS).

Sighting Advisory System (SAS)

The right whale Sighting Advisory System (SAS) was initiated in early 1997 as a partnership among several federal and state agencies and other organizations to conduct aerial and ship board surveys to locate right whales and to alert mariners to right whale sighting locations in a near real time manner. The SAS surveys and opportunistic sightings reports document the presence of right whales and are provided to mariners via fax, email, NAVTEX, Broadcast Notice to Mariners, NOAA Weather Radio, several web sites, and the Traffic Controllers at the Cape Cod Canal. Fishermen and other vessel operators can obtain SAS sighting reports, and make necessary adjustments in operations to decrease the potential for interactions with right whales. The SAS has also served as the only form of active entanglement monitoring in the

Cape Cod Bay and Great South Channel feeding areas. Some of these sighting efforts have resulted in successful disentanglement of right whales. SAS flights have also contributed sightings of dead floating animals that can occasionally be retrieved to increase our knowledge of the biology of the species and effects of human impacts.

In 2009, with the implementation of the new ship strike regulations and the Dynamic Management Area (DMA) program, the SAS alerts were modified to provide current SMA and DMA information to mariners on a weekly basis in an effort to maximize compliance with all active right whale protection zones.

5.4.1.4 Marine Mammal Health and Stranding Response Program (MMHSRP)

NMFS was designated the lead agency to coordinate the MMHSRP which was formalized by the 1992 Amendments to the MMPA. The program consists of the following components:

- All coastal states established volunteer stranding networks and are authorized through Letters of Authority from NMFS regional offices to respond to marine mammal strandings.

- Biomonitoring helps assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains and marine ecosystem health.

- The Analytical Quality Assurance (AQA) was designed to ensure accuracy, precision, level or detection, and intercomparability of data in the chemical analyses of marine mammal tissue samples.

- NMFS established a Working Group on Marine Mammal Unusual Mortality Events to provide criteria to determine when a UME is occurring and how to direct responses to such events. The group meets annually to discuss many issues including recent mortality events involving endangered species both in the United States and abroad.

- The National Marine Mammal Tissue Bank provides protocols and techniques for the long-term storage of tissues from marine mammals for retrospective contaminant analyses. Additionally, a serum bank and long-term storage of histopathology tissue are being developed.

5.4.2 Reducing Threats to Listed Sea Turtles

NMFS has implemented multiple measures to reduce the capture and mortality of sea turtles in fishing gear, and other measures to contribute to the recovery of these species. While some of these actions occur outside of the action area for this consultation, the measures affect sea turtles that do occur within the action area.

5.4.2.1 Education and Outreach Activities

Education and outreach activities are considered one (1) of the primary tools to reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques, as well as guidelines for recreational fishermen and boaters to avoid the likelihood of interactions with marine mammals. NMFS is engaged in a number of education and outreach activities aimed specifically at increasing mariner awareness of the threat of ship strike to right whales. NMFS intends to continue these outreach efforts in an attempt to reduce interactions with protected species, and to reduce the likelihood of injury to protected species when interactions do occur.

5.4.2.2 Sea Turtle Stranding and Salvage Network (STSSN)

There is an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts which not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles, reducing mortality of injured or sick animals. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring, and to identify sources of mortality. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help provide an understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

5.4.2.3 Sea Turtle Disentanglement Network (STD)

NMFS Northeast Region established the Northeast Sea Turtle Disentanglement Network (STDN) in 2002. This program was established in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast. The STDN is considered a component of the larger STSSN program and it operates in all states in the region. The STDN responds to entangled sea turtles in order to disentangle and release live animals, thereby reducing serious injury and mortality. In addition, the STDN collects data on these events, providing valuable information for management purposes. The NMFS Northeast Regional Office oversees the STDN program and manages the STDN database.

5.4.2.4 Regulatory Measures for Sea Turtles

Large-Mesh Gillnet Requirements in the Mid-Atlantic

Since 2002, NMFS has regulated the use of large mesh gillnets in Federal waters off North Carolina and Virginia (67 FR 13098, March 21, 2002) to reduce the impact of these fisheries on ESA-listed sea turtles. These restrictions were revised in 2006 (71 FR 24776, April 26, 2006). Currently, gillnets with stretched mesh size 7-inches (17.8 cm) or larger are prohibited in the Exclusive Economic Zone (as defined in 50 CFR 600.10) during the following times and in the following areas: (1) north of the NC/SC border to Oregon Inlet at all times, (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14, (3) north of Currituck Beach Light, NC to Wachapreague Inlet, VA from April 1 through January 14, and (4) north of

Wachapreague Inlet, VA to Chincoteague, VA from April 16 through January 14.

NMFS has also issued regulations to address the take of sea turtles in gillnet gear fished in Pamlico Sound, NC. Waters of Pamlico Sound are closed to fishing with gillnets with a stretched mesh size larger than 4 ¼ inch (10.8 cm) from September 1 through December 15 each year to protect sea turtles. The closed area includes all inshore waters of Pamlico Sound, and all contiguous tidal waters, south of 35°46.3' N. lat., north of 35 ° 00' N. lat., and east of 76 ° 30' W. long.

TED Requirements in Trawl Fisheries

Turtle Excluder Devices (TEDs) are required in the shrimp and summer flounder fisheries. TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. Approved TEDs are required in the shrimp trawl fishery operating in the Atlantic and Gulf Areas unless the trawler is fishing under one of the exemptions (*e.g.*, skimmer trawl, try net) and all requirements of the exemption (50 CFR 223.206) are met. On February 21, 2003, NMFS issued a final rule to amend the TED regulations to enhance their effectiveness in reducing sea turtle mortality resulting from shrimp trawling in the Atlantic and Gulf Areas of the southeastern United States by requiring an escape opening designed to exclude leatherbacks as well as large loggerhead and green turtles (68 FR 8456; February 21, 2003). In 2011, NMFS published a Notice of Intent to prepare an Environmental Impact Statement (EIS) and to conduct scoping meetings. NMFS is considering a variety of regulatory measures to reduce the bycatch of threatened and endangered sea turtles in the shrimp fishery of the southeastern United States in light of new concerns regarding the effectiveness of existing TED regulations in protecting sea turtles (76 FR 37050, June 24, 2011).

TEDs are also required for summer flounder trawlers in the summer flounder fishery-sea turtle protection area. This area is bounded on the north by a line extending along 37° 05'N latitude (Cape Charles, VA) and on the south by a line extending out from the North Carolina-South Carolina border. Vessels north of Oregon Inlet, NC are exempt from the TED requirement from January 15 through March 15 each year (50 CFR 223.206). The TED requirements for the summer flounder trawl fishery do not require the use of the larger escape opening. NMFS is considering increasing the size of the TED escape opening currently required in the summer flounder fishery and implementing sea turtle conservation requirements in other trawl fisheries and in other areas (72 FR 7382, February 15, 2007; 74 FR 21630, May 8, 2009).

Sea Turtle Conservation Requirements in the HMS Fishery

NMFS completed the most recent biological opinion on the FMP for the Atlantic HMS fisheries for swordfish, tuna, and shark on June 1, 2004, and concluded that the Atlantic HMS fisheries, particularly the pelagic longline fisheries, were likely to jeopardize the continued existence of leatherback sea turtles. A RPA was provided to avoid jeopardy to leatherback sea turtles as a result of operation of the HMS fisheries. Although the Opinion did not conclude jeopardy for loggerhead sea turtles, the RPA is also expected to benefit this species by reducing mortalities resulting from interactions with the gear. A number of requirements have been put in place as a result of the Opinion and subsequent research. These include measures related to the fishing gear, bait, disentanglement gear and training.

In 2008, NMFS completed a section 7 consultation on the continued authorization of HMS Atlantic shark fisheries. The commercial fishery uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

Sea Turtle Handling and Resuscitation Requirements

NMFS published as a final rule in the *Federal Register* (66 FR 67495, December 31, 2001) specifying handling and resuscitation requirements for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the regulations (50 CFR 223.206). These measures help to prevent mortality of turtles caught in fishing or scientific research gear.

Exception for injured, dead, or stranded specimens

Any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other Federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, is allowed to take threatened or endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of or salvage a dead endangered or threatened sea turtle (50 CFR 223.206(b); 50 CFR 222.310). This take exemption extends to NMFS' Sea Turtle Stranding and Salvage Network.

6.0 CLIMATE CHANGE

The discussion below presents background information on global climate change and information on past and predicted future effects of global climate change throughout the range of the listed species considered here. Additionally, we present the available information on predicted effects of climate change in the action area (i.e., mouth of the Chesapeake Bay and offshore, Atlantic waters of Virginia) and how listed sea turtles and sturgeon may be affected by those predicted environmental changes over the life of the proposed action (i.e., between now and 2015). Climate change is relevant to the Status of the Species and Environmental Baseline sections of this Opinion; rather than include partial discussion in several sections of this Opinion, we are synthesizing this information into one discussion. Effects of the proposed action that are relevant to climate change are included in the Effects of the Action section below (section 7.0 below).

6.1 Background Information on Global Climate Change

The global mean temperature has risen 0.76°C (1.36°F) over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007) and precipitation has increased nationally by 5%-10%, mostly due to an increase in heavy downpours (NAST 2000). There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Ocean acidification resulting from massive amounts of carbon dioxide and other pollutants released into the air can have major adverse impacts on the calcium balance in the oceans. Changes to the marine ecosystem due to climate change include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007); these trends are most apparent over the past few decades. Information on future impacts of climate change in the action area is discussed below.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next century. Both of the principal climate models used by the National Assessment Synthesis Team (NAST) project warming in the southeast by the 2090s, but at different rates (NAST 2000): the Canadian model scenario shows the southeast U.S. experiencing a high degree of warming, which translates into lower soil moisture as higher temperatures increase evaporation; the Hadley model scenario projects less warming and a significant increase in precipitation (about 20%). The scenarios examined, which assume no major interventions to reduce continued growth of world greenhouse gases (GHG), indicate that temperatures in the U.S. will rise by about 3°-5°C (5°-9°F) on average in the next 100 years, which is more than the projected global increase (NAST 2000). A warming of about 0.2°C (0.4°F) per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007). This temperature increase will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has resulted in increased precipitation, river discharge, and glacial and sea-ice melting (Greene *et al.* 2008).

The past three decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene *et al.* 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (Greene *et al.* 2008, IPCC 2006). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the earth's atmosphere caused by anthropogenic forces (IPCC 2006). The NAO impacts climate variability throughout the northern hemisphere (IPCC 2006). Data from the 1960s through the present show that the NAO index has increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2006). This warming extends over 1000m (0.62 miles) deep and is deeper than anywhere in the world oceans and is particularly evident under the Gulf Stream/ North Atlantic Current system (IPCC 2006). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater (NADW) formation (Greene *et al.* 2008, IPCC 2006). There is evidence that the NADW has already freshened significantly (IPCC 2006). This in turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the whole earth system (Greene *et al.* 2008).

While predictions are available regarding potential effects of climate change globally, it is more difficult to assess the potential effects of climate change over the next few decades on coastal and marine resources on smaller geographic scales, such as the shoreline of Dam Neck Annex, especially as climate variability is a dominant factor in shaping coastal and marine systems. The effects of future change will vary greatly in diverse coastal regions for the U.S. Warming is very likely to continue in the U.S. over the next 25 to 50 years regardless of reduction in GHGs, due to emissions that have already occurred (NAST 2000). It is very likely that the magnitude and frequency of ecosystem changes will continue to increase in the next 25 to 50 years, and it is possible that the rate of change will accelerate. Climate change can cause or exacerbate direct stress on ecosystems through high temperatures, a reduction in water availability, and altered frequency of extreme events and severe storms. Water temperatures in streams and rivers are likely to increase as the climate warms and are very likely to have both direct and indirect effects on aquatic ecosystems. Changes in temperature will be most evident during low flow periods when they are of greatest concern (NAST 2000). In some marine and freshwater systems, shifts in geographic ranges and changes in algal, plankton, and fish abundance are associated with high confidence with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels and circulation (IPCC 2007).

A warmer and drier climate is expected to result in reductions in stream flows and increases in water temperatures. Expected consequences could be a decrease in the amount of dissolved oxygen in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch *et al.* 2000). Because many rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate, anticipating and planning adaptive strategies may be critical (Hulme 2005). A warmer-wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants other than heat currently degrade water quality (Murdoch *et al.* 2000). Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources in the southeast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. A global analysis of the potential effects of climate change on river basins indicates that due to changes in discharge and water stress, the area of large river basins in need of reactive or proactive management interventions in response to climate change will be much higher for basins affected by dams than for basins with free-flowing rivers (Palmer *et al.* 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to adapt so that systems that might ordinarily be capable of responding to variability and change are less able to do so. Because stresses on water quality are associated with many activities, the impacts of the existing stresses are likely to be exacerbated by climate change. Within 50 years, river basins that are affected by dams or by extensive development may experience greater changes in discharge and water stress than unaffected, free-flowing rivers (Palmer *et al.* 2008).

While debated, researchers anticipate: 1) the frequency and intensity of droughts and floods will change across the nation; 2) a warming of about 0.2°C (0.4°F) per decade; and 3) a rise in sea level (NAST 2000). A warmer and drier climate will reduce stream flows and increase water temperature resulting in a decrease of DO and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing. Sea level is expected to continue rising: during the 20th century global sea level has increased 15 to 20 cm (6-8 inches).

6.2 Species-Specific Information on Climate Change Effects

6.2.1 Loggerhead Sea Turtles

The most recent Recovery Plan for loggerhead sea turtles as well as the 2009 Status Review Report identifies global climate change as a threat to loggerhead sea turtles. In the future, increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events are expected as a result of climate change and are all potential threats for loggerheads. Increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Daniels *et al.* 1993; Fish *et al.* 2005; Baker *et al.* 2006). The BRT noted that the loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis *et al.* 2006; Baker *et al.* 2006; both in Conant *et al.* 2009). Along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels may cause severe effects on nesting females and their eggs as nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. However, if global temperatures increase and there is a range shift northwards, beaches not currently used for nesting may become available for loggerhead sea turtles, which may offset some loss of accessibility to beaches in the southern portions of the range.

Climate change has the potential to result in changes at nesting beaches that may affect loggerhead sex ratios. Loggerhead sea turtles exhibit temperature-dependent sex determination. Rapidly increasing global temperatures may result in warmer incubation temperatures and highly female-biased sex ratios (*e.g.*, Glen and Mrosovsky 2004; Hawkes *et al.* 2009); however, to the extent that nesting can occur at beaches further north where sand temperatures are not as warm, these effects may be partially offset. The BRT specifically identified climate change as a threat to loggerhead sea turtles in the neritic/oceanic zone where climate change may result in future trophic changes, thus affecting loggerhead prey abundance and/or distribution. In the threats matrix analysis, climate change was considered for oceanic juveniles and adults and eggs/hatchlings. The report states that for oceanic juveniles and adults, "although the effect of trophic level change from...climate change...is unknown it is believed to be very low." For eggs/hatchlings the report states that total mortality from anthropogenic causes, including sea level rise resulting from climate change, is believed to be low relative to the entire life stage.

Van Houtan and Halley (2011) recently developed climate based models to investigate loggerhead nesting (considering juvenile recruitment and breeding remigration) in the North Pacific and Northwest Atlantic. These models found that climate conditions/oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average 60% (range 18%-88%) of the observed nesting changes over the past several decades. In terms of future nesting projections, modeled climate data show a future positive trend for Florida nesting, with increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal.

6.2.2 Kemp's Ridley Sea Turtles

The recovery plan for Kemp's ridley sea turtles (NMFS *et al.* 2011) identifies climate change as a threat; however, no significant climate change-related impacts to Kemp's ridley sea turtles have been observed to date. Atmospheric warming could cause habitat alteration which may change food resources such as crabs and other invertebrates. It may increase hurricane activity, leading to an increase in debris in nearshore and offshore waters, which may result in an increase in entanglement, ingestion, or drowning. In addition, increased hurricane activity may cause damage to nesting beaches or inundate nests with sea water. Atmospheric warming may change convergence zones, currents and other oceanographic features that are relevant to Kemp's ridleys, as well as change rain regimes and levels of nearshore runoff.

Considering that the Kemp's ridley has temperature-dependent sex determination (Wibbels 2003) and the vast majority of the nesting range is restricted to the State of Tamaulipas, Mexico, global warming could potentially shift population sex ratios towards females and thus change the reproductive ecology of this species. A female bias is presumed to increase egg production (assuming that the availability of males does not become a limiting factor) (Coyne and Landry 2007) and increase the rate of recovery; however, it is unknown at what point the percentage of males may become insufficient to facilitate maximum fertilization rates in a population. If males become a limiting factor in the reproductive ecology of the Kemp's ridley, then reproductive output in the population could decrease (Coyne 2000). Low numbers of males could also result in the loss of genetic diversity within a population; however, there is currently no evidence that this is a problem in the Kemp's ridley population (NMFS *et al.* 2011). Models (Davenport 1997; Hulin and Guillon 2007; Hawkes *et al.* 2007; all referenced in NMFS *et al.* 2011) predict very long-term reductions in fertility in sea turtles due to climate change, but due to the relatively long life cycle of sea turtles, reductions may not be seen until 30 to 50 years in the future.

Another potential impact from global climate change is sea level rise, which may result in increased beach erosion at nesting sites. Beach erosion may be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents. In the case of the Kemp's ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. The Padre Island National Seashore (PAIS) shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and the sand temperatures slightly cooler than at Rancho Nuevo, PAIS could become an increasingly important source of males for the population.

6.2.3 Leatherback Sea Turtles

Although leatherbacks are probably already beginning to be affected by impacts associated with anthropogenic climate change in several ways, no significant climate change-related impacts to leatherback turtle populations have been observed to date (PIRO BO 2012). However, over the long term, climate change-related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Changes in marine systems associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation including shifts in ranges and changes in algal, plankton, and fish abundance could affect leatherback prey distribution and abundance. Climate change is expected to expand foraging habitats into higher latitude waters and some concern has been noted that increasing temperatures may increase the female:male sex ratio of hatchlings on some beaches (Morosovsky *et al.* 1984 and Hawkes *et al.* 2007 in NMFS and USFWS 2007d). However, due to the tendency of leatherbacks to have individual nest placement preferences and deposit some clutches in the cooler tide zone of beaches, the effects of long-term climate on sex ratios may be mitigated (Kamel and Mrosovsky 2004 in NMFS and USFWS 2007d). Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson *et al.* 2008). Leatherbacks have expanded their range in the Atlantic north by 330 km in the last 17 years as warming has caused the northerly migration of the 15°C sea surface temperature (SST) isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Leatherbacks are speculated to be the best able to cope with climate change of all the sea turtle species due to their wide geographic distribution and relatively weak beach fidelity. Leatherback sea turtles may be most affected by any changes in the distribution of their primary prey, jellyfish, which may affect leatherback distribution and foraging behavior (NMFS and USFWS 2007d). Jellyfish populations may increase due to ocean warming and other factors (Brodeur *et al.* 1999; Attrill *et al.* 2007; Richardson *et al.* 2009), which may or may not affect leatherbacks as there is no evidence that any leatherback populations are currently food-limited. Even though there may be a benefit to leatherbacks due to climate change influence on productivity we do not know what impact other climate-related changes may have such as increasing sand temperatures, sea level rise, and increased storm events.

As discussed for loggerheads, increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Fish *et al.* 2005). This effect would potentially be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents.

6.2.4 Green Sea Turtles

The five year status review for green sea turtles (NMFS and USFWS 2007c) notes that global climate change is affecting green sea turtles and is likely to continue to be a threat. There is an increasing female bias in the sex ratio of green turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause as warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. At least one nesting site, Ascension Island, has had an increase in mean sand temperature in recent years (Hays *et al.* 2003 in NMFS and USFWS 2007c). Climate change may also affect nesting beaches through sea level rise which may reduce the availability of nesting habitat and increase the risk of nest inundation. Loss of appropriate nesting habitat may also be accelerated by a combination of other environmental and oceanographic changes, such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion. Oceanic changes related to rising water temperatures could result in changes in the abundance and distribution of the primary food sources of green sea turtles, which in turn could result in changes in behavior and distribution of this species. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as salinity and temperature changes (Short and Neckles 1999; Duarte 2002).

6.2.5 Right, Humpback, and Fin Whales

The impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of sea water due to melting ice and increased rainfall, sea level rise, the loss of polar habitats and potential shifts in the distribution and abundance of prey species. Of the main factors affecting distribution of cetaceans, water temperature appears to be the main influence on geographic ranges of cetacean species (Macleod 2009). As such, depending on habitat preferences, changes in water temperature due to climate change may affect the distribution of certain species of cetacean. For instance, fin and humpback whales are distributed in all water temperatures zones, therefore, it is unlikely that their range will be directly affected by an increase in water temperatures (MacLeod 2009). However, North Atlantic right whales, which currently have a range of sub-polar to sub-tropical, may respond to an increase in water temperature by shifting their range northward, with both the northern and southern limits moving poleward.

In regards to marine mammal prey species, there are many potential direct and indirect effects that global climate change may have on prey abundance and distribution, which in turn, poses potential behavioral and physiological effects to marine mammals, such as right whales. For example, Greene *et al.* (2003) described the potential oceanographic processes linking climate variability to the reproduction of North Atlantic right whales. Climate-driven changes in ocean circulation have had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey resource for right whales. More information is needed in order to determine the potential impacts global climate change will have on the timing and extent of population movements, abundance, recruitment, distribution and species composition of prey (Learmonth *et al.* 2006). Changes in climate patterns, ocean currents, storm frequency, rainfall, salinity, melting ice, and an increase in river inputs/runoff (nutrients and pollutants) will all directly affect the distribution, abundance and migration of prey species (Waluda *et al.* 2001; Tynan & DeMaster 1997; Learmonth *et al.* 2006). These changes will likely have several indirect effects on marine mammals, which may include changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success

(Macleod 2009). Global climate change may also result in changes to the range and abundance of competitors and predators which will also indirectly affect marine mammals (Learmonth *et al.* 2006). A decline in the reproductive fitness as a result of global climate change could have profound effects on the abundance and distribution of large whales in the Atlantic.

6.2.6 Atlantic Sturgeon

Atlantic sturgeon have persisted for millions of years and throughout this time have experienced wide variations in global climate conditions and have successfully adapted to these changes. As such, climate change at normal rates (thousands of years) is not thought to have historically been a problem for sturgeon species. However, at the given rate of global climate change, future affects to Atlantic sturgeon are possible. Rising sea level may result in the salt wedge moving upstream in affected rivers. Atlantic sturgeon spawning occurs in fresh water reaches of rivers because early life stages have little to no tolerance for salinity. Similarly, juvenile Atlantic sturgeon have limited tolerance to salinity and remain in waters with little to no salinity. If the salt wedge moves further upstream, Atlantic sturgeon spawning and rearing habitat could be restricted. In river systems with dams or natural falls that are impassable by sturgeon, the extent that spawning or rearing may be shifted upstream to compensate for the shift in the movement of the saltwedge would be limited. While there is an indication that an increase in sea level rise would result in a shift in the location of the salt wedge, at this time there are no predictions on the timing or extent of any shifts that may occur; thus, it is not possible to predict any future loss in spawning or rearing habitat. However, in all river systems, spawning occurs miles upstream of the saltwedge. It is unlikely that shifts in the location of the saltwedge would eliminate freshwater spawning or rearing habitat. If habitat was severely restricted, productivity or survivability may decrease.

The increased rainfall predicted by some models in some areas may increase runoff and scour spawning areas and flooding events could cause temporary water quality issues. Rising temperatures predicted for all of the U.S. could exacerbate existing water quality problems with DO and temperature. While this occurs primarily in rivers in the southeast U.S. and the Chesapeake Bay, it may start to occur more commonly in the northern rivers. Atlantic sturgeon are tolerant to water temperatures up to approximately 28°C (82.4°F); these temperatures are experienced naturally in some areas of rivers during the summer months. If river temperatures rise and temperatures above 28°C are experienced in larger areas, sturgeon may be excluded from some habitats.

Increased droughts (and water withdrawal for human use) predicted by some models in some areas may cause loss of habitat including loss of access to spawning habitat. Drought conditions in the spring may also expose eggs and larvae in rearing habitats. If a river becomes too shallow or flows become intermittent, all Atlantic sturgeon life stages, including adults, may become susceptible to strandings or habitat restriction. Low flow and drought conditions are also expected to cause additional water quality issues. Any of the conditions associated with climate change are likely to disrupt river ecology causing shifts in community structure and the type and abundance of prey. Additionally, cues for spawning migration and spawning could occur earlier in the season causing a mismatch in prey that are currently available to developing sturgeon in rearing habitat.

6.3 Effects of Climate Change in the Action Area

Information on how climate change will affect the action area is extremely limited. Scientists from George Mason University and Center for Ocean-Land-Atmosphere Studies in Maryland found that from 2000 to 2099 the average warming for Virginia and the adjoining areas would be 3.1°C (5.6°F) and that precipitation would increase by 11% (Bryant 2008). NOAA tide gauge data reported by the State indicates that the sea level within Virginia portion of the Chesapeake Bay has risen, on average, at a rate of approximately 4.5 mm/yr since recordings began in 1927. Similarly, Zervas (2004) observed sea level rise rates of 4.4 mm/yr in the Mid-Atlantic region between northern New Jersey and Northeastern North Carolina. In addition, offshore waters of Virginia range between 7°C to 28°C (http://www.surf-forecast.com/breaks/Virginia-Beach/seatemp, last visited 5/30/2012), with an expected rise in sea surface temperature over the next 100 years of up to 3°C (Nicholls *et al.* 2007).

6.4 Effects of Climate Change in the Action Area to Listed Species of Sea Turtles, Whales, and Atlantic sturgeon

As there is significant uncertainty in the rate and timing of change as well as the effect of any changes that may be experienced in the action area due to climate change, it is difficult to predict the impact of these changes on whales, sea turtles, and Atlantic sturgeon; however, we have considered the available information to consider likely impacts to these species in the action area. The proposed action will be under taken for a period of three to six months, beginning between FY 2012 and FY 2014; thus, we consider here, likely effects of climate change during the period from now until 2015.

6.4.1 Whales

As described above, the impact of climate change on cetaceans is likely to be related to changes in sea temperatures, potential freshening of seawater due to melting ice and increased rainfall, sea level rise, the loss of polar habitats and potential shifts in the distribution and abundance of prey species. These impacts, in turn, are likely to affect the distribution of species of whales. Based on the location of the action area (i.e., Mid-Atlantic waters off of Virginia), the most likely effect to whales in the action area from climate change would be if warming temperatures led to changes in the seasonal distribution of whales. This may mean that ranges and seasonal migratory patterns are altered to coincide with changes in prey distribution on foraging grounds located outside of the action area, which may result in an increase or decrease of listed species of whales in the action area. As humpback and fin whales are distributed in all water temperature zones, it is unlikely that their range will be directly affected by an increase in water temperature; however, for right whales, increases in water temperature may result in a northward shift of their range. This may result in an unfavorable effect on the North Atlantic right whale due to an increase in the length of migrations (Macleod 2009) or a favorable effect by allowing them to expand their range. However, over the life of the proposed action (through 2015) it is unlikely that this possible shift in range will be observed due the extremely small increase in water temperature predicted to occur during the lifetime of the project (i.e., approximately 0.21°C); if any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to right whales or a significant modification to the number of whales likely to be present in the action area over the life of the proposed action.

6.4.2 Atlantic sturgeon

Although climate change has the potential to affect Atlantic sturgeon in various ways (see section 6.2.6), due to the location of the action area (i.e., coastal, offshore waters), the most likely effect to Atlantic sturgeon in the action area from climate change would be if warming temperatures led to changes in their range and migratory patterns. Warming temperatures predicted to occur over the next 100 years would likely result in a northward shift/extension of their range (i.e. into the St. Lawrence River, Canada) while truncating the southern distribution, thus effecting the recruitment and distribution of sturgeon rangewide. However, over the life of the proposed action (i.e., through 2015), this increase in sea surface temperature would be minimal (i.e., approximately 0.21°C) and thus, it is unlikely that this expanded range will be observed over the next three years that the project will be undertaken. If any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to Atlantic sturgeon or a significant modification to the number of sturgeon likely to be present in the action area over the life of the proposed action.

Although the action area is not a spawning ground for Atlantic sturgeon, sturgeon are likely to migrating through the action area to reach their natal rivers to spawn. Elevated temperatures could modify cues for spawning migration, resulting in an earlier spawning season, and thus, altering the time of year sturgeon may or may not be present within the action area. This may cause an increase or decrease in the number of sturgeon present in the action area. However, because spawning is not triggered solely by water temperature, but also by day length (which would not be affected by climate change) and river flow (which could be affected by climate change), it is not possible to predict how any change in water temperature alone will affect the seasonal movements of sturgeon through the action area.

In addition, changes in water temperature may also alter the forage base and thus, foraging behavior of Atlantic sturgeon. Any forage species that are temperature dependent may also shift in distribution as water temperatures warm and thus, potentially cause a shift in the distribution of Atlantic sturgeon. However, because we do not know the adaptive capacity of these individuals or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict how these changes may affect foraging sturgeon. If sturgeon distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sturgeon shifted to areas where different forage was available and sturgeon were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sturgeon shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sturgeon feed on a wide variety of species and in a wide variety of habitats.

6.4.3 Sea turtles

As described above, sea turtles are most likely to be affected by climate change due to increasing sand temperatures at nesting beaches, which in turn would result in increased female:male sex ratio among hatchlings; sea level rise, which could result in a reduction in available nesting beach habitat and increased risk of nest inundation; changes in the abundance and distribution of forage species, which could result in changes in the foraging behavior and distribution of sea turtle species; and, changes in water temperature, which could possibly lead to a northward shift in their range.

Over the time period considered in this Opinion, sea surface temperatures are expected to rise less than 1°C. Warming temperatures would likely result in a shift in the seasonal distribution of sea turtles in the action area, such that sea turtles may begin northward migrations from their southern overwintering grounds earlier in the spring and thus would be present in the action area earlier in the year. Likewise, if water temperatures were warmer in the fall, sea turtles could remain in the action area later in the year. Sea turtles are known to enter Virginia waters when sea surface temperatures are at or above 11°C, and current ranges of sea surface temperatures in Virginia waters range from 7°C to 28°C. As increases in sea surface temperatures are expected to be extremely small over the next three years (i.e., approximately 0.21°C), it is unlikely that a shift in sea turtle distribution will be seen over the over the timeframe of the action. If any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to sea turtles or a significant modification to the number of sea turtles likely to be present in the action area over the next three years.

It has also been speculated that the nesting range of some sea turtle species may shift northward with increasing temperature. Nesting in the mid-Atlantic generally is extremely rare. A loggerhead sea turtle nested on the northern portion of the Dam Neck Annex beach in 1992, and the eggs were relocated to Back Bay National Wildlife Refuge, where they completed successfully (Navy 2012a). A loggerhead sea turtle also nested unsuccessfully on the southern portion of the Dam Neck Annex in 2002 (Navy 2012a). Loggerhead sea turtle nesting are known to nest at Back Bay National Wildlife Refuge and Sandbridge Beach, Virginia, and a green sea turtle nest was discovered in 2005 on Sandbridge Beach (Navy 2012b). It is important to consider that in order for nesting to be successful in the mid-Atlantic, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings not to die when they enter the water. As nesting has been successful thus far in areas near the action area, the environmental conditions necessary for sea turtle hatchling success is likely to persist over the next three years. However, regardless of the persistence of these environmental factors, as noted above, predicted increases in water temperatures between now and 2015 are not expected to be large enough to cause a significant shift in the distribution of sea turtles. As such, it is unlikely that there will be a significant shift in nesting trends in Virginia to suggest that an increase in nesting will occur along the shorelines of the Virginia Coast, let alone the action area. As the proposed action serves to replenish the beach along the Dam Neck Annex SPS, the proposed action will not contribute to the loss of any potential beach habitat, but instead, will serve to create beach habitat that could potentially be used by sea turtles to nest in the future. Although future renourishment cycles have not been determined, continued replenishment of the beaches along the Dam Neck Annex SPS are expected in the future and as such, these beaches will be maintained. Future renourishment activities at the Dam Neck Annex SPS will ensure that this beach habitat, which could be used by nesting sea turtles in the future, is maintained. Therefore, if, over the next three years any sea turtles begin to shift to more northern areas to nest, available nesting habitat would be present on the beach of Dam Neck Annex due to the creation and maintenance of this beach habitat.

Sea level rise, however, has the potential to remove possible beach nesting habitat. Based on NOAA tide gauge data, sea level is expected to rise approximately 4.5 mm/yr in the action area; over the next three years, this equates to an approximately 13.5 mm (0.5 inches) increase in sea level along the shoreline of the action area. The small increase in sea level along the shorelines of the action area will not remove a significant area of the beach and thus, potential nesting areas will remain present over the next three years.

Changes in water temperature may also alter the forage base and thus, foraging behavior of sea turtles. Changes in the foraging behavior of sea turtles in the action area and thus, could lead to either an increase or decrease in the number of sea turtles in the action area, depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature. For example, if there was a decrease in sea grasses in the action area resulting from increased water temperatures or other climate change related factors, it is reasonable to expect that there may be a decrease in the number of foraging green sea turtles in the action area. Likewise, if the prey base for loggerhead, Kemp's ridley or leatherback sea turtles was affected, there may be changes in the abundance and distribution of these species in the action area. However, as noted above, because we do not know the adaptive capacity of these individuals or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict changes to the foraging behavior of sea turtles over the next three years. If sea turtle distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sea turtles shifted to areas where different forage was available and sea turtles were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sea turtles shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sea turtles feed on a wide variety of species and in a wide variety of habitats.

7.0 EFFECTS OF THE ACTION

This section of an Opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). This Opinion examines the likely effects (direct and indirect) of the proposed action on Atlantic sturgeon, whales and sea turtles in the action area and their habitat within the context of the species current status, the environmental baseline and cumulative effects. As explained in the Description of the Action, the proposed action under consideration in this Opinion includes the repair of the SPS by fully replenishing the beach and the seaward side of the existing manmade dune with sand, and reshaped to its 1996 dimensions, and the transport of material to and from the borrow areas.

7.1 Effects of Dredging Operations

As explained in the Description of the Action section above, over the two phases of the proposed action, hopper dredges will be used for sand renourishment along the Dam Neck Annex SPS. Below, the effects of hopper dredging on threatened and endangered species will be considered. Effects of the proposed dredging include (1) entrainment and impingement of Atlantic sturgeon and sea turtles; (2) alteration of sea turtle and Atlantic sturgeon prey and foraging behavior due to dredging; (3) suspended sediment associated with dredging operations; (4) underwater noise generated during dredging operations; and (5) the potential for interactions between project vessels and individual whales, Atlantic sturgeon, or sea turtles.

As noted above, sea turtles are likely to occur in the action area from April-November of any year. The primary concern for loggerhead, Kemp's ridley, and green sea turtles is entrainment and the potential for effects to foraging, while the primary concern for leatherbacks is vessel collision. Right whales are likely to be present from approximately November-May; humpbacks from September-April; and fin whales from October-January; however, individual transient whales could be present in the action area outside of these time frame as this area is used by whales moving between calving/mating grounds and foraging grounds. Due to their large size, whales are not vulnerable to entrainment in dredges; as such, the primary concern for listed species of whales is the potential for vessel collisions. Atlantic sturgeon are likely to be present in the action area year round. The primary concern for Atlantic sturgeon is entrainment, loss of forage and vessel collision.

7.1.1 Alteration of foraging habitat

As discussed above, listed species of whales may be present within the action area year round as this area is used by whales moving between southern calving/mating grounds and northern foraging grounds. Whales forage upon pelagic prey items (e.g., krill, copepods, sand lance) and as such, dredging and its impacts on the benthic environment will not have any direct or indirect effects on whale prey/foraging items. As such, the remainder of this section will discuss the effects of dredging and the alteration of sea turtle and Atlantic sturgeon foraging habitat.

Atlantic sturgeon

Subadult (less than 150cm in total length, not sexually mature, but have left their natal rivers) and adult Atlantic sturgeon undertake seasonal, nearshore (i.e., typically depths less than 50 meters), coastal marine migrations along the United States eastern coastline (Erickson *et al.* 2011; Dunton *et al.* 2010). Based on tagging data, it is believed that beginning in the fall, Atlantic sturgeon undergo large scale migrations to more southerly waters (e.g., off the coast North Carolina, the mouth of the Chesapeake Bay) and primarily remain in these waters throughout the winter (i.e., approximately December through March), while in the spring, it appears that migrations begin to shift to more northerly waters (e.g., waters off New Jersey and New York) (Dovel and Berggren 1983; Dunton *et al.* 2010; Erikson *et al.* 2011). Atlantic sturgeon aggregate in several distinct areas along the Mid-Atlantic coastline; Atlantic sturgeon are most likely to occur in areas adjacent to estuaries and/or coastal features formed by bay mouths and inlets (Stein *et al.* 2004; Laney *et. al* 2007; Erickson et al. 2011; Dunton *et al.* 2010). These aggregation areas are located within the coastal waters off North Carolina; waters between the Chesapeake Bay and Delaware Bay; the New Jersey Coast; and the southwest shores of Long Island (Laney *et. al* 2007; Erickson et al. 2011; Dunton *et al.* 2010). Based on five fishery-independent surveys, Dunton *et al.* (2010) identified several "hotspots" for Atlantic sturgeon captures, including an area off Sandy Hook, New Jersey, and off Rockaway, New York. These "hotspots" are aggregation areas that are most often used during the spring, summer, and fall months (Erickson *et al.* 2011; Dunton *et al.* 2010). These areas are believed to be where Atlantic sturgeon overwinter and/or forage (Laney *et. al* 2007; Erickson *et al.* 2011; Dunton *et al.* 2010). Areas between these sites serve as migration corridors to and from these areas, as well as to spawning grounds found within natal rivers.

The borrow site where dredging will occur is at least 7 to 12 miles away from the nearest identified aggregation areas (i.e., nearshore waters between Chesapeake Bay and Delaware Bay; southern Virginia and North Carolina). Based on the location of known aggregation areas, available information on habitat at the borrow area, and distribution of Atlantic sturgeon, it is unlikely that the borrow sites are used for overwintering and/or foraging. While opportunistic foraging may occur at these sites, it is more likely that the borrow areas are used by migrating individuals as they move from foraging, overwintering, and spawning grounds. We expect that Atlantic sturgeon occur within the action area primarily during the fall, winter, and spring months, with opportunistic foraging while migrating.

Sea Turtles

Sea turtles occur in the action area from April through November each year with the largest numbers present from June through October of any year (Stetzar 2002). One of the main factors influencing sea turtle presence in northern waters is seasonal temperature patterns (Ruben and Morreale 1999). Temperature is correlated with the time of year, with the warmer waters in the late spring, summer, and early fall being the most suitable for cold-blooded sea turtles. Sea turtles are most likely to occur in the action area between April and November when water temperatures are above 11°C. Sea turtles have been documented in the action area by the CETAP aerial and boat surveys as well as by surveys conducted by NMFS Northeast Science Center and observers on commercial fishing vessels. Additionally, satellite tracked sea turtles have been documented in the action area (seaturtle.org tracking database). The majority of sea turtle observations have been of loggerhead sea turtles, although Kemp's ridley, green and leatherback sea turtles have also been documented in the area.

In addition to temperature, water depth also affects sea turtle distribution. Water depths in and around the borrow site range from approximately 30 to 65 feet (USACE 2009). Satellite tracking studies of sea turtles found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 feet (Morreale and Standora 1990; Ruben and Morreale

1999). This depth was interpreted not to be as much an upper physiological depth limit for turtles, as a natural limiting depth where light and food are most suitable for foraging turtles (Morreale and Standora 1990). The areas to be dredged and the depths preferred by sea turtles do overlap, suggesting that if suitable foraging items were present, loggerheads and Kemp's ridleys may be foraging in the offshore shoal where dredging will occur. Green sea turtles feed almost exclusively on sea grasses, as there are no SAV beds in Sandbridge Shoal where dredging will occur, green sea turtles are not likely to use the areas to be dredged for foraging.

Alteration of Foraging Habitat

Dredging can affect Atlantic sturgeon and sea turtles by reducing prey species through the alteration of the existing biotic assemblages. As noted above, the borrow areas are not believed to be an area where Atlantic sturgeon concentrate to forage. However, opportunistic foraging may occur at these sites as surveys of the borrow area indicate the presence of potential Atlantic sturgeon foraging items (e.g., primarily polycheates; to a lesser extent, amphipods, bivalves, gastropods, jellyfish). Since dredging involves removing the bottom material down to a specific depth, dredging is likely to entrain and kill some of these forage items that may be consumed by Atlantic sturgeon during their migrations.

Similar to Atlantic sturgeon, the offshore borrow sites are not known to be an area where sea turtles concentrate to forage; however, based on surveys conducted at the borrow site, potential sea turtle foraging items appear to be present (e.g., bivalves, gastropods, decapods), although in low concentrations. Of the listed species found in the action area, loggerhead and Kemp's ridley sea turtles are the most likely to utilize these areas for opportunistic feeding, foraging mainly on available benthic species, such as crabs and mollusks (Morreale and Standora 1992; Bjorndal 1997). As no seagrass beds exist at the borrow areas, green sea turtles will not use the borrow sites as foraging areas and as such, dredging activities are not likely to disrupt normal feeding behaviors of green sea turtles. Additionally, jellyfish, the primary foraging item of leatherback sea turtles, are not likely to be affected by dredging activities as jellyfish occur within the upper portions of the water column and away from the sediment surface where dredging will occur. As jellyfish are not likely to be entrained during dredging, there is not likely to be any reduction in available forage for leatherback sea turtles due to the dredging operations. However, as suitable loggerhead and Kemp's ridley sea turtle foraging items occur on the benthos of the borrow area, and depths within the borrow area are suitable for use by these species of sea turtles, some opportunistic foraging by loggerhead and Kemp's ridley sea turtles is likely to occur at this site and therefore, may be affected by dredging activities within this portion of the action area.

While some offshore areas may be more desirable to certain turtles or sturgeon due to prey availability, there is no information to indicate that Sandbridge Shoal (the borrow area) has more abundant turtle or sturgeon prey or better foraging habitat than other surrounding areas. The assumption can be made that sea turtles and sturgeon are not likely to be more attracted to the borrow area/shoal than to other foraging areas and should be able to find sufficient prey in alternate areas. Depending on the species, recolonization of a dredged area can begin in as short as a month (Guerra-Garcia and Garcia-Gomez 2006). The dredged area is expected to be completely recolonized by benthic organisms within approximately 12 months. These conclusions are supported by a benthic habitat study which examined an area of Sandbridge

Shoals following dredging, which concluded that recolonization of the dredged area was rapid, with macrobenthic organisms abundant on the first sampling date following cessation of dredging activities (less than a month later), and that there was no significant difference in macrofaunal abundance or biomass/production between areas that had and had not been dredged (Diaz *et al.* 2006); suggesting that dredging had no long term impact on prey availability. As such, recolonization of the borrow areas should be complete within 1 year after the proposed dredge cycle (by 2015). In addition, under the proposed action, the entire Sandbridge Shoal will not be dredged; a "No Dredge Zone" will be established adjacent to those areas of the shoal to be dredged throughout the proposed action. According to Diaz *et al.* (2004), leaving small, untouched, areas of similar habitat around or adjacent to a disturbed area will increase the likelihood, as well as possible rate, of recolonization within those areas disturbed by dredging operations. It also should be noted that only a small percentage of the available sand at the borrow areas (approximately 1.6 percent of the entire shoal) is proposed to be removed and suitable foraging items should continue to be available at each borrow area at all times.

When the shoal targeted for dredging is considered within the context of the entire complex of shoals off the Virginia coast, it can be concluded that they are not necessarily unique habitats. A recent study by Dibajnia and Nairn (*in press*) identified 181 shoals between Delaware and Chesapeake Bays that were between the 10 m (33 ft) and 40 m (130 ft) depth contours and greater than 2 kilometers (1.2 miles) in length, all of which fit the general characteristics of Sandbridge Shoal. Assuming that these shoals are rectangular in shape, their surface area is estimated to be in excess of 238,765 ha (590,000 acres). It should be noted, however, that this is only a first-order approximation; the referenced study only focuses on shoals deemed to be economically viable for dredging and excludes shoreface attached shoals, shorter shoals, and those in deeper waters. Accordingly, available shoal habitat is larger. However, even under this conservative evaluation, the proposed action will affect only approximately 0.04 % of the shoals within Dibajnia and Nairn's study area. Additionally, in total, there is nearly 2,560,000 acres of seafloor offshore of Maryland and Virginia. Cumulatively, the reasonably foreseeable, future dredging projects offshore will affect less than 0.05% of the nearshore seafloor in the region (NASA 2010). NMFS anticipates that while the dredging activities may temporarily disrupt normal feeding behaviors for sea turtles and Atlantic sturgeon by causing them to move to alternate areas, the action is not likely to remove critical amounts of prey resources from the action area and any disruption to normal foraging is likely to be insignificant. In addition, the dredging activities are not likely to alter the habitat in any way that prevents sea turtles, Atlantic sturgeon, or whales from using the action area as a migratory pathway to other near-by areas that may be more suitable for foraging.

7.1.2 Entrainment

7.1.2.1 Sea Turtles

Because of their large size, leatherback sea turtles are not vulnerable to entrainment in hopper dredges. To date, no leatherback sea turtles have been documented entrained in any dredge operation along the U.S. Atlantic coast. Therefore, this section of the Opinion will only consider the effects of entrainment on loggerhead, Kemp's ridley and green sea turtles.

The National Research Council's Committee on Sea Turtle Conservation (1990) estimated that dredging mortalities, along with boat strikes, were second only to fishery interactions as a source of probable mortality of sea turtles. Experience has shown that injuries sustained by sea turtles entrained in hopper dredge dragheads are usually fatal. Mortality in hopper dredging operations most often occurs when turtles are entrained in the dredge draghead, pumped through the intake pipe and then killed as they cycle through the centrifugal pump and into the hopper. Because entrainment is believed to occur primarily as the dredge is being placed or removed from the bottom, creating suction in the draghead, or when the dredge is operating on an uneven or rocky substrate causing the draghead to rise off the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. Recent information from the USACE suggests that the risk of entrainment is highest when the bottom terrain is uneven or when the dredge is conducting "clean up" operations at the end of a dredge cycle when the bottom is trenched and the dredge is working to level out the bottom. In these instances, it is difficult for the dredge operator to keep the draghead buried in the sand and sea turtles near the bottom may be more vulnerable to entrainment. However, it is possible to operate the dredge in a manner that minimizes potential for such incidents as noted in the Monitoring Specifications for Hopper Dredges (Appendix B).

Sea turtles have been killed in hopper dredge operations along the East and Gulf coasts of the US. Documented turtle mortalities during dredging operations in the USACE South Atlantic Division (SAD; i.e., south of the Virginia/North Carolina border) are more common than in the USACE North Atlantic Division (NAD; Virginia-Maine) probably due to the greater abundance of turtles in these waters and the greater frequency of hopper dredge operations. For example, in the USACE SAD, over 467 sea turtles have been entrained in hopper dredges since 1980 and in the Gulf Region over 186 sea turtles have been killed since 1995. Records of sea turtle entrainment in the USACE NAD begin in 1994. Since this time, at least 72 sea turtles deaths (see Table 4) related to hopper dredge activities have been recorded in waters north of the North Carolina/Virginia border (USACE Sea Turtle Database).[9]

Table 4. Sea Turtle Takes in USACE NAD Dredging Operations

Project Location	Year of Operation	Cubic Yardage Removed	Observed Takes
York Spit, VA	2011	NA	1 Loggerhead
Thimble Shoal Channel	2009	NA	3 Loggerheads
York Spit	2007	608,000	1 Kemp's Ridley
Cape Henry	2006	NA	3 Loggerheads
Thimble Shoal Channel	2006	300,000	1 loggerhead
Delaware Bay	2005	50,000	2 Loggerheads

9 The USACE Sea Turtle Data Warehouse is maintained by the USACE's Environmental Laboratory and contains information on USACE dredging projects conducted since 1980 with a focus on information on interactions with sea turtles.

Thimble Shoal Channel	2003	1,828,312	7 Loggerheads 1 Kemp's ridley 1 unknown
Cape Henry	2002	1,407,814	6 Loggerheads 1 Kemp's ridley 1 green
VA Beach Hurricane Protection Project (Cape Henry)	2002	NA	1 Loggerhead
York Spit Channel	2002	911,406	8 Loggerheads 1 Kemp's ridley
Cape Henry	2001	1,641,140	2 loggerheads 1 Kemp's ridley
VA Beach Hurricane Protection Project (Thimble Shoals)	2001	NA	5 loggerheads 1 unknown
Thimble Shoal Channel	2000	831,761	2 loggerheads 1 unknown
York River Entrance Channel	1998	672,536	6 loggerheads
Atlantic Coast of NJ	1997	1,000,000	1 Loggerhead
Thimble Shoal Channel	1996	529,301	1 loggerhead
Delaware Bay	1995	218,151	1 Loggerhead
Cape Henry	1994	552,671	4 loggerheads 1 unknown
York Spit Channel	1994	61,299	4 loggerheads
Delaware Bay	1994	NA	1 Loggerhead
Cape May NJ	1993	NA	1 Loggerhead
Off Ocean City MD	1992	1,592,262	3 Loggerheads
			TOTAL = 73 Turtles

Official records of sea turtle mortality in dredging activities in the USACE NAD begin in the early 1990s. Before this time, endangered species observers were not required on board hopper dredges and dredge baskets were not inspected for sea turtles or sea turtle parts. The majority of sea turtle takes in the NAD have occurred in the Chesapeake Bay. This is largely a function of the large number of loggerhead and Kemp's ridley sea turtles that occur in the Chesapeake Bay each summer and the intense dredging operations that are conducted to maintain the Chesapeake Bay entrance channels and for beach nourishment projects at Virginia Beach. Since 1992, the take of 10 sea turtles (all loggerheads) has been recorded during hopper dredge operations in the Philadelphia, Baltimore and New York Districts. Hopper dredging is relatively rare in New England waters where sea turtles are known to occur, with most hopper dredge operations being completed by the specialized Government owned dredge Currituck which operates at low suction and has been demonstrated to have a very low likelihood of entraining or impinging sea turtles. To date, no hopper dredge operations (other than the Currituck) have occurred in the New

England District in areas or at times when sea turtles are likely to be present.

Most of the available information on the effects of hopper dredging on sea turtles in the USACE NAD has come from operations in Virginia waters, particularly in the entrance channels to the Chesapeake Bay. Since 1994, 63 sea turtles mortalities have been observed on hopper dredges operating in Virginia waters. In Thimble Shoals Channel, maintenance dredging took several turtles during the warmer months of 1996 (1 loggerhead) and 2000 (2 loggerheads, 1 unknown). A total of 6 turtles (5 loggerhead, 1 unknown) were taken in association with dredging in Thimble Shoal Channel during 2001, and one turtle was taken in May 2002 (1 loggerhead). Nine sea turtle takes were reported during dredging conducted in September and October 2003 (7 loggerhead, 1 Kemp's ridley, 1 unknown) and one sea turtle take (1 loggerhead) was reported in the summer of 2006. Most recently, Thimble Shoals Channel was dredged in the spring of 2009, with 3 loggerheads killed during this operation.

Incidental takes have occurred in the Cape Henry and York Spit Channels as well. In May and June 1994, parts of at least five sea turtles were observed (at least 4 loggerheads and 1 unknown) during dredging at Cape Henry. In September and October 2001, 3 turtle takes were observed (1 Kemp's ridley and 2 loggerheads). Eight turtle takes were observed during dredging at Cape Henry in April, May, June and October 2002 (1 green, 1 Kemp's and 6 loggerhead). Three loggerheads were killed during the dredging of the Cape Henry Channel in the summer of 2006. At York Spit, four loggerheads were taken in dredging operations occurring during one week in June 1994. Nine turtles were taken in dredging operations at York Spit in 2002 (8 loggerheads, 1 Kemp's ridley). York Spit was last dredged in the summer of 2007, with the take of 1 Kemp's ridley reported. In 1998, dredging in the York River Entrance Channel took 5 loggerheads. No turtles had been observed in dredging operations in Rappahannock Shoal Channels or the Sandbridge Shoals borrow area.

It should be noted that the observed takes may not be representative of all the turtles killed during dredge operations. Typically, endangered species observers are required to observe a total of 50% of the dredge activity (i.e., 6 hours on watch, 6 hours off watch). As such, if the observer was off watch or the cage was emptied and not inspected or the dredge company either did not report or was unable to identify the turtle incident, there is the possibility that a turtle could be taken by the dredge and go unnoticed. Additionally, in older Opinions (i.e., prior to 1995), NMFS frequently only required 25% observer coverage and monitoring of the overflows which has since been determined to not be as effective as monitoring of the intakes. These conditions may have led to sea turtle takes going undetected.

NMFS raised this issue to the USACE during the 2002 season, after several turtles were taken in the Cape Henry and York Spit Channels, and expressed the need for 100% observer coverage. On September 30, 2002, the USACE informed the dredge contractor that when the observer was not present, the cage should not be opened unless it is clogged. This modification was to ensure that any sea turtles that were taken and on the intake screen (or in the cage area) would remain there until the observer evaluated the load. The USACE's letter further stated "Crew members will only go into the cage and remove wood, rocks, and man-made debris; any aquatic biological material is left in the cage for the observer to document and clear out when they return on duty.

In addition, the observer is the only one allowed to clean off the overflow screen. This practice provides us with 100% observation coverage and shall continue." Theoretically, all sea turtle parts were observed under this scheme, but the frequency of clogging in the cage is unknown at this time. Obviously, the most effective way to ensure that 100% observer coverage is attained is to have a NMFS-approved endangered species observer monitoring all loads at all times. This level of observer coverage would document all turtle interactions and better quantify the impact of dredging on turtle populations. More recently issued Opinions have required 100% observer coverage which increases the likelihood of takes being detected and reported.

Sea turtles have been found resting in deeper waters, which could increase the likelihood of interactions from dredging activities. In 1981, observers documented the take of 71 loggerheads by a hopper dredge at the Port Canaveral Ship Channel, Florida (Slay and Richardson 1988). This channel is a deep, low productivity environment in the Southeast Atlantic where sea turtles are known to rest on the bottom, making them extremely vulnerable to entrainment. The large number of turtle mortalities at the Port Canaveral Ship Channel in the early 1980s resulted in part from turtles being buried in the soft bottom mud, a behavior known as brumation. Since 1981, 77 loggerhead sea turtles have been taken by hopper dredge operations in the Port Canaveral Ship Channel, Florida. Chelonid turtles have been found to make use of deeper, less productive channels as resting areas that afford protection from predators because of the low energy, deep water conditions. While sea turtle brumation has not been documented in mid-Atlantic or New England waters, it is possible that this phenomenon occurs in these waters.

It is likely that not all sea turtles killed by dredges are observed onboard the hopper dredge. Several sea turtles stranded on Virginia shores with crushing type injuries from May 25 to October 15, 2002. The Virginia Marine Science Museum (VMSM) found 10 loggerheads, 2 Kemp's ridleys, and 1 leatherback exhibiting injuries and structural damage consistent with what they have seen in animals that were known dredge takes. While it cannot be conclusively determined that these strandings were the result of dredge interactions, the link is possible given the location of the strandings (e.g., in the southern Chesapeake Bay near ongoing dredging activity), the time of the documented strandings in relation to dredge operations, the lack of other ongoing activities which may have caused such damage, and the nature of the injuries (e.g., crushed or shattered carapaces and/or flipper bones, black mud in mouth). Additionally, in 1992, three dead sea turtles were found on an Ocean City, Maryland beach while dredging operations were ongoing at a borrow area located 3 miles offshore. Necropsy results indicate that the deaths of all three turtles were dredge related. It is unknown if turtles observed on the beach with these types of injuries were crushed by the dredge and subsequently stranded on shore or whether they were entrained in the dredge, entered the hopper and then were discharged onto the beach with the dredge spoils.

A dredge could crush an animal as it was setting the draghead on the bottom, or if the draghead was lifting on and off the bottom due to uneven terrain, but the actual cause of these crushing injuries cannot be determined at this time. Further analyses need to be conducted to better understand the link between crushed strandings and dredging activities, and if those strandings need to be factored into an incidental take level. More research also needs to be conducted to determine if sea turtles are in fact undergoing brumation in mid-Atlantic or New England waters.

Regardless, it is possible that dredges are taking animals that are not observed on the dredge which may result in strandings on nearby beaches.

Due to the nature of interactions between listed species and dredge operations, it is difficult to predict the number of interactions that are likely to occur from a particular dredging operation. Projects that occur in an identical location with the same equipment year after year may result in interactions in some years and none in other years as noted in the examples of sea turtle takes above. Dredging operations may go on for months, with sea turtle takes occurring intermittently throughout the duration of the action. For example, dredging occurred at Cape Henry over 160 days in 2002 with 8 sea turtle takes occurring over 3 separate weeks while dredging at York Spit in 1994 resulted in 4 sea turtle takes in one week. In Delaware Bay, dredge cycles have been conducted during the May-November period with no observed entrainment and as many as two sea turtles have been entrained in as little as three weeks. Even in locations where thousands of sea turtles are known to be present (e.g., Chesapeake Bay) and where dredges are operating in areas with preferred sea turtle depths and forage items (as evidenced by entrainment of these species in the dredge), the numbers of sea turtles entrained is an extremely small percentage of the likely number of sea turtles in the action area. This is likely due to the distribution of individuals throughout the action area, the relatively small area which is affected at any given moment and the ability of some sea turtles to avoid the dredge even if they are in the immediate area.

The number of interactions between dredge equipment and sea turtles seems to be best associated with the volume of material removed, which is closely correlated to the length of time dredging takes, with a greater number of interactions associated with a greater volume of material removed and a longer duration of dredging. The number of interactions is also heavily influenced by the time of year dredging occurs (with more interactions correlated to times of year when more sea turtles are present in the action area) and the type of dredge plant used (sea turtles are apparently capable of avoiding pipeline and mechanical dredges as no takes of sea turtles have been reported with these types of dredges). The number of interactions may also be influenced by the terrain in the area being dredged, with interactions more likely when the draghead is moving up and off the bottom frequently. Interactions are also more likely at times and in areas when sea turtle forage items are concentrated in the area being dredged, as sea turtles are more likely to be spending time on the bottom while foraging.

Few interactions with listed sea turtles have been recorded during dredging at offshore borrow areas. This is likely due to the transitory nature of most sea turtles occurring in offshore borrow areas as well as the widely distributed nature of sea turtles in offshore waters. This lack of information is also largely due to the infrequency of dredging in offshore borrow areas in the USACE NAD, which makes it even more difficult to predict the likely number of interactions between this action and listed sea turtles. However, as sea turtles have been documented in the action area and suitable habitat and forage items are present, it is likely that sea turtles will be present in the action area when dredging takes place. As sea turtles are likely to be less concentrated in the action area than they are while foraging in Virginia waters such as the entrance channels to the Chesapeake Bay, the level of interactions during this project are likely to be fewer than those recorded during dredging in the Chesapeake Bay area (i.e., the Thimble

Shoals and Cape Henry projects noted above).

In the USACE Sea Turtle Database, records for 38 projects occurring during "sea turtle season" (i.e., April 1 – November 30) are available that report the cubic yardage removed during a project (see Table 5). As noted above, the most complete information is available for the Norfolk district. Records for 22 projects occurring in the April – November time frame that report cubic yards removed are available for channels in the Chesapeake Bay (see Table 6). NMFS has made calculations from that data which indicate that, in the Chesapeake Bay, an average of 1 sea turtle is killed for approximately every 387,000 cy removed. This calculation has been based on a number of assumptions including the following: that sea turtles are evenly distributed throughout all channels and borrow areas for which takes have occurred, that all dredges will take an identical number of sea turtles, and that sea turtles are equally likely to be encountered throughout the April to November time frame.

Table 5. Dredging projects in USACE NAD with recorded cubic yardage

Project Location	Year of Operation	Cubic Yards Removed	Observed Takes
York Spit/Thimble Shoals, VA	2011	1,630,713	0
Cape Henry, VA	2011	2,472,000	0
York Spit Channel, VA	2009	372,533	0
Dewey and Bethany Beach, DE	2009	397,956	0
York Spit, VA	2007	608,000	1 Kemp's Ridley
Atlantic Ocean Channel, VA	2006	1,118,749	0
Thimble Shoal Channel	2006	300,000	1 loggerhead
Dewey Beach/Cape Henlopen (DE Bay)	2005	1,134,329	0
Delaware Bay	2005	50,000	2 Loggerheads
Cape May Point, NJ	2005	2,425,268	0
Thimble Shoal Channel, VA	2004	139,200	0
VA Beach Hurricane Protection Project	2004	844,968	0
Thimble Shoal Channel, VA	2003	1,828,312	7 Loggerheads 1 Kemp's ridley 1 unknown
York River Entrance Channel, VA	2003	343,092	0
Off Ocean City MD	2002	744,827	0
Cape Henry, VA	2002	1,407,814	6 Loggerheads 1 Kemp's ridley 1 green
York Spit Channel, VA	2002	911,406	8 Loggerheads 1 Kemp's ridley
Chincoteague Inlet, VA	2002	84,479	0
Cape Henry, VA	2001	1,641,140	2 loggerheads 1 Kemp's ridley
Thimble Shoal Channel, VA	2000	831,761	2 loggerheads 1 unknown

Cape Henry , VA	2000	759,986	0
York River Entrance Channel, VA	1998	672,536	6 loggerheads
Off Ocean City MD	1998	1,289,817	0
York Spit Channel, VA	1998	296,140	0
Cape Henry, VA	1998	740,674	0
Atlantic Coast of NJ	1997	1,000,000	1 Loggerhead
Thimble Shoal Channel, VA	1996	529,301	1 loggerhead
Delaware Bay	1995	218,151	1 Loggerhead
Cape Henry Channel, VA	1995	485,885	0
Bethany Beach (DE Bay)	1994	184,451	0
York Spit Channel, VA	1994	61,299	4 loggerheads
Cape Henry , VA	1994	552,671	4 loggerheads 1 unknown
Dewey Beach (DE Bay)	1994	624,869	0
Off Ocean City MD	1994	1,245,125	0
Off Ocean City MD	1992	1,592,262	3 Loggerheads
Off Ocean City MD	1991	1,622,776	0
Off Ocean City MD	1990	2,198,987	0
	TOTAL	*33,361,477 cy*	*57 Turtles*

Table 6. Projects in USACE NAD with recorded cubic yardage – Chesapeake Bay Only

Project Location	Year of Operation	Cubic Yards Removed	Observed Takes
York Spit/Thimble Shoals	2011	1,630,713	0
Cape Henry	2011	2,472,000	0
York Spit Channel	2009	372,533	0
York Spit	2007	608,000	1 Kemp's Ridley
Atlantic Ocean Channel	2006	1,118,749	0
Thimble Shoal Channel	2006	300,000	1 loggerhead
Thimble Shoal Channel	2004	139,200	0
Thimble Shoal Channel	2003	1,828,312	7 Loggerheads 1 Kemp's ridley 1 unknown
York River Entrance Channel	2003	343,092	0
Cape Henry	2002	1,407,814	6 Loggerheads 1 Kemp's ridley 1 green
York Spit Channel	2002	911,406	8 Loggerheads 1 Kemp's ridley
Cape Henry	2001	1,641,140	2 loggerheads 1 Kemp's ridley
Cape Henry	2001	1,641,140	0
Thimble Shoal Channel	2000	831,761	2 loggerheads 1 unknown
Cape Henry	2000	759,986	0
York River Entrance Channel	1998	672,536	6 loggerheads

York Spit Channel	1998	296,140	0
Cape Henry	1998	740, 674	0
Thimble Shoal Channel	1996	529,301	1 loggerhead
Cape Henry Channel	1995	485,885	0
York Spit Channel	1994	61,299	4 loggerheads
Cape Henry	1994	552,671	4 loggerheads 1 unknown
	TOTAL	***19,344,352 cy***	***50 turtles***

As noted above, sea turtles are likely to be less concentrated in the action area for this consultation than they are in the Chesapeake Bay area. Based on this information, NMFS believes that hopper dredges operating in the offshore borrow areas are less likely to interact with sea turtles than hopper dredges operating in the Chesapeake Bay area. Based on habitat characteristics and geographic area, the level of interactions during this project may be more comparable to the level of interactions recorded for dredging projects in Delaware Bay or offshore New York and New Jersey (i.e., Cape May, Sea Girt, lower Delaware Bay).

Records for 17 projects occurring during "sea turtle season" (i.e., April 1 – November 30) in the Baltimore, Philadelphia and New York District (all offshore) are available that report the cubic yardage removed during a project; however an important caveat is that observer coverage at these projects has ranged from 0 to 50% (see Table 7).

As explained above, for projects prior to 1995, observers were only present on the dredge for every other week of dredging. For projects in 1995 to the present, observers were present on board the dredge full time and worked a 6-hour on, 6-hour off shift. The only time that cages (where sea turtle parts are typically observed) were cleaned by anyone other than the observer was when there was a clog. If a turtle or turtle part was observed in such an instance, crew were instructed to inform the observer, even if off-duty. As such, it is reasonable to expect that even though there was only 50% observer coverage, an extremely small amount of biological material went unobserved. To make the data from the 1993 and 1994 dredge events when observers were only on board every other week, comparable to the 1995-2006 data when observers were on board full time, NMFS has assumed that an equal number of turtles were entrained when observers were not present. This calculation is reflected in Table 7 as "adjusted entrainment number."

Table 7. Projects in USACE NAD with recorded cubic yardage (with Chesapeake Bay projects removed)

Project Location	Year of Operation	Cubic Yards Removed	Observed Entrainment	Adjusted Entrainment Number
Dewey and Bethany Beach (DE)	2009	397,956	0	0
Dewey Beach/Cape Henlopen (DE Bay)	2005	1,134,329	0	0
Delaware Bay	2005	50,000	2 Loggerhead	2 Loggerhead

Cape May Point, NJ	2005	2,425,268	0	0
VA Beach Hurricane Protection Program	2004	844,968	0	0
Off Ocean City MD	2002	744,827	0	0
Chincoteague Inlet	2002	84,479	0	0
Offshore New Jersey	1997	1,000,000	1 Loggerhead	1 Loggerhead
Off Ocean City MD	1998	1,289,817	0	0
Delaware Bay	1995	218,151	1 Loggerhead	1 Loggerhead
Bethany Beach (DE Bay)	1994	184,451	0	0
Dewey Beach (DE Bay)	1994	624,869	0	0
Off Ocean City MD	1994	1,245,125	0	0
Off Ocean City MD	1992	1,592,262	3 Loggerheads	6 Loggerheads
Off Ocean City MD	1991	1,622,776	0	0
Off Ocean City MD	1990	2,198,987	0	0
	TOTAL	***15,658,265 cy***	***7 Loggerheads***	***10 Loggerheads***

As information available (number of days dredged, cubic yards removed) on projects outside of the Chesapeake Bay is incomplete and observer coverage has been relatively low, it is difficult to estimate the number of sea turtles likely to be taken in these areas. It is reasonable, based on the available information, to calculate the number of sea turtles entrained during projects where cubic yardage is available, not just for projects where entrainment has occurred (which would overestimate the likelihood of interactions). Using this method, and based on the adjusted entrainment number in Table 7, an estimate of 1 sea turtle per 1.6 million cubic yards is calculated. As noted above, it is likely that including the Chesapeake Bay data would overestimate the number of interactions in offshore borrow areas likely due to the concentration of sea turtles in the Chesapeake Bay and differences in habitat between the Chesapeake Bay entrance channels and the offshore channels or borrow areas considered above. Based on this approach, we estimate that dredging in offshore borrow areas outside of the Chesapeake Bay is likely to result in the entrainment of 1 sea turtle for every 1.6 million cubic yards of material removed by a hopper dredge. This calculation is based on a number of assumptions including the following: that sea turtles are evenly distributed throughout all borrow areas, that all dredges have a similar entrainment rate, and that sea turtles are equally likely to be encountered throughout the April to November time frame.

Sea turtle species likely to be entrained
With the exception of one green turtle entrained in a hopper dredge operating in Chesapeake Bay, all other sea turtles entrained in dredges operating in the USACE NAD have been loggerheads and Kemp's ridley. Of these 73 sea turtles, 63 have been loggerhead, 5 have been Kemp's ridleys, 1 green and 4 unknown. Overall, of those identified to species, approximately 90% of the sea turtles taken in dredges operating in the USACE North Atlantic Division have been loggerheads. No Kemp's ridleys or greens have been entrained in dredge operations outside of the Chesapeake Bay area. The high percentage of loggerheads is likely due to several factors including their tendency to forage on the bottom where the dredge is operating and the

fact that this species is the most numerous of the sea turtle species in Northeast and Mid-Atlantic waters. It is likely that the documentation of only one green sea turtle entrainment in Virginia dredging operations is a reflection of the low numbers of green sea turtles that occur in waters north of North Carolina. The low number of green sea turtles in the action area makes an interaction with a green sea turtle extremely unlikely to occur.

Based on the above information, we expect that 1 sea turtle is likely to be injured or killed for approximately every 1.6 million cy of material removed from the proposed borrow area and that at least 90% will be loggerheads. Under the preferred proposed alternative, the SPS replenishment would require approximately 700,000 cy of material. Based on this information, we anticipate that no more than 1 sea turtle is likely to be entrained over the life of the proposed action (i.e. through 2015). Due to the nature of the injuries expected to result from entrainment, all of the turtles are expected to die.

NMFS expects that nearly all of the sea turtles will be loggerheads and that the entrainment of a Kemp's ridley during a particular dredge cycle will be rare; however, as Kemp's ridleys have been documented in the action area and have been entrained in hopper dredges, it is possible that this species will interact with the dredge over the course of the project life. As such, over the life of the proposed action either 1 loggerhead or 1 Kemp's ridley sea turtle could be killed in hopper dredging operations; however, it is likely that this one sea turtle will be a loggerhead sea turtle as approximately 90% of the sea turtles taken in dredges operating in the USACE NAD have been loggerheads.

As explained in the Status of the Species section, it is likely that the sea turtles entrained in hopper dredges operating in the waters off Virginia originate from several of the recovery units, primarily from the PFRU, NRU, and GCRU, with smaller amounts possible from the DTRU and NGMRU. Based on the best available information on sea turtles in the action area, NMFS anticipates that a loggerhead entrained at the Sandbridge Shoal borrow site is likely to be either a benthic immature or sexually mature turtle. There is no information to suggest that either sex is disproportionately taken in hopper dredges. Therefore, either a male or female loggerhead may be entrained in the dredge.

7.1.2.2 Atlantic Sturgeon

Atlantic sturgeon are vulnerable to entrainment in hopper dredges. However, given the large size of adults (greater than 150cm) and the size of the openings on the dragheads, adults are unlikely to be vulnerable to entrainment. USACE reports that from 1990-2011, 30 interactions with sturgeon occurred during dredge operations. Of these, 17 were reported as Atlantic sturgeon, with 15 of these entrained in hopper dredges. Of the 7 Atlantic sturgeon for which size is available, all were juveniles. Information on these interactions is presented in Table 8. Most of these interactions occurred within rivers and harbors; however, to date, few records exist for interactions between hopper dredges and Atlantic sturgeon along coastal/offshore borrow sites (Table 9).

Table 8. USACE Atlantic Sturgeon Entrainment Records from Hopper Dredge

Operations 1990-2011

Project Location	Corps Division/District*	Month/Year of Operation	Cubic Yards Removed	Observed** Entrainment
Winyah Bay, Georgetown (SC)	SAD/SAC	Oct-90	517,032	1
Savannah Harbor (GA)	SAD/SAS	Jan-94	2,202,800	1
Savannah Harbor	SAD/SAS	Dec-94	2,239,800	2
Wilmington Harbor, Cape Fear River (NC)	SAD/SAW	Sep-98	196,400	1
Charleston Harbor (SC)	SAD/SAC	Mar-00	5,627,386	2
Brunswick Harbor (GA)	SAD/SAS	Feb-12	1,459,630	1
Charleston Harbor	SAD/SAC	Jan-04	1,449,234	1
Brunswick Harbor	SAD/SAS	Mar-05	966,000	1
Brunswick Harbor	SAD/SAS	Dec-06	1,198,571	1
Savannah Entrance Channel	SAD/SAS	Nov-07	973,463	1
Sandy Hook Channel (NJ)	NAD/NANY	Aug-Nov-08	23,500	1
York Spit (VA)	NAD/NAN	Apr-11	700,000	2
		Total	**17,553,816**	**15**

* SAD= South Atlantic Division; NAD= North Atlantic Division; SAC=Charleston District; SAS=Savannah District; SAW=Wilmington District; NANY=New York District; NAN=Norfolk District.

** Records based on sea turtle observer reports which record listed species entrained , as well as all other organisms entrained during dredge operations.

Table 9: Atlantic Sturgeon Entrainment: Coastal/Offshore Projects in USACE NAD Since 1998 with Recorded Cubic Yardage

*a: 14 Atlantic sturgeon removed during pre-dredge trawl/relocation trawling (September and November, 2003).
*b: 1 Atlantic sturgeon removed during pre-dredge trawl/relocation trawling on 10/26/02.
*c: 1 Atlantic sturgeon removed during pre-dredge trawl/relocation trawling on 11/02/02.

Project Location	Year of Operation	Cubic Yards Removed	Observed Entrainment	Observed Entrainment
York Spit Channel, VA	2011	1,630,713	2	2
Cape Henry, VA	2011	2,472,000	0	0
York Spit Channel, VA	2009	372,533	0	0
Dewey and Bethany Beach, DE	2009	397,956	0	0
Sandy Hook Channel, NJ	2008	23,500	1	1
York Spit Channel, VA	2007	608,000	0	0
Atlantic Ocean Channel, VA	2006	1,118,749	0	0
Thimble Shoal Channel	2006	300,000	0	0
Dewey Beach/Cape Henlopen	2005	1,134,329	0	0
Cape May Point, NJ	2005	2,425,268	0	0
Thimble Shoal Channel, VA	2004	139,200	0	0
VA Beach Hurricane Protection Project	2004	844,968	0	0

Thimble Shoal Channel, VA (*a)	2003	1,828,312	0	0
Off Ocean City MD	2002	744,827	0	0
Cape Henry, VA (*b)	2002	1,407,814	0	0
York Spit Channel, VA (*c)	2002	911,406	0	0
Cape Henry, VA	2001	1,641,140	0	0
Thimble Shoal Channel, VA	2000	831,761	0	0
Cape Henry , VA	2000	759,986	0	0
Off Ocean City MD	1998	1,289,817	0	0
York Spit Channel, VA	1998	296,140	0	0
Cape Henry, VA	1998	740,674	0	0
Atlantic Coast of NJ	1997	1,000,000	0	0
Thimble Shoal Channel, VA	1996	529,301	0	0
Cape Henry Channel, VA	1995	485,885	0	0
Bethany Beach, DE	1994	184,451	0	0
York Spit Channel, VA	1994	61,299	0	0
Cape Henry , VA	1994	552,671	0	0
Dewey Beach, DE	1994	624,869	0	0
Off Ocean City MD	1994	1,245,125	0	0
Off Ocean City MD	1992	1,592,262	0	0
	TOTAL	28,194,956	3	3

* Records based on sea turtle observer reports which record listed species entrained as well as all other organisms entrained during dredge operations.

In the Northeast Region (Maine through Virginia), endangered species observers have been present on all hopper dredges operating between April 1 and November 30 since 1992. While the primary responsibility of observers is to document sea turtle interactions, observers document all biological material entrained in the dredges. As such, they record any interactions with sturgeon. Sturgeon interactions have routinely been reported to NMFS. Therefore, we expect that the "observed entrainment" numbers noted above are comprehensive and that any interactions with Atlantic sturgeon would be recorded. While observers have not operated on dredges working from December – March, in the Northeast Region dredging during this time of year is rare (due to weather conditions) and we do not anticipate that there are many undocumented interactions between Atlantic sturgeon and hopper dredges. Dredging in the offshore environment, such as where this project will occur, is very rare in the winter months.

In general, entrainment of large mobile animals, such as sturgeon or sea turtles, is relatively rare. Several factors are thought to contribute to the likelihood of entrainment. In areas where animals are present in high density, the risk of an interaction is greater because more animals are exposed to the potential for entrainment. It has also been suggested that the risk of entrainment is highest in areas where the movements of animals are restricted (e.g., in river channels) where there is limited opportunity for animals to move away from the dredge. Because dredging will occur in an open ocean environment, the movements of Atlantic sturgeon will not be restricted and we anticipate that most Atlantic sturgeon will be able to avoid the dredge. Further, because Atlantic sturgeon are likely to be using the borrow sites as a migration corridor and are not aggregated in this area, the density of Atlantic sturgeon in this area is likely to be very low. The hopper dredge draghead operates on the bottom and is typically at least partially buried in the sediment. Sturgeon are benthic feeders and are often found at or near the bottom while foraging or while moving within rivers. Information suggests that Atlantic sturgeon migrating in the marine environment do not move along the bottom but move further up in the water column. If Atlantic sturgeon are up off the bottom while in offshore areas, such as the borrow areas, the potential for interactions with the dredge are further reduced. Based on this information, the likelihood of an interaction of an Atlantic sturgeon with a dredge operating under the proposed action is expected to be low.

However, because we know that entrainment is possible and that not all mobile animals will be able to escape from the dredge (as evidenced by past entrainment of sea turtles and sturgeon), we anticipate that entrainment is still possible and as such, effects of these interactions on Atlantic sturgeon must be assessed. As noted above, outside of rivers/harbors, only 3 Atlantic sturgeon have been observed entrained in a hopper dredge (see Table 9). The low level of interactions may be, in part, due to the use of pre-trawl/dredge relocation trawling (see Table 9; just because 0 Atlantic sturgeon were entrained in some locations, Atlantic sturgeon were still documented prior to dredging operations) or the infrequency of dredging offshore borrow/coastal areas in the USACE NAD. It is also possible that interactions with Atlantic sturgeon have occurred and not been reported to NMFS; however, based on information that has been provided to NMFS and discussions with observers, under-reporting is likely to be very rare.

Based on what we know about Atlantic sturgeon behavior in coastal/offshore areas such as the borrow areas, it is reasonable to consider that the risk of entrainment at these borrow areas is similar to that at other non-riverine/harbor areas. Some of the areas considered in this analysis (see Table 9) are closer to shore than the borrow areas and may be more heavily used than the borrow area. Thus, an estimate of interactions derived from this information is likely an overestimate. However, at this time, this is the best available information on the potential for interactions with Atlantic sturgeon in the borrow areas.

It is important to note that because observer coverage has been variable, observed interactions may not be representative of all Atlantic sturgeon injured or killed during dredge. As such, we have adjusted the entrainment numbers to account for any instances where observer coverage was less than 100%.

Past experience calculating the likelihood of interactions between hopper dredges and other species (i.e., sea turtles) indicates that there is a relationship between the number of animals entrained and the volume of material removed. The volume of material removed is correlated to the amount of time spent dredging but is a more accurate measure of effort because reports often provide the total days of a project but may not provide information on the actual hours of dredging vs. the number of hours steaming to the disposal site or in port for weather or other delays. Thus, we will use information available for all non-riverine/harbor projects in the mid-Atlantic for which cubic yards of material removed are available to calculate the number of Atlantic sturgeon likely to be entrained during dredging operations. Using this method, and using the dataset presented in Table 9, we have calculated an entrainment rate of 1 Atlantic sturgeon is likely to be injured or killed for approximately every 9.4 million cy of material removed from the proposed borrow area. This calculation is based on a number of assumptions including the following: that Atlantic sturgeon are evenly distributed throughout the action area, that all dredges will have the same entrainment rate, and that Atlantic sturgeon are equally likely to be encountered throughout the time period when dredging will occur. While this estimate is based on several assumptions, it is reasonable because it uses the best available information on entrainment of Atlantic sturgeon from past dredging operations, including dredging operations in the vicinity of the action area, it includes multiple projects over several years, and all of the projects have had observers present which we expect would have documented any entrainment of Atlantic sturgeon.

Under the preferred proposed alternative, the SPS replenishment would require approximately 700,000 cy of material. Based on the information outlined above, NMFS anticipates that no more than 1 Atlantic sturgeon is likely to be entrained over the life of the proposed action (i.e. through 2014). Due to the nature of the injuries expected to result from entrainment, any entrained sturgeon is expected to die. As such, over the life of the project, NMFS anticipates that up to 1 Atlantic sturgeon could be killed. Because we expect that adult Atlantic sturgeon are too large to be vulnerable to entrainment and given the size of other sturgeon that have been entrained in other hopper dredging operations, we expect that this sturgeon will be a subadult.

7.1.3 Interactions with the Sediment Plume

Dredging operations cause sediment to be suspended in the water column. This results in a sediment plume in the water, typically present from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (USACE 1983).

Resuspension of fine-grained dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. In the vicinity of hopper dredge operations, a near-bottom turbidity plume of resuspended bottom material may extend 2,300 to 2,400 ft down current from the dredge (USACE 1983). In the immediate vicinity of the dredge, a well-defined upper plume is generated by the overflow process. Approximately 1,000 ft behind the dredge, the two plumes merge into a single plume (USACE 1983). Suspended solid concentrations may be as high as several tens of parts per thousand (ppt; grams per liter) near the discharge port and as high as a few parts per thousand near the draghead. In a study done by Anchor Environmental (2003), nearfield concentrations ranged from 80.0 to 475.0 mg/l. Turbidity levels in the near-surface plume appear to decrease exponentially with increasing distance from the dredge due to settling and dispersion, quickly reaching concentrations less than 1 ppt. By a distance of 4,000 feet from the dredge, plume concentrations are expected to return to background levels (USACE 1983). Studies also indicate that in almost all cases, the vast majority of resuspended sediments resettle close to the dredge within one hour, and only a small fraction takes longer to resettle (Anchor Environmental 2003).

No information is available on the effects of total suspended solids (TSS) on juvenile and adult sea turtles or whales; however, studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). TSS is most likely to affect sea turtles or whales if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle prey. As Atlantic sturgeon, sea turtles and whales are highly mobile they are likely to be able to avoid any sediment plume and any effect on Atlantic sturgeon, sea turtle or whale movements is likely to be insignificant. Additionally, the TSS levels expected are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical (Breitburg 1988 in Burton 1993; Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993)) and benthic communities (390.0 mg/L (EPA 1986)).

While the increase in suspended sediments may cause Atlantic sturgeon, sea turtles or whales to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movements to alter their course out of the sediment plume. Based on this information, any increase in suspended sediment is not likely to affect the movement of Atlantic sturgeon, sea turtles or whales between foraging areas or while migrating or otherwise negatively affect listed species in the action area. Based on this information, it is likely that the effect of the suspension of sediment resulting from dredging operations will be insignificant.

7.1.4 Collisions with Dredges

There have not been any reports of dredge vessels colliding with listed species, but contact injuries resulting from dredge movements could occur at or near the water surface and could therefore involve any of the listed species present in the action area. Because the dredge is unlikely to be moving at speeds greater than three knots during dredging operations, blunt trauma injuries resulting from contact with the hull are unlikely during dredging operations. It is more likely that contact injuries during actual dredging would involve the propeller of the vessel and are more likely to occur when the dredge is moving from the dredging area to port or between dredge locations. While the distance between these areas is relatively short, the dredge in transit would be moving at faster speeds, particularly when empty and returning to the borrow area (i.e., between 8 to 10 knots from November 1 to April 30 of any year; between 8 to 14 knots from May 1 to October 31 of any year), than during dredging operations (i.e., 3 knots). The speed of the dredge while empty is not expected to exceed 14 knots if operations occur from May 1 to October 31; however, during the period of time listed species of whales are most likely to be present in the action area, vessel speeds, while transiting to and from the borrow area, will not exceed 10 knots (see mitigation measures above, section 3.3).

The dredge vessel may collide with marine mammals and sea turtles when they are at the surface or, in the case of Atlantic sturgeon, in the water column when migrating. These species have been documented with injuries consistent with vessel interactions and it is reasonable to believe that the dredge vessels considered in this Opinion could inflict such injuries on Atlantic sturgeon, marine mammals and sea turtles, should they collide. As mentioned, sea turtles are found distributed throughout the action area in the warmer months, generally from April through November; Atlantic sturgeon primarily during fall, winter, and spring months (approximately October-March); right whales primarily from November-May; humpbacks from September-April; and fin whales from October-January; however, individual transient right whales could be present in the action area outside of these time frame as this area has been used by whales migrating between calving/mating grounds and foraging grounds.

Effects of Vessel Collisions on Sea Turtles

Interactions between vessels and sea turtles occur and can take many forms, from the most severe (death or bisection of an animal or penetration to the viscera), to severed limbs or cracks to the carapace which can also lead to mortality directly or indirectly. Sea turtle stranding data for the U.S. Gulf of Mexico and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993, about 9% of living and dead stranded sea turtles had propeller or other boat strike injuries (Lutcavage *et al.* 1997). According to STSSN stranding data from 2001-2008, at least 520 sea turtles (loggerhead, green, Kemp's ridley and leatherbacks) that stranded on beaches within the NMFS Northeast Region (Maine through Virginia) showed evidence of propeller wounds and were, therefore, probable vessel strikes. In the vast majority of cases, it is unknown whether these injuries occurred pre- or post- mortem; however, in 18 cases there was evidence that the turtle was alive at the time of the strike.

Information is lacking on the type or speed of vessels involved in turtle vessel strikes. However, there does appear to be a correlation between the number of vessel struck turtles and the level of recreational boat traffic (NRC 1990). Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that turtles are more likely to avoid injury from slower-moving vessels since the turtle has more time to maneuver and avoid the vessel. The speed of the dredge is not expected to exceed 3 knots while dredging and is expected to operate at a maximum speed of 14 knots while transiting to and from the borrow area to the pumpout station/buoy. As such, the 14 knot or less speed of the dredge vessel is likely to reduce the chances of collision with a sea turtle. In addition, the risk of ship strike will be influenced by the amount of time the animal remains near the surface of the water. For the proposed action, the greatest risk of vessel collision will occur during transit between shore and the offshore borrow site to be dredged. Sea turtles present in these shallow nearshore waters are most likely to be foraging along the bottom, thereby reducing the likelihood of interaction with a vessel as they will be found primarily on the bottom and away from the surface of the water column near the hull of the vessel. The presence of an experienced endangered species observer who can advise the vessel operator to slow the vessel or maneuver safely when sea turtles are spotted will further reduce to a discountable level the potential for interaction with vessels (i.e., when sea turtles are sighted, distances of 100 yards will be maintained from the sighted animal).

Effects of Vessel Collisions on Atlantic Sturgeon

Although there have been no documented reports of dredge vessels colliding with Atlantic sturgeon, vessel strikes have been identified as a threat to Atlantic sturgeon and this species is known to be vulnerable to interactions with vessels. While the exact number of Atlantic sturgeon killed as a result of being struck by boat hulls or propellers is unknown, it is an area of concern in the Delaware and James Rivers. Brown and Murphy (2010) examined twenty-eight dead Atlantic sturgeon observed in the Delaware River from 2005-2008. Fifty-percent of the mortalities resulted from apparent vessel strikes and 71% of these (10 of 14) had injuries consistent with being struck by a large vessel (Brown and Murphy 2010). Eight of the fourteen vessel struck sturgeon were adult-sized fish (Brown and Murphy 2010). Given the time of year in which the fish were observed (predominantly May through July; Brown and Murphy 2010), it is likely that many of the adults were migrating through the river to the spawning grounds. Similarly, five sturgeon were reported to have been struck by commercial vessels within the James River, VA in 2005, and one strike per five years is reported for the Cape Fear River. Locations that support large ports and have relatively narrow waterways seem to be more prone to ship strikes (e.g., Delaware and James Rivers) (ASSRT 2007).

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (e.g., foraging, migrating, etc.). It is important to note that vessel strikes have only been identified as a significant concern in the Delaware and James rivers and current thinking suggests that there may be unique geographic features in these areas (e.g., potentially narrow migration corridors combined with shallow/narrow river channels) that increase the risk of interactions between vessels and Atlantic sturgeon. These geographic features are not present in the waters of the action area and thus, vessel strike is not considered to be a significant threat in the open waters of the ocean. Additionally, in contrast to the Delaware and James rivers where several vessel-struck individuals are identified each year, very few Atlantic sturgeon with injuries consistent with vessel strike have been observed in the ocean environment. Although the likelihood of a vessel collision with Atlantic sturgeon in the ocean environment is expected to be low, we cannot discount the possibility of such an interaction and as such, will discuss below the risk of such an interaction.

As described above, although Atlantic sturgeon may be found foraging in the action area, Atlantic sturgeon are likely to be primarily using the action area as a migratory route to and from spawning, overwintering, and/or foraging sites along the U.S. eastern coastline. Based on available information, it is believed that when migrating, Atlantic sturgeon are found primarily at mid-water depths (Cameron 2010) and while foraging, within the bottom meter of the water column. As depths within the portion of the action area that dredges will be operating will be between 30 to 65 feet, there should be sufficient clearance between the underkeel of the dredge and the bottom so that Atlantic sturgeon should be able to continue essential behaviors (e.g., migration, foraging) without an interaction with a dredge to occur. However, Atlantic sturgeon are not restricted to these depths, and on occasion, have been known to occur in the upper water column. Similar to sea turtles, it may be assumed that Atlantic sturgeon are more likely to avoid injury from slower-moving vessels since the sturgeon has more time to maneuver and avoid the vessel. The speed of the dredge is not expected to exceed 3 knots while dredging and is expected to operate at a maximum speed of 14 knots while transiting to and from the borrow area. As such, the 14 knot or less speed of the dredge vessel is likely to reduce the chances of collision with an Atlantic sturgeon. In addition, as noted above, locations that support large ports and have relatively narrow waterways seem to be more prone to ship strikes. Neither of these characteristics applies to the action area, which is located in waters offshore of Virginia, and as such, further reduces the likelihood of an interaction/strike of a dredge vessel with an Atlantic sturgeon. Based on this and the best available information, the potential interaction of a dredge/vessel and an Atlantic sturgeon is likely to be discountable.

Effects of Vessel Collisions on Whales

Large whales, particularly right whales, are vulnerable to injury and mortality from ship strikes. Ship strike injuries to whales take two forms: (1) propeller wounds characterized by external gashes or severed tail stocks; and (2) blunt trauma injuries indicated by fractured skulls, jaws, and vertebrae, and massive bruises that sometimes lack external expression (Laist *et al.* 2001). Collisions with smaller vessels may result in propeller wounds or no apparent injury, depending on the severity of the incident. Laist *et al.* (2001) reports that of 41 ship strike accounts that reported vessel speed, no lethal or severe injuries occurred at speeds below ten knots, and no collisions have been reported for vessels traveling less than six knots. A majority of whale ship strikes seem to occur over or near the continental shelf, probably reflecting the concentration of vessel traffic and whales in these areas (Laist *et al.* 2001). As discussed in the Status of the Species section, all whales are potentially subject to collisions with ships. However, due to their critical population status, slow speed, and behavioral characteristics that cause them to remain at the surface, vessel collisions pose the greatest threat to right whales. From 2003-2007, NMFS confirmed that seven female right whales have been killed by ship collisions, one of which was carrying a near-term fetus. Because females are more critical to a population's ability to replace its numbers and grow, the premature loss of even one reproductively mature female could hinder the species' likelihood of recovering.

Most ship strikes have occurred at vessel speeds of 13-15 knots or greater (Jensen and Silber 2003; Laist *et al.* 2001). An analysis by Vanderlaan and Taggart (2006) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%. Under the proposed action, the speed of the dredge is not expected to exceed 3 knots while dredging and it is expected to operate at a maximum speed of 10 knots while transiting to and from the borrow area during the months of November 1 to April 30, and a maximum speed of 14 knots when transiting during the months of May 1 to October 31 of any year. As noted above, observers will be present during vessels transiting to and from the disposal site; NMFS guidelines on interactions with and harassment of whales will be followed; and, all dredge operators will monitor the right whale sighting reports (i.e., SAS, DMAs, and SMAs) to ascertain the potential presence of listed species of whales within the action area. Based on these measures, and the fact that all vessels operators and observers will receive training on prudent vessel operating procedures to avoid vessel strikes with all protected species, the potential interaction of a dredge/vessel and a listed species of whale is likely to be discountable

7.1.5 Dredge Noise and Effects of Exposure to Increased Underwater Noise Levels

The level of a sound in water can be expressed in several different ways, but always in terms of dB relative to 1 micro-Pascal (μPa). Decibels, a log scale, is used to "compress" very large differences of sound level (e.g., from a whisper to cracking of thunder) into more manageable numbers. Each 10 dB increase is a ten-fold increase in sound pressure. Accordingly, a 10 dB increase is a 10x increase in sound pressure, and a 20 dB increase is a 100x increase in sound pressure.

Several measures of sound will be considered here:

- Peak sound pressure level (SPL) is the maximum sound pressure level in a signal measured in dB re 1 μPa (micropascal).
- Sound exposure level (SEL) is the integration over time of the squared instantaneous sound pressure normalized to a 1-sec period. This measure is an indication of the total acoustic energy received by an organism from a particular source. Measured in dB re 1μPa2-s.
- Root mean square (RMS) pressure level is the square root of the time average of the squared pressures. Measured in dB re 1 μPa.

Sound levels are analyzed in several different ways. The most common approach is "root mean square" (rms); however, one may measure "Peak" sound level, which is the highest level of sound within a signal. Peak is most often used to give an indication of the maximum level of a sound, but it does not give a good picture of the overall sound pressure in a signal. SEL is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a particular source.

7.1.5.1 Summary of available information on hearing ability of listed species

Right, Humpback, and Fin Whale Hearing

In order for right, humpback, and fin whales to be adversely affected by dredge noise, they must be able to perceive the noises produced by the activities. If a species cannot hear a sound, or hears it poorly, then the sound is unlikely to have a significant effect (Ketten 1998). Baleen whale hearing has not been studied directly, and there are no specific data on sensitivity, frequency or intensity discrimination, or localization (Richardson *et al.* 1995) for these whales. Thus, predictions about probable impact on baleen whales are based on assumptions about their hearing rather than actual studies of their hearing (Richardson *et al.* 1995; Ketten 1998). Ketten (1998) summarized that the vocalizations of most animals are tightly linked to their peak hearing sensitivity. Hence, it is generally assumed that baleen whales hear in the same range as their typical vocalizations, even though there are no direct data from hearing tests on any baleen whale. Most baleen whale sounds are concentrated at frequencies less than 1 kHz (Richardson *et al.* 1995), although humpback whales can produce songs up to 8 kHz (Payne and Payne 1985). Based on indirect evidence, at least some baleen whales are quite sensitive to frequencies below 1 kHz but can hear sounds up to a considerably higher but unknown frequency. Most of the man-made sounds that elicited reactions by baleen whales were at frequencies below 1 kHz (Richardson *et al.* 1995). Some or all baleen whales may hear infrasounds, sounds at frequencies well below those detectable by humans. Functional models indicate that the functional hearing of baleen whales extends to 20 Hz, with an upper range of 30 Hz. Even if the range of sensitive hearing does not extend below 20-50 Hz, whales may hear strong infrasounds at considerably lower frequencies. Based on work with other marine mammals, if hearing sensitivity is good at 50 Hz, strong infrasounds at 5 Hz might be detected (Richardson *et al.* 1995). Fin whales are predicted to hear at frequencies as low as 10-15 Hz. The right whale uses tonal signals in the frequency range from roughly 20 to 1000 Hz, with broadband source levels ranging from 137 to 162 dB (RMS) re 1 μPa at 1 m (Parks & Tyack 2005). One of the more common sounds made by right whales is the "up call," a frequency-modulated upsweep in the 50–200 Hz range (Mellinger 2004). The following table summarizes the range of sounds produced by right, humpback, and fin whales (from Au *et al.* 2000):

Table 10. Summary of known right, humpback, and fin whale vocalizations

Species	Signal type	Frequency Limits (Hz)	Dominant Frequencies (Hz)	Source Level (dB re 1μPa RMS)	References
Northern right	Moans	< 400	--	--	Watkins and Schevill (1972)
	Tonal	20-1000	100-2500	137-162	Parks and Tyack (2005)
	Gunshots		50-2000	174-192	Parks et al. (2005)
Humpback	Grunts	25-1900	25-1900	--	Thompson, Cummings, and Ha (1986)
	Pulses	25-89	25-80	176	Thompson, Cummings, and Ha (1986)
	Songs	30-8000	120-4000	144-174	Payne and Payne (1985)
Fin	FM moans	14-118	20	160-186	Watkins (1981), Edds (1988), Cummings and Thompson (1994)
	Tonal	34-150	34-150		Edds (1988)
	Songs	17-25	17-25	186	Watkins (1981)

Most species also have the ability to hear beyond their region of best sensitivity. This broader range of hearing probably is related to their need to detect other important environmental phenomena, such as the locations of predators or prey. Considerable variation exists among marine mammals in hearing sensitivity and absolute hearing range (Richardson *et al.* 1995; Ketten 1998); however, from what is known of right, humpback, and fin whale hearing, hearing ranges of these species are likely to have peak sensitivities in low frequency ranges.

Sea Turtle Hearing

The hearing capabilities of sea turtles are poorly known. Few experimental data exist, and since sea turtles do not vocalize, inferences cannot be made from their vocalizations as is the case with baleen whales. Direct hearing measurements have been made in only a few species. An early experiment measured cochlear potential in three Pacific green turtles and suggested a best hearing sensitivity in air of 300–500 Hz and an effective hearing range of 60–1,000 Hz (Ridgway *et al.* 1969). Sea turtle underwater hearing is believed to be about 10 dB less sensitive than their in-air hearing (Lenhardt 1994). Lenhardt *et al.* (1996) used a behavioral "acoustic startle response" to measure the underwater hearing sensitivity of a juvenile Kemp's ridley and a juvenile loggerhead turtle to a 430-Hz tone. Their results suggest that those species have a hearing sensitivity at a frequency similar to those of the green turtles studied by Ridgway *et al.* (1969). Lenhardt (1994) was also able to induce startle responses in loggerhead turtles to low frequency (20–80 Hz) sounds projected into their tank. He suggested that sea turtles have a range of best hearing from 100–800 Hz, an upper limit of about 2,000 Hz, and serviceable hearing abilities below 80 Hz. More recently, the hearing abilities of loggerhead sea turtles were measured using auditory evoked potentials in 35 juvenile animals caught in tributaries of Chesapeake Bay (Bartol *et al.* 1999). Those experiments suggest that the effective hearing range of the loggerhead sea turtle is 250–750 Hz and that its most sensitive hearing is at 250 Hz. In general, however, these experiments indicate that sea turtles generally hear best at low frequencies and that the upper frequency limit of their hearing is likely about 1 kHz.

Atlantic Sturgeon Hearing

There are no data both in terms of hearing sensitivity and structure of the auditory system for Atlantic sturgeon; however, there are a few studies or published data available on hearing in other sturgeon species, such as the closely related lake sturgeon (Lovell *et al.* 2005; Meyer *et al.* 2010). Initial studies by Meyer and Popper (2002) measuring responses of the ear using physiological methods suggest that a species of *Acipenser* may be able to detect sounds from below 100 Hz to possibly higher than 1,000 Hz. Lovell *et al.* (2005) suggests that lake sturgeon can hear sounds from below 100 Hz to about 500 Hz, whereas Meyer *et al.* (2010) reported evidence to suggest that the same species may hear up to 800 Hz. Since both studies examined responses of the ear and did not examine whether fish would behaviorally respond to sounds detected by the ear, it is hard to determine thresholds for hearing (that is, the lowest sound levels that an animal can hear at a particular frequency).

In addition, due to the lack of an acoustic coupling between the swim bladder and inner ear (characteristic of hearing specialist), sturgeon are considered hearing "generalists," meaning that they are unlikely to detect sound at frequencies above 1 to 1.5 kilohertz (kHz), and compared to "hearing specialists," they have a higher sound detection threshold (i.e., require higher intensity before detection) for the same frequencies of sound (Popper 2008; NMFS 2008). Additionally, as hearing generalists, sturgeon rely primarily on particle motion to detect sounds (Lovell *et al.* 2005), which does not propagate as far from the sound source as does pressure. Based on this and the best available information, hearing thresholds for Atlantic sturgeon are expected to range from 100 Hz to 1000 Hz (Meyer and Popper 2002; Popper 2005; Lovell *et al.* 2005).

7.1.5.2 Criteria for Assessing Potential for Physiological and Behavior Effects

When anthropogenic disturbances elicit responses from sea turtles, Atlantic sturgeon, and marine mammals, it is not always clear whether they are responding to visual stimuli, the physical presence of humans or manmade structures, acoustic stimuli, or any combination of these.

However, because sound travels well underwater it is reasonable to assume that, in many conditions, marine organisms would be able to detect sounds from anthropogenic activities before receiving visual stimuli. As such, exploring the acoustic effects of the proposed dredging operations provides a reasonable and conservative estimate of the magnitude of disturbance caused by the general presence of a hopper dredge in the marine environment, as well as the specific effects of sound on marine mammal and sea turtle behavior.

Marine organisms rely on sound to communicate with conspecifics and derive information about their environment. There is growing concern about the effect of increasing ocean noise levels due to anthropogenic sources on marine taxa, particularly marine mammals. Effects of noise exposure on these taxa can be characterized by the following range of behavioral and physical responses (Richardson *et al.* 1995):

1. Behavioral reactions – Range from brief startle responses, to changes or interruptions in feeding, diving, or respiratory patterns, to cessation of vocalizations, to temporary or permanent displacement from habitat.

2. Masking – Reduction in ability to detect communication or other relevant sound signals due to elevated levels of background noise.

3. Temporary threshold shift (TTS) – Temporary, fully recoverable reduction in hearing sensitivity caused by exposure to sound. TTS may occur within specified frequency range or across all frequency ranges.

4. Permanent threshold shift (PTS) – Permanent, irreversible reduction in hearing sensitivity due to damage or injury to ear structures caused by prolonged exposure to sound or temporary exposure to very intense sound. PTS may occur within a specified frequency range or across all frequency ranges.

5. Non-auditory physiological effects – Effects of sound exposure on tissues in non-auditory systems either through direct exposure or as a consequence of changes in behavior (e.g., resonance of respiratory cavities or growth of gas bubbles in body fluids).

Under the proposed action, dredging will produce sound that may affect listed species of sea turtles, whales and Atlantic sturgeon. The criteria described below will be used to assess the physiological and behavior effects of dredge noise on listed species of whales, sea turtles, and Atlantic sturgeon.

Whales

NMFS is in the process of developing a comprehensive acoustic policy that will provide guidance on assessing the impacts of anthropogenically produced sound on marine mammals. In the interim, NMFS' current thresholds for determining impacts to marine mammals typically center around root-mean-square (RMS) received levels of 180 dB re 1μPa for potential injury, 160 dB re 1μPa for behavioral disturbance/harassment from an impulsive noise source (e.g., seismic survey), and 120 dB re 1μPa for behavioral disturbance/harassment from a continuous noise source (e.g., dredging). These thresholds are based on a limited number of experimental studies on captive odontocetes and pinnipeds, a limited number of controlled field studies on wild marine mammals, observations of marine mammal behavior in the wild, and inferences from studies of hearing in terrestrial mammals. In addition, marine mammal responses to sound can be highly variable, depending on the individual hearing sensitivity of the animal, the behavioral or motivational state at the time of exposure, past exposure to the noise which may have caused habituation or sensitization, demographic factors, habitat characteristics, environmental factors that affect sound transmission, and non-acoustic characteristics of the sound source, such as whether it is stationary or moving (NRC 2003). Nonetheless, the threshold levels referred to above are considered conservative and are based on the best available scientific information and will be used as guidance in the analysis of effects on listed species of whales for this Opinion.

Sea Turtles

Currently there are no established thresholds for injury or behavioral disturbance/harassment for sea turtles. As noted above, the hearing capabilities of sea turtles are poorly known and there is little available information on the effects of noise on sea turtles; however, McCauley *et al.* (2000) noted that decibel levels of 166 dB re 1 μPa RMS were required before any behavioral reaction (e.g., increased swimming speed) was observed, and decibel levels above 175 dB re 1 μPa RMS elicited avoidance behavior of sea turtles. Based on this and the best available information, NMFS believes any underwater noise levels at or above 166 dB re 1μPa RMS has the potential to adversely affect sea turtles (e.g., injury, temporary threshold shifts, behavior alteration) and thus, will be used as guidance in the analysis of effects on listed species of sea turtles for this Opinion.

Atlantic sturgeon

No information on the effects of dredge noise on fish is currently available; however, information on the effects of noise exposure from other underwater activities, such as pile driving, are available and as such, serve as the best available information on underwater noise levels and potential effects to Atlantic sturgeon.

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, USFWS, FHWA, and the California, Washington and Oregon DOTs, supported by national experts on sound propagation activities that affect fish and wildlife species of concern. In June 2008, the agencies signed an MOA documenting criteria for assessing physiological effects of pile driving on fish. The criteria were developed for the acoustic levels at which physiological effects to fish could be expected. It should be noted, that these are onset of physiological effects (Stadler and Woodbury 2009), and not levels at which fish are necessarily mortally damaged. These criteria were developed to apply to all species, including listed green sturgeon, which are biologically similar to shortnose and Atlantic sturgeon and for these purposes can be considered a surrogate. The interim criteria are:

- Peak SPL: 206 decibels relative to 1 micro-Pascal (dB re 1 μPa).

- cSEL[10] :187 decibels relative to 1 micro-Pascal-squared second (dB re 1 μPa^2-s) for fishes above 2 grams (0.07 ounces).

- cSEL: 183 dB re 1 μPa^2-s for fishes below 2 grams (0.07 ounces).

NMFS has relied on these criteria in determining the potential for physiological effects in ESA Section 7 consultations conducted on the US West Coast. At this time, they represent the best available information on the thresholds at which physiological effects to sturgeon are likely to occur. It is important to note that physiological effects may range from minor injuries from which individuals are anticipated to completely recover with no impact to fitness to significant injuries that will lead to death. The severity of injury is related to the distance from the noise source and the duration of exposure (i.e., the closer to the source and the greater the duration of the exposure, the higher likelihood of significant injury). As such, for the purposes of this Opinion, we consider exposure to underwater noise levels of 206 dB re 1 μPa Peak and 187 dB 1 $\mu Pa^2 \cdot s$ cSEL a conservative estimate of the level of dredge noise that has the potential to incur physiological effects upon Atlantic sturgeon. Please note, use of the 183 dB 1 $\mu Pa^2 \cdot s$ cSEL threshold, is not appropriate for this consultation because all Atlantic sturgeon in the action area will be larger than 2 grams. As explained here, physiological effects could range from minor injuries that a fish is expected to completely recover from with no impairment to survival to major injuries that increase the potential for mortality, or result in death.

In regards to behavioral responses to underwater noise, results of empirical studies of hearing of fishes, amphibians, birds, and mammals (including humans), in general, show that behavioral responses vary substantially, even within a single species, depending on a wide range of factors, such as the motivation of an animal at a particular time, the nature of other activities that the animal is engaged in when it detects a new stimulus, the hearing capabilities of an animal or species, and numerous other factors (Brumm and Slabbekoorn 2005). Thus, it may be difficult to assign a single criterion above which behavioral responses to noise would occur.

In order to be detected, a sound must be above the "background" level. Additionally, results from some studies suggest that sound may need to be biologically relevant to an individual to elicit a behavioral response. For example, in an experiment on responses of American shad to sounds produced by their predators (dolphins), it was found that if the predator sound is detectable, but not very loud, the shad will not respond (Plachta and Popper 2003). But, if the sound level is raised an additional 8 or 10 dB, the fish will turn and move away from the sound source. Finally, if the sound is made even louder, as if a predator were nearby, the American shad go into a frenzied series of motions that probably helps them avoid being caught. It was speculated by the researchers that the lowest sound levels were those recognized by the American shad as being from very distant predators, and thus, not worth a response. At somewhat higher levels, the shad recognized that the predator was closer and then started to swim away. Finally, the loudest sound

- [10] cSEL is the energy accumulated over multiple strikes and indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on the level of the single strike SEL. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single strike SELs. Thus, cSEL (dB) = Single-strike SEL + $10\log_{10}(N)$; where N is the number of strikes.

was thought to indicate a very near-by predator, eliciting maximum response to avoid predation. Similarly, results from Doksaeter *et al.* (2009) suggest that fish will only respond to sounds that are of biological relevance to them. This study showed no responses by free-swimming herring (*Clupea* spp.) when exposed to sonars produced by naval vessels; but, sounds at the same received level produced by major predators of the herring (killer whales) elicited strong flight responses. Sound levels at the fishes from the sonar in this experiment were from 197 dB to 209 dB re 1 μPa RMS at 1,000 to 2,000Hz.

For purposes of assessing behavioral effects of pile driving at several West Coast projects, NMFS has employed a 150dB re 1 μPa RMS SPL criterion at several sites including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. For the purposes of this consultation we will use 150 dB re 1 μPa RMS as a conservative indicator of the noise level at which there is the potential for behavioral effects. That is not to say that exposure to noise levels of 150 dB re 1 μPa RMS will always result in behavioral modifications or that any behavioral modifications will rise to the level of "take" (i.e., harm or harassment) but that there is the potential, upon exposure to noise at this level, to experience some behavioral response.

As hearing generalists, sturgeon rely primarily on particle motion to detect sounds (Lovell *et al.* 2005), which does not propagate as far from the sound source as does pressure. However, a clear threshold for particle motion was not provided in this study. In addition, flanking of the sounds through the substrate may result in higher levels of particle motion at greater distances than would be expected from the non-flanking sounds. Unfortunately, data on particle motion from pile driving, and even dredging, is not available at this time, and we are forced to rely on sound pressure level criteria. Although we agree that more research is needed, other studies have been conducted that support use of this level as an indication for when behavioral effects could be expected (e.g., Mueller-Blenke *et al.* 2010; Andersson *et al.* 2007; Purser and Radford 2011; Wysocki *et al.* 2007). Given the available information from studies on other fish species, we consider 150 dB re 1 μPa RMS to be a reasonable estimate of the noise level at which exposure may result in behavioral modifications and as such, we will use 150 dB re 1 μPa RMS as a guideline for assessing when behavioral responses to dredge noise may be expected. The effect of any anticipated response on individuals will be considered in the effects analysis below.

7.1.5.3 Noise Associated with Dredging

Noise generated by dredges are considered continuous and low in frequency (i.e., no rapid rise times; frequency bandwidth between 50 and 1000 Hertz (Hz)) (Richardson *et al.* 1995; Defra 2003; MALSF 2009; 74FR 46090, September 8, 2009) and as such, are within the audible range of listed species of whales, sea turtles and Atlantic sturgeon (e.g., auditory bandwidth for right, humpback, and fin whales are 7 Hz-22kHz (Southall *et al.* 2007); hearing thresholds for sea turtles are 100-1000 Hz (Ketten and Bartol 2005); approximately 100-500 Hz for sturgeon (Meyer and Popper 2002; Popper 2005; Lovell *et al.* 2005)). Low frequency noise tends to carry long distances in water, but due to spreading loss, is attenuated as the distance from the source increases. Under the proposed action, underwater noise will be generated through the use of a hopper dredge. The primary noise produced from a hopper dredge is associated with the suction pipes and pumps used to remove the fill from the seabed; however, these noise levels fluctuate with the operational status of the dredge, with the highest levels occurring during loading operations (i.e., during the removal of the substrate) (Greene 1985a, 1987). Greene (1987) measured hopper dredge noise during the removal of gravel in the Beaufort Sea and reported received levels of 142 dB re 1 μPa at 0.93 kilometers (km) (0.58 miles) for loading operations at a depth of 20 meters, 127 dB re 1 μPa at 2.4 km (1.5 miles) while underway, and 117 dB re 1 μPa at 13.3 km (8.3 miles) while pumping at a depth of 13 meters. However, based on our review of the paper by Greene (1987) and a document by the USACE (Clarke *et al.* 2003), which dealt with the removal of sand substrate via a hopper dredge, NMFS has determined that the most appropriate document to use in the analysis of dredge noise, for the purposes of this proposed action, is the information presented by Clarke *et al.* (2003), as it deals with the removal of similar substrate and the recorded levels of underwater noise are in accordance with thresholds established by NMFS (i.e., RMS values) for marine mammals. Additionally, in the analysis of dredge noise and propagation undertaken by NMFS, a transmission loss of 15 log R was used over 10 log R as the latter is more appropriate to use for dredging operations occurring in extremely shallow waters (e.g., less than 25 feet). Based on this information, NMFS has calculated that within 794 meters from the dredge, noise levels could reach 120 dB re 1 μPa RMS, with source levels of approximately 164 dB re 1 μPa RMS (approximately 154 dB re 1 μPa^2-s cSEL; 179 dB re 1 μPa Peak) being produced approximately 1 meter from the dredge. It should be noted that to date, equations that take into account other factors affecting perceived underwater noise levels and the propagation of noise (e.g., water depth, frequency, absorptive bottom substrate, ambient noise levels, level of activity in the area, etc.) have not been developed and as such, the estimated distances by NMFS are most likely overestimates of where increased underwater noise levels will be experienced. Based on the best available information, listed species of whales and sea turtles and Atlantic sturgeon may be exposed to increased underwater noise levels within the action area; however, the audibility and behavioral response of listed species of whales and sea turtles and Atlantic sturgeon is dependent on many factors, such as the physical environment (e.g., depth), existing ambient noise, acoustic characteristics of the sound (e.g., frequency), hearing ability of the animal, as well as behavioral context of the animal (e.g., feeding, migrating, resting) (Southall *et al.* 2007).

7.1.5.4 Effects of Exposure to Dredge Noise

7.1.5.4.1 Exposure to Injurious Levels of Sound

As described above, NMFS considers 180 dB re 1 μPa RMS to be the onset of potential for injury for cetaceans; 166 dB re 1 μPa RMS for sea turtles; and 206 dB re 1 μPa Peak and 187 dB re 1 μPa2-s cSEL for the onset of potential injury/mortality to Atlantic sturgeon. However, based on the scientific literature, injury likely occurs at some level well above this level. Therefore, these levels are considered conservative. Regardless, hopper dredging under the proposed action will not generate source levels in excess of 180 dB re 1 μPa RMS (approximately 195 dB re 1 μPa Peak) and thus is not likely to cause injury to whales, sea turtles or Atlantic sturgeon. The predominant noise source associated with hopper dredging is caused by the noise generated by suction pipes and pumps. Although source levels of some dredging operations have been reported to reach source levels of 180 dB re 1 μPa RMS (195 dB re 1 μPa Peak) within 10 meters or less of the dredge, it is extremely unlikely that whales, Atlantic sturgeon, or sea turtles would be exposed to such injurious sound levels as the dredges are moving at very slow speeds (i.e., 10 knots or less), minimizing the likelihood that a sea turtle, Atlantic sturgeon, or whale would be unable to move away from an approaching vessel before the received level reaches a potentially injurious threshold. Based on this information, and the fact that the source levels of dredge noise under the proposed action will not exceed 164 dB re 1 μPa RMS (154 dB re 1 μPa2-s cSEL; 179 dB re 1 μPa Peak), sea turtles, Atlantic sturgeon, and whales are not likely to be exposed to levels of dredge related noise that will result injury.

7.1.5.4.2 Exposure to Behaviorally Disturbing Levels of Sound

Sea Turtles

There is very little information about sea turtle behavioral reactions to levels of sound below the thresholds suspected to cause injury or TTS. However, as noted above, McCauley (2000) noted that dB levels of 166 dB re 1 μPa RMS were required before any behavioral reaction was observed. As underwater noise levels produced by dredging operations throughout the 1.5 life of the proposed action will not exceed 166 dB re 1 μPa RMS (i.e., maximum underwater noise levels will be 164 dB re 1 μPa RMS within 1 meter of the dredge) under water noise levels are not likely to reach levels that will disturb sea turtles.

Atlantic sturgeon

As noted above, 150 dB re 1 μPa RMS is believed to be a reasonable estimate of the noise level at which exposure may result in behavioral modifications. As dredging operations will produce underwater noise levels above 150 dB re 1 μPa RMS within 10 meters of the dredge, and as the hearing threshold of Atlantic sturgeon overlaps with that of dredges, it is likely that if present in the action area, Atlantic sturgeon will be able to detect the presence of the dredge, resulting in possible behavioral modification. However, based on a recent study done in the James River, Atlantic sturgeon continued normal behavior within the river, regardless of the presence of a dredge and showed no signs of impeded movement, up or downriver, due to the presence of the dredge and in fact, actively moved past the dredge (Cameron 2010). Additionally, an avoidance response (e.g., due to dredge noise) was never observed by Atlantic sturgeon as indicated by Atlantic sturgeon remaining in close proximity to the dredge following tagging release. (i.e., the fish remained in proximity to the dredge for 3.5 to 21.5 hours following release). Based on this information, it is unlikely that the elevated levels of underwater noise will cause significant behavioral changes of Atlantic sturgeon that may be present in the offshore borrow site and thus, if any minor movements away from the area being dredged do occur, it is extremely unlikely that these movements will cause substantial changes to essential Atlantic sturgeon behaviors (e.g., reproduction, foraging, resting, and migration). Additionally, as noted above, the extent of underwater noise is not likely to present a barrier to Atlantic sturgeon movements and as such, if individuals are present within the vicinity of the action area, they are likely to continue normal behaviors (e.g., feeding, resting, and migrating) in other portions of the action area and/or in other locations within Virginia coastal waters. Based on this and the best available information, NMFS concludes that dredge noise is not likely to cause significant behavior modification to Atlantic sturgeon.

Whales

As described above, dredging noise is not expected to cause injury to whales; however, there is potential for whales to be exposed to behaviorally disturbing levels of sound produced by these activities. Potentially disturbing levels of construction-related noise (120-160 dB re 1 μPa RMS) are expected to propagate over distances ranging from 1.0 to 794 meters from the source. As dredging operations are proposed to occur year round and humpbacks are likely to occur in the action area from September-April; right whales from November-May; and Fin whales from October-January; and, individual transient whales could be present in the action area outside of these time frame as this area is used by whales migrating between calving/mating grounds and foraging grounds, there is a potential for listed species to be exposed to increased underwater noise levels at any time throughout the year. Based on this information, the remainder of the acoustics portion of the analysis will focus on the effects of dredge noise on listed species of whales.

Characterizing the effects of noise on whales involves assessing the species' sensitivity to the particular frequency range of the sound; the intensity, duration, and frequency of the exposure; the potential physiological effects caused by the animals response to the increase in underwater noise; and, the potential behavioral responses that could lead to impairment of feeding, breeding, nursing, breathing, sheltering, migration, or other biologically important functions. To date, few studies have been done that analyze and assess the effects of dredge noise and operations on marine mammals. Much of any analysis involving the effects of anthropogenic sounds on listed species relates to how an animal may change behavior upon exposure to vessel noise and operations (e.g., drillships and seismic vessels) and as such, will be used as the best available information in referencing potential effects of dredge noise on listed species of whales.

The most commonly observed marine mammal behavioral responses to vessel noise and activities include increased swim speed (Watkins 1981), horizontal and vertical (diving) avoidance (Baker *et al.* 1983; Richardson *et al.* 1985), changes in respiration or dive rate (Baker *et al.* 1982; Bauer and Herman 1985; Richardson *et al.* 1985; Baker and Herman 1989; Jahoda *et al.* 2003), and interruptions or changes in feeding or social behaviors (Richardson *et al.* 1985; Baker *et al.* 1982; Jahoda *et al.* 2003). However, Watkins (1981) noted that the passage of a tanker within 800 m did not disrupt feeding humpback whales and Brewer *et al.* (1993) and Hall *et al.* (1994) reported numerous sightings of marine mammals, including bowhead whales, in the vicinity of offshore drilling operations in the Beaufort Sea, with one whale sighted 400 m of the drilling vessel. Additionally, based on the review of a number of papers describing the response of marine mammals to non-pulsed sound, Southall *et al.* (2007) reported that in general, behavioral responses of marine mammals did not occur until sounds were higher than 120 dB and that many animals had no observable response at all when exposed to anthropogenic sound at levels of 120 dB re 1 μPa RMS or even higher.

Although the above studies demonstrate that a high degree of variability exists in the intensity of responses of marine mammals to vessel noise and activities, it is still unclear whether these responses are due solely to the increase in underwater noise levels, the physical presence of a nearby vessel, or a combination of both. Often, specific acoustic features of the sound and contextual variables (i.e., proximity, durations, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone (75 FR Register 20482, April 19, 2010). For instance, Baker *et al.*

(1982) found that abrupt changes in engine speed and aggressive maneuvers such as circling the whale or crossing directly behind or in front of the whale or its projected path elicited much stronger responses than unobtrusive maneuvering (tracking in parallel to the whale and changing vessel speed only when necessary to maintain a safe distance from the whale). Reactions were even less intense during a simple straight line passby, which most closely represents the type of vessel transit that will take place as a result of the construction activities (i.e., not targeted toward viewing whales).

Richardson *et al.* (1985) observed strong reactions in bowhead whales to approaching boats and subtler reactions to drillship playbacks, but also found that bowhead whales often occurred in areas where low frequency underwater noise from drillships, dredges, or seismic vessels was readily detectable, suggesting that bowheads may react to transient or recently begun industrial activities, but may tolerate noise from operations that continue with little change for extended periods of time (hours or days).

Watkins (1986) compiled and summarized whale responses to human activities in Cape Cod Bay over 25 years, and found that the types of reactions had shifted over the course of time, generally from predominantly negative responses to an increasing number of uninterested or positive responses, although trends varied by species and only emerged over relatively long spans of time (i.e., individual variability from one experience to the next remains high). Watkins also noted that whales generally appeared to habituate rapidly to stimuli that were relatively non-disturbing.

One playback experiment on right whales recorded behavioral reactions on summer foraging grounds to different stimuli, including an alert signal, vessel noise, other whale social sounds, and a silent control (Nowacek *et al.* 2004). No significant response was observed in any case except the alert signal broadcast ranging from 500 to 4,500 Hz. In response to the alert signal, which had measured received levels between 130 and 150 dB, whales abandoned current foraging dives, began a high power ascent, remained at or near the surface for the duration of the exposure, and spent more time at subsurface depths (1 to 10 m) (Nowacek *et al.* 2004). The only whale that did not respond to this signal was the sixth and final whale tested, which had potentially already been exposed to the sound five times. The lack of response to a vessel noise stimulus from a container ship and from passing vessels indicated that whales are unlikely to respond to the sounds of approaching vessels even when they can hear them (Nowacek *et al.* 2004). This non-avoidance behavior could be an indication that right whales have become habituated to the vessel noise in the ocean and therefore do not feel the need to respond to the noise or may not perceive it as a threat. In another study, scientists played a recording of a tanker using an underwater sound source and observed no response from a tagged whale 600 meters away (Johnson and Tyack 2003). These studies may suggest that if right whales are startled or disturbed by novel construction sounds, they may temporarily abandon feeding activities, but may habituate to those sounds over time, particularly if the sounds are not associated with any aversive conditions.

The evidence presented above indicates that animals do respond and modify behavioral patterns in the presence of vessel noise and activity, although adequate data does not yet exist to quantitatively assess or predict the significance of minor alterations in behavior to the health and viability of marine mammal and sea turtle populations. Based on this information it is reasonable to assume that the potential exists that dredge noise and operations under the proposed action may similarly cause behavioral changes to listed species of whales in the action area. However, in previous studies the areas of research were known to be sites where whales concentrated and as such had a higher probability of being exposed to elevated underwater noise levels that resulted in behavioral alterations. The action area is not known as an area where listed species of whales congregate for the purposes of foraging, resting, or reproduction. Instead, the action area is primarily used for migration to and from foraging and calving grounds throughout the year. As such, the behavioral responses observed in previous studies due to vessel noise and operations are extremely unlikely to occur under the proposed action as it is extremely unlikely that whales will be found in high concentrations in the action area, resulting in an extremely low probability that a whale will be within 794 meters of the dredge at any one time and therefore, exposed to levels of underwater noise levels that could adversely affect and/or cause behavioral changes to the animal in a manner that disrupts essential behaviors (e.g., feeding, resting, migrating, reproducing). In addition, in the unlikely event that a whale approaches the area where the dredge is in operation, the mitigation measures the Navy has established as part of the proposed action (e.g., NMFS approved sea turtle/marine mammal observer on board all dredge vessels; shut down of dredge pumps when a whale is observed within 1 km of the dredge; 500 yard restriction on vessel approach to right whales; compliance with SAS operations), will ensure that whales will not be exposed to underwater noise levels greater than or equal to 120 dB re 1 μPa RMS. Based on the best available information, NMFS concludes that the effects of dredge noise on listed species of whales will be insignificant and discountable.

In addition, it should be noted that when assessing the potential effects of anthropogenic noise on marine mammals, it is important to consider that there are "zones of audibility" and "zones of responsiveness" that will affect marine mammal responses to anthropogenic noise. The most extensive zone is the zone of audibility, the area within which the mammal might hear noise (Richardson *et al.* 1995). The zone of responsiveness is the region within which the animal reacts behaviorally (i.e., stop feeding) or physiologically (i.e., increase in respiratory rates) (Richardson *et al.* 1995). Marine mammals usually do not respond overtly to audible, but weak man made sounds and therefore, the zone of responsiveness is usually much smaller than the zone of audibility (Richardson *et al.* 1995). It is believed that marine mammals will not remain in areas where received levels of continuous underwater noise are 140 + dB at frequencies to which the animals are most sensitive (Richardson *et al.* 1995). As such, although underwater noise levels of 120 dB re 1 μPa RMS may be audible to listed species of whales within 794 meters of the dredge, the behavioral response to elevated noise levels most likely will occur within 40 meters or less from the dredge where underwater noise levels will be greater than or equal to 140 dB re 1 μPa RMS. As noted above, it is extremely unlikely for whales to be within 1 km of the dredge and therefore, extremely unlikely for a whale to be within 40 meters or less of the dredge where responses to underwater noise levels are believed to occur. In addition, with the mitigation measures in place, listed species of whales will not be exposed to levels greater than or equal 120 dB re 1 μPa RMS as all pumps will be turned off upon a whale observed within 1 km of the dredge. As such, based on the best available information, NMFS concludes that the effects of dredge noise on listed species of whales are discountable.

7.1.6 Fuel Oil Spills

Fuel oil spills could occur from the dredge plant or tender vessel. A fuel oil spill would be an unintended, unpredictable event. Marine animals, including whales, Atlantic sturgeon, and sea turtles, are known to be negatively affected by exposure to oil and other petroleum products. Without an estimate of the amount of fuel oil released it is difficult to predict the likely effects on listed species. No accidental spills of diesel fuel are expected during dredging operations; however, if such an incident does occur, spill prevention and response plans will be implemented to prevent and minimize any impacts associated with a spill will be implemented by all personnel to ensure a rapid response to any spill. As the effects of a possible spill are likely to be localized and temporary, sea turtles, Atlantic sturgeon, and whales are not likely to be exposed to oil and any effects would be discountable. Additionally, should a response be required by the United States Environmental Protection Agency or the USCG, there would be an opportunity for NMFS to conduct a consultation with the lead Federal agency on the oil spill response.

7.2 Effects of Sand Placement/Beach Renourishment

As noted in the Description of the Action, the Dam Neck Annex SPS will be replenished under the proposed action. The primary effects under consideration are: (1) reduction in Atlantic sturgeon and sea turtle prey and alteration of foraging behavior; and (2) suspended sediment associated with beach replenishment operations.

7.2.1 Interactions with the Sediment Plume

The placement of sand for the Dam Neck Annex SPS will cause an increase in localized turbidity associated with the beach nourishment operations in the nearshore environment and from the anchoring of the dredge and pump-out stations. Nearshore turbidity impacts from fill placement are directly related to the quantity of fines (silt and clay) in the nourishment material. As the material from the offshore borrow sites is comprised of medium sized grains of sand, and consists of beach quality sand of similar grain size and composition as indigenous beach sands, short suspension time and containment of sediment during and after placement activities is expected. As such, turbidity impacts are expected to be short-term (i.e., within several hours of the cessation of operations (Greene 2002)) and spatially limited to the vicinity of the dredge outfall pipe, the pump-out station, and dredge anchor points.

The Atlantic States Marine Fisheries Commission (Greene 2002) review of the biological and physical impacts of beach nourishment cites several studies that report that the turbidity plume and elevated TSS levels drop off rapidly seaward of the sand placement operations. Wilber *et al.* (2006) evaluated the effects of a beach nourishment project along the coast of northern New Jersey and reported that maximum bottom surf zone and nearshore TSS concentrations related to nourishment activities were 64 mg/L and 34 mg/L. These TSS levels were only slightly higher than background maximum bottom TSS concentrations in the surf and nearshore zones on unnourished portions of the beach (i.e., less than 20 mg/L). Additionally, Wilber *et al.* (2006) reported that elevated TSS concentrations associated with the active beach nourishment site were limited to within 400 m (1,310 ft) of the discharge pipe in the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves). Other studies found that the turbidity plume and elevated TSS levels are expected to be limited to a narrow area of the swash zone up to 500 m (1,640 ft) downcurrent from the discharge pipe (Schubel *et al.* 1978; Burlas *et al.* 2001). Based on this and the best available information, turbidity levels created by the beach renourishment operations for the Dam Neck Annex SPS are expected to be between 34-64 mg/l; limited to an area approximately 500 meters down current from the discharge pipe, with dissipation occurring within several hundred meters along the shore; and, are expected to be short term, only lasting several hours.

As noted above in section 7.1.3, no information is available on the effects of TSS on juvenile and adult sea turtles. Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). TSS is most likely to affect Atlantic sturgeon and sea turtles if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle prey. As Atlantic sturgeon and sea turtles are highly mobile they are likely to be able to avoid any sediment plume and any effect on sea turtle movements is likely to be insignificant. Additionally, the TSS levels expected are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical (Breitburg 1988 in Burton 1993; Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993)) and benthic communities (390.0 mg/L (EPA 1986)) and while the increase in suspended sediments may cause Atlantic sturgeon and sea turtles to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movements to alter course out of the sediment plume and is not likely to affect the movement or migration ability of Atlantic sturgeon and sea turtles. Based on this information, it is likely that the effect of the suspension of sediment resulting from beach fill operations on sea turtles and Atlantic sturgeon will be insignificant.

7.2.2 Alteration of Foraging Habitat

Sea Turtles

Of the listed species found in the action area, loggerhead and Kemp's ridley sea turtles are the most likely to utilize the nearshore area for feeding should forage items be available; however, based on the information provided to NMFS, the nearshore waters of the action area (i.e., within 300 feet of the mean high water mark where sand will be placed) are comprised primarily of polychaetes, snails, and aquatic insects, with low numbers of mollusks and crustaceans, the preferred forage of Kemp's and loggerhead sea (Navy 2012a; Morreale and Standora 1992 Bjorndal 1997). Additionally, water depths within this portion of the action area where sand will be placed range from approximately 2 to 10 feet (Navy 2012a, the website with Chesapeake Navigation Chart), which are inconsistent with the preferred habitats of foraging sea turtles (i.e., depths ranging from 16 to 49 feet; Morreale and Standora 1990). Based on this information, limited Kemp's ridley and loggerhead sea turtle foraging is expected to occur within this portion of the action area. In addition, as no seagrass beds exist along the nearshore area of Dam Neck Annex, green sea turtles will not use the nearshore area as foraging areas and as such, sand placement and beach nourishment are not likely to disrupt normal feeding behaviors of green sea turtles. Additionally, leatherback sea turtles are primarily pelagic, feeding on jellyfish and may come into shallow water if there is an abundance of jellyfish nearshore. However, as the nearshore area along Dam Neck Annex is not known to be an area where jellyfish concentrate, leatherback sea turtles are unlikely to be found foraging in the nearshore area where disposal activities will occur. As such, beach nourishment activities are not likely to disrupt leatherback foraging behavior.

Atlantic sturgeon

As described above, Atlantic sturgeon concentrate in several distinct areas along the eastern coastline of the United States, with the nearshore waters between the Chesapeake Bay and the Delaware Bay being one of these identified areas (i.e., Stein *et al.* 2004; Laney *et. al* 2007; Erickson et al. 2011; Dunton *et al.* 2010; NEFOP and ASM data 2006-2010; NEMAP data 2007-2011; NMFS inshore Trawl data 1972-2011). The portion of the action area where beach nourishment operations will take place is located within the range of this concentration area. Based on this and the best available information, the portion of the action area where beach nourishment operations will take place is likely to be used by foraging, overwintering, and/or migrating sturgeon throughout year, with the spring months likely to be months of highest sturgeon use (survey data from NEFOP and ASM 2006-2010; NEMAP 2007-2011; NMFS inshore Trawl 1972-2011). As such, the placement of sand at the Dam Neck Annex SPS could affect available Atlantic sturgeon food sources and thus, the foraging ability of Atlantic sturgeon. However, as Atlantic sturgeon foraging often occurs at or near areas with SAV and/or shellfish resources, the lack of these resources within the shallow nearshore waters of this portion of the action reduces the likelihood that foraging Atlantic sturgeon would be present in the action area.

Sea Turtle and Atlantic Sturgeon Foraging Effects

Beach nourishment can affect Atlantic sturgeon and sea turtles by reducing prey species through the alteration of the existing biotic assemblages. The placement of dredged sand at the Dam Neck Annex SPS will bury existing subtidal benthic organisms (e.g., polycheates, crustaceans and mollusks) along the area extending seaward, approximately 300-feet from the mean high water mark.

While some nearshore areas may be more desirable to certain turtles or Atlantic sturgeon due to prey availability, there is no information to indicate that the nearshore areas proposed for beach nourishment have more abundant sturgeon and turtle prey or better foraging habitat than other surrounding areas. The assumption can be made that sturgeon and sea turtles are not likely to be more attracted to the nearshore waters along the Dam Neck Annex SPS than to other foraging areas and should be able to find sufficient prey in alternate areas. Depending on the species, recolonization of a newly renourished beach are can begin in as short as 2 to 7 months (Burlas *et al.* 2001; Hackney *et al.* 1996; Jutte *et al.* 1999(a)(b)) when there is a good match between the fill material and the natural beach sediment. As the sand being placed along the Dam Neck Annex SPS is similar in grain size as the indigenous beach sand, it is expected that recolonization of the nearshore benthos will occur within 2 to 6.5 months after beach renourishment is complete. As such, no long term impacts on the numbers of species or community composition of the beach infauna is expected (USACE 1994; Burlas *et al.* 2001)

NMFS anticipates that while the beach nourishment activities may temporarily disrupt normal feeding behaviors for sturgeon and sea turtles by causing them to move to alternate areas, the beach nourishment activities are not likely to alter the habitat in any way that prevents sturgeon and sea turtles from using the action area as a migratory pathway to other near-by areas that may be more suitable for foraging. In addition, the placement of sand seaward of the shoreline, where previously no beach area existed, will have beneficial effects on benthic organisms by restoring and creating new beach habitat and therefore, providing additional sources of prey along the Dam Neck Annex SPS that previously were not present. As such, based on the best available information, the placement of sand is not likely to remove critical amounts of prey resources from the action area and any disruption to normal foraging is likely to be insignificant.

7.3 Fuel Oil Spills

Throughout the proposed project, construction vehicles will be present on the existing roads and also during the use of heavy machinery on the beach of Dam Neck Annex during the proposed action. The nearshore marine environment may be affected if a spill or leak from construction vehicles or heavy machinery occurs. Construction-related impacts are expected to be temporary and will not likely be adverse because any accidental release of contaminants or liquid fuels will be addressed in accordance with Navy spill prevention and response plans. As the effects of a possible spill are likely to be localized and temporary, sturgeon, sea turtles and whales are not likely to be exposed to oil and any effects would be discountable. Additionally, should a response be required by the United States Environmental Protection Agency or the USCG, there would be an opportunity for NMFS to conduct a consultation with the lead Federal agency on the oil spill response.

7.4 Climate Change-Related Effects of the Dam Neck Annex SPS Repairs

In sections 6.0 above we considered effects of global climate change, generally, on listed species of whales, sea turtles, and Atlantic sturgeon. Given the likely rate of climate change, it is unlikely that there will be any noticeable effects to sea turtles, whales, or Atlantic sturgeon in the action area over the life of the proposed action (i.e., through 2015). As explained above in sections 6.0, based on currently available information and predicted habitat changes, these effects are most likely to be changes in distribution/seasonal migrations of sea turtles, whales, and Atlantic sturgeon throughout the coastal waters of Virginia. Additionally, the proposed action will not affect the ability of these species to adapt to climate change or affect their movement or distribution along the coastline of Virginia or within waters of the Chesapeake Bay or Atlantic Ocean.

8.0 CUMULATIVE EFFECTS

Cumulative effects as defined in 50 CFR 402.02 to include the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions are not considered in the definition of "cumulative effects." Ongoing Federal actions are considered in the "Environmental Baseline" section above.

Sources of human-induced mortality, injury, and/or harassment of Atlantic sturgeon, whales, or sea turtles resulting from future State, tribal, local or private actions in the action area that are reasonably certain to occur in the future include incidental takes in state-regulated fishing activities, pollution, global climate change, and vessel collision. While the combination of these activities may affect Atlantic sturgeon, whales, or sea turtles, preventing or slowing the species' recovery, the magnitude of these effects in the action area is currently unknown. However, this Opinion assumes effects in the future would be similar to those in the past and are therefore reflected in the anticipated trends described in the status of the species/environmental baseline section.

State Water Fisheries- Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. A 1990 National Research Council report estimated that 550 to 5,500 sea turtles (juvenile and adult loggerheads and Kemp's ridleys) die each year from all other fishing activities besides shrimp fishing. Fishing gear in state waters, such as bottom trawls, gillnets, trap/pot gear, and pound nets, take sea turtles each year. NMFS is working with state agencies to address the take of sea turtles in state-water fisheries within the action area of this consultation where information exists to show that these fisheries take sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle takes in one or more gear types. However, given that state managed commercial and recreational fisheries along the Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional takes of sea turtles in these fisheries are anticipated. There is insufficient information by which to quantify the number of sea turtle takes presently occurring as a result of state water fisheries as well as the number of sea turtles injured or killed as a result of such takes. While actions have been taken to reduce sea turtle takes in some state water fisheries, the overall effect of these actions on reducing the take of sea turtles in state water fisheries is unknown, and the future effects of state water fisheries on sea turtles cannot be quantified.

Right and humpback whale entanglements in gear set for state fisheries are also known to have occurred (e.g., Waring *et al.* 2007; Glass *et al.* 2008). Actions have been taken to reduce the risk of entanglement to large whales, although more information is needed on the effectiveness of these actions. State water fisheries continue to pose a risk of entanglement to large whales to a level that cannot be quantified.

Information on interactions with Atlantic sturgeon with state fisheries operating in the action area is not available, and it is not clear to what extent these future activities will affect listed species differently than the current activities described in the Status of the Species/Environmental Baseline section. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the status of the species/environmental baseline section.

Vessel Interactions- As noted in the Environmental Baseline section, private vessel activities in the action area may adversely affect listed species in a number of ways, including entanglement, boat strike, or harassment. As vessel activities will continue in the future, the potential for a vessel to interact with a listed species exists; however, the frequency in which these interactions will occur in the future is unknown and thus, the level of impact to sea turtle, whale, or Atlantic sturgeon populations cannot be projected. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the status of the species/environmental baseline section.

Pollution and Contaminants – Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts from them on Atlantic sturgeon, sea turtles, or whales. However, the level of impacts cannot be projected. Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, and industrial development. Chemical contamination may have an effect on listed species reproduction and survival. However, this Opinion assumes effects in the future would be similar to those in the past and are therefore reflected in the anticipated trends described in the status of the species/environmental baseline section.

9.0 INTEGRATION AND SYNTHESIS OF EFFECTS

NMFS has estimated that the over the life of the proposed action (i.e., through 2015), up to 1 sea turtle will be entrained in hopper dredging operations. As described above in section 7.1.2.1, based on previous dredging operations in the NAD, this entrained sea turtle is likely to be a loggerhead; however, it is possible that this sea turtle will be a Kemp's ridley. Additionally, NMFS has estimated that over the life of the proposed action, up to 1 subadult Atlantic sturgeon will be entrained in hopper dredging operations. As explained in the "Effects of the Action" section, effects of habitat alteration, dredge noise, suspended sediment, vessel interactions, and fuel spills on sea turtles, whales, or Atlantic sturgeon as a result of dredging, beach nourishment, and stone breakwater construction will be insignificant and/or discountable. In addition, as explained above, no whales or green or leatherback sea turtles are likely to be entrained in any dredge operating within the offshore shoals, and thus, NMFS has determined that the likelihood of an interaction (i.e., entrainment) between a green or leatherback sea turtle or a whale and a hopper dredge is discountable.

In the discussion below, NMFS considers whether the effects of the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the species. The purpose of this analysis is to determine whether the proposed action would jeopardize the continued existence of the species. In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Below, for each of the listed species that may be affected by the proposed action, NMFS summarizes the status of the species and considers whether the proposed action will result in reductions in reproduction, numbers or distribution of that species and then considers whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of that species, as those terms are defined for purposes of the federal Endangered Species Act.

9.1 Kemp's ridley sea turtles

Kemp's Ridley sea turtles are listed as a single species classified as "endangered" under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007b). Nest count data provides the best available information on the number of adult females nesting each year. As is the case with the other sea turtles species discussed above, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females, and the age structure of the Kemp's ridley population, nest counts cannot be used to estimate the total population size (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles, there were an estimated 7,000-8,000 adult female Kemp's ridleys in 2006 (NMFS and USFWS 2007b), which represents an increase in the nesting trend for Kemp's ridleys.

The most recent review of the Kemp's ridley as a species suggests that it is in the early stages of recovery (NMFS and USFWS 2007b). Nest count data indicate increased nesting and increased numbers of nesting females in the population. NMFS also takes into account a number of recent conservation actions including the protection of females, nests, and hatchlings on nesting beaches since the 1960s and the enhancement of survival in marine habitats through the implementation of TEDs in the early 1990s and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico in general (NMFS and USFWS 2007b). More female Kemp's ridley sea turtles are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime, resulting in a positive population trend globally.

Despite the threats faced by individual Kemp's ridley sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While NMFS is not able to predict with precision how climate change will continue to affect Kemp's ridley sea turtles in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

As noted above, NMFS has estimated that over the life of the proposed action (i.e., through 2015), up to 1 sea turtle will be entrained and killed in hopper dredge operations, with the possibility that this one sea turtle could be a Kemp's ridley. The mortality of 1 Kemp's ridley represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females, the death of 1 Kemp's ridley represents less than 0.01% of the population. While the death of 1 Kemp's ridley will reduce the number of Kemp's ridleys compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species or its stable to increasing trend as this loss represents a very small percentage of the population (less than 0.01%). Reproductive potential of Kemp's ridleys is not expected to be affected in any other way other than through a reduction in numbers of individuals. A reduction in the number of Kemp's ridleys would have the effect of reducing the amount of potential reproduction as any dead Kemp's ridleys would have no potential for future reproduction. In 2006, the most recent year for which data is available, there were an estimated 7-8,000 nesting females. While the species is thought to be female biased, there are likely to be several thousand adult males as well. Given the number of nesting adults, it is unlikely that the loss of 1 Kemp's ridley would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the stable to increasing trend of this species. Additionally, the proposed action will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting now or through 2015 (i.e., see section 6.0).

The proposed action is not likely to reduce distribution because the action will not impede Kemp's ridleys from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors. Additionally, given the small percentage of the species that will be killed as a result of the proposed action, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of Kemp's ridleys because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of Kemp's ridleys is likely to be increasing and at worst is stable.

Based on the information provided above, the death of 1 Kemp's ridley sea turtle over life of the proposed action (i.e., through 2015) will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect Kemp's ridleys in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) the death of 1 Kemp's ridley represents an extremely small percentage of the species as a whole; (3) the death of 1 Kemp's ridley will not change the status or trends of the species as a whole; (4) the loss of this Kemp's ridley is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of this Kemp's ridley is likely to have such a small effect on reproductive output that the loss of this individual will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of Kemp's ridleys in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that Kemp's ridleys will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Kemp's ridley sea turtles in any geographic area and thus, it will not affect the overall distribution of Kemp's ridley sea turtles. The proposed action will not utilize Kemp's ridley sea turtles for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of 1 Kemp's ridley; however, as explained above, the loss of this individual and what would have been their progeny is not expected to affect the persistence of Kemp's ridleys. As the reduction in numbers and future reproduction is very small, the loss of this individual will not change the status or trend of Kemp's ridleys, which is stable to increasing. The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that Kemp's ridleys can be brought to the point at which they are no longer listed as endangered or threatened.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of 1 individual Kemp's ridley, is not likely to appreciably reduce the survival and recovery of this species.

9.2 Northwest Atlantic Ocean DPS of Loggerhead Sea Turtles

The *Northwest Atlantic DPS of loggerhead sea turtles* is listed as "threatened" under the ESA. It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the Status of the Species/Environmental Baseline and Cumulative Effects sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, dredging, and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

Based on the information provided in this Opinion, NMFS anticipates the entrainment and mortality of no more than 1 loggerhead sea turtle over the life of the proposed action (i.e., through 2015). The lethal removal of up to 1 loggerhead sea turtle from the action area would be expected to reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not necessarily mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The final revised recovery plan for loggerheads compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit.

It is likely that the sea turtles entrained in hopper dredges operating in the waters off Virginia originate from several of the recovery units. Limited information is available on the genetic makeup of sea turtles in the mid-Atlantic. Cohorts from each of the five western Atlantic subpopulations are expected to occur in the action area. Genetic analysis of samples collected from immature loggerhead sea turtles captured in pound nets in the Pamlico-Albemarle Estuarine Complex in North Carolina from September-December of 1995-1997 indicated that cohorts from all five western Atlantic subpopulations were present (Bass *et al.* 2004). In a separate study, genetic analysis of samples collected from loggerhead sea turtles from Massachusetts to Florida found that all five western Atlantic loggerhead subpopulations were represented (Bowen *et al.* 2004). Bass *et al.* (2004) found that 80 percent of the juveniles and sub-adults utilizing the foraging habitat originated from the south Florida nesting population, 12 percent from the northern subpopulation, 6 percent from the Yucatan subpopulation, and 2 percent from other rookeries. The previously defined loggerhead subpopulations do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU encompasses both the south Florida and Florida panhandle subpopulations, the NRU is roughly equivalent to the northern nesting group, the Dry Tortugas subpopulation is equivalent to the DTRU, and the Yucatan subpopulation is included in the GCRU.

Based on the genetic analysis presented in Bass *et al.* (2004), and the small number of loggerheads likely to occur in the action area from the DTRU or the NGMRU, it is extremely unlikely that the 1 loggerhead that is likely to be entrained during dredging operations is likely to have originated from either of these recovery units. The majority, at least 80% of the loggerheads entrained, are likely to have originated from the PFRU, with the remainder from the NRU and GCRU. As such, the one loggerhead that may be entrained under the proposed action is expected to be from the PFRU; however, it is possible that this sea turtle may be from the NRU or the GCRU.

As noted above, the most recent population estimates indicate that there are approximately 15,735 females nesting annually in the PFRU and approximately 1,272 females nesting per year in the NRU. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatan, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatan since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit; however, the 2008 recovery plan indicates that the Yucatan nesting aggregation has at least 1,000 nesting females annually. As the numbers outlined here are only for nesting females, the total number of loggerhead sea turtles in each recovery unit is likely significantly higher. The loss of 1 loggerhead represents an extremely small percentage of the number of sea turtles in the PFRU. Even if the total population was limited to 15,735 loggerheads, the loss of 1 individual would represent approximately 0.006 % of the population. Similarly, the loss of 1 loggerhead from the NRU or GCRU represents an extremely small percentage from either recovery unit. Even if the total NRU population was limited to 1,272 loggerheads, the loss of 1 individual would represent approximately 0.08% of the NRU population, while the loss of 1 loggerhead from the GCRU, which is expected to support at least 1,000 nesting females, represents less than 1.0 % of the population. The loss of such a small percentage of individuals from any of these recovery units represents an even smaller percentage of the species as a whole. As such, it is unlikely that the death of this individual will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the population as a whole. Additionally, this action is not likely to reduce the distribution of loggerheads as the action will not impede loggerheads from accessing suitable foraging grounds or disrupt other migratory behaviors.

In general, while the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of loggerhead sea turtles because: the species is widely distributed geographically, it is not known to have low levels of genetic diversity, and there are several thousand individuals in the population.

Based on the information provided above, the death of up to 1 loggerhead sea turtle as a result of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect loggerheads in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent loggerheads from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 loggerhead represents an extremely small percentage of the species as a whole; (2) the loss of this loggerhead will not change the status or trends of any nesting aggregation, recovery unit or the species as a whole; (3) the loss of up to 1 loggerhead is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of up to 1 loggerhead is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; and, (4) the action will have no effect on the distribution of loggerheads in the action area or throughout its range; and, (6) the action will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that loggerheads will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate.

Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action will not appreciably reduce the likelihood of survival of the loggerhead sea turtle species. Also, it is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of loggerheads in any geographic area and since it will not affect the overall distribution of loggerheads other than to cause minor temporary adjustments in movements in the action area. The proposed action will not utilize loggerheads for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect any of these species of sea turtles, or affect their continued existence. As explained above, the proposed action is likely to result in the mortality of up to 1 loggerhead over the life of the proposed action (i.e., through 2015); however, as explained above, the loss of this individual over this time period is not expected to affect the persistence of loggerhead sea turtles. In summary, the effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the action may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of this individual, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that loggerhead sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While NMFS is not able to predict with precision how climate change will continue to affect loggerhead sea turtles in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the mortality of up to 1 loggerhead, is not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

9.3 Atlantic Sturgeon

As explained above, the proposed action is likely to result in the mortality of up to 1 subadult Atlantic sturgeon during hopper dredging operations. This one subadult Atlantic sturgeon could come from any of the five DPSs.

Gulf of Maine DPS

Individuals originating from the GOM DPS are likely to occur in the action area. The GOM DPS has been listed as threatened. While Atlantic sturgeon occur in several rivers in the GOM DPS, recent spawning has only been documented in the Kennebec River and possibly the Androscoggin River. No total population estimates are available. We have estimated, based on fishery-dependent data, that there are approximately 645 subadults in the GOM DPS. GOM DPS Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. While there are some indications that the status of the GOM DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

NMFS has estimated that the proposed action will result in the possible mortality of up to 1 subadult Atlantic sturgeon, which could be a GOM DPS Atlantic sturgeon. The following analysis applies to the worst case scenario of the one sturgeon mortality coming from the GOM DPS. In addition, as described above, the total population size of the GOM DPS is unknown at this time; however, in the absence of an estimate of the overall GOM DPS population, NMFS has provided a subadult population estimate for the GOM DPS (see above). This represents the best available information on subadult population numbers for the GOM DPS and will therefore, allow us to consider the loss of these individuals against the life stage for which we have an estimated population size.

The mortality of up to 1 subadult Atlantic sturgeon from the GOM DPS subadult population represents a very small percentage of the subadult population (i.e., less than 0.2% of the subadult population). While the death of up to 1 subadult Atlantic sturgeon will reduce the number of GOM DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult (less than 0.2%) population). In addition, as described above, juveniles, based on their smaller size (i.e., 40-150 cm), are more likely to be entrained than full sized adults (>150 cm). As such, the reproductive potential of the GOM DPS is not expected to be significantly affected in any way other than through a reduction in numbers of individuals. A reduction in the number of GOM DPS Atlantic sturgeon would have the effect of reducing the amount of potential reproduction as any dead GOM DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in a small reduction in the number of eggs laid or larvae produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the status of this species. Additionally, as the proposed action will occur outside of the rivers where GOM DPS fish are expected to spawn (e.g., the Kennebec River in Maine), the proposed action will not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede GOM DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds. Any effects to distribution will be minor and temporary and limited to the temporal and geographic scale of the proposed action.

Based on the information provided above, the death of up to 1 subadult GOM DPS Atlantic sturgeon over the life of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect GOM DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 subadult GOM DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the death of up to 1 subadult GOM DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this subadult GOM DPS Atlantic sturgeon are not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this subadult GOM DPS Atlantic sturgeon are likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of GOM DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of GOM DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging GOM DPS Atlantic sturgeon.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that GOM DPS Atlantic sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of GOM DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of GOM DPS Atlantic sturgeon. The proposed action will not utilize GOM DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of up to 1 subadult GOM DPS Atlantic sturgeon; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the GOM DPS. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status of GOM DPS Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that GOM DPS can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual GOM DPS Atlantic sturgeon inside and outside of the action area, the proposed action will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are not able to predict with precision how climate change will continue to impact Atlantic sturgeon in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of up to 1 subadult GOM DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

New York Bight DPS

Individuals originating from the NYB DPS are likely to occur in the action area. The NYB DPS has been listed as endangered. While Atlantic sturgeon occur in several rivers in the NYB DPS, recent spawning has only been documented in the Delaware and Hudson Rivers. The vast majority of spawning occurs in the Hudson River, with Delaware River origin Atlantic sturgeon making up less than 20% of the NYB DPS adult population. We have estimated, based on fishery-dependent data, that there are approximately 2,853 subadults in the New York Bight DPS. NYB DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for the Hudson or Delaware River spawning populations, or for the DPS as a whole.

NMFS has estimated that the proposed action will result in the possible mortality of up to 1 subadult Atlantic sturgeon, which could be a NYB DPS Atlantic sturgeon. The following analysis applies to the worst case scenario of the one sturgeon mortality coming from the NYB DPS. In addition, as described above, the total population size of the NYB DPS is unknown at this time; however, in the absence of an estimate of the overall NYB DPS population, NMFS has provided a subadult population estimate for the NYB DPS (see above). This represents the best available information on subadult population numbers for the NYB DPS and will therefore, allow us to consider the loss of these individuals against the life stage for which we have an estimated population size.

The mortality of up to 1 subadult Atlantic sturgeon from the NYB DPS subadult population represents a very small percentage of the subadult population (i.e., less than 0.04% of the population). While the death of up to 1 subadult Atlantic sturgeon will reduce the number of NYB DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult (less than 0.04%) population). In addition, as described above, juveniles, based on their smaller size (i.e., 40-150 cm), are more likely to be entrained than full sized adults (>150 cm). As such, the reproductive potential of the NYB DPS is not expected to be significantly affected in any way other than through a reduction in numbers of individuals. A reduction in the number of NYB DPS Atlantic sturgeon would have the effect of reducing the amount of potential reproduction as any dead NYB DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in a small reduction in the number of eggs laid or larvae produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the status of this species. Additionally, as the proposed action will occur outside of the rivers where NYB DPS fish are expected to spawn (e.g., the Hudson and Delaware Rivers), the proposed action will not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede NYB DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds. Any effects to distribution will be minor and temporary and limited to the temporal and geographic scale of the proposed action.

Based on the information provided above, the death of up to 1 subadult NYB DPS Atlantic sturgeon over the life of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect NYB DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 subadult NYB DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the death of up to 1 subadult NYB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this subadult NYB DPS Atlantic sturgeon are not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this subadult NYB DPS Atlantic sturgeon are likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of NYB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of NYB DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging NYB DPS Atlantic sturgeon.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that NYB DPS Atlantic sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of NYB DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of NYB DPS Atlantic sturgeon. The proposed action will not utilize NYB DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of up to 1 subadult NYB DPS Atlantic sturgeon; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the NYB DPS. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status of NYB DPS Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that NYB DPS can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual NYB DPS Atlantic sturgeon inside and outside of the action area, the proposed action will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are not able to predict with precision how climate change will continue to impact Atlantic sturgeon in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of up to 1 subadult NYB DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

Chesapeake Bay DPS

Individuals originating from the CB DPS are likely to occur in the action area. The CB DPS has been listed as endangered. While Atlantic sturgeon occur in several rivers in the CB DPS, recent spawning has only been documented in the James River. Using fishery-dependent data, we have estimated that there are 819 subadults in the CB DPS. Chesapeake Bay DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for the James River spawning population or for the DPS as a whole.

NMFS has estimated that the proposed action will result in the possible mortality of up to 1 subadult Atlantic sturgeon, which could be a CB DPS Atlantic sturgeon. The following analysis applies to the worst case scenario of the one sturgeon mortality coming from the CB DPS. In addition, as described above, the total population size of the CB DPS is unknown at this time; however, in the absence of an estimate of the overall CB DPS population, NMFS has provided a subadult population estimate for the CB DPS (see above). This represents the best available information on subadult population numbers for the CB DPS and will therefore, allow us to consider the loss of these individuals against the life stage for which we have an estimated population size.

The mortality of up to 1 subadult Atlantic sturgeon from the CB DPS subadult population represents a very small percentage of the subadult population (i.e., approximately 0.1% of the population). While the death of up to 1 subadult Atlantic sturgeon will reduce the number of CB DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult (approximately 0.1%) population). In addition, as described above, juveniles, based on their smaller size (i.e., 40-150 cm), are more likely to be entrained than full sized adults (>150 cm). As such, the reproductive potential of the CB DPS is not expected to be significantly affected in any way other than through a reduction in numbers of individuals. A reduction in the number of CB DPS Atlantic sturgeon would have the effect of reducing the amount of potential reproduction as any dead CB DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in a small reduction in the number of eggs laid or larvae produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the status of this species. Additionally, as the proposed action will occur outside of the rivers where CB DPS fish are expected to spawn (i.e., James River), the proposed action will not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede CB DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds. Any effects to distribution will be minor and temporary and limited to the temporal and geographic scale of the proposed action.

Based on the information provided above, the death of up to 1 subadult CB DPS Atlantic sturgeon over the life of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect CB DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 subadult CB DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the death of up to 1 subadult CB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this subadult CB DPS Atlantic sturgeon are not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this subadult CB DPS Atlantic sturgeon are likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of CB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of CB DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging CB DPS Atlantic sturgeon.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that CB DPS Atlantic sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of CB DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of CB DPS Atlantic sturgeon. The proposed action will not utilize CB DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of up to 1 subadult CB DPS Atlantic sturgeon; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the CB DPS. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status of CB DPS Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that CB DPS can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual CB DPS Atlantic sturgeon inside and outside of the action area, the proposed action will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are not able to predict with precision how climate change will continue to impact Atlantic sturgeon in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of up to 1 subadult CB DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

South Atlantic DPS

Individuals originating from the SA DPS are likely to occur in the action area. The SA DPS has been listed as endangered. Spawning occurs in multiple rivers (e.g., Altamaha River) in the SA DPS but spawning populations have been extirpated in some river in the SA DPS. There is no published population estimate for the DPS or total estimate for any river within the DPS. We have estimated, based on fishery-dependent data, that there are approximately 1,170 subadults in the SA DPS. SA DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for any spawning population or for the DPS as a whole.

NMFS has estimated that the proposed action will result in the possible mortality of up to 1 subadult Atlantic sturgeon, which could be a SA DPS Atlantic sturgeon. The following analysis applies to the worst case scenario of the one sturgeon mortality coming from the SA DPS. In addition, as described above, the total population size of the SA DPS is unknown at this time; however, in the absence of an estimate of the overall SA DPS population, NMFS has provided a subadult population estimate for the SA DPS (see above). This represents the best available information on subadult population numbers for the SA DPS and will therefore, allow us to consider the loss of these individuals against the life stage for which we have an estimated population size.

The mortality of up to 1 subadult Atlantic sturgeon from the SA DPS subadult population represents a very small percentage of the subadult population (i.e., less than 0.09% of the population). While the death of up to 1 subadult Atlantic sturgeon will reduce the number of SA DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult (less than 0.09%) population). In addition, as described above, juveniles, based on their smaller size (i.e., 40-150 cm), are more likely to be entrained than full sized adults (>150 cm). As such, the reproductive potential of the SA DPS is not expected to be significantly affected in any way other than through a reduction in numbers of individuals. A reduction in the number of SA DPS Atlantic sturgeon would have the effect of reducing the amount of potential reproduction as any dead SA DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in a small reduction in the number of eggs laid or larvae produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the status of this species. Additionally, as the proposed action will occur outside of the rivers where SA DPS fish are expected to spawn (i.e., Altamaha River), the proposed action will not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede SA DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds. Any effects to distribution will be minor and temporary and limited to the temporal and geographic scale of the proposed action.

Based on the information provided above, the death of up to 1 subadult SA DPS Atlantic sturgeon over the life of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect SA DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 subadult SA DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the death of up to 1 subadult SA DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this subadult SA DPS Atlantic sturgeon are not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this subadult SA DPS Atlantic sturgeon are likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of SA DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of SA DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging SA DPS Atlantic sturgeon.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that SA DPS Atlantic sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of SA DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of SA DPS Atlantic sturgeon. The proposed action will not utilize SA DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of up to 1 subadult SA DPS Atlantic sturgeon; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the SA DPS. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status of SA DPS Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that SA DPS can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual SA DPS Atlantic sturgeon inside and outside of the action area, the proposed action will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are not able to predict with precision how climate change will continue to impact Atlantic sturgeon in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of up to 1 subadult SA DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

Carolina DPS

Individuals originating from the Carolina DPS are likely to occur in the action area. The Carolina DPS has been listed as endangered. Spawning occurs in multiple rivers in the Carolina DPS but spawning populations have been extirpated in some rivers in the Carolina DPS. There is no published population estimate for the DPS or total estimate for any river within the DPS. Using fishery-dependent data, we have estimated that there are 972 subadults in the Carolina DPS. Carolina DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for any spawning population or for the DPS as a whole.

NMFS has estimated that the proposed action will result in the possible mortality of up to 1 subadult Atlantic sturgeon, which could be a Carolina DPS Atlantic sturgeon. The following analysis applies to the worst case scenario of the one sturgeon mortality coming from the Carolina DPS. In addition, as described above, the total population size of the Carolina DPS is unknown at this time; however, in the absence of an estimate of the overall Carolina DPS population, NMFS has provided a subadult population estimate for the Carolina DPS (see above). This represents the best available information on subadult population numbers for the Carolina DPS and will therefore, allow us to consider the loss of these individuals against the life stage for which we have an estimated population size.

The mortality of up to 1 subadult Atlantic sturgeon from the Carolina DPS subadult population represents a very small percentage of the subadult population (i.e., approximately 0.1% of the population). While the death of up to 1 subadult Atlantic sturgeon will reduce the number of Carolina DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult (approximately 0.1%) population). In addition, as described above, juveniles, based on their smaller size (i.e., 40-150 cm), are more likely to be entrained than full sized adults (>150 cm). As such, the reproductive potential of the Carolina DPS is not expected to be significantly affected in any way other than through a reduction in numbers of individuals. A reduction in the number of Carolina DPS Atlantic sturgeon would have the effect of reducing the amount of potential reproduction as any dead Carolina DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in a small reduction in the number of eggs laid or larvae produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the status of this species. Additionally, as the proposed action will occur outside of the rivers where Carolina DPS fish are expected to spawn, the proposed action will not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds.

The proposed action is not likely to reduce distribution because the action will not impede Carolina DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds. Any effects to distribution will be minor and temporary and limited to the temporal and geographic scale of the proposed action.

Based on the information provided above, the death of up to 1 subadult Carolina DPS Atlantic sturgeon over the life of the proposed action will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect Carolina DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to 1 subadult Carolina DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the death of up to 1 subadult Carolina DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this subadult Carolina DPS Atlantic sturgeon are not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this subadult Carolina DPS Atlantic sturgeon are likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of Carolina DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of Carolina DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging Carolina DPS Atlantic sturgeon.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that Carolina DPS Atlantic sturgeon will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Carolina DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of Carolina DPS Atlantic sturgeon. The proposed action will not utilize Carolina DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the mortality of up to 1 subadult Carolina DPS Atlantic sturgeon; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the Carolina DPS. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status of Carolina DPS Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that CB DPS can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual Carolina DPS Atlantic sturgeon inside and outside of the action area, the proposed action will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are not able to predict with precision how climate change will continue to impact Atlantic sturgeon in the action area or how the species will adapt to climate-change related environmental impacts, we have considered the effects of the proposed action in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the entrainment and mortality of up to 1 subadult Carolina DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

10.0 CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS' biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of the loggerhead and Kemp's ridley sea turtle or Atlantic sturgeon, and is not likely to adversely affect leatherback or green sea turtles or right, humpback or fin whales. Because no critical habitat is designated in the action area, none will be affected by the proposed action.

11.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations 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 to attempt to engage in any such conduct. Harm is further defined by NMFS to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of 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 to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken so that they become binding conditions for the exemption in section 7(o)(2) to apply. Failure to implement the terms and conditions through enforceable measures may result in a lapse of the protective coverage of section 7(o)(2).

Amount or Extent of Take

The proposed dredging project has the potential to directly affect loggerhead and Kemp's ridley sea turtles or Atlantic sturgeon by entraining or capturing these species in the dredge. These interactions are likely to cause injury and/or mortality to the affected sea turtles and sturgeon. Based on the distribution of sea turtles and Atlantic sturgeon in the action area and information available on historic interactions between sea turtles or Atlantic sturgeon and dredging operations, NMFS believes that it is reasonable to expect that no more than 1 sea turtle is likely to be injured or killed for approximately every 1.6 million cy of material removed from the borrow areas. As such, over the course of the project life, NMFS expects that up to 1 sea turtle will be entrained, with this sea turtle being a loggerhead or a Kemp's ridley; however, as NMFS has estimated that at least 90% of turtles entrained in USACE NAD dredging operations are loggerheads, this one sea turtle is likely to be a loggerhead. In regards to Atlantic sturgeon, NMFS believes it is reasonable to expect that no more than 1 Atlantic sturgeon is likely to be entrained for approximately every 9.4 million cy of material removed from the borrow areas. As such, over the course of the project life, NMFS expects that a total of 1 subadult Atlantic sturgeon will be entrained during hopper dredging operations. As such over the project life, NMFS expects a total of 1 subadult Atlantic sturgeon to be taken, with the potential that the sturgeon taken may come from the GOM, NYB, CB, SA, or Carolina DPS. Due to the nature of the injuries expected by entrainment, any entrained Atlantic sturgeon or sea turtle is expected to die.

NMFS also expects that dredging may collect an additional unquantifiable number of parts from previously dead sea turtles or Atlantic sturgeon. While collecting decomposed animals or parts thereof in federal operations is considered to be a take, based on the definition of "take" in Section 3 of the ESA and "wildlife" at 50 CFR § 222.102, NMFS recognizes that decomposed sea turtles or Atlantic sturgeon may be taken in dredging operations that may not necessarily be related to the dredging activity itself. Theoretically, if dredging operations are conducted properly, no takes of sea turtles or Atlantic sturgeon should occur as the turtle draghead defector should push the turtles and Atlantic sturgeon to the side and the suction pumps should be turned off whenever the dredge draghead is away from the substrate. However, due to certain environmental conditions (e.g., rocky bottom, uneven substrate), the dredge draghead may periodically lift off the bottom and entrain previously dead sea turtle or Atlantic sturgeon parts (as well as live turtles or Atlantic sturgeon) that may be on the bottom through the high level of suction.

Thus, the aforementioned anticipated level of take refers to those turtles or sturgeon that NMFS confirms as freshly dead. While this definition is subject to some interpretation by the observer, a fresh dead animal may exhibit the following characteristics: little to no odor; fresh blood present; fresh (not necrotic, pink/healthy color) tissue, muscle, or skin; no bloating; color consistent with live animal; and live barnacles. A previously (non-fresh) dead animal may exhibit the following characteristics: foul odor; necrotic, dark or decaying tissues; sloughing of scutes; pooling of old blood; atypical coloration; and opaque eyes. NMFS recognizes that decomposed sea turtles or Atlantic sturgeon may be taken in dredging operations that may not necessarily be related to the dredging activity itself. NMFS expects that the proposed dredging may take an additional unquantifiable number of previously dead sea turtle or Atlantic sturgeon parts.

NMFS believes this level of incidental take is reasonable given the seasonal distribution and abundance of these species in the action area and the historic level of take recorded during other dredging operations in the USACE NAD. In the accompanying Opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to loggerhead or Kemp's ridley sea turtles or to any DPS of Atlantic sturgeon.

Measures have been undertaken by the USACE to reduce the takes of sea turtles and Atlantic sturgeon during dredging activities (e.g., use of a state-of-the-art sea turtle deflector on all dredges; draghead operated in a manner that will reduce the risk of interactions with sea turtles and Atlantic sturgeon; the suction in the drag head will be turned off when it is lifted off the bottom; see section 3.3). In addition to these measures, NMFS has determined that the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of sea turtles or Atlantic sturgeon.

Reasonable and Prudent Measures
NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take resulting from the proposed action:

RPMs related to Hopper Dredging Activities

1. NMFS must be contacted within 3 days prior to commencement of hopper dredging and again within 3 days following completion of the dredging activity. Upon contacting NMFS, the Navy shall report to NMFS whether:
    a. Hopper dredges are outfitted with state-of-the-art sea turtle deflectors on the draghead and operated in a manner that will reduce the risk of interactions with sea turtles or Atlantic sturgeon which may be present in the action area;
    b. NMFS-approved observer is present on board the vessel for any hopper dredging occurring in the April 1 – November 30 time frame;
    c. NMFS-approved observer is present on board the vessel for any hopper dredging occurring from December 1 – March 31 for Atlantic sturgeon;
    d. All hopper dredges are equipped and operated in a manner that provides endangered/threatened species observers with a reasonable opportunity for detecting interactions with listed species and that provides for handling, collection, and resuscitation of turtles injured during project activity. Full cooperation with the endangered/threatened species observer program is essential for compliance with the ITS; and,
    e. Measures are taken to protect any turtles or sturgeon that survive entrainment in the hopper dredge.

RPMS for all aspects of the project

2. All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to NMFS.

3. All Atlantic sturgeon that are captured during the project must be scanned for the presence of Passive Integrated Transponder (PIT) tags. Tag numbers must be recorded and reported to NMFS.

4. Any dead sturgeon must be transferred to NMFS or an appropriately permitted research facility NMFS will identify so that a necropsy can be undertaken to attempt to determine the cause of death. Sturgeon should be held in cold storage.

5. Any dead sea turtles must be held until proper disposal procedures can be discussed with NMFS. Turtles should be held in cold storage.

6. All sturgeon and turtle captures, injuries or mortalities associated with the proposed project must be reported to NMFS within 24 hours.

Terms and conditions

In order to be exempt from prohibitions of section 9 of the ESA, the Navy, USACE, and BOEM must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Because the Navy is the lead agency for this consultation, the terms and conditions are directed to it, except where noted.

1. To implement RPM #1(a-d), the Navy must contact NMFS ((978)-281-9328 or mail: Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930)). This correspondence will serve both to alert NMFS of the commencement and cessation of dredging activities, to give NMFS an opportunity to provide the Navy with any updated contact information or reporting forms, and to provide NMFS with information of any incidences with listed species.

2. To implement RPM #1(a), hopper dredges must be equipped with the rigid deflector draghead as designed by the ACOE Engineering Research and Development Center, formerly the Waterways Experimental Station (WES), or if that is unavailable, a rigid sea turtle deflector attached to the draghead. Deflectors must be checked and/or adjusted by a designated expert prior to a dredge operation to insure proper installment and operation during dredging. The deflector must be checked after every load throughout the dredge operation to ensure that proper installation is maintained. Since operator skill is important to the effectiveness of the WES-developed draghead, operators must be properly instructed in its use. Dredge inspectors must ensure that all measures to protect sea turtles are being followed during dredge operations.

3. To implement RPM #1(b-c), observer coverage on hopper dredges operating in Sandbridge Shoal/Atlantic Ocean must be sufficient for 100% monitoring of hopper dredging operations. This monitoring coverage must involve the placement of a NMFS-approved observer on board the dredge for every day that dredging is occurring. While onboard, observers shall provide the required inspection coverage on a rotating basis so that combined monitoring periods represent 100% of total dredging through the project period. The Navy must ensure that ACOE dredge operators and/or any dredge contractor adhere to the attached "Monitoring Specifications for Hopper Dredges" with trained NMFS-approved observers, in accordance with the attached "Observer Protocol" and "Observer Criteria" (Appendix B). No observers can be deployed to the dredge site until ACOE has written confirmation from NMFS that they have met the qualifications to be a "NMFS-approved observer" as outlined in Appendix B. If substitute observers are required during dredging operations, ACOE must ensure that NMFS approval is obtain before those observers are deployed on dredges.

4. To implement RPM #1(b-c), the Navy shall require of the dredge operator that, when the observer is off watch, the cage shall not be opened unless it is clogged. The Navy shall also require that if it is necessary to clean the cage when the observer is off watch, any aquatic biological material is left in the cage for the observer to document and clear out when they return on duty. In addition, the observer shall be the only one allowed to clean

off the overflow screen.

5. To implement RPM #1(c), the Navy must ensure that any initial dredge cycles that occur during the months of December through March must have 100% observer coverage for Atlantic sturgeon. After this time period, the Navy and NMFS will reconvene and assess whether 100% observer coverage year round is appropriate or whether modifications to observer coverage are necessary.

6. To implement RPM #1(d), if sea turtles are present during dredging or material transport, vessels transiting the area must post a bridge watch/observer, avoid intentional approaches closer than 100 yards when in transit, and reduce speeds to below 4 knots if the bridge watch/observer identifies a listed species in the immediate vicinity of the dredge.

7. To implement RPM #1(d), the Navy must ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize takes of sea turtles. Training shall include measures discussed in Appendix B.

8. To implement RPM #1(e), the procedures for handling live sea turtles must be followed in the unlikely event that a sea turtle survives entrainment in the dredge (Appendix C).

9. To implement RPM#1(e), the Navy, in coordination with the USACE, and contractors as appropriate, must remove, via a net, any sturgeon observed in the hopper/basket of the dredge and if alive, inspected for injuries, placed on board the vessel with a flow through live well, and returned to the ocean away from the project site.

10. To implement RPM #2, the Navy must ensure that fin clips are taken (according to the procedure outlined in Appendix E) of any sturgeon captured during the project and that the fin clips are sent to NMFS for genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies.

11. To implement RPM #3, all collected sturgeon must be inspected for a PIT tag with an appropriate PIT tag reader. Any tag numbers must be recorded and reported to NMFS.

12. To implement RPM #4, in the event of any lethal takes of Atlantic sturgeon, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS. The form included as Appendix H (sturgeon salvage form) must be completed and submitted to NMFS.

13. To implement RPM #4, if a decomposed Atlantic sturgeon or Atlantic sturgeon body part is entrained during any dredging operations, the Navy must ensure that an incident report is completed and the specimen is photographed. Any sturgeon parts that are considered 'not fresh' (i.e., they were obviously dead prior to the dredge take (e.g., foul odor; necrotic dark or decaying tissue; sloughing of scutes; atypical coloration; and/or opaque eyes) and

the Navy anticipates that they will not be counted towards the ITS) must be frozen. The Navy must submit an incident report for the decomposed sturgeon part, as well as photographs, to NMFS within 24 hours of the take (see Appendix B and H) and request concurrence that this take should not be attributed to the Incidental Take Statement. NMFS shall have the final say in determining if the take should count towards the Incidental Take Statement.

14. To implement RPM #5, in the event of any lethal takes of sea turtles, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS. The form included as Appendix G must be completed and submitted to NMFS.

15. To implement RPM #5, if a decomposed turtle or turtle part is entrained during any dredging operations, an incident report must be completed and the specimen must be photographed. Any turtle parts that are considered 'not fresh' (i.e., they were obviously dead prior to the dredge take and the Navy anticipates that they will not be counted towards the ITS) must be frozen and transported to a nearby stranding or rehabilitation facility for review. The Navy must ensure that the observer submits the incident report for the decomposed turtle part, as well as photographs, to NMFS within 24 hours of the take (see Appendix B and G) and request concurrence that this take should not be attributed to the Incidental Take Statement. NMFS shall have the final say in determining if the take should count towards the Incidental Take Statement.

16. To implement RPM #6, the Navy must contact NMFS within 24 hours of any interactions with Atlantic sturgeon or sea turtles, including non-lethal and lethal takes. NMFS will provide contact information annually when alerted of the start of dredging activity. Until alerted otherwise, the Navy should contact Danielle Palmer: by email (danielle.palmer@noaa.gov) or phone (978) 282-8468 or the Section 7 Coordinator by phone (978)281-9328 or fax 978-281-9394). Take information should also be reported by e-mail to: incidental.take@noaa.gov.

17. To implement RPM #6, the navy must photograph and measure any Atlantic sturgeon or sea turtles observed during project operations (including whole sturgeon or sea turtles or body parts observed at the disposal location or on board the dredge, hopper or scow) and the corresponding form (Appendix G and/or H) must be completed and submitted to NMFS **within 24 hours** by fax (978-281-9394) or e-mail (incidental.take@noaa.gov).

18. To implement RPM #6, any time a take occurs the Navy must immediately contact NMFS to review the situation. At that time, the Navy must provide NMFS with information on the amount of material dredged thus far and the amount remaining to be dredged during that cycle. Also at that time, the Navy and the USACE should discuss with NMFS whether any new management measures could be implemented to prevent the total incidental take level from being exceeded and will work with NMFS to determine whether this take represents new information revealing effects of the action that may not have been previously considered.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed action. Specifically, these RPMs and Terms and Conditions will keep NMFS informed of when and where dredging activities are taking place and will require the Navy and the USACE to report any take in a reasonable amount of time, as well as implement measures to monitor for entrainment during dredging. The Navy has reviewed the RPMs and Terms and Conditions outlined above and has agreed to implement all of these measures as described herein and in the referenced Appendices. The discussion below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the action as proposed by the Navy.

RPMs #1 and #6 and Terms and Conditions #1 and #16-18 are necessary and appropriate because they will serve to ensure that NMFS is aware of the dates and locations of all dredging activities as well as any incidences of interactions of listed species. This will also allow NMFS to monitor the duration and seasonality of dredging activities as well as give NMFS an opportunity to provide the Navy with any updated contact information for NMFS staff. These RPMs and Terms and Conditions will help us determine whether and when reinitiation may be required due to changes in the action, or exceedances of incidental take. This is only a minor change because it is not expected to result in any delay to the project and will merely involve an occasional telephone call or e-mail between the Navy and NMFS staff.

RPM #1(a) and Term and Condition #2 are necessary and appropriate as the use of draghead deflectors is accepted standard practice for hopper dredges operating in places and at times of year when sea turtles are known to be present and has been documented to reduce the risk of entrainment for sea turtles, thereby minimizing the potential for take of these species. It is believed that this holds true for Atlantic sturgeon as well. This represents only a minor change as all of the hopper dredges likely to be used for this project already have draghead deflectors, dredge operators are already familiar with their use, and the use will not affect the efficiency of the dredging operation. Additionally, maintenance of the existing channel is conducted with draghead deflectors in place.

RPMs #1(b-c), and #3 and Terms and Conditions #3-4 are necessary and appropriate to ensure the proper handling and documentation of any interactions with listed species as well as requiring that these interactions are reported to NMFS in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. The inclusion of these RPMs and Terms and Conditions is only a minor change as the Navy included observer coverage in the original project description and the increase in coverage (e.g., the addition of the months from December through March) will represent only a small increase in the cost of the project and will not result in any delays. These also represent only a minor change as in many instances they serve to clarify the duties of the inspectors or observers.

RPM #1(d) and Terms and Conditions #6-7 are necessary and appropriate as they will require that dredge operators use best management practices, including slowing down to 4 knots should listed species be observed, that will minimize the likelihood of take. This represents only a minor change as following these procedures should not increase the cost of the dredging operation or result in any delays of reduction of efficiency of the dredging project.

RPM #1(e) and Terms and Conditions # 8-9 are necessary and appropriate to ensure that any sea turtles or Atlantic sturgeon that survive entrainment in a hopper dredge are given the maximum probability of remaining alive and not suffering additional injury or subsequent mortality through inappropriate handling. This represents only a minor change as following these procedures will not result in an increase in cost or any delays to the proposed project.

RPM#2-3 and Term and Condition #10-11 are necessary and appropriate to maximize the potential for detection of any affected sturgeon. The taking of fin clips allows NMFS to run genetic analysis to determine the DPS of origin for Atlantic sturgeon. This allows us to determine if the actual level of take has been exceeded. Sampling of fin tissue is used for genetic sampling. This procedure does not harm sturgeon and is common practice in fisheries science. Tissue sampling does not appear to impair the sturgeon's ability to swim and is not thought to have any long-term adverse impact. Checking and tagging fish with PIT tags allows the Navy to determine the identity of detected fish and determine if the same fish is detected more than once. PIT tagging is not known to have any adverse impact to fish. NMFS has received no reports of injury or mortality to any sturgeon sampled or tagged in this way. This represents only a minor change as following these procedures will have an insignificant impact on the cost of the project and will not result in any delays.

RPM #4 and Term and Condition #12-13 are necessary and appropriate to determine the cause of death of any dead sturgeon observed during the bridge replacement project. This is necessary for the monitoring of the level of take associated with the proposed action. This represents only a minor change as following these procedures will have an insignificant impact on the cost of the project and will not result in any delays.

RPM #5 and Terms and Condition #14-15, are necessary and appropriate as future analysis may be needed on the dead sea turtle. Additional analysis will dependent on available freezer space, availability of organizations capable of conducting the analysis, and the size/condition of the sample. NMFS will provide guidance on this matter upon the Navy's notification of take. If NMFS determines that the animal is not necessary to save for future analysis, disposition of dead sea turtle species (loggerhead, leatherback, Kemp's ridley, or green turtles) taken either whole or in parts should be disposed of (after a photograph is taken and a reporting form has been completed) by attaching a weight to the animal and dumping the specimen away from the areas being dredged (e.g., between the shore and the site of dredging operations). This represents only a minor change as following these procedures will have an insignificant impact on the cost of the project and will not result in any delays.

12.0 CONSERVATION RECOMMENDATIONS

In addition to Section 7(a)(2), which requires agencies to ensure that proposed projects will not jeopardize the continued existence of listed species, Section 7(a)(1) of the ESA places a responsibility on all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species." Conservation Recommendations are discretionary activities designed 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.

1. When endangered species observers are required on hopper dredges, 100% overflow screening is recommended. While monitoring 100% of the inflow screening is required as a term and condition of this project's Incidental Take Statement, observing 100% of the overflow screening would ensure that any takes of sea turtles are detected and reported.

2. To facilitate future management decisions on listed species occurring in the action area, the Navy should maintain a database mapping system to: a) create a history of use of the geographic areas affected; and, b) document endangered/threatened species presence/interactions with project operations.

3. The Navy should support ongoing and/or future research to determine the abundance and distribution of sea turtles and Atlantic sturgeon in offshore Virginia waters, as well as within waters at the mouth of the Chesapeake Bay.

4. The Navy should work with the USACE to investigate, support, and/or develop additional technological solutions to further reduce the potential for sea turtle or Atlantic sturgeon takes in hopper dredges. For instance, NMFS recommends that the USACE coordinate with other Southeast Districts, the Association of Dredge Contractors of America, and dredge operators regarding additional reasonable measures they may take to further reduce the likelihood of sea turtle takes. The diamond-shaped pre-deflector, or other potentially promising pre-deflector designs such as tickler chains, water jets, sound generators, etc., should be developed and tested and used where conditions permit as a means of alerting sea turtles and sturgeon of approaching equipment. New technology or operational measures that would minimize the amount of time the dredge is spent off the bottom in conditions of uneven terrain should be explored. Pre-deflector use should be noted on observer daily log sheets, and annual reports to NMFS should note what progress has been made on deflector or pre-deflector technology and the benefits of or problems associated with their usage. NMFS believes that development and use of effective pre-deflectors could reduce the need for sea turtle relocation trawling.

5. New approaches to sampling for turtle or sturgeon parts should be investigated. Project proponents should seek continuous improvements in detecting takes and should determine, through research and development, a better method for monitoring and estimating sea turtle or Atlantic sturgeon takes by hopper dredges. Observation of overflow and inflow screening appears to be only partially effective and may provide only minimum estimates of total sea turtle or Atlantic sturgeon mortality. NMFS believes that some listed species taken by hopper dredges may go undetected because body parts are forced through the sampling

screens by the water pressure (as seen in 2002 Cape Henry dredging) and are buried in the dredged material, or animals are crushed or killed, but not entrained by the suction and so the takes may go unnoticed (or may subsequently strand on nearby beaches). The only mortalities that are documented are those where body parts float, are large enough to be caught in the screens, or can be identified to species.

6. NMFS recommends that all sea turtles and Atlantic sturgeon entrained in hopper dredge dragheads be sampled for genetic analysis by a NMFS laboratory. Any genetic samples from live sea turtles or Atlantic sturgeon must be taken by trained and permitted personnel (i.e., NMFS approved observer). Copies of NMFS genetic sampling protocols for live and dead turtles or Atlantic sturgeon are attached as Appendix D and Appendix G.

7. The Navy and the USACE should consider devising and implementing some method of significant economic incentives to hopper dredge operators such as financial reimbursement based on their satisfactory completion of dredging operations, or a certain number of cubic yards of material removed, or hours of dredging performed, *without taking turtles or sturgeon*. This may encourage dredging companies to research and develop "turtle or sturgeon friendly" dredging methods, more effective deflector dragheads, pre-deflectors, top-located water ports on dragarms, etc.

8. When whales are present in the action area, vessels transiting the area should post a bridge watch, avoid intentional approaches closer than 100 yards (or 500 yards in the case of right whales) when in transit, and reduce speeds to below 4 knots.

13.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the Navy's proposed repairs to the Dam Neck Annex Shoreline Protection System. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) a new species is listed or critical habitat designated that may be affected by the action; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered. If the amount or extent of incidental take is exceeded, the Navy must immediately request reinitiation of formal consultation.

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APPENDIX A
Map of Action Area

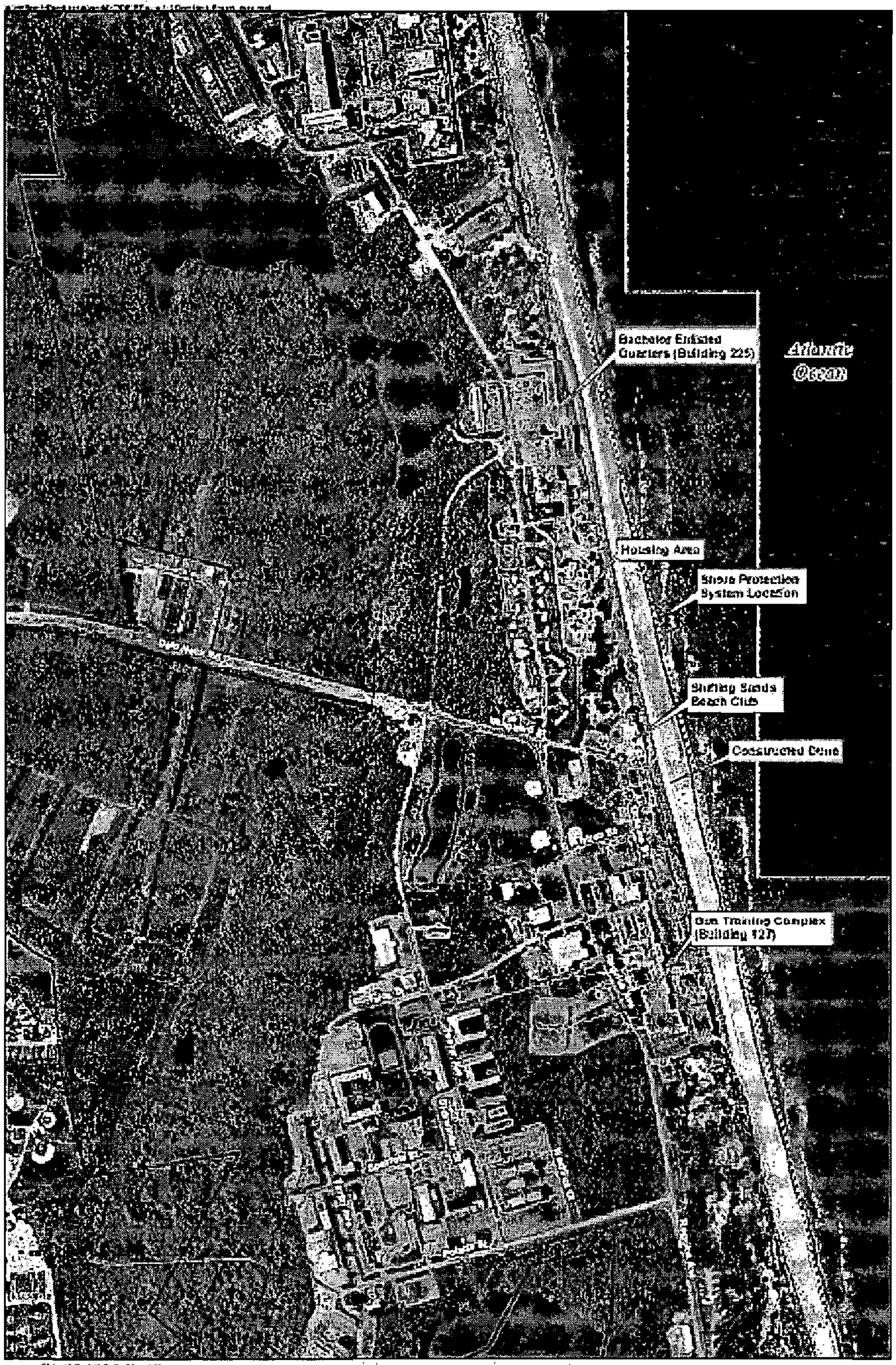


Figure 1-2 Project Area
Naval Air Station (NAS) Oceana
Dam Neck Annex, Virginia Beach, Virginia

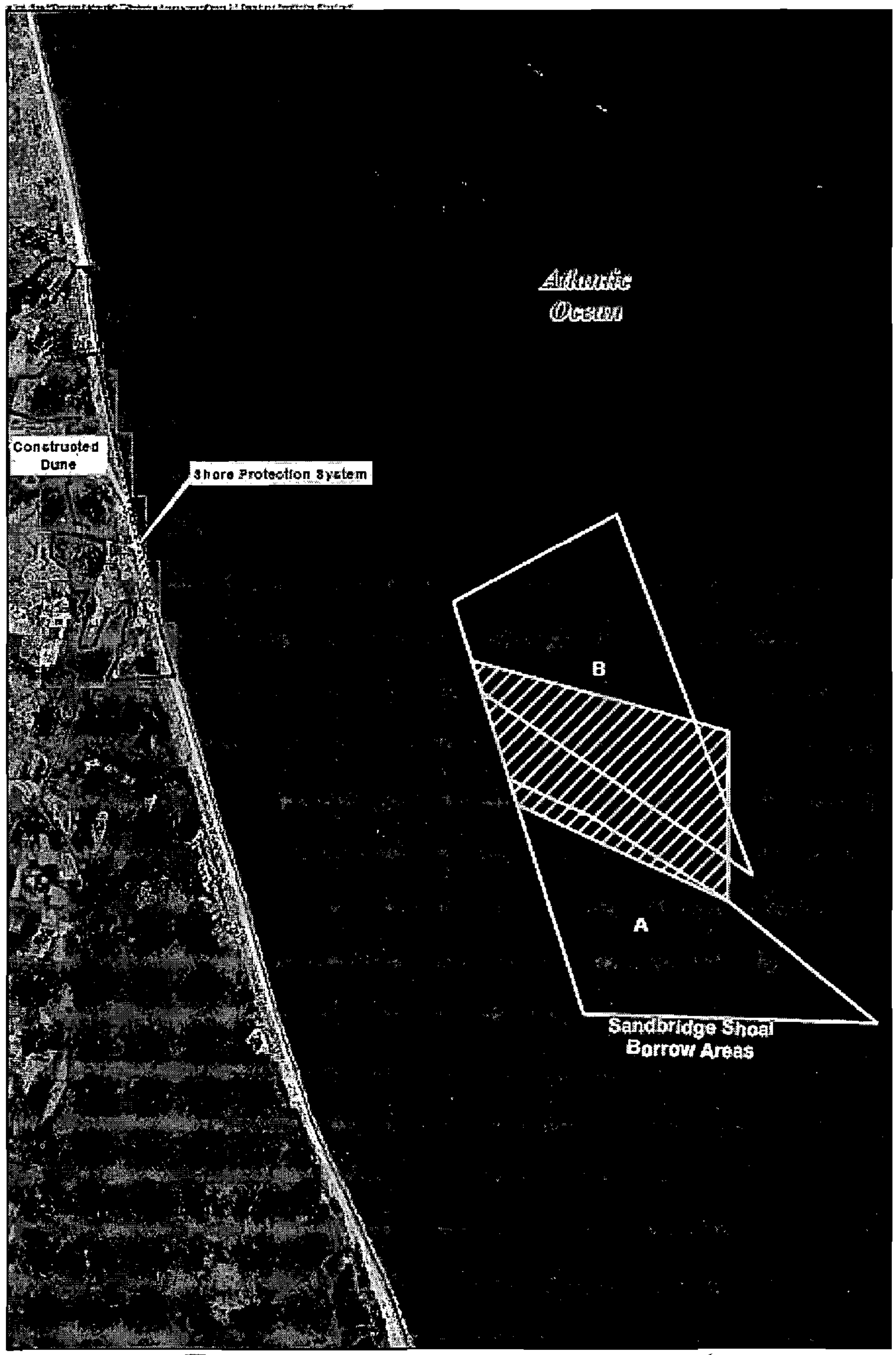


Figure 2-1 Sandbridge Shoal
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

APPENDIX B

MONITORING SPECIFICATIONS FOR HOPPER DREDGES

I. EQUIPMENT SPECIFICATIONS

A. Baskets or screening

Baskets or screening must be installed over the hopper inflows with openings no smaller than 4 inches by 4 inches to provide 100% coverage of all dredged material and shall remain in place during all dredging operations of any calendar year. Baskets/screening will allow for better monitoring by observers of the dredged material intake for sea turtles and their remains. The baskets or screening must be safely accessible to the observer and designed for efficient cleaning.

B. Draghead

The draghead of the dredge shall remain on the bottom **at all times** during a pumping operation, except when:

1) the dredge is not in a pumping operation, and the suction pumps are turned completely off;
2) the dredge is being re-oriented to the next dredge line during borrow activities; and
3) the vessel's safety is at risk (i.e., the dragarm is trailing too far under the ship's hull).

At initiation of dredging, the draghead shall be placed on the bottom during priming of the suction pump. If the draghead and/or dragarm become clogged during dredging activity, the pump shall be shut down, the dragarms raised, whereby the draghead and/or dragarm can be flushed out by trailing the dragarm alongside the ship. If plugging conditions persist, the draghead shall be placed on deck, whereby sufficient numbers of water ports can be opened on the draghead to prevent future plugging.

Upon completion of a dredge track line, the drag tender shall:

1) throttle back on the RPMs of the suction pump engine to an idling speed (e.g., generally less than 100 RPMs) **prior to** raising the draghead off the bottom, so that no flow of material is coming through the pipe into the dredge hopper. Before the draghead is raised, the vacuum gauge on the pipe should read zero, so that no suction exists both in the dragarm and draghead, and no suction force exists that can impinge a turtle on the draghead grate;
2) hold the draghead firmly on the bottom with no flow conditions for approximately 10 to 15 seconds before raising the draghead; then, raise the draghead quickly off the bottom and up to a mid-water column level, to further reduce the potential for any adverse interaction with nearby turtles;
3) re-orient the dredge quickly to the next dredge line; and

4) re-position the draghead firmly on the bottom prior to bringing the dredge pump to normal pumping speed, and re-starting dredging activity.

C. Floodlights

Floodlights must be installed to allow the NMFS-approved observer to safely observe and monitor the baskets or screens.

D. Intervals between dredging

Sufficient time must be allotted between each dredging cycle for the NMFS-approved observer to inspect and thoroughly clean the baskets and screens for sea turtles and/or turtle parts and document the findings. Between each dredging cycle, the NMFS-approved observer should also examine and clean the dragheads and document the findings.

II. OBSERVER PROTOCOL

A. Basic Requirement

A NMFS-approved observer with demonstrated ability to identify sea turtle species and Atlantic sturgeon must be placed aboard the dredge(s) being used, starting immediately upon project commencement to monitor for the presence of listed species and/or parts being entrained or present in the vicinity of dredge operations.

B. Duty Cycle

NMFS-approved observers are to be onboard for every week of the dredging project until project completion. While onboard, observers shall provide the required inspection coverage on a rotating basis so that combined monitoring periods represent 100% of total dredging through the project period.

C. Inspection of Dredge Spoils

During the required inspection coverage, the trained NMFS-approved observer shall inspect the galvanized screens and baskets at the completion of each loading cycle for evidence of sea turtles or Atlantic sturgeon. The Endangered Species Observation Form shall be completed for each loading cycle, whether listed species are present or not (Appendix F). If any whole (alive or dead) sea turtles or Atlantic sturgeon, or turtle or sturgeon parts are taken incidental to the project(s), the NMFS Section 7 Coordinator (978-281-9328) must be contacted within 24 hours of the take. An incident report for sea turtle and/or Atlantic sturgeon take (Appendix G and Appendix H) shall also be completed by the observer and sent to Danielle Palmer via FAX (978) 281-9394 within 24 hours of the take. Incident reports shall be completed for every take regardless of the state of decomposition. NMFS will determine if the take should be attributed to the incidental take level, after the incident report is received. Every incidental take (alive or dead, decomposed or fresh) should be photographed, and photographs shall be sent to NMFS either electronically (danielle.palmer@noaa.gov) or through the mail. Weekly reports, including all completed load sheets, photographs, and relevant incident reports, as well as a final report, shall be submitted to NMFS NER, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298.

D. Information to be Collected

For each sighting of any endangered or threatened marine species, record the following information on the Endangered Species Observation Form (Appendix F):

1) Date, time, coordinates of vessel
2) Visibility, weather, sea state
3) Vector of sighting (distance, bearing)
4) Duration of sighting
5) Species and number of animals
6) Observed behaviors (feeding, diving, breaching, etc.)
7) Description of interaction with the operation

E. Disposition of Parts

If any whole sea turtles or Atlantic sturgeon (alive or dead, decomposed or fresh) or turtle or sturgeon parts are taken incidental to the project(s), Danielle Palmer (978) 282-8468 or Mark Murray-Brown (978) 281-9306 must be contacted within 24 hours of the take. All whole dead sea turtles or Atlantic sturgeon, or turtle or sturgeon parts, must be photographed and described in detail on the Incident Report of Sea Turtle or Atlantic Sturgeon Mortality (Appendix G or Appendix H). The photographs and reports should be submitted to Danielle Palmer, NMFS, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298. After NMFS is notified of the take, observers may be required to retain turtles for future analysis. Additional analysis will dependent on available freezer space, availability of organizations capable of conducting the analysis, and the size/condition of the sample. NMFS will provide guidance on this matter upon the Navy's notification of take. If NMFS determines that the animal is not necessary to save for future analysis, disposition of dead sea turtle species (loggerhead, leatherback, Kemp's ridley, or green turtles) taken either whole or in parts, or any Atlantic sturgeon should be disposed of (after a photograph is taken and a reporting form has been completed) by attaching a weight to the animal and dumping the specimen away from the areas being dredged (e.g., between the shore and the site of dredging operations). If possible, a mark or tag (e.g., Inconel tag) should be placed on the carcass or part in the event that the animal is recaptured or stranded. If the species is unidentifiable or if there are entrails that may have come from a turtle, the subject should be photographed, placed in plastic bags, labeled with location, load number, date and time taken, and placed in cold storage. Unidentifiable species or parts will be collected by NMFS or NMFS-approved personnel (contact Danielle Palmer at (978) 282-8468). Live turtles (both injured and uninjured) should be held onboard the dredge until transported as soon as possible to the appropriate stranding network personnel for rehabilitation (Appendix C). No live turtles should be released back into the water without first being checked by a qualified veterinarian or a rehabilitation facility.

III. OBSERVER REQUIREMENTS

Submission of resumes of endangered species observer candidates to NMFS for final approval ensures that the observers placed onboard the dredges are qualified to document takes of endangered and threatened species, to confirm that incidental take levels are not exceeded, and to provide expert advice on ways to avoid impacting endangered and threatened species. NMFS does not offer certificates of approval for observers, but approves observers on a case-by-case basis.

A. Qualifications

Observers must be able to:

1) differentiate between leatherback (*Dermochelys coriacea*), loggerhead *Caretta caretta*), Kemp's ridley *(Lepidochelys kempii*), green (*Chelonia mydas*), and hawksbill *(Eretmochelys imbricata*) turtles and their parts, and shortnose (*Acipenser brevirostrum*) and Atlantic (*Acipenser oxyrinchus oxyrinchus*) sturgeon and their parts;
2) handle live sea turtles and sturgeon and resuscitate and release them according accepted procedures;
3) correctly measure the total length and width of live and whole dead sea turtle and sturgeon species;
4) observe and advise on the appropriate screening of the dredge's overflow, skimmer funnels, and dragheads; and
5) identify marine mammal species and behaviors.

B. Training

Ideally, the applicant will have educational background in marine biology, general experience aboard dredges, and hands-on field experience with the species of concern. For observer candidates who do not have sufficient experience or educational background to gain immediate approval as endangered species observers, the below observer training is necessary to be considered admissible by NMFS. We can assist the USACE by identifying groups or individuals capable of providing acceptable observer training. Therefore, at a minimum, observer training must include:

1) instruction on how to identify sea turtles and sturgeon and their parts;
2) instruction on appropriate screening on hopper dredges for the monitoring of sea turtles and sturgeon (whole or parts);
3) demonstration of the proper handling of live sea turtles and sturgeon incidentally captured during project operations. Observers may be required to resuscitate sea turtles according to accepted procedures prior to release;
4) instruction on standardized measurement methods for sea turtle and sturgeon lengths and widths; and

5) instruction on how to identify marine mammals; and
6) instruction on dredging operations and procedures, including safety precautions onboard a vessel.

APPENDIX C

Sea Turtle Handling and Resuscitation

It is unlikely that sea turtles will survive entrainment in a hopper dredge, as the turtles found in the dragheads are usually dead, dying, or dismantled. However, the procedures for handling live sea turtles follow in case the unlikely event should occur.

Please photograph all turtles (alive or dead) and turtle parts found during dredging activities and complete the Incident Report of Sea Turtle Take (Appendix G).

Handling:
Do not assume that an inactive turtle is dead. The onset of rigor mortis and/or rotting flesh are often the only definite indications that a turtle is dead. Releasing a comatose turtle into any amount of water will drown it, and a turtle may recover once its lungs have had a chance to drain. There are three methods that may elicit a reflex response from an inactive animal:

- Nose reflex. Press the soft tissue around the nose which may cause a retraction of the head or neck region or an eye reflex response.
- Cloaca or tail reflex. Stimulate the tail with a light touch. This may cause a retraction or side movement of the tail.
- Eye reflex. Lightly touch the upper eyelid. This may cause an inward pulling of the eyes, flinching or blinking response.

General handling guidelines:

- Keep clear of the head.
- Adult male sea turtles of all species other than leatherbacks have claws on their foreflippers.
  Keep clear of slashing foreflippers.
- Pick up sea turtles by the front and back of the top shell (carapace). Do not pick up sea turtles by
  flippers, the head or the tail.
- If the sea turtle is actively moving, it should be retained at the OCNGS until transported by stranding/rehabilitation personnel to the nearest designated stranding/rehabilitation facility. The rehabilitation facility should eventually release the animal in the appropriate location and habitat for the species and size class of the turtle.

<u>**Live sea turtles within dredge gear**</u>
When a sea turtle is found in the dredge gear, observe it for activity and potential injuries.

< **If the turtle is actively moving,** it should be retained onboard until evaluated for injuries by a permitted rehabilitation facility. Due to the potential for internal injuries associated with hopper entrainment, it is necessary to transport the live turtle to the nearest rehabilitation facility as soon as possible, following these steps:

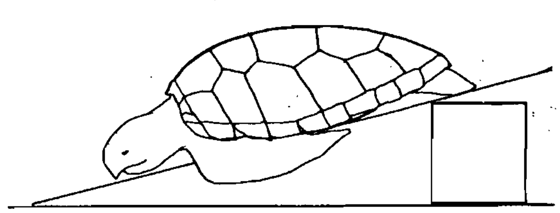
1) Contact the nearest rehabilitation facility to inform them of the incident. If the rehabilitation personnel cannot be reached immediately, please contact NMFS

stranding hotline at 866-755-6622 or NMFS Sea Turtle Stranding Coordinate at 978-282-8470.

2) Keep the turtle shaded and moist (e.g., with a water-soaked towel over the eyes, carapace, and flippers), and in a confined location free from potential injury.
3) Contact the crew boat to pick up the turtle as soon as possible from the dredge (within 12 to 24 hours maximum). The crew boat should be aware of the potential for such an incident to occur and should develop an appropriate protocol for transporting live sea turtles.
4) Transport the live turtle to the closest permitted rehabilitation facility able to handle such a case.

Sea Turtle Resuscitation Regulations: (50 CFR 223.206(d)(1))
If a turtle appears to be comatose (unconscious), contact the designated stranding/rehabilitation personnel immediately. Once the rehabilitation personnel has been informed of the incident, attempts should be made to revive the turtle at once. Sea turtles have been known to revive up to 24 hours after resuscitation procedures have been followed.

- Place the animal on its bottom shell (plastron) so that the turtle is right side up and elevate the hindquarters at least 6 inches for a period of 4 up to 24 hours. The degree of elevation depends on the size of the turtle; greater elevations are required for larger turtles.
- Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches then alternate to the other side.
- Periodically, gently conduct one of the above reflex tests to see if there is a response.
- Keep the turtle in a safe, contained place, shaded, and moist (e.g., with a water-soaked towel over the eyes, carapace, and flippers) and observe it for up to 24 hours.
- If the turtle begins actively moving, retain the turtle until the appropriate rehabilitation personnel can evaluate the animal. The rehabilitation facility should eventually release the animal in a manner that minimizes the chances of re-impingement and potential harm to the animal (i.e., from cold stunning).
- Turtles that fail to move within several hours (up to 24) should be transported to a suitable facility for necropsy (if the condition of the sea turtle allows).



Dead sea turtles
The procedures for handling dead sea turtles and parts are described in Appendix B-II-E.

Stranding/rehabilitation contacts

- Virginia Marine Science Museum (Hotline: (757)-437-6159)
- Virginia Aquarium Stranding Program (Hotline: 757-385-7576; General: 757-385-7575)
- National Aquarium of in Baltimore (**for live animals only**) (Hotline: (410)373-0083)
- NMFS Stranding Hotline at (866)-755-6622

APPENDIX D
Protocol for Collecting Tissue from Sea Turtles for Genetic Analysis

Materials for collecting genetic samples:

- surgical gloves
- alcohol swabs
- betadine swabs
- sterile disposable biopsy punches
- sterile disposable scalpels
- permanent marker to externally label the vials
- scotch tape to protect external labels on the vials
- pencil to write on internal waterproof label
- waterproof label, 1/4" x 4"
- screw-cap vial of saturated NaCl with 20% DMSO*, wrapped in parafilm
- piece of parafilm to wrap the cap of the vial after sample is taken
- vial storage box

* The 20% DMSO buffer within the vials is nontoxic and nonflammable. Handling the buffer without gloves may result in exposure to DMSO. This substance soaks into skin very rapidly and is commonly used to alleviate muscle aches. DMSO will produce a garlic/oyster taste in the mouth along with breath odor. The protocol requires that you wear gloves each time you collect a sample and handle the buffer vials. DO **NOT** store the buffer where it will experience extreme heat. The buffer must be stored at room temperature or cooler, such as in a refrigerator.

Please collect two small pieces of muscle tissue from ***all*** live or dead sea turtles. A muscle sample can be obtained no matter what stage of decomposition a carcass is in. Please utilize the equipment in these kits for genetic sampling of *turtles only* and contact Kate Sampson when you need additional supplies.

Sampling protocol for live turtles:

1. Stabilize the turtle on its plastron. When turtles are placed on their carapace they tend to flap their flippers aggressively and injuries can happen. Exercise caution around the head and jaws.

2. The biopsy location is the dorsal surface of the rear flipper, 5-10 cm from the posterior (trailing) edge and close to the body. Put on a pair of surgical gloves and wipe this area with a Betadine swab. **Insert photo**

3. Wipe the hard surface (plastic dive slate, biopsy vial cap or other available clean surface) that will be used under the flipper with an alcohol swab and place this surface underneath the Betadine treated flipper.

4. Using a new (sterile and disposable) plastic skin biopsy punch, gently press the biopsy punch into the flesh, as close to the posterior edge of the rear flipper as possible. Press down with moderate force and rotate the punch one or two complete turns to make a circular cut all the

way through the flipper. The biopsy tool has a sharp cutting edge so exercise caution at all times.

5. Repeat the procedure on the other rear flipper (one sample per rear flipper) with the same biopsy punch so that you now have two samples from this animal.

6. Remove the tissue plugs by knocking them directly from the biopsy punch into a single vial containing 20% DMSO saturated with salt. It is important to ensure that the tissue samples do not come into contact with any other surface or materials during this transfer.

7. Wipe the biopsy area with another Betadine swab.

8. Dispose of the used biopsy punch in a sharps container. It is very important to use a new biopsy punch and gloves for each animal to avoid cross contamination.

Sampling protocol for dead turtles:

1. The best place to obtain the muscle sample is on the ventral side where the front flippers insert near the plastron. It is not necessary to cut very deeply to get muscle tissue.

2. Using a new (sterile and disposable) scalpel cut out two pieces of muscle of a size that will fit in the vial.

3. Transfer both samples directly from the scalpel to a single vial of 20% DMSO saturated with salt.

4. Dispose of the used scalpel in a sharps container. It is very important to use a new scalpel and gloves for each animal to avoid cross contamination.

Labeling of sample vials:

1. Use a pencil to write stranding ID, date, species and SCL on a waterproof label and place it in the vial with the samples.

2. Use a permanent marker to label stranding ID, date, species and SCL on the outside of the vial.

3. Apply a piece of clear scotch tape over the label on the outside of the vial to protect it from being erased or smeared.

4. Wrap Parafilm around the cap of the vial by stretching as you wrap.

5. Place the vial in the vial storage box.

6. Complete the Sea Turtle Biopsy Sample Collection Log (Appendix I).

7. Attach a copy of the STSSN form (Appendix J) to the Collection Log - be sure to indicate on the STSSN form that a genetic sample was taken.

At the end of the calendar year submit all genetic samples to:

Kate Sampson
NOAA/NMFS/NER
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930
O: (978) 282-8470
C: (978) 479-9729

APPENDIX E
Procedure for obtaining fin clips from sturgeon for genetic analysis

Obtaining Sample

1. Wash hands and use disposable gloves. Ensure that any knife, scalpel or scissors used for sampling has been thoroughly cleaned and wiped with alcohol to minimize the risk of contamination.

2. For any sturgeon, after the specimen has been measured and photographed, take a one-cm square clip from the pelvic fin.

3. Each fin clip should be placed into a vial of 95% non-denatured ethanol and the vial should be labeled with the species name, date, name of project and the fork length and total length of the fish along with a note identifying the fish to the appropriate observer report. All vials should be sealed with a lid and further secured with tape Please use permanent marker and cover any markings with tape to minimize the chance of smearing or erasure.

Storage of Sample

1. If possible, place the vial on ice for the first 24 hours. If ice is not available, please refrigerate the vial. Send as soon as possible as instructed below.

Sending of Sample

1. Vials should be placed into Ziploc or similar resealable plastic bags. Vials should be then wrapped in bubble wrap or newspaper (to prevent breakage) and sent to:

Julie Carter
NOAA/NOS – Marine Forensics
219 Fort Johnson Road
Charleston, SC 29412-9110
Phone: 843-762-8547

a. Prior to sending the sample, contact Russ Bohl at NMFS Northeast Regional Office (978-282-8493) to report that a sample is being sent and to discuss proper shipping procedures.

APPENDIX F
ENDANGERED SPECIES OBSERVER FORM
Borrow Area Dredging
Dam Neck Annex Shoreline Protection System Repair Project

Daily Report

Date: ______________________________

Geographic Site: ____

Location: Lat/Long ____________________ Vessel Name ___________________________

Weather conditions: ____

____

Water temperature: Surface ____________ Below midwater (if known) ____________

Condition of screening apparatus: ____

____

____

Incidents involving endangered or threatened species? (Circle) Yes No
(*If yes, fill out Incident Report of Sea Turtle/Shortnose Sturgeon Mortality*)

Comments (type of material, biological specimens, unusual circumstances, etc.:)

____

____

____

Observer's Name: ____

Observer's Signature: ____

BRIDGE WATCH SUMMARY

Species	# of Sightings	# of Animals	Comments

APPENDIX G

Incident Report of Sea Turtle Take

Species ____________ Date ______________ Time (specimen found) _______________

Geographic Site ____
Location: Lat/Long ____
Vessel Name ______________________ Load # ______________________
Begin load time ______________________ End load time______________________
Begin dump time ______________________ End dump time ______________________

Sampling method ____
Condition of screening ____
Location where specimen recovered____
____

Draghead deflector used? YES NO Rigid deflector draghead? YES NO
Condition of deflector ____
____

Weather conditions____
____

Water temp: Surface _______________ Below midwater (if known) ___________________

Species Information: *(please designate cm/m or inches.)*
Head width ______________________ Plastron length ______________________
Straight carapace length _______________ Straight carapace width_______________
Curved carapace length _______________ Curved carapace width _______________

Condition of specimen/description of animal (please complete attached diagram)
____
____
____

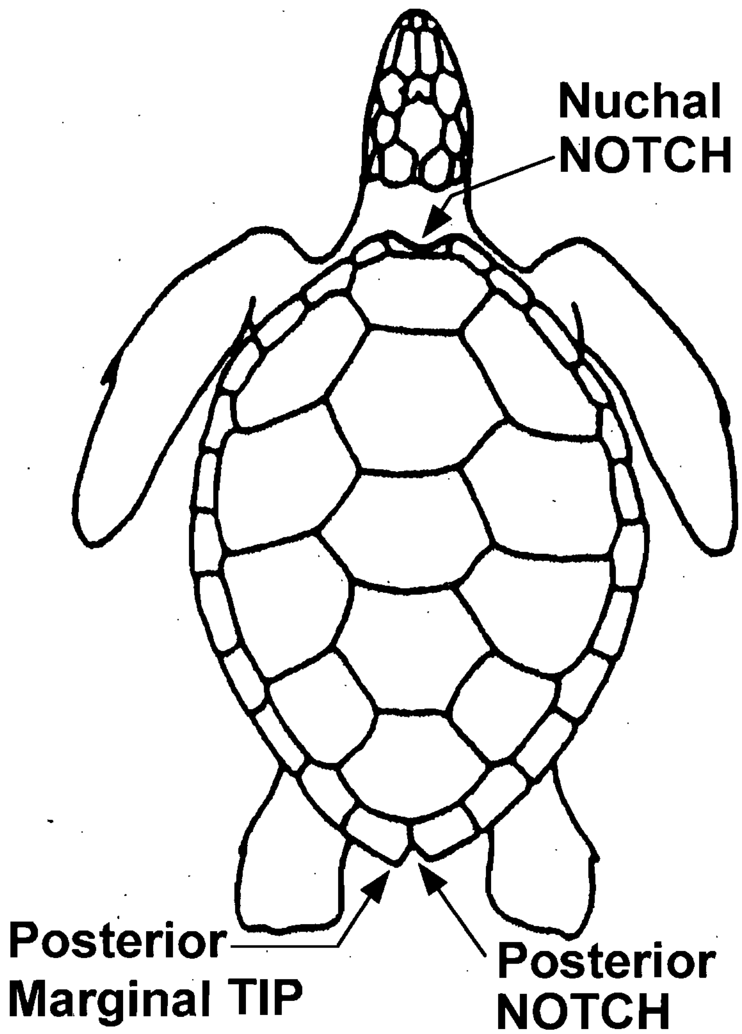
Turtle Decomposed: NO SLIGHTLY MODERATELY SEVERELY

Turtle tagged: YES NO *Please record all tag numbers.* Tag # ____________________
Genetic sample taken: YES NO
Photograph attached: YES NO
(please label *species, date, geographic site* and *vessel name* on back of photograph)

Comments/other (include justification on how species was identified) ____________________
____
____
Observer's Name ______________________________
Observer's Signature ______________________________

APPENDIX G, Continued
Incident Report of Sea Turtle Take

Draw wounds, abnormalities, tag locations on diagram and briefly describe below.



Description of animal:

APPENDIX H

Incident Report of Atlantic Sturgeon Take

Photographs should be taken and the following information should be collected from all sturgeon (alive and dead) found in association with the Dam Neck Annex Shoreline Protection System repair.

Date ______________ Time (specimen found) ______________

Geographic Site ____
Location: Lat/Long ____
Vessel Name ______________________ Load # ______________________
Begin load time ______________________ End load time ______________________
Begin dump time ______________________ End dump time ______________________

Sampling method ____
Condition of screening ____
Location where specimen
recovered ____

____

Draghead deflector used? YES NO Rigid deflector draghead? YES NO
Condition of deflector ____

____

Weather
conditions ____

____

Water temp: Surface ______________ Below midwater (if known) ______________

Species Information: *(please designate cm/m or inches.)*
Fork length (or total length) ______________ Weight ______________

Condition of specimen/description of animal

____

____

____

____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY
Fish tagged: YES / NO *Please record all tag numbers.* Tag # ______________
Genetic sample taken: YES NO
Photograph attached: YES / NO
(please label *species, date, geographic site* and *vessel name* on back of photograph)
Comments/other (include justification on how species was identified)

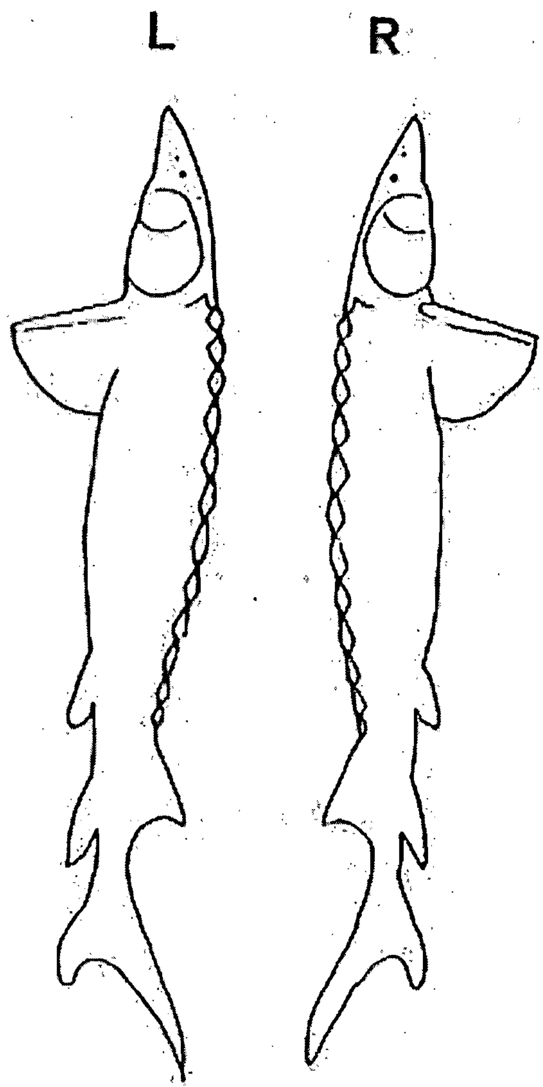
____

____

Observer's Name ______________ Observer's Signature ______________

Appendix H, continued

Draw wounds, abnormalities, tag locations on diagram and briefly describe below



Description of fish condition:

APPENDIX I

Sea Turtle Biopsy Sample Collection Log

				Stranding Date																				
NER ID	SPECIES CODE	FIELD ID	FLIPPER TAG	YEAR	MONTH	DAY	Sample Date (If diff. from stranding date) (mm/dd/yy)	COUNTY	STATE	CAPTURE TYPE	SEX	SCL (cm)	CCL (cm)	TTYPE	TSTORE	LAT D	LAT M	N OR S	LONG D	LONG M	E OR W	OCEAN BASIN	DATE XFER	WHERE?
																						Atlantic		
																						Atlantic		
																						Atlantic		
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																						Atlantic		

Notes:

Leave Blank, NMFS to fill in
Species Code: Use CC, DC, LK, EI or CM
Year/Month/Day: Stranding Data (should also be listed on vial)
Capture Type: Use Stranding or Incidental Capture
Ttype: Tissue Type, will likely be muscle

SEA TURTLE STRANDING AND SALVAGE NETWORK – STRANDING REPORT

OBSERVER'S NAME / ADDRESS / PHONE:
First ________________ M.I.____ Last ________________
Affiliation ________________
Address ________________
____
Area code/Phone number ________________

STRANDING DATE:
Year 20☐☐ Month ☐☐ Day ☐☐
Turtle number by day ☐☐

State coordinator must be notified within 24 hrs; this was done by ☐***phone (860)572-5955 x107*** ☐***email*** ☐***fax (860)572-5969***

SPECIES: (check one)
- ☐ CC = Loggerhead
- ☐ CM = Green
- ☐ DC = Leatherback
- ☐ EI = Hawksbill
- ☐ LK = Kemp's Ridley
- ☐ LO = Olive Ridley
- ☐ UN = Unidentified

Check Unidentified if not positive. Do Not Guess.

STRANDING LOCATION: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)
State ________________ County ________________
Descriptive location (be specific) ________________
____
____
Latitude ________________ Longitude ________________

Carcass necropsied? ☐Yes ☐No
Photos taken? ☐Yes ☐No
Species verified by state coordinator? ☐ Yes ☐ No

CONDITION: (check one)
- ☐ 0 = Alive
- ☐ 1 = Fresh dead
- ☐ 2 = Moderately decomposed
- ☐ 3 = Severely decomposed
- ☐ 4 = Dried carcass
- ☐ 5 = Skeleton, bones only

FINAL DISPOSITION: (check)
- ☐1 = Left on beach where found; painted? ☐Yes* ☐No(5)
- ☐2 = Buried: ☐ on beach / ☐ off beach; carcass painted before buried? ☐ Yes* ☐ No
- ☐3 = Salvaged: ☐ all / ☐ part(s), what/why? ________________
____
- ☐4 = Pulled up on beach/dune; painted? ☐Yes* ☐No
- ☐6 = Alive, released
- ☐7 = Alive, taken to rehab. facility, where? ________________
____
- ☐8 = Left floating, not recovered; painted? ☐Yes* ☐No
- ☐9 = Disposition unknown, explain ________________
____

If painted, what color? ________________

SEX:
- ☐ Undetermined
- ☐ Female ☐ Male

Does tail extend beyond carapace?
☐ Yes; how far?_______ cm / in
☐ No

How was sex determined?
☐ Necropsy
☐ Tail length (adult only)

TAGS: ***Contact state coordinator before disposing of any tagged animal!!***
Checked for flipper tags? ☐ Yes ☐ No
Check all 4 flippers. If found, record tag number(s) / tag location / return address
____
____
____

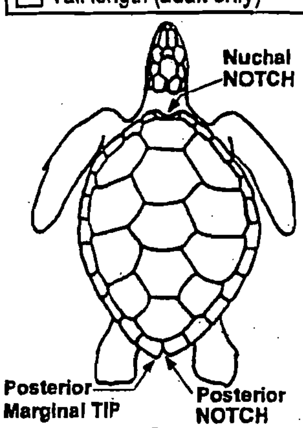
PIT tag scan? ☐ Yes ☐ No
If found, record number / tag location
____
____

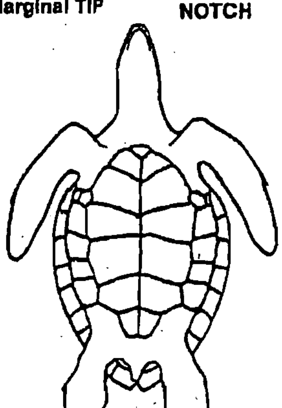
Coded-wire tag scan? ☐ Yes ☐ No
If positive response, record location (flipper)
____

Checked for living tag? ☐Yes ☐ No
If found, record location (scute number & side)
____

CARAPACE MEASUREMENTS: (*see drawing*)

Using calipers		**Circle unit**
Straight length (NOTCH-TIP)	________	cm / in
Minimum length (NOTCH-NOTCH)	________	cm / in
Straight width (Widest Point)	________	cm / in
Using non-metal measuring tape		**Circle unit**
Curved length (NOTCH–TIP)	________	cm / in
Minimum length (NOTCH-NOTCH)	________	cm / in
Curved width (Widest Point)	________	cm / in
		Circle unit
Weight ☐ actual / ☐ est.	________	kg / lb





Mark wounds / abnormalities on diagrams at left and describe below (note tar or oil, gear or debris entanglement, propeller damage, epibiota, papillomas, emaciation, etc.). **Please note if no wounds / abnormalities are found.**
____
____
____
____
____
____

Appendix 9

F

Essential Fish Habitat Assessment

002860_VH05_05-B3272

Essential Fish Habitat Assessment for Repairs to the Shoreline Protection System at Naval Air Station Oceana, Dam Neck Annex Virginia Beach, Virginia

April 2012

Prepared for

UNITED STATES DEPARTMENT OF THE NAVY

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
348 Southport Circle, Suite 101
Virginia Beach, Virginia 23452

UNCLASSIFIED

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List of Abbreviations and Acronyms

ASFMC	Atlantic States Fishery Management Commission
BOEM	Bureau of Ocean Energy Management
BRAC	Base Closure and Realignment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter(s)
cy	cubic yards
EA	environmental assessment
EEZ	exclusive economic zone
EFH	essential fish habitat
ft	foot/feet
FY	fiscal year
FMP	fishery management plan
GMFMC	Gulf of Mexico Fishery Management Council
HAPC	habitat area of particular concern
in	inch(es)
INRMP	Integrated Natural Resources Management Plan
IUCN	International Union for Conservation of Nature
kg	kilogram(s)
km	kilometer(s)
lbs	pounds
MAFMC	Mid-Atlantic Fishery Management Council
m	meter (s)
m^3	cubic meters
mi	mile(s)
mm	millimeter
MMS	Minerals Management Service
MOA	Memorandum of Agreement

Abbreviations and Acronyms (cont.)

NAS	Naval Air Station
NAVD	North American Vertical Datum
NEFMC	New England Fishery Management Council
NEFSC	North East Fisheries Science Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCS	outer continental shelf
OCSLA	Outer Continental Shelf Lands Act
ppt	parts per thousand
SAFMC	South Atlantic Fishery Management Council
SPS	Shoreline Protection System
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USMC	United States Marine Corps
VIMS	Virginia Institute of Marine Science

1 Introduction and Background

Naval Air Station (NAS) Oceana, Dam Neck Annex, commissioned in 1942, is home to 14 tenant commands, i.e., military units located on base. Dam Neck Annex (Figure 1-1) is a 1,372-acre facility located along the Atlantic coast in the Hampton Roads region of Virginia, in the City of Virginia Beach. Dam Neck Annex is located approximately 2 miles (mi) (3.2 kilometers [km]) east of NAS Oceana, 5 mi (8.0 km) south of the primary Virginia Beach resort area, and approximately 20 mi (32.2 km) east of the City of Norfolk. The mission of Dam Neck Annex is to provide the facilities and resources needed to support the land, sea, and air training and operations of tenant commands.

The beaches at Dam Neck Annex are prone to erosion from seasonal hurricanes, tropical storms, nor'easters, and winter conditions that direct wind and wave actions on to the installation's beaches. In the early 1990s the beach became so severely eroded that $124 million worth of Navy facilities, primarily the bachelor enlisted quarters, Shifting Sands Beach Club, housing area, and the weapons gun line, were at risk of being severely damaged or destroyed by flooding and wave action from coastal storms. To protect these facilities, the Navy established an $8.9 million emergency military construction project (P994) in fiscal year (FY) 1995 to construct a shoreline protection system (SPS) (Figure 1-2). The project was completed in October 1996 and included constructing a reinforced sand dune and replenishing the beach on the seaward side of the dune. The constructed dune, which extends from Building 225 south to Building 127, measures 5,282 feet (ft) (1,610 meters [m]) long, 20 ft (6.1 m) high, and 50 ft (15.2 m) wide, and covers approximately 11 acres of nearshore upland. The dune contains a buried stone seawall to protect the nearest real property on the landward side of the dune (U.S. Department of Defense 1996). However, the stone seawall was not designed to provide permanent protection for the buildings and their contents. Approximately 874,000 cubic yards (cy) (668,000 cubic meters [m^3]) of sand were used to construct the SPS, including the constructed dune and beach replenishment. Approximately 115,000 cy (88,000 m^3) of the total of 874,000 cy (668,000 m^3) was trucked in from commercial borrow pits located approximately 10 mi (16.1 km) from the installation to construct the sand dune on top of the stone seawall. The constructed dune was planted with American beach grass (*Ammophila breviligulata*), Atlantic coastal/bitter panic grass (*Panicum amarum*), and sea oats (*Uniola paniculata*). Six pedestrian crossover bridges were constructed over the dune to provide pedestrian access to the beach. There are natural sand dunes both north and south of the constructed dune. The dunes are revegetated annually as specified in the installation's Integrated Natural Resources Management Plan (INRMP) (Geo-Marine, Inc. November 2006).

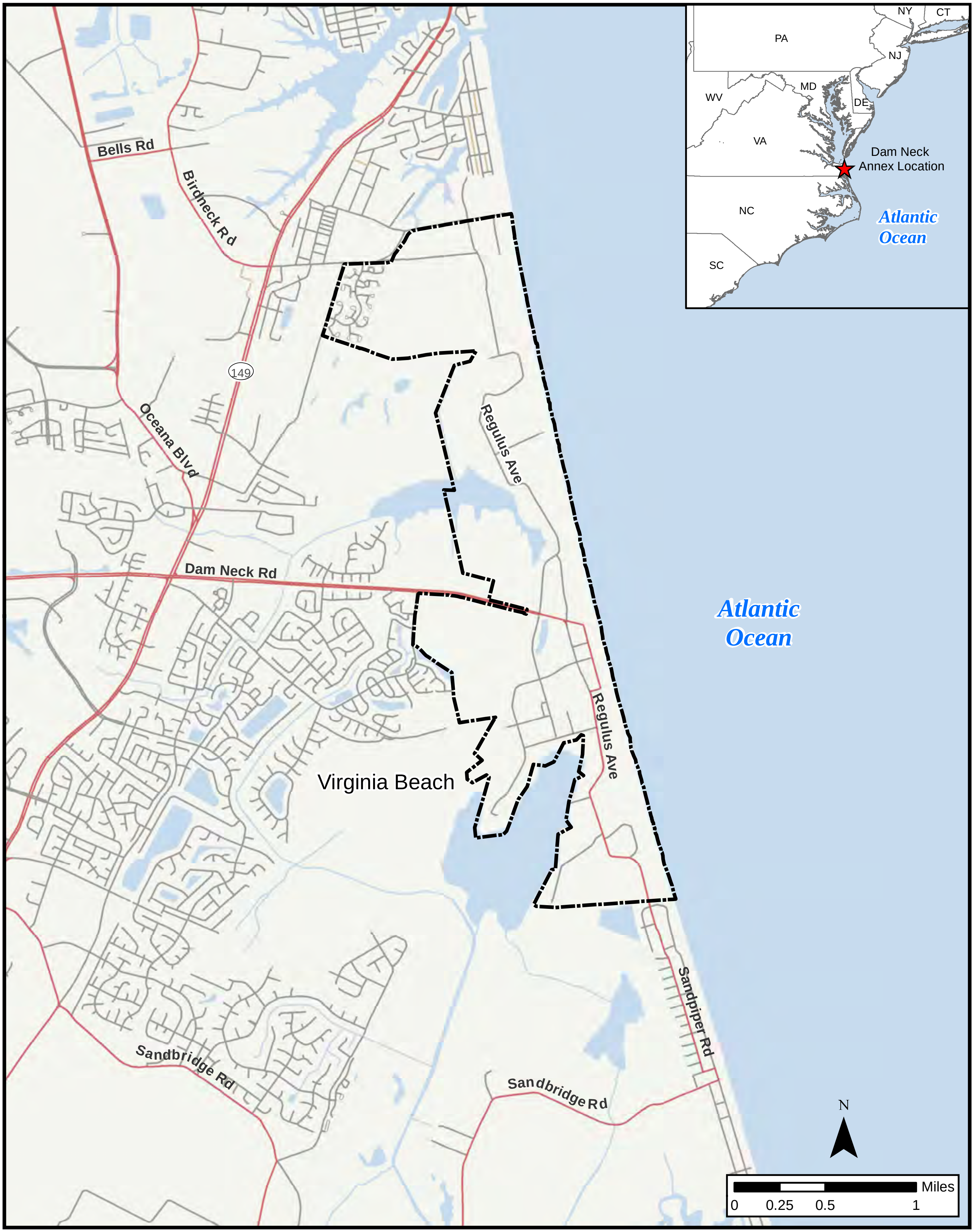
The remaining approximately 759,000 cy (580,000 m^3) of sand were placed along the 9,280 ft (2,828.5 m) of the beach in front of the constructed sand dune and extend approximately one-half mile to both the north and south of the constructed dune. The beach replenishment covered approximately 4.5 acres of nearshore upland, 8 acres of intertidal area, and 28 acres of nearshore area below the mean low water line. The beach was designed to be 200 ft (60.9 m) wide from the dune centerline to the ocean. Sand for the beach replenishment was dredged from a borrow site in the Sandbridge Shoal, an approved U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM) dredge site approximately 3 mi (4.8 km) offshore of the project location. The sand was pumped from the dredge to the beach replenishment area. BOEM authorized the Navy to extract outer continental shelf (OCS) sand in the Sandbridge Shoal for use in the beach replenishment project.

It was anticipated that periodic replenishment of the SPS would be required to maintain its design integrity and effectiveness. The initial beach replenishment cycle was estimated to be 12 years, based upon design expectations. However, a three-year study conducted by the Navy to monitor the performance of the 1996 beach replenishment revealed that a 12-year cycle was inadequate and recommended the beach be replenished again in 2003-2004 (i.e., approximately seven to eight years). In 2004, Special Project R123-01 (repairs to the SPS) replenished the sand that had eroded from the beach and dune since the SPS was constructed (U.S. Department of the Navy September 1, 2003).

Approximately 700,000 cy (535,000 m^3) of sand were placed along the original 9,280 ft (2,828.5 m) of beach front that had been replenished in 1996, covering the same acreage. The dune system needed only minor spot repair with additional sand and vegetation. Sand for the replenishment was provided through a negotiated agreement with BOEM and was dredged by hopper dredge from Sandbridge Shoal (Figure 1-3). A sand-slurry was then pumped from the hopper dredge onto the Dam Neck Annex beach through a pipeline, which was moved along the beach. Bulldozers and graders shaped the beach and dune to the original 1996 configuration.

Since 2004, the combined effects of winds, wave action, and storm damage have caused the beach portion of the SPS to lose a major amount of sand, lowering the level of protection for the Dam Neck Annex facilities. The beach portion of the SPS is integral to the proper functioning and stability of the overall SPS. Without the beach, the constructed dune would quickly erode, leaving only the buried stone seawall which, as noted, was not designed to provide permanent protection for the buildings. The dune, including the buried stone seawall, is currently in relatively good condition, although the sand portion has been sheared into steep slopes in several locations. Sand also covers the bottom rungs of the pedestrian crossover bridges. Erosion of the SPS has progressed to a point where a moderate

M:\VA_Beach\DamNeck\Maps\MXD\EFH Report\Figure 1-1 Vicinity_Map.mxd



Installation Boundary

Figure 1-1 Project Vicinity
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 1-2 Dam Neck Project_Area.mxd

Shore Protection System Location
Installation Boundary
Building
Constructed Dune

Source: ESRI, U.S. Navy

Figure 1-2 Project Area
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

0 125 250 500
Feet

M:\VA_Beach\DamNeck\Maps\MXD\EA\Figure 1-3 Dam Neck Sandbridge Shoal.mxd

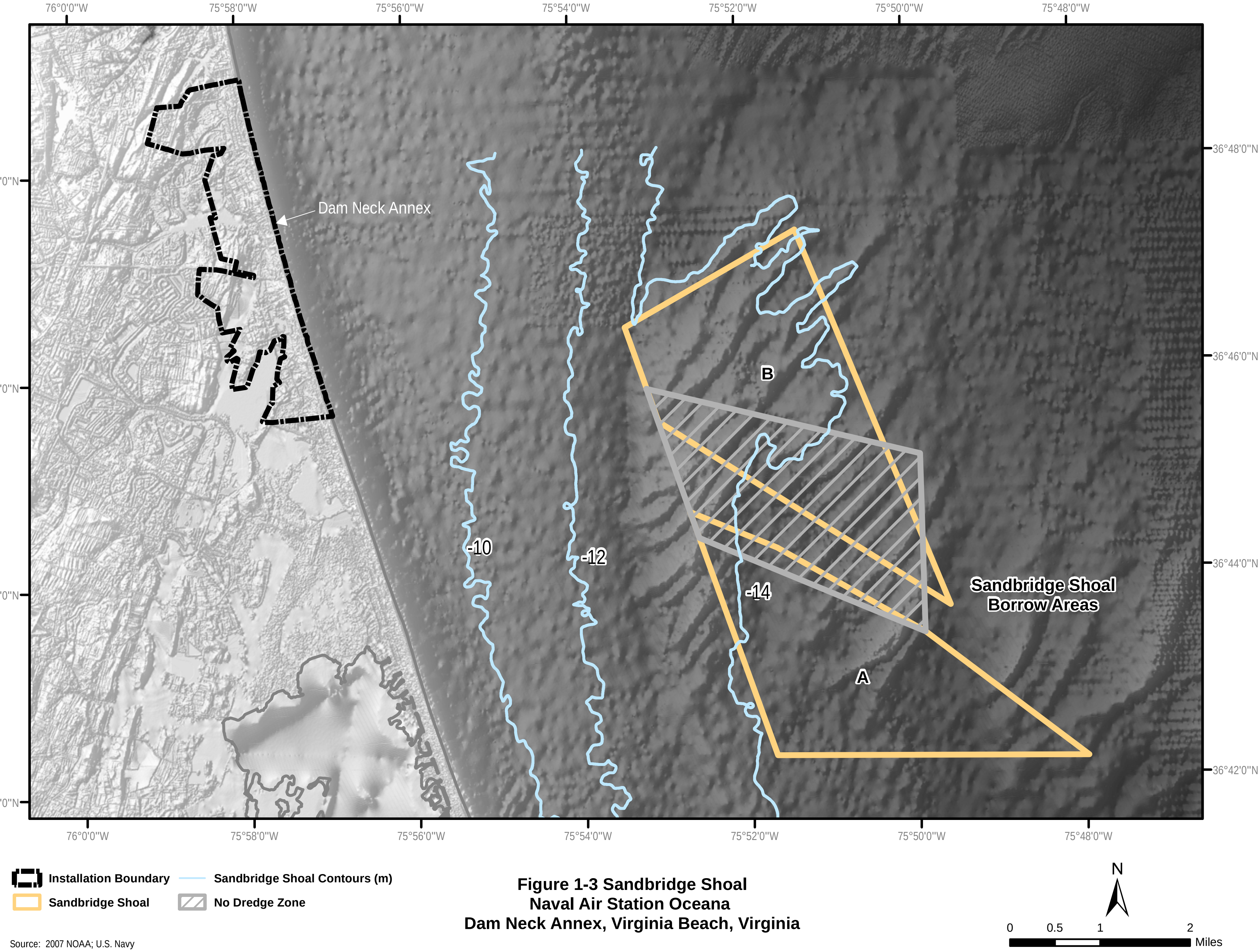


Figure 1-3 Sandbridge Shoal
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: 2007 NOAA; U.S. Navy

winter storm season could erode the dune down to the buried seawall. Dam Neck Annex has implemented temporary measures to reduce erosion, including installing dune fencing and using discarded Christmas trees to capture sand, until the SPS can be repaired.

The U.S. Department of the Navy (Navy) is proposing to repair the SPS at NAS Oceana, Dam Neck Annex and is preparing an environmental assessment (EA) to evaluate the reasonably foreseeable environmental consequences of the proposed SPS repairs. Reasonably foreseeable environmental consequences of the proposed project could include potential impacts on essential fish habitat (EFH).

EFH, as defined by the Magnuson-Stevens Fishery Conservation and Management Act (Act) includes "*waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. . . . For the purpose of interpreting the definition of essential fish habitat, 'waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle*" (50 Code of Federal Regulations [CFR] 600.10).

As such, federal agencies are directed to consult (under the Act) with the National Marine Fisheries Service (NMFS) when any of their proposed activities may have an adverse effect on EFH. The Act defines an adverse effect as "any impact which reduces quality and/or quantity of EFH." Similarly, the Act notes that "adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

This EFH assessment has been prepared pursuant to Section 305(b)(2) of the Act and includes the following information: 1) a description of the proposed action; 2) identification of species of concern; 3) an analysis of the effects of the proposed action; 4) proposed mitigation; and 5) the Navy's conclusions about the effects of the proposed action.

2 Proposed Project

The Navy is proposing to repair the SPS at NAS Oceana, Dam Neck Annex. The portion of the SPS that would be repaired (replenished) is approximately 2 mi (3.2 km) long, including the approximately 1 mi (1.6 km) area in front of the constructed dune, with additional approximately 0.5 mi (0.8 km) portions extending north and south of the dune. Sand for the beaches would be dredged from a BOEM-approved borrow area in Sandbridge Shoal, which is located approximately 3 mi (4.8 km) east of the proposed project. The anticipated implementation date of the repairs is between FY 2012 and FY 2014, depending on funding.

The Navy is preparing an EA to evaluate the reasonably foreseeable environmental consequences of the proposed SPS repairs. The EA evaluates two action alternatives: Alternative 1—Full Replenishment of the SPS (Preferred Alternative), and Alternative 2—Full Replenishment of the SPS and Construction of a Dune. Both alternatives are described briefly below.

The Navy is the lead agency for this proposed action, with the BOEM serving as a cooperating agency for the National Environmental Policy Act (NEPA) process and coordinating with the Navy during Magnuson-Stevens Fishery Conservation and Management Act consultation.

2.1 Alternative 1 (Preferred Alternative) - Full Replenishment

Under Alternative 1, the SPS at the Dam Neck Annex would be restored to its original condition (Figure 2-1). The beach would be fully replenished, and the seaward side of the constructed dune would be replenished with sand and reshaped to the 1996 dimensions. The restored areas of the constructed dune would be revegetated with native grasses such as American beach grass, Atlantic coastal/bitter panic grass, switchgrass (*Panicum virgatum*), and saltmeadow hay (*Spartina patens*). Accumulated sand would be removed from the pedestrian crossover bridges.

A total of approximately 700,000 cy (535,000 m^3) of sand would be needed. The volume of sand required includes an extra 25% that is expected to be lost during the replenishment operation. It is estimated that approximately 472,500 cy (361,300 m^3) would be placed on the beach and 52,500 cy (40,100 m^3) would be added to the constructed dune. This sand replaces the volume eroded since 2004 by normal wind, wave, and current action as well as sand removed during storms.

Alternative 1 includes authorization by BOEM to access OCS sand in the borrow area known as Sandbridge Shoal, for the extent of the lease agreement, in order to dredge sand for the replenishment. The approved Sandbridge Shoal borrow area encompasses approximately 13,500 acres (55 km^2) in the Atlantic Ocean approximately 3 mi (4.8 km) east of the proposed project location (see Figure 2-1). Substrates within the shoal are primarily medium-grained sand appropriate for beach restoration projects (U.S. Army Corps of Engineers and Minerals Management Service June 2009). A hopper dredge would be used to pump the sand from Sandbridge Shoal. The hopper dredge would remove approximately 2,800 cy (2,100 m^3) of sand per trip to the shoal. Once the sand is pulled from the shoal, the dredge would be transported to pump-out stations/buoys located close to shore (approximately 0.5 mi [0.8 km]) where the sand slurry would be pumped from the dredge onto the Dam Neck Annex beach through a pipeline at no more than five different pump-out stations/buoys positioned approximately 2,500 to 3,000 ft (762 to 914 m) apart along the area to be replenished. No more than two bulldozers and two graders would then be used to shape the beach and dune to the original 1996 design. The bulldozers and graders would be operated eight hours a day. The maximum distance the deposited sand would extend into the water from the shore is 300 ft (91.4 m). The Navy will ensure that the contractor uses best management practices to avoid erosion during sand placement. Repairs are estimated to require three to six consecutive months to complete.

One hopper dredge would be used to complete the project. Dredging operations would occur 24 hours per day, with approximately 9.8 hours per day spent at the borrow area. The remainder of the day would be spent in transit or at the pump-out stations/buoys. It would be expected that the hopper dredge would complete approximately seven round-trips per day from the borrow area to the pump-out stations/buoys.

Alternative 1 would be a single one-time action. However, it is anticipated that future replenishment of the beaches would be necessary and would be on a similar cycle and require similar volumes of sand as past similar projects at Dam Neck Annex. (Catastrophic storm events may require shorter cycles and larger volumes of sand.) The Navy will initiate appropriate consultations when additional beach replenishment is required.

2.2 Alternative 2 - Full Replenishment and Construction of a Dune

Under Alternative 2, as with Alternative 1, the SPS would be restored to its original condition: the beach would be fully replenished, and the seaward side of the constructed dune would be replenished with sand and reshaped to the 1996 dimensions (Figure 2-2). Alternative 2 also would include constructing a manmade dune, including a stone core, along the approximately half-mile sections of dune north and south of the SPS. The restored areas of the existing dune and

M:\VA_Beach\DamNeck\Maps\MXD\EFH Report\Figure 2-1 Dam Neck Alternative 1.mxd

Shore Protection System Location
Installation Boundary
Building
Constructed Dune - Replenished and Reshaped
Sand Replenishment
Source: ESRI, U.S. Navy

Figure 2-1 Alternative 1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

N

0 125 250 500 Feet

M:\VA_Beach\DamNeck\Maps\MXD\EFH Report\Figure 2-2 Dam Neck Alternative 2.mxd

Figure 2-2 Alternative 2
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia

Source: ESRI, U.S. Navy

the newly constructed dune would be planted with native grasses such as the species identified in Section 2.1. Accumulated sand would be removed from the pedestrian crossover bridges along the restored areas of the dune.

Alternative 2 also requires authorization by BOEM to extract OCS sand from Sandbridge Shoal for use in beach replenishment. Sand would be acquired, transported, and distributed as described under Alternative 1. Repairs would take an estimated six to nine consecutive months to complete but could take longer if additional sand is required.

Under Alternative 2, a total of approximately 1.1 million cy (841,100 m^3) of sand would be required. The volume of sand needed includes an extra 25% that is expected to be lost during the replenishment operation. Approximately 472,500 cy (361,300 m^3) would be placed on the beach, 52,500 cy (40,100 m^3) on the existing dune, and 300,000 cy (229,400 m^3) would be added to the newly constructed dune. Extension of the constructed dune would not prevent the need for periodic beach replenishment, but its stone core would afford a greater level of protection during strong storms, giving the Navy additional time to prepare for emergency replenishment that may be required earlier than planned if storms continue to erode the beach.

3 EFH Consultation History

In 1996, the Navy completed an EA for the Minerals Management Service's (MMS) Issuance of a Noncompetitive Lease for the Sandbridge Shoal Sand and Gravel Borrow Area. However, because EFH areas along coastal Virginia were first designated by the Mid-Atlantic Fishery Management Council (MAFMC) and published by the National Oceanic and Atmospheric Administration (NOAA) NMFS in 1999, formal consultation was not initiated for the 1996 project.

In 2003, the Navy completed an EA for a beach replenishment project at Dam Neck Annex. The Navy and MMS negotiated a leasing agreement and Memorandum of Agreement (MOA) signed on September 1, 2003. The MMS sent an approval request letter to Congress (September 30, 2003) and the Navy began sand dredging in October 2003. The project was completed by April 2004 to avoid impacts on sea turtles that begin nesting in April. In addition, impacts on fish species were avoided because many species with designated EFH are spawning during this time.

In conjunction with the EA, the Navy also submitted an EFH assessment to the NMFS on July 21, 2003. On September 10, 2003 the Navy received email correspondence from the NMFS confirming approval of the Navy's EFH assessment for the proposed project. The correspondence included the following conservation recommendations to fulfill Section 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act:

- *Detailed bathymetric surveys* [should] *be conducted prior to dredging, the results of those surveys* [should] *be mapped, and that copies of those maps* [should] *be provided to NMFS. The maps should clearly illustrate the location of the borrow site(s) and its (their) spatial relationship to previously used borrow areas and the shoreline. We further recommend that the site(s)* [should] *be surveyed again following project completion, and again 5 years following project completion to determine the amount of recovery, if any, at the site(s). We further request copies of the surveys performed from previous dredge actions conducted by the Dam Neck NAS at Sandbridge Shoal, if available.*

- *Surficial sediments* [should] *be removed from shoal flanks, if practicable. The shoal crest and adjacent troughs, which are more productive biologically, shall be avoided when feasible.*

- *Methods to prolong retention of sand to increase time intervals between nourishment cycles need to be investigated and implemented where feasible.*

- *Alternative sources of borrow, as well as alternative stabilization options need to be investigated to avoid serious impacts to the integrity of Sandbridge Shoal and other offshore shoals* (U.S. Department of the Navy September 1, 2003).

4 Sandbridge Shoal

Under the Outer Continental Shelf Lands Act (OCSLA), BOEM has the authority to regulate mineral exploration and development of the OCS. BOEM will determine whether to issue a negotiated agreement for the Navy to extract sand from Sandbridge Shoal. Sandbridge Shoal is located approximately 3 mi (4.8 km) east of Dam Neck Annex and Sandbridge Beach.

Sandbridge Shoal is a relatively shallow feature with a minimum water depth of approximately 29.5 ft (9 m) (Maa and Hobbs 1998). As such, the ridge and trough topography of the fine-grained to medium-grained sand landform is shaped predominantly by exposure to wave and current energy. The wave-current influence erodes and accretes the shoal body in bands, thus forcing a south-southwesterly migration, as seen in the comparison of bathymetric surfaces from 1981 and 2006. Studies have documented smooth-crested wave-orbital bedforms in benthic video and still shots (Cutter and Diaz 1998; Diaz et al. 2003). In general, research has shown that species diversity and densities (including the species that are found in the benthic habitats on and in the vicinity of Sandbridge Shoal) increase as depth increases along the Continental Shelf (Cutter and Diaz 1998; Diaz et al. 2006). As a result, these benthic habitats become more biologically diverse farther from the shoal. More recently, Diaz et al. (2006) have confirmed that physical processes drive the structuring of sediment surfaces on the shoal. Benthic abundance and diversity also varies with seasons. Greater abundance and diversity are found in the spring months with both dropping off during the summer months and reaching their lowest amounts during the winter months (Versar 2004; Brooks et al. 2006). Slacum et al. (2010) reported that species diversity, abundance and richness were all lower in the winter than in spring, summer and fall.

Further, complexity of the bottom structure is important to biological diversity of benthic habitats. Slacum et al. (2010) found that on the inner continental shelf of the Mid-Atlantic Bight, flat bottom areas have greater species richness, diversity and abundance. Also, they reported within regions of sand shoals, there was greater abundance in areas with a steeper gradient. Species richness has also been reported to be greater in the troughs surrounding shoals than on the shoal tops themselves (Vasslides and Able 2008).

Dredging on the shoal between 1996 and 2007 removed 6,810,000 cy (15,206,619 m^3) of material for beach replenishment. Dredging has occurred at large ridges of high relief, a typical dredging tactic that results in retention of some ridge relief. The shoal remains structurally complete and exposed to the wave-current influence. However, because recovery of sand volume is relatively slight between dredging events, the total surface area of the shoal will be reduced through time with continued dredging.

The shoal supports a variety of fishes and invertebrates. Fishes common to the shoal include, from the most abundant to the least abundant, sea robins (Scorpaeniformes), spotted hake (*Urophycis regius*), butterfish (Stromateidae spp.), pinfish (*Lagodon rhomboids*), smallmouth flounder (*Etropus microstomus*) and other flounder (*Paralichthys* spp.) (Diaz et al. 2006). Habitat utilization for the most abundant fishes can vary from year to year. However, most often these fishes are found in sandy areas and, after dredging, are more likely to be found on the shoal itself (Diaz et al. 2003; Diaz et al. 2006). Invertebrates common to the shoal include hermit crabs (*Pagurus* spp.), sand shrimp (*Crangon septemspinosa*), and Atlantic brief squid (*Lolliguncula brevis*) (Diaz et al. 2006). Overall, Sandbridge Shoal and its vicinity support a food web with three trophic levels: primary producers, primary consumers (bivalves and amphipods), and secondary consumers (demersal fish).

Benthic species observed by Diaz et al. (2006) commonly included amphiods, bivalves, lancelets and, less commonly, decapods, nemerteans, echinoderms, anemones, isopods, gastropods, phoronids, and tunicates. Polychaeta were the most abundant class observed overall. No significant differences in macrofaunal abundance occurred between dredged locations and control plots. Therefore, there is little evidence to suggest that dredging is significantly impacting benthic habitat. If benthic habitat and species were to be impacted the impacts would be temporary. The benthic community composition at Sandbridge Shoal is typical of other shallow sandy habitats found along the Atlantic continental shelf (Diaz et al. 2006). A review of scientific literature for the Atlantic and Gulf continental shelves suggests that recovery of benthic communities from human disturbance occurs within 3 months to 2.5 years (Brooks et al. 2006).

Macrobenthic and fish communities on the shoal continue to be healthy despite the recurring dredging. Diaz et al. (2006) monitored dredged areas to identify biological impacts associated with dredging. Biological activity on the shoal tends to be highest in the silty, patchy substrate to the east of the shoal. Despite dredging, negative impacts on macrobenthos or demersal fishes have not been documented.

5 Identification of Managed Species

To facilitate EFH consultation, the New England Fishery Management Council (NEFMC), the MAFMC, South Atlantic Fishery Management Council (SAFMC), and the NMFS northeast regional office created the *Guide to EFH Designations*,[1] pursuant to the Magnuson-Stevens Fishery Conservation and Management Act. A 10' x 10' grid system was developed to isolate Atlantic coastal areas from Virginia and northward and, as such, identify fisheries with designated EFH within each square. This guide was used to determine the list of species to be analyzed in this EFH assessment. Tables 5-1 and 5-3 illustrate the 10' x 10' squares of interest (see also Figure 5-1). The species lists for Square 1 and Square 2 are provided in Tables 5-2 and 5-4.

5.1 Square 1

Table 5-1 Square 1: EFH Designation Boundary for Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

Boundary	North	East	South	West
Coordinate	36°50.0' N	75°50.0'W	36°40.0'N	76°00.0'W

The coordinates above encompass the waters in the Atlantic Ocean that affect the project area, including Sandbridge Shoal. These waters affect Muddy Creek, Porpoise Point, and northern Long Island, and Virginia Beach from Rudee Inlet on the north, south past Sandbridge Beach, Virginia, to east of halfway down Long Island just north of the Wash Flats.[2]

Table 5-2 Square 1: Project Area Species with Designated Essential Fish Habitat

Species					
Common Name	Scientific Name	Eggs	Larva	Juveniles	Adult
Red Hake	(*Urophycis chuss*)	X	X	X	
Witch Flounder	(*Glyptocephalus cynoglossus*)	X			
Windowpane Flounder	(*Scophthalmus aquosus*)	X		X	
Atlantic Sea Herring	(*Clupea harengus*)				X
Bluefish	(*Pomatomus saltatrix*)			X	X
Summer Flounder	(*Paralichthys dentatus*)			X	X
Scup	(*Stenotomus chrysops*)	N/A	N/A	X	X
Black Sea Bass	(*Centropristis striata*)	N/A		X	X

[1] http://www.nero.noaa.gov/hcd/webintro.html
[2] http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407550.html

Table 5-2 Square 1: Project Area Species with Designated Essential Fish Habitat

Species					
Common Name	Scientific Name	Eggs	Larva	Juveniles	Adult
Spiny Dogfish	(*Squalus acanthias*)	N/A	N/A	X	
King Mackerel	(*Scomberomorus cavalla*)	X	X	X	X
Spanish Mackerel	(*Scomberomorus maculatus*)	X	X	X	X
Cobia	(*Rachycentron canadum*)	X	X	X	X
Red Drum	(*Sciaenops occelatus*)	X	X	X	X
Sand Tiger Shark	(*Carcharias taurus*)		X		X
Atlantic Sharpnose Shark	(*Rhizopriondon terraenovae*)				X
Dusky Shark	(*Carcharhinus obscurus*)		X	X	
Sandbar Shark	(*Carcharhinus plumbeus*)		X, HAPC	X, HAPC	X, HAPC
Scalloped Hammerhead Shark	(*Sphyrna lewini*)			X	
Tiger Shark	(*Galeocerdo cuvieri*)		X	X	X
Clearnose Skate	(*Raja eglanteria*)			X	X
Little Skate	(*Raja erinacea*)			X	X
Winter Skate	(*Leucoraja ocellata*)			X	X

Source: http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407550.html, http://www.nero.noaa.gov/hcd/skateefhmaps.htm

Key:

HAPC = Habitat area of particular concern (designated).
N/A = Either no data on the designated life stages were available or those life stages are not present in the species' reproductive cycle.
X = Designated EFH in the analyzed 10' x 10' square.

5.2 Square 2

Table 5-3 Square 2: EFH Designation Boundary for Naval Air Station Oceana, Dam Neck Annex, Virginia Beach, Virginia

Boundary	North	East	South	West
Coordinate	36°50.0' N	75°40.0'W	36°40.0'N	76°50.0'W

The coordinates for Square 2 include the project area and Sandbridge Shoal. These waters are one square east of the square affecting and within North Bay and Shipps Bay and affecting southern Virginia Beach.[3]

Table 5-4 Square 2: Project Area Species with Designated Essential Fish Habitat

Species					
Common Name	Scientific Name	Eggs	Larva	Juveniles	Adult
Witch Flounder	(*Glyptocephalus cynoglossus*)	X			
Windowpane Flounder	(*Scophthalmus aquosus*)	X	X	X	
Atlantic Sea Herring	(*Clupea harengus*)			X	X
Monkfish	(*Lophius americanus)*	X	X		
Bluefish	(*Pomatomus saltatrix*)			X	X

[3] http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407540.html

Table 5-4 Square 2: Project Area Species with Designated Essential Fish Habitat

Species					
Common Name	**Scientific Name**	**Eggs**	**Larva**	**Juveniles**	**Adult**
Atlantic Butterfish	(*Peprilus triacanthus*)			X	
Summer Flounder	(*Paralichthys dentatus*)			X	X
Scup	(*Stenotomus chrysops*)	N/A	N/A	X	X
Black Sea Bass	(*Centropristis striata*)	N/A	X	X	X
Surf Clam	(*Spisula solidissima*)	N/A	N/A	X	
Spiny Dogfish	(*Squalus acanthias*)	N/A	N/A	X	X
King Mackerel	(*Scomberomorus cavalla*)	X	X	X	X
Spanish Mackerel	(*Scomberomorus maculatus*)	X	X	X	X
Cobia	(*Rachycentron canadum*)	X	X	X	X
Red Drum	(*Sciaenops occelatus*)	X	X	X	X
Sand Tiger Shark	(*Carcharias taurus*)		X		X
Atlantic Sharpnose Shark	(*Rhizopriondon terraenovae*)				X
Dusky Shark	(*Carcharhinus obscurus*)		X	X	
Sandbar Shark	(*Carcharhinus plumbeus*)		X	X	X
Scalloped Hammerhead Shark	(*Sphyrna lewini*)			X	
Tiger Shark	(*Galeocerdo cuvieri*)		X	X	X
Clearnose Skate	(*Raja eglanteria*)			X	X

Source: http://www.nero.noaa.gov/hcd/STATES4/virginia/virginia/36407540.html
http://www.nero.noaa.gov/hcd/skateefhmaps.htm

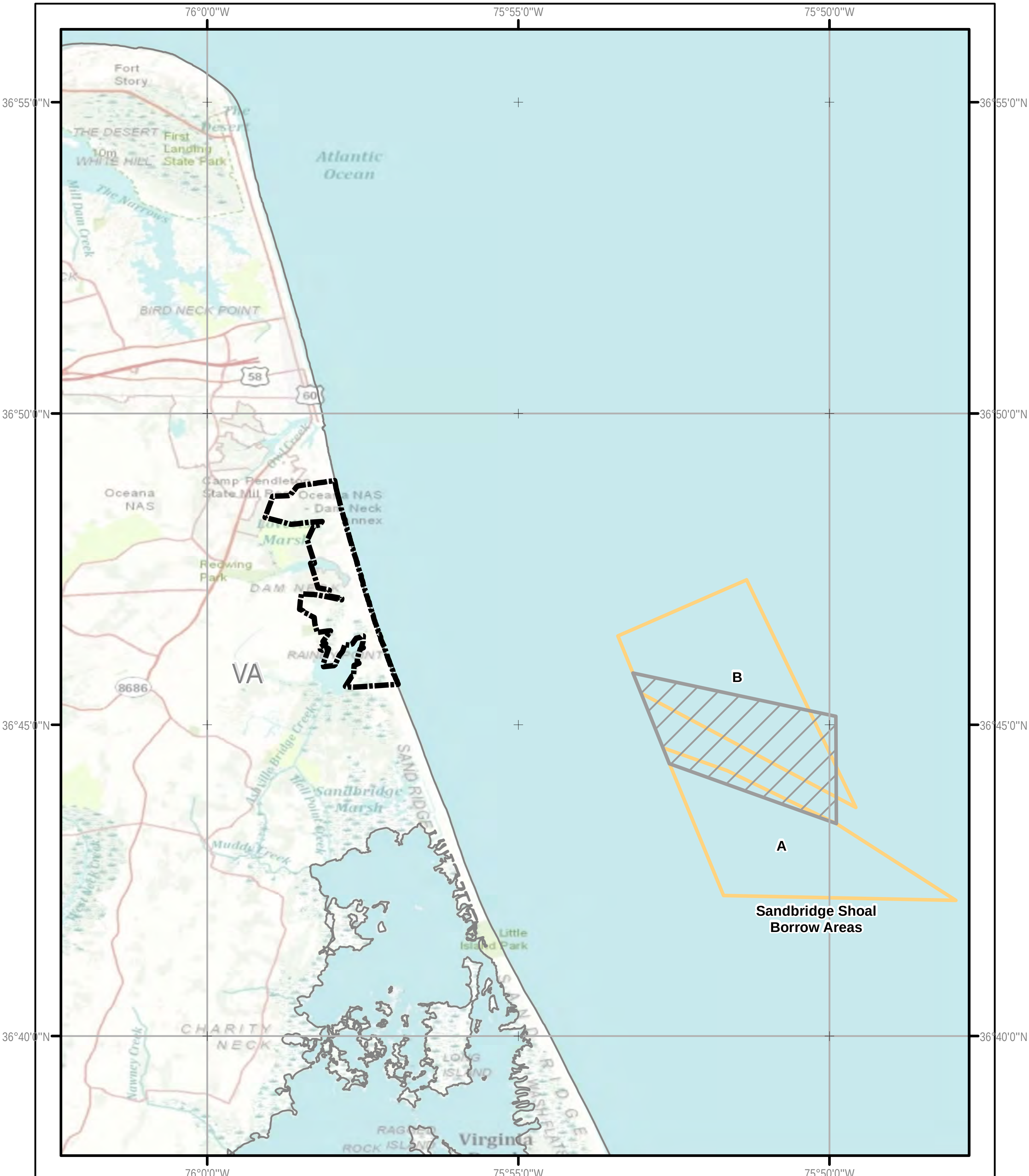
Key:
N/A = Either no data were available on the designated life stages or those life stages are not present in the species' reproductive cycle.
X = Designated EFH within analyzed 10' x 10' square.

These species are further classified by geographic area. Project area species that are classified as “New England Species” include red hake, witch flounder, windowpane flounder, Atlantic sea herring, clearnose skate, little skate, and winter skate. “Mid-Atlantic Species” include black sea bass, scup, bluefish, spiny dogfish, summer flounder, and surf clam. Project area species classified as “Highly Migratory” include sand tiger shark, sandbar shark, Atlantic sharpnose shark, scalloped hammerhead shark, tiger shark, and dusky shark. “South Atlantic Species” include red drum, king mackerel, Spanish mackerel, and cobia[4].

As noted in Tables 5-2 and 5-4, EFH applies to each life stage of the potentially affected species, and different life stages of the same species may use different habitats. The life stages of bony and cartilaginous fish are distinct from each other at sub-adult stages. EFH is designated for egg, larval, juvenile, and adult life history stages of bony fish. EFH is designated for egg, neonate/early juvenile, late juvenile/subadult, and adult life history stages of cartilaginous fish. Additional details for each of these species, their life stages, habitats, and

[4] http://www.nero.noaa.gov/hcd/list.htm

potential project impacts are included in Section 6, Evaluation of Impacts on EFH Species.



Installation Boundary
Sandbridge Shoal
No Dredge Zone

Figure 5-1
Naval Air Station Oceana
Dam Neck Annex, Virginia Beach, Virginia
National Marine Fisheries Service
10 x 10 Minute Squares for EFH Designation

N
0 0.5 1 2 Miles

6 Evaluation of Impacts on EFH Species

This section provides a description of each EFH managed species and life stage characteristics. In addition, the section evaluates potential impacts on each EFH species as a result of implementing the proposed repairs to the SPS at Dam Neck Annex. Impacts associated with sand removal at the Sandbridge Shoal are also included. Life history and EFH descriptions focus on the Mid-Atlantic Bight, which is the coastal region that encompasses the project area.

6.1 Red Hake

6.1.1 Species Description

Red hake (*Urophycis chuss*) is a demersal fish that is typically found from North Carolina northward to southern Newfoundland. Red hake are found in greatest abundance between Georges Bank and New Jersey, well north of the project area. Red hake migrate seasonally, as temperatures fluctuate. In warmer months, they are most common in water depths less than 328 ft (100 m), and during colder months they are most common in water depths greater than 328 ft (100 m). In the Mid-Atlantic Bight during the spring and fall, red hake are found most frequently in coastal waters but tend to move farther offshore in the summer to avoid warmer water temperatures. Some juveniles, however, may be found in deep holes and coastal bay channels during these warmer periods (Steimle et al. 1999a).

Habitat characteristics for red hake eggs are poorly defined because field collections typically do not separate red hake eggs from the eggs of similar species. Larvae have been collected on the middle to OCS of the Mid-Atlantic Bight in water temperatures between 46 degrees Fahrenheit (°F) and 73°F (8 degrees Celsius [°C] and 23°C), with the majority found between 51°F and 66°F (11°C and 19°C), in depths of 32.8 ft to 656 ft (10 m to 200 m [Steimle et al. 1999a]). Juvenile red hake seek shelter from predators in scallop beds (Traver and Col 2006). Adult red hake generally prefer soft sediments, such as soft sand and muddy bottom.

Red hake are managed under the *Northeast Multispecies Fishery Management Plan (FMP)* administered by the NEFMC, one of the eight regional councils established under the Magnuson-Stevens Act. There are two stocks—northern and southern—with the southern stock extending to the Mid-Atlantic Bight. According to the 2010 red hake stock assessment, red hake in the southern stock were not considered to be in an overfished condition (Northeast Fisheries Science Center 2011).

6.1.2 EFH

Designated EFH for the egg, larval, and juvenile life stages of red hake is found in the project area. EFH for these life stages is described below.

Eggs

Designated EFH within the project area for red hake eggs includes surface waters of the continental shelf from the mid-Atlantic south to Cape Hatteras, North Carolina. In general, EFH characteristics for red hake eggs include sea surface temperatures below 50°F (10°C) along the inner continental shelf and water salinity of less than 25 parts per thousand (ppt). Red hake eggs have most often been observed from May through November, peaking in June and July (National Oceanic and Atmospheric Administration Fisheries 1998a).

Larvae

Project area EFH for red hake larvae is the same as previously described for red hake eggs. In general, EFH characteristics for the larvae include surface temperatures below 66°F (19°C); depths less than 656 ft (200 m); and water salinity greater than 0.5 ppt. Red hake larvae are typically observed from May through December, peaking in September and October (National Oceanic and Atmospheric Administration Fisheries 1998a).

Juveniles

Designated EFH in the project area for red hake juveniles includes bottom habitats with a substrate of shell fragments, including live scallop beds. Typical EFH characteristics for juveniles include water temperatures below 60°F (16°C); water depths less than 328 ft (100 m); and a salinity range of 31 ppt to 33 ppt (National Oceanic and Atmospheric Administration Fisheries 1998a).

6.1.3 Potential Project Impacts

Because the most significant population centers for this species tend to occur from New Jersey northward, only minor impacts on red hake would be expected to result from the proposed action. Red hake eggs would not be expected to be present in the dredge area because they prefer low (<10ºC) water temperatures, so it is unlikely that red hake eggs would be directly impacted by dredging operations. Similarly, although demersal red hake larvae would be unlikely to be found within the project area, if present, they would likely be associated with structure (e.g., shells) and depressions on the shoal seafloor, which may be found in the troughs of ridges within the borrow areas. If larvae are present they could be drawn into the dredge. However, large populations of red hake larvae would not likely be concentrated in the dredging area, and because of the relatively small scale of the area to be impacted compared with the area of the continental shelf over which larvae are likely to occur, no significant impacts on red hake populations are expected.

Juvenile red hake also could be found in the proposed dredge area; however, with the preference for colder temperatures, juveniles would likely be located in nearshore waters farther north. Also, red hake favor finer grained sediments than those in the dredge area. Any red hake juveniles remaining on the bottom or venturing too close to the dredge intake could be entrained. If red hake juveniles were present during dredging it would be expected that because of their high mobility they would easily avoid intake. Any losses in the red hake population from entrainment of individual juveniles would likely be small because they would not be expected to be concentrated at the site. Potential impacts on the food web would be temporary, further minimizing any adverse impacts. Although increased bathymetric relief, left by the dredge at the shoal, may favor red hake larvae and juveniles, this beneficial impact would be minor because of the relatively small size of the impact area and would be expected to gradually dissipate as hydrodynamic forces rework and smooth the shoal surface.

6.2 Witch Flounder

6.2.1 Species Description

The witch flounder (*Glyptocephalus cynoglossus*) is a right-eyed, small-mouthed flounder (groundfish) common throughout the Gulf of Maine and in deeper areas on and adjacent to Georges Bank and along the continental shelf edge as far south as Cape Hatteras, North Carolina. Like the red hake, the witch flounder is managed under the *Northeast Multispecies FMP* administered by the NEFMC. However, unlike the red hake, witch flounder is assessed as one unit stock. According to the 2008 stock assessment, witch flounder was in an overfished condition and overfishing was occurring (Northeast Fisheries Science Center 2008a).

Witch flounder egg and larvae are pelagic, generally found over deep water in water temperatures ranging from 39°F to 54°F (4°C to 13°C) in depths ranging from 98.4 ft to 492 ft (30 m to 150 m). Once larvae become juveniles, they inhabit the bottom. Both juveniles and adults are found in water temperatures ranging from 32°F to 59°F (0°C to 15°C), most frequently at 35°F to 48°F (2°C to 9°C). They are found over mud, clay, silt, and muddy sand substrates at depths ranging from 65.6 ft to 5,134 ft (20 m to 565 m), though primarily found at 295 ft to 984 ft (90 m to 300 m). Adult witch flounder are very closely tied to these mud/silt, muddy-sand, and clay substrates and rarely occur on any other bottom type (Cargnelli et al. 1999a).

6.2.2 EFH

Designated EFH for the egg life stage of witch flounder is found in the project area. EFH for this life stage is described below.

Eggs

Designated EFH for witch flounder eggs in the project area include surface waters of the continental shelf from the mid-Atlantic south to Cape Hatteras, North Carolina. In general, EFH characteristics for witch flounder eggs include sea surface temperatures below 55°F (13°C) over deep water with a high salinity.

Witch flounder eggs are most commonly observed from March to October (National Oceanic and Atmospheric Administration Fisheries 1998b).

6.2.3 Potential Project Impacts

Although the project area is considered EFH for witch flounder eggs because of habitat requirements, this species preference for colder, deeper waters indicates that witch flounder eggs in the shoal area would be unlikely. Thus no impact at this life stage would be expected. Both juveniles and adults prefer deeper waters with fine-grained bottom sediments and thus occurrence would be expected to be limited. No impacts on witch flounder populations would be expected from implementation of the proposed action.

6.3 Windowpane Flounder

6.3.1 Species Description

The windowpane flounder (*Scophthalmus aquosus*) is a thin-bodied, left-eyed flatfish species distributed in the northwest Atlantic from the Gulf of St. Lawrence southward to Florida. It typically inhabits shallow sandy bottom habitats of estuaries (including the Chesapeake Bay), near-shore waters, and the continental shelf. It is managed under the *Northeast Multispecies FMP* administered by the NEFMC. It is managed as two stocks, with the Southern New England/Middle Atlantic stock occurring in the project area. The windowpane flounder is not a commercial fishing target; rather, it is generally caught as bycatch in bottom trawl fisheries. As of the 2008 stock assessment, the Southern New England/Middle Atlantic stock of windowpane flounder had not been overfished, but overfishing was occurring (Northeast Fisheries Science Center 2008a).

Windowpane flounder eggs have been collected in the water column where temperatures range from 41°F to 68°F (5°C to 20°C). However, the majority of windowpane flounder eggs were collected at 39°F to 60°F (4°C to 16°C) in spring (March to May), 50°F to 60°F (10°F to 16°C) in summer (June to August), and 57°F to 68°F (14°C to 20°C) in autumn (September to November), all at depths of less than 229.6 ft (70 m). Windowpane larvae typically inhabit the bottom once they reach 10 millimeters (mm) in length. They have been observed predominantly in the water column at 37°F to 57°F (3°C to 14°C) in spring, 50°F to 62°F (10°C to 17°C) in summer, and 55°F to 66°F (13°C to 19°C) in autumn, also in water less than 229.6 ft (70 m) deep. Windowpane juveniles are typically most abundant at bottom temperatures of 39°F to 44°F (4°C to 7°C) in spring and 57°F to 60°F (14°C to 16°C) in autumn, both at depths of less than 164 ft (50 m). Adults are distributed on the continental shelf in similar fashion as are juveniles. Adults may migrate to near-shore or estuarine habitats in the southern Mid-Atlantic Bight during spring through autumn (Chang et al. 1999).

6.3.2 EFH

Designated EFH for egg, larval, and juvenile life stages of windowpane flounder is found in the project area. EFH for these life stages is described below.

Eggs

Designated EFH in the project area for windowpane flounder eggs include surface waters of the continental shelf off the mid-Atlantic south to Cape Hatteras, North Carolina. In general, EFH characteristics for windowpane flounder eggs include surface temperatures of less than 68°F (20°C), and water depths of less than 229.6 ft (70 m). In the mid-Atlantic, the eggs are most commonly observed from February through November, peaking in May and October (National Oceanic and Atmospheric Administration Fisheries 1998c).

Larvae

EFH for windowpane flounder larvae in the project area includes pelagic waters in the mid-Atlantic south to Cape Hatteras, North Carolina. The characteristics and observation times for windowpane flounder larvae are the same as those previously noted for windowpane eggs (National Oceanic and Atmospheric Administration Fisheries 1998c).

Juveniles

Designated EFH in the project area for windowpane juveniles includes bottom habitats with a substrate of mud or fine-grained sand in the mid-Atlantic south to Cape Hatteras, North Carolina. General characteristics of EFH for windowpane flounder juveniles includes water temperatures below 77°F (25°C); water depths from 3.28 ft to 328 ft (1 m to 100 m); and a salinity ranging from 5.5 ppt to 36 ppt (National Oceanic and Atmospheric Administration Fisheries 1998c).

6.3.3 Potential Project Impacts

Although windowpane flounder eggs are likely to be present in the dredging area, they are most predominant in pelagic waters. However, the eggs are distributed widely over the continental shelf, and although eggs could be impacted during dredging, the overall impact at the population level would not be significant. There may be some limited adverse impacts on windowpane flounder, particularly juveniles, due to their year-round presence (slightly less in the warmest summer months) in bottom habitats such as those at the dredge site. Because of their mobility, juveniles should be able to avoid direct adverse impacts from dredging. However, because they are demersal, individuals may remain on the bottom during dredging or venture too close to the dredge intake and could be entrained. Juveniles may be vulnerable because of their slower swimming speed. Alterations in bottom habitat and resulting impacts on benthos could affect food web components, resulting in limited, adverse impacts on juvenile windowpane flounder. Sediment disturbed by dredging operations would likely cause a temporary, localized reduction in prey species. These impacts would be temporary, with no long-term impact on windowpane flounder populations. Overall impacts would be minor because the scale of the area affected would be limited compared with the habitat available to the species throughout its range. Impacts associated with altered bottom habitat within the shoal would gradually dissipate as physical environmental forces rework and smooth the shoal surface.

6.4 Atlantic Sea Herring

6.4.1 Species Description

The Atlantic sea herring (*Clupea harengus*) is a coastal pelagic species that is widely distributed in the northern Atlantic, ranging from Labrador to Cape Hatteras, North Carolina. It is an important commercial species, with spring and autumn spawning populations that support the commercial fishing industry. The Atlantic sea herring's primary spawning locations are outside the project area (i.e., off the Maine coast, Jeffreys Ledge [off the New Hampshire coast], and Nantucket Shoals and Georges Bank). Adult Atlantic sea herring make extensive migrations for feeding, spawning, and overwintering. As of the 2009 Transboundary Resource Assessment Committee Status Report, this species was not overfished, and overfishing was not occurring (New England Fishery Management Council 2010).

Atlantic sea herring eggs are usually spawned in depths of 131 ft to 262 ft (40 m to 80 m) on Georges Bank, 65.6 ft to 64 ft (20 m to 50 m) in the coastal Gulf of Maine, and as shallow as 36 ft to 42.6 ft (11 m to 13 m) off southwest Nova Scotia. The eggs are laid mostly on gravel, but also on sand, rocks, shell fragments, aquatic macrophytes, and structures such as lobster pots. Larvae Atlantic sea herring are typically found in water temperatures ranging from 46°F to 57°F (8°C to 14°C) at depths from 164 ft to 295 ft (50 m to 90 m). Juvenile Atlantic sea herring tend to prefer water salinity greater than 29 ppt and a water temperature of less than 50°F (10°C). Depending on the location of the waterbody, adult Atlantic sea herring may be found in 37°F to 50°F (3°C to 10°C) at 16.4 ft to 246 ft (5m to 75 m) in spring, 42°F to 69°F (6°C to 21°C) at 65.2 ft to 426 ft (20 m to130 m) in summer, 41°F to 51°F (5°C to 11°C) at 29.5 ft to 557 ft (9 m to 170 m) in fall, and 37°F to 46°F (3°C to 8°C) at 98.4 ft to 328 ft (30 m to100 m) in winter (Reid et al. 1999).

6.4.2 EFH

Designated EFH for the juvenile and adult life stages of Atlantic sea herring is found in the project area. EFH for these life stages is described below.

Juveniles

Project area EFH for Atlantic sea herring juveniles includes pelagic waters and bottom habitats in the mid-Atlantic south to Cape Hatteras, North Carolina. Typical characteristics of this EFH include water temperatures below 50°F (10°C); water depths ranging from 49.2 ft to 442 ft (15 m to 135 m), and water salinity ranging from 26 ppt to 32 ppt (National Oceanic and Atmospheric Administration Fisheries 1998d).

Adults

Project area EFH for Atlantic sea herring adults (and spawning adults) is the same as the juvenile EFH. However, adult Atlantic sea herring EFH characteristically includes water temperatures below 50°F (10°C), water depths that range from 65.6 ft to 426 ft (20 m to 130 m), and a salinity greater than 28 ppt. EFH for spawning adults has slightly different characteristics: water temperatures below 59°F (15°C), water depths from 65.6 ft to 262 ft (20 m to 80 m), and a salinity range of 32 ppt to 33 ppt. Spawning generally occurs from July through November (National Oceanic and Atmospheric Administration Fisheries 1998d).

6.4.3 Potential Project Impacts

Because of their mobility, juvenile Atlantic sea herring would be able to relocate from the dredge areas to avoid direct impacts. No indirect impacts on Atlantic sea herring would be expected as a consequence of alterations to bottom habitat. Although juveniles may make use of bottom habitats, no indirect impacts from bottom alterations or food web components would be expected. All impacts on food web components would be temporary, and overall impacts on Atlantic sea herring from project implementation would be minor. Adult Atlantic sea herring may be present in the water column in the shoal area, although they prefer deeper, colder water. Adult Atlantic sea herring are not generally associated with bottom habitats and would not likely be impacted by dredging portions of the shoal.

6.5 Monkfish

6.5.1 Species Description

Monkfish (*Lophius americanus*), the name used in commerce, or goosefish, the name recognized by the American Fisheries Society, is a large, slow-growing demersal anglerfish (Steimle et al. 1999b). It can grow to 55 inches (in) (140 centimeters [cm]) in length and weigh up to 48.5 pounds (lbs) (22 kilograms [kg]) (Steimle et al. 1999b). They are solitary ambush predators of invertebrates and fish (Steimle et al. 1999b). Their distribution in the Northwest Atlantic is from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina (Steimle et al. 1999b; Richards et al. 2008). They are most commonly caught in bottom trawl surveys off the coast of Virginia from February to March and from September to October (Richards et al. 2008). Individuals can be found just below the tide line to depths of up to approximately 2,953 ft (900 m) (Richards et al. 2008).

Monkfish eggs are large in size (1.6 mm to 1.8 mm) and are released in buoyant, long mucoid veils or rafts that may be up to 20 ft to 40 ft (6 m to 12 m) long and 0.5 ft to 5 ft (0.15 m to 1.5 m) wide and weigh more than 11 lbs (5 kg) (Steimle et al. 1999b). Monkfish larvae remain within the open egg chamber in the veil for two to three days after hatching. After they are released from the veil, they become pelagic (Steimle et al. 1999b). Monkfish larvae can be common in the Mid-Atlantic Bight and southern New England. In 1996, monkfish larvae made up 8.1% of the larvae collected in the shore zone of north-central New Jersey (Steimle et al. 1999b). However, only one monkfish individual was collected the year before (Steimle et al. 1999b).

Juveniles are bottom-dwelling and generally prefer temperatures less than 55°F (13°C) and depths greater than 66 ft (20 m). Adults are most abundant at temperatures between 39°F and 57°F (4°C and 14°C) and, as a result, are found in deeper waters (usually up to 1,640 ft [500 m]) during the warm months and shallower waters (less than 656 ft [200 m]) during the colder months (Steimle et al. 1999b). Both adults and juveniles usually range from along the OCS in the mid-Atlantic up to the Gulf of Maine (National Oceanic and Atmospheric Administration Fisheries 1998e).

The structure of the stock is not clearly understood because no genetic divergence has been discovered between monkfish individuals collected in North Carolina and in Maine in depths up to 984 ft (300 m). Growth patterns and recruitment did differ between northern and southern portions of the species range. As a result, two management areas were designated in 1999: the Northern Management Area, which includes the Gulf of Maine and northern Georges Bank, and the Southern Management Area, which includes southern Georges Bank and Mid-Atlantic Bight (Steimle et al. 1999b; Richards et al. 2008). Population estimates of monkfish from 2002 to 2006 either remained stable or declined (Haring and Maquire 2008). As of 2010, the monkfish stock was not overfished and overfishing was not occurring (Northeast Fisheries Science Center 2010a).

6.5.2 EFH

Designated EFH for the egg and larval life stages of monkfish is found in the project area. EHF for these life stages is described below.

Eggs

Designated EFH within the project area for monkfish eggs includes surface waters of the Gulf of Maine, Georges Bank, southern New England, and the mid-Atlantic south to Cape Hatteras, North Carolina. Generally, the following conditions exist where monkfish egg veils are found: sea surface temperatures below 64.4°F (18°C) and water depths of 49.2 ft to 3,281 ft (15 m to 1,000 m). Monkfish egg veils are most often observed during the months of March to September (National Oceanic and Atmospheric Administration Fisheries 1998e).

Larvae

Project area EFH for monkfish larvae includes pelagic waters of the Gulf of Maine, Georges Bank, southern New England and the mid-Atlantic south to Cape Hatteras, North Carolina. Generally, the following conditions exist where monkfish larvae are found: water temperatures below 59°F (15°C) and water depths of 82 ft to 3,281 ft (25 m to 1,000 m). Monkfish larvae are most often observed during the months of March to September (National Oceanic and Atmospheric Administration Fisheries 1998e).

6.5.3 Potential Project Impacts

Monkfish eggs are unlikely to be concentrated within the dredge area because monkfish are widely distributed in the northwest Atlantic. If monkfish eggs are present within the dredge area they are unlikely to be drawn into the dredge because they float on the surface of the water. If individual eggs are drawn into the dredge, the number of individuals impacted would be small compared with the number likely to be present across the entire continental shelf. Therefore, no significant impacts on monkfish populations would be expected.

If monkfish larvae are present within the dredge area, individuals could be drawn into the dredge. However, large concentrations of monkfish are unlikely to occur in the dredge area because monkfish are widely distributed in the northwest Atlantic. If individual larvae are drawn into the dredge, the number of individuals impacted would be small compared with the number likely to be present across the entire continental shelf. Therefore, no significant impacts on monkfish populations would be expected.

6.6 Bluefish

6.6.1 Species Description

The bluefish (*Pomatomus saltatrix*) is a migratory, pelagic species found throughout the world (with the exception of the eastern Pacific) in most temperate coastal regions, though rarely between southern Florida and northern South America. They travel in schools and undertake seasonal migrations, moving into the Mid-Atlantic Bight during spring and south or farther offshore during fall. In the Mid-Atlantic Bight, they are found in large bays and estuaries as well as across the entire continental shelf. Bluefish are currently managed under a joint management plan developed collaboratively by the MAFMC and the Atlantic States Marine Fisheries Commission (ASMFC). As of 2010, the Atlantic bluefish stock was not in an overfished condition and overfishing was not occurring (Shepherd and Nieland 2010).

In the Mid-Atlantic Bight, bluefish eggs are found in the open ocean, where water temperatures range from 64°F to 71°F (18°C to 22°C) and the salinity is greater than 31 ppt. Larvae in the Mid-Atlantic Bight are found in open oceanic waters, near the edge of the continental shelf in the southern Bight and over mid-shelf depths farther north, where water temperatures range from 64°F to 75°F (18°C to 24°C) and the salinity ranges from 30 ppt to 32 ppt. Juvenile bluefish occur in estuaries, bays, and the coastal ocean of the Bight and in many habitats, with the exception of the marsh surface. Juveniles tend to leave the estuaries in October and migrate south to spend the winter months south of Cape Hatteras, North Carolina. Adult bluefish can be found in the open ocean, large embayments, and most estuarine systems within their range. They typically prefer warmer temperatures and are not found in the Mid-Atlantic Bight when temperatures decline below 57°F to 60°F (14°C to 16°C) (Fahay et al. 1999).

6.6.2 EFH

Designated EFH for the juvenile and adult life stages of bluefish is found in the project area. EFH for these life stages is described below.

Juveniles

Designated EFH for bluefish juveniles is similar to bluefish eggs and larvae EFH, which includes pelagic waters found over the continental shelf at mid-shelf depths. In addition, EFH for juveniles also includes the “slope sea” and Gulf stream between latitudes 29ºN and 40º N. In inshore waters, EFH includes all major estuaries between Penobscot Bay, Maine, and St. Johns River, Florida. Within the project area, juvenile bluefish occur in Mid-Atlantic estuaries from May through October, in the “mixing” and “seawater” zones (National Oceanic and Atmospheric Administration Fisheries n.d.[a]).

Adults

Pelagic and inshore EFH for bluefish adults are the same as for bluefish juveniles (National Oceanic and Atmospheric Administration Fisheries n.d.[a]).

6.6.3 Potential Project Impacts

Juvenile and adult bluefish could be present during dredging operations. However, because of their high mobility, the bluefish should readily relocate from the project area to avoid direct adverse impacts. Because of their open water orientation, disturbance and alteration of bottom habitat at the shoal area would be expected to have only minimal indirect impacts on bluefish juveniles and adults. Alteration of bottom habitat and associated impacts on benthos at the shoal would most likely not result in impacts on the food web because of the relatively small scale of the project area compared with the large amount of comparable habitat on the continental shelf. Furthermore, prey items would be readily available in other locations. Food web impacts at the shoal area would be temporary, further reducing potential impacts on bluefish.

6.7 Atlantic Butterfish

6.7.1 Species Description

The Atlantic butterfish (*Peprilus triacanthus*) is a small, bony foodfish that ranges from Newfoundland and the Gulf of St. Lawrence to the Atlantic and Gulf coasts of Florida; however, it is found in greatest abundance from the Gulf of Maine to Cape Hatteras, North Carolina. Butterfish migrate seasonally, moving northward and inshore during the summer (feeding and spawning), and southward and offshore as water temperatures drop. Spawning occurs from June through August (Cross et al. 1999; Overholtz 2006). This species is managed under the *Atlantic Mackerel, Squid, and Butterfish FMP* (Mid-Atlantic Fishery Management Council August 1998).

Both eggs and larvae of Atlantic butterfish are pelagic and are found from the OCS to high salinity estuaries in the Mid-Atlantic Bight. Butterfish eggs have been collected in water temperatures ranging from 53.6°F to 73.4°F (12°C to 23°C), usually at depths of less than 656 ft (200 m), and larvae have been collected in water temperatures ranging from 39.2°F to 82.4°F (4°C to 28°C), predominantly in less than 393.7 ft (120 m) of water. Juvenile and adult butterfish are fairly common, if not abundant, in the high- salinity and mixing zones of estuaries from Massachusetts Bay to the mid-Atlantic. Juveniles and adults are pelagic and are commonly found in water temperatures ranging from 39.9°F to 70.9°F (4.4°C to 21.6°C), usually over habitats comprising sand, mud, and mixed substrates (Cross et al. 1999). According to the 2010 stock assessment, overfishing of Atlantic butterfish was not likely to be occurring (Northeast Fisheries Science Center 2010b).

6.7.2 EFH

Designated EFH for the juvenile life stage of Atlantic butterfish is found in the project area. EFH for this life stage is described below.

Juveniles

Offshore, designated EFH for Atlantic butterfish is the pelagic waters found over the continental shelf (from the coast out to the limits of the exclusive economic zone [EEZ]), from the Gulf of Maine through Cape Hatteras, North Carolina in areas where the highest percentage (75%) of juvenile butterfish were collected in the North East Fisheries Science Center (NEFSC) trawl surveys. Inshore, EFH is the “mixing” and/or “seawater portions of all the estuaries where juvenile butterfish are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile butterfish are collected at depths between 33 ft and 1,200 ft (10 m and 366 m) and temperatures between 37°F and 82°F (2.8°C and 27.8°C) (National Oceanic and Atmospheric Administration Fisheries n.d.[b]).

6.7.3 Potential Project Impacts

Temperature preferences and migration information indicates that juvenile Atlantic butterfish could occur in project area waters throughout all seasons except winter. But because of their mobility, juveniles would be able to relocate from the dredge areas to avoid direct impacts. No indirect impacts on butterfish would be expected as a consequence of alterations to bottom habitat. Juveniles may make use of bottom habitats, but no indirect impacts from bottom alterations or food web components would be expected. All impacts on food web components would be temporary, and overall impacts on butterfish from project implementation would be minor.

6.8 Summer Flounder

6.8.1 Species Description

The summer flounder (*Paralichthys dentatus*) is a demersal flatfish distributed from the southern Gulf of Maine to South Carolina. However, it is found in greatest abundance in the Mid-Atlantic Bight from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. It is managed under the *Summer Flounder, Scup and Black Sea Bass FMP* that is administered jointly by the ASMFC and the MAFMC. As of 2008, summer flounder had not been in an overfished condition, but overfishing continues to occur (Terceiro 2010a; Northeast Fisheries Science Center 2008b). Summer flounder exhibit strong seasonal inshore/offshore migrations; adults and juveniles generally inhabit shallow coastal and estuarine waters during spring and summer but remain offshore during fall and winter (Terceiro 2006a; Packer et al. 1999).

Summer flounder eggs are found in the water column in temperatures ranging from 48.2°F to 73.4°F (9°C to 23°C) but are more abundant in water temperatures of 53.6°F to 66.2°F (12°C to 19°C). Larval summer flounder have been found in temperatures ranging from 32°F to 73.4°F (0°C to 23°C) but are more abundant in water temperatures of 48.2°F to 64.4°F (9°C to 18°C). Transforming larvae and juveniles are more commonly found in the higher salinity portions of estuaries. Adult summer flounder are found in water temperatures ranging from 48.2°F to 78.8°F (9°C to 26°C), depending on the time of year, and prefer sandy habitats (Packer et al. 1999).

6.8.2 EFH
Designated EFH for the juvenile and adult life stages of summer flounder is found in the project area. EFH for these life stages is described below.

Juveniles
Designated EFH for juveniles in the project area includes the demersal waters found over the continental shelf from the Gulf of Maine to Cape Hatteras, North Carolina. Juvenile summer flounder use multiple estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas where water temperatures are higher than 37°F (2.8°C) and salinities range from 10 ppt to 30 ppt (National Oceanic and Atmospheric Administration Fisheries n.d.[c]).

Adults
Designated EFH for adult summer flounder in the project area is the same area as summer flounder juvenile EFH. Adults typically inhabit shallow coastal and estuarine waters during warmer months and move farther offshore on the OCS at depths of 500 ft (152.4 m) in colder months (National Oceanic and Atmospheric Administration Fisheries n.d.[c]).

6.8.3 Potential Project Impacts
Juveniles and adults may be in the project area if dredging occurs during warmer months. Any summer flounder remaining on the bottom or venturing too close to the dredge intake could be entrained. Juveniles would be more vulnerable than adults because they swim more slowly. But because of their mobility, juvenile and adult summer flounder should easily be able to relocate and avoid impacts from dredging. No significant impacts on summer flounder populations would be expected because summer flounder would not be expected to be concentrated in the project area. Because of their demersal feeding nature, impacts on benthos and alterations in bottom habitat impacting the food web may impact summer flounder. However, all impacts would be minor in scale, and because habitat across the continental shelf is abundant, food web components would be only temporarily affected.

6.9 Scup
6.9.1 Species Description
Scup (*Stenotomus chrysops*) is a demersal, schooling species distributed in the Mid-Atlantic Bight from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. It is a temperate species that, in the Mid-Atlantic Bight, is commonly found during the summer in larger estuaries and in coastal waters; however, during the winter, scup can be found along the OCS to about 656 ft (200 m). As such, they undertake extensive migrations yearly, migrating north and inshore to spawn during the spring. Commercial and recreational scup fisheries are managed under the *Summer Flounder, Scup and Black Sea Bass FMP* that is administered by both the ASFMC and the MAFMC. Data from 2006 indicated that the scup stock was in an overfished condition (Terceiro 2006b). According to the 2010 stock assessment, scup was not considered overfished and overfishing was not occurring (Terceiro 2010b).

Scup eggs are commonly found in larger bodies of coastal waters (i.e., bays and sounds) in and near southern New England during spring and summer, usually in water temperatures ranging from 47°F to 74°F (8.5°C to 23.7°C). Larval scup, like scup eggs, are pelagic, occurring in coastal waters during warmer months. Juveniles tend to live inshore during warmer months, often in intertidal and subtidal habitats, over sand, silty-sand, shell, mud, mussel beds, and eelgrass habitats. Typical water temperatures where juveniles have been collected range from 41°F to 80°F (5°C to 27°C). Adults are found in similar habitats as juveniles and also near structures such as rocky ledges, wrecks, and artificial reefs (Steimle et al. 1999c).

6.9.2 EFH

Designated EFH for juvenile and adult life stages of scup is found in the project area. EFH for these life stages is described below.

Juveniles

Offshore EFH for juvenile scup includes the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, North Carolina; inshore EFH includes estuaries where scup are identified as being common, abundant, or highly abundant. In general, juveniles are found during the summer and spring in estuaries and bays between Virginia and Massachusetts, in association with the various habitats described above, where water temperatures are higher than 45^{o}F (7°C) and salinities are greater than 15 ppt (National Oceanic and Atmospheric Administration Fisheries n.d.[d]).

Adults

Designated EFH for adult scup is the same as juvenile EFH (National Oceanic and Atmospheric Administration Fisheries n.d.[d]).

6.9.3 Potential Project Impacts

Because juvenile and adult scup are demersal, the disturbance of bottom sediments associated with dredging could adversely impact scup and interfere with feeding and migration at these life stages. This potential would most likely be limited considering their preference for hard bottom environments. There is also a possibility that individual scup could become entrained during dredge operations; however, no permanent impacts on overall scup populations would be expected. Any adverse impacts, such as increased turbidity and loss of benthic prey, would be highly localized and temporary. Because of the relatively small scale of the area that would be impacted compared with abundant habitat elsewhere, these indirect impacts would be expected to be minor. All impacts would be temporary.

6.10 Black Sea Bass

6.10.1 Species Description

The black sea bass (*Centropristis striata*) is a warm, temperate species found from southern Nova Scotia to southern Florida and into the Gulf of Mexico. It is commonly associated with structured habitats, including reefs and shipwrecks.

This species is managed cooperatively by the ASMFC and the MAFMC. Like other warm, temperate migratory species, the black sea bass does not tolerate cold winter conditions in inshore waters. As such, the distribution of this species changes seasonally, heading offshore during cold months and moving to coastal habitats as water temperatures increase (Steimle et al. 1999d; Shepherd 2006).

Black sea bass eggs are generally found in the water column where temperatures range from 53°F to 75°F (12°C to 24°C) and in less than 164 ft (50 m) of water. Larval sea bass are found in the water column where temperatures range from 51°F to 78°F (11°C to 26°C) but most frequently where temperatures range from 55°F to 69°F (13°C to 21°C) and at depths of less than 328 ft (100 m). During winter and spring, juveniles are typically found in bottom habitats where water temperatures are higher than 41°F (5°C) in 65 ft to 787 ft (20 m to 240 m) of water. During summer and fall, they are more commonly associated with coastal habitats. While offshore habitats for adult black sea bass are less known, adults are common along the coast during warmer periods of the year and, as mentioned previously, often are found near wrecks and reefs (Steimle et al. 1999d). It is thought that black sea bass in the Mid-Atlantic region is not overfished and overfishing is not occurring (Shepherd 2009).

6.10.2 EFH

Designated EFH for larvae, juvenile, and adult life stages of black sea bass is found in the project area. EFH for these life stages is described below.

Larvae

Designated EFH for black sea bass larvae is the same as black sea bass egg EFH, in addition to pelagic waters over the continental shelf stretching from the Gulf of Maine to Cape Hatteras, North Carolina. Larvae that are transforming into juveniles are still found in inshore estuaries but move to structured inshore habitats (i.e., sponge beds) as they become more demersal (National Oceanic and Atmospheric Administration Fisheries n.d.[e]).

Juveniles

Juvenile black sea bass EFH includes both offshore and inshore habitats; offshore EFH includes demersal waters over the continental shelf, and inshore EFH includes estuaries where black sea bass juveniles are commonly or abundantly found. General characteristics of EFH for juveniles include waters that are warmer than 43°F (6°C) and with a salinity of greater than 18 ppt. Habitats that juveniles are often associated with include rough bottom; shellfish and eelgrass beds; man-made structures in sandy areas; and offshore clam beds and shell patches (National Oceanic and Atmospheric Administration Fisheries n.d.[e]).

Adults

Designated EFH for adult black sea bass is the same as juvenile EFH.

6.10.3 Potential Project Impacts

Although black sea bass larvae could be present in the intertidal zone during dredging operations, these demersal larvae tend to be associated with structures (e.g., shells) and depressions on the shoal seafloor, which are not commonly found in the shoal area.

Juveniles and adults may be present during sand removal; however, the shoal area does not have black sea bass preferred habitat or suitable substrate. As a result, if present, their numbers would likely be low. Potentially, any black sea bass occurring on the bottom or venturing too close to the dredge intake could be entrained. Juveniles would be more vulnerable because they swim more slowly. Black sea bass would not be expected to be concentrated in the dredging area, and thus no significant impacts on black sea bass populations would be expected. Black sea bass juveniles and adults may suffer minor indirect impacts from food web disturbance caused by impacts on benthos and altered habitat conditions within the proposed dredging area. These impacts would be temporary and localized and would affect only a relatively small area of bottom compared with the total area of bottom habitat available for the species. As such, overall impacts would be expected to be minor. Enhanced topography on the shoal seafloor following dredging may be of benefit to black sea bass by increasing bottom heterogeneity and enhancing habitat, although such benefits would be minor because of the relatively small scale of the area impacted. Any beneficial impacts would diminish as natural processes rework the seafloor and furrows fill in with material from the surrounding area.

6.11 Atlantic Surf Clam

6.11.1 Species Description

The Atlantic surf clam (*Spisula solidissima*) is a mollusk (bivalve) that is found in sandy habitats over the continental shelf from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. In the Mid-Atlantic, surf clams are generally found from the intertidal zone to a depth of about 196 ft (60 m). It is managed under the MAFMC's *Atlantic Surf Clam and Ocean Quahog FMP*. A 2010 stock assessment indicated that the Atlantic surf clam was not in an overfished condition and was not being overfished (Northeast Fisheries Science Center 2010b).

Surf clam juveniles and adults are typically found in well-sorted, medium sand habitats but occasionally in fine sand, as well. In the United States, surf clams are found in greatest abundance on Georges Bank, south of Cape Cod, Massachusetts, off Long Island, southern New Jersey, and the Delmarva Peninsula (Cargnelli et al. 1999b).

6.11.2 EFH

Designated EFH for the juvenile life stage of Atlantic surf clam is found in the project area. EFH for this life stage is described below.

Juveniles

Designated EFH for Atlantic surf clam juveniles is federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ. Within the substrate of this area, surf clam juveniles are normally found 3 ft (0.9

m) below the sediment surface in up to 200 ft (60 m) of water (National Oceanic and Atmospheric Administration Fisheries n.d.[f]).

6.11.3 Potential Project Impacts

Dredging at the offshore sand shoals is expected to have adverse effects on this non-motile organism via entrainment. The majority of the clams in the dredged area would be impacted. While this would represent a short-term loss of surf clam individuals in the impact area, it is expected that post-dredging habitat conditions would return to pre-dredging habitat conditions. As such, it is anticipated that surf clam populations would gradually recover to pre-project levels within a few years. Surf clam predators, including Atlantic cod (*Gadus morhua*), would be adversely affected by loss of food in the impacted area until surf clam populations recovered. Studies conducted from 2002 to 2005 by the Virginia Institute of Marine Science (VIMS) on the effects of dredging on the benthic community in offshore sand shoals suggests that benthic invertebrate communities are able to rebound within a few years (Diaz et al. 2004). Dredging would also cause an increase in turbidity, which may temporarily impair the ability of the clams to feed, but this impact should be limited because the sediment is coarse-grained.

6.12 Spiny Dogfish

6.12.1 Species Description

The spiny dogfish (*Squalus acanthias*) is a coastal shark that is distributed in the western North Atlantic from Labrador to Florida. It is the most abundant species of shark in the western North Atlantic and is also highly migratory. During the spring and autumn, spiny dogfish are found in coastal waters between North Carolina and southern New England. However, during summer, dogfish migrate northward towards the Gulf of Maine/Georges Bank region and into Canadian waters, returning south in autumn and winter. The species is managed by the MAFMC, and as of 2006 this species had not been overfished and was not in an overfished condition (Sosebee and Rago 2006; Northeast Fisheries Science Center 2006).

During the spring, juvenile and adult spiny dogfish are generally found in deeper, warmer waters on the OCS from North Carolina to Georges Bank. However, in the fall, they migrate to the shallower, moderately warm waters from southern New England into the Gulf of Maine. Their seasonal distribution in coastal waters is very similar, and they are only transient visitors to coastal estuaries (McMillan and Morse 1999).

6.12.2 EFH

Designated EFH for juvenile and adult life stages of spiny dogfish is found in the project area. EFH for these life stages is described below.

Juveniles

Project area EFH for juvenile spiny dogfish includes the waters of the continental shelf from North Carolina to the Gulf of Maine. General characteristics of this EFH include water temperatures that range from 37°F to 82°F (2°C to 27°C) in depths of 33 ft to 1,280 ft (10 m to 390 m) (National Oceanic and Atmospheric Administration Fisheries n.d.[g]).

Adults

Designated EFH for adult spiny dogfish in the project area is the same as juvenile EFH. Adults also prefer the same temperature range as juveniles, but in water depths of 33 ft to 1,476 ft (10 m to 449 m) (National Oceanic and Atmospheric Administration Fisheries n.d.[g]).

6.12.3 Potential Project Impacts

Spiny dogfish may be present in the borrow area during the cooler (winter-spring) months; therefore, EFH may be adversely affected by dredging operations. The mobility of adults and juveniles would enable them to avoid any direct adverse impacts from proposed dredging operations. Bottom sediment disturbance associated with dredging could interfere with feeding, predation, avoidance, and migratory movements of this species; however, these adverse impacts would be temporary and highly localized. No indirect impacts on the population would be expected because of the relatively small area that would be impacted compared with the range of the species and the readily available preferable habitat on the Mid- and South Atlantic Bight continental shelf. Any food web impacts would be expected to be temporary and local when compared with available habitat elsewhere.

6.13 King Mackerel

6.13.1 Species Description

The king mackerel (*Scomberomorus cavalla*), the largest of the mackerels, is a migratory fish that is found in warm waters, predominantly from Virginia south to Brazil, including the Caribbean and the Gulf of Mexico, but also as far north as the Gulf of Maine. It is managed under the *FMP for the Coastal Migratory Pelagic Resources in the Gulf of Mexico and South Atlantic Region*, managed jointly by the SAFMC and the Gulf of Mexico Fishery Management Council (GMFMC). As of the 2009 assessment the Atlantic king mackerel was not in an overfished condition and overfishing was not occurring (South Atlantic Fishery Management Council 2009).

The king mackerel is a coastal pelagic species, typically found at depths of 115 ft to 591 ft (30 m to 189 m) (National Marine Fisheries Service 2011a). Their affinity for warm water (typically above 68° F [20°C]) and food supply dictates their migration patterns, heading south in the fall and north in the spring. King mackerel also spawn from April through November (South Atlantic and Gulf of Mexico Fishery Management Council 2011a).

6.13.2 EFH

Designated EFH for all the life stages of king mackerel is found in the project area. EFH is the same for all life stages of the king mackerel, as described below.

EFH for coastal migratory pelagic species, including king mackerel, includes the sandy shoals of capes and offshore bars, high profile rocky bottom, and barrier island ocean-side waters (to the shelf break zone) in the Mid- and South Atlantic Bights. In addition, coastal inlets and state-designated nursery habitats of particular importance to coastal migratory pelagics are considered EFH (National Oceanic and Atmospheric Administration Fisheries n.d.[h]).

6.13.3 Potential Project Impacts

All king mackerel life stages may occur in the project area from late spring through summer. Pelagic king mackerel eggs or larvae present within the shoal area would be sparsely distributed. King mackerel juveniles and adults could be present during dredging, especially during summer and early fall. However, as these life stages are pelagic, juveniles and adults could easily avoid impacts from dredging operations. Alterations of bottom habitat and impacts on benthos would be unlikely to affect king mackerel because abundant, comparable bottom habitat occurs elsewhere within their range. Food web impacts would be minimal because of the relatively small scale of impact and temporary nature of the disturbance.

6.14 Spanish Mackerel

6.14.1 Species Description

The Spanish mackerel (*Scomberomorus maculatus*), much smaller than its relative the king mackerel, is a migratory fish occurring in two sub-populations: the Gulf of Mexico and the South Atlantic. Spanish mackerel fisheries in federal waters are managed by the SAFMC and GMFMC through the *FMP for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico*. Amendment 5 to the FMP extended the management area for Atlantic mackerels through the MAFMC’s jurisdiction. In the Atlantic region, the ASMFC cooperates with the SAFMC to adopt regulations for state waters that complement the regulations approved by federal management councils. As of 2008, the Spanish mackerel was not in an overfished condition and overfishing was not occurring for either sub-population (South Atlantic Fishery Management Council 2008).

Spanish mackerel is a mid-level epipelagic carnivore, residing at depths of 33 ft to 115 ft (10 m to 35 m) (Florida Museum of Natural History n.d.[a]). Large fast-moving schools frequently occur close to the water’s surface and at temperatures above 68°F (20°C) (South Atlantic and Gulf of Mexico Fishery Management Council 2011b). The fast growing mackerels are capable of reproduction by the second year and spawning occurs from April to September off the North Carolina and Virginia coasts for the South Atlantic population (South Atlantic and Gulf of Mexico Fishery Management Council 2011b). The Atlantic population follows the coastline northward during the warmer summer months and southerly in the autumn and winter months (Florida Museum of Natural History n.d.[a]).

6.14.2 EFH

Designated EFH for all life stages of Spanish mackerel is found in the project area. EFH is the same for all life stages of the Spanish mackerel as described below.

EFH for coastal migratory pelagic species, including Spanish mackerel, includes the sandy shoals of capes and offshore bars, high-profile rocky bottom, and barrier island ocean-side waters (to the shelf break zone) in the Mid- and South Atlantic Bights. In addition, coastal inlets and state-designated nursery habitats of particular importance to coastal migratory pelagics are considered EFH (National Oceanic and Atmospheric Administration Fisheries n.d.[h]).

6.14.3 Potential Project Impacts

All Spanish mackerel life stages may occur in the project area from late spring through summer. Pelagic Spanish mackerel eggs or larvae present within the off-shore borrow areas would be sparsely distributed. Spanish mackerel juveniles and adults could be present during dredging, especially during summer and early fall. However, as these are pelagic life stages, the juveniles and adults could avoid impacts from dredging operations. Alterations of bottom habitat and impacts on benthos are unlikely to affect Spanish mackerel because abundant comparable bottom habitat occurs elsewhere within their range. Food web impacts would be minimal because of the relatively small scale of impact and temporary nature of the disturbance.

6.15 Cobia

6.15.1 Species Description

The cobia (*Rachycentron canadum*) is a dark-brown pelagic fish with a single dorsal fin (National Marine Fisheries Services 2011c). Cobia are known to live up to 10 years and reach a length of 6 ft (1.8 m) and a weight exceeding 100 lbs (45 kg) (South Atlantic and Gulf of Mexico Fishery Management Council 2011c). In the United States, cobia is found from Virginia to Florida and in the Gulf of Mexico, though the species has a circumtropical distribution (South Atlantic and Gulf of Mexico Fishery Management Council 2011c). Cobia is managed as part of the SAFMC and GMFMC's *FMP for Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic Region* (National Marine Fisheries Service 2011b). Cobia is not in an overfished condition nor is overfishing occurring (National Marine Fisheries Service 2011b).

Cobia are often found over the continental shelf as well as around any structure that interrupts the open water, including pilings, buoys, platforms, anchored boats, and flotsam (Florida Museum of Natural History n.d.[b]). Cobia spawn in coastal bays and estuaries from late June to mid-August along the southeastern United States (National Marine Fisheries Service 2011b). In the Atlantic, cobia migrate north from wintering grounds in the Florida Keys to coastal Virginia and the Carolinas (National Marine Fisheries Service 2011b).

6.15.2 EFH

Designated EFH for all life stages of cobia is found in the project area. EFH is the same for all life stages of the cobia as described below.

EFH for coastal migratory pelagic species, including cobia, includes the sandy shoals of capes and offshore bars, high-profile rocky bottom, and barrier island ocean-side waters (to the shelf break zone). In addition, coastal inlets and state-designated nursery habitats of particular importance to coastal migratory pelagics are considered EFH. Designated EFH specific to cobia includes high salinity bays, estuaries, and seagrass habitat in the Mid- and South Atlantic Bights (National Oceanic and Atmospheric Administration Fisheries n.d.[h]).

6.15.3 Potential Project Impacts

Cobia may be in the project area from early summer through fall. Eggs and larvae are pelagic and densities would not likely be elevated in the project area. Therefore, impacts on these life stages from project operations would not be expected. Cobia juveniles and adults may be present at the shoal. Because cobia feed on bottom-dwelling prey, individuals could be temporarily found near the bottom. Cobia juveniles and adults that are present during construction could avoid dredging impacts and relocate to adjacent areas. Only juveniles would be subjected to potential entrainment, but this impact would be unlikely. Therefore, no significant direct impacts on cobia populations would be expected from dredging operations. Loss of benthos and alterations of bottom habitat could reduce the suitability of the borrow area as a foraging area for several months to years following dredging. However, these disturbances would not likely impact cobia because abundant, undisturbed bottom is ubiquitous in the area and food web impacts would be temporary and negligible.

6.16 Red Drum

6.16.1 Species Description

Red drum (*Sciaenops ocellatus*) is a relatively quickly growing euryhaline fish. A coastal species, it can be found in the Atlantic Ocean from Cape Cod, Massachusetts south to Tuxpan, Mexico in the Gulf of Mexico (Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department February 9, 2005).

Adults spawn pelagic eggs from August through October, commonly near tidal inlets (Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department February 9, 2005). Currents transport larvae into estuaries where they remain until they are 3.5 to 5 years old, at which point they swim offshore to join the adult spawning population (Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department February 9, 2005). The red drum is managed by the Atlantic Marine Fisheries Commission. Its 2009 assessment indicated that overfishing was not occurring in either its northern or southern stocks (North Carolina Division of Marine Fisheries 2010a).

6.16.2 EFH

Designated EFH for all life stages of red drum is found in the project area. EFH is the same for all life stages of the red drum, as described below.

Project area EFH (which includes Virginia south to the Florida Keys) for the red drum includes the following habitats to a depth of 164 ft (50 m) offshore: tidal freshwater; estuarine emergent vegetated wetlands (including flooded saltmarshes, brackish marsh, and tidal creeks); estuarine scrub/shrub (i.e., mangrove fringe); submerged rooted vascular plants (i.e., seagrasses); oyster reefs and shell banks; unconsolidated bottom (i.e., soft sediments); ocean high salinity surf zones; and artificial reefs (National Oceanic and Atmospheric Administration Fisheries n.d.[i]).

6.16.3 Potential Project Impacts

Although red drum eggs and larvae would not likely be in the project area consistently, during spawning periods they may traverse the dredging site. It is expected that sand dredging operations would not affect these life stages. Additionally, eggs and larvae, if present, would be at low densities and any impacts would be negligible for the overall red drum populations. Red drum juveniles would be transient only in the borrow area and thus unlikely to be affected by dredging operations. Impacts on adults would be expected only from reduction of their prey or modification of the food web such as loss of crabs, shrimp, and/or forage fish that inhabit littoral and near-shore environments. These impacts on red drum populations would be expected to be minor.

6.17 Sand Tiger Shark

6.17.1 Species Description

The sand tiger shark (*Carcharias taurus*) can be found in the western Atlantic Ocean from the Gulf of Maine to Argentina. In the United States it is typically found in Cape Cod, Massachusetts and Delaware Bay during the summer months (Florida Museum of Natural History n.d.[c]). Inshore, the sharks are commonly found at depths ranging from 6 ft to 626 ft (1.8 m to 191 m), in a variety of areas, including the surf zone, shallow bays, coral and rocky reefs, and deeper areas around the outer continental shelves (Florida Museum of Natural History n.d.[c]).

A migratory species, the sand tiger shark, moves towards the equator in fall and winter and poleward during the summer (Florida Museum of Natural History n.d.[c]; National Marine Fisheries Service December 22, 2010). Currently sand tiger sharks are regulated on the east coast of the Unites States by the NMFS under the *Highly Migratory Species FMP* (National Marine Fisheries Service December 22, 2010). NMFS considers the sand tiger shark a species of concern. The International Union for Conservation of Nature (IUCN) and the American Fisheries Society both list the species as “vulnerable” (National Marine Fisheries Service December 22, 2010).

6.17.2 EFH

Designated EFH for the larval (early juvenile) and adult life stages of sand tiger shark is found in the project area. Descriptions of EFH for these life stages are described below.

Larvae (Early Juveniles)

Designated EFH for early juvenile (larval life stage) sand tiger shark includes the shallow coastal waters from Barnegat Inlet, New Jersey, south to Cape Canaveral, Florida to the 82- ft (25-m) isobath (National Oceanic and Atmospheric Administration Fisheries n.d.[j]).

Adults

EFH for adults includes the shallow coastal waters to the 82-ft (25-m) isobath from Barnegat Inlet, New Jersey to Cape Lookout, North Carolina and from St. Augustine, Florida to Cape Canaveral, Florida (National Oceanic and Atmospheric Administration Fisheries n.d.[j]).

6.17.3 Potential Project Impacts

Generally, because sand tiger sharks favor littoral and inshore areas, designated EFH could be adversely affected by dredging operations associated with the proposed project. However, because of their mobility, neonates, juveniles and adults should be able to easily avoid any direct negative impacts. A potential indirect impact would include loss of food resources such as crabs in the shoal area as a result of dredging operations. However, adverse impacts would be expected to be temporary and highly localized. Given the ubiquitous amount of undisturbed habitat within the sand tiger shark's range, any food web impacts from the project would be considered minor and temporary.

6.18 Atlantic Sharpnose Shark

6.18.1 Species Description

The Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) is commonly found in both warm-temperate and tropical waters from New Brunswick, Canada, through the Gulf of Mexico and along the coast of Brazil. The sharks reside off the shores of South Carolina, Florida, and the Florida Keys, year-round. They are found at depths up to 920 ft (280 m) but mostly remain in waters less than 32 ft (10 m) deep, especially in estuaries and harbors (Florida Museum of Natural History n.d.[d]).

They migrate in large, sexually segregated schools inshore to mate or give birth in late spring and offshore to deeper waters in winter. The number of pups in each litter ranges between four and seven and is related to the size of the mother. IUCN lists the species as one of least concern and they are not in an overfished condition (North Carolina Division of Marine Fisheries 2010b).

6.18.2 EFH

Designated EFH for the adult life stage of Atlantic sharpnose shark is found in the project area. EFH for this life stage is described below.

Adults

For adults, project area EFH includes shallow coastal areas to the 82-ft (25-m) isobath from Cape May, New Jersey south to the North Carolina/South Carolina border (National Oceanic and Atmospheric Administration Fisheries n.d.[k]).

6.18.3 Potential Project Impacts

Atlantic sharpnose sharks are known to frequent coastal areas and may be present within the shoal during dredging operations if dredging takes place during warmer months. The disturbance of bottom sediments associated with dredging could interfere with feeding, predation, and avoidance patterns of this shark species. Adults would be able to avoid direct impacts because of their mobility. No indirect impacts on Atlantic sharpnose shark populations would be expected due to the relatively small area impacted when compared with the range of the species and the readily available preferable habitat along the Mid- and South-Atlantic Bights. Any impacts on the food web would be expected to be temporary and localized.

6.19 Dusky Shark

6.19.1 Species Description

The dusky shark (*Carcharhinus obscurus*) is a coastal-pelagic species that occurs along continental coastlines in tropical and temperate waters from Nova Scotia to Cuba (including the northern Gulf of Mexico) and from Nicaragua to southern Brazil in the western Atlantic (Florida Museum of Natural History n.d.[e]). Males and females migrate separately, moving north during the summer months and south in the winter.

The dusky shark can be found from the surface to a depth of 1,240 ft (400 m). Adults avoid areas of low salinity and rarely enter estuaries, but the young are born and congregate in very shallow coastal water (nurseries) in estuaries and bays from New Jersey to Cape Hattaras. Females mate in the spring every second year. In the western Atlantic, the number of young per litter ranges from six to ten and sexes are represented in a 1:1 ratio (Florida Museum of Natural History n.d.[e]). NMFS lists the dusky shark as a species of concern and the IUCN lists the species in the western North Atlantic as “vulnerable” (Florida Museum of Natural History n.d.[e]; National Marine Fisheries Service January 24, 2011).

6.19.2 EFH

Designated EFH for the larval (early juvenile) and juvenile (late juvenile) life stages of dusky shark is found in the project area. EFH for these life stages is described below.

Larvae (Early Juveniles)

Project area EFH for early juveniles includes shallow coastal waters, inlets, and estuaries to the 82-ft (25-m) isobath from the eastern end of Long Island, New York, south to Cape Lookout, North Carolina (National Oceanic and Atmospheric Administration Fisheries n.d.[l]).

Juveniles (Late Juveniles)

For late juveniles, project area EFH includes shallow coastal waters, inlets, and estuaries to the 656-ft (200-m) isobath from Assateague Island at the Virginia/Maryland border to Jacksonville, Florida (National Oceanic and Atmospheric Administration Fisheries n.d.[l]).

6.19.3 Potential Project Impacts

Because dusky sharks are known to frequent coastal areas, neonates and juveniles may be adversely affected by dredging operations. However, neonates and juveniles, because of their mobility, should be able to easily avoid any direct impacts. The disturbance of bottom sediments associated with dredging could result in minor impacts on feeding, predation, avoidance, and migratory movements for this species. The dusky shark would experience a deficit of prey items in the immediate dredging area, but this adverse impact would be expected to be temporary and highly localized. With comparable habitat readily available throughout their range in the Mid- and South Atlantic Bights, any impacts on the food web would be expected to be insignificant and temporary.

6.20 Sandbar Shark

6.20.1 Species Description

The sandbar shark (*Carcharhinus plumbeus*) is a coastal-pelagic species that inhabits temperate and tropical waters around the globe. It is the most abundant species of large shark in the western Atlantic, spending most of the time in water depths of 60 ft to 200 ft (20 m to 65 m). It is believed that the sandbar shark favors a smooth substrate and will avoid coral reefs and other rough-bottom areas. The sandbar shark typically grows to 6 ft (1.8 m) and 110 lbs (50 kg) but can reach up to 7.5 ft (2.4 m) in length and 200 lbs (90 kg). Males and females reach maturity when they are 4 ft to 5.5 ft (1.3 m to 1.8 m) long. In the northern hemisphere, mating occurs in the spring or early summer (May through June) and pups, 1.5 ft to 2 ft (0.55 m to 0.70 m) long, are born from June through August. In the western North Atlantic, the bays and estuaries from Delaware to North Carolina are crucial sand bar shark nursery areas (Florida Museum of Natural History n.d.[f]).

The sandbar shark moves into deeper water for seasonal migrations, which are typically influenced by temperature and ocean currents. In the western North Atlantic, adult sandbar sharks move as far north as Cape Cod, Massachusetts during the warmer summer months and return to the south at the onset of the cooler weather. Males migrate earlier and in deeper water than females and often travel in large schools, while females make solitary migrations. Sandbar sharks have small litters, slow growth rates, and a relatively long gestation period; consequently this shark is vulnerable to over-exploitation by fishing. The IUCN lists this species as “near threatened” throughout its range, with the exception of the northwest Atlantic region, where it is assessed as “lower risk/conservation dependent” (Florida Museum of Natural History n.d.[f]). According to the North Carolina Department of Marine Fisheries (2010b), the sandbar shark is a primary shark species in their shark fishery; however, the 2006 assessment indicated that the stock was overfished and overfishing was occurring.

6.20.2 EFH

Designated EFH for the larval (early juvenile), juvenile (late juvenile), and adult life stages of sandbar shark is found in the project area. EFH for these life stages is described below.

Larvae (Early Juveniles)

Project area EFH for early juveniles includes shallow coastal areas to the 82-ft (25-m) isobath from Montauk, Long Island, New York south to Cape Canaveral, Florida. Nursery areas include shallow coastal waters from Great Bay, New Jersey to Cape Canaveral, particularly the Delaware and Chesapeake bays during summer. General characteristics of these EFH areas include salinity greater than

22 ppt and water temperatures higher than 69°F (21°C) (National Oceanic and Atmospheric Administration Fisheries n.d[m]).

Juveniles (Late Juveniles)

Designated EFH for late juveniles in the project area includes areas at the shelf break and benthic areas between the 328-ft and 656-ft (100-m and 200-m) isobaths (National Oceanic and Atmospheric Administration Fisheries n.d[m]).

Adults

For adults, project area EFH includes shallow coastal areas from the coast to the 164-ft (50-m) isobath from Nantucket, Massachusetts south to Miami, Florida (National Oceanic and Atmospheric Administration Fisheries n.d[m]).

Habitat Areas of Particular Concern (HAPC)

Habitat areas of particular concern (HAPC) for the sandbar shark also exist in the project area. These important nursery and pupping grounds have been identified in shallow areas at the mouth of Great Bay, New Jersey; the lower and middle Delaware Bay; the lower Chesapeake Bay, Maryland (nearest to the project area); and near the Outer Banks, North Carolina, in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore of those islands (National Oceanic and Atmospheric Administration Fisheries n.d[m]).

6.20.3 Potential Project Impacts

Neonates/early juveniles are known to congregate in estuaries, so impacts on these life stages would not be expected. However, the project area does contain HAPC for larvae and juveniles as well as adults. Because of their mobility, neonates, juveniles, and adults located in the project area should be able to easily avoid any direct negative impacts from dredging operations. However, since they are a bottom-dwelling species, any individuals remaining on the bottom or venturing too close to the dredge intake could be entrained. Juveniles and adults are opportunistic bottom feeders whose prey items might be negatively impacted by dredging operations. The disturbance of bottom sediments associated with dredging could interfere with feeding, predation, avoidance, and migratory movements of this shark species. However, these impacts would be expected to be minor because of the availability of food within their range throughout the Mid- and South Atlantic Bights. As such, no significant indirect impacts on sandbar shark populations would be expected. Any adverse impacts would be temporary and highly localized.

6.21 Scalloped Hammerhead Shark

6.21.1 Species Description

The scalloped hammerhead shark (*Sphyrna lewini*) is a circumglobal pelagic species, residing in coastal warm temperate and tropical seas. The species is distinguished from other hammerheads by an indentation located centrally on the front margin of the broadly arched head. In the western Atlantic, scalloped hammerhead sharks are found from New Jersey south to Brazil, including the Gulf of Mexico and Caribbean Sea. This shark occurs over continental and insular shelves and offshore to depths of 902 ft (275 m). Typically it spends most of the day inshore, even entering estuarine habitats, moving offshore to hunt at night. Scalloped hammerheads are thought to live more than 30 years, with total lengths of 12.1 ft to 14.1 ft (3.7 m to 4.3 m) and a maximum weight of 336 lbs (152.4 kg). Young scalloped hammerheads live in large schools, while adults occur singly, in pairs, and in small schools. In the northwestern Atlantic, males reach maturity at lengths of 5.9 ft (1.8 m) and approximately 64 lbs (29 kg) while females mature at 8.2 ft (2.5 m) and approximately 177 lbs (80 kg) (Florida Museum of Natural History n.d.[g]).

In some locations, schools of small scalloped hammerheads migrate poleward during the summer months. In the United States, hammerhead sharks are grouped with large coastal species and are considered to be most vulnerable to overfishing. The IUCN lists this species as “lower risk/near threatened” throughout its range (Florida Museum of Natural History n.d.[g]). According to the 2009 assessment, the Atlantic stock of the scalloped hammerhead shark was overfished and overfishing was occurring (Hayes et al. 2009; Federal Register 2011).

6.21.2 EFH

Designated EFH for the juvenile (late juvenile) life stage of scalloped hammerhead shark is found in the project area. EFH for this life stage is described below.

Juveniles (Late Juveniles)

Project area EFH for late juveniles includes all shallow coastal waters of the United States Atlantic seaboard from the shoreline to the 656-ft (200-m) isobath (National Oceanic and Atmospheric Administration Fisheries n.d[n]).

6.21.3 Potential Project Impacts

Scalloped hammerhead juveniles may be in project area waters between July and August. EFH would be adversely affected by the proposed project’s dredging operations. Juveniles should be able to easily avoid any direct negative dredging impacts because of their mobility. This species is known to move between inshore and offshore environments; their favored prey fish species could be negatively impacted by increased turbidities associated with dredging operations. However, any decrease in availability of prey would be highly localized and temporary.

6.22 Tiger Shark

6.22.1 Species Description

The tiger shark (*Galeocerdo cuvier*) is a large shark species that can grow to more than 18 ft (5 m) and 2,000 lbs (907 kg) (National Oceanic and Atmospheric Administration n.d. [p]), although the typical size is 10 ft to 14 ft (3 m to 4 m) and 850 lbs to 1,400 lbs (385 kg to 635 kg). The species is widely distributed throughout the world's temperate and tropical waters, with the exception of the Mediterranean Sea (Florida Museum of Natural History n.d.[h]). In the eastern United States, tiger sharks are found from Cape Cod, Massachusetts, to the Gulf of Mexico (National Oceanic and Atmospheric Administration Fisheries n.d.[p]). Tiger sharks will tolerate a variety of marine habitats but are commonly found in murky waters in coastal areas, including river estuaries, harbors, and other inlets where runoff from the land may attract prey (Florida Museum of Natural History n.d.[h]). Though often observed at the water's surface, tiger sharks have been reported at depths of 1,085 ft (350 m) (Florida Museum of History n.d.[h]). In the Atlantic, tiger sharks are part of the large coastal shark management group (National Oceanic and Atmospheric Administration Fisheries n.d.[p]).

Tiger sharks migrate seasonally to temperate waters in warmer months and to the tropics in winter. These sharks are known to make long oceanic migrations between islands and to travel long distances quickly. In the northern hemisphere, mating takes place between March and May and 10 to 80 pups per female are born between April and June of the following year. The IUCN considers the tiger shark as "near threatened" throughout its range (Florida Museum of History n.d.[h]).

6.22.2 EFH

Designated EFH for the larval (early juvenile), juvenile (late juvenile), and adult life stages of tiger shark is found in the project area. EFH for these life stages is described below.

Larvae (Early Juveniles)

Project area EFH for early juveniles includes shallow coastal areas to the 656-ft (200-m) isobath from Cape Canaveral north to offshore of Montauk, Long Island (National Oceanic and Atmospheric Administration Fisheries n.d.[o]).

Juveniles (Late Juveniles)

For late juveniles, project area EFH includes areas from Cape Lookout, North Carolina north to just south of the Chesapeake Bay, Maryland, from inshore to the 328-ft (100-m) isobath and north of the mouth of the Chesapeake Bay to offshore of Montauk, Long Island (National Oceanic and Atmospheric Administration Fisheries n.d.[o]).

Adults

Project area EFH for adults includes areas offshore of the Chesapeake Bay, Maryland south to Ft. Lauderdale, Florida (National Oceanic and Atmospheric Administration Fisheries n.d.[o]).

6.22.3 Potential Project Impacts

Although it is possible that there may be tiger sharks in the project area, it is unlikely that they would be impacted. The tiger shark is a highly mobile species and would be able to leave any area disturbed during dredging operations. Neonates and juveniles should be able to easily avoid any direct negative impacts because of their mobility. No indirect impacts on the tiger shark would be expected from dredging of the shoal. Impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

6.23 Clearnose Skate

6.23.1 Species Description

Clearnose skate (*Raja eglanteria*) occur primarily in the inshore Mid-Atlantic and inshore Southern New England (Sosebee 2006). In many parts of its range, the clearnose skate is considered the most common skate, reaching a maximum disc width of 18.9 in (48 cm) and a maximum length of 33 in (84 cm). It is thought that male skates of this species mature at 29.5 in (75 cm) total length while females mature at 29.9 in (76 cm) total length (Florida Museum of History n.d.[i]). This skate has been caught in salinities ranging from 12 ppt to 35 ppt and temperatures from 43.3°F to 80.6°F (6.3°C to 27°C) (Florida Museum of History n.d.[i]). Clearnose skate populations are managed by the NMFS under the *Northeast Skate Complex FMP*.

Commonly caught in inshore waters, the clearnose skate is a warm season visitor in the northern parts of its range, migrating south and/or offshore during the fall and winter. This species is not currently listed with the IUCN (Florida Museum of History n.d.[i]). According to the NEFSC the species is not overfished and overfishing is not occurring (Sosebee 2006).

6.23.2 EFH

Designated EFH for the juvenile and adult life stages of clearnose skate is found in the project area. EFH is the same for all life stages of the clearnose skate, as described below.

Project area EFH for juveniles and adults includes in- and near-shore habitats with soft bottom and rocky or gravelly substrates (including in the Chesapeake Bay) (National Oceanic and Atmospheric Administration Fisheries n.d.[q]).

6.23.3 Potential Project Impacts

Disturbance of bottom habitat by dredging operations could negatively impact the clearnose skate, which favors the soft bottom habitat that is prevalent regionally in the project area. Although increased turbidity may impact sight feeding, skates would avoid the impact area to feed in neighboring waters. Because elevated turbidities would be localized and temporary (i.e., coarse-grained sediments), adverse impacts would be expected to be minor. Benthic food sources lost during dredging operations would be expected to repopulate the affected areas within a few years (Diaz et al. 2004). Also, because the skate is a highly mobile species, it would be capable of foraging in other locations near the shoal while the benthic community recovers. Therefore, the proposed project would not result in significant adverse impacts on EFH for this species.

6.24 Little Skate

6.24.1 Species Description

The little skate (*Leucoraja erinacea*) is the second smallest skate species and is found in the western Atlantic from the southern Gulf of St. Lawrence and Nova Scotia to North Carolina. Little skate are diurnal and are typically found on sandy or gravely bottoms from shallow waters to 295 ft (90 m) deep (Florida Museum of History n.d.[j]). They are known to tolerate temperatures from 34.2ºF to 69.8ºF

(1.2ºC to 21ºC) and salinity ranges of 27 ppt to 33.8 ppt; optimally ranging from 29 ppt to 33 ppt (Centre for Marine Biodiversity n.d.; Florida Museum of History n.d.[j]). Little skate populations are managed by the NMFS under the *Northeast Skate Complex FMP*.

Skates move seasonally in response to changes in water temperature, generally offshore in summer and early autumn and inshore during winter and spring (Sosebee 2006). Little skates are oviparous, laying 10 to 35 eggs annually at any time of year but most often from October to January and June to July. The IUCN does not list little skate as endangered or vulnerable (Florida Museum of History n.d.[j]). According to the NEFSC, little skate is not overfished nor is overfishing occurring (Sosebee 2006).

6.24.2 EFH

Designated EFH for the juvenile and adult life stages of little skate is found in the project area. EFH is the same for all life stages of the little skate as described below.

Project area EFH for juveniles and adults includes in- and near-shore habitats with sandy, gravelly, or mud substrates (including the Chesapeake Bay) National Oceanic and Atmospheric Administration Fisheries n.d.[q]).

6.24.3 Potential Project Impacts

The disturbance of bottom habitat by dredging could negatively impact little skate EFH. Little skate are known to bury themselves in sea floor depressions during daylight hours. Disturbance of bottom habitat by dredging operations could increase turbidities and negatively impact the little skate by limiting sight feeding. Elevated turbidities would be localized and temporary, and adverse impacts would be expected to be minor. Benthic food sources lost during dredging operations would be expected to repopulate the affected areas within a few years (Diaz et al. 2004). It is expected that adverse impacts would be temporary and highly localized.

6.25 Winter Skate

6.25.1 Species Description

The winter skate (*Leucoraja ocellata*) is found in the western Atlantic from the Newfoundland Banks and the southern Gulf of St. Lawrence, Canada, south to North Carolina. It is commonly observed in waters along the New England coast. Residing from the surface to 300 ft (90 m) deep, the winter skate prefers sand and gravel bottoms in shoal water in the northern portion of its range. The winter skate tends to be nocturnal and is relatively inactive during the day (Florida Museum of History n.d.[k]). Winter skate populations have been managed by the NMFS under the *Northeast Skate Complex FMP*.

The winter skate lives on average to 19 years and reaches approximately 41 in (105 cm) total length and 15 lbs (7 kg). Males reach sexual maturity at 11 years of age and 29 in (73 cm) total length; females are mature at 11 to 12 years of age and 30 in (76 cm) total length. Winter skates are oviparous without a defined reproductive season. Each female produces approximately 40 egg cases per year, each containing one embryo. The oblong egg cases, measuring 2.2 in to 3.9 in (5.5 cm to 9.9 cm) long and 1.4 in to 2.1 in (3.5 cm to 5.3 cm) wide, are released by the female in offshore waters on rock bottom habitats. Embryos remain in the egg cases during the gestation period of about 1.5 years. The IUCN does not list winter skate as endangered or vulnerable (Florida Museum of History n.d.[k]). According to the NEFSC, winter skate is not overfished, but overfishing is occurring (Sosebee 2006).

6.25.2 EFH

Designated EFH for the juvenile and adult life stages of winter skate is found in the project area. EFH is the same for all life stages of the winter skate as described below.

Project area EFH for juveniles and adults includes in- and near-shore habitats with sandy, gravelly, or mud substrates (including the Chesapeake Bay) (National Oceanic and Atmospheric Administration Fisheries n.d.[q]).

6.25.3 Potential Project Impacts

The disturbance of bottom habitat by dredging could negatively impact winter skate EFH. Skates are known to bury themselves in sea floor depressions during daylight hours. Additionally, turbidity could interfere with feeding, predation, and avoidance patterns. Turbidity may impact sight feeding, but the skates would likely flee the area to feed in neighboring waters where turbidity is reduced. It is expected that these adverse impacts, however, would be temporary and highly localized. Additionally, the wide range for prey within the species' distribution increases the potential for feeding opportunities elsewhere. As a result, only minor, temporary, and localized impacts on the species would be expected from dredging operations.

7 Summary of Impacts

7.1 Project Impacts

It has been determined that the proposed action would not have substantial adverse effects on EFH. The primary adverse effect of sand dredging and sand placement in the nearshore area, under either Alternative 1 or 2, on all managed fish and invertebrate species would be on the local benthic community. The primary direct effect on this community from dredging would the entrainment of infauna and epifauna that reside in and on the sandy sediment, including the managed surf clam. Similar impacts would occur where anchors would be placed and in the chain sweep areas when anchoring during both dredging and discharge activities. Placement of the pipeline within intertidal areas and onto the beach would not likely affect these communities. The primary direct effect of sand placement on the nearshore area would be the burial of the local benthic community. The benthos within the nearshore area could consist of worms, snails, aquatic insects, and crustaceans. Deposition of sand in the nearshore area would bury benthic organisms; however, many of the larger mobile benthic species in the intertidal zone have the ability to burrow through the sand, reducing impacts on these species (Burlas et al. 2001). The smaller, immobile species would be more affected. These species tend to have high reproductive rates, which would aid in recovery and re-colonization of the benthic community (Burlas et al. 2001). Burlas et al. (2001) reported recovery times for the intertidal benthic communities as 2 to 6.5 months following beach replenishment. Other studies have shown that recovery within the intertidal zone has taken 2 to 7 months (Hackney et al. 1996) and 3 to 6 months (Jutte et al. 1999a,b as cited in Burlas et al. 2001). Therefore, no significant impacts on EFH would be expected.

These activities would have a negligible impact on the regional benthic community because these types of assemblages, found on the sandy shoals and the flat bottom near-shore areas, are ubiquitous, and the community found within the spatial extent of the dredge area is similar to that found in the broad extent of the near-shore continental shelf of the Mid-Atlantic Bight. As noted in the Diaz et al. (2004) study of offshore sand shoals of coastal Virginia, a viable community was re-established within a few years after dredging.

In addition to the direct impacts of dredging on the benthic community, indirect impacts on managed fish species would include a diminished availability of bottom-dwelling food resources such as crustaceans and other invertebrates. The benthic prey species found on the shoals and sand bottom, such as crustaceans and worms, would likely be impacted during dredging operations.

It is expected that that turbidity could increase because of removal of sand from the shoal, overflow of sand from the hopper dredge at the borrow site, and nearshore sand deposition. Turbidity created by the removal of sand at the offshore borrow site would likely be similar to sedimentation disturbance caused by natural sediment transport processes (CSA International, Inc. et al. 2009). Sediment plumes up to 2,000 m (6,562 ft) from hopper dredges have been recorded for sediments composed of silty clay (LaSalle et al. 1991). Because the sediments found at Sandbridge Shoal area coarser grain size it would be likely that the plumes would be much smaller. Anchor Environmental (2003) reported that turbidity plume concentrations from hopper dredges in the nearfield can range between 80 to 475 mg/L and decrease quickly with distance from the dredge. Much less information is available regarding turbidity plumes in offshore environments because of the tendency for offshore sands to be coarser and the more dynamic oceanographic conditions that are found in the open ocean environment causing minimized settling effects and reduced time in the water column (CSA International, Inc. et al. 2009).

Turbidity in the nearshore environment, similar to the offshore environment, would consist of medium-grained sand and occur in an area of existing natural disturbance (i.e., storm activity, tidal flow, and wave activity). Wilbur et al. (2006) reported that turbidity concentrations following beach replenishment (between 34 mg/L and 64 mg/L) were less than those created by storm events (between 81 mg/L and 425 mg/L). It would be expected that the turbidity concentration from the proposed action in the nearshore zone would be similar to those reported in Wilbur et al. (2006). A study conducted by Versar, Inc. (2004) indicated that turbidity plumes associated with deposition of sand during beach replenishment were short-lived and small and did not increase local turbidity above background levels (i.e., those created by natural disturbance).

Increases in turbidity, both offshore and nearshore, could disturb the ability of surf clams and other mollusks to feed, but this effect would be temporary and limited. Increased turbidities would temporarily cause difficulty for finfish in locating prey, but this effect would be short-term and would not be expected to cause significant adverse effects on species in the area because they can easily migrate to another area to feed. The dredging would limit feeding within the borrow area, but prey would still be accessible in nearby non-affected areas. Nearby areas of the shoal, and the biota that inhabit them, could also experience increased turbidity and sedimentation, but it is anticipated that these impacts also would be temporary and minor. Eggs and larvae (neonates) are the life stages that would most likely be directly affected by a temporary increase in turbidity and potential decrease in dissolved oxygen concentrations caused by dredging. These life stages are more sensitive and less able to emigrate from the affected area and therefore would be more susceptible to impacts, as compared with juveniles and adults.

Finfish inhabiting the sand bottom and shoals, such as black sea bass, summer flounder, windowpane flounder, winter flounder, and witch flounder would temporarily exit the disturbed area when dredging begins, but would return shortly after dredging operations cease. A small number of these fish could become entrained.

The juvenile and adult bony finfish found in the water column are highly mobile and would also likely exit the area during dredging, although a number of these fish, and some of the demersal cartilaginous species (skates), may still become entrained. If an adult or juvenile managed species were in the disturbed area when dredging begins, they would likely migrate to another area, returning shortly after dredging operations cease. Again, it is possible, although highly unlikely, that one of the managed skates or sharks would become entrained. This is unlikely due to their low densities in any one area at a given time and their innate ability to avoid the disturbance.

Cartilaginous finfish found within the project area such as the clearnose skate, spiny dogfish, sand tiger shark, sandbar shark, and dusky shark migrate seasonally, moving southward along the Atlantic Coast in search of warmer waters during the winter. They are usually found alone or in pairs when not migrating, so it is unlikely that there would be any significant concentrations of these species in the project area, especially in the winter. Pups and small juveniles of these species are primarily found inshore in estuaries and in shallow coastal waters, so impacts on these species would be negligible.

7.2 Cumulative Impacts

The Council on Environmental Quality (CEQ) regulations define cumulative impacts as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what other agency (federal or non-federal) or person undertakes such other actions” (40 CFR §1508.7). Cumulative impacts can result from individually minor but collectively significant actions by various agencies (federal, state, and local) or individuals that take place over time. Accordingly, a cumulative impacts analysis must identify and define the scope of other actions and their relationship with the proposed action or its alternatives if there is an overlap in space and time.

The geographic area assessed for cumulative impacts on EFH is Sandbridge Shoal, the surrounding designated EFH grids as presented in Sections 5.1 and 5.2, and other proximal offshore areas near the project area. It is anticipated that implementation of the repairs would occur between FY 2012 and FY 2014 with approximately 700,000 cy (535,000 m^3) of sand for Alternative 1 to 1.1 million cy (841,100 m^3) of sand for Alternative 2 required. Repairs under Alternative 1 are expected to require three to six consecutive months, while six to nine consecutive months would be required under Alternative 2. Assuming dredge depths of 2 ft to 6 ft (0.6 m to 1.8 m), from approximately 72 to 217 acres of Sandbridge Shoal would be impacted under Alternative 1 and from approximately 114 to 341 acres would be impacted under Alternative 2 (see Table 7-1).

Table 7-1 Estimated Affected Acreage Based on Alternative and Dredge Depth

Alternative	Sand Required (cy)	Dredge Depth		
		2 feet	4 feet	6 feet
1	700,000	217	108	72
2	1,100,000	341	170	114

7.2.1 Impact Sources and Potential Effects

Impacts on EFH in the area can be attributed to several sources, including other sand replenishment projects, neighboring navigation channel dredging, point and non-point source pollution, fishing activities, and natural meteorological events.

Recent dredge projects using Sandbridge Shoal and other substrate intrusive projects (see Section 7.2.2) can result in both direct and indirect impacts, including habitat alterations, loss of benthic invertebrates, and changes in local bathymetry. Increased coastal erosion at beaches landward and adjacent to a mining site resulting in alteration of the littoral sediment budget can occur as a result of these types of projects. Also, a shoal's function as fishery habitat may be adversely affected subsequent to these types of projects.

Runoff from sources such as storm water and agriculture may carry chemicals and increased nutrients to the Atlantic Ocean. Increased coastal development in Virginia (and other nearby states) contributes to non-point source pollution by increasing non-permeable surface area, which in turn results in increased chemical and nutrient runoff. Pollution within the marine environment can cause organism death, anoxic habitats and eutrophication, low species' fecundity, and decreased health. Fish habitat can be affected when buoyant plumes of pollution move along the coast. Agricultural runoff, storm water, and other sources carry toxic chemicals and excess nutrients into coastal waters. All of these factors can lead to reproductive failure, deformations, and death in fish and invertebrates, and/or low dissolved oxygen habitats. Impacts on EFH from both point and non-point sources of pollution are expected to continue into the future.

Several commercial fisheries may operate in the area that could impact both EFH species and their habitat. Trawl fisheries target demersal species such as flatfishes or pelagic species such as bluefish. Bottom trawls can remove bottom dwelling organisms such as benthic invertebrates, epifauna, and vegetation (Collie et al. 1997). Epifauna provides a protected habitat for the crustaceans and small fish that are potential prey species for EFH species. Trawling may change the seafloor surface by creating tracks where trawl doors have gouged into the sediment. Trawling may also flatten the sediment surface, reducing habitat for EFH species and their prey. In addition, trawlers are nonselective in their catch and thus have the potential to reduce both EFH species and their prey. Gillnet fishing may also take place in the project vicinity. This fishing method can result in bycatch thus reducing population numbers of non-targeted organisms, such as sublegal size fish and prey species.

Recreational fishing can also result in catching designated EFH species within the vicinity of the borrow area. Mortality of some individuals of these species is expected from the bycatch of non-target species and juveniles. Fish and benthic invertebrate mortalities will likely parallel an increase in recreational fishing activity.

Repeated anchoring during fishing, dredging, or other intensive activities can lead to patches void of benthic organisms. Stable sand environments often support colonial epifauna such as sponges and bryzoans. When the epiflora is repeatedly removed by bottom fishing, the habitat may become less suitable for commercially valuable fish and shellfish species (Bradstock and Gordon 1983; Poiner and Kennedy 1984; Sainsbury 1988). Also, pots and traps may be used for crab and fish species. During storms these pots and traps may be dragged along the seafloor bottom, tearing up benthic habitat and damaging sessile organisms (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Bottom trawls have been shown to remove bottom-dwelling organisms such as brittle stars and urchins as well as plant-like organisms and colonial worm tubes (Collie et al. 1997). Epifauna, which are generally less abundant, have also been shown to be disturbed by bottom trawling. Epiflora provides habitat for shrimp, polychaetes, and small fish, which are potential prey species for commercially desirable fish species.

A natural source of disturbance of EFH species would be hurricanes, tropical storms, and nor'easters, which can increase turbidity and alter benthic habitat of EFH species and their prey. These types of events can disrupt food webs in the area affected.

7.2.2 Description of Other Projects

Projects by federal, state, and local agencies that could potentially generate cumulative impacts with the proposed action are described below. No privately funded projects were identified that could potentially generate cumulative impacts with the proposed action.

Sandbridge Shoal Dredge Projects

Recent historical dredge projects using Sandbridge Shoal have included removing nearly 4 million cy of sand since 1996. Indirect impacts resulting from dredging (which directly cause bathymetry changes) may include increased coastal erosion at beaches landward and adjacent to the mining site, thereby altering the littoral sediment budget. It is expected that the shoal will not naturally recover the volume of the sand that is dredged (U.S. Army Corps of Engineers and Minerals Management Service June 2009). However, current research sponsored by BOEM suggests dredging will not threaten the geomorphic integrity of the shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009). Although its function as fishery habitat may be adversely affected, to date there has been limited evidence of any sustained disturbance beyond transient and localized impacts (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

Sandbridge Beach Replenishment

The USACE, Norfolk District, in cooperation with BOEM, completed an EA in 2009 assessing the impacts of continuing beach replenishment and hurricane protection measures at Sandbridge Beach in Virginia Beach, Virginia. The proposed action evaluated in the 2009 EA and the previous replenishment cycles used sand dredged from Sandbridge Shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

A hopper dredge will be used to obtain sand from Sandbridge Shoal. The USACE estimates 1.5 to 2.0 million cy of sand will be needed to replenish the beach. Replenishment cycles using approximately the same amount of sand are estimated to be required every three to five years at the Sandbridge oceanfront (U.S. Army Corps of Engineers and Minerals Management Service June 2009). The current replenishment cycle was expected to begin in spring 2012 and be completed in two to three months (Roehrs July 20, 2011). Due to finding reasons, the project is now expected to begin December 2012 at the earliest (Applegate February 17, 2012).

Virginia Beach Resort Beach Replenishment

The City of Virginia Beach is planning to replenish the resort beach from Rudee Inlet to Joint Expeditionary Base (JEB) Fort Story. The resort beach is located on the city's Atlantic coast. The city plans to begin the project December 2012 at the earliest and complete it within three months (Applegate May 19, 2011; Applegate February 17, 2012). The project will widen the resort beach to 300 ft along its entire length, which will require between 1.5 million and 2 million cy of sand (Applegate May 19, 2011). The sources of the sand for the beach replenishment will be the Thimble Shoals and Atlantic Ocean federal navigation channels and areas immediately adjacent to the channels (Roehrs July 20, 2011; U.S. Army Corps of Engineers Norfolk District June 2006). The Thimble Shoals channel runs through the mouth of the Chesapeake Bay and over the southern tunnels of the Chesapeake Bay Bridge-Tunnel. It is located approximately 2 mi off the Chesapeake Bay shoreline of Virginia Beach. The Atlantic Ocean channel is a naturally deeper area of the continental shelf off of Virginia Beach's Atlantic shoreline. An EA for the beach replenishment has been completed and all required permits have been obtained (Roehrs July 20, 2011; U.S. Army Corps of Engineers Norfolk District June 2006).

Rudee Inlet Dredging

The next round of maintenance dredging in Rudee Inlet is scheduled for FY 2012 (City of Virginia Beach May 18, 2011). Rudee Inlet is located south of Virginia Beach's resort beach on the Atlantic coast. Four sections of the inlet will be dredged to their permitted depths:

- The external deposition basin outside the mouth of the inlet would be dredged to 22 ft below mean lower low water (MLLW) mark.

- The main channel of the inlet would be dredged to 12 ft below the MLLW mark.

- The internal sand trap would be dredged to 20 ft below the MLLW mark.
- The turning basin would be dredged to 9 ft below the MLLW mark (Roehrs July 20, 2011).

The City of Virginia Beach and the USACE dredge Rudee Inlet every year. On average, 250,000 cy of sediment are removed from the inlet every year, including the four sections listed above. Some years, the amount of sediment removed can reach approximately 300,000 cy. The sediment dredged from Rudee Inlet is deposited on the resort beach to the north of the inlet, between 2^{nd} and 9^{th} Streets (Roehrs July 20, 2011).

JEB Little Creek Maintenance Dredging

The Navy conducted maintenance dredging at JEB Little Creek in Virginia Beach, Virginia. JEB Little Creek is located on the shoreline of the Chesapeake Bay at the city line between Virginia Beach and the City of Norfolk to the west. The installation's harbor, Little Creek Harbor, is a tributary to the bay. The existing slips, approaches, and basins in Little Creek Harbor were dredged to depths ranging from -8.0 ft to -31.0 ft below mean low water. Both hydraulic and mechanical (bucket) dredging methods were used (U.S. Army Corps of Engineers Norfolk District Regulatory Branch 2010). Approximately 1.2 million cy of sediment were dredged. The dredged materials were disposed of at the Norfolk Ocean Dredged Material Disposal Site (ODMDS); the James River upland site at the Shirley Plantation in Charles City County, Virginia; or used for beach nourishment projects, as applicable (Navy Region Mid-Atlantic June 9, 2010). The project was completed in early 2011.

Willoughby Shoreline Dune Restoration

The City of Norfolk restored 6,000 ft of dune along the shoreline of the Willoughby Spit, located on the Chesapeake Bay in the northwestern part of the City of Norfolk. Sand for the dune restoration was excavated and dredged from areas along the Ocean View shoreline and from the northern shoreline of Norfolk (U.S. Army Corps of Engineers Norfolk District Regulatory Branch 2010). The project was completed in spring 2010.

Shoreline Restoration and Protection Project at JEB Fort Story

The Navy is proposing to conduct a shoreline restoration and protection project at JEB Fort Story, located in Virginia Beach, Virginia. The beaches and primary sand dunes at JEB Fort Story have experienced sporadic episodes of severe erosion during major storm events. Erosion is placing rare terrestrial habitats and manmade structures (including aids to navigation), military training facilities, and historic resources at risk of damage or destruction. The Navy is preparing an EA to evaluate the reasonably foreseeable environmental consequences of the proposed shoreline restoration and protection project. The EA analyzes two action alternatives: targeted replenishment of beaches and construction of breakwaters and full replenishment of beaches. Targeted replenishment of beaches and construction of breakwaters is the preferred alternative.

Under Alternative 1(preferred alternative), a total of approximately 750,000 cy of sand would be needed for the beach replenishment. Alternative 1 includes authorization by BOEM to access Sandbridge Shoal, for the extent of the lease agreement, in order to dredge sand for the replenishment. A hopper dredge would be used to pump the sand from the Sandbridge Shoal. Beach replenishment and breakwater construction would be implemented in phases, with beach replenishment occurring first. Beach replenishment would occur over a three to six consecutive month period starting between FY 2012 to FY 2014, depending on funding. Breakwater construction would occur over a six to twelve consecutive month period between FY 2017 and FY 2019, depending on funding.

Previous Dredging at the Sandbridge Shoal

Both the USACE and the Navy have used Sandbridge Shoal as an offshore borrow area for sand replenishment projects at Sandbridge Beach and Dam Neck Annex. Evaluations of sand resources estimate that the shoal may have contained between 22 million to 105 million cy prior to any dredging (U.S. Army Corps of Engineers and Minerals Management Service June 2009). From 1996 to 2012 (not including proposed dredging at Dam Neck Annex), approximately 9.56 to 9.81 million cy will have been dredged from the shoal for the following projects:

- 1996 shoreline protection project at Dam Neck Annex (810,000 cy of sand).
- 1998 beach replenishment at Sandbridge Beach (1.1 million cy of sand).
- 2002 beach replenishment at Sandbridge Beach (2 million cy of sand).
- 2003 shoreline protection project at Dam Neck Annex (700,000 cy of sand).
- 2007 beach replenishment at Sandbridge Beach (2.2 million cy of sand).
- 2012 planned beach replenishment at Sandbridge Beach (2 million cy of sand) (U.S. Army Corps of Engineers and Minerals Management Service June 2009).
- FY 2012 – 2014 proposed shoreline restoration and protection project at JEB Fort Story (Alternative 1: 750,000 cy of sand; Alternative 2: 1 million cy of sand).

At least 12.4 to 12.2 million cy of sand will remain in the shoal following completion of these projects, based on conservative estimates of an original volume of 22 million cy of sand. This volume represents approximately 56% of the conservative original volume of sand in the shoal (U.S. Army Corps of Engineers and Minerals Management Service June 2009).

7.2.3 Conclusions

Sandbridge Shoal's function as habitat may be adversely impacted by both the proposed project and other regional impacts. Presently, there has been little evidence of any disturbance beyond temporary and localized impacts on EFH and species supported by shoal habitat. The entire Sandbridge Shoal complex is made up of more than 13,500 acres of sand to muddy sand substrate. Project dredging is expected to impact a relatively small fraction of this area. The proposed action, when considered along with known or anticipated projects and other impact-producing factors, would result in only temporary cumulative adverse impacts on EFH within the region.

Other EFH within the region (specifically within the nearshore sand deposit sites) may be adversely impacted by both the proposed project and other regional projects. Similar replenishment projects such as the Sandbridge Beach project (spring 2012), the Virginia Beach Resort project (spring 2012), the JEB/Fort Story Shoreline Restoration and Protection project (proposed FY 2012-2014), and the Willoughby Shoreline project (completed spring 2010) could have cumulative effects on EFH within the nearshore region if deposition of sand alters the local habitat. It is expected that the cumulative effects related to these five projects would be minor because of the timing of the projects and the ability of fish species using the EFH to move to other acceptable habitat. For example, the nearshore benthic habitat impacted during the 2010 Willoughby shoreline project should be recovering and begin to be able to sustain EFH.

8 Mitigation Measures

The Navy will implement measures to minimize or avoid effects on EFH and managed species based on consultation with federal agencies. Overarching measures to mitigate impacts are as follows: 1) implementation of best management and engineering practices, 2) completion of hydrographic surveys pre- and post- dredging; and 3) coordination with the NMFS to create a management plan to be enacted for the next replenishment so that harvesting of the shoal would remain sustainable.

The main impacts on EFH from the proposed action would be on benthos and benthic habitats and on managed fish and invertebrate species, some of which are important recreationally and/or commercially.

To minimize potential entrainment impacts on late juvenile and early adult life stage fishes, the dredge drag head will be screened. Similarly, whenever possible, the suction in the drag head will be turned off when it is lifted off the bottom to prevent possible entrainment of vulnerable species.

The benthic community would be expected to begin re-colonization shortly after dredging ends and would recover to background or pre-dredge conditions within a few years. A 2006 literature synopsis found that the recovery of benthic faunal assemblages can occur anywhere from 3 months to 2.5 years after dredging, depending on the species present, the specific details of the dredging, and environmental conditions (Brooks et al. 2006). Mitigation measures that may be incorporated to decrease impacts on EFH could include maintaining shoal morphology and leaving undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery. These measures would in turn decrease adverse effects on demersal and pelagic fish, benthic invertebrates, and prey species, and would support habitat in general.

Overflow of hoppers during loading is the largest contributor to turbidity in dredging operations (Minerals Management Service November 1999). Operational techniques and other measures would be considered in an effort to reduce the size and duration of turbidity plumes during dredging. Sediments ideal for beach replenishment (i.e., those with less silt and clay) are also best for minimizing turbidity plumes. As a result, plumes would be expected to be smaller in area and duration for this operation than for other dredging activities.

Fuel spill prevention and response plans will be implemented to reduce the likelihood of vessel fuel spills during fuel transfer or accidents and to minimize the impacts on the local environment if a spill occurs. As a result of these measures, the effects of a spill would be expected to be minor.

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