Appendix 2

Threatened and Endangered Species Coordination

BIOLOGICAL ASSESSMENT
OF THREATENED AND ENDANGERED SPECIES

FOR
GARDEN CITY/SURFSIDE BEACH (REACH 3)

Of the

MYRTLE BEACH
STORM DAMAGE REDUCTION PROJECT

HORRY and GEORGETOWN COUNTIES,
SOUTH CAROLINA

April 2016

Table of Contents

1.0 BACKGROUND AND AUTHORIZATION 1
2.0 PROPOSED PROJECT 3
3.0 PRIOR CONSULTATIONS 8
4.0 LIST OF SPECIES 8
  4.1 U.S. Department of Interior 8
  4.2 The National Marine Fisheries Service 9
5.0 GENERAL EFFECTS ON LISTED SPECIES/CRITICAL HABITAT 10
6.0 SPECIES ASSESSMENTS 10
  6.1 Manatee 10
  6.2 Kemp's ridley, leatherback, loggerhead, green, and hawksbill sea turtles 12
  6.3 Shortnose sturgeon 22
  6.4 Atlantic Sturgeon 23
  6.5 Sea beach Amaranth 25
  6.6 Piping plover and designated piping plover critical habitat 26
  6.7 Rufa Red Knot 28
  6.6 Blue (NOAA Fisheries list), finback, humpback, right, sei, and sperm whales 32
7.0 SUMMARY OF PROTECTIVE MEASURES 36
8.0 SUMMARY EFFECT DETERMINATION 37
9.0 LITERATURE CITED 38

1.0 BACKGROUND AND AUTHORIZATION

The U.S. Army Corps of Engineers (USACE) and the Bureau of Ocean Energy Management (BOEM) are acting as cooperating agencies in the analyses required by the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and other federal laws governing environmental protection. This Biological Assessment (BA) has been prepared by USACE in cooperation with the BOEM in order to meet the federal agency consultation requirements of Section 7 of the ESA. This document evaluates the effects of the proposed beach renourishment project on federally listed and proposed threatened and endangered species under the jurisdiction of the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). Consultation with NMFS is not required because in-water impacts of the project are covered by the NMFS South Atlantic Regional Biological Opinion (NMFS 1997).

The Myrtle Beach Storm Damage Reduction Project was authorized for construction by Section 101 of the Water Resources Development Act of 1990, Public Law 101-640. Section 934 of the Water Resources Development Act of 1986 (WRDA86), Public Law 99-662, authorized the Government to extend the Federal participation in periodic beach nourishment until 2046. The final Environmental Impact Statement (EIS) was completed in January 1993 with the Record of Decision (ROD) being signed on 1 November 1993.

The authorized project calls for construction of a separate protective beach in three separable reaches, North Myrtle Beach (Reach 1), Myrtle Beach (Reach 2), and Garden City/Surfside Beach (Reach 3). The total project reach is 25.4 miles (Figure 1).

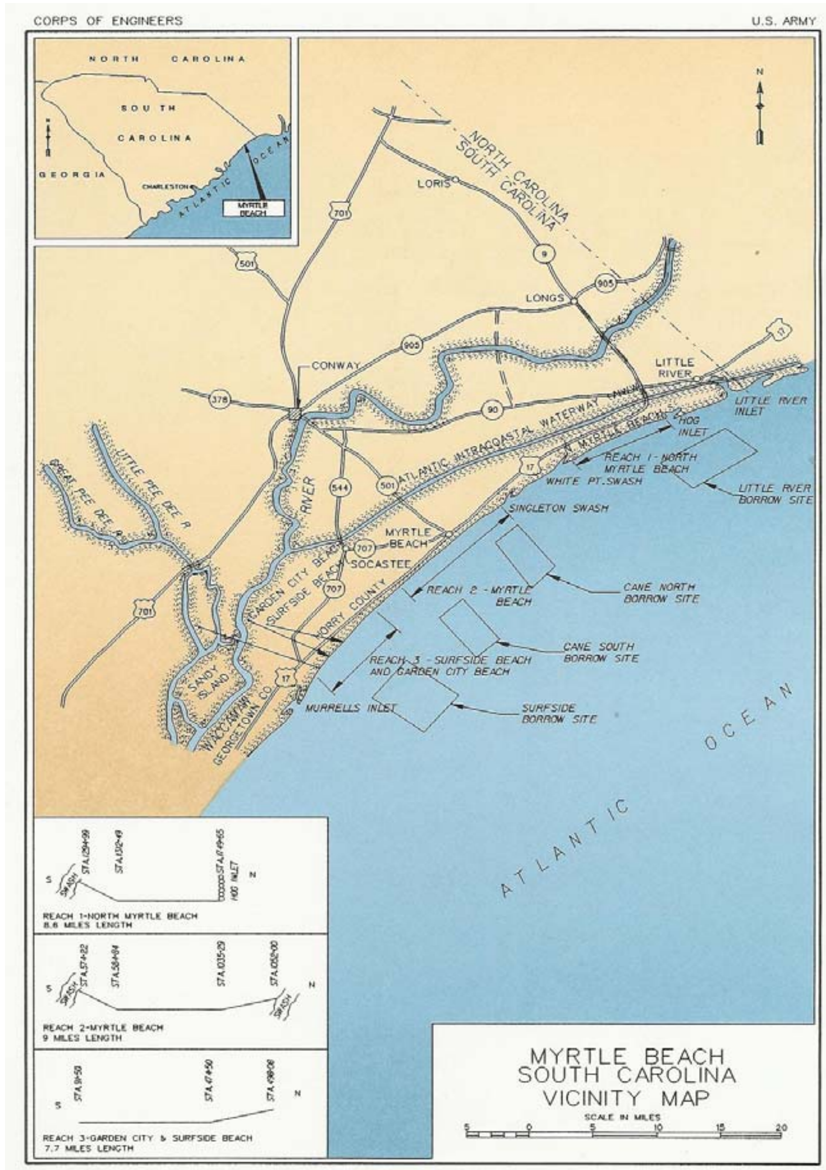

Figure 1. Myrtle Beach Storm Damage Reduction Project Reaches and Borrow Areas

Initial construction of North Myrtle Beach (Reach 1) was completed in May 1997. Initial placement consisted of 57.7 cubic yards per linear foot along 8.6 miles of beach. This quantity includes material for the protective berm, advanced nourishment and overfill ratio, for a total placement of 2,622,900 cubic yards. Future re-nourishment of 490,000 cubic yards was planned for every ten years. Initial construction of Myrtle Beach (Reach 2) was completed in December 1997. Initial placement consisted of 47.1 cubic yards per linear foot along 9.0 miles of beach. This quantity includes material for the protective berm, advanced nourishment and overfill ratio, for a total placement of 2,250,000 cubic yards. Future re-nourishment of 440,000 cubic yards was planned for every eight years with the final nourishment being 550,000 cubic yards for the last ten years of the project life. Initial construction of Surfside/Garden City Beach (Reach 3) was completed in November 1998, with approximately 1,517,494 cubic yards of sand was placed along 7.7 miles of beach in Horry and Georgetown Counties extending from 1.2 miles south of the Horry/Georgetown County line to Myrtle Beach State Park in Horry County. Future re-nourishment of 360,000 cubic yards was planned for every eight years with the final nourishment being 450,000 cubic yards for the last ten years of the project life.

Along with long term coastal erosion processes, the 2005 hurricane season resulted in significant coastal erosion. As a result of erosion caused by Hurricane Ophelia, the Grand Strand Storm Damage Reduction project qualified for restoration under the authority of Public Law 84-99. In 2007/2008 approximately 902,725 yards (Reach 1), 1,497.975 yards (Reach 2), and 857,633 yards (Reach 3) of Federal outer continental shelf (OCS) sand from Little River, Cane South, and Surfside borrow areas, respectively, was used to re-nourish 25.3 miles of shoreline along the Grand Strand. Material was excavated from borrow areas located within the OCS and therefore the Bureau of Ocean Energy Management (BOEM) was a partner on the project. Section 8(k) of the Outer Continental Shelf Lands Act (OCSLA) grants BOEM the authority to convey, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration, or for use in construction projects funded in whole or part or authorized by the federal government. In July 2007, BOEM issued USACE a noncompetitive lease for extraction of marine minerals from the Little River, Cane South, and Surfside Borrow Areas.

The project's trigger point for re-nourishment is when 25% of the project length has storm berm width less than 25%. Recent monitoring reports from the respective Sponsors show the reaches have varied success. For the 2015 Sponsor Monitoring Reports, 36 of the 42 monitored transects in Reach 1 (the City of North Myrtle Beach) had met the re-nourishment trigger (88% of the Reach length). In contrast Reach 2 (the City of Myrtle Beach), had no monitoring locations that approached the trigger point. The average berm width for this Reach was 69.6 feet, with only 875 feet of project (approximately 2%) meeting the trigger point. (This was limited to the Withers Swash area.) This reach has lost approximately 15% of the material placed during the last re-nourishment. With respect to Reach 3, 17 of the 29 monitored stations (approximately 59%) reached or exceeded the re-nourishment trigger point (60% of the Reach length) (Table 1). Despite the resiliency of Reach 2, when all three reaches are combined, the Project has met its official trigger point for re-nourishment, as shown in the table below. This project was first operational in 1998 (base year). As a result, the remaining project life is now 32 years. For the current project, funding is only available for Reach 3 (Garden City/Surfside Beach).

Table 1. Project Reach Lengths Met or Exceeded Re-nourishment Point

Reach	Reach Length (lf)	Reach Length Meeting Trigger Point (lf)
Reach 3	40,656	24,000

2.0 PROPOSED PROJECT

The Myrtle Beach project consists of three separable reaches which have previously been constructed simultaneously at each nourishment project. Currently, funding is only available for Reach 3, Garden City/Surfside, and therefore, this Biological Assessment will only evaluate the effects related to Reach 3 of the Myrtle Beach Storm Damage Reduction Project.

The proposed project at Reach 3 consists of a protective storm berm and an advanced nourishment construction berm. The protective storm berm reduces damages which will occur during severe storm events. The advanced nourishment berm acts as a buffer for the protective storm berm against long term erosional forces. The protective storm berm has a top elevation of 6.0 NAVD 88 and a crest width of 10 feet. The fore slope of the protective berm is 1 vertical to 20 horizontal down to natural ground. The advance nourishment berm sits adjacent the protective storm berm. The advance nourishment berm has a top elevation of 6.0 NAVD 88. The fore slope of the advance nourishment is 1 vertical to 5 horizontal down to elevation 2.0 NAVD 88 then a fore slope of 1 vertical to 20 horizontal down to the bottom. At each location, the plan includes dune grass and dune fencing. Where possible, USACE would like to plant seabeach amaranth as a small component of the dune grass planting. The length of the dune and beachfill for the project is approximately 40,300 feet.

The project is anticipated to be constructed with a hopper dredge, booster pump, and land based heavy equipment (i.e. bulldozers and front-end loaders); however, the use of a cutterhead dredge remains a possibility. Monitoring of project impacts performed by SCDNR and CCU have previously recommended the continued use of a hopper dredge of borrow areas associated with the Myrtle Beach project to minimize benthic impacts and foster quicker benthic recovery.

The borrow area for Reach 3 was identified in the March 1993 General Design Memorandum for the project as the Surfside Borrow Area (Figure 2). Portions of it have been used in the past for the 1998 and 2007/2008 nourishment projects. The area extends from 2 to 5 miles offshore and comprises approximately 6.0 square miles. The site is generally featureless and data indicates that it is relatively homogenous and sandy. This borrow area will serve as the source of sand for the current project. The mean phi size of the material in the borrow area is 1.77; the percent passing the #200 sieve is 5.1%; and the average usable depth is 4.5'.

Figure 2 shows the areas within the overall borrow area that dredged material was removed for placement along Reach 3 in 1998 and 2007/2008. In 2005, borrow area investigations determined that the Surfside borrow area contained at least 15.2 million cubic yards of beach compatible material. The 2007/2008 renourishment project borrowed 857,633 cy from the borrow area. Based on the volume calculations from 2007, there is sufficient quantity of material within the site to complete the proposed renourishment of Reach 3. The dredge will remove the sand to a depth not to exceed ten feet within the borrow areas. The borrow area will be divided into dredging zones and the contract specifications will require the contractor remove material completely from one borrow zone prior to moving to another borrow zone.

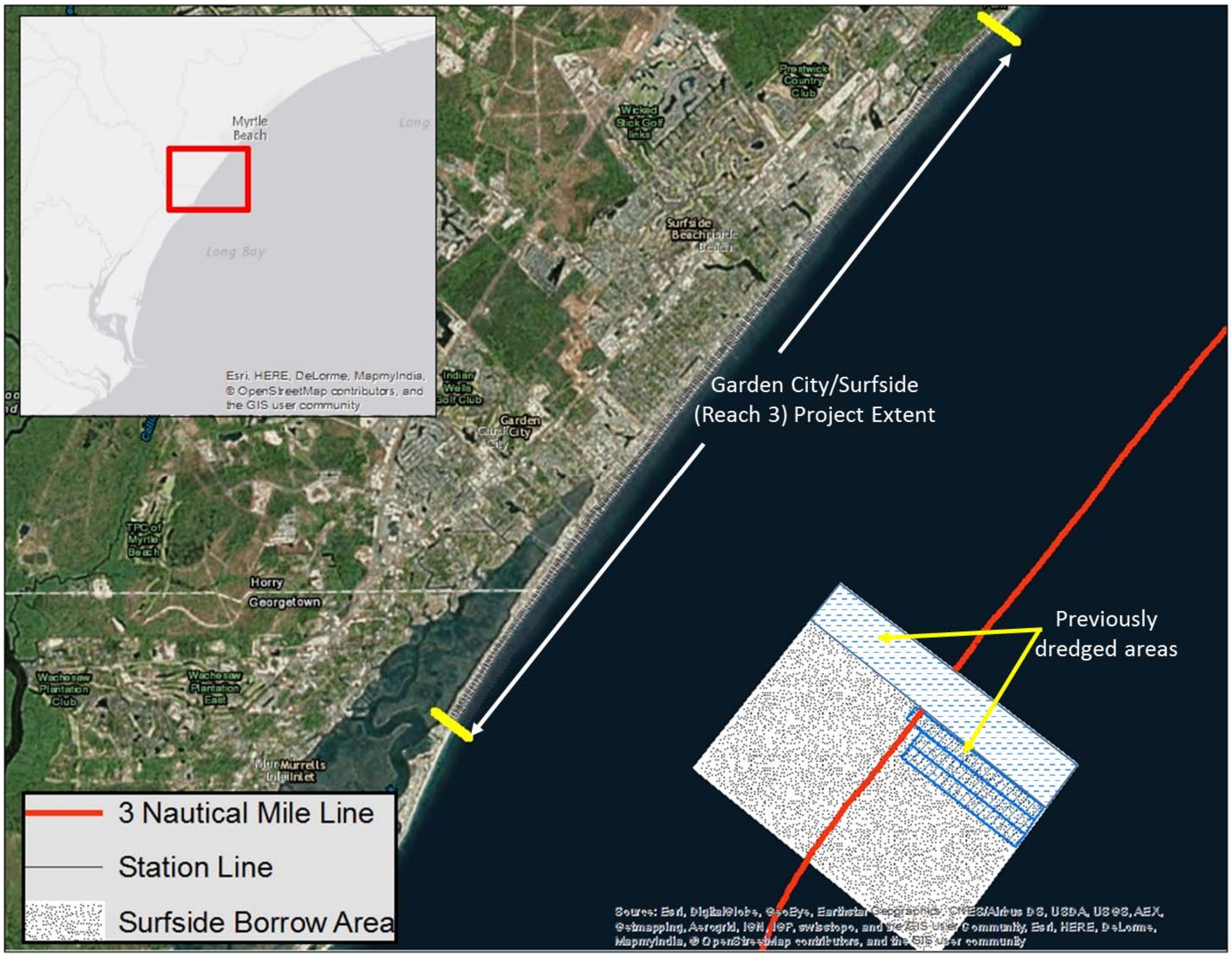

Figure 2. Garden City/Surfside (Reach 3) Project Extent and Surfside Borrow Area

Bathymetric monitoring associated with the 2007 renourishment indicated that the borrow area used in 2007 accreted approximately 452,660 CY within 1 year post-construction (Figure 3). SCDNR performed monitoring of the physical characteristics of the infill following construction. While the Surfside borrow area was not specifically monitored, results from Little River and Cane South borrow areas indicate that beach compatible material (e.g., < 10% fines) was accreting. These data indicate that the previously dredged portion of the borrow area may have recharged with beach compatible material and may be able to be used again. While the historic data indicate that the borrow area has sufficient quantity for this periodic nourishment effort, detailed borrow area investigations are ongoing to determine if previously dredged areas have recharged with beach compatible material. Figure 4 shows the locations of the 2006 vibracores that were performed as well as the locations of the 2016 targets. The ongoing geotechnical refinements include both bathymetric surveys and vibracores to determine the amount and quality of the material. The intent of this effort is to maximize the most efficient use of the borrow area for the continued longevity of the project. If suitable material is not located in previously dredge areas, undredged portions of the larger identified borrow area with known beach compatible material will be used. This information will be shared with resource agencies prior to construction.

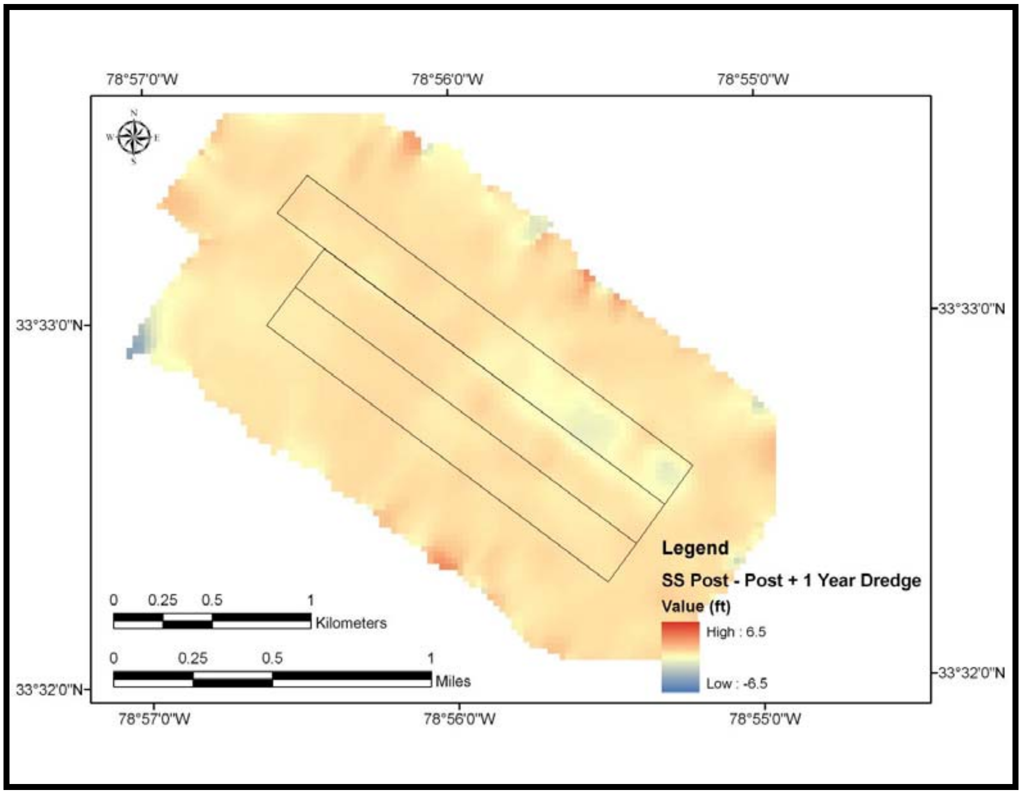

Figure 3. Surfside borrow area post dredging +1 year change map (CCU 2009)

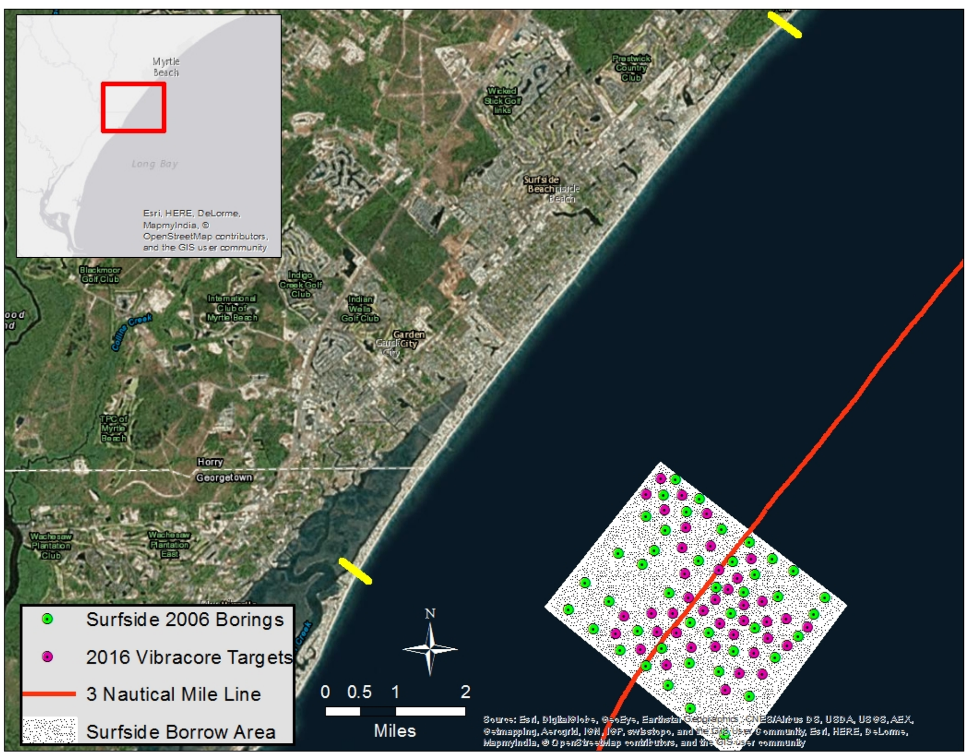

Figure 4. Vibracore Locations in Surfside Borrow Area

The beach renourishment is anticipated to start in the winter of 2016/2017 and continue 24 hours per day, 7 days per week for a period of approximately 4-5 months including mobilization.

Sand fencing will be placed along the landward edge of the nourishment fill to promote dune growth (Figure 5). Native vegetation will be planted to further expedite dune formation and stabilization, as well as creating beach dune habitat. Fencing will be installed according to sea turtle friendly design standards included in OCRM's "How to Build a Dune" brochure. Similar sand fencing was completed in the 1998 project and the 2007/2008 project. Work is expected only during daylight hours and limited amount of equipment such as small backhoes and tractors is expected to be used on the beach. Sand fencing will be the Corps' Charleston District standard design with 5.5' spacing between panels. The planting matrix will consist of the following plants: bitter panicum (*Panicum amarum "Northpa"*), sea oats (*Uniola paniulata*), seashore elder (*Iva imbricate*), and saltmeadow cordgrass (*Spartina patens*). Sweet grass (*Muhlenbergia "filipes")* will be planted on the toe of the backside of the dune system. The plants will be space 2 feet on center, and rows will be spaced at 2 to 4 feet depending on which plant species is in the row. Fertilizer will be placed in the hole at the time of planting. As stated earlier, USACE would like to plant seabeach amaranth as a small component of the planting matrix since it is within the historic range of the plant.

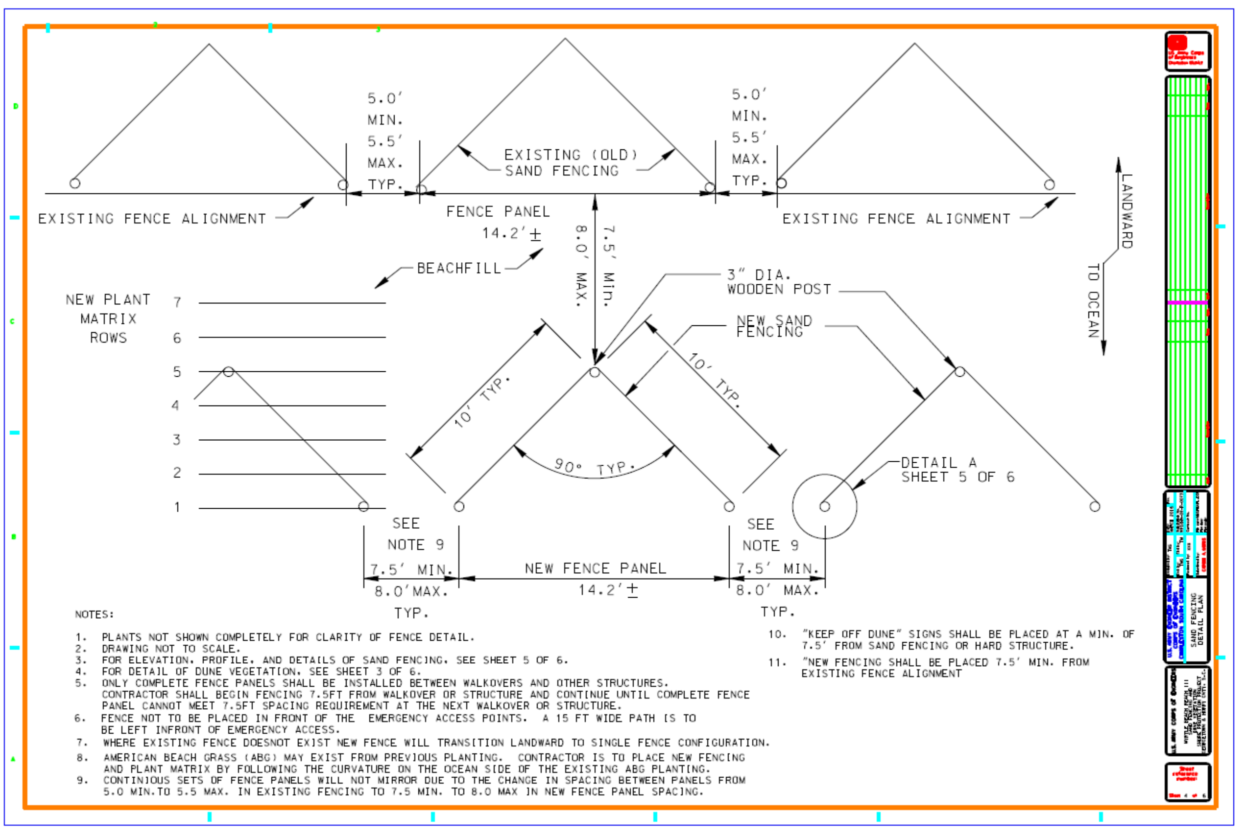

Figure 5. Sand Fencing Typical Design

This project will protect infrastructure and will restore and preserve dry sand and dune habitat used by shorebirds and endangered species, such as nesting sea turtles. Impacts of beach nourishment projects are relatively well understood and when designed properly the impacts are limited to a minimal temporal and spatial extent.

3.0 PRIOR CONSULTATIONS

Formal Section 7 consultation was conducted in 1992 regarding the Myrtle Beach project. The conclusion of the biological opinion rendered by the U.S. Fish and Wildlife Service (FWS) at that time determined that the nourishment, as proposed, had the potential to effect but was not likely to jeopardize the continued existence of the loggerhead sea turtle (*Caretta caretta*). The conclusion of the Biological Opinion rendered by the FWS was that the dredging project was not likely to adversely affect sea-beach amaranth (*Amaranthus pumilus*). For the 2007/2008 project, USACE submitted another Biological Assessment to the USFWS requesting formal consultation for impacts to sea turtles. The USFWS submitted a Biological Opinion (BiOp) on January 19, 2007. The BiOp determined that the following species were not likely to be adversely affected: sea-beach amaranth, piping plover, West Indian manatee, Kemp's ridley sea turtle, and hawksbill sea turtle. The USFWS concluded that the project was not likely to jeopardize the continued existence of the loggerhead, green, or leatherback sea turtles. The USFWS submitted several Terms and Conditions for USACE to adhere to.

4.0 LIST OF SPECIES

4.1 U.S. Department of Interior

The following species have been listed by the U.S. Department of Interior as occurring or possibly occurring along beaches in Georgetown or Horry County, South Carolina.

Key

E = Federally endangered

T = Federally threatened

CH = Critical Habitat

* = Contact NMFS for more information on this species

Common Name	Scientific Name	Status	Occurrences
West Indian manatee	*Trichechus manutus*	E	Known
Piping plover	*Charadrius melodus*	T, CH	Known
Kemp's ridley sea turtle	*Lepidochelys kempii**	E	Known
Leatherback sea turtle	*Dermochelys coriacea**	E	Known
Loggerhead sea turtle	*Caretta caretta*	T, CH	Known
Green sea turtle	*Chelonia mydas**	T	Known
Shortnose sturgeon	*Acipenser brevirostrum**	E	Known

Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus**	E	Known
Sea-beach amaranth	*Amaranthus pumilus*	T	Known

4.2 The National Marine Fisheries Service

The following list shows the threatened (T) and endangered (E) species and critical habitats for NMFS species found in South Carolina waters. All in-water work is covered under the existing regional Biological Opinion (NMFS, 1997) and the ongoing consultation between USAC, BOEM and NMFS for a new South Atlantic Regional Biological Opinion.

Listed Species

Common Name	Scientific Name	Status	Date Listed
Marine Mammals			
Blue whale	*Balaenoptera musculus*	E	12/02/70
Finback whale	*Balaenoptera physalus*	E	12/02/70
Humpback whale	*Megaptera novaeangliae*	E	12/02/70
Right whale	*Eubaleana glacialis*	E, CH	12/02/70
Sei whale	*Balaenotera borealis*	E	12/02/70
Sperm whale	*Physeter macrocephalus*	E	12/02/70
Turtles			
Green sea turtle	*Chelonia mydas*	T*	07/28/78
Hawksbill sea turtle	*Eretmochelys imbricata*	E	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	12/02/70
Leatherback sea turtle	*Dermochelys coriacea*	E	06/02/70
Loggerhead sea turtle	*Caretta caretta*	T, CH	07/28/78
Fish			
Shortnose sturgeon	*Acipenser brevirostrum*	E	03/11/67
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*	E	02/06/12

Species Proposed for Listing: None

Designated Critical Habitat: North Atlantic Right Whale, Loggerhead Sea Turtle

Proposed Critical Habitat: None

Candidate Species: None

5.0 GENERAL EFFECTS ON LISTED SPECIES/CRITICAL HABITAT

Since all aspects of the proposed work will occur on the ocean beach or on a marine shoal, the project will not affect any listed species occurring in forested or freshwater habitats. Thus, the bald eagle, red-cockaded woodpecker, wood stork, Canby's dropwort, Pondberry, chaff-seed will not be affected by this construction effort.

Species that could be present in the project area during the proposed action are the shortnose and Atlantic sturgeons, and the hawksbill, Kemp's ridley, leatherback, loggerhead, and green sea turtles. However, loggerheads are the primary sea turtle nesters in this area. The West Indian manatee rarely visits the area; however, some sightings have been recorded over the years. The piping plover winters in this area and critical habitat has been designated south of the project area at Murrell's Inlet. Further, there are no known populations of sea-beach amaranth in the project area; however, the project footprint is within the historic range of the plant. On the open ocean, the blue, finback, humpback, right, sei and sperm whales are occasionally sited and are subject to influence by vessel traffic.

6.0 SPECIES ASSESSMENTS

6.1 Manatee

West Indian manatees are massive fusiform-shaped animals with skin that is uniformly dark grey, wrinkled, sparsely haired, and rubber-like. Manatees possess paddle-like forelimbs, no hind limbs, and a spatulate, horizontally flattened tail. Females have two axillary mammae, one at the base of each forelimb. Adults are about 10 feet in length and weigh 800-1200 pounds (USFWS, 2010). Newborns average 4 to 4½ feet in length and about 66 pounds (Odell 1981).

The West Indian manatee (*Trichechus manatus*) was listed as endangered on March 11, 1967, under a law that preceded the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.). Additional Federal protection is provided for this species under the Marine Mammal Protection Act of 1972, as amended (16 USC 1461 et seq.). The manatee population in the United States is confined during the winter months to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia (USFWS, 1996). However, during the summer months, they may migrate as far north as coastal Virginia on the East Coast and as far west as Louisiana on the Gulf of Mexico (USFWS, 1991).

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. SC DNR indicates that manatees have been observed in SC since 1850. From 1850-2004 there have been 1117 records of manatees were documented in SC. These data suggest that manatees are infrequent visitors in SC (http://www.dnr.sc.gov/manatee/dist.html, Figure 6). However, in 2012, the SCDNR online reporting system noted that manatee sightings were reported beginning in April and lasting until October. In 2014, the USFWS recorded 4 sightings of manatees in Georgetown County and 8 in Horry County (Mark Caldwell, USFWS personal communication). There is no designation of critical habitat for the West Indian manatee in SC.

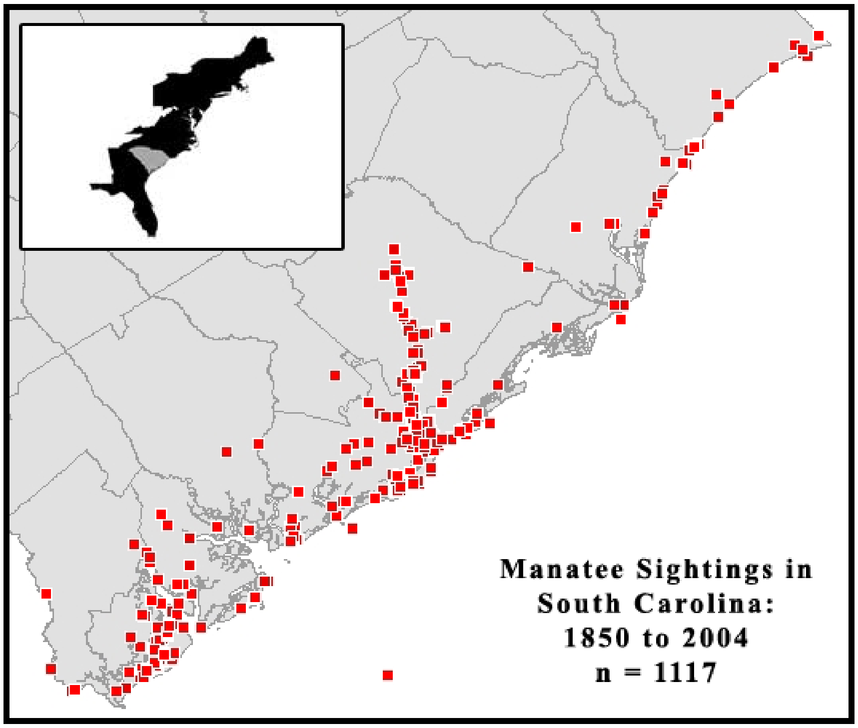

Figure 6. Manatee Sightings in SC 1850 to 2004

c. Project Impacts.

(1) Habitat. Typical coastal habitats utilized by manatees which are found within South Carolina include coastal tidal rivers, salt marshes, and vegetated bottoms where they feed on the aquatic vegetation and, in some cases, smooth cordgrass (*Spartina alterniflora*) (USFWS 2007). Project related impacts to estuarine and nearshore ocean habitat of the area associated with the placement of sediment on the beach should be minor and direct impacts to specific habitat requirements will be avoided.

(2) Food Supply. Specific food sources utilized by the manatee in South Carolina are unknown; however, the manatee diet in Florida consists primarily of vascular plants and is likely the same in South Carolina, including aquatic vegetation and salt marsh grasses. The proposed action will involve negligible change to the physical habitat of the beach and nearshore environment with no known impacts to aquatic vascular plants and overall estuarine and nearshore productivity should remain high throughout the project area. Therefore, potential food sources for the manatee should be unaffected.

(3) Relationship to Critical Periods in Life Cycle. Since the manatee is considered to be an infrequent summer resident of the South Carolina coast, the proposed action should have little effect on the manatee since its habitat and food supply will not be significantly impacted. The Corps will implement precautionary measures for avoiding impacts to manatees from associated transiting vessels during construction activities, as detailed in the "Guidelines for Avoiding Impacts to the West Indian Manatee" established by the USFWS.

(4) Effect Determination. Since the habitat and food supply of the manatee will not be significantly impacted, overall occurrence of manatees in the project vicinity is infrequent, all dredging will occur in the offshore environment, and precautionary measures for avoiding impacts to manatees, as established by USFWS, will be implemented for transiting vessels associated with the project, the proposed action is **not likely to adversely affect the west Indian manatee**. To ensure the protection of manatees, all Federal and contract personnel associated with this project will be instructed on the potential presence of manatees and the need to avoid vessel or plant collisions with manatees. Construction that takes place in the warmer months will abide by the *Standard Manatee Construction Conditions* (FL Fish and Wildlife Commission 2005).

6.2 Kemp's ridley, leatherback, loggerhead, green, and hawksbill sea turtles

a. Status. There are five species of sea turtles on the Atlantic Coast, Kemp's ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), Loggerhead sea turtle (*Caretta caretta*), Green sea turtle (*Chelonia mydas)*, and the Hawksbill sea turtle (*Eretmochelys imbricata*). These five species of sea turtles are protected by the Convention on International Trade in Endangered Species (CITES). They are also listed as endangered or vulnerable in the Red Data Book by the International Union for the Conservation of Nature (IUCN). The hawksbill, Kemp's ridley and leatherback were listed as endangered by the U. S. Endangered Species Act in 1973. The green turtle and the loggerhead were added to the list as threatened in 1978. A final rule to establish 9 Distinct Population Segments for the loggerhead sea turtle was established in 2001 (76 FR 58868). The Northwest Atlantic Ocean DPS is within the range of the proposed project.

b. Critical Habitat. The USFWS has designated critical habitat for nesting loggerheads in South Carolina (Federal Register/ Vol. 79, No. 132. July 10, 2014). There is no designated critical habitat in the project vicinity. The closest designated habitat is LOGG-T-SC-01 "North Island" which is approximately 18 miles south of the project area. NMFS designated critical habitat for the loggerhead sea turtle in a final ruling on July 10, 2014 (FR Vol. 79, No. 132). This ruling established critical habitat for 5 habitat types based on their Physical or Biological Features (PBFs) and the Primary Constituent Elements (PCEs) that support the PBFs: nearshore reproductive, overwintering, breeding, migratory, and sargassum. None of these habitat types are located in or near the project area.

c. Background. Sea turtles vary in size from an average of 75 pounds for the olive ridley (does not occur in the project area) to the giant leatherback, which may exceed 800 pounds. Modified for living in the open ocean, they have paddle-like front limbs for swimming. The thick neck and head cannot be drawn back into the body. Sea turtles also have special respiratory mechanisms and organs to excrete excess salt taken in with seawater when they feed.

Detailed life history information associated with the in-water life cycle requirements for sea turtles and a subsequent analysis of impacts from the proposed dredging activities is provided within the following NMFS Section 7 consultation document:

National Marine Fisheries Service. 1997. Regional Biological Opinion for the Continued Hopper Dredging of Channels and Borrow Areas in the Southeastern

United States. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland

d. Occurrence in Immediate Project Vicinity. Of the five listed species of sea turtles, only the loggerhead is considered to be a regular nester in SC. However, in September 1996, a green sea turtle nested on Garden City Beach and another also nested on Garden City Beach in September 2002. Leatherback nests were recorded on Huntington Beach State Park in 2000, at Botany Bay in June 2003, on Folly Beach in July 2003, and on Edisto Beach in 2009. During the last renourishment project in 2007 and 2008, USACE implemented a monitoring program for sea turtle nesting activity at the Myrtle Beach and North Myrtle Beach Reaches of the overall project. Garden City/Surfside was not monitored because nourishment took place in the winter at that Reach. A total of 21 nests (all loggerheads) were found, 16 in Myrtle Beach and 5 in North Myrtle Beach. Nests in Myrtle Beach were relocated to Myrtle Beach State Park and nests from North Myrtle Beach were relocated to Waites Island. Nests from Myrtle Beach and North Myrtle Beach had an average hatch success rate of 79% and 38%, respectively. The success rate from North Myrtle Beach was skewed from the fact that 3 of the 5 nests were washed away during erosion from Tropical Storm Hanna that heavily impacted Waites Island (0% success). Grand and Beissinger (1997) found that the average in situ hatch success in South Carolina is 72.3%. Excluding the three nests that were damaged from erosion, both project reaches exceeded the average hatch success rate.

Figure 7 and Table 2 show the history of sea turtle nesting at Garden City and Surfside Beaches over the last 7 years (SCDNR unpublished data).

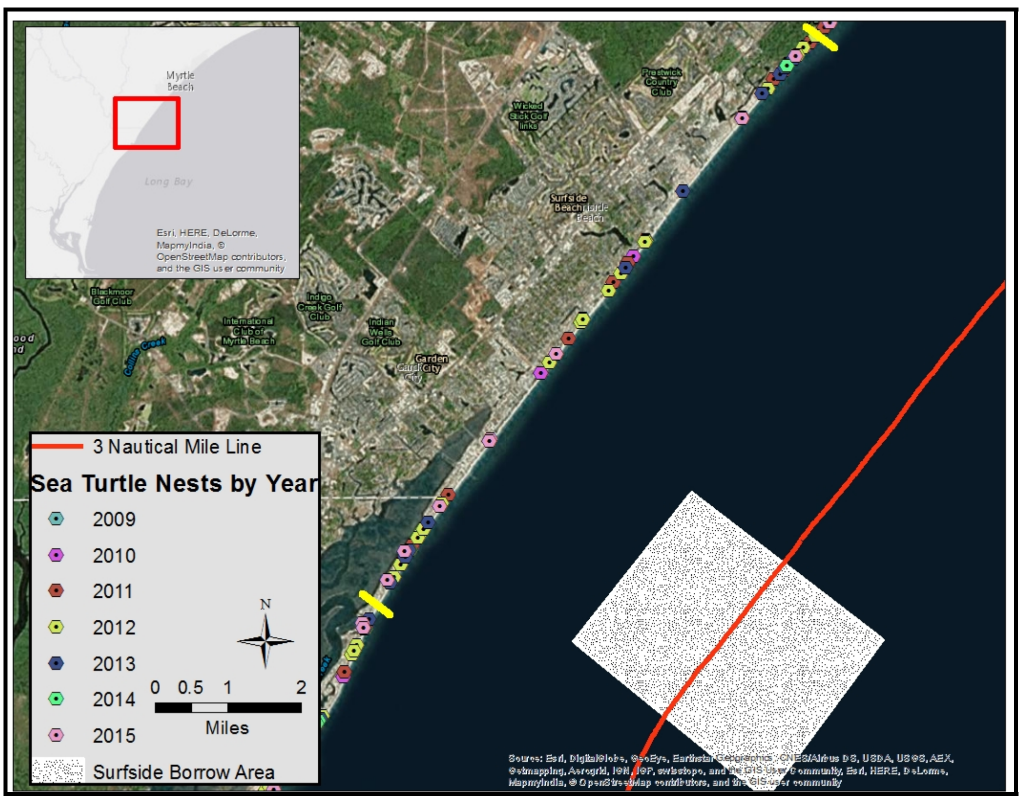

Figure 7. Garden City/Surfside Beach and sea turtle nesting locations (2007-2015)

Table 2. Turtle nesting in Garden City and Surfside Beaches from 2009 through 2015

Year	Project Beach	Observed Nests	False Crawls
2009	Garden City	0	0
2010	Garden City	5	2
2011	Garden City	6	4
2012	Garden City	16	4
2013	Garden City	10	6
2014	Garden City	6	11
2015	Garden City	7	1
2009	Surfside	1	0
2010	Surfside	2	0
2011	Surfside	5	3
2012	Surfside	7	2
2013	Surfside	1	1
2014	Surfside	0	0
2015	Surfside	1	0

The 2007 Biological Opinion was issued for loggerhead, green and leatherback sea turtles. USFWS used historic nesting data as an estimate of the number of nests that could be affected by the project. The following table was provided to show the average number of nests that could be taken (Table 2).

Table 2. Average Number of Sea Turtle Nests that could be taken (USFWS 2007 Myrtle Beach BiOp)

SPECIES	NESTS*	TAKE TYPE	CRITICAL HABITAT AFFECTED
loggerhead sea turtle	12.94	harm/harassment	none
green sea turtle	0.29	harm/harassment	none
leatherback sea turtle	0	none	none

SCDNR data over the last several years has shown that green sea turtles are nesting along these beaches every other year. For the Garden City/Surfside proposed project, it appears like the average nesting rate is higher for green sea turtles and is approximately 2 nests per year for this reach, while the number of nesting loggerheads per year is approximately 7.14. The average nesting density over the last 7 years has been 0.81 nests/mile/year. No leatherbacks were observed nesting along Garden City or Surfside Beaches over the last 7 years.

Table 2. Turtle nesting by Species at Garden City and Surfside Beaches from 2009 through 2015

Beach	Year	Species	Number of Nests	False Crawls
Garden City	2009	Loggerhead	0	0
Garden City	2009	Green	0	0
Garden City	2010	Loggerhead	1	0
Garden City	2010	Green	4	2
Garden City	2011	Loggerhead	6	4
Garden City	2011	Green	0	0
Garden City	2012	Loggerhead	11	2
Garden City	2012	Green	5	2
Garden City	2013	Loggerhead	10	6
Garden City	2013	Green	0	0
Garden City	2014	Loggerhead	0	0
Garden City	2014	Green	6	11
Garden City	2015	Loggerhead	6	1
Garden City	2015	Green	1	0
Surfside	2009	Loggerhead	1	1
Surfside	2009	Green	0	0
Surfside	2010	Loggerhead	1	0
Surfside	2010	Green	1	0
Surfside	2011	Loggerhead	5	2
Surfside	2011	Green	0	0
Surfside	2012	Loggerhead	7	0
Surfside	2012	Green	0	0
Surfside	2013	Loggerhead	1	1
Surfside	2013	Green	0	0
Surfside	2014	Loggerhead	0	0
Surfside	2014	Green	0	0
Surfside	2015	Loggerhead	1	0
Surfside	2015	Green	0	0

e. Current Threats to Continued Use of the Area. In addition to affecting the coastal human population, coastal sediment loss also poses a threat to nesting sea turtles. A large percentage of sea turtles in the United States nest on nourished beaches (Nelson and Dickerson 1988a), therefore, nourishment has become an important technique for nesting beach restoration (Crain *et al.* 1995). Most of the project area has experienced consistent erosion over the last decades.

The primary threats facing these species worldwide are the same ones facing them in the project area. Of these threats, the most serious seem to be loss of breeding females through accidental drowning by shrimpers (Crouse, *et al.* 1987) and human encroachment on traditional nesting beaches. Research has shown that the turtle populations have greatly declined in the last 20 years due to a loss of nesting habitat along the beachfront and by incidental drowning in shrimp trawl nets. It appears that the combination of poorly placed nests coupled with unrestrained human use of the beach by auto and foot traffic has impacted this species greatly. Other threats to these sea turtles include excessive natural predation in some areas and potential interactions with hopper dredges during the excavation of dredged material. With the exception of hopper dredges, none of the dredge plants (i.e., pipeline dredges) proposed for potential use in the construction of this project are known to take sea turtles.

f. Project Impacts. The areas of affected environment for this proposed project are the borrow area (an approximately 6 mi2 site and located between 2 and 5 miles offshore) (see Figure 2) and the placement of approximately 1.7 million cubic yards of sand along 40,656 feet of beach along Garden City and Surfside Beaches (see Figure 2). This sand placement will result in an increase in the size of the dry beach, conversion of existing intertidal beach to dry beach and shifting the intertidal zone seaward from its existing location, and conversion of some subtidal beach to intertidal beach and shifting the subtidal zone seaward from its existing location.

In order to avoid periods of peak sea turtle abundance during warm water months and minimize impacts to sea turtles in the offshore environment, beach placement of sediment will be targeted to occur outside of the South Carolina sea turtle nesting season of 1 May through 31 October, where practicable. The South Atlantic Regional Biological Opinion (SARBO) authorizes year round hopper dredging at borrow areas in South Carolina. However, the Charleston District will attempt to complete the project within the winter months to avoid impacts to nesting turtles and minimize impacts to turtles in the offshore environment. This assessment only analyzes impacts to nesting sea turtles. Offshore impacts to turtles are covered in the SARBO.

In the event that construction activities extend into the nesting season (i.e. weather, equipment breakdown, logistics, etc.), all available data associated with the nesting activities within the project area will be utilized to consider risks of working within the nesting season. Upon evaluation of site-specific conditions, if nourishment beach activities extend into a portion of the nesting season, monitoring for sea turtle nesting activity will be considered throughout the construction area including the disposal area and beachfront pipeline routes so that nests laid in a potential construction zone can be bypassed and/or relocated outside of the construction zone prior to project commencement. The location and operation of heavy equipment on the beach within the project area will be limited to daylight hours to the maximum extent practicable in order to minimize impacts to nesting sea turtles.

(1) Beach Placement. Post-nourishment monitoring efforts have documented potential impacts on nesting loggerhead sea turtles for many years (Fletemeyer 1984; Raymond 1984; Nelson and Dickerson 1989; Ryder 1993; Bagley *et al*. 1994; Crain *et al*. 1995; Milton *et al*. 1997; Steinitz *et al.* 1998; Trindell *et al*. 1998; Davis *et al*. 1999; Ecological Associates, Inc. 1999; Herren 1999; Rumbold *et al*. 2001; Brock 2005; and Brock *et al.* 2009). Results from these studies indicate that, in most cases, nesting success decreases during the year following nourishment as a result of escarpments obstructing beach

accessibility, altered beach profiles, and increased compaction. A comprehensive post-nourishment study conducted by Ernest and Martin (1999) documented an increase in abandoned nest attempts on nourished beaches compared to control or pre-nourished beaches as well as a change in nest placement with subsequent increase in wash-out of nests during the beach equilibration process.

As suggested by the historical literature, there are inherent changes in beach characteristics as a result of mechanically placing sediment on a beach from alternate sources. The change in beach characteristics often results in short-term decreases in nest success and/or alterations in nesting processes. However, when done properly, beach construction projects may mitigate the loss of nesting beach when the alternative is severely degraded or non-existent habitat (Brock et al. 2009). This section of the South Carolina coast is a relatively low density nesting area. As stated earlier, the nesting density from 2007-2015 in Reach 3 was 0.81 nests/mile/year. At the south end of Garden City Beach (near Murrells Inlet) the nesting density has still only been 1.71 nests/mile/year (SCDNR unpublished data).

i. Pipe Placement. In the event that construction operations extend into the sea turtle nesting season pipeline routes and pipe staging areas may act as an impediment to nesting females approaching available nesting habitat or to hatchlings orienting to the water's edge. If the pipeline route or staging areas extend along the beach face, including the frontal dune, beach berm, mean high water line, etc., some portion of the available nesting habitat will be blocked. Nesting females may either encounter the pipe and false crawl, or nest in front of the pipeline in a potentially vulnerable area to heavy equipment operation, erosion, and washover. If nests are laid prior to placement of pipe and are landward of the pipeline, hatchlings may be blocked or mis-oriented during their approach to the water.

Though pipeline alignments and staging areas may pose impacts to nesting females and hatchlings during the nesting season, several measures can be implemented to minimize these impacts. If construction activities extend into the nesting season, monitoring will be done in advance to document all nests within the beach placement template. Construction operations and pipeline placement could be modified to bypass existing nests. If bypassing is not a practical alternative for a given project, the relocation of nests outside of construction areas would be implemented. Throughout the period of sea turtle nesting and hatching, construction pipe that is placed on the beach parallel to the shoreline should be placed as far landward as possible so that a significant portion of available nesting habitat can be utilized and nest placement is not subject to inundation or wash out. Furthermore, temporary storage of pipes and equipment can be located off the beach to the maximum extent practicable. If placement on the beach is necessary, it will be done in a manner so as to impact the least amount of nesting habitat by placing pipes perpendicular to shore and as far landward as possible without compromising the integrity of the existing or constructed dune system.

ii. Slope and escarpments. Beach nourishment projects are designed and constructed to equilibrate to a more natural profile over time relative to the wave climate of a given area. Changes in beach slope as well as the development of steep escarpments may develop along the mean high water line as the constructed beach adjusts from a construction profile to a natural beach profile (Nelson *et al.* 1987). Though escarpment formation is a natural response to shoreline erosion, the escarpment formation as a result of the equilibration process during a short period following a nourishment event may have a steeper and higher vertical face than natural escarpment formation and may slough off more rapidly landward.

Though the equilibration process and subsequent escarpment formation are features of most beach projects, management techniques can be implemented to reduce the impact of escarpment formations. For completed sections of beach during beach construction operations, and for subsequent months following as the construction profile approaches a more natural profile, visual surveys for escarpments and slope adjustments could be performed. Escarpments that are identified prior to or during the nesting season that interfere with sea turtle nesting (exceed 18 inches in height for a distance of 100 ft.) can be leveled to the natural beach for a given area. If it is determined that escarpment leveling is required during the nesting or hatching season, leveling actions will be coordinated with the project sponsor.

iii. Incubation Environment. Physical changes in sediment properties that result from the placement of sediment, from alternate sources, on the beach pose concerns for nesting sea turtles and subsequent nest success. Nesting can be affected by insufficient oxygen diffusion and variability in moisture contenct levels within the egg clutch. Additionally, nest temperature can affect the sex ratio of developing turtles. Eggs incubated at constant temperatures of 28°C or below develop into males. Those kept at 32°C or above develop into females. Therefore, the pivotal temperature, those giving approximately equal numbers of males and females, is approximately 30°C (Yntema and Mrosovsky 1982). Matching borrow site sands with the native beach sands is extremely important to maintain consistency. As addressed previously, the borrow site sand and native beach sands have historically been shown to be compatible. USACE is evaluating specific areas within the borrow site for dredging and will share this information with resource agencies, including USFWS, when available. Only beach compatible sands will be used.

iv. Lighting. Artificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles and other types of beachfront lights has been documented in the disorientation (loss of bearings) and misorientation (incorrect orientation) of hatchling turtles. Artificial lighting on beaches also tends to deter sea turtles from emerging from the sea to nest; thus, evidence of lighting impacts on nesting females is not likely to be revealed by nest to false crawl ratios considering that no emergence may occur (Mattison *et al*. 1993; Witherington 1992; Raymond 1984). The presence of artificial lighting on or within the vicinity of nesting beaches is detrimental to critical behavioral aspects of the nesting process including nesting female emergence, nest site selection, and the nocturnal sea-finding behavior of both hatchlings and nesting females. The impact of light on nesting females and hatchlings can be minimized by reducing the number and wattage of light sources or by modifying the direction of light sources through shielding, redirection, elevation modifications, etc. (Figure 8). If shielding of light sources is not effective, it is important that any light reaching the beach has spectral properties that are minimally disruptive to sea turtles like long wavelength light. The spectral properties of low-pressure sodium vapor lighting are the least disruptive to sea turtles among other commercially available light sources.

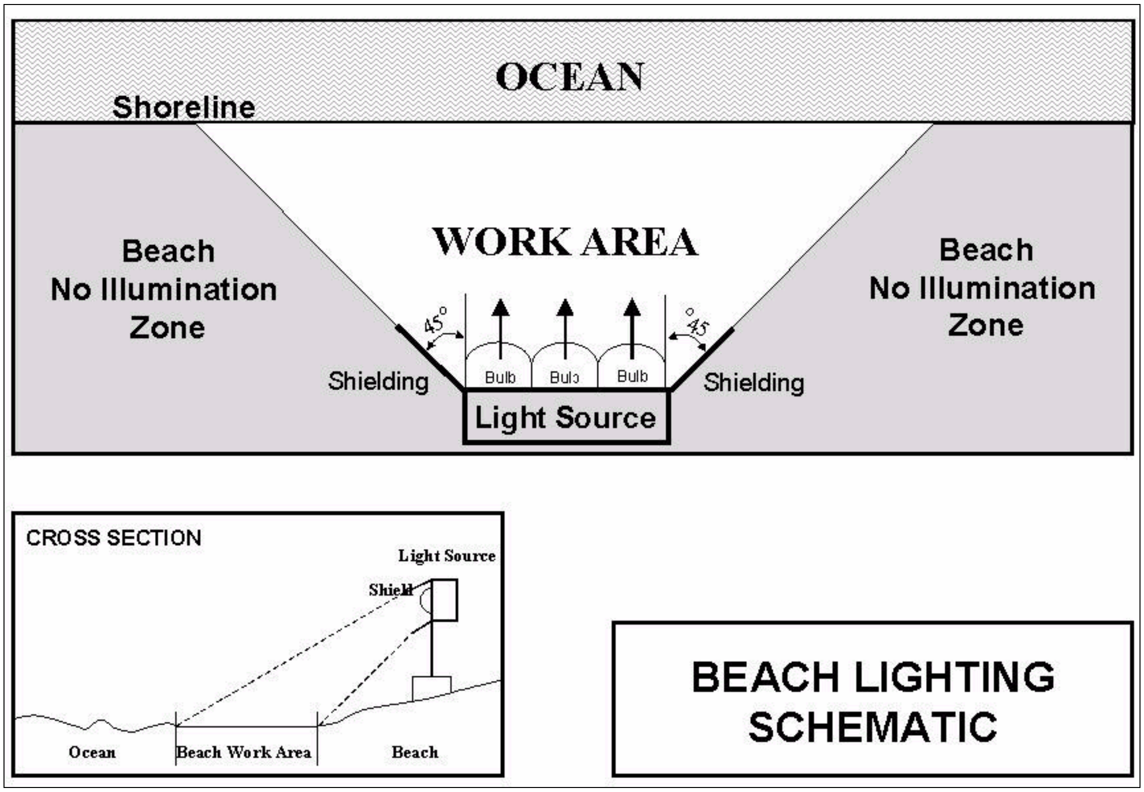

Figure 8. Beach lighting schematic

During beach placement construction operations associated with the proposed project, lighting is required during nighttime activities at both the hopper dredge pumpout site and the location on the beach where sediment is being placed. In compliance with the US Army Corps of Engineers Safety and Health Requirements Manual (2008), a minimum luminance of 30 lm/ft2 is required for dredge operations and a minimum of 3 lm/ft2 is required for construction activities on the beach. For dredging vessels, appropriate lighting is necessary to provide a safe working environment during nighttime activities on deck (i.e. general maintenance work deck, endangered species observers, etc.). During beach construction operations, lighting is generally associated with the active construction zone around outflow pipe and the use of heavy equipment in the construction zone (i.e. bulldozers) in order to maintain safe construction operations at night.

USFWS has expressed concerns that on newly nourished beaches where the elevation of the beach berm is raised for coastal storm damage reduction purposes, it is possible that lighting impacts to nesting females and emerging hatchlings from adjacent lighting sources (streets, parking lots, hotels, etc) may become more problematic as shading from dunes, vegetation, etc. is no longer evident (Brock 2005; Brock et al. 2009; Ehrhart and Roberts 2001). In a study on Brevard county beaches, Brock (2005) found that loggerhead hatchling disorientations increased significantly post-nourishment. This was attributed to the increase in light sources not previously visible to be seen by hatchlings as a result of the increase in profile elevation combined with an easterly expansion of the beach.

If beach construction activities extend into the sea turtle nesting and hatching season, all lighting associated with project construction will be minimized to the maximum extent practicable while maintaining compliance with all Corps, U.S. Coast Guard, and OSHA safety requirements. Direct lighting of the beach and near shore waters will be limited the immediate construction area(s). Lighting aboard dredges and associated vessels, barges, etc. operating near the sea turtle nesting beach shall be limited to the minimal lighting necessary to comply with the Corps, U.S. Coast Guard, and OSHA requirements. Lighting on offshore or onshore equipment will be minimized through reduced wattage, shielding, lowering, and/or use of low pressure sodium lights, in order to reduce illumination of adjacent beach and nearshore waters will be used to the extent practicable.

(2) Dredging Impacts. The effects of dredging are evidenced through the degradation of habitat and incidental take of marine turtles. Channelization of inshore and nearshore habitat and the disposal of dredged material in the marine environment can destroy or disrupt resting or foraging grounds (including grass beds and coral reefs) and may affect nesting distribution through the alteration of physical features in the marine environment. Hopper dredges are responsible for incidental take and mortality of marine turtles during dredging operations, however the use of turtle deflectors on the drag heads has dramatically reduced the incidence of “takes”. Other types of dredges (clamshell and pipeline) have not been implicated in incidental take (NMFS and USFWS, 1991). Incidental takes of sea turtles by hopper dredges comes under the jurisdiction of NOAA Fisheries and is covered by a separate Biological Opinion (NMFS, 1997).

(3) Summary Effect. This project is not being designed to enhance turtle habitat; however, because turtles may attempt to nest here and false crawls may occur due to the lack of suitable habitat, it has been determined that the project may adversely affect the loggerhead and green sea turtle populations. Upon completion of the project, the total area of suitable nesting habitat will be increased.

Placement of the dredged material is anticipated to occur during the months of November through April; however, it is possible that the start of construction work will be delayed until nesting season or that completion of the project will be delayed and construction will extend into the nesting season. If any construction work occurs during sea turtle nesting season, then the following precautions will be taken to minimize the effects to sea turtles:

- If any construction of the project occurs during the period between May 1 and September 15, the dredging contractor will provide nighttime monitoring along the beach where construction is taking place to ensure the safety of female turtles attempting to nest. Cease construction activities if a sea turtle is sighted on an area of beach scheduled for fill until the turtle returns to the ocean. A buffer zone around the female will be imposed in the event of an attempt to nest.

- If any construction of the project occurs during the period between May 1 and September 15, daily nesting surveys will be conducted starting either May 1 or 65 days prior to the start of construction, whichever is later. These surveys will be performed between sunrise and 9:00 A.M. and will continue until the end of the project, or September 15, whichever is earlier. Any nests found in the area that will be impacted by construction activities will be moved to a safe location. The nesting surveys and nest relocations will only be performed by people with a valid South Carolina DNR license.

- For construction activities occurring during the period May 1 through October 31, staging areas for equipment and supplies will be located off of the beach to the maximum extent possible.
- For construction activities occurring during the period May 1 through October 31, use of heavy equipment will be limited to the area undergoing renourishment.
- For construction activities occurring during the period May 1 through October 31, all on-beach lighting associated with the project will be limited to the minimum amount necessary around active construction areas to satisfy Occupational Safety and Health Administration (OSHA) requirements.
- For construction activities occurring during the period May 1 through October 31, use predator proof trash receptacles to minimize presence of species that prey upon hatchlings.
- USACE will adhere to all terms and conditions of the South Atlantic Regional Biological Opinion which evaluates in-water impacts on sea turtles, sturgeon and large whales.
- The USFWS and SCDNR will be notified immediately if a sea turtle, nest, or hatchlings are impacted by the construction.

Immediately after completion of the project, the Corps of Engineers will perform tilling to a depth of at least 24 inches in order to reduce compaction associated with newly placed sand. Visual surveys for escarpments along the project area will be made immediately after completion of the project and prior to May 1 for 3 subsequent years, if needed. Results of the surveys will be submitted to the USFWS prior to any action being taken. Since the project should not occur during the sea turtle nesting season, escarpment leveling will not be performed until immediately prior to the nesting season. The USFWS will be contacted immediately if subsequent reformation of escarpments exceeding 18 inches in height for a distance of 100 feet occurs during nesting and hatching season. This coordination will determine what appropriate action must be taken. An annual summary of escarpment surveys and action taken will be submitted to the USFWS.

Adherence to the above precautions should minimize the effects to nesting loggerhead sea turtles and emerging loggerhead sea turtle hatchlings. The monitoring and relocation program will minimize potential adverse effects to nesting sea turtles. Completion of the project will recreate lost habitat and protect existing turtle nesting habitat as well as the structures on the island. However, because of the possibility of missing a sea turtle nest during the nest monitoring program or inadvertently breaking eggs during relocation, it has been determined that the proposed project **is likely to adversely affect the loggerhead and green sea turtles for beach placement activities**. This determination has been made per USFWS ESA Consultation Handbook and states that, "in the event the overall effect of the proposed action is beneficial to the listed species, but also is likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species." The project will have **no effect on critical habitat (either terrestrial or marine) for loggerhead sea turtles**. Since leatherback nesting has been documented in the past but is not common, the proposed project **may affect but is not likely to adversely affect the leatherback sea turtle for beach placement activities**. **There will be no effect on all other sea turtle species for beach placement activities.** Since all in water dredging activities are addressed and covered by reference in the 1997 NMFS SARBO, no additional sea turtle consultation with NMFS is required.

6.3 Shortnose sturgeon

Detailed life history information associated with the life cycle requirements for shortnose Sturgeon and a subsequent analysis of impacts from the proposed dredging activities are provided within the following Section 7 consultation document:

> *National Marine Fisheries Service. 1997. Regional Biological Opinion for the Continued Hopper Dredging of Channels and Borrow Areas in the Southeastern United States. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland*

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. The Shortnose Sturgeon occurs in Atlantic seaboard rivers from southern New Brunswick, Canada to northeastern Florida, USA. They typically inhabit estuarine and riverine habitats and are not often found offshore. SCDNR reports that in SC they inhabit Winyah Bay Rivers, those that drain into Lake Marion, The Santee, Cooper and Savannah rivers, and the ACE Basin.

Studies have shown that the shortnose sturgeon exists in many of the large coastal river systems in South Carolina. Little is known about the shortnose sturgeon population level, life history or ecology. Their status is probably due to exploitation, damming of rivers and deterioration of water quality. Because there is no coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the sturgeon in the immediate project area.

c. Current Threats to Continued Use of the Area. Pollution, blockage of traditional spawning grounds, and over fishing are generally considered to be the principal causes of the decline of this species.

d. Project Impacts.

(1) Habitat. The shortnose sturgeon is principally a riverine species and is known to use three distinct portions of river systems: (1) non-tidal freshwater areas for spawning and occasional over wintering; (2) tidal areas in the vicinity of the fresh/saltwater mixing zone, year-round as juveniles and during the summer months as adults; and (3) high salinity estuarine areas (15 ppt salinity or greater) as adults during the winter. Habitat conditions suitable for juvenile and adult shortnose sturgeon could occur within the estuaries behind the project area; however, spawning habitat should lie well outside of the project area and should not be affected by this project. The presence of juvenile shortnose sturgeon is not likely due to high salinity. Adults are found in shallow to deep water (6 to 30 feet) and, if present, would be expected to occupy the deeper waters during the day and the shallower areas adjacent to the deeper waters during the night (Dadswell *et al*. 1984).

(2) Food Supply. The shortnose sturgeon is a bottom feeder, consuming various invertebrates and stems and leaves of macrophytes. Adult foraging activities normally occur at night in

shallow water areas adjacent to the deep-water areas occupied during the day. Juveniles are not known to leave deep-water areas and are expected to feed there. The foraging ecology of the shortnose sturgeon is not known for any portion of its range, and little information exists on the animal's food habits (SCDNR, 2009a). Dredging for this project will occur at a borrow site located offshore; therefore, shallow water feeding areas will not be affected by the project.

Effect Determination. Since shortnose sturgeons rarely inhabit coastal ocean waters, and tend to stay closer to the freshwater/saltwater divide, it is unlikely that the shortnose sturgeon occurs in the project area along the beachfront of Garden City/Surfside Beach. Because there is not a large coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the sturgeon in the immediate project area. However, should it occur, its habitat would be only minimally altered by the proposed project. Any shortnose sturgeon in the area should be able to avoid being taken by a slow moving pipeline dredge or hopper dredge. Although hopper dredges have been known to impact shortnose sturgeons, dredging for this project will occur in offshore environments, outside of its habitat range. Therefore, impacts from dredges are not anticipated to occur, but are covered by reference in the 1997 NMFS SARBO. For beach placement activities it has been determined that the proposed project will have **no effect on shortnose sturgeon.**

6.4 Atlantic Sturgeon

a. Status. Endangered.

Within the Federal Register dated February 6, 2012 (Volume 77, Number 24), NMFS issued a final determination to list the Carolina and South Atlantic distinct population segments (DPSs) of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) as endangered under the Endangered Species Act (ESA) of 1973, as amended. This final rule was made effective April 6, 2012. NMFS had not designated any "critical habitat" for this species at the time this document was prepared. Since the Atlantic sturgeon is found within the project area, the purpose of this section is to address project impacts on this potentially listed species.

b. Occurrence in Immediate Project Vicinity. Although specifics vary latitudinally, the general life history pattern of Atlantic sturgeon is that of a long lived, late maturing, estuarine dependent, anadromous species. The species' historic range included major estuarine and riverine systems that spanned from Hamilton Inlet on the coast of Labrador to the Saint Johns River in Florida (Murawski and Pacheco 1977; Smith and Clungston 1997).

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Spawning adults generally migrate upriver in the spring/early summer; 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 Clungston 1997; Caron *et al*. 2002). In some southern rivers, a fall spawning migration may also occur (Rogers and Weber 1995; Weber and Jennings 1996; Moser *et al.* 2000. Atlantic sturgeon spawning is believed to occur in flowing water between the salt front and fall line of large rivers, where optimal flows are 46-76 cm/s and deep depths of 11-27 meters (Borodin 1925; Leland 1968; Crance 1987; Moser *et al*. 2000; Bain *et al*. 2000). Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (e.g., cobble) (Gilbert 1989; Smith and Clungston 1997).

Juveniles spend several years in the freshwater or tidal portions of rivers prior to migrating to sea (Gilbert 1989). Upon reaching a size of approximately 76-92 cm, the subadults may move to coastal waters (Murawski and Pacheco 1977; Smith 1985), where populations may undertake long range migrations (Dovel and Berggren 1983; Bain 1997; Van den Avyle 1984). Tagging and genetic data indicate that subadult and adult Atlantic sturgeon may travel widely once they emigrate from rivers. Subadult Atlantic sturgeon wander among coastal and estuarine habitats, undergoing rapid growth (Dovel and Berggren 1983; Stevenson 1997). These migratory subadults, as well as adult sturgeon, are normally captured in shallow (10-50m) near shore areas dominated by gravel and sand substrate (Stein *et al*. 2004). Coastal features or shorelines where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy, Massachusetts Bay, Rhode Island, New Jersey, Delaware, Delaware Bay, Chesapeake Bay, and North Carolina, which presumably provide better foraging opportunities (Dovel and Berggren 1983; Johnson *et al*. 1997; Rochard *et al*. 1997; Kynard *et al*. 2000; Eyler *et al*. 2004; Stein *et al*. 2004; Dadswell 2006). Because there is not a large coastal river associated with this project, there is a lack of suitable freshwater spawning areas for the Atlantic sturgeon in the immediate project area.

c. Current Threats to Continued Use of the Area. According to the Atlantic sturgeon status review (Atlantic Sturgeon Status Review Team, 2007), projects that may adversely affect sturgeon include dredging, pollutant or thermal discharges, bridge construction/removal, dam construction, removal and relicensing, and power plant construction and operation. Potential direct and indirect impacts associated with dredging that may adversely impact sturgeon include entrainment and/or capture of adults, juveniles, larvae, and eggs by dredging and closed net sea turtle relocation trawling activities, short-term impacts to foraging and refuge habitat, water quality, and sediment quality, and disruption of migratory pathways.

d. Project Impacts.

(1) Habitat and Food Supply. Dredging activities can impact benthic assemblages either directly or indirectly and may vary in nature, intensity, and duration depending on the project, site location, and time interval between maintenance operations. However, the relatively small size of the proposed borrow area, it's distance from major riverine inlets, and the short duration of disturbance will limit any disruption of food supply to the Atlantic sturgeon.

(2) Relationship to Critical Periods in Life Cycle. Analyses of the surficial and sub-bottom sediments have been conducted within the proposed borrow areas to assure compatibility with the native sediment. Several vibracore samples were taken to document the physical characteristics of the sediment relative to depth and sub-bottom geophysical surveys were conducted to correlate the physical samples with the underlying geology layers of the borrow area. These data are used to evaluate quality and quantity of sediment relative to depth so that post-dredging surface sediments are not different from pre-dredging conditions. Assuming similarity in post dredging composition of sediment, no long term impacts to sturgeon from alterations physical habitat (i.e. changes in benthic substrate) are expected.

(3) Effect Determination. Atlantic sturgeons have been taken by hopper dredges in the past and to lesser extent mechanical dredges. Therefore, the proposed dredging activity will have **no effect if performed by a cutterhead dredge and may affect and is likely to adversely affect the Atlantic sturgeon if performed by a hopper dredge.** Since USACE has initiated consultation with NMFS on a new regional Biological Opinion which covers dredging of borrow areas, no additional Atlantic sturgeon consultation with NMFS is required.

Endangered species observers (ESOs) on board hopper dredges as well as trawlers will be responsible for monitoring for incidental take of Atlantic sturgeon. For hopper dredging operations, dragheads as well as all inflow and overflow screening will be inspected for sturgeon species following the same ESO protocol for sea turtles. Furthermore, all ESOs on board trawlers will be capable of identifying Atlantic sturgeon as well as following safe handling protocol as outlined in Moser *et al.* 2000.

6.5 Sea beach Amaranth

a. Status. Threatened

Sea beach amaranth (*Amaranthus pumilus*) is an annual plant historically native to the barrier island beaches of the Atlantic coast from Massachusetts to South Carolina. No other vascular plant occurs closer to the ocean. The species was federally listed as threatened by the U.S. Fish and Wildlife Service in 1993 (USACE, 2001). Seabeach amaranth is listed as threatened and of national concern in South Carolina.

Germination takes place over a relatively long period of time, generally beginning in April and continuing at least through July. Upon germinating, this plant initially forms a small-unbranched sprig but soon begins to branch profusely into a clump, often reaching a foot in diameter and consisting of 5 to 20 branches. Occasionally a clump may get as large as a yard of more across, with hundreds of branches. The stems are fleshy and pink-red or reddish, with small rounded leaves that are 1.3 to 2.5 centimeters in diameter. The leaves are clustered toward the tip of the stem, are normally a somewhat shiny, spinach-green color, and have a small notch at the rounded tip. Flowers and fruits are relatively inconspicuous and are borne in clusters along the stems. Flowering begins as soon as plants have reached sufficient size, sometimes as early as June in the Carolinas but more typically commencing in July and continuing until their death in late fall or early winter. Seed production begins in July or August and reaches a peak in most years in September; it likewise continues until the plant dies (USACE, 2001).

Seabeach amaranth occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of non-eroding beaches. It occasionally establishes small temporary populations in other habitats, including sound side beaches, blowouts in foredunes and in dredged material placed for beach renourishment or disposal. Seabeach amaranth appears to be intolerant of competition and does not occur on well-vegetated sites. The species appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. These characteristics allow it to move around in the landscape as a fugitive species, occupying suitable habitat as it becomes available (USACE, 2001).

b. Occurrence in Immediate Project Vicinity. Historically, seabeach amaranth occurred in 31 counties in 9 states from Massachusetts to South Carolina. It has been eliminated from six of the States in its historic range. The only remaining large populations are in North Carolina. Surveys in South Carolina found that the number of plants along our coast dropped by 90% (from 1,800 to 188) as a result of Hurricane Hugo, subsequent winter storms and beach rebuilding projects that occurred in its wake. South Carolina populations are still very low and exhibit a further downward trend although 1998 was a better year than most with 279 plants identified along the coast. It is possible that the abundant rainfall associated with El Nino in the spring of 1998 produced a larger than normal population. The remaining populations in areas with suitable habitat are in constant danger of extirpation from hurricanes, webworm predation, and other natural and anthropogenic factors (USACE, 2001). At the present time, there are no known populations of seabeach amaranth in the project area.

c. Current Threats to Continued Use of Area. Seabeach amaranth cannot compete with dense perennial beach vegetation and only occurs in the newly disturbed habitat of a high-energy beach. It occurs on barren or sparsely-vegetated sand above the high water line, an area classified as marine wetland. This habitat usually disappears completely when seawalls or other hard structures are built along the shoreline. This loss of habitat from seawall construction and global sea level rise are thought to be major factors in the species' extirpation throughout parts of its historic range. It has been postulated that estuarine and coastal shore plants will suffer some of the most significant impacts as a result of global climate changes. Coastal development will prevent these species from migrating up slope to slightly higher ground if sea levels rise. To a large extent, this is already occurring as beaches are being fortified to prevent erosion. Beach renourishment projects eliminate existing plants if conducted during the summer and may bury the seed needed to reestablish the plant the following year if conducted during the winter. However, beach renourishment projects often rebuild the habitat this species requires. Fortification with seawalls and other stabilization structures or heavy vehicular traffic may eliminate seabeach amaranth populations locally. Any given site will become unsuitable at some time because of natural forces. However, if a seed source is no longer available in adjacent areas, seabeach amaranth will be unable to reestablish itself when the site is once again suitable or new favorable habitat is created. In this way, it can be progressively eliminated even from generally favorable stretches of habitat surrounded by permanently unfavorable areas (USACE, 2001).

Effect Determination. Because there are no known populations of seabeach amaranth in the project area, there is also no known viable seed source. As such, the proposed project **may effect, but is not likely to adversely affect** sea beach amaranth. However, USACE has discussed with the USFWS the possibility of trying to plant the foredune area of the dune vegetation planting matrix with seabeach amaranth in select areas. USACE is requesting conservation recommendations should this be a viable option.

6.6 Piping plover and designated piping plover critical habitat

a. Status. Threatened.

Piping plovers are small shorebirds approximately six inches long with sand-colored plumage on their backs and crown and white under parts. Breeding birds have a single black breast band, a black bar across the forehead, bright orange legs and bill, and a black tip on the bill. During the winter, the birds lose the black bands, the legs fade to pale yellow, and the bill becomes mostly black.

The piping plover breeds on the northern Great Plains, in the Great Lakes region, and along the Atlantic coast (Newfoundland to North Carolina); and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico, and in the Bahamas West Indies.

Piping plovers nest along the sandy beaches of the Atlantic Coast from Newfoundland to North Carolina, the gravelly shorelines of the Great Lakes, and on river sandbars and alkali wetlands throughout the Great Plains region. They prefer to nest in sparsely vegetated areas that are slightly raised in elevation (like a beach berm). Piping plover breeding territories generally include a feeding area, such as a dune pond or slough, or near the lakeshore or ocean edge. The piping plover winters along the coast, preferring areas with expansive sand or mudflats (feeding) in close proximity to a sandy beach (roosting). The primary threats to the piping plover are habitat modification and destruction, and human disturbance to nesting adults and flightless chicks. A lack of undisturbed habitat has been cited as a reason for the decline of other shorebirds such as the black skimmer and least tern (USACE, 2001).

The piping plover is an occasional visitor along the South Carolina coast during the winter months and individuals are occasionally sighted in the project area. However, there are no large wintering concentrations in the state. Piping plovers are considered a threatened species under the Endangered Species Act of 1973, as amended, when on their wintering grounds. The species is not known to nest in the project area; however, it may winter in the area. The USFWS has designated 15 areas along the South Carolina (SC) coast as critical habitat for the wintering populations of the piping plover. This includes approximately 138 miles of shoreline along the SC coast along margins of interior bays, inlets, and lagoons. There is a designated critical habitat to the south of the project at Murrells Inlet. However, there is no designation for any of the project area footprint. Public reporting of piping plover activity in the Garden City/Surfside area of South Carolina has been sparse (ebird.org, 2016).

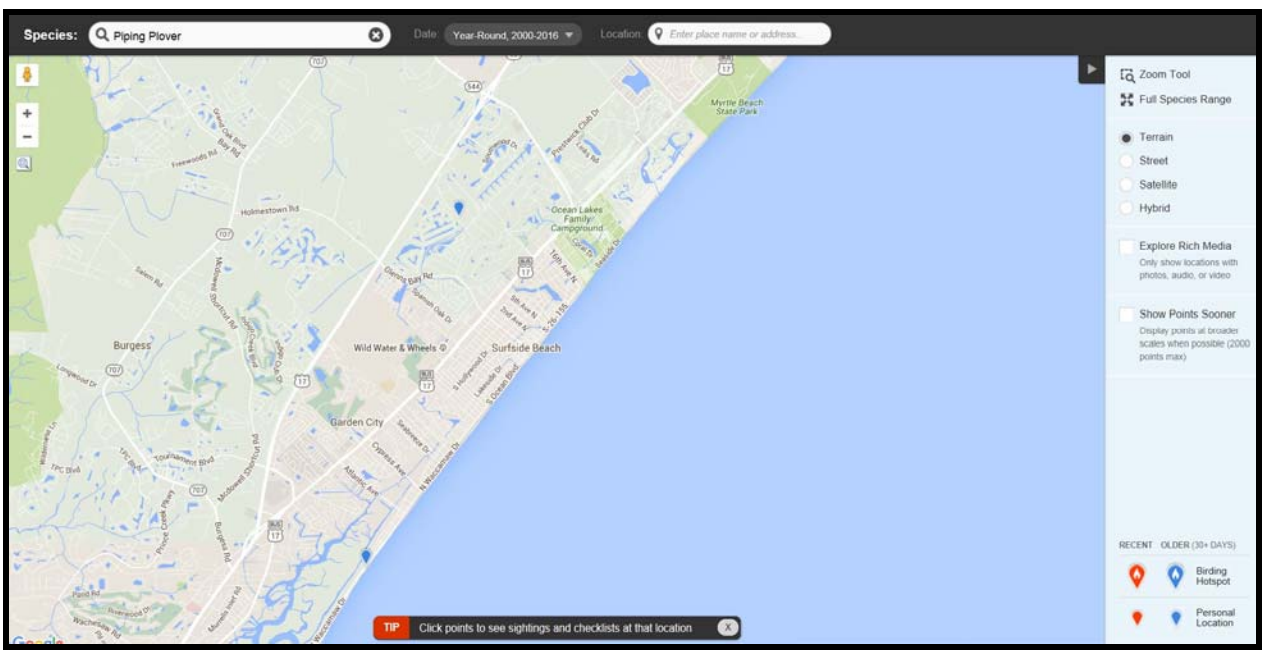

Figure 9. Piping plover reported sightings on ebird.org.

Effect Determination. Direct loss of nests from the disposal of the dredged material will not occur, as the species is not known to nest in the project area. Piping plover foraging distribution on the beach during the winter months may be altered as beach food resources may be affected by disposal of material. Such disruptions will be temporary and of minor significance since the birds can easily fly to other loafing and foraging locations. Placement of material may provide additional foraging habitat for the piping plover. For these reasons, it has been determined that the proposed project is **not likely to adversely affect the piping plover.**

6.7 Rufa Red Knot

a. Status. Threatened

Rufa red knots (*Calidris canutus rufa*) are medium-sized shorebirds approximately 9 to 11 inches long. Red knots have a proportionately small head, small eyes, and short neck, and a black bill that tapers from a stout base to a relatively fine tip. The bill length is not much longer than head length. Legs are short and typically dark gray to black, but sometimes greenish in juveniles or older birds in nonbreeding plumage. Nonbreeding plumage is dusky gray above and whitish below. Juveniles resemble nonbreeding adults, but the feathers of the scapulars (shoulders) and wing coverts (small feathers covering base of larger feathers) are edged with white and have narrow, dark bands, giving the upperparts a scalloped appearance. Breeding plumage of red knots is a distinctive rufous (red). The face, prominent stripe above the eye, breast, and upper belly are a rich rufous-red to a brick or salmon red, sometimes with a few scattered light feathers mixed in. The feathers of the lower belly and under the tail are whitish with dark flecks. Upperparts are dark brown with white and rufous feather edges; outer primary feathers are dark brown to black. Females are similar in color to males, though the rufous colors are typically less intense, with more buff or light gray on the dorsal (back) parts (USFWS, 2013a).

Each year red knots make one of the longest distance migrations known in the animal kingdom, traveling up to 19,000 mi annually. This migration occurs between the red knot's breeding grounds in the Canadian Arctic and several wintering areas, including the Southeast United States, the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America ("Winter" is used to refer to the nonbreeding period of the red knot life cycle when the birds are not undertaking migratory movements.). During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed. Southbound red knots tend to be less concentrated than during either their northbound migrations and in their wintering areas (USFWS, 2013a).

Red knots undertake long flights that may span thousands of miles without stopping. As red knots prepare to depart on long migratory flights, they undergo several physiological changes. Before takeoff, the birds accumulate and store large amounts of fat to fuel migration and undergo substantial changes in metabolic rates. In addition, leg muscles, gizzard, stomach, intestines, and liver all decrease in size, while pectoral muscles and heart increase in size. Due to these physiological changes, red knots arriving from lengthy migrations are not able to feed maximally until their digestive systems regenerate, a process that may take several days. Because stopovers are time-constrained, red knots require stopovers rich in easily digested food to achieve adequate weight gain (USFWS, 2013a).

Red knots generally nest in dry, slightly elevated tundra locations, often on windswept slopes with little vegetation. Breeding areas are located inland, but near arctic coasts. Nests may be scraped into patches of mountain avens (*Dryas octopetala*) plants, or in low spreading vegetation on hummocky ground containing lichens, leaves, and moss. Female red knots lay only one clutch (group of eggs) per season, and, as far as is known, do not lay a replacement clutch if the first is lost. The usual clutch size is four eggs, though three-egg clutches have been recorded. The incubation period lasts approximately 22 days from the last egg laid to the last egg hatched, and both sexes participate equally in egg incubation. After the eggs hatch, red knot chicks and adults quickly move away from high nesting terrain to lower, wetland habitats. Young are precocial, leaving the nest within 24 hours of hatching and foraging for themselves. Females are thought to leave the breeding grounds and start moving south soon after the chicks hatch in mid-July. Thereafter, parental care is provided solely by the males, but about 25 days later (around August 10) they also abandon the newly fledged juveniles and move south. Not long after, they are followed by the juveniles (USFWS, 2013a).

Red knots are a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp and crab-like organisms, marine worms, and horseshoe crab eggs. Red knots do not necessarily prefer hard-shelled mollusks (in fact they do not, when given the choice), but they are specialized in finding and processing such prey. Due to this specialization, red knots have less ability to find the actively crawling soft-bodied worms and small crustaceans on which other sandpiper species specialize. Foraging activity is largely dictated by tidal conditions, as red knots rarely wade in water more than 0.8 to 1.2 in deep. Due to bill morphology, red knots are limited to foraging on only shallow-buried prey, within the top 0.8 to 1.2 in of sediment. Red knots and other shorebirds that are long-distance migrants must take advantage of seasonally abundant food resources at migration stopovers to build up fat reserves for the next non-stop, long-distance flight. During the migration period, although foraging red knots can be found widely distributed in small numbers within suitable habitats, birds tend to concentrate in those areas where abundant food resources are consistently available from year to year. A prominent departure from typical prey items occurs each spring when red knots feed on the eggs of horseshoe crabs, particularly during the key migration stopover within the Delaware Bay of New Jersey and Delaware. The Delaware Bay serves as the principal spring migration staging area for the red knot because of the abundance and availability of horseshoe crab eggs. Horseshoe crab eggs are a superabundant source of easily digestible food. Horseshoe crabs occur along the Atlantic coast from Maine to Florida, along Florida's Gulf coast, and along Mexico's Yucatan Peninsula. Within this geographic range, horseshoe crabs are most abundant between Virginia and New Jersey, with the largest population occurring in Delaware Bay. Each spring, adult horseshoe crabs migrate from deep bay waters and the Atlantic continental shelf to spawn on intertidal sandy beaches. Beaches within estuaries are preferred spawning areas because they are low energy environments and are protected from the surf. Horseshoe crab spawning generally occurs from March through July, with the peak spawning activity occurring around the evening new and full moon high tides in May and June. Horseshoe crabs and surface egg availability are not found in similar densities in other areas on the Atlantic coast, which may explain why shorebirds concentrate in the Delaware Bay. Besides supporting red knots, Delaware Bay supports high numbers of other shorebird species, and ranks among the 10 largest shorebird migration staging sites in the Western

Hemisphere. Outside of Delaware Bay, horseshoe crab eggs are eaten opportunistically when available in nonbreeding habitats but are not considered a primary food resource for red knots in these areas. Delaware Bay provides the final Atlantic coast stopover for a significant majority (50 to 80 percent) of the red knot population making its way to the arctic breeding grounds each spring. Red knots stopping in Delaware Bay depend on horseshoe crab eggs to achieve remarkable rates of weight gain. No single stopover area is more important for the red knot than the Delaware Bay because the nutritive yield of the bay is so high. The timing of the arrival of red knots and other shorebirds in Delaware Bay typically coincides with the annual peak of the horseshoe crab spawning period. Red knots in Delaware Bay rely almost entirely on horseshoe crab eggs to support their very high rates of weight gain. Research has provided strong evidence that a majority of red knots stop at the Delaware Bay during the spring migration, and that these birds are highly reliant on a superabundance of horseshoe crab eggs to gain weight during their stopover period. On the breeding grounds, the red knot's diet consists mostly of terrestrial invertebrates, though early in the season, before insects and other macroinvertebrates are active and accessible, red knots will eat grass shoots, seeds, and other vegetable matter (USFWS, 2013a).

Red knots are restricted to ocean coasts during winter, and occur primarily along the coasts during migration. Habitats used by red knots in migration and wintering areas are similar in character, generally coastal marine and estuarine (partially enclosed tidal area where fresh and salt water mixes) habitats with large areas of exposed intertidal sediments. In North America, red knots are commonly found along sandy, gravel, or cobble beaches, tidal mudflats, salt marshes, shallow coastal impoundments and lagoons, and peat banks. In the southeastern U.S., red knots forage along sandy beaches during spring and fall migration from Maryland through Florida. In addition to the sandy beaches, red knots also forage along peat banks and tidal mudflats during migration. Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats, including sand spits, islets, shoals, and sandbars, often associated with inlets. From South Carolina to Florida, red knots are found in significantly higher numbers at inlets than at other coastal sites (USFWS, 2013a).

Red knots occupy all known wintering areas from December to February, but may be present in some wintering areas as early as September or as late as May. Wintering areas for the red knot include the Atlantic coasts of Argentina and Chile (particularly the island of Tierra del Fuego that spans both countries), the north coast of Brazil (particularly in the State of Maranhão), the Northwest Gulf of Mexico (discussed below) from the Mexican State of Tamaulipas through Texas (particularly at Laguna Madre) to Louisiana, and the Southeast United States from Florida (particularly the central Gulf coast) to North Carolina. Smaller numbers of knots winter in the Caribbean, and along the central Gulf coast (Alabama, Mississippi), the mid-Atlantic, and the Northeast United States. The core of the Southeast wintering area (i.e., that portion of this large region supporting the majority of birds) is thought to shift from year to year among Florida (particularly the central Gulf coast), Georgia, and South Carolina. However, the geographic limits of this wintering region are poorly defined. Although only small numbers are known, wintering knots extend along the Atlantic coast as far north as Virginia, Maryland, and New Jersey. Still smaller numbers of red knots have been reported between December and February from Long Island, New York, through Massachusetts and as far north as Nova Scotia, Canada. Small numbers of red knots also winter along the central Gulf coast (Florida Panhandle, Alabama, Mississippi, and eastern Louisiana). Red knots occupy the southernmost wintering areas, in Tierra del Fuego, from late October to February, with some birds arriving as early as late September. Birds wintering in the Caribbean or the United States typically stay later, through March or even May. Birds wintering in the Southeast seem to arrive in November, while birds wintering in Texas seem to arrive much earlier, in late July or August. Major spring stopover areas along the Atlantic coast include Río Gallegos, Península Valdés, and San Antonio Oeste (Patagonia, Argentina); Lagoa do Peixe (eastern Brazil, State of Rio Grande do Sul); Maranhão (northern Brazil); the Virginia barrier islands; and Delaware Bay. However, large and small groups of red knots, sometimes numbering in the thousands, may occur in suitable habitats all along the Atlantic and Gulf coasts from Argentina to Massachusetts (USFWS, 2013a).

Some red knots from the Southeast-Caribbean wintering area, and from South American wintering areas, utilize spring stopovers along the Southeast United States, from Florida to North Carolina. The length of stopover at these locations is generally believed to be brief; although data exist showing that some stopovers last for several weeks. Red knots typically use mid-Atlantic stopovers from late April through late May or early June. The stopover time in Delaware Bay is about 10 to 14 days. From Delaware Bay and other mid-Atlantic stopovers, birds tend to fly overland directly northwest to the central Canadian breeding grounds, with many stopping briefly along the shores of James and Hudson Bays. Knots that winter in Tierra del Fuego tend to work their way up the South America Atlantic coast, using stopover sites in Argentina and Uruguay before departing from Brazil (USFWS, 2013a).

Important fall stopover sites include southwest Hudson Bay (including the Nelson River delta), James Bay, the north shore of the St. Lawrence River, the Mingan Archipelago, and the Bay of Fundy in Canada; the coasts of Massachusetts and New Jersey and the mouth of the Altamaha River in Georgia; the Caribbean (especially Puerto Rico and the Lesser Antilles); and the northern coast of South America from Brazil to Guyana. However, birds can occur all along the coasts in suitable habitat. In the mid-Atlantic, southbound red knots start arriving in July. Numbers of adults peak in mid-August and most depart by late September, although data shows that some birds stay through November. Migrant juveniles begin to appear along the U.S. Atlantic coast in mid-August, occurring in much lower numbers and scattered over a much wider area than adults. Several studies suggest that adult red knots fly directly to South America from the eastern seaboard of the United States, arriving in northern South America in August (USFWS, 2013a).

The primary threats to the red knot are loss of both breeding and non-breeding habitat; reduced prey availability throughout the non-breeding range; potential for disruption of natural predator cycles on the breeding grounds; and increasing frequency and severity of asynchronies (i.e., mismatches) in the timing of their annual migratory cycle relative to favorable food and weather conditions (USFWS, 2013b).

The red knot is a regular visitor along the South Carolina coast during both the spring and fall migrations. Flocks of over 1000 birds have been observed in the spring with lesser numbers being observed in the fall. The red knot also uses the South Carolina coast as a wintering area. Public reporting of red knot activity in the Garden City/Surfside area of South Carolina has been sparse (ebird.org, 2016).

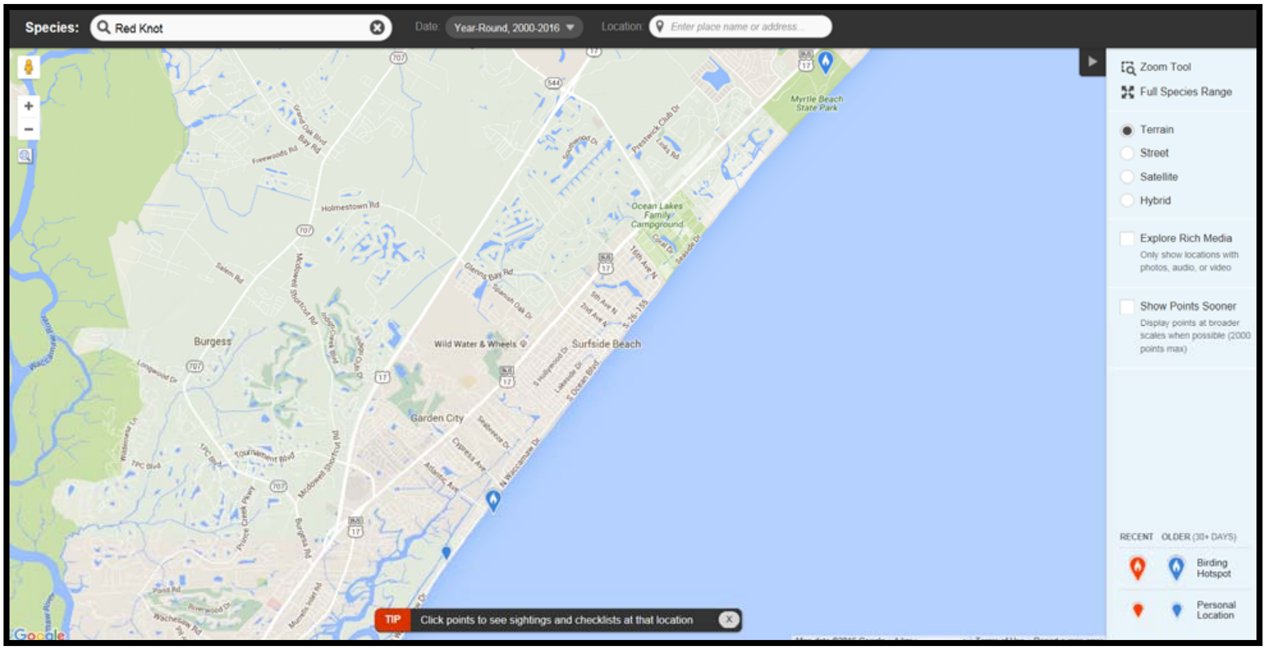

Figure 10. Red knot reported sightings on ebird.org

Effect Determination

Placement of the dredged material is anticipated to occur during the winter months. Direct loss of nests from the disposal of the dredged material will not occur, since the species does not nest in the project area. Red knot foraging distribution on the beach during the spring and fall migrations and winter months may be altered as beach food resources may be affected by placement of material along the project area; however, this impact is expected to be minor since most birds use areas outside of the immediate project area. In addition, previous studies of beach nourishment projects have shown a short term impact to the beach and surf zone infaunal community with a recovery within six months (SCDNR, 2009b). Due to the expected short term impacts to the beach infaunal community and since the number of red knots in the immediate project area is limited, it has been determined that the proposed project may affect but is **not likely to adversely affect the rufa red knot**.

6.6 Blue (NOAA Fisheries list), finback, humpback, right, sei, and sperm whales

The blue whale reaches lengths of up to 100 feet. Blue whales have weighed up to 160 tons. They feed on small shrimp-like crustaceans. The whales consume up to eight tons of these animals a day during their feeding period. A blue whale produced the loudest sound ever recorded from an animal, and some scientists have speculated that they may be able to remain in touch with each other over hundreds of miles. The number of blue whales in the southern hemisphere was severely depleted by whaling. Due to commercial whaling the size of the population is less than ten percent of what it was.

The finback whale is the second largest whale, reaching lengths of up to 88 feet and weighs up to 76 tons. The finback whale because of its crescent-shaped dorsal fin, and obvious characteristic, is easily seen at sea. Depending on where they live, finback whales eat both fish and small pelagic crustaceans, and squids. It sometimes leaps clear of the water surface, yet it is also a deeper diver than some of the other baleen whales. The finback's range is in the Atlantic from the Arctic Circle to the Greater Antilles, including the Gulf of Mexico. In the Pacific Ocean the Finback ranges from the Bering Sea to Cape San Lucas, Baja California.

The humpback whale reaches a maximum length of about 50 feet long and a maximum weight of about 37.5 tons. They are mostly black, but the belly is sometimes white. Flippers and undersides of the flukes are nearly all white. They are migratory. They eat krill and schooling fish. In the Atlantic they migrate from Northern Iceland and Western Greenland south to the West Indies, including the Northern and Eastern Gulf of Mexico. In the Pacific Ocean they migrate from the Bering Sea to Southern Mexico. The humpback is one of the most popular whales for whale watching on both the east and west coasts. Scientists estimate that there are 10,000 humpbacks worldwide, only about 8% of its estimated initial population.

The sei whale is one of the largest whales. It can reach a length of 60 feet and a weight of 32 tons. They feed primarily on krill and other small crustaceans, but also feed at times on small fish. The sei whale is the fastest of the baleen whales and can reach speeds of more than 20 miles per hour. In the Atlantic Ocean the Sei whale ranges from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the Sei whale may range from the Bering Sea to Southern Mexico. The Sei whale is endangered due to past commercial whaling.

Unlike the other great whales on the endangered species list, the sperm whale is a toothed whale. It is the largest of the toothed whales reaching a length of 60 feet in males and 40 feet in females. Sperm whales are noted for their dives that can last up to an hour and a half and go as deep as 2 miles under the surface. It is the most abundant of all the endangered whales, with an estimated population of two million. Sperm whales feed mainly on squid, including the giant squid. They range in the Atlantic Ocean from the Arctic Circle to the Gulf of Mexico. In the Pacific Ocean the sperm whale ranges from the Bering Sea to Southern Mexico. The sperm whale was almost hunted to extinction for its oil (spermaceti). This oil was used in the manufacture of ointments, cosmetics, and candles. The sperm whales usually inhabit the offshore waters.

The right whale is the most endangered species of whale off of the U.S. coasts. The right whale got its name because it was the "right" whale to hunt. It was slow moving and floated after being killed. Current estimates indicate that presently no more than a few hundred exist. Right whales can reach a length of 60 feet and a weight of 100 tons. Although the species has been internationally protected since 1937, it has failed to show any signs of recovery.

Right whales have been observed along the eastern coast of North America from the Florida Keys north to the Gulf of St. Lawrence in Canada. They are found in relatively large numbers around Massachusetts and near Georges Bank in the spring, and then they migrate to two areas in Canadian waters by mid-summer. Most cows that give birth in any given year travel in the winter to the coastal waters of Georgia and Florida to calve and raise their young for the first three months. The Bay of

Fundy, between Maine and Nova Scotia, appears to serve as the primary summer and fall nursery hosting mothers and their first-year calves. The calf will stay with its mother through the first year and it is believed that weaning occurs sometime in the fall. Calves become sexually mature in about 8 years. Females are believed to calve about every three to four years. Sightings of right whales and their occurrence in the inshore waters of the State, although very rare, are generally assumed to represent individuals seen during this migration.

Right whales feed primarily on copepods and euphausids. They swim very close to the shoreline, often noted only a few hundred meters offshore. Because of their habit of traveling near the coast, there is concern over impacts resulting from collisions with boats and ships. Some right whales have been observed to bear propeller scars on their backs resulting from collisions with boats (NMFS, 1984). Destruction or pollution of right whale habitat is not known to be a problem in the project area.

Critical Habitat.

The proposed action area falls within a small portion of the critical calving habitat for NARWs. NMFS defines in the rule (81 FR 4837) the physical features that are essential to the conservation of the NARW as being: "(1) Sea surface conditions associated with Force 4 or less on the Beaufort Scale; (2) Sea surface temperatures of 7°C to 17°C; and (3) Water depths of 6 to 28 meters, where these features simultaneously co-occur over contiguous areas of at least 231 km^2 of ocean waters during the months of November through April." NMFS notes that the critical habitat was designated based in part on 2 models that predict calving habitat, and that the habitat extends from New Smyrna, FL to Cape Fear, NC between 10 and 50 km from shore (Figure 11). NMFS also notes that the essential features of NARW calving habitat may require special management considerations because of: offshore energy development, large-scale offshore aquaculture operations, and global climate change. The concern with the first two of these is more in fragmenting habitat than any changes to the 3 PCE's. Infrastructure that could limit the availability of essential features such that NARWs are not able to move about could have a negative impact on calving critical habitat. NMFS also identified 5 categories of activities that have the potential to affect essential features. One of these is USACE maintenance dredging or permitting of dredging and disposal activities under the Clean Water Act.

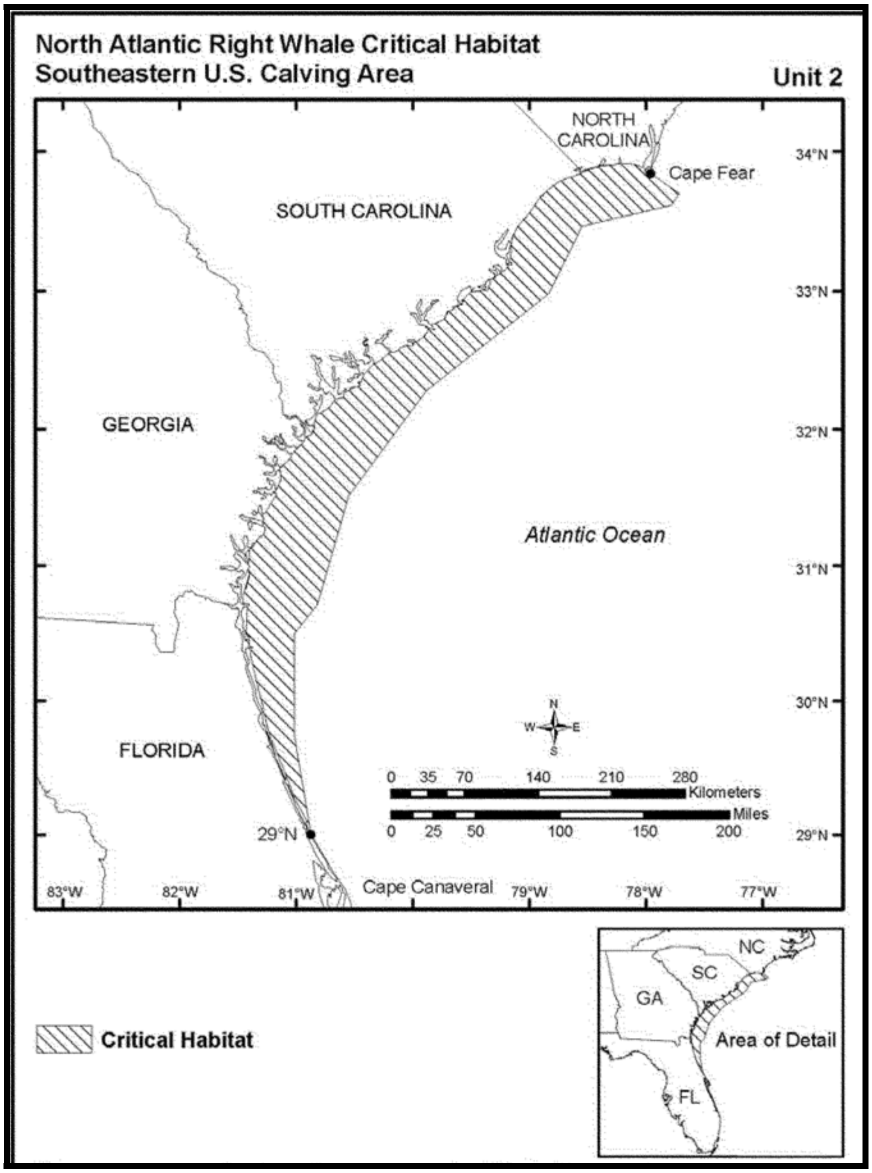

Figure 11. North Atlantic right whale (NARW) critical habitat area for the southeastern calving whales (81 FR 4837 / NOAA-NMFS-2016-01633)

The proposed project consists of the dredging and placement of material for beach placement; however, this activity is unlikely to adversely affect essential habitat features of the right whale calving area. Excavation and disposal of dredge material does not affect water temperature or sea surface roughness. Water depth would only be slightly modified by the dredging of borrow areas and disposal of dredge material at designated sites. The proposed action would occur only in relatively small areas of the overall critical habitat. Changes in water depth within entrance channels, offshore disposal sites, or borrow areas are not likely to affect the selectability of calving habitat features by right whales, nor will the actions significantly alter the PCEs or create an impediment to migration through the calving grounds. USACE and BOEM have evaluated the rule for NARW critical habitat and have determined that the proposed action will have discountable effects on the new NARW designated critical habitat. USACE and BOEM are currently consulting with NMFS on this designation on a regional level and no consultation is needed for this BA.

Effect Determination

Of these six species of whales being considered, only the right whale would normally be expected to occur within the project area during the construction period; therefore the other species of whales are not likely to be affected. The majority of right whale sightings occur from December through February. Since the proposed work is expected to occur during this time period, the dredge will be required to have endangered species observers standing watch on the bridge of the dredge to look for whales during construction. The presence of a hydraulic cutter-head pipeline or hopper dredge in this area should pose no direct impacts to the right whale, however, when relocating, the dredge and any supporting vessels are required to alter course and stop if necessary to avoid approaching whales. If whales are spotted during the day within 10 miles of the dredging operation, then the dredge is required to reduce transit speed at night, should it need to relocate during that time period. Corps contract specifications expressly require avoidance of right whales. For these reasons, it has been determined that the project as proposed is **not likely to adversely affect the right whale**. (The 29 October 1997 "National Marine Fisheries Service, Regional Biological Opinion on Hopper Dredging along the South Atlantic Coast" has jurisdiction on right whale effects)

7.0 SUMMARY OF PROTECTIVE MEASURES

West Indian Manatee

When work occurs during the manatee migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The standard manatee conditions will be implemented from 15 April to 31 October, if construction takes place during these months. The Contractor will be instructed to take necessary precautions to avoid any contact with manatees. If manatees are sighted within 100 yards of the dredging area, all appropriate precautions will be implemented to insure protection of the manatee. The Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 100 yards of the manatee. Operation of equipment closer than 50 feet to a manatee will necessitate immediate shutdown of that equipment.

North Atlantic Right Whale

Since the construction is anticipated to be scheduled during the right whale migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing right whales. The Contractor may be held responsible for any whale harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the Endangered Species Act and could result in prosecution of the Contractor under the Endangered Species Act or the Marine Mammals Protection Act. The time when most right whale sightings occur is December, January, and February. The Contractor will be instructed to take necessary precautions to avoid any contact with whales. If whales are sighted within 1000 feet of the borrow area, all appropriate precautions will be implemented to insure protection of the whale. In addition, the Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than this distance.

Sea Turtles

If work occurs during the sea turtle nesting period, in order to minimize impacts to nesting sea turtles and emerging hatchlings a beach monitoring and nest relocation program for sea turtles will be implemented. This program will include daily patrols of sand placement areas at sunrise, relocation of any nests laid in areas to be impacted by sand placement, and monitoring of hatching success of the relocated nests. Sea turtle nests will be relocated to an area suitable to both the USFWS and the SCDNR. The Corps will perform any necessary maintenance of beach profile (tilling and shaping or knocking down escarpments) during construction and prior to each nesting season.

During construction of this project, staging areas for construction equipment will be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all dredge pipes that are placed on the beach will be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes will be off the beach to the maximum extent possible. Temporary storage of pipes on the beach will be in such a manner so as to impact the least amount of nesting habitat and will likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline will be recommended as the method of storage).

During construction of this project, all on-beach lighting associated with the project will be limited to the immediate area of active construction only. Such lighting will be shielded, low-pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters will be placed over vehicle headlights (i.e., bulldozers, front end loaders). Lighting on offshore equipment will be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all U.S. Coast Guard and OSHA requirements. Shielded, low pressure sodium vapor lights will be highly recommended for lights on any offshore equipment that cannot be eliminated.

8.0 SUMMARY EFFECT DETERMINATION

This assessment has examined the potential impacts of the proposed project on designated habitat and listed species of plants and animals that are, or have been, present in the project area. Both primary and secondary impacts to habitat have been considered. Based on the analysis provided by this document, the following determinations have been made.

- It has been determined that the proposed project is not likely to adversely affect the manatee.
- It has been determined that the proposed project is not likely to adversely affect Kemp's ridley, leatherback, or hawksbill sea turtles.

- It has been determined that the proposed project will have no effect on the shortnose sturgeon.
- It has been determined that the proposed project will not adversely affect the Atlantic sturgeon.
- It has been determined that the proposed project is not likely to adversely affect the piping plover.
- It has been determined that the proposed project is not likely to adversely affect the rufa red knot.
- It has been determined that the proposed project is not likely to adversely affect seabeach amaranth.
- It has been determined that the proposed project will have no effect on critical habitat for the wintering piping plover.
- It has been determined that the proposed project may adversely affect the nesting loggerhead and green sea turtle and any resulting hatchlings.
- It has been determined that the proposed project will have no effect on critical habitat for the loggerhead sea turtle.
- It has been determined that the proposed project will not adversely modify critical habitat for the North Atlantic right whale.

9.0 LITERATURE CITED

Bagley, D., T. Cascio, R. Owens, S. Johnson, and L. Ehrhart. 1994. Marine turtle nesting at Patrick Air Force Base, Florida; 1987-1993; trends and issues. Pages 180-181 in K.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. Environmental Biology of Fishes. 48: 347-358.

Borodin, N. 1925. Biological observations on the Atlantic sturgeon. Transactions of the American Fisheries Society. 55: 184-190.

Brock, K. 2005. Effects of a shore protection project on loggerheads and green turtle nesting activity and reproduction in Brevard County, FL. MS. Thesis, University of Central FL, Orlando, FL. 66pp.

Brock, Kelly A., Joshua S. Reece, Llewellyn M. Ehrhart. 2009. The effects of artificial beach nourishment on marine turtles: differences between Loggerhead and Green turtles. Restoration Ecology 17(2), pp 297-307.

Caron, F.D. Hatin, and R. Fortin. 2002. Biological characteristics of adult Atlantic sturgeon in the Saint Lawrence River estuary and the effectiveness of management rules. Journal of Applied Ichthyology. 18: 580-585.

Crain, D.A., A.B. Bolten, and K.A. Bjorndal. 1995. Effects of beach nourishment on sea turtles: review and research initiatives. Restoration Ecology 3(2): 95-104.

Crance, J.H. 1987. Habitat suitability index curves for anadromous fishes. In: Common strategies of anadromous and Catadromous fishes, ed. M.J. Dadswell. Bethesda, MD, American Fisheries Society. Symposium 1: 554.

Crouse, Deborah T., L. B. Crowder, and H. Caswell. 1987. A staged-based population model for loggerhead sea turtles and implications for conservation. Ecology 68(5):1412-1423.

Dadswell, M., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818. NOAA FAO Fisheries Synopsis No. 140.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. Fisheries. 31: 218-229.

Davis, Jr., D.A., FitzGerald, M.V. and Terry, J. 1999. Turtle nesting on adjacent beaches with different construction styles: Pinellas County, Florida. Journal of Coastal Research, Vol 15:1, 111-120 pp.

Dovel, W.L. and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River estuary, New York. New York Fish and Game Journal. 30: 140-172.

eBird.org. 2016. eBird: An online database of bird distribution and abundance [web application]. Cornell Lab of Ornithology, Ithaca, New York and National Audubon Society, New York, NY. Available at *http://ebird.org*.

Ecological Associates, INC., 1999. Martin County Beach Nourishment Project Sea Turtle Monitoring and Studies, 1997 Annual Report and Final Assessment. Jensen Beach, Florida: Ecological Associates, Inc., 115p.

Ehrhart, L.M. and Roberts, K.A., 2001. Marine turtle nesting and reproductive Success and Patrick Air Force Base; Summer 2001. Orlando, FL: Univ. of Central FL, Final report to US Air Force Eastern Space and Missile Center; Patrick Air Force Base, FL, 58 pp.

Ernest, R.G and R.E. Martin. 1999. Martin County beach nourishment project: sea turtle monitoring and studies. 1997 annual report and final assessment. Unpublished report prepared for the FLDEP.

Federal Register, Volume 66, No. 132, Tuesday, July 10, 2001, Rules and Regulations.

Fletemeyer, J., 1984. The impact of beach renourishment on sea turtle nesting. In: TAIT, L.S. (compiler), Proceedings of the 1983 Joint Annual Meeting of the American Shore and Beach Preservation Association and Florida Shore and Beach Preservation Association,Tallahassee, Florida, pp. 168-177.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight): Atlantic and shortnose sturgeons. US Fish and Wildlife Service Biological Report – 82 (11.91).

Grand, J. and Beissinger, S. 1997. When relocation of loggerhead sea turtle nests becomes a useful strategy. Journal of Herpetoloty. 31 (3).

Herren, R.M. 1999. The effect of beach nourishment on loggerhead (Caretta caretta) nesting and reproductive success a Sebastian Inlet, Florida. MS Thesis. University of Central Florida, Orlando, Florida. 138 pages.

Hopkins-Murphy, Sally R., Charlotte P. Hope, and Margaret E. Hoyle, 1999. A History of Research and Management of the Loggerhead Turtle (Caretta caretta) on the South Carolina Coast. Final Report to the U.S. Fish and Wildlife Service.

Hopkins, J. Stephen, Richard D. Hamilton II, (SCDNR) and Stephen D. Roff (SCPRT) 1999. 1999 Research Plan: Development of Restoration Techniques for Seabeach Amaranth (*Amaranthus pumilus*) in South Carolina

Johnson, J.H., D.S. Dropkin, B.E. Warkentine, J.W. Rachlin, and W.D. Andres. 1997. Food habits of Atlantic sturgeon off the New Jersey coast. Transactions of the American Fisheries Society. 126: 166-170.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitats used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: a hierarchical approach. Transactions of the American Fisheries Society. 129: 487-503.

Leland, J.G., III. 1968. A survey of the sturgeon fishery of SC. Contributed by Bears Bluff Labs. No. 47: 27pp.

Mattison, C., C. Burney, and L. Fisher. 1993. Trends in the spatial distribution of sea turtle activity on an urban beach (1981-1992). Pp. 102-104.

Milton, S.L.; Shulman, A.A., and Lutz, P.L., 1997. The effect of beach renourishment with aragonite versus silicate sand on beach temperature and loggerhead sea turtle nesting success. Journal of Coastal Research, 13, 904-915.

Moser, Mary L., Mark Bain, Mark R. Collins, Nancy Haley, Boyd Kynard, John C. O'Herron II, Gordon Rogers, Thomas S. Squiers. 2000. A protocol for use of shortnose and Atlantic sturgeons. US Dept of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-OPR-18, May 2000.

Murawski, S.A. and A.L. Pacheco. 1977. Biological and fisheries data on Atlantic sturgeon. National Marine Fisheries Service Technical Series Report 10: 1-69.

National Marine Fisheries Service, 1984. Marine Fisheries Review, The Status of Endangered Whales. National Marine Fisheries Service, Scientific Publications Office, Seattle, Washington.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service, Office of Protected Species. 1997. Regional Biological Opinion for Hopper Dredging Along South Atlantic Coast. Silver Spring, Maryland.

Nelson, D.A. and DD. Dickerson. 1987. Correlation of loggerhead turtle nest digging times with beach sand consistency. Paper presented at the Seventh Annual Workshop on Sea Turtle Biology and Conservation. Wekiwa Springs State Park, FL, February, 1987.

Nelson, D. A. and D. D. Dickerson. 1988. Effects on beach nourishment on sea turtles. In: Tait, L.S. (compiler) Proceedings of the Fifth Annual National Conservation on Beach Preservation Technology: new directions in beach management, St. Petersburg, Florida. Florida Shore and Beach Preservation Assessment, Tallahasee, Florida.

Nelson, D. A. and D. D. Dickerson. 1989. Effects of beach nourishment on sea turtles. In: S. Eckert, K. Eckert, and T. Richardson (compilers). Proceedings of the ninth annual symposium on sea turtle conservation and biology. NOAA Technical Memorandum NMFS-SEFSC-232. pp. 125-127.

Raymond, P.W., 1984. The effects of beach restoration on marine turtle nesting in south Brevard County, Florida. Unpubl. MS thesis, Universityof Central Florida, Orlando, Florida, USA.

Rogers, S.G. and W. Weber. 1995. Status and restoration of Atlantic and shortnose sturgeons in GA. Final Report to NMFS, Southeast Regional Office, St. Petersburg, FL.

Rumbold, D.G., Davis, P.W. and Perretta, C. 2001. Estimating the effect of beach nourishment on Caretta caretta (loggerhead sea turtle) nesting. Restoration Ecology 9(3): 304-310.

South Carolina Department of Natural Resources. 2009a. Shortnose Sturgeon, Description. ACE Basin Executive Summary. From: http://www.dnr.sc.gov/marine/mrri/acechar/specgal/sturgeon.htm. Accessed on December 15, 2009.

South Carolina Department of Natural Resources. 2009b. Using Historical Data and Meta-analyses to Improve Monitoring and Management of Beach Nourishment in South Carolina: Final Report. Charleston, SC.

Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon in North American. Environmental Biology of Fishes. 14(1): 61-72.

Smith, T.I.J., and J.P. Clungston. 1997. Status and management of Atlantic sturgeon in North America. Environmental Biology of Fishes. 48: 335-346.

Steinitz, M. J., Salmon, M. and Wyneken, J. 1998. Beach renourishment and loggerhead turtle reproduction: a seven year study at Jupiter Island, Florida. Journal of Coastal Research 14(3):1000-1013.

Stein, A.B., K.D. Friedland, and M. Sutherland. 2004. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transactions of the American Fisheries Society. 133: 527-537.

Stevenson, J.T. 1997. Life history characteristics of Atlantic sturgeon in the Hudson River and a model for fishery management. MS Thesis, Marine Environmental and Estuarine Studies Program, Un. Of MD, College Park, MD. 222pp.

Trindell, R., D. Arnold, K. Moody, and B. Morford. 1998. Post-construction marine turtle nesting monitoring results on nourished beaches. Pages 77-92 in Tait, L.S. (compiler). Proceedings of the 1998 Annual National Conference on Beach Preservation Technology. Florida Shore & Beach Preservation Association, Tallahassee, Florida.

U.S. Army Corps of Engineers. 2001. Biological Assessment for the Operations and Maintenance Dredging and Disposal for the Murrells Inlet Project, Georgetown County, South Carolina, April, 2001.

U.S. Fish and Wildlife Service. 1996. Florida manatee recovery plan. U.S. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2010. West Indian manatee (Trichechus manatus), Species profile page. http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A007. Accessed on April 9, 2010.

U.S. Fish and Wildlife Service. 2013a. Rufa Red Knot Ecology and Abundance. Supplement 2 to Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*). New Jersey Field Office, Pleasantville, New Jersey.

U.S. Fish and Wildlife Service. 2013b. Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*). New Jersey Field Office, Pleasantville, New Jersey.

Van Den Avyle, M.J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) – Atlantic sturgeon, US Fish and Wildlife Service Biological Report 82(11.25) and US Army Corps of Engineers, TR EL-82-4, Washington, DC.

Weber, W. and C.A. Jennings. 1996. Endangered species management plan for the shortnose sturgeon. Final Report to Port Stewart Military Reservation, Fort Stewart, GA.

Witherington, B.E. 1992. Behavioral responses of nesting sea turtles to artificial lighting. Herpetologica 48, 31–39.

Yntema, C.L. and Mrosovsky, N. 1982. Critical periods and pivotal temperatures for sexual differentiation in loggerhead sea turtles. Canadian Journal of Zoology, 60: 1012-1016.