DRAFT ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

TYBEE ISLAND, GEORGIA
SHORELINE PROTECTION PROJECT
2019 HURRICAN HARVEY, IRMA, MARIA
EMERGENCY SUPPLEMENTAL RENOURISHMENT

U.S. ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT
APRIL 2019

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SAVANNAH DISTRICT
100 W. OGLETHORPE AVENUE
SAVANNAH, GEORGIA 31401-3604

DRAFT FINDING OF NO SIGNIFICANT IMPACT

Name of Action: Tybee Island, Georgia Shoreline Protection Project - Hurricane Harvey, Irma, Maria Emergency Supplemental

1. Project Description: The U.S. Army Corps of Engineers, Savannah District (Savannah District) is proposing to perform an emergency supplemental funds renourishment with the incorporation of resiliency feature(s) to the Tybee Island Shoreline Protection Project, an authorized Federal project. The project includes placing approximately 1,800,000 cubic yards of material on the beach at Tybee Island within the limits of the Federal project. The project includes an expansion of the existing borrow area off the coast of Tybee Island to accommodate this emergency supplemental renourishment as well as future renourishments. The exact quantity to be placed and the final project template will be determined based on physical conditions and funds available at the time of construction.

2. Coordination: Savannah District is coordinating this project with Federal and State resources agencies and the interested public and issued a Notice of Availability of the draft Environmental Assessment (EA) in order to:

a. Inform agencies and individuals of the proposed work and the environmental evaluation contained in the draft EA, and

b. Provide an opportunity for comments on that evaluation and findings.

3. Environmental Impacts:

a. The proposed emergency supplemental funds renourishment is within the same footprint and will use similar techniques and equipment as to what has previously been performed at Tybee Island during the first periodic renourishment in 1987 by the Savannah District, the subsequent 1995 work by Georgia Ports Authority, and the USACE renourishments in 2000, 2008, 2015 and 2018. In addition to the routine renourishment practices, dune construction will occur throughout the federal footprint to tie together existing dune communities, fill in hotspot (flood prone) areas, and build resiliency into the federal project.

c. All previous renourishments at Tybee Island received required environmental approvals. The Red Knot, a newly-listed species, was analyzed in accordance with the Endangered Species Act for this renourishment, and an Essential Fish Habitat (EFH) analysis is being submitted to the National

Marine Fisheries Service (NMFS). The Savannah District, has determined that if recommendations to minimize take on listed species are implemented as outlined in the older USFWS Biological Opinion the renourishment may affect piping plovers, their designated critical habitat, red knots and sea turtles due to potential incidental take while sturgeon and other listed species are not likely to be adversely affected.

d. The proposed action is in compliance with all environmental laws. Unavoidable adverse impacts to benthic communities would occur as a result of the proposed project. The quality of the sediment placed on the beach will be visually monitored during construction by the dredging contractor to ensure that rocky or clay material is not deposited on the beach. Individual organisms within the benthic communities would be lost as a result of the proposed excavation and renourishment activities. However, benthic organisms would be expected to recolonize the borrow area and beach. A layer of sandy sediment will be left at the surface of the borrow area to encourage recolonization. Special conditions as described in the Final EA will be incorporated into the construction contract and a watch and monitoring program will be implemented to protect threatened and endangered species that may occur in the project area.

e. The high compatibility and low percent fines of the borrow area sediment should reduce turbidity levels during construction. A small turbidity plume is expected at the beach discharge point in association with construction activities. However, this increase is not likely to result in a violation of state water quality standards and should be temporary in nature. Temporary shore-parallel dikes will be constructed in the immediate construction area as needed to control the effluent and maximize the settling of sediments from the discharge before the waters reach the Atlantic Ocean. Significant adverse cumulative impacts to water quality should not occur as a result of this project.

f. No adverse secondary impacts which have a significant probability of occurrence were identified from either the proposed excavation or nourishment operations.

g. Overall, the environmental impacts of implementing the proposed action are expected to be minor in scope and temporary in duration.

4. Determination: I have determined that this action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, the action does not require the preparation of a detailed statement under Section 102(2)(c) of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*). My determination was made considering the following factors discussed in this EA:

a. The proposed action has been designed to minimize impacts and avoid adverse impacts to threatened or endangered species potentially occurring in the project area.

b. No unacceptable adverse cumulative or secondary impacts would result from project implementation.

c. The work has been designed to avoid impacts to any potential cultural resources in the project area.

d. No additional long term adverse impacts to the environment would be associated with the proposed project.

e. No significant impacts on air quality are expected from the proposed project.

f. The proposed action complies with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", and does not represent disproportionate high and adverse human health or environmental effects on minority populations and low-income populations in the United States.

g. The proposed action does not involve activities that would pose any disproportionate environmental health risk or safety risk to children in accordance with EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (21 April 1997).

h. No work will be performed before November 1, 2019 or after April 30, 2020, in order to avoid impacts to nesting sea turtles without obtaining approval from Georgia Department of Natural Resources, Coastal Resources Division.

5. Findings: The proposed Tybee Island Hurricanes Harvey, Irma, Maria Emergency Supplemental Funding Shoreline Protection Project would result in no significant adverse environmental impacts and is the alternative that represents sound engineering practices, adds resiliency, and meets environmental standards.

DRAFT

Date

Daniel H. Hibner, P.E.
Colonel, U.S. Army
Commanding

Tybee Island, Georgia
Hurricanes Harvey, Irma, Maria Emergency Supplemental Funding
Shoreline Protection Project
DRAFT ENVIRONMENTAL ASSESSMENT

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DRAFT March 2019

1.0 PURPOSE AND NEED FOR ACTION

The purpose of this document is to evaluate the environmental impacts of the proposed emergency supplemental beach renourishment with the incorporation of a new borrow area for the Tybee Island Shore Protection Project (TISPP) on Tybee Island, Georgia. The TISPP is a Federally-designed and constructed Coastal Storm Risk Management project to reduce risk from waves, erosion, and inundation within the project area. The proposed renourishment is in response to the storm damage Tybee Island received with hurricane Irma on September 11, 2017 and will be funded as a part of the Hurricanes Harvey, Irma, Maria Emergency Supplemental (HIM Sup).

1.1 BACKGROUND

Tybee Island is located 17 miles east of Savannah at the mouth of the Savannah River on the Atlantic Ocean. Tybee Island is Georgia's most densely developed barrier island, bordered on the north by the South Channel of the Savannah River, on the east by the Atlantic Ocean, and on the south and west by Tybee Creek and a vast tidal marsh system. Tybee Island has an average width of 0.5 miles and the ground elevation varies from 10 to 18 feet above mean lower low water[1] (MLLW) and slopes westward to the salt marshes. Figure 1 shows the location of Tybee Island.

This authorized 3.5 mile long project was initially constructed in 1974 with a 50-year project life and periodic renourishments to occur every 7 years (Figure 1). The federal footprint begins at the north terminal groin, extends 13,200 linear feet to the south terminal groin and is referred to as Tybee Front Beach. From the south terminal groin to the mouth of Tybee Creek and 1800' along Back River beach was added to the authorized project in 1998 and is referred to as Back River Beach. Tybee Beach was last renourished in 2015 and repaired in 2018. In 2019, there will be 5 years left in the project life (i.e. Federal participation). The 2015 renourishment was intended to provide material to maintain the beach and guard from potential erosion through 2024. After hurricanes Matthew in 2016 and Irma in 2017, supplemental nourishment was conducted in 2018 to add material that was lost due to storm damage. The Borrow Area Extension (BAE) of 2008 was used for the 2008 and 2015 renourishments and the 2018 hurricane repairs. Table 1 provides a history of previous beach nourishments.

[1] Project elevations for design and construction are established from NOAA tide gage Station 8670870 at Fort Pulaski, GA and based on MLLW in accordance with ER 110-2-8160 and EM 110-2-6056. Conversion from MLLW to NAVD88 at Station 9670870: +0' MLLW = +4.05' NAVD88

Figure 1: Tybee Island Shore Protection Project.

Table 1: Chronology of Recent Beach Renourishment and Erosion Control Efforts for Tybee Island.	
YEAR	**ACTION**
1975	800-ft North End Terminal Groin constructed
1975-1976	Initial nourishment. – Sand placed on the beach between North End Terminal Groin and 18th Street (13,200 feet long).
1986-1987	600-ft South End Terminal Groin constructed between 18th & 19th St. Rehabilitation of North End Terminal Groin. Sand placed from between the groins and on 1,400' of shoreline south of South End Groin.
1993	Beach material was placed on beach by Corps & Georgia Ports Authority (GPA) from Savannah Harbor deepening. The source of sand was the navigation channel.
1994	South Tip Groin Field constructed by GPA with State funds.
1995	Material placed between South End Groin and 13th Street by GPA. Sand placed within South Tip Groin Field by GPA. The original borrow area was the source of sand.
2000	Back River Groin Field constructed, initial nourishment of Back River & renourishment of South Tip & renourishment of oceanfront. The original borrow area was the source of sand.
2001 - 2004	North end groin/start of renourishment area 26,660 yd^3 accretion Second St. renourishment area 369,858 yd^3 erosion Middle Beach 25,954 yd^3 erosion South Beach (Tybrisa) renourishment area 92,620 yd^3 erosion South Tip Beach 33,685 yd^3 accretion Back River/Tybee Creek at seawall 24,428 yd^3 erosion Back River/Tybee Cr. north of seawall 27,913 yd^3 accretion Average annual 142,084 yd^3 erosion
2008	Oceanfront Beach and Back River Renourishment with material from Borrow Area Extension (BAE) 2008
2015	Oceanfront Beach and Back River Renourishment with material from BAE 2008
2016	270,000 yd^3 lost to erosion from Hurricane Matthew May 2016 – Nov 2016 462,000 yd^3 lost from Construction Template 47,000 yd^3 lost from Design Template
2017	Nov 2016 – May 2017 144,000 yd^3. lost natural erosion 156,000 yd^3. lost Hurricane Irma May 2017 – Sep 2017 840,000 yd^3 lost from Construction Template 68,000 yd^3 lost from Design Template
2018	Oceanfront Beach Renourishment with material from BAE 2008

1.2 SCOPE AND AUTHORITY

The Federal TISPP was authorized in June 1971 by Senate and House resolutions pursuant to Section 201 of the Flood Control Act of 1965 (Public Law (PL) 89-298), as presented in House Document No. 92-105, for a life of 10 years. Section 201 provided a procedure for authorization of projects with, at that time, an estimated Federal first cost of construction of less than $10 million. The authorizing language reads as follows:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That pursuant to the provisions of Section 201 of Public Law 298, Eighty-ninth Congress, (79 Stat. 1073; 42 U.S.C. 1962d-5) the project providing for beach erosion control on Tybee Island, Georgia, is hereby approved substantially in accordance with

the recommendations of the Secretary of the Army and the Chief of Engineers in House Document Numbered 105, Ninety-second Congress, at an estimated cost of $404,000."

The authority for Federal participation in periodic nourishment of beach projects was increased from 10 years to 15 years by Section 156 WRDA 1976, which reads as follows:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to provide periodic beach nourishment in the case of each water resources development project where such nourishment has been authorized for a limited period for such additional periods as he determines necessary but in no event shall such additional period extend beyond the fifteenth year which begins after the date of initiation of construction of such project."

Section 934 of WRDA 1986 modified Section 156 of WRDA 1976 by extending the authority for Federal participation in periodic nourishment from 15 years to 50 years and reads as follows:

"Section 156 of the Water Resources Development Act of 1976 (42 U.S.C. 1962d-5f) is amended by striking out "fifteenth" and inserting in lieu thereof "fiftieth."

Following the passage of WRDA 1986, a "Section 934" report was prepared which concluded that the authorized Federal project for Tybee Island was economically feasible under the current policy and economic guidelines, and the project should be extended for the remaining life of 30 years (from 1994). The study was initiated in 1990, completed in October 1994 and the "Tybee Island Beach Erosion Control Project, Section 934 Reevaluation Report" was approved in June 1995. Accordingly, the project life of the Tybee Island project was established in September 1974, with the initiation of construction of the North Terminal Groin and Federal participation in the project cost sharing. The project will terminate in September 2024.

The TISPP was further modified by Section 301 of WRDA 1996, which amended the authorized project as follows:

"The project for beach erosion control, Tybee Island, Georgia, authorized pursuant to section 201 of the Flood Control Act of 1968 (42 U.S.C. 1962d-5; 79 Stat. 1073-1074) is modified to include as an integral part of the project the portion of Tybee Island located south of the existing south terminal groin between 18th and 19th Streets, including the east bank of Tybee Creek up to Horse Pen Creek."

By letter dated 14 March 1997, Headquarters, US Army Corps of Engineers (HQUSACE) authorized a study to determine if the South Tip Beach and Tybee Creek up to Horse Pen Creek should be added to the authorized TISPP. The "Special Report on South Tip Beach/Tybee Creek" was completed in May 1998 in response to this authority and was approved by HQUSACE in August 1998. The report recommended

extending the southern limits of the authorized project for an additional 1,100 feet to provide protection for structures along the South Tip and another 1,800 feet to provide protection to the eastern bank of the Back River/Tybee Creek. Another name for Tybee Creek is Back River. Both names are used throughout this report due to the long history of addressing this area by both names.

The TISPP, City of Tybee Island, Chatham County, Georgia, HIM Sup was authorized in the Bipartisan Budget Act of 2018 (PL 115-123), Division B, Subdivision 1, Title IV. PL 115-123 provides Construction funding to address emergency situations at Corps of Engineers projects, and to construct, and to rehabilitate and repair damages caused by natural disasters to Corps projects.

Future Study Authority:

Currently a Beach Renourishment Evaluation Study is taking place evaluating the feasibility of extending the period of nourishment an additional 15 years beyond the 50 year completion of the TISPP. Section 1037 of WRDA 2014 extending the authority for Federal participation in periodic renourishment an additional 15 years beyond the 50 year completion reads as follows:

"to provide that, at the request of the non-Federal interest, the Secretary shall carry out, for any coastal storm risk management project for which periodic renourishment is authorized for a maximum period of 50 years, a study to determine the feasibility of extending the period of nourishment for a period not to exceed 15 additional years beyond the 50 year maximum period of federal participation in cost shared renourishment"

1.3 PROJECT COOPERATION AGREEMENT

On 6 May 1999, the Department of the Army and the City of Tybee Island, Georgia entered into a Local Cooperation Agreement. The project cost-share is 60.7% Federal and 39.3% non-Federal.

1.4 PROJECT GOALS AND OBJECTIVES

The overall objectives of the renourishment project are to replenish the volume of sand lost since the last nourishment of the project shoreline due to storm events, increase the storm protection function of the beaches, and to maintain or improve resiliency of the beaches within the project limits and over the project's lifetime.

1.5 PROJECT DESCRIPTION

A description of the authorized project can be found in section 1.1 of this document (Figure 1).This section describes the construction being planned under the HIM Sup funding.

Project elevations for design and construction are established from NOAA tide gage Station 8670870 at Fort Pulaski, GA and based on MLLW in accordance with ER 110-2-8160 and EM 110-2-6056. Conversion from MLLW to NAVD88 at Station 9670870: +0' MLLW = +4.05' NAVD88.

Previous investigations have found that dunes within the federal footprint would protect the Federal investment, improve the storm protection benefits, decrease maintenance costs, and delay the need for subsequent renourishment projects (USACE 1988, USACE 1994). Historic erosion rates across the beach profile have shown high erosion in areas known as "hot spots" (Figure 2). The following is a quote from the Section 905(b) Study, dated Sept. 2004, "Since 1975, over 6.9 million CY of sand have been placed along Tybee's shoreline. The net erosion rate estimated for the beach erosion control project is approximately 78,000 CY/yr. However, hot spots alone that occur primarily at Second Street lose over 125,000 CY/yr". These hot spots create areas that are vulnerable to storm surge. This can cause damage to infrastructure, existing dunes and breaches in the design template.

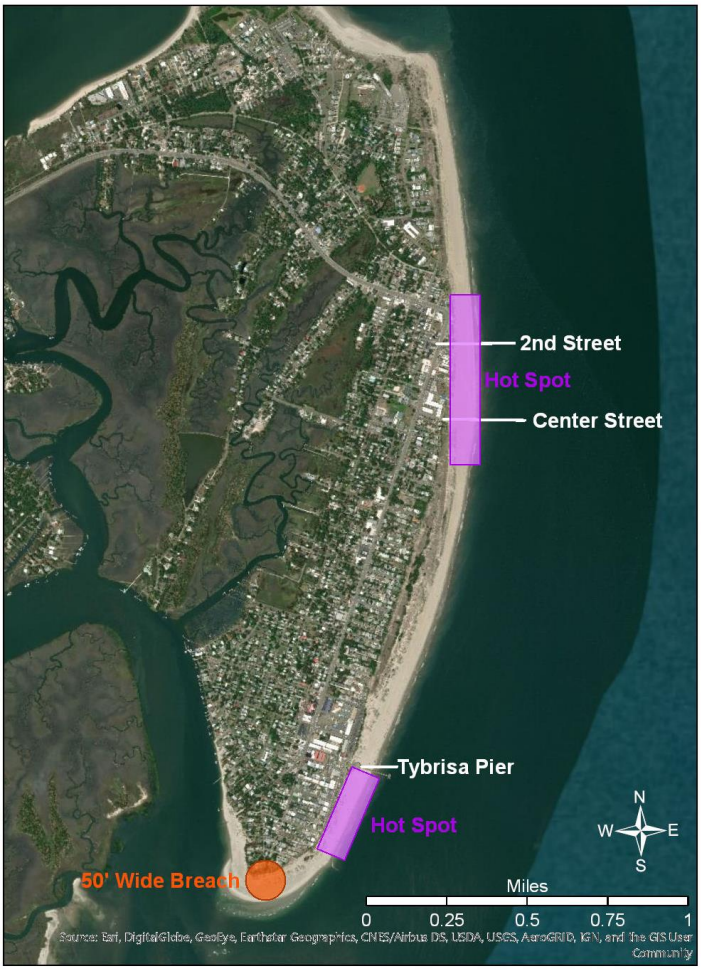


Figure 2: Tybee Island erosion hotspots.

As proposed, the project will be constructed using a hydraulic cutterhead pipeline dredge and support equipment. A submerged pipeline will extend from the borrow site to the southerly tip of Tybee Island. Submerged pipeline shall rest on the ocean bottom and will not move. Shore pipe will be progressively added to perform fill placement along the shorefront or creekfront areas to be renourished. Temporary toe dikes will be utilized in a shore parallel direction to control the hydraulic effluent and reduce turbidity. The sand will be placed in the form of varying design templates based upon longshore volumetric fill requirements which reflect beach conditions at the time of construction. Additional beach fill will be strategically placed in areas of documented highest erosional stress "hot spots" (**Error! Reference source not found.**). Existing dunes are minimal in the hot spot areas.

South Tip Beach incurred a 50' wide breach (**Error! Reference source not found.**) in the berm after Hurricane Matthew along with erosion to existing dunes. Surveys after Hurricanes Irma showed an increase in the breach and continued erosion of the dunes. A field examination in October of 2018 shows the breach has exposed the dunes to continuous erosion from wave action.

The project template design is based on project performance and erosion rates since the last renourishment project in 2018. Areas include the North Beach (North End Groin to Oceanview Court), Second Street area (Oceanview Court to Center Street), Middle Beach (Center Street to 11th Street), South Beach (11th Street to South End Groin), and South Tip Groin Field. Fill will be placed within these areas to provide a more stable beach profile. Beach widths on the Oceanfront Beach will vary from a 25-foot width berm, to a berm approximately 350 feet wide at the elevation of +11.2 MLLW. Based on natural angle of repose on the existing beach, and experience with previous placement, a beach slope of 1 vertical on 25 horizontal will be required on the oceanfront beach (Figure 3).

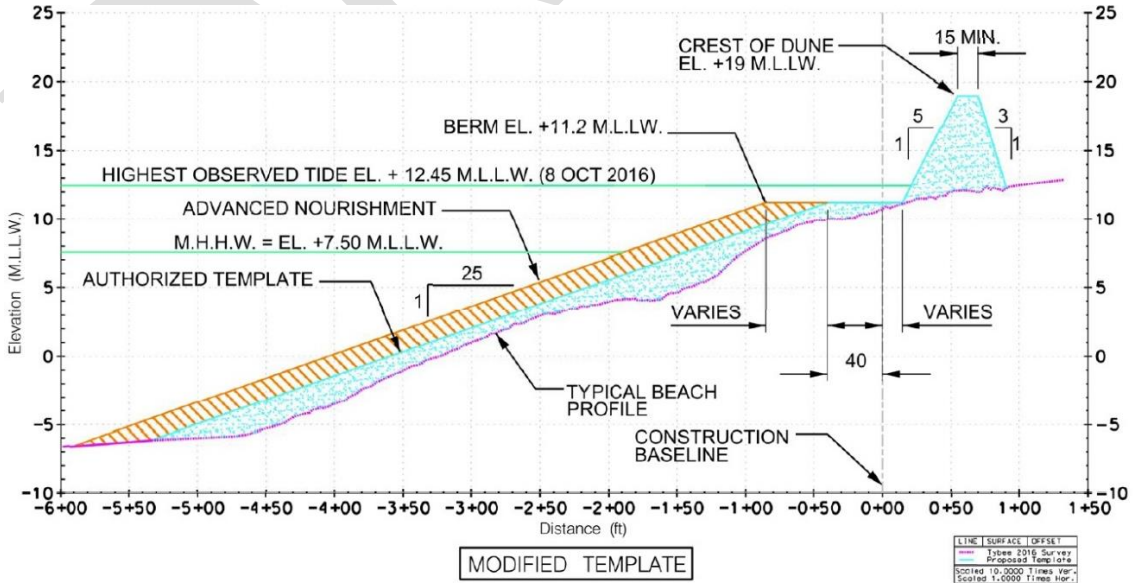


Figure 3: Project Template.

A substantial dune system exists from stations 00+00 to 35+00 and from 55+00 to 110+00 (Figure 4). The area between stations 35+00 to 55+00, in the proximity of Center Street, and stations 110+00 to 125+00, south of Tybrisa Pier, are known as the "hot spots". Stations 35+00 to 55+00 historically has had the highest erosion rate on the project and no dunes exists in this area. Stations 55+00 to 110+00 has a high erosion rate and before Hurricane Matthew a substantial dune system existed in this area. Major storm and meteorological events since 2016 have caused the dunes in this area to erode into the berm.

The proposed sand source for this renourishment is the 2019 BAE (Figure 5). The original borrow area is located approximately 4,000 feet southeast of the southernmost Federal terminal groin. The borrow site limits need to be extended, principally in a northerly direction, since the volume of sand remaining within the previously permitted area was deemed insufficient to construct the 2019 HIM Sup renourishment project in its entirety. Extension of the borrow site in a northward direction was selected to avoid potential impacts to Little Tybee Island CBRA Unit No.1 to the south. Additionally, expansion of the borrow site to the east was not pursued due to the silty nature of the material to the east (i.e. seaward) of the previously authorized borrow site.

In order to support the expansion of the previously defined borrow site, geotechnical, environmental and cultural resources investigations were conducted for the proposed borrow site expansion. An updated hydrographic survey data for the borrow site was performed in August 2018. Sediment compatibility analyses were performed for the proposed borrow site expansion area. The geotechnical evaluation demonstrated that the sediment characteristics were typical of ebb tidal shoal and highly compatible with the existing beach sediments of Tybee Island (Section 2.2.4 of this EA).

The Northwest facing side of the 2019 BAE is ~3,090 feet (long edge toward Tybee). The Northeast facing side of the 2019 BAE is ~6,800 feet (long edge facing the Savannah River navigation channel). The East facing side of the 2019 BAE is ~7,160 feet (long edge facing the ocean.) The total area of the 2019 proposed BAE is ~625 acres. Total area of the 2015 borrow area was ~213 acres. Total area of the 2008 borrow locations was ~256 acres. Total of yellow "original borrow area limits" was ~290 acres. The total area of the whole borrow area, including the 2019 extension, is ~1,340 acres. The borrow area is further discussed below in Section 2.4.4.

Beach fill final placement will be based on physical conditions and funds available at the time of construction. Alternative bid schedules will be used to optimize the quantity of beach fill placed for the funds available. The proposed project is expected to commence by November 2019, and be completed by April 30, 2020.

All lands needed for construction of the TISPP are sponsor owned. The State of Georgia granted a perpetual easement to the City of Tybee Island for the planning, construction, installation, operation, maintenance, repair and renourishment of

beachfront lands claimed by the State of Georgia. The City of Tybee Island and the State of Georgia entered into a Non-Exclusive Intergovernmental Mineral License for the life of the project to allow for the removal of sand from the offshore borrow areas. The existing Mineral License will be amended once again for the expansion of the off shore Borrow Area to supply material for this HIM Sup renourishment. Except for the amendment of Mineral License, there are no additional real estate requirements for this project. See Appendix G.

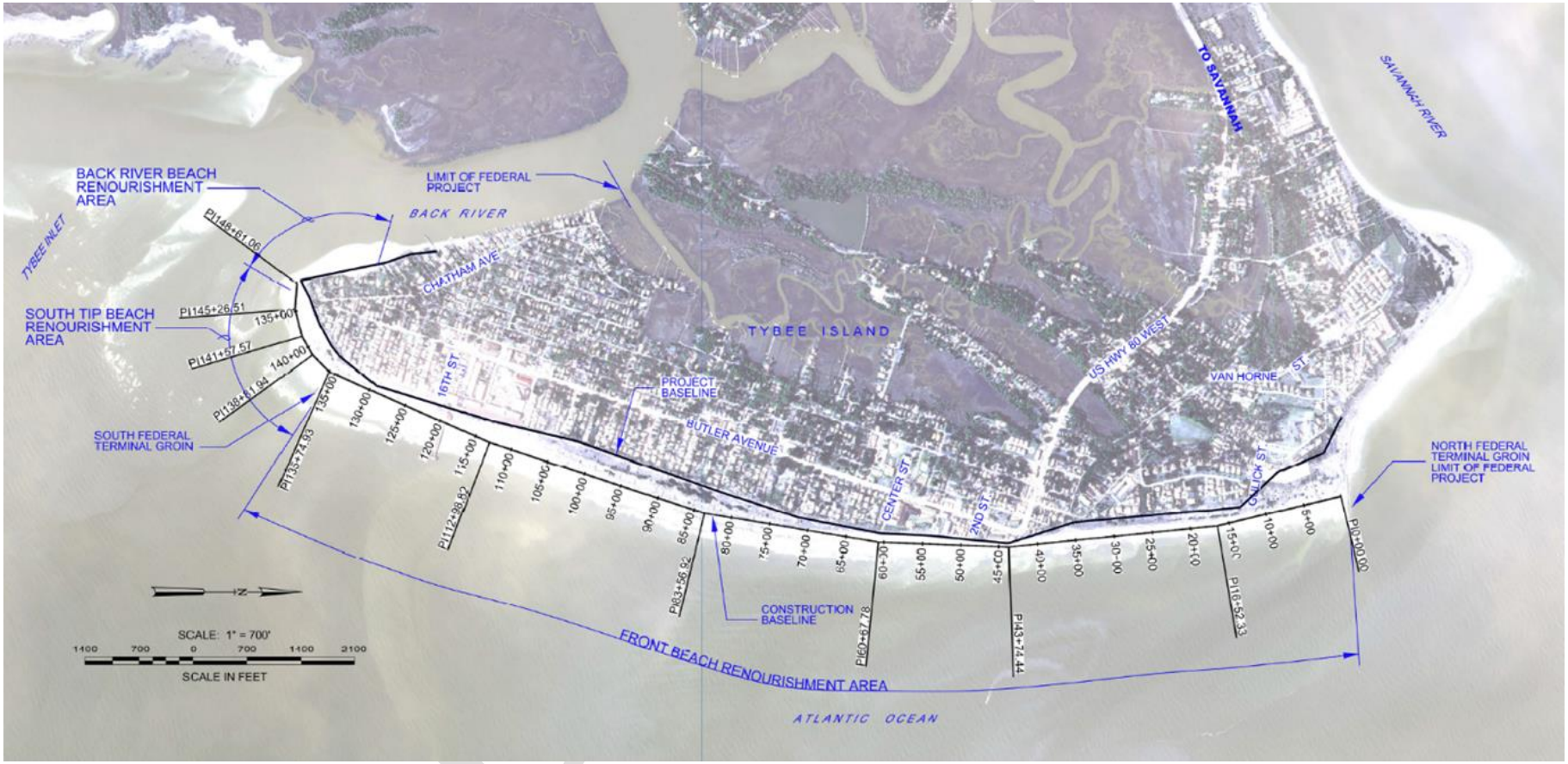


Figure 4: Project Features

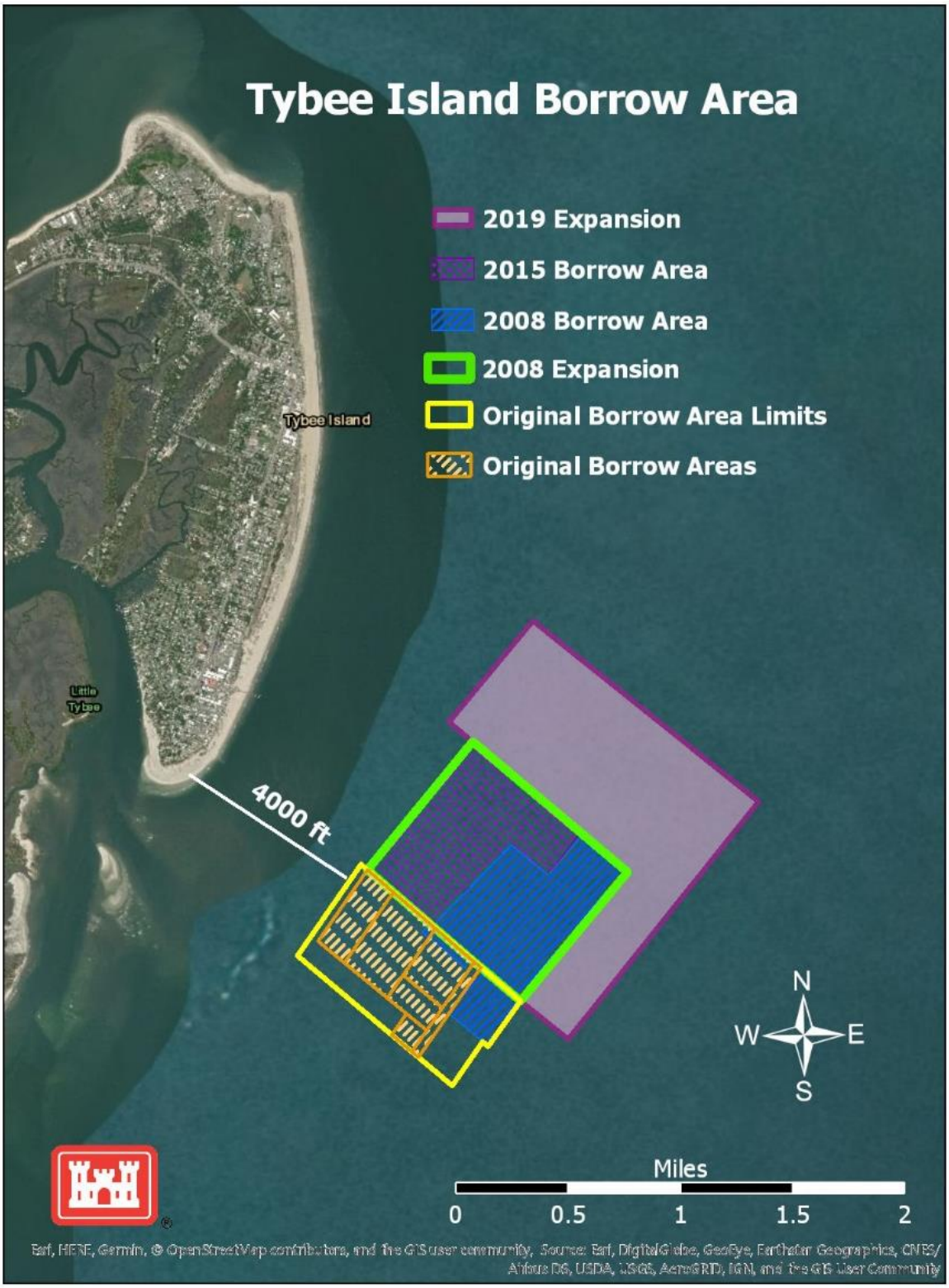


Figure 5: Tybee Island Borrow Area History and Planned Expansion

2.0 EXISTING ENVIRONMENT

Tybee Island is one of a series of barrier islands lying along the Atlantic coast from Florida to North Carolina. The island is located directly south of the Savannah River entrance, about 17 miles east of the city of Savannah, Chatham County, Georgia. It is bounded on the north by the Savannah Harbor, to the east by the Atlantic Ocean, and on the south and west by Tybee Creek and a vast tidal marsh system. The major portion of the land mass above high tide is occupied by the City of Tybee Island. The City of Tybee Island is the only population center on the island with the major portion of its economy primarily oriented toward support facilities which service summer vacationers. The project area includes the area highlighted in Figure 1. Wetlands and Hardgrounds were considered in this analysis but there are none within the project area.

2.1 CLIMATE

The climate of Tybee Island is warm and temperate. On average, Tybee Island has 212 sunny days with the summer high averaging 89ºF and the winter low averaging 42ºF. Tybee Island averages 53 inches of rainfall a year. The dry months occur November through February. The largest portion of rain falls during the wet summer months of June through September. In general the mid afternoon thunderstorms common in the area supply the majority of the rain during the wet months with hurricane conditions causing heavy rainfall in September. Hurricanes tend to follow the path of warm water along the Gulf Stream, putting the Georgia coast in the most common path for storms. Climate change is predicted to impact Tybee Island by increasing rainfall, increasing risk of hurricanes due to warming ocean temperatures and sea level rise. The National Oceanic and Atmospheric Administration (NOAA) Sea level rise site (NOAA 2018) for the region includes a current sea level rise rate of 2.98 mm/yr (~1.2 in/yr) at Fort Pulaski located 3 miles west of Tybee Island.

2.2 PHYSICAL LANDSCAPE

The coastal barrier islands of Georgia are erosional remnants of Pleistocene coastal sand bodies extending from the mainland toward the Atlantic Ocean. Characteristic development includes oceanward frontages of beach dune ridges constructed during the present or Holocene high sea level stand. The extremely wide, shallow and gently sloping continental shelf, a shortage of sand available for coastal deposition, and the rise in sea level are the major geologic factors controlling deposition on these islands. Periods of seaward growth and periods of erosion are evident and islands experience spit-type migration adjacent to the major tidal inlets rather than landward migration. The ridge and swell topography sometimes supports isolated or perched wetlands within the dune system. Sand, wind, and vegetation interact to form coastal dunes.

2.2.1 Dunes and Berm

Historically dune areas on Tybee Island have been replaced by sea walls and revetment. Construction of residences, hotels and other businesses has removed much of the natural areas on the island. Efforts to construct dunes on Tybee have been locally driven. Large dunes have formed in front of sand fencing and around catwalks along the oceanfront beach intermittently between 2nd street and the South end. Dunes have also formed along Back River. Dunes currently occur discontinuously along approximately 80% of the landward side of the federal project footprint (Figure 4). Dune areas exist mainly on the central portion of the oceanfront beach and the north end of the island. The average height of Tybee Island dunes is approximately 18.5 feet MLLW (Range: 12-23 feet MLLW).

The Oceanfront Beach has a wide, gently sloping shelf. The Back River shoreline has a steeper grade. The natural beach slope on Back River is typically 1 vertical on 13 horizontal compared to a typical slope of 1 vertical on 20 horizontal in the intertidal zone along the oceanfront beach. Offshore depths drop off rapidly to 20 or 30 feet along the northern end of the Back River area, with a more gradual transition to the south. A design beach slope of 1V:15H will be used for construction and has performed effectively during previous renourishments in this area. The average elevation of the berm is 11.2 feet MLLW.

2.2.2 Erosion

History. Overall longshore transport for Tybee Island is from North to South. At the Second Street Beach there is a nodal point and material is also transported to the north. Material from the beach moves to the offshore bar on the south end of the island and eventually to barrier islands south. There has not been documented shoaling in any navigation channels due to the renourishment.

Oceanfront Beach. Erosion along the Oceanfront beach has been well documented (Oertel et.al., 1985). Prior to Hurricane Matthew in 2016, the area had been spared of any major hurricanes during the past 100 years. During that time period, major forces dictating the shoreline position have been seasonal storms. Generally, northeasterly storms have caused the most damage, while low pressures storms approaching from the southeast typically have resulted in accretion due to movement of sand from offshore bars onto the beach. The shoreline position varied greatly prior to construction of shore stabilization projects. In efforts to control erosion on the oceanfront, numerous groins and revetments have been constructed as well as a sea wall constructed between 1936 and 1941. This sea wall has a top elevation of 12.2 feet above MLLW. Although the seawall has provided some protection of property, it has also caused additional lowering of the beach profile due to reflected wave action.

South Tip Beach. After initial monitoring studies indicated rapid erosion occurring adjacent to the south end of the island following the first Federal renourishment project on Tybee Island between 1974 and 1976, specific studies were undertaken in the inlet to determine the cause (Oertel 1979, Posey and Seyle 1980). Later studies conducted

by the Engineering and Research Development Center (Smith, 2008) found that erosion is occurring on the northern end of the island and accretion on the southern end, with 73% of the erosion to the shoreline and shelf being caused by the Savannah Harbor Shipping Channel and the rest due to natural processes. The project dredging maintains the channel position for navigation safety and efficiency but cuts off the natural sand bypassing mechanism. Construction of jetties and channel dredging generally causes deflation of the ebb shoal and eventual downdrift erosion (Smith, 2008). Natural erosional processes include the concentration of wave energy at the south end of the island, the seasonal production of wave-induced coastal currents flowing toward the Tybee Inlet throat, and the asymmetrical tidal flow which produces a strong flood dominated channel adjacent to the south end of Tybee Island. This flood dominant channel at the south tip of the island is evident in aerial photographs as well as an ebb dominant channel close to the Little Tybee Island shoreline.

Back River. Historic aerial photographs of the Back River Beach area show cyclic erosion and accretion cycles similar to that which has been found on the oceanfront. Evidence of previous efforts to control erosion in this area include the seawall which extends approximately 500 feet into the Back River as well as a series of deteriorated wooden groins which were built between 1931 and 1941. Private property owners have attempted to protect the shoreline by placing relatively small stone ranging in size from 6 inches to 18 inches. It is estimated that a one-year storm would cause failure of the rip-rap. Results of the first year monitoring effort after the South Tip Beach field groin construction by the City of Tybee Island, are contained in the report by Erik Olsen and associates, "Tybee Island, Georgia, 1-Year and 2-Year Shoreline Monitoring Reports, August 1996 and in the interim 18-month monitoring report (April 1997). Approximately 64,000 cubic yards (cy) of sand eroded from the Back River Beach during the first 12 months after groin construction. An additional 49,200 cy of material was accreted in the groin cells along the South Tip Beach during the same period of time (USACE 1997).

Little Tybee Island. The direction of longshore transport at the south end of Tybee Island is from the north to the south and the borrow area used for the first nourishment in 1976 was filled with migrating sand prior to beginning the renourishment in 1987. In 1978, the Savannah District conducted a study of the south end of Tybee to determine flow rates through the shoal area (Oertel et.al., 1985). At that time it was determined that the flood dominant channel along the beach and the ebb dominant channel between the shoals and Little Tybee provided the transport mechanism for feeding sediments to the shoal system in the inlet. This condition would also provide sediment for accretion on Little Tybee Island as long as there was a sediment source adjacent to the flood dominant channel. Olsen's monitoring report (1996) showed that erosion along the northern shoreline of Little Tybee Island has occurred during the monitoring period possibly due to migration of the ebb dominant channel at the mouth of Back River towards the south.

The dynamics of Tybee Inlet transformed the seaward face of Little Tybee Island from a marsh-front shoreline to a sandy beachfront (Erik Olsen memo to Larry Lyons dated

September 12, 1997). This large scale morphological change resulted from the landward migration of a major shoal feature and ultimate "welding" of the shoal to the existing shorefront of Little Tybee Island between 1945 and 1961. The process both closed and infilled a relatively significant tidal channel which had existed between the shoal and Little Tybee Island. The location, size and orientation of the main and secondary channels which carry most of the flow between Back River and the Atlantic Ocean changed continually. Flow directionality, both into and out of Back River, is influenced by these features which tend to serve as conduits through the ebb tidal platform. No discernible cause and effect relationship between ongoing shoreline protection projects at Tybee Island and measured shoreline changes at Little Tybee Island has been made or expected (Erik Olsen memo, September 12, 1997). This report concluded that the continued surveying of Little Tybee Island contributed little benefit to the overall monitoring study of Tybee Island. It was recommended at the time to discontinue monitoring of Little Tybee Island in the future (Erik Olsen memo, September 12, 1997). Table 1 lists a chronology of erosion control projects preformed on Tybee Island, Georgia.

Physical Factors Impacting Erosion. There are basic physical factors that will continue to influence erosion despite the past attempts to reduce or control beach erosion at Tybee Island. Primary influences on the morphology of Tybee Island include wind, tidal fluctuations, tidal currents, proximity of the beach to the Savannah Harbor shipping channel, and nearshore waves.

Winds. The predominant winds of higher velocity are from the westerly quadrant, while the prevailing winds of greater duration are from the northeasterly quadrant.

Wave and Currents Climate. Ocean swell and sea data indicate that the duration of both seas and swells of all magnitudes are greatest from the southeast. The wave directions range from northeasterly to southerly.

Tides. The mean tidal range at Tybee Beach is 6.8 feet, and the spring range is 9.0 feet. Tidal records at the Fort Pulaski gage near the mouth of the Savannah River show a maximum reading of 19.88 feet MLLW during 2016's Category 1 Hurricane Matthew. Tides of 13 feet MLLW are frequently recorded at the Fort Pulaski gage. More recently, the peak tide level reached in association with Tropical Storm Irma on September 11, 2017 was 19.56 feet MLLW. Prior to Matthew and Irma, the record peak tide level reached was 18.18 feet MLLW in 1947 when an unnamed Category 2 hurricane made landfall near Ossabaw Island, GA. The mean tidal range at Back River entrance is 6.8 feet and the diurnal range is 8.0 feet. Tidal currents during maximum ebb and flood tides range from approximately 1.5 to 2 feet per second and generally are swifter in the center of the creek.

2.2.3 Sediment Characteristics – Berm and Intertidal Beach

In November 2018, 14 samples of the native beach sediment were collected from the same locations used during previous borrow area expansions in 1998 and 2007 (Table 2). It is important to note that although the existing beach sediment is referred to as "native", it is actually the result of several previous renourishment projects from different borrow areas. One sample each was collected from the beach berm and from the intertidal beach at 7 sampling locations. Samples were transported to the USACE Environmental Material Unit in Marietta, Georgia for laboratory testing. Samples were washed and sieved according to ASTM Method D422. In addition, the Munsell color was determined by ASTM Method 1535, and the visual shell content was estimated.

Table 2: Native beach sample locations, consistent with 2007 geotechnical investigation.

Station ID	Northing (ft)	Easting (ft)	Location
1	725578	1063583	Back River Groin Field
2	726363	1065277	17th Street Beach Access
3	729308	1066513	11th Street Beach Access
4	732106	1067159	6th Street Beach Access
5	733805	1067170	2nd Street Beach Access
6	735184	1067080	2nd Avenue Beach Access
7	737462	1066852	Gulick Street

Sediment characteristics varied along the beach. Sediment characteristics of the native beach material are listed in Table 3 and shown in Figure 6. In general, the native beach sediment consisted of light gray to very pale brown, moderately to poorly graded, fine to medium sized sand with an average shell content of approximately 4.5%. Mean grain size ranged from 0.18 to 0.63 mm, with an average value of 0.32 mm (Table 3). Samples with relatively high mean grain size also had relatively high shell content, indicating that the larger fraction of sediment is generally made up of shells. Sorting coefficients ranged from 0.33 to 1.29 phi, with an average value of 0.87 phi. The percentage of fines (i.e. sediment passing the No. 200 sieve) was less than or equal to 1% for all samples. The range of grain size distributions. In general, the mean grain size, sorting coefficient, and percentage shell content were greater on the north-beach than on the south-beach, however these values were greatest at the mid-beach sample location (6th street). The trend of coarser, well graded sand at the north-beach, and finer, poorly graded sand at the south-beach was also observed in the 2007 study and likely reflects greater erosion at the north-beach. Mean grain size and sorting were fairly consistent between the berm and the intertidal beach, however the average shell content was slightly greater for the intertidal beach (5.8%) than for the berm (3.3%)

Native beach material from the 2018 study was slightly finer (mean grain size of 0.30 mm) than native beach material from the 2007 study (mean grain size of 0.35 mm). The 2018 native beach material was more poorly graded (well sorted) than the 2007 study, with an average sorting coefficient of 0.87 phi compared to 1.31 phi. In addition, the average shell content in 2018 (4.5%) was less than in 2007 (12.6%).

Table 3: Sediment characteristics of the native beach material from 2018 sampling.								
Sample Location	**Mean (mm)**	**Mean (phi)**	**Median (mm)**	**Median (phi)**	**Sorting coeff. (phi)**	**% Shell (est.)**	**% Fines**	**Color**
Gulick Street - Berm	0.46	1.11	0.49	1.04	1.11	4.50	0.60	10YR-7/2 & 7/4
Gulick Street - Intertidal Beach	0.24	2.03	0.22	2.16	0.82	5.40	1.00	10YR-6/1 & 7/4
2nd Avenue - Berm	0.31	1.69	0.24	2.06	1.20	6.90	0.70	10YR-7/1
2nd Avenue - Intertidal Beach	0.44	1.19	0.34	1.54	1.45	13.20	0.40	10YR-7/2 & 7/4
2nd Street - Berm	0.24	2.07	0.21	2.24	0.90	6.40	0.40	10YR-7/1
2nd Street - Intertidal Beach	0.18	2.47	0.18	2.45	0.36	0.00	1.00	10YR-7/1
6th Street - Berm	0.35	1.51	0.35	1.53	0.97	2.60	0.50	10YR-7/1
6th Street - Intertidal Beach	0.63	0.67	0.68	0.57	1.29	10.00	0.20	10YR-7/2 & 7/4
11th Street - Berm	0.36	1.46	0.34	1.54	1.10	2.10	0.30	10YR-7/2 & 7/4
11th Street - Intertidal Beach	0.51	0.98	0.51	0.99	1.15	11.70	0.50	10YR-7/2 & 7/4
17th Street - Berm	0.21	2.22	0.20	2.31	0.60	0.40	0.30	10YR-7/1
17th Street - Intertidal Beach	0.19	2.37	0.19	2.37	0.44	0.00	0.70	10YR-7/1
Back River - Berm	0.19	2.43	0.19	2.43	0.33	0.00	0.20	10YR-7/1
Back River - Intertidal Beach	0.19	2.37	0.19	2.37	0.39	0.30	0.10	10YR-7/1
Average of All Samples	0.30	1.75	0.28	1.83	0.87	4.54	0.49	
Berm Average	0.29	1.78	0.27	1.88	0.89	3.27	0.43	
Intertidal Beach Average	0.30	1.73	0.29	1.78	0.84	5.80	0.56	
North Beach Average	0.30	1.76	0.27	1.92	0.97	6.07	0.68	
Mid Beach Average	0.47	1.09	0.48	1.05	1.13	6.30	0.35	
South Beach Average	0.25	1.97	0.25	2.00	0.67	2.42	0.35	

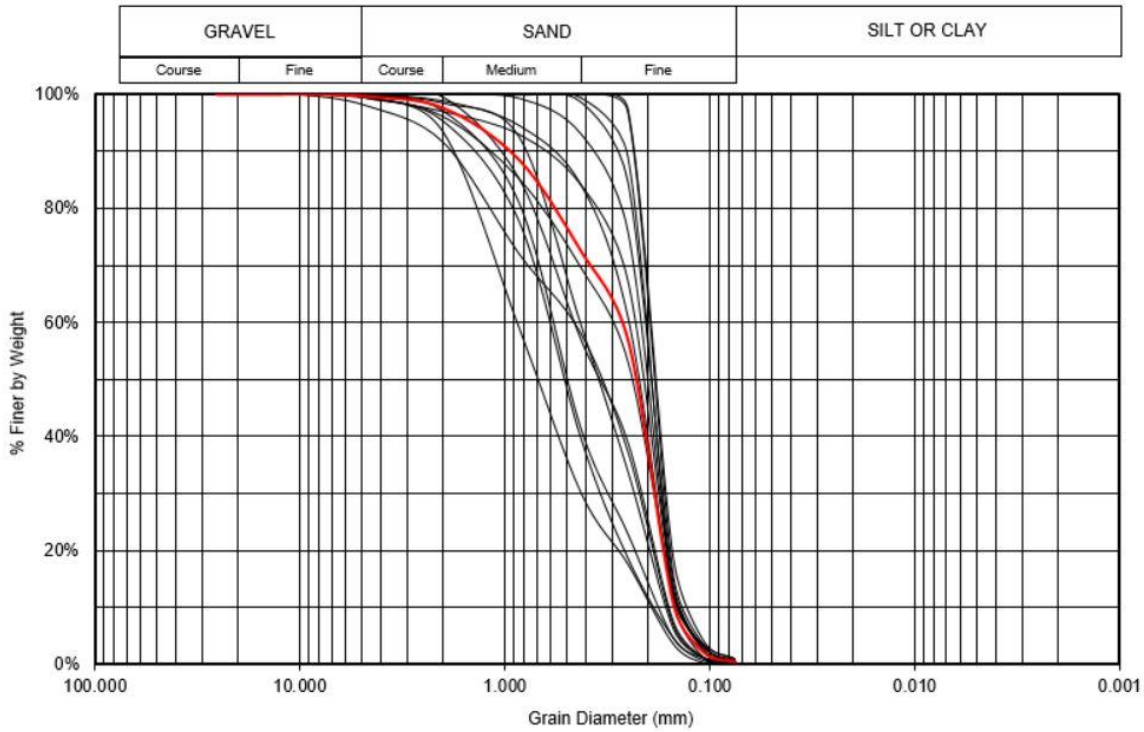
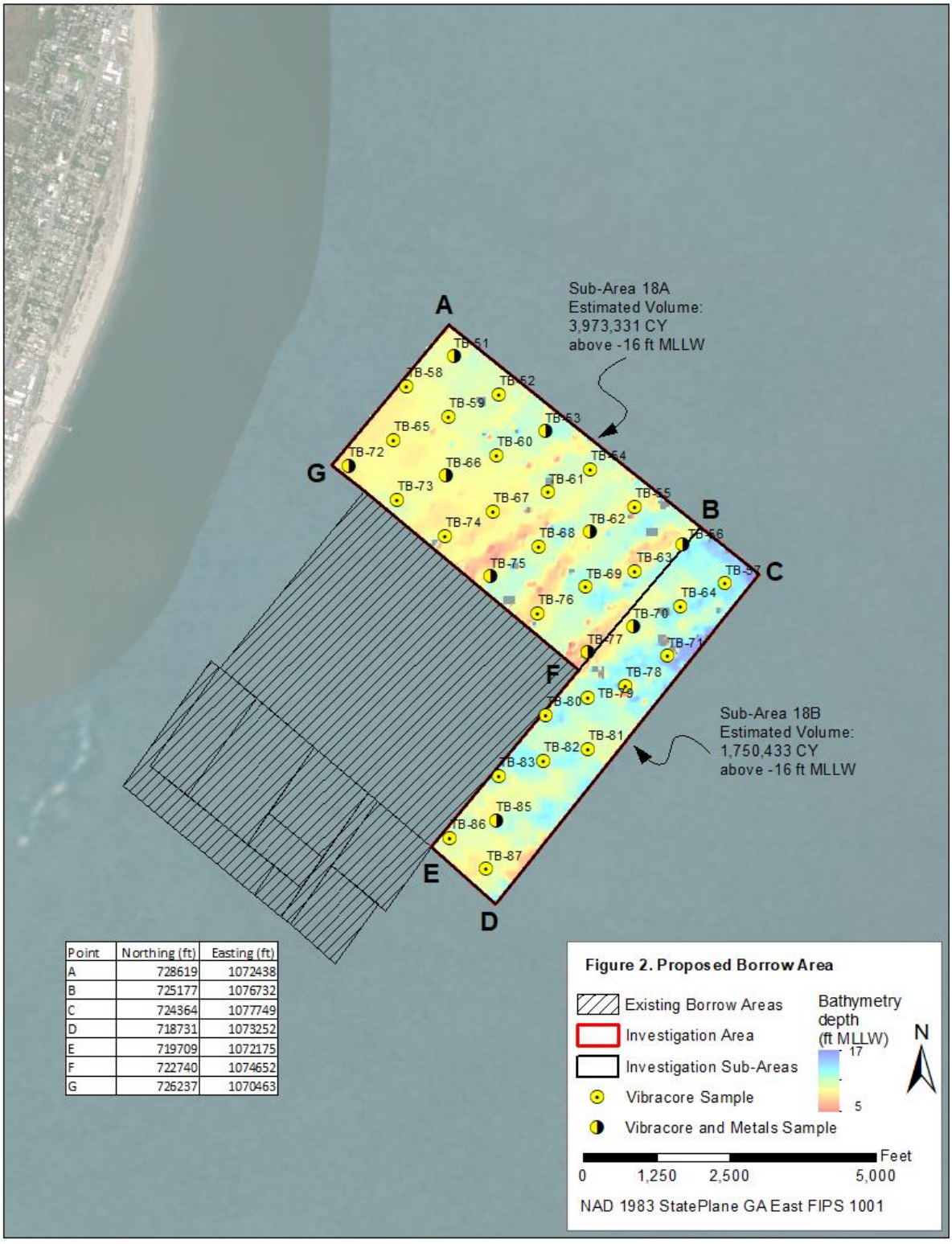


Figure 6: Grain size distribution of native beach sediment samples from 2018. The average value is shown in red.

2.2.4 Sediment Characteristics – Borrow Area

Material to be placed on the beach will be obtained from an offshore borrow area located approximately one mile off the coast of Tybee Island (Figure 7) with an average depth of approximately –10.3 feet MLLW ranging from -5 to -17 feet MLLW. The proposed offshore borrow site is an expansion of a presently defined and permitted area utilized for construction of the 2008, 2015, and 2018 Tybee Island renourishment projects. The borrow area is located adjacent to, and to the northeast of the existing borrow areas. Sediment in the proposed borrow area was characterized using hydrographic survey, vibracore borings, and materials testing. In general, approximately 5.72 million cubic yards (MCY) of beach-compatible sand is readily available above an elevation of -16 feet MLLW. The cut depth of -16 feet MLLW is consistent with adjacent borrow areas and would be the scenario most likely to maximize the volume of beach-compatible material while minimizing the likelihood of disturbing layers of sediment with greater than 10% fines content. The compatible sand above -16 feet MLLW ranges in thickness across the study area from approximately 2 to 10 feet thick.

The offshore borrow site was divided into two sub-areas based on proximity to the beach and estimated thickness of beach-compatible material. These sub-areas are shown in Figure 7. Greater volumes were estimated to be available in sub-area 18A (3.97 MCY above -16 feet MLLW) compared to sub-area 18B (1.75 MCY above 16 feet MLLW). A summary of sediment characteristics for the proposed borrow area is provided in Table 4. In general, the sediment consists of light gray to light brownish gray, well graded (poorly sorted), fine sized sand with a shell content of approximately 8%. The average percentage of fines (sediment passing the No. 200 sieve) was 3.27%., which is well within the state requirement of less than 10%. In addition, the shell content was within the state requirement of less than 15% of total volume. A portion of the moist samples tested were outside of the desired Munsell color range of 10YR6.5/1 to 10YR7/1, however, once the sand is placed on the beach, the color will lighten as the sediment is dried by the sun. Oven dried samples were roughly two values lighter and ranged from white to very pale brown, consistent with existing beach sediment.



Point	Northing (ft)	Easting (ft)
A	728619	1072438
B	725177	1076732
C	724364	1077749
D	718731	1073252
E	719709	1072175
F	722740	1074652
G	726237	1070463

Figure 7: Proposed borrow area with bathymetry and location of vibracore samples.

Table 4: Sediment Characteristics for composite profiles measured above -16 feet MLLW and native beach material.

Area	Median (phi)	Median (mm)	Percent Fines	Percent Shell	Mean (phi)	Sorting Coefficient (phi)	Overfill Factor	
							SPM[a]	Dean (1974)[b]
Area 18A	2.28	0.21	3.70[c]	8.23	2.05	1.19	1.40	1.20
Area 18B	2.31	0.20	2.51[c]	8.09	2.14	1.05	1.60	1.30
Entire Study Area	2.29	0.20	3.27[c]	8.18	2.09	1.13	1.45	1.25
2018 Native Beach Material	1.83	0.28	0.49[c]	4.54	1.75	0.87	--	--
2008 Borrow Area Material	2.13	0.23	0.23[d]	9.0	1.71	1.39	1.14	1.06
2007 Native Beach Material	2.02	0.25	0.05[d]	12.6	1.53	1.31	--	--

[a] Overfill factor was calculated according to the method described in the Short Protection Manual and USACE (2008)
[b] Overfill factor was calculated according to the method described in Dean (1974)
[c] Percent passing the #200 sieve
[d] Percent passing the #230 sieve

Sediment Compatibility

An evaluation of the compatibility of borrow area material above -16 feet MLLW was performed in a manner consistent with previous Tybee Island borrow area investigations (Olsen, 2008). The grain size distribution of the borrow area material was compared with the native beach material and overfill factors were determined. The overfill factor is a parameter that describes how much fill is required, taking into account the differences in grain size distribution between the borrow area and the native beach material. Application of the overfill factor assumes that borrow material placed on the beach will undergo sorting as a result of coastal processes, and over time, will approach the grain size distribution of the native material (USACE, 2008). The overfill factor is determined by comparing mean sediment diameter and sorting values of the native beach and borrow area sediments. The overfill calculation is only an approximate volume estimation, and design volumes will be based on equilibrium beach profile concepts (which take into account borrow and native material grain size) and assessment of historical erosion rates.

Two different methods were used to calculate the overfill factor: the modified Shore Protection Manual (SPM; 1984) method and the Dean (1974) method. Each method emphasizes different aspects of the grain size distributions of the borrow area and native beach. The SPM method is generally more conservative (i.e. resulting in a greater overfill factor) than the Dean (1974) method. Calculated overfill factors ranged from 1.2 to 1.4 for sub-area 18A and from 1.3 to 1.6 for sub-area 18B (Table 4). For comparison, the overfill factors from the 2008 borrow area expansion ranged from 1.06 to 1.14. The higher overfill factors for the proposed borrow area reflect that the sediment is somewhat finer (mean grain size of 0.23 mm) than both the native beach sediment (mean grain size of 0.30 mm) and sediment from the 2008 borrow area (mean grain

size of 0.31 mm). Because of this, it is recommended that an appropriate volume of overfill be added in order to account for variations in the grain size distribution of the borrow area sediment and the native beach sediment. This will likely result in dredged volumes greater than what have been needed for previous Tybee Island beach renourishment projects. A comparison of the grain size distribution of the native beach material and proposed borrow areas is shown in Figure 8.

As stated previously, the grain size distribution varies considerably between the north-beach and the south-beach. This bi-modal distribution makes it difficult to compare the average values of the borrow material to those of the native beach material. The borrow area sediment has a mean grain size (0.23 mm) that is closer to the mean grain size of the south-beach (0.25 mm) than the north-beach (0.30 mm), and a sorting coefficient (1.13 phi) that is closer to the sorting coefficient of the north beach (0.97 phi) than the south-beach (0.67 phi). Despite this uncertainty, it is important to note that previous renourishment projects have used similarly compatible material from nearby borrow areas with satisfactory results. It is expected that material from the proposed borrow area will perform similarly well to past renourishment projects.

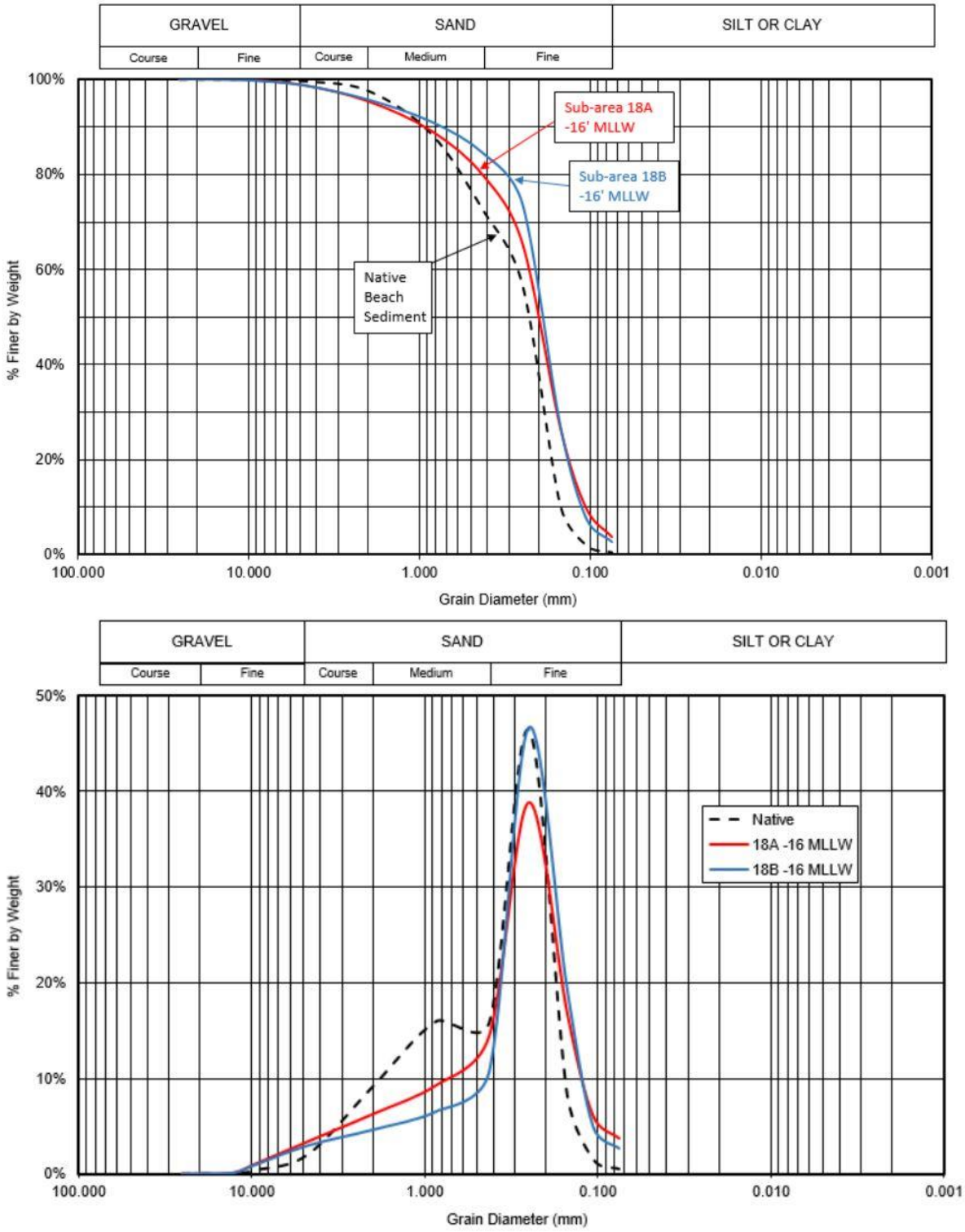


Figure 8: Grain size distribution of native beach material (black dashed line), sub-area 18A fill material (red line), and sub-area 18B (blue line).

Contaminant Testing

Sediment from the proposed borrow area was tested for heavy metals, consistent with previous borrow area investigations. In November 2018, 10 sediment samples were collected according to United State Environmental Protection Agency (USEPA) Region 4 guidance (USEPA, 2014) from selected vibracore borings at a depth above -16 feet MLLW (Figure 7). Sediment samples were transferred to laboratory provided containers and immediately stored on ice prior to shipment to the analytical laboratory. All samples were analyzed for heavy metals using USEPA Method 6010D by a National Laboratory Accreditation Program certified laboratory (Test America in Savannah, GA). A complete list of sample locations and depths is listed in Table 5.

Table 5: Sediment sample locations and elevations.

Boring ID	Northing (ft)	Easting (ft)	Sample Elevation (ft MLLW)
TB-51	728089	1072544	-13.3 to -13.7
TB-53	726814	1074107	-13.0 to -13.3
TB-56	724871	1076452	-11.9 to -12.3
TB-62	725084	1074863	-11.3 to -11.7
TB-66	726052	1072402	-11.3 to -11.7
TB-70	723463	1075605	-12.7 to -13.1
TB-72	726215	1070752	-11.8 to -12.2
TB-75	724333	1073176	-12.2 to -12.6
TB-77	723034	1074824	-7.6 to -8.0
TB-85	720160	1073263	-14.5 to -14.9

Previous sediment testing at adjacent borrow area sites have revealed no issues of concern. Similarly, no contaminants were found during the current investigation that exceed sediment ecological screening values set forth in the USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (USEPA, 2015). A summary of metals results is shown in Table 6.

Table 6: Summary of metals results.

Sample	Units	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
TB-51	mg/kg	1.2 J	0.11 U	4.7	1.8	0.0094 U	1.0 U	0.064 U
TB-53	mg/kg	1.4 J	0.10 U	3.4	0.97 J	0.0097 U	1.0 U	0.063 U
TB-56	mg/kg	2.6	0.11 U	2.3	0.99 J	0.0094 U	1.2 J	0.064 U
TB-62	mg/kg	1.6 J	0.10 U	3.3	1.4	0.0082 U	1.0 U	0.062 U
TB-66	mg/kg	1.9 J	0.10 U	3.9	1.5	0.0084 U	1.0 U	0.062 U
TB-70	mg/kg	1.2 J	0.10 U	4.8	1.8	0.0080 U	1.0 U	0.063 U
TB-72	mg/kg	4.4	0.10 U	2.9	1.3	0.0091 U	0.99 U	0.061 U
TB-75	mg/kg	0.88 U	0.11 U	3.5	1.2	0.010 U	1.1 U	0.066 U
TB-77	mg/kg	3.1	0.11 U	2.6	1.2	0.0098 U	1.1 U	0.068 U
TB-85	mg/kg	2.1	0.10 U	3.4	0.98 J	0.0094 U	0.99 U	0.061 U
Maximum Value	mg/kg	4.4	0.11 U	4.8	1.8	0.010 U	1.2 J	0.068 U
Screening Level[a]	mg/kg	7.24	0.68	52.3	30.2	0.13	NL	0.73

[a] Screening level for metals based on the Georgia Ecological Screening Value for Marine/Estuarine Sediment (USEPA, 2015).
NL – Not listed
U – The analyte was not detected at the method limit of detection
J – The analyte was positively identified; the quantitation is an estimation

2.3 WATER QUALITY

There are no known pollution sources other than storm water discharges and non-point source pollutants in the general vicinity of Tybee Island. Tybee Island waters are tested by GA DNR Coastal Resources Division personnel for enterococcus bacteria once a week from five different locations. If bacteria levels exceed state criteria, then a beach advisory or closing is issued until levels fall below threshold values. On October 10, 2018, a beach advisory was issued for Polk Street Beach on Tybee Island due to exceeded enterococcus bacteria standards with a cumulative advisory status occurring for 6 days (GA Department of Public Health, Coastal Health District). Enterococcus bacteria is found in warm blooded animals including humans but also birds, raccoons, deer, dolphins and other wildlife. It is difficult to determine exactly where the bacteria came from but some sources could include animal waste, storm water runoff, or boating waste.

Georgia's water quality standards consist of two groups of criteria: the general criteria that apply to all waters and the specific criteria based on use. The general criteria include: waters shall be free of materials, oils, and scum, associated with municipal or domestic sewage, industrial waste or any other waste which will settle to form sludge deposits, produce turbidity, color, or odor, or that may otherwise interfere with legitimate water uses; waters shall be free from toxic, corrosive, acidic, and caustic substances in amounts which are harmful to humans, animals, or aquatic life. General criteria also include acute (one time exposure) and chronic (exposure over a period of time) concentrations of metals, as well as maximum allowable concentrations of pollutants such as pesticides and other chemicals.

Specific criteria include bacteria, dissolved oxygen, pH, nutrients, and temperature. Georgia Department of Natural Resources (GA DNR) Environmental Protection Division is responsible for setting and enforcing water quality standards. The goals of establishing these standards are provided in GA's Rules and Regulations for Water Quality Control, Chapter 391-3-6-.03(2)(a).

The State of Georgia classifies all waters into categories which have different standards depending on the designated use of the water body. These uses include: (a) Drinking Water Supplies; (b) Recreation; (c) Fishing, Propagation of Fish, Shellfish, Game and Other Aquatic Life; (d) Wild River; (e) Scenic River; and (f) Coastal Fishing. Recreation designation is assigned if the water supports general recreational activities such as water skiing, boating or swimming. The littoral waters of Tybee Island are considered Recreational.

Turbidity, expressed in Nephelometric Turbidity Units (NTU), quantitatively measures the light scattering properties of the water. Turbidity levels at the project area are influenced by the Savannah River on the north, Back River on the south, and by waves and tidal action.

However, the properties of the material suspended in the water column that create turbid conditions are not reflected when measuring turbidity. The two reported major sources of turbidity in coastal areas are very fine organic particulate matter, and sand-sized sediments that are re-suspended around the seabed by local waves and currents (Dompe and Haynes 1993). Higher turbidity levels are typically expected around inlet areas, and particularly in estuarine areas, due to high nutrient and entrained sediment levels. Although some colloidal materials remain suspended in the water column upon disturbance, high turbidity episodes usually return to background conditions within several days to several weeks, depending on the duration of the disturbance (storm event, dredging, etc.or other) and on the amount of suspended fines.

Rule 391-3-6-.03(5)(d) states that all waters shall be free from turbidity which results in a substantial visual contrast in a water body due to a man-made activity. The upstream appearance of a body of water shall be as observed at a point immediately upstream of a turbidity-causing man-made activity. That upstream appearance shall be compared to a point which is located sufficiently downstream from the activity so as to provide an appropriate mixing zone. For land disturbing activities, proper design, installation, and maintenance of best management practices and compliance with issued permits shall constitute compliance with Paragraph 391-3-6-.03(5)(d).

2.4 COASTAL RESOURCES

The U.S. Congress passed the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 *et seq.*) in 1982 to address problems caused by coastal barrier development. This Act defined a list of undeveloped coastal barriers along the Atlantic and Gulf coasts and was passed to limit federally-subsidized development within a defined Coastal Barrier Resources System (Unit). The CBRA System, Little Tybee Island Sytem Unit N01, is located immediately south of the offshore borrow site at the south end of Tybee Island https://www.fws.gov/cbra/maps/effective/13-001A.pdf. The borrow site expansion was developed to avoid impacts to Little Tybee Island Unit No. 1 zone. All offshore dredging activities associated with the beach renourishment project will continue to be setback from the Little Tybee Island CBRA Zone line which extends along the southerly perimeter of the borrow site utilized in 1994 (by the Georgia Ports Authority (GPA)) and 2000 (by the USACE)

2.5 PLANT COMMUNITIES

2.5.1 Dune Communities

A descrition of the physical dune feature and location can be found in section 2.2.1 of this document. Coastal dune habitat (Figures 9 and 10) is generally categorized as primary dunes, typically characterized by sea oats, panic grass (*Panicum amarum*) and other rhizomatous grasses; and secondary dunes, which are located behind the first set of dunes and are older and more stable than the primary dune habitat. Secondary dunes support a higher diversity of plants due to the increased habitat stability and

nutrient content of the sediments. Swales, located between dune peaks, support the highest diversity of plants due to the more favorable conditions such as less wind, increased water, and higher sediment nutrient content. Foredune (part of a system of sand dunes on the side nearest to the ocean) pioneer species are normally long-lived perennials whereas drift-line pioneers are typically annual plants. The difference between life forms in the two habitats reflects the continually wind-blown, sand-disturbed and nutrient-poor foredunes and the nutrient-rich drift line that is disturbed by winter storms. Annuals may temporarily colonize foredune habitats, but they typically experience high mortality from salt spray.

Figure 9: Dunes along the central portion of the project area, just north of Tybrisa Pier. Note the shorebirds resting within the sandy area between vegetated dunes.

Figure 10: Sand fencing and signs along the central portion of Tybee Island just north of Tybrisa Pier.

The primary foredune pioneers are the herbaceous vines and grasses such as railroad vine (*Ipomoea pes-caprae*), shoreline sea purslane (*Sesuvium portulacastrum*), sea oats (*Uniola paniculata*), panic grass (*Panicum amarum*), common broomsedge, and beach pennywort (*Hydrocotyle bonariensis*) and Spanish bayonet (*Yucca* spp.). Plants found on the beach include sea rocket (*Cakile* spp.); beach hogwort (*Croton punctatus*); beach sandspur (*Cenchrus tribuloides*); salt meadow cordgrass (*Spartina patens*); sea purslane (*Sesuvium* spp.); beach spurge (*Euphorbia polygonifolia*) and seashore-elder (*Iva imbricata*). The foredune areas in the Tybee Island project area are generally dominated by sea oats, panic grass and railroad vine (i.e beach morning glory; Figure 11).

Figure 11: Pioneer plant, railroad vine (Ipomea pes-caprae), on the foredune of the South Beach dune area.

In areas along the landward side of the federal footprint where dunes do not exist, the plant community is made up of primarily *Ipomoea sagittata, Spartina patens,* rhizomatous grasses such as *Distichlis spicata,* and *Oxalis* species.

2.5.2 Invasive/Exotic Species

The introduction of non-native or invasive species can have detrimental effects on an ecosystem. As defined by Executive Order (EO) 13112 (February 3, 1999) an invasive species is an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health. EO 13112 charges the Federal government with duties to not authorize, fund, or carry out actions that it believes are

likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless. The Georgia Aquatic Nuisance Species Management Plan and may be viewed at http://www.georgiawildlife.com. The Georgia Invasive Species Advisory Committee has identified 20 exotic plant species that area serious problem in Georgia and 8 exotic plant species that pose a serious threat to becoming a problem in Georgia. No invasive plant species have been identified within the federal project footprint.

2.5.3 Protected Species

The species listed in Table 7 may be found in the general study area and have been classified as threatened or endangered pursuant to the Endangered Species Act (ESA) of 1973. As such, these species must be protected from adverse impacts that could be expected to cause damage either to the individuals or to habitat that has been found to be critical for the species' survival or recovery. Each of these species are described in detail in the Biological Assessment of Threatened and Endangered Species (BATES), Appendix B with respect to their sightings and habitat in Chatham County, Georgia.

Table 7: Federal Threatened and Endangered Plant Species.

Species	Federal	Habitat
Pondberry (*Lindera melissifolia*)	Endangered	Pond margins and wet savannas

Source: USFWS, Southern Region, 2018; Georgia State DNR Wildlife Resources Division Biodiversity Portal 2018
*No Plant Critical Habitat exists within the project area.

2.6 Fish and Wildlife Resources

2.6.1 Dune Communities

A description of the physical dune feature and location can be found in section 2.2.1 of this document. Small mammals, including mice, rice rats, moles, and rabbits, are found in and around dunes, and they are preyed on by snakes, including the Eastern diamondback rattlesnake, and birds of prey. The eastern fence lizard (*Sceloporus undulates*), six-lined racerunners (*Cnemidophorus sexlineatus*), and anoles (*Anolis carolinensis*) can be found in sandy areas including dunes and primarily feeds on insects. Dunes supply foraging and nesting habitat for shore birds - including the endangered piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*).

2.6.2 Marine Intertidal Zone

The marine intertidal, or beach areas, are inhabited by ghost shrimp, ghost crabs, hermit crabs, coquina clams, burrowing polychaete worms, and other invertebrates (Sandifer et al., 1980). The most important recreational surf fish include striped mullet, kingfish, spot, red drum, black drum, tarpon, and flounder.

Macrobenthic invertebrates inhabiting these beach areas range from species used directly by man for food, such as shrimp, crabs, oysters, and clams to other species such as polychaetes, crustaceans, mollusks, and other less well known, but valuable, species which make up the remainder of the food chain. Open water areas are populated by a variety of species of phytoplankton and zooplankton (USACE, 1998).

Species composition varies within different areas of the beach, with less species diversity occurring in the upper beach zone. The following types of organisms are typically found along sandy beaches in their respective zones: 1) upper beach: burrowing organisms such as talitrid amphipods (sand fleas), ocypodid crabs, and isopods; and transient animals, such as scavenger beetles; 2) midlittoral zone: polychaetes, isopods, and haustoriid amphipods; and interstitial organisms that feed on bacteria and unicellular algae among the sand grains; 3) swash zone: polychaete worms, coquina clams, and mole crabs; and 4) surf zone: shellfish, foraging fish and predatory birds; offshore migrating predators are most common in this zone (Trevallion et al. 1970; Thompson 1973; Reilly and Bellis 1978).

Coquina clams (*Donax* spp.) and mole crabs (*Emerita talpoida*) inhabit the wet beach. These species are a significant portion of the prey base for ecologically and economically important coastal birds and fish (Peterson et al. 2000). Field sampling was performed in July 1994 to characterize benthic invertebrates along the Tybee Island Beach Nourishment Project area for GPA (ATM 1994). *Donax* spp. and *E. talpoida* were documented in small numbers in each of the three segments of the beach that were sampled. Polychaete siphons and burrows were abundant in the surf zone (ATM 1994).

Approximately 36 species of birds regularly use the marine intertidal habitat (Sandifer et al., 1980). The majority of these birds feed on the beaches. Surveys completed 2014 through 2015 identified 48 species on Tybee Beach (Table 8).

Table 8: Bird survey results from Tybee Island completed August 2014 - August 2015.

Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
American Crow	*Corvus brachyrhynchos*	Lesser Black-backed Gull	*Larus fuscus*
American Oystercatcher	*Haematopus palliatus*	Least Tern	*Sternula antillarum*
Barn Swallow	*Hirundo rustica*	Mounring Dove	*Zenaida macroura*
Black-bellied Plover	*Pluvialis squatarola*	Northern Mockingbird	*Mimus polyglottos*
Belted Kingfisher	*Megaceryle alcyon*	Osprey	*Pandion haliaetus*
Black Skimmer	*Rynchops niger*	Pigeon	*Columbidae* spp.
Black Vulture	*Coragyps atratus*	Piping Plover	*Charadrius melodus*
Brown Pelican	*Pelecanus occidentalis*	Purple Sandpiper	*Calidris maritima*
Boat-tailed Grackle	*Quiscalus major*	Ring-billed Gull	*Larus delawarensis*
Bufflehead	*Bucephala albeola*	Redwing	*Turdus Iliacus*
Caspian Tern	*Hydroprogne caspia*	Red Knot	*Calidris canutus*
Common Loon	*Gavia immer*	Red-throated Loon	*Gavia stellata*

Double-crested Cormorant	*Phalacrocorax auritus*	Rock Pigeon	*Columba livia*
Dunlin	*Calidris alpina*	Royal Tern	*Thalasseus maximus*
Eastern Kingbird	*Tyrannus tyrannus*	Ruddy Turnstone	*Arenaria interpres*
European Starling	*Sturnus vulgaris*	Sanderling	*Calidris alba*
Fish Crow	*Corvus ossifragus*	Sandwich Tern	*Thalasseus sandvicensis*
Forster's Tern	*Sterna forsteri*	Savannah Sparrow	*Passerculus sandwichensis*
Great Black-backed Gull	*Larus marinus*	Semipalmated Plover	*Charadrius semipalmatus*
Great Egret	*Ardea alba*	Seaside Sparrow	*Ammodramus maritimus*
Green Heron	*Butorides virescens*	Snowy Egret	*Egretta thula*
Herrin Gull	*Larus argentatus*	Tree Swallow	*Tachycineta bicolor*
House Sparrow	*Passer domesticus*	Turkey Vulture	*Cathartes aura*
Laughing Gull	*Leucophaeus atricilla*	Willet	*Tringa semipalmata*

Five species of sea turtles are found in the waters along the coast of Georgia: loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), and hawksbill sea turtle (*Eretmochelys imbricata*).

Sea turtle nesting season in Chatham County extends from May 1st through October 31st. Sea turtle nesting data for Tybee Island is available from the Tybee Island Marine Science Center. During sea turtle nesting season, early morning patrols for sea turtle nesting activity along the Tybee Island project area shoreline are performed daily by trained volunteer staff (Tybee Island Sea Turtle Cooperators) under the supervision of personnel of the Tybee Island Marine Science Center. The Marine Science Center is the authorized sea turtle permit holder.

When studying nearshore softbottom communities, the influence of sediment composition on benthic community patterns has been recognized for decades (e.g., Peterson 1913; Thorson 1957) and is related mainly to feeding mode (Sanders 1958; Rhoads 1974). Infaunal assemblages are strongly associated with sediment particle size and type (Shaw et al. 1982; Byrnes et al. 1999). Cross-shelf patterns are partly due to the connectivity between depth and sediment characteristics. Depth-related changes in infauna also reflect increased environmental stability in deeper waters. The shallow shelf can be relatively severe for infaunal communities due to physical habitat instability (Day et al. 1971; Flint and Holland 1980; Tenore 1985). In addition to physical habitat stability, fluctuating food resources and the effects of seasonality also contribute to the spatial and temporal patchiness of softbottom infaunal communities (Johnson 1970; Flint and Holland 1980; Barry & Dayton 1991; McIntosh 1991). The effects of seasonality are more apparent along the shallow shelf with winter densities generally lower than other seasons (Shaw et al. 1982; Harper 1991) due to patterns in reproductive periodicity related to temperature. Reproduction is relatively stable at greater shelf depths where environmental stability promotes seasonal persistence (Warwick 1980; Schaffner and Boesch 1982).

2.6.3 Marine Subtidal Zone

The marine subtidal system include recreational fisheries for red drum, spotted sea trout, Atlantic croaker, striped mullet, saltwater catfish, spot, and kingfish. Sharks also frequent the nearshore area at Tybee. Common shark species include: bonnet head, Atlantic black tip, sandbar, tiger, nurse and lemon. There has never been a recorded shark fatality at Tybee Island.

Whale species that are visitors to the coastal waters off Tybee Island during their migration patterns include the finback whale (*Balaenoptera physalusI*), humpback whale (*Megaptera novaeangliae*), northern right whale (*Eubalaena glacialis*), sei whale (*Balaenoptera borealis*), and the sperm whale (*Physeter macrocephalus catodon*). These species could be found in transit along the Georgia coast during migrations. The bottlenose dolphin (*Tursiops* spp.) is both a nearshore and offshore species and a frequent sight swimming in the waters off of Tybee Beach.

The manatee is federally protected under the Marine Mammal Protection Act of 1972 and the ESA of 1973. The manatee was listed as an endangered species throughout its range in 1967 (32 FR 4061) and received federal protection with the passage of the ESA in 1973.

During the winter months, most manatees are restricted to peninsular Florida. During the summer, manatees disperse with some individuals moving north along the Atlantic Coast and some west along the Gulf coast. Manatees are known to inhabit both salt and fresh water habitats throughout their range where sufficient depths are available (1-5 meters or more). They may be encountered in canals, sluggish rivers, shallow estuarine habitats and salt water bays.

Between October and April, manatees appear to concentrate in areas of warmer water. During the remainder of the year, manatees appear to choose areas with an adequate food supply and water depth, often in close proximity to a source of fresh water. Manatees primarily consume submergent, emergent and floating vegetation.

Manatees are found in Georgia and South Carolina mainly during warmer months of the year. Records in Georgia are primarily random sightings and carcass finds and are not the result of systematic research. The Georgia population is primarily migratory in nature and therefore fluctuates with season. Manatees are most frequently sighted in Georgia waters from April through October in the waters of Camden, Glynn and McIntosh counties.

The existing scientific literature on offshore benthic assemblages along the east coast of the United States and Gulf of Mexico continental shelf was reviewed by Brooks et al. (2006). Polychaetes were most often cited as the principal infaunal taxa present in studies from both the Gulf of Mexico and Atlantic coasts of the United States. The polychaetes, *Prionospio cristata, Nephtys incisa, N. picta,* and *Spiophanes bombyx*,

were the only dominant taxa found in both the Gulf of Mexico and the east coast of the United States (Brooks et al. 2006). Polychaetes of the Family Spionidae are tube-building surface deposit feeders while polychaetes of the Family Nephtyidae are free-living predators consuming mollusks, crustaceans and other polychaetes (Fauchald and Jumars 1979).

2.6.4 Invasive/Exotic Species

The Georgia Invasive Species Advisory Committee has identified 110 nuisance species that currently exist in Georgia or have a high probability of being introduced. This list includes 77 animal species (mollusks, amphibians, mammals, reptiles, fish, birds, and crustaceans) and 33 disease causing organisms. There are also 99 insects listed as nuisance species.

Eight invasive species have been documented to occur on Tybee Island. The green porcelain crab (*Petrolisthes armatus),* the green mussel (*Perna viridis)* and the titan acorn barnacle (*Megabalanus coccopoma)* (Alan Power, pers. Comm. 2008). The green mussel is a native of the Indo-Pacific region. The first green mussel was found on Tybee in November 2003 (Power et. al. 2004). It is believed the mussel was introduced to Georgia from boats and equipment being transferred between coasts without adequate cleaning of attached organisms and draining of bilge water (Power et. al. 2004). The Asian tiger shrimp (*Penaeus monondon*) is a non-native species introduced through accidental release from aquaculture facilities and have been documented from Georgia to Texas. Three individuals were collected during 2013 near Tybee Island. Invasive bird species documented on Tybee Island include the European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), Eurasian collard dove (*Streptopelia decaocto*) and the rock dove (*Columba livia*).

2.6.5 Protected Species

The species listed in Table 9 may be found in the general project area and have been classified as threatened or endangered pursuant to the ESA of 1973. As such, these species must be protected from adverse impacts that could be expected to cause damage either to the individuals or to habitat that has been found to be critical for the species' survival or recovery. Each of these species are described in detail in the BATES, Appendix B with respect to their sightings and habitat in Chatham County, Georgia.

Table 9: Federal Threatened and Endangered Species

U.S. Fish and Wildlife Service Jurisdiction

Common Name	Scientific Name	Status
Florida manatee	*Trichechus manatus latirostris*	Endangered
Piping plover*	*Charadrius melodus*	Threatened
Red Knot	*Calidris canutus rufa*	Threatened
Wood stork	*Mycteria americana*	Endangered

Bachman's warbler	*Vermivora bachmanii*	Endangered
Kirtland's warbler	*Dendroica kirtlandii*	Endangered
Red-cockaded woodpecker	*Picoides borealis*	Endangered
Eastern Indigo snake	*Drymarshon corais couperi*	Threatened
Loggerhead sea turtle*+	*Caretta caretta*	Threatened
Leatherback turtle+	*Dermochelys coriacea*	Endangered
Flatwoods salamander	*Ambystoma cingulatum*	Threatened
National Marine Fisheries Service Jurisdiction		
North Atlantic Right Whale*	*Eubalaena glacialis*	Endangered
Sei Whale	*Balenoptera borealis*	Endangered
Blue whale	*Balaenoptera musculus*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Green turtle	*Chelonia mydas*	Threatened
Kemp's Ridley turtle	*Lepidochelys kempii*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Atlantic sturgeon*	*Acipenser oxyrhyncus*	Endangered

*Critical Habitat for this species found within or near the project area.
+ Species also under the National Marine Fisheries Service Jurisdiction
NOTE: List developed by the USFWS, Information for Planning and Consultation (IPaC) Website, October 2018

2.6.6 Essential Fish Habitat

Essential fish habitat (EFH) is defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1802(10)) of 1996 as those waters and substrate necessary for fish spawning, breeding, feeding or growth to maturity. The MSA is the primary law responsible for governing marine fisheries management in U.S. federal waters and aims to promote conservation, reduce bycatch, and rebuild overfished industries. EFH occurring in the project area or vicinity includes oyster reefs, estuarine emergent wetlands, intertidal flats, and marine and estuarine water columns. Details can be found in Appendix D of this document.

Managed fish species occurring in the project area include King mackerel, Spanish mackerel, Bluefish, Gag grouper, Red drum, Shrimp (brown, white, and pink), Cobia, Atlantic sturgeon, Dolphin, Summer Flounder, Spot, and Red snapper. No EFH-Habitat Areas of Particular Concern have been identified in the project area.

2.7 CULTURAL RESOURCES

Tybee Island was relatively uninhabited and used mainly for purposes related to navigation and defense until after the Antebellum period (1820 -1860). Historic, or architectural, resources located on the northern end of the island reflect the island's ties to its military and maritime history and are some of the oldest structures on the island.

Historic resources elsewhere on the island chronicle the island's growth into a coastal resort community from the 1870s through the 1960s.

Several historic resources surveys have been conducted on Tybee Island to assist the island with meeting its historic preservation goals and objectives. The City of Tybee Island conducted two recent historic resources surveys that documented 835 buildings and structures (Ciucevich 2016; 2017). To be included in the survey resources needed to be at least 40 years or older with a moderate-to-high degree of integrity. To date there have been no formal evaluations of the inventory data for National Register of Historic Places eligibility or recommendations by Georgia Historic Preservation Division staff. Previous surveys resulted in the documentation of 450 resources and the nomination of three (3) National Register of Historic Places (NRHP) Historic Districts and 10 individual NRHP listings (Ciucevich 1997; 2002; Cloues 1980; Reiter 1993) (Table 10). A multiple property nomination form for Raised Tybee Cottages was submitted in 2005 (Ciucevich 2005). A search of Georgia's Natural, Archaeological and Historic Resources GIS (GNAHRGIS) database provided a return of 946 historic resources on the island. NRHP eligibility of most of these resources has yet to be determined as the surveys above were not conducted for Section 106 purposes. None of these historic resources or NRHP-listed districts or individual listings are within the Federal Project footprint (see Figure 1).

Table 10: Historic districts and structures on Tybee Island.

District/National Register-Listed Resource	**Date Listed**
Fort Screven Historic District	1982
Tybee Island Back River Historic District	1999
Tybee Island Strand Cottages Historic District	1999
Sea View Apartments	2003
Mulherin-Righton Raised Tybee Cottage	2008
J. Herbert and Julia Johnson Raised Tybee Cottage	2008
Dutton-Waller Raised Tybee Cottage	2008
Morgan-Ille Cottage	2008
Rourke-Butler Raised Tybee Cottage	2009
Carbo House (Classic Tybee Boarding House)	2010
Wallis Cottage/Beach View Hotel	2012
Bordley Cottage/Beach View house	2014
Edgar Weil House	2016

Limited archaeological investigations have been carried out on or in the vicinity of Tybee Island, primarily for previous USACE beach renourishment actions and Georgia Department of Transportation projects. A search of GNAHRGIS resulted in the identification of 20 archaeological sites within a 1 mile radius of Tybee Island. Only eight of the sites are terrestrial or shoreline archaeological sites which date from the Civil War period through the 20th century. The remainder are submerged resources off-shore and represent the remains of shipwrecks dating from the War of 1812, Civil War and later. Of the 20 sites, one site was recommended not eligible for the NRHP; one

site was recommended eligible for the NRHP, and the remainder have unknown NHRP status. Three archaeological sites are located within the Federal Project footprint.

2.8 SOCIOECONOMICS

The coastline of Tybee Island possesses visually pleasing attributes including the Atlantic Ocean and existing beach and dune systems. The major industry on Tybee Island is tourism. The majority of the population of Tybee Island is white (Table 11). As of 2016, approximately 14.5% of the population of Tybee Island is below the poverty level (Table 12).

Table 11: 2012-2016 American Community Survey 5-Year Estimates of Race.

Race	Number of People	% of Population
Total	3,068	
White alone	2,961	96.5%
Black or African American alone	48	1.6%
American Indian and Alaska Native alone	6	0.2%
Asian alone	0	0.0%
Native Hawaiian and Other Pacific Islander alone	0	0.0%
Some other race alone	0	0.0%
Two or more races	53	1.7%

Table 12: Poverty Status in the Past 12 Months. 2012-2016 American Community Survey 5-Year Estimates.

Population for whom poverty status is determined	2,958
Below Poverty Level	429
Percent Below Poverty Level	14.50%

2.9 RECREATION RESOURCES

Common water related activities along the Tybee Island coastline include onshore fishing, offshore fishing, sailing, sailboarding, kayaking, body boarding, surfing, personnel water craft, and other activities such as kite surfing. There are two piers located within the project area which provide recreational opportunity for fishing and crabbing: the Tybrisa Pier and Pavilion along the south end of beach and the Tybee Fishing Pier located on the backside of the island along Back River. A third fishing pier, the Lazaretto Creek Fishing Pier, is located on Lazaretto Creek just east of Tybee Island and offers fishing and crabbing from the pier. The inshore recreational fishery is centered primarily in the sounds and major rivers during the warmer months (April to September) and in the rivers and creeks during the colder months (October to March) (USFWS 1993). Surf fishing is limited and generally occurs during warm months (Musick and Pafford 1984; Pafford and Nicholson 1989). The most important recreational surf fish include striped mullet, kingfish, spot, red drum, black drum, tarpon, and flounder (USACE 1997). Common fish caught in the offshore area of Tybee Island

include Spanish mackerel, king mackerel, cobia, red snapper, gag grouper, amberjack, bluefish, black sea bass, sheepshead, white marlin, blue marlin, tarpon, spotted sea trout, dolphin fish and red drum (http://www.tybee.com/tour/fishing.html, Accessed on November 9, 2018).

The waters directly offshore of the TISPP area are used for recreational boating and recreational fishing. Recreational boat access on Tybee Island is from the Lazaretto Creek Boat Ramp or the Tybee Boat Ramp. Commercial services are available at Tybee Marina located in close proximity to the Tybee Boat ramp.

2.10 Environmental Justice and Protection of Children

The goal of environmental justice is to ensure that all Americans are afforded the same degree of protection from environmental and health hazards and have equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work. The EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (11 February 1994), directs federal agencies to make environmental justice part of their mission to the greatest extent practicable and permitted by law.

The EO 13045, Protection of Children from Environmental Health Risks and Safety Risks (21 April 1997), recognizes a growing body of scientific knowledge that demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; because children eat, drink, and breathe more in proportion to their body weight; because their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

2.11 Air Quality

Ambient air quality along coastal Chatham County is generally good due to prevalent onshore and offshore breezes. The project area is located in an attainment area as determined by the Clean Air Act and the State Implementation Plan.

2.12 Traffic, Transportation and Navigation

The waters directly offshore of the TISPP area are used for recreational boating and recreational fishing. Recreational boat access on Tybee Island is from the Lazaretto Creek Boat Ramp or the Tybee Boat Ramp. Commercial services are available at Tybee Marina located in close proximity to the Tybee Boat ramp. Tybee Island is

located directly south of the Savannah River and the Savannah Harbor entrance channel (Figure 1). Savannah Harbor is a major deep-water port with heavy ship traffic.

2.13 NOISE

For purposes of regulation, noise is measured in A-weighted decibels (dBA). This unit uses a logarithmic scale to weigh sound frequencies. Table 13 shows typical noise levels and corresponding impressions. Ambient noise levels in Chatham County are quiet to moderate and are typical of recreational environments. The major noise producers include the breaking surf, birds, beach goers, adjacent commercial and residential areas, and boat and vehicular traffic.

Table 13: Typical Noise Levels and Impressions.

Source	Decibel Level	Subjective Impression
Normal breathing	10	Threshold of hearing
Soft whisper	30	---
Library	40	Quiet
Normal conversation	60	---
Television audio	70	Moderately loud
Ringing telephone	80	---
Snowmobile	100	Very loud
Shouting in ear	110	---
Thunder	120	Pain threshold

3.0 ALTERNATIVES

This chapter describes the alternatives and summarizes the environmental consequences for the proposed action including the Without Project Condition.

3.1 ALTERNATIVE A. WITHOUT PROJECT CONDITION (NO ACTION)

This alternative would result in continued erosion to the TISPP, including potential loss of property and structures. Since December 2008 an average loss of approximately 164,000 cy/yr has occurred on the oceanfront beach. The majority of erosion occurred at the Second Street “hot spot” with a lesser degree of erosion in the vicinity of the Tybrisa Pier. With no renourishment, the beach would continue to erode, with a concomitant loss in storm damage protection and recreational benefits. In addition, if erosion were to be allowed to continue unimpeded, seawall and dune damage would be expected to occur at an accelerated rate as seen in Figure 12.

Figure 12: South tip Tybee Island dune damage and erosion. Photo taken 4 December 2018.

3.2 ALTERNATIVE B. BEACH RENOURISHMENT

The proposed project template design is based on project performance and erosion rates since the last renourishment project in 2018, the calculated storm damage. Areas include the North Beach (North End Groin to Oceanview Court), Second Street area (Oceanview Court to Center Street), Middle Beach (Center Street to 11th Street), South Beach (11th Street to South End Groin), and Back River/Tybee Creek (South Tip Groin Field to Inlet Avenue). Fill will be placed within these areas to provide a more stable beach profile. Beach widths on the Oceanfront Beach will vary from a 25-foot width berm, to a berm approximately 350 feet wide at the elevation of +11.2 MLLW. Based on natural angle of repose on the existing beach, and experience with previous placement, a beach slope of 1 vertical on 25 horizontal will be required on the oceanfront beach (Figure 3).

Incorporation of existing dunes within the Federal project would include approximately 9,500 linear feet of existing dunes meeting the requirements of the modified template along the Front Beach renourishment area. The angle of repose of existing dunes with matching characterization of available sand was measured throughout the project. Existing dunes in the federal project are shown in Figure 13 in orange.

The proposed offshore borrow site is an expansion of a presently defined and permitted area utilized for the construction of the 1994 GPA South Beach project and the Savannah District 2000 renourishment (Figure 5).

The borrow site expansion area encompasses approximately 625 acres and contains approximately 5.72 MCY of beach-compatible sand to an excavation depth of -16 feet. MLLW.

3.3 ALTERNATIVE C. BEACH RENOURISHMENT WITH ADDED SAND DUNE CONSTRUCTION

The proposed project template design is the same as above (Alternative B) with the addition of dune construction within the federal project. Recommended dune construction within the federal project includes 3,700 linear feet of the Front Beach renourishment area addressing hot spots (Figure 13, blue shaded area). In addition, placing 12,000 cy along 1,100 linear feet along the South Tip renourishment area would be considered for dune construction in order to rebuild dunes to meet the requirements of the recommended template. Dune construction and repair would utilize approximately 5% volume of sand traditionally used for advanced renourishment. The dune template matches existing dunes that have been shown in surveys to feed the berm during cases of heavy erosion by acting as a reservoir of sand and provide protection against storm surge events with a 1% exceedance probability. The angle of repose of existing dunes with matching characterization of available sand was measured throughout the project. The recommended dune portion of the template will use a 1V:5H slope on the seaward side of the dune and a 1V:3H slope on the landward side of the dune (Figure 3). Based on field data, this geometry is sufficient to prevent slumping during placement and construction of dunes. Dune crest height of +19 feet MLLW matching existing dune height is recommended and is sufficient to protect against storm surge with a 1% exceedance probability while taking into consideration sea level rise. A minimum dune crest width of 15 feet matching existing dunes is recommended allowing for construction of dunes within the federal foot print and maintaining a distance from the edge of the berm that will prevent erosion to the dunes from wave action. Vegetation would be planted on the dunes for stabilization and sand fencing could be placed at the toe of the dune to limit pedestrian traffic. Figures 3 and **Error! Reference source not found.** show the proposed design template.

The proposed offshore borrow site is an expansion of a presently defined and permitted area utilized for previous construction and is described above in Alternative B.

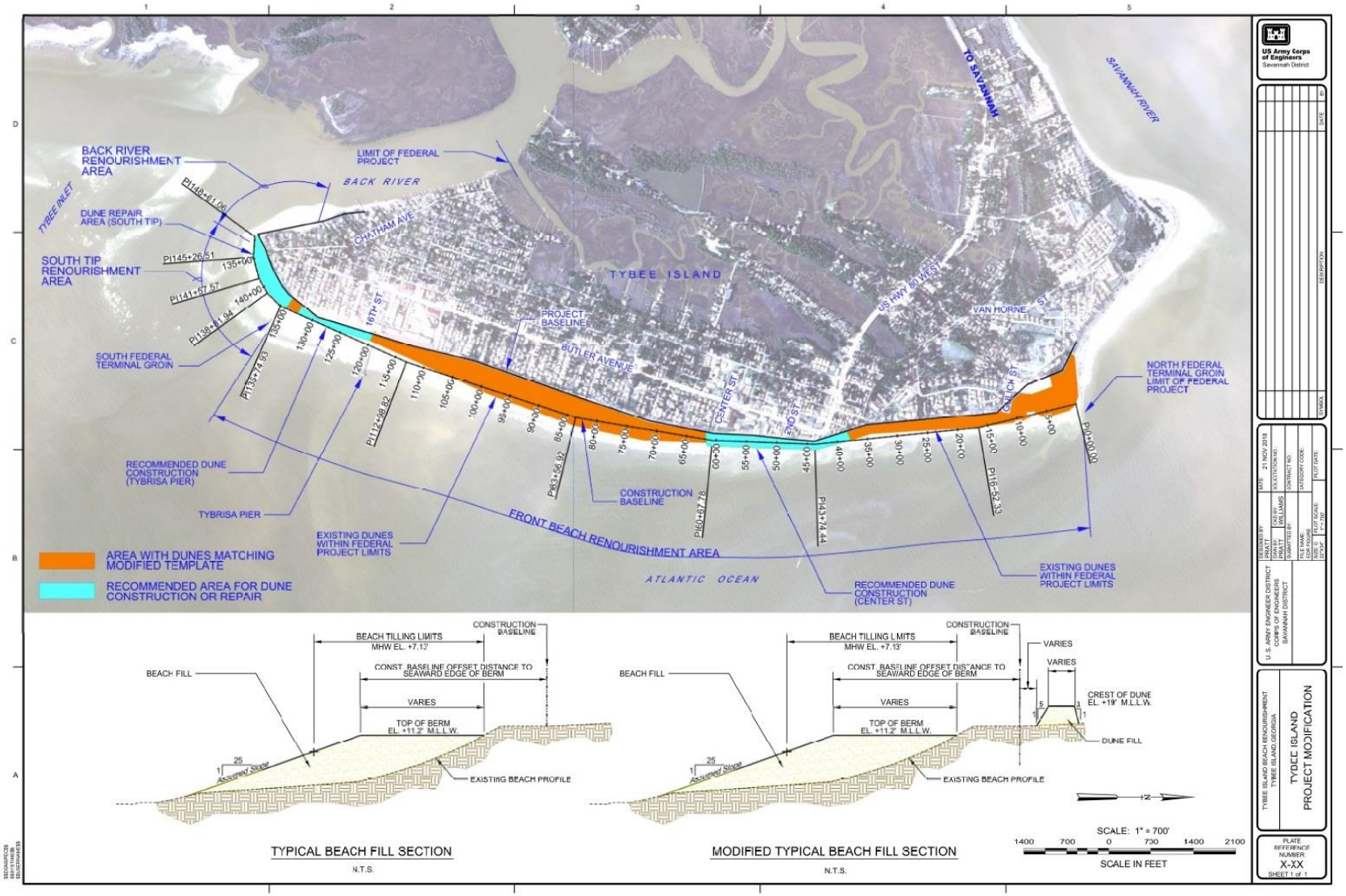


Figure 13: Tybee Island Project description. Typical Beach Fill (Action Alternative B). Modified Typical Beach Fill (Action Alternative C). Existing dunes within the federal project are shown in orange. Recommended dune construction areas (Action Alternative C) are shown in blue.

4.0 ENVIRONMENTAL CONSEQUENCES

This section addresses the environmental consequences of the Without Project Condition and those impacts associated with Alternative B and Alternative C.

4.1 CLIMATE

No Action Alternative, Alternatives B and C. Implementation of the No Action Alternative and Alternatives B or C would not result in impacts to the climate of Tybee Island.

The impact of current or projected effects of climate change on TISPP is difficult to estimate given the uncertainty in predictions of future weather patterns. Through an award provided by NOAA National Sea Grant College Program, the City of Tybee Island partnered with researchers and outreach professionals from Georgia Sea Grant, the University of Georgia, and Stetson University to develop a sea-level rise adaptation plan for Tybee Island (Evans et al 2016). Currently, sea level rise is occurring at 2.98 mm/yr (1.2 in/yr) at Fort Pulaski located 3 miles west of Tybee Island (NOAA 2018).

4.2 PHYSICAL LANDSCAPE

4.2.1 Dunes and Berm

No Action Alternative. Implementation of the No Action Alternative would allow for continued damage and erosion of the existing dunes and the berm on Tybee Island causing long-term negative impacts (Figure 12).

Areas where there are no dunes would continue to be weak points in the dune fields. When flood events occur, water will be funneled through these weak points causing damage to the dune fields.

Alternative B. Implementation of Alternative B would have minor positive impacts to the existing dunes and long term positive impacts to the berm.

Adding sediment to the berm will aid in erosion control of the berm and create a large protective measure for the existing dune fields. Areas where there are no dunes would continue to be weak points in the dune fields. When flood events occur, that can top the larger berm, water will be funneled through these weak points causing damage to the dune fields.

Renourishing the berm will bring the elevation of the berm up to +11.2 feet MLLW with a 1V:25H slope to closure along the front beach. As discussed in Section 3.2 of this EA, the proposed borrow site sediment characteristics are similar to the native material.

Placement of sand on Tybee Island beach will be subject to conditions of the shoreline immediately prior to project bid.

Alternative C. Implementation of Alternative C would have long term positive impacts to the dunes and berm.

Adding sediment to the berm will aid in erosion control of the berm and create a large protective measure for the existing dune fields. Weak points within the dune fields would be remedied by constructing dunes to heights of 19 feet MLLW. Construction of dunes includes vegetation plantings and sand fencing. The vegetation and sand fencing will limit pedestrian traffic while also acting as sand traps, thus continuing the building up of the dune fields on Tybee Island. A robust dune field will feed the berm with sand during storm events, allowing for longer periods of time between needed renourishments and creating a natural erosion control system within the federal project.

4.2.2 Sediment Characteristics

No Action Alternative. Implementation of the No Action Alternative would not alter the sediment characteristics of the existing Tybee Island beach. The No Action Alternative would allow for the continued erosion of sediment from Tybee Island beach.

Alternatives B and C. Implementation of Alternative B or Alternative C would have no long-lasting impacts to the sediment characteristics of the existing beach.

Although differing sources of borrow material have been historically placed onto Tybee Island, similarities exist between the existing beach sediment data sets, suggesting no long-term negative effects on beach sediment characteristics. Table 4 and Figure 6 compare the grain size distributions measured from the borrow area expansion and the natural beach sediment. North Tybee Island sediments generally tend to be coarser (i.e. contain more shell) than beaches to the south. Based on available data, this trend has persisted historically to some degree.

The sediments within the proposed borrow site expansion are closely compatible with the existing beach sediments of Tybee Island in terms of grain size characteristics and percent shell content (Table 4: Sediment Characteristics for composite profiles measured above -16 feet MLLW and native beach material.). In general, the grain size distribution curves for the borrow site expansion area and existing beach are very similar (Figure 8). The existing beach contains approximately 3.64% less shell than the borrow site. The existing beach composite has a median diameter of 0.28 mm while the median diameter of the borrow area is 0.20 mm. The borrow site sediments have a low fraction of fine material averaging 3.27%.

4.2.3 Borrow Area

No Action Alternative. Implementation of the No-Action Alternative would not impact the offshore borrow site.

Alternative B. Implementation of Alternative B would result in short-term negative impacts to the borrow area through the removal of sediment from the borrow site. However, it is expected that the lost sediment will be renourished naturally over time.

Alternative C. Implementation of Alternative C would result in short term negative impacts to the borrow area similar to the impacts discussed above in Alternative B. However, due to the dune construction, Alternative C would result in slightly more (58,000 cy) of sediment being removed from the borrow site extension.

4.3 WATER QUALITY

No Action Alternative. Implementation of the No Action Alternative would not impact water quality within or near Tybee Island.

Alternatives B and C. Implementation of Alternative B or Alternative C would have minor short-term negative impacts to water quality around Tybee Island. The beach fill is expected to exhibit some degree of construction-related turbidity in excess of natural conditions. This turbidity is usually generated by the fines ratio of the pumped sediments suspended within the return effluent. A small turbidity plume is expected at the offshore borrow site and beach discharge point in association with construction activities. Temporary, shore-parallel dikes will be constructed in the immediate construction area as needed to control the effluent and maximize the settling of sediments from the discharge before the waters reach the Atlantic Ocean. Turbidity impacts are expected to be short-term and limited to the period of construction given the low percentage of fine material (less than 1%) within the borrow site sediments. Construction of the proposed TISPP is expected to last 5 months. No permanent degradation of water quality will occur. All work performed during construction will be done in a manner so as not to violate applicable water quality standards. Water Quality Certification will be requested from the GA DNR. A Section 404(b)(1) evaluation for the proposed project may be found in Appendix A.

4.4 COASTAL RESOURCES

No Action Alternative. Implementation of the No Action Alternative would have no significant effect on Little Tybee Island, the only coastal barrier resource within the project area.

Alternatives B and C. Implementation of Alternative B or C would have no significant impact on Little Tybee Island, the only coastal barrier resource within the project area.

Removal of sediment from open water shoals can potentially alter local wave heights and propagation via wave refraction and wave diffraction effects. While the alteration of

wave climate in the immediate vicinity of a borrow site is not in itself particularly problematic, the potential 'shadow' effect of the alteration can under certain conditions extend shoreward, thereby altering the littoral transport regime at the shoreline.

In order to analyze the impacts of the proposed dredging of a candidate offshore borrow area, a refraction/diffraction (RIF/DIF) model was utilized to predict potential changes in wave climate and the associated longshore and cross-shore transport before/after the 1994-95 GPA project. The model, RIF/DIF 1, was applied using existing bathymetry with varying input wave conditions derived from Wave Information Studies data from the USCAE Coastal and Engineering Center (ATM 1994). The changes in wave climate within the grid boundaries due to borrow site modification were analyzed to predict changes in longshore transport, cross-shore transport and associated erosion. The configuration of the borrow area for the GPA project, was eventually developed to avoid any adverse impacts in wave climate and sediment transport. A RIF/DIF model was also performed to assess the impact of deepening the borrow site on wave refraction and shoreline erosion for the South Tip Beach/Tybee Creek project. The model determined that any wave refraction that would occur would be limited to the outer shoals in the area and would not impact the south end of Tybee Island and the north end of Little Tybee Island (USACE 1997). The GPA offshore borrow area was eventually refined by the Savannah District USACE and again dredged in 2000 for purposes of beach restoration at Tybee Island. The modeling analysis has been deemed sufficient to further modify the existing borrow area limits in a manner that the study findings would not be compromised.

Given that the presently proposed borrow area expansion is in a northerly direction, the use of the expanded borrow area should not significantly affect the existing shoal system. The proposed offshore borrow site expansion includes the extension of wave barriers along the landward side to minimize potential impacts. Sand removed from the proposed expanded borrow site should remain in the littoral drift systems. A large portion of the sediment placed as beach fill eroded annually from Tybee Island benefits the shoal system of Tybee Inlet. Much of the nourishment sand placed on the Tybee Island shoreline serves to sustain the sand sharing system with Little Tybee Island by littoral drift southward across the Tybee Inlet shoals to Little Tybee Island.

All offshore dredging activities associated with the beach renourishment project will continue to be setback from the Little Tybee Island CBRA Zone line which extends along the southerly perimeter of the borrow site utilized in 1994 (by the GPA) and 2000 and 2008 (by the Savannah District). The borrow site was developed to avoid impacts to Little Tybee Island Unit N01; therefore, Alternatives B and C are not expected to significantly impact Little Tybee Island.

4.5 PLANT COMMUNITIES

4.5.1 Dune Communities

No Action Alternative. Implementation of the No Action Alternative would result in negative long-term impacts to the dune plant communities. Loss of frontal dune vegetation and escarpment formation would be expected during storm events, resulting in the loss of foredune areas along the central and southern portions of the project area. The storm protection value of the existing dunes within the project area would be reduced by major storm events. Small scale dune planting projects, such as installation of salt-tolerant dune vegetation (sea oats and panic grass) by local volunteer and school groups, would continue; however, their success may be jeopardized due to increased risk of erosion. Sand fencing has been shown to encourage dune development and natural colonization by *U. paniculata* (Gibson and Looney 1994) and increase the survival rate of planted dune grasses (Mendelssohn et al. 1991). Posting of signs would continue to provide protection of dunes from human impacts.

Alternative B. Implementation of Alternative B would result in positive impacts to the dune plant communities. The proposed beach nourishment project will establish a large dry beach area for protection of existing dune habitat within the project area and encourage installation and success of future dune planting projects. The renourishment sand will provide a source of material for wind-blown accretion of the existing dune system within the central oceanfront area and south end beaches. Sand fencing may encourage dune development and natural colonization by sea oats. Posting of signs would continue to provide protection of dunes from human impacts.

Alternative C. Implementation of Alternative C would result in positive long-term impacts to the dune wildlife communities. Alternative C will have similar benefits as seen in Alternative B due to the renourished berm adding protection to the existing and new dune fields. The new dune fields will plug weak points that are at risk of increased erosion rates during flooding events. By filling in the existing dune field with dunes at 19 feet MLLW, the life of the dune field and the plants that inhabit it will be extended and protected. Existing plants within the project footprint will be covered with sand during dune construction. However, some of the existing plants may grow through the placed material but others will be buried. Native plants will be planted to colonize constructed dunes. This will increase the overall number of native plants within the dune field.

4.5.2 Invasive/Exotic Species

No Action Alternative. Implementation of the No Action Alternative would not result in any impacts from invasive/exotic plant species.

Alternative B. Implementation of Alternative B would have no impact on the introduction or the eradication of invasive/exotic plant species.

USACE and the USDA have a compliance agreement requiring measures to prevent the spread of certain plant pests that may be present in the soil (ER 1110-1-5). Major portions of all southeastern states are in a quarantine area for such pests, including the imported fire ant. In addition, adjacent states to the north have introduced infestations

resulting from movement of soil from infested southeastern states. The Contractor shall thoroughly clean all construction equipment and tools at the previous job site in a manner that ensures that these implements are free from residual soil, egg deposits from plant pests, noxious weeds, and plant seeds. Equipment shall be cleaned using water under pressure, and hand tools shall be thoroughly cleaned by brushing or other means to remove all soil. In addition, all construction equipment used for this USACE contract shall be thoroughly cleaned by the Contractor before it is removed from this job site. The Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements that may be necessary.

Alternative C. Implementation of Alternative C would have a positive long-term impact on invasive/exotic plant species control. Native plants will be planted to colonize constructed dunes. This will increase the number of native plants within the dune field, giving a boost to the native species over potential invasive/exotic plant species. Cleaning of equipment prior to reaching the project site will be required to prevent any introduction or transportation of invasive species.

See the Alternative B description for the USACE and the USDA compliance agreement requiring measures to prevent the spread of certain plant pests that may be present in the soil (ER 1110-1-5).

4.5.3 Protected Species

There are no protected plant species found within the project area. Threatened or endangered plant species within Chatham County can be found in Section 2.5.3 of this EA and a detailed account of their locations can be found within Appendix B – BATES.

4.6 Fish and Wildlife Resources

4.6.1 Dune Communities

No Action Alternative. Implementation of the No Action Alternative would result in negative long-term impacts to the dune wildlife communities. Loss of frontal dune wildlife habitat and escarpment formation would be expected during storm events, resulting in the loss of foredune areas along the central and southern portions of the project area. Overall, the wildlife would have reduced dune habitat along Tybee Beach.

Alternative B. Implementation of Alternative B would result in positive impacts to the dune wildlife communities. The proposed beach nourishment project will establish a large dry beach area for protection of existing dune habitat within the project area and encourage installation and success of future dune planting projects. The renourishment sand will provide a source of material for wind-blown accretion of the existing dune system within the central oceanfront area and south end beaches. Sand fencing may encourage dune development and natural colonization by sea oats, thus increasing the amount of dune habitat available to wildlife.

Alternative C. Implementation of Alternative C would result in positive long-term impacts to the dune wildlife communities. Alternative C will have similar benefits as seen in Alternative B due to the renourished berm adding protection to the existing and new dune fields. The new dune fields will plug weak points that are at risk of increased erosion rates during flooding events. By filling in the existing dune field with dunes of at 19 feet MLLW, the life of the dune field and the wildlife that inhabit it will be extended and protected.

4.6.2 Marine Intertidal Zone

No Action Alternative. Implementation of the No Action Alternative would not impact the marine intertidal zone.

Alternative B and C. Implementation of Alternative B or Alternative C would cause short-term negative impacts to the marine intertidal zone.

The intertidal areas of sandy beaches are generally populated by small, short-lived organisms with high reproductive potential. Placement of sand at the beach fill site will bury the majority of benthic fauna, resulting in nearly complete mortality of infauna as existing intertidal and shallow subtidal areas are converted to dry beach habitat. Some species may be able to migrate vertically depending upon the thickness of the new sand layer (Mauer et al. 1978; Mauer et al. 1986). Changes in infaunal community structure are anticipated based upon differences in generation time and reproductive strategies of infaunal organisms. Species with pelagic larvae may repopulate newly filled areas at a higher rate than species which rely on adult horizontal migration from adjacent areas. Adults of certain taxa are incapable of vertical movement, and therefore, must rely on horizontal migration.

Several studies have investigated the recolonization of beach infauna following nourishment projects and found that nourished beaches exhibit short-term declines in infaunal abundance, biomass, and taxa richness following beach nourishment, recovering to pre-nourishment levels within one year after sand placement (Hurme and Pullen 1988; Dodge et al. 1991; 1995). Several factors appear to influence the effects of recruitment/recolonization of infauna populations at the beach fill site. These factors include the size and type of the fill sediment and the compatibility of the fill to the existing beach. Coarser grains allow for more efficient burrowing and low content of fines minimizes the effects on feeding efficiency. Some studies have suggested that changes in the geomorphology and sediment characteristics may have a greater influence on the recovery rate of invertebrates than direct burial or mortality (USDOI/FWS 2000). Donoghue (1999) found that the timing of beach fill placement episodes, the size and type of fill, and the compatibility of the fill material to the native sediments is critical to the short-term and long-term impacts to beach invertebrate populations

Placement of sediment that closely matches the existing beach sediment is considered extremely important in the minimization of adverse effects to beach fauna (Hayden and Dolan 1974; Gorzelany and Nelson 1987; Baca and Lankford 1988). Four studies at project locations where the beach fill appeared to match natural sediment characteristics demonstrated limited initial impacts on macro invertebrate abundances and recovery within days to weeks (Hayden and Dolan,1974; Naqvi and Pullen 1982; Gorzelany and Nelson, 1987; Burlas et al. 2001). Van Dolah et al. (1992) attributed rapid recovery to the similarity of fill material to existing sediments, as well as placement of the fill high on the beach, well above MSL.

Peterson et al. (2006) reviewed monitoring data from several beach nourishment projects and inferred that rapid biological recoveries appear to have occurred only under placement of compatible sediments on beaches with high long-shore sediment transport. Studies which failed to demonstrate substantial and long-lasting impacts of beach nourishment on the benthic infaunal populations (Hayden and Dolan 1974; Naqvi and Pullen 1982; Gorzelany and Nelson 1987; Burlas et al. 2001) appear to have used more compatible sediments and were performed on beaches characterized by high rates of long-shore sediment transport (Peterson et al. 2006). In contrast, projects which showed longer-lasting impacts (Reilly and Bellis, 1983; Rakocinski et al. 1996; Peterson et al. 2000; Manning 2003; Versar 2003) were conducted at sites of low long-shore sediment transport rates. Long-shore transport may enhance immigration of benthic invertebrates by increasing the rate of dispersal from adjacent beaches (Peterson et al. 2006).

Winter densities of infaunal population are generally lower than other seasons (Shaw et al. 1982; Harper 1991; Byrnes et al. 1999) due to patterns in reproductive periodicity related to temperature. Construction of the proposed Tybee Island renourishment project during the fall, winter and early spring months (October through March) would potentially reduce the recovery time of nearshore benthic infaunal populations by filling outside of peak reproductive periods during periods when infaunal population densities are comparatively lower. Infaunal species that recruit from pelagic larvae should repopulate and recover relatively quickly since project construction would be completed prior to the peak larval recruitment seasons in the spring.

The proposed Tybee Island Beach Renourishment Project has incorporated several mitigative guidelines for beach nourishment projects to minimize the potential negative effects of beach nourishment on the sandy beach ecosystem. These measures include selection of a highly compatible sediment source to the existing beach sediment (Figure 6) and the low silt/clay content of borrow site sediment. This sediment compatibility should reduce the recovery time of softbottom benthic populations following beach nourishment and result in lower turbidity levels during project construction.

The quality of the sediment placed on the beach will be visually monitored during construction by the dredging contractor to ensure that rocky or clay material is not deposited on the beach. If continuous areas of clay or other unsuitable material are

encountered, the dredging contractor will be directed a new location and depth within the borrow area. Any unsuitable areas will be recorded and avoided in future passes of the dredge during operations. Given the quality of the sediments within the proposed offshore borrow site and compatibility with the existing beach sand, it is anticipated that impacts to infaunal populations at the proposed Tybee Island beach renourishment site would be short term.

4.6.3 Marine Subtidal Zone

No Action Alternative. Implementation of the No Action Alternative would not impact the marine subtidal zone.

Alternatives B and C. Implementation of Alternative B or Alternative C would result in short-term negative impacts to the marine subtidal zone.

Dredging of the offshore borrow site expansion area will result in the removal and destruction of the benthic infauna populations within the softbottom sediment of the offshore borrow site. Monitoring of previous beach nourishment projects has indicated that dredging has minimal, long-term adverse effects on benthic habitats (Culter and Mahadevan 1982; Saloman et al. 1982; Rakocinski et al. 1996; Hammer et al. 2000). Saloman et al. (1982) compared the pre-construction and post-construction samples at offshore sites dredged during the 1976 Panama City beach project. The results of this study indicate that benthic recovery by opportunistic invaders occurred soon after dredging and was nearly complete within one year. In a study of a borrow site offshore of Duval County, FL, the numbers of taxa and individuals collected by trawls greatly exceeded the control area four months after dredging and were generally higher 7 and 13 months after dredging (Applied Biology Inc. 1979).

Infaunal recolonization occurs from inward migration of adults from adjacent areas (Van Dolah et al. 1984) and settlement of pelagic larvae. Opportunistic species colonize defaunated areas relatively quickly (Grassle and Grassle 1974; McCall 1977; Simon and Dauer 1977). The later stages of colonization are more gradual and dependent on environmental conditions. Later successional stages involve taxa that are less opportunistic and have longer life spans. In dredged areas with prolonged effects to the infaunal community, traditional opportunist species persist (Wilber and Stern 1992), and later successional stages may not fully recover for two to three years. Changes in infaunal community structure are anticipated based upon differences in generation time and reproductive strategies of infaunal organisms and may persist for two to more than three years (Dodge et al. 1995).

While levels of abundance and diversity may recover within one to two years (Saloman et al. 1982), it may take many years to recover in terms of sediment characteristics and species composition (Bowen and Marsh 1988; Van Dolah 1996).

Following these suggestions to promote recovery of softbottom communities within offshore borrow sites, and in addition to the selection of a high quality, beach-compatible sediment source, the dredging plan for the proposed Tybee Island borrow site is to leave a layer of sandy sediment at the surface of the borrow site for benthic recolonization and to leave ridges/fingers at mean tide level within the borrow site as a source of benthic infauna/macrofauna for recolonization. These ridges, in addition to non-dredged buffer areas around magnetic anomalies, should provide a source of adult benthic infauna for horizontal migration into the dredged areas, provided that surface sediments are suitable. This dredging plan should allow for more rapid recovery of benthic populations within the offshore borrow site by providing a source of adult benthic infauna for horizontal migration into the dredged areas.

Mortality of epifauna and demersal/burrowing fish species inhabiting open sand is likely during dredging activities, as these species are limited in their mobility and may not be able to flee the area prior to disturbance. The slow-moving and sessile taxa, such as echinoderms, gastropods, and bivalves, will experience greater mortality during dredging activities than the more motile, demersal fish species. The most common epifaunal species within the Tybee Island offshore area are geographically widespread, therefore, low levels of direct mortality should not negatively affect the sustainability of these populations.

Grazers and detrivores that feed upon the macroinvertebrate communities within the proposed offshore borrow site will be temporarily displaced during dredging activities. If infaunal community structure changes persist for a period of two to three years, short-term impacts to selective bottom feeders may also occur due to loss of specific prey species within the dredged areas. Adjacent sandy areas would provide alternative feeding habitat for grazers and detritivores during infaunal recolonization of the offshore borrow site, and alternative feeding habitat for epifauna and demersal fishes is not limited within the offshore area of Tybee Island.

4.6.4 Invasive/Exotic Species

No Action Alternative. Implementation of the No Action Alternative would not result in any impacts from invasive/exotic animal species.

Alternatives B and C. Implementation of Alternative B or Alternative C would have no impact on the introduction or the eradication of invasive/exotic animal species. All equipment will be cleaned prior to reaching the construction site to reduce introduction.

See 4.5.2 for a description of the USACE and the USDA compliance agreement requiring measures to prevent the spread of certain pests that may be present in the soil (ER 1110-1-5).

4.6.5 Protected Species

No Action Alternative. Implementation of the No Action Alternative would result in long-term negative impacts to protected species. Continued shoreline erosion and beach profile deflation may reduce the amount of habitat for threatened and endangered sea turtles, and birds. Sufficient sand with the right characteristics (i.e. grain size and composition) and in the proper locations is crucial for sea turtles to nest, and for birds to nest and feed. Under the No Action Alternative, the level of protection provided by the buffering beach and dunes from incident storms would be substantially reduced, potentially decreasing sea turtle and shorebird nesting success by increasing the likelihood of nest inundation during storms. Critical habitat for the piping plover would also be reduced due to erosion. The No Action Alternative would not negatively affect other listed endangered species found in Chatham County. The No Action Alternative would have no impacts to the borrow area.

Alternatives B and C. Implementation of Alternative B or Alternative C will result in short-term negative impacts for sea turtles, piping plover, red knot, whales, and manatees. However, implementation of Alternative B or Alternative C will have long-term positive impacts on sea turtles nesting habitat, piping plover critical habitat, and red knots.

A BATES has been prepared to address impacts to Federally listed threatened and endangered species or designated critical habitat (See Appendix B). It contains a thorough review of potential impacts to species listed in Table 9**Error! Reference source not found.** (section 2.6.5). This document will be coordinated with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) during the public review period.

Under U.S. Fish and Wildlife Jurisdiction:

The proposed beach renourishment and dredging operations *may affect manatees* because the species does occur in the general vicinity of the proposed project area *but are not likely to adversely affect manatees* because any dredging contract issued would include the special conditions listed below to ensure protection of manatees including that all submerged pipeline will be on the ocean bottom and not allowed to move. The proposed beach renourishment and dredging operations *may affect piping plovers and their critical habitat* because the species and a portion of its critical habitat does occur in the proposed project area *but are not likely to adversely affect piping plovers or adversely modify their critical habitat* because any dredging contract issued would include the special conditions listed below to ensure protection of piping plovers. It is the District's belief that the piping plover would ultimately benefit from the project due to erosion control of the bird's critical habitat area.

The proposed beach renourishment and dredging operations *may affect red knots* because the species does occur in the proposed project area *but are not likely to adversely affect red knots* because any dredging contract issued would include the special conditions listed below to ensure protection of red knots. It is the District's belief

that the red knots would ultimately benefit from the project due to erosion control of their habitat area.

The proposed beach renourishment and dredging operations *will have no effect on wood storks* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *will have no effect on Bachman's warbler* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *will have no effect on Kirtland's warbler* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *will have no effect on red-cockaded woodpeckers* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *will have no effect on eastern indigo snakes* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *may affect loggerhead and leatherback sea turtles and the loggerhead critical habitat* because these species and a portion of the loggerhead critical habitat does occur near the proposed project area *but are not likely to adversely affect loggerhead and leatherback sea turtles or adversely modify loggerhead critical habitat* because any dredging contract issued would include the special conditions listed below to ensure protection of sea turtles. It is the District's belief that sea turtles would ultimately benefit from the project due to erosion control of the species' nesting areas.

The proposed beach renourishment and dredging operations *will have no effect on the flatwoods salamander* because no suitable habitat for this species would be impacted by beach nourishment activities.

The proposed beach renourishment and dredging operations *will have no effect on pondberry* because no suitable habitat for this species would be impacted by beach nourishment activities.

Under National Marine Fisheries Jurisdiction:

The proposed beach renourishment and dredging operations *may affect North Atlantic right whales and the their critical habitat* because the species and a portion of the North Atlantic right whale critical habitat does occur within the proposed project area *but are*

not likely to adversely affect North Atlantic right whales or adversely modify their critical habitat because any dredging contract issued would include the special conditions listed below to ensure protection of whales and their critical habitats. The proposed beach renourishment and dredging operations *will have no effect on* sei, fin, and humpback whales, because the North Atlantic right whale is the only species likely to be encountered during construction.

The proposed beach renourishment and dredging operations *may affect sea turtles and the loggerhead critical habitat* because the species and a portion of the loggerhead critical habitat does occur near the proposed project area *but are not likely to adversely affect sea turtles or adversely modify loggerhead critical habitat* because any dredging contract issued would include the special conditions mentioned above and listed below to ensure protection of sea turtles.

The proposed beach renourishment and dredging operations *may affect shortnose sturgeon* because the species may occur near the proposed project area *but are not likely to adversely affect shortnose sturgeon* because; eggs and larvae would be expected to be found well upstream and would not be expected to be impacted by the project, juvenile shortnose sturgeon spend their first year in the upper freshwater reaches of the estuary, no shortnose sturgeon larvae (including ichthyoplankton and ichthyofauna) were found during a 2-year study in 2000 in the Savannah River estuary (Jennings and Weyers 2003) and no indication has been found that the shortnose sturgeon frequents barrier island beaches.

The proposed beach renourishment and dredging operations *may affect Atlantic sturgeon* because the species may occur near the proposed project area *but are not likely to adversely affect Atlantic sturgeon or adversely modify their critical habitat* because; it is not expected that Atlantic sturgeon would commonly use habitats, open nearshore ocean, where the project's activities would be performed, no impacts to sturgeon eggs or larvae are expected and the proposed work is not happening in Atlantic sturgeon critical habitat.

Conditions to avoid adverse impacts to these species are affixed to the construction contract (see below). These conditions will be included in the 2019 renourishment.

Special Conditions

1. Piping plover, red knots, sea turtles, whales and the Florida manatee have been sighted in the general vicinity of the project. The Contractor shall maintain a special watch for these species for the duration of this contract for these animals and any sightings will be reported to the Contracting Officer.

2. Endangered Species Watch Plan. A watch plan (see sample, Attachment E-1) that is adequate to protect endangered species from the impacts of the dredging and associated operations must be approved by the Contracting Officer before any

dredging activities take place. The watch plan shall be for the entire period of dredging and transportation of material from the borrow area to the beach project area and shall include the following:

a. Watch plan coordinator's name
b. Names and qualifications of designated observers
c. Name(s) of the person(s) responsible for reporting sightings.

3. The contractor will instruct all personnel associated with the dredging and renourishing of the beach of the potential presence of piping plover, red knots, manatees, dolphins, sturgeon, whales, and sea turtles, and the need to avoid collisions with these species.

4. All personnel associated with the dredging and renourishing of the beach will be advised that there are civil and criminal penalties for harming, harassing, or killing of piping plover, red knots, manatees, sea turtles, and whales which are protected under the Marine Mammal Protection Act of 1972, and or the ESA of 1973. The contractor may be held responsible for any manatee harmed, harassed, or killed as a result of project activities.

5. Siltation or turbidity barriers will be made of material in which manatees cannot become entangled, be properly secured, and be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

6. All vessels associated with the project will operate at "no wake/idle" speeds at all times while in the immediate area and while in the water where the draft of the vessel provides less than four feet clearance from the bottom. All vessels will follow routes of deep water whenever possible.

7. Extreme care will be taken in lowering equipment or materials, including, but not limited to pipelines, dredging equipment, anchors, etc., below the water surface to the ocean floor; taking any precautions not to harm any manatee(s) that may have entered the project area undetected. All such equipment will be lowered at the lowest possible speed.

8. To prevent a crushing hazard to manatees, if plastic pipeline is used to transport material from the borrow site to the beach the pipeline will be secured to the ocean floor or to a fixed object along its length to prevent movement with the tides or wave action.

9. Dredge lighting must be shielded, or low-sodium, to prevent potential disruption of courtship or nesting by sea turtles during 1 May through 30 August.

10. The contractor agrees that any adverse interactions with piping plovers, red knots, manatee, sea turtle, sturgeon, whales or any other threatened or endangered species shall be reported immediately to the Corps of Engineers (912-652-5058), the USFWS Coastal Suboffice (912-832-8739), and the GA DNR (Weekdays: 912-264-7218 or 1-800-241-4113; nights and weekends: 1-800-241-4113). Notification will also be made to the above offices upon locating a dead, injured, or sick endangered or threatened species specimen. Care will be taken in handling dead specimens to preserve biological materials for later analysis of cause of death. Any dead manatee(s) found in the project area must be secured to a stable object to prevent the carcass from being moved by the current before the authorities arrive. The finder has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. In the event of injury or mortality of a manatee, all aquatic activity in the project area must cease pending section 7 consultation under the ESA between the USFWS and the USACE.

11. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

12. A minimum of two 3-feet by 4-feet temporary manatee awareness construction signs labeled “Manatee Habitat-Idle Speed In Construction Area” shall be installed and maintained at prominent locations within the construction area/docking facility prior to initiation of construction and removed upon completion of the project. One sign shall be placed visible to vessel operators and one shall be visible to water related dredging crews.

13. The contractor will keep a log detailing sightings, collision, or injury to piping plover, red knots, manatees, sea turtles, sturgeon, whales, or other endangered species which have occurred during the contract period. Following project completion, a report summarizing the above incidents and sightings will be submitted to the USFWS, 4980 Wildlife Dr. NE, Townsend, Georgia 31331, to the GA DNR, Nongame Conservation Section, 1 Conservation Way, Brunswick, GA 31520, and to the U.S Army Corps of Engineers, Savannah District, Navigation Section, ATTN: CESAS-OP-SN, 100 W. Oglethorpe Ave., Savannah, Georgia 31401-3640.

14. All temporary project materials will be removed upon completion of the work. No construction debris or trash will be discarded into the water.

15. Shorebird monitoring will be conducted prior to and during construction activities in the vicinity of critical habitat unit GA-1 for piping plovers. A 200 foot buffer zone will be established around feeding piping plovers and red knots. If necessary,

construction activities would be modified to minimize any disturbance to wintering or migratory shorebirds on site. Any construction related activities that could potentially harass feeding piping plovers or red knots shall cease while piping plovers and red knots are in the buffer zone. If birds settle into designated construction areas such as truck routes, the creation of alternate truck routes would avoid disturbance to the birds. Relocation of the travel corridor shall also be considered if birds appear agitated or disturbed by construction related activities.

4.6.6 Essential Fish Habitat

No Action Alternative. Implementation of the No Action Alternative would have no impacts on EFH.

Alternatives B and C. Implementation of Alternative B or Alternative C will have short-term negative impacts on EFH.

EFH in the proposed project area includes intertidal flats and marine and estuarine water column. Short term impacts to marine surf zone fishes due to increased turbidity and loss of habitat during construction would occur. These effects are expected to be temporary and minor. Measures will be taken during construction to reduce turbidity through temporary toe dikes. Depending on tide and weather patterns minor upstream turbidity effects could potentially impact estuarine waters. No significant impacts to fish species would be expected. Some minor impacts associated with turbidity increases at the borrow area and on the beach would be expected during dredging and placement. Fish species abundance may be temporarily impacted by decreases in prey abundance due to filling. These impacts are expected to be temporary and minor in nature. Short-term negative impacts to benthic organisms on the flats are expected but these areas are expected to recolonize post-construction.

When taking into account the overall effect of the proposed work, Savannah District expects the proposed renourishment to have no more than minimal negative impacts to EFH or the aquatic ecosystem and is not likely to adversely affect listed species.

Results of the last renourishment monitoring did not show significant adverse impacts to benthic organisms in the borrow area or on the beach. Based on the time of year construction is scheduled, the short duration, and the protective measures in place (type of equipment, endangered species watch plans, etc.) the Savannah District has identified no need for mitigation.

4.7 CULTURAL RESOURCES

No Action Alternative. Implementation of the No Action Alternative would result in some long-term negative impacts to cultural resources on Tybee Island and no impacts to cultural resources within the borrow area.

Under the No Action Alternative the ongoing erosion would have no direct impacts on historic resources or NHRP- listed districts or individual properties as none are located within the Federal Project footprint. Indirect adverse impacts could occur to historic resources outside of the Federal Project footprint as the erosion creates vulnerable areas, or breaches, within the project template where flooding from storm surges could occur. Currently the berms, sediments and dunes that are part of the Federal Project reduce flood risk damages to 527 historic resources, including 3 NRHP- listed historic districts and 4 individually NRHP-listed properties located as far back as 3 rows from the beach (Figure 14). USACE identified two hotspots within the Federal Project footprint where accelerated erosion in the berm is occurring (see Figure 2). Historic resources immediately west of these vulnerable areas could be indirectly adversely affected by flooding caused by storm surges. These areas would remain vulnerable until the next scheduled renourishment

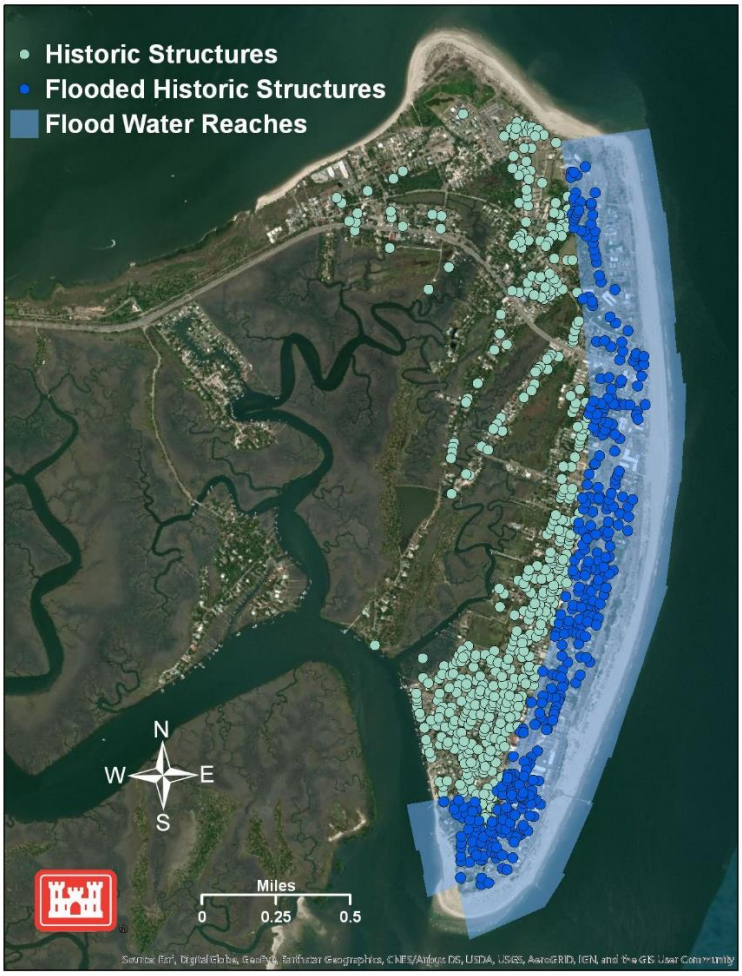


Figure 14: Historic resources located within areas that could potentially be affected by coastal storm surge (in blue).

There are no known NRHP-eligible or listed archaeological sites within the Federal Project footprint that would be impacted by the continued erosion. Previous surveys identified three archaeological sites that are located within the Federal Project footprint. Two were located along the Atlantic side (east side) of the island, and the other is located on the western side along Back River. All sites are 19th-20th century shipwrecks with undetermined NRHP status. One site on the eastern side of Tybee Island and the site on Back River were identified during pedestrian surveys. These remains were not observed during a site visit to Tybee Island conducted in December 2018 to document the current conditions of the beach and dunes nor during a subsequent visit in January 2019. It is possible that renourishment actions conducted in 2000, 2008 and 2015 may have buried these remains. The remains that were identified during the remote sensing survey would also likely be buried under previously placed sediments. Repeated episodes of beach renourishment would have created an overburden that would afford the resources *in situ* preservation. Rates of erosion in these areas of the Federal Project footprint have not been modeled, however, it would be assumed that erosion would occur and would potentially expose the resources over time. These resources would be adversely affected by exposure to the elements as wood would degrade, the saltwater would cause metals to corrode and smaller artifacts could be carried away from the site during coastal storms. Exposure would also increase the potential for vandalism and looting of the sites.

Alternative B. Implementation of Alternative B would result in no impacts to cultural resources.

Under this alternative, sediments would be placed on the shorefront to fill areas where erosion is occurring within the Federal Project footprint. Sediments would be obtained from a new off-shore borrow area. Consultation conducted with the Georgia State Historic Preservation Office (SHPO) for past periodic renourishment actions (1987, 2000, 2008 and 2015) determined that placement of sediments on the shorefront in the Federal Project footprint has no effect on historic resources, NRHP-listed districts or individually listed properties, or archaeological sites. Existing parking lots and the beach area will be used as construction staging areas and beach access will be through existing access points. No new facilities will be required for the renourishment. No impacts to historic or archaeological resources will be associated with the use of these areas. Approximately 527 historic resources, including 3 NRHP-eligible districts and 4 individual listings that are outside of the Federal Project footprint and located up to approximately 1,500 ft. back from the beach would receive indirect benefits from implementation of this alternative as the sediments would fill the vulnerable areas, providing more protection from flooding due to coastal storm surges.

A remote sensing investigation of the proposed borrow area addition to identify significant cultural resources is ongoing. Results of the survey and determination of effects will be coordinated with the SHPO and interested tribes to comply with Section 106 of the National Historic Preservation Act. Significant resources and those determined to need more detailed investigation to determine NRHP eligibility will be

buffered with a 100-ft. diameter circle and avoided. Should Savannah District determine that the buffered anomalies have reduced the available capacity to a level that is not sufficient for renourishment additional investigations will be conducted to mitigate adverse impacts before any ground disturbing activities occur within identified anomaly and associated buffer area.

Alternative C. Implementation of Alternative C would cause no impacts to cultural resources.

Implementation of Alternative C would result in the same impacts as Alternative B. Dune construction that would occur under this alternative would have no visual effects on any historic resources, NRHP-listed districts or individually listed properties as the dunes would not introduce new or out of character elements into the viewshed.

The results of the remote sensing survey of the proposed borrow area addition and consultation with the GA SHPO and tribes would be required to comply with Section 106. Significant resources and those that required additional detailed investigation to determine NHRP eligibility will be buffered and avoided as described in Alternative A. If avoidance is not possible, additional investigations will be conducted to mitigate adverse impacts.

4.8 SOCIOECONOMICS

No Action Alternative. Implementation of the No Action Alternative would result in long-term negative impacts to the socioeconomics of Tybee Island. In general, economic losses result from potential beach loss due to storm damages and erosion. If no action is taken, shoreline recession and loss of elevation of the beach berm can potentially undermine the oceanfront structures. Beach loss results in a loss of tourists and revenue to Chatham County and the City of Tybee Island.

Alternatives B. Implementation of Alternative B would result in positive impacts to the socioeconomics.

Renourishment of the berm will significantly increase the tourism amenity value and the recreational beach area. If the shoreline recession continues unabated, there will be incidental repercussions to tourism and the local economy.

Alternative C. Implementation of Alternative C would result in long-term positive impacts to the socioeconomics of Tybee Island. Renourishment of the berm and construction of the dunes will significantly increase the tourism amenity value, the recreational beach area, and storm protection benefit of the beach. Risk of flooding to businesses and homes during storm events, would be reduced due to the added protection of a continuous dune field.

4.9 RECREATION RESOURCES

No Action Alternative. Implementation of the No Action Alternative would create long-term negative impacts because of the continued erosion and reduction of recreational areas. No offshore recreational impacts are associated with the No Action Alternative.

Alternatives B and C. Implementation of Alternative B or Alternative C would create some short-term negative impacts but overall would result in long term positive impacts to the recreational resources of Tybee Island.

Beach use would be temporarily restricted over short lengths of the beach during project construction for safety reasons, but would resume after construction is completed within each segment. Recreational fishing would be temporarily curtailed by turbidity near the offshore borrow site and beach nourishment site during project construction. Recreational surf fishing within the project area may be affected during the summer following nourishment activities due to short-term changes in the infaunal prey base for surf zone fishes such as kingfishes, Florida pompano and spot. Short-term impacts to foraging habitat for surf zone fishes along the beach fill site are expected during the first warm season following completion of construction activities based upon the potential reductions in the prey base. No long-term adverse effects (greater than 1 year) to recreational fishing are expected.

The presence of dredging equipment would create a public safety risk for swimming in the nearshore in the immediate construction area. Recreational boating may be detoured during construction and restricted from the dredging area. These are temporary and short-term effects limited to the period of construction. No long-term effects are anticipated. The No-Action alternative would assume continued erosion and reduction of recreational beaches. No offshore recreational impacts are associated with the No-Action alternative. Dry beach recreational benefits are the most common incidental benefit produced by a beach nourishment project. These benefits result from an increased capacity for recreational activity by the new beach surface.

4.10 Environmental Justice and Protection of Children

No Action Alternative. Implementation of the No Action Alternative would not result in any impacts in terms of environmental justice and the protection of children.

The No Action Alternative would allow for continued shoreline erosion and beach profile deflation. This would not disproportionately affect children's safety or environmental health risks to children or adults, including minority or low-income residents.

Alternatives B and C. Implementation of Alternative B or Alternative C would not result in any impacts in terms of environmental justice and the protection of children.

No changes in demographics, housing, or public services would likely occur as a result of the beach nourishment project. With respect to the protection of children, the

likelihood of disproportionate risk to children is not significant. No anticipated impacts to low-income or minority populations are expected. Beach renourishment would result in long-term positive recreational opportunities and storm protection for all residents and visitors. The proposed project does not involve activities that would pose any disproportionate environmental health risk or safety risk to children or adults.

4.11 AIR QUALITY

No Action Alternative. Implementation of the No Action Alternative would have no impacts to air quality.

Alternatives B and C. Implementation of Alternative B or Alternative C would have short-term negative impacts to air quality. This impact would be de minimis. The short-term impact from emissions by the dredge and other construction equipment associated with the proposed nourishment project will not significantly impact air quality. Exhaust emissions of the construction equipment, both onshore and offshore, would have a temporary effect on the air quality. No permanent impacts to air quality would occur.

4.12 TRAFFIC, TRANSPORTATION AND NAVIGATION

No Action Alternative. Implementation of the No Action Alternative would result in long-term negative impacts to the traffic and transportation and no impacts to navigation around Tybee Island. Highway 80, the only road on and off the island, is susceptible to severe damage and closure during storm events. Emergency Beach Vehicular Access points are at a continued risk of erosion, limiting the number of locations an emergency vehicle can get on and off the beach (Figure 15).

Figure 15: Eroded emergency vehicular access road. Location: 19th Street Beach Access Road.

Alternatives B and C. Implementation of Alternative B or Alternative C would result in long-term positive impacts to traffic and transportation and short-term minor impacts to the navigation around Tybee Island.

The added protection from flooding along the front part of Tybee Island would protect that the section of Highway 80 parallel to the Tybee Beach. Added berm height and width (a part of both Alternative B and Alternative C) would protect emergency beach vehicle access points from erosion. Minor impacts to recreational boating would be short-term and would cease following project completion.

4.13 NOISE

No Action Alternative. Implementation of the No Action Alternative would not result in any impacts from noise.

Alternatives B and C. Implementation of Alternatives B or C of the beach nourishment project would result in short-term negative impacts from noise.

Equipment used during construction will temporarily raise the noise level in the areas of the dredge and the discharge point on the beach. Construction equipment would be properly maintained to minimize these effects in compliance with local laws.

5.0 RECOMMENDED ALTERNATIVE

The recommended alternative is Alternative C – Beach Renourishment with Added Sand Dune Construction.

5.1 PLAN COMPONENTS

This renourishment will be constructed on part of the authorized project template. It will consist of a 40-foot berm, based off the construction baseline, at +11.2' MLLW, with a 1V:25H foot slope extending to closure.

Modification of the template will include incorporating existing dunes within the limits of the federal project. The construction of new dunes (see Figure 13) will use a 1V:5H slope on the seaward side extending to closure, minimum 15 foot wide crest at elevation +19' MLLW and a 1V:3H slope on the landward side extending to closure. The seaward dune toe will vary in distance from the baseline.

5.2 COST ESTIMATE

TISPP, Chatham County, Georgia, HIM Sup is funded under Public Law 115-123 Bipartisan Budget Act of 2018 (PL 115-123), designated by Congress as being used for emergency requirements pursuant to section 251 (b)(2)(A)(i) of the Balanced Budget and Emergency Deficit Control Act of 1985. Of these funds, Tybee Island is authorized $13 million in federal funding to be utilized for an emergency renourishment and new resiliency features.

5.3 COST SHARING

PL 115-123 provides 100% of the federal funding to address emergency situations at USACE projects, and to construct, and to rehabilitate and repair damages caused by natural disasters to USACE projects. As such, an amendment to the Project Cooperation Agreement, signed 6 May 1999, will be executed before construction efforts begin. The amendment will include provisions, as allowed within the guidance on PL 115-123, for the local non-Federal sponsor to contribute additional construction funding for a locally preferred plan.

5.4 DESIGN AND CONSTRUCTION

Design for beach renourishment will be based on erosion rates, previous designs and breaches to the template from storm events. Construction will be based off previous methods used for renourishment of the beach berm. A hydraulic cutterhead dredge will pump sand into the beach berm template.

The angle of repose of existing dunes, and the grain size distribution of existing beach sand was measured throughout the project. The recommended dune portion of the template will use a 1:5 slope on the seaward side of the dune and a 1:3 slope on the landward side of the dune. Based on field data, this geometry is sufficient to prevent slumping during placement and construction of dunes. Dune crest height of +19' MLLW matching existing dune height is recommended and is sufficient to protect against storm surge with a 1% exceedance probability while taking into consideration sea level rise. A minimum dune crest width of 15' matching existing dunes is recommended allowing for construction of dunes within the federal foot print and maintaining a distance from the edge of the berm that will prevent erosion to the dunes from wave action. See Figure 16 for the historical dune profile.

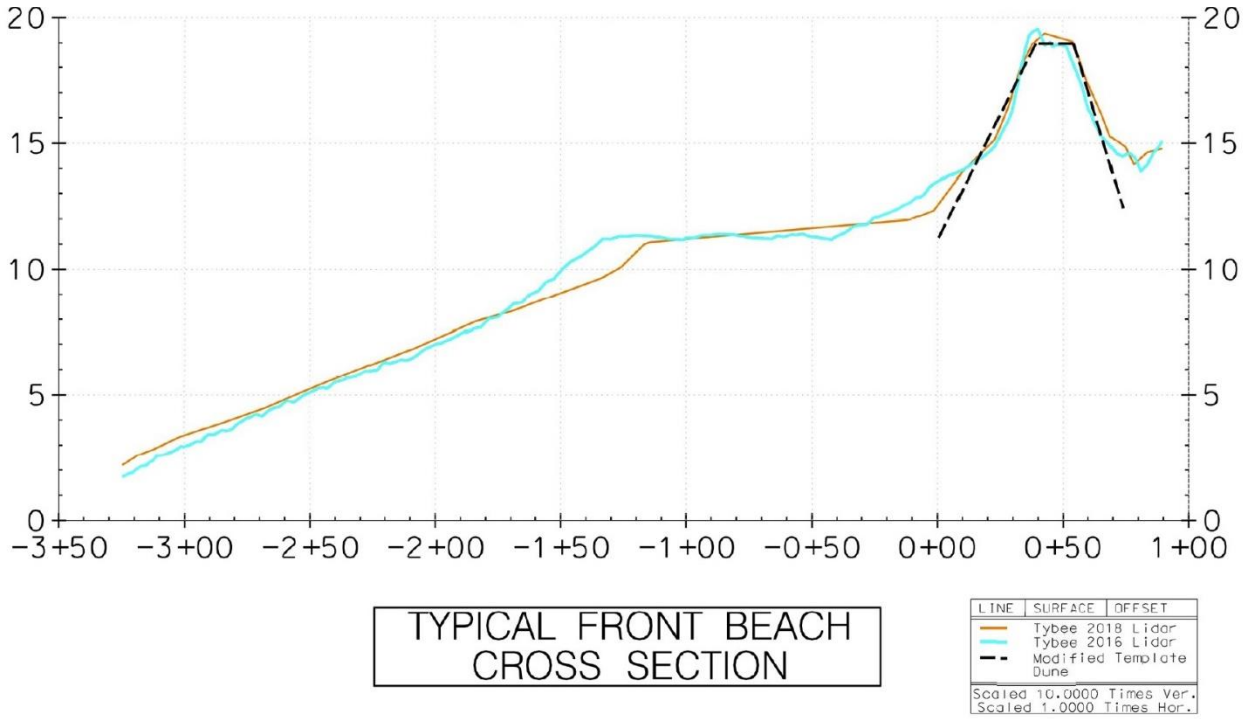


Figure 16: Historic dune profiles and the modified template design.

The dunes will be stabilized by plantings. At least two species of plants from Table 14 will be planted one foot from the toe of the dunes in a matrix on both the landward and seaward sides. Plants will be planted on 2-3 feet centers (NRCS 2011). At least one species from Table 15 will be planted along the toe of the landward side of the dune on 3 feet centers. Snow fence will be placed parallel to the dune on the landward side to limit pedestrian traffic and to help stabilize and grow the dunes.

Table 14: Grasses, Sedges, and Rushes than can be planted as a part of dune restoration efforts on Tybee Island.

Grasses, Sedges, and Rushes	
Species	**Common Name**
Uniola paniculata	Sea Oats
Panicum amarum	Bitter Panicum
Spartina patens	Saltmeadow Cordgrass
Muhlenbergia capillaris	Sweetgrass
Schizachyrium spp.	Seacoast bluestem, coastal little bluestem etc.

Table 15: Vines than can be planted as a part of dune restoration efforts on Tybee Island.

Vines	
Species	**Common Name**
Ipomoea sagittata	Saltmarsh Morning-glory
Ipomoea stolonifera	Beach Morning-glory/Fiddle-leaf Morning-glory
Passiflora incarnata	Purple Passionflower
Oenothera humifusa	Dune Primrose

5.4.1 Borrow Site

The proposed offshore borrow site is an expansion of a presently defined and permitted area utilized for the construction of the 1994 GPA South Beach project, the Savannah District 2000 renourishment, and the 2008, 2015 and 2018 renourishments (Figure 5). It is described in detail in sections 1.5 and 2.2.4 of this document.

5.4.2 Future Periodic Renourishments

This Tybee Beach renourishment project is a onetime renourishment as a part of the HIM Sup authorization for post storm construction.

The original Federal TISPP, which was authorized in June 1971 by Senate and House resolutions and amended multiple times, is due to expire September 2024. Currently a Section 1037 of WRDA 2014 Beach Renourishment Evaluation Study is taking place evaluating the feasibility of extending the period of nourishment an additional 15 years beyond the 50 year completion of the TISPP.

5.4.3 Summary of Environmental Impacts of the Proposed Actions

Table 17 on the following pages provides a summary comparison of the alternatives (Preferred Alternative and No Action Alternative) with respect to the resources discussed in this EA.

Table 16: Summary of Findings and Impacts.

Summary of the Findings and Impacts Resources	**Alternative C - (Preferred Alternative)**	**No Action Alternative**
Climate	No Impacts	No Impacts
Physical Landscape		
Dunes and Berm	Long-term Positive Impacts	Long-term Negative Impacts
Sediment Characteristics	No Impacts	No Impacts
Borrow Area	Short-term Negative Impacts	No Impacts
Water Quality	Short-term Negative Impacts	No Impacts
Coastal Resources	No Impacts	No Impacts
Plant Communities		
Dune Communities	Long-term Positive Impacts	Long-term Negative Impacts
Invasive/Exotic Species	Long-term Positive Impacts	No Impacts
Protected Species	No Impacts	No Impacts
Fish and Wildlife Resources		
Dune Communities	Long-term Positive Impacts	Long-term Negative Impacts
Marine Intertidal Zone	Short-term Negative Impacts	No Impacts

Marine Subtidal Zone	Short-term Negative Impacts	No Impacts
Protected Species	Short-term Negative Impacts & Long-term Positive Impacts	Long-term Negative Impacts
Essential Fish Habitat	Short-term Negative Impacts	No Impacts
Cultural Resources	No Impacts	Long-term Negative Impacts No Impacts (Borrow Area)
Socioeconomics	Long-term Positive Impacts	Long-term Negative Impacts
Recreation Resources	Short-term Negative Impacts Long-term Positive Impacts	Long-term Negative Impacts
Environmental Justice and Protection of Children	No Impacts	No Impacts
Air Quality	Short-term Negative Impacts	No Impacts
Traffic, Transportation and Navigation	Short-term Negative Impacts Long-term Positive Impacts	Long-term Negative Impacts
Noise	Short-term Negative Impacts	No Impacts

5.4.4 Summary of Conditions to Minimize Potential Adverse Impacts

To minimize potential adverse impacts to sea turtles and to protect larval and estuarine fishery resources, the District will attempt to schedule the majority of the work between November and 30 April. This construction window will avoid impacts to nesting sea turtles, migratory West Indian manatees, and benefit juvenile life stages of fishery species that are likely present in warmer months. The District will abide by Section 7 of the ESA [16 U.S.C. 1531 et seq.] which outlines the procedures for Federal interagency cooperation to conserve Federally listed species and designated critical habitats. Through consultation with the District in 2008, a BO was issued by USFWS to addresses the project's impacts to non-breeding piping plovers, critical habitat for the piping plover, and nesting loggerhead and leatherback sea turtles. A new BO is being developed for this renourishment. The District will consider any new Reasonable and Prudent Measures to minimize take in this proposed renourishment. The 2008 BO concluded the project was not likely to jeopardize the continued existence of the loggerhead or leatherback sea turtles or the piping plover. No adverse modifications were determined for piping plover Critical Habitat Unit GA-1 (Figure 1). The following Reasonable and Prudent Measures were recommended and implemented to minimize take of the above listed species:

The USACE included in their proposed action conservation measures to minimize the effects of this action on sea turtles and piping plovers:

1. Construction equipment and materials will be staged and stored in a manner that will minimize impacts to sea turtles and piping plovers to the maximum extent practicable.

2. Existing beach access points will be used for vehicle and equipment beach access to the maximum extent practicable. Existing vegetated habitat at the

beach access points must be protected to the maximum extent practicable. The access must be delineated by fence or other suitable material to ensure vehicles and equipment transport stay within the access corridor.

3. Shorebird monitoring will be performed to detect piping plovers or concentrations of other shorebirds once a month for the entire beach and another time during the month on the critical habitat on the north part of the island. This will be done prior to and during the construction activities.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of nesting and hatchling loggerheads and leatherbacks and non-breeding piping plovers in the proposed areas of dredged material placement and associated activities in the action area.

1. If the beach renourishment project extends into the sea turtle nesting season (beyond April 30), surveys for nesting sea turtles must be conducted daily before work is begun. If nests are constructed in the area of beach renourishment, the eggs must be relocated to minimize sea turtle nest burial, crushing of eggs, or nest excavation.

2. Immediately after completion of the beach renourishment project and prior to the next four nesting seasons, beach compaction must be monitored and tilling must be conducted as required to reduce the likelihood of impacting sea turtle nesting and hatching activities, and foraging, roosting and loafing piping plovers. (If tilling is needed, it must only occur above the primary wrack line.)

3. Immediately after completion of the beach renourishment project and prior to the next four nesting seasons, monitoring must be conducted to determine if escarpments greater than 18" high and 100' long are present in the project area. In the event escarpments meeting these criteria are detected they must be leveled to reduce the likelihood of impacting sea turtle nesting and hatching activities. Escarpments occurring outside the template of the project will not be leveled.

4. Disturbance to piping plover Critical Habitat GA-1 by the USACE beach nourishment project will be minimized by only filling a small portion of the area (33 acres out of 91 acres) and implementing buffer zones or traffic relocation routes around feeding/loafing plovers detected in the construction area. Surveys for piping plovers must be done within the action area to document the continued use of the Critical Habitat GA-1, as well as, the remaining action area in accordance with the most recent BO. The amount of pedestrian traffic and unleashed pet occurrences should also be recorded.

5. Lighting associated with the project night work must be minimized to reduce the possibility of disrupting and disorienting nesting and/or hatchling sea turtles and piping plover roosting activities.

6. The USACE shall ensure that contractors conducting the beach nourishment work fully understand the sea turtle and piping plover protection measures detailed in this incidental take statement.

A new or updated BO may be issued for this project during Pre-Construction Engineering and Design phase to address any changes that may have occurred since the 2018 renourishment.

NMFS provided the following EFH conservation recommendations:

1. The District shall limit dredging to depths likely to fill in with beach compatible sediments.

2. The District shall monitor the borrow area and surf zone in a similar manner to the 2015 study.

The District acknowledges the borrow area is likely to fill in with fines and would need to be surveyed again prior to use in any future renourishments.

The proposed project will impact critical habitat unit GA-1 for the wintering piping plover by placing a small amount of fill in the area (Figure 1**Error! Reference source not found.**). A watch plan to ensure plovers are not harmed will be utilized. Construction activities will be re-routed or stopped if plovers are in the vicinity of the work area. The USFWS 2008 BO contains recommendations which will be implemented to minimize impacts to the piping plover. Any recommendations to minimize impacts from the new BO being developed would be implemented. The GA DNR requires beach construction to occur outside the sea turtle nesting season (May 1 – October 31). However, nesting data from Tybee indicate the season is generally over by mid-September. The proposed construction timeline for this project is November 2019 through April 2020. Any agreements concerning renourishment during nesting season (1 May-30 Oct) would require consultations with GA DNR, NMFS, and USFWS. It is highly unlikely renourishment would extend beyond 30 April however, the USFWS has outlined conditions to regulate construction activities during sea turtle nesting season in their 2008 BO. The District will include these conditions or conditions from the most recent BO in any contract for construction. The Red Knot (*Calidris canutus rufa*) is a migratory shorebird that has recently been listed as Threatened under ESA. Any updates to this species will be addressed in accordance with the ESA and NEPA.

The beach will be tilled and monitored for sand compaction and beach profile immediately after construction and monitored for four years after construction, including the first winter/spring following completion of construction, to determine post-

nourishment compaction and dimensions of any escarpments inside the template. Only areas of compaction greater than 500 cone penetrometer index units need to be mechanically tilled. Compaction testing will be conducted by qualified USACE personnel and GA DNR biologists.

The material needed for the proposed alternatives will be excavated from the borrow area and placed on the beach areas by hydraulic cutterhead pipeline dredge. The 1997 NMFS BO on hopper dredging in the southeast found that hopper dredging was much more likely than pipeline dredging to result in adverse impacts to sea turtles and sturgeon. The use of a hydraulic cutterhead pipeline dredge would minimize potential adverse impacts to sea turtles and sturgeon. Conditions to avoid potential adverse impacts to threatened and endangered species that might occur in the general project area will be added to any contract issued for the work. These conditions are explained in detail in Section 5.4.6 of this EA and in Appendix B, BATES and the 2008 BO from USFWS.

6.0 COORDINATION

NEPA coordination (including Section 106 National Historic Preservation Act) for the addition of dune construction to the TISPP as a part of the HIM Sup, and the expansion of the borrow site for the federal project was initiated on 6 September 2018 in the form of a scoping letter emailed to federal agencies, state agencies and tribes.

7.0 COMPLIANCE WITH LAWS AND REGULATIONS

Table 18 summarizes compliance of the proposed action with applicable Federal and State Laws.

Table 17: Relationship of Project to Environmental Requirements.

Federal Statutes	**Level of Compliance***
Anadromous Fish Conservation Act	Full
Archaeological and Historic Preservation Act	PARTIAL
Clean Air Act	PARTIAL
Clean Water Act	PARTIAL
Coastal Barrier Resources Act	Full
Coastal Zone Management Act	PARTIAL
Comprehensive Environmental Response, Compensation and Liability Act	NA
Endangered Species Act	PARTIAL
Estuary Protection Act	Full
Farmland Protection Policy Act	NA
Federal Water Project Recreation Act	Full
Fish and Wildlife Coordination Act	PARTIAL
Flood Control Act of 1944	Full
Land and Water Conservation Fund Act	NA
Magnuson Fishery Conservation and Management Act	PARTIAL
Marine Mammal Protection Act	Full
National Environmental Policy Act	PARTIAL

National Historic Preservation Act	PARTIAL
North American Wetlands Conservation Act	Full
Resource Conservation and Recovery Act	NA
Rivers and Harbors Act	Full
Water Resources Development Acts of 1976, 1986, 1990, and 1992	Full
Water Resources Planning Act	Full
Watershed Protection and Flood Prevention Act	Full
Wild and Scenic Rivers Act	NA
Executive Orders (EO), Memoranda, etc.	Full
Migratory Bird (E.O. 13186)	Full
Protection and Enhancement of Environmental Quality (E.O. 11514)	Full
Protection and Enhancement of Cultural Environment (E.O. 11593)	Full
Exotic Organisms (E.O. 11987)	Full
Floodplain Management (E.O. 11988)	Full
Protection of Wetlands (E.O. 11990)	Full
Relating to Protection and Enhancement of Environmental Quality (E.O. 11991)	Full
Environmental Justice in Minority and Low-Income Populations (E.O. 12898)	Full
Invasive Species (E.O. 13112)	Full
Protection of Children from Health Risks and Safety Risks (E.O. 13045)	Full
Prime and Unique Farmlands (CEQ Memorandum, 11 August 1980)	NA

*Level of Compliance:
Full Compliance (Full): Having met all requirements of the statute, E.O., or other environmental requirements.
Partial Compliance (Partial): Not having met some of the requirements at current stage of planning. Compliance with these requirements is ongoing.
Non-Compliance (NC): Violation of a requirement of the statute, E.O., or other environmental requirement.
Not Applicable (NA): No requirements for the statute, E.O, or other environmental requirement for the current stage of planning.

8.0 CONCLUSIONS

Based on a review of the information in this document, Alternative C appears to be the best course of action and is the Preferred Alternative to meet the project goals and result in only minimal adverse impacts. The proposed actions would increase the resiliency of Tybee Island in the face of a changing climate, combat beach erosion, and aid in the long-term economic growth of the economy on Tybee Island.

9.0 LIST OF PREPARERS

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11.0 LIST OF ACRONYMS

BAE	Borrow Area Extension
BATES	Biological Assessment of Threatened and Endangered Species
BO	Biological Opinion
CBRA	Coastal Barrier Resources Act
cy	Cubic Yards
EFH	Essential Fish Habitat
EO	Executive Order
ESA	Endangered Species Act
GA DNR	Georgia Department of Natural Resources
GNAHRGIS	Georgia's Natural, Archaeological and Historic Resources GIS
GPA	Georgia Ports Authority
HIM Sup	Hurricanes Harvey, Irma, Maria Supplemental
HQUSACE	Headquarters United States Army Corps of Engineers
MCY	Million Cubic Yards
MLLW	Mean Lower Low Water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Units
PL	Public Law
RIF/DIF	Refraction/Diffraction
SHPO	State Historic Preservation Office
SPM	Shore Protection Manual
TISPP	Tybee Island Shoreline Protection Project
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WRDA	Water Resources Development Act