Status Report
Modeling Technical Review Group (MTRG)
Savannah Harbor Expansion Project

January 17, 2001

A meeting was held on Wednesday, January 17, 2000 in Atlanta, GA at the USEPA offices. The goals of the meeting were as follows:

- Present and discuss Salinity and Hydrodynamic Model calibration results.
- Discuss Dissolved Oxygen Model inputs and calibration.

The following persons attended the meeting and participated in the MTRG discussions:

Matt Goodrich	ATM	843-884-8750	mgoodrich@appliedtm.com
Bo Ellis	ATM	843-884-8750	boellis@att.net
David Sample	LAW	770-421-7046	dsample@lawco.com
Larry Neal	Harbor Comm/LAW	770-499-6791	lneal@lawco.com
Daniel Mendelsohn	ASA	401-789-6224	mendo@appsci.com
Jim Greenfield	EPA	404-562-9238	greenfield.jim@epa.gov
Paul Conrads	USGS	803-750-6140	pconrads@usgs.gov
Eduardo Yassuda	ASATM	843-884-8750	eyassuda@asatm.com.br
William Bailey	USACOE	912-652-5781	william.g.bailey@sas02.usace.army.mil
Jack Blanton	SKIO	912-598-2457	jjack@skio.peachnet.edu
James Martin	USACE WES	601-634-3714	martinj@wes.army.mil

No written comments were provided for consideration by the MTRG.

General Discussion

Opening Comments:

Jim Greenfield stated that EPA believes the raw data presented in the 1999 Hydrodynamic and Water Quality Monitoring Report should be made available. The data would need to be in an ASCII or database format. Jim Greenfield plans to write a letter on behalf of the EPA to GPA and USACE Savannah District requesting that the data be made available.

Presentation of the Hydrodynamic and Salinity Model Calibration Results:

Daniel Mendelsohn presented an update on the Hydrodynamic and Salinity Model calibration. The Powerpoint slide show used for the presentation is shown in Attachment A. The presentation outline is as follows:

1. Outstanding Issues

1.1. Data Issues

1.2. Data/model presentation issues

1.3. Modeling issues

- Convergence testing in progress
- BFHYDRO/BFWASP salinity comparison in progress.
- Industry temperature loads not included yet due to lack of data.
- Improved hydrodynamic model by including river slope.

2. Review of Similar Modeling Studies

2.1. ECOM application to NY Harbor

Model author: Blumberg and Mellor (1987)

Investigator: Blumberg, A. F., L. A. Khan and John, J. P., 1999. "Three-Dimensional Hydrodynamic Model of New York Harbor Region", Journal of Hydraulic Engineering, ASCE, vol. 125, no. 8, pp. 799-816

2.2. POM application to Lake Erie

Model author: Blumberg and Mellor (1987)

Investigator: Kuan, C., K. W. Bedford, D. J. Schwab, 1993. "A preliminary credibility analysis of the Lake Erie portion of the Great Lakes Forecasting System for Springtime Heating Conditions" in Qualilative Skill Assessment for Coastal Ocean Models, Lynch, D. R. and A. M. Davies, Coastal and Estuarine Studies, Vol.47, AGU, Washington, DC.

2.3. ECOM application to Mamala Bay

Model author: Blumberg and Mellor (1987)

Investigators:

MamalaBayStudy: Final Report, Vol. I, Prepared by the Mamala Bay Study Commission, April 1996.

Hydrodynamics portion investigated by Blumberg

2.4. ECOM application to Massachusetts Bay

Model author: Blumberg and Mellor (1987)

Investigator: Signell, Blumberg and Jenter (1995)

2.5. CH3D-WES application to NY Bight

Model author: Sheng (1986)

Investigator: Scheffner, N. W., S. R. Vemulakonda, D. J. Mark, H. L. Butler and K.W. Kim (1994). "New York Bight Study, Report 1: Hydrodynamic Modeling, US Army Corps of Engineers, Waterways Experiment Station.

2.6. CE-QUAL-W2 application to Savannah River

Model author: US Army Engineers Waterways Experiment Station, Environmental and Hydraulic Laboratories (1986). Model originally developed by Buchak and Edinger (1982)

Investigator: Hall, R. W. "Application of CE-QUAL-W2 to the Savannah River Estuary", Technical Report: EL-87-4, US Army Corps of Engineers, Washington, DC.

2.7. EFDC application to St. Johns River

Model author: Hamrick (1996)

Investigator: Sucsy, P and Morris, F., St. Johns Water Management District

3. 1999 Model/Data Comparison Statistics

3.1. Mean water surface elevation (WSE)
3.2. WSE harmonics
3.3. WSE phase
3.4. M2 amplitude
3.5. Current phase
3.6. Salinity time series plots
3.7. Salinity percentiles
3.8. Salinity RMS errors
3.9. Salinity mean errors

MTRG Discussion Points During Hydro/Salinity Model Presentation:

1. Outstanding Issues

1.1. Data Issues

- The suggested specific conductance interference near August 12, 1999 has not yet been confirmed or disproved. In the absence of confirmation, the suggested interference will be ignored.

- ATM chose a measured vs. simulated comparison period from August 4, 1999 to September 8, 1999 based on the most complete availability of boundary data. The model can be expected to perform consistently only if the proper boundary forcing is applied. Water quality and hydrodynamic data collected between August 4th and September 8th provides the required measured data to be considered a proper boundary condition. Water quality and hydrodynamic data collected before and after this time period have less complete data records. Reasons for a less complete data record include elimination of data during QA/QC process and the Hurricane Floyd critical instrument removal. The MTRG recommended that this time period be referred to as a "comparison period," not a "calibration period" since the model calibration still uses the entire data record.

  The MTRG recommended that ATM calculate statistics for both the entire calibration period as well as the "comparison period."

  Paul Conrads distributed a handout that identified a total of eleven tidal conditions during the summer of 1999. The tidal conditions were a variety of "normal" tides, periods of "extreme" tides and spring and neap cycles. The MTRG recommended that measured vs. simulated data comparison statistics be provided for these different periods. Comparison statistics for the different tidal conditions will enable the MTRG to assess the model capabilities during "normal", "extreme", spring and neap tidal conditions.

1.2. Modeling issues

An update was given to the MTRG on the status of the following issues:

- Convergence testing in progress
- BFHYDRO/BFWASP salinity comparison in progress.
- Industry temperature loads not included yet due to lack of data.
- Improved hydrodynamic model by including river slope.

2. Review of Similar Modeling Studies

- Daniel Mendelsohn compared seven model applications that had similarities to the Savannah Estuary application. A comparison of the available model/data statistics showed that the Savannah model is comparable to or better than similar applications.

3. 1999 Model/Data Comparison Statistics

3.1. Mean water surface elevation:

The water surface set-up was greatly improved in the upriver section of the model for the latest simulations.

3.2. WSE harmonics:

The damping of the tidal wave was significantly improved at I-95 bridge and above.

3.3. WSE phase:

There was a slight improvement to the phase lead error in the model.

3.4. Current amplitude:

The M2 amplitude, which contains most of the energy, is much improved at all stations above station GPA-04.

3.5. Current phase:

There were small improvements upriver.

3.6. Salinity time series and statistics plots:

Comparison of salinity, model-observation statistics showed improvement over the previous calibration scenario presented at the November 13, 2000 MTRG Meeting in Savannah. Measured vs. simulated data comparison of mean salinity as a function of river mile also showed good agreement. The simulated salinities at station GPA-14 are now showing the appropriate concentration of salinity during the spring tide events, as shown by the measured data.

3.7. Salinity percentiles:

James Martin recommended that the lines and data points in the percentile plots be swapped, such that the lines represent the simulated data and the points represent the measured data.

The MTRG recommended that the comparison period for the percentiles match the other statistics comparison periods.

4. Summary

Based on the discussions described above, the MTRG agreed to the following results and recommendations:

- The model intercomparison presentation showed that the Savannah model compares well to similar model applications.
- The latest model runs show improvement.
- Because of the good agreement with measured and simulated data at GPA-14, that location should be considered for use as the chlorides sub-model boundary.
- The draft final report will be submitted to the MTRG the week of January 29th.

5. Other MTRG Comments

- Jack Blanton commented on the CD distributed to the MTRG after the November 13th MTRG Meeting in Savannah.
    - The measured vs. predicted presentation graphics are good.
    - The ability of the model to simulate currents down throughout the water column, especially near the river bottom, needs to be improved. The improvement in the simulated currents may improve the salt transport simulation.
    - The bad ADCP measured data, ("noise") near the surface should be deleted from the measured current plots. Model to observation comparison in the "noisy" region is misleading.
    - Smoothing of the bathymetry near "sill" features (e.g., at Houlihan Br, the entrance to the Back River or the Tide Gate) may improve salt transport in the model. The MTRG consensus was that bathymetry smoothing is merited in such instances.
- Jim Greenfield requested the distribution of an animation file of the salinity and temperature simulations once the model calibration phase is completed. Jim Greenfield recommended that stations GPA-05 and GPA-06 be included in the animation file.

6. Analysis Performed After the MTRG Meeting

Jack Blanton suggested that a progressive salt flux diagram would be useful to evaluate the salt transport of the model. Subsequent to the meeting the progressive salt flux analysis was performed and the results are shown graphically in Appendix C. As the progressive salt flux diagram is essentially the cumulative salt exposure at a station, the results have been labeled as the 'salt dose' and have units of (ppt-hours). The two plots compare the most recent calibration scenario to the previous three calibration scenarios and measured data at selected monitoring stations.

Water Quality Model Input and Calibration

Eduardo Yassuda presented an update on Task SEGDO1, Water Quality Model development. The Powerpoint slide show used for the presentation is shown in Attachment B. The presentation outline is as follows:

1. Point-Source Dischargers
2. Reaeration Coefficient
3. Calibration Methodology

MTRG Discussion Points During Water Quality Model Presentation:

1. Point-Source Dischargers

- Kerr-McGee has two outfalls: numbers 1 and 4. Clarification of the data presented in the Wastewater Characterization Report (WWCS) is needed to ensure that the loads for each outfall are accurately represented in the Water Quality Model.

- The MTRG prefers that the model use a "stair-step" loading, not linear interpolation between load points. Eduardo Yassuda will check and confirm that the model is using a "stair-step" loading.

- The MTRG recommends that a constant BOD5 loading of 8 mg/l be used for all municipal loading when there is only sparse measured data (not at President Street).

- The electronic WWCS data obtained from the Harbor Committee needs to be checked. There was an apparent swapping of data between variables during data exporting/importing.

- It was noted that the NH_3 data for International Paper is reported in µg/L.

- ATM will coordinate with the Harbor Committee to provide a list of the f-ratios and $BOD_{ultimate}$ loads which will be provided to the MTRG at the next meeting to review, discuss and approve for model calibration.

2. Reaeration Coefficient

- Eduardo explained that the EPA measured reaeration coefficient includes boat drifting with the current, and this results in the weak correlation between diffusion rate and current velocity.

- The reaeration calculation in the model will always use the O'Connor-Dobbins formula.

- Eduardo will plot the reaeration coefficient for several reaches and present at the next meeting.

- There is a minimum reaeration coefficient in the model based on Thomann, and a maximum will be implemented if necessary (i.e., if the results show unbelievable coefficients).

- Eduardo presented color contour plots of the vertical dissolved oxygen distribution at a point versus time. The MTRG recommended the addition of the measured data to this plot by including two 'bands' of measured data at the appropriate depths.

3. Calibration Methodology

- James Martin requested that the "whole suite" of statistics (i.e., similar to those calculated for the hydro/salinity model) be included in the WQ model calibration.

- The MTRG agreed that inclusion of a two-component BOD rate be further evaluated for use in the Water Quality Model. Roy Burke will be asked to provide his input to the approach and explain any concerns from GA EPD. ATM noted that while the adding the additional rate is simple, the process of coding and testing is not trivial and will take some time and budget. ATM will provide an estimate of the necessary time and budget at the next MTRG Meeting.

Future Activity

MTRG Schedule Milestones Identified in the Meeting:

DATE	MTRG SCHEDULE MILESTONE
Week of January 29, 2001	A CD containing pdf electronic files of the *Draft Final Hydrodynamic and Salinity Model Calibration Report* are to be distributed to MTRG via Fed-Ex Mailing.
February 21, 2001 (Wednesday)	MTRG Comments on *Draft Final Hydrodynamic and Salinity Model Calibration Report* are due.
February 23, 2001 (Friday)	Compilation of MTRG Comments on the *Draft Final Hydrodynamic and Salinity Model Calibration Report* are to be distributed electronically to the MTRG.
February 28, 2001 (Wednesday)	Next MTRG meeting in Atlanta.

Comments and questions related to any particular issue should be directed to Chris Ahern of ATM (cahern@appliedtm.com).