ENVIRONMENTAL IMPACT STATEMENT
APPENDIX S: Essential Fish Habitat Evaluation

SAVANNAH HARBOR EXPANSION PROJECT

Chatham County, Georgia and Jasper County, South Carolina

January 2012

ADDENDUM 1

NMFS Draft Essential Fish Habitat Conservation Recommendations

US Army Corps of Engineers
Savannah District
South Atlantic Division

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Essential Fish Habitat provisions of the
Magnuson-Stevens Fishery Conservation and Management Act

The NMFS Southeast Region's Habitat Conservation Division has reviewed the Draft Environmental Impact Statement (EIS), Draft General Re-evaluation Report (GRR), and the additional information provided by the U.S. Army Corps of Engineers (COE) for the essential fish habitat (EFH) consultation for the Savannah Harbor Expansion Project (SHEP). The COE concludes SHEP would not have significant adverse impacts on EFH or federally managed fishery species. The documents and information provided are sufficient for NMFS to evaluate this determination and to provide appropriate EFH conservation recommendations.

EFH Consultation History
Section 1 of the Biological Opinion provides a chronology of the coordination that has occurred between the COE and NMFS since 1991. While not a list of all meetings that occurred, the chronology includes the key elements of the EFH consultation and is incorporated into this review by reference.

Proposed Project
Section 2.1 of the draft Biological Opinion describes the proposed action, and that section of the draft Biological Opinion is incorporated into this review by reference. Since the Draft EIS and Draft GRR were released in November 2010, two modifications to SHEP have occurred that are significant for the EFH consultation:

- NMFS anticipates the COE will identify the National Economic Development (NED) plan in the Final EIS and Final GRR as its preferred alternative; i.e., the COE will propose deepening the federal navigation channel to 47 feet. In the Draft EIS and Draft GRR, the COE discussed a proposal by the Georgia Ports Authority to deepen the channel to 48 feet (i.e., there was a Locally Preferred Plan and the COE indicated it was inclined to accept that plan as the Recommended Plan), but the Georgia Ports Authority has since withdrawn this proposal. Should the project be amended to deepen the channel to 48 feet, the COE would need to reinitiate EFH consultation.
- NMFS anticipates the Final EIS and Final GRR will specify placement of all sediment from the Entrance Channel (Ocean Bar Channel) into either the Savannah Ocean Dredged Material Disposal Site (ODMDS) or an upland confined disposal site. The COE communicated this change to NMFS on March 23, 2011, in the COE's detailed response to the comments NMFS provided on January 25, 2011. Should the project be amended to reintroduce disposal at locations other than the ODMDS or upland confined disposal sites, the COE would need to reinitiate EFH consultation.

Entrance Channel (Ocean Bar Channel) Deepening and Extension
In November 2009, the COE first advised NMFS of the need to extend the Ocean Bar Channel seaward of station -60+000B (which marks the seaward limit of the existing channel). The length and dredging needed for this extension would depend on the project depth (DEIS Table 3-1). Under the NED plan, the channel would be lengthened 37,860 feet. Table 3-9 of the Draft EIS does not list the volume of material that would need to be dredged to extend the channel to the 47-foot depth contour, but based on the information provided it appears to be on the order of four million cubic yards.

It is uncertain whether hardbottom habitat occurs in the path of the proposed channel extension. The Southeast Area Monitoring and Assessment Program (SEAMAP-SA 2001[1]) reports hardbottom may be present within or adjacent to the proposed channel extension (Draft EIS, Appendix S, Figure 9-1). The precision of the maps within SEAMAP-SA (2001) is limited. While some data examined include direct observations of the sea bottom, habitat affinities of fish caught by trawls or traps are also considered and used to infer whether hardbottom is near the trawl or trap. Also, because of the difficulties of accurately determining sample locations of historical data, SEAMAP-SA (2001) reports habitat after aggregating data into grid cells measuring 1 minute of latitude by 1 minute of longitude. Based on anecdotal accounts, the COE believes no hardbottom habitat occurs in the path of the proposed channel extension. The late inclusion of the channel extension component into the overall project design has prevented the COE from performing the sea bottom surveys normally included in a Draft EIS. To address this deficiency, the COE proposes to survey the area when developing the detailed plans needed for soliciting dredging contracts (i.e., after conclusion of interagency and public coordination required by the National Environmental Policy Act).

Any hardbottom habitat impacted from extending the Ocean Bar Channel would be a Habitat Area of Particular Concern (HAPC). Over 30 fish species managed by the South Atlantic Fishery Management Council have an affinity for hardbottom habitat and are used by SEAMAP-SA (2001) as an indicator that hardbottom habitat occurs near a fish trap or trawl. These species include four of the five finfish managed by the South Atlantic Fishery Management Council that are currently listed as overfished and likely to occur near the Ocean Bar Channel (black sea bass, red grouper, red porgy, and red snapper). Given the importance of any hardbottom habitat within the channel extension and their HAPC designation, the COE should closely coordinate with NMFS during the planning and execution of the hardbottom survey. Any hardbottom found would likely require compensatory mitigation; working through the State of Georgia's artificial reef program may be a viable option for providing this mitigation. These surveys and plans for any compensatory mitigation required should be completed before the Record of Decision is signed.

Direct Impacts to Salt Marsh

The extent of direct impacts to salt marsh from excavating channel bend wideners, enlarging Kings Island Turning Basin, and removing the Tidegate is projected to be 14.08 acres for the 47-foot alternative (please note Section 6.04 lists the impacts as 15.48 acres and Appendix C lists them as 15.68 acres). As compensatory mitigation, the COE proposes to regrade approximately 42 acres of a former confined disposal site (CDF 1S) near the confluence of the Front and Middle rivers to an elevation that would support the cordgrass *Spartina alterniflora*. The regraded area would then be allowed to revegetate naturally; planting of *Spartina alterniflora* would be conducted only if the area did not achieve 15% vegetative cover after one year and 80% vegetative cover after five years (with interim goals of 25, 40, and 60% cover at the end of two, three, and four years, respectively). NMFS agrees with this approach and notes the value of

[1] Southeast Area Monitoring and Assessment Program-South Atlantic. 2001. Distribution of Bottom Habitat on the Continental Shelf from North Carolina through the Florida Keys. SEAMAP-SA Benthic Mapping Workgroup, Atlantic States Marine Fisheries Commission, Washington DC. 166 pages.

having clear success criteria for judging performance and triggering corrective actions. A tidal creek also would be constructed within the restored marsh. Additional detail on the alignment and depth of this creek is needed, and NMFS offers to assist the COE with these determinations.

In various parts of the Draft EIS, the COE suggests more mitigation is being provided at CDF 1S than is necessary and that this excess mitigation would be applied to future projects. NMFS does not support this approach. Substantial amounts of salt marsh would be indirectly impacted by the flow rerouting included in SHEP (Table 1), and mitigation for this impact is occurring via preservation of uplands, freshwater wetlands, and tidal freshwater wetlands (i.e., the mitigation is not type-for-type). Consequently, if any excess mitigation is being provided, the excess is in the form of preserved freshwater marsh, not restored salt marsh, since salt marsh will still have a net decrease from the project even after counting the enhanced acres at CDF 1S.

Indirect Impacts to Tidal Marsh and Creeks

The Department of Interior concludes previous deepening projects within the Savannah River Estuary have reduced the amount of tidal freshwater marsh from 12,000 acres to 3,300 acres, and the majority of the remaining tidal freshwater wetlands occur within the Savannah National Wildlife Refuge. The Draft EIS and Draft GRR discuss indirect[2] impacts to marsh communities by examining five salinity regimes (tidal freshwater < 0.5 ppt, salt marsh > 4.0 ppt, and three levels of brackish marsh 0.6 to 1.0 ppt, 1.1 to 2.0 ppt, and 2.1 to 4.0 ppt). The amounts and locations of these communities within the Savannah River Estuary reflects a dynamic interaction of the inflows of seawater from the ocean and freshwater from the Savannah River; this interaction occurs through a network of tidal rivers, creeks, and marshes. Sea level rise will affect the long-term input of seawater to the estuary and management of upstream reservoirs, and future basin-wide precipitation patterns (e.g., drought) will affect medium- and long-term inputs of freshwater. As was true for past deepenings of the navigation channel, SHEP will increase the amount of seawater flowing into the Savannah River Estuary, thereby resulting in new mixing patterns for seawater and freshwater. These new salinity levels, and their persistence, will determine the amounts and locations of post-construction marsh communities.

After making assumptions on sea level rise and river flows, the COE estimates the net conversion of tidal freshwater and brackish marsh into salt marsh (Table 1). The extent of these conversions for the NED plan is not clear. A 47-foot alternative for the navigation channel was not examined for SHEP until the late planning stages, well after much of the detailed modeling studies for examining effects on marshes were complete. Consequently, the Draft EIS and Draft GRR have relatively little information about the marsh succession expected to result from a 47-foot channel, and the information that is presented was not subject to the same level of interagency and peer review. In Draft EIS Appendix L (page 31), the COE concludes deepening the federal navigation channel to 47 feet would result in the net loss of 1177 acres of tidal freshwater marsh, a net loss of 298 acres of salt marsh, and a net gain of 1476 acres of brackish marsh. The predicted loss of salt marsh is not intuitive and not consistent with the gains in salt marsh predicted by the COE for the other depth alternatives, including 46 feet and 48 feet (COE

[2] Section 1508.8 of CEQ Regulations for Implementing the National Environmental Policy Act define indirect impacts as impacts that are caused by the action but occur later in time or farther removed in distance, but are still reasonably foreseeable.

2007). As of the date of this letter, the COE has not responded to our requests to verify the acreages in Appendix L.

While the Draft EIS appears to lack precise information on the impacts from the 47-foot channel on marsh communities, inferences can be made based on the predictions associated with other channel depths (Table 1). Approximately 1177 acres of tidal freshwater marsh would be converted to brackish marsh and salt marsh. While much of this marsh conversion would occur within portions of the Savannah National Wildlife Refuge, which the Department of Interior manages for migrating waterfowl, thereby diminishing the value of the marsh for this management purpose, it should be noted that increasing salinities could enhance tidal creek habitat for juvenile fish, crabs, and shrimp that prefer higher salinities than tidal freshwater. Nonetheless the COE aims to minimize the impacts to tidal freshwater marsh by rerouting water flows within the estuary. After examining model predictions of dozens of alternatives, the COE proposes a suite a flow modifications referred to as "Plan 6a" for minimizing impacts to tidal freshwater from the 45-foot, 46-foot, 47-foot, and 48-foot deepening alternatives, and a related suite, "Plan 6b," for the 44-foot alternative. The combination of a 47-foot channel and flow rerouting Plan 6a would result in 223 acres of tidal freshwater marsh and 740 acres of salt marsh being converted to a corresponding amount of brackish marsh.

As compensatory mitigation for these impacts, the COE proposes to purchase for Savannah National Wildlife Refuge tracts of land that include substantial, but not quantified, amounts of freshwater marsh or tidal freshwater marsh. The general plan for these purchases is described in Draft EIS Appendix C (VI Mitigation Plans), and the unnumbered table on page 90 of the appendix indicates 2245 acres of wetlands would be purchased to compensate for impacts resulting from the 47-foot channel. This amount was determined via the "SOP" that is used by staff from the COE's Regulatory Division. The Savannah National Wildlife Refuge has an approved (but largely unfunded) land acquisition plan that totals over 45,000 acres, so the COE envisions meeting the mitigation requirement by working closely with the Refuge to execute a portion of the land acquisition plan.

Indirect Impacts to Dissolved Oxygen Concentrations

The effects of SHEP on the concentrations of dissolved oxygen (DO) within the Savannah Harbor Estuary are complex to measure, model, and forecast. During development of the Draft EIS and Draft GRR, the COE coordinated with resource agencies on several studies that examined DO. Comparison of results from these studies must be done carefully because key model inputs (e.g., river flows, point-source pollution discharges) varied between reports or were not clearly stated and because the portion of the water column summarized differed (efforts to obtain clarification from the COE were not successful). Ideally, four sets of numbers are needed (existing conditions, deepening only, deepening plus flow rerouting, and deepening plus flow rerouting plus the injection of DO) by the COE to calculate mitigation needed to offset the effects of channel deepening and flow rerouting. The COE's use of tables to capture the temporal and spatial variability of DO concentration is effective, so NMFS used this format to assemble the four sets of numbers needed.

Table 2 presents the COE's forecasts of the effects of the project on the concentration of DO on a large portion of the Savannah River Estuary. Currently, large portions of the estuary frequently

experience low concentrations of DO, especially within Middle River, Lower Back River, and Back River. While deepening the navigation channel to 47 feet would increase the frequency of low concentrations of DO, rerouting water flows to bring freshwater to the Savannah National Wildlife Refuge is forecasted to have a greater impact than the deepening on the concentrations of DO within Back River (although rerouting the water is forecasted to partly offset impacts from deepening in portions of the Middle River). The COE plans to offset the impacts by injecting dissolved oxygen into the harbor via Speece cones at three locations (two on Hutchinson Island and one upriver from I-95 before the Savannah River divides into its distributary network).

Monitoring and Adaptive Management Plan (MAMP)
Gauging the effects of the channel deepening and flow rerouting is essential to determining whether the effects of SHEP are within the prescribed limits and that corrective actions, when necessary, are taken in a timely manner. On July 31, 2009, NMFS provided the COE with a detailed review of the MAMP. Those recommendations include several recommendations to increase the value of the monitoring program for understanding impacts to NMFS' trust resources. While the MAMP (Draft EIS Appendix D) has been improved since our last detailed review by updating the budget and adding finfish monitoring, several deficiencies are still present which must be addressed before NMFS can conclude the MAMP is adequate to mitigate impacts to EFH caused by the channel deepening and flow rerouting. The MAMP must:

<u>List specific predictions that will be evaluated and triggers for action</u>. The COE defines adaptive management to include: 1) evaluating the accuracy of the predicted environmental impacts; 2) assessing the effectiveness of the mitigation features; and 3) modifying the project as needed to ensure the levels of environmental effects predicted within the EIS are not exceeded. The plan appearing in Appendix D is not consistent with the COE's definition of adaptive management. Expected ranges of impacts are not provided. Instead, Appendix D emphasizes goals for the calibration of the models. As noted previously by NMFS and others resource agencies, calibration of models does not equate to ecological performance measures. NMFS recommends that the ecological performance measures be expressed as ranges, rather than single targets, to allow predictions to be tailored to seasonal conditions or less predictable environmental drivers (such as drought). Expression as ranges will also allow differentiation of levels that would become points of heightened concern or monitoring from levels that would serve as triggers for corrective actions. Further, the ecologically based performance measure ranges themselves may require adjustment if monitoring shows ecosystem responses differing from predicted outcomes.

<u>Include a component that addresses dissolved oxygen (DO) concentrations</u>. The concentration of DO within the Savannah Harbor Estuary has been reduced by runoff, industrial discharges, flow alterations, and deepening of the navigation channel. Modeling studies conducted to support development of a Total Maximum Daily Load for DO concentrations in the Savannah River Estuary estimate that, because of channel dredging, the existing concentration of DO is 1 mg/L lower than it was during the baseline year (1854) and condition (12-foot controlling depth); deepening the channel to 47 feet would further lower the concentration of DO in the estuary. While the COE believes an injection system can be used to offset any additional reductions in the concentration of DO that would result from a deepened navigation channel, the technology has not been demonstrated to be effective in applications with a tidal range similar to the Savannah

River Estuary. A limited test of the technology in 2007 had equivocal results, and the COE's model results show that several areas within the estuary (e.g., Lower Back River 3) will not be fully mitigated by the injection system. Added to this technological uncertainty is the budgetary uncertainty resulting from the operation of the injection system being dependent on timely federal appropriations in perpetuity for basic operation, maintenance, and increases in capacity should changes in climate or sea level rise result in greater decreases of DO than what was modeled for the Draft EIS and Draft GRR. Given the potential for unacceptable, detrimental impacts to DO concentrations within the estuary resulting from SHEP on tidal or daily time scales, the MAMP should include a process that allows informed decisions to be made in a timely manner (i.e., days) to ensure DO concentrations meet project requirements for shortnose sturgeon and other fishery species.

Include the Dissolved Oxygen Injection System in the "Components of Approved Adaptive Management Plan." Draft EIS, Appendix D, Section 10 describes modifications that could be implemented without further public coordination or agency approvals. The proposed DO injection system has not been proven to be an effective mechanism for sustaining sufficient levels of DO in the environmental setting of the SHEP. Because DO concentration is a key requirement for ensuring the survival of shortnose sturgeon and other benthic fishes, it is imperative that the MAMP provide readily implementable and timely procedures for making adjustments to the deployment and operation of Speece cones to meet the required concentrations of DO. Section 10 B should be amended to include adjusting and/or expanding the DO injection system as required to meet required DO concentrations.

Clarify the decision making process for the MAMP. NMFS and other agencies have consistently indicated to the COE that the success of the overall mitigation plan for SHEP depends on whether there is reasonable assurance that there will be no net harm to the estuary. A key component of a viable MAMP will be the adoption through an interagency collaboration of ecological performance measures. A robust, durable interagency collaborative decision-making process for identifying and adopting these performance measures is a necessary component of the MAMP.

Essential Fish Habitat Conservation Recommendations

NMFS finds the project, as proposed, would have substantial adverse impacts on EFH. Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH conservation recommendations when an activity is expected to adversely impact EFH. Based on this requirement, NMFS provides the following:

EFH Conservation Recommendations

1. The COE shall complete surveys for hardbottom habitat within the proposed Ocean Bar Channel extension, including a 1000-foot buffer from each channel edge. The methods and plans for the survey shall be developed in coordination with NMFS. Any hardbottom habitat shall be mitigated through a plan developed in coordination with NMFS.

2. The COE shall develop ecological performance criteria for each component of the MAMP. The performance criteria shall specify ranges of values believed to be acceptable based on the current understanding of how the Savannah River Estuary is expected to respond to the deepening of the navigation channel, rerouting of river and tidal flows, variability in river inflows, sea level rise, and other factors that affect the dynamic distribution of habitats within the Savannah River Estuary. The COE also shall make publicly available the GIS data (e.g., polygons used for all calculations of marsh acreage) and other information needed to allow resource agencies and the public to examine the basis of the performance criteria and to gauge effects from the project.

3. The COE shall establish, via a charter or similar mechanism, an expert team to independently oversee the MAMP. The team shall include representatives from academia as well as the federal and state resource agencies. The charter shall specify how team members will access monitoring data and reports and the team's decision making authority with respect to certifying the efficacy of the data and reports and determining when corrective measures are needed. A clear commitment to establish the team, as evidenced by including a draft charter in the Record of Decision would help provide NOAA the reasonable assurance it needs to conclude the mitigation plan adequately addresses the potential environmental impacts of the project.

4. The MAMP shall include a real-time component that examines the concentration of DO so that changes to the deployment and/or operations of the Speece cones (or other methods the COE uses to inject oxygen into harbor waters) can be made to achieve established performance criteria. The locations of real-time monitoring shall be developed in consultation with NMFS and, at a minimum, shall include the locations within the estuary expected to have lower concentrations of dissolved oxygen despite the injection. Data from the real-time monitoring shall be available publicly.

5. The MAMP shall include monitoring of crabs and shrimp along with the finfish and vegetation monitoring so that the effects of SHEP on a full suite of fishery species that use the marshes as nursery habitat can be gauged.

6. Dredging shall not occur when the concentration of DO is below 3.0 milligrams per liter within the bottom waters of portion of the estuary that is being dredged. The zones used in the Draft EIS, Draft GRR, and supporting material for examining the concentration of DO would be zones used for implementing this conservation recommendation.

Section 305(b)(4)(B) of the Magnuson-Stevens Act and implementing regulation at 50 CFR Section 600.920(k) require the COE to provide a written response to this letter within 30 days of its receipt. If it is not possible to provide a substantive response within 30 days, an interim

response should be provided to NMFS. A detailed response then must be provided prior to final approval of the action. The COE's detailed response must include a description of measures proposed by your agency to avoid, mitigate, or offset the adverse impacts of the activity. If the COE's response is inconsistent with these EFH conservation recommendations, the COE must provide a substantive discussion justifying the reasons for not following the recommendation.

Comments on Sections of the EFH Assessment (Draft EIS Appendix S)

The following comments, organized by section of the EFH Assessment, are mostly editorial and are provided to guide the COE in completing the project's administrative record. The general comment is that the EFH assessment has very little discussion of impacts to fish and how they interact with the EFH within the project area.

1.0. Overview: Rather than listing the EFH not in the project area, it would be better to list the EFH that is in the project area.

Table 1-1.

- Red drum is no longer managed under the Magnuson-Stevens Act and should be deleted from this table.
- America shad, hickory shad, blueback herring, shortnose sturgeon, and Atlantic sturgeon are not managed by SAFMC, do not have federal fishery management plans, and accordingly do not have EFH designations. These species should be deleted from this table.
- *Lilopenaeus* should be *Lytopenaeus*, and the HAPC designations for brown shrimp also apply to white shrimp.
- Pink shrimp, *Farfantepenaeus duorarum*, should be added to the table.
- Colum "EFH for Life Stages by Ecosystem" should be "Life Stages by Ecosystem."

Table 1-2.

- For the portion of the table focused on estuarine areas, the columns indicating potential impacts should be amended to include a column for the flow rerouting aimed at diverting freshwater towards the Savannah NWR, since this diversion will alter salinity and, accordingly, affect the distribution of marsh and oyster habitats.
- For the portion of the table focused on marine areas, inlet should be added (as a row).
- "Geographically Defined Habitat Areas of Particular Concern" should be "Habitat Areas of Particular Concern" since the table lists HAPCs defined habitat as well as those defined geographically.
- Hoyt Hills, Charleston Bump, Hurl Rocks, and Broad River should be deleted since they are outside the project area.

2.0 Potential Effects in Estuarine Areas. Oyster reefs and intertidal flats are described as not occurring in the project impact area, yet they are common in the areas affected by the rerouting of water flows and the channel deepening.

3.0 Impacts on Estuarine Emergent Wetlands. A citation for this quote should be provided.

3.1 Impacts from Excavation of Estuarine Emergent Wetlands. This section is confusing because the impacts to wetlands are the same for all alternatives, but the total amount of excavation is less for the 44-foot alternative that the others.

Figures 3-1, 3-2, 3-3, and 3-4. The text within the figures is not legible. Captions are needed for all figures to identify the purpose of each figure.

3.2 Mitigating Excavation of Estuarine Emergent Wetlands.

- NMF does not support the COE applying any mitigation that it believes is in excess of SHEP requirement to future projects.
- NOAA as well as FWS requested inclusion of creeks within the restored marsh.

Figure 3-4. The text within the figure is not legible. Figure needs a caption.

Table 4-1 and Table 4-12. The portion of the table dealing with indirect impacts should be expanded to include brackish and salt marsh. Gains in marsh acreage from the channel deepening should be listed as well as the direct losses listed in the bottom row. The portion currently labeled as salt marsh should be modified to indicate direct impacts to salt marsh.

4.2. Avoiding and Minimizing Impacts to Palustrine Emergent Wetlands. The bullets in the latter portion or this section (page 17), discuss impacts to American shad, southern flounder, and striped bass. While discussion of the impacts to these species is relevant to the project, none of these species have EFH designations. Accordingly, this discussion should be removed from the Appendix S and placed in a more appropriate location within the EIS.

4.3 Mitigation for Impacts to Palustrine Emergent Wetlands. Table 4-15 will need to be replaced with a table representing the 47-foot depth alternative.

5.1 Temporary Increases in Turbidity and 7.1 Temporary Increases in Turbidity.

- We agree that the effects of suspended sediments should be viewed as a function of concentration and exposure. So what concentration and exposure combinations is the COE proposing to be acceptable for SHEP?
- A citation should be provided for the work of Dr. Hayes. The relevant studies were performed during 1984, not 1986. Hayes, D.; Raymond, G.; McLellan, T. 1984. Sediment resuspension from dredging activities. Proceedings of Conference Dredging `84: Dredging and Dredged material Disposal, 14-16 November 1984, Clearwater Beach, FL. R.L. Montgomery and J.W. Leach (eds.), American Society of Civil Engineers, NY. Pages 72-82

5.2 Decreases in Dissolved Oxygen in the Water Column. Tables 5-3, 5-4, 5-5, 5-6, and 5-7 should be replaced with tables that provide the predicted concentrations of DO, not the predicted difference from the baseline.

5.3 Mitigation for Decreases in Dissolved Oxygen in Water Column. How will the screens be cleaned to ensure clogging does not increase flow velocities above the 0.5 feet per second?

9.0 Impacts to Live and Hard Bottom. Surveys should be done before completing the ROD.

Table 1. Predicted changes to marsh acreages within the study area from the channel deepening and the flow rerouting. Neither the Draft EIS, Draft GRR, nor any supporting materials provided to NMFS have information to complete the cells highlighted in yellow. This deficiency is not critical. It should be noted that this table does not appear in the Draft EIS or Draft GRR; the table was assembled from several information sources listed below. The acres reported for the 47-foot channel, deepening only, may be an error and have not been verified by the COE.

	Deepening Only (acres)					Deepening and Flow Rerouting (acres)				
	Tidal Freshwater	Brackish Marsh			Salt Marsh	Tidal Freshwater	Brackish Marsh			Salt Marsh
Depth	**<0.5 ppt**	**0.6 to 1.0 ppt**	**1.1 to 2.0 ppt**	**2.1 to 4.0 ppt**	**>4.0 ppt**	**<0.5 ppt**	**0.6 to 1.0 ppt**	**1.1 to 2.0 ppt**	**2.1 to 4.0 ppt**	**>4.0 ppt**
Current	4072	864	555	834	2506	N/A	N/A	N/A	N/A	N/A
44 feet						4394	1137	749	855	1698
45 feet	3105	1319	630	906	2873	4040	1781	588	745	1678
46 feet	3015	1050	921	789	3057	3871	1650	862	700	1749
47 feet	2895	1009	1355	1365	2208	3849	1641	889	687	1766
48 feet	2860	830	1215	739	3188	3735	1340	1191	790	1776
	Change from Deepening Only (acres)					**Change from Deepening and Flow Rerouting (acres)**				
44 feet	-551					322	273	194	21	-808
45 feet	-967	455	75	72	367	-32	917	33	-89	-828
46 feet	-1057	186	366	-45	551	-201	768	307	-134	-757
47 feet	-1177	145	800	531	-298	-223	777	334	-147	-740
48 feet	-1212	-34	660	-95	682	-337	476	636	-44	-730

Sources:

- GRR 1.1.31 – Specifically, Table 2 of *Savannah Harbor Expansion Project, Evaluation of Marsh/Wetland Impacts with Proposed Mitigation Plan, November 2007,* which was provided in September 2010.
- Table 1 of *Savannah Harbor Expansion Project, Evaluation of Marsh/Wetland Impacts, Plan 6a ONLY, August 2007*, which was provided to us by email on August 28, 2007, but does not appear to be an appendix to the Draft EIS or Draft GRR.
- Table 5-4 from the Draft EIS, September 2010.
- "Appendix A" of Appendix C to the Draft EIS, September 2010.
- Page 31 of Appendix L from the DEIS.

Table 2. Forecasts of the effects of SHEP, by zone, on the concentrations of dissolved oxygen within bottom waters of the Savannah River Estuary. Upper left panel shows existing conditions, upper right panel shows effects of deepening the federal navigation channel to 47 feet, lower right shows the combined effects of deepening the navigation channel and rerouting water flows, and the lower left panel shows the combined effects of deepening, flow rerouting, and injections of dissolved oxygen. Colors are based on State Water Quality Standards, which are 5.0 mg/L daily average and 4.0 mg/L instantaneous measures, and the level where deleterious effects are commonly reported (3.0 mg/L).

Zones - Existing Conditions

Zone	Episodic				Chronic				Constant
No.	1%	5%	10%	25%	50%	75%	90%	95%	99%
FR1	4.13	4.20	4.26	4.37	4.50	4.59	4.72	4.80	4.84
FR2	3.94	3.99	4.03	4.25	4.37	4.54	4.65	4.69	4.76
FR3	3.70	3.77	3.83	4.03	4.19	4.38	4.71	4.79	4.99
FR4	3.66	3.71	3.75	3.99	4.12	4.37	4.93	5.31	5.54
FR5	3.68	3.76	3.88	4.08	4.27	4.77	5.41	5.65	5.79
FR6	3.96	4.01	4.11	4.32	4.55	5.20	5.78	5.92	6.04
FR7	4.44	4.55	4.69	5.09	5.85	6.18	6.41	6.56	6.70
FR8	4.86	5.05	5.29	5.66	6.15	6.43	6.67	6.80	6.98
FR9	5.67	5.90	6.02	6.26	6.54	6.81	7.07	7.23	7.34
FR10	5.71	5.85	6.02	6.30	6.57	6.81	7.16	7.24	7.32
FR11	4.88	5.10	5.28	5.59	5.88	6.18	6.45	6.55	6.68
MR1	4.48	4.58	4.70	4.89	5.17	5.54	5.84	5.97	6.04
MR2	4.20	4.31	4.51	4.79	5.13	5.50	5.80	5.91	6.03
MR3	3.85	4.04	4.10	4.38	4.74	5.22	5.59	5.72	5.85
MR4	4.39	4.51	4.61	4.78	5.05	5.24	5.44	5.54	5.70
MR5	2.31	2.55	2.97	3.46	5.33	6.16	6.53	6.82	7.01
MR6	2.15	2.53	3.05	3.58	5.69	6.33	6.80	6.94	7.27
LBR1	4.30	4.50	4.59	4.80	4.99	5.19	5.30	5.45	5.57
LBR2	3.70	3.81	3.96	4.13	4.35	4.55	4.71	4.77	4.89
LBR3	3.54	3.58	3.65	3.78	3.95	4.11	4.24	4.35	4.46
BR1	3.53	3.58	3.64	3.90	4.04	4.21	4.43	4.50	4.60
BR2	3.30	3.38	3.46	3.62	3.82	3.99	4.14	4.30	4.39
BR3	3.46	3.51	3.56	3.63	3.74	3.85	3.97	3.99	4.02
SCh1	3.51	3.56	3.63	3.72	3.83	3.95	4.04	4.10	4.16
SCh2	3.94	4.04	4.09	4.25	4.38	4.49	4.61	4.65	4.73
SR	4.90	4.95	5.18	5.52	5.84	6.17	6.35	6.41	6.48
StbR	4.74	4.93	5.09	5.44	5.79	6.09	6.30	6.43	6.56

Zones - 47 feet

Zone	Episodic				Chronic				Constant
No.	1%	5%	10%	25%	50%	75%	90%	95%	99%
FR1	3.94	4.01	4.06	4.22	4.35	4.47	4.56	4.60	4.65
FR2	3.66	3.74	3.83	4.00	4.15	4.30	4.44	4.49	4.57
FR3	3.51	3.57	3.63	3.83	3.95	4.11	4.45	4.80	5.34
FR4	3.53	3.59	3.65	3.85	3.97	4.12	4.45	4.77	5.45
FR5	3.68	3.72	3.78	3.94	4.08	4.22	4.63	4.95	5.07
FR6	3.70	3.79	3.86	3.99	4.12	4.30	4.76	5.05	5.28
FR7	4.48	4.53	4.65	4.90	5.48	5.99	6.35	6.60	7.11
FR8	4.41	4.49	4.61	4.90	5.70	6.22	6.51	6.62	6.78
FR9	5.26	5.62	5.78	6.12	6.39	6.71	6.97	7.20	7.48
FR10	4.34	4.81	4.97	5.32	5.90	6.42	6.69	7.01	7.22
FR11	4.24	4.65	4.95	5.25	5.65	6.14	6.52	6.66	7.16
MR1	4.26	4.32	4.40	4.63	4.91	5.17	5.43	5.59	5.97
MR2	3.99	4.11	4.27	4.53	4.89	5.24	5.49	5.61	5.78
MR3	3.80	3.98	4.03	4.34	4.68	5.11	5.43	5.57	5.68
MR4	3.92	4.12	4.23	4.48	4.74	5.07	5.27	5.41	5.64
MR5	1.50	2.03	2.49	3.09	4.86	6.24	6.57	6.92	7.11
MR6	2.12	2.55	3.03	3.59	5.59	6.38	6.81	7.07	7.34
LBR1	3.54	4.35	4.78	5.21	5.45	5.69	5.99	6.18	6.50
LBR2	3.66	3.86	4.00	4.18	4.41	4.59	4.81	4.96	5.32
LBR3	3.16	3.41	3.55	3.87	4.19	4.61	4.86	5.03	5.26
BR1	3.27	3.41	3.55	3.71	3.94	4.16	4.36	4.43	4.61
BR2	2.55	2.80	3.00	3.22	3.43	3.66	3.84	3.91	4.02
BR3	3.01	3.20	3.34	3.51	3.70	3.87	4.02	4.08	4.20
SCh1	2.38	2.55	2.74	2.89	3.07	3.30	3.64	3.74	3.95
SCh2	3.68	3.81	3.91	4.12	4.29	4.43	4.57	4.64	4.72
SR	4.69	4.74	4.97	5.31	5.62	5.97	6.11	6.16	6.23
StbR	3.56	4.27	4.54	5.10	5.62	6.03	6.33	6.51	6.74

Zones - 47 feet + Flow Rerouting

Zone	Episodic				Chronic				Constant
No.	1%	5%	10%	25%	50%	75%	90%	95%	99%
FR1	3.93	3.99	4.05	4.20	4.34	4.48	4.56	4.60	4.65
FR2	3.66	4.08	4.17	4.32	4.46	4.61	4.76	4.82	4.93
FR3	3.61	3.66	3.70	3.91	4.04	4.22	4.58	5.09	5.47
FR4	3.61	3.66	3.70	3.92	4.03	4.20	4.60	5.02	5.53
FR5	3.73	3.78	3.88	4.05	4.18	4.38	4.83	5.07	5.28
FR6	3.72	3.83	3.89	4.07	4.19	4.38	4.86	5.15	5.34
FR7	4.40	4.53	4.65	4.89	5.45	5.93	6.31	6.55	7.12
FR8	4.38	4.49	4.60	4.86	5.64	6.14	6.44	6.57	6.72
FR9	4.91	5.32	5.48	5.97	6.38	6.69	7.02	7.20	7.36
FR10	4.69	5.04	5.23	5.55	5.89	6.32	6.60	6.85	7.16
FR11	4.18	4.59	4.81	5.11	5.65	6.14	6.40	6.66	6.94
MR1	4.20	4.34	4.43	4.66	4.94	5.17	5.47	5.66	5.99
MR2	4.22	4.36	4.49	4.71	4.98	5.24	5.55	5.68	5.78
MR3	4.19	4.36	4.44	4.64	4.94	5.19	5.41	5.60	5.83
MR4	4.36	4.45	4.59	4.77	5.06	5.30	5.59	5.69	5.99
MR5	2.20	2.78	3.12	3.86	5.36	6.19	6.53	6.78	7.03
MR6	6.15	6.32	6.45	6.64	6.90	7.23	7.41	7.51	7.61
LBR1	4.06	4.82	5.12	5.49	5.80	6.10	6.32	6.55	6.70
LBR2	4.48	4.57	4.69	4.92	5.14	5.38	5.56	5.68	5.81
LBR3	2.54	2.67	2.82	3.04	3.32	3.63	3.82	3.89	4.02
BR1	1.83	2.18	2.70	3.50	4.11	4.69	4.94	5.02	5.09
BR2	1.59	1.80	1.98	2.36	2.76	3.06	3.32	3.41	3.56
BR3	1.72	1.95	2.05	2.22	2.47	2.92	3.40	3.53	3.74
SCh1	2.30	2.47	2.68	2.91	3.05	3.28	3.64	3.78	3.91
SCh2	3.68	3.80	3.92	4.09	4.28	4.43	4.55	4.61	4.76
SR	4.68	4.73	4.96	5.30	5.61	5.96	6.10	6.15	6.22
StbR	3.75	4.30	4.59	5.11	5.67	6.05	6.32	6.45	6.66

Zones - 47 feet + Flow Rerouting + DO injection

Zone	Episodic				Chronic				Constant
No.	1%	5%	10%	25%	50%	75%	90%	95%	99%
FR1	4.21	4.27	4.32	4.46	4.57	4.64	4.75	4.82	4.84
FR2	4.16	4.18	4.19	4.44	4.52	4.72	4.79	4.83	4.90
FR3	3.88	3.98	4.03	4.26	4.41	4.55	4.87	4.87	5.00
FR4	3.89	3.97	4.06	4.28	4.41	4.61	5.05	5.37	5.57
FR5	3.97	4.06	4.21	4.38	4.57	4.89	5.37	5.63	5.80
FR6	4.25	4.29	4.37	4.54	4.66	5.15	5.67	5.98	6.16
FR7	4.64	4.69	4.81	5.13	5.78	6.27	6.53	6.65	6.74
FR8	5.00	5.06	5.33	5.65	6.22	6.61	6.87	6.92	7.21
FR9	5.66	5.95	6.07	6.39	6.76	7.07	7.30	7.55	7.71
FR10	6.25	6.37	6.51	6.81	7.07	7.31	7.73	7.87	8.04
FR11	5.51	5.68	5.84	6.14	6.38	6.64	7.01	7.15	7.32
MR1	4.70	4.85	4.98	5.18	5.45	5.74	6.04	6.16	6.22
MR2	4.73	4.87	5.00	5.27	5.53	5.78	6.04	6.12	6.27
MR3	4.74	4.90	4.92	5.20	5.47	5.74	5.99	6.11	6.30
MR4	5.25	5.37	5.47	5.66	5.93	6.16	6.45	6.67	6.86
MR5	3.44	3.73	4.15	4.58	6.34	6.96	7.39	7.62	7.81
MR6	2.26	2.54	2.95	3.37	5.01	5.42	5.58	5.69	5.96
LBR1	5.32	5.51	5.62	5.83	6.03	6.27	6.52	6.70	6.83
LBR2	4.86	4.94	5.10	5.29	5.51	5.75	6.05	6.10	6.27
LBR3	4.10	4.24	4.34	4.49	4.69	4.99	5.23	5.40	5.63
BR1	3.86	4.00	4.01	4.33	4.50	4.66	4.86	4.89	4.98
BR2	3.65	3.74	3.84	3.98	4.18	4.48	4.67	4.68	4.75
BR3	3.57	3.69	3.75	3.86	3.93	4.05	4.26	4.37	4.41
SCh1	3.58	3.65	3.72	3.84	3.94	4.02	4.10	4.16	4.21
SCh2	4.08	4.19	4.22	4.39	4.53	4.61	4.72	4.76	4.83
SR	6.07	6.15	6.30	6.64	6.94	7.22	7.72	7.77	7.89
StbR	5.10	5.32	5.44	5.75	6.08	6.34	6.51	6.59	6.74

Sources: Pages 9, 26, and 31 of GRR 1.1.32 (Evaluation of Water Quality Impacts with Proposed Mitigation Plan, September 2009; Table B-7 of GRR 1.1.4 (Oxygen Injection Design Report Savannah Harbor Expansion Project, Savannah, Georgia, October 15, 2010).