

1.0 INTRODUCTION

1.1 BACKGROUND AND SITE DESCRIPTION

The purpose of this report is to describe the planning, execution, and results of an extensive hydrodynamic and water quality monitoring study of the Lower Savannah River. The study was undertaken by Applied Technology and Management, Inc. (ATM), with authorization through the Tier II Environmental Impact Statement (EIS) for the Georgia Ports Authority's (GPA) Savannah Harbor Expansion Project. The data collected in 1999, along with data collected in 1997 (under the Tier I Environmental Impact Statement), will support the calibration and verification of a three-dimensional hydrodynamic and water quality model of the Lower Savannah River.

The Lower Savannah River system and surrounding upland areas are depicted in Figure 1-1. For the purposes of this report, the Lower Savannah River (study area) consists of the following segments:

- The main trunk of the Savannah River from the mouth at Fort Pulaski (River Mile or RM +0.0) to Clyo, Georgia (RM +61.0).
- The South Channel from the RM +0.0 to Fort Jackson (RM+10.4) at the confluence of the Front River, Back River, and South Channel.
- The Back River, Little Back River, and Middle River, including the canals, creeks, marsh areas, and backwater areas located within the Savannah National Wildlife Refuge.
- Abercorn Creek from the Savannah River to upstream of the City of Savannah's Raw Water Intake near Raccoon Creek.

This Data Report presents the data collected during the 1999 Data collection Effort on the Savannah River as outlined in the task statements. Only raw data is presented in this report, no interpretation or analysis was attempted. Interpretation and analysis will be addressed in modeling reports described in the task statements.

This version of the Data Report is considered the Final Draft. A summary of the Draft Data Report distributions to the MTRG and final edits to the Draft Data Report are discussed in Section 1.5.5.

Collection of Water Samples

- Water chemistry sampling at all 32 Continuous In-Stream Water Quality Stations for a 7-week period on high- and low-slack tides. (See Section 7.0)
- Special Events included longitudinal profiling of 10 stations established by EPD in the 1980s, 24-hour dynamic sampling and profiling, marsh exchange sampling and profiling, chlorophyll-a sampling, and cross-sectional profiling. (See Section 9.0)
- LTBOD samples were collected 3 times at 6 in-stream stations for high- and low-slack tides. LTBOD samples were collected at Clio during the same 3 times as the in-stream sample collections. LTBOD samples were also collected at 5 marsh stations on a flooding and draining event for each marsh. (See Section 10.0)

1.4 STUDY GOALS AND OBJECTIVES

The goal of the field deployment and sampling program was to obtain data sufficient to support the calibration of a predictive model, and to quantify the salinity, chloride, and dissolved oxygen conditions as they exist at present. The field-gauging program and sampling program was designed to obtain hydrodynamic and water quality information during a low flow period (lower headwater discharges allowing for maximum salinity and chloride intrusion into the estuarine system) and high water temperatures (to capture low dissolved oxygen levels). Sampling protocols and frequencies for the various parameters of interest were designed to acquire both conditions and discrete records of variation over tidal cycles.

1.5 RESULTS OF THE 1999 DATA COLLECTION

Applied Technology and Management performed the summer 1999 data collection in accordance with the task statements approved by the MTRG, accepted by the SEG and recommended to Georgia Port Authority.

The task statements were drafted as a collaborative effort between the MTRG, SEG, GPA and ATM. As stated in Section 1.3, task statements SEG311, SEG312, and SEG313 are found in Appendix A. The MTRG agreed that the finalized task statements outlined a complete data set that would be more than sufficient for the purposes of calibrating the water quality models described in each task statements.

The MTRG met during the data collection event and immediately after to review the data collected to date and provide further consultation to the data collection effort. The MTRG was briefed on the progress of the Data Collection Effort. ATM presented unexpected developments in the Data Collection Event for discussion in the MTRG. The decisions of the MTRG were then applied to the Data Collection Effort. Through collaboration with the MTRG, the 1999 Data Collection effort succeeded in meeting all objectives outlined in the task statements.

1.5.1 Preparation for the 1999 Data Collection Effort

Preparation for the summer 1999 Data Collection Effort started soon after the final approval of the task statements were obtained from the MTRG on May 4, 1999. Instrumentation, personnel, and equipment were mobilized to Savannah from July 5 through 16, 1999.

Continuous water quality monitoring station mounts were being deployed by July 19, 1999. All In-stream water quality instruments were deployed by August 10, 1999. The instrument servicing schedule was begun August 3, 1999. Week 1 of the Water Chemistry Sampling Effort started on August 2, 1999. Table 5.1 shows the schedule of water quality and hydrodynamic instrument deployment and servicing.

Innovative practices were used to deploy the continuously monitoring water quality instruments. Where no structures for mounting instruments were available, mounting systems were designed and fabricated. Section 2 of this report describes the designs and variety of deployments used for the summer of 1999 data collection.

1.5.2 Performing the Data Collection Tasks

ATM deployed as many as 10 engineers staff members to perform the tasks described in the task statements. During most days of the Data Collection Effort, three boats were on the

Savannah River performing separate data collection tasks. Some data collection events required all boats to perform the same data collection tasks at different points on the river. Figure 8-2 shows images of the different boats performing data collection tasks.

Even with all the careful consideration, planning and preparation for the data collection events there were interruptions in the data collection. Weather events and equipment breakdowns interrupted data collection during several occasions. Most weather event interruptions were recoverable with extra effort on good weather days. With additional effort on good weather days or combining tasks for a day of data collection, the interruptions were recovered.

Inclement weather was the most common data collection interruption during the summer of 1999. Lightning and heavy rain events are considered inclement weather ATM policy does not allow field crews to work when these conditions arise. Although considered extremely hot and dry during August and most of September, afternoon thunderstorm and frontal systems were a regular occurrence. In order to deal with the frequent afternoon storm, data collection efforts were organized so they were nearly completed before 3 PM.

Interruptions were unavoidable in the 14 weeks of the data collection. Overall the interruptions that did occur during the data collection were not detrimental to the overall data collection. In most cases recovery from inclement weather and equipment failure was possible.

Inevitably some equipment will fail during a water quality monitoring study. Given the size and scope of the 1999 Hydrodynamic and Water Quality Monitoring of the Lower Savannah River, few equipment failures were experienced. Equipment failures did result in lost in-stream continuous water quality data but the failures were discovered after the short deployment period, less than two weeks. Therefore the failures did not result in total loss of the water quality data at any specific location as the individual failures were usually short lived. Continuous In-stream Water Chemistry data are plotted for each station in Figures 5-3 to 5-31.

1.5.3 Hurricane Floyd

The evacuation of Savannah for the Hurricane Floyd was an interruption in the data collection effort that was unrecoverable. Table 1-1 describes the data not collected due to the interruption in the data collection caused by Hurricane Floyd.

Event 1 in Table 1-1 summarizes the interruption of the Water Chemistry Sample Collection Effort. Chatham County officials announced the mandatory evacuation of Savannah and the surrounding areas due the approaching Hurricane Floyd at 2:00 PM on Monday September 13, 1999. The evacuation was mandatory by 8:00 AM September 14, 1999. Table 1-3 summarizes the Continuous In-Stream Monitoring Stations where water chemistry data were not collected from September 14 through 17, 1999.

Event 2 in Table 1-1 summarizes the interruption in the Continuous In-stream Water Quality Data Collection Effort. ATM personnel accomplished the removal of five continuously monitoring water quality stations on Monday September 13, 1999 before evacuating that evening. Section 5.2 describes why the specific Continuous In-stream Water Quality Monitoring Stations were removed due to the approaching hurricane. The Continuous In-stream Water Quality Stations that were removed Monday September 13, 1999 and then redeployed September 20, 1999 are listed below.

- GPA-26B
- GPA-26S
- GPA-04B
- GPA-04S
- GPA-03B

Event 3 in Table 1-1 summarizes the interruption in the Continuous In-stream Hydrodynamic Data Collection Effort. The bottom mounted Acoustic Doppler Current Profiler (ADCP) at GPA-04 was removed on Monday September 13, 1999 when the water quality instruments were removed. As discussed in Section 5.2, the instrument location was thought to be the most vulnerable due to their proximity to the ocean and the potential loss of the instruments. Anchors for the navigation channel markers served as tether points for the instrument mounting structures on the bottom of the River. If the markers had dragged their anchors due to the storm surge, the instruments tethered to the navigation channel markers could be lost.

Mounting systems are described in Section 2 of this report. Further detail in the mounting system for each station is available in Appendix B, the formatted “as-built” notes. The locations of the Continuous In-stream Water Quality Stations are described in Section 5 of this report.

Locations of the Continuous In-stream Hydrodynamic Stations, including the two bottom mounted ADCP locations, are described in Section 3.

1.5.4 Water Chemistry Data Invalidated by Laboratory Error

Results from 57 of 130 week 7 BOD water chemistry samples submitted to Analytical Environmental Services (AES) are unusable due to laboratory error. Table 1-2 summarizes the loss of BOD data as a result the laboratory diluting or performing the analysis with too little sample volume. The week 7 Continuous In-stream Water Quality Stations where the Water Chemistry Data was lost are listed in Table 1-3.

Section 8.0 describes the Water Chemistry Sampling Event and presents the valid results from the laboratory analyses. Tables summarizing weekly laboratory results are located in Appendix J. Issues related to the laboratory error and split samples analysis are presented in the January 17, 2000 report titled: *Findings of In-Stream Water Chemistry Data, Savannah Harbor Expansion Project – Field Data Collection, August 2 through October 9, 1999*. The January 17, 2000 Report can be found in Appendix R.

1.5.5 QA/QC of the Data Presented in the Data Report

The data presented in the Final Data Report have undergone an extensive Quality Analysis and Quality Control (QA/QC) process. Data that are not shown in the data presentation and are not described in Sections 1.5.3 or 1.5.4 were not accepted after the QA/QC process.

Examples of how the QA/QC process was applied to the different types of instrument deployments and water sampling efforts, listed in Section 1.3, are found in the corresponding Sections of the Final Data Report Text. The corresponding Section numbers for each type of data listed are referenced in Section 1.3.

1.5.6 MTRG Conclusions

With the exception of the specific examples described in Section 1.5.3 and 1.5.4, ATM successfully completed the objectives outlined in the task statements. At the August 29, 2000 MTRG meeting in Atlanta, the MTRG concluded that the 1999 Data Collection Effort results

presented in this Data Report are acceptable for the next phase outlined in the task statements, model calibration. Calibration of the Hydrodynamic, Salinity, Dissolved Oxygen and Chloride models will therefore be calibrated to the data presented in this report.

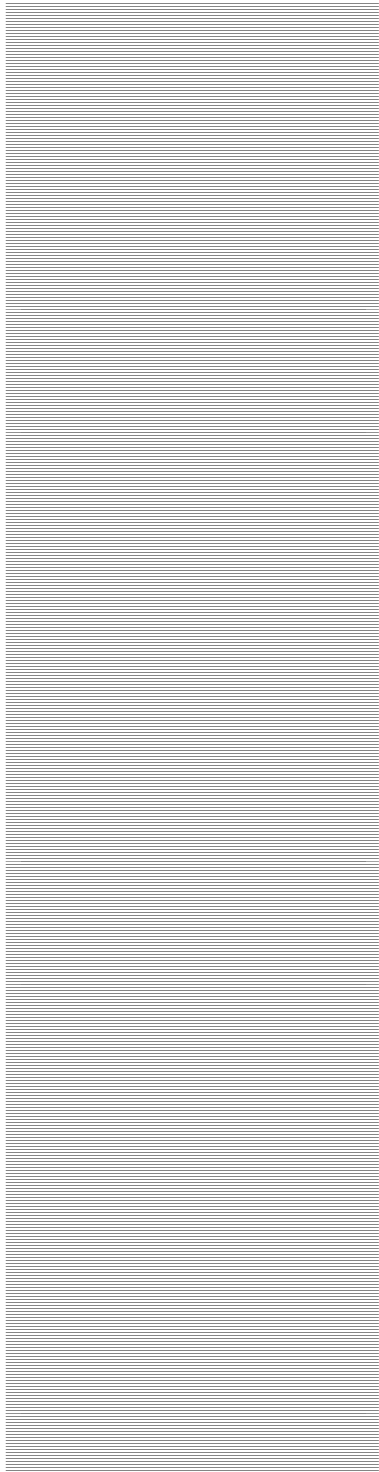
Comments from the MTRG on the April 27, 1999 and June 16, 1999 distributions of Draft Data Report are located in Appendix S. After reviewing the Draft Data Report and discussing all comments submitted by individual members, the MTRG developed responses to each of the comments, which are listed below each of the comments. MTRG comments on the Draft Data Report were applied to the April 27, 1999 and June 16 distributions of the Draft Data Report to produce the Final Data Report.

The April 27, 1999 distribution of the Draft Data Report to the MTRG contained the following components:

- Table of Contents
- List of Figures
- Sections 1.0 to 11.0
- Appendix A to Q

The June 16, 1999 distribution of the Draft Data Report to the MTRG contained the following components:

- Updated Table of Contents
- Updated List of Figures
- Additional Appendix G Figures, Contours of all ADCP Transects
- Updated Section 8.0, Savannah Labs J-values replaced
- Completed Section 10, LT BOD Data added
- Completed Section 11, Added USGS and Continuous Instrument Water Surface Elevation Plots
- Added Appendix R, January 17, 1999 Report titled: *Findings of In-Stream Chemistry Data, Savannah Harbor Expansion Project – Field Data Collection, August 2 through October 9, 1999*



TABLES

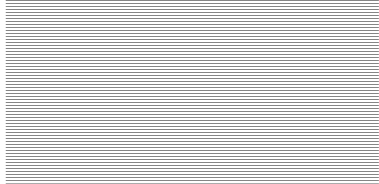


Table 1-1: Summary of the Data Collection Interruption Due to Hurricane Floyd (September 15 to 17, 1999)

Event #	Type of Data	Dates	Description of Data Not Collected
1	Continuous In-Stream Water Chemistry Data	September 14 through 17, 1999	59 of 65 Week 7 (September 13 to 17, 1999) Water Chemistry Samples at the Continuous In-Stream Water Quality Stations. The water quality samples that were not collected for Week 7 are listed in Table 1-3.
2	Continuous In-Stream Water Quality Data	September 14 through 20, 1999	Continuous Instrument Data at GPA-03B, GPA-04B, GPA-04S, GPA-26B and GPA-26S. Instruments were removed to avoid loss from Hurricane. See Section 5.2 for specific discussion of instrument removal and replacement September 20, 1999.
3	Continuous In-Stream Hydrodynamic Data	September 14 through 20, 1999	ADCP removed from GPA04 to avoid loss from Hurricane Floyd. See Section 3.6 for discussion on instrument removal and replacement September 20, 1999.

Table 1-2: Summary of Week 7 (October 5 to 9, 1999) Water Chemistry Samples Results Invalidated by Laboratory Error

Type of Data	Dates	Description of Water Chemistry Data lost
Continuous In-Stream Water Chemistry Data	October 5 through 9, 1999.	57 of 130 BOD and CBOD samples provided to AES Laboratories were either diluted or analyzed with reduced volumes. The results of the analysis for those 57 samples are therefore invalid. The sampling locations that were invalid are listed in Table 1-4.

Table 1-3: Continuous In-Stream Water Quality Stations Where Week 7
 (September 13 to 17, 1999) Water Chemistry Samples Were Not Collected
 Due to Hurricane Floyd Evacuation (September 14 to 17, 1999),

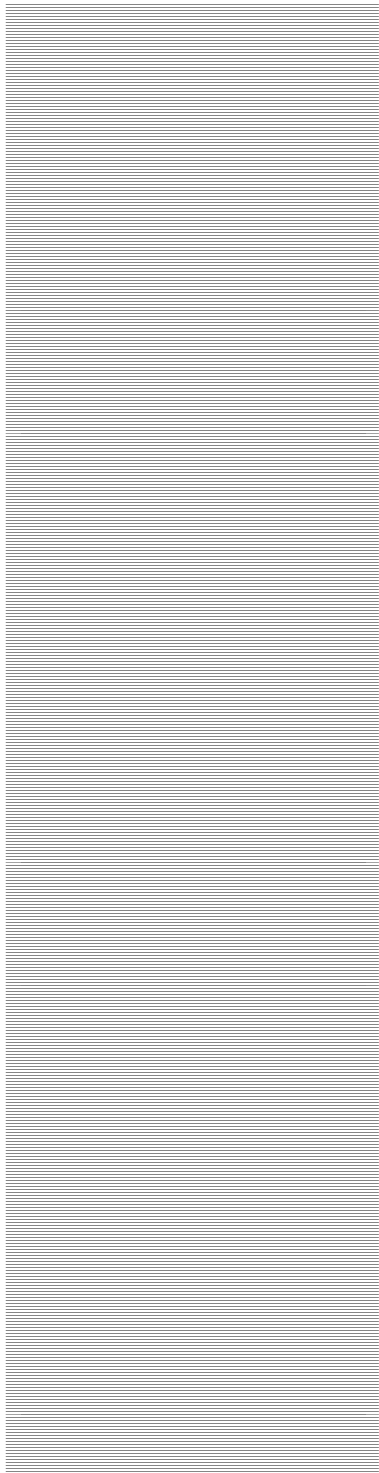
See Event #1 in Table 1-1.

(X = Water Chemistry Sample Not Collected)

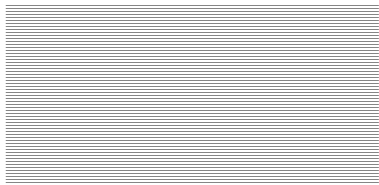
Sampling Station	High Slack Sample	Low Slack Sample
GPA-02B	X	X
GPA-02S	X	X
GPA-03B	X	X
GPA-04B	X	X
GPA-04S	X	X
GPA-05B	X	X
GPA-06B		X
GPA-06S		X
GPA-07S	X	X
GPA-08B		X
GPA-08S		X
GPA-09B	X	X
GPA-09S	X	X
GPA-10S	X	X
GPA-11RB	X	X
GPA-12RS	X	X
GPA-14B	X	X
GPA-15S	X	X
GPA-16M	X	X
GPA-17M	X	X
GPA-18B	X	X
GPA-19B	X	X
GPA-20B	X	X
GPA-21B	X	X
GPA-21S	X	X
GPA-22B		X
GPA-22S		X
GPA-23M	X	X
GPA-24M	X	X
GPA-25M	X	X
GPA-26B	X	X
GPA-26S	X	X

Table 1-4: Continuous In-Stream Water Quality Stations Where
 Week 7 (October 5 to 9, 1999) BOD and CBOD Sample Results
 Were Invalidated Due to Laboratory Error
 (X = Both BOD and CBOD Analysis Results Invalid)

Sampling Station	High Slack Sample	Low Slack Sample
GPA-02B	X	X
GPA-02S	X	X
GPA-03B	X	X
GPA-04B	X	X
GPA-04S	X	
GPA-05B	X	
GPA-06B	X	
GPA-06S		X
GPA-09S	X	
GPA-11RB	X	
GPA-21B	X	X
GPA-22B	X	X
GPA-23M	X	X
GPA-24M	X	X
GPA-25M	X	X
GPA-26B	X (CBOD only)	X
GPA-26S	X	X



FIGURES





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Figure 1-1:
Location Map of the Study Area

