



# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**  
176 Croghan Spur Road, Suite 200  
Charleston, South Carolina 29407

September 9, 2002

Mr. Douglas H. Plachy  
Senior Project Manager  
U.S. Army Corps of Engineers  
P.O. Box 889  
Savannah, Georgia 31402-0889

*DP 13 Sep 02*

Dear Mr. Plachy:

The U.S. Fish and Wildlife Service, with the assistance of the U.S. Geological Survey, has reviewed the Hydrodynamic and Salinity Model Approval Package, Savannah Harbor (Package) that we received on August 7, 2002 from Applied Technology and Management, Inc. We are submitting the following comments with the understanding that the Savannah District is responsible for coordinating and compiling reviews of the Package.

Since early in the planning process the lead agency has proposed to use the hydrodynamic model as the primary tool to assess potential Savannah Harbor expansion impacts on critical aquatic and wetland resources. The hydrodynamic model would be used not only for direct estimates of changes in parameters such as salinity but also would be used for critical inputs to other models and analyses. The wetland succession model will use the water surface elevation predictions from the hydrodynamic model to estimate depth, duration and frequency of wetland flooding. These hydraulic estimates from the hydrodynamic model will be used in conjunction with salinity predictions to project wetland impacts. Current velocity and salinity predictions from the hydrodynamic model will be used in conjunction with a habitat model to help estimate impacts to striped bass spawning, egg and larval habitat. Any errors in the hydrodynamic model will be compounded through its use in conjunction with the additional evaluations. Therefore, our goal is that the model be able to provide satisfactory estimates of water surface elevation and salinity in the area of the Savannah National Wildlife Refuge.

Itemized below are comments on particular aspects of the model

- 1 The errors in the water surface elevations have been reduced from greater than 50 cm in the Draft Calibration report to 2-20 cm in the Package. The model over-predicts the water levels for almost all requested stations and periods. The over-predictions are consistent between the calibration and validation

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periods. With clear documentation of the model error and application of water-level corrections, if necessary, the water-level simulations should be adequate for impact assessment and mitigation planning.

2. The salinity simulations have also improved since the Draft Calibration Report. The error in salinity simulations may be correlated to the stream flow boundary condition. Although we did not do a systematic analysis, the error in the salinity simulation appears to be greatest during the low-flow calibration periods ( $\sim 5,000$  ft<sup>3</sup>/s) and to decrease as flows increased ( $\sim 9,000$  ft<sup>3</sup>/s). The applications of the state-space transform functions greatly increase the accuracy of the model. With the transform functions and clear documentation of the model error, the salinity simulation should be adequate for impact assessment and mitigation planning. Error corrections and documentation will need to be considered for areas in the model domain without measured data. Caution will have to be used if applying the model with inputs beyond the range of the calibration data set range.
3. The temperature simulations are fully adequate.
4. The documentation of the currents simulations indicates that the model generally over-predicts the currents. The differences between the modeled and measured currents range from 0 to 27 cm/s for the 10<sup>th</sup> and 90<sup>th</sup> percentiles and mean values. The RMSE for station GPA 14 (at I-95) for the various calibration periods range from 12 to 22 cm/s. The highest differences occur in the riverine zone from I-95 upstream, which is near the upstream boundary of the striped bass study area. Additional statistical evaluation of the hydrodynamic model performance will be necessary before deciding whether the current predictions are adequate to use in a striped bass habitat model. One additional statistic that will be needed is comparison of the mean flood and ebb currents for each of the tidal periods. These additional statistics will help establish clear documentation of the model error and any subsequent correction that will be needed for any applications directly using the current predictions.
5. Although the measurements of volume flow are only taken over a portion of the tidal cycle and are not continuous over the data collection period, they provide a good indication of whether the correct flow is moving through critical parts of the model. In many locations in the model domain, restrictions in channel geometry make it difficult to accurately measure the volume flow. It is unclear whether the statistics in the Package are adjusted for timing error, or if the peak flood or ebb flow was measured. In either case, the reported error may be greater than the actual error. As with the currents simulations, caution should be used with volume flow simulations from the model.


6. The additional information in the Package concerning the method and results of convergence testing for the Front River and Back River is a great improvement over the Draft Calibration Report. The convergence test for the two representative reaches of the system appears to be adequate.

As stated in the Package Executive Summary, numerical models are only an approximation of reality. Generally, the reliability of these models is in making relative, rather than absolute, predictions of the response of the system to changing boundary conditions. The reality for the aquatic and tidal freshwater marsh resources is that absolute changes to the systems are often critical to their existence. A major concern of the reviewing agencies, from the beginning of the modeling process, was how hydrodynamic and water-quality models could be used to make either absolute predictions or “near” absolute predictions. The discussion in Package Section 1.2 “Recommendations for model application” addresses these concerns and offers three approaches that account, document, and adjust for model error. All of these approaches are valid and could be used depending on the particular application under consideration. Other approaches may need to be considered as applications are further developed.

In summary, we believe that the model (with transform functions) is performing acceptably with regard to the most important simulations, i.e. water-level and salinity. Therefore, we believe that the model is adequate to assess wetland impacts and striped bass impacts resulting from project-induced changes in these factors. However, caution will have to be used if applying the model with inputs beyond the range of the calibration data set range. The accuracy of current velocity simulations is variable, but we are hopeful that the additional statistical evaluation will show that they are adequate for the striped bass application.

The model development and review process has been a long one. The goal of the participants has been to produce the best tool for determining the impacts of the Savannah Harbor Expansion Project. The time and effort has been well spent as seen in the improvements in the calibration and the model error corrections. Please contact Mr. Ed EuDaly at this office if you have any questions or need additional information.

Sincerely yours,



Roger L Banks  
Field Supervisor

RLB/EME