Appendix C

Environmental Resources Documentation

- **C1: Existing Environmental Conditions Supporting Information**
- **C2: Section 7(a)(2)/7(d) Evaluation for Critical Habitat for Atlantic sturgeon Savannah River Expansion Project**
- **C3: 404(b)(1) Analysis**
- **C4: Savannah Harbor Expansion Project Monitoring and Adaptive Management Plan**
- **C5: 8-Step Process for EO 11988: Floodplain Management**

Appendix C1

Existing Environmental Conditions Supporting Information Documentation

- **U.S. Fish and Wildlife Service Information for Planning and Consultation List of federally listed threatened and endangered species**
- **Georgia Department of Natural Resources, Richmond County list of state listed species**
- **South Carolina Department of Natural Resources, Aiken County list of state listed species**
- **2013 Final Wetland Delineation Report, Fish Passage Project at New Savannah Bluff Lock and Dam**

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Georgia and South Carolina

Local offices

Georgia Ecological Services Field Office

(706) 613-9493
(706) 613-6059

105 Westpark Drive
Westpark Center Suite D
Athens, GA 30606-3175

South Carolina Ecological Services

(843) 727-4707
(843) 727-4218

176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558

http://www.fws.gov/charleston/

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species

[1] are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

NAME	STATUS
Red-cockaded Woodpecker Picoides borealis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7614	Endangered
Wood Stork Mycteria americana No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8477	Threatened

Reptiles

NAME	STATUS
Gopher Tortoise Gopherus polyphemus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6994	Candidate

Fishes

NAME	STATUS
Atlantic Sturgeon Acipenser oxyrinchus oxyrinchus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/3252	Endangered
Shortnose Sturgeon Acipenser brevirostrum No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6635	Endangered

Flowering Plants

NAME	STATUS
Harperella Ptilimnium nodosum No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/3739	Endangered
Relict Trillium Trillium reliquum No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8489	Endangered
Smooth Coneflower Echinacea laevigata No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/3473	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

NAME	SEASON(S)
American Bittern Botaurus lentiginosus https://ecos.fws.gov/ecp/species/6582	Wintering
American Kestrel Falco sparverius paulus	Year-round
Bachman's Sparrow Aimophila aestivalis https://ecos.fws.gov/ecp/species/6177	Year-round
Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626	Year-round
Brown-headed Nuthatch Sitta pusilla	Year-round

Chuck-will's-widow Caprimulgus carolinensis	Breeding
Fox Sparrow Passerella iliaca	Wintering
Kentucky Warbler Oporornis formosus	Breeding
Least Bittern Ixobrychus exilis https://ecos.fws.gov/ecp/species/6175	Breeding
Loggerhead Shrike Lanius ludovicianus https://ecos.fws.gov/ecp/species/8833	Year-round
Mississippi Kite Ictinia mississippiensis	Breeding
Painted Bunting Passerina ciris	Breeding
Prairie Warbler Dendroica discolor	Breeding
Prothonotary Warbler Protonotaria citrea	Breeding
Red-headed Woodpecker Melanerpes erythrocephalus	Year-round
Rusty Blackbird Euphagus carolinus	Wintering
Sedge Wren Cistothorus platensis	Migrating
Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295	Wintering
Swainson's Warbler Limnothlypis swainsonii	Breeding
Swallow-tailed Kite Elanoides forficatus https://ecos.fws.gov/ecp/species/8938	Breeding

Wood Thrush	Hylocichla mustelina	Breeding
Worm Eating Warbler	Helmitheros vermivorum	Migrating

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

PFO1A

PFO1C

LAKE

L1UBHh

RIVERINE

R2UBH

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Rare, Threatened, and Endangered Species
Known to Occur in Richmond County Georgia

County	an_pl	el_group	Scientific Name	Common Name	State status
Richmond	Animal	Fishes	Acipenser brevirostrum	Shortnose Sturgeon	E
Richmond	Animal	Amphibians	Ambystoma tigrinum tigrinum	Eastern Tiger Salamander	
Richmond	Animal	Invertebrates	Aphodius aegrotus	A dung beetle	
Richmond	Animal	Invertebrates	Aphodius alabama	A dung beetle	
Richmond	Animal	Reptiles	Clemmys guttata	Spotted Turtle	U
Richmond	Animal	Mammals	Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	R
Richmond	Animal	Fishes	Elassoma okatie	Bluebarred Pygmy Sunfish	E
Richmond	Animal	Invertebrates	Elimia caelatura	Savannah Elimia	
Richmond	Animal	Invertebrates	Elliptio congaraea	Carolina Slabshell	
Richmond	Animal	Invertebrates	Elliptio fraterna	Brother Spike	
Richmond	Animal	Fishes	Etheostoma fricksium	Savannah Darter	
Richmond	Animal	Fishes	Etheostoma serrifer	Sawcheek Darter	
Richmond	Animal	Reptiles	Farancia erytrogramma erytrogramma	Common Rainbow Snake	
Richmond	Animal	Invertebrates	Fusconaia masoni	Atlantic Pigtoe	E
Richmond	Animal	Mammals	Geomys pinetis	Southeastern Pocket Gopher	T
Richmond	Animal	Reptiles	Gopherus polyphemus	Gopher Tortoise	T
Richmond	Animal	Birds	Haliaeetus leucocephalus	Bald Eagle	T
Richmond	Animal	Reptiles	Heterodon simus	Southern Hognose Snake	T
Richmond	Animal	Amphibians	Lithobates capito	Gopher Frog	R
Richmond	Animal	Amphibians	Lithobates virgatipes	Carpenter Frog	
Richmond	Animal	Fishes	Moxostoma robustum	Robust Redhorse	E
Richmond	Animal	Mammals	Myotis austroriparius	Southeastern Myotis	
Richmond	Animal	Mammals	Myotis lucifugus	Little Brown Myotis	
Richmond	Animal	Amphibians	Necturus punctatus	Dwarf Waterdog	
Richmond	Animal	Fishes	Notropis chalybaeus	Ironcolor Shiner	
Richmond	Animal	Birds	Nyctanassa violacea	Yellow-crowned Night-heron	
Richmond	Animal	Birds	Passerina ciris	Painted Bunting	
Richmond	Animal	Mammals	Perimyotis subflavus	Tri-colored Bat	
Richmond	Animal	Birds	Picoides borealis	Red-cockaded Woodpecker	E
Richmond	Animal	Reptiles	Pituophis melanoleucus mugitus	Florida Pine Snake	
Richmond	Animal	Invertebrates	Toxolasma pullus	Savannah Lilliput	T
Richmond	Plant	Vascular Plants	Astragalus michauxii	Sandhill Milkvetch	T
Richmond	Plant	Vascular Plants	Berberis canadensis	American Barberry	E
Richmond	Plant	Vascular Plants	Ceratiola ericoides	Rosemary	T
Richmond	Plant	Vascular Plants	Chamaecyparis thyoides	Atlantic White-cedar	R
Richmond	Plant	Vascular Plants	Crataegus dispar	Aiken Hawthorn	
Richmond	Plant	Vascular Plants	Cypripedium acaule	Pink Ladyslipper	U
Richmond	Plant	Vascular Plants	Dryopteris celsa	Log Fern	
Richmond	Plant	Vascular Plants	Hymenocallis coronaria	Shoals Spiderlily	T
Richmond	Plant	Vascular Plants	Ilex cuthbertii	Cuthbert Holly	
Richmond	Plant	Vascular Plants	Liatris pauciflora	Few-flower Gay-feather	
Richmond	Plant	Vascular Plants	Liatris secunda	Sandhill Gay-feather	
Richmond	Plant	Vascular Plants	Lindera subcoriacea	Bog Spicebush	
Richmond	Plant	Vascular Plants	Macbridea caroliniana	Carolina Bogmint	R
Richmond	Plant	Vascular Plants	Melanthium latifolium	Broadleaf Bunchflower	
Richmond	Plant	Vascular Plants	Nestronia umbellula	Indian Olive	R
Richmond	Plant	Vascular Plants	Portulaca umbraticola ssp. coronata	Wingpod Purslane	
Richmond	Plant	Vascular Plants	Sarracenia rubra	Sweet Pitcherplant	T
Richmond	Plant	Vascular Plants	Scirpus lineatus	Drooping Bulrush	
Richmond	Plant	Vascular Plants	Scutellaria altamaha	Altamaha Skullcap	
Richmond	Plant	Vascular Plants	Scutellaria ocmulgee	Ocmulgee Skullcap	T
Richmond	Plant	Vascular Plants	Stellaria alsine	Longstalk Starwort	
Richmond	Plant	Vascular Plants	Stewartia malacodendron	Silky Camellia	R
Richmond	Plant	Vascular Plants	Stylisma pickeringii var. pickeringii	Pickering's Morning-glory	T
Richmond	Plant	Vascular Plants	Stylisma pickeringii var. pickeringii	Pickering's Morning-glory	T
Richmond	Plant	Vascular Plants	Symphyotrichum georgianum	Georgia Aster	T

Rare, Threatened, and Endangered Species Known to Occur in Aiken County
South Carolina
June 11, 2014

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Vertebrate Animals					
Acipenser brevirostrum	Shortnose Sturgeon	LE: Endangered	SE: Endangered	G3	S3
Ambystoma tigrinum tigrinum	Eastern Tiger Salamander			G5	S2S3
Clemmys guttata	Spotted Turtle		ST: Threatened	G5	S5
Condylura cristata	Star-nosed Mole			G5	S3?
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat		SE: Endangered	G3G4	S2?
Gopherus polyphemus	Gopher Tortoise	C: Candidate	SE: Endangered	G3	S1
Haliaeetus leucocephalus	Bald Eagle		ST: Threatened	G5	S2
Heterodon simus	Southern Hognose Snake			G2	SNR
Hyla avivoca	Bird-voiced Treefrog			G5	S5
Lasiurus cinereus	Hoary Bat			G5	SNR
Micrurus fulvius	Eastern Coral Snake			G5	S2
Neotoma floridana	Eastern Woodrat			G5	S3S4
Neotoma floridana floridana	Eastern Woodrat			G5T5	S3S4
Nerodia floridana	Florida Green Water Snake			G5	S2
Picoides borealis	Red-cockaded Woodpecker	LE: Endangered	SE: Endangered	G3	S2
Pituophis melanoleucus	Pine or Gopher Snake			G4	S3S4
Rana capito	Gopher Frog		SE: Endangered	G3	S1
Sciurus niger	Eastern Fox Squirrel			G5	S4
Seminatrix pygaea	Black Swamp Snake			G5	SNR
Spilogale putorius	Eastern Spotted Skunk			G4	S4
Ursus americanus	Black Bear			G5	S3?
Invertebrate Animals					
Atrytone arogos	Arogos Skipper			G3	SNR
Animal Assemblage					
Waterbird Colony				GNR	SNR
Vascular Plants					
Aesculus parviflora	Small-flowered Buckeye			G3	S1
Agalinis linifolia	Flax Leaf False-foxglove			G4?	SNR
Allium cuthbertii	Striped Garlic			G4	S2
Anemone caroliniana	Carolina Anemone			G5	SH
Aristida condensata	Piedmont Three-awned Grass			G4?	S2
Astragalus villosus	Bearded Milk-vetch			G4	S1

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Botrychium lunarioides	Winter Grape-fern			G4?	S1
Calamovilfa brevipilis	Pine-barrens Reed-grass			G4	S1
Carex cherokeensis	Cherokee Sedge			G4G5	S2
Carex collinsii	Collins' Sedge			G4	S2
Carex elliottii	Elliott's Sedge			G4?	S1
Carex folliculata	Long Sedge			G4G5	S1
Carex socialis	Social Sedge			G4	S1
Cladrastis kentukea	Yellowwood			G4	S1
Coreopsis rosea	Rose Coreopsis			G3	S2
Croton elliottii	Elliott's Croton			G2G3	S2S3
Cystopteris protrusa	Lowland Brittle Fern			G5	S2
Delphinium carolinianum	Carolina Larkspur			G5	S1
Dirca palustris	Eastern Leatherwood			G4	S2
Echinacea laevigata	Smooth Coneflower	LE: Endangered		G2G3	S3
Echinodorus tenellus	Dwarf Burhead			G5?	S2
Eleocharis robbinsii	Robbins Spikerush			G4G5	S2
Elliottia racemosa	Georgia Plume			G2G3	SX
Enemion biternatum	False Rue-anemone			G5	S1
Euonymus atropurpureus	Eastern Wahoo			G5	S1
Forestiera ligustrina	Upland Swamp Privet			G4G5	S2
Gaura biennis	Biennial Gaura			G5	S1
Halesia parviflora	Small-flowered Silverbell-tree			GNR	S2
Hymenocallis coronaria	Shoals Spider-lily			G2Q	S2
Ilex amelanchier	Sarvis Holly			G4	S3
Ipomopsis rubra	Red Standing-cypress			G4G5	S2
Juniperus communis	Ground Juniper			G5	SNR
Kalmia cuneata	White-wicky			G3	S2
Lindera subcoriacea	Bog Spicebush			G2G3	S3
Ludwigia spathulata	Spatulate Seedbox			G2	S2
Macbridea caroliniana	Carolina Bird-in-a-nest			G2G3	S3
Magnolia cordata	Piedmont Cucumber Tree			GNRQ	S1
Magnolia pyramidata	Pyramid Magnolia			G4	S1
Myriophyllum laxum	Piedmont Water-milfoil			G3	S2
Nestronia umbellula	Nestronia			G4	S3
Nolina georgiana	Georgia Beargrass			G3G5	S3
Paronychia americana	American Nailwort			G3G4	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Pityopsis pinifolia	Pine-leaved Golden Aster			G4	S2
Platanthera lacera	Green-fringe Orchis			G5	S2
Ptilimnium nodosum	Harperella	LE: Endangered		G2	S1
Rhododendron flammeum	Piedmont Azalea			G3	S3
Rhynchospora inundata	Drowned Hornedrush			G4?	S2?
Rorippa sessiliflora	Stalkless Yellowcress			G5	SNR
Ruellia caroliniensis ssp. *ciliosa*	Sandhills Wild Petunia			G5T3T5	S1
Sagittaria isoetiformis	Slender Arrow-head			G4?	S3
Sarracenia rubra	Sweet Pitcher-plant			G4	S3S4
Scirpus etuberculatus	Canby Bulrush			G3G4	SNR
Solidago auriculata	Eared Goldenrod			G4	S1
Sporobolus pinetorum	Carolina Dropseed			G3	S2
Stylisma pickeringii var. *pickeringii*	Pickering's Morning-glory			G4T3	S1
Syngonanthus flavidulus	Yellow Pipewort			G5	S2
Trepocarpus aethusae	Aethusa-like Trepocarpus			G4G5	S1
Tridens carolinianus	Carolina Fluff Grass			G3G4	S1
Trillium discolor	Faded Trillium			G4	S4
Trillium lancifolium	Narrow-leaved Trillium			G3	S1
Trillium pusillum var. *pusillum*	Least Trillium			G3T2	S1
Trillium reliquum	Relict Trillium	LE: Endangered		G3	S1
Xyris brevifolia	Short-leaved Yellow-eyed Grass			G4G5	S1
Communities					
Atlantic white cedar swamp				G2	S2
Bald cypress - tupelo gum swamp				G5	S4
Basic forest				GNR	S2
Bay forest				G3G4	S3
Bottomland hardwoods				G5	S4
Celtis laevigata - tilia americana var. *caroliniana* / *aesculus pavia* forest	Sugarberry - Southern Basswood / Red Buckeye Forest			G1G3	SNR
Cove forest				G5	S4
Depression meadow				G3	S2
Fagus grandifolia - (*liquidambar styraciflua*) / *oxydendrum arboreum* / *kalmia latifolia* forest	Piedmont/coastal Plain Beech - Mountain Laurel Slope Forest			G3?	SNR

Scientific Name	Common Name	USESA Designation	State Protection	Global Rank	State Rank
Fagus grandifolia - quercus nigra forest	Coastal Plain Mesic Beech - Water Oak Forest			G3	SNR
Mesic mixed hardwood forest				G5	S4
Nyssa biflora - (*acer rubrum*) / *ilex opaca* / *leucothoe axillaris* / *carex atlantica* ssp. *capillacea* forest	Swamp Blackgum Floodplain Seepage Forest			G2G3	SNR
Nyssa biflora - acer rubrum var. *rubrum* / *lyonia lucida* forest	Sandhills Swamp Blackgum Floodplain Forest			G3G4	SNR
Oak - hickory forest				G5	S5
Pine - scrub oak sandhill				G4	S4
Pine savanna				G3	S2
Pinus palustris / *quercus laevis* - *quercus incana* / *aristida beyrichiana* - *baptisia perfoliata* woodland	South Atlantic Xeric Longleaf Pine Sandhill			G2G3	SNR
Pocosin				G3G4	S3S4
Pond pine woodland				G4G5	S3
Seepage pocosin				G3	S1S2
Small stream forest				G5	S5
Southern mixed hardwood forest				GNR	S1
Streamhead pocosin				G4	S4
Upland pine - wiregrass woodland				G3	S3
Xeric sandhill scrub				G5	S3
Geological					
Carolina bay				GNR	SNR

Final

Wetland Delineation Report

Fish Passage Project Site
New Savannah Bluff Lock and Dam
Aiken County, South Carolina

A Feature of the Savannah Harbor Expansion Project

Prepared for:

U.S. Army Corps of Engineers, Savannah District

Prepared by:

Tetra Tech, Inc., Atlanta, Georgia

Contract No. W9126G-11-D-0058
Delivery Order No. CV01

June 2013

Tetra Tech, Inc.

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Introduction

The U. S. Army Corps of Engineers (USACE) is planning to construct a fish passage structure at the New Savannah Bluff Lock and Dam on the Savannah River near Augusta, Georgia. The fish passage will be constructed as a feature of the Savannah Harbor Expansion Project (SHEP), as recommended in the January 2012 Final General Reevaluation Report (GRR) / Environmental Impact Statement (EIS) for the project and subsequently approved for detailed design. The fish passage structure will be constructed in the upland area along the east bank of the Savannah River, in Aiken County, South Carolina. The project area (Figure 1) also includes a construction easement and marshaling area, as well as a proposed access road to the site from County Highway 201. A wetland investigation was conducted at the site in November 2012.

Areas identified as wetlands may be subject to regulatory jurisdiction under section 404 of the Clean Water Act (CWA) (33 U.S.C. 1344). Section 404 considerations as well as section 401 state water quality certifications under the CWA for SHEP project features were addressed through the GRR/EIS process. Appropriate compensatory mitigation will be provided by USACE for site specific impacts to wetlands as a result of fish passage project implementation.

This report summarizes the findings of the field investigation, including a narrative description of the site, wetland determination data forms (Attachment A), photographic documentation (Attachment B), and wetland delineation figures (Attachment C). Also included are the following maps:

Attachment D- United States Geological Survey (USGS) topographic map
Attachment E- National Wetland Inventory (NWI) map
Attachment F- Federal Emergency Management Agency Flood Insurance Rate Map (FEMA FIRM)
Attachment G- Natural Resources Conservation Service (NRCS) soils map

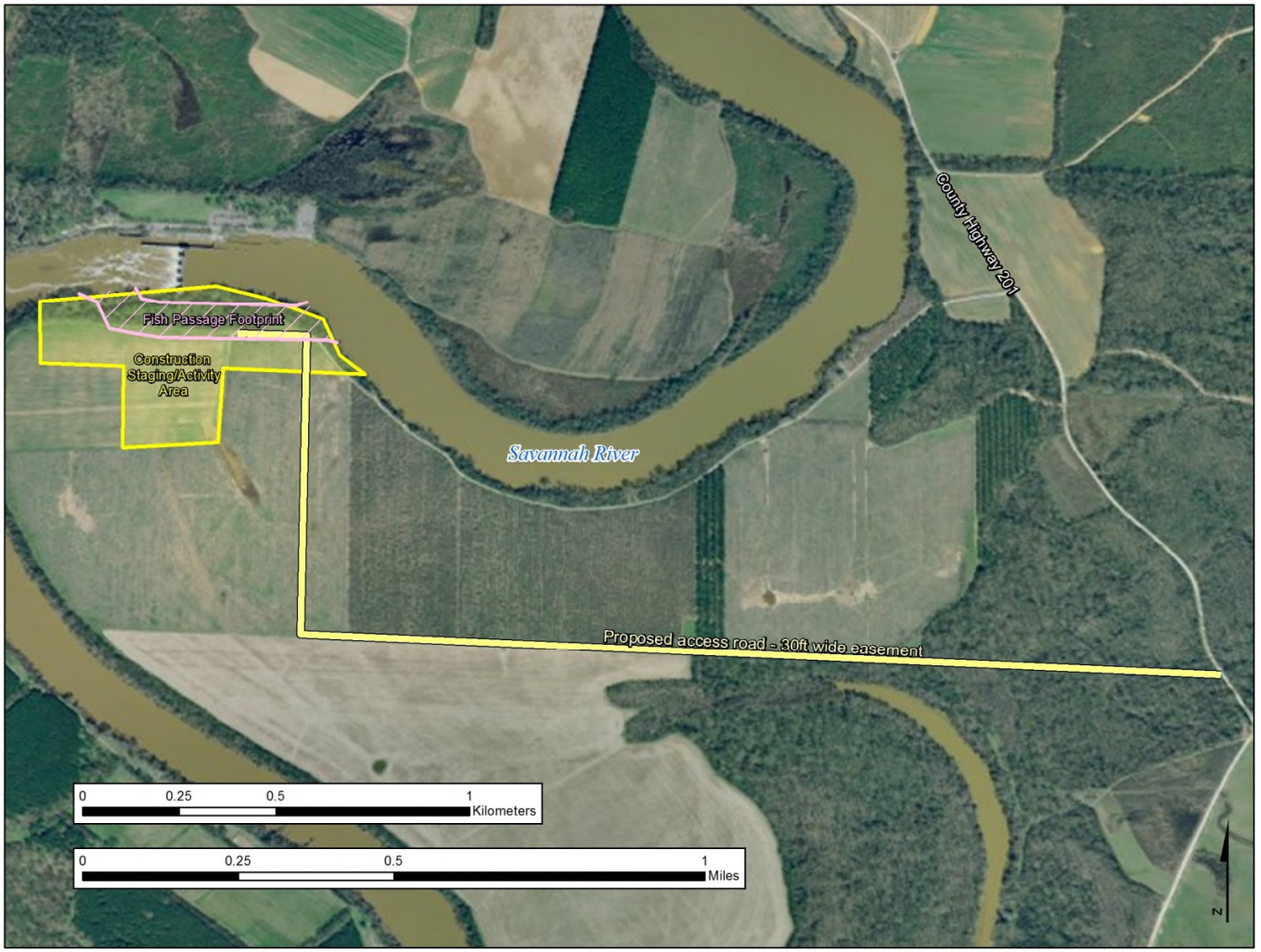

Figure 1 New Savannah Bluff Lock and Dam project area

Methodology

The wetland delineation was conducted using methodology set forth by the USACE in the 1987 Environmental Laboratory publication *Corps of Engineers Wetland Delineation Manual: Technical Report Y-87-1*, the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0),*" and *US Army Corps of Engineers Regulatory Guidance Letter RGL 05-05* which describes the ordinary high water mark.

The USACE and the US Environmental Protection Agency (EPA) define wetlands as follows: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

Each site was evaluated for wetland characteristics comprised of wetland hydrology, hydrophytic vegetation, and hydric soils.

Hydrophytic vegetation decisions are based on the assemblage of plant species growing on a site, rather than the presence or absence of particular indicator species. Hydrophytic vegetation is present when the plant community is dominated by species that can tolerate prolonged inundation or soil saturation during the growing season. Hydrophytic vegetation decisions are based on the wetland indicator status (Reed [1988] or current approved list) of species that make up the plant community. Species in the facultative categories (FACW, FAC, and FACU) are recognized as occurring in both wetlands and uplands to varying degrees. Although most wetlands are dominated mainly by species rated OBL, FACW, and FAC, some wetland communities may be dominated primarily by FACU species and cannot be identified by dominant species alone. In those cases, other indicators of hydrophytic vegetation must also be considered, particularly where indicators of hydric soils and wetland hydrology are present.

The National Technical Committee for Hydric Soils (NTCHS) defines a hydric soil as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (USDA Soil Conservation Service 1994). Most hydric soils exhibit characteristic morphologies that result from repeated periods of saturation or inundation for more than a few days. Saturation or inundation, when combined with microbial activity in the soil, causes the depletion of oxygen. This anaerobiosis promotes certain biogeochemical processes, such as the accumulation of organic matter and the reduction, translocation, or accumulation of iron and other reducible elements. These processes result in distinctive characteristics that persist in the soil during both wet and dry periods, making them particularly useful for identifying hydric soils in the field (USDA Natural Resources Conservation Service 2006).

Wetland hydrology indicators are used in combination with indicators of hydric soil and hydrophytic vegetation to determine whether an area is a wetland. Indicators of hydrophytic vegetation and hydric soil generally reflect a site's medium- to long-term wetness history. Wetland hydrology indicators provide evidence that the site has a continuing wetland hydrologic regime and that hydric soils and hydrophytic vegetation are not relicts of a past hydrologic

regime. Wetland hydrology indicators confirm that an episode of inundation or soil saturation occurred recently, but may provide little additional information about the timing, duration, or frequency of such events (National Research Council 1995). Hydrology indicators are often the most transitory of wetland indicators. Some hydrology indicators are naturally temporary or seasonal, and many are affected by recent or long-term meteorological conditions.

Wetland delineation data forms were completed for representative wetland and upland data points at the site (Attachment A). Photographic documentation was also recorded (Attachment B). Wetland boundaries were flagged in the field and waypoints defining the boundaries were surveyed using a handheld GPS unit (Garmin GPSMAP 76S). Wetland delineation figures, depicting wetland boundaries on aerial photographs, are included as Attachment C.

Savannah District staff reviewed and verified the wetland delineation documentation and analysis presented in this report. The District verification was documented in a Memorandum for Record (MFR) dated May 29, 2013. The MFR is included as Attachment H to this report.

Site Description

The project site is located on the east bank of the Savannah River, in the Inner Coastal Plain region of South Carolina. This region, which is below the Fall Line, is an area of level to hilly topography, dissected by numerous streams. The project area is depicted in Figure 1. The land immediately adjacent to the lock and dam, on the east bank of the river (south side of the dam) is federally owned. This upland area consists of a mature hardwood-conifer mixed forest that serves as a riparian buffer along the river. The surrounding land within the project area is owned by a single property owner, Mr. Leroy Simkins, and is used primarily for silviculture. The proposed fish passage structure would be constructed partially on the Federal property adjacent to the lock and dam and partially on Mr. Simkins' property. The proposed construction staging area is located in an adjacent fallow field on Mr. Simkins' property. Some small soybean plants are growing in this area amongst weedy, herbaceous vegetation. The proposed access road enters the site from County Highway 201 and runs east-west along the southern boundary of Mr. Simkins' property. It cuts though a mixed hardwood forest in the area nearest to the highway. The forest is upland in nature except for a single linear wetland feature (Wetland 2) that crosses the proposed access road. The proposed access road continues westward through an upland scrub-pine-hardwood area with immature trees, mostly 2-6 inches in diameter at breast height (DBH). The proposed road then cuts through a narrow strip of mature planted loblolly pines (*Pinus taeda*) and then through a dense plantation of water oaks (*Quercus nigra*) that are approximately 6 inches DBH. Just beyond the oak plantation, the proposed access road turns northward and cuts through another upland scrub-pine-hardwood area with immature trees; the road ends at the proposed fish passage structure. Wetlands identified on the project site are described below.

Wetland 1 (edge of Savannah River)

The Savannah River is a navigable waterway that is approximately 450 feet wide at the New Savannah Bluff Lock and Dam (see figure in Attachment C). The NWI map (Attachment E) shows the Savannah River as a permanently flooded, unconsolidated bottom, riverine system (R2UBH) downstream of the dam and an impounded, unconsolidated bottom lacustrine system

(L1UBHh) just upstream of the dam. The NRCS soils map (Attachment G) identifies the river as "water". The land adjacent to the river is mapped as "Toccoa loam". The entire project area is mapped as a zone AE flood hazard area on the FEMA FIRM (Attachment F).

Upstream of the dam, the river has shallow banks and a narrow wetland fringe that is vegetated with American elm (*Ulmus americana*), Chinese privet (*Ligustrum sinense*), elephant's ear (*Colocasia esculenta*), and giant cutgrass (*Zizaniopsis miliacea*). Downstream of the dam, the bank is very steep and is heavily armored with large rip rap.

Wetland 2

A forested wetland was identified near County Highway 201, within the footprint of the proposed access road (see figure in Attachment C). This area is mapped as a temporarily flooded, broad-leaved deciduous, forested palustrine wetland (PF01A) on the NWI map (Attachment E). This area is mapped as "Chewacla loam" on the NRCS soils map (Attachment G), and is within a zone AE flood hazard area, as shown on the FEMA FIRM (Attachment F).

This linear depressional feature, approximately 60 feet wide, cuts through the mixed hardwood forest. The depression is about four feet deep relative to the surrounding uplands. The feature contains mature water tupelo (*Nyssa aquatic*a) trees, over 24 inches in diameter, and hardly any other vegetation. The ground was covered in leaves and there was no water present at the time of the field investigation, but water stains on the tree trunks indicate that there is periodic inundation, up to four feet deep. Tree trunks were heavily buttressed.

Proposed Project Effects on Wetlands

The proposed project will result in the permanent loss of a narrow fringe of wetland over approximately 672 feet along the Savannah River where the fish passage structure is proposed. This is approximately 0.21 acres of vegetated wetland (not including areas of open water or rip rap banks devoid of vegetation). In order to complete construction of the fish passage structure, this loss will be unavoidable. The project will establish approximately 3, 200 linear feet of armored edge habitat along the alignment of the fish passage structure (approximately 1,600 feet on each side) that will generally be void of wetland vegetation.

Construction of the proposed east-west access road will result in the loss of approximately 0.02 acres of forested wetland. The wetland swale is approximately 30 feet wide at this location. This project is within the scope of Nationwide Permit (NWP) #14 (Linear Transportation Projects). A properly sized culvert or other provision for adequate drainage will be required at this crossing. It is anticipated that the access road will remain in place following construction to provide access for future operation and maintenance of the fish passage facility.

References

National Research Council. 1995. Wetlands: Characteristics and boundaries. Washington, DC: National Academy Press.

Reed, P. B., Jr. 1988. National list of plant species that occur in wetlands: 1988 national summary. Biological Report 88(24). Washington, DC: U.S. Fish and Wildlife Service.

USDA (U.S. Department of Agriculture) Natural Resources Conservation Service. 2006. Field indicators of hydric soils in the United States, version 6.0. ed. G. W. Hurt and L. M. Vasilas. Fort Worth, TX: USDA. NRCS in cooperation with the National Technical Committee for Hydric Soils. (http://soils.usda.gov/use/hydric/)

USDA Soil Conservation Service. 1994. Changes in hydric soils of the United States. Federal Register 59(133): 35680-35681, July 13, 1994.

Attachment A

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WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-W1

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): swale Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR or MLRA): LRR Lat: 33.3632 Long: -81.9195 Datum: WGS 84

Soil Map Unit Name: Chewacla loam NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain In Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers In Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No _____	**Is the Sampled Area within a Wetland?** Yes ✔ No _____
Hydric Soil Present?	Yes ✔	No _____	
Wetland Hydrology Present?	Yes ✔	No _____	

Remarks:
Sample area is in a linear depression within an upland hardwood forest.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ✔ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ✔ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ✔ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No ✔	Depth (inches): _____
Water Table Present?	Yes _____	No ✔	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✔	Depth (inches): _____

Wetland Hydrology Present? Yes ✔ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The swale is a well-defined drainage channel. Water tupelo trees in th swale are highly buttressed, and have well defined high water marks on the trunks. There is a well defined scarp along the bank. A sparsely vegetated concave surface and sphagnum moss also indicate wetland hydrology.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: NS-W1

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa aquatica	90	Yes	OBL
2.			
3.			
4.			
5.			
6.			
	90 = Total Cover		

50% of total cover: 45% 20% of total cover: _____

Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0 = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
	0 = Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

The site is dominated by mature water tupelo trees. Ground is covered by leaf litter.

SOIL

Sampling Point: NS-W1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/3	100%					silty loam	
5-12	10YR 5/4	100%	2.5YR 4/8	20%	C	M	silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ✓ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain In Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☑ No ☐

Remarks: Soil is dry. Redox concentrations indicate hydric soil.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-U1

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): ridge Local relief (concave, convex, none): convex Slope (%): 0-2%

Subregion (LRR or MLRA): LRR Lat: 33.3631 Long: -81.9196 Datum: WGS 84

Soil Map Unit Name: Chewacla loam NWI classification: PF01A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No ✔
Hydric Soil Present?	Yes _____	No ✔	
Wetland Hydrology Present?	Yes _____	No ✔	

Remarks:
Sample area is in on the ridge beside a swale within an upland hardwood forest.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes _____ No ✔ Depth (inches): _____

Water Table Present? Yes _____ No ✔ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✔ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
There are no indicators of wetland hydrology.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: NS-U1

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1. Platanus occidentalis	50%	Yes	FACW
2.			
3.			
4.			
5.			
6.			
	50 = Total Cover		
50% of total cover: 25%	20% of total cover:		
Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 15' radius)			
1. Rubus betulifolius	20%	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 15' radius)			
1. Lygodium japonicum	10%	Yes	FAC
2. Smilax bona-nox	15%	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		
50% of total cover: 22.5%	20% of total cover: 9%		
Woody Vine Stratum (Plot size: 15' radius)			
1. Vitis riparia	15%	Yes	FACW
2.			
3.			
4.			
5.			
	15 = Total Cover		
50% of total cover: 7.5%	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

The site is dense with vines and blackberry bushes.

SOIL

Sampling Point: NS-U1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-2%	10YR 3/3	100%					silty clay loam	
2-12	2.5YR 4/4	100%					silty clay loam	with large roots

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☑

Remarks: No indicators of hydric soil.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-W2

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): river bank Local relief (concave, convex, none): steep slope Slope (%): 40%

Subregion (LRR or MLRA): LRR Lat: 33.3717 Long: -81.9422 Datum: WGS 84

Soil Map Unit Name: Water NWI classification: R2UBH

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ✔, or Hydrology ✔ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No ✔	**Is the Sampled Area within a Wetland?** Yes ✔ No _____
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes ✔	No _____	

Remarks:
Sample area is on lower bank of the Savannah River, approximately 400' downstream of the dam. Bank is heavily armored with large rip rap. The wetland determination was based solely on the hydrology, as the rip rap banks prohibited the use of vegetation and soil indicators.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ✔ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No ✔	Depth (inches): _____
Water Table Present?	Yes _____	No ✔	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✔	Depth (inches): _____

Wetland Hydrology Present? Yes ✔ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The Savannah River is a navigable waterway. There is an evident high water mark on rip rap. Aquatic vegetation (water hyacinth) is washed onto the bank. The river is 30-40' deep downstream of the dam.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: NS-W2

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (If observed, list morphological adaptations below).

The site is covered in heavy rip rap. The bank is unvegetated.

SOIL

Sampling Point: NS-W2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: rip rap

Depth (inches): surface

Hydric Soil Present? Yes ☐ No ☐

Remarks: Large rip rap prevented an examination of soil.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-U2

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): river bank Local relief (concave, convex, none): steep slope Slope (%): 40%

Subregion (LRR or MLRA): LRR Lat: 33.3717 Long: -81.9422 Datum: WGS 84

Soil Map Unit Name: Toccoa loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain in Remarks.)

Are Vegetation ✔, Soil ✔, or Hydrology ✔ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No ✔
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes _____	No ✔	

Remarks:
Sample area is on upper bank of the Savannah River, approximately 400' downstream of the dam. Bank is heavily armored with large rip rap. The wetland determination was based on the hydrology, as the rip rap banks prohibited the use of soil indicators and vegetation was sparse and highly impacted by the rip rap.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) (**LRR U**)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) (**LRR T, U**)

Field Observations:

Surface Water Present?	Yes _____	No ✔	Depth (inches): _____
Water Table Present?	Yes _____	No ✔	Depth (inches): _____
Saturation Present? (Includes capillary fringe)	Yes _____	No ✔	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The stream bank is very steep and there is an evident high water mark on rip rap. The sample area is above the high water mark.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: NS-U2

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	5%	Yes	FACW
2. Acer rubrum	5%	Yes	FAC
3.			
4.			
5.			
6.			
	10	= Total Cover	

50% of total cover: 5% 20% of total cover: _____

Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 15' radius)			
1. Ligustrum sinense	5%	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 15' radius)			
1. Vitis riparia	5%	Yes	FACW
2.			
3.			
4.			
5.			
	5	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

The site is covered in heavy rip rap. The bank is sparsely vegetated .

SOIL

Sampling Point: NS-U2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: rip rap

Depth (inches): surface

Hydric Soil Present? Yes ☐ No ☐

Remarks: Large rip rap prevented an examination of soil.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-W3

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): river bank Local relief (concave, convex, none): slope Slope (%): 2-4%

Subregion (LRR or MLRA): LRR Lat: 33.3718 Long: -81.9405 Datum: WGS 84

Soil Map Unit Name: Water NWI classification: L1UBHh

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology ✔ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No _____	**Is the Sampled Area within a Wetland?** Yes ✔ No _____
Hydric Soil Present?	Yes ✔	No _____	
Wetland Hydrology Present?	Yes ✔	No _____	

Remarks:
Sample area is on bank of the Savannah River, approximately 100' upstream of the dam. The bank has a shallow slope and is vegetated.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ✔ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ✔ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No ✔	Depth (inches): _____
Water Table Present?	Yes _____	No ✔	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✔	Depth (inches): _____

Wetland Hydrology Present? Yes ✔ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
The Savannah River is a navigable waterway. The sample area is on a depositional area approximately 15' from the deep water portion of the river channel. It appears that sediment settles out along the river bank after high flow events.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: NS-W3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana	15%	Yes	FACW
2.			
3.			
4.			
5.			
6.			
	15	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 15' radius)			
1. Ligustrum sinense	15%	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	15	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15' radius)			
1. Colocasia esculenta	50%	Yes	FACW
2. Zizaniopsis miliacea	30%	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

The site is dominated by hydrophytic vegetation, which is growing on sediment deposits along the river bank.

SOIL

Sampling Point: NS-W3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	7.5YR 3/1	100%					organic	partially decomposed plant material with roots
2-12	10YR 5/3	100%	7.5YR 5/6	10%	C	M	sandy clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☑ No ☐

Remarks: A depleted matrix with redox concentrations indicates hydric soils.

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: New Savannah Bluff Lock and Dam City/County: Aiken Sampling Date: 11-28-2012

Applicant/Owner: USACE- Savannah District (applicant) State: SC Sampling Point: NS-U3

Investigator(s): Julie Kaplan Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): river bank Local relief (concave, convex, none): steep slope Slope (%): 2-4%

Subregion (LRR or MLRA): LRR Lat: 33.3718 Long: -81.9405 Datum: WGS 84

Soil Map Unit Name: Toccoa loam NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✔ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ✔ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No ✔
Hydric Soil Present?	Yes _____	No ✔	
Wetland Hydrology Present?	Yes _____	No ✔	

Remarks:
Sample area is on the upper bank of the Savannah River, approximately 100' upstream of the dam. The bank has a shallow slope and is vegetated.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No ✔	Depth (inches): _____
Water Table Present?	Yes _____	No ✔	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No ✔	Depth (inches): _____

Wetland Hydrology Present? Yes _____ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No indicators of wetland hydrology.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: NS-U3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinus taeda	50%	Yes	FAC
2. Quercus alba	5%	No	FACU
3.			
4.			
5.			
6.			
	55	= Total Cover	

50% of total cover: 27.5% 20% of total cover: _____

Sapling Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Shrub Stratum (Plot size: 15' radius)			
1. Ligustrum sinense	60%	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	60	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 15' radius)			
1. Smilax bona-nox	15%	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	15	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Woody Vine Stratum (Plot size: 15' radius)			
1. N/A			
2.			
3.			
4.			
5.			
	0	= Total Cover	

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	0 (A)		0 (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

The site is heavily wooded. The ground is covered with fallen leaves.

SOIL

Sampling Point: NS-U3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	5YR 3/2	100%					silt	contains a lot of organic matter
1-12	5YR 4/6	100%					silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.

[2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ☐ No ☑

Remarks: No indicators of hydric soils.

Attachment B

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New Savannah Bluff Lock and Dam wetland delineation photo log

Photo 1: Data Point NSB-W1.

Photo 2: Data Point NSB-W1 soil.

Photo 3: Data Point NSB-U1.

Photo 4: Data Point NSB-U1 soil.

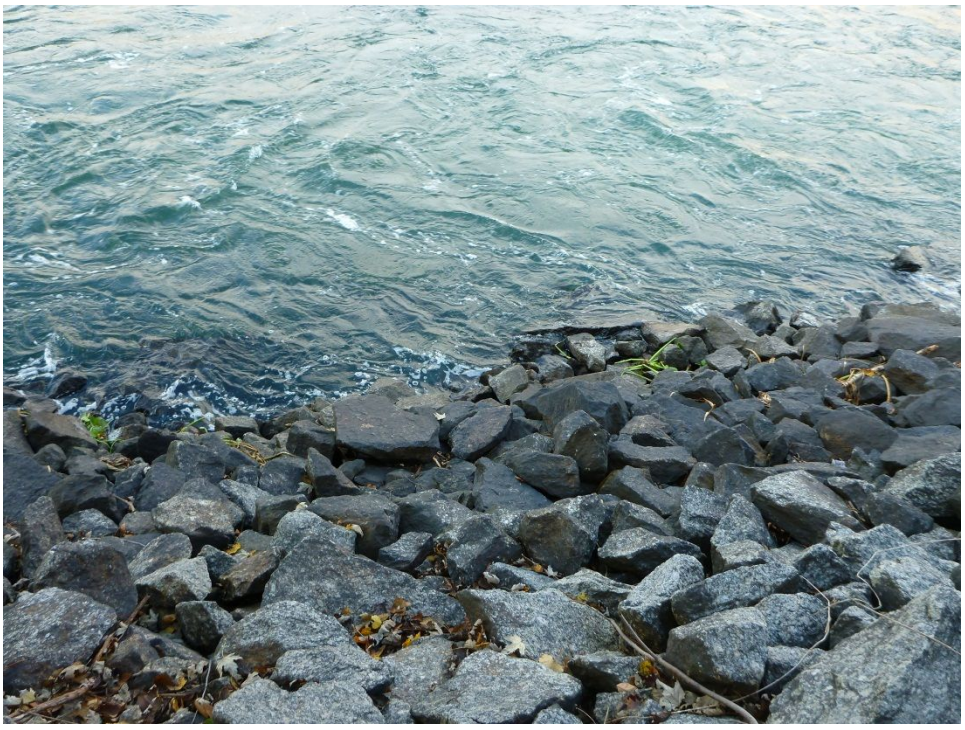

Photo 5: Data Point NSB-W2.

Photo 6: Data Point NSB-U2.

Photo 7: Data Point NSB-W3.

Photo 8: Data Point NSB-W3 soil.

Photo 9: Data Point NSB-U3.

Photo 10: Data Point NSB-U3 soil.

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Attachment C

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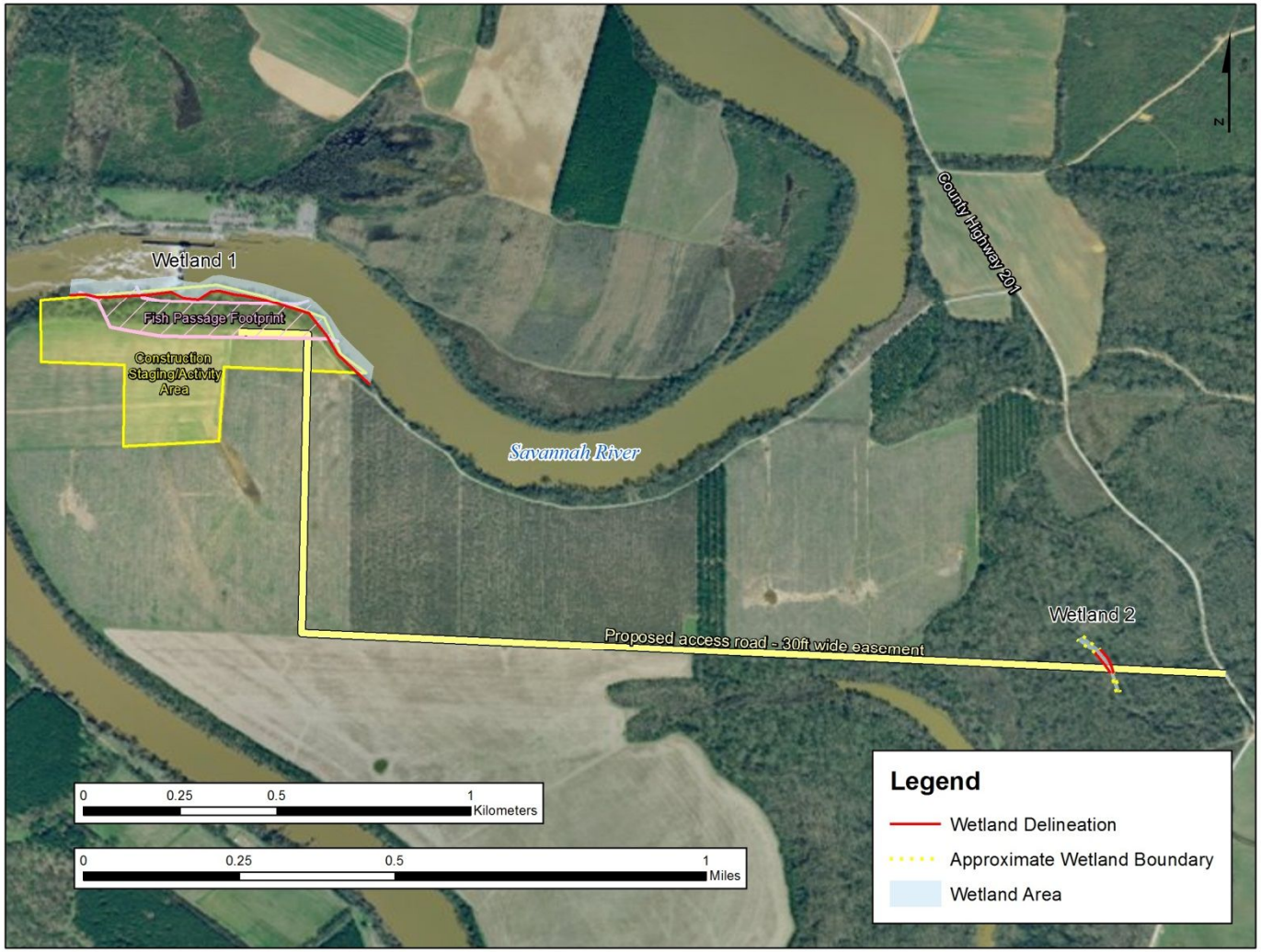
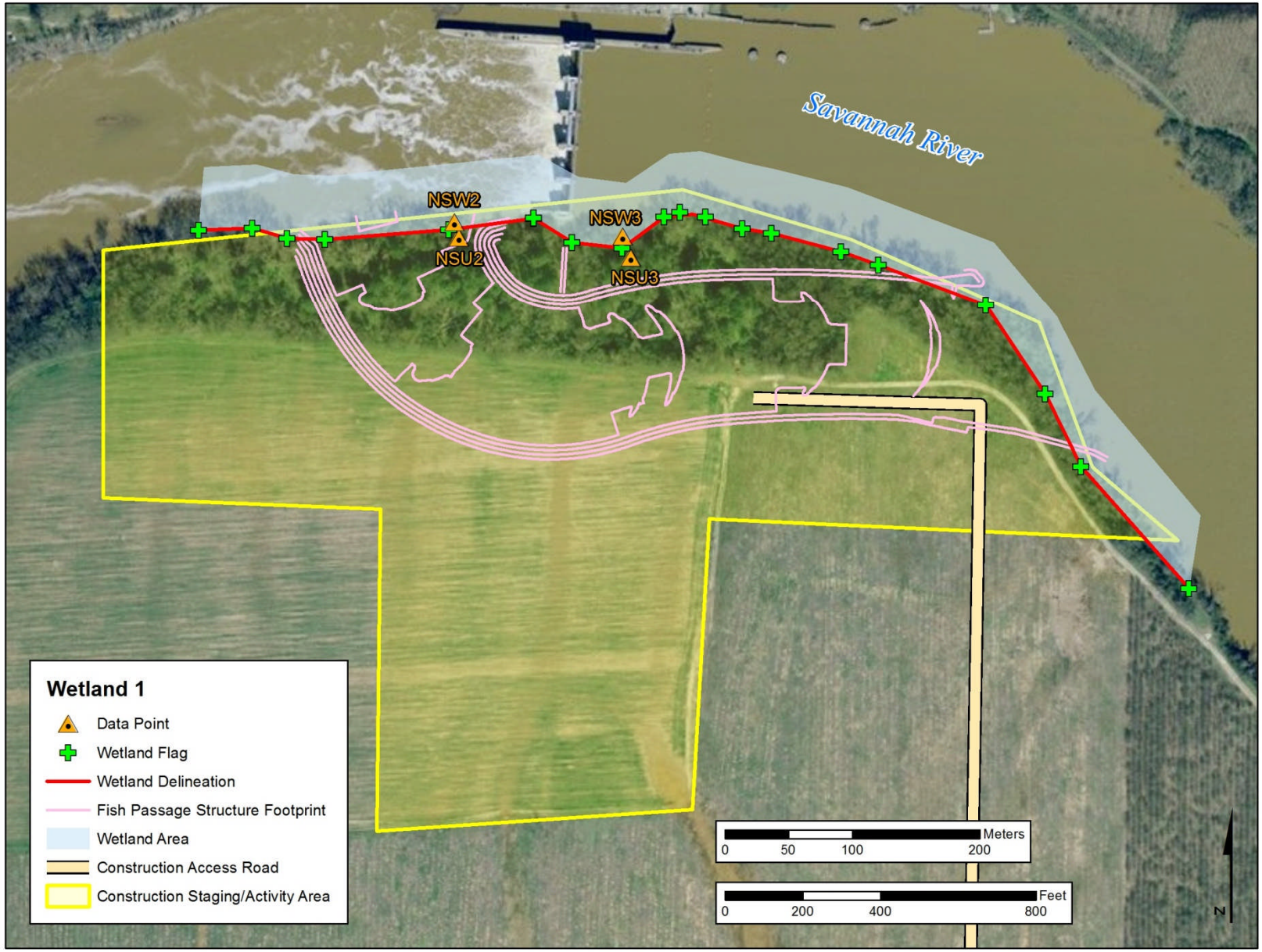
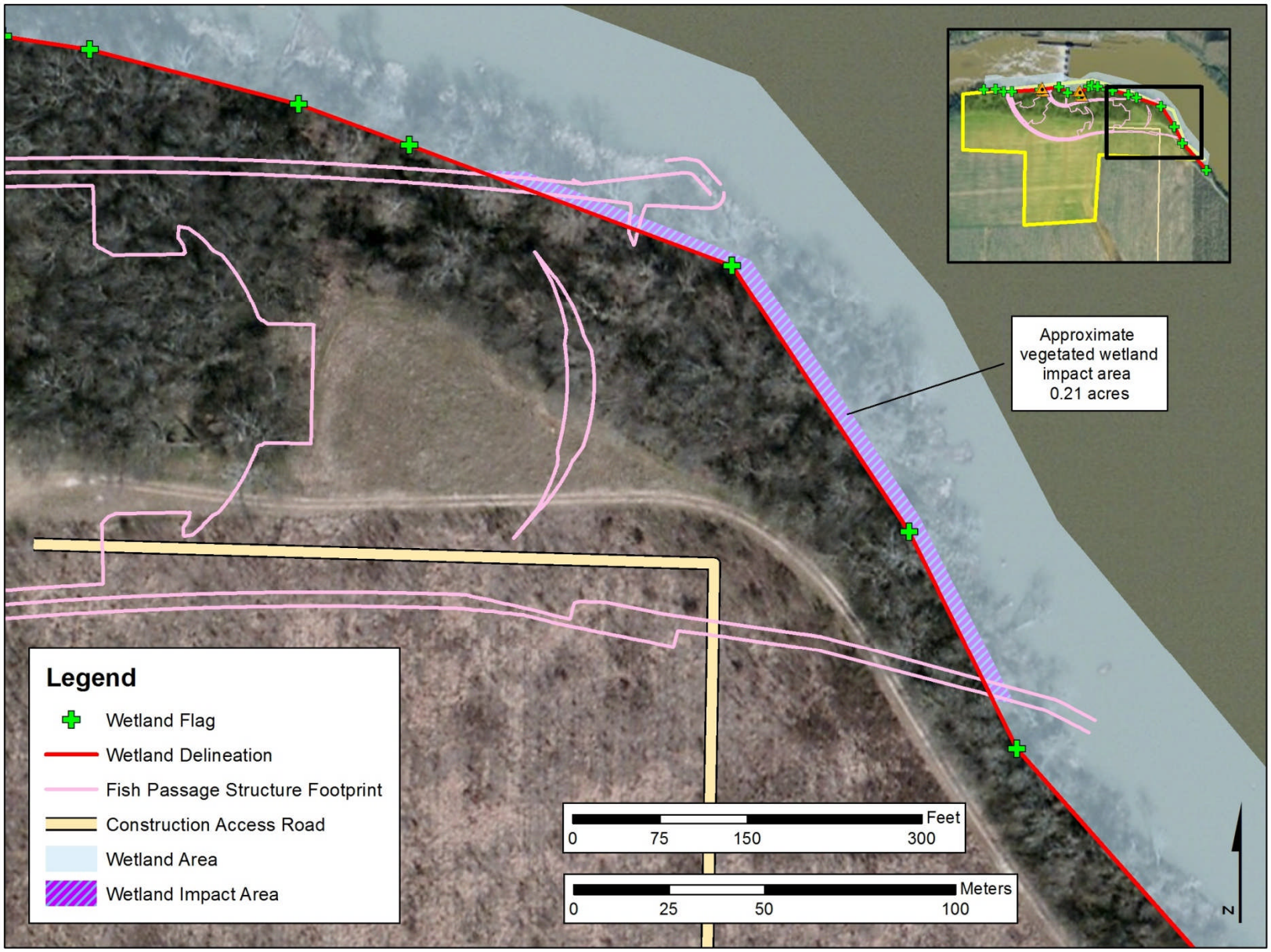


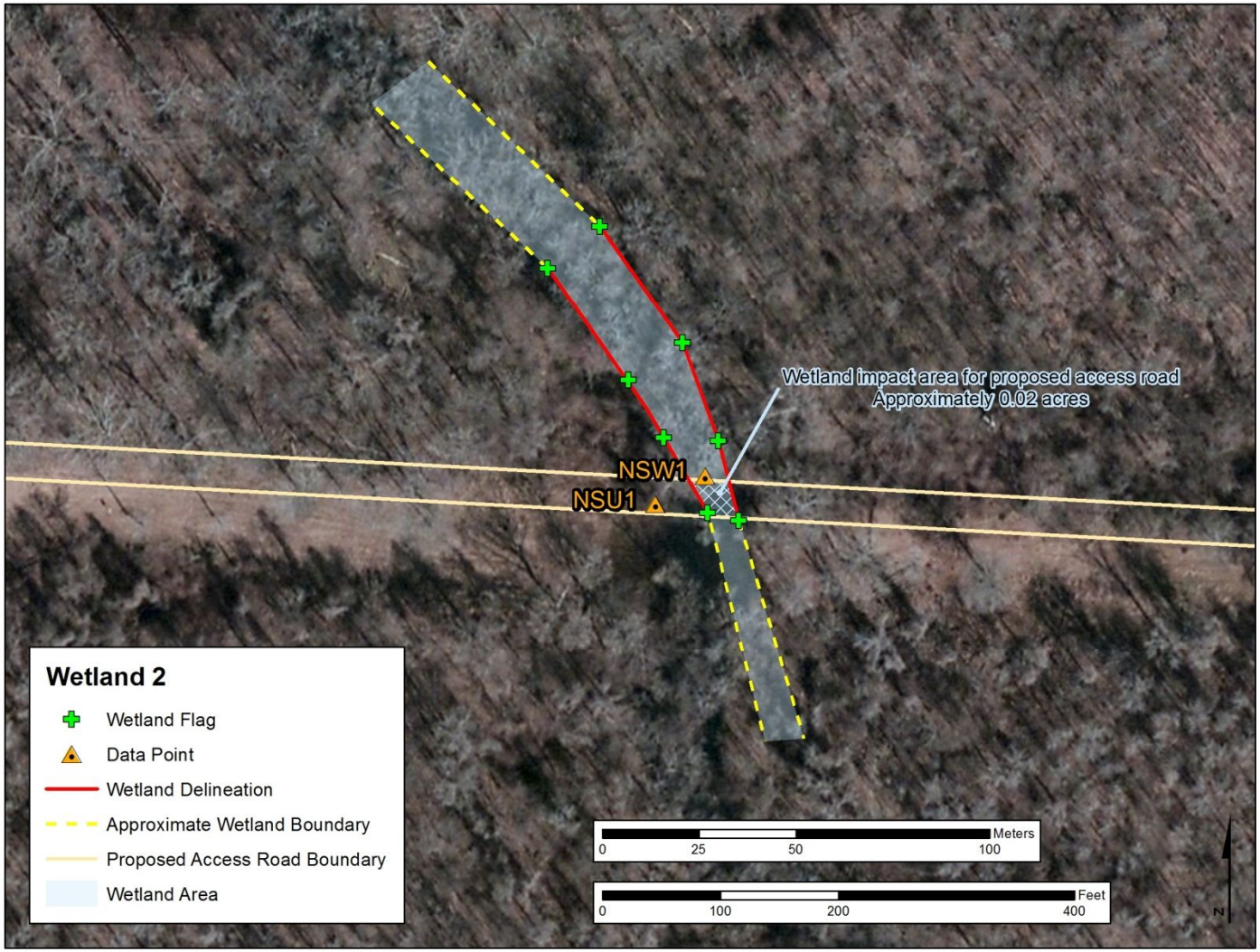
New Savannah Bluff Lock and Dam Wetland Delineation



New Savannah Bluff Lock and Dam Wetland Delineation



New Savannah Bluff Lock and Dam Wetland Delineation



New Savannah Bluff Lock and Dam Wetland Delineation

Attachment D

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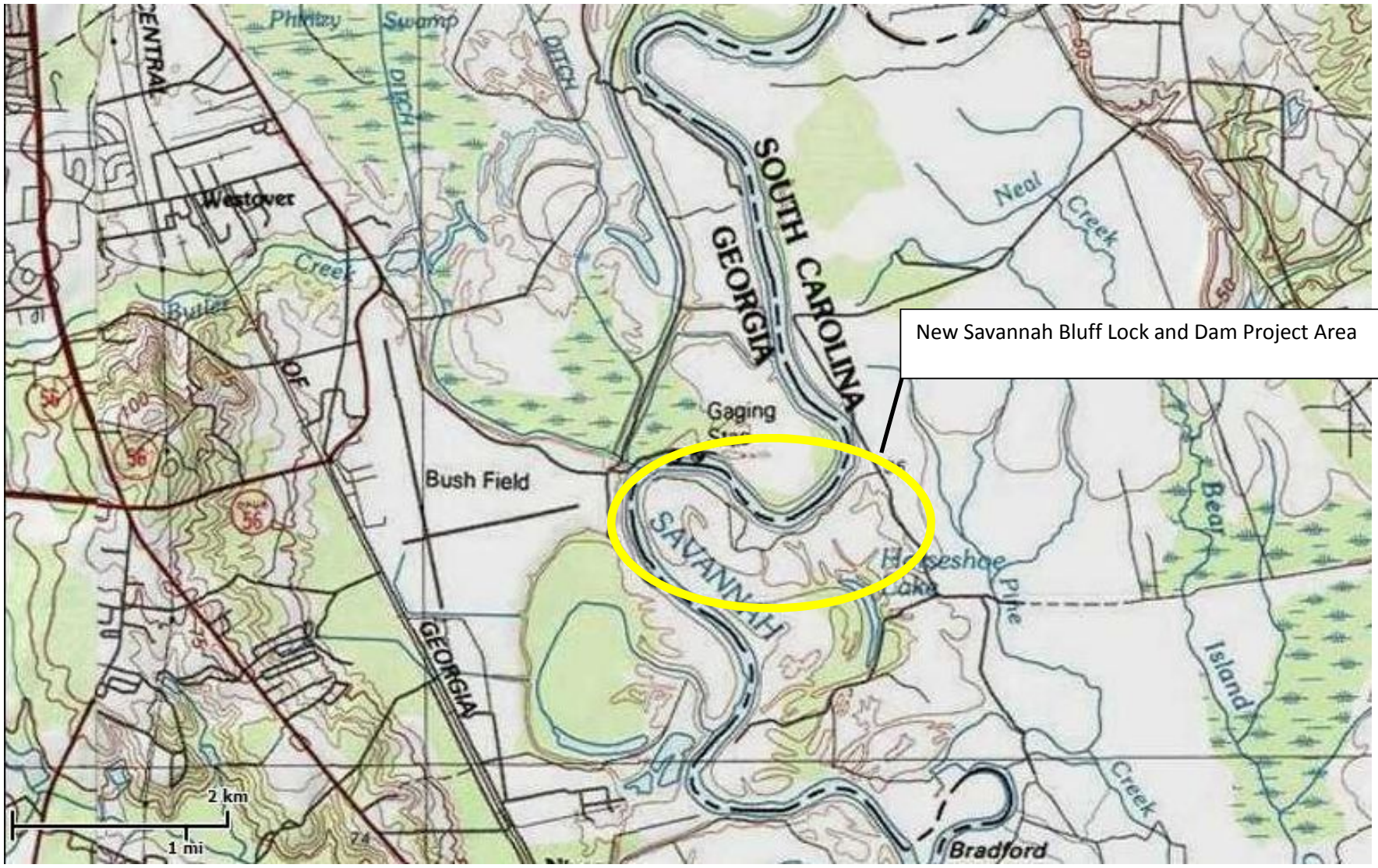

USGS topographic map

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Attachment E

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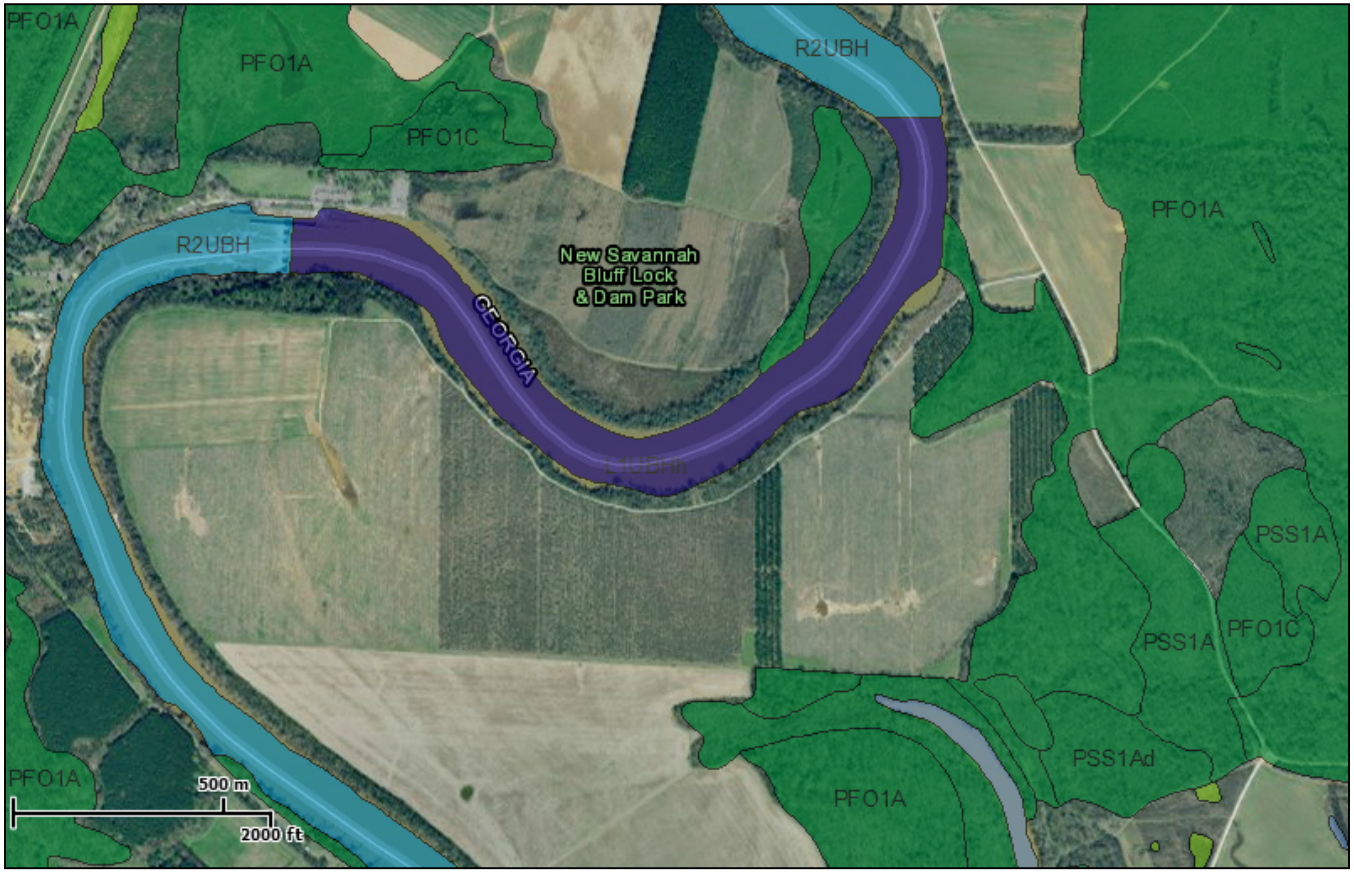
U.S. Fish and Wildlife Service

National Wetlands Inventory

New Savannah Bluff Lock and Dam

Oct 30, 2012



Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

User Remarks:

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Attachment F

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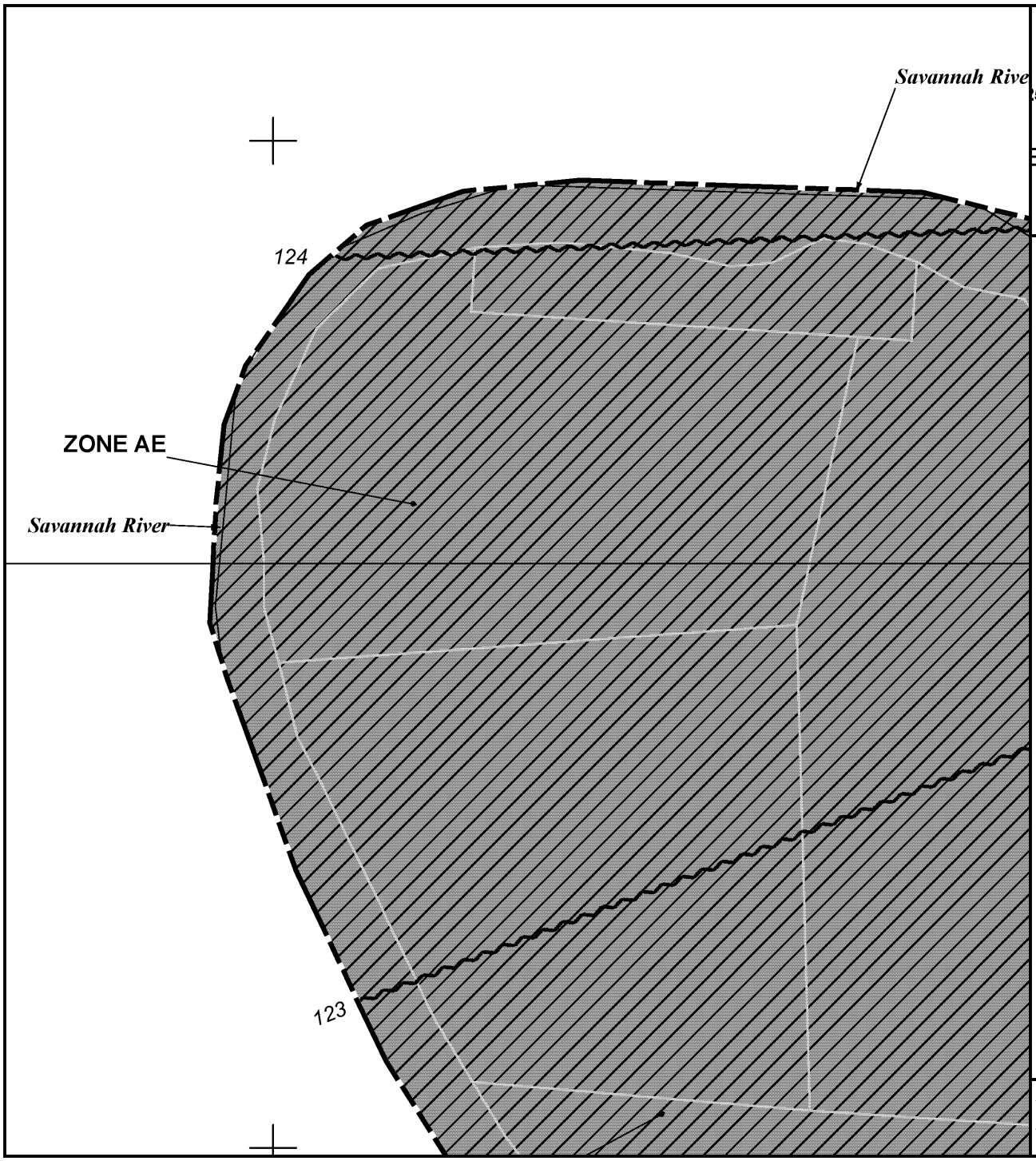


MAP SCALE 1" = 500'

500 0 500 1000 FEET

0 150 300 METER

PANEL 0627E

NFIP NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

AIKEN COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

PANEL 627 OF 775

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

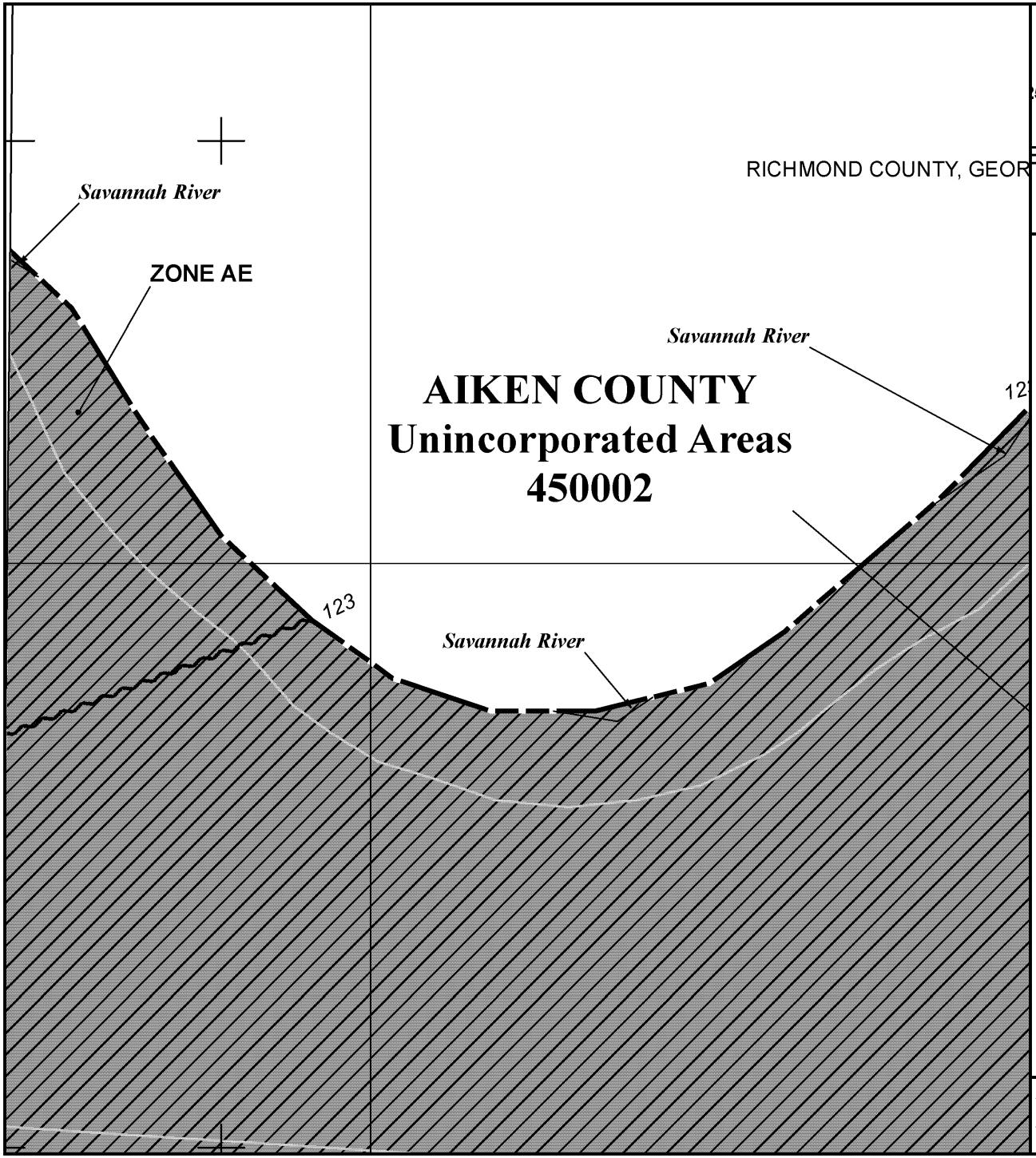
COMMUNITY	NUMBER	PANEL	SUFFIX
AIKEN COUNTY	450002	0627	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
45003C0627E

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency



MAP SCALE 1" = 500'

250 0 500 1000 FEET

0 150 300 METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0631E

FIRM

FLOOD INSURANCE RATE MAP

AIKEN COUNTY, SOUTH CAROLINA
AND INCORPORATED AREAS

PANEL 631 OF 775

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

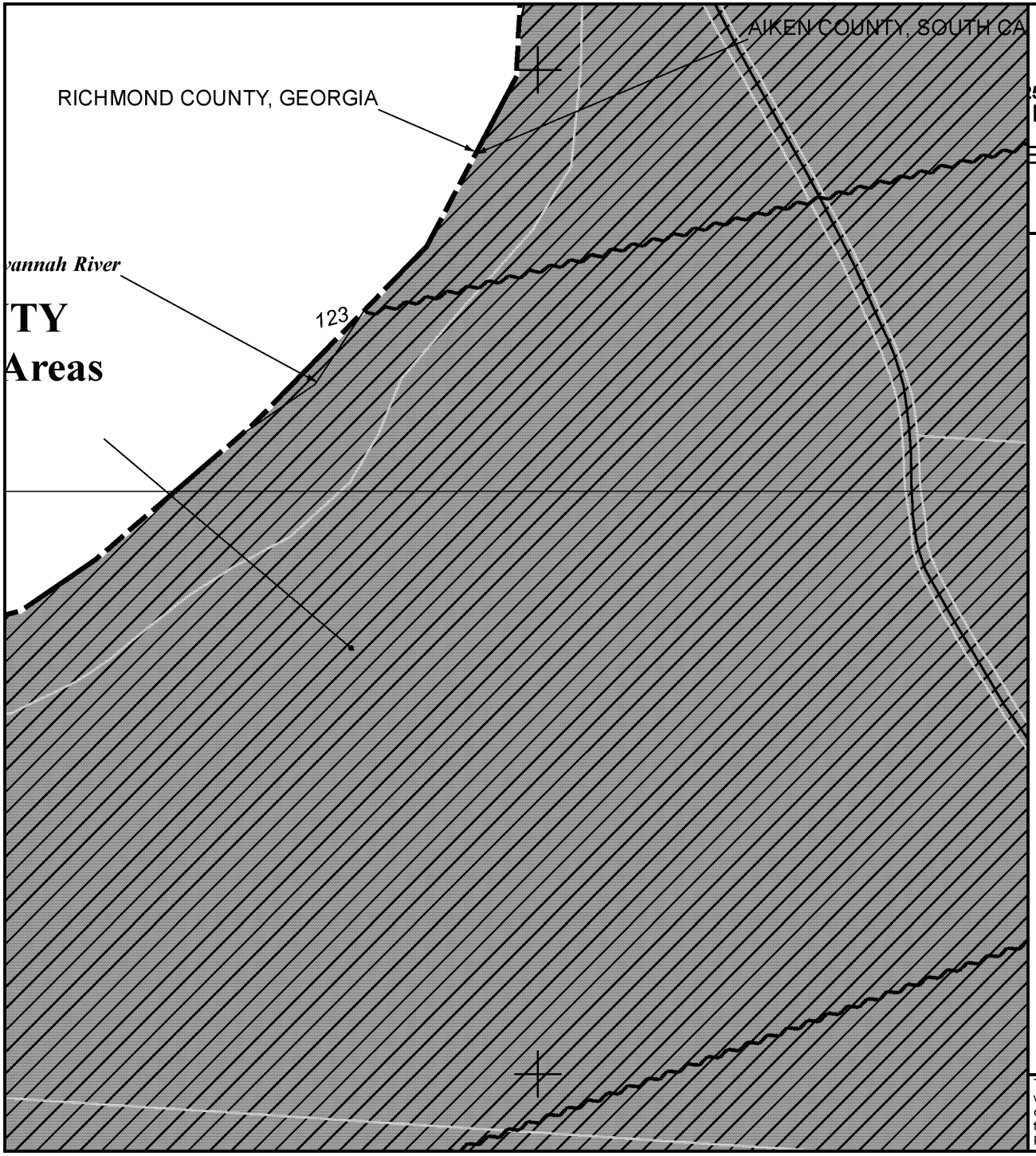
COMMUNITY	NUMBER	PANEL	SUFFIX
AIKEN COUNTY	450002	0631	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
45003C0631E

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency



MAP SCALE 1" = 500'

50 0 500 1000 FEET

0 150 300 METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0631E

FIRM

FLOOD INSURANCE RATE MAP

AIKEN COUNTY, SOUTH CAROLINA

AND INCORPORATED AREAS

PANEL 631 OF 775

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AIKEN COUNTY	450002	0631	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
45003C0631E

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency

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Attachment G

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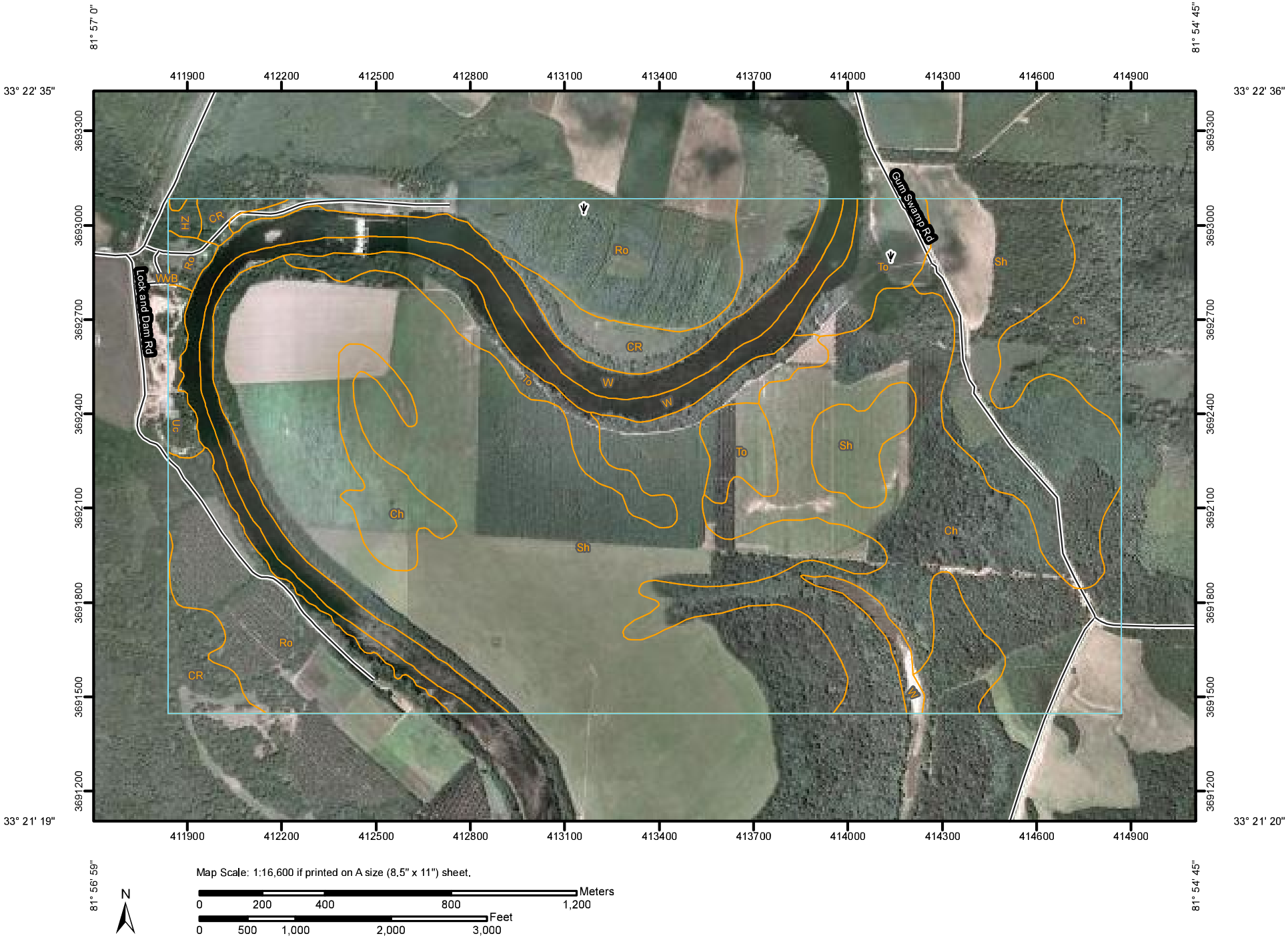
81° 57' 0"
81° 54' 45"
33° 22' 35"
33° 22' 36"
33° 21' 19"
33° 21' 20"
411900
412200
412500
412800
413100
413400
413700
414000
414300
414600
414900
3693300
3693000
3692700
3692400
3692100
3691800
3691500
3691200
Gum Swamp Rd
Lock and Dam Rd
HZ
CR
Ro
WB
Un
W
To
Sh
Ch
81° 56' 59"
81° 54' 45"
Map Scale: 1:16,600 if printed on A size (8.5" x 11") sheet.
N
Meters
0
200
400
800
1,200
Feet
0
500
1,000
2,000
3,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:16,600 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at scales ranging from 1:15,840 to 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Aiken County Area, South Carolina
Survey Area Data: Version 15, Oct 4, 2011

Soil Survey Area: Richmond County, Georgia
Survey Area Data: Version 5, Aug 7, 2008

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 7/24/2007; 9/8/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Aiken County Area, South Carolina (SC615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Ch	Chewacla loam	268.3	21.9%
Sh	Shellbluff silty clay loam	530.0	43.2%
To	Toccoa loam	69.9	5.7%
W	Water	69.8	5.7%
Subtotals for Soil Survey Area		**937.9**	**76.5%**
Totals for Area of Interest		**1,226.1**	**100.0%**

Richmond County, Georgia (GA245)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CR	Chewacla-Riverview association	58.0	4.7%
HZ	Hydraquents, mucky	2.5	0.2%
Ro	Riverview silt loam	152.8	12.5%
Uc	Udorthents, sandy and loamy	8.9	0.7%
W	Water	65.9	5.4%
WvB	Wickham-Urban land complex, 2 to 6 percent slopes	0.0	0.0%
Subtotals for Soil Survey Area		**288.2**	**23.5%**
Totals for Area of Interest		**1,226.1**	**100.0%**

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Attachment H

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CESAS-PD 29 May 13

MEMORANDUM FOR RECORD

SUBJECT: Wetland Delineation, Fish Passage Project Site, New Savannah Bluff Lock and Dam, Aiken County, South Carolina

1. I have reviewed the report entitled "Final Wetland Investigation, Fish Passage Project Site, New Savannah Bluff Lock and Dam, Aiken County, South Carolina" prepared by Tetra Tech, Inc., and submitted in April 2013. This report was prepared under Task Order CV01, W9126G-11-D-0058.

2. The report identified two discrete jurisdictional wetland areas within the study area (a 30 –to 75-ft wide corridor along the proposed access road centerline and the construction limits of the fish passage structure): a narrow vegetated wetland fringe along approximately 672 ft of the Savannah River (approximately 0.21 acres) and a small forested wetland swale located along the proposed access road (approximately 0.02 acres).

3. After reviewing the wetland determination data forms and the narrative report, and conducting an onsite inspection of the wetland flagging marking the boundaries of the wetlands, I have concluded that the wetlands in the study area were delineated in accordance with criteria contained in the 1987 "Corps of Engineers Wetland Delineation Manual," as amended by the November 2010 "Regional Supplement: Atlantic and Gulf Coastal Plain."

4. The maps included in Attachment C of the report are acceptable depictions of the approximate location/boundaries of all the potentially jurisdictional waters in the study area.

CHARLES (WIN) SEYLE
Biologist
Planning Division

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Appendix C2

- **Section 7(a)(2)/7(d) Evaluation for Critical Habitat for Atlantic sturgeon Savannah River Expansion Project**

Section 7(a)(2)/7(d) Evaluation for
Critical Habitat for Atlantic sturgeon
Savannah River Expansion Project

April 2018

Summary:

In accordance with Sections 7(a)(2) and 7(d) of the Endangered Species Act (ESA), Savannah District, U.S. Army Corps of Engineers (USACE) provides the following information for NOAA Fisheries Service to re-initiate consultation on the Savannah Harbor Expansion Project (SHEP) as a result of NOAA's August 17, 2017 final rule designating the Savannah River as critical habitat for Atlantic sturgeon.

NOAA's designation of critical habitat for Atlantic sturgeon included four physical and/or biological features (PBF) essential to the conservation of the species. PBFs are defined as the features that support the life history needs of the species, including but not limited to, water characteristics, soil type, geological features, sites, prey, vegetation, symbiotic species or other features. A feature may be a single habitat characteristic, or a more complex combination of habitat characteristics. Features may include habitat characteristics that support ephemeral or dynamic habitat conditions. Features may also be expressed in terms of relating to principles of conservation biology, such as patch size, distribution distances, and connectivity. The four PBFs identified for critical habitat for Atlantic sturgeon are:

- Hard substrate in freshwater = Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range).
- Salinity gradient and soft substrate below spawning areas = Aquatic habitat between the river mouth and spawning sites with a gradual downstream gradient of 0.5, up to as high as 30 parts per thousand salinity, and soft substrate (e.g., sand, mud).
- Unobstructed water of appropriate depth = Water between the river mouth and spawning sites of appropriate depth and absent physical barriers to passage (e.g., locks, dams, gear, thermal plumes, turbidity, sound, reservoirs, etc.).
- Water quality = Water quality conditions, especially in the bottom meter of the water column, with appropriate temperature and oxygen values.

The purpose of critical habitat is to increase the number of adults spawning, then protect the eggs/larvae/juveniles they produce so those individuals survive to subsequent life stages and ultimately spawn themselves.

The analysis also discusses whether irreversible or irretrievable commitment of resources would be made during the upcoming SHEP construction activities, in accordance with Section 7(d).

Consultation History:

The original SHEP Biological Opinion (SER-2010-05579, referred to heretofore as the original Opinion) was issued in November 2011. NOAA issued a first amendment to the Opinion (SER-2013-11301) in September 2013. They issued a second addendum (SER-2017-18749) in October 2017. The second addendum addresses changes to the SHEP Fish Passage feature at the New Savannah Bluff Lock and Dam (NSBLD) resulting from the Water Infrastructure Improvements for the Nation (WIIN) Act and provides revised Reasonable and Prudent Measures and associated Terms and Conditions. The second amendment also addresses a review of the first two seasons (December 2015 through March 2016 and December 2016 through March 2017) of dredging on the entrance channel that resulted in unforeseen impacts to green sea turtles and Atlantic sturgeon. The second amendment stated that the "potential effects of the proposed action to newly designated Atlantic sturgeon critical habitat will be evaluated in a subsequent amendment."

Applicable Law:

Section 7(a)(2) of the ESA requires each Federal agency, in consultation with the resource agency, to ensure that any action authorized, funded, or implemented is not likely to jeopardize the continued existence of any endangered or threatened species or result in the adverse modification of designated critical habitat. Section 7(d) states that after initiation of consultation required by subsection 7(a)(2), the Federal agency and the permit applicant shall not make any irreversible or irretrievable commitment of resources that has the effect of foreclosing the formulation or implementation of any reasonable and prudent alternatives. The implementing regulations are at 50 C.F.R. Part 402, with definitions in Section 402.02; irreversible or irretrievable commitment of resources is addressed in Section 402.09; and formal consultation is addressed in Section 402.14.

Descriptions of the SHEP Construction Actions that remain:

1. McCoys Cut Flow Re-routing Feature:

The McCoy's Cut feature is a component of the flow re-routing mitigation plan of SHEP. Construction is expected to begin in August 2018. The flow re-routing features work in combination to increase freshwater flows into portions of the estuary and limit salinity intrusion. This would reduce salinity impacts to tidal freshwater and brackish wetlands from the deepening project. These features benefit tidally influenced wetlands adjacent to the Middle, Back and Little Back River system, which are part of the Savannah River distributary system. This system of smaller cuts and rivers joins the navigation channel on the Savannah (or Front) River in several locations. The original approved plan can be found in Appendix C (http://www.sas.usace.army.mil/Missions/Civil-Works/Savannah-Harbor-Expansion/Final-Environmental-Impact-Statement/) of the 2012 Final Environmental Impact Statement for SHEP (SHEP FEIS). USACE proposed a modification to the McCoy's Cut feature in 2017 which included additional dredging and placing the excavated sediment to create wetlands. Those actions are described in detail

in the Draft Supplemental Environmental Assessment found at the following website: (http://www.sas.usace.army.mil/Portals/61/docs/Planning/PlansandReports2/McCoys%20Cut%20EA,Draft%20FONSI,%20Appendices.pdf?ver=2017-05-23-145815-383). The Final EA and signed FONSI is expected to be completed by mid-April 2018 and will replace the draft document on the website.

The majority of the McCoy's Cut work area is within the Savannah National Wildlife Refuge and is tidally influenced and surrounded by wetlands. The Rifle Cut area is dominated by tidal, emergent wetlands, while the McCoy's Cut area contains mostly forested wetlands with small fringe areas of emergent wetlands. The material to be dredged from the Middle and Little Back Rivers will be beneficially used to create wetlands by placing them behind the cut closure structures to an elevation suitable for marsh creation. The quantity of material to be dredged is enough to fill the two cuts to elevation +8 to +8.5 feet mean lower low water (MLLW). Geotechnical investigations were conducted to characterize the dredged material and found it be largely a course sandy material with very little fines and organics. Approximately 184,000 cubic yards of this material will be used to create the wetlands. Once the excavated sediments have been placed in the cuts, the eastern ends of both cuts will be armored with rock to approximately elevation +5 feet MLLW. Above this elevation, protection against erosion will be provided by hay bales secured with live stakes and several rows of container plantings. This will reduce the risk of erosion until vegetation establishes naturally along the length of the cuts. Savannah District expects this work to construct approximately nine acres of wetlands. Hydraulic dredge equipment will be limited to 24 inches or smaller and no overflow on scows will be allowed. Mechanical dredge could be used. In addition, no bottom dump scows will be allowed.

The remaining excavated sediments could be transported to an area within the Sediment Basin or to DMCA IN. The location in the Sediment Basin where Savannah District is planning to construct a broad berm as described in the 2012 final environmental impact statement (FEIS). Approximately 45 round trips will be needed to transport the excavated sediments to the Sediment Basin. Those transits will be coordinated with the Harbor Pilots to avoid traffic conflicts with other ships in the project area. The sediments would be placed within the Georgia waters side of the Sediment Basin. The placement of the excavated sediments will help fill the no longer operated Sediment Basin. The area is approximately 30 acres in size, with a bottom elevation of -15 feet MLLW based on an October 2016 hydrosurvey. The placement priority will be at the downstream or eastern end of the box and will be limited to a placement elevation of -10 feet MLLW (target height for broad berm as described in the 2012 SHEP FEIS) or greater.

As a result of logistical concerns of using the Houlihan Bridge during construction, an area was identified on the Savannah National Wildlife Refuge as a possible access site for the contractor to haul material and supplies to and from the construction site. A temporary pile supported platform will be installed on the edge of the existing tidal wetland and the Back River, impacting approximately 0.13 acres of tidal wetlands and 0.10 acres of river. Dike improvements will also be completed leading to the new access platform, impacting approximately 0.23 acres of managed wetlands inside U.S. Fish and Wildlife Service (USFWS) diked system. This platform is expected to be in place for the duration of the

construction timeframe which is estimated to be approximately one year, and will be removed at the end of the construction.

2. Boat Ramp on Hutchinson Island:

The boat ramp on Hutchinson Island will be constructed to mitigate for adverse impacts to recreational boaters from closing Rifle Cut. Construction is expected to begin by December 2020. Closing Rifle Cut will lengthen the transit time and distance travelled by recreational boaters currently using this area to reach the Back River from the only public boat ramp in this area at Houlihan Bridge on the Front River. To mitigate for this impact, Savannah District agreed to construct a new boat ramp on the north side of Hutchinson Island on the Back River. The 2-lane concrete boat ramp would include a floating dock, The Hutchinson Island boat ramp would be located in Georgia in a site that was heavily disturbed during Tide Gate construction. Construction of the boat ramp would not require the filling of jurisdictional wetlands, however some fill material (concrete, rock) would be placed into the unconsolidated river bottom in Back River. Detailed designs for the boat ramp in Back River have not been developed. However, construction of a two-lane boat ramp would only involve placing a small amount of concrete into Back River and placing some riprap along the bank for stabilization. The boat ramp will measure approximately 36 feet across with a width of approximately 40 feet

3. Inner Harbor Dredging:

Dredging the inner harbor will deepen the channel to -47 feet MLLW (5 feet deeper) from the mouth of the harbor (Station 0+000) to Station 103+000. Construction is expected to begin in October 2018. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at the Garden City Terminal. Inner harbor channel deepening would also require construction of two meeting areas (Table 1) and two bend wideners (Table 2) as described in the 2012 SHEP FEIS.

Table 1: Proposed Meeting Areas

Location	Description
GA waters: Station 14+000 to 22+000	The existing 400-foot wide channel would be widened 100 feet on the south to provide an average width of 500 feet. Side slopes would be 3H:1V
GA and SC waters: Station 55+000 to 59+000	The existing 400-foot wide channel would be widened 100 feet to the north to provide an average width of 500 feet. Side slopes would be 3H:1V

Table 2: Proposed Bend Wideners

Widener	Location	Description
1	GA waters: Stations 27+500 to 31+500	156-foot bottom width plus side of slope of less than 100 feet. South of channel
2	SC waters: Stations 52+250 to 55+000	76-foot bottom width plus side of slope of less than 100 feet. North side of channel

A cutterhead pipeline dredge and/or mechanical dredge will be used to deepen the inner harbor channel from Stations 0+000 to 103+000. The material dredged from the inner harbor will be placed in existing upland dredged material containment areas (DMCAs). The most recent sediment characterization completed for the 2012 SHEP FEIS of the inner harbor maintenance sediments indicated that the sediments are primarily silts and clays from Station 56+000 to 103+000. The reach from Station 25+000 to 56+000 is a transition reach that has a higher percentage of sand in its distributions than the sediment distributions of the upstream reach. A notable exception is in the vicinity of Station 36+000, which has a high percentage of silts and clays and almost no sand. This location is near the confluence of the inner harbor channel and both Elba Island and Fields Cut. The inner channel sediment distributions from Stations 0+000 (mouth of the Savannah River) to 25+000 are primarily sand, which indicates that the source of sediment from this reach is offshore.

4. Marsh Restoration (DMCA 1S)

As a result of direct impacts to brackish marsh habitat as a result of the SHEP, Savannah District evaluated possible sites within coastal Georgia that could support the long term success of a restored salt and brackish marsh system. The 2012 FEIS identified restoration of a previously-used sediment placement area -- DMCA 1S as meeting those requirements. Construction is expected to begin in May/June 2019. DMCA 1S is located at the confluence of Front River and Middle River, and is within the boundaries of the Savannah National Wildlife Refuge. Restoration of the site would occur by grading it down to an elevation that would allow the growth of *Spartina alterniflora* (i.e., +7.6 to +7.8 MLLW). Once the new elevations have been established, the approximately 40.3-acre site would be allowed to naturally vegetate. A “feeder creek” system would be constructed toward the interior of the restored marsh. The creek would provide another mechanism of ensuring adequate exchange of brackish surface water with the interior of the site. Savannah District would then let the site naturally re-vegetate. More information regarding the marsh restoration efforts at DMCA 1S can be found in Section 5.01.1.2 of the 2012 SHEP FEIS.

5. Fish Passage at the NSBLD

During the 2012 SHEP study and environmental approval process; creating a fish passage at the NSBLD was identified by the natural resource agencies as an appropriate mitigation for the impacts of SHEP to sturgeon habitat after the consideration of numerous other options. Because of the tidal nature of the estuary, the interagency team could not identify any measure that could be constructed in the harbor that would improve or increase sturgeon habitat on all tidal and river flows. The National Marine Fisheries Service (NMFS) specifically viewed the NSBLD fish passage feature of SHEP as a significant contribution to recovery of sturgeon and other anadromous fish in the Savannah River, especially when combined with other mitigation features such as dissolved oxygen injection systems and flow re-routing features. More information on the original design of the fish passage at NSBLD can be found in Section 5.03.2.1 of the 2012 FEIS.

The WIIN Act 2016 deauthorized the NSBLD as a stand-alone structure, substantially altering the mitigation design described and approved as part of the 2012 SHEP FEIS. The 2016 Act provided the Secretary of the Army with the following options to modify the SHEP fish passage feature:

1. Repair the NSBLD lock wall and modify the structure such that the structure is able to:
    - Maintain the pool for navigation, water supply, and recreational activities
    - Allow safe passage over the structure to historic spawning grounds of shortnose sturgeon, Atlantic sturgeon, and other migratory fish; OR

2. Construct at an appropriate location across the Savannah River a structure that is able to maintain the pool for water supply and recreational activities; and
    - Removal of the New Savannah Bluff Lock and Dam on completion of construction of the fish passage structure; and

The design and construction to fulfill the SHEP fish passage mitigation requirements will be cost shared under the project.

In response to the WIIN Act of 2016, Savannah District is currently evaluating several alternatives to identify the best design to fulfill SHEP's mitigation requirement to enable sturgeon to pass that point in the river. Construction is expected to begin by January 2021. USACE is coordinating with engineering and biology staff from NMFS as part of this evaluation of new alternatives.

6. Sediment Basin Sill Construction:

The Sediment Basin sill construction is a feature of the SHEP flow re-routing plans to reduce the expected increase in upstream salinity levels. That re-routing would, in turn, minimize adverse impacts to fishery habitat. As part of the flow re-routing plan, Savannah District would deposit both new work sediment and rock to construct a sill and broad berm

at the lower end of the Sediment Basin. Those features would allow natural processes to later fill that basin. It is anticipated that a small dredge will be used to construct broad berm at mouth of Sediment Basin. Information regarding the Sediment Basin can be found in Section 5.26 and 6.19.2 of the 2012 SHEP FEIS. Construction is expected to begin in July/August 2020. A bathymetric survey is conducted in the Sediment Basin every four months during the channel deepening. The monitoring will continue after completion of the Tidegate removal to document changes in the sedimentation rate within the Sediment Basin.

7. Dissolved Oxygen Injection System:

As stated in Section 5 of the 2012 FEIS, deepening the navigation channel would adversely impact dissolved oxygen levels in the harbor without mitigation. Since dissolved oxygen is a critical environmental resource in the harbor, Savannah District will be using a land-based oxygen injection system to mitigate for impacts to dissolved oxygen levels as a result from the SHEP. The systems would use water withdrawn from the river through pipes, super-saturate it with oxygen, and then return it to the river. The water intake structure would include screens to reduce the intake of trash and other suspended solids. The screens would be sized to keep flow velocities from exceeding 0.5 foot per second to minimize entrainment of fish larvae. The intake and discharge would be located along the side of the river and not extend into the authorized navigation channel. More information on the dissolved oxygen system can be found in Section 5.02.2 of the 2012 SHEP FEIS. Construction of the system is underway, and the downriver plant is expected to be complete in May 2018. Construction of the upriver plant is scheduled to be complete by June 2018. Maintenance dredging around the intakes will be required to keep the system operating.

8. Aids to Navigation:

As stated in Section 5.22 of the 2012 SHEP FEIS, no utilities are expected to be impacted by the proposed deepening of the harbor. Savannah District contacted the U.S. Coast Guard and they indicated that U.S. Coast Guard would need to purchase and install new navigational markers for the approximately 38,000-foot extension to the existing ocean bar channel (from Stations -60+000B to -97+680B). If the harbor deepening project inadvertently damages any aids to navigation (i.e., existing beacons, electronic components in the lighted buoys or their hulls), Savannah District would work with the Coast Guard to move, repair, and/or replace those navigational markers. Installation of the aids to navigations is expected to be complete by May 2020.

Action Area

The action area (defined in 50 CFR 402.02 as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action”) for this action is the Savannah Harbor Navigation Channel, along with the Savannah River leading up to the NSBLD.

Effects Analysis on Critical Habitat for Atlantic Sturgeon

1. **PBF 1: Hard substrate in freshwater = Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range**)

    a. Eggs: Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 ppt range) necessary for the settlement and development of fertilized eggs

Of all of the SHEP construction features that will be constructed, there are not any that are expected to cause immediate impacts to the egg life stage of critical habitat for Atlantic sturgeon for the hard substrate. There are two SHEP construction features, however, that are expected to affect the egg life stage of critical habitat for Atlantic sturgeon at a later time period. Creation of the diversion structure for McCoys Cut has the potential to provide approximately 200,000 square feet of hard substrate in low salinity waters, providing substrate necessary for the settlement and development of fertilized eggs. As a result of the construction of the fish passage at the NSBLD, the gravel bar downstream of NSBLD may spread out or move to a new location as a result of the change in flow direction. This may change the location of where potential substrate is available for the settlement and development of fertilized eggs.

    b. Larvae: Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 ppt range) necessary for the growth and development of juveniles

Of all of the SHEP construction features that will be constructed, there are not any that are expected to cause immediate impacts to the larvae life stage of critical habitat for Atlantic sturgeon for the hard substrate PBF. There are two SHEP construction features, however, that are expected to effect the egg life stage of critical habitat for Atlantic sturgeon at a later time period. Creation of the diversion structure for McCoys Cut has the potential to provide hard substrate in low salinity waters, providing substrate necessary for the growth and development of juveniles. As a result of the construction of the fish passage at the NSBLD, the gravel bar downstream of NSBLD may spread out or move to a new location as a result of the change in flow direction. This may change the location of where potential substrate is available for the growth and development of juveniles.

    c. Adult: Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 ppt range) necessary for the settlement of fertilized eggs

Of all of the SHEP construction features being proposed, there are not any that are expected to cause immediate impacts to the adult life stage of critical habitat for Atlantic sturgeon for the hard substrate. There are two SHEP construction features, however, that are expected to effect the egg life stage of critical habitat for Atlantic sturgeon at a later time period. Creation of the diversion structure for McCoys Cut has the potential to provide hard substrate in low salinity waters, providing substrate necessary for the settlement of

fertilized eggs. As a result of the construction of the fish passage at the NSBLD, the gravel bar downstream of NSBLD may spread out or move to a new location as a result of the change in flow direction. This may change the location of where potential substrate is available for the settlement of fertilized eggs.

d. Evaluation

The proposed McCoys Cut Flow Re-routing feature "**May Affect but Not Adversely Modify**" critical habitat for Atlantic sturgeon for the hard substrate PBF for all three life stages (eggs, larvae, and adults) but in a positive way. One aspect of the McCoys Cut flow re-routing is the placement of crushed stone/rock next to the sheet pile as part of the construction of the diversion structure. This placement of crushed stone/rock has the potential to help provide critical habitat for Atlantic sturgeon with regards to the availability of approximately 200,000 square feet of hard substrate in fresh water. In addition, the Fish Passage at the NSBLD "May Affect but Not Adversely Modify" critical habitat for Atlantic sturgeon for the Hard Substrate PBF for all three life stages of the Atlantic sturgeon. As a result of the construction of the fish passage at the NSBLD, the gravel bar downstream of NSBLD may spread out or moved to a new location by the change in flow direction changing the location of where potential substrate is available for the settlement/development of fertilized eggs as well as the growth and development of juveniles. This habitat will not be lost, however there is the potential it could be moved slightly as a result of the change in water flow as a result of the construction of the fish passage structure.

The following SHEP construction features will have "**No effect"** on critical habitat for any of the three life stages for the hard substrate PBF for Atlantic sturgeon: the construction of the boat ramp at Hutchinson Island, Inner Harbor dredging, Sediment Basin weir construction, marsh restoration at DMCA 1S, installation of the dissolved oxygen injection system and the placement of aids to navigation. All of these proposed SHEP construction features occur in habitat where the water's salinity is greater than 0.5 ppt and where hard substrate is not present as most of the channel bottom consists of sand and silt.

2. **PBF 2: Salinity gradient and soft substrate below spawning areas = Aquatic habitat between the river mouth and spawning sites with a gradual downstream gradient of 0.5, up to as high as 30 parts per thousand salinity, and soft substrate (e.g., sand, mud).**

    a. Juvenile: Aquatic habitat inclusive of waters with a gradual downstream gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites necessary for juvenile foraging and physiological development

Of all of the upcoming SHEP construction features being proposed, there are several that are expected to immediately impact the juvenile life stage of the salinity gradient and soft substrate PBF during and after construction is completed. The construction of the McCoys Cut diversion structure as designed, is expected to change salinities within Middle and Front Rivers from 0.5-30 ppt to salinities less than 0.5 ppt to reduce salinity

impacts to tidal freshwater and brackish wetlands as a result of the SHEP. The construction of the boat ramp at Hutchinson Island will remove approximately 200 square feet of soft substrate within habitat that has a salinity range between 0.5 to 30 ppt that would have been available be used for foraging habitat for juvenile Atlantic sturgeon. Dredging the inner harbor as well as filling in the sediment basin with new work sediment will cause a temporary loss of foraging habitat but is expected to quickly recover and will not cause a permanent loss of critical habitat for the salinity gradient and soft substrate PBF for juvenile Atlantic sturgeon.

b. Evaluation

The McCoys Cut diversion structure, construction of the boat ramp at Hutchinson Island, dredging the inner harbor, and the filling of the Sediment Basin **"May Affect but Not Adversely Modify"** critical habitat for Atlantic sturgeon for the salinity gradient and soft substrate PBF. The construction of the McCoys Cut diversion structure will cause a conversion of an area of approximately 44 million square feet within the Back River portion of the Savannah River that was between 0.5-30 ppt to less than 0.5 ppt. This area will see a decrease in river salinities that would have otherwise been available for juvenile foraging, but with the conversion of the habitat to salinities less than 0.5 ppt, it would not be considered ideal foraging habitat. There will also be two areas within the Front River portion Savannah River totaling approximately 100 million square feet whose salinities will change from 0.5 ppt and less to 0.5-30 ppt which will provide additional suitable foraging habitat for juvenile Atlantic sturgeon. The benefit of the construction of the McCoys Cut flow re-routing feature is even with the loss of the area within the Back River for suitable foraging habitat for juvenile Atlantic sturgeon, as a result of the width size of the river areas within the Front River where there will be an increase in salinities, there will be an overall gain in suitable foraging habitat by about half.

The construction of the boat ramp on Hutchinson Island will remove a small area (approximately 200 square feet) of soft substrate. Approximately 44 million square feet of suitable forging habitat will be lost but approximately 109 square feet of suitable foraging habitat will be gained as a result of the McCoys Cut flow re-routing feature, as well as the construction of the boat ramp on Hutchinson Island. Deepening the inner harbor as well as the filling of the Sediment Basin will temporarily remove the bottom sediments and any benthos that reside there. This will decrease sturgeon foraging habitat for a period of time. Most of the deepening activities will occur within the footprint of the existing maintained navigation channel. Though an initial loss of benthic resources are likely, recovery between 6-months to two years is expected. Thus, the impacts to sturgeon foraging habitat are expected to be short-term as a result of deepening the inner harbor. The filling of the Sediment Basin will also cause a temporary loss of foraging habitat during the filling process, but this will only be a temporary loss of foraging habitat, not a permanent loss.

The following SHEP construction features will not impact the juvenile life stage of critical habitat for the salinity gradient and soft substrate PBF for Atlantic sturgeon: Fish passage at NSBLD, marsh restoration at DMCA 1S, installation of the dissolved oxygen injection system, placement of aids to navigation, as well as the conversion of McCoombs Cut from open water to wetlands as part of the McCoys Cut Flow re-routing feature. The fish

passage feature will occur in habitat where salinities are less than 0.5 ppt, which is not preferable habitat for juvenile foraging and physiological development as they prefer water where the salinities range from 0.5 to 30 ppt. The marsh restoration efforts at DMCA 1S involve grading down existing uplands to convert upland habitat to wetland habitat. This would not involve construction within the Savannah River itself and therefore would not impact any of the existing foraging habitat for juvenile Atlantic sturgeon. The installation of the dissolved oxygen injection system is also land-based and does not require any construction within the Savannah River or removal/conversion of soft bottom habitat and therefore will not impact the juvenile life stage of the "salinity gradient and soft substrate" PBF. The placement of aids to navigation would require work within the Savannah River, however the field work to perform these functions is short term and would have temporary effects and would not remove or change the existing soft substrate for juvenile foraging and physiological development. The conversion of McCoombs Cut from open water to wetlands as part of the McCoys Cut Flow re-routing would not impact critical habitat for juvenile Atlantic sturgeon for the "salinity gradient and soft substrate" PBF as McCoombs cut is located within a section of the Savannah River where salinities are less than 0.5 ppt, which is not preferable juvenile foraging and physiological development as they prefer water where the salinities range from 0.5 to 30 ppt.

3. **PBF 3: Unobstructed water of appropriate depth = Water between the river mouth and spawning sites of appropriate depth and absent physical barriers to passage (e.g., locks, dams, gear, thermal plumes, turbidity, sound, reservoirs, etc.).**

    a. Juvenile (Locating, accessing and using habitat for development): Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support seasonal and physiologically dependent movement of juveniles to appropriate salinity zones within the river estuary

None of the upcoming the SHEP construction features will impact critical habitat for juvenile Atlantic sturgeon for the unobstructed water depth PBF since there are no designs that would cause obstructions within the 0.5 to 30 ppt range.

    b. Subadults (Holding): Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support holding of subadults. Water depths in main river channels must also be deep enough (at least 1.2 meters) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.

    c. Adults (Spawning movements): Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary for unimpeded movement of adults to and from spawning

sites. Water depths in main river channels must also be deep enough (at least 1.2 meters) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.

d. Adults (Staging or resting): Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support staging or resting for pre-/post-spawning condition adults. Water depths in main river channels must also be deep enough (at least 1.2 meters) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.

The construction of the McCoys Cut diversion structure and the construction of the closure structure at McCoombs Cut to create wetland habitat is expected to immediately impact the subadult and adult life stages of the "unobstructed water depth" PBF. These features would cause an obstruction within the Savannah River for Atlantic sturgeon subadults and adults between the river mouth and spawning site for their holding, spawning movements, and staging/resting life stages, thereby causing the Atlantic sturgeon to travel approximately 2,400 feet to McCoys Cut to continue their way up river to find additional spawning and resting areas. The diversion structure will increase flows through McCoys Cut and will act as an attractor for upstream migration. The construction of the diversion structure as part of the McCoys Cut flow re-routing feature will modify approximately 1/3 of the river's width. While it is expected that most of structure will remain underwater most of the time and provide approximately eight feet of water between the top of the diversion structure and the water's surface, the sturgeon will most likely seek the unobstructed two-thirds of the river's width before they continue heading upstream.

e. Evaluation:

The construction of the McCoys Cut diversion structure and the construction of the closure structure at McCoombs Cut to create wetland habitat **"May Affect but Not Adversely Modify"** critical habitat for Atlantic sturgeon for the "unobstructed water depth" PBF for the following life stages (subadults, adults (spawning movement), and adults (staging or resting)).

The following SHEP construction features will not impact any of the life stages of critical habitat for the unobstructed water depth PBF for Atlantic sturgeon: construction of the fish passage at NSBLD, the construction of the rock sill/weir at the Sediment Basin, the construction of the boat ramp at Hutchinson Island, dredging the Inner Harbor, marsh restoration at DMCA 1S, installation of the dissolved oxygen injection system, and placement of aids to navigation.

Implementation of the fish passage feature at NSBLD will remove an obstruction that has prevented Atlantic sturgeon from passing between the river mouth and their historic spawning sites. The area above the NSBLD was not designated as critical habitat.

The rock sill/weir as designed at the Sediment Basin will be constructed at approximately -9 feet MLLW, so it would not be an obstruction to sturgeon traveling up or down the river. The -9 feet MLLW was selected because it matches the natural river depth just upstream of the Tide Gate. The construction of the boat ramp is also not expected to obstruct the movement of Atlantic sturgeon moving up and down the Savannah River as the boat ramp will only encompass approximately 200 square feet of the river. Dredging the Inner Harbor involves temporarily removing the bottom sediments and therefore will not cause an obstruction within the Savannah River. The turbidity plume for dredging is localized and temporary to the dredge and does not cover the whole width of the river. Therefore it would not act as an obstruction. In addition water release from the DMCA will not cause a turbidity plume that will block the river. The marsh restoration efforts at DMCA 1S and the installation of the dissolved oxygen injection system are both land based activities and do not involve any in-water work that would prevent the sturgeon from freely traveling the Savannah River. The placement of the aids to navigation would not obstruct the movement of sturgeon or any other fish species from transiting up the river such as a lock, dam, etc. The size of the aids are small enough that that the sturgeon should easily swim around them and continue their path up the Savannah River.

The construction of the diversion structure at McCoys Cut and the conversion of open water to wetland habitat in McCoombs cut will not cause an obstruction for critical habitat for juvenile Atlantic sturgeon. The location where the construction of the diversion structure and the creation of wetlands at McCoombs Cut would occur in water where the salinity is less than 0.5 ppt, which is less preferable than where the water's salinity is 0.5-30 ppt.

There are not new locks, dams, thermal plumes, sound, reservoirs, gear, etc that would act as a barrier.

4. **PBF 4: Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values necessary to support annual and inter-annual larval survival, growth, development, and recruitment.**

    a. Larvae: Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values necessary to support annual and inter-annual larval survival, growth, development, and recruitment.

Of all of the upcoming SHEP construction features, only the construction of the fish passage structure at NSBLD has the potential to impact the water quality PBF for larval Atlantic sturgeon. The USACE Savannah District will follow best management practices during the construction of the fish passage structure to reduce impacts to critical habitat for Atlantic sturgeon during all life stages, especially during the spawning period. Reasonable and Prudent Measure 9.3.2.1 to the NMFS Biological Opinion amendment dated October 13, 2017 states "To protect spawning sturgeon and their offspring, no in-water construction will be performed at the downstream entrance of the fish passage

channel during the late winter/spring spawning period through the early summer larval period".

b. Juveniles: Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values necessary to support annual and inter-annual juvenile survival, growth, development, and recruitment.

c. Subadults: Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values necessary to support annual and inter-annual subadult survival, growth, development, and recruitment.

d. Adults: Water quality conditions, especially in the bottom meter of the water column, with temperature and oxygen values necessary to support spawning; annual and inter-annual adult survival

Of all of the upcoming SHEP construction features, only the dredging of the Inner Harbor and the dredging associated with the McCoys Cut flow re-routing feature has the potential to impact the juvenile, subadult, and adult water quality PBF for Atlantic sturgeon.

Dredging activities associated with the McCoys Cut flow re-routing feature could cause some temporary turbidity which could temporarily impact water quality (dissolved oxygen levels in particular) within the project area. The effects are expected to be minor in amount, localized in extent, and short in duration. Dredging the Inner Harbor also has the potential to cause decreased DO levels as a result of the deeper water depths. However, the installation of the dissolved oxygen injection will compensate for those DO impacts.

e. Evaluation:

Dredging activities associated with McCoys Cut flow re-routing feature as well as the Inner Harbor, **"May Affect but Not Adversely Modify"** the water quality PBF for juvenile, subadults, and adult Atlantic sturgeon.

Savannah District will follow best management practices during the dredging activities associated with the McCoys Cut flow re-routing feature including the monitoring of water quality (dissolved oxygen, pH, turbidity) downstream of the dredging activity to prevent sediment plumes that could adversely affect the water quality in the deep hole located in the lower Middle River. It will also only conduct dredging in only one area at a time (either in upper Middle River or the Back River, but not both at the same time). In addition, the size of the dredge will be limited.

Dredging the inner harbor **"May Affect But Not Likely to Adversely Modify"** critical habitat for Atlantic sturgeon because the water quality impacts will be short in duration and will recover after dredging ends. It is expected that the installation of the dissolved oxygen injection system will compensate for the DO impacts caused by the deeper water depths from the Inner Harbor dredging. The system's design provides the best balance of system

spacing, size and effectiveness. Installation of the dissolved oxygen injection system will substantially reduce the projected negative impacts to dissolved oxygen levels within the harbor from the harbor deepening. The design studies indicate that the dissolved oxygen system will increase by 6.5 percent or 89 acres the amount of acceptable summer habitat for sturgeon, a highly stressful time for the species in this river because of recurring low dissolved oxygen levels. In addition, once the bottom sediments are dredged from inner harbor, they will be placed in existing upland DMCAs. Savannah District will monitor the water quality within the DMCAs and will only discharge water into the receiving waters of the harbor when dissolved oxygen, turbidity, and pH levels are within state standards.

Construction of the fish passage structure at NSBLD is not expected to impact for the water quality PBF for larval Atlantic sturgeon. In addition to minimizing effects to spawning sturgeon and their offspring, by limiting construction so that no in-water fish passage construction downstream of the NSBLD occurs between August 15 and April 15 of any year, Savannah District will adhere to the following protective measures:

a) Appropriate erosion and turbidity controls shall be used wherever necessary to limit sediments from entering the water.
b) Dredging and construction shall be conducted with minimum environmental impact.
c) No construction debris shall be allowed to enter the water.
d) To ensure passage throughout the habitat, adequate pathways must be provided at all times so that fish can migrate between foraging habitat and spawning habitat; no blocking of the channel is allowed.
e) Normal water flows must be maintained throughout the construction areas.
f) Savannah District shall not reduce flows during spring/early summer to aid in the construction of the fish passage.

The following SHEP construction features will not impact the water quality PBF for any of the life stages of Atlantic sturgeon: the construction of the boat ramp at Hutchinson Island, construction of the rock sill/weir at the Sediment Basin, marsh restoration at DMCA 1S, and placement of aids to navigation.

The construction of the boat ramp at Hutchinson Island will be performed in water shallower than four feet; therefore, not in critical habitat. Turbidity, associated with the disturbance of sediments during construction of the boat ramp would occur within critical habitat for Atlantic sturgeon, but it would be minor and would not affect dissolved oxygen levels or temperature levels at the site. As a result of the construction of the rock sill/weir at the Sediment Basin, there is the potential for temporary water quality impacts during the construction, but these are anticipated to be minor and short-term in nature. It is not anticipated that either temperature or dissolved oxygen levels would reach unacceptable levels as a result of those construction activities.

The movement, repair, installation of the navigational aids, and the marsh restoration efforts at DMCA 1S would not have any negative impacts to the water quality PBF. The field work to perform these functions is short term and would have temporary effects. Once the work is complete, any impacts to water quality would be minor and would not

change either temperature or dissolved oxygen levels within the area where work is performed.

Section 7(d) Statement

To reduce potential impacts to critical habitat for Atlantic sturgeon during the construction of the SHEP – including its McCoys Cut flow re-routing feature, the fish passage at NSBLD, and inner harbor dredging; various protective measures will be followed. These protections include time of year restrictions on when work cannot be performed. For the McCoys Cut flow re-routing feature, construction of the diversion and closure structure at McCoys/McCoombs Cut would only occur between May 15 and November 1 since most sturgeon are not expected to be in that portion of the Savannah River during that timeframe. To minimize effects to spawning sturgeon and their offspring during the construction of the fish passage at the NSBLD, bubble curtains/screens or other recommended methods could be used just downstream of the NSBLD structure rather than preforming no in-water construction downstream of the NSBLD for eight months (August 15 and April 15 of any year). Impacts to critical habitat for Atlantic sturgeon from the Inner Harbor dredging will be offset by the other SHEP project features, particularly construction and operation of the dissolved oxygen injection system and fish passage at NSBLD. Savannah District will not make any irreversible or irretrievable commitment of resources that would foreclose the formulation or implementation of any reasonable and prudent alternatives to avoid jeopardizing the continued existence of Atlantic sturgeon as covered in the NMFS Biological Opinion for SHEP and present in Savannah Harbor.

Conclusion of Section 7(a)(2) Evaluation

The protective measures that will be used during the SHEP construction, including fish passage at the NSBLD, the McCoys Cut flow re-routing feature, and the Inner Harbor dredging, should reasonably protect Atlantic sturgeon and not jeopardize their critical habitat.

References

November 04, 2011. NOAA Fisheries Final Biological Opinion for Savannah Harbor Expansion Project (SHEP)

September 23, 2013. NOAA Fisheries Amendment to Biological Opinion for Savannah Harbor Expansion Project (SHEP).

October 13, 2017. NOAA Fisheries Amendment to Biological Opinion for Savannah Harbor Expansion Project (SHEP).

USACE. Final Environmental Impact Statement, Savannah Harbor Expansion Project Chatham County, Georgia and Jasper County S.C. January 2012.

Appendix C3

- **Section 404(b)(1) Analysis**

SECTION 404(b)(1) EVALUATION

FOR

SAVANNAH HARBOR EXPANSION PROJECT
FISH PASSAGE AT NEW SAVANNAH BLUFF LOCK AND DAM
RICHMOND COUNTY, GEORGIA AND AIKEN COUNTY, SOUTH CAROLINA

September 2018

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OF DREDGE AND FILL MATERIAL

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1.0 INTRODUCTION

The following evaluation is prepared in accordance with Section 404(b)(1) of the Clean Water Act of 1977 to evaluate the environmental effects of the proposed placement of dredged or fill material in waters of the United States. This evaluation supplements the Savannah Harbor Expansion Project (SHEP) Section 404(b)(1) evaluation which can be found in Appendix H (http://www.sas.usace.army.mil/Portals/61/docs/SHEP/Reports/EIS/Appendix%20H%20Section%20404b1%20SHEP%20FINAL%20EIS.pdf) of the SHEP 2012 Final Environmental Impact Statement. Specific portions of the regulations are cited and an explanation of the regulation is given as it pertains to the project. These guidelines can be found in Title 40, Part 230 of the Code of Federal Regulations (https://www.ecfr.gov/cgi-bin/text-idx?SID=b94f445cf586aaff7dde767b5a8a09cd&mc=true&node=pt40.27.230&rgn=div5).

2.0 PROPOSED ACTION AND ENVIRONMENTAL SETTING

2.1 ENVIRONMENTAL SETTING

The New Savannah Bluff Lock & Dam (NSBLD) study area is located along the Savannah River, approximately 13 miles downstream from Augusta, Georgia, and 187 miles upstream from Savannah, Georgia.

2.2 PROPOSED ACTION

The proposed action consists of the construction of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The currently existing lock and dam would be removed, including the foundation down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 106.22 feet (NAVD88, 107.0 NGVD29). A floodplain bench approximately 250 feet in width would be excavated to elevation 110 (NAVD88) on the Georgia side of the existing dam location. The bench would be in the existing park. The bench would ease the passage of flood waters past that point in the river. The bench would be grassed to prevent erosion. At the weir, the pool is expected to be 2.0 feet higher than the weir crest for normal river flows of 5,000 cubic feet per second. Therefore, the pool elevation at the weir would fluctuate between elevation 110 and 111 feet (NAVD 88) during normal river flows. The pool at 5th St. Bridge would be around elevation 112.4 (NAVD 88) (1.9 feet lower than existing) during normal flow conditions. As a result of the footprint of the floodplain bench, the existing boat ramp will need to be removed and a new boat ramp will be constructed further north.

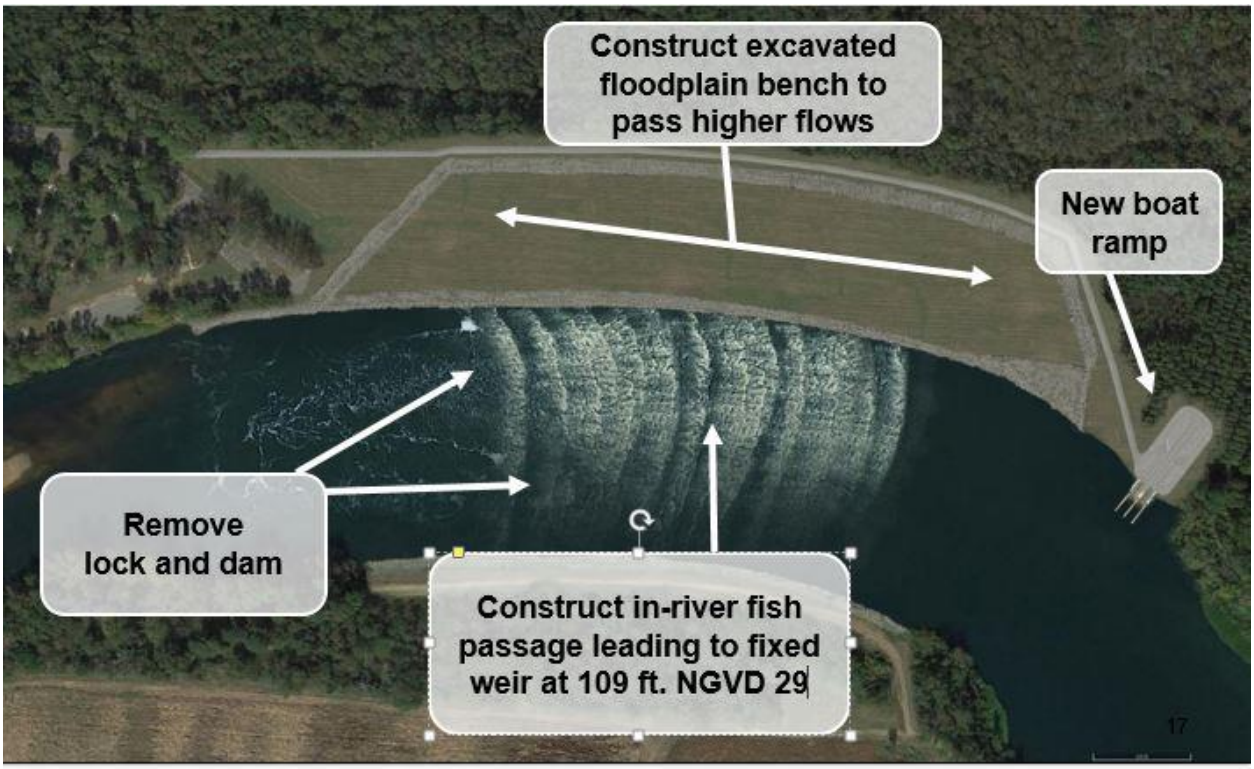

Figure 1: Aerial Depiction of the Proposed Project Alterative

2.3 GENERAL DESCRIPTION:

Description of Actions Subject to Section 404 of Clean Water Act

The construction of the in-river fish passage structure will require the placement of approximately 46,500 tons of bedding stones, 74,000 tons of rip rap, and approximately 44,500 tons of weir stones within the Savannah River. The construction of the new boat ramp will require approximately 7,000 tons of bedding stone. The proposed action will also require the demolition of the existing lock and dam structure.

Threatened, Endangered and other Listed Species

The National Marine Fisheries Service (NMFS) provided the USACE Savannah District with the original Biological Opinion for the Savannah Harbor Expansion Project (SHEP) on November 4, 2011. The original Opinion evaluated fish passage at the NSBLD for Atlantic and shortnose sturgeon (which are federally listed species) as one of several measures to avoid and minimize effects resulting from deepening and expansion of the navigation channel. The fish passage project was intended to provide improved access to upstream spawning habitat for these listed species by allowing them to have access to the full length of the Savannah River. On October 10, 2017, USACE Savannah District received the second amendment to the original Biological Opinion for SHEP. The second amendment to the Biological Opinion provided certain terms and conditions

to follow to minimize impacts to spawning sturgeon and their offspring within the project area during construction of the fish passage structure.

3.0 SUBPART B - COMPLIANCE WITH THE GUIDELINES

The following objectives should be considered in making a determination of any proposed discharge of dredged or fill material into waters of the U.S.

3.1 RESTRICTIONS ON DISCHARGE - (SECTION 230.10)

"(a) ***except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practical alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences."***

No other practicable alternative with less environment impacts on the aquatic ecosystem has been identified.

"(b) ***Discharge of dredged material shall not be permitted if it;"***

"(1) ***Causes or contributes, after consideration of disposal dilution and dispersions, to violations of any applicable state water quality standard;"***

"(2) ***Violates any applicable toxic effluent standard or prohibition under Section 370 of the Clean Water Act."***

The stone and rock that will be placed in the water to create the in-river fish passage structure along with the construction of the new boat ramp will be clean and will not compose of any toxic or hazardous materials. Turbidity curtains will be installed across the cuts to prevent turbidity plumes from leaving the placement site.

"(3) ***Jeopardizes the continued existence of species listed as endangered and threatened under the Endangered Species Act of 1973, as amended."***

Endangered species are addressed in the EA for this action. Federally listed species such as the Atlantic and shortnose sturgeon are known to be within the project area. As stated in the second amendment of the SHEP Biological Opinion, several terms and conditions were provided to minimize impacts to spawning Atlantic and shortnose sturgeon during construction effort. The terms and conditions that were provided and will be followed during construction are as follows:

a. To minimize effects to spawning sturgeon and their offspring, no in-water fish passage construction downstream of the NSBLD shall occur between August 15 and April 15 of any year. In-water construction of the fish passage may be performed downstream of the dam between April 16 and August 14 of any year, and upstream of the dam throughout the year.

b. In addition, the following protection measures during the construction of the fish passage should be completed

- ❖ Appropriate erosion and turbidity controls shall be utilized wherever necessary to limit sediments from entering the water.
- ❖ Dredging and construction shall be conducted with minimum environmental impact.
- ❖ No construction debris shall be allowed to enter the water.
- ❖ To ensure passage throughout the habitat, adequate pathways must be provided at all times so that fish can migrate between foraging habitat and spawning habitat; no blocking of the channel is allowed.
- ❖ Normal water flows must be maintained throughout the construction areas.
- ❖ The USACE shall not reduce flows during spring/early summer to aid in the construction of the fish passage.

"(4) ***Violates any requirements imposed by the Secretary of Commerce to protect any marine sanctuary designated under Title Ill of the Marine Protection Research and Sanctuaries Act of 1972."***

No marine sanctuary or other items addressed under this Act would be affected by the proposed work.

"(c) ***Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted which will cause or contribute to significant degradation of the waters of the United States. Findings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations, and tests required by Subparts B and G of the consideration of Subparts C-F with special emphasis on the persistence and permanence of the effects contributing to significant degradation considered individually or collectively include:"***

"(1) Significantly adverse effects of the discharge of pollutants on human health or welfare including, but not limited to effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites."

The proposed work is expected to improve water quality and conservation. Therefore, this project is expected to have a beneficial effect on, fish, shellfish, wildlife, and special aquatic sites.

"(2) Significantly adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent upon aquatic ecosystems, Including the transfer, concentration, and spread of pollutants or their by-products outside the disposal site through biological, physical, and chemical processes."

The analytical results of sediment sampling indicated that no contamination exists that would impact the proposed construction activities.

"(3) Significantly adverse effects of the discharge of pollutants on aquatic ecosystems diversity, productivity, and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy; or"

"(4) Significantly adverse effects of the discharge of pollutants on recreational, aesthetic, and economic values."

The proposed changes to the project would remove a current obstruction to migratory fish species including the federally listed shortnose and Atlantic sturgeon. The removal of the current lock and dam structure would be beneficial by removing a large man made concrete structure and restoring the river to a more natural appearance. The shoaling areas created would also add to create a more aesthetically pleasing view of the river channel. The overall impact would be a significant improvement to aesthetics.

"(d) ***Except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practical steps have been taken which will minimize the potential adverse impacts of the discharge on the aquatic ecosystem."***

Approximately 165,000 tons of various rock/stone sizes will be placed in the Savannah River to create a fish passage. This fish passage will help migratory fish species, included the federally listed shortnose and Atlantic sturgeon, to access areas within the Savannah River that they have historically not had access to since the lock and dam was created. This will provide more foraging and spawning habitat which should help with the overall fish diversity within the project area and help the overall water quality in the project area by restoring the river to more natural state. The placement of the rocks/stones in the river should also help aerate the water, creating more oxygenated water for the aquatic resources in the area.

3.2 FACTUAL DETERMINATION. - (SECTION 230.11)

3.2.1 Physical Substrate Determinations

Consideration shall be given to the similarity in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site and any potential changes in substrate elevation and bottom contours.

Stone/rock material for the project would come from the local quarries and would be cleaned before being placed in the water. There will be three different types of rock/stone that will be placed in the Savannah River: bedding stone, rip rap, and weir stone. These stone will be placed by mechanical equipment.

Possible loss of environmental values

No long term loss of environmental values are expected. The features in the project design are designed to improve environmental values of the project area. With implementation of the proposed action, there some impacts to the existing wetlands as a result of a small construction foot printed needed to construct an access road. This access road would be within the Freshwater Forested/Shrub Wetland immediately to the north of the project. The construction of an access road associated with the proposed action would impact approximately 0.50 acres of the forested/shrub wetland area. There would be some impacts to riverine wetlands as a result of the construction of the fish passage structure as approximately 0.3 acres of riverine wetland habitat would be lost. The net effect of the removal of the lock and dam structure however is an increase in wetted areas, restoration of riverine habitat, and the restoration of part of the Augusta shoals and makes up for the small loss of wetland impacts resulting from the proposed project.

Actions to minimize impacts

Any fill material used would be the minimum necessary to fulfill the project design. Turbidity curtains will be installed across the cuts to prevent turbidity plumes from leaving the placement site.

3.2.2 Water Circulation, Fluctuations, and Salinity Determinations

Consideration shall be given to water chemistry, salinity, clarity, color, odor, taste, dissolved gas levels, temperature, nutrients, and eutrophication plus other appropriate characteristics. Also to be considered are the potential diversion or obstruction of flow, alterations of bottom contours, or other significant changes in the hydrologic regime. Changing the velocity of water flow can result in adverse changes in location, structure, and dynamics of aquatic communities, shoreline erosion and deposition, mixing rates and stratification, and normal water-level fluctuation patterns. These effects can alter or destroy aquatic communities.

There is no substantial change in water circulation, fluctuation, or salinity due to the creation of wetlands from that described in the 2012 FEIS. The additional proposed dredging would increase flows, thereby enabling the SHEP flow re-routing features to perform as originally intended and approved.

3.2.2.1 Loss of Environmental Value

As described above, this project is designed to improve environmental values of the project area. With implementation of the proposed action, there some impacts to the existing wetlands as a result of a small construction foot printed needed to construct an

access road. This access road would be within the Freshwater Forested/Shrub Wetland immediately to the north of the project. The construction of an access road associated with the proposed action would impact approximately 0.50 acres of the forested/shrub wetland area. There would be some impacts to riverine wetlands as a result of the construction of the fish passage structure as approximately 0.3 acres of riverine wetland habitat would be lost. The net effect of the removal of the lock and dam structure however is an increase in wetted areas, restoration of riverine habitat, and the restoration of part of the Augusta shoals and makes up for the small loss of wetland impacts resulting from the proposed project.

3.2.2.2 Actions to Minimize Impacts

Proposed fills are the minimum necessary to accomplish the project purposes. Turbidity curtains will be installed across the cuts to prevent turbidity plumes from leaving the placement site.

3.2.3 Suspended Particulate/Turbidity Determinations

Effects due to potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site. Factors to be considered include grain size, shape and size of any plume generated, duration of the discharge and resulting plume, and whether or not the potential changes will cause violations of applicable water quality standards. Consideration shall include the proposed method, volume, location, and rate of discharge, as well as the individual and combined effects of current patterns, water circulation and fluctuations, wind and wave action, and other physical factors on the movement of suspended particulates.

Turbidity impacts due to construction are expected to be temporary. In addition, plans include sediment barriers and silt screens to restrict turbidity and sediment loss during construction.

3.2.3.1 Loss of Environmental Values

Due to reduction in light transmission, reduction in photosynthesis, reduced feeding and growth of sight dependent species, direct destructive effects to nektonic and planktonic species, reduced DO, increased levels of dissolved contaminants, aesthetics.

Adverse impacts are expected to be minor and temporary and cease soon after construction is completed.

3.2.3.2 Actions to Minimize Impacts

The District follows sediment and erosion control best management practices in its designs. Turbidity curtains will be installed across the cuts to prevent turbidity plumes from leaving the placement site.

The analytical results of sediment sampling indicate that no contamination exists that would impact the proposed construction activities.

3.2.4 Contamination Determination

Consider the degree to which the proposed discharge will introduce, relocate, or increase contaminants. This determination shall consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants. Consideration of Evaluation and Testing (parts 230.60, and 230.61).

There is no reason to expect any contaminant related impacts from the proposed work.

3.2.5 Aquatic Ecosystem and Organism Determinations

Effect on the structure and function of the aquatic ecosystem and organisms and effect on the re-colonization and existence of indigenous aquatic organisms or communities.

3.2.5.1 Threatened and Endangered Species

This work is expected to have no effect on threatened or endangered species, with implementation of the proposed protective measures as prescribed as part of the second amendment to the SHEP Biological Opinion from NMFS issued on October 10, 2017.

3.2.5.2 Fish, Crustaceans, Mollusks and other Aquatic Organisms in the Food Web

Immobile biota would be lost during construction activities. This would be minor, temporary adverse impacts since these species are expected to quickly repopulate the construction site. Other biota that are mobile would avoid the construction area. Long term benefits are anticipated from the proposed action by removing a blockage within the Savannah River and allowing fish and wildlife species to have access to the full length and width of the Savannah River for foraging and spawning needs.

3.2.5.3 Other Wildlife

This project is expected to result in minor improvement in the habitat for other wildlife.

3.2.5.4 Special Aquatic Sites

The proposed action will enhance the freshwater habitat within the project area for migratory fish species by restoring the flow to its natural condition and by allowing access to additional spawning and foraging habitat that has been blocked off for several decades by the existing lock and dam structure. This will allow for more fish population diversity within the project area and provide more areas for essential fish spawning areas for federally listed species such as the Atlantic and shortnose sturgeon.

3.2.5.5 Potential Effects on Human Use Characteristics

The proposed work is expected to result in positive long term impacts regarding this issue.

3.2.5.6 Possible Loss of Environmental Values

The proposed work is expected to increase the environmental value of the site.

3.2.5.7 Actions to Minimize Impacts

Turbidity (silt) curtains will be installed across the cuts to prevent turbidity plumes from leaving the placement site.

3.2.6 Proposed Disposal Site Determination

Each disposal site shall be specified through application of the guidelines. The mixing zone shall be confined to the smallest practicable zone within each specified disposal site that is consistent with the type of dispersion determined to be appropriate by the application of the guidelines.

The proposed amount of fill required for the proposed project is the minimum required to fulfill the project purpose of the flow rerouting features and provide additional fish and wildlife habitat by creating approximately nine acres of tidal wetlands. No practicable alternatives are available that produce the same benefits.

3.2.7 Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative effects attributable to the discharge of dredged or fill material in waters of the United States should be predicted to the extent reasonable and practical.

The net effect of the removal of the lock and dam structure however and the implementation of the proposed project is an increase in wetted areas, restoration of riverine habitat, and the restoration of part of the Augusta shoals. These benefits makes up for the small loss of wetland impacts resulting from the proposed project to create the fish passage structure along with the access road.

3.2.8 Determination of Secondary Effects on the Aquatic Ecosystem

Secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material.

With the proposed project, habitat for the fish and wildlife community within the project area by restoring the river flows to a more natural condition and will allow migratory fish species full access to the Savannah River and to spawning and foraging areas that have been historically block off as a result of the lock and dam structure.

4.0 FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH RESTRICTIONS ON DISCHARGE – (SECTION 230.12)

4.1 DETERMINATIONS

a. An ecological evaluation of the discharge of dredged material associated with the proposed action has been made following the evaluation guidance in 40 CFR 230.6, and the evaluation considerations at 40 CFR 230.5.

b. Potential short-term and long-term effects of the proposed action on the physical, chemical, and biological components of the aquatic ecosystem have been evaluated. The

proposed discharge will not result in significant degradation of the environmental values of the aquatic ecosystem.

c. There are no less environmentally damaging practicable alternatives to the proposed work that would accomplish the project goals and objectives. Several alternatives were eliminated for not accomplishing all project goals or for being too costly. The No Action alternative is found to be less acceptable.

(1) The proposed action will not cause or contribute to violations of any applicable State water quality standards, will not violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act, will not jeopardize the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, and will not violate any requirement imposed by the Secretary of Commerce to protect any marine sanctuary designated under Title III of the Marine Protection, Research, and Sanctuaries Act of 1972.

(2) The proposed work will not cause or contribute to significant degradation of the waters of the United States.

(3) The discharge includes all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem.

4.2 FINDINGS

Based on the determinations made in this Section 404 (b) (1) evaluation, the finding is made that, with the conditions enumerated in this document, the proposed action complies with the Section 404(b)(1) Guidelines.

Appendix C4

- **Savannah Harbor Expansion Project Monitoring and Adaptive Management Plan**

ENVIRONMENTAL IMPACT STATEMENT
APPENDIX D: Monitoring and Adaptive Management Plan

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

US Army Corps of Engineers
Savannah District
South Atlantic Division

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Monitoring and Adaptive Management Plan

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Monitoring and Adaptive Management Plan

1 BACKGROUND

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) state that agencies may perform monitoring "to assure that their decisions are carried out and should do so in important cases." The Savannah Harbor Expansion Project is an important one, as it has the potential to adversely affect nationally important resources. In addition, since predictions are made about future effects to biological resources, there is a degree of uncertainty about the impacts which the recommended action would actually produce. Those uncertainties include both the accuracy of the predictive impact tools, the changes to the environment, and the biological responses that will occur as a result of changes in the environment. A site map on the following page shows the upper portion of the harbor, where natural resources are most at risk.

The approaches taken in this plan follow those described in the 2003 NEPA Task Force Report to the CEQ on Modernizing NEPA Implementation. This project will follow the following process, as described in that report:

Predict → Mitigate → Implement → Monitor → Adapt

Field investigations were conducted during the development of the EIS to identify important resources in the project area and obtain data from which to develop predictive tools for impact evaluation. Those correspond to the "Predict" step shown above. Field investigations will continue once a decision is reached on whether to implement the proposed harbor expansion. The studies will be conducted during two different phases of the "Implement" step shown above: both prior to and during construction. Other studies would be performed during the "Monitor" step. Long-term monitoring will be conducted over the life of the project. That phase is not shown in the process above. The various studies will vary by phase and may have a different purpose in each phase. These will be defined later in this document when the particular studies are discussed in detail. It should be noted that the Water Quality Monitoring Plan is included as an attachment to the Section 404(B)(1) Evaluation in Appendix H.

2 DEFINITION OF ADAPTIVE MANAGEMENT

For this project, adaptive management is defined as evaluating the accuracy of the predicted environmental impacts, assessing the effectiveness of the mitigation features, and modifying the project as needed to ensure the levels of environmental effects predicted in the Environmental Impact Statement (EIS) are not exceeded.

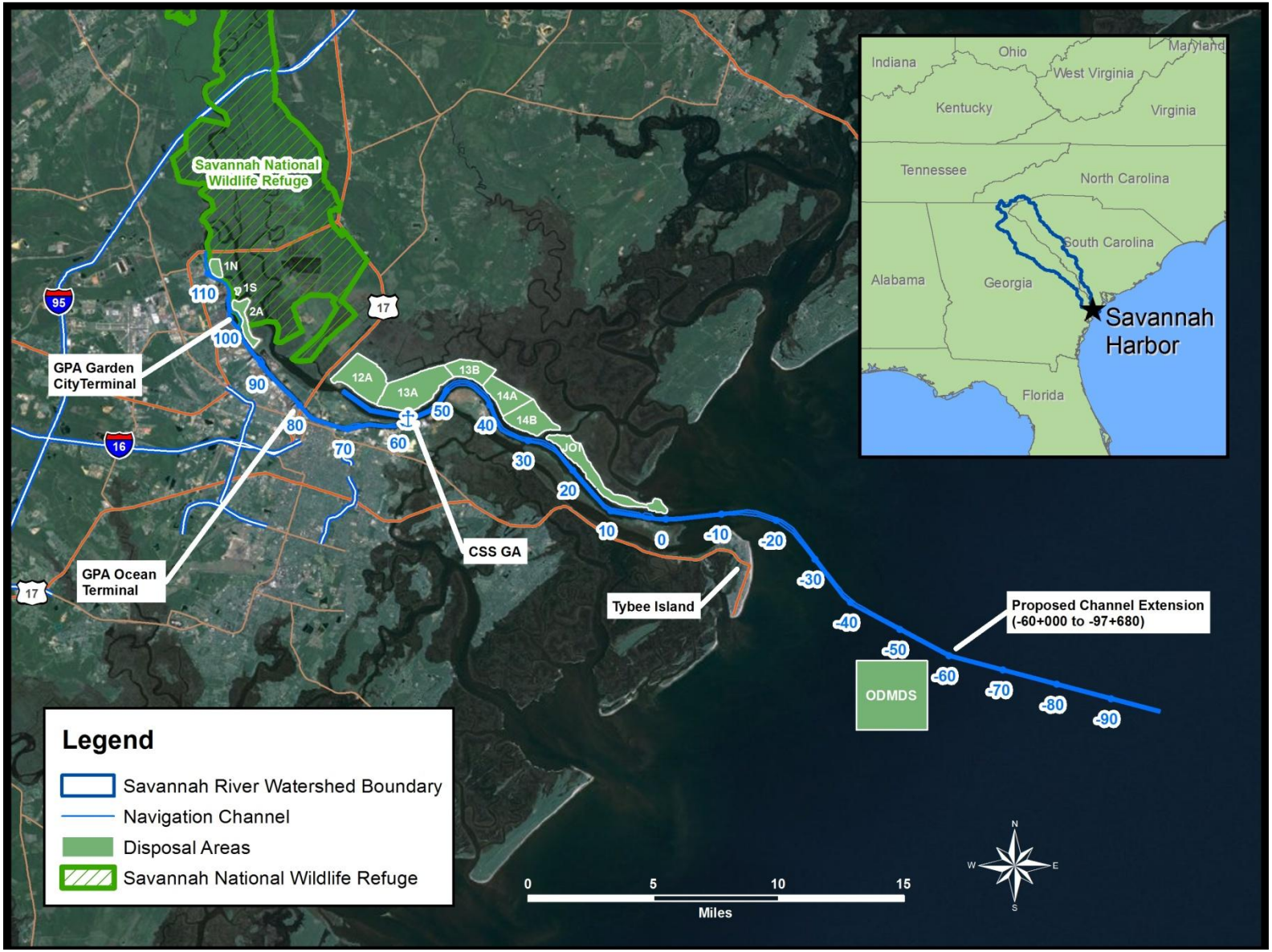

Figure 1. Savannah Harbor overview map.

3 GOALS OF AN ADAPTIVE MANAGEMENT PLAN

The definition of adaptive management as stated above has three components. There is a corresponding goal for the adaptive management program for each of those components.

The first component consists of evaluating the accuracy of the predicted environmental impacts. The corresponding goal is to improve the predictive capability of the models used to identify and quantify project-induced impacts. This includes both the hydrodynamic and water quality models. These models are explained in detail in other portions of this EIS, but they can be summarized as follows: The hydrodynamic model is a 3-dimensional computer model named the Environmental Fluid Dynamics Computer Code (EFDC) which was originally developed at the Virginia Institute of Marine Science and is now maintained by Tetra Tech under contract to the US Environmental Protection Agency (EPA). The model uses a finite difference solution scheme and a sigma-stretched vertical grid. The water quality model is the Water Quality Analysis Simulation Program (WASP), originally developed in 1983. The model includes the time-varying processes of advection, dispersion, point and diffuse mass loading, and boundary exchange. Both the water column and the underlying benthos can be included. These models are available to the public through the Total Maximum Daily Load (TMDL) Modeling Toolbox maintained by EPA Region 4. Tetra Tech applied the models to the Savannah River estuary and developed an enhanced grid which extends 61 miles upriver and 17 miles oceanward of the harbor entrance. The models' calibrations were approved by an interagency team including members of EPA Region 4, the USGS, the US Army Corps of Engineers' Engineering Research and Development Center (ERDC), the South Carolina Department of Health and Environmental Control (SC DHEC), and the Georgia Department of Natural Resources (GA DNR).

The second component consists of assessing the effectiveness of the mitigation features. Here the goal is to identify how effective the constructed mitigation feature is at reducing impacts. Physical parameters would be monitored within the estuary that describes how the system is functioning with the mitigation in place. Biota would also be monitored to determine the system's biological responses to those parameters. Natural variation will nearly guarantee that the conditions that actually occur in the first few years after construction will be different than the conditions under which the models were run during the feasibility phase. After post-construction monitoring data is available, the updated models would be rerun using the observed river flow conditions. This would provide the basis for the model's predictions for conditions under the observed conditions. Those predictions would be compared to the observed physical parameters to determine the accuracy of the models and the effectiveness of the mitigation features.

The final component is modifying the project as needed to ensure the levels of environmental effects predicted in the EIS are not exceeded. The goal for this component is to implement whatever modification is needed to the mitigation plan to keep the levels of observed environmental effects of the SHEP within the values predicted in the EIS. These modifications could occur any time during the construction or post-construction phases. If necessary, monitoring could continue beyond the length of the full post-construction monitoring program for the period needed to evaluate the effectiveness of a mitigation feature that was changed. All adaptive management project modifications would be monitored for a minimum of two years to

ensure that the modification was effective and that the observed environmental effects are then within the values predicted in the EIS.

4 IMPACT EVALUATION FRAMEWORK

The basic framework under which the project impacts are expected to occur is as follows:

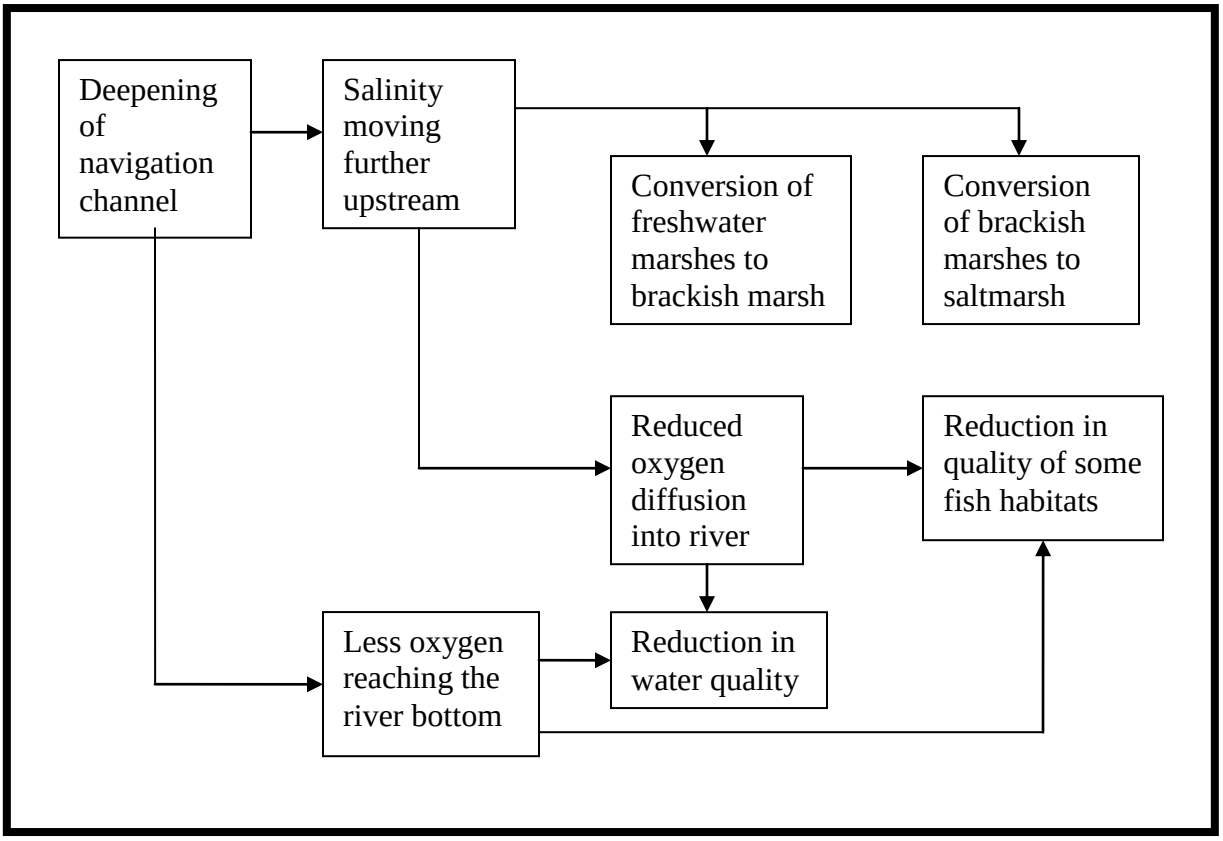

Figure 2. Impact evaluation framework.

5. PRE-CONSTRUCTION MONITORING

A. Goals. The first goal of the Pre-Construction Monitoring is to establish the baseline data bank for the Savannah Harbor estuary to assist with impact assessment during the Construction Monitoring and Post-Construction Monitoring phases of the project. Monitoring would be conducted for a period of one year before the construction begins which would affect aquatic resources in the inner harbor. This monitoring would be used to update the studies conducted during the feasibility phase and, thus, update the pre-project baseline from which impacts are measured. The Pre-Construction Monitoring would include eleven study efforts which are: (1) establishment of a baseline data bank; (2) monitoring of hydrologic and hydraulic data; (3) intense monitoring of hydrologic parameters within the lower estuary; (4) an assessment and recalibration (if required) of the hydrodynamic and water quality models; (5) groundwater monitoring; (6) monitoring of wetland sites; (7) bathymetric surveys to facilitate the assessment and recalibration of the hydrodynamic and water quality models; (8) monitoring of chloride levels within the vicinity of the City of Savannah's water intake on Abercorn Creeks; (9) Shortnose sturgeon distribution studies in the Savannah Harbor estuary; (10) Shortnose sturgeon study at the New Savannah Bluff Lock and Dam; and (11) establishment of ranges of predicted values. Prior to conducting the monitoring, the Corps would coordinate the sampling plans for the various monitoring study components with the natural resource agencies.

A second important goal will be to establish ranges of acceptable performance parameters for the Savannah Harbor estuary. While these may not be triggers for a specific action, they will indicate if the system is not performing as predicted so that the situation may be investigated. Performance will be established for specific conductance, salinity, flow, and concentration of dissolved oxygen (DO). An example for salinity is for specified flows at Clyo, ranges of modeled post project salinity values would be generated for each of the eight continuous water quality monitoring stations. From these data, graphs would be developed for each of the eight stations. A trendline and expected ranges of the modeled values would be developed. During construction and post-construction monitoring, data would be compared to these ranges to determine if the mitigation is performing as expected.

B. Major Components

1. Establishment of a Baseline Data Bank. In addition to the data that would be generated from the various Pre-construction monitoring studies, there is a wealth of existing data on resources in Savannah Harbor. The Corps would identify (with assistance from the Federal and state natural resources) existing data resources, reports, surveys, etc. that would provide useful data in regards to establishing the SHEP baseline. This information would include data on the resources of concern such as water quality, fisheries, groundwater, wetlands, etc. A baseline data bank would be established for use by the Corps, the Cooperating Agencies and the natural resource agencies. The cost to establish this data bank is estimated to be $100,000.

2. Collection of Hydrologic and Hydraulic Data. The relevant components of the Hydrologic Monitoring Plan that was developed in February 2006 by an interagency team and edited by the USGS SC Water Science Center for the Savannah River Estuary would be implemented. This monitoring would better define the complex interactions between the

estuarine ecosystem and the quantity and quality of water available. For this project, this would consist of installing and beginning to operate continuous recorders for hydrologic and hydraulic data. The project would fund USGS to perform this work for a period of one year.

The project would install and operate the following new continuous recording water quality stations:

- Middle River at GA 25, near Port Wentworth, GA
- Little Back River at GA 25, near Port Wentworth, GA
- Back River at US 17 at Savannah, GA
- Savannah River at I-95
- Lower Middle River in the fish hole

The project or project sponsor would fund operation of the following existing continuous recording water quality stations for this phase of the project:

- 02198920 Savannah River at GA25, at Port Wentworth, GA
- 021989773 Savannah River at USACE Dock at Savannah, GA
- 021989784 Little Back River above Lucknow Canal, near Limehouse, SC (independently funded by Georgia Ports Authority)

Continuous water level, streamflow, and water-quality data (water temperature, specific conductance, pH, dissolved oxygen and turbidity) would be collected on a 15-minute interval. All streamflow stations would use the new High-Data Rate (HDR) Geostationary Orbiting Earth Satellite (GOES) Data Collection Platforms (DCPs) to allow for hourly data transmissions, with one set of redundant data, during normal streamflow conditions. This would provide up to date hydrologic information. The streamflow stations would use thresholds to trigger random satellite transmissions during severe storms, and floods.

The Corps may not be able to install a piling in Middle River in the fish hole at a location that provides the information desired about that specific site, because the piling could be a hinderance to safe navigation. If further coordination reveals that a piling is not acceptable, then periodic manual sampling would be performed. The project would fund USGS or another qualified organization to perform this work.

The continuous real-time data would be available to resource managers and the general public through the USGS National Water Information System Web (NWISWeb) software or similar program. The USGS would also publish the collected data in the USGS Annual Data Report series. The PDF-report format would be available on the USGS publications web pages.

The estimated cost for this monitoring is $875,000, which is based on the following components:

Install new water quality stations	5 @ $50,000 = $250,000
Upgrade existing water quality stations	3 @ $35,000 = $105,000
Operate water quality stations for 1 year	8 @ $65,000 = $520,000
	Total = $875,000

The Corps would also include hydrologic and hydraulic data obtained by others during this pre-construction period.

Figure 3. Locations of continuous recording water quality stations.

3. Intense Monitoring of Hydrologic Parameters within the Lower Estuary. Intense monitoring of hydrologic parameters within the lower estuary would be conducted for one lunar cycle (28-day period). This work would be conducted to provide information on the hourly, daily and weekly variations in the aquatic environment of the estuary. A report would be prepared and provided by the contractor performing the work. The information would be used to update the hydrodynamic and water quality models, if the data indicated that an update was warranted.

Intense sampling would be performed within the lower estuary over a lunar cycle during the summer. Sampling will be performed at multiple depths and at least twelve stations that will be

selected by the Corps in consultation with the resource agencies. This sampling would address those constituents considered important to evaluate the water quality regime in Savannah Harbor. It would also address how parameters change over a tidal cycle and over the course of a lunar cycle. It would be performed during the summer to monitor the estuarine system when the water quality is most stressed. The sampling would focus on the parameters that most affect water quality in the estuary. Those include river discharge, flow volumes, flow velocity, flow direction, water surface elevation, depth, salinity, dissolved oxygen, and water temperature. Some sampling would also be conducted for turbidity, suspended solids, pH, specific conductance, Biochemical Oxygen Demand (BOD) 5-day and chloride. Prior to conducting the event, a detailed monitoring plan will be coordinated with the Cooperating Agencies.

The estimated cost for the field monitoring is $350,000 and is based on the cost to perform a somewhat larger effort in Savannah Harbor in 1999. The cost would include a report of the data.

4. Update (If required) of the Hydrodynamic and Water Quality Models. The data gathered from the intense monitoring and the bathymetric surveys would be used to update the hydrodynamic and water quality models if the data indicate that an update is warranted, e.g. if the modeling performance guidelines are not being met, an update would be warranted. If the calibration of a model is revised, the model would be reviewed by the natural resource agencies. A report would be prepared addressing whether an update to the calibration of the models is warranted and if so, that update. Included in the report will be documentation of the changes in the resource impacts predictions by using the recalibrated model. The cost to assess and recalibrate the hydrodynamic and water quality models is estimated to be $120,000 and is based on recent similar efforts for the feasibility phase of the Savannah Harbor Expansion Project. The work would be performed by either the Corps or a modeling contractor.

5. Groundwater Monitoring. Monitoring of chloride in the Upper Floridan aquifer would be conducted along critical groundwater flow paths where chloride migrating downward through the confining unit beneath the Savannah River could move toward Savannah area production wells. Sentry wells would be installed along critical groundwater flow paths near the top of the aquifer to monitor downward migration of chloride through the confining unit and deeper in the aquifer to monitor how horizontal flow of freshwater within the aquifer mixes with and dilutes the chloride. The sentry wells would be located west of the locations of exploratory borings SHE-11 and SHE-13, and on Cockspur Island near Fort Pulaski. Monitoring wells would also be installed upgradient of critical groundwater flow paths to provide information on background chloride concentrations associated with groundwater withdrawals in the Savannah area independent of SHEP dredging activities. Background wells would be installed near the top of the aquifer and deeper in the aquifer. Six new groundwater monitoring wells would be installed. The Georgia DNR-EPD would approve the locations and depths of the background wells. Background chloride concentrations at sentry and background wells would be established. At least four background samples would be collected from each sentry and background well and statistical methods used to establish background chloride concentrations at each sentry and background well. The Georgia DNR-EPD would approve the collection of background samples and the statistical methods used to establish background chloride concentrations. The estimated cost to monitor the wells during the pre-construction monitoring is $30,000.

The Corps, in coordination with the Georgia DNR-EPD, would establish benchmark chloride concentrations for each sentry well. The Corps would determine what chloride concentrations caused by SHEP dredging activities would result in a measurable increase in chloride concentrations at Savannah area production wells. Savannah area production wells include industrial, commercial, municipal, agricultural, and other unpermitted wells. The benchmark chloride concentrations must be protective of the Savannah area production wells. The benchmarks would be established for each pair of sentry wells and for sentry wells near the top of the Upper Floridan aquifer and deeper in the aquifer. The benchmark concentrations established would require the approval of the Georgia DNR-EPD. The Corps would also develop a remediation and implementation plan which could be implemented if it is determined that the chloride entering the Upper Floridan aquifer due to deepening through the confining unit could affect Savannah area production wells. The plan would include adaptive management measures specific to accelerated chloride intrusion into the aquifer. This plan would be submitted to the Georgia DNR-EPD for review and approval.

6. Monitoring of Wetland Sites. Six of the seven marsh sites previously monitored by the USGS Florida Fish and Wildlife Cooperative Research Unit would be monitored again as part of this project. Figure 4 shows the location of both the old and new monitoring locations.

In this phase, the distribution and density of wetland vegetation would be would be monitored for one year. The marsh transects would be sampled twice annually (June and October), and sampling protocols would follow those described in Kitchens (2003) and generally follow those performed when the USGS monitored in 2000/2001. The Coop Unit would prepare and provide a report of their findings.

The project would install and operate new continuous recording stations at the twelve tidal marsh locations where wetland vegetation would be monitored. The six new monitoring locations were chosen to expand monitoring in highly sensitive marshes, in areas where significant salinity changes are possible under a variety of scenarios, and to monitor community shifts both vertically (up and down river) and laterally (interior vs. exterior). The preliminary locations are shown in Figure 4, although some adjustments may be made prior to commencement of the work; these adjustments would be made in close consultation with the resource agencies. These tidal marsh stations would record water surface elevation, specific conductance of surface waters that flood the marsh, and specific conductance of waters in the root zone, and water depth every 30 minutes. The recorded data would be downloaded monthly. Wetland vegetation would be monitored for one year. This would include sampling over two seasons. The project would fund the USGS Florida Fish and Wildlife Cooperative Research Unit to perform the work. They would monitor the same 6 sites as they did in 2000/2001 as well as the six additional marsh locations. They would prepare and provide a report of their findings.

The estimated cost for this initial monitoring is $336,000, which is based on the following components:

Install tidal marsh stations	12 @ $10,000	= $120,000
Operate tidal marsh stations for 1 year	12 @ $20,000	= $240,000
	Total	= $360,000

The cost for this initial monitoring is somewhat higher than would be needed for a repetitive operation due to the initial equipment purchases. These costs also include the twice-a-year vegetation sampling and analysis that the Florida Coop Unit would perform as part of their marsh monitoring.

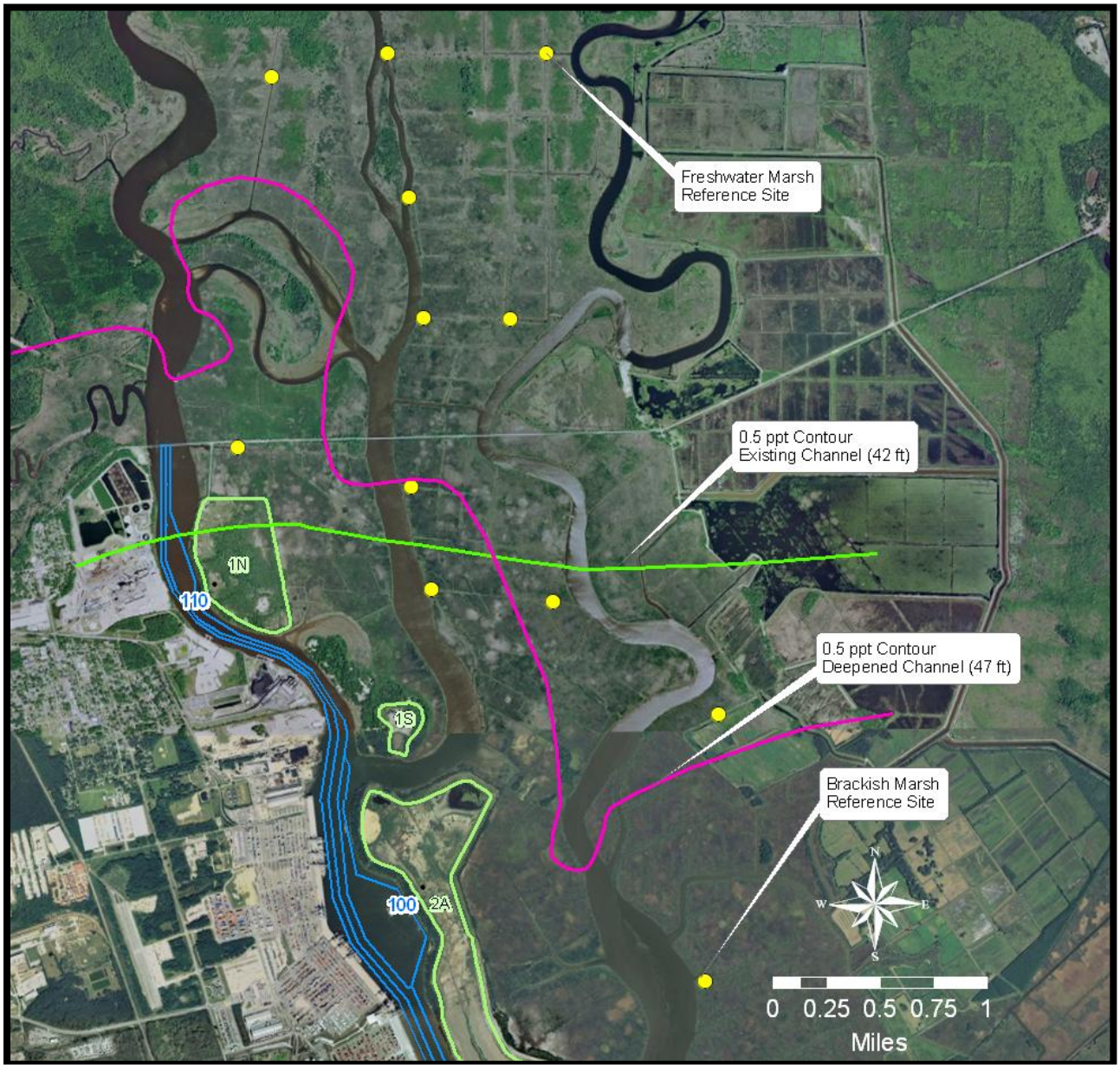

Figure 4. Wetlands monitoring locations.

7. Bathymetry Monitoring. The Corps would conduct or fund bathymetric surveys of the riverine areas not normally surveyed to obtain up-to-date information on the depth and width of the tidal rivers that are included in the hydrodynamic model. Those surveys would typically consist of bank-to-bank cross-sectional surveys performed on 500-foot intervals. These surveys would cover the Front, Middle, and Back Rivers from I-95 to Old Fort Jackson. The estimated cost for this work is $158,000.

8. Chloride Monitoring. The Corps would conduct or fund monitoring of chloride levels at the City of Savannah's water intake on Abercorn Creek. This work would consist of two components. The first component consists of an automated sampler to be installed near the City's water intake to collect samples on at least a daily basis. These samples would be collected and analyzed in a laboratory to identify chloride levels at the intake. All of the collected samples may not be analyzed, dependent upon flow and tide variables. The second component is installation of two chloride meters; one at the City intake and one in Abercorn Creek near its confluence with Savannah River. The lab analyses will be used to verify the data collected by the meters and determine their level of accuracy and reliability with the low chloride levels that are generally encountered. The meter data will also be used to provide additional detail, including trends and timing, between the lab samples. One or both of the meters are expected to be a permanent installation, whose operation and maintenance would become a responsibility of the City of Savannah when the SHEP monitoring period ends. The estimated cost for this work is $250,000.

9. Shortnose Sturgeon Distribution Study in the Savannah Harbor Estuary. The distribution of Shortnose sturgeon in the harbor would be monitored for one year, possibly by the SC DNR Marine Resources Division in much the same manner as the study conducted in 1999/2000. This monitoring would include capturing, tagging and tracking both adult and juvenile sturgeon. Water quality would be measured and documented where sturgeon are captured and later found. Monitoring would be performed in each season. The study area would include Front, Middle, and Back Rivers. The bottom substrate would be identified when fish are found to intensively use a specific area. Water quality data will also be collected at receiver location. The work would not track fish over a 24-hour period, as had been conducted in 1999/2000. That information would not be needed for this project. The Corps would coordinate with NOAA Fisheries on the scope of work before the work began. The contractor will prepare and provide a report of their findings. The estimated cost for this monitoring is $200,000.

10. Shortnose Sturgeon at New Savannah Bluff Lock and Dam. The movement of fish at the New Savannah Bluff Lock and Dam (NSBL&D) would be monitored for one year. This monitoring would include capturing, tagging and tracking Shortnose sturgeon and possibly other representative species of the NSBL&D area fish community (Striped bass, Robust redhorse, and American shad). Based on availability, up to 25 Shortnose sturgeon (and a total of 75 fish) would be collected and implanted with combined radio and acoustic transmitters. If possible, fish would be captured within 1 km of the dam by electrofishing, hook and line, or gill net.

USGS would monitor fish continuously in the vicinity of NSBL&D using a fixed station radio receiver. In addition, during the migration season they would search the river weekly between NSBL&D and the Jackson, SC Landing and NSBL&D and the Augusta Water Supply Dam for

fish with transmitters. On a monthly basis, they would search the Savannah River from the Savannah Harbor Kings Island Turning Basin to the NSBL&D, and above to the Augusta Water Supply Dam. When located, species, identification number, and location would be recorded. Temperature would be recorded several times daily using temperature loggers established at fixed locations at NSBL&D, 1, 10, 50, 100 and 200 km below the dam, and 1 km above the dam. Dissolved oxygen concentration, turbidity, and river stage at NSBL&D would be recorded at least weekly. Dam discharge will be recorded daily.

The contractor will prepare and provide a report of their findings. The estimated cost for this initial monitoring is $300,000.

11. Establish Ranges of Predicted Values. The hydrodynamic and water quality models would be used to establish ranges of predicted values for performance parameters at specific points in the Savannah Harbor estuary. From these datasets, graphs for specific monitoring points in the estuary would be created. An example graph is shown below. The graph will include a trendline and expected ranges for existing conditions at the same monitoring points for comparison to conditions observed during the construction period. Inclusion of existing conditions trends will be important to the comparison because in some locations (i.e., Front River) salinity will be increasing while in other locations (i.e., Back River) salinity will be decreasing. An example of this follows:

For specific conductance, which is a model output parameter, trendlines and expected ranges of modeled specific conductance values would be prepared for specified freshwater flows at each of the eight continuous water quality monitoring stations for post-project and existing conditions. From this data, graphs would be developed for each monitoring station (see below). The y-axis would be specific conductance values and the x-axis would be freshwater flow values as measured at Clyo. The trendline and expected ranges of the modeled values could then be compared to water quality data collected during construction.

For dissolved oxygen, another model output parameter, trendlines and expected ranges of modeled DO values would be prepared for specified freshwater flows (or another parameter) at each of the eight continuous water quality monitoring stations. However, correlation of DO datasets to freshwater flows (or another parameter) would be useful for making only general comparisons. While salinity and conductivity variations in the harbor are largely dependent on tides and freshwater flows, DO in the harbor is influenced by several other factors, including temperature and waste discharge volumes to the river. Since the industries report their waste discharge volumes to the states on a monthly basis, detailed comparisons of expected (modeled) and observed data would not be available for DO on a real-time basis.

For flow, model data would show predicted flows at the three water quality stations along the Georgia Highway 25 / South Carolina Highway 170 Bridge for various river flows at Clyo.

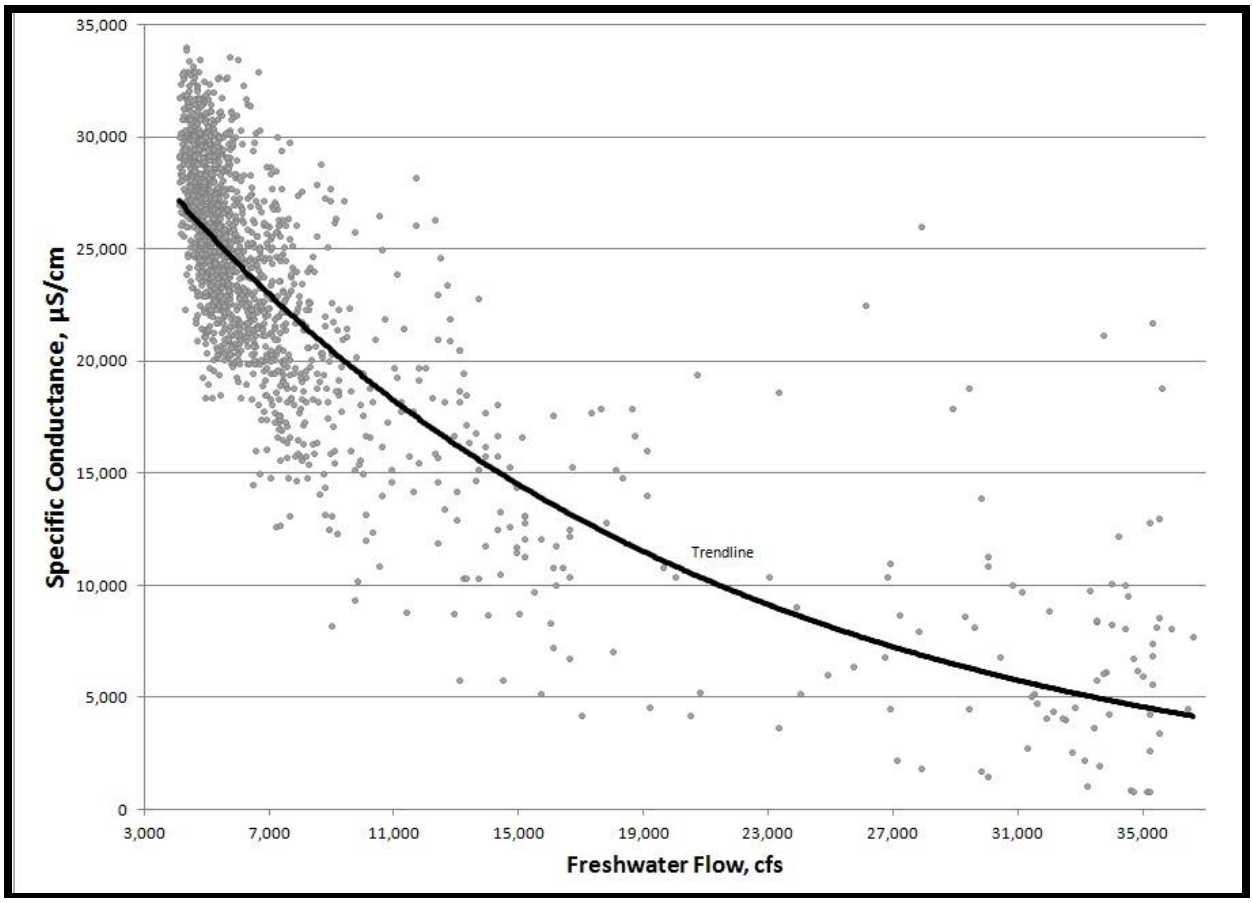

Figure 5. Example of trendline and expected ranges for specific conductance.

C. Reporting

The Corps would establish a website that is available to the public which will house data and reports that become available during the pre-construction period. Data obtained by USGS from the continuous water quality monitoring would be included in the annual reports that they post on their websites and make available to the public. A summary of reports to be provided by the Corps for the Pre-Construction Monitoring is as follows:

Report on Intensive Monitoring of Hydrologic Parameters

Report on Update of the Hydrodynamic Models

Annual Report on Groundwater Monitoring

Report on Monitoring of the 12 Wetland Sites

Report of the Monitoring of Shortnose sturgeon in the Savannah Harbor Estuary

Report on the Monitoring of Shortnose sturgeon at the NSBL&D

Report of ranges of predicted performance values for parameters at specific points in the Savannah Harbor estuary during construction

D. Cost Summary

The costs for the monitoring that would be performed during the pre-construction period are summarized as follows:

Baseline Data Bank	$100,000
Continuous Riverine Monitoring	$875,000
Intense Monitoring	$350,000
Assess & Recalibrate Models	$120,000
Bathymetry Monitoring	$158,000
Chloride Monitoring	$250,000
Groundwater Monitoring	$30,000
Wetlands	$360,000
Shortnose sturgeon-Savannah Harbor	$200,000
Shortnose Sturgeon-NSBL&D	$300,000
Reporting	$50,000
Oversight & Contracting	$100,000
Pre-Construction Total:	**$2,893,000**

6. MONITORING DURING CONSTRUCTION

A. Goals. Monitoring would be conducted during the construction period to ensure the construction is performed within the environmental constraints imposed by the EIS and the approvals of the natural resource agencies. Monitoring would also be performed to ensure that levels of impacts predicted in the EIS are not exceeded and that unexpected impacts do not present themselves. The length of the construction period will depend on the amount of funds that are received to perform the work. At present, the estimated construction period is about 4 years. The Corps would perform the monitoring described in this section for whatever length of time it takes to construct the project. The cost estimates shown below assume a 4-year construction estimate. If construction requires more than four years, monitoring during construction will be extended to ensure that levels of impacts predicted in the EIS are not exceeded and that unexpected impacts do not present themselves. Additional funding will be secured to accomplish this rather than reducing the planned post-construction monitoring and adaptive management.

B. Major Components. Monitoring during the Construction phase would include fifteen major study components. Some of these study components (five) would be a continuation of study efforts started during the Pre-construction phase, while others would be initiated to specifically address the potential impacts of the project that could occur during the construction phase.

The Corps would continue to operate the eight continuous recorders for hydrologic and hydraulic data that were established or funded as part of the Pre-Construction Monitoring. The monitoring of the 12 marsh sites would be continued (with the exception of during year 1 of construction), as would groundwater monitoring, monitoring of chloride levels at the City of Savannah's water intake on Abercorn Creek, and monitoring the distribution of Shortnose sturgeon in the Savannah Harbor estuary.

New monitoring efforts that would be conducted during the construction phase include:

- a bathymetric survey of the Sediment Basin to facilitate the model assessments
- an assessment of how well the models predict the salinity and dissolved oxygen levels during construction
- a Transfer Efficiency Study (oxygen injection systems)
- monitoring effluent from the seven CDFs that would be used for disposal of the dredged material
- monitoring dissolved oxygen concentrations in the vicinity of the dredge during the summer months
- monitoring cadmium in the inflow and effluent in CDFs 14A and 14B
- monitoring cadmium levels in the sediments placed in CDFs 14A and 14B
- wildlife use surveys in CDFs 14A and 14B
- biological monitoring of cadmium levels in birds (tissue or blood samples) that use CDFs 14A and 14B, both before and during placement of cadmium-laden sediments

On a regular basis (every four months), the Corps would assess how well the hydrodynamic and water quality models predict the salinity and D.O. levels that are occurring during the construction process. This process will serve as the mechanism to identify the emergence of any unexpected variances with the predictions about how the harbor would function after the project's construction is complete.

As part of the assessment of the hydrodynamic and water quality models predictions, the Corps would conduct bathymetric surveys of the Sediment Basin. This information would be needed to allow the hydrodynamic model to reflect the changing conditions that would occur during the construction period.

In addition to the specific construction monitoring components listed above, the Corps would perform its normal quality assurance inspections during construction. The Corps places the environmental compliance requirements that it receives from natural resource agencies for a proposed action in the contract documents that it prepares for the work. The contractor who performs the work is then responsible for performing the work in compliance with those requirements. The Corps' inspectors provide quality assurance by overseeing the work

performed by the dredging and civil engineering contractors. Those inspectors ensure the contractors perform the work within the environmental clearances obtained for the project.

C. Details of the Monitoring

1. Hydrologic and Hydraulic Data Collection. The Corps would fund operation of the continuous monitoring in the rivers. Operation of one station (Savannah River at USACE Dock) is being fully funded by another source and would not be an expense for this project. Similarly, some of the operating costs for three other existing stations are being funded by another source and would not be an expense for this project. This riverine monitoring would be performed by the USGS. The costs for this work are estimated as follows:

Operate water quality stations	4 years x 8 @ $65,000 = $2,080,000

2. Monitoring of Wetland Sites. The Corps would continue to fund monitoring of the 12 marsh sites during years 2, 3, and 4 of construction, when dredging occurs in the inner harbor. Monitoring of wetland sites would temporarily cease during year 1 when no inner harbor dredging is expected to occur. This monitoring would be performed by the USGS Florida Fish and Wildlife Cooperative Research Unit. The costs for this work are estimated as follows:

Monitor marsh sites	3 years x 12 @ $20,000 = $720,000

A report would be prepared at the end of the construction monitoring summarizing the results of this study.

3. Chloride Monitoring. Monitoring of chloride levels at the City of Savannah's water intake on Abercorn Creek would continue during the construction phase of the project. Monitoring would be performed to ensure unforeseen increases in chloride levels do not occur during the construction period. The Corps would fund or perform this work. The estimated cost for this work is as follows:

Chloride monitoring	4 years x $100,000 = $400,000

4. Groundwater Monitoring. The Corps would continue to conduct or fund monitoring of chloride levels in the Floridan aquifer. The project would use the sentry and background gradient wells that were installed during the pre-construction monitoring period for this purpose. Chloride levels would be recorded four times a year in each well. An annual monitoring report would be prepared and provided to the Georgia DNR-EPD by January 31st of each year following the initiation of dredging. The report would include the results of the previous year's monitoring. Additionally, differences in the long-term trends of chloride concentrations in the sentry and background wells would be used to evaluate the impacts of SHEP dredging activities from impacts of groundwater withdrawals on chloride concentrations in the Upper Floridan aquifer. The estimated cost for this work is as follows:

Groundwater monitoring	4 years x $7,500 = $30,000

5. Shortnose Sturgeon Distribution Study-Savannah Harbor. The Corps would fund monitoring of Shortnose sturgeon distribution in Savannah Harbor each year of the construction period. This monitoring would duplicate the work conducted in the Pre-Construction Monitoring. The costs for this work are estimated as follows:

Shortnose sturgeon monitoring	4 years x $200,000 = $800,000

A report would be prepared at the end of construction monitoring summarizing the findings of this study.

6. Bathymetric Surveys of the Sediment Basin. The Sediment Basin would be allowed to fill naturally after construction of the submerged sill at its lower end. The depths in the Sediment Basin affect water and salinity movement up Back River, and the Basin will likely be filling throughout the duration of the construction and some of the post-construction monitoring period. As a result, bathymetric surveys will be needed of the Basin on a periodic basis to perform a proper assessment of the hydrodynamic model's accuracy in predicting conditions that are being observed during the monitoring period. The Corps would perform or fund these surveys, which would be conducted every 4 months. The costs for these surveys are estimated as follows:

Bathymetric surveys of Sediment Basin	4 years x 3 x $25,000 = $300,000

7. Transfer Efficiency Study. The work would also include a Transfer Efficiency Study of the dissolved oxygen systems. That near-field study would identify the efficiency at which the systems add oxygen to the estuarine waters. The Corps would provide the resource agencies with an opportunity to review the study plan and propose methods of monitoring and data analysis. The Corps would use this efficiency rate to determine how it needs to operate the systems to add the amount of oxygen determined by the modeling to be needed to compensate for the impacts of the harbor deepening project. This Transfer Efficiency Study would be conducted when construction of the oxygen injection systems is complete. As presently scheduled, that would occur early in the schedule for construction of the overall project. The two downstream oxygen injection systems (Hutchinson Island) are scheduled to be installed and operational prior to commencement of dredging the inner harbor, and the upstream system (near Georgia Power's Plant McIntosh) is scheduled to be complete and operational within one year of that point. A report would be prepared describing the results of the study as well as prescribing the standard operating procedures for the oxygen injection systems. This study is estimated to cost $300,000.

8. Model Predictions of Dissolved Oxygen and Salinity during Construction. The Corps will regularly assess (every four months) how well the hydrodynamic and water quality models predict the salinity and D.O. levels that are occurring during the construction process. The Corps expects the dredging in the navigation channel upstream of Fields Cut to generally proceed at about 2,900 feet per month, so the hydrodynamics of the estuary would not be altered substantially on a monthly basis. The assessment would be performed by comparing the models' predictions against what is being measured at the 8 continuous water quality monitoring stations. The model grid would be updated to reflect the new bathymetry and the actual river flows would

be used. Conducting this assessment every 4 months is believed to be sufficient to identify the emergence of any unexpected results. This process would serve as the mechanism to identify the emergence of any unexpected variances with the predictions about how the harbor would function after construction is complete. The costs for these assessments are estimated as follows:

Assess Hydrodynamic and WQ models 4 years x 3 x $60,000 = $720,000

9. Monitoring of Effluent from the CDFs. The effluent from all of the CDFs used for the SHEP would be monitored to ensure that no applicable water quality standards would be violated. At the beginning of deposition of new work material, into the CDFs, the contractor would construct a 500 mg/L Total Suspended Solids (TSS) standard and determine turbidity (in NTUs) associated with the standard. The contractor would then visually compare effluent turbidity at each of the discharging weirs to the standard on a daily basis. The contractor would measure (weekly) turbidity at each outfall pipe with a discharge. Measurements would include dissolved oxygen, salinity, conductivity, temperature and turbidity. Measurements would be made with a Hydrolab or similar instrument. A water sample would be obtained from each outfall pipe every two weeks and analyzed for NTUs, TSS in mg/L. Monitoring reports would include the results of the sampling and analyses (as well as the discharge point and dates of discharge) and be submitted to the Georgia DNR-EPD , SC DHEC, and USFWS on a monthly basis. The annual cost for this monitoring is about $143,000.

10. Monitoring of Dissolved Oxygen Levels in the Vicinity of the Dredge during the Summer Months. Dissolved oxygen levels in Savannah Harbor become stressed during the summer months. The Corps is required to monitor dissolved oxygen levels in the vicinity of hydraulic pipeline dredges performing dredging in the inner harbor during the summer months. This monitoring would also be implemented during the SHEP construction. The cost for this monitoring is about $75,000 per year. The Corps will coordinate a detailed monitoring plan with Georgia DNR-EPD prior to conducting these events. The standard for the monitoring agreed upon with NMFS and the GA DNR EPD is:

> "Dredging operations must maintain a daily average of 5.0 mg/L and an instantaneous average of 4.0 mg/L throughout the water column during those times of year when the ambient condition in the waterbody has a dissolved oxygen level above these values. If it is determined that the ambient condition in the waterbody is less than these values, the criteria will revert to the "ambient condition" and the water quality standard will allow for a 0.1 mg/L deficit from the "ambient" dissolved oxygen value. Since the available dissolved oxygen deficit has already been allocated, the USACE will only be able to conduct maintenance dredging when the dissolved oxygen, one meter from the bottom, is 3.0 mg/L or greater and the maintenance dredging does not affect the dissolved oxygen levels in the Savannah River Harbor. Exceptions for maintenance dredging when dissolved oxygen levels are less than 3.0 mg/L may be allowed if coordination occurs with NMFS and GA DNR-EPD and subsequent issuance of a waiver from GA DNR-EPD."

11. Monitoring of Inflow and Effluent in CDFs Containing Cadmium-Laden Sediments. All cadmium-laden sediments would be placed in CDFs 14A and/or 14B. Detailed design could result in the deposition of all cadmium-laden sediments in a single DMCA -- #14A. Monitoring of dredging and disposal operations in areas with cadmium-laden sediments would require monitoring of the inflow and effluent from CDFs 14A and/or 14B for cadmium.

Additional monitoring of the inflow and discharges from CDFs 14A and 14B where cadmium-laden sediments would be placed would be conducted. Samples would be taken from the inflow (head section of the discharge pipe) on a weekly basis. Sampling would be conducted weekly to determine the cadmium concentrations in the effluent discharged from CDFs 14A and 14B Should the effluent dissolved cadmium concentration be found to be higher than the State standard (8.8 ug/L for South Carolina), sampling would be repeated within two days and would include both the outfall pipe sample and a receiving water sample taken approximately 100 feet down current of the point at which the effluent enters the receiving water. Should the receiving water sample be found to violate State standards, corrective action would be undertaken to eliminate the violation. Monitoring of the effluent from CDFs 14A and 14B for cadmium would continue as long as a discharge occurs and until all sediments have been dewatered, stabilized and covered. Following the installation of a clean cover, cadmium would be monitored in the effluent for one year. The above effluent monitoring plan will include a quarterly metals analytical scan with the inclusion of ammonia. The results of the effluent monitoring plan would be reported to the Georgia DNR-EPD, SC DHEC, and USFWS on a quarterly basis. The estimated cost to conduct this monitoring in CDFs 14A and 14B is $380,000.

12. Analyses of Sediments Placed in CDFs 14A and/or 14B. Sampling of cadmium-laden sediments discharged into CDFs 14A and 14B would also be conducted during construction. Once placement of the cadmium-laden sediments has been completed in the CDF, grab samples would be collected to characterize the cadmium levels of the surface sediments. This would occur prior to the placement of the cover. Approximately 86 grab samples would be collected to a depth of 15 cm of the surface of the sediments in 14A and 14B and analyzed for cadmium. After the cover has been placed, approximately 86 grab samples would be collected and analyzed to characterize the cadmium levels in the exposed cover sediments. The samples will be evenly spaced across the CDFs. If the concentrations of cadmium in the sediments are less than 4 mg/kg, the sampling would be complete. If the distribution of sediments with a cadmium concentration of 4 mg/kg or greater extends over a cumulative area of 25 acres or greater, sediments from operation and maintenance dredging would be scheduled to be placed in the area at the earliest possible time to provide an additional cover. After placement of the cover of operation and maintenance material is placed into the CDF, sediment sampling and analyses would be conducted again as previously described, except samples will be collected to a depth of 30 cm. This process would be repeated until cadmium concentrations in the sediments were less than 4mg/kg. The estimated cost to conduct this monitoring in CDFs 14A and 14B is $416,000 per year for two years. Detailed design could result in the deposition of all cadmium-laden sediments in a single DMCA – CDF 14A.

13. Wildlife Use in CDFs 14A and 14B. The Corps would perform monthly wildlife use surveys in CDFs 14A and 14B. These one-day surveys would record all birds and other major vertebrates seen within each CDF. Monitoring would be performed during placement of sediment and for a minimum of three years after placement is complete and continue as long as other cadmium-related sampling is occurring. If there is a concern about the number of birds or other animals or a particular species using the CDF, some type of hazing may be appropriate. Any hazing decisions would be coordinated with the USFWS.

14. Avian Blood/Feather Monitoring in CDFs 14A and/or 14B. During Year 1 of construction and prior to commencement of dredging in the inner harbor, baseline avian blood/feather sampling would be conducted in CDFs 14A and/or 14B to determine background avian cadmium blood levels. Blood/feather monitoring would continue throughout the remainder of the construction period (estimated to be three additional years) during placement of cadmium-laden sediments and the cap/cover in CDFs 14A and 14B. Since the CDFs would reenter the rotation program after the covering sediments have been placed, the CDFs may be dry or wet, depending on the year. Their hydrologic condition will drastically alter their bird use, as different species use the CDFs in those two conditions. The season also drastically affects bird use of the CDFs. Sampling would be timed to correspond when the majority of each species arrives and mid-season which corresponds to approximately April and September. Sampling in April would maximize exposure time for wintering species (September through April), while sampling in about September should maximize exposure time for summer nesting species (April through September). All work will be closely coordinated with the USFWS prior to commencement, including potentially substituting reference site sampling or liver tissue sampling with a smaller target sample size for the baseline dataset if agreed to by the USFWS. The estimated cost to conduct this monitoring is $100,000 per year.

D. Reporting

The Corps would post the monitoring information on the public website as it becomes available. The USGS would include the hydrologic and hydraulic data collected from the continuous recorders in their annual report to the state.

A summary of reports that would be prepared to address the various monitoring efforts that would be conducted during the construction phase is as follows:

- A report summarizing the findings of the three years of monitoring of the 12 wetland sites.
- Annual reports of the groundwater monitoring data to be submitted to Georgia DNR-EPD by January 31st of the following year.
- A report summarizing the findings of the four years of monitoring of Shortnose sturgeon distribution in the Savannah Harbor estuary.
- A report on the results of the Transfer Efficiency Study
- Twelve reports summarizing the results of the hydrodynamic and water quality model assessments. The Corps would prepare a brief technical paper after each assessment of the hydrodynamic and water quality models documenting the findings of the comparison between observed water quality data and predicted levels. The Corps would provide this

report and hydrodynamic and water quality model output data to the natural resource agencies. After a 30-day review period, the Corps would revise the report as necessary and place it on the public website.

- Monthly reports containing the data from the monitoring of the effluent from CDFs used for dredged material from the SHEP. These reports would be sent to the Georgia DNR-EPD, SC DHEC, and USFWS as wells as being posted online.
- Quarterly reports containing the data from the monitoring of the effluents from CDFs 14A and 14B for cadmium and other analytes. These reports would be sent to the Georgia DNR-EPD, SC DHEC, and USFWS as well as being posted online.
- A summary report of the findings of the monitoring efforts for the construction phase of the project. At the end of the construction period, the Corps would prepare a report of the data obtained during this phase. For the hydrologic and hydraulic data, the report would include the Corps' conclusions about the comparisons between observed water quality data and predicted levels. The Corps would provide this report to natural resource agencies and make it available to the public.

E. Cost Summary

The costs for the monitoring that would be performed during a 4-year construction period are summarized as follows:

Continuous Riverine Monitoring	$2,080,000
Bathymetry Monitoring (Sediment Basin)	$300,000
Chloride Monitoring	$400,000
Groundwater Monitoring	$30,000
Transfer Efficiency Study	$300,000
Wetlands	$720,000
Shortnose sturgeon	$800,000
Assess Hydrodynamic and WQ models	$720,000
Monitoring of DO-Dredge	$300,000
Monitoring of Effluent from CDFs	$572,000
Cadmium Monitoring-Effluent	$380,000
Cadmium Monitoring-Sediments	$832,000
Wildlife Use Studies-CDFs	$300,000
Avian Blood/Feather Monitoring	$400,000
Reporting	$200,000
Oversight & Contracting	$400,000
During Construction Total:	**$8,734,000**

7. POST-CONSTRUCTION MONITORING

A. Goals. The main goal of the Post-Construction Monitoring is to verify that the project does not produce more impacts than predicted and that the mitigation features function as they were designed.

Monitoring conducted during the Post-Construction monitoring period would include many of the same study elements performed during the Pre-Construction and construction monitoring periods including operation of the continuous hydrologic and hydraulic data monitors, monitoring of the marsh sites, bathymetric surveys, updating and assessing the hydrodynamic and water quality models, chloride monitoring at the City of Savannah's water supply intake on Abercorn Creek, groundwater monitoring at the sentry and upgradient background wells, intense hydrologic and hydraulic monitoring events (as performed in the Pre-Construction Monitoring) and monitoring of Shortnose sturgeon.

Other study elements in the Post-Construction monitoring phase include fish, crab, and shrimp distribution and abundance studies in marsh areas, an assessment of the impacts of the project on Striped bass habitat, monitoring of the marsh restoration site in Disposal Area 1S, two intense surveys (1 week) to determine the location of the freshwater interface at high and low tides, and impact assessment studies using the field data collected and the hydrodynamic and water quality models.

Although construction of the project would be complete, some cadmium monitoring would still be occurring. This monitoring would include monitoring of effluent from the CDFs during dewatering of the disposal areas, sampling, wildlife use surveys in the CDFs 14A and 14B, monitoring of cadmium levels in birds in CDFs 14A and 14B, and analysis of channel sediments prior to maintenance dredging.

Post-construction monitoring would be conducted for a period of 10 years, however, not all study elements would be conducted for ten years as described below.

B. Major Components. This phase would begin after completion of the final construction activities that would alter salinity or river flow distribution in the estuary. This consists of the channel dredging, the flow-altering components of the mitigation plan, and the dissolved oxygen system.

1. Hydrologic and Hydraulic Data Monitoring. The Corps would continue to operate the eight continuous hydrologic and hydraulic data recorders for ten years. USGS staff would perform this work. They would include the data in their state annual reports. This monitoring would help the Corps document and assess the hydrodynamic and water quality changes that resulted from the harbor deepening.

2. Intense Hydrologic Data Monitoring. The Corps would conduct two intense hydrologic monitoring events. These events would monitor conditions over a lunar cycle (28 days). One of the events would be conducted in year 1 and the other in year 5. Sampling will be performed at multiple depths and at least twelve stations that will be selected by the Corps in

consultation with the resource agencies. The parameters included in these events would be the same as those in the Pre-construction monitoring intensive survey. Prior to conducting the events, a detailed monitoring plan will be coordinated with the cooperating agencies. A report would be prepared for each sampling event to summarize the results. The Corps would use the data to update (if required) the hydrodynamic and water quality models. The Corps may collect and use data at points established as being important to the agencies.

3. Bathymetric Surveys in Unique Areas. The Corps would **c**onduct two bathymetric surveys of riverine areas not normally surveyed to obtain up-to-date information on the depth and width of the tidal rivers that are included in the hydrodynamic model. The surveys would extend from I-95 to Old Fort Jackson and include the Front, Middle, and Back Rivers. These surveys would be conducted at the same time as the intense hydrologic and hydraulic surveys. Data from these surveys would also be used to update (if required) the hydrodynamic and water quality models; if the modeling performance guidelines are not being met, an update would be warranted.

4. Hydrodynamic and Water Quality Model Assessments. The data gathered from the bathymetric surveys and the intense hydrologic surveys would be used to update (if required) the hydrodynamic and water quality models; if the modeling performance guidelines are not being met, an update would be warranted. These model assessments would occur twice during Post-Construction Monitoring. A report would be prepared summarizing both model assessments. The natural resource agencies would review these reports.

5. Identification of the Freshwater Interface. Two intense one-week studies would be conducted to identify the freshwater interface location during both high and low tides. This study would focus on salinity and dissolved oxygen. One use of the results would be to compare the locations indentified for the interface to those locations predicted by the hydrodynamic and water quality models. As flows and other environmental factors which influence the freshwater interface are variable, the exact timing of the study will be determined in consultation with all the resource agencies.

6. Chloride Levels-City of Savannah's Water Intake. The Corps would continue to monitor chloride levels at the City of Savannah's water intake on Abercorn Creek. Corps staff may perform this work. This monitoring would be conducted for a period of five years after completion of construction. The Corps would post the data on the public website. One or both of the meters are expected to be a permanent installation, whose operation and maintenance would become a responsibility of the City of Savannah when the SHEP monitoring period ends.

7. Chloride Levels-Groundwater. The Corps would continue to monitor chloride levels in groundwater at the sentry and upgradient background wells that the Corps installed to identify any unforeseen adverse impacts to the Floridan drinking water aquifer. Savannah District staff may perform this work. The Corps would post the data on the public website. These wells would be maintained and monitored throughout the Post-Construction Monitoring period and for the life of the project. Any changes to the monitoring protocol or adaptive management measures would be conducted in accordance with the GA DNR-EPD and SC DHEC water quality certifications, and the adaptive management procedures outlined below.

8. Monitoring of the Marsh Sites. The USGS Florida Fish and Wildlife Cooperative Research Unit or other qualified organization would monitor the twelve sites they monitored in the Pre-Construction and Construction monitoring in the same manner. They would perform this work for ten years. They would measure marsh salinities continuously and sample vegetation twice a year. They would prepare a report of their findings in year 5 that included data from years 1-4. They would prepare a comprehensive report at the conclusion of year 10 to include data from the entire monitoring period. The final report would also include a comparison to the Pre-Construction monitoring results, the predicted values, and their previous work at these sites. Each year, the contractor would provide a summary of data collected that year.

9. Monitoring of the Marsh Restoration Site in Disposal Area 1S. The marsh site in Disposal Area 1S would be monitored for a period of seven years. Monitoring would include identification of any invasive species, and a plan to control invasive species, if required. Annual reports would be prepared that summarize results of the monitoring. The report prepared for year 7 would summarize the results of the monitoring in years 1-7 and provide an overall assessment of the success of the marsh restoration efforts in Disposal Area 1S and any recommendations as to what further actions might be required at the site to complete the marsh restoration efforts. Release of any excess credits (only for use on the Savannah Harbor Federal Navigation Project) would occur after the long-term health/productivity of the restoration site is verified by the Federal Cooperating Agencies.

10. Shortnose Sturgeon Distribution-Savannah Harbor Estuary. SC DNR Marine Resources Division or another qualified organization would monitor the distribution of Shortnose sturgeon in the same manner as previously performed. The work would be performed for five years and a report prepared discussing each year's findings. An additional year of this monitoring would be conducted in the ninth year of the Post-Construction Monitoring. The final report which would be provided in year 10 would be a comprehensive one describing their findings both prior to and after construction.

11. Fish Distribution Study. The USGS Georgia Fish and Wildlife Cooperative Research Unit or another qualified organization would monitor fish, crab, and shrimp abundance and distribution along the edges of marshes using a drop survey method that was a component of the study performed in 2000-2001(Jennings and Weyers, 2003). They would perform this work in years 1, 3, 5, and 9 after construction and prepare a report of each year's findings. The report provided in year 10 would be a comprehensive one describing their findings both prior to and after construction.

12. Shortnose Sturgeon Passage Study-NSBL&D. The USGS Georgia Fish and Wildlife Cooperative Research Unit or another qualified organization would monitor fish movement through the New Savannah Bluff Lock & Dam off-channel rock ramp fish bypass structure and monitor Shortnose sturgeon distribution patterns in the vicinity of the dam. They would perform this work for five years and then again in year 9 of the Post-Construction Monitoring. In this phase of the project they would search the river weekly between NSBL&D and the Jackson, SC Landing and NSBL&D and the Augusta Water Diversion Dam would be searched weekly for fish with transmitters during the migration season. On a monthly basis, they would search the Savannah River from the Savannah Harbor Kings Island Turning Basin past the

NSBL&D to the Augusta Diversion Dam. This phase may include the installation and use of a series of active infrared video cameras to monitor fish movement within the fish bypass structure. The system would operate continuously and collect images of fish at the upper end of the passage facility. The recorded video would be reviewed to determine the species composition, fish orientation (upstream versus downstream) and abundance. The USGS would prepare a report of each year's findings. The report provided in year 10 would be a comprehensive one describing their findings both prior to and after construction. The findings of this effort will be used to judge the effectiveness of the fish passage facility, when compared to the goals of 75 percent upstream sturgeon passage, 85 percent downstream sturgeon passage, and causing no harm to passing sturgeon.

13. Shortnose Sturgeon and Striped Bass Habitat Assessments. Evaluations of the impacts of the SHEP on Shortnose sturgeon and Striped bass habitats would be conducted in years 2, 4, and 9 of the Post-Construction Monitoring. The field data collected in other tasks would be used in conjunction with the updated hydrodynamic and water quality models to conduct this assessment. A report would be prepared at the end of each year the evaluations are performed. The report would assess any further impacts to Shortnose sturgeon and Striped bass habitats beyond that described in the EIS.

14. Impact Assessment. Data collected from the bathymetric surveys and the intense hydrologic surveys described above would be used to assess impacts and to evaluate the effectiveness of the mitigation features. In addition, the data will be used to update the hydrodynamic and water models. The physical monitoring data would be included in the models and compared to what those models predict should have occurred under the observed conditions. If the models successfully predict salinity and dissolved oxygen levels (which will be known from field measurements) for the conditions observed during the monitoring, then they would be a reliable tool for impact assessments. This study effort would be conducted once a year for ten years. Reports for this element of the monitoring would include annual reports describing the results of the studies conducted each year during years 1-9 of Post-Construction Monitoring and a final report describing the results of the modeling performed in Year 10 as well as the overall result of all ten modeling efforts.

15. Monitoring of CDF effluents. The Corps would continue to monitor water quality discharges from the CDFs that were used for the construction. This work may extend for a year or two until the CDFs are dewatered from the new work placement. Savannah District staff would perform the work. The District would prepare an Annual Report. This monitoring would ensure the discharges comply with water quality standards.

Following the installation of a stable clean cover over the cadmium-laden sediments in CDFs 14A and 14B, cadmium would be monitored in the effluent from these CDFs weekly for a period of one year. In addition, a quarterly metals scan with the inclusion of ammonia would be conducted. All of the above information would be furnished to the GA DNR-EPD, SC DHEC, and USFWS.

After the CDFs enter the O&M phase, the Corps would monitor the CDF effluents for the life of the project following its normal procedures.

16. Wildlife Use Monitoring in CDFs 14A and/or 14B. Monitoring of wildlife use in CDFs 14A and 14B would be continued from the construction phase for a minimum of three years after placement of the cadmium-laden sediments and would continue as long as other cadmium-related monitoring events are being conducted. The monitoring would be conducted in the same manner as the monitoring conducted during the construction phase of the project.

17. Avian Blood/Feather Monitoring in CDFs 14A and/or 14B. Avian blood/feather monitoring would continue for a minimum of three years after the placement of the cadmium-laden sediments in CDFs 14A and/or 14B is complete. It would continue until cadmium concentrations are determined to not significantly differ from the baseline concentrations for three consecutive years. The monitoring would be conducted in the same manner as the monitoring conducted during the construction phase of the project. Should the proposed blood/feather sampling as described in the During and Post-Construction monitoring indicate there is a statistically significant change (95% confidence level) in the cadmium blood levels of birds in the CDFs before and after placement of cadmium-laden dredged material, then the Corps would conduct avian liver tissue sampling as outlined below in Section 8. The cost to perform this work is estimated at $100,000 per year for blood/feather sampling, plus an additional $50,000 to conduct liver tissue sampling should it be necessary.

18. Cadmium Monitoring-Channel Sediments. At the end of construction, sediment samples would be taken from the exposed channel bottom sediment surface and analyzed for grain size and metals (including cadmium). Analysis of the river bottom would provide an assessment of cadmium concentrations (as well as other metals) in sediment at the sediment-water interface.

As a condition of the Section 401 Water Quality Certification, the Georgia DNR-EPD and SC DHEC have requested sediment analyses prior to any maintenance dredging in those reaches of the channel with cadmium-laden sediments. Samples are to be taken from two locations in the channel 45 days prior to dredging, analyzed for cadmium, and the results furnished to the Georgia DNR-EPD, SC DHEC, and USFWS prior to initiation of dredging. This protocol would remain in effect through two maintenance dredging cycles. The Georgia DNR-EPD would review the results of the cadmium analyses and determine if additional such monitoring was warranted.

C. Reporting

Savannah District would place the data that is collected during the Post-Construction Monitoring and the reports that are produced onto the public website that was established during the Pre-Construction period. The District would prepare an Annual Report of data collected. The report would be provided to natural resource agencies and then placed on the public website.

A summary of reports concerning the various monitoring efforts that would be conducted during the Post-Construction Monitoring is as follows:

1. Intense Hydrologic Surveys Reports. Surveys would be conducted during years 1 and 5 of the Post Construction Monitoring.

2. Bathymetric Survey Reports. Surveys would be conducted during years 1 and 5 of the Post-Construction Monitoring.

3. Hydrodynamic and Water Model Update Reports. Model updates would be conducted after data from intense hydrologic and hydraulic surveys and bathymetric surveys become available, i.e., years 2 and 4 of the Post-Construction Monitoring Program.

4. Freshwater Interface Study Reports. Survey would be conducted during years 3 and 8 of Post-Construction Monitoring.

5. Groundwater Monitoring Reports. Annual reports will be furnished to Georgia DNR-EPD by 31st of January following the year of data collection.

6. Transfer Efficiency Study Report. One-time study that would occur either very late in construction or first part of Post-Construction Monitoring. This study is not included in the Post-Construction Monitoring Cost Summary below because it was included in the Construction Monitoring Cost Summary.

7. Marsh monitoring (12 sites) reports. Two reports will be prepared to address the ten years of Post-Construction Monitoring and changes from Pre-Construction Monitoring. One report in year 5 to address the findings of the first four years of monitoring and a report at the end of year 10 of the monitoring which would address years 5-10 of the monitoring and the overall 10-year study effort.

8. Monitoring of Marsh Restoration Site (1S) Reports. Seven reports to address seven years of Post-Construction Monitoring. The report for year 7 would be a comprehensive report to address monitoring of the site in years 1-7 and the success of the marsh restoration in Disposal Area 1S.

9. Monitoring of Shortnose sturgeon distribution in the Savannah Harbor Estuary Reports. Two reports to address six years of monitoring. One report in year six to address the findings of the monitoring for years 1-5, and a comprehensive report in year 10 to address the results of the monitoring conducted in year 9 and the overall findings of the six years of monitoring.

10. Monitoring of Shortnose sturgeon from NSBL&D to Savannah Harbor Reports. Two reports to address six years of monitoring. One report in year 6 to address the findings of the monitoring for years 1-5, and a comprehensive report in year 10 to address the results of the monitoring conducted in year 9 and the overall findings of the six years of monitoring.

11. Fish, Crab, and Shrimp Distribution Study Reports. Four reports to address four years of monitoring. Three reports would be prepared to address the results of the monitoring that would occur in years 1, 3, and 5 and a comprehensive report in year 10 to address the results of the monitoring conducted in year 9 and the overall findings of the four years of monitoring for this

study element. Reports would be provided to NMFS within 12 months of completing each year of sampling.

12. Shortnose sturgeon and Striped bass habitat assessment reports. Three reports to address the six evaluations. A report would be prepared to address the results of the studies conducted in years 2 and 4, and a comprehensive report prepared in year 10 to address the impacts of the monitoring that would be conducted in year 9 and an the overall findings of the three years of study.

13. Impact Assessment Study Reports. Annual, reports to address the findings of this study would be prepared each year for ten years. These would include a comparison of ranges of predicted performance values for parameters at specific points in the post-construction Savannah Harbor estuary to measured values.

14. Monitoring of effluent from CDFs 14A and/or 14B Reports. Annual, with the exception that Georgia DNR-EPD, SC DHEC, and USFWS would be provided a quarterly synopsis.

D. Cost Summary

The costs for this Post-Construction monitoring are estimated as follows:

Operate water quality stations	10 years x 8 @ $65,000	=	$5,200,000
Bathymetric Surveys (Unique Areas)	2 @ $158,000	=	$316,000
Intensive Monitoring	2 @ $350,000	=	$700,000
Freshwater Interface	2@ $40,000	=	$80,000
Assess Hydrodynamic and WQ Models	2 @ $150,000	=	$300,000
Chloride monitoring	5 years x $80,000	=	$400,000
Groundwater monitoring	10 years x $7,500	=	$75,000
Wetlands	10 years x 12 @ $20,000	=	$2,400,000
Monitor Marsh Restoration Site 1S			$680,000
Shortnose sturgeon monitoring	6 years x $200,000	=	$1,200,000
Fish passage at NSBL&D	6 years x $250,000	=	$1,500,000
Shortnose Sturgeon and Striped Bass Habitat Assessments	3 years x $ 70,000	=	$210,000
Fish distribution along marshes	4 years x $125,000	=	$500,000
Impact Assessment (using data and models)			$938,000
Monitor CDF effluent			$286,000
Wildlife Use Studies-CDFs 14A and 14B			$415,000
Avian Blood/Feather Monitoring			$350,000
Sampling Exposed Miocene for Cadmium			$78,000
Reporting			$500,000
Oversight			$700,000
Post Construction Total:			**$16,828,000**

Table 1. Summary of Major Monitoring Events

Element	Pre	During	Post										
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Post Year 10
Establish Baseline Data Bank	X												
Installation of Continuous Water Quality Data Recorders (5 new, 3 upgrade)	X												
Update Hydrodynamic and WQ Models (If Necessary)	X												
Bathymetric Surveys of Sediment Basin		X											
D.O. Transfer Efficiency Study		X											
D.O. Levels near Dredge during Summer Months		X											
Cadmium Sediment Sampling in 14A/14B		X											
CDF Effluent		X	X	X									
Monitoring of 8 Continuous Water Quality Data Recorders	X	X	X	X	X	X	X	X	X	X	X	X	4 Recorders
2 Intensive Water Quality/Hydrologic Monitoring Events	X		X				X						
2 Bathymetric Surveys in Unique Areas	X		X				X						
Hydrodynamic/Water Quality Model Assessment		X		X				X					
Freshwater Interface Determination					X					X			
Chloride Monitoring at Abercorn Creek Intake	X	X	X	X	X	X	X						
Groundwater Chloride Monitoring	X	X	X	X	X	X	X	X	X	X	X	X	8 Wells
Monitoring of 12 Marsh Sites (Chloride/Hydrologic/Vegetation)	X	X	X	X	X	X	X	X	X	X	X	X	
Monitoring of Marsh Restoration Site (1S)			X	X	X	X	X	X	X				
Shortnose Sturgeon Distribution in Estuary	X	X	X	X	X	X	X				X		
Shortnose Sturgeon Distribution at NSBL&D	X		X	X	X	X	X				X		
Fish Distribution Along Marshes			X		X		X				X		
Impact Assessment Review (Comprehensive Physical Data/Model Comparison and Review)			X	X	X	X	X	X	X	X	X	X	
Wildlife Use in 14A/14B (Avian/Terrestrial Field Counts)		X	X	X	X								
14A/14B Inflow/Effluent (Georgia)		X	X										
14A/14B Bird Tissue Analysis		X	X	X	X								
Sampling Exposed Miocene for Cadmium			X	X									
Shortnose Sturgeon and Striped Bass Habitat Monitoring				X		X					X		

8 PERFORMANCE MEASURES

A. Goals. This section will define the manner in which the findings of the monitoring would be evaluated and used in decision-making.

B. Components. The monitoring that would be conducted can be placed in one of the following four categories:

- Pre-Construction monitoring to establish a baseline prior to implementation of the harbor deepening project. The field investigations performed for this study would be conducted early in the study process and be updated to ensure information is available that reflects conditions just prior to the deepening;
- Monitoring during construction to identify any impacts that occur that are beyond the range of those expected to occur;

- Post-Construction monitoring to ensure the impacts that occur do not exceed those that were predicted and evaluate the effectiveness of the mitigation features; and
- Post-Construction monitoring to document the effects on a specific resource.

As stated in the background section of this appendix, the two aspects of performance that need to be distinguished are the accuracy of the impact assessment tools (primarily models) and the biological responses that will occur as a result of changes in the environment. The manner in which the monitoring is evaluated, therefore, would depend on the original purpose of that particular monitoring effort.

Pre-Construction Monitoring

The Pre-Construction monitoring consists of Geomorphic and Biologic components that would provide information to establish a pre-project baseline. Pre-construction monitoring would also include the establishment of a baseline data base using existing data and reports available on Savannah Harbor. The Continuous Riverine Monitoring, the Bathymetric Surveys and the Intensive Monitoring would be used to assess whether the hydrodynamic and water quality models should be recalibrated to increase their accuracy and reliability. Models that can accurately simulate conditions within the Savannah Harbor estuary are essential to examining whether biological responses that occur as a result of the project are within expected ranges. The Corps would enter the new information into the models, assess the accuracy and reliability based on the previous calibration, and determine whether that accuracy and reliability could be increased substantially if the model is recalibrated with the more up-to-date information. The Corps would use generally the same performance goals for the models that the Federal Cooperating Agencies established when the models were initially applied to Savannah Harbor with one exception. The USFWS recommended that the goal for salinity should be changed from +/- 0.5 ppt to +/- 10% when salinity is within the range of 1 to 5 ppt. While the table below reflects that recommendation, it may not be achievable. The modelers would make every effort to make the models as accurate as possible. The performance goals for the various parameters are summarized on the following page:

Table 2. Modeling Performance Goals

Parameter		Percentiles					Timing of Maxima (Min)
		5 %	10 %	50 %	90 %	95 %	
Elevation (cm)		+/- 2	-	+/- 2	-	+/- 2	+/- 30
Salinity (ppt) *	1-5 ppt	-	-	+/- 10 %	+/- 10 %	-	+/- 30
	< 1 ppt	-	-	+/- 0.1	+/- 0.1	-	+/- 30
DO (mg/L)		-	+/- 0.2	+/- 0.2	-	-	+/- 30
DO Deficit (mg/L)		-	+/- 0.2	+/- 0.2	-	-	+/- 30
Temperature (^{o}C) **		-	-	+/- 1	-	-	-
Surface Currents (m/s) ***		+/- 25%	-	-	-	+/- 25%	+/- 30
Volume Flows (m/s) ***		+/- 25%	-	-	-	+/- 25%	-

* The salinity goals have been refined for the post project-approval period
* 50% represent Absolute Mean Error for temperature
** 5% and 95% represent the max. ebb and flood conditions for current and flow

After the model has been reviewed and possibly recalibrated, model runs will be made to establish ranges of predicted data values on selected performance parameters for specific points in the Savannah Harbor estuary. The data will be used to create graphs with trendline and curves showing the expected ranges of modeled values as described in the pre-construction section of this appendix. Performance parameters will be established for specific conductance, salinity, and DO. During construction and post-construction monitoring, measured values would be compared to these predicted ranges to determine if the project is performing as expected.

Monitoring During Construction

Many variables need examination to determine whether the responses of the Savannah River Estuary that occur as a result of the project are within the expectations provided in the EIS and as monitored by the ranges described above. To make the assessment, the Corps would combine results from several monitoring efforts. All the data that is collected will be used in those evaluations. Data from the Continuous Riverine Monitoring are expected to be available on a 24-hour basis and reflect near real-time conditions. Therefore, they will be most useful in identifying whether any impacts are occurring beyond the range of those expected.

The Corps would regularly assess (every four months) how well the hydrodynamic and water quality models predict the salinity and dissolved oxygen levels that are occurring during the construction process. The assessment would be performed by comparing the model's predictions against what is being measured at the 8 continuous water quality monitoring stations. The model grid would be updated to reflect the new bathymetry and the actual river flows. If the modeling performance guidelines are not being met, recalibration of the model may be warranted.

These regular assessments also will be useful in identifying whether any impacts are occurring beyond the range of those expected. Using DO concentration as an example, the locations of the Continuous Riverine Monitoring stations correspond to zones SR, FR8, MR3, LBR2, LBR3, MR1, BR1, and FR3 in reports that supplement the GRR, and those reports contain tables that predict the frequency of particular average DO concentrations within the bottom waters of each zone during the time of year when DO is expected to be at its lowest. Near real-time results from the Continuous Riverine Monitoring stations can show whether the expectations for these zones are being met and can serve as proxies for what might be occurring elsewhere in the harbor.

Salinity provides another example. During the pre-construction monitoring period, modeled salinity and flow data at the continuous gauging station locations will be used to establish thresholds of acceptable response of the system to the harbor deepening. During and after the construction, measured salinity and flow data would be compared to modeled salinity for the observed flows at the continuous gauging stations to evaluate the ecosystem's response to the construction project. Plots will be generated showing the model projected relations between maximum, minimum, and mean salinity and streamflow. From these plots, trendlines will be developed and curves of the expected ranges of values will be computed to represent the expected range of responses of the system. The curves will provide salinity values for a corresponding streamflow at a particular site. As the real-time data is collected, the plots could be updated in near real-time to evaluate how the system is responding with respect to projected deepening conditions.

Model data for flow will show the predicted flows, as well as pre-construction flow data, at the three water quality monitoring stations along Georgia Highway 25 / South Carolina Highway 170 Bridge. Using methods similar to those described above, flow data during construction would be compared to these ranges of predicted values to evaluate if the system is responding as predicted.

Modeled data for various river flows at Clyo would be used to assess DO at the eight water quality monitoring stations.

Conducting these assessments every four months should be sufficient to assess performance of the models and the emergence of any unexpected impacts. This process would serve as the mechanism to identify the emergence of any unexpected variances with the predictions about how the harbor would function after construction is complete.

If the monitoring identifies impacts that are outside the range of those expected, the Corps would consult with the Cooperating Agencies to identify what actions may be appropriate. This could include more detailed monitoring in certain locations to obtain a better understanding of what is occurring, or a delay, reordering, or cessation of construction activities. The Corps would re-evaluate the data if a Cooperating Agency believes that the impacts are going outside the expected range.

The Corps would prepare a brief technical paper after each assessment of the hydrodynamic and water quality models documenting the findings of the comparison between observed data and

predicted levels. The Corps would provide this report to the natural resource agencies for review and comment. The Corps would then make the report available to the public.

In addition to the data from the continuous water quality monitors, the graphs of ranges of predicted values, and the use of the hydrodynamic and water quality models to assess project impacts during construction, other "tools" would also be available to measure the performance of the project during the construction phase of the project. These assessment tools would include the monitoring of dissolved oxygen levels in the harbor in the summer months, monitoring of chloride levels at the City of Savannah's water intake on Abercorn Creek, groundwater monitoring, and monitoring of effluent from the CDFs to ensure there are no violations of applicable water quality standards, analyses of cadmium concentrations of sediments placed in CDFs 14A and 14B, and monitoring of dissolved oxygen levels in the vicinity of the dredge during the summer months.

Post-Construction Monitoring

The Corps would again combine several of the monitoring efforts to evaluate model performance and identify whether any impacts occur that are beyond the range of those expected. All the data would be used in these evaluations of how the Savannah Harbor estuary and tidal marshes responded to the harbor deepening. The physical monitoring data would be included in the hydrodynamic and water quality models and compared to what those models would have predicted would occur under those conditions. The Corps would use the range of variability shown in the model performance goals to help in its assessment of the models' accuracy in predicting the observed effects. The District would continue to refine the hydrodynamic and water quality models to improve their accuracy and reduce their range of variability. It would also use the range of +/- 50 acres to assess the acreages of tidal freshwater, brackish, and salt marsh when the wetland impact and mitigation evaluations were conducted. The following table shows the predicted acres of marsh using the salinity criteria developed by the Wetlands interagency coordination team.

Table 3. Predicted Acres of Marsh Types

	Tidal Freshwater	**Brackish**	**Salt**
	<0.5 ppt	**0.6 to 4.0 ppt**	**>4.0 ppt**
Current	4072 acres	2253 acres	2806 acres
Predicted	3849 acres	3217 acres	1766 acres

In addition, monitoring data from continuous water quality monitoring stations will be compared to modeled values for those same points. Post-construction conditions within the Savannah Harbor estuary that are outside the ranges predicted would not necessarily trigger corrective action but would trigger coordination among the agencies so that the Corps may determine what action, if any, would be appropriate as described below.

Acceptability Criteria

This document does not include specific acceptability criteria for all water quality or biologic parameters which would be monitored for this project. Although identification of specific values would establish points at which action would need to be taken, it would also limit the judgment of experts about potential cumulative effects of changes in several parameters which do not exceed a single threshold. The monitoring and adaptive management plan is based on a collaborative decision making process among experts in several natural resource agencies. Establishing thresholds at this time would limit the ability of those agencies to respond to situations in a manner that they determine would be best for this estuary. Exceptions are noted in the three paragraphs below.

The Georgia DNR-EPD and South Carolina DHEC (as a condition of their Section 401 Water Quality Certifications) requested that a benchmark chloride concentration be established for each sentry well. The chloride concentration in the groundwater determined from the monitoring of sentry wells and up-gradient wells will have specific triggers for corrective action. The Corps must also determine what chloride concentrations caused by SHEP dredging activities would result in a measurable increase in chloride concentrations at Savannah area production wells. The benchmark chloride concentrations must be protective of the Savannah area production wells. The Corps would establish benchmark chloride concentrations for each pair of sentry wells near the top of the Upper Floridian aquifer and deeper in the aquifer. The establishment of the benchmark chloride concentration would be accomplished prior to the commencement of the dredging and would serve as a trigger for corrective action.

Another example is the conditional requirements under which the Corps would conduct vegetation sampling in the CDFs where cadmium-laden sediments are deposited. Vegetation sampling would be conducted in the event that elevated concentrations of cadmium (4mg/kg or greater) in a cumulative total of 25 acres or more of the covering layer. This sampling would be conducted on a quarterly basis. Sampling of vegetation would be initiated in defined "hot spots" to determine cadmium uptake by plants. Specific details of the vegetation sampling procedures would be determined in coordination with the USFWS before implementation. Samples collected from CDFs 14A and 14B would be compared to control samples derived from other low cadmium environments found in adjacent CDFs. Where at all possible, vegetation comparisons to reference will be by species and sampling would include all dominant species growing in the cover cap. If vegetations samples have significantly elevated cadmium concentrations, then efforts would be initiated to eradicate vegetation and/or place additional, low cadmium sediments over the original capping layer. These measures would eliminate wildlife exposure should vectors for uptake of cadmium be identified. When soil sampling indicates sustained cadmium concentrations are less than 4 mg/kg, the vegetation monitoring would be complete.

Similarly, there is a conditional requirement under which the Corps would conduct avian tissue analyses. Should the proposed blood sampling as described in the During and Post-Construction monitoring indicate there is a statistically significant change (95% confidence level) in the cadmium blood levels of birds in the CDFs before and after placement of cadmium-laden dredged material, then the Corps would conduct avian liver tissue sampling. Since the CDFs

would reenter the rotation program after the covering sediments have been placed, the CDFs may be dry or wet, depending on the year. Their hydrologic condition will drastically alter their bird use, as different species use the CDFs in those two conditions. Consequently, if/when the CDFs are dry, three individuals from two species (six total) would be sampled at the beginning and end of the nesting season (April and August) from species that use typically use the CDFs for nesting. Also, if/when the CDFs are dry, three individuals from two species (six total) would be sampled at the beginning and end of the wintering season (October/November and March/ April). Samples would be obtained from species that typically use the CDFs during the winter months as outlined in Appendix M. The Corps may also choose to collect baseline liver tissue data. Post-construction liver tissue data would be compared to baseline data (if available) and published avian liver cadmium toxicity levels (screening level). Project liver tissue data would have to significantly exceed baseline data and/or the screening levels to trigger additional management options.

The field data collected, ranges of predicted values at water quality monitoring stations determined during pre-construction, and the hydrodynamic and water quality models using observed river flows would be the main tools which would be used to determine how the project is performing and if the impacts are generally as expected. Even though the potential impacts of the project were evaluated under a likely range of conditions, the actual circumstances experienced after construction will be somewhat different from those used for evaluation in the project's feasibility phase. Consequently, the monitoring data will be used to evaluate the response of the system to the mitigation features. In addition, the hydrodynamic and water quality models would be used to examine post-project performance under actual conditions, e.g. high/low flows, drought, or some combination of these. The performance (accuracy) of the models would be assessed once during pre-construction monitoring and twice during post-construction monitoring and recalibrated, if necessary. This repetition in modeling assessment/ recalibration would improve their predictive accuracy by decreasing their range of uncertainty. The Corps and the resource agencies would use the modeling data (after any necessary post-construction recalibration of the models) and compare those data to actual field results to determine whether the Savannah Harbor estuary is responding to SHEP as expected. The hydrodynamic and water models would be used to evaluate project performance once a year for ten years as part of the post-construction monitoring. The Corps would prepare a report after each of the ten assessments of the hydrodynamic and water quality models documenting the findings of the comparison between observed data and predicted levels. The Corps would provide this report to the natural resource agencies for review and comment. The Corps would then make the report available to the public.

Other tools that would be available to assist with the post-construction assessment of the performance of the project would include the study of the 12 marsh sites, the monitoring of the marsh restoration site in Disposal Area 1S, data from the chloride monitoring at the City of Savannah's water intake, groundwater monitoring, the data from the Shortnose sturgeon distribution study in the Savannah Harbor estuary, the data from the Shortnose sturgeon passage study at NSBL&D, the fish distribution study, and the data from the assessment of project impacts on Striped bass habitat. These studies would be used to evaluate the performance of the project as described below.

The 12 marsh sites would be monitored for ten years after completion of the project. The data could then be compared to the predictions in the EIS, post-construction modeled impacts (using observed river flows), past reports, and data gathered during previous years (one year of pre-construction and four years of construction) to evaluate impacts of the project on marshes (especially tidal freshwater) in the project area.

The Corps would use the following revegetation rate as the acceptability criteria for restoration of brackish marsh at Area 1S. A reference marsh site would be identified in the vicinity of Disposal Site 1S to facilitate the evaluation of the marsh restoration progress.

Table 4. Revegetation Rate for Area 1S

Time Period	Percent Vegetative Cover
Construction	0
Year 1	15
Year 2	25
Year 3	40
Year 4	60
Year 5	80
Year 6	85
Year 7	90

Marsh restoration in Disposal Site 1S includes an adaptive management plan which would require continued efforts until the success criteria are achieved. These efforts may include adjusting the elevation of the site as many times as necessary to achieve success and the planting of juvenile *Spartina alterniflora* plants if the site does not naturally re-vegetate at the rate of colonization indicated in the above table. Should the restored marsh not meet the success criteria in the above table, then the ICT would identify and/or recommend corrective actions, including planting requirements and associated sprig densities, which would achieve compliance with the re-vegetation criteria in the above table. The need for corrective action(s) would be determined and/or implemented annually with agency involvement and concurrence. Annual monitoring reports would be generated over a period of seven years and provided to a Wetland ICT. If at the end of seven years the plant density at the restored marsh is not within 10 percent of the reference site, the Corps would implement further actions to achieve successful marsh regeneration on this site.

The wetland restoration in Disposal Area 1S would also include an adaptive management plan with respect to invasive species. The site would be monitored for invasive species, and an invasive species control plan would be developed and implemented, if required.

The water quality model and ten years of post-construction data from the eight continuous recorders would provide information on how the project affected the dissolved oxygen regime in the Savannah Harbor estuary.
Ten years of post-construction data from the eight continuous water quality recorders would provide information on how the project affected the salinity regime in the Savannah Harbor estuary. This data would be supplemented with data from two intense hydrologic monitoring events (years 1 and 5 of post-construction monitoring) and two studies to identify the location of the freshwater interface (years 3 and 8 of post-construction monitoring).

Five years (years 1-5 of post-construction monitoring) would be available to assess the impacts of the project on chloride levels in the vicinity of the City of Savannah's water supply intake on Abercorn Creek. This data would be used to determine if the observed values are within the range of accuracy of the predicted values and to aid the City of Savannah in their operational procedures for the raw water storage pond.

Ten years of data from the sentry and upgradient background wells would be available to assess the impacts of the project on chloride levels in the Upper Floridan aquifer. This data could be compared to the five years of groundwater monitoring data collected during the one-year of pre-construction monitoring and the four years of the construction period.

The study of the passage of Shortnose sturgeon at NSBL&D would be conducted in years 1-5, and 9 of the post-construction monitoring. This study would concentrate on fish passage at NSBL&D. The Corps would prepare a report describing the findings of the monitoring of fish passage at New Savannah Bluff Lock and Dam. That report would identify whether any modifications to the fish passage structure are recommended for the mitigation feature to function as intended. The findings of this effort will be used to judge the effectiveness of the fish passage facility, when compared to the goals of 75 percent upstream sturgeon passage, 85 percent downstream sturgeon passage, and causing no harm to passing sturgeon.

Monitoring of Shortnose sturgeon would provide information on the locations of the estuary used by the Savannah River population. Monitoring of Shortnose sturgeon distribution in the Savannah Harbor estuary would be conducted during years 1-5 and year 9 of post-construction. This data would then be compared to the five years of data collected during pre-construction and the construction period to determine if there are any trends in Shortnose sturgeon distribution that might be attributable to the project. Changes that are not explained by known habitat parameters (salinity and dissolved oxygen) may require additional investigation. If greater losses of sturgeon habitat occur than would be expected under the observed flow conditions, then additional mitigation may be warranted.

Fish, crab, and shrimp distribution studies in Savannah Harbor would be conducted in years 1, 3, 5 and 9 of post-construction monitoring. This survey would monitor fish, crab, and shrimp abundance and distribution along the edges of marshes using a drop survey. The results of this study would be compared to the data collected during a similar study in 2000-2001 to determine if there are any observable changes in fish distribution and abundance that might be attributable to the project.

The field data collected would be used with the updated hydrodynamic and water quality models to evaluate the impacts of the project on Striped bass habitat. This study would be conducted during years 2, 4, and 9 of the post-construction monitoring. Data from this study would be used to determine if impacts to Striped bass habitat exceed those predicted during feasibility, and if so, what additional mitigation may be warranted.

The Corps believes that the monitoring efforts outlined above would allow the Corps and the resource agencies to determine how the completed project is performing (including its mitigation features). Consequently, the Corps and the natural resource agencies would be able to evaluate the impacts of the project to ensure they do not exceed those that are predicted, the effectiveness of the project's mitigation features, and the project's effects on specific resources. Savannah District would prepare a final monitoring report that would summarize the results and findings from the various components of the monitoring program. It would initially provide that document to the Cooperating Agencies and then to the public.

9 ADAPTIVE MANAGEMENT - DECISION MAKING PROCESS

A. Goals. This section will define the process by which decisions are made concerning whether the mitigation features of the project – or the entire navigation project – needs to be modified. It will also describe the participants in the decision-making process, the timeline for making those decisions, any authorizations that are needed from higher authorities, and coordination that would occur with those not participating in making the decisions.

B. Decision Process. The decision process in regards to the implementation of any adaptive management measures would be ongoing throughout the Construction and Post-Construction phases of the project. The Corps would maintain close coordination with the Cooperating Agencies and the state natural resource agencies throughout the monitoring conducted during the Construction and Post-Construction Phases of the project. During the Construction phase of the project, the Corps would place monitoring data and reports as they become available on a public website. After the reports are available for a given year, the Corps would meet with the Cooperating Agencies and the state natural resource agencies to review the new information. Meetings between the Corps and the agencies would be held more frequently during the construction phase of the project if the data indicate the need to do so.

Adaptive management measures that might be implemented during the construction phase of the project would be focused on changes to how the project is being constructed or how the various monitoring efforts are being conducted. Actual data would be compared to pre-construction modeled predicted performance and the modeled performance using actual river flows. If the monitoring identifies impacts that are outside the range of those expected, the Corps would consult with the Cooperating Agencies and the natural resource agencies to identify what actions may be appropriate. This could include more detailed monitoring in certain locations to obtain a better understanding of what is occurring. The monitoring could also dictate changes in how the project is being constructed, such as modifying the operation of the CDFs to improve the water quality in the effluent or a delay in the dredging operations until a problem could be assessed and corrective measures implemented. Adaptive management measures that might be required

during construction of the project could be implemented in an expeditious manner since decisions regarding changes to the monitoring plan or the construction process are normally delegated to the District/Division level.

After construction of the project is complete, the adaptive management decision process would become more focused on the long-term mitigation features of the project. The coordination process between the Corps and the Cooperating Agencies and the state natural resource agencies during the Post-Construction Monitoring phase of the project would be much the same as in the Construction phase. Some of the post-construction monitoring efforts would be conducted over 10 years. Should one agency request it, a meeting would be held at the end of each year between the Corps, the Cooperating Agencies, and the state natural resource agencies to discuss the new data that would be available or the implementation of an adaptive management measure if the data indicates that to be required. Meetings between the Corps and the agencies could be held more frequently if the need arises. At the end of the Post-Construction monitoring period, the Corps would review and consolidate the reports of the various monitoring efforts. The consolidated report would contain pertinent information from the various reports, focusing on issues which the Corps believes are most critical to decisions on the need to modify the navigation project or the mitigation plan. The report would identify whether the Corps believes that any modifications are warranted and recommendations on what modifications should occur. That report should be available within six months of receipt of the last monitoring report and within one year of the end of the Post-Construction monitoring.

The Corps would coordinate that draft report with the Cooperating Agencies and the state natural resource agencies. The agencies would review the draft report for 30 days and provide their comments at a meeting that the Corps would host on this issue. The Corps would consider the comments and revise the report if necessary.

The Corps would then issue a final monitoring report for public comment. The Corps would review the public's comments and prepare a decision document. It would provide that document to the Cooperating Agencies (USFWS Region 4, EPA Region 4, NOAA-Southeast Regional Office, and GPA/GA DOT) for review prior to the Federal agencies (including the Corps) making a joint decision on whether any modifications are warranted. Each of the Federal agencies must concur that a specific modification is warranted for that measure to be implemented. After the agencies' joint decision, the Corps would notify the public of the agencies' final determination.

If an agreed-upon measure is included in this EIS and its implementation has thus been environmentally evaluated, no additional authorizations or environmental approvals would be required to implement the measure. If an agreed-upon measure is not included in this EIS and it has not been evaluated by the Corps in some other NEPA document, the District would prepare a NEPA document to obtain environmental approvals to implement that measure. The Corps would fund that effort using the adaptive management funds that were previously set aside. If the budgeted adaptive management funds have been expended, the Corps would request additional funds through the Construction Program budget process.

If agreement cannot be reached because one of the parties believes that additional data is needed to conclude a feature is needed, adaptive management funds could be used for an additional year of monitoring to obtain the needed information. The agencies would recognize that the additional monitoring reduces the amount of funds remaining to implement whatever measures are determined to be warranted. In this case, the group would hold the adaptive management funds for another year until the monitoring is conducted and a report made available with the additional information.

If after either the 10-year Post-Construction monitoring period is complete or after an additional year's worth of data is collected, it appears that the agencies will not be able to agree on whether a specific modification is warranted, upon the request of two of the four Federal agencies, the Corps would convene a meeting of the Federal agencies in Washington. At that meeting, Washington-level agency representatives would make a decision on the issue.

C. Decision Criteria. During the monitoring for the construction and post-construction phases, the Corps, the Cooperating Agencies, and the state Natural Resource Agencies will review the monitoring data and reports as they become available. The agencies will review the information to determine whether the impacts are generally as expected and whether changes to the project and its mitigation plan are warranted. An indicator of impacts within the expected ranges would be monitoring data for points in the estuary within the ranges determined by pre-construction modeling over a range of flow conditions. Even though the team examined the performance of the project alternatives under a range of conditions, the conditions that are experienced during and after the construction are still likely to be different from those that were examined during this feasibility phase. The team will use the post-construction monitoring data and the model predications for points in the estuary to evaluate the response of the ecosystem and the effectiveness of the mitigation features. The natural resource agencies recognized that models could not be developed to replicate conditions observed in this complex estuary with 100% accuracy. They established performance goals for the models (a portion of which is shown in the table below), which the developers were able to meet. However, there was still some inaccuracy in the models, which is discussed in the Engineering Appendix of the GRR. Predictions about the biological and physical responses of the estuary to SHEP appear in the EIS and this appendix.

As discussed previously, adaptive management measures that would be implemented during the construction phase of the project would be centered around changes to the monitoring plan or the various construction processes (dredging, disposal of the dredged material, etc.). The need to implement any adaptive management measure during the construction process would be determined through a review of the wealth of data that would be generated by the various field monitoring efforts conducted during the construction process. The decision to implement any adaptive management measure during the construction process would also be based on model predictions of dissolved oxygen and salinity that would be conducted during the construction phase of the project. The Corps would regularly assess (every four months, e.g., twelve times during the construction phase of the project) how well the hydrodynamic and water quality models predict the salinity and dissolved oxygen levels measured in the field. These assessments would be performed by comparing the model's predictions against what is being measured at the 8 continuous water quality monitoring stations. The model grid would be updated to reflect the

new bathymetry and the actual river flows. Section 8 of this appendix provides additional detail and examples of how this adaptive management process would work.

Obviously, the post-construction phase of the project would present the best opportunity to evaluate the performance of the project and its mitigation features with respect to the response of the ecosystem. Because the project would be completed, the models would be assessed and recalibrated, if required, and post-construction field data would be available. The Corps believes that the goals which the natural resource agencies (EPA, USFWS, USGS, SC DHEC, and Georgia DNR-EPD) established for the performance of the models can also serve in the post-construction phase as an effective tool for examining whether the constructed project performs as expected. If the observed results are within the expected ranges (taking into account the models' performance goals), then the project would be performing as expected. No modification to the project and its mitigation plan would be warranted.

The performance (accuracy) of the hydraulic and water quality models will be assessed and recalibrated, if necessary, both during and after construction. The present plan includes collecting detailed data (intense monitoring), assessing the models' performance, and recalibrating, if necessary, once during the pre-construction monitoring period and twice during the post-construction monitoring period. This repetition in modeling assessment/recalibration will improve their predictive accuracy by decreasing their range of uncertainty. The modeling performance goals shown below could be improved upon. (The model performance goal for salinity when salinity in the range of 1 to 5 ppt, which has been changed in the table below from +/- 0.5 ppt to +/- 10% at the request of the USFWS, may not be achievable.)

The natural resource agencies would use the accuracy and reliability of the models after the post-construction assessment/ calibration to review the performance of the project and its mitigation features. The modeling data and predictions in the EIS for the estuary's response to the project would be compared to actual field results to evaluate whether the project is performing as expected. The ranges for values predicted by the models described in Section 5 Pre-Construction Monitoring of this appendix will be compared to post-construction measured data to further assess the performance of the mitigation. An overall assessment of the project's performance would be conducted once per year for the 10 years of the Post-Construction monitoring period.

Table 5. Federal Modeling Performance Goals

Parameter		Percentiles					Timing of Maxima (Min)
		5 %	10 %	50 %	90 %	95 %	
Salinity (ppt)	1-5 ppt	-	-	+/- 10 %	+/- 10 %	-	+/- 30
	< 1 ppt	-	-	+/- 0.1	+/- 0.1	-	+/- 30
DO (mg/L)		-	+/- 0.2	+/- 0.2	-	-	+/- 30
DO Deficit (mg/L)		-	+/- 0.2	+/- 0.2	-	-	+/- 30
Surface Currents (m/s) **		+/- 25%	-	-	-	+/- 25%	+/- 30
Volume Flows (m/s) **		+/- 25%	-	-	-	+/- 25%	-

*Section 8 provides additional explanation of this table
** 5% and 95% represent the maximum ebb and flood conditions for current and flow

10 ADAPTIVE MANAGEMENT – IMPLEMENTING WARRANTED MODIFICATIONS

A. Goals. The Corps would obtain funding sufficient to implement the actions described in the following section during the project construction period. The project would remain in a construction status until all of the construction is complete, the Post-Construction Monitoring is complete, and any adaptive management measures implemented that were determined to be required. The District intends to obtain funds for adaptive management each year it obtains funds to perform regular construction activities. The Corps will develop a construction funding plan as well as a mitigation and adaptive management funding plan. The Corps will seek funding each year as identified in the funding plans. If the total adaptive management costs exceed the above estimates, the Corps would seek to obtain Corps approvals for any additional amounts needed through the normal (Construction Program) budget process. Funds for un-programmed adaptive management needs would be considered should excess construction funds become available during the year. Adaptive management funds currently estimated at $2 million per year will be sought for the entire duration of the monitoring period and for any action needed based on the monitoring results. Any project funds that are not used during the year due to unforeseen circumstances would be carried forward as needed and justified. In addition, the non-Federal sponsor, acting through the Georgia Ports Authority, has agreed to set aside, in advance, their cost-shared portion of the monitoring and adaptive management funds in an escrow account upon approval of the project. Those adaptive management funds would be expended if the modifications are deemed necessary by the Federal Lead and Cooperating Agencies.

If modifications are found to be warranted and they are contained in the group of actions described in the following section and the EIS, they could be implemented without further public coordination or environmental approvals. If then-existing programmed funding is not sufficient

to implement the above-mentioned warranted modifications, the Corps would seek to identify funds for reprogramming. Funds to be reprogrammed must first be identified as excess to another project's needs. If such funds are identified, the District will seek to obtain them to implement the needed adaptive management actions, thereby minimizing unanticipated adverse project effects.

If modifications are identified that are not in the following section, the Corps would prepare the documents needed to coordinate the proposed action with the public and the agencies to obtain the required environmental approvals.

If modifications are deemed warranted that are larger in scope than those described in the following section and require additional funding, the Corps would submit the appropriate documents to its Headquarters for approval. If additional Federal funding is required, Congressional action would likely be needed to obtain those funds.

B. Components of Approved Adaptive Management Plan. The following adaptive management features are included as part of the Savannah Harbor Expansion Project:

- Enlarging the diversion structure at the mouth of McCoys Cut;
- Enlarging the deepened area at McCoys Cut, Middle & Back Rivers;
- Constructing a diversion structure at the junction of Middle and Back Rivers;
- Removing the Tidegate sill;
- Raising or lowering the height of the submerged sill at the Sediment Basin;
- Improving fish passage at the New Savannah Bluff Lock & Dam;
- Acquisition of additional freshwater wetlands;
- Modifying the oxygen injection systems; Constructing and operating additional oxygen injection systems;
- Modifying the wetland restoration area at former Disposal Area 1S;
- Preferential placement of maintenance sediments into CDFs 14A and/or 14B as additional covering material.

Removing the Tidegate sill may increase tidal flows up Back River. This may be necessary to address water quality issues or improve fishery habitats. Enlarging the diversion structure at the mouth of McCoys Cut may be needed to draw more freshwater into the Middle and Back River portions of the estuary. Enlarging the deepened area at McCoys Cut, as well as Middle and Back Rivers would perform the same effect and could be needed in addition to enlarging the diversion structure. The additional freshwater flows down those two rivers would make freshwater vegetation more dominant in those portions of the estuary and improve some types of fish habitats in those locations. Constructing a diversion structure at the junction of Middle and Back Rivers would direct more freshwater down one of those two rivers. This additional freshwater flow down one arm may be needed to preferentially improve habitats along one of those two rivers. Fish passage at the NSBL&D could be improved by several methods, including (1) altering flows in the fish passage structure to enable that structure to attract and pass the Shortnose sturgeon, as intended, (2) modifying the fish passage rock ramp, or (3) enabling passage through the lock or gates on the dam. Acquisition of additional bottomland hardwoods/freshwater wetlands would compensate for additional impacts to freshwater marshes

beyond those that are predicted in the EIS. Additional dissolved oxygen may be needed under some flow conditions. The additional capacity would allow the systems to function as intended under all flow conditions. Modifications to the wetland restoration area at former Disposal Area 1S may be needed for brackish marsh to revegetate the site. This may include re-grading the site, depositing additional sediment, or sprigging. Additional maintenance sediments may be needed on CDFs 14A and/or 14B as additional covering material to adequately minimize the risk to wildlife using the sites. The project would pay the incremental cost of depositing O&M sediments in those sites instead of the regularly scheduled deposition site.

Any or all of these features would be implemented if post-construction monitoring finds them to be needed. Implementation of any or all of these specific features may not be needed. The adaptive management funding would be viewed programmatically. More could be spent on a given single item than is shown for the individual features identified below, but the total amount available for use in adaptive management would be the amount shown below. Which of these (or other) features would be implemented would depend on the monitoring results and the decisions of the Federal Cooperating Agencies.

C. Cost Summary. The cost to implement these features is estimated to be as follows:

Enlarging the McCoys Cut diversion structure	
Use 10% of initial cost of $2,324,082	$ 232,408
Enlarging the deepened area at McCoy's Cut, Middle, & Back Rivers	
Use 10% of initial cost of $7,287,980	$728,798
Diversion structure at Middle and Back Rivers	
Use 5% of initial cost of $1,800,688	$ 90,034
Removing the Tidegate sill	$2,908,990
Modifying the submerged berm at the Sediment Basin	
Use 10% of initial cost of $23,514,049	$2,351,405
Improving fish passage at the NSBL&D	$ 630,200
Acquiring additional freshwater wetlands	
Use 5% of initial acquisition	
$10,000/ acre x 0.05 x 2,683 acres	$1,341,500
Additional capacity in dissolved oxygen systems	
Use 10% of initial construction cost $56,643,000	$5,664,300
Modify the restoration site at Disposal Area 1S	
Use 10% of initial cost of $14,075,959	$1,407,596
Incremental cost to place O&M sediments in CDFs 14A/14B	
Use $1.00/CY x 782,500 CY x 2 CDFs	$1,565,000
Contingency Monitoring (3 x $1,000,000)	$3,000,000
Total	$19,920,231

The cost to acquire additional preservation lands shown above is based on a 48-foot depth alternative. Since the funds to be set aside for acquisition of additional lands depends on the

initial acreage to be acquired, the total adaptive management funding would be less for the other depth alternatives and would be as follows:

Table 6. Cost of Adaptive Management

CHANNEL DEPTH ALTERNATIVE	REQUIRED WETLAND ACQUISITION (ACRES)	COST OF ADDITIONAL WETLAND ACQUISITION	TOTAL ADAPTIVE MANAGEMENT COSTS*
44-FOOT	N/A	0	$ 18,579,000
45-FOOT	1,643	$821,500	$ 19,400,000
46-FOOT	2,188	$1,094,000	$ 19,673,000
47-FOOT	*2,245*	*$1,122,500*	*$ 19,701,000*
48-FOOT	2,683	$1,341,500	$ 19,920,000

*Total costs rounded to nearest $1,000

As a result of coordination with the natural resource agencies after release of DEIS, the Corps substantially increased the size of the fish bypass structure. The larger bypass would greatly increase the amount of flow passing through it (from 5% in the original design to 100% during the majority of the spawning season). The natural resource agencies now state that the percent of river flow passing through the structure roughly corresponds to the effectiveness they expect in passing SNS. Therefore, since the larger structure is more likely to pass SNS, the likelihood of needing to modify the structure after construction for it to function as intended is greatly reduced. The funds identified for adaptive management for the fish bypass should be sufficient to modify it if the post-construction monitoring indicates such action is warranted.

The adaptive management funds may be used to perform more work at a particular location than is shown above, as long as the total cost of the adaptive management stays within the total (plus contingencies) for the group of items shown above. Should other project features require adaptive management, then a portion of the funds outlined above may be used to modify those features, including performing vegetation sampling in CDFs with cadmium-laden sediments. Further, if the Cooperating Agencies believe that some other feature(s) would be more effective in addressing an identified problem, the Corps may use the funds authorized for adaptive management to implement that feature(s). The Corps may need to obtain additional environmental clearances to implement such a feature if it is not evaluated in this EIS or some other Corps NEPA document.

If the total adaptive management costs exceed the above estimates, the Corps would seek to obtain Corps approvals for those cost increases and request additional funds through the normal (Construction program) budget process and as described above.

D. Monitoring After Implementing an Adaptive Management Feature. Six of the eleven adaptive management features would alter flows in the estuary. To ensure a modification is performing as intended, additional Post-Construction monitoring would be conducted for two years after implementing the adaptive management feature. Longer focused monitoring could be necessary to demonstrate that the adaptive management feature performs as intended. The

monitoring would be focused to identify/confirm the type of effect intended by the feature. For instance, if the Tidegate sill is removed, the monitoring would focus on monitoring flows and water quality in Back River. The adaptive management funds identified in the previous section would be used to pay for this additional monitoring. Should the Cooperating Agencies determine additional monitoring is needed, then the monitoring period could be extended.

At the end of the monitoring period, the Corps would prepare a report on the effectiveness of the modification. The Corps would include a recommendation on whether further action is warranted. The Federal Cooperating Agencies (including Corps) would review the report and reach agreement on whether further action is needed.

11 LONG-TERM MONITORING

A. Goals. Monitoring would be conducted on a regular basis to ensure the project's recurring maintenance operations comply with environmental clearances and that the mitigation features continue to function as they are intended.

B. Major Components. For the project to reach this phase, the estuary would have reached its normal state of dynamic equilibrium and the Federal agencies determined that the mitigation features are effective. The Corps would inspect the mitigation features on at least an annual basis to determine if maintenance is required. Maintenance would be performed as a normal O&M activity.

Limited monitoring would be required to ensure the mitigation features continue to function as intended. Most of the mitigation features are designed to increase freshwater flows in Back and Middle Rivers. The other main physical feature located in the estuary would be the dissolved oxygen injection systems. The performance of all of these features could be assessed by monitoring salinity and water quality at specific critical points within the estuary. Therefore, the Long Term monitoring program is focused on providing that information.

The Corps would fund the USGS operation of continuous recorders for hydrologic and hydraulic data at four locations, as follows:

- 02198920 Savannah River at GA25, at Port Wentworth, GA
- 021989773 Savannah River at USACE Dock at Savannah, GA
- Back River at US 17 at Savannah, GA
- Savannah River at I-95

The Corps expects the Georgia Ports Authority to continue to fund (independent of SHEP) operation of a fifth station, 021989784 – Little Back River above Lucknow Canal, at the freshwater supply intake for the Savannah National Wildlife Refuge.

The estimated cost for this work is shown as follows:

Operate water quality stations	4 @ $69,250 = $277,000 per year

The Corps would perform a bathymetric survey every year at the following locations:

- McCoy's Cut
- Deepened area in Upper Middle River
- Deepened area in Little Back River

The estimated cost for these surveys is $60,000 per year.

The Georgia DNR-EPD and SC DHEC have mandated long-term monitoring of the sentry and background groundwater wells as a condition of their Section 401 Water Quality Certifications for the SHEP. These wells would be monitored for the life of the project, and an annual report would be prepared and submitted to the Georgia DNR-EPD summarizing the results of the monitoring. The cost to monitor the wells is estimated to be $7,500 per year.

The Corps would monitor water quality in effluent from CDFs as part of the annual O&M dredging program.

The costs to operate and maintain the dissolved oxygen systems are not included in this document. Those costs are shown elsewhere in the EIS.

C. Reporting. The USGS would include the hydrodynamic and water quality data collected at the continuous recorders in its annual state monitoring report. That report would be made available to the public. The Corps would furnish other data and internal reports to the agencies upon request.

D. Cost Summary. The annual costs for the long-term monitoring are summarized as follows:

Continuous Riverine Monitoring	$277,000
Annual Bathymetric Surveys	$ 60,000
Groundwater Wells	$ 7,500
Total	$344,500

These costs do not include the costs to operate and maintain the mitigation features. Periodic dredging may be needed to retain the flow capabilities of the flow-re-routing features. Adjustment of the rock used in these structures may be required after high river flows. Maintenance would also be needed to ensure the fish bypass at NSBL&D performs as intended. That maintenance would include periodic debris and sediment removal. The dissolved oxygen systems would need to be operated each year and maintained throughout their operating period. They would also need major rehabilitation when the equipment needs to be replaced. The annual cost to maintain the dissolved oxygen systems over the life of the project, including periodic replacement of equipment, is estimated to be $1,300,000.

Appendix C5

- **Savannah Harbor Expansion Project Cultural Resources Programmatic Agreement**

ENVIRONMENTAL IMPACT STATEMENT
APPENDIX G: Programmatic Agreement for Cultural Resources

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

US Army Corps of Engineers
Savannah District
South Atlantic Division

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PROGRAMMATIC AGREEMENT

AMONG THE US ARMY CORPS OF ENGINEERS, SAVANNAH DISTRICT, THE GEORGIA STATE HISTORIC PRESERVATION OFFICER, THE SOUTH CAROLINA STATE HISTORIC PRESERVATION OFFICER, AND THE US NAVY NAVAL HISTORY AND HERITAGE COMMAND

WHEREAS, the US Army Corps of Engineers, Savannah District (Savannah District), proposes to expand the Savannah Harbor Navigation Project by deepening the existing navigation channel between station 103+000 and -60+000 by up to 6 feet, extending the bar channel seaward, constructing bend wideners in selected areas along the existing channel, deepening the existing Kings Island Turning Basin, constructing passing lanes, disposing of dredged material in existing disposal areas and possible new sites, and creating fish and wildlife mitigation lands, as described in the attached letter report, and

WHEREAS, the Savannah Harbor Expansion Project lies within the States of South Carolina and Georgia, and

WHEREAS, the Savannah District recognizes that the proposed Savannah Harbor Expansion Project may have an effect upon properties included in or eligible for inclusion in the National Register of Historic Places (National Register)and has consulted with the Advisory Council on Historic Preservation (Council), the Georgia State Historic Preservation Officer (Georgia SHPO), and the South Carolina State Historic Preservation Officer (South Carolina SHPO) pursuant to regulation 36 CFR, Part 800 implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470h-2(f), and

WHEREAS, the Naval History and Heritage Command of the US Navy (US Navy) owns the National Register listed property CSS *Georgia* and has requested to be a Consulting Party for actions associated with this resource, and

WHEREAS, the definitions given in Appendix A are applicable throughout this Programmatic Agreement;

NOW THEREFORE, the Savannah District, the Consulting Parties composed of the Council, Georgia SHPO, the South Carolina SHPO, and US Navy agree that the project shall be administered in accordance with the following stipulations to satisfy Savannah District's Section 106 responsibilities for all individual aspects of the project.

Site Specific Stipulations

The Savannah District, subject to receiving funds appropriated by the Congress of the United States, shall ensure that the following measures are carried out:

In consultation with the consulting parties, the Savannah District shall prepare and implement a data recovery plan to mitigate impacts of the Savannah Harbor Expansion Project upon the CSS *Georgia*. The plan shall meet all requirements contained in the General Stipulations section of this Programmatic Agreement.

General Stipulations

The Savannah District, subject to receiving funds appropriated by the Congress of the United States, will ensure that the following measures are carried out:

1. The Savannah District shall ensure that archeological surveys of areas that may be affected by the proposed Savannah Harbor Expansion Project are conducted in a manner consistent with the Secretary of Interior's Standards and Guidelines for Identification (48 F.R. 44720-23) and any standards and guidelines developed by the Georgia SHPO and the South Carolina SHPO. The surveys shall be conducted in consultation with the Georgia SHPO and the South Carolina SHPO, and reports of the survey shall be submitted to the Georgia SHPO and the South Carolina SHPO for review and comment.

2. The Savannah District shall evaluate properties identified through the surveys in accordance with 36 CFR, Part 800.4. If the survey results in the identification of properties that are eligible for, or included in, the National Register of Historic Places, Savannah District shall determine the effect of the proposed project upon those resources in accordance with 36 CFR, Part 800.5.

3. The Savannah District shall identify and evaluate alternatives to avoid and/or mitigate adverse effects to properties determined eligible for inclusion, or included in, the National Register of Historic Places in accordance with 36 C.F.R. Part 800.6.

4. The Savannah District shall insure that data recovery plans are developed in consultation with the Georgia SHPO or South Carolina SHPO (as appropriate), and US Navy (as appropriate) for the recovery of archaeological data from properties determined eligible for inclusion in the National Register of Historic Places. The plans shall be consistent with the Secretary of the Interior's Standards and Guidelines for Archeological Documentation (48 F.R. 44734-37) and take into account the Council's publication, *Treatment of Archeological Properties* (Advisory Council on Historic Preservation 1980), and any standards and guidelines set forth by the Georgia SHPO, South Carolina SHPO, and US Navy (as appropriate). The plans shall specify, at a minimum:

a. the property, properties, or portions of properties where data recovery is to be carried out;

b. any property, properties, or portions of properties that will be destroyed without data recovery;

c. the research questions to be addressed through the data recovery, with an explanation of their relevance and importance;

d. the methods to be used, with an explanation of their relevance to the research questions;

e. the methods to be used in analysis, data management, and dissemination of data, including a schedule;

f. the proposed disposition of recovered materials and records;

g. proposed methods for involving the interested public in the data recovery;

h. proposed methods for disseminating results of the work to the interested public;

i. proposed methods by which local historic sites and historic preservation agencies and individuals will be kept informed of the work and afforded the opportunity to participate; and,

j. a proposed schedule for the submission of progress reports to the Savannah District, the Georgia SHPO, South Carolina SHPO, US Navy (as appropriate), and the Council.

5. The data recovery plans shall be submitted by the Savannah District to the Georgia SHPO and/or South Carolina SHPO (as appropriate), the US Navy (as appropriate),and the Council for 45 days review. Unless the Georgia SHPO, South Carolina SHPO, the US Navy (as appropriate), or the Council objects within 45 days after receipt of a data recovery plan, the Savannah District shall ensure that it is implemented.

6. The Savannah District shall ensure that all archeological survey, testing, and data recovery work carried out pursuant to this Programmatic Agreement is carried out by or under the direct supervision of a person or persons meeting at a minimum the standards for archeologist set forth in the Secretary of the Interior's Standards and Guidelines for Archeological Documentation (48 F.R. 44716-42).

7. The Savannah District shall ensure that all materials and records resulting from survey, testing, and data recovery are curated in accordance with 36 CFR, Part 79.

8. The Savannah District shall ensure that all final archeological reports resulting from actions pursuant to this agreement will be provided to the Georgia SHPO, the South Carolina SHPO, the US Navy (as appropriate), and the Council. The Savannah District shall ensure that all such reports are responsive to the contemporary professional standards, and to the Department of Interior's Format Standards for Final Reports of Data Recovery Programs (42 F.R. 5377-79).

9. Any party to this Programmatic Agreement may request that it be amended, whereupon the parties will consult in accordance with 36 CFR, Part 800.6(c)(7) to consider amendment.

10. The Council, the Georgia SHPO, the South Carolina SHPO, and US Navy (as appropriate) may monitor activities carried out pursuant to this Programmatic Agreement, and the Council will review such activities if so requested. The Savannah District will cooperate with the Council, the Georgia SHPO, the South Carolina SHPO, and the US Navy (as appropriate) in carrying out their monitoring and review responsibilities.

11. The parties to this agreement shall consult to review implementation of the terms of this agreement and determine whether revisions are needed. If revisions are needed, the parties to this agreement will consult in accordance with 36 CFR, Part 800 to make such revisions.

12. Any party to this agreement may terminate it by providing 30 days notice to the other parties, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination. In the event of termination, the Savannah District will comply with 36 CFR, Parts 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

13. Should the Georgia SHPO, South Carolina SHPO, the US Navy (as appropriate), or the Council object within 45 days to any actions proposed pursuant to the agreement, the Savannah District shall consult with the objecting party to resolve the objection. If the Savannah District determines that the objection cannot be resolved, the Savannah District shall request further comments of the Council pursuant to 36 CFR, Part 800.7. Any Council comment provided in response to such a request will be taken into account by the Savannah District in accordance with 36 CFR, Part 800.7 with reference only to the subject of the dispute; the Savannah District's responsibility to carry out all actions under this agreement that are not the subjects of the dispute will remain unchanged.

14. At any time during implementation to the measures stipulated in this agreement, should an objection to any such measure be raised by a member of the public, the Savannah District shall take the objection into account and consult as needed with the objecting party, the Georgia SHPO, the South Carolina SHPO, the US Navy (as appropriate), or the Council to resolve the objection.

15. In the event the Savannah District does not carry out the terms of the Programmatic Agreement, the Savannah District will comply with 36 CFR, Parts 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

Execution and implementation of this Programmatic Agreement evidences that the Savannah District has satisfied its Section 106 responsibilities for all individual undertakings of the program.

16. Nothing herein shall constitute, or be deemed to constitute, an obligation of future appropriations by the United States.

US ARMY CORPS OF ENGINEERS, SAVANNAH DISTRICT:

Jeffrey M. Hall DATE: 4 Nov 2011

Jeffrey M. Hall
Colonel, US Army
Commanding

GEORGIA STATE HISTORIC PRESERVATION OFFICER:

Dave Crass DATE: 22 NOV. '11

David Crass, Ph.D., Division Director and Deputy State Historic Preservation Officer

SOUTH CAROLINA STATE HISTORIC PRESERVATION OFFICER:

Elizabeth M. Johnson DATE: 11/30/2011

Elizabeth M. Johnson, Deputy State Historic Preservation Officer

US NAVY, NAVAL HISTORY AND HERITAGE COMMAND:

J.A. Delloach DATE: 2/23/12

J.A. Delloach, Rear Admiral, U.S. Navy (RET.)
Director, Naval History and Heritage Command

APPENDIX A
DEFINITIONS

Consulting Parties. The consulting parties for the entire project include the US Army Corps of Engineers, Savannah District, the Georgia State Historic Preservation Officer, the South Carolina State Historic Preservation Officer, and the Advisory Council on Historic Preservation. The Naval History and Heritage Command of the US Navy is a Consulting Party for any actions regarding the National Register listed property CSS *Georgia*.

CSS *Georgia*. The CSS *Georgia* was a Confederate ironclad that was constructed in Savannah in 1862, served in the harbor during the Civil War, and was scuttled on December 21, 1864, to prevent capture. The wreck site is located on the Savannah Harbor navigation channel bottom and side slope within Chatham County, Georgia, and Jasper County, South Carolina. The site was listed in the National Register of Historic Places in 1982 at the national level of significance for its architecture, association with important historical personages and events, and for its ability to provide information important in history. The vessel is owned by the US Government and is administered by the US Navy. The Naval History and Heritage Command of the US Navy will act as a Consulting Party for actions affecting this resource.

Savannah Harbor Expansion Project
Historic Properties

I. Previous and Proposed Agreement Documents for the Savannah Harbor Navigation Project

In 1992, Savannah District, the South Carolina and Georgia State Historic Preservation Offices, and the Advisory Council on Historic Preservation entered into a Programmatic Agreement to address impacts of the then existing Savannah Harbor Navigation Project and the then proposed harbor deepening project. This deepening project was completed in 1994. All stipulations of the agreement have been carried out.

In 1992, Savannah District, the South Carolina and Georgia State Historic Preservation Offices, and the Advisory Council on Historic Preservation entered into a Programmatic Agreement to address impacts associated with the closing of New Cut and removing the tide gate from operation in Savannah Harbor. Compliance with Stipulation 12 is continuing. All other stipulations have been carried out.

Stipulation 12 states: "In consultation with the Council, the GASHPO, and the SCSHPO, Savannah District will prepare a Memorandum of Agreement to outline procedures for identifying, evaluating, and mitigating and/or removing adverse effects of the Savannah Harbor Navigation Project upon the CSS *Georgia*, a property listed in the National Register of Historic Places."

In 2002, Savannah District and the Georgia Ports Authority initiated studies of the CSS *Georgia* to determine the effects of past and future harbor operation and maintenance activities and the effect of the proposed Savannah Harbor Expansion Project upon this property and to identify mitigation alternatives. The reports have been coordinated with the South Carolina and Georgia State Historic Preservation Officers.

Savannah District prepared a Programmatic Agreement to address Section 106 compliance for the proposed Savannah Harbor Expansion Project. Consulting Parties include the Georgia and South Carolina State Historic Preservation Offices, the Naval History and Heritage Command of the US Navy, and Savannah District. The Advisory Council on Historic Preservation decided not to participate. All parties reviewed and commented upon the draft agreement. All issues and concerns were resolved in the revised final version. The agreement document is currently being circulated for signatures.

II. Project Description

A. Deepen the existing 42-foot-deep inner harbor navigation channel by up to 6 feet between stations 0+000 and +103+000 and to a width that will not disturb existing side slopes. The present project features include an additional 2 feet of allowable over depth and up to 4 feet of advance maintenance dredging. These project features will be retained.

B. Deepen the existing 44-foot-deep bar channel by up to 6 feet from station 0+000 to station –60+000 and to a width that will not disturb existing side slopes. The present project features include an additional 2 feet of allowable over depth and up to 4 feet of advance maintenance dredging. These project features will be retained.

C. Construct bend wideners and perform full-channel-width dredging in isolated areas as necessary to facilitate ship movement.

D. Construct an approximately 38,600-foot-long extension to the 600-foot-wide bar channel to a depth of up to 50 feet plus 2 feet of allowable over depth and up to 4 feet of advance maintenance dredging.

E. Deepen the existing 42-foot-deep Kings Island Turning Basin by 6 feet. The present project features include an additional 2 feet of allowable over depth and up to 4 feet of advance maintenance dredging. These project features will be retained.

F. Construct a passing lane 100 feet wide on the north side of the channel from stations +55+000 to +60+000 and a passing lane 100 feet wide on the south side of the channel from stations +16+000 to +20+000.

G. Dispose of dredged material in existing Savannah Harbor operation and maintenance dredged material disposal areas.

H. Construct mitigation features for project impacts to environmental resources.

III. Alternatives Considered During Project Design in Order to Reduce the Area of Potential Effect.

The initial project design was to deepen the full channel bottom width for the entire 165,000-foot-long navigation channel by up to 10 feet. This design would have resulted in side slope sloughing that would have impacted an area up to 50 to 80 feet wide on either side of the navigation channel. The design was subsequently modified to deepen the channel by no more than 6 feet and to dredge to a width that would not affect existing side slopes.

The initial project design also included a series of 16 bend wideners varying from 76 to 156 feet in width and with a total length of over 56,000 linear feet. The results of a ship simulation study resulted in a new design with four bend wideners with widths from 76 to 156 feet and a total length of less than 15,250 linear feet and nine areas to be dredged to the full existing channel width with a total length of less than 49,000 feet.

IV. Area of Potential Effect

A. Channel bottom and side slopes of bar channel extension.

B. Channel bottom and side slopes of existing navigation channel.

C. Channel bottom and side slopes of bend wideners and channel side slopes where full-channel-width dredging will occur.

D. Channel bottom and side slopes of the Kings Island Turning Basin.

E. Channel bottom and side slopes in proposed passing lane areas.

F. Existing disposal sites.

G. Environmental mitigation features.

V. Previously Disturbed Areas Located within the Area of Potential Effect for which No Historic Property Investigations are Proposed

A. The existing navigation channel bottom between stations +103+000 and -52+000 has been dredged to a depth well below historic harbor depths. Historically, the deepest place in the inner harbor was a 30-foot-deep hole located near station +57+000 and the average channel depth was less than 15 feet. Any historic properties that were once located in the dredged channel bottom were removed by previous harbor deepening projects

B. That portion of the existing bar channel bottom located between stations -52+000 and -60+000 was surveyed prior to construction during the last harbor deepening project. No historic properties were located.

C. The side slopes and adjacent tops of slopes of the existing navigation channel between stations +103+000 and -60+000 were surveyed prior to construction of the last harbor deepening project. Historic properties that would be affected by construction of that project were identified and mitigated. Since much of the proposed project is to be constructed in a manner that will not alter existing channel side slopes and tops of slopes, these areas will not be investigated for historic properties, except in places where previous surveys have identified historic properties located immediately adjacent to the existing project.

D. Those portions of proposed bend wideners and the proposed passing lane that overlap existing harbor turning basins and channels that have been dredged to a depth of 38 or more feet, well below historic channel depths, will not be surveyed. Historic properties located in these areas would have been removed as part of previous dredging projects.

E. The bottom of the Kings Island Turning Basin has been dredged to a depth well below that which could have contained historic properties. This area will not be surveyed.

F. The existing Savannah Harbor dredged material disposal sites have been used for a number of years. Original land surfaces that may contain historic properties are buried under 30 or more feet of dredged material. Existing offshore disposal areas were designed to avoid impacts to any sonar targets or magnetic anomalies identified during the planning process.

VI. Areas Investigated or to be Investigated for Historic Properties

A. Channel bottom and side slopes of bar channel extension.

B. Sides slopes of the existing navigation channel between stations +103+000 and -60+000 in areas where the full channel width must be dredged to facilitate ship movements and in areas where historic properties abut the existing navigation channel.

C. Bottoms and side slopes of bend wideners where they do not overlap existing turning basins.

D. Sides slopes of the Kings Island Turning Basin.

E. Bottom and side slopes of proposed passing lanes.

F. Lands and water bottoms proposed for enhancement for project-related impacts to environmental resources.

VII. Investigations Completed or in Progress.

A. The portion of the existing navigation project that was deepened in 1994 (stations 103+000 to –60+000 plus the Kings Island Turning Basin) was surveyed at that time and historic properties were investigated and mitigated.

B. Remote sensing surveys were conducted of the Back River sediment basin area and portions on upper Back River were surveyed as part of the studies required under the terms of the 1992 Programmatic Agreement for the closing of New Cut and the removal of the tide gate from operation. The survey area included the Back River, from shore to shore, from the mouth of the sediment basin at its juncture with the Savannah Harbor navigation channel to Hog Island.

C. Investigations of the CSS *Georgia* to identify past, present, and future impacts from the existing navigation project and the effects of the proposed expansion project have been conducted. The reports of these investigations have been coordinated with the Georgia and South Carolina State Historic Preservation Offices.

D. In 2003, Savannah District contractor Panamerican Consultants, Inc., completed a survey of the first channel design.

E. In 2005, Savannah District contractor Panamerican Consultants, Inc., conducted a survey of new design elements and conducted diver investigations of a 10 magnetic anomalies and/or sonar targets located within the area of potential effect.

F. Savannah and Wilmington Districts conducted a study to determine the incremental effect of the proposed expansion project upon Ft. Pulaski National Monument.

G. In 1992, as part of the New Cut Closure Project studies, Savannah District contractor Tidewater Atlantic Resources, Inc., conducted low water shoreline and remote sensing surveys of the Back River from its mouth to the lower end of Hog Island in Little Back River. Thirty-one archaeological sites and 26 magnetic anomalies and/or sonar targets were recorded.

H. In 1993 and 1994, Savannah District archaeologists conducted archival research, archaeological survey, site documentation and monitoring, and diver investigations of the sites and anomalies/targets identified in Back River above the tide gate during the 1992 survey. A number of the sites were determined eligible for inclusion in the National Register of Historic Places. The report concluded that the New Cut Closure Project had caused erosion at some of the resources, but, these sites had since stabilized and the detailed research and documentation conducted by Savannah District was adequate to mitigate this effect.

I. Savannah District recovered core samples from an area of the proposed off-shore bend widener that analysis of sub-bottom profiler data indicated the presence of a Pleistocene stream channel. The cores were analyzed in and results reported by New South Associates, Inc., in 2005.

VIII. Resource Potential and Status of Investigations:

A. *Bar Channel Extension (Outside State Waters) –Stations –60+000 to –98,600--Bottom and Side Slopes.*

The project, as originally proposed, included a 25,000-foot long channel extension, Savannah District archaeologists and hydrographic surveyors conducted side scan sonar and cesium magnetometer surveys of the proposed channel extension area. The survey area was 700 feet wide, sufficient to include the 600-foot proposed channel width and side slopes. In 2005, Savannah District contracted with Panamerican Consultants, Inc., to analyze the data, identify anomalies and/or targets for further evaluation, and conduct diver investigations of potentially significant anomalies and/or targets. The contractor has completed the analyses and has investigated one magnetic anomaly/sonar target. The anomaly/target was identified as modern debris.

As part of studies to identify potential impacts to the Floridan Aquifer, Savannah District conducted sub-bottom profiler surveys of the existing bar channel area, as well as areas on the bar considered for bend wideners and channel extension. The purpose of the survey was to identify the depth and character of the aquifer's Miocene-age cap and to locate former Pleistocene stream channels that cut into the cap. Since stream banks have a higher potential for containing prehistoric archaeological sites, the results of these surveys were also examined by District archaeologists. No Pleistocene streams were found in the extension area.

Due to changes in shoals, in 2009, the bar channel extension was redesigned to be a 38,600- foot-long by 600-foot-wide channel located on a different alignment. Savannah District is contracting for a side scan sonar, magnetometer, and sub-bottom profiler, and diver investigation of the new location. In order to ensure that avoidance of impacts to potentially significant cultural resources is a viable alternative, the area being surveyed is 1100 feet wide. The survey is designed to locate shipwrecks and landforms likely to contain prehistoric sites.

B. Bend Wideners and Full-width Dredging Areas.

Bend Widener (SC waters)—Stations –21+000 to –14+000, 76-foot bottom width plus side slope of 20 feet. Savannah District archaeologists and hydrographic surveyors conducted side scan sonar and magnetometer surveys of this area. The survey area was 300 feet wide. In 2005, the District contracted with Panamerican Consultants, Inc., to analyze the data, identify anomalies and/or targets for further evaluation, and conduct diver investigations of the anomalies. The contractor completed the analyses and recommended no anomalies and/or targets for evaluation.

Sub-bottom profiler surveys conducted as part of the aquifer impact studies identified a Pleistocene stream channel that bisected this area. Savannah District geologists and a contract geoarchaeologist with Brockington and Associates selected four areas from which to take core samples—three located along the banks of the stream and one located on a terrace that formed within the stream channel as sea level rose. Analysis of the cores revealed that the sediments within and adjacent to the stream channel date to the mid-Pleistocene Era and are not associated with human activity.

Full-channel-width Dredging Area (SC waters)—Stations +9+000 to +12+750—side slope impact area of ca. 20 feet. The easterly 1000 feet has been previously impacted by construction of a 36-foot-deep turning basin. The remaining area was surveyed in 2003 by Savannah District contractor Panamerican Consultants for a then-planned 76-foot-wide bend widener plus side slopes. Eight anomalies and/or targets were recommended as potentially significant. Due to project redesign, all are located over 200 feet from the revised area of potential effect. No further investigations are recommended.

Full-channel-width Dredging Area (GA waters)—Stations +9+500 to +11+500—side slope impact area of ca. 20 feet. This area was surveyed for a previous deepening project. No magnetic anomalies and/or targets were located. No further investigations are recommended.

Full-channel width Dredging Area (SC waters)—Stations +27+250 to +31+750—side slope impact area of ca. 20 feet. In 2003, an area 300 feet wide was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with a then-planned 76-foot-wide channel widener plus side slopes. Ten magnetic anomalies and/or targets were recommended as potentially significant. Due to project redesign, all are located over 100 feet from the revised area of potential effect.

Full-channel-width Dredging Area (SC waters)—Stations +41+500 to +49+500—side slope impact area of ca. 20 feet. This area was surveyed as part of a previous deepening project. The survey identified four anomalies and/or targets for further evaluation. Two of the targets, SH-R15 and SH-R19N-1 were located within that project's area of potential of effect and were investigated. Both targets were found to be generated by modern debris. The remaining two anomalies/targets, SH-R16-2 and SH-R17N-1, have not been investigated. These targets will be relocated and assessed.

Full-channel-width Dredging Area (GA waters)—Stations +31+000 to +49+500—side slope impact area of ca. 20 feet. In 2003, an area 300 feet wide was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with a then-planned 76-foot-wide channel widener plus side slopes. Seven individual or clusters of anomalies and/or targets recommended as potentially significant are located within or near to the side slope impact area. Two anomalies and/or targets clusters (cluster 7C-1, 7C-9, 7C-10 and cluster 7E-6, 7E-14, 7E-18, 7E-34, 7E-53, 7E-55) were investigated by Panamerican Consultants, Inc., in 2005 and were found to be generated by modern debris. The remaining three potentially significant individual anomalies and one cluster are recommended for evaluation. Anomaly 7B-4 and anomaly cluster 7C-5, 7C-14 appear to extend into the area of potential effect and will be investigated.

Bend Widener (GA waters)—Stations +49+500 to +53+000—156-foot bottom width plus side slope of less than 75 feet. In 2003, an area 450 feet wide was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with this widener. In 2005, Panamerican Consultants considered diving on anomalies 7A-1 and 7A-8, but, further analysis of the fathometer data and additional remote sensing data gathered as part of that investigation found that the anomalies were located in the dredged channel bottom and were generated by modern debris. Anomaly 7A-9 would be located within the side slope of the proposed bend widener and, based on limited dated, anomalies 7A-26, 7A-28, 7A-31, and 7A-32 are located sufficiently near to the area of potential effect to warrant further investigation.

Bend Widener (SC waters)—Stations +52+250 to +55+000—76-foot bottom width plus side slope of less than 100 feet. In 2003, an area 350 feet wide was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with this widener. No anomalies and/or targets were recommended for further investigation. No further investigations are proposed for this bend widener.

Full-channel-width Dredging (GA waters)—Stations +63+250 to +69+000—side slope impact area of ca. 20 feet. The westernmost 1,750 feet of this area overlaps the Fig Island Turning Basin that has been previously dredged to 38 feet. The eastern portion of this area was surveyed as part of a previous deepening project. Five anomalies and/or targets were identified, none of which were recommended for additional investigation. No further investigations are recommended for this area.

Full-channel-width Dredging (GA waters)—Stations +69+000 to +71+000—side slope impact area of ca. 20 feet. In 2003, an area 500 feet wide was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with a then-planned 76-foot-wide channel widener plus side slopes. Four anomalies located within the existing channel side slope (4-22, 4-24, 4-26, and 4-27) are recommended for further investigation.

Full-channel-width Dredging (GA waters)—Stations +76+000 to +77+500—side slope impact area of ca. 20 feet. In 2003, an area 150 feet wide (to the shoreline) was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with a then-planned 76-foot-wide channel widener plus side slopes. One anomaly (3-1) was recommended for additional investigation based on the characteristics of its magnetic signature, however, this anomaly is located at the toe of the side slope of the existing navigation channel in an area that has been dredged to 36 feet for commercial wharves. Based on the history of bottom disturbance in this area, no further investigations are recommended for this anomaly.

Full-channel-width Dredging (GA waters)—Stations +87+750 to +89+500—side slope impact area of ca. 20 feet. In 2003, an area 400 feet wide (to the shoreline) was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with a then-planned 76-foot-wide channel widener plus side slopes. No anomalies and/or targets located within the side slope impact area were recommended for further investigation. No further investigations are proposed for this area.

Bend Widener (GA waters)—Stations +101+000 to +103+000—128.6 feet plus side slope of less than 100 feet. This area was investigated by a Georgia Ports Authority archaeological contractor as part of studies conducted for proposed channel modifications associated with the construction of Container Berth 8. Section 106 compliance was completed as required by a Department of the Army Permit issued under the authority of Section 404 of the Clean Water Act of 1972. It has since been dredged. No further investigations are recommended for this area.

C. *Kings Island Turning Basin Side Slopes (GA waters)—Stations 98+500 to 100+500—side slope impact area of ca. 20 feet.*

In 2003, an area 150 feet wide (to the shoreline) was surveyed by Savannah District contractor Panamerican Consultants, Inc., in order to identify potential impacts associated with side slope changes. No anomalies and/or targets were recommended for additional investigation. Two shoreline sites that had been identified by a previous survey and determined not to be eligible for inclusion in the National Register of Historic Places were relocated. No further investigations are recommended for this area.

D. *Passing Lanes*

GA and SC waters—Stations +55+000 to +68+500—100 feet wide plus side slope of less than 100 feet.

In 2005, Savannah District contractor Panamerican Consultants, Inc., surveyed an area 400 feet wide to identify potential impacts associated with this passing lane. One previously identified resource, CSS *Georgia*, is located within this area and is discussed in the following section. The survey also identified a number of magnetic anomalies and sonar targets, six of which were selected for diver investigation. Three were found to be generated by modern harbor debris, one (GA waters) was generated by the remains of a steel-hulled sailing vessel dating to the late nineteenth or early twentieth century, and two (SC waters) were generated by the remains of Confederate crib obstructions.

The sailing vessel has been tentatively identified as the pilot boat *Eclipse*, which burned in this general area in 1918. The vessel is potentially eligible for inclusion in the National Register of Historic Places. It is located behind (north of) the submerged remains of the original Fig Island jetty where historical documentation indicates that the bark *Undine* was also abandoned in 1893. *Undine* was built in 1867 as a clipper ship by William Pyle of Sunderland, England. Attempts were made to redesign the passing lane to avoid impacts to these resources, however, it was found that a shorter lane would not meet the needs of the larger vessels transiting the channel.

The Confederate crib obstructions, although severely degraded, are sufficiently intact for the site to be recommended as eligible for inclusion in the National Register of Historic Places at the local level for their archaeological research potential and association with significant events.

GA waters—Stations +16+000 to +20+000—100 feet wide plus side slopes of less than 100 feet.

An area 100 feet wide was surveyed in 1994 for the previous channel deepening project. No potentially significant sonar targets or magnetic anomalies were located in this area. The remaining 100-foot-wide impact area associated with the construction of the proposed passing lane will be surveyed. Archival research has shown that this area of the harbor has the lowest potential for containing shipwreck remains.

E. *Fish and Wildlife Mitigation Lands (GA and SC)*

In compliance with requirements of the Clean Water Act, Savannah District is working with the US Fish and Wildlife Service, US Environmental Protection Agency, the Georgia Department of Natural Resources, and the South Carolina Department of Health and Environment identified properties to be used, and actions to be taken, for mitigation of wetland impacts. Lands being considered include wetlands, submerged river bottoms, and high ground.

Plan 6a. This plan includes the following features, McCoy Cut diversion structure, channel deepening on McCoy Cut to -4m NGVD and Upper Middle and Little Back Rivers to -3m NGVD, fill entire sediment basin to -3.85M NGVD by constructing a submerged sill, close Rifle Cut, remove tide gate abutments and piers, close lower (western) arm of McCoy Cut. Because the proposed features are designed to change the hydraulics of the Middle, Little Back, and Back Rivers, the area of effect includes the construction areas as well as any areas that will be subjected to increased erosion or deposition. In order to determine the effect of the proposed plan upon historic properties, the construction areas, as well as the entire lengths of Middle, Little Back, and Back River channels and shorelines will need to be archaeologically surveyed. These surveys will include archival research, shoreline low water survey and testing, remote sensing (magnetometer and side scan sonar) surveys of submerged areas, and diver investigation of anomalies and/or targets.

One portion of Back River has been surveyed previously. In 1992, Tidewater Atlantic Research, Inc., conducted remote sensing and low water surveys of the Back River area as part of the studies required under the terms of the 1992 Programmatic Agreement for the closing of New Cut and the removal of the tide gate from operation. The survey area included the Back River, from shore to shore, from the mouth of the sediment basin at its juncture with the Savannah Harbor navigation channel to lower end of Hog Island in Little Back River. The survey identified 31 archaeological sites. Sixteen were wrecked or abandoned vessels. One was a prehistoric archaeological site. The remaining sites were related to historic rice plantations (e.g. wharves, dikes, dams, bulkheads, canals, trunks, mills, etc.). The 1992 survey also identified 26 magnetic anomalies and/or sonar targets.

In 1993 and 1994 Savannah District archaeologists conducted archival research, archaeological survey, site monitoring, and diver investigations of sites, magnetic anomalies, and/or sonar targets in the portion of the 1992 survey area located above the tide gate. The purpose of the work was to determine the historical significance of the previously recorded resources and to assess the effect of the New Cut Closure Project upon these resources. A number of sites were determined eligible for inclusion in the National Register of Historic Places. The research concluded that the project had caused some erosion, the areas had stabilized and the extensive documentation conducted during the survey was sufficient to document the portions of the resources that were impacted. The potential impact of Plan 6a upon these resources will be evaluated.

Seven of the magnetic anomalies and/or sonar targets were located in the sediment basin area below the tide gate. More detailed evaluations of these anomalies/targets are needed to determine if they are located within the area of potential effect and their potential significance.

The remaining portions of the area of effect for Plan 6a are located within the Savannah National Wildlife Refuge. None of these areas have been previously surveyed for cultural resources.

Oxygenation Systems. Two areas have been proposed for construction of oxygenation systems. The area of effect for these systems includes the construction areas, as well as the submerged areas near the outlet pipes that would be subjected to larger increases in oxygen levels. Increases in oxygen result in increased degradation of submerged resources (e.g. wrecks, wharves, artifacts, etc.),

One system would be located on the South Carolina side of Back River at the tide gate. The terrestrial and submerged areas have been severely disturbed by tide gate construction and disposal of dredged material. The second system would be above the harbor located on Drakies Bluff in Georgia. The terrestrial portions of the area of effect will be surveyed for historic properties. The submerged portion of the area of effect includes a channel known as Drakies Cut. Historically, this was a small creek known as Canoe Cut. The creek was enlarged (drag lines and dredging) in the early 20th century and became the main navigation channel.

Other Environmental Mitigation Features. Other proposed environmental features include: constructing a boat ramp on Hutchinson Island, construct a fish passage at New Savannah Bluff Lock and Dam, stocking of striped bass, and restoring brackish marsh in existing Disposal Area 1S. Fish stocking will have no effect upon historic properties. The Hutchinson Island boat ramp would be located in Georgia within the area that was heavily disturbed during Tide Gate Construction and that has previously been determined to not contain historic properties. The fish ladder would be located in South Carolina in an area believed to have been disturbed during original lock and dam construction. Savannah District will conduct archival research and an archaeological survey during the design process to verify that the entire area has been disturbed. Disposal Area 1S (Georgia) was not surveyed prior to its use as a Savannah Harbor disposal area. While it is unlikely that any historic properties buried beneath the disposal sediments would retain sufficient integrity to be determined eligible for inclusion in the National Register of Historic Places, Savannah District will conduct archival research and coring investigations to investigate this possibility.

IX. Previously Identified Significant Properties Located in the Vicinity of the Area of Potential Effect Warranting Special Consideration.

A. *National Monuments.*

Fort Pulaski National Monument (GA)--Station -2+000 to 8+000. Constructed during the 1830s and 1840s, Fort Pulaski is operated and maintained as an historic site by the National Park Service. It is included in the National Register of Historic Places at the national level of significance for its architecture, association with significant events, association with significant people, and archaeological research potential. Erosion is an on-going problem on the channel ward side of monument property. While the fort itself is not endangered by the erosion, associated archaeological deposits may be. The shoreline is well outside the channel side slope and the erosion is unassociated with channel maintenance dredging.

The Monument has expressed concern about the incremental effect of wakes from deeper draft ships that would transit a deeper navigation channel. Savannah and Wilmington Districts conducted an engineering study to determine the nature and scope of this incremental effect. This study concluded that the proposed expansion project would result in a negligible increase in erosion. No further studies are recommended.

B. *National Historic Landmarks.*

Savannah National Historic Landmark District (GA)--stations +72+000 to +79+000. The Savannah National Historic Landmark District is located along the south shore of the Savannah Harbor navigation channel. The district is listed in the National Register of Historic Places at the national level for its architecture. All but one small area is protected by modern bulkheads, wharves, or rip rap. The exception is located near station +75+500 where a brick-faced wharf constructed during the last quarter of the nineteenth century forms an alcove in the modern bulkhead. This area is used for small boat mooring. Proposed channel improvements will have no effect upon the landmark district.

Fort James Jackson National Historic Landmark (GA)--station +58+000 and +59+000. Fort Jackson is located at the top of the channel side slope on the south shore of the Savannah Harbor navigation channel. It is owned by the State of Georgia and is operated and maintained as a historic site by the Coastal Heritage Society. It is listed in the National Register at the national level of significance for its architecture and association with significant events and historic figures. In 2003, in accordance with a Memorandum of Agreement between Savannah District and the Georgia State Historic Preservation Office, the District completed a bank stabilization project to protect this property from harbor operation and maintenance activities. The potential for future harbor deepening was considered in the design process. No further protection is required for this property.

C. *National Register Listed Sites.*

CSS *Georgia* (SC & GA waters)--station 58+500 to 59+000. The wreck of CSS *Georgia* is included in the National Register of Historic Places at the national level of significance for architecture, association with significant events, association with significant people, and archaeological research potential. The National Register boundary includes the channel side slope, the top of slope, and an area extending 50 feet into the authorized navigation channel. The boundary between South Carolina and Georgia runs through the wreck site. Since 1984, Savannah District has had an agreement with both states to avoid the site area during dredging by 50 horizontal feet for a distance of 1000 feet along the channel. No dredging has been conducted of any portion of the existing navigation channel located between stations +58+000 and +59+000 since 1992.

A 1992 Programmatic Agreement required Savannah District to determine past, present, and future effects of the existing Savannah Harbor Navigation Project upon this resource and to identify and evaluate alternatives to mitigate these effects. This evaluation study was conducted in 2003 in conjunction with studies to determine the incremental effect of

the proposed expansion project. The studies demonstrated that past, present, and future operation and maintenance activities have, and will continue to have, an adverse effect upon the wreck site. In addition, the proposed passing lane that would be constructed as part of the expansion project would adversely affect the site. The draft report of these investigations has been coordinated with the Georgia and South Carolina State Historic Preservation Offices. The Savannah Harbor operation and maintenance project will conduct archaeological data recovery prior to construction of the expansion project. The expansion project will be responsible for final clearance of explosive ordnance prior to deepening the channel and constructing the passing lane.

The Savannah and Ogeechee Canal (GA)--station +79+000. The river lock and northern terminus of the Savannah and Ogeechee Canal is located on the south shore adjacent to the Highway 17 Bridge. The canal was constructed during the 1830s. It is listed in the National Register of Historic Places at the state level for architecture and archaeological research potential. The proposed project will have no effect upon the canal.

D. *Properties Pending Formal Nomination to the National Register of Historic Places.*

Pennyworth Island (Back River, GA). During 1993 and 1994, Savannah District archaeologists conducted archival research, shoreline inspection, and documentation of sites along the shoreline of Pennyworth Island, in support of the New Cut Closure Project. As a result of these investigations, Savannah District recommended that Pennyworth Island was eligible for inclusion in the National Register of Historic Places at the local level for its ability to provide information on 19th century rice culture along the Savannah River. The island had a diverse history spanning the period from 1825 to the early 20th century and was one of the last active rice plantations on the river. The investigations documented all historic shoreline features, noted that shoreline erosion had been on-going for many years, and recommended that no further work be conducted for the New Cut Closure Project.

The island was in private ownership during the 1993/1994 fieldwork. Recently, it was purchased by Chatham County. The County used the 1993/1994 research to prepare a nomination to the National Register of Historic Places. The nomination is pending approval. The island may be affected by the proposed environmental mitigation measures included in the Savannah Harbor Expansion Project. Affects may include increased shoreline erosion or accretion and will be addressed in accordance with the Programmatic Agreement for the project.

E. *Properties Formally Determined Eligible for Inclusion in the National Register of Historic Places.*

Fig Island Channel Site (GA)--station +72+000 to +73+500. The Fig Island Channel Site is located on the north side slope and shore of the existing navigation channel. The site has been determined eligible for inclusion in the National Register of Historic Places at the state level for its archaeological research potential. The site area was once a channel

between Fig and Hutchinson Islands. The channel was used for disposal of wrecked and derelict vessels during the eighteenth and nineteenth centuries.

The eastern third of the site has been bulk headed and lies beneath the US Army Corps of Engineers Depot. The western two-thirds of the site has been the subject of a number of archaeological investigations. The District excavated and documented three vessels as mitigation for the effects of a 1980s channel widening project. During the 1993/94 deepening project, the District excavated and documented parts of 20 vessels. The vessels spanned the period ca. 1770 to 1900 and were located within the area of potential effect for that deepening project.

In 2000, portions of the site's 1854 pile dam wall were illegally removed. In 2003, the extreme western portion of the site was investigated as part of planning for a Chatham County project that included bulk heading the adjacent slip. One eighteenth century hull was located within the project's potential area of effect. This project requires a Department of the Army Permit that would be issued under the authority of Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1972. Federal permitting and consultation under Section 106 is proceeding as part of that project. A Memorandum of Agreement has been completed identifying mitigation procedures for effects to this resource.

The remaining non-bulk headed portions of the site have been purchased by a developer who intends to bulkhead the shoreline and construct residential and commercial buildings on the site. The bulkhead would require a Department of the Army permit. The project is in an early planning stage and the owner has not applied for a permit.

The Fig Island Channel Site area will not be affected by bend widener construction or full- channel-width dredging, however, since the channel side slope has been determined eligible for inclusion in the National Register of Places, the District has conducted a slope stability analysis study to determine if incremental erosion would occur at the site. The analysis indicated that there would be no impact to the side slope.

Mansfield/Shaftsbury Plantation—09CH685 (Back River, GA). Savannah District archaeologists conducted archival research and field documentation for this plantation as part of the 1993/1994 New Cut Closure Project studies. The plantation was recommended eligible for inclusion in the National Register at the local level of significance for its ability to provide information on historic rice culture along the Savannah River. No further investigations were recommended for this resource as part of the New Cut Closure Project. The site may be affected by increased shoreline erosion or accretion as part of the Savannah Harbor Expansion Project. Impacts to the site will be identified and addressed in accordance with the Programmatic Agreement.

Poplar Grove Plantation—38JA203 (Back River, SC). Savannah District archaeologists conducted archival research and field documentation for this plantation as part of the 1993/1994 New Cut Closure Project studies. The plantation was recommended eligible for inclusion in the National Register at the local level of significance for its ability to

provide information on historic rice culture along the Savannah River. No further investigations were recommended for this resource as part of the New Cut Closure Project. The site may be affected by increased shoreline erosion or accretion as part of the Savannah Harbor Expansion Project. Impacts to the site will be identified and addressed in accordance with the Programmatic Agreement.

Shubra Plantation—38JA204 (Back River, SC). Savannah District archaeologists conducted archival research and field documentation for this plantation as part of the 1993/1994 New Cut Closure Project studies. The plantation was recommended eligible for inclusion in the National Register at the local level of significance for its ability to provide information on historic rice culture along the Savannah River. No further investigations were recommended for this resource as part of the New Cut Closure Project. The site may be affected by increased shoreline erosion or accretion as part of the Savannah Harbor Expansion Project. Impacts to the site will be identified and addressed in accordance with the Programmatic Agreement.

X. Consultation with Native American Tribes

The notice of availability for the 1998 draft Environmental Impact Statement for the expansion project was provided to a number of Native American Tribes. In March 2006 and November 2010, coordination letters were sent to the nineteen Federally recognized Native American Tribes who have an interest in the proposed project area informing them of the status of the project and inviting their comments. Several Tribes responded and requested that they be notified should sites with Native American components be encountered.

XI. Consultation with the Georgia and South Carolina Historic Preservation Offices

The draft Programmatic Agreement (PA) and preliminary project description were coordinated with the Georgia and South Carolina Historic Preservation Offices in March 2006. Shortly after both offices reviewed and approved the agreement, it was determined that project planning would proceed for an extended period and it was likely that large, new features would be added. It was decided to hold the document until more of the new features and their potential effect on historic properties could be identified. While the agreement document itself has not been changed, the attached supporting documentation report (this document) has been updated to reflect the final proposed project. The PA and supporting documentation are being re-coordinated with the state offices.

XII. Consultation with the Advisory Council on Historic Preservation

The Advisory Council on Historic Preservation was contacted in May 2006 and asked if they wished to participate in the Programmatic Agreement. They indicated that they would not participate at that time. They are being contacted to reconfirm that position.

XIII. Public Involvement

A number of public involvement meetings have been held as part of the National Environmental Policy Act compliance activities. Two of these events included manned cultural resources information booths which informed the public about the cultural resources studies and potential impacts to these resources.

Savannah District conducted a media day and created brochures during studies of the CSS *Georgia*. A local television station ran a series of stories on the progress of the investigations and one former reporter is creating a documentary about the vessel. District archaeologists made presentations to a large number of groups. Among them were the Society for Georgia Archaeology, local chapters of the Sons of Confederate Veterans and the United Daughters of the Confederacy, the Coastal Georgia Archaeological Society, an honors sorority, and other groups.

The 1998 draft environmental impact statement elicited 1,588 responses from individuals supporting archaeological recovery of the CSS *Georgia* and stabilization of Fort James Jackson (since completed).

C5
8-Step Process for EO 11988: Floodplain Management

8-Step Process for
EO 11988: Floodplain Management

Savannah Harbor Expansion Project (SHEP) Georgia and South Carolina: Fish Passage at New Savannah Bluff Lock and Dam (NSBLD) Integrated Post Authorization Analysis Report and Environmental Assessment
-- Section 1319 of the 2016 Water Infrastructure Improvements for the Nation Act
--Decision Process for E.O. 11988 as Provided by 24 CFR §55.20

Step 1: ***Determine whether the action is located in a 100-year flood plain (or a 500-year flood plain for critical actions).***

This action is located in a 100-year flood plain. The Recommended Plan is the construction of a fixed crest weir that would be 500 feet in width with an average crest elevation of 109.2 feet NAVD88. A floodplain bench approximately 275 feet in width would be excavated down to elevation 110 NAVD88 on the Georgia side of the existing dam location. The bench would ease the passage of flood waters past that point in the river. The dam would be removed. Therefore, E.O. 11988 applies. An evaluation of direct and indirect impacts associated with construction, occupancy, and modification of the flood plain is required.

Any modifications to the structure of NSBLD are likely to have an impact on water surface elevations within the pool of the Savannah River upstream of the existing lock and dam. Normal pool elevations upstream of the dam are likely to be lower during normal flow conditions, and there will be more variability in the pool elevation due to the construction of a fish passage structure.

This alternative would not cause any additional flooding for the 2-year through 100-year flood events. The relatively low weir crest elevation and flood bench provide sufficient conveyance to pass high flows without inducing additional inundation in the overbanks.

Step 2: ***Notify the public for early review of the proposal and involve the affected and interested public in the decision making process.***

The District issued a public notice to inform stakeholders and natural resource agencies that it is conducting an evaluation to identify the best way to modify the SHEP as required by the WIIN Act. The District received numerous comments on the proposed study. The District also attended an education workshop on May 31, 2017, that was hosted jointly by the Augusta Chamber of Commerce, the City of Augusta, and the City of North Augusta. That workshop provided additional information on the issues in the community that could be affected by the SHEP fish passage feature.

Due to the complex nature of the project, the historical relativity and local interests, and the nature of the changes posed by the project and the WRDA 2016 legislation, the Savannah District developed a wide range of opportunities for public engagement at various points during the planning process. For more details see section 5.1 of the integrated document. Some public concerns that were brought to USACE attention are:

- Rehab the lock and dam
- Integrate a fish ladder
- Maintain the pool and riverfront
- Allow fish to move to Augusta Shoals
- Protect the shoals lily
- Ensure boat races continue
- Keep flood protection
- River is of economic importance to the city

A draft EA will be sent out for public review in 2018.

Step 3: *Identify and evaluate practicable alternatives.*

The objective of this study is to mitigate for impacts to shortnose and Atlantic sturgeon by building a fish passage at the NSBLD.

The planning constraints identified in this study are as follows:
• The study is constrained in developing the alternatives based on the "project modifications" required in WRDA 2016.
• No rise impacts to 1 percent chance exceedance (100-year) flood plain
• The study approach was limited to analyzing the flood risk, and impacts to navigation, water supply, and recreation.
• Construction of the SHEP fish passage is required to start by January 2021 and be completed within 3 years in accordance with the SHEP Biological Opinion.

SHEP fish bypass study considered several alternative sites and actions:

A. Locate the Project Within the Flood plain

1. No Action Alternative

The NAA typically represents the most likely future without project condition. As described previously (Sections 1.0 and 1.2.2), USACE is retaining SHEP Plan A (Figure 14) as the NAA (page 28 of Appendix C – Final SHEP 2012 EIS) because it was the authorized plan on the date of enactment of the WIIN Act.

2. Alternative 1-1 – Repair Lock Wall Georgia Side Fish Passage

Alternative 1-1 (Figure 15) consists of repairing the NSBLD gates and piers and the riverside lock wall (Figure 16). Additionally, a 200' wide fish ramp structure would be constructed through the lock chamber and into the adjacent area of the park on the Georgia side of the river. The fish passage structure would be constructed with boulders and stone sized following the same design that was previously-approved for the bypass. The structure would have a 2 percent slope upstream to the weir crest, and a 10 percent slope upstream from the crest to the river bed.

3. Alternative 2-3 – Fixed Crest 500' (Recommended for further consideration)

Alternative 3 (Figure 17) consists of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The fish passage structure would constructed as described in Alternative 1-1 with these changes. The lock and dam would be removed, including the foundation, down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 106.22 feet (NAVD88, 107.0 NGVD29).

4. Alternative 2-6a – Fixed Crest with Bench

Alternative 2-6 (Figure 18) consists of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The fish passage structure would be constructed as described in Alternative 1-1 with these changes. The lock and dam would be removed (Figure 16), including the foundation down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 109.22 feet NAVD88 (110.0 NGVD29). A floodplain bench (Figure 19) approximately 275 feet in width would be excavated to elevation 110 feet NAVD88 (110.8 NGVD29) on the Georgia side of the existing dam location. The bench would ease the passage of flood waters past that point in the river. The bench would be there (grassed or rock lined) to prevent erosion.

5. Alternative 2-6b – Fixed Crest Weir with Bench

Alternative 2-6b (Figure 20) consists of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The fish passage structure would constructed as described in Alternative 1-1 with these changes. The lock and dam would be removed (Figure 16), including the foundation, down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 106.2 feet (NAVD88, 107.0 NGVD29). A floodplain bench (Figure 19) approximately 275 feet in width would be excavated to elevation 110 (NAVD88) on the Georgia side of the existing dam location. The bench would ease the passage of flood waters past that point in the river. The bench would be (grassed or rock lined) to prevent erosion. The floodplain bench would be partially inundated for the 1-yr return interval flow of 16,500 cfs.

6. Alternative 2-6c – Fixed Crest Weir with Bench

Alternative 2-6c (Figure 20) consists of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The fish passage structure would constructed as described in Alternative 1-1 with these changes. The lock and dam would be removed (Figure 16), including the foundation, down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 107.2 feet (NAVD88, 108.0 NGVD29). A floodplain bench (Figure 19) approximately 275 feet in width would be excavated to elevation 110 (NAVD88) on the Georgia side of the existing dam location. The bench would ease the passage of flood waters past that point in the river. The bench would be (grassed or rock lined) to prevent erosion. The floodplain bench would be partially inundated for the 1-yr return interval flow of 16,500 cfs

7. Alternative 2-6d – Fixed Crest Weir with Bench

Alternative 2-6d (Figure 20) consists of a fixed crest weir with a rock ramp sloping upstream from the existing dam location. The fish passage structure would constructed as described in Alternative 1-1 with these changes. The lock and dam would be removed (Figure 16), including the foundation, down to elevation 91.22 (NAVD88). The weir would be 500 feet in width with an average crest elevation of 108.2 feet (NAVD88, 109.0 NGVD29). A floodplain bench (Figure 19) approximately 275 feet in width would be excavated to elevation 110 (NAVD88) on the Georgia side of the existing dam location. The bench would ease the passage of flood waters past that point in the river. The bench would be (grassed or rock lined) to prevent erosion. The floodplain bench would be partially inundated for the 1-yr return interval flow of 16,500 cfs

8. Alternative 2-8 – Fixed Crest with 2 Gates

Alternative 2-8 (Figure 10) consists of a fixed weir with a rock ramp at the existing dam site with an active flood passage structure in an excavated bypass channel through the park on the Georgia side of the river. The fish passage structure would constructed as described in Alternative 1-1 with these changes. The structure in the bypass channel would consist primarily of two 50' gates used to pass high flows. The bypass channel would ease the passage of flood waters past that point in the river.

The weir would be 500 feet in width with an average crest elevation of 109.22 feet NAVD88 (110.0 NGVD29). The lock and dam would be removed, including the foundation down to 91.22 feet NAVD88.

B. Locate the Project Outside of the Flood plain

No alternatives located outside of the flood plain were considered as part of the final array. During preliminary analysis, alternatives which did not meet the goals of the project, were not cost effective, or involved HTRW were eliminated

C. No Action or Alternative Actions that Serve the Same Purpose

A no action alternative was considered and rejected because without any action, required mitigation under the Endangered Species Act of 1973 would not be accomplished.

Step 4: ***Identify Potential Direct and Indirect Impacts of Associated with Flood plain Development.***

Section 3.6.1 of the Integrated Document for this project describes the impacts to the flood plain that would be expected under each alternative. With implementation of the recommended plan, the weir and the flood plain bench would lower the pool and contain floodwaters within the existing flood plain and would not adversely impact the flood plain.

Step 5: ***Where practicable, design or modify the proposed action to minimize the potential adverse impacts to lives, property, and natural values within the flood plain and to restore, and preserve the values of the flood plain.***

The four 2-6 (a, b, c, and d) alternatives are variation on changing the weir height. This was done as tradeoff analysis between recreational impacts and low level flooding of property.

Step 6: ***Reevaluate the Alternatives.***

Although the Recommended Plane is in a flood plain, the project has been designed in order to minimize effects on flood plain values.

The no action alternative is impracticable because it will not satisfy the need to provide Mitigation.

Step 7: ***Determination of No Practicable Alternative***

It is our determination that there is no practicable alternative for locating the project out of the flood zone. This is due to the need to mitigate by allowing fish passage in the river.

A final notice will be published during the public review of these documents.

Step 8: ***Implement the Proposed Action***

USACE will assure that this plan, as modified and described above, is executed and necessary language will be included in all agreements with participating parties. USACE will also take an active role in monitoring the construction process to ensure no unnecessary impacts occur nor unnecessary risks are taken.