Biological Assessment of Threatened and Endangered Species

ENCLOSURE A

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1.0 PROJECT BACKGROUND

The Georgia Ports Authority (GPA) is conducting studies to be used by the U. S. Army Corps of Engineers (USACE) to produce an Environmental Impact Statement (EIS) under Section 203 of the Water Resources Development Act (WRDA) of 1986. The EIS will assess the potential environmental Effects of deepening a portion of the existing Savannah Harbor to better serve the economic interests of the State of Georgia and federal interests in navigation. The Feasibility Report, along with the EIS, will present the findings of the engineering, economic, and real estate evaluations, which will lead to the selection of a final plan. To qualify as a federal navigation project, the study must meet all applicable federal regulations. The final EIS and Feasibility Report will explore 4 deepening alternatives and evaluate each of these according to environmental and economic criteria. The alternatives include deepening the existing channel by 2 feet, 4 feet, 6 feet, and 8 feet, including appropriate overdredge allowances and advanced maintenance.

2.0 DESCRIPTION OF PROJECT

The Inner Harbor area proposed for deepening roughly corresponds to channel Stations 0+000 (near Fort Pulaski) to 103+000 (above the Kings Island Turning Basin (KITB)): 103,000 river feet. The Bar Channel (BC) or ocean channel proposed for deepening begins at Station 0+000 and extends to a maximum length of approximately 85,000 feet. The maximum proposed project length is therefore approximately 36 miles. Figure A-1 shows the extent of the proposed project. The plan proposes to continue the present side slopes to the new depths which will provide a new channel bottom width of less than the average 500 feet of the existing channel. The project includes among its advantages the maintenance of the existing channel top width which reduces impacts to existing marshes and structures. Side slopes will therefore not be disturbed in this project, except where bend wideners have been located. Ongoing engineering evaluations will provide detailed estimates of volumes and proposed dredge depths by reach for each alternative in the *Preliminary EIS*.

3.0 MAJOR ISSUES

The proposed project has the potential to impact threatened and endangered species primarily through (1) dredging and disposal of dredge spoil, and (2) by increasing salinity levels and lowering dissolved oxygen (DO) concentrations in the Lower Savannah River. Protection of

species, such as whales and sea turtles, from dredging operations are presented in this document. The potential impacts of salinity and DO modifications on shortnose sturgeon are also discussed at length.

4.0 ENVIRONMENTAL SETTING

The project area is located mostly in Chatham County, Georgia, and Jasper County, South Carolina. These counties lie in the Coastal Plains physiographic province. The area is roughly bisected by the Savannah River which, including certain of its tributary channels, constitutes the boundary between the states of Georgia and South Carolina. The river enters the study area flowing in a generally southerly direction, then bends in the vicinity of Savannah to flow in a generally easterly direction to the Atlantic Ocean. Mainland areas are separated from the ocean by a line of barrier islands and intervening salt marshes and tidal rivers. The mouth of the Savannah River is located just north of Tybee Island.

The mainland of Chatham County, Georgia, is dominated by the City of Savannah. The city center is located on the southern bluff of the Savannah River approximately 18 miles above the river's mouth. The lands south of the city center and west of the coastal marshes are primarily devoted to urban development. Urban and industrial development extends northwestward along the Georgia side of the river, gradually giving way to natural woodlands and agricultural areas in the western part of the county.

The mainland of Jasper County, South Carolina, is predominately rural. Lands opposite the City of Savannah are characterized by a system of dikes, canals, and former rice fields constructed in the 18th and 19th centuries. The South Carolina side of the Savannah River is dominated by a brackish/salt marsh system.

Tidal fluctuations within Savannah Harbor are semidiurnal, averaging 6.8 feet at the mouth of the harbor and 7.9 feet at the upstream limit of the harbor. The tidal influence extends upriver approximately 45 miles to Ebenezer Landing, Georgia. The project area enjoys a temperate climate characterized by warm, humid summers and mild winters. The seasonal mean temperatures are 51° in winter, 64° in Spring, 80° in Summer, and 66° in Autumn. Precipitation averages 48.9 inches per year, with about 1/2 falling during summer thunder showers. Snow is rare. The frost-free season averages approximately 270 days. Hurricanes pose an occasional threat, mainly in September and October.

The Savannah area is rich with natural resources associated with a coastal environment. The Savannah River, other coastal streams, sounds, and adjacent Atlantic Ocean waters contain an abundance of marine life, some of which has great commercial value, such as shrimp, blue crabs, and oysters. The barrier islands and marshlands support many species of plants and animals, all part of the highly productive biomass of an estuarine system.

South Carolina, by amendment dated May 28, 1993, to its Water Classifications and Standards, Regulation 61-68, has classified the portion of Savannah Harbor within its boundaries upstream from Fort Pulaski to the Seaboard Coastline Railroad as Class SB and the portion oceanward as Class SA waters. Class SB is defined as tidal saltwaters suitable for primary and secondary contact recreation, crabbing, and fishing, except harvesting of clams, mussels, or oysters for market purposes or human consumption. Also suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora. Class SA is defined as tidal saltwaters suitable for primary and secondary contact recreation. Suitable also for uses listed in Class SB, with the same exception. The State of Georgia, through its Rules and Regulations for Water Quality Control, Chapter 3913-6, Revised May 29, 1994, has classified the Savannah River from mile 0 at Fort Pulaski to the open sea (including the littoral waters of Tybee Island) as recreation waters. From Fort Pulaski to Mile 27.4 (Seaboard Coastline Railroad Bridge), the river is classified as Coastal Fishing.

In 1927, the U. S. Congress established the Savannah National Wildlife Refuge which encompasses 26,000 acres of lowlands and marshes along the eastern bank of the Savannah River beginning near River Mile 18.5 is managed by the U. S. Fish and Wildlife Service (USF&W). The southern end of the Refuge lies adjacent to the upper 3 miles of Savannah Harbor. The refuge is located on the Atlantic flyway of migratory waterfowl. Approximately 3,000 acres of old rice fields and 18 freshwater impoundments have been developed into suitable resting and breeding areas for thousands of waterfowl that winter there each year. The Refuge is an important nesting area for the wood duck and provides excellent habitat for many other species of birds, mammals, reptiles, and amphibians. The Refuge helps serve the recreational needs of the area through its fishing, hunting, and wildlife observation opportunities.

5.0 THREATENED AND ENDANGERED SPECIES

Table A-1 (on the following page) is a list of the threatened or endangered species that might be in the project area. The list contains Threatened and Endangered Species which may be found in the Savannah Harbor Area, Chatham County, Georgia, and Jasper County, South Carolina. These species were excerpted from a list provided by USF&W, dated February 28, 1998. In accordance with Section 7 of the Endangered Species Act of 1973, we have evaluated the impacts the proposed action could have on any threatened or endangered species potentially occurring in the project area.

Table A-1

Federally Listed Threatened and Endangered Species
Distribution in Georgia and South Carolina

Common Name	Scientific Name	Status
Animals		
Acornshell, southern	*Epioblasma othcaloogensis*	E
Bat, gray	*Myotis grisescens*	E
Bat, Indiana	*Myotis sodalis*	E
Clubshell, ovate	*Pleurobema perovatum*	E
Clubshell, southern	*Pleurobema decisum*	E
Combshell, upland	*Epioblasma metastriata*	E
Darter, amber	*Percina antesella*	E
Darter, Cherokee	*Etheostoma scotti*	T
Darter, Etowah	*Etheostoma etowahae*	E
Darter, goldline	*Percina aurolineata*	T
Darter, snail	*Percina tanasi*	T
Eagle, bald	*Haliaeetus leucocephalus*	T
Heelsplitter, Carolina	*Lasmigona decorata*	E
Kidneyshell, triangular	*Ptychobranchus greeni*	E
Logperch, Conasauga	*Percina jenkinsi*	E
Manatee, West Indian	*Trichechus manatus*	E
Moccasinshell, Alabama	*Medionidus acutissimus*	T
Moccasinshell, Coosa	*Medionidus parvulus*	E
Pigtoe, southern	*Pleurobema georgianum*	E
Plover, piping	*Charadrius melodus*	T
Pocketbook, fine-lined	*Lampsilis altilis*	T
Shiner, blue	*Cyprinella (=Notropis) caerulea*	T
Snake, eastern indigo	*Drymarchon corais couperi*	T
Stork, wood	*Mycteria americana*	E
Sturgeon, shortnose	*Acipenser brevirostrum*	E
Tern, roseate	*Sterna dougallii dougallii*	T
Turtle, Kemp's ridley (Atlantic)	*Lepidochelys kempii*	E
Turtle, green	*Chelonia mydas*	T
Turtle, hawksbill	*Eretomochelys imbricate*	E
Turtle, leatherback	*Dermochelys coriacea*	E
Turtle, loggerhead sea	*Caretta caretta*	T
Whale, finback	*Balaenoptera physalus*	E
Whale, right	*Eubalaena glacialis*	E
Whale, sei	*Balaenoptera borealis*	E
Whale, sperm	*Physeter catodon*	E
Woodpecker, red-cockaded	*Picoides borealis*	E

Note: E = Endangered; T = Threatened

--CONTINUED--

Table A-1
(continued)

Federally Listed Threatened and Endangered Species
Distribution in Georgia and South Carolina

Common Name	Scientific Name	Status
Plants		
American chaffseed	*Schwalbea americana*	E
Black-spored quillwort	*Isoetes melanospora*	E
Bunched arrowhead	*Sagittaria fasciculata*	E
Canby's dropwort	*Oxypolis canbyi*	E
Dwarf-flowered heartleaf	*Hexastylis naniflora*	T
Floirda torreya	*Torreya taxifolia*	E
Fringed campioin	*Silene polypetala*	E
Green pitcher-plant	*Sarracenia oreophila*	E
Hairy rattleweed	*Baptisia arachnifera*	E
Harperella	*Ptilimnium nodosum (=Fluviatile)*	E
Kral's water-plantain	*Sagittaria secundifolia*	T
Large-flowered skullcap	*Scutellaria montana*	E
Little amphianthus	*Amphianthus pusillus*	T
Mat-forming quillwort	*Isoetes tegetiformans*	E
Miccosukee gooseberry	*Ribes echinellum*	T
Michaux's sumac	*Rhus michauxii*	E
Mohr's Barbara's buttons	*Marshallia mohrii*	T
Mountain sweet pitcher-plant	*Sarracenia rubra* ssp. *Jonesii*	E
Persistent trillium	*Trillium persistens*	E
Pondberry	*Lindera melissifolia*	E
Relict trillium	*Trillium reliquum*	E
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E
Schweinitz's sunflower	*Helianthus schweinitzii*	E
Seabeach amaranth	*Amaranthus pumilus*	T
Small whorled pogonia	*Isotria medeoloides*	T
Smooth coneflower	*Echinacea laevigata*	E
Swamp pink	*Helonias bullata*	T
Tennessee yellow-eyed grass	*Xyris tennesseensis*	E
Virginia spiraea	*Spiraea virginiana*	T

Note: E = Endangered; T = Threatened

State Listed Species Possibly Occurring in Chatham County

Common Name	Scientific Name	Status
Wilson's plover	*Charadrius wilsonia*	Rare
Peregrine falcon	*Falco peregrinus*	Endangered
American oystercatcher	*Haematopus palliatus*	Rare
Least tem	*Sterna antillarum*	Rare
Gull-billed tem	*Sterna nilotica*	Threatened
Climbing buckthorn	*Sageretia minutiflora*	Threatened
Ball-moss	*Tillandsia recurvata*	Threatened
Southeastern bat	*Myotis austroriparius*	Fed - candidate
Bachman's sparrow	*Aimophila aestivalis*	Fed - candidate
Gopher tortoise	*Gopherus polyphemus*	Fed - candidate
Island glass lizard	*Ophisaurus compressus*	Fed - candidate
Florida gopher frog	*Rana areolata aesopus*	Fed - candidate
Carolina gopher frog	*Rana areolata capito*	Fed - candidate
Altamaha lance mussel	*Elli.ptio shepardiana*	Fed - candidate
Altamaha spinymussel	*Elliptio spinosa*	Fed - candidate
Corkwood	*Leitneria floridana*	Fed - candidate
Pondspice	*Litsea aestivalis*	Fed - candidate
Pineland plantain	*Plantago sparsiflora*	Fed - candidate

Endangered and Threatened Animals in Jasper County, South Carolina

Common Name	Scientific Name	Status
Shortnose Sturgeon	*Acipenser brevirostrum*	FE
Bachman's Sparrow	*Aimophila Aestivalis*	SC
Flatwoods Salamander	*Ambystoma cingulatum*	SE
Barrel Floater	*Anodonta Couperiana*	SC
Spotted Turtle	*Clemmus Guttata*	SC
Bluebarred Pygmy Sunfish	*Ellassoma Okatie*	SC
Carolina Slabshell	*Elliptio Congaraea*	SC
Gopher Tortoise	*Gopherus Polyphemus*	SE
Bald Eagle	*Haliaeetus leucocephalus*	FT/SE
Southern Hognose Snake	*Heterodon Simus*	SC
Bird-Voiced Treefrog	*Hyla Avivoca*	SC
Striped Mud Turtle	*Kinosternon Baurii*	SC
Pygmy Sperm Whale	*Kogia Breviseps*	SC
Yellow Lampmussel	*Lampisilis Cariosa*	SC
Rayed Pink Fatmucket	*Lampisilis Splendida*	SC
Wood Stork	*Mycteria Americana*	FE
Eastern Woodrat	*Neotoma Floridana*	SC
Eastern Woodrat	*Neotoma Floridana Floridana*	SC
Mimic Glass Lizard	*Ophisaurus Mimicus*	SC
Red-Cockaded Woodpecker	*Picoides Borealis*	FE
Pine or Gopher Snake	*Pituophis Melanoleukus*	SC
Florida Pine Snake	*Pituophis Melanoleukus Mugitus*	SC
Dwarf Siren	*Pseudobranchus Striatus*	ST
Gulf Coast Mud Salamander	*Pseudotriton Montanus Flavissimus*	SC
Eastern Floater	*Pyganodon Cataracta*	SC
Eastern Fox Squirrel	*Sciurus Niger*	SC
Black Swamp Snake	*Seminatrix Pygaea*	SC
Least Tern	*Sterna Antillarum*	ST
Paper Pondshell	*Utterbackia Imbecillis*	SC
Eastern Creekshell	*Villosa Delumbis*	SC
Carolina Dog-Hobble	*Agarista Populifolia*	SC
White Colicroote	*Aletris Abovata*	SC
Purple Silkyscale	*Anthaenantia Rufa*	SC
Piedmont Three-Awned Grass	*Aristida Condensata*	SC
Coastal-Plain Water-Hyssop	*Bacopa Cyclophylla*	SC
One-Flower Balduina	*Balduina Uniflora*	SC
Bandana-of-the-Everglades	*Canna Flaccida*	SC
Cayaponia	*Cayaponia Boykinii*	SC

Endangered and Threatened Animals in Jasper County, South Carolina (continued)

Common Name	Scientific Name	Status
Buckwheat-tree	*Cliftonia Monophylla*	SC
Narrowleaf Rushfoil	*Crotonopsis Linearis*	SC
Piedmont Flatsedge	*Cyperus Tetragonus*	SC
Rose Balm	*Dicerandra Odoratissima*	SC
Broomsedge	*Dichanthelium Aciculare*	SC
Southern Privet	*Forestiera Segregata*	SC
Two-Wing Silverbell	*Halesia Diptera*	SC
Small-Flowered Silverbell-Tree	*Halesia Parviflora*	SC
Creeping St. John's-Wort	*Hypericum Adpressum*	RC
Southern Lepuropetalon	*Lepuropetalon Spathulatum*	SC
Gopher-Apple	*Licania Michauxii*	SC
Southern Twayblade	*Listera Australis*	SC
Pondspice	*Litsea Aestivalis*	SC
Rusty Lyonia	*Lyonia Ferruginea*	SC
Lance-Leaf Loosestrife	*Lysimachia Hybrida*	SC
Ogeechee Tupelo	*Nyssa Ogeche*	SC
Sampson Snakeroot; Scurf Pea	*Orbexilum Lupinellum*	SC
Hairy Fever-Tree	*Pinckneya Pubens*	SC
Pineland Plantain	*Plantago Sparsiflora*	SC
Yellow Fringeless Orchid	*Plananthera Integra*	SC
Dwarf Milwort	*Polygala Nana*	SC
Leafy Pondweed	*Potamogeton Foliosus*	SC
Crested Fringed Orchid	*Pteroglossaspis Ecristata*	SC
Myrtle-Leaf Oak	*Quercus Myrtifolia*	SC
Soft-Hail Coneflower	*Rudbeckia Mollis*	SC
Tiny-Leaved Buckthorn	*Sageretia Minutiflora*	SC
Grassleaf Arrowhead	*Sagittaria Craminea Var Weatherbiana*	SC
Chaffseed	*Schwalbea Americana*	FE
Baldwin Nutrush	*Scleria Baldwinii*	SC
Giant Spiral Ladies'-Tresses	*Spiranthes Longilabris*	SC
Powdery Thalia	*Thalia Dealbata*	SC

Key to Symbols:
FE = Federally Endangered
FT = Federally Threatened
NC = Of Concern, National (unofficial--plants only)
RC = Of Concern, Regional (unofficial--plants only)
SE = State Endangered
ST = State Threatened
SC = Of Concern, State

6.0 DISCUSSION OF POTENTIAL IMPACTS

The Savannah District and Applied Technology and Management Inc. (ATM) have reviewed information concerning each of these species and evaluated the potential for the proposed action to impact these species. The results of our evaluation are contained in the following paragraphs:

6.1 MANATEES (*Trichechus manatus*)

Manatees inhabit sluggish rivers, sheltered marine bays, and shallow estuaries, eating most aquatic plants and any terrestrial plants they can reach. Records in Georgia are primarily random sightings, and carcass finds and are not the result of systematic research. Systematic aerial surveys were initiated in 1976, and sight records have been increasing in south Georgia in recent years. Sightings made by the public and researchers are recorded by the Georgia Department of Natural Resources. The results of a database query of manatee sightings performed by the Georgia Department of Natural Resources on July 13, 1998, reports 6 sightings of manatees in the lower Savannah River for 1998, 18 sightings in 1997, and 6 sightings in 1996. Contact will be maintained with USFWS Manatee Coordinator (Robert Turner. Jacksonville, Florida), Georgia DNR, and South Carolina DNR to update the manatee sightings for the final EIS.

The Georgia population is primarily migratory in nature and, therefore, fluctuates with season. Manatees are found in Georgia and South Carolina mainly during the warmer months of the year. Manatees were observed in the river from October to December of 1997. During the fall months of 1997, a telemetry collared female with a calf were sighted at warm water effluents during low tide and salt marshes during high tide. Additional adults manatees were also sighted at these locations during the fall months of 1997. The majority of manatee sightings, occurring in warmer months, are mostly southward along the Georgia coast from Chatham County toward Florida. Manatees have been observed infrequently in the Savannah River as far upstream as the King's Island Turning Basin (KITB) (Rathburn et al., 1981); however, their occurrence is rare.

Precautions to avoid injuring any animal present during project action will need to be implemented. Such precautions are listed as follows: 1) All construction personnel are responsible for observing water related activities for the presence of manatees. Qualified, recognized expert personnel will be retained to train contractor staff as well as provide subsequent oversight in observing for endangered species. 2) All construction personnel will

be advised that there are civil and criminal penalties for harming, harassing, or killing manatees that are protected under the Marine Mammal Protection Act and the Endangered Species Act of 1973, as amended. 3) Siltation barriers will be used in a manner and made from a material in which manatees cannot become entangled, and be properly secured, and regularly monitored to avoid manatee entrapment. Barriers should must not block entry or exit from essential habitat. 4) If manatees are seen within 100 yards of the active daily dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. Operation of any equipment closer than 50 ft. to a manatee shall necessitate immediate shutdown of that equipment. Activities will not resume until the manatee(s) has departed of its own volition. 5) Operation of vessels associated with the project will observe a "no wake" speed at all times in waters that provide less than 4 ft. from the bottom. 6) Boats used to transport personnel will be shallow-draft vessels, where navigation safety permits and will follow routes of deep water to the extent possible. Designated endangered species watchers will be posted in each boat. 7) The contractor will keep a log detailing sightings, collisions, or injury to manatees that occur during the dredging operations. 8) Any collision with, any/or injury to a manatee will be reported immediately to the South Carolina Department of Natural Resources, the Georgia Department of Natural Resources, and the U.S. Fish and Wildlife Service. 9) Temporary signs concerning manatees shall be posted prior to and during all construction/dredging activities. A sign measuring 3 by 4 ft., which reads *Caution: Manatee Area* will be posted in a location prominently in a location visible to water related construction crews. A second sign should be posted if vessels are associated with the construction, and should be placed visible to the vessel operator. The second sign should be at least 8 ½ " by 11 " which reads *Caution: Manatee Habitat. Idle speed is required if operating a vessel in the construction area. All equipment must be shutdown if a Manatee come within 50 ft. of operation. Any collisions with and/or injury to a manatee shall be reported immediately tot he Georgia Department of Natural Resource (912-264-7218), the South Carolina Department of Natural Resources (843-844-2473), and the U.S. Fish and Wildlife Service (803-765-5626 or 912-652-4036).*

Provided the above conditions and those listed in section 9 are placed on all dredge contracts, placed on all dredging contracts, the proposed project is not likely to adversely affect this species. In addition, the project area contains no habitat that has been designated as being critical for the species' survival.

6.2 WHALES

There are 6 species of whales listed as endangered in the State of Georgia: Right whale (*Balaena glacialis*), Sea whale (*Balenoptera borealis*), Blue Whale (*Balaena musculus*), Sperm Whale (*Physeter macrocenhalus*), Finback whale (*Balaenortera physalus*), and Humpback whale (*Mecraptera novaeangliae*). These species could be found in transit through the area during migrations.

6.2.1 Right Whale

Right whales visit the coasts of Georgia and Florida to calve in shallow coastal water. The winter calving season for the right whale appears to begin as early as September and can end as late as April. The peak of whale abundance and calving appears to be from December through March. The right whale is of particular concern in Savannah in that it is expected to occasionally be found off shore as individuals transit the coast towards their wintering, calving grounds.

The National Recovery Plan for the Northern right whale, dated December 1991 (NMFS, 1991), defines the coastal waters of the southeastern United States and, especially, the shallow waters from Savannah, Georgia, south to Cape Canaveral, Florida, as the wintering ground for a small but significant part of the Atlantic right whale population. According to the recovery plan, most records of sighting involve adult females, many of them accompanied by very young calves, although a few juveniles and males have been sighted in the region. The area surrounding Savannah Harbor which could be affected by commercial ships visiting the harbor or dredges used to maintain channel depths in the Navigation Project is not within the critical habitat defined by the NMFS for this species.

A study more recent than the recovery plan (Kraus et al., 1993) has found the area around the Florida/Georgia border and Jacksonville, Florida, in the widest area of the shallow-water shelf in the Georgia Bight, to be the primary and probably only calving ground for western North Atlantic right whales. They found cow/calf pairs to be primarily limited to the coastal waters between latitudes 27 degrees 30 minutes N and 32 degrees N. They also report right whales to be concentrated between Daytona Beach, Florida and Brunswick Georgia. Highest densities are around Jacksonville, Florida, and the Florida/Georgia border. Most whales occur between December and February within 15 miles of shore (but can be seen between November and late March). A few sightings have been reported as early as September and as late as June. This study documents 6 right whale sightings is between Brunswick and Savannah. They quote an

earlier estimate that no more than 350 right whales survive in the western North Atlantic and state that there have been 272 sightings of 87 identified non-calf right whales and 66 calves between 1980 and 1992. They further state that 74 percent of the known reproducing females have been documented off the southeast coast for the period 1980 to 1992.

Recent known occurrences of right whales in the Savannah area.

- (December 1992 to March 1993). Aerial surveys for right whales have been conducted for the past 2 years by the Savannah District during Savannah Harbor bar channel dredging. During the December 1992 bar channel dredging, aerial surveys were conducted by Christopher Slay, New England Aquarium, from November 30 to December 20, 1992. Surveys were flown on all but 1 day, December 19, 1992. One right whale was spotted during the survey (December 8, 1992). These data indicate that 5 percent of the survey days resulted in detection of a right whale.

- (December 1993 to March 1994). Two right whales were spotted by a pilot boat and the pre-dredge turtle survey crew on December 4, 1993. Aerial surveys were flown every day that weather permitted from December 12, 1993, to February 22, 1994 (58 days flown out of 73 possible). Whales were spotted on December 12, 1993 (3 subadults), December 18, 1993 (cow/calf pair), and January 23, 1994 (cow/calf pair). These data indicate that 5 percent of the survey days resulted in detection of right whales. However, 2 out of 19 survey days in December (11 percent) resulted in detection of right whales.

- (December 1994 to March 1995). Aerial surveys were conducted as weather allowed between December 1 and 31, 1994. Twenty complete surveys were flown and 1 whale was spotted on December 5, 1994 (5 percent of survey days).

- (December 1995). No aerial survey was conducted. No whales were sighted from the dredge during the Bar Channel dredging performed from December 5 to 26, 1995.

- Analyses by Kraus et al., 1993, on the mean latitude of whale sightings by week, indicate that areas at or north of Savannah fall within 1 standard deviation of the mean for December 1 to January 4. This is also true for the weeks of March 16 through April 5.

Human activities, including pollution, ship traffic, fisheries activities, and habitat loss, have been suggested to be significantly affecting the species (Kraus et al., 1993). Ship strikes are known to be a major cause of mortality in the right whale (NMFS, 1991), although there are apparently no documented strikes by ships associated with any southeastern dredging project (NMFS, 1991). Most right whales spotted in the southeast are found from 1 to 15 nautical miles from shore (Kraus et al., 1993, Ellis et al., 1993). Kraus et al. (1993) found that swimming speeds of cow-calf pairs averaged 0.41 km per hour and whales not accompanied by calves averaged 0.51 km per hour. Movements of individual cow-calf pairs ranged from less than 1 km per day to 38.8 km per day. One statistical test found that non-cow right whales travel significantly farther and faster than right whales accompanied by a calf. They also found that cows with calves are more active at the surface than other classes of right whales in the region. It appears that the behavior of this species, including its swimming speed, makes it particularly susceptible to impact from collisions with ships.

Available data indicate that right whales can be expected to transit the Savannah bar primarily during the month of December for the fall migration and for the spring migration to begin transit in mid-March. Impacts from hydraulic dredging associated with maintenance dredging of Savannah inner harbor are expected to be minimal. Some Bar Channel dredging operations, such as hopper dredging and vessel traffic associated with offshore hydraulic dredging, could potentially impact this species unless protective provisions are in place to avoid collisions.

To ensure that the proposed work does not impact the right whale, the District would abide by the conditions set by the NMFS in its extant Biological Opinion. The District has also established precautionary collision avoidance measures to be implemented during dredging operations that take place during the time right whales are present in waters off Savannah harbor. These measures are not limited to hopper dredging but are also applied to any

dredging activity that requires transporting of dredged material through waters that might contain right whales to an offshore or nearshore disposal site. These measures apply to the dredge and any attendant vessel associated with the dredging activity with a length of over 20 feet.

Each dredging contract for the Savannah Harbor Bar Channel will contain the following provisions. Each contractor will be required to instruct all personnel associated with the dredging/construction project about the possible presence of endangered right whales in the area and the need to avoid collisions. A qualified, recognized expert personnel will be retained to assist in the instruction of contractor personnel. Each contractor will also be required to brief his personnel concerning the civil and criminal penalties for harming, harassing or killing species that are protected under the Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972. Dredges and all other disposal and attendant vessels are required to stop, alter course, or otherwise maneuver to avoid approaching the known location of a right whale. The contractor will be required to submit an endangered species watch plan that is adequate to protect right whales from the impacts of the proposed work. The conditions in the current regional opinion, which the District would also abide by as long as the opinion is in effect, include the following: monitoring by endangered species observers with at-sea large whale identification experience to conduct daytime observations for whales between December 1 and March 31. During daylight hours, the dredge operator must take necessary precautions to avoid whales. During evening hours or when there is limited visibility due to fog or sea states of greater than Beaufort 3, the dredge must slow down to 5 knots or less when transiting between areas if whales have been spotted within 15 nautical miles of the vessels path within the previous 24 hours. (Contractors will be required to use daily available information on the presence of right whales in the project area.) Between December 1 and March 31, 100 percent dedicated daytime whale observer coverage is required. Monitoring by sea turtle observers is allowed between April 1 and November 30. If a Right Whale Early warning System (RWEW) is in place, it will be deemed to provide adequate information on the presence of whales during dredging operations. The District agrees to abide by and incorporate into its dredging contracts within the critical habitat area all mutually agreed upon operating rules emanating from this RWEW system.

6.2.2 Other Whales

Dredging activities are not expected to affect other species of whales for 2 reasons: 1) no other species of whales are expected to occur with regularity in nearshore waters where dredging would occur, and 2) other whales are not known to exhibit behaviors that would make them susceptible to ship collisions as is known to be the case for the right whale.

6.3 EASTERN COUGARS (*Felis concolor cougar*)

There have been no confirmed sightings of eastern cougars in the area of Savannah harbor in recent years. The proposed plan would not include substantial land-use changes that would provide or degrade any habitat suitable for these cats. Therefore, the project would not have any adverse affect on this species. In addition, the project would not destroy or modify any habitat determined critical for the species survival.

6.4 WOOD STORK (*Mycteria americans*)

Wood storks are known to frequent the more protected estuarine areas of the region for both feeding and nesting. Wood stork rookeries are located on hammocks and along the edges of the marsh behind the barrier islands. This species has been observed in the Savannah Harbor area, particularly at the Savannah National Wildlife Refuge and in the Wright River adjacent to the dredged material disposal areas. They occasionally rest within the disposal areas and feed there when conditions are right. A recent high number of 55 individuals were observed feeding in the disposal areas on September 23, 1995. These birds have a unique feeding technique and require higher prey concentrations than other wading birds. Acceptable water regimes for the wood stork involve periods of flooding, during which prey (fish) populations increase, alternating with dryer periods during which receding water levels concentrate fish at high densities. Fish trapped in the dredged material disposal areas during maintenance dredging may provide a source of food for wood storks once dewatering of the disposal areas are near completion. Continued use of upland disposal sites could be considered a minor enhancement of wood stork feeding habitat. Finally, the proposed project would not adversely affect this species. In addition, the purposed project would not destroy or modify any habitat determined critical for the species, survival.

6.5 BALD EAGLE (*Halibuts leucocephalus*)

Bald eagles are found in the Savannah Harbor area. They have been observed resting and hunting in the dredged material disposal areas north of Savannah. A recent high number of 4 individuals were seen flying over the disposal areas on November 23, 1994. Two active nests

are located at the Savannah National Wildlife Refuge and several eaglets have been fledged from these nests in recent years. Bald eagles have also nested along the Wright River north of the disposal areas. The proposed plan would not affect the existing nest sites or areas immediately adjacent to them. The proposed plan may enhance the disposal areas for eagles by attracting migrating birds to the diked disposal areas. Standing water in these disposal areas is known to be used by waterfowl in winter and during their migrations, and eagles will feed on waterfowl. Therefore, the proposed project would not adversely affect this species. In addition, the purposed plan would also not destroy or modify any habitat determined critical for the species' survival.

6.6 PEREGRINE FALCON (*Falco peregrines*)

The American peregrine falcon (F.p. anatum) was listed as endangered in 1970 under the Endangered Species Conservation Act of 1969, and was listed as endangered under the Endangered Species Act of 1973. Other races were listed as threatened or endangered due to similarity of appearance in 1984. The USF&W now proposes (FR 30 June 1995, pp. 34406-34409) to remove the species from the endangered species list. This is a large, rapid flying falcon that feeds on other birds. It occurs throughout much of North America, with few nesting birds in the plains or southeast. Birds that nest in subarctic areas generally winter in South America, while those that nest at lower latitudes exhibit variable migratory behavior. Peregrine falcons declined precipitously in North America following World War II. Research implicated DDT as causing egg shell thinning, resulting in nesting failures. Following restrictions on DDT, the population size of the species has increased. In the fall and spring, small numbers of this species--usually 1 or 2 individuals--can sometimes be seen feeding on shorebirds in the disposal areas. The proposed plan should maintain or increase the numbers of shorebirds using the disposal areas. That should be beneficial to this species. Therefore, the purposed project would not adversely effect this species. In addition, the project area contains no habitat which has been designated as being critical for the species' survival.

6.7 PIPING PLOVER (*Charadrius melodus*)

This species is a small, stocky shorebird that resembles sandpipers. Preferred habitats for the species are sandy beaches along the ocean and inland lakes, bare areas in dredge disposal sites, and natural alluvial islands in rivers. Shorelines with little vegetation are preferred for both nesting and feeding. These plovers feed primarily on fly larvae, beetles, crustaceans, mollusks, and other invertebrates that they pluck from the sand (Bent, 1929). Breeding grounds along the Atlantic Coast range from Newfoundland to North Carolina. Wintering areas

on the Atlantic Coast are from North Carolina southward through Florida and in the Bahamas and West Indies. The piping plover departs for wintering habitats by early September and returns to the breeding grounds in late March or early April. This species has been observed in the past on Tybee Island during the winter months (Steve Calver, personal observation) and could be expected at that time on other shorelines near the coast. A January 1991 survey by the GA DNR located 27 individuals on the Georgia barrier islands (information from Dwight Harley, April 30, 1991). A January 15, 1996, survey found 124 individuals along the Georgia coast (Mike Harris (GA DNR), personal communication). The primary threats to the piping plover are modification and destruction of habitat and disturbance of nesting adults and chicks (USF&W, 1985). This species occasional use of the dredged material disposal areas would not be impacted by the proposed plan. The bird island construction proposed as part of the mitigation plan for diking Disposal Area 14A is expected to provide additional wintering habitat for this species. Proposed disposal operations on Daufuskie and Tybee Islands could provide additional wintering habitat by increasing the amount of both high tide and intertidal beach. Therefore, the purposed project would not adversely affect this species. In addition, the proposed plan would not destroy or modify any habitat determined critical for the species' survival.

6.8 RED-COCKADED WOODPECKER (*Picoides borealis*)

This species requires forested habitat of at least 50 percent pine 30 years or older. No habitat that could potentially be used by this species would be impacted by the project. No known colony of these woodpeckers is located along the Savannah Harbor or on adjacent properties. Finally, the purposed project would not adversely affect this species. In addition, the project would not destroy or modify any habitat determined critical for the species' survival.

6.9 BACHMAN'S WARBLER (*Vermivora bachmanii*)

The present distribution of Bachman's warbler is unknown. Some authors consider it to probably be extinct (Post and Gauthreaux, 1989). Sightings in the mid-1970s came from Charleston County, South Carolina; several Louisiana locations; Kentucky; Maryland; and near the Long/McIntosh County line in Georgia. This species formerly bred mostly in swamps with an understory of cane. It is currently extremely rare with very few recent sightings. Most authorities agree that if the Bachman's warbler still exists it is most likely in the Ilon Swamp area in Charleston and Berkeley Counties, South Carolina. No habitat used by this species would be impacted by the project. Therefore, the project would not adversely affect this species. In addition, the proposed project would also not destroy or modify any habitat determined critical

for the species, survival.

6.10 KIRTLAND'S WARBLER (*Dendroica Kirtlandii*)

This very rare warbler breeds in Michigan and winters in the Bahamas. It is a rare transient along the Southern Atlantic Coast, including Georgia and South Carolina. We are aware of no estimate of the number of individuals migrating through the state. It would be expected to occur as a very rare migrant in coastal scrub and forest land, especially after storms. No habitat would be impacted by this project that this species might use. Therefore, the purposed project would not adversely effect this species. In addition, the proposed project would not destroy or modify any habitat determined critical for the species' survival.

6.11 EASTERN INDIGO SNAKE (*Drymarchon corais*)

The eastern indigo seems to prefer high, dry, well-drained sandy soils, closely paralleling the sandhill habitat preferred by the gopher tortoise. However, especially during the warmer months, indigos also frequent streams and swamps, and individuals are occasionally found in flat woods. Therefore, the purposed project would not adversely affect this species. In addition, the proposed project would not destroy or modify any habitat determined critical for the species' survival.

6.12 SEA TURTLES

Five species of sea turtles are found along the Georgia and South Carolina coast which are listed as endangered or threatened. These are the Kemp's (Atlantic) Ridley Turtle (*Levidochelys kempii*), green turtle (*Chelonia-mydas*), Leatherback turtle (*Dermochelys coriacea*), Loggerhead turtle *(Caretta caretta*), and Hawksbill turtle (*Eretomochelys imbricata*). All species of marine turtles listed previously are presently classified as federally endangered, except the green sea turtle and the loggerhead turtle, which are listed as threatened. The loggerhead turtle is known to nest on Tybee Island. The Kemp's ridley, leatherback, hawksbill, and green sea turtles also inhabit Georgia waters, but nest in other areas. (Schroeder, 1987; Schroeder and Warner, 1988; and Teas and Martinez, 1989; The University of Georgia Cooperative Extension Service, 1992; USF&W, 1993). Green turtles and leatherback turtles have been known to nest in Georgia on rare occasions (USF&W, 1993). The stranding records for Chatham County, Georgia indicate that 4 turtles were stranded in the County from January 1 to June 30, 1989, and 212 strandings occurred in the State of Georgia during 1989. Approximately 95 percent of these strandings occurred from May to November.

Since the turtles are known to occur in the vicinity of the Bar Channel, there is a potential that

they may be directly impacted by certain dredging operations within the bar channel. Research by the USACE WES and historic data indicate that hopper dredges in a given situation are much more likely to cause adverse impacts to sea turtles than stationary dredges (hydraulic pipeline, clamshell, bucket). Those impacts are apparently the result of the speed at which the equipment moves across the bottom of the channel. The high speed of hopper dredges does not allow sufficient time for turtles to recognize the danger and avoid entrainment. Because of the potential impacts to sea turtles, use of stationary dredges would be preferred. However, due to the high cost of stationary dredges, hopper dredges are still used, and their use is environmentally acceptable, provided restrictions to minimize their environmental impact are included in their operation. The USACE WES (1994) has conducted research on the distribution and abundance of sea turtles in order to develop restrictions on hopper dredging which would minimize its impact on sea turtles. They have found that turtles are usually either missing or present in only very low numbers in Savannah from December through March. The WES study states that caution should be taken when using absolute dates for arrival and departure of sea turtles. Other factors such as seasonal differences in temporal movements and water temperature effects (relatively low abundance was found in the winter months when surface water temperatures were less than or equal to 16°C) may be at play. Restrictions on hopper dredge operation have been developed and agreed upon by NMFS and the USACE which minimize those impacts. Those restrictions are being refined as research in this area continues. These may change with increased knowledge of sea turtle distribution and abundance and as new hopper dredging equipment and techniques are developed. If, in a specific dredging operation, costs for equipment types are identical, use of a stationary dredge would be preferred since it would be expected to have less impact on sea turtles. To ensure that dredging operations are not likely to adversely impact sea turtles, all dredging operations would be done in compliance with the appropriate Biological Opinion for navigation channels in the southeast issued by the NMFS.

If the project is constructed during the turtle nesting season, a turtle nest monitoring program would be conducted to insure protection of any turtles that may try to nest on the existing beach or the newly formed beach. In the actual project implementation, the standard procedures that have been developed previously shall be followed. In conclusion, if the projects as stated above are implemented, this project is not likely to adversely affect the sea turtles or their habitat. In addition the project contains no habitat which has been designated as being critical for species survival.

6.13 SHORTNOSE STURGEON (*Acipenser brevirostrum*)

The shortnose sturgeon, *Acipenser brevirostrum*, is an endangered anadromous fish which is restricted to east coast rivers of North America. Eighteen distinct population segments have been identified in rivers stretching from Canada to northern Florida. It is a member of the Acipenseridae family, which is among the most primitive and ancient of the bony fishes. Original settlers to colonial and early America were struck by the immense numbers of sturgeon in coastal rivers such as the Delaware River. Commercial fishing began in the 1870s and took on unrestrained dimensions with the growth of the caviar market. By the beginning of the century there were dramatic declines due to overfishing and the first attempts for preservation were made in 1907. Since that time loss of habitat, installation of dams on spawning rivers, pollution and dredging in spawning areas have caused a collapse in most sturgeon stocks (T. Smith et al., 1992).

The species was listed as endangered by the USF&W on March 11, 1967 (32 CFR 4001). The reason for the listing was the virtual disappearance of the shortnose sturgeon from commercial catches, which led the USF&W to conclude that the species was on the verge of extinction. The early listing of the shortnose sturgeon made access to the fish difficult and hence left many aspects of its biology and environmental tolerances unstudied. Much of what is known about the fish in its natural setting has come from northern climate studies which are not readily applicable to the shortnose sturgeon living in southern, warm climate waters. Warm water estuarine environments are considered to be far more stressful due to their intermittent hypoxia and high summer temperatures. Hence, feeding habits, temperature dependent behavior, tolerance of stressful conditions, such as low DO, may differ greatly between northern and southern populations. Information from laboratory tolerance studies are also not easily transferable to the natural setting, because these studies often examine a single, readily isolatable factor, whereas in the wild the fish are subject to a multiplicity of coalescing factors whose synergistic impacts are often quite different from what would be predicted in a laboratory. The paucity of knowledge on the shortnose sturgeon is underscored by the fact that some of the biological data in NOAA's synopsis (Dadswell et al., 1984) is considered by some experts to be inaccurate, while other data, though accurate, reflect northern climate conditions.

The *Recovery Plan* (1997) for the shortnose sturgeon lists the following as factors affecting its recovery: dredging; pollutant discharges (both point and nonpoint); bridge construction and removal; dam construction, removal and re-licensing; power plant construction and operation, poaching and incidental takes by commercial fishermen. Fishing mortality caused by incidental taking from shad fishing is thought by some researchers to be the greatest direct cause of

mortality. The long term recovery objective for the shortnose sturgeon is "to recover all discrete population segments to levels of abundance at which they no longer require protection under the Endangered Species Act" *(Recovery Plan, 1997).* The Recovery Plan aims at the achievement and preservation of a minimum population size for each population segment, for which critical habitat must be maintained and mortality minimized. On most rivers the determination of a "minimum population" is not known due to lack of previous records and lack of continuing field research programs.

The majority of populations have their greatest abundance and are found throughout most of the year in the upper portions of the estuary of their respective river (NMFS, 1984). They remain in the estuaries and near the region of the saltwater-freshwater transition zone until late winter, when they move upriver to spawn. The general pattern of seasonal movement appears to involve an upstream migration from late January through March when water temperatures range from 48.2°F to 53.6°F. Post-spawning fish begin moving back downstream in March and leave the freshwater reaches of the river in May. In the Savannah River, juvenile and adult sturgeon use the area located above the freshwater-saltwater transition zone throughout the year as a feeding ground. During the summer, this species tends to use deep holes in the vicinity of the freshwater-saltwater transition zone (Flournoy et al., 1992; Rogers and Weber, 1994; Hall et al., 1991).

All the dynamics of spawning are not well understood. Spawning occurs in upstream freshwater, is temperature dependent, is affected by stream velocity and requires a suitable substratum. Spawning commences at about 47°F to 48.2°F and ceases at about 53.6°F to 59.5 °F. If the stream velocity, or other conditions, are not suitable, the mature female may not release her eggs but instead resorbs them and aborts the spawning. Females appear to prefer channels with rough substrates having a channel velocity between 0.2 to 0.8 m/sec (Buckley and Kynard, 1985).

The shortnose sturgeon in the southern rivers mature earlier than those in northern rivers because they grow faster (Dadswell et al., 1984). In Georgia males spawn first at 2 to 3 years and females spawn at 6 years or less. In the St Johns River, Canada, males mature at 10 to 11 years and females in 12 to 18 years. The northern fish continue to grow for much longer periods and become much larger in size. The southern shortnose sturgeon live a shorter life. Northern adults are estimated to live 30 to 60 years, while southern adults live 10 to 20 years (Kynard, 1994). The oldest fish ever recorded was a 67-year old female in the St. John River

and a 32-year old male from the same river.

Shortnose sturgeon are benthic omnivores (Dadswell et al., 1984) that forage for insects, crustaceans and small fishes. The juveniles are believed to randomly vacuum the bottom, taking in food and non-food stuffs, while the adults are more selective in their feeding. Both juveniles and adults seem to feed on whatever is most abundant locally. Feeding is believed to be continuous and the spatial dispersion of captured fish suggest that they feed individually. The preferred prey is small gastropods (NMFS, 1984), but the species will feed on crustaceans, insect larvae, and molluscs (NMFS, 1995). Hall et al., 1991, mention the small clam *Corbicula* as being a prey item. Feeding habits appear to differ in northern and southern regions. Shortnose sturgeon in the Altamaha and Ogeechee rivers of Georgia, showed weight loss and lack of movement after June, when temperatures exceeded 80.6°F (Flournoy et al., 1992; Rogers and Weber, 1994).

The shortnose sturgeon is often confused with the larger Atlantic sturgeon. The former grows to about 4 feet in length, while the latter grows to over 9 feet. Another difference is that the Atlantic sturgeon is truly anadromous, in that it spawns in freshwater but lives in the ocean, whereas the shortnose sturgeon has been described as “freshwater amphidromous” where adults spawn in freshwater, live mostly above the freshwater-brackish water transition zone, and only periodically make use of saline waters at the river’s mouth. A petition has recently been filed for inclusion of the Atlantic Sturgeon onto the Threatened and Endangered Species List.

6.13.1 Salinity and DO Tolerance

Most of the DO tolerance information on the shortnose sturgeon has been obtained from laboratory experiments. These experiments have mostly aimed at establishing lethal limits and did not test for chronic exposure or behavioral responses to hypoxia. Furthermore, these tests usually examine factors in isolation, whereas in the wild numerous factors exist synergistically. It is, therefore, difficult to extrapolate from these tests to actual environmental conditions. A review of the literature has failed to identify a consensus on criteria for different life stages. Laboratory experiments on juvenile shortnose sturgeon have shown a substantial mortality above a salinity of 5 ppt and at DO levels of 3.5 mg/L and below (Winn et al., 1990). However, tolerance of low DO concentrations appears to depend on age. The younger shortnose sturgeon were found to be sensitive to low DO, while the older juveniles showed greater tolerance.

As previously noted, laboratory experiments are difficult to apply to actual field conditions. For example, Jenkins (1993) reports findings suggesting that salinities up to 7 ppt are acceptable for the nurturing of small sturgeon and other studies indicate that juveniles often move up and downstream with the saltwater-freshwater during summer months (Pottle and Dadswell, 1979), possibly to avoid high salinity levels (greater than 7.0 ppt; Smith et al., 1992). Analysis of salinity field data taken in July-August 1997 show a bottom salinity ranging from 0.2-22.0 ppt at GPA 06 (located south of the KITB) and a bottom salinity ranging from 0.1-15.2 at GPA-08 (located north of the KITB. These 2 stations bracket what has been identified as a habitat area for juvenile shortnose sturgeon. The maximum bottom salinities are double and nearly triple those reported for the onset of avoidance behavior.

The critical DO range for juvenile shortnose sturgeon appears to lie somewhere between 2.5 to 3.5 mg/L. Jenkins et al. (1993) found that juvenile mortality was at 86 percent at DO of 2.5 mg/L, but older sturgeon (>100 days) had less than 20 percent mortality at the 2.5 mg/L concentration. A dissolved oxygen level of 2.5 killed 100 percent of fish 25 days old, 96 percent of fish 32 days old and 86 percent of fish 64 days old but only 12 percent of the 104 and 310 days old fish. Young fish also died at significantly higher rates at oxygen levels of 3.0 mg/1 while this concentration did not appear to adversely effect fish greater than 77 days old. In each test at a DO concentration less than or equal to 3.0 mg/1 changes in the fishes behavior were noted. estuarine systems dissolved oxygen regularly falls below 3.0 mg/L. This is also true of the bottom waters of the Savannah River (Winn et al.). No mortality occurred at concentrations of 3.5 mg/L. Tolerance to low DO conditions is significantly increased with age. Juveniles may have the ability to move where the DO conditions are within tolerances.

Movements and Habitats in the Savannah River

Hall et al. (1991) undertook telemetry studies to determine seasonal movements and habitat areas of adult and juvenile shortnose sturgeon in the Savannah River. They found that upriver spawning migrations occurred from mid-February to mid-March when river temperatures ranged from 48.2°F to 53.6°F. Downstream migrations began in mid-March with all adult shortnose sturgeon leaving the freshwater reaches by early May. The study identified 2 spawning sites, 1 at RM 111-118, the other at RM 171-173. These areas were characterized by high velocities and scoured sand, and a clay and gravel substrate. Depths ranged from 20 feet to 30 feet and bottom velocities averaged 2.7 feet per second.

The freshwater-saltwater boundary was found to be a region that was used by adult and juvenile sturgeon during both fall and winter as a feeding ground. Three sites at RM 24.6, RM 22.3, and RM 22.2 were identified by Hall et al. (1991) as feeding areas. A probable nursery area for juvenile shortnose and Atlantic sturgeon was identified, approximately 1.2 to 3.1 miles downriver of the freshwater-saltwater boundary region (see Figure A-2). This area was characterized by sandy-mud and clay-mud bottom at a depth of 33-46 feet.

A subsequent study was undertaken by Collins and Smith (1993) in order to characterize the adult Savannah River shortnose sturgeon population. The study reported that spawning locations varied annually but generally occurred upriver, between RM 111 and RM 173, primarily during late February but as late as mid-April, and at temperatures of 50EF to 61.7EF. The spawning areas were characterized by strong currents and scoured, coarse substrate which were also present in the spawning areas of the Saint John River, Canada, and the Connecticut River (Dadswell, 1979; Buckley and Kynard, 1985). These conditions are believed necessary for successful spawning, egg attachment, and hatching.

Nonspawning fish remained in the vicinity of the fresh-brackish water transition zone (RM 18.6-25) throughout the spawning season. Most shortnose sturgeon left the upriver freshwater areas in spring soon after the spawning season (January-April) and began their return in late Autumn or early winter. The study's findings supported the hypothesis of the important habitat function of the fresh-brackish water interface area and the downriver portion of the lower Savannah River. These 2 areas were found to serve as a staging area for the spawning migration and a holding area for fish that do not participate in the upriver migration.

Most shortnose sturgeon left the freshwater portion of the Savannah River by mid-April. This was also reported by Hall et al. (1991), who noted that shortnose sturgeon in the Savannah River had left fresh water by early May, although some remained in the vicinity of the freshwater-brackish water transition zone through the summer. This behavior differs from that of shortnose sturgeon in the northern portion of this species' range where some segments of the population stay in freshwater all year round.

Juvenile and adult sturgeon use the area located 1 to 3 miles from the freshwater-saltwater transition zone throughout the year as a feeding ground. During the summer, this species tends to use deep holes at or just above the freshwater-saltwater transition zone (Flournoy et al., 1992; Rogers and Weber, 1994; Hall et al., 1991). It is not known to what degree the

juvenile fish feed during the summer months when they visit these deeper pockets. However, it is believed that shortnose sturgeon in the Savannah River show evidence of weight loss and stress during summer months (Dr. Mark Collins, private communication). A review of the literature failed to yield information on the typical DO concentrations within these deep pockets, nor was any information available on the toleration ranges of the shortnose sturgeon to low DO concentrations at these depths. This boundary was thought to occur in the Savannah River between river miles 20.5 and 23.6 in 1987 (Hall et al., 1991). Data also indicate that KITB at about river mile 19.3 (an area of intense dredging) is used as a nursery area for juvenile sturgeon and as a habitat for all shortnose sturgeon during parts of the year (Hall et al., 1991). Sturgeon therefore can be expected throughout the year somewhere within the area from about River Mile 17.5 to 26.6.

The adult population in the Savannah River is thought to be between 300 to 3,000 fish. In 1989 the most statistically accurate method yielded an estimate of 1,003 and in 1990 an estimate of 655 (Kennedy et al., 1992). Development of a more accurate estimate of population would require further research.

In 1984, the USF&W and South Carolina Wildlife and Marine Resources Department (SCWMRD) coordinated a stock restoration program for shortnose sturgeon in the Savannah River. From 1984 to 1992, nearly 100,000 fish were stocked into the Savannah River. About 85 percent were small untagged juveniles. Recaptures of tagged fish indicate that stocked sturgeon grow and behave similar to wild juveniles. The stocking is a long term effort whose contribution towards restoration remains to be judged. The shortnose sturgeon is a long lived species which matures at an advanced age, hence successful reproduction and adaptation to the Savannah River by the stocked species can only be evaluated over a very long timeframe.

Serious gaps in the knowledge of shortnose movement and habitat exist for the location of larval habitats, larval survival and growth rates as well as early juvenile habitat. The carrying capacity for shortnose sturgeon of the Savannah River is in dispute (Smith et al., 1992). Other unknowns are the lethal and sublethal affects of hypoxic waters for different age groups; the location of adults during summer and fall and the extent to which the lower estuarine and coastal ocean saline waters are used by adults. Adult use of saline waters is unknown since the telemetry signal which is used to track the fish is lost once they enter saline waters. Two major weakness in any predictive study on this species are (1) the absence of general environmental tolerance information for southern climate waters and (2) the absence of specific

baseline data on the shortnose sturgeon population in the Savannah River.

6.13.2 Impacts to Shortnose Sturgeon

Dredging Impacts

Shortnose sturgeon are believed to be present in Savannah Harbor during routine maintenance dredging. Several field studies indicate that the channel and turning basin down to about River Mile 17 is a habitat for shortnose sturgeon of all age groups during parts of the year. It is not known how extensively the channels and turning basins are used as feeding areas. These areas are routinely dredged every year and the proposed project will deepen this area further. The effects of dredging on benthic organisms on which the shortnose sturgeon feeds are such that this area is not expected to be used extensively for feeding after a dredging operation.

Overall there will be very little effect on the project maintenance dredging since the same routine and the same volumes (except for the 1-time dredging volume of new materials) will be dredged in the "No Action" as well as the worst case scenario. The *LTMS* study showed that volumes have reached equilibrium, have remained steady, and will not increase by a deepening project. The engineering analysis on sedimentation impacts shows that, overall, there will be no impacts on sedimentation except a slight increase in annual shoaling at the KITB; shoaling will shift slightly upstream.

Direct Impacts from the Dredge

Adult and juvenile sturgeons are believed to be very mobile, even when occupying resting areas during the summer months. The potential for the adult and juvenile fish being hit by the cutterhead is very low. However, there have been reports, from other dredged rivers, of shortnose sturgeon being pumped into the hoppers. The sturgeon eggs, which are not mobile, would not be impacted since spawning and egg attachment occur at River Mile 112 to 119 and from River Mile 172 to 174 (Hall et al., 1991), an area well upstream of the project. A review of the recent literature shows that larvae habitat is presently unknown and hence direct dredging impacts on larvae, though improbable, can not be dismissed with certainty. The direct impacts of deepening and dredging in shortnose habitat in the vicinity of KITB, an area that is used by the fish during summer months (and non-spawning fish from February through May) is not known. Based on past experience, one could conclude that since fish return to these areas each year, after dredge maintenance has occurred, then they will continue to do so in the future.

Project Actions Related to Shortnose Sturgeon

Because of the potential project impacts on the shortnose sturgeon and the lack of site specific information concerning this species, a study will be performed to monitor the behavior of sturgeon in areas affected by the deepening. The impacts of deepening, if any, will be evaluated by a monitoring effort that will aim at a determination of trends in population size, verification of continuing juvenile recruitment, and a determination of sturgeon behavior relative to the areas that have been deepened.

The recommended study will have a 5-year duration. The first year of the study will be during the design phase of action, before dredging operations begin. This will allow for the acquisition of baseline conditions. The second and third years of the study will follow completion of the dredging operations.

Specific tasks of the study will include the following:

- Monitoring abundance of juveniles and adults by mark-recapture and CPUE
- Monitoring the age distribution
- Verifying continued recruitment of age of fish
- Telemetry work to determine behavior of adults and juveniles relative to impacted areas
- Water quality monitoring to accompany all samples

Sonic telemetry and “mark and recapture” studies are 2 methods that can be used to acquire data. Locations that could be used to place sonic receivers in the Savannah River and a

description on how the mark and recapture study will be managed are described in the draft proposal *"Savannah River Shortnose Sturgeon: Habitat Use, Population Size and Tolerance to Environmental Tolerances"* (Collins and Smith, 1991).

Habitat Improvement

Collins et al. (1991) reported that the KITB was a habitat for juvenile Shortnose sturgeon. However, since this data was collected, several events have changed the flow conditions in the Savannah River, including closure of the tide gate, advanced maintenance dredging in the KITB, and closure of New Cut. Shortnose sturgeon population or habitat studies have not been conducted since 1991.

Presently, there is concern about the environmental conditions in the juvenile habitat, KITB, determined from Collins et al. (1991). Post-project conditions in the KITB will exceed the environmental tolerances of juvenile Shortnose Sturgeon***. However, present continuous salinity data from May 1997 to August 1997 indicates that environmental tolerances are already exceeded.*** Juveniles remain at the freshwater-saltwater boundary in holes to escape elevated summer water temperatures. Continuous data from May 1997 to August 1997 show that the freshwater-saltwater boundary is upriver from the KITB.

To address the concern of the environmental conditions for juvenile shortnose sturgeon, a habitat improvement project action will be undertaken. The location just upriver from the KITB to Port Wentworth will be dredged 8 feet to provide conditions to juveniles that are similar to those found at the time of Collins et al. (1991). Depth, for example, at this location will be increased from approximately 36 feet to 44 feet, the approximate depth of the KITB in 1991. The habitat improvement project will not change the shoreline in the location to be dredged for habitat improvement.

Impacts Due to the Dredge Plume

Since spawning occurs far upstream of the dredging project, impacts to eggs and larvae are not expected. However, there is a potential for impacts to juvenile and adult fish feeding in the area or migrating through the area to spawn. Fish feeding in the area, being mobile, could avoid the dredge plume since a dredge creates a great deal of noise while operating. Furthermore, it is likely that the suspended sediment raised by the dredge does not exceed the high suspended sediment loading which occurs during storm events.

Studies performed by Dr. D.F. Hayes in 1986 on a hydraulic cutterhead dredge operating in Savannah Harbor indicated that average suspended sediment concentrations within 1,600 feet of the dredge were generally raised less than 200 mg/L in the lower water column and less than 100 mg/L and 50 mg/L in the middle and upper water column, respectively.

"Concentration of suspended sediments from a cutterhead dredging operation ranges from 10 to 300 mg/L near the cutterhead to a few milligrams per liter 1,000 to 2,000 feet from the dredge (Barnard, 1978; Raymond, 1983; Hayes, Raymond, and McLellan, 1984)." Quoted from "Field Studies of Sediment Resuspension Characteristics of Selected Dredges," by Thomas N. McLellan, Robert N. Havis, Donald F. Hayes, Gene L. Raymond; April 1989; USACE Technical Report HL-89-9 (Page 12). The present study found that for hydraulic dredges surface TSS levels were near background while bottom levels were one to several times background. Absolute TSS levels near the bottom ranged from 10.0 mg/L to 340 mg/L. The ratio of maximum plume TSS to background TSS varied from 1.8 to 3.8 times background measurements (Page 54). A study from the Back River is discussed on Pages 42-46.

Savannah River has a naturally high suspended sediment load which, during storm events, is expected to increase well beyond the 200 mg/L increase created by a hydraulic dredge. Also during storm events the higher suspended sediment loads would likely be more uniform throughout the water column due to mixing as the plume proceeds downstream. Therefore, the sturgeon would not be able to move up in the water column to avoid the increased sediment load as it would be able to do in a dredge induced situation.

Criteria Used for Modeling Impacts to Juvenile Shortnose Sturgeon

Environmental Tolerances

Shortnose sturgeon begin upstream spawning migrations in mid-February, downstream migrations end in mid-May. Spawning occurs at 2 locations: the first is at RM 111-118 and the second at RM 171-173. Spawning is not likely to be affected by the project because it occurs upriver, outside of the area of the proposed action. Previous studies (Hall et al., 1991) have identified the freshwater-saltwater boundary as a feeding ground for juveniles and adults in the fall and winter. Approximately 1.2 to 3.1 miles downriver of the boundary region is a probable nursery area for juveniles (Hall et al.,1991). Juveniles remain near the freshwater-saltwater boundary all year until they mature and join the spawning population migrations. The KITB (KITB) has been identified as a habitat that juveniles prefer. Collins (1992) reports that the main concentration of juveniles from February to May is located at KITB (Collins et al. 1992,

pg.4). During summer months the deeper regions of the KITB near the freshwater-saltwater boundary provide a location for juveniles that presumably are seeking lower temperatures. A literature search, undertaken for the present study, failed to locate an acceptable temperature data range for the shortnose sturgeon population within the Savannah River.

As previously noted, information on salinity tolerance for shortnose sturgeon juveniles is limited. Studies in Russia on 3 species of sturgeon indicate that salinity tolerance increases with age and size (Krayushkina and Dyubin, 1974). Experiments have shown that there is increasing tolerance to salinity with increasing size and age. Winn et al. (1990), report that juvenile shortnose sturgeon, in their laboratory studies, were most sensitive to salinities of 5 ppt and above and that mortality of juvenile shortnose sturgeon can occur at salinity of 10 ppt and higher. Sensitivity of juveniles to salinity above 5 ppt in the laboratory tolerance tests suggest that exposure to rapid increases in salinity can be lethal to juveniles, and could possibly displace fish further upstream to less saline waters (Winn et al. pg. 9). In a laboratory experiment reported by Jenkins et al. (1993), survival of all age groups at salinities up to 7 ppt was excellent, A salinity of 9 ppt appeared to be a threshold at which significant mortalities began to occur, especially among the youngest fish. *A concentration of 8 ppt. was selected to be the salinity simulation criterion*.

As previously mentioned, under acceptable laboratory temperature and salinity conditions, no mortality was observed in juveniles at DO concentrations of 3.5 mg/L or greater. Therefore, a conservative 3.5 mg/L DO concentration was selected as the model simulation criterion. However, it must be emphasized that the lethal DO limit for juveniles, in natural conditions for southern climate systems, has not been established. Estuarine systems in the southern United States, including the Savannah River, undergo intermittent hypoxia where DO levels often fall below 3 mg/L during the summer months for brief periods of time.

A review of the existing scientific literature did not locate any studies or any consensus regarding the synergistic relationship between temperature, salinity, and DO for the shortnose sturgeon. Some researchers (Flournoy et al., 1992), have noted that tolerance of low DO levels may decrease at temperatures higher than 28°C. The response of the juvenile shortnose sturgeon to the synergistic interplay of these factors needs to be researched before their tolerances to low DO, high temperature and increased salinity stresses can be ascertained. The results of the model simulations, therefore, cannot be readily related to generally recognized survival criteria, such as those that exist for salmonid species. The model

simulation criteria for juvenile shortnose sturgeon are summarized on Table A-2.

Table A-2

Model Simulation Criteria for Shortnose Sturgeon

Shortnose Sturgeon Juvenile Tolerances	
DO (mg/L)	>3.5
Salinity (ppt)	0-8.0
Shortnose Sturgeon Juvenile Habitats	
Savannah River (river miles)	17.5-26.6

Model Simulation--Present Conditions

The calibrated hydrodynamic model was used to investigate potential impacts on the shortnose sturgeon. The quantification of impacts on existing salinity and dissolved oxygen concentrations is presented in relation to prescribed flow conditions. Initial examination of the data identified the highly variable nature of the salinity concentrations and made determination of a static representative condition unrealistic. For this reason, it was decided that a statistical representation of the salinity provided a more scientifically based condition for use in impact analyses. The data from each of the stations were then analyzed in order to provide the cumulative percentile values of salinity. For example, a number of 10 ppt at the 50th percentile identifies that 50 percent of the time the salinity is *less* than 10 ppt. As was the case for salinity, the highly variable nature of the dissolved oxygen concentrations made determination of a static representative condition unrealistic. Using the methodologies described in Section 3.1.8.2 of the *DEIS*, the cumulative percentiles for dissolved oxygen were determined from the continuous data. Whereas for the salinity, the critical values are the *higher* concentrations, for dissolved oxygen the critical values are the *lower* concentrations. Therefore in preparing the percentiles, the 90th percentile represents the value for which 90 percent of the time the measured concentrations are above the prescribed value.

The modeling simulations used a flow rate of 8,200 cubic feet per second. This was the average flow rate for the continuous data collected from July to August 1997 and serves as a good representative summer condition. Existing water temperature during these months at the stations of concern was found to be as high as 29°C.

For the juvenile habitats of concern, the bottom salinity data, for all tides, at an average flow rate of 8,200 cubic feet per second, at the 90th percentile are provided below on Table A-3.

Table A-3

Existing Condition Model Simulations for Salinity
in the Front River Juvenile Shortnose Sturgeon Habitat Areas

	River Miles	Salinity (ppt)
Front River	24.4	0.3
	21.7	3.1
	20.5	6.0
	16.6	13.3

Existing Condition--Predicted Salinity at 8,200 cfs

In the KITB (RM 19.2), the existing salinity is estimated to be 12.5 ppt at the 90th percentile. This estimate was arrived at by interpolating salinity contours within the KITB. August 1997 continuous data suggest that bottom salinities tend to follow a linear relationship between the data stations. Salinity contours in the model output section of this report also show that salinity varies linearly between two data stations. Therefore, the predicted values in the KITB, RM 19.2, can be determined by interpolating between existing salinities of RM 21.7 and RM 16.6. It was more accurate to give only one linear interpolation in providing a predicted salinity value.

Existing Condition--Bottom DO at 8,200 cfs

The present DO concentration in the KITB, meets the 3.5 mg/L criterion 63 percent of the time.

For the juvenile habitats of concern, the bottom DO data, for all tides, at an average flow rate of 8,200 cubic feet per second, for all percentiles are provided below on Table A-4.

Table A-4

Existing Condition--Dissolved Oxygen at
Shortnose Sturgeon Juvenile Habitats

Station	River Mile	Percentile (mg/L)								
		90th	80th	70th	60th	50th	40th	30th	20th	10th
Front River										
GPA-11 (B)	24.4	6.0	6.3	6.4	6.5	6.6	6.6	6.7	6.8	7.2
GPA-09 (B)	21.7	4.3	4.8	5.1	5.4	5.8	6.2	6.5	6.8	7.0
GPA-08 (B)	20.5	3.6	4.1	4.5	4.8	5.2	5.6	6.0	6.5	7.1
GPA-06 (B)	16.6	3.3	3.5	3.7	3.8	3.9	4.0	4.2	4.3	4.6

Note: S = Surface, M = Mid-Depth, B = Bottom

Model Simulation--Predicting Future "With Project" Impacts on Shortnose Sturgeon Juveniles

Model simulations were performed in order to obtain predicted values of change in dissolved oxygen and salinity concentrations for the project deepening conditions. The simulations were made using a using a flow rate of 8,200 cubic feet per second. Each predicted change is rendered on a 90th percentile basis, which means that the predicted *decrease* in DO, and predicted *increase* in salinity, will be a maximum value, 90 percent of the time. Present dissolved oxygen concentrations and the predicted decreases over the habitat areas of concern are presented longitudinally in the water quality sections of the *DEIS* and the Engineering Appendices.

Predicted DO Changes

Table A-5 provides information on the predicted bottom dissolved oxygen conditions. Locations upriver from the KITB on the Front River RM 24.4 (GPA-11) are predicted to undergo a decrease at the 90th percentile of 0.1 mg/L DO (bottom) and at RM 21.7 (GPA-09); there will be no predicted change. At RM 20.5 there will be a decrease of 0.1 mg/L. The concentration will then be 3.5 mg/L for the 90th percentile, thus acceptable conditions will be met 90 percent of the time. Further downriver of the KITB, at RM 16.6, the maximum decrease will be 0.3 mg/L and the time when acceptable conditions will be met is reduced form 80 percent of the time to 60 percent. The KITB has been shown to be the location that has the highest population of juveniles, therefore, decreases in dissolved oxygen concentrations, in this area, are of special concern. Because of this concern, supplemental data points were added to show the predicted

bottom effects across the KITB. A total of 5 supplemental points were added and these locations are shown in Figure A-3.

Table A-5

Predicted Condition--Bottom Dissolved Oxygen
at Shortnose Sturgeon Juvenile Habitats

Station	River Mile	Percentile (mg/L)								
		90th	80th	70th	60th	50th	40th	30th	20th	10th
Front River										
GPA-11 (B)	24.4	5.9	6.3	6.4	6.5	6.6	6.6	6.7	6.8	7.2
GPA-09 (B)	21.7	4.3	4.8	5.1	5.4	5.8	6.2	6.5	6.8	7.0
GPA-08 (B)	20.5	3.5	4.1	4.5	4.8	5.2	5.6	6.0	6.5	7.1
GPA-06 (B)	16.6	3.0	3.2	3.4	3.5	3.6	3.7	3.9	4.0	4.4

Note: S = Surface, M = Mid-Depth, B = Bottom

AT KIB0 the predicted decrease is 0.3 mg/L. This point is halfway between RM 16.6 (GPA-06) and RM 20.5 (GPA-08), where the predicted decreases are 0.3 mg/L and 0.1 mg/L, respectively. KIB1 is at the most downriver end of the KITB and the decrease at this point is 0.2 mg/L. The points KIB3, KIB4, and KIB5 are in the KITB and are in a straight line along the river. KIB3 is at the deepest point of KITB. Decreases at all 3 points are 0.2 mg/L.

The percent of time that acceptable conditions will be met were determined by subtracting the maximum predicted decreases at each point from the existing condition until it was equal to the 3.5 mg/L criterion. In each case, the time in which acceptable conditions are met in the KITB has been established as 63 percent of the time. The percentage of time that the impacted condition will be acceptable is 50 percent of the time. At KIB 0, approximately 1 mile down river of the KITB, the maximum predicted decrease in DO was 0.3 mg/L. Although no continuous data is available for this point thus no percent of time at acceptable conditions can be given. Duration criteria were not attempted, since these do not exist in the literature, hence, the amount of time this concentration can be tolerated by juveniles cannot be addressed with any certainty.

Predicted Salinity Changes

Predicted salinity increases in the Front River to the 90th percentile are as follows: at RM 21.7 (GPA-09) there is an increase of 2.0 ppt. At RM 20.5 (GPA-08) there is an increase of 2.8 ppt. At RM 16.6 (GPA-06) there is an increase of 5.2 ppt. The predicted salinity at these points will be as follows.

River Miles	Salinity (ppt)
24.4	0.6
21.7	7.1
20.5	12.8
16.6	22.6

Salinity at RM 19.2 (KITB) will increase by 4.05 ppt. This value was calculated by a linear interpolation between the predicted increases at RM 20.5 and RM 16.6, since the salinity is observed to follow a liner relationship. The predicted salinity at the KITB will be 16.5 ppt at the 90th percentile. According to the model simulation, areas upriver from the KITB experience some increase in salinity and decrease in DO. However, these modest increases may be tolerable to the juvenile population. The model simulation criteria were determined from the best available data. Tolerances and the relationship between stress and other tolerances have not been researched to give any definitive values.

Project Actions Related to Shortnose Sturgeon

This is addressed in Section 6.13.2, Project Actions Related to Shortnose Sturgeon.

Conclusions

Impacts to the KITB, a known habitat for juvenile shortnose sturgeon, are described above. Model run results of the post project condition predict bottom DO will be below the model criterion of 3.5 mg/l DO at the 50^{th} percentile (in the present condition the criterion is exceeded at the 60^{th} percentile). Based on these results the post project conditions are likely to adversely affect this species. Since impacts to shortnose sturgeon, an endangered species, are unacceptable, the project will mitigate to avert any decrease in DO in the post project condition. The project will also undertake a five-year study of shortnose sturgeon in the Savannah River and consider a range of critical habitat improvement measures. Given the anticipated implementation of measures to avert decreases in DO within the Savannah River, the project will not adversely affect shortnose sturgeon. Critical habitat for juvenile shortnose sturgeon will therefore neither be destroyed nor degraded.

6.15 FLATWOODS SALAMANDER (*Ambysoma cingulatum*)

The flatwoods salamander is a candidate to be listed as a federal threatened species. Flatwoods Salamanders are strictly a Coastal Plain species that range from Alabama to the lower Coastal Plains of Georgia and the southern half of South Carolina. They are found in pine flatwoods-wire grass communities with adjoining cypress heads and naturally occurring ponds without large predatory fish.

A flatwoods salamander's body is silvery gray with some individuals being nearly black with a total length of about 5.2 in (13 cm). The back and tail are heavily mottled and black to dark brown, irregular blotches. Larvae are aquatic and quite unique in shape and pattern. The larvae are long and slender, with slender legs and fragile tail fins. Bodies are black to brown with white to yellow longitudinal lines. Eggs are laid in small clumps, 1 to 35, attached to pine needles, twigs and other vegetation at the edge or in shallow water.

Possible loss of habitat as a result of this type project would be the creation of a dredge spoil site. However only existing dredge spoil sites will be used in this project. No habitat that this species uses will be affected by the project action. Therefore, there would be no adverse effect on this species. In addition there will be no habitat destroyed or affected that is determined to be critical for this species' survival.

7.0 QUALITY OF DREDGED MATERIAL

Regulation of dredged material placement within waters of the United States and ocean waters is a complex issue and is the shared responsibility of the USEPA and the USACE. The primary federal environmental statute governing transportation of dredged material to the ocean for the purpose of disposal is the Marine Protection Research and Sanctuaries Act (MPRSA). The primary federal environmental statute governing the discharge of dredged or fill material into waters of the United States is Clean Water Act (CWA). All proposed dredged material disposal activities regulated by MPRSA and CWA must also comply with the applicable requirements of NEPA and its implementing regulations. To meet the complex legislative demands for dredged material evaluations, the USACE and the USEPA jointly publish a series of guidance documents to assist in an environmental effects evaluation of dredging projects and dredged material management alternatives.

The Sampling and Analysis Plan *(SAP)* for this project considered the procedures and guidance

provided by these documents. Physical and chemical data were collected on both the new work (NW) and O&M sediments so that a wide range of dredged material management alternatives could be considered and properly implemented. The Dredged Material Environmental Effects Evaluation (DMEEE) utilized the results of the sampling and analysis to provide an assessment of the both the project sediments (which includes the virgin material within existing channel limits, but below the existing project depth and the material proposed for excavation from required new bend wideners) and the existing O&M material. The assessment was primarily completed to support the Section 404(b)(1) and the Section 103 Evaluations, both of which are EIS attachments.

The DMEEE did not reveal any potentially unacceptable adverse effects from the excavation, transportation, discharge, and management of the material proposed for excavation to create the various Harbor deepening alternatives. The DMEEE did caution that surficial sediments from the vicinity of the destroyed Savannah RACON/Light (75,000 ft seaward of Fort Pulaski) should be further evaluated prior to dredging. If a project alternative of less than (-)50 ft MLW is selected, excavation may not be required in this area. The DMEEE further stated that "[i]f appropriate action is not taken by Neptune Orient Lines…" (the responsible party in the accident that destroyed the tower) "…or the USCG, additional sampling of the immediate vicinity using approved grab sampling techniques should be undertaken prior to any excavation of this reach for deepening. The sampling effort should be designed so that the results will be sufficient to develop an appropriate low-cost management alternative.should be removed and disposed of by approved methods by the shipping line responsible for the contaminating spill before construction of the Harbor deepening project.

Additionally, GPA and the USEPA have some concerns with the concentrations of tributyltin (TBT) found in some of the O&M sediments. While there is no official guidance concerning the benthic toxicity of TBT in sediments (prior to biological testing), and less for terrestrial species, the values reported in the bulk sediment chemistry were higher than expected and GPA is working with the Savannah USACE and Region 4 USEPA to develop an additional testing scope to ensure that the O&M material is best managed to reduce any possible effects from organotin compounds.

For the most part, the "No Action" Alternative is being evaluated incrementally against the various deepening alternatives. In the case of dredged material management, the issues are somewhat complicated by the need for continued maintenance of the existing approved harbor

project. Should the results of the EIS indicate that the “No Action” Alternative be selected, no additional environmental clearance will be required for the annual maintenance dredged material. The material will be managed according to the approved composite alternative selected in *LTMS*.

The new work sediments underlying the existing harbor project were lain down by processes long before the modern industrial age, and anthropogenic impacts to those sediments should be minimal. The contaminant-testing of these materials was conducted primarily to confirm this conclusion. Anthropogenic impacts while unexpected are possible from such pathways as ground water and natural or man-made deep areas that have since filled-in.

The primary environmental effects expected from the management of proposed deepening dredged material are therefore physical. These include water column impacts such as temporary sediment loading of the water column; benthic impacts such as the temporary dislocation of benthic organisms and the fine-grained more organic substrate; and volumetric issues such as the potential to more quickly fill or reduce the project life of disposal areas (confined disposal facilities and the ODMDS).

For these reasons, it is possible that biological effects may be greater for the “No Action” Alternative if sampling shows significant contamination of portions of the O&M material. During deepening, the O&M material is removed together with the significantly greater volume of virgin sediments that will dilute this contamination.

8.0 COORDINATION

A *BATES* was included in the *Preliminary EIS* submitted to resource agencies in December 1994. In August 1995, the NMFS released a Regional Biological Opinion covering dredging for navigation channels. This *BATES* incorporates the conditions included in that opinion.

9.0 DETERMINATION

Based on the above evaluation, the operations for the deepening of the Savannah Harbor as proposed in the *Environmental Impact Statement* portion of the *Savannah Deepening Project* and as outlined in this document will not have significant adverse impacts on any of threatened and endangered species that may be present within the area or their habitat.

Shortnose sturgeon are not likely to be adversely affected by the project in light of the project's intent to implement mitigation measures to avert a lowering of DO in the KITB. Without mitigation to avert a decrease in DO , model runs show a degradation in the bottom dissolved oxygen concentrations in the KITB and therefore a determination of likely to affect. Actions related to shortnose sturgeon are discussed in Section 6.13.2. In addition, the study on the Savannah River population of shortnose sturgeon should be done in phases. The first phase should one year and determine the present status of the population of the KITB. Subsequent phases should then be completed to determine environmental tolerances and habitats of the shortnose sturgeon population in the Savannah River.

A determination of not likely to affect is concluded for the Manatees, Sea Turtles, and Right Whales. To ensure protection during dredging deepening and other operations the conditions listed below for the protection of Manatees, Sea Turtles, and Right Whales are made a part of the dredging contracts:

A. The contractor will instruct all personnel associated with the dredging of the presence of manatees and the need to avoid collisions with the manatees and right whales. Qualified, recognized expert personnel will be retained to train contractor staff as well as provide subsequent oversight in observing for endangered species.

B. All personnel associated with the dredging will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972.

C. Siltation barriers will be used in a manner and made from a material in which manatees cannot become entangled, and be properly secured, and regularly monitored to avoid manatee entrapment. Barriers should must not block entry or exit from essential habitat.

D. If manatees are seen within 100 yards of the active daily dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. Operation of any equipment closer than 50 ft. to a manatee shall necessitate immediate shutdown of that equipment. Activities will not resume until the manatee(s) has departed of its own volition.

E. Operation of vessels associated with the project will observe a "no wake" speed at all times

in waters that provide less than 4 ft. from the bottom.

F. Boats used to transport personnel will be shallow-draft vessels, where navigation safety permits and will follow routes of deep water to the extent possible. Designated endangered species watchers will be posted in each boat.

G. The contractor will keep a log detailing sightings, collisions, or injury to manatees which occur during the dredging operations.

H. Any collision with, and/or injury to a manatee will be immediately reported to , the Georgia Department of Natural Resources [weekdays, 8:00 AM to 4:30 PM.; or (1-800) 272-8363; nights and weekends: (1-800) 241-4113], the South Carolina Department of Natural Resources (843) 844-2473, and U.S. Fish & Wildlife Service (803) 765-5626 or (912) 652-4036.

I. Temporary signs concerning manatees shall be posted prior to and during all construction/dredging activities. A sign measuring 3 by 4 ft., which reads *Caution: Manatee Area* will be posted in a location prominently in a location visible to water related construction crews. A second sign should be posted if vessels are associated with the construction, and should be placed visible to the vessel operator. The second sign should be at least 8 ½ " by 11 " which reads *Caution: Manatee Habitat. Idle speed is required if operating a vessel in the construction area. All equipment must be shutdown if a Manatee come within 50 ft. of operation. Any collisions with and/or injury to a manatee shall be reported immediately tot he Georgia Department of Natural Resource (912-264-7218), the South Carolina Department of Natural Resources (843-844-2473), and the U.S. Fish and Wildlife Service (803-765-5626 or 912-652-4036).*

J. The contractor will instruct all personnel associated with the dredging of the presence of Right Whales and the need to avoid collisions with these mammals. A qualified, recognized expert personnel will be retained to brief all personnel on the habits and behavior of the right whale.

K. The contractor shall restrict vessel speeds during the high risk season of December to March of each year such that collisions with adult or juvenile whales can be avoided.

L. That the contractor shall he required to post a whale watch and submit a whale watch plan prior to conducting any dredging activities at the site. These measures apply to the dredge and any attendant vessel associated with the dredging activity with a length of over 20 feet.

M. Each dredging contract for the Savannah Harbor Bar Channel will contain the following provisions:

1. Each contractor will be required to instruct all personnel associated with the dredging/construction project about the possible presence of endangered right whales in the area and the need to avoid collisions. Qualified, recognized expert personal will be retained to train contractor staff as well as provide subsequent oversight in observing for endangered species. Each contractor will also be required to brief his personnel concerning the civil and criminal penalties for harming, harassing or killing species that are protected under the Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972.

2. Dredges and all other disposal and attendant vessels are required to stop, alter course, or otherwise maneuver to avoid approaching the known 10 location of a right whale.

3. The contractor will be required to submit an endangered species watch plan that is adequate to protect right whales from the impacts of the proposed work. This plan will include provision on board the dredge and all attendant vessels of trained observers (in accordance with the NMFS Regional Opinion) to watch for right whales at all times the vessel is in motion. Observers would be required during those months when whales may be expected to be present in the area.

4. Contractors will be required to use daily available information on the presence of right whales in the project area. NMFS requires monitoring by endangered species observes with at sea large whale identification experience to conduct daytime observations for whales between December 1 and March 31, when humpback and right whales occur in the vicinity of channels and borrow areas, north of Cape Canaveral. Monitoring by the sea turtle observers is acceptable between April I and November 30. Monitoring will be 100 percent for the first year of the biological opinion, unless subsequently altered upon authorization from NMFS. During daylight hours, the dredge operator must take necessary precautions to avoid whales. During evening hours or when there is limited

visibility due to fog or sea states of greater than Beaufort 3, the dredge must slow down to 5 knots or less when transiting between areas if whales have been spotted within 15 nautical miles of he vessels path within the previous 24 hours. South of Cape Canaveral, surveys for whales should be conducted by endangered species observers during the intervals between dredge spoil monitoring. If a right whale is known to be within 15 nautical miles of the project area on a given day, hopper dredges and any attendant vessels 20 feet or greater in length will be required to limit speeds that night to 5 knots or less when in the project area. The project area is defined as the Bar Channel to 103+000, and routes traveled between the two.

5. If a right Whale Early Warning System (RWEW) is in place, it will be deemed to provide adequate information on the presence of whales during dredging operations. The District agrees to abide by and incorporate into its dredging contracts within the critical habitat area all mutually agreed upon operating rules emanating from this RWEW system.

All hopper dredging will be generally be scheduled for December through March, and the following conditions will apply:

1. One hundred percent inflow screening is required, and 100 percent overflow screening is recommended when sea turtle observers are required on hopper dredges in areas and seasons when sea turtles may be present. If conditions disallow 100 percent inflow screening, inflow screening can be reduced, but 100 percent overflow screening is required, and an explanation must be included in the preliminary dredging report.

2. The sea turtle deflecting draghead is required for all hopper dredging during the months that turtles may be present, unless a waiver is granted by the COE SAD in consultation with NMFS.

3. To prevent impingement of sea turtles within the water column, every effort should be made to keep the dredge pumps disengaged when the dragheads are not firmly on the bottom.

4. A trained turtle observer will be placed on the hopper dredges to monitor for sea turtles for 100 percent of the period from November 1 to November 30, and April 1 to

May 31. No sea turtle monitoring is required between December 1 and March 31.

5. The water intake ports on the top of the draghead shall be screened with metal elliptical cages, or other suitable means to exclude sea turtles from entering the drag arm. No dredging shall be performed by a hopper dredge without a turtle deflector device in place.

6. Dredging shall be suspended upon the taking of more than 1 turtle in any day, the taking of 1 hawksbill turtle, or once 5 or more turtles are taken. Dredging operations will not commence, again, until coordination with South Atlantic Division and the NMFS has taken place and any remediation requirements are implemented, such as relocation trawling with a shrimp boat, to ensure compliance with the Endangered Species Act.

7. A report summarizing the take of sea turtles will be submitted to the National Marine Fisheries Service (NMFS) immediately following completion of the project.

A determination of no adverse effect is concluded for the Eastern Cougar, Wood Stork, Bald Eagle, Peregrine Falcon, Piping Plover, Red-Cockaded Woodpecker, Bachman's Warbler, Kirkland's Warbler, Eastern Indigo Snake, and Flatwoods Salamander.

NOTE: These are the conditions currently being followed in accordance with the NMFS 1995 Biological Opinion for Navigation Channels in the Southeast, and additional guidance provided by South Atlantic Division. Should a new Biological Opinion be issued, the District would consider the conditions listed here void, and would abide by the conditions as stated in that opinion and any further guidance provided by South Atlantic Division.

10.0 REFERENCES

Barnard. 1978. *Prediction and Control of Dredged Material Dispersion around Dredging and Open-Water Pipeline Disposal Operation.* Technical Report DS-78-13. U. S. Army Corps of Engineers, Vicksburg.

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