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July 1, 2005

Joseph T. Hoke, Jr., P.E.  
U.S. Army Corps of Engineers  
Savannah District  
P.O. Box 889  
Savannah, GA 31402-0889

Dear Mr. Hoke,

We have reviewed the Savannah Harbor hydrodynamic and water quality models presented in *Development of the Hydrodynamic and Water Quality Models for the Savannah Harbor Expansion Project* (SHEP) prepared by Tetra Tech, Inc. on May 20, 2005. The purpose of the review was to determine whether or not the present models are suitable to evaluate impacts resulting from proposed harbor deepening. The review included an interim meeting of the model review group in Atlanta on June 16-17, at which model performance was discussed in detail. The model review group identified a number of issues and concerns that should be investigated and resolved before the models are used for final project impact evaluations (see meeting summary attached below). Depending on the results of these investigations, model re-calibration may be necessary.

Our position is final impact evaluations should wait until these investigations are complete, the model review group has the opportunity to consider the results, and any required model adjustment is performed. In the near term, the Department is not opposed to the use of the present models for preliminary screening purposes.

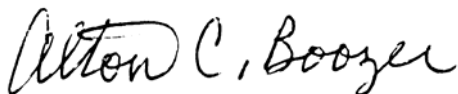
In addition to the concerns listed in the attached document, the following items would need to be addressed before the Department could accept the models for use in final impact analysis:

1. The hydrodynamic model projects too little salt water up the Middle River (see report figures J-21, J-23, K-21, and K-23). We understand that the neural network modeling linking the river segments to the marshes depends on salinity predictions at USGS-gaged locations on the Front and Little Back Rivers and not on the Middle River. However, stations MR-10 and MR-12R (and by extension, MR-12) were identified by the Federal agencies as important locations for the salinity calibration. We also note the model predicts Middle River is well mixed, so the model under-predicts salinity in Middle River in the mid-depth and bottom layers as well as the surface layer.

2. The report does not adequately account for the occasional, dramatic differences between predicted and observed dissolved oxygen which occur primarily in the 1997 confirmation simulation but also to some degree in the 1999 calibration simulation (see report figures P-1, P-3, P-11, P-5, Q-1, Q-2, Q-3, Q-4, Q-5, and Q-6). We understand that, in some cases, these differences are thought to reflect instrumentation problems with the dissolved oxygen monitoring equipment rather than inaccuracies in the water quality model. We understand that the dissolved oxygen dataset is currently being screened and possibly corrected when sampling error is identified. This effort should be concluded and documented, and the model and report should be modified as necessary. Finally, any significant differences between model and data that remain should be acknowledged and explained to the extent possible.
3. The potential impact of oxygen demand loading from the dredge spoil areas has not been identified. Loadings from the dredge spoil areas should be addressed by the future Total Maximum Daily Load (TMDL) rather than the SHEP if project alternatives do not increase loadings to the Savannah or Back Rivers. However, if project alternatives are in fact expected to increase loadings above existing levels, then any impacts on dissolved oxygen should be addressed by the SHEP.
4. Our acceptance of the hydrodynamic and water quality models for water quality certification will depend on more than the ability of the models to evaluate water quality impacts. In order for the Department to accept the models for certification purposes, we would also have to determine that the hydrodynamic and water quality models satisfy the requirements of the wetlands and fisheries impact evaluations. It is our understanding that these requirements have not yet been established. Until they are, we cannot give final acceptance of the hydrodynamic and water quality models for water quality certification.

Overall, we find the model calibration results to be encouraging. The Savannah Harbor system is complex, and the present models represent this complex system very well in many respects. We anticipate the issues identified above and in the attached meeting summary can be addressed prior to final impact evaluations. We appreciate the opportunity to review and comment on the models and look forward to continued cooperation on this important matter.

Sincerely,

A handwritten signature in black ink that reads "Alton C. Boozer". The signature is written in a cursive style and is positioned to the left of a vertical red line.

Alton C. Boozer  
Chief, Bureau of Water

ACB/wmc

**Savannah Harbor Expansion Model Review Meeting**  
**June 16-17, 2005**  
**Savannah Harbor Expansion Interagency Water Quality Team Meeting**  
**June 17, 2005**  
**Tetra Tech, Inc. – Atlanta, GA**

**Attendees:**

Roy Burke, GAEPD  
Paul Lamarre, GAEPD  
Wade Cantrell, SCDHEC  
Bill Bailey, USACE Savannah District  
Joe Hoke, USACE Savannah District  
Jim Greenfield, USEPA Region 4  
Paul Conrads, USGS (via phone)  
Larry Neal, MACTEC  
Margaret Tanner, MACTEC  
Steven Davie, Tetra Tech, Inc.  
Will Anderson, Tetra Tech, Inc.  
Yuri Plis, Tetra Tech, Inc.

**Agenda:**

1. WASP model – consistency with enhanced grid and status of TMDL process
2. Status of calibration report from Tetra Tech
  - Issues/concerns from Federal and State agencies
  - Dr. Kim's (ITR USACE) comments
  - July 1, 2005 deadline for agency position
3. Application of the models for impact simulations (inputs and outputs)
  - Comments from states and other users

**I. Status of TMDL (Jim Greenfield):**

- EPA will now use one model for the harbor – enhanced grid
- WQ standard for dissolved oxygen still being developed, EPA headquarters is going to talk to GAEPD about proposing the standard
- SCDHEC will still have to develop a site specific criteria for SC waters
- Recruitment (fish) model will be used to develop the criteria values; being used in the Escatawpa River Estuary for the dissolved oxygen criterion (3.0 g/L); using daily dissolved oxygen values and comparing to acute and chronic limits
- 2004 loads being used to update the TMDL – using July, August, and September average DMR data – Jim send to MACTEC for review
- Riverside Power Plant decommissioned
- Kerr McGee immediate oxygen demand load is now removed
- Need to check heat loads with GA Power (MACTEC to verify this with GA Power)

## **II. Issues and Concerns on Final Report on Hydrodynamic and Water Quality**

### **Models:**

1. Discussed Dr. Kim's comments and went around the table discussing issues and concerns from each agency/group represented.
2. Larry Neal summarized his organization's concerns in a handout.
3. The group then had a wide-ranging discussion of that included a number of issues. These are summarized in the next two sub-sections. The first paragraph is the group's attempt to develop categories for the comments that describe the amount of effort expected to address a concern. The second paragraph states the concern and the category of future effort (in bold) expected to address it. These issues should be considered further before using the models to identify impacts of the recommended plan.

### **Ways to address concerns with the models and the reports**

The group categorized the concerns according to the level of action that is appropriate to fully address each concern. The following four categories were developed, roughly in order of the effort expected:

- A** Explain better in the report, no modeling action needed.
- B** Keep in mind when interpreting the model results.
- C** Additional sensitivity model runs are needed.
- D** Recalibrate / revise model.

(note: a "C" action could turn into a "D" action depending on the results)

### **Summary of issues and concerns and actions to address each concern [option from above]:**

1. **[B]** Marsh water quality loads:
  - a. **[A]** Inclusion in the enhanced grid
  - b. **[A]** Equal comparison between the TMDL and enhanced grids
  - c. **[C]** Is the CBODu too high?
  - d. **[C]** Mass exchange – flows and concentration
  - e. **[C]** Surface to bottom – CBODu vertical differences are a function of how marsh areas were loaded into the enhanced model
2. **[C]** Offshore boundary:
  - a. Salinity 34 to 36 ppt versus 32.5 to 35 ppt
    - i. Mass flux surface to bottom – may need to re-distribute at FR-26
  - b. Dissolved oxygen saturation 95 to 105% versus 90%
  - c. Temperature
  - d. Larry Neal gave info "World Ocean Atlas 2001" with data
  - e. CBOD decay rate – confirmed 0.5 multiplier on ocean cells
3. **[C]** Surface salinity:
  - a. Model appears to under predict surface salinity on the Front River. How does this impact the marsh succession modeling? The EFDC will output salinity for the neural net application, which feeds the marsh succession model. Right now, the neural net is using the USGS gages located between the Talmadge Bridge and I-95, located on Front and Back Rivers. These gages are considered to be mid-depth. The EFDC model is

- predicting salinity well at the bottom and at mid-depth but under predicting salinity at the surface.
4. **[A & B]** Ebb flows and currents:
    - a. Under prediction of the ebb flows and currents on the Little Back and Back Rivers
  5. **[A]** Water level at SR-17 on the Upper Savannah River
    - a. Potential of adding marsh storage areas upstream of I-95 Bridge
    - b. Show comparisons at the USGS Hardeeville gage (show plot)
  6. **[C & A]** Global versus source-specific BOD decay rates
    - a. Sensitivity of calibration
    - b. Sensitivity on allocation scenarios (more for TMDL)
  7. **[A]** Check all point sources and heat loads, especially Plant MacIntosh (MACTEC to verify)
  8. **[none]** BOD loads from Corps' confined dredged sediment placement sites in SC and potential impacts on dissolved oxygen (future TMDL issue)
  9. **[A]** Grid convergence test:
    - a. Show results of the TMDL grid with the same depth;
    - b. Show results on TMDL grid, enhanced grid, and convergence grid on the same plots;
    - c. Show comparisons on the Middle and Little Back Rivers;
    - d. Perform moving average of results to reduce tidal noise; and
    - e. Quantification of grid convergence test results.
  10. **[B & C]** Delay in EFDC model salinity results at US FWS Dock comparisons of model versus data
  11. **[A]** Clearer description of 1999 versus 2002 bathymetry and why the 2002 bathymetry data is representative of 1997 through 2003 conditions in the harbor
  12. **UA/SA Analysis:** The group concluded that the inability to run the models over a 7-year duration was the result of synthetic data that was developed to fill in a data gap around December 2000. The group concluded that the inability of the model to run over the entire 7-year period of data does not reflect on the structure of the model or its performance, and should not be a consideration of the model's usefulness for its intended purposes of predicting impacts of the Savannah Harbor Expansion Project, developing a dissolved oxygen TMDL, or permitting point source discharges.

### **III. Model Application for Identifying Impacts to Water Quality.**

The Interagency Water Quality Team then discussed application of the models for identifying impacts to water quality from the Savannah Harbor Expansion Project.

1. The impact evaluation runs should use a varying flow, rather than the uniform flow that was previously proposed by Savannah District.
2. Dissolved oxygen should be reported at increments of 0.1 mg/L, rather than the 0.5 mg/L that was proposed by Savannah District.

3. Model results in hourly outputs will be sufficient.
4. BOD loads should use the loads reported in 2004, rather than what was reported in 1999. The loads should be averaged over the entire summer. The loads should be run through both the RIV1 model and WASP.
5. Potential impacts to the assimilative capacity of the harbor would need to be identified. This should be performed with the following model inputs:
  - August 1999 tides, flows, temperature, and salinity
  - Loads from upstream sources should include CBOD and ammoniaNOTE: A. flows would be varying, rather than uniform as previously proposed  
B. flows measured at Clyo are considered representative of the critical conditions and the 7Q10 flow did occur during 1999
6. Natural condition runs would need to be performed. This should be performed with the following model inputs:
  - Without point sources – no heat and BOD loads in harbor and upstream
  - Without nonpoint sources – no stormwater loads, but marshes should be included
  - Existing bathymetry (as expressed in calibrated model)
7. Further identification of potential impacts to temperature would be developed as part of the impact runs for Fisheries, which will include runs over January,
8. For water quality impact evaluation runs, the following scenarios would need to be evaluated:
  - A. Natural condition without deepening
  - B. Natural condition with deepening
  - C. 2004 point source loads with deepening
  - D. 2004 point source loads without deepening
9. The Corps expects to perform the following runs to evaluate potential effects of deepening the navigation channel:
  1. existing = 42 feet
  2. 44 feet
  3. 45 feet
  4. 46 feet
  5. 47 feet
  6. 48 feet
10. The team recognized that the various scenarios and model outputs that had been requested will require a great deal of effort and would produce a very large quantity of information. The team also recognized that some of that information may, ultimately, not be useful. To minimize the time spent developing, presenting, and interpreting model outputs, the team recommended they meet again as soon as the initial water quality model runs had been completed. The hope is that the initial outputs would show what type of information is truly needed to identify impacts from the proposed actions and

differentiate between the plans. This would allow other information to no longer be developed, presented or interpreted. The team recommended that the initial runs consist of (A) 2004 point source loadings, (B) natural conditions, and (C) maximum permitted loadings. Each of these three scenarios should be run for both the existing channel depth and the maximum deepening being considered.

Prepared by:  
Steven Davie  
Tetra Tech, Inc.