1-1-2013

Water Quality Modeling in the Ross Barnett Reservoir using Environmental Fluid Dynamics Code

Gregory Alan Jackson

Recommended Citation

Jackson, Gregory Alan, "Water Quality Modeling in the Ross Barnett Reservoir using Environmental Fluid Dynamics Code" (2013). *Theses and Dissertations*. 4978.
https://scholarsjunction.msstate.edu/td/4978

Water quality modeling in the Ross Barnett Reservoir using Environmental Fluid Dynamics Code

By

Gregory Alan Jackson

A Thesis
Submitted to the Faculty of
Mississippi State University
in Partial Fulfillment of the Requirements
for the Degree of Master of Science
in Civil and Environmental Engineering
in the Department of Civil and Environmental Engineering

Mississippi State, Mississippi

May 2013

Water quality modeling in the Ross Barnett Reservoir using Environmental Fluid Dynamics Code

By

Gregory Alan Jackson

Approved:

James L. Martin
Professor and Graduate Coordinator of
Civil and Environmental Engineering
(Major Professor)

William H. McAnally
Research Professor of Civil and
Environmental Engineering
(Committee Member)

Dennis D. Truax
Professor of Civil and Environmental
Engineering
(Committee Member)

Sarah A. Rajala
Dean of the Bagley College of
Engineering

Name: Gregory Alan Jackson

Date of Degree: May 10, 2013

Institution: Mississippi State University

Major Field: Civil and Environmental Engineering

Major Professor: James L. Martin

Title of Study: Water quality modeling in the Ross Barnett Reservoir using Environmental Fluid Dynamics Code

Pages in Study: 128

Candidate for Degree of Master of Science

This thesis investigates the utilization of hydrodynamic models as tools for assessing factors impacting water quality in the Ross Barnett Reservoir. The primary focus is development of a hydrodynamic model that provides transport information to subsequent application of a water quality model. Environmental Fluid Dynamics Code (EFDC) is a complex, dynamic, multi-dimensional computer model used to simulate hydrology in water bodies.

The secondary focus is on data acquisition and manipulation methods for completing the hydrodynamic modeling. Monitoring was completed to create modern bathymetry of Ross Barnett Reservoir to provide accurate model cell grid representation. Temperature and dissolved oxygen profile monitoring occurred to provide data for model output comparison. The EFDC model successfully predicted lake stratification and subsequent mixing based on changes in observed meteorological conditions.

DEDICATION

I would like to dedicate this research to my wife and best friend, Donna Jackson.

ACKNOWLEDGEMENTS

The author wishes to express thanks to Greg Burgess, P.E., with the Pearl River Valley Water Management District for his kind support in providing historical records from the Ross Barnett Reservoir which were very valuable to the completion of this thesis. Additionally, Jim Greenfield, P.E. generously reviewed the EFDC model development and provided guidance on the model grid structure and input files to allow the EFDC models to run successfully.

TABLE OF CONTENTS

CHAPTER

APPENDIX

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1 Motivation and Justification

Mississippi Department of Environmental Quality (MDEQ) is required to permit water quality discharge activities based on computer model results. MDEQ also uses these water quality models to create Total Maximum Daily Load (TMDL) reports. The models may be generated by MDEQ, industrial permit applicants, or by the US Environmental Protection Agency (EPA). Regardless of the generating office, it is incumbent upon MDEQ to understand and utilize these models in-house as much as possible for efficient use of taxpayer funds.

This author is studying the utilization of hydrodynamic models as tools for assessing factors impacting water quality in the Pearl River Watershed for MDEQ. The Ross Barnett Reservoir (RBR), a major feature of the Pearl River Watershed, is a flood control, water supply reservoir located near Jackson, Mississippi, created in the 1960s by construction of a 3 mile earthen dam and flow control structure. MDEQ, in cooperation with EPA, Georgia Pacific, and Louisiana DEQ is creating a series of linked water quality models of the Pearl River Watershed. The models generated for the RBR discussed herein can be integrated into this multi-agency work product to model the Pearl River.

The primary focus of this study is development of a hydrodynamic model that provides transport information to the subsequent application of a water quality model based on the EPA’s Water Analysis Simulation Program (WASP) (EPA, 2012). MDEQ and EPA support WASP modeling for water quality permitting and TMDL development. WASP is preferred to other models by MDEQ when questions regarding nutrient cycles and dynamic flows need answers. The steady-state models MDEQ uses for routine permitting do not adequately address the dynamic nutrient cycle or diurnal fluctuations for development of permit limits, waste load allocations, or TMDLs. The dynamic model results and diurnal capabilities from WASP are better suited to these model needs.

The model selected for this hydrodynamic application is the Environmental Fluid Dynamics Code (EFDC), selected primarily because the model has a built in linkage file for WASP models. However, there are multiple versions of the model available, including versions with different vertical coordinate schemes (e.g. Z-Grid versus a generalized vertical coordinate model, GVCM). There are limited temperature data available from 2006, the development model timeframe, so a second EFDC model input set will be tested to compare the model's ability to predict conditions as monitored in 2012 as part of this study.

1.2 Research Approach

The generalized approach used in this study and discussed in following sections was to:

- Select the models for use in this application and to provide information to subsequent water quality simulations.

- Evaluate the characteristics of Ross Barnett Reservoir and model input requirements and design and conduct field studies to provide data sufficient to support the model application.
- Using available data from 2006 and data collected in 2012 as part of this study, apply and compare two versions of EFDC (with regard to vertical coordinates) and apply the development model (2006 construct) to the 2012 data set to evaluate the models ability to predict temperature and water surface elevation compared to measured events.
- Based on the final selection, complete the model application and develop linkage information for the subsequent application of a water quality model.
- Provide guidance of the data required and application of EFDC to comparable systems for future applications by MDEQ.

1.3 Ross Barnett Reservoir History and Operation

Construction of the Ross Barnett Reservoir on the Pearl River was authorized by the 1958 Mississippi Legislature. The project was sought to provide drinking water for the city of Jackson and to create a recreational area for central Mississippi by installing a 3 mile long earthen dam across the Pearl River north of Jackson. With a budget of $25 million, construction began in February 1960. The earthen dam and concrete water control structure were completed in September 1961, and the reservoir reached full pool stage for the first time on January 29, 1965 (The Rez News, 2012).

The reservoir is managed by the Pearl River Valley Water Management District (PRVWMD). This is a self-funded quasi-government agency. It controls the operations of water management and the surrounding lake-shore property. All of the homes and subdivisions on PRVWMD land are leased to the home owners with long-term 99 year contracts. The operational goal for PRVWMD is to maintain a sufficient drinking water supply for the Jackson metro area. The standard pool elevation is maintained between 90 to 91 meters above sea level.

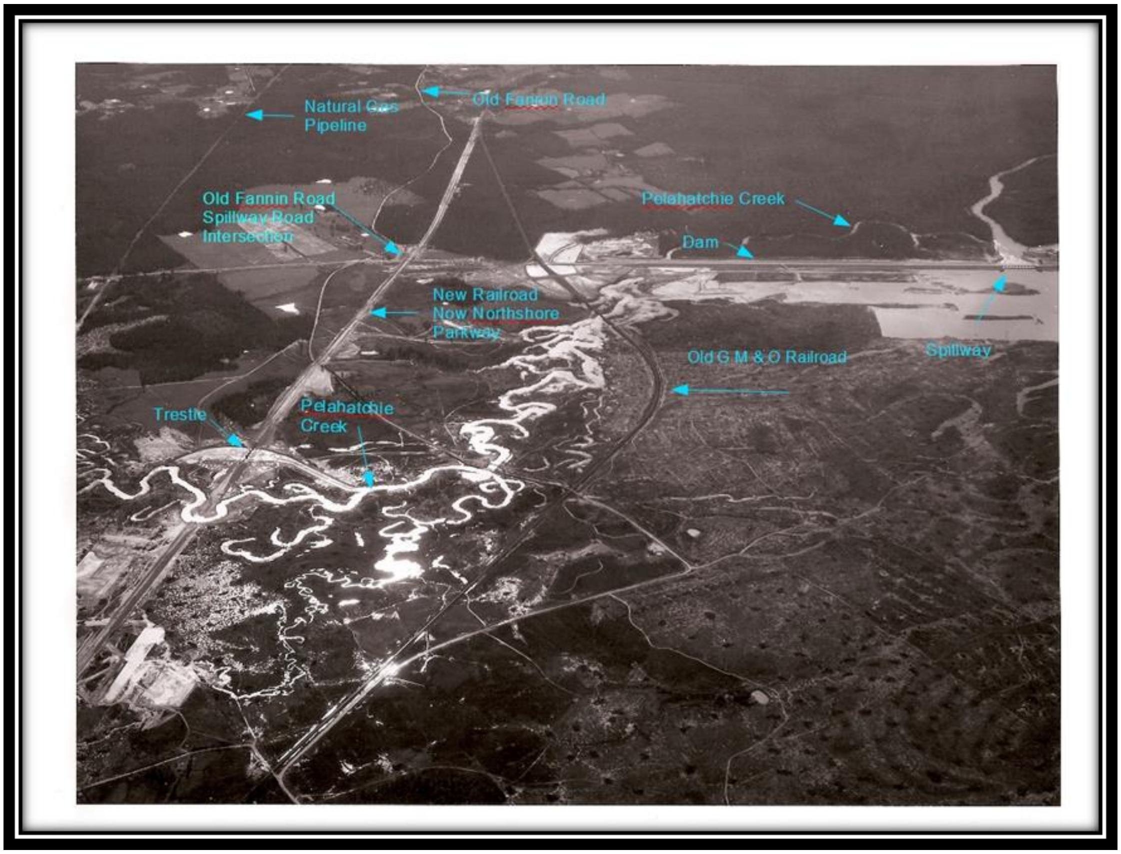


Figure 1.1 Aerial Photography Prior to Construction 1961 (The Rez News, 2012)

Photographs of the watershed prior to construction show a moderate sloped pine savannah with gently rolling hills. The resulting 37,000 acre reservoir is primarily a shallow water body with the majority of the deeper sections in and around the original channel areas of the Pearl River near the dam and in Pelahatchie Creek. The water depths range from 5 – 8 meters in the deep areas and 1 – 3 meters in the shallows.

CHAPTER II

APPROACH

2.1 Determine EFDC Model Parameters

Creating a successful hydrodynamic model requires collection of data and information to drive the physical and environmental processes in the model to simulate within a reasonable amount of accuracy the real world conditions. Many assumptions to reduce complexity are required to make the use of modeling an affordable predictive tool for use in water quality research.

The EFDC model requires atmospheric data and water quantity data in time series format. Water flow data are collected at US Geological Survey (USGS) gage sites and other sources. Weather data are collected from the National Weather service for the same time span. These forcing data are then applied to the model based on a cell structure that mimics the geometry of the water body. The complexity or simplicity of the cell structure determines part of the costs associated with providing the model input. These model inputs must balance in the economy of building the model. It is a waste of resources to obtain minute by minute flow and apply that data to a single cell model. On the other hand, a 100 meter square cell structure can provide extensive detail on the transport functions between cells, but without side by side monitoring, the model output are merely speculation at what is actually occurring in the water column. The balance of model complexity and data input must be achieved to provide a reasonable modeled simulation in comparison to the measured results.

2.2 Study Water Body Geometry and Prepare Model Grid

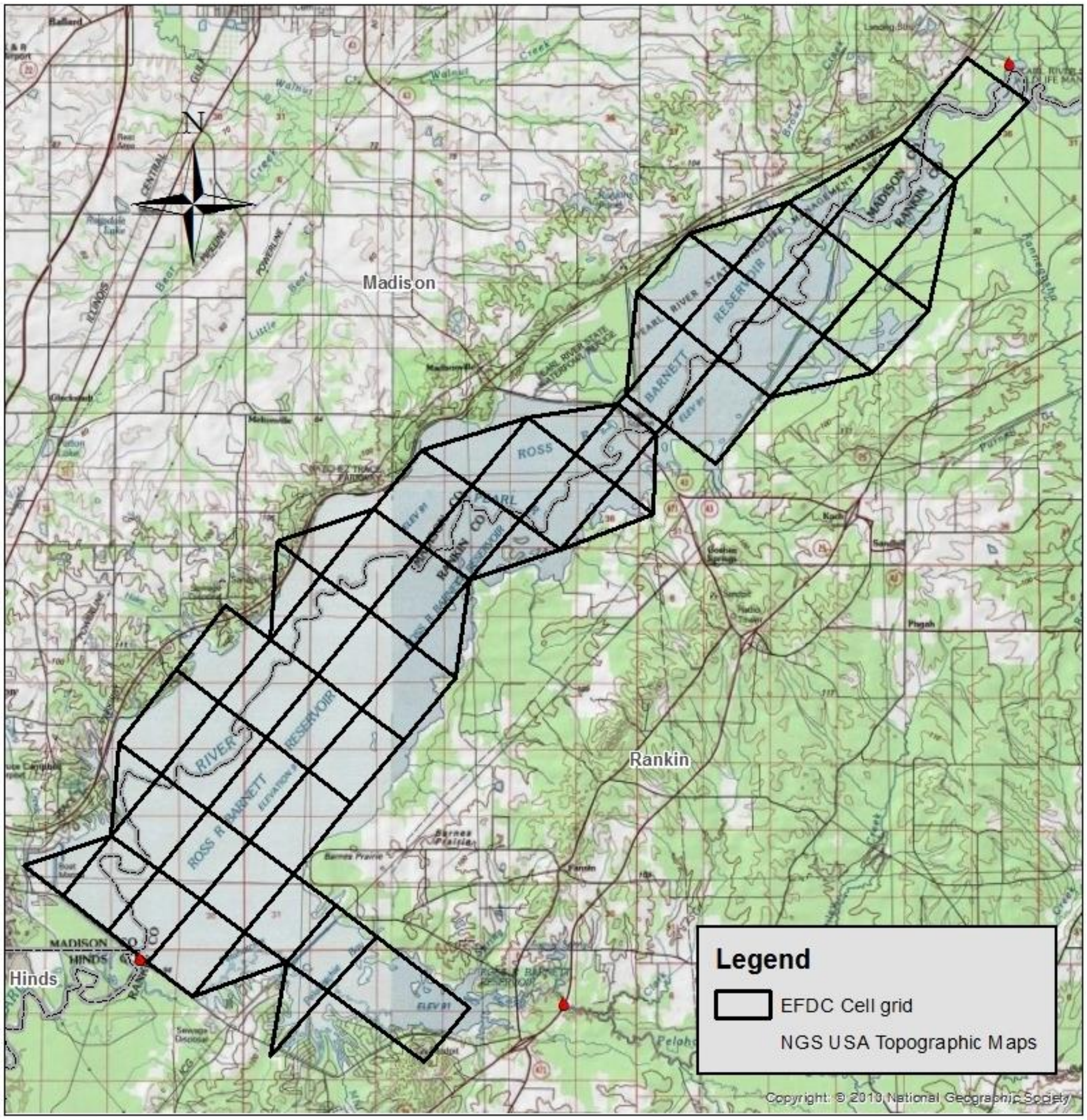


Figure 2.1 EFDC Model Cell Grid Layout

The first step in creating the cell structure was overlaying the map of the reservoir with a grid. To simplify this grid, the east – west gird was set parallel to the dam and the north – south grid perpendicular to the dam. The typical grid cell was roughly 1 km by 2 km. The rectangular cells were converted to triangular cells in some locations by transecting the rectangle to more accurately "fit" the water body. Field monitoring was conducted to create a modern bathymetry for the reservoir. Available maps were not sufficient to prepare the cell structure estimated depths suitable for model refinement. (FHS Maps) Three monitoring events were completed to obtain bathymetry and water quality temperature and dissolved oxygen profile values. These monitoring data sets will be compared to model output to determine the effectiveness of the EFDC models.

2.3 Determine Timeframe for Model

In June, 2006, US EPA Region 4 and MDEQ jointly monitored the Pearl River at several stations in Jackson, Mississippi downstream of the Ross Barnett Reservoir to gather stream data to create a water quality model for determining the waste load allocation (WLA) for the Jackson, Mississippi Savannah Street POTW. This effort was successful in generating a complete data set for model development in this segment. The conditions in the river were near critical conditions with low flows and high temperatures. The WLA as well as two TMDLs were created based on this dataset.

This successful monitoring effort and water quality model development generated the idea to build a series of models that link the segments of the Pearl River from the Ross Barnett Reservoir to the water diversion control structure at Walkiah Bluff in south Mississippi. The EFDC models for the Reservoir will be a part of this overall effort. Weather and flow data collected during 2006 were used to match the output from the

Reservoir model to the input used in the Jackson Pearl River model previously developed. The 2006 data set for this model was gathered from December 31, 2005 through January 1, 2007 for all of the time series input files for the EFDC development models.

CHAPTER III

DATA ACQUISITION

3.1 Water Quality Profile Data

The vertical thermal regime has dual significance for the water-quality modeler. Temperature has a strong influence on the rates of chemical and biological reaction. It has an additional significance as a tracer of transport in the water column. The heat balance can be utilized as a tracer for estimating vertical mixing rates in freshwater systems. (Chapra, 1997) The EFDC model can predict the temperatures at the various vertical cells which simulates the vertical profile. This profile can be completely mixed, in that the temperatures are somewhat equivalent throughout the profile, or the profile can show stratification where more than one thermal layer exists.

Water profiling measures the temperature and dissolved oxygen each foot of depth from the surface to the bottom. The largest temperature difference between each measurement indicates the location of the thermocline, the plane of water separating the upper (epilimnion) and the lower (hypolimnion) layers. Strong storm or persistent winds may overcome the density variations between the epilimnion and hypolimnion and will physically mix the water which will generate a temperature and dissolved oxygen profile with similar values from the surface to the bottom. The successful EFDC model will replicate time periods of vertical stratification and alternatively time periods with complete mixing throughout the profile.

3.1.1 Profile Monitoring

Four profile monitoring events were conducted for this study in 2012. There are no profile data available from the 2006 EFDC model design year. MDEQ personnel used a Hydrolab MS5 data sonde to measure temperature, dissolved oxygen, oxygen saturation, pH, conductivity, and total dissolved solids at various locations in RBR. The profiles were collected on May 29, 2012, May 30, 2012, June 1, 2012, and September 7, 2012.

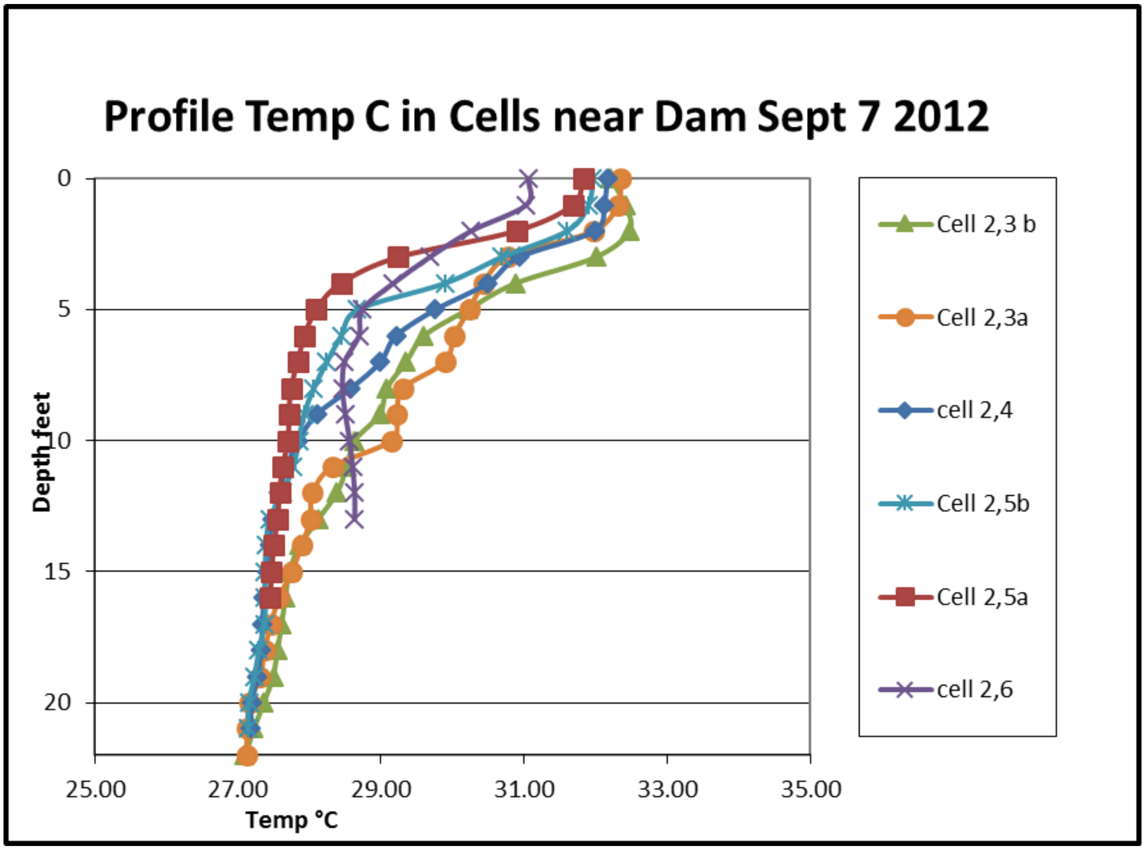


Figure 3.1 Profile Data at Dam Forebay

The May and September profile data indicate thermal and oxygen stratification in the water column. The vertical profiles measured on June 1, 2012 were completely mixed. The profile data collected for this study as well as a map of the station locations are shown in APPENDIX K. The temperature profile measurements collected across the forebay of the dam on September 7, 2012 are indicated in Figure 3.1. The comparison of stratification and completely mixed profiles collected on two occasions at the same location are shown in Figure 3.2.

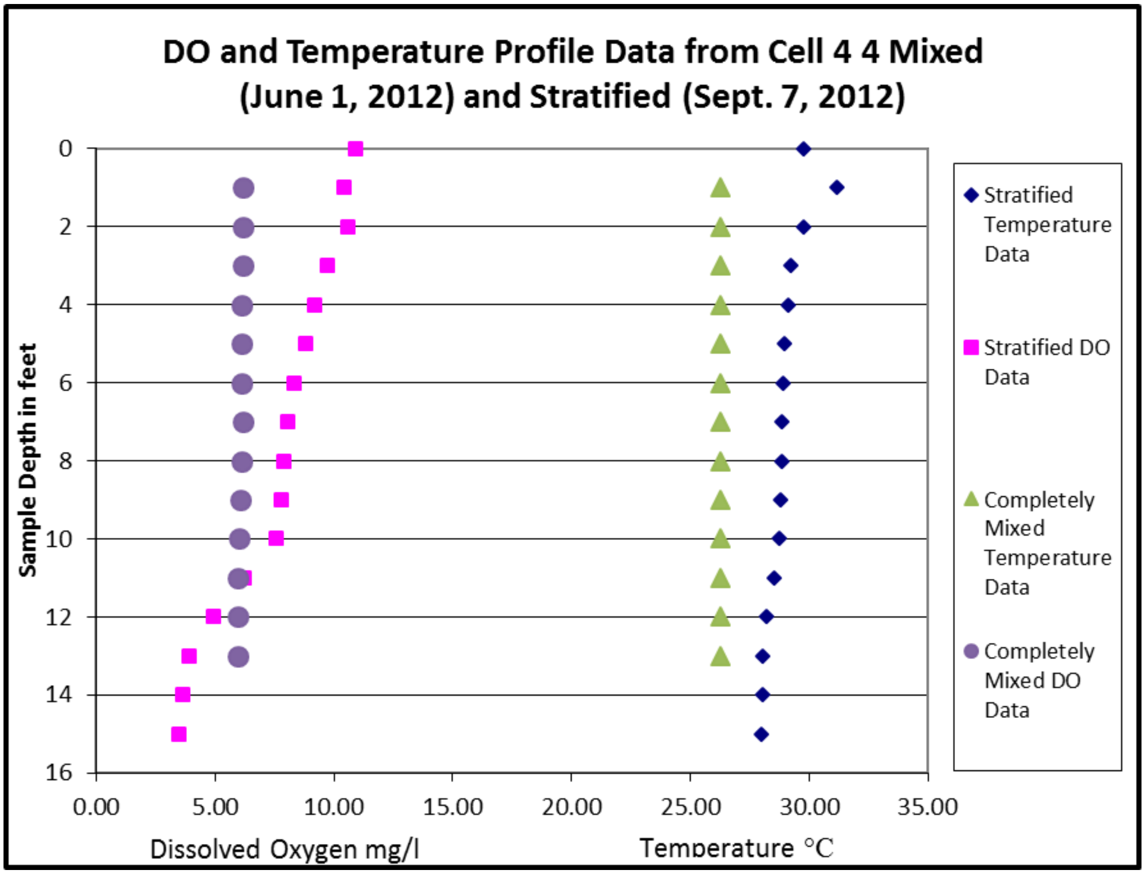


Figure 3.2 Profile Data from Cell 4 4 Showing Completely Mixed and Stratified Data

3.1.2 Thermal Stratification

The temperature regime in the main body of the reservoir is the result of two primary processes: 1) the heat and momentum transfer across the lake's surface and 2) the relationship between mixing energy and density differences within the water body. The surface temperature will influence the profile by raising the water body temperatures during the summer or lowering the temperatures in the winter as a consequence of a number of factors including solar radiation, air temperature, relative humidity, wind speed, and cloud cover. (Chapra, 1997) Each of these variable time series data are input in the EFDC model input file structure.

3.1.3 Dissolved Oxygen Stratification

The stratification of dissolved oxygen is impacted by temperature stratification as well as the depth of the euphotic zone, the layer of light penetration through the water column. The phytoplankton in the water column generate oxygen through photosynthesis which increases the dissolved oxygen available in the water column. Turbidity and shading as well as increased depth will reduce the available solar radiation used by the organisms which reduces the production rate. This rate is also controlled by the water temperature. In a stratified condition, higher temperature water with lower density is "floating" on top of the thermocline and transport of the dissolved oxygen created in this zone to the lower zone does not easily occur. Physical mixing is needed to move this higher DO level to the hypolimnion. The dissolved oxygen profile prediction may therefore indicate the location of the thermocline in the EFDC model output.

3.2 Bathymetry

Water depth measurements were recorded in the reservoir on MDEQ's vessel *Mississippi Sound*, a tri pontoon, 40 foot converted oil skimmer now stationed on the reservoir. A Garmin model 400 gps enabled depth finder which uses dual frequency sonar to determine water depth was used to record the date, time, latitude, longitude, depth, and temperature as the vessel trolled. Continuous recording was achieved when the trolling speed remained below 5 mph.

The riverine portions of the upper reservoir and of Pelahatchie Bay were measured with MDEQ's 17 foot Boston Whaler. The depth measurements were recorded with a Humminbird gps enabled depth finder. Figure 3.3 below indicates the sounding locations recorded for this study.

3.2.1 Depth Finders Used

Both depth finders collect and store data on removable SD cards. Each manufacturer provides downloadable software to retrieve and review the time, date, depth, latitude, longitude, and surface temperature collected at the measurement locations. One variable between the vessels used was the transponder depth which was accounted for by adding the distance between the water surface and the mounted depth of the transponder to the initial depth results.

3.2.2 Depth Finder Software

Garmin BaseCamp version 3.3.3 was used to interpret the analog data collected from the depth finder and convert the data to a form acceptable for use in an excel spreadsheet. My_HumminbirdPC version 3.2.2 was used to complete the same tasks for the data collected with this model.

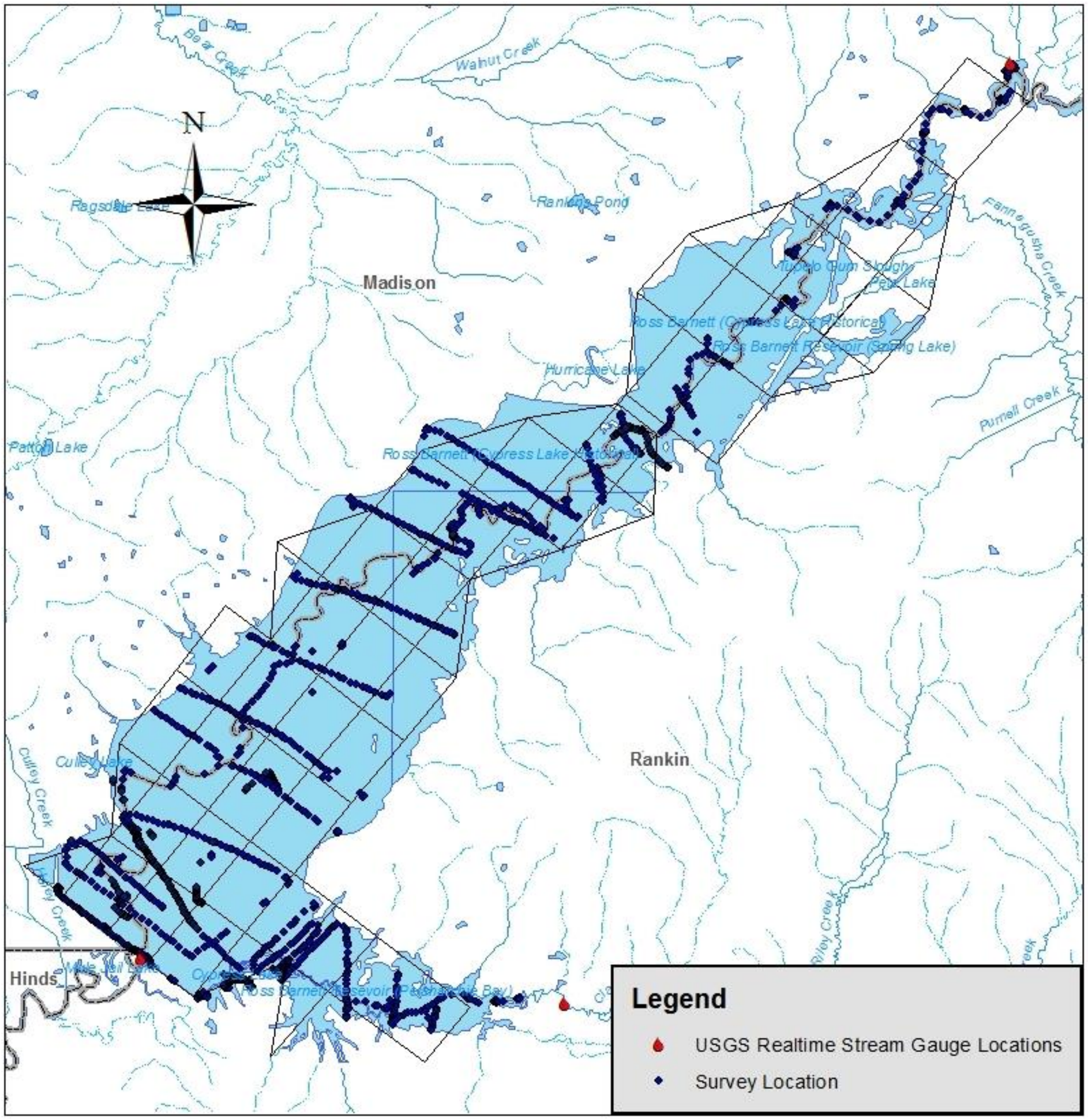


Figure 3.3 Bathymetry Measurement Locations

3.2.3 ARC GIS 3D Assessment Tool

After the bottom surface elevations were estimated, ARC GIS 3D assessment tool was used to estimate the bathymetry for the watershed. The GIS tool locates each surface elevation and extrapolates the surrounding values based on the given values and smooth the estimates to provide a reasonable estimate of the entire surface. To control the smoothing function, controls were included around the channel area to limit the impact of the deeper channel on the surrounding flat shallow areas.

3.2.4 Estimate Water Surface Elevation

To determine the bottom surface elevation, the water depth is subtracted from the water surface elevation. The water surface elevation may be reasonably estimated based on the gage readings taken upstream and downstream of the depth measurement. The USGS gages at Ratliff Ferry and at the dam each record the water surface elevation tied to mean sea level. To estimate the water surface elevation at the measurement location a weighted average elevation was calculated based on the latitude of the measurement location compared to the latitude of the gages. This water surface elevation estimate was created for each measurement and the depth recording was subtracted to provide a bottom surface elevation. Figure 3.4 Bathymetry Image shows the results of the bathymetry study with the darker blue areas indicating the deeper channel areas and the brown areas showing the shallow areas.

3.2.5 Difference noted in upstream and downstream gage elevations

One interesting phenomenon found in preparing the gauge depths to estimate the water surface elevation is that the water surface elevation at the forebay of the dam was elevated higher than the water surface elevation upstream at the Ratliff Ferry gauge. The gauges are both referenced to the same datum. .

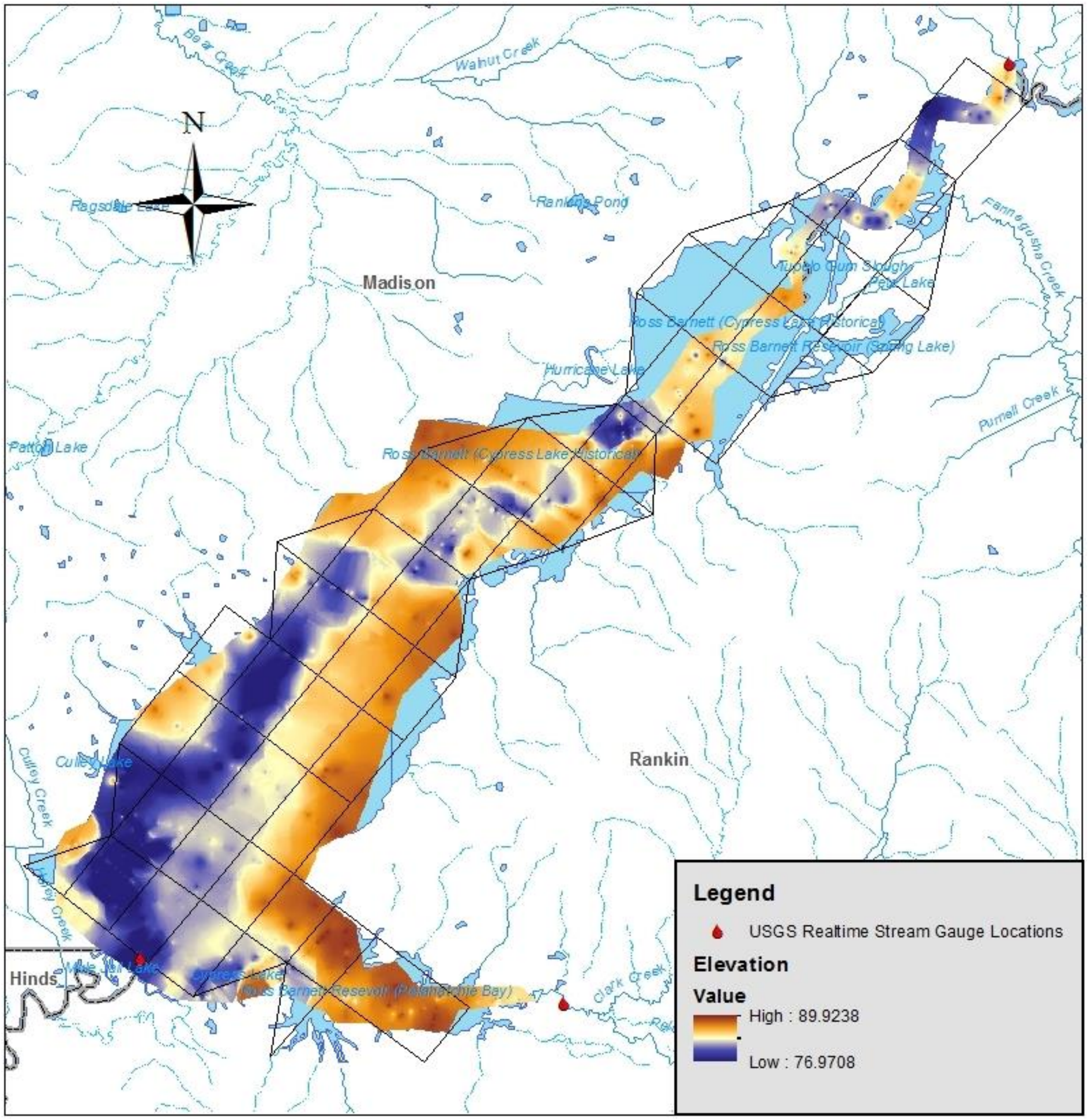


Figure 3.4 Bathymetry Image

3.3 Water Flows

The USGS maintains water elevation gauges at Ratliff's Ferry (USGS 02484650) and at the Ross Barnett Reservoir water control structure (USGS 02485600). The data from these gauges were reviewed to determine water surface elevation during the bathymetry studies

PRVWMD maintains ongoing flow and elevation records for the water body. Daily logs were reviewed for the flow going through the control structure and the water surface elevation at the dam during 2006. The flows are recorded at Ratliff Ferry based on the stage discharge curve and are available from the USGS website. Outflows from the PRVWMD water control structure are estimated based on the open gate positions. Changes in outflow are recorded at each change in the control gates. The PRVWMD log sheet values were entered into an excel spreadsheet and formatted to produce the EFDC QSER.INP file. See APPENDIX G.

The flows when compared to each other show natural curves at Ratliff Ferry compared to squared curves at the outfall structure. This is explained by the opening and closing of the control structure to maintain the pool target elevation. Figure 3.5 shows flow in cfs for 100 days from 2006 at Ratliff Ferry in magenta, flows out the dam in brown, and downstream measurements at the Highway 80 gauge in blue for comparison.

3.3.1 Water Balance

A water balance was created to show in general that the water leaving the reservoir was equal to the water entering the system fluctuating with the overall water surface elevation. To determine the volume of water in the system, the model grid was adjusted to average depths for each cell.

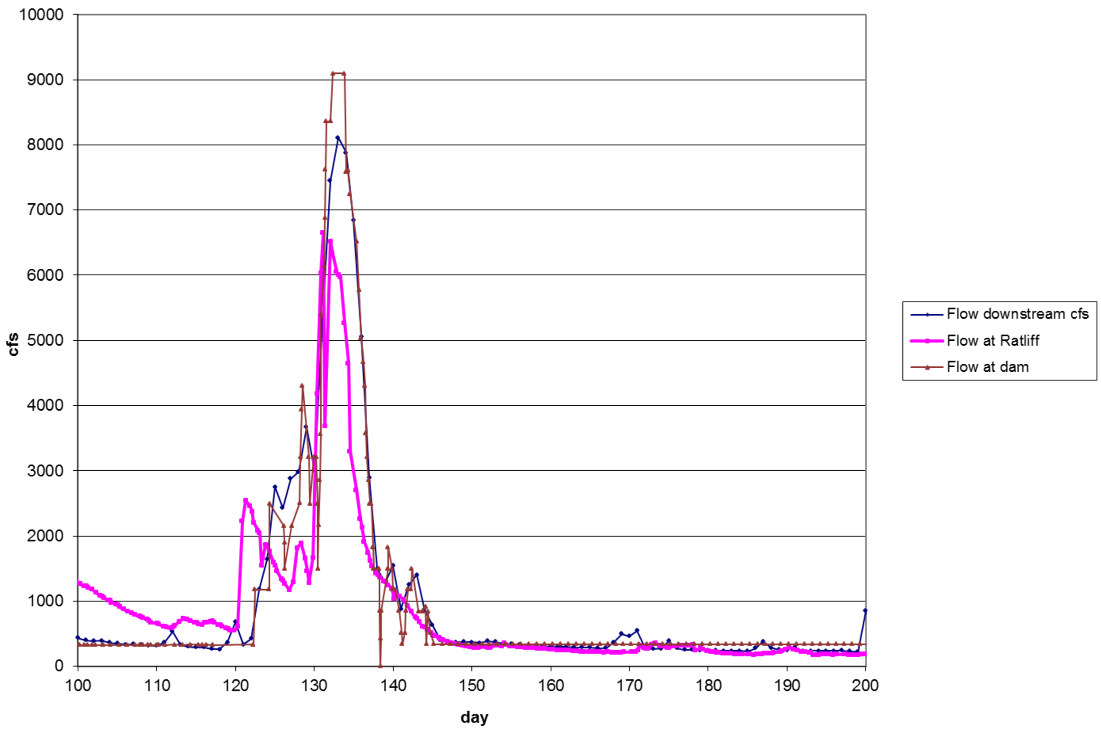


Figure 3.5 Flow in cfs Below the Dam, At the Dam, and At Ratliff Ferry

PRVWMD provided the historical estimation of volume to depth created in 1959 prior to construction. These volume estimates are considerably understated compared to the bathymetry collected during this study. Figure 3.6 compares the volume to depth curve supplied by the 1959 estimate and the curve created by ARC GIS based on the 2012 bathymetry. The pink line represents the EFDC model cell structure with adjusted depths which simulates the 2012 bathymetry. Depth averages were selected to equate the modern bathymetry and model output at the mid-range.

3.3.2 Unit Conversion Process

All depth values were converted to metric with a range of 90.00 meters to 90.75 meters. All stage values in 2006 were between these values. The model cell structure is set in kilometers and volumes were converted to cubic meters. EFDC QSER.INP file converts the input flows from cubic feet per second to cubic meters per second for the model units.

3.3.3 Detail Assumptions Made and Discarded

An initial estimate of the flows entering from ungagged streams proved an over estimate of the water balance. A watershed scaled inflow compared between Pelahatchie Creek and Ratliff Ferry overestimated the flows and resulted in model instability. The water balance process showed the inflow from Pelahatchie Creek somewhat balanced the outflows from the drinking water withdrawal and evaporation in the system. The assumption carried forward is the inflow from Ratliff Ferry balanced with the outflow from the dam with other minor sinks and sources balancing each other.

The other major assumption made in this study was the 1959 volume curve is not valid based on the 2012 bathymetry measurements. This may be due to modern computer analysis of the geospatial data, or upper portions of the watershed may be included in this study, which were omitted from the original volume estimate.

3.3.4 Review Other Withdrawals and Inputs to the System

An unknown amount of water enters from the Pelahatchie River system and other smaller tributaries. The current Pelahatchie gauge was not installed until later in 2006 so no measured flow data are available. The withdrawal rate used by the drinking water system is estimated for that time as well.

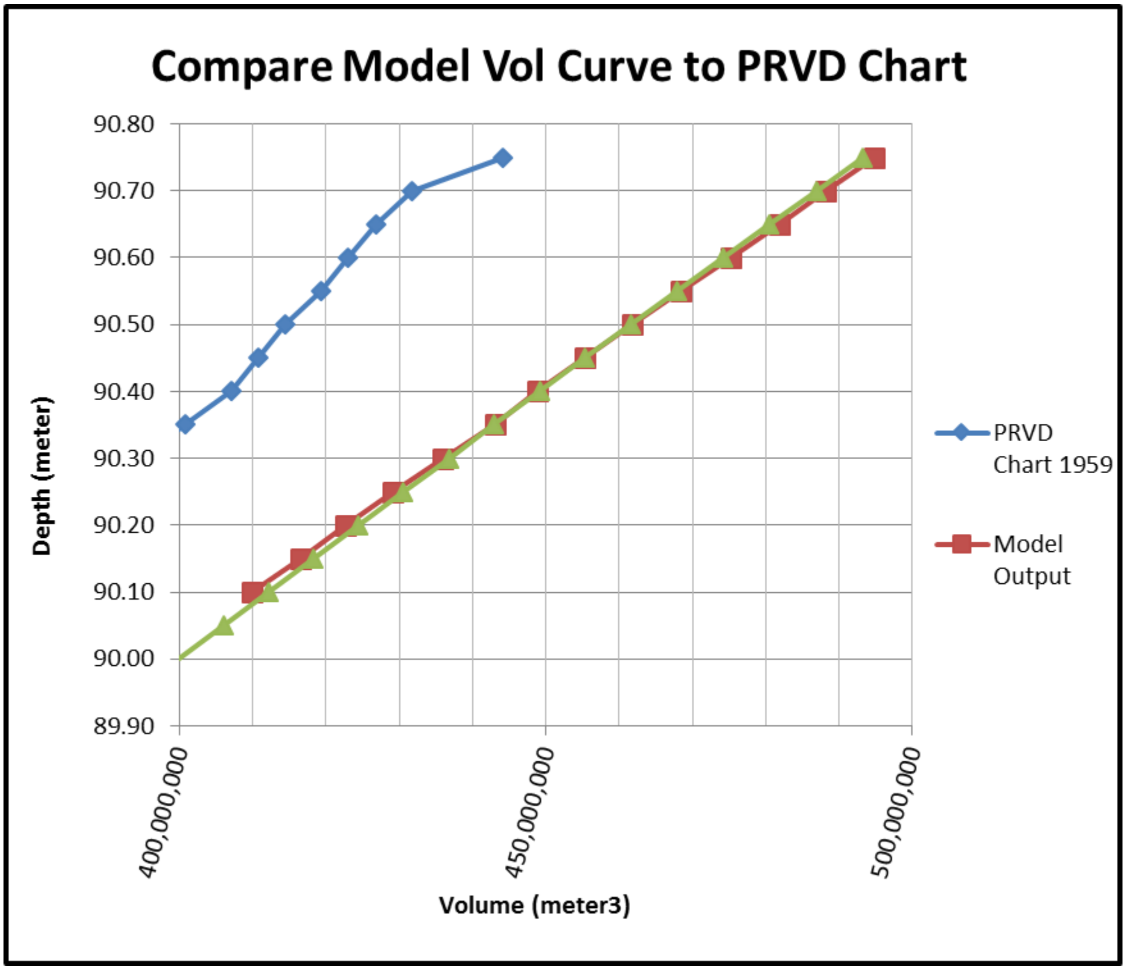


Figure 3.6 Compare Model Volume to Modern Bathymetry

3.4 Weather Data

The data for the atmospheric input file were gathered from the National Climatic Data Center Online for the model run times. The website allows a request by station and time frame and returns data tables of historic values for atmospheric conditions measured at the station. The station selected is the USAF WBAN_ID 722350 Allen Jackson Field located near the Jackson Mississippi International Airport (National Climatic Data Center, 2012). The station is located southwest of the Ross Barnett Reservoir between

Highway 25 and US Highway 80 in Rankin County. Table 3.1 Weather Data Fields provides the field name and description of data provided by the NCDC.

EFDC will either accept direct input of the relative humidity or calculate internally based on the input of the wet bulb temperature and the dry temperature. This model uses the internal calculation method.

3.4.1 Weather Data Assumptions

The atmospheric data were collected approximately 7 miles southwest of the Reservoir which provides sufficient coverage for atmospheric conditions throughout the watershed. The solar data were estimated based on the latitude at the weather station.

3.4.2 Wind Direction Conversion

The north-south lines of the cell structure are 52 degrees off of true north. The wind direction data were modified to adjust wind direction to match the cell structure. The cell structure east-west lines, parallel to the dam, were set and corresponding cell grid was laid perpendicular to this. The wind direction was the only modification to the weather data based on the grid cell structure.

Table 3.1 Weather Data Fields

Data Field	**Description**
USAF WBAN	Station name and location identification catalog station number and NCDC WBAN number
YR-MODAHRMN	Date in year, month, day, hour and minute in Greenwich Mean Time
DIR	Wind direction by compass heading in degrees
SPD	Average Wind speed in miles per hour
GUS	Wind Gust speed in miles per hour
CLG	Could ceiling elevation in hundreds of feet
SKC	Sky cover observation
L M H	Cloud type cover location, low, medium, or high
TEMP	Air Temperature in Degree Fahrenheit
DEWP	Dewpoint Temperature in Fahrenheit
SLP	Sea Level Pressure in millibars
ALT	Altimeter setting in inches
STP	Station Pressure in millibars
MAX	Maximum temperature reading for the day
MIN	Minimum temperature reading for the day
PCP01	Precipitation for the preceding one hour in inches
PCP06	Precipitation for the preceding six hours in inches

3.5 Solar Data

The solar data were collected from an estimation based on the location of the watershed using the 1991 – 2005 National Solar Radiation Database (NSRDB). The data are modeled hourly solar radiation values that statistically replicate the actual solar output for the hour and location represented. (National Renewable Energy Laboratory U.S. Department of Energy, 2012)

3.6 Water Quality Data

MDEQ retains all water quality data monitored and reported in Mississippi in an electronic database for easy storage and retrieval. Review of these data recorded since 2001 show that there was one monitoring station located at the pier near the Highway 43 bridge that was visited monthly during 2006. These water quality data are shown in Table 3.2 Water Quality Data 2006. The temperature data are shown in Figure 3.7. These data will be compared to the model predicted temperature for this cell in the EFDC model output.

Table 3.2 Water Quality Data 2006

Date	TOC Mg/L	Conductivity Umhos/Cm	DO % sat	DO Mg/L	pH	TN Mg/L	TP Mg/L	Temp °C
01/17/06	5	67.0	95.4	10.44	7.33	1.07	0.11	11.32
02/14/06	10	60.3	123.9	14.78	6.43	1.01	0.14	7.17
03/07/06	8	32.7	84.4	8.73	6.24	0.74	0.07	14.15
04/04/06	9	38.7	97.5	8.95	7.56	1.03	0.08	19.36
05/08/06	9	72.0	83.8	7.27	6.93	1.81	0.15	22.12
06/05/06	10	56.6	83.7	6.55	6.60	1.07	0.13	27.00
07/05/06	9	67.5	72.0	5.52	7.20	1.04	0.07	28.65
08/08/06	10	67.0	77.4	5.92	7.28	0.89	0.08	30.94
09/13/06	7	85.4	86.6	6.29	6.98	1.16	0.07	26.96
10/10/06	7	102.7	94.5	8.28	6.97	0.75	0.12	22.16
11/08/06	8	54.3	72.0	7.38	5.85	1.21	0.11	14.67
12/05/06	11	61.7	107.0	12.61	6.88	1.33	0.13	9.03

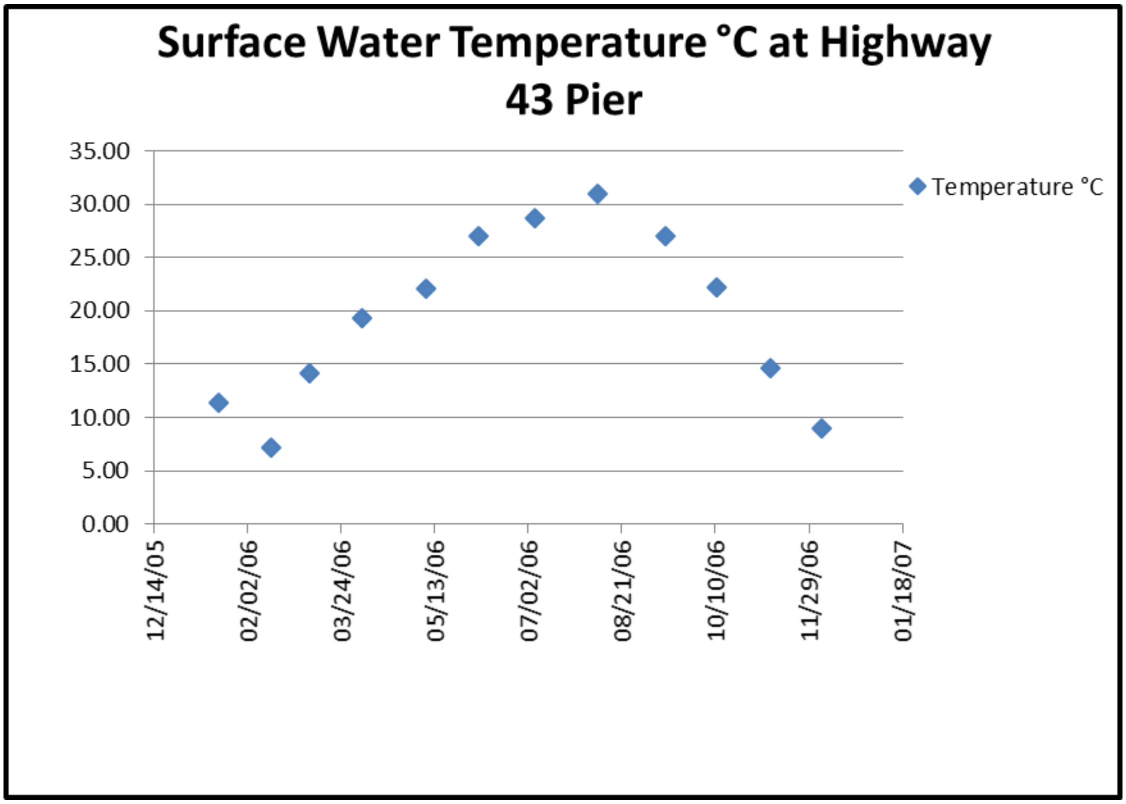


Figure 3.7 Surface Water Temperature at Highway 43 Pier

3.7 Pearl River Valley Water Management District Information

Flow and stage data from daily log sheets was provided for 2006. Hourly flows and observations were recorded and transferred to an excel spreadsheet for data manipulation and EFDC model input file structure. PRVWMD also provided the historical depth-volume curve, the operations chart, and plans for the control structure dimensions.

The current operational plan for the summer is to transition from the winter target depth of 296.00 feet to 297.50 feet from April 10 through April 25. The operational bands have a lower elevation, target elevation, and upper elevation. The goal in operations is to hit the target water elevation while staying within the lower and upper limits. The target elevations and dates are shown in Table 3.

Table 3.3 PRVWMD Target Surface Elevation

Date	**Surface Elevation in feet**
January 1	296.00
April 10	296.00
April 20	296.50
April 25	297.00
June 1	297.50
October 12	297.25
November 1	297.00
December 1	296.00

CHAPTER IV

EFDC MODEL INPUT FILES

4.1 EFDC File Structure and Input Decks

The EFDC model configuration uses the FORTRAN 77 source code EFDC.FOR and two files: EFDC.COM, the common block file declarations and arrayed variable dimensions, and EFDC.PAR, containing the parameter statement specifying the dimensions of arrayed variables. The common files are universal for all model applications. The parameter file is unique to each application. Table 4 below lists the input files used in this application of EFDC. (Tetha Tech, Inc., 2002)

Table 4.1 EFDC Input Files

File Name	Type of Input Data
ASER.INP	Atmospheric forcing time series file
CELL.INP	Horizontal cell type identifier file
CELLLT.INP	Horizontal cell type identifier file for saving mean mass transport
CELLGVC.INP	Horizontal cell type identifier for Z-Grid inclusion
DXDY.INP	File specifying horizontal grid spacing and depth
EFDC.INP	Master input file
LXLY.INP	File specifying horizontal cell center coordinates and cell orientation
PSER.INP	Open boundary water surface elevation time series file
QSER.INP	Volumetric source-sink time series file
SHOW.INP	File controlling screen print of conditions during simulation run
SSER.INP	Salinity time series file
TEMP.INP	Starting temperature file
TSER.INP	Temperature time series file
WSER.INP	Wind speed and direction time series file

4.2 EFDC Input File ASER.INP

This file contains the atmospheric and thermal data as well as precipitation and evapotranspiration data. The header lines start with a "C" to identify these lines as notes for the modeler and provide header information on the file. This is standard for all of the input files.

The first line of data are the variable MASER which numbers the input time steps in the file, the variable TCASER is a factor to convert time steps to seconds, the variable TAASER is a constant time to be added before unit conversion, and the variable RAINCVT and EVAPCVT convert rainfall and evapotranspiration rates to meters per second if needed. The time series data follow this line in order with the following variables:.

- timestep variable TASER
- wind speed WINDS in miles per hour converted to meters per second
- wind direction WINDD in bearing angle in the direction the wind is blowing
- atmospheric pressure PATM in millibars
- dry and wet bulb temperature TDRY and TWET in degrees C
- rainfall rate RAIN
- evapotranspiration rate EVAP
- incident solar short-wave radiation SOLSWR in Joules/second/meter squared
- CLOUD estimates the could cover in percentage of cover

The data were set in the format for the ASER input file. The data are provided in Greenwich Mean Time (GMT) from the National Climatic Data Center and were adjusted to Central Standard Time. See APPENDIX A for a sample of the input file.

4.3 EFDC Input File CELL.INP

The first step in creating an EFDC model is to study the water body and determine the parameters of the cell structure. The cells are created by imposing a horizontal plane domain of quadrilateral and optional triangular grids. The EFDC model solves the hydrodynamics equations within the horizontal coordinate system that is curvilinear and orthogonal. The gridlines also correspond to lines having a constant value of one of the horizontal coordinates. EFDC identifies these gridlines with I and J coordinate directions. I represents the north-south gridlines and J represents the east-west gridlines. Each cell is then identified with the gridline number of the southwest corner of the quadrilateral or triangle within that quadrilateral. (Tetha Tech, Inc., 2002)

There are 8 north-south gridlines and 16 east-west gridlines in this cell structure. The southwest corner cell is I=2 and J=2, cell 2,2. The northern most cell is I=6 and J=16, Cell 6,16. Many of the edge cells were converted to triangular shapes to better fit the model cell structure to the water body. These cells maintain the naming convention using the southwest corner of the corresponding quadrilateral. The southeast triangle is cell I=7 and J=2, cell 7,2 even though the 7th gridline is not used to form this triangular cell. See Figure 4.1 below.

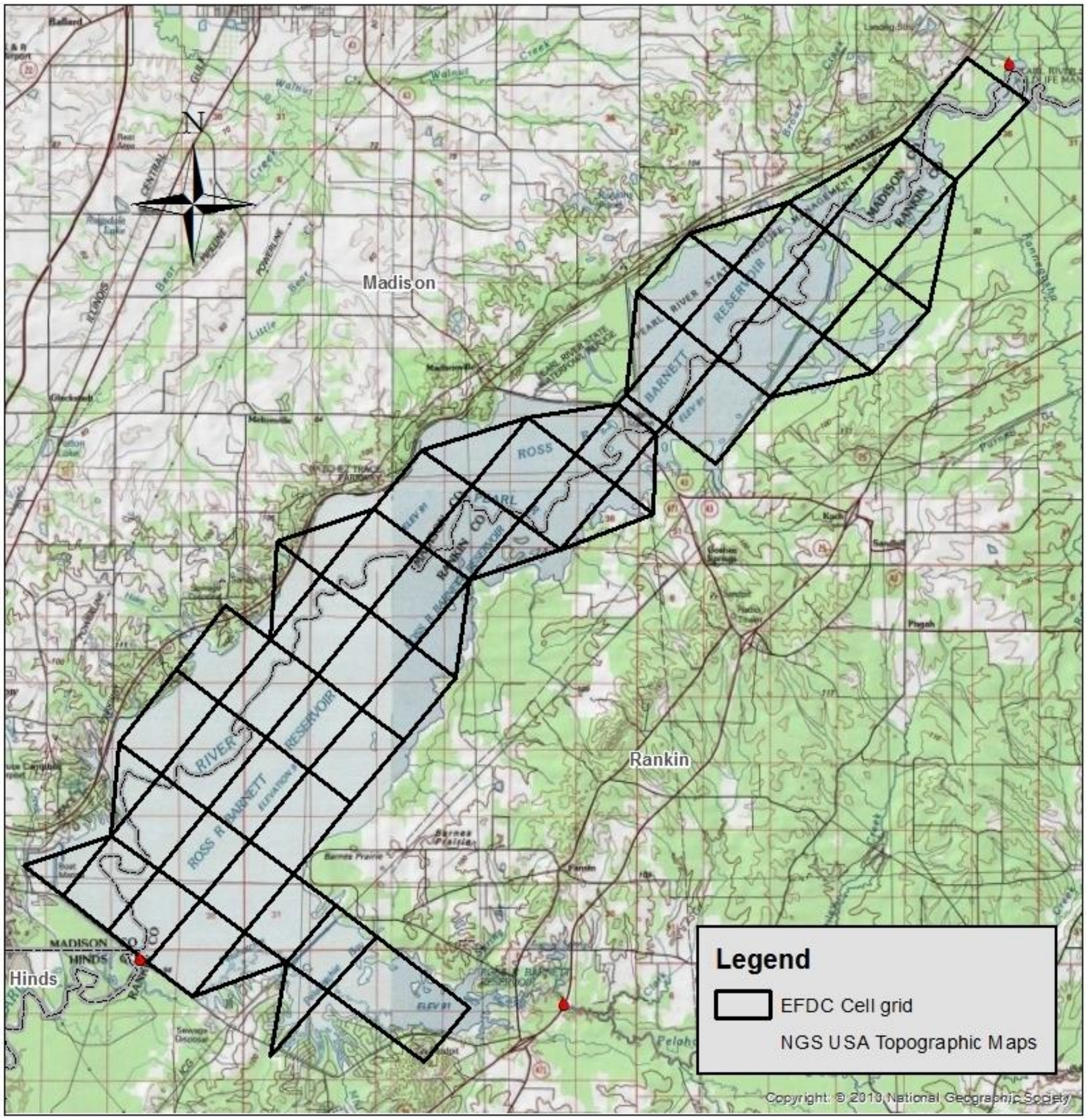


Figure 4.1 EFDC Cell Grid Structure

The model uses the CELL.INP file to describe this horizontal gridline structure and identify the cells used in the model. Each active quadrilateral cell receives a 5 as an identifier. Triangular cells receive a 1 through 4 depending on the corner of the triangle with the right angle. Each cell that is a dry border or dry corner receives a 9. All unused cells in the structure receive a 0. APPENDIX B shows this file.

4.4 EFDC Input Files CELLLT.INP and CELLGVC.INP

These two input files start by copying the CELL.INP file. The CELLLT.INP file informs the model on the mean mass transport function for the cell. No new cell designations are allowed in this input file. The CELLGVC.INP file is used by the model when applying the Z-Grid function to provide variable vertical cell counts to the grid. All of the input designations 1-5 are converted to 1 in this file.

4.5 EFDC Input Files DXDY.INP and LXLY.INP

The geometry of the gridlines and corresponding cell structure is provided by the DXDY.INP file along with the starting depth and bottom surface elevation for each cell. The LXLY.INP file provides the coordinates for the center point of the cell. An arbitrary reference point to the southwest of the grid is selected and the grid distance from that point to the center of the cell is provided. (Tetha Tech, Inc., 2002) APPENDIX C and APPENDIX D show these files.

4.6 EFDC Input File EFDC.INP

This is the main input for controlling the options of the FORTRAN program. All of the variable input decks are set up and controlled by this series of cards. Each card controls an input variable or series of variables. APPENDIX E contains the input deck for the 2006 3 layer EFDC model.

4.7 EFDC Input File PSER.INP

This file specifies the surface elevation time series for use at open boundaries. The variable MPSER specifies the number of time data lines. TCPSER and TAPSER adjust and convert the time data units to seconds. FMLADJ and ADDADJ convert elevation data to meters if needed and adjust the time steps respectively. (Tetha Tech, Inc., 2002) APPENDIX F shows a sample of this file.

The model is sensitive to these data input. The data set that provided the best model results was by applying the water surface elevations measured at the dam to the northern open boundary at cell 6,16. The other options considered were:

- applying a steady state elevation at cell 6,16,
- applying the Ratliff Ferry measured elevations to cell 6,16,
- and applying the forcing functions to alternate cells.

The steady state alternative dampened the flow response with a steady state surface elevation for the entire water body. The Ratliff Ferry elevation data alternative had a large spike in response to heavy rain events because it is in the riverine portion of the water body. This overestimated the water depth at the dam. Using alternate cells did not provide improvement in the model results.

The PSER.INP file is controlled with cards 16 - 21 in the EFDC.INP file. Card 16 provides the number of forcing functions available for directional open boundaries, and, in this case, card 21 indicates the cell to be used.

4.8 EFDC Input File QSER.INP

This input file allows the volumetric flow data, both sources and sinks, to be entered in a time series format. The variable NQSER shows the number of data lines in the data set. The input file allows for distribution of the flow percentages across the vertical cell profile. In a natural stream, each vertical cell would typically receive equivalent flow percentages. At a control structure, the flows can be specified to the specific cells as designed. Inflows are positive and outflows are negative values. In this study the outflows at the water intake structure and at the reservoir control structure are taken from the two bottom vertical cells. APPENDIX G contains a sample of this file structure.

Within the EFDC.INP file, cards 23 and 24 control the QSER.INP file. Card 23 indicates the number of flows that will be entered. Card 24 shows the cells where the flow is applied as well as which time series parameters to associate with each source and sink in the model. Card 24 also has variable QSFACTOR for each flow that allows the modeler to adjust the percentage of the flow to be used in the model.

4.9 EFDC Input File SHOW.INP

The SHOW.INP file is used to control the computer monitor during model run. The output from a specific cell can be viewed during the application. This is useful to the modeler to provide information on model stability as it is running.

4.10 EFDC Input File TEMP.INP

The TEMP.INP file provides the starting temperature for each cell in the model as well as the distribution of that temperature along the vertical profile. APPENDIX H contains this file.

4.11 EFDC Input File TSER.INP

This file provides the air temperature input file in a time series format for the modeled area. This data set is entered in degrees centigrade. APPENDIX I provides a sample of this input file.

4.12 EFDC Input File WSER.INP

This file provides the wind speed and direction for the model. In this application, the given compass direction was modified to set the axis of the dam on the east-west gridline. This provided for a true north-south gridline structure within the model as flow was perpendicular to the dam.

Variable WINDS(M) provides the compass direction the wind is traveling toward and variable WINDD(M) provides the wind speed in miles per hour. The model converts the speed to meters per second internally. APPENDIX J contains a sample of this file.

CHAPTER V

EFDC VERTICAL CELL STRUCTURES

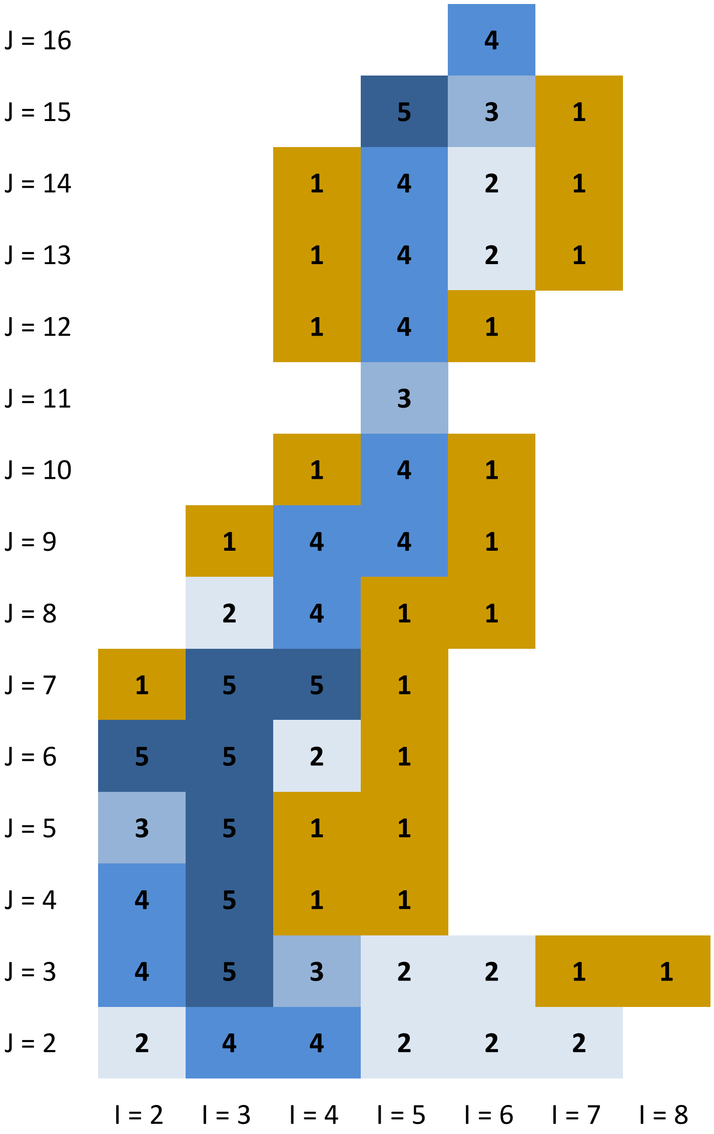
5.1 EFDC Model with 3 Equal Vertical Cells

The first EFDC model set up for this study used the generalized vertical coordinate system (GVCM). Each cell in the grid structure was divided into 3 equivalent layers, bottom, middle, and surface. If the cell was 6 meters deep, then each layer was 2 meters thick. Similarly, if the cell was 3 meters deep, then each layer was 1 meter thick. In the EFDC.INP file, cards 9 - 10 control this operation.

5.2 EFDC Model with 5 Layer Z-Grid Cell Structure

The second EFDC model set up used a Z-Grid for the vertical segment designation. The program determines the optimum number of vertical cells to be used based on the depth of each cell. Every grid cell has a surface layer. In cases of a shallow cell, the surface layer is also the only layer. Table 5.5 displays the model cell grid structure along with the number of vertical cells created by the model. The layers with 1 vertical cell have a completely mixed single cell represented by the EFDC model output. Cells with multiple layers are evenly divided into equivalent thicknesses.

Table 5.1 Z-Grid Model Cell Structure



J = 16					4		
J = 15				5	3	1	
J = 14			1	4	2	1	
J = 13			1	4	2	1	
J = 12			1	4	1		
J = 11				3			
J = 10			1	4	1		
J = 9		1	4	4	1		
J = 8		2	4	1	1		
J = 7	1	5	5	1			
J = 6	5	5	2	1			
J = 5	3	5	1	1			
J = 4	4	5	1	1			
J = 3	4	5	3	2	2	1	1
J = 2	2	4	4	2	2	2	
	I = 2	I = 3	I = 4	I = 5	I = 6	I = 7	I = 8

5.3 EFDC Model Stage Output Comparison

All of the time series input files for the 3 layer model and the 5 layer Z-Grid model were the same. The EFDC.INP file cards (9, 9A, and 10) were modified to generate the different model runs. The 5 layer Z-Grid model was more difficult to run. The time step had to be decreased to successfully run the model.

Both model runs were successful in predicting the surface water elevation at the dam. The PSER.INP file provides the surface elevation to the model which was applied at the northern open boundary Cell 6,16. The model output at the southern output Cell 4,2 was compared to the stage data collected at that location.

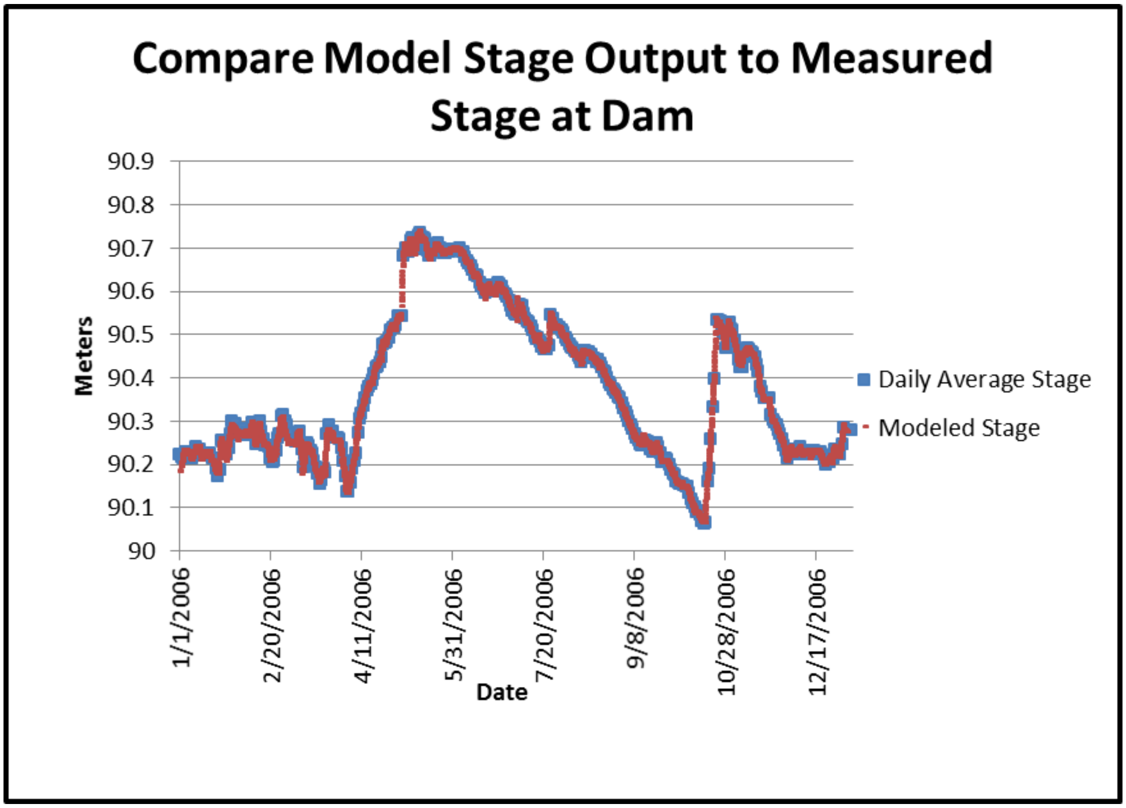


Figure 5.1 Stage Prediction and Measured at Cell 4,2

Due to the PSER.INP file containing the stage information; it is not surprising to have a very good representation of the stage throughout the model output with both models. The 5 layer Z-Grid model run has more output shown due to the smaller time step. Several PSER.INP file alternatives were considered along with applying the forcing to several cells within the grid. The alternative of applying the dam stage at the northern boundary provided the best model representation of the stage recorded at the dam.

5.4 Model Output Temperature Comparison

The monthly temperature values recorded at the Highway 43 pier were used to calibrate the modeled temperature output. Calibration was achieved by adjusting the solar radiation variable in the ASER.INP file. The variables SOLRCVT and CLDCVT allow for input of the percentage of solar radiation and cloud cover respectively. The best fit was achieved with SOLRCVT set to 0.35 and CLDCVT set to 1.0. The maximum temperature recorded in August, 2006 was used as the target.

Cloud cover was recorded at the Jackson Airport and entered as an estimated value applied to the extent of the modeled area. The solar radiation was estimated based on the watershed latitude. The air temperature is also input as a variable and drives the overall temperature of the water. Adjustment of the cloud cover and solar input variables is necessary to balance the temperature output.

The spring and early summer values are a bit low, the maximum is achieved, and the fall values are over predicting the measurements in both output files. Both models successfully predict alternating stratified and completely mixed profiles. The 3 Layer model has a better fit to the data in spring and fall when the maximum temperature is targeted with calibration.

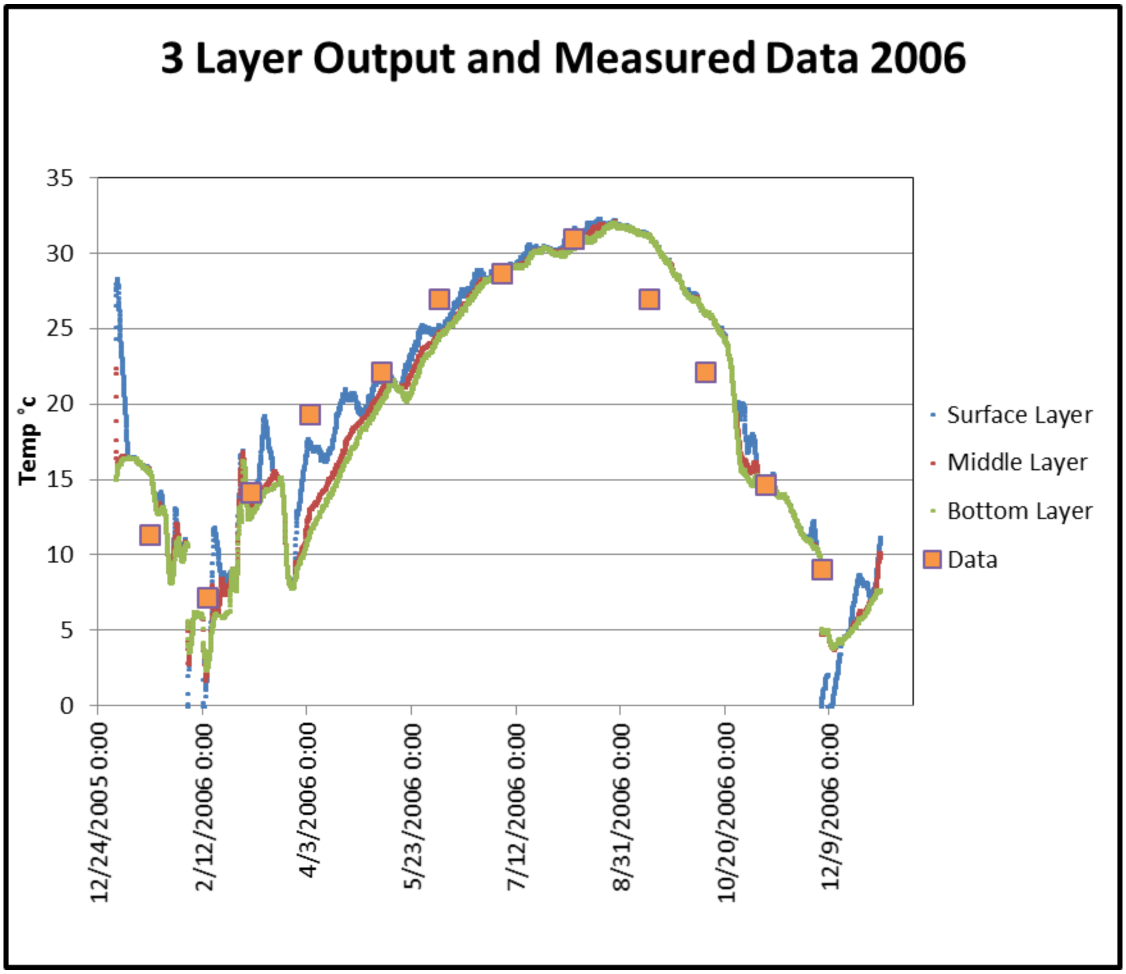


Figure 5.2 EFDC 3 Layer Temperature Output

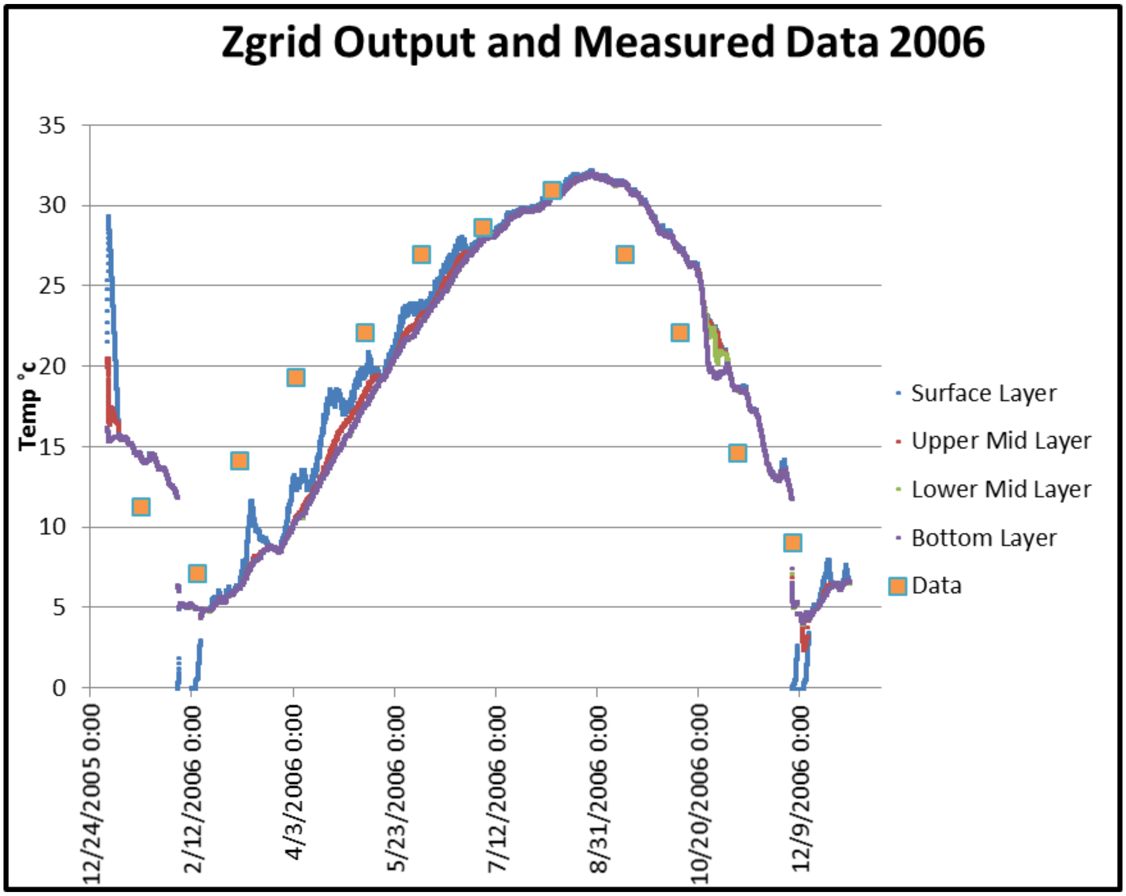


Figure 5.3 EFDC Z-Grid Temperature Output

CHAPTER VI

CONFIRMATION MODEL

6.1 EFDC Model for 2012 Data

The 2006 EFDC model compared well with the few temperature measurements available. The model was calibrated to the known temperature in Cell 5,10 and predicted the remaining temperature trend reasonably well. To determine the success of the model to predict other measured values, another EFDC model was constructed using 2012 data. The construct of the model was maintained, and the atmospheric and flow data from 2012 were input. Table 6.1 shows the input files that were modified with 2012 data and the files that were not changed. The EFDC.INP control file was modified to output the correct calendar dates for 2012.

6.1.1 Monitored Data Input

The ASER.INP, TSER.INP, and WSER.INP files were constructed with 2012 data from the same weather station used for the 2006 models. The flow data for the QSER.INP file was gathered from the Lena, MS USGS gauge upstream and the Pearl River Highway 80 USGS gauge downstream. These are the two closest gauges with flow data available for 2012. The PSER.INP file represents stage data from the USGS gauge at the reservoir dam.

Table 6.1 EFDC Model Input Files Modified for 2012

File Name	Type of Input Data	Modified for 2012 EFDC Model
ASER.INP	Atmospheric forcing time series file	Modified with 2012 data
CELL.INP	Horizontal cell type identifier file	Not changed
CELLLT.INP	Horizontal cell type identifier file for saving mean mass transport	Not changed
CELLGVC.INP	Horizontal cell type identifier for Z-Grid inclusion	Not changed
DXDY.INP	File specifying horizontal grid spacing and depth	Not changed
EFDC.INP	Master input file	Slightly modified to update calendar dates on output and add vertical segments
LXLY.INP	File specifying horizontal cell center coordinates and cell orientation	Not changed
PSER.INP	Open boundary water surface elevation time series file	Modified with 2012 data
QSER.INP	Volumetric source-sink time series file	Modified with 2012 data
SHOW.INP	File controlling screen print of conditions during simulation run	Not changed
SSER.INP	Salinity time series file	Not changed
TEMP.INP	Starting temperature file	Not changed
TSER.INP	Temperature time series file	Modified with 2012 data
WSER.INP	Wind speed and direction time series file	Modified with 2012 data

6.1.2 Using 2006 EFDC Model Structure with 2012 Data Set

The cell grid structure size and depth from the 2006 model was used for the 2012 model. This model output can be compared to the profile monitoring events from 2012 to determine the models predictive capability against measured data.

6.2 2012 Water Surface Elevation Measured and Predicted

The 2012 EFDC model provides a good estimation of the water surface elevation at the dam. The elevation output is shown in Figure 6.1.

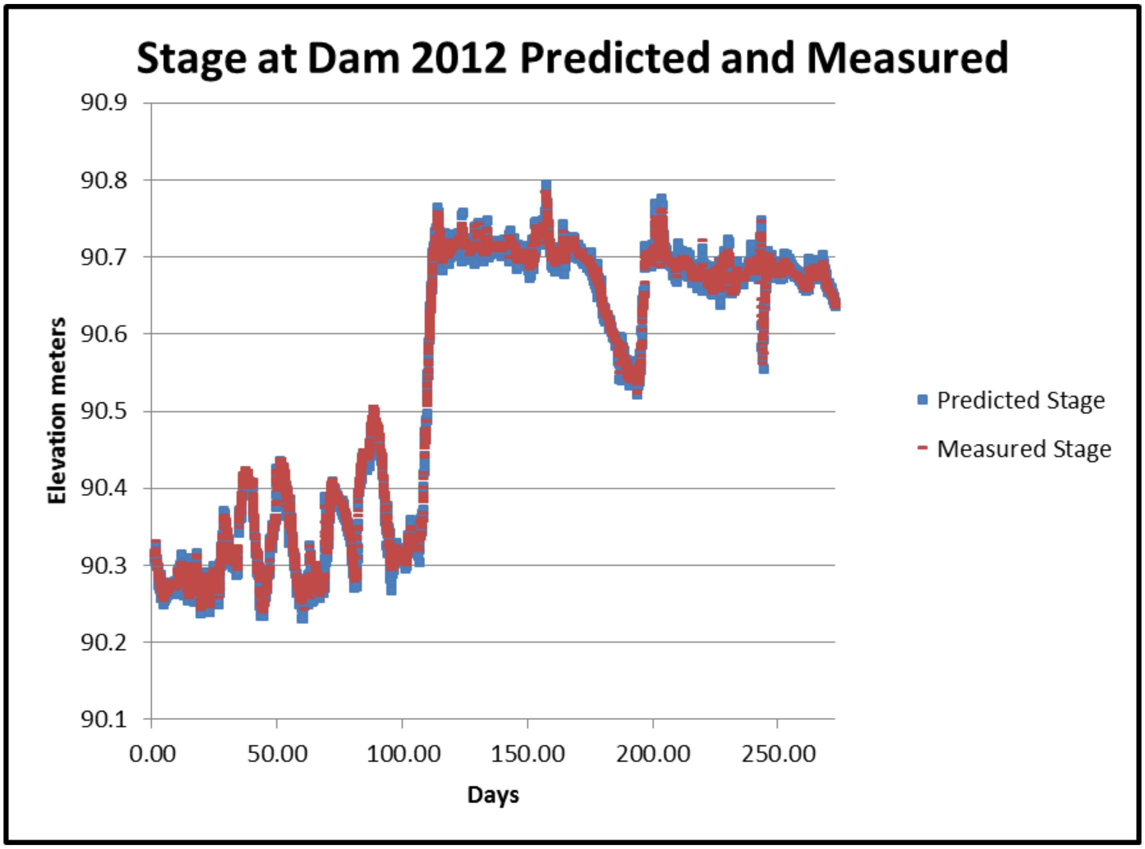


Figure 6.1 Stage at Dam for 2012 Predicted and Measured

6.3 2012 Profile Measurements and Predictions

The temperature profiles were collected at random locations. These locations match 12 EFDC model grid cells among the 4 sampling events. See APPENDIX K for a map showing the station locations. Three monitoring events indicated stratification of temperature and the data from June 1, 2012 indicated a completely mixed profile.

The following profile charts show a selection of the predicted temperature compared to the measured profiles. After initially running the 3 layer model with 2012 data, it was determined that more refinement was needed to provide comparable results to the measured data. The EFDC.INP file was modified to make a 5 layer equivalent model.

In Cell 5,9 there are two profiles available, May 30, 2012 and September 7, 2012. Both instances were stratified. The model under predicted the temperature at the surface but did predict stratification. However, more refinement is needed to catch the location of the thermocline. The model over predicted the temperature in the lower layers. The model also predicted the completely mixed occurrence found on June 1, 2012 at other stations.

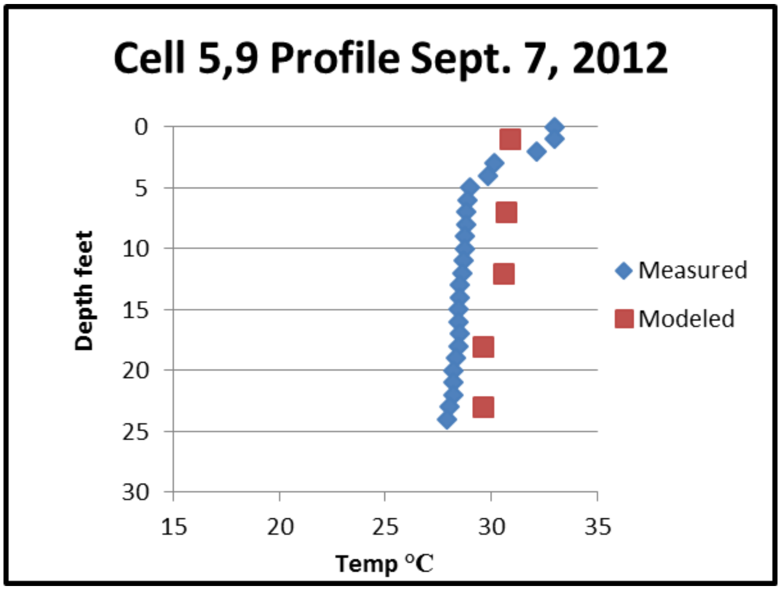


Figure 6.2 Cell 5.9 Profile Sept. 7 2012 Temperatures

The May results are shown in Figure 6.3 below. The model under predicted the temperatures but did predict the stratification for this date.

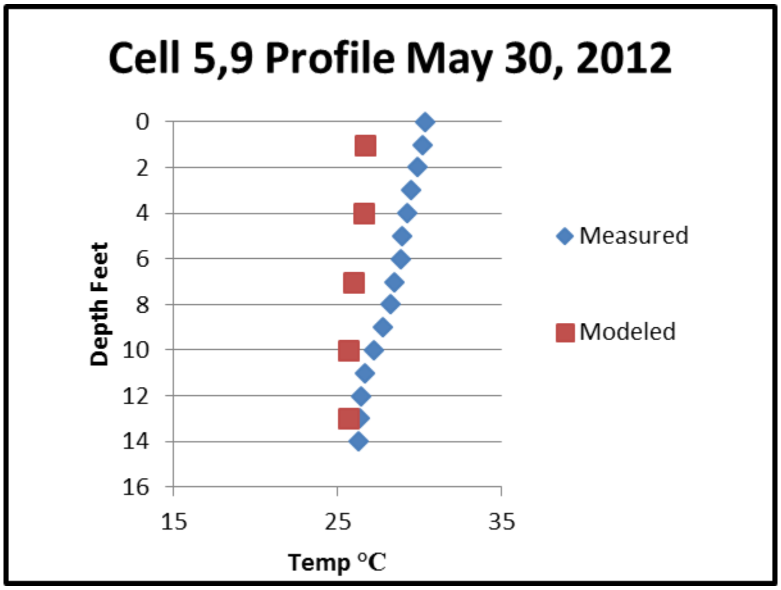


Figure 6.3 Cell 5.9 Profile May 30, 2012 Temperatures

Cell 4,7 represents a shallow section of the water body. The depth measured was 7 feet. The model did a good job getting within the range of the temperature and showed stratification. See Figure 6.4 below. Here, again, more model refinement may be necessary to improve the model output.

In Cell 2,3 there are two measured profiles from September 7, 2012. The model was within one half of a degree C to predicting the surface temperature but did not predict the stratification in this cell as measured. See Figure 6.5.

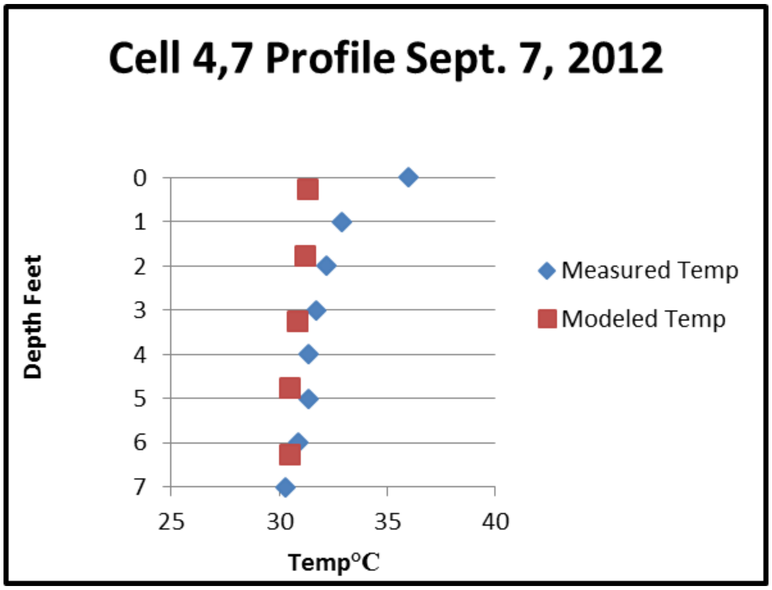


Figure 6.4 Cell 4,7 Profile Sept. 7, 2012 Temperatures

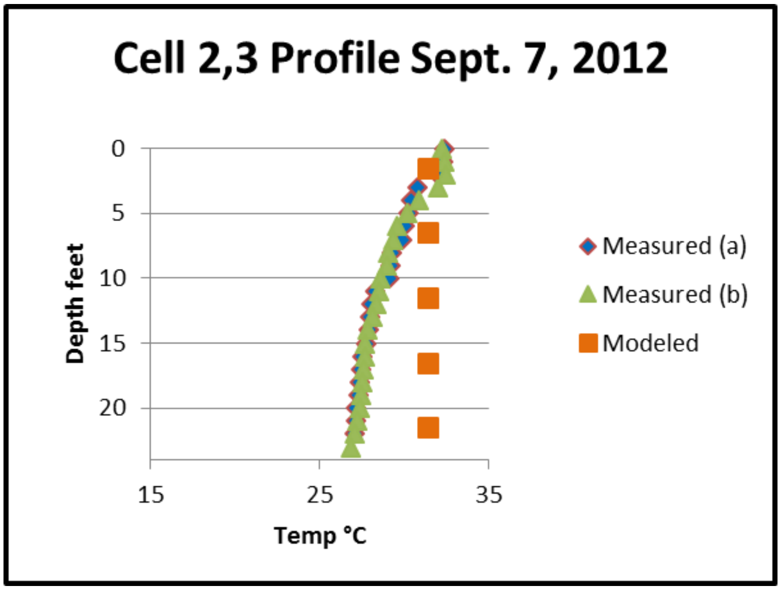


Figure 6.5 Cell 2,3 Profiles Sept 7, 2012 Temperatures

6.4 2012 Model Temperature Calibration

The solar intensity was adjusted in the 2006 data set to calibrate the model to the temperatures found at Cell 5,10. The 2012 5 layer model under predicted the surface water temperature using the 35% solar intensity. The model temperature output improved when the solar intensity was adjusted to 45%. Figures 6.6 and 6.7 show the profiles for Cell 5,9 with this modification.

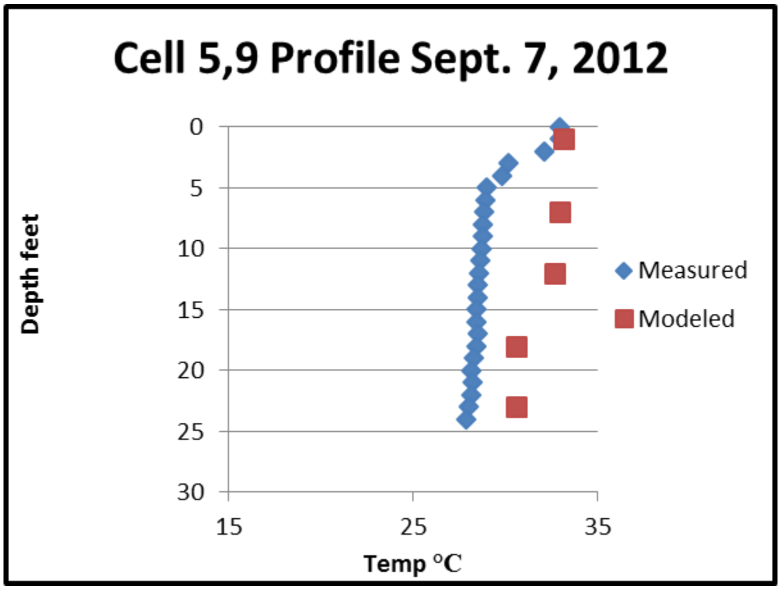


Figure 6.6 Cell 5,9 Profile with modified solar input Sept. 7, 2012

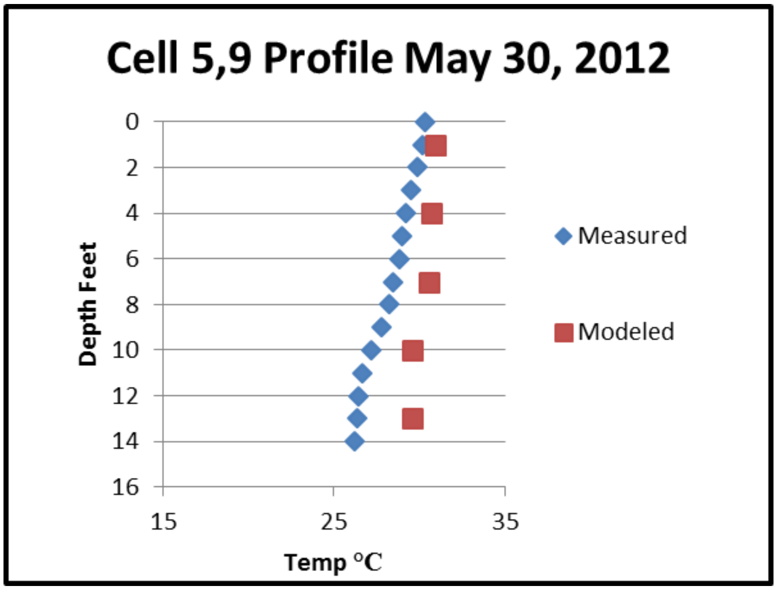


Figure 6.7 Cell 5,9 Profile with modified solar input May 30, 2012

CHAPTER VII

CONCLUSION

7.1 Study Results and Model Year Selection

The EFDC models predict the surface elevation and temperature reasonably well and provide the hydrodynamic information for subsequent WASP water quality model applications for the reservoir. The selection of the model application period was important to be able to verify the model output. In retrospect, 2006 was a good year for the downstream application of the Pearl River models and future discharge permit waste load allocations, however, due to the limited temperature data available in 2006, a model year with more data would have been better for this study.

7.2 Model Grid Creation

The EFDC grid development was difficult to create. The initial attempts in this study were too complicated and ultimately failed to run. There was too much detail in the grid development to try to set the DXDY.INP and LXLY.INP files by hand. Automated tools to create these input files are in development and should provide an easier solution to setting up the model grids when they are available.

To achieve a successful model run, the grid developed for this study was simplified to a 1 km by 2 km rectangular grid pattern. The DXDY.INP and LXLY.INP were created by hand and provide reasonable model results.

7.3 Bathymetry

The water balance required a good bathymetry data set. Utilization of the available bathymetry from the 1959 estimate did not work. Relying on existing USGS Quad maps and other maps also failed. There was too great a difference in that estimate and in what was found in this bathymetry study. It was critical to a successful model grid development to have a reasonable measurement of the existing bathymetry to set the water quantity budget for the study. The study achieved a good water quantity balance with the model representing the model grid volume to the measured volume.

7.4 Vertical Cell Development Options

The limited water quality and temperature data from 2006 were used to calibrate the EFDC 3 layer and 5 layer Z-Grid models. There was added model development complexity and difficulty in using the Z-Grid model. The model output results did not justify these additional complexity and difficulties based on comparing the model outputs from both the 3 layer and 5 layer Z-Grid applications.

7.5 Model Validation with 2012 Data

The construct of the 3 layer 2006 model was used with 2012 variable data to study the reliability of the model to predict temperature with other another data set. This construct did not provide sufficient detail to adequately determine stratification. The EFDC model was further modified to create a 5 layer model. This 2012 5 layer model output provided good results as to stratification and temperature in the northern cells given the variations in the sources of data used to construct the 2012 input decks.

The temperature values modeled were under predicting the measured values. Modification of the solar intensity from 35% to 45% appeared to provide better results. However, more refinement is needed to predict stratification in the southern cells to match the stratification seen in the data.

7.6 Conclusion

Future applications of EFDC for reservoirs by MDEQ should be useful provided there are adequate temperature data available within the model timeframe and located in various locations within the water body. There should be good bathymetry data available to set the vertical grid structure. Water flow data and elevation data for the timeframe are also critical to EFDC model development. Additionally, an automated tool to create the DXDY.INP and LYLY.INP files is needed to provide the efficiency needed by MDEQ in building a successful EFDC model.

REFERENCES

Environmental Fluid Dynamics Code (EFDC). (2012). Retrieved 2012, from EPA Ecosystems Research, Athens GA: http://www.epa.gov/athens/wwqtsc/html/efdc.html

NNDC Climate Data Online. (2012). Retrieved April 3, 2012, from NOAA Satellite and Information Service: http://www1.ncdc.noaa.gov/pub/orders/CDO1674265832433.html

USGS National Water Information System: Web Interface. (2012). Retrieved 2012, from USGS 02484650 Pearl River at Ratliff's Ferry NR Ratliff, MS: http://waterdata.usgs.gov/ms/nwis/uv/?site_no=02484650&agency_cd=USGS&referred_module=sw

USGS National Water Information System: Web Interface. (2012). Retrieved 2012, from USGS 02485600 Ross Barnett Reservoir NR Jackson, MS: http://waterdata.usgs.gov/ms/nwis/uv/?site_no=02485600

USGS National Water Information System: Web Interface. (2012). Retrieved 2012, from USGS 02486000 Pearl River at Jackson, MS: http://waterdata.usgs.gov/ms/nwis/uv/?site_no=02486000

Chapra, S. C. (1997). *Surface Water Quality Modeling.* New York: McFraw-Hill.

EPA. (2012). *Environmental Fluid Dynamics Code (EFDC) Fact Sheet.* Retrieved 2012, from EPA Environmental Fluid Dynamics Code (EFDC): http://www.epa.gov/athens/wwqtsc/EFDC.pdf

EPA. (2012). *Water Quality Analysis Simulation Program (WASP)*. Retrieved 2012, from EPA: Ecosystems Research, Athens GA: http://www.epa.gov/athens/wwqtsc/html/wasp.html

FHS Maps. (n.d.). Ros Barnett Reservoir Fishing & Boating Map. FHS Maps.

National Climatic Data Center. (2012). *National Climatic Data Center*. Retrieved April 3, 2012, from National Oceanic and Atmospheric Administration: http://www.ncdc.noaa.gov/cdo-web/

National Renewable Energy Laboratory U.S. Department of Energy. (2012). *National Solar Radiation Database 1991 - 2005 Update: User's Manual.* Retrieved 2011, from Department of Energy Information Bridge: http://www.osti.gov/bridge/product.biblio.jsp?query_id=1&page=0&osti_id=908182&Row=0&formname=basicsearch.jsp

Tetha Tech, Inc. (2002). *User's Manual for Environmental Fluid Dynamics Code Hydro Version (EFDC-Hydro) Release 1.00.* Fairfax, Virginia: EPA.

The Rez News. (n.d.). *Rez News*. Retrieved September 2012, from The Rez News Rez History: http://www.thereznews.com/p/rez-history.html

APPENDIX A

EFDC INPUT FILE ASER.INP SAMPLE

```
C      Jackson Allen field   Reference day (Julian day 0) 12/31/2005 - 6 hours for GMT
C        data from 12/31/2005 to 1/1/2007 from Allen Jackson Field
C  ATMOSPHERIC FORCING FILE, USE WITH 28 JULY 96 AND LATER VERSIONS OF EFDC
C
C  MASER     =NUMBER OF TIME DATA POINTS
C  TCASER    =DATA TIME UNIT CONVERSION TO SECONDs
C  TAASER    =ADDITIVE ADJUSTMENT OF TIME VALUES SAME UNITS AS INPUT TIMES
C  IRELH     =0 VALUE TWET COLUMN VALUE IS TWET, =1 VALUE IS RELATIVE HUMIDITY
C  RAINCVT   =CONVERTS RAIN TO UNITS OF M/SEC
C  EVAPCVT   =CONVERTS EVAP TO UNITS OF M/SEC, IF EVAPCVT<0 EVAP IS INTERNALLY OMPUTED
C  SOLRCVT   =CONVERTS SOLAR SW RADIATION TO JOULES/SQ METER
C  CLDCVT    =MULTIPLIER FOR ADJUSTING CLOUD COVER
C  IASWRAD   =0 DISTRIBUTE SW SOL RAD OVER WATER COL AND INTO BED, =1 ALL TO SURF AYER
C  REVC      =1000*EVAPORATIVE TRANSFER COEF, REVC<0 USE WIND SPD DEPD DRAG COEF
C  RCHC      =1000*CONVECTIVE HEAT TRANSFER COEF, REVC<0 USE WIND SPD DEPD DRAG COEF
C  SWRATNF   =FAST SCALE SOLAR SW RADIATION ATTENUATION COEFFCIENT 1./METERS
C  SWRATNS   =SLOW SCALE SOLAR SW RADIATION ATTENUATION COEFFCIENT 1./METERS
C  FSWRATF   =FRACTION OF SOLSR SW RADIATION ATTENUATED FAST  0<FSWRATF<1
C  DABEDT    =DEPTH OR THICKNESS OF ACTIVE BED TEMPERATURE LAYER, METERS
C  TBEDIT    =INITIAL BED TEMPERATURE
C  HTBED1    =CONVECTIVE HT COEFFCIENT BETWEEN BED AND BOTTOM WATER LAYER  NO DIM
C  HTBED2    =HEAT TRANS COEFFCIENT BETWEEN BED AND BOTTOM WATER LAYER  M/SEC
C  PATM      =ATM PRESS MILLIBAR
C  TDRY/TEQ  =DRY ATM TEMP ISOPT(2)=1 OR EQUIL TEMP ISOPT(2)=2
C  TWET/RELH =WET BULB ATM TEMP IRELH=0, RELATIVE HUMIDITY IRELH=1
C  RAIN      =RAIN FALL RATE LENGTH/TIME (in/hr from BNL)
C  EVAP      =EVAPORATION RATE IS EVAPCVT>0.
C  SOLSWR    =SOLAR SHORT WAVE RADIATION AT WATER SURFACE  ENERGY FLUX/UNIT AREA
C  CLOUD     =FRATIONAL CLOUD COVER
C
C MASER  TCASER  TAASER  IRELH  RAINCVT  EVAPCVT  SOLRCVT  CLDCVT
C
C IASWRAD      REVC  RCHC  SWRATNF        SWRATNS  FSWRATF DABEDT TBEDIT
C
C TASER(M)  PATM(M)  TDRY(M)  TWET(M)  RAIN(M)  EVAP(M)  SOLSWR(M)      CLOUD(M)
C /TEQ  /RELH /HTCOEF

13744.000      86400  -0.250 0.000  7.06E-06      -1      0.35    1
0.000  -1      -1.000 1.000  0       0.6    20      25
0.000  1001.4 12.222 6.667  0       0      0       0
0.037  1001.1 11.111 6.667  0       0      0       0
0.079  1000.5 12.222 7.222  0       0      0       0
0.121  1000.5 11.667 7.778  0       0      0       0
0.125  1000.4 11.667 7.778  0       0      0       0
```

APPENDIX B

EFDC INPUT FILE CELL.INP

```
C Cell.inp
C    0        1
C    1234567890
C
17  0000999000
16  0009959900
15  0099451900
14  0094555900
13  0095552900
12  0093559900
11  0999599000
10  0994519000
 9  0945529000
 8  9955299000
 7  9455190000
 6  9355590000
 5  9555590000
 4  9555599990
 3  9355555590
 2  9455523990
 1  9999999999
C
C   1234567890
C            1
```

APPENDIX C

EFDC INPUT FILE DXDY.INP

```
C       dxdy.inp        file,   in      free    format
C       set equal to 90.45 bathymetric depth
C       I       J       DX      DY      DEPTH
C
2       2       1250    1900    3.00    87.70   0       0       0
3       2       1400    1900    6.00    84.70   0       0       0
4       2       1500    1900    6.00    84.70   0       0       0
5       2       1150    1900    3.00    87.70   0       0       0
6       2       1600    1900    3.00    87.70   0       0       0
7       2       1500    1900    3.00    87.70   0       0       0
2       3       1250    1900    6.00    84.70   0       0       0
3       3       1400    1900    7.00    83.70   0       0       0
4       3       1500    1900    4.00    86.70   0       0       0
5       3       1150    1900    3.00    87.70   0       0       0
6       3       1600    1900    2.50    88.20   0       0       0
7       3       1500    1900    2.00    88.70   0       0       0
8       3       3000    1900    2.00    88.70   0       0       0
2       4       1250    2230    5.64    85.06   0       0       0
3       4       1400    2230    6.50    84.20   0       0       0
4       4       1500    2230    2.00    88.70   0       0       0
5       4       1150    2230    1.50    89.20   0       0       0
2       5       1250    2000    4.00    86.70   0       0       0
3       5       1400    2000    6.50    84.20   0       0       0
4       5       1500    2000    2.00    88.70   0       0       0
5       5       1150    2000    1.50    89.20   0       0       0
2       6       1250    2000    6.50    84.20   0       0       0
3       6       1400    2000    6.50    84.20   0       0       0
4       6        718    2000    2.00    88.70   0       0       0
5       6       1150    2000    1.50    89.20   0       0       0
2       7       1250    2070    1.50    89.20   0       0       0
3       7       1400    2070    7.00    83.70   0       0       0
4       7       1500    2070    7.00    83.70   0       0       0
5       7       1150    2070    1.50    89.20   0       0       0
3       8       1400    1870    2.00    88.70   0       0       0
4       8       1500    1870    6.00    84.70   0       0       0
5       8       1150    1870    1.50    89.20   0       0       0
3       9       1400    2150    1.50    89.20   0       0       0
4       9       1500    2150    6.00    84.70   0       0       0
5       9       1150    2150    6.00    84.70   0       0       0
6       9       1600    2150    1.00    89.70   0       0       0
4       10      1500    1600    1.50    89.20   0       0       0
5       10      1150    1600    6.00    84.70   0       0       0
6       10      1600    1600    1.50    89.20   0       0       0
5       11      1150     280    6.00    84.70   0       0       0
4       12      1500    2100    1.00    89.70   0       0       0
5       12      1150    2100    6.00    84.70   0       0       0
6       12      1600    2100    1.00    89.70   0       0       0
4       13      1500    1940    1.00    89.70   0       0       0
```

5	13	1150	1940	6.00	84.70	0	0	0
6	13	1600	1940	3.00	87.70	0	0	0
7	13	1500	1940	1.00	89.70	0	0	0
4	14	1500	2060	1.00	89.70	0	0	0
5	14	1150	2060	5.00	85.70	0	0	0
6	14	1600	2060	3.00	87.70	0	0	0
7	14	1500	2060	1.00	89.70	0	0	0
5	15	1150	2870	5.00	85.70	0	0	0
6	15	1600	2870	5.00	85.70	0	0	0
7	15	1500	2870	1.00	89.70	0	0	0
6	16	1600	2560	5.00	85.70	0	0	0

APPENDIX D

EFDC INPUT FILE LXLY.INP

```
C       lxly.inp        file,   in      free    format  across  line
C
C       I       LX      LY      YLTUTMNCCUE     CCVE    CCUN    CCVN
C
2       2       625     950     1       0       0       1       1
3       2       1950    950     1       0       0       1       1
4       2       3400    950     1       0       0       1       1
5       2       4725    950     1       0       0       1       1
6       2       6100    950     1       0       0       1       1
7       2       7650    950     1       0       0       1       1
2       3       625     2850    1       0       0       1       1
3       3       1950    2850    1       0       0       1       1
4       3       3400    2850    1       0       0       1       1
5       3       4725    2850    1       0       0       1       1
6       3       6100    2850    1       0       0       1       1
7       3       7650    2850    1       0       0       1       1
8       3       9900    2850    1       0       0       1       1
2       4       625     4915    1       0       0       1       1
3       4       1950    4915    1       0       0       1       1
4       4       3400    4915    1       0       0       1       1
5       4       4725    4915    1       0       0       1       1
2       5       625     7030    1       0       0       1       1
3       5       1950    7030    1       0       0       1       1
4       5       3400    7030    1       0       0       1       1
5       5       4725    7030    1       0       0       1       1
2       6       625     9030    1       0       0       1       1
3       6       1950    9030    1       0       0       1       1
4       6       3400    9030    1       0       0       1       1
5       6       4725    9030    1       0       0       1       1
2       7       625     10565   1       0       0       1       1
3       7       1950    10565   1       0       0       1       1
4       7       3400    10565   1       0       0       1       1
5       7       4725    10565   1       0       0       1       1
3       8       1950    12535   1       0       0       1       1
4       8       3400    12535   1       0       0       1       1
5       8       4725    12535   1       0       0       1       1
3       9       1950    14545   1       0       0       1       1
4       9       3400    14545   1       0       0       1       1
5       9       4725    14545   1       0       0       1       1
6       9       6100    14545   1       0       0       1       1
4       10      3400    16420   1       0       0       1       1
5       10      4725    16420   1       0       0       1       1
6       10      6100    16420   1       0       0       1       1
5       11      4725    17360   1       0       0       1       1
4       12      3400    18550   1       0       0       1       1
```

5	12	4725	18550	1	0	0	1	1
6	12	6100	18550	1	0	0	1	1
4	13	3400	20570	1	0	0	1	1
5	13	4725	20570	1	0	0	1	1
6	13	6100	20570	1	0	0	1	1
7	13	7650	20570	1	0	0	1	1
4	14	3400	22570	1	0	0	1	1
5	14	4725	22570	1	0	0	1	1
6	14	6100	22570	1	0	0	1	1
7	14	7650	22570	1	0	0	1	1
5	15	4725	25035	1	0	0	1	1
6	15	6100	25035	1	0	0	1	1
7	15	7650	25035	1	0	0	1	1
6	16	6100	27750	1	0	0	1	1

APPENDIX E

EFDC INPUT FILE EFDC.INP

```
*******************************************************************************
*                                                                             *
*   WELCOME TO THE ENVIRONMENTAL FLUID DYNAMICS COMPUTER CODE SERIES          *
*   DEVELOPED BY JOHN M.  HAMRICK.                                            *
*                                                                             *
*   THIS IS THE MASTER INPUT FILE efdc.inp, AND SHOULD BE USED WITH THE       *
*   15 AUGUST 1998 OR LATER VERSION OF efdc.f DIRECTLY RELEASED BY DEVELOPER  *
*                                                                             *
*   THIS FILE IS SELF DOCUMENTED WITH DEFINITIONS AND GUIDENCE FOR EACH       *
*   INPUT VARIABLE CONTAINED IN ITS CARD IMAGE SECTION.  REFER TO USERS MAN   *
*   AVAILABLE FROM DEVELOPER AT ham@visi.net FOR ADDTIONAL DOCUMENTATION      *
*                                                                             *
*******************************************************************************
C1  TITLE FOR RUN                                                             |
C                                                                             |
       TITLE OR IDENTIFIER FOR THIS INPUT FILE AND RUN                        |
C     (LIMIT TO 80 CHARACTERS LENGTH)                                         |
#C1  TITLE                                                                    |
     'ROSS BARNETT RESERVOIR April Run'
 -------------------------------------------------------------------------------
C1A  GRID CONFIGURATION AND TIME INTEGRATION MODE SELECTION                    |
C                                                                              |
      IGRIDH:  0 SINGLE HORIZONTAL GRID WITHOUT HORIZONTAL PARALLELIZATION     |
               1 SINGLE HORIZONTAL GRID WITH HORIZONTAL PARALLELIZATION        |
                 GE.2, NUMBER OF HORIZONTAL GRIDS WITH HORIZONTAL DOMAIN       |
                 DECOMPOSITION PARALLELIZATION                                 |
              -1 ONE DIMENSIONAL CHANNEL NETWORK WITH HEC TYPE CROSS SECTIONS  |
      INESTH:  1 NO NESTING FOR IGRIDH.GE.2                                    |
               2 2 TO 1 NESTING (FINE TO COARSE) FOR IGRIDH.GE.2               |
               3 3 TO 1 NESTING (FINE TO COARSE) FOR IGRIDH.GE.2               |
      IGRIDV:  0 STANDARD SIGMA VERTICAL GRID OR SINGLE LAYER DEPTH AVERAGE    |
                  1 GENERAL VERTICAL GRID WITH SIGMA AND RESCALED HEIGHT REGIONS
      ITIMSOL: 0 THREE TIME LEVEL INTEGRATION                                  |
               1 TWO TIME LEVEL INTEGRATION                                    |
  ISHOUSATONIC:  1 ACTIVATE HOUSATONIC RIVER SUPERFUND SEDTOX OPTIONS
 C                                                                             |
 C1A  IGRIDH  INESTH  IGRIDV  ITIMSOL    ISHOUSATONIC
      0       0       0       0          0
 -------------------------------------------------------------------------------
 C2  RESTART, GENERAL CONTROL AND AND DIAGNOSTIC SWITCHES                      |
 C                                                                             |
       ISRESTI: 1 FOR READING INITIAL CONDITIONS FROM FILE  restart.inp        |
               -1 AS ABOVE BUT ADJUST FOR CHANGING BOTTOM ELEVATION            |
                2 INTIALIZES A KC LAYER RUN FROM A KC/2 LAYER RUN FOR KC.GE.4  |
               10 FOR READING IC'S FROM restart.inp WRITTEN BEFORE 8 SEPT 92   |
       ISRESTO:-1 FOR WRITING RESTART FILE restart.out AT END OF RUN           |
                N INTEGER.GE.0 FOR WRITING restart.out EVERY N REF TIME PERIODS|
       ISRESTR: 1 FOR WRITING RESIDUAL TRANSPORT FILE restran.out              |
```

```
      ISLOG:   1 FOR WRITING LOG FILE efdc.log                                |
      ISPAR:   0 FOR EXECUTION OF CODE ON A SINGLE PROCESSOR MACHINE          |
               1 FOR PARALLEL EXECUTION, PARALLELIZING PRIMARILY OVER LAYERS  |
               2 FOR PARALLEL EXECUTION, PARALLELIZING PRIMARILY OVER         |
                 NDM HORIZONTAL GRID SUBDOMAINS, SEE CARD CARD C9             |
      ISDIVEX: 1 FOR WRITING EXTERNAL MODE DIVERGENCE TO SCREEN               |
      ISNEGH:  1 FOR SEARCHING FOR NEGATIVE DEPTHS AND WRITING TO SCREEN      |
      ISMMC:   1 FOR WRITING MIN AND MAX VALUES OF SALT AND DYE               |
                 CONCENTRATION TO SCREEN                                      |
      ISBAL:   1 FOR ACTIVATING MASS, MOMENTUM AND ENERGY BALANCES AND        |
                 WRITING RESULTS TO FILE bal.out                              |
      ISHP:    1 FOR CALLING HP 9000 S700 VERSIONS OF CERTAIN SUBROUTINES     |
      ISHOW:   1 TO SHOW PUV&S ON SCREEN, SEE INSTRUCTIONS FOR FILE show.inp  |
C                                                                             |
C2  ISRESTI ISRESTO ISRESTR ISPAR ISLOG ISDIVEX ISNEGH ISMMC ISBAL ISHP ISHOW |
   0       -1       0       0     0     0       1      0     0     0    2
------------------------------------------------------------------------------
C3  EXTERNAL MODE SOLUTION OPTION PARAMETERS AND SWITCHES                     |
C                                                                             |
      RP:        OVER RELAXATION PARAMETER                                    |
      RSQM:      TRAGET SQUARE RESIDUAL OF ITERATIVE SOLUTION SCHEME          |
      ITERM:     MAXIMUN NUMBER OF ITERARTIONS                                |
      IRVEC:   0 STANDARD RED-BLACK SOR SOLUTION                              |
               1 MORE VECTORIZABLE RED-BLACK SOR (FOR RESEARCH PURPOSES)      |
               2 RED-BLACK ORDERED CONJUGATE GRADIENT SOLUTION                |
               3 REDUCED SYSTEM R-B CONJUGATE GRADIENT SOLUTION               |
               9 NON-DRYING CON GRADIENT SOLUTION WITH MAXIMUM DIAGNOSTICS    |
      RPADJ:     RELAXATION PARAMETER FOR AUXILLARY POTENTIAL ADJUSTME        |
                 OF THE MEAN MASS TRANSPORT ADVECTION FIELD                   |
                 (FOR RESEARCH PURPOSES)                                      |
      RSQMADJ:   TRAGET SQUARED RESIDUAL ERROR FOR ADJUSTMENT                 |
                 (FOR RESEARCH PURPOSES)                                      |
      ITRMADJ:   MAXIMUM ITERARTIONS FOR ADJUSTMENT(FOR RESEARCH PURPOSES)    |
      ITERHPM:   MAXIMUM ITERATIONS FOR STRONGLY NONLINER DRYING AND WETTING  |
                 SCHEME (ISDRY=3 OR OR 4)  ITERHPM.LE.4                       |
      IDRYCK:    ITERATIONS PER DRYING CHECK (ISDRY.GE.1)  2.LE.IDRYCK.LE.20  |
      ISDSOLV: 1 TO WRITE DIAGNOSTICS FILES FOR EXTERNAL MODE SOLVER          |
         FILT:   FILTER COEFFICIENT FOR 3 TIME LEVEL EXPLICIT ( 0.0625 )      |
C       1.E-3                                                                 |
#C3 RP    RSQM   ITERM IRVEC RPADJ RSQMADJ ITRMADJ ITERHPM IDRYCK ISDSOLV   FILT |
   1.8  1.E-8   200    9     1.8    1.E-16  1000    0       20      0        0.0625
------------------------------------------------------------------------------
C4  LONGTERM MASS TRANSPORT INTEGRATION ONLY SWITCHES                         |
C                                                                             |
      ISLTMT:  1 FOR LONG-TERM MASS TRANSPORT ONLY (FOR RESEARCH PURPOSES)    |
      ISSSMMT: 0 WRITES MEAN MASS TRANSPORT TO restran.out AFTER EACH         |
                 AVERAGING PERIOD  (FOR RESEARCH PURPOSES)                    |
               1 WRITES MEAN MASS TRANSPORT TO restran.out AFTER LAST         |
```

```
                  AVERAGING PERIOD  (FOR RESEARCH PURPOSES)                    |
       ISLTMTS: 0 ASSUMES LONG-TERM TRANSPORT SOLUTION IS TRANSIENT            |
                  (FOR RESEARCH PURPOSES)                                      |
                1 ASSUMES LONG-TERM TRANSPORT SOLUTION IS ITERATED TOWARD      |
                  STEADY STATE (FOR RESEARCH PURPOSES)                         |
       ISIA:    1 FOR IMPLICIT LONG-TERM ADVECTION INTEGRATION FOR ZEBRA       |
                  VERTICAL LINE R-B SOR (FOR RESEARCH PURPOSES)                |
       RPIA:      RELAXATION PARAMETER FOR ZEBRA SOR(FOR RESEARCH PURPOSES)    |
       RSQMIA:    TRAGET RESIDUAL ERROR FOR ZEBRA SOR (FOR RESEARCH PURPOSES)  |
       ITRMIA:    MAXIMUM ITERATIONS FOR ZEBRA SOR (FOR RESEARCH PURPOSES)     |
        ISAVEC:  1 USE ALTIVEC ENABLED SUBROUTINES (MAC G4 ONLY)               |
C                                                                              |
 #C4  ISLTMT  ISSSMMT ISLTMTS  ISIA  RPIA  RSQMIA   ITRMIA    isavec           |
       0       0       0        0     1.8   1.E-10   100        0
 ------------------------------------------------------------------------------
 C5   MOMENTUM ADVEC AND HORIZ DIFF SWITCHES AND MISC SWITCHES                 |
 C                                                                             |
       ISCDMA:  1 FOR CENTRAL DIFFERENCE MOMENTUM ADVECTION                    |
                0 FOR UPWIND DIFFERENCE MOMENTUM ADVECTION                     |
                2 FOR EXPERIMENTAL UPWIND DIFF MOM ADV (FOR RESEACH PURPOSES)  |
       ISHDMF:  1 TO ACTIVE HORIZONTAL MOMENTUM DIFFUSION                      |
       ISDISP:  1 CALCULATE MEAN HORIZONTAL SHEAR DISPERSION TENSOR OVER LAST  |
                  MEAN MASS TRANSPORT AVERAGING PERIOD                         |
       ISWASP: 4 or 5 TO WRITE FILES FOR WASP4 or WASP5 MODEL LINKAGE          |
       ISDRY:     GREATER THAN 0 TO ACTIVE WETTING & DRYING OF SHALLOW AREAS   |
                1 CONSTANT WETTING DEPTH SPECIFIED BY HWET ON CARD 11          |
                  WITH NONLINEAR ITERATIONS SPECIFIED BY ITERHPM ON CARD C3    |
                2 VARIABLE WETTING DEPTH CALCULATED INTERNALLY IN CODE         |
                  WITH NONLINEAR ITERATIONS SPECIFIED BY ITERHPM ON CARD C3    |
               11 SAME AS 1, WITHOUT NONLINEAR ITERATION                       |
               12 SAME AS 2, WITHOUT NONLINEAR ITERATION                       |
                3 DIFFUSION WAVE APPROX, CONSTANT WETTING DEPTH (NOT ACTIVE)   |
                4 DIFFUSION WAVE APPROX, VARIABLE WETTING DEPTH (NOT ACTIVE)   |
       ISQQ:    1 TO USE STANDARD TURBULENT INTENSITY ADVECTION SCHEME         |
       ISRLID:  1 TO RUN IN RIGID LID MODE (NO FREE SURFACE)                   |
       ISVEG:   1 TO IMPLEMENT VEGETATION RESISTANCE                           |
                2 IMPLEMENT WITH DIAGNOSTICS TO FILE cbot.log                  |
       ISVEGL:  1 TO INCLUDE LAMINAR FLOW OPTION IN VEGETATION RESISTANCE      |
       ISITB:   1 FOR IMPLICIT BOTTOM & VEGETATION RESISTANCE IN EXTERNAL MODE |
                  FOR SINGLE LAYER APPLICATIONS (KC=1) ONLY                    |
       ISEVER:  1 TO DEFAULT TO EVERGLADES HYDRO SOLUTION OPTIONS              |
       IINTPG:  0 ORIGINAL INTERNAL PRESSURE GRADIENT FORMULATION              |
                1 JOCABIAN FORMULATION                                         |
                2 FINITE VOLUME FORMULATION                                    |
 C                                  11                                         |
 #C5 ISCDMA ISHDMF ISDISP ISWASP ISDRY ISQQ ISRLID ISVEG ISVEGL ISITB ISEVER iintpg |
           0     0     0     8     0     1     0     0     0      0      0    0
 ------------------------------------------------------------------------------
```

```
C6   DISSOLVED AND SUSPENDED CONSTITUENT TRANSPORT SWITCHES                 |
C6   TURB INT=0,SAL=1,TEM=2,DYE=3,SFL=4,TOX=5,SED=6,SND=7,CWQ=8             |
C                                                                           |
      ISTRAN:  1 OR GREATER TO ACTIVATE TRANSPORT                           |
      ISTOPT:    NONZERO FOR TRANSPORT OPTIONS, SEE USERS MANUAL            |
      ISCDCA:  0 FOR STANDARD DONOR CELL UPWIND DIFFERENCE ADVECTION        |
               1 FOR CENTRAL DIFFERENCE ADVECTION FOR THREE TIME LEVEL STEPS |
               2 FOR EXPERIMENTAL UPWIND DIFFERENCE ADVECTION (FOR RESEARCH) |
      ISADAC:  1 TO ACTIVATE ANTI-NUMERICAL DIFFUSION CORRECTION TO         |
                 STANDARD DONOR CELL SCHEME                                 |
      ISFCT:   1 TO ADD FLUX LIMITING TO ANTI-NUMERICAL DIFFUSION CORRECTION |
      ISPLIT:  1 TO OPERATOR SPLIT HORIZONTAL AND VERTICAL ADVECTION        |
                 (FOR RESEARCH PURPOSES)                                    |
      ISADAH:  1 TO ACTIVATE ANTI-NUM DIFFUSION CORRECTION TO HORIZONTAL    |
                 SPLIT ADVECTION STANDARD DONOR CELL SCHEME (FOR RESEARCH)  |
      ISADAV:  1 TO ACTIVATE ANTI-NUM DIFFUSION CORRECTION TO VERTICAL      |
                 SPLIT ADVECTION STANDARD DONOR CELL SCHEME (FOR RESEARCH)  |
      ISCI:    1 TO READ CONCENTRATION FROM FILE restart.inp                |
      ISCO:    1 TO WRITE CONCENTRATION TO FILE restart.out                 |
C                                                                           |
#C6   ISTRAN ISTOPT ISCDCA ISADAC ISFCT ISPLIT ISADAH ISADAV ISCI ISCO      |
1      1      0      0      0      0      0      0      1     1     !turb    0
0      1      0      1      1      0      0      0      0     0     !sal     1
1      1      0      1      1      0      0      0      1     1     !tem     2
0      1      0      1      1      0      0      0      0     0     !dye     3
0      0      0      1      1      0      0      0      0     0     !sfl     4
0      0      0      1      1      0      0      0      0     0     !tox     5
0      0      0      1      1      0      0      0      1     1     !sed     6
0      0      0      1      1      0      0      0      0     0     !snd     7
0      0      0      1      1      0      0      0      0     0     !cwq     8
-----------------------------------------------------------------------------
C7  TIME-RELATED INTEGER PARAMETERS                                         |
C                                                                           |
      NTC:     NUMBER OF REFERENCE TIME PERIODS IN RUN                      |
      NTSPTC:  NUMBER OF TIME STEPS PER REFERENCE TIME PERIOD               |
      NLTC:    NUMBER OF LINEARIZED REFERENCE TIME PERIODS                  |
      NTTC:    NUMBER OF TRANSITION REF TIME PERIODS TO FULLY NONLINEAR     |
      NTCPP:   NUMBER OF REFERENCE TIME PERIODS BETWEEN FULL PRINTED OUTPUT |
               TO FILE efdc.out                                             |
      NTSTBC:  NUMBER OF REFERENCE TIME PERIODS BETWEEN TWO TIME LEVEL      |
               TRAPEZOIDAL CORRECTION TIME STEP                             |
      NTCNB:   NUMBER OF REFERENCE TIME PERIODS WITH NO BUOYANCY FORCING    |
      NTCVB:   NUMBER OF REF TIME PERIODS WITH VARIABLE BUOYANCY FORCING    |
      NTCMMT:  NUMBER OF NUMBER OF REF TIME TO AVERAGE OVER TO OBTAIN       |
               RESIDUAL OR MEAN MASS TRANSPORT VARIABLES                    |
      NFLTMT:  USE 1 (FOR RESEARCH PURPOSES)                                |
      NDRYSTP: MIN NO. OF TIME STEPS A CELL REMAINS DRY AFTER INTIAL DYRING |
C     92    dt=20s                                                          |
```

```
 #C7  NTC  NTSPTC NLTC NTTC NTCPP NTSTBC NTCNB NTCVB NTSMMT NFLTMT NDRYSTP IYEAR
IMONTH IDAY      |
   370  2880    0    0    800    4      0      0      10      1   100 2005   12     31
-------------------------------------------------------------------------------
 C8  TIME-RELATED REAL PARAMETERS                                              |
 C                                                                             |
       TCON:     CONVERSION MULTIPLIER TO CHANGE TBEGIN TO SECONDS             |
       TBEGIN:   TIME ORIGIN OF RUN                                            |
       TREF:     REFERENCE TIME PERIOD IN SEC (ie 44714.16s or 86400s)         |
       CORIOLIS: CONSTANT CORIOLIS PARAMETER IN 1/SEC                          |
       ISCORV:   1 TO READ VARIABLE CORIOLIS COEFFICIENT FROM lxly.inp FILE    |
       ISCCA:    WRITE DIAGNOSTICS FOR MAX CORIOLIS-CURV ACCEL TO FILEefdc.log |
       ISCFL:    1 WRITE DIAGNOSTICS OF MAX THEORETICAL TIME STEP TO cfl.out   |
                 GT 1  TIME STEP ONLY AT INTERVAL ISCFL FOR ENTIRE RUN         |
       ISCFLM:   1  TO MAP LOCATIONS OF MAX TIME STEPS OVER ENTIRE RUN         |
      DTSSFAC:  DYNAMIC TIME STEPPING IF 0.0.LT.DTSSFAC.LT.1.0                 |
      DTSSDHDT:  DYNAMIC TIME STEPPING RATE OF DEPTH CHANGE FACTOR             |
 C              731.0           0.1         1.0
 #C8   TCON TBEGIN TREF CORIOLIS ISCORV ISCCA ISCFL ISCFLM  DTSSFAC   DTSSDHDT |
       86400.  0    86400.   7.36E-05   0     0   0       0         0.0         0.0
-------------------------------------------------------------------------------
 C9  SPACE-RELATED AND SMOOTHING  PARAMETERS                                   |
 C                                                                             |
       IC:      NUMBER OF CELLS IN I DIRECTION                                 |
       JC:      NUMBER OF CELLS IN J DIRECTION                                 |
       LC:      NUMBER OF ACTIVE CELLS IN HORIZONTAL + 2                       |
       LVC:     NUMBER OF VARIABLE SIZE HORIZONTAL CELLS                       |
       ISCO:    1 FOR CURVILINEAR-ORTHOGONAL GRID (LVC=LC-2)                   |
       NDM:     NUMBER OF DOMAINS FOR HORIZONTAL DOMAIN DECOMPOSITION          |
                ( NDM=1, FOR MODEL EXECUTION ON A SINGLE PROCESSOR SYSTEM OR   |
                  NDM=MM*NCPUS, WHERE MM IS AN INTEGER AND NCPUS IS THE NUMBER |
                  OF AVAILABLE CPU's FOR MODEL EXECUTION ON A PARALLEL         |
                  MULTIPLE PROCESSOR SYSTEM )                                  |
       LDW:     NUMBER OF WATER CELLS PER DOMAIN                               |
                ( LDW=(LC-2)/NDM, FOR MULTIPE VECTOR PROCESSORS, LWD MUST BE   |
                  AN INTEGER MULTIPLE OF THE VECTOR LENGTH OR STRIDE NVEC      |
                  THUS CONSTRAINING LC-2 TO BE AN INTEGER MULTIPLE OF NVEC )   |
       ISMASK:  1 FOR MASKING WATER CELL TO LAND OR ADDING THIN BARRIERS       |
                 USING INFORMATION IN FILE mask.inp                            |
       ISPGNS:  1 FOR IMPLEMENTING A PERIODIC GRID IN COMP N-S DIRECTION OR    |
                 CONNECTING ARBITRATY CELLS USING INFO IN FILE mappgns.inp     |
       NSHMAX:  NUMBER OF DEPTH SMOOTHING PASSES                               |
       NSBMAX:  NUMBER OF INITIAL SALINITY FIELD SMOOTHING PASSES              |
       WSMH:    DEPTH SMOOTHING WEIGHT                                         |
       WSMB:    SALINITY SMOOTHING WEIGHT                                      |
 C                                                                             |
 #C9  IC   JC    LC   LVC  ISCO NDM LDW  ISMASK ISPGNS NSHMX NSBMX    WSMH     WSMB |
       10   17    57   55   0     1    55   0       0      1     0       0.0625 0.0625
```

```
-------------------------------------------------------------------------------
C9A  VERTICAL SPACE-RELATED PARAMETERS                                          |
C                                                                               |
      KC:      NUMBER OF VERTICAL LAYER                                         |
    KSIG:      NUMBER OF VERTICAL LAYERS IN SIGMA REGION FOR IGRIDV = 1         |
 ISETGVC;    0 READ BOTTOM LAYER ID FROM GVCLAYER.INP
             1 AUTOMATICALLY SET BOTTOM LAYER ID USING SELVREF, SELVREF
                 AND BELV (IN DXDY.INP) AND WRITE RESULTS TO GVCLAYER.OUT
 SELVREF:      REFERENCE SURFACE ELEVATION IN RESCALED HEIGHT REGION (METERS) |
 BELVREF:      REFERENCE (MINIMUM) BOTTOM ELEVATION IN RESCALED HEIGHT REGION |
 ISGVCCK:    0 NORMAL SETTING (OPTION 1 USED FOR DEBUGGING SIGMA/GVC COMPARE) |
             1 USE MULTI-LAYER BOTTOM FRICTION FOR SINGLE LAYER SIGMA           |
C                                                                               |
C9A  KC  KSIG  ISETGVC  SELVREF  BELVREF  ISGVCCK                               |
     3     3   1        90.7    75       0
-------------------------------------------------------------------------------
C10 LAYER THICKNESS IN VERTICAL                                                 |
C                                                                               |
          K:  LAYER NUMBER, K=1,KC                                              |
        DZC:  DIMENSIONLESS LAYER THICKNESS (THICKNESSES MUST SUM TO 1.0)       |
              FOR IGRIDV=1, THE TOP KSIG LAYERS ARE PRESENT IN BOTH THE         |
                       SIGMA AND RESCALED HEIGHT REGIONS                        |
C                                                                               |
C10     K        DZC                                                            |
        1          0.3333
        2          0.3333
        3          0.3333
 -------------------------------------------------------------------------------
C11 GRID, ROUGHNESS AND DEPTH PARAMETERS                                         |
C                                                                               |
      DX:       CARTESIAN CELL LENGTH IN X OR I DIRECTION                       |
      DY:       CARTESION CELL LENGHT IN Y OR J DIRECTION                       |
      DXYCVT:   MULTIPLY DX AND DY BY TO OBTAIN METERS                          |
      IMD:      GREATER THAN 0 TO READ MODDXDY.INP FILE                         |
      ZBRADJ:   LOG BDRY LAYER CONST OR VARIABLE ROUGH HEIGHT ADJ IN METERS     |
      ZBRCVRT:  LOG BDRY LAYER VARIABLE ROUGHNESS HEIGHT CONVERT TO METERS      |
      HMIN:     MINIMUM DEPTH OF INPUTS DEPTHS IN METERS                        |
      HADJ:     ADJUCTMENT TO DEPTH FIELD IN METERS                             |
      HCVRT:    CONVERTS INPUT DEPTH FIELD TO METERS                            |
      HDRY:     DEPTH AT WHICH CELL OR FLOW FACE BECOMES DRY                    |
      HWET:     DEPTH AT WHICH CELL OR FLOW FACE BECOMES WET                    |
      BELADJ:   ADJUCTMENT TO BOTTOM BED ELEVATION FIELD IN METERS              |
      BELCVRT:  CONVERTS INPUT BOTTOM BED ELEVATION FIELD TO METERS             |
C                                                                               |
#C11 DX DY DXYCVT IMD  ZBRADJ ZBRCVT HMIN HADJ HCVT HDRY  HWET  BELADJ BELCVT |
     1000. 1000. 1.  0   0.01   1.0   0.01  0.0  1.0  0.03   0.0   0.0    1.00
-------------------------------------------------------------------------------
C11A TWO-LAYER MOMENTUM FLUX AND CURVATURE ACCELERATION CORRECTION FACTORS    |
```

```
 C                                                                             |
       ICK2COR: 0 NO CORRECTION                                                |
       ICK2COR: 1 CORRECTION USING CK2UUC,CK2VVC,CK2UVC FOR CURVATURE          |
       ICK2COR: 2 CORRECTION USING CK2FCX,CK2FCY FOR CURVATURE                 |
       CK2UUM:  CORRECTION FOR UU MOMENTUM FLUX                                |
       CK2VVM:  CORRECTION FOR UU MOMENTUM FLUX                                |
       CK2UVM:  CORRECTION FOR UU MOMENTUM FLUX                                |
       CK2UUC:  CORRECTION FOR UU CURVATURE ACCELERATION                       |
       CK2VVC:  CORRECTION FOR VV CURVATURE ACCELERATION                       |
       CK2UVC:  CORRECTION FOR UV CURVATURE ACCELERATION                       |
       CK2FCX:  CORRECTION FOR X EQUATION CURVATURE ACCELERATION               |
       CK2FCY:  CORRECTION FOR Y EQUATION CURVATURE ACCELERATION               |
 C                                                                             |
 C11A ICK2COR  CK2UUM  CK2VVM  CK2UVM  CK2UUC  CK2VVC  CK2UVC  CK2FCX  CK2FCY  |
         0     0.0825  0.0825  0.0825  0.0825  0.0825  0.0825  0.0825  0.0825
 -------------------------------------------------------------------------------
C11B CORNER CELL BED STRESS CORRECTION
C
     ISCORTBC: 1 TO CORRECT BED STRESS AVERAGEING TO CELL CENTERS IN CORNERS
                 2 TO USE SPATIALLY VARYING CORRECTION FOR CELLS IN CORNERC.INP
     ISCORTBCD: 1 WRITE DIAGNOSTICS EVERY NSPTC TIME STEPS
     FSCORTBC: CORRECTION FACTOR, 0.0 LE FSCORTBC LE 1.0
             1.0 = NO CORRECTION, 0.0 = MAXIMUM CORRECTION, 0.5 SUGGESTED
C
C11B ISCORTBC ISCORTBCD FSCORTBC
     0         1        0.414
 -------------------------------------------------------------------------------
 C12 TURBULENT DIFFUSION PARAMETERS                                            |
C                                                                              |
       AHO:     CONSTANT HORIZONTAL MOMENTUM AND MASS DIFFUSIVITY M*M/S        |
         AHD:     DIMESIONLESS HORIZONTAL MOMENTUM DIFFUSIVITY                 |
       AVO:     BACKGROUND, CONSTANT OR MOLECULAR KINEMATIC VISCOSITY M*M/S    |
       ABO:     BACKGROUND, CONSTANT OR MOLECULAR DIFFUSIVITY M*M/S            |
       AVMN:    MINIMUM KINEMATIC EDDY VISCOSITY M*M/S                         |
       ABMN:    MINIMUM EDDY DIFFUSIVITY M*M/S                                 |
       VISMUD:  CONSTANT FLUID MUD VISCOSITY M*M/S                             |
       AVBCON:  EQUALS ZERO FOR CONSTANT VERTICAL VISCOSITY AND DIFFUSIVITY    |
                  WHICH ARE SET EQUAL TO AVO AND ABO OTHERWISE SET TO 1.0      |
       ZBRWALL: SIDE WALL LOG LAW ROUGHNESS HEIGHT. USED WHEN HORIZONTAL       |
                MOMENTUM DIFFUSION IS ACTIVE AND AHO OR AHD ARE NONZERO        |
C             1.E-6  1.E-9  1.E-6  1.E-9                                       |
C12 AHO  AHD  AVO    ABO    AVMN   ABMN    VISMUD AVBCON ZBRWALL               |
    0.0  0.0  1.E-6  1.4E-7  1E-6  1.4E-7  1.e-6  1.0    0.0
-------------------------------------------------------------------------------|
C12A TURBULENCE CLOSURE OPTIONS                                                |
C                                                                              |
       ISSTAB:  0 FOR GALPERIN ET AL STABILTIY FUNCTIONS IN CALAVBOLD          |
                1 FOR GALPERIN ET AL STABILTIY FUNCTIONS                       |
```

```
                 2 FOR KANTHA AND CLAYSON (1994) STABILTIY FUNCTIONS              |
                 3 FOR KANTAH (2003) STABILITY FUNCTIONS                          |
                   NOTE OPTIONS SELECTED HERE OVER RIDE ISTOPT(0) ON C6           |
        ISSQL:   0 SETS QQ AND QQL STABILITY FUNCTIONS PROPORTIONAL TO            |
                      MOMENTUM STABILITY FUNCTIONS (EXCEPT FOR ISSTAB=3)          |
                          1 SETS QQ AND QQL STABILITY FUNCTIONS TO CONSTANTS      |
                               (FOR ISSTAB = 0,1,2) THIS OPTION NOT ACTIVE        |
        ISAVBMN: SET TO 1 TO ACTIVATE MIN VIS AND DIFF OF AVMN AND ABMN           |
        ISFAVB:  SET TO 1 OR 2 TO AVG OR SQRT FILTER AVV AND AVB                  |
        ISINWV:  SET TO 1 TO ACTIVATE INTERNAL WAVE PARAMETERIZATION              |
        ISLLIM:  0 FOR NO LENGHT SCALE AND RIQMAX LIMITATIONS                     |
                 1 LIMIT RIQMAX IN STABILITY FUNCTION ONLY                        |
                 2 DIRECTLY LIMIT LENGTH SCALE AND LIMIT RIQMAX IN STAB FUNC      |
        IFPROX:  0 FOR NO WALL PROXIMITY FUNCTION                                 |
                 1 FOR PARABOLIC OVER DEPTH WALL PROXIMITY FUNCITON               |
                 2 FOR OPEN CHANNEL WALL PROXIMITY FUNCITON                       |
        ISVTURB: SET TO 1 TO INCLUDE VEGETATION GENERATED TURBULENCE PRODUCTION |
           VTURBEFF: EFFICIENCY FACTOR FOR VEGETATION TURBULENCE PRODUCTION (0,1)
C                                                                                 |
C12A ISSTAB ISSQL ISAVBMN ISFAVB  ISINWV ISLLIM IFPROX  ISVTURB  VTURBEFF        |
      1      0      0       2       0       1    2       0        0.0
-------------------------------------------------------------------------------|
 C13 TURBULENCE CLOSURE PARAMETERS                                                |
C                                                                                 |
        VKC:    VON KARMAN CONSTANT                                               |
        CTURB1: TURB CONSTANT, B1 USE 16.6 FOR ALL CLOSURES                       |
        CTURB2: TURB CONSTANT, B2 USE 10.1 FOR ALL CLOSURES                       |
        CTE1:   TURB CONSTANT E1 FOR SHEAR PRODUCTION IN Q*Q*L EQ.                |
        CTE2:   TURB CONSTANT E2 DISSIPATION IN Q*Q*L EQ. USE 1.0                 |
        CTE3:   TURB CONSTANT E3 (SOMETIMES CALL E2)BOUYANCY TERM IN Q*Q*L EQ.  |
        CTE4:   TURB CONSTANT E4 (SOMETIMES CALL E3)WALL FUNCTION IN Q*Q*L EQ.  |
        CTE5:   TURB CONSTANT E5 2ND OPEN CHANNEL WALL FUNCTION IN Q*Q*L EQ.     |
        RIQMAX: MAXIMUM TURB INTENSITY RICHARDSON NUMBER FOR STABLE CONDITIONS   |
        QQMIN:  MINIMUM TURBULENT INTENSITY SQUARED                               |
        QQLMIN: MINIMUM TURBULENT INTENSITY SQUARED TIMES MACRO-SCALE             |
        DMLMIN: MINIMUM DIMENSIONLESS MACRO-SCALE                                 |
C       1.8  1.0  1.8/5. 1.33 0.25        1.E-8 1.E-12 1.E-4     |RIQ - no
C13 VKC CTURB1 CTURB2 CTE1 CTE2  CTE3  CTE4 CTE5 RIQMAX QQMIN  QQLMIN  DMLMIN  |
    0.4  16.6   10.1  1.8  1.0   1.8   1.33 0.25 0.28   1.E-8  1.E-12 1.E-4
 --------------------------------------------------------------------------------
 C14 TIDAL & ATMOSPHERIC FORCING, GROUND WATER AND SUBGRID CHANNEL PARAMETERS   |
 C   SET TO TURN ON WIND AND ATMOSPHER                                            |
        MTIDE:   NUMBER OF PERIOD (TIDAL) FORCING CONSTITUENTS                    |
        NWSER:   NUMBER OF WIND TIME SERIES (0 SETS WIND TO ZERO)                 |
        NASER :  NUMBER OF ATMOSPHERIC CONDITION TIME SERIES (0 SETS ALL  ZERO) |
        ISGWI:   1 TO ACTIVATE SOIL MOISTURE BALANCE WITH DRYING AND WETTING      |
                 2 TO ACTIVATE GROUNDWATER INTERACTION WITH BED AND WATER COL     |
       ISCHAN:   1 ACTIVATE SUBGRID CHANNEL MODEL AND READ MODCHAN.INP            |
```

```
      ISWAVE:   1 FOR WAVE CURRENT BOUNDARY LAYER  REQUIRES FILE wave.inp       |
                2 FOR WCBL AND WAVE INDUCED CURRENTS REQUIRES FILE wave.inp     |
     ITIDASM:   1 FOR TIDAL ELEVATION ASSIMILATION (NOT ACTIVE)                 |
      ISPERC:   1 TO PERCOLATE OR ELIMINATE EXCESS WATER IN DRY CELLS           |
     ISBODYF:   TO INCLUDE EXTERNAL MODE BODY FORCES FROM FBODY.INP             |
                1 FOR UNIFORM OVER DEPTH, 2 FOR SURFACE LAYER ONLY              |
    ISPNHYDS:   1 FOR QUASI-NONHYDROSTATIC OPTION                               |
C
C14 MTIDE NWSER NASER ISGWI ISCHAN ISWAVE ITIDASM ISPERC ISBODYF  ISPNHYDS
    0     1     1     0     0      0      0       0      0         0
-------------------------------------------------------------------------------
C15 PERIODIC FORCING (TIDAL) CONSTITUENT SYMBOLS AND PERIODS                    |
C                                                                               |
      SYMBOL:  FORCING SYMBOL (CHARACTER VARIABLE) FOR TIDES, THE NOS SYMBOL    |
      PERIOD:  FORCING PERIOD IN SECONDS                                        |
C                                                                               |
#C15 SYMBOL   PERIOD
-------------------------------------------------------------------------------
C16 SURFACE ELEVATION OR PRESSURE BOUNDARY CONDITION PARAMETERS                 |
C                                                                               |
      NPBS:  NUMBER OF SURFACE ELEVATION OR PRESSURE BOUNDARY CONDITIONS        |
             CELLS ON SOUTH OPEN BOUNDARIES                                     |
      NPBW:  NUMBER OF SURFACE ELEVATION OR PRESSURE BOUNDARY CONDITIONS        |
             CELLS ON WEST OPEN BOUNDARIES                                      |
      NPBE:  NUMBER OF SURFACE ELEVATION OR PRESSURE BOUNDARY CONDITIONS        |
             CELLS ON EAST OPEN BOUNDARIES                                      |
      NPBN:  NUMBER OF SURFACE ELEVATION OR PRESSURE BOUNDARY CONDITIONS        |
             CELLS ON NORTH OPEN BOUNDARIES                                     |
      NPFOR: NUMBER OF HARMONIC FORCINGS                                        |
      NPFORT: FORCING TYPE, 0=CONSTANT, 1=LINEAR, 2= QUADRATIC VARIATION        |
      NPSER: NUMBER OF TIME SERIES FORCINGS                                     |
      PDGINIT: ADD THIS CONSTANT ADJUSTMENT GLOBALLY TO THE SURFACE ELEVATION   |
C                                                                               |
#C16  NPBS NPBW NPBE NPBN  NPFOR NPFORT NPSER  ggg                              |
      0    0    0    1     0      0      1      0.0
-------------------------------------------------------------------------------
C17 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE BOUNDARY COND. FORCINGS      |
C                                                                               |
      NPFOR:      FORCING NUMBER                                                |
      SYMBOL:     FORCING SYMBOL (FOR REFERENCE HERE ONLY)                      |
      AMPLITUDE:  AMPLITUDE IN M (PRESSURE DIVIDED BY RHO*G), NPFORT=0          |
                  COSINE AMPLITUDE IN M, NPFORT.GE.1                            |
      PHASE:      FORCING PHASE RELATIVE TO TBEGIN IN SECONDS, NPFORT=0         |
                  SINE AMPLITUDE IN M, NPFORT.GE.1                              |
      NOTE: FOR NPFORT=0 SINGLE AMPLITUDE AND PHASE ARE READ, FOR NPFORT=1      |
            CONST AND LINEAR COS AND SIN AMPS ARE READ FOR EACH FORCING, FOR    |
            NPFORT=2, CONST, LINEAR, QUAD COS AND SIN AMPS ARE READ FOR EACH    |
            FOR EACH FORCING                                                    |
```

```
C                                                                               |
#C17 NPFOR    SYMBOL     AMPLITUDE      PHASE
-------------------------------------------------------------------------------
C18 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE ON SOUTH OPEN BOUNDARIES    |
C                                                                               |
      IPBS:      I CELL INDEX OF BOUNDARY CELL                                  |
      JPBS:      J CELL INDEX OF BOUNDARY CELL                                  |
      ISPBS:   0 FOR ELEVATION SPECIFIED                                        |
               1 FOR RADIATION-SEPARATION CONDITION, ZERO TANGENTIAL VELOCITY |
               2 FOR RADIATION-SEPARATION CONDITION, FREE TANGENTIAL VELOCITY |
      NPFORS:    APPLY HARMONIC FORCING NUMBER NPFORS                           |
      NPSERS:    APPLY TIME SERIES FORCING NUMBER NPSERS                        |
    TPCOORDS:    TANGENTIAL COORIDINATE ALONG BOUNDARY (NPFORT.GE.1)            |
C                                                                               |
#C18 IPBS     JPBS   ISPBS    NPFORS  NPSERS  TPCOORDS
 -------------------------------------------------------------------------------
C19 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE ON WEST OPEN BOUNDARIES     |
C                                                                               |
      IPBW:   SEE CARD 19                                                       |
      JPBW:                                                                     |
      ISPBW:                                                                    |
      NPFORW:                                                                   |
      NPSERW:                                                                   |
      TPCOORDW:
C                                                                               |
#C19 IPBW     JPBW   ISPBW    NPFORW  NPSERW     TPCOORDW                       |
-------------------------------------------------------------------------------
C20 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE ON EAST OPEN BOUNDARIES     |
C                                                                               |
      IPBE:   SEE CARD 19                                                       |
      JPBE:                                                                     |
      ISPBE:                                                                    |
      NPFORE:                                                                   |
      NPSERE:                                                                   |
      TPCOORDE:                                                                 |
C                                                                               |
#C20 IPBE     JPBE   ISPBE    NPFORE  NPSERE      TPCOORDE
 -------------------------------------------------------------------------------
C21 PERIODIC FORCING (TIDAL) SURF ELEV OR PRESSURE ON NORTH OPEN BOUNDARIES    |
C                                                                               |
      IPBN:   SEE CARD 19                                                       |
      JPBN:                                                                     |
      ISPBN:                                                                    |
      NPFORN:                                                                   |
      NPSERN:                                                                   |
     TPCOORDN:                                                                  |
C                                                                               |
#C21 IPBN     JPBN   ISPBN    NPFORN  NPSERN  TPCOORDN
```

```
      6       16      0        0        1        0
 -------------------------------------------------------------------------------
C21A WATER SURFACE ELEVATION AND VELOCITY DATA ASSIMILATION                    |
C                                                                              |
      ISWSEDA:  1 FOR WATER SURFACE ELEVATION DATA ASSIMILATION                |
      NLWSEDA :   NUMBER OF LOCATIONS FOR WATER SURFACE ELEVATION ASSIMILAITON|
      ISUVDA:   1 FOR BAROTROPIC VELOCITY DATA ASSIMILAITON                    |
                2 FOR LAYERED VELOCITY DATA ASSIMILAITON                       |
      NLUVDA :    NUMBER OF LOCATIONS FOR VELOCITY DATA ASSIMILAITON           |
         NUVSER:     NUMBER OF HORIZONTAL VELOCITY VECTOR TIME SERIES           |
C                                                                              |
 C21A   ISWSEDA  NLWSEDA  ISUVDA  NLUVDA  NUVSER                               |
       0        0        0         0      0        'okokokokok
------------------------------------------------------------------------------
 C21B WATER SURFACE ELEVATION DATA ASSIMILATION  (NO DATA IS ISWESDA=0)        |
C                                                                              |
      IWSEDA:     I CELL INDEX FOR WATER SURFACE ELEV DATA ASSIMILAITON        |
      JWSEDA:     J CELL INDEX FOR WATER SURFACE ELEV DATA ASSIMILAITON        |
      NWSESERA:     TIME SERIES ID FOR WATER SURFACE ELEVATION ASSIMILATION    |
      TSWSEA:      WEIGHTING FACTOR, 0.- 1., 1. = FULL ASSIMILATION            |
C                                                                              |
C21B ICWSEDA   JCWSEDA  NWSESERA  TSWSEDA                                      |
-------------------------------------------------------------------------------
C21C VELOCITY DATA ASSIMILATION  (NO DATA IF ISUVDA=0)                         |
C                                                                              |
      IUVDA:    I CELL INDEX FOR VELOCITY DATA ASSIMILAITON                    |
      JUVDA:    J CELL INDEX FOR VELOCITY DATA ASSIMILAITON                    |
      NUVSERA:    TIME SERIES ID FOR VELOCITY DATA ASSIMILATION                |
      TSUVDA:     WEIGHTING FACTOR, 0.- 1., 1. = FULL ASSIMILATION             |
      FSUVDA:     IMPLICITNESS FACTOR, 0 EXPLICIT, 1 IMPLICIT                  |
      IWUVDA:     0 NO ZONAL, 1 INVERSE ZONE, 2 INVERSE SQUARE ZONE            |
      IRUVDA:     I,J ZONE RADIUS OF INFLUENCE                                 |
      RRUVDA:     DX,DY ZONE RADIUS OF INFLUECE (NONE ZERO TO USE)             |
C                                                                              |
C21C ICUVDA  JCUVDA  NUVSERA  TSUVDA  FSUVDA  IWUVDA  IRUVDA  RRUVDA           |
-------------------------------------------------------------------------------
C22 SPECIFY NUM OF SEDIMENT AMD TOXICS AND NUM OF CONCENTRATION TIME SERIES    |
C                                                                              |
      NTOX:   NUMBER OF TOXIC CONTAMINANTS (DEFAULT = 1)                       |
      NSED:   NUMBER OF COHESIVE SEDIMENT SIZE CLASSES (DEFAULT = 1)           |
      NSND:   NUMBER OF NON-COHESIVE SEDIMENT SIZE CLASSES (DEFAULT = 1)       |
      NSSER:  NUMBER OF SALINITY TIME SERIES                                   |
      NTSER:  NUMBER OF TEMPERATURE TIME SERIES                                |
      NDSER:  NUMBER OF DYE CONCENTRATION TIME SERIES                          |
      NSFSER: NUMBER OF SHELLFISH LARVAE CONCENTRATION TIME SERIES             |
      NTXSER: NUMBER OF TOXIC CONTAMINANT CONCENTRATION TIME SERIES            |
              EACH TIME SERIES MUST HAVE DATA FOR NTOX TOXICANTS               |
      NSDSER: NUMBER OF COHESIVE SEDIMENT CONCENTRATION TIME SERIES            |
```

```
              EACH TIME SERIES MUST HAVE DATA FOR NSED COHESIVE SEDIMENTS      |
      NSNSER: NUMBER OF NONCOHESIVE SEDIMENT CONCENTRATION TIME SERIES         |
              EACH TIME SERIES MUST HAVE DATA FOR NSND NON-COHESIVE SEDIMENTS  |
      ISDBAL: SET TO 1 FOR SEDIENT MASS BALANCE                                |
C                                                                              |
#C22  NTOX NSED  NSND  NSSER NTSER NDSER NSFSER NTXSER NSDSER NSNSER ISSBAL    |
      0    0     0     0     1     0     0     0     0     0     0
-------------------------------------------------------------------------------
 C23 VELOCITY, VOLUMN SOURCE/SINK, FLOW CONTROL, AND WITHDRAWAL/RETURN DATA    |
C                                                                              |
      NQSIJ:  NUMBER OF CONSTANT AND/OR TIME SERIES SPECIFIED SOURCE/SINK      |
              LOCATIONS (RIVER INFLOWS,ETC)              .                     |
      NQJPIJ: NUMBER OF CONSTANT AND/OR TIME SERIES SPECIFIED SOURCE           |
              LOCATIONS TREATED AS JETS/PLUMES           .                     |
      NQSER:  NUMBER OF VOLUMN SOURCE/SINK TIME SERIES                         |
      NQCTL:  NUMBER OF PRESSURE CONTROLED WITHDRAWAL/RETURN PAIRS             |
      NQCTLT: NUMBER OF PRESSURE CONTROLED WITHDRAWAL/RETURN TABLES            |
      NQWR:   NUMBER OF CONSTANT OR TIME SERIES SPECIFIED WITHDRAWL/RETURN     |
              PAIRS                                                            |
      NQWRSR: NUMBER OF TIME SERIES SPECIFYING WITHDRAWL,RETURN AND            |
              CONCENTRATION RISE SERIES                                        |
      ISDIQ:  SET TO 1 TO WRITE DIAGNOSTIC FILE, diaq.out                      |
C                                                                              |
#C23 NQSIJ NQJPIJ NQSER NQCTL NQCTLT NQWR NQWRSR  ISDIQ   |
         4     0      4     0     0      0     0      0
-------------------------------------------------------------------------------
C24 VOLUMETRIC SOURCE/SINK LOCATIONS, MAGNITUDES, AND CONCENTRATION SERIES     |
C                                                                              |
      IQS:      I CELL INDEX OF VOLUME SOURCE/SINK                             |
      JQS:      J CELL INDEX OF VOLUME SOURCE/SINK                             |
      QSSE:     CONSTANT INFLOW/OUTFLOW RATE IN M*M*M/S                        |
      NQSMUL:   MULTIPLIER SWITCH FOR CONSTANT AND TIME SERIES VOL S/S         |
                = 0  MULT BY 1. FOR NORMAL IN/OUTFLOW (L*L*L/T)                |
                = 1  MULT BY DY FOR LATERAL IN/OUTFLOW (L*L/T) ON U FACE       |
                = 2  MULT BY DX FOR LATERAL IN/OUTFLOW (L*L/T) ON V FACE       |
                = 3  MULT BY DX+DY FOR LATERAL IN/OUTFLOW (L*L/T) ON U&V FACES|
      NQSMFF:   IF NON ZERO ACCOUNT FOR VOL S/S MOMENTUM FLUX                  |
                = 1  MOMENTUM FLUX ON NEG U FACE                               |
                = 2  MOMENTUM FLUX ON NEG V FACE                               |
                = 3  MOMENTUM FLUX ON POS U FACE                               |
                = 4  MOMENTUM FLUX ON POS V FACE                               |
      NQSERQ:   ID NUMBER OF ASSOCIATED VOLUMN FLOW TIME SERIES                |
      NSSERQ:   ID NUMBER OF ASSOCIATED SALINITY TIME SERIES                   |
      NTSERQ:   ID NUMBER OF ASSOCIATED TEMPERATURE TIME SERIES                |
      NDSERQ:   ID NUMBER OF ASSOCIATED DYE CONC TIME SERIES                   |
      NSFSERQ:  ID NUMBER OF ASSOCIATED SHELL FISH LARVAE RELEASE TIME SERIES |
      NTXSERQ:  ID NUMBER OF ASSOCIATED TOXIC CONTAMINANT CONC TIME SERIES     |
      NSDSERQ:  ID NUMBER OF ASSOCIATED COHEASIVE SEDIMENT CONC TIME SERIES    |
```

```
      NSNSERQ:  ID NUMBER OF ASSOCIATED NONCOHEASIVE SED CONC TIME SERIES      |
     QSFACTOR: FRACTION OF TIME SERIES FLOW NQSERQ ASSIGNED TO THIS CELL
C                                                                              |
#C24 IQS  JQS   QSSE  NQSMUL NQSMFF NQSERQ NS- NT- ND- NSF- NTX- NSD- NSN- QSFACTOR|
6    16   0     0      0      1      0   1   0   0    0    0    0   1.0 !PEARL RIVER
INFLOW
8     3   0     0      0      2      0   1   0   0    0    0    0   0.01 !Pelahatchie
Inflow add for other areas
4    2   0     0      0      3      0   1  0     0    0    0    0   1.0 !Pearl River
outflow
3    2   0     0      0      4      0   1   0   0    0    0    0   0.7  !OB CURTIS
OUTFLOW 25 MGD plant
-------------------------------------------------------------------------------
C25 TIME CONSTANT INFLOW CONCENTRATIONS FOR TIME CONSTANT VOLUMETRIC SOURCES  |
C                                                                              |
      SAL:  SALT CONCENTRATION CORRESPONDING TO INFLOW ABOVE                   |
      TEM:  TEMPERATURE CORRESPONDING TO INFLOW ABOVE                          |
      DYE:  DYE CONCENTRATION CORRESPONDING TO INFLOW ABOVE                    |
      SFL:  SHELL FISH LARVAE CONCENTRATION CORRESPONDING TO INFLOW ABOVE      |
      TOX:  NTOX TOXIC CONTAMINANT CONCENTRATIONS CORRESPONDING TO             |
            INFLOW ABOVE  WRITTEN AS TOXC(N), N=1,NTOX A SINGLE DEFAULT        |
            VALUE IS REQUIRED EVEN IF TOXIC TRANSPORT IS NOT ACTIVE            |
C                                                                              |
#C25 SAL TEM     DYE   SFL  TOX1-20                                            |
    0     0     0     0     0
    0     0     0     0     0
    0     0     0     0     0
    0     0     0     0     0
-------------------------------------------------------------------------------
C26 TIME CONSTANT INFLOW CONCENTRATIONS FOR TIME CONSTANT VOLUMETRIC SOURCES  |
C                                                                              |
      SED:  NSED COHESIVE SEDIMENT CONCENTRATIONS CORRESPONDING TO             |
            INFLOW ABOVE  WRITTEN AS SEDC(N), N=1,NSED. I.E., THE FIRST        |
            NSED VALUES ARE COHESIVE A SINGLE DEFAULT VALUE IS REQUIRED        |
            EVEN IF COHESIVE SEDIMENT TRANSPORT IS INACTIVE                    |
      SND:  NSND NON-COHESIVE SEDIMENT CONCENTRATIONS CORRESPONDING TO         |
            INFLOW ABOVE  WRITTEN AS SND(N), N=1,NSND. I.E., THE LAST          |
            NSND VALUES ARE NON-COHESIVE. A SINGLE DEFAULT VALUE IS            |
            REQUIRED EVEN IF NON-COHESIVE SEDIMENT TRANSPORT IS INACTIVE       |
C                                                                              |
#C26 SED1  SND1                                                                |
    0     0
    0     0
    0     0
    0     0
-------------------------------------------------------------------------------
C27 JET/PLUME SOURCE LOCATIONS, GEOMETRY AND ENTRAINMENT PARAMETERS            |
C                                                                              |
```

```
         ID:  ID COUNTER FOR JET/PLUME                                            |
       ICAL:  1 ACTIVE, 0 BYPASS                                                  |
       IQJP:  I CELL INDEX OF JET/PLUME                                           |
       JQJP:  J CELL INDEX OF JET/PLUME                                           |
       KQJP:  K CELL INDEX OF JET/PLUME (DEFAULT, QJET=0 OR JET COMP DIVERGES)    |
        NPORT:  NUMBER OF IDENTIAL PORTS IN THIS CELL                             |
       XJET:  LOCAL EAST JET LOCATION RELATIVE TO DISCHARGE CELL CENTER (M)       |
       YJET:  LOCAL NORTH JET LOCATION RELATIVE TO DISCHARGE CELL CENTER (M)      |
       ZJET:  ELEVATION OF DISCHARGE (M)                                          |
      PHJET:  VERTICAL JET ANGLE POSITIVE FROM HORIZONTAL (DEGREES)               |
      THJET:  HORIZONTAL JET ANGLE POS COUNTER CLOCKWISE FROM EAST (DEGREES)      |
       DJET:  DIAMETER OF DISCHARGE PORT (M)                                      |
       CFRD:  ADJUSTMENT FACTOR FOR FROUDE NUMBER                                 |
      DJPER:  ENTRAINMENT ERROR CRITERIA                                          |
C                                                                                 |
C27 ID ICAL IQJP JQJP KQJP NPORT XJET  YJET  ZJET  PHJET THJET DJET  CFRD  DJPER|
-------------------------------------------------------------------------------
C28 JET/PLUME SOLUTION CONTROL AND OUTPUT CONTROL PARAMETERS                      |
C                                                                                 |
         ID:   ID COUNTER FOR JET/PLUME                                           |
       NJEL:   MAXIMUM NUMBER OF ELEMENTS ALONG JET/PLUME LENGTH                  |
      NJPMX:   MAXIMUM NUMBER OF ITERATIONS                                       |
      ISENT:   0 USE MAXIMUM OF SHEAR AND FORCED ENTRAINMENT                      |
               1 USE SUM OF SHEAR AND FORCED ENTRAINMENT                          |
      ISTJP:   0 STOP AT SPECIFIED NUMBER OF ELEMENTS                             |
               1 STOP WHEN CENTERLINE PENETRATES BOTTOM OR SURFACE                |
               2 STOP WITH BOUNDARY PENETRATES BOTTOM OR SURFACE                  |
      NUDJP:  FREQUENCY FOR UPDATING JET/PLUME (NUMBER OF TIME STEPS)             |
       IOJP:  1 FOR FULL ASCII, 2 FOR COMPACT ASCII OUTPUT AT EACH UPDATE         |
              3 FOR FULL AND COMPACT ASCII OUTPUT, 4 FOR BINARY OUTPUT            |
       IPJP:  NUMBER OF SPATIAL PRINT/SAVE POINT IN VERTICAL                      |
      ISDJP:  1 WRITE DIAGNOSTIS TO jplog__.out                                   |
      IUPJP:   I INDEX OF UPSTREAM WITHDRAWAL CELL IF ICAL=2                      |
       JUPJP:   J INDEX OF UPSTREAM WITHDRAWAL CELL IF ICAL=2                     |
       KUPJP:   K INDEX OF UPSTREAM WITHDRAWAL CELL IF ICAL=2                     |
C                                                                                 |
C28 ID  NJEL    NJPMX ISENT ISTJP NUDJP IOJP IPJP  ISDJP IUPJP JUPJP KUPJP        |
-------------------------------------------------------------------------------
C29 JET/PLUME SOURCE PARAMETERS AND DISCHARGE/CONCENTRATION SERIES IDS            |
C                                                                                 |
            ID:  ID COUNTER FOR JET/PLUME                                         |
          QQJP:  CONSTANT JET/PLUME FLOW RATE IN M*M*M/S                          |
                     FOR ICAL = 1 OR 2  (FOR SINGLE PORT)                         |
       NQSERJP:  ID NUMBER OF ASSOCIATED VOLUMN FLOW TIME SERIES                  |
     NQWRSERJP:  ID NUMBER OF ASSOCIATED WITHDAWAL-RETURN TIME SERIES (ICAL=2)    |
       NSSERJP:  ID NUMBER OF ASSOCIATED SALINITY TIME SERIES                     |
       NTSERJP:  ID NUMBER OF ASSOCIATED TEMPERATURE TIME SERIES                  |
       NDSERJP:  ID NUMBER OF ASSOCIATED DYE CONC TIME SERIES                     |
```

```
      NSFSERJP: ID NUMBER OF ASSOCIATED SHELL FISH LARVAE RELEASE TIME SERIES |
      NTXSERJP: ID NUMBER OF ASSOCIATED TOXIC CONTAMINANT CONC TIME SERIES    |
      NSDSERJP: ID NUMBER OF ASSOCIATED COHEASIVE SEDIMENT CONC TIME SERIES   |
      NSNSERJP: ID NUMBER OF ASSOCIATED NONCOHEASIVE SED CONC TIME SERIES     |
C                                                                             |
C29  ID   QQJP   NQSERJP NQWRSERJP  NS-  NT-  ND-  NSF-  NTX-  NSD-  NSN-     |
-------------------------------------------------------------------------------
C30 TIME CONSTANT INFLOW CONCENTRATIONS FOR TIME CONSTANT JET/PLUME SOURCES   |
C                                                                             |
      SAL:  SALT CONCENTRATION CORRESPONDING TO INFLOW ABOVE                  |
      TEM:  TEMPERATURE CORRESPONDING TO INFLOW ABOVE                         |
      DYE:  DYE CONCENTRATION CORRESPONDING TO INFLOW ABOVE                   |
      SFL:  SHELL FISH LARVAE CONCENTRATION CORRESPONDING TO INFLOW ABOVE     |
      TOX:  NTOX TOXIC CONTAMINANT CONCENTRATIONS CORRESPONDING TO            |
            INFLOW ABOVE  WRITTEN AS TOXC(N), N=1,NTOX A SINGLE DEFAULT       |
            VALUE IS REQUIRED EVEN IF TOXIC TRANSPORT IS NOT ACTIVE           |
C                                                                             |
#C30 SAL TEM DYE SFL TOX1-20                                                  |
-------------------------------------------------------------------------------
C31 TIME CONSTANT INFLOW CONCENTRATIONS FOR TIME CONSTANT JET/PLUME SOURCES   |
C                                                                             |
      SED:  NSED COHESIVE SEDIMENT CONCENTRATIONS CORRESPONDING TO            |
            INFLOW ABOVE  WRITTEN AS SEDC(N), N=1,NSED. I.E., THE FIRST       |
            NSED VALUES ARE COHESIVE A SINGLE DEFAULT VALUE IS REQUIRED       |
            EVEN IF COHESIVE SEDIMENT TRANSPORT IS INACTIVE                   |
      SND:  NSND NON-COHESIVE SEDIMENT CONCENTRATIONS CORRESPONDING TO        |
            INFLOW ABOVE  WRITTEN AS SND(N), N=1,NSND. I.E., THE LAST         |
            NSND VALUES ARE NON-COHESIVE. A SINGLE DEFAULT VALUE IS           |
            REQUIRED EVEN IF NON-COHESIVE SEDIMENT TRANSPORT IS INACTIVE      |
C                                                                             |
#C31 SED1  SND1  SND2   SND3                                                  |
-------------------------------------------------------------------------------
 C32 SURFACE ELEV OR PRESSURE DEPENDENT FLOW INFORMATION                      |
C                                                                             |
      IQCTLU:   I INDEX OF UPSTREAM OR WITHDRAWAL CELL                        |
      JQCTLU:   J INDEX OF UPSTREAM OR WITHDRAWAL CELL                        |
      IQCTLD:   I INDEX OF DOWNSTREAM OR RETURN CELL                          |
      JQCTLD:   J INDEX OF DOWNSTREAM OR RETURN CELL                          |
      NQCTYP:   FLOW CONTROL TYPE
                =-1  RATING CURVED FLOW AS FUNCTION UPSTREAM DEPTH            |
                = 0  HYDRAULIC STRUCTURE: INSTANT FLOW DRIVEN BY ELEVATION    |
                     OR PRESSURE DIFFERCENCE TABLE                            |
                = 1  ACCELERATING FLOW THROUGH TIDAL INLET                    |
      NQCTLQ:   ID NUMBER OF CONTROL CHARACTERIZATION TABLE                   |
      NQCMUL:   MULTIPLIER SWITCH FOR FLOWS FROM UPSTREAM CELL                |
                = 0  MULT BY 1. FOR CONTROL TABLE IN (L*L*L/T)                |
                = 1  MULT BY DY FOR CONTROL TABLE IN (L*L/T) ON U FACE        |
                = 2  MULT BY DX FOR CONTROL TABLE IN (L*L/T) ON V FACE        |
```

```
                 = 3  MULT BY DX+DY FOR CONTROL TABLE IN (L*L/T) ON U&V FACES  |
      NQCMFU:    IF NON ZERO ACCOUNT FOR FLOW MOMENTUM FLUX IN UPSTREAM CELL   |
                 = 1  MOMENTUM FLUX ON NEG U FACE                              |
                 = 2  MOMENTUM FLUX ON NEG V FACE                              |
                 = 3  MOMENTUM FLUX ON POS U FACE                              |
                 = 4  MOMENTUM FLUX ON POS V FACE                              |
      NQCMFD:   IF NON ZERO ACCOUNT FOR FLOW MOMENTUM FLUX IN DOWNSTREAM CELL  |
                 = 1  MOMENTUM FLUX ON NEG U FACE                              |
                 = 2  MOMENTUM FLUX ON NEG V FACE                              |
                 = 3  MOMENTUM FLUX ON POS U FACE                              |
                 = 4  MOMENTUM FLUX ON POS V FACE                              |
      BQCMFU:    UPSTREAM MOMENTUM FLUX WIDTH (M)                              |
      BQCMFD:    DOWNSTREAM MOMENTUM FLUX WIDTH (M)                            |
C                                                                              |
#C32 IQCTLU JQCTLU IQCTLD JQCTLD NQCTYP NQCTLQ NQCMUL NQC_U NQC_D BQC_U BQC_D  |
-------------------------------------------------------------------------------
C33 FLOW WITHDRAWAL, HEAT OR MATERIAL ADDITION, AND RETURN DATA                |
C                                                                              |
      IWRU:      I INDEX OF UPSTREAM OR WITHDRAWAL CELL                        |
      JWRU:      J INDEX OF UPSTREAM OR WITHDRAWAL CELL                        |
      KWRU:      K INDEX OF UPSTREAM OR WITHDRAWAL LAYER                       |
      IWRD:      I INDEX OF DOWNSTREAM OR RETURN CELL                          |
      JWRD:      J INDEX OF DOWNSTREAM OR RETURN CELL                          |
      KWRD:      J INDEX OF DOWNSTREAM OR RETURN LAYER                         |
      QWRE:        CONSTANT VOLUME FLOW RATE FROM WITHDRAWAL TO RETURN         |
      NQWRSERQ:  ID NUMBER OF ASSOCIATED VOLUMN WITHDRAWAL-RETURN FLOW AND     |
                    CONCENTRATION RISE TIME SERIES                             |
      NQWRMFU:   IF NON ZERO ACCOUNT FOR WITHDRAWAL FLOW MOMENTUM FLUX         |
                 = 1  MOMENTUM FLUX ON NEG U FACE                              |
                 = 2  MOMENTUM FLUX ON NEG V FACE                              |
                 = 3  MOMENTUM FLUX ON POS U FACE                              |
                 = 4  MOMENTUM FLUX ON POS V FACE                              |
      NQWRMFD:    IF NON ZERO ACCOUNT FOR RETURN FLOW MOMENTUM FLUX            |
                 = 1  MOMENTUM FLUX ON NEG U FACE                              |
                 = 2  MOMENTUM FLUX ON NEG V FACE                              |
                 = 3  MOMENTUM FLUX ON POS U FACE                              |
                 = 4  MOMENTUM FLUX ON POS V FACE                              |
      BQWRMFU:   UPSTREAM MOMENTUM FLUX WIDTH (M)                              |
      BQWRMFD:   UPSTREAM MOMENTUM FLUX WIDTH (M)                              |
     ANGWRMFD: ANGLE FOR HORIZONTAL FOR RETURN FLOW MOMENTUM FLUX              |
C                                                                              |
C33 IWRU JWRU KWRU IWRD JCWRD KWRD QWRE NQW_RQ NQWR_U NQWR_D BQWR_U BQWR_D AN_D 100
9   b=0.4
--------------------------------------------------------------------------------
C34 TIME CONSTANT WITHDRAWAL AND RETURN CONCENTRATION RISES                    |
C                                                                              |
      SAL:   SALTINITY RISE                                                    |
      TEM:   TEMPERATURE RISE                                                  |
```

```
      DYE:   DYE CONCENTRATION RISE                                           |
      SFL:   SHELLFISH LARVAE CONCENTRATION RISE                              |
      TOX#:  NTOX TOXIC CONTAMINANT CONCENTRATION RISES                       |
C                                                                             |
#C34 SALT  TEMP  DYEC  SFLC  TOX1                                             |
-------------------------------------------------------------------------------
C35 TIME CONSTANT WITHDRAWAL AND RETURN CONCENTRATION RISES                   |
C                                                                             |
      SED#:    NSEDC COHESIVE SEDIMENT CONCENTRATION RISE                     |
      SND#:    NSEDN NONCOHESIVE SEDIMENT CONCENTRATION RISE                  |
C                                                                             |
#C35 SED1  SND1  SND2                                                         |
-------------------------------------------------------------------------------
C36 SEDIMENT INITIALIZATION AND WATER COLUMN/BED REPRESENTATION OPTIONS
C   DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0
C
  ISEDINT: 0 FOR CONSTANT INITIAL CONDITIONS
           1 FOR SPATIALLY VARIABLE WATER COLUMN INITIAL CONDITIONS
             FROM SEDW.INP AND SNDW.INP
           2 FOR SPATIALLY VARIABLE BED INITIAL CONDITIONS
             FROM SEDB.INP AND SNDB.INP
            3 FOR SPATIALLY VARIABLE WATER COL AND BED INITIAL CONDITIONS
  ISEDBINT: 0 FOR SPATIALLY VARYING BED INITIAL CONDITIONS IN MASS/AREA
            1 FOR SPATIALLY VARYING BED INITIAL CONDITIONS IN MASS FRACTION
              OF TOTAL SEDIMENT MASS (REQUIRES BED LAYER THICKNESS
              FILE BEDLAY.INP)
    ISEDWC: 0 COHESIVE SED WC/BED EXCHANGE BASED ON BOTTOM LAYER CONDITIONS
            1 COHESIVE SED WC/BED EXCHANGE BASED ON WAVE/CURRENT/SEDIMENT
              BOUNDARY LAYERS EMBEDDED IN BOTTOM LAYER
     ISMUD: 1 INCLUDE COHESIVE FLUID MUD VISCOUS EFFECTS USING EFDC
              FUNCTION CSEDVIS(SEDT)
    ISNDWC: 0 NONCOH SED WC/BED EXCHANGE BASED ON BOTTOM LAYER CONDITIONS
            1 NONCOH SED WC/BED EXCHANGE BASED ON WAVE/CURRENT/SEDIMENT
              BOUNDARY LAYERS EMBEDDED IN BOTTOM LAYER
    ISEDVW: 0 FOR CONSTANT OR SIMPLE CONCENTRATION DEPENDENT
              COHESIVE SEDIMENT SETTLING VELOCITY
           >1 CONCENTRATION AND/OR SHEAR/TURBULENCE DEPENDENT COHESIVE
              SEDIMENT SETTLING VELOCITY. VALUE INDICATES OPTION TO BE USED
              IN EFDC FUNCTION CSEDSET(SED,SHEAR,ISEDVWC)
            1 HUANG AND METHA - LAKE OKEECHOBEE
            2 SHRESTA AND ORLOB - FOR KRONES SAN FRANCISCO BAY DATA
            3 ZIEGLER AND NESBIT  - FRESH WATER
           98 LICK FLOCCULATOIN
           99 LICK FLOCCULATION WITH FLOC DIAMETER ADVECTION
    ISNDVW: 0 USE CONSTANT SPECIFIED NON-COHESIVE SED SETTLING VELOCITIES
              OR CALCULATE FOR CLASS DIAMETER IS SPECIFIED VALUE IS NEG
           >1 FOLLOW OPTION 0 PROCEDURE BUT APPLY HINDERED SETTLING
              CORRECTION. VALUE INDICATES OPTION TO BE USED WITH EFDC
```

```
              FUNCTION CSNDSET(SND,SDEN,ISNDVW) VALUE OF ISNDVW INDICATES
              EXPONENTIAL IN CORRECT (1-SDEN(NS)*SND(NS)**ISNDVW
        KB:   MAXIMUM NUMBER OF BED LAYERS (EXCLUDING ACTIVE LAYER)
  ISDTXBUG: 1 TO ACTIVATE SEDIMENT AND TOXICS DIAGNOSTICS
C
C36 ISEDINT ISEDBINT ISEDWC ISMUD ISNDWC ISEDVW ISNDVW KB   ISDTXBUG
--------------------------------------------------------------------------------
C36a SEDIMENT INITIALIZATION AND WATER COLUMN/BED REPRESENTATION OPTIONS
C    DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0
C
  ISBEDSTR:  0 USE HYDRODYNAMIC MODEL STRESS FOR SEDIMENT TRANSPORT
             1 SEPARATE GRAIN STRESS FORM TOTAL IN COH AND NONCOH COMPONENTS
             2 SEPARATE GRAIN STRESS FROM TOTAL APPLY TO COH AND NONCOH SEDS
             3 USE INDEPENDENT LOG LAW ROUGHNESS HEIGHT FOR SEDIMENT TRANSPORT
               READ FROM FILE SEDROUGH.INP
             4 SEPARATE GRAIN STRESS FROM TOTAL USING COH/NONCOH WEIGHTED
               ROUGHNESS AND LOG LAW RESISTANCE (IMPLEMENTED 5/31/05)
             5 SEPARATE GRAIN STRESS FROM TOTAL USING COH/NONCOH WEIGHTED
               ROUGHNESS AND POWER LAW RESISTANCE (IMPLEMENTED 5/31/05)
  ISBSDIAM:  0 USE D50 DIAMETER FOR NONCOHESIVE ROUGHNESS
             1 USE 2*D50 FOR NONCOHESIVE ROUGHNESS
             2 USE D90 FOR NONCOHESIVE ROUGHNESS
             3 USE 2*D90 FOR NONCOHESIVE ROUGHNESS
  ISBSDFUF:  1 CORRECT GRAIN STRESS PARTITIONING FOR NONUNIFORM FLOW EFFECTS
               CAN NOW BE USED FOR ISBEDSTR=4 AND 5
  COEFTSBL:    COEFFICIENT SPECIFYING THE HYDRODYNAMIC SMOOTHNESS OF
               TURBULENT BOUNDARY LAYER OVER COEHESIVE BED IN TERMS OF
               EQUIVALENT GRAIN SIZE FOR COHESIVE GRAIN STRESS
               CALCULATION,  FULLY SMOOTH = 4, FULL ROUGH = 100.
               NOT USED FOR ISBEDSTR=4 AND 5
  VISMUDST:    KINEMATIC VISCOSITY TO USE IN DETERMINING COHESIVE GRAIN STRESS
  ISBKERO:   1 FOR BANK EROSION SPECIFIED BY EXTERNAL TIME SERIES
             2 FOR BANK EROSION INTERNALLY CALCULATED BY STABILITY ANALYSIS
C                  0
C36a ISBEDSTR ISBSDIAM ISBSDFUF  COEFTSBL  VISMUDST   ISBKERO
--------------------------------------------------------------------------------
C36B SEDIMENT INITIALIZATION AND WATER COLUMN/BED REPRESENTATION OPTIONS
*  DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0
*
*   ISEDAL:  1 TO ACTIVATE STATIONARY COHESIVE MUD ACTIVE LAYER
*   ISNDAL:  1 TO ACTIVATE NON-COHESIVE ARMORING EFFECTS
*            2 SAME AS 1 WITH ACTIVE-PARENT LAYER FORMULATION
*   IALTYP:  0 CONSTANT THICKNESS ARMORING LAYER
*            1 CONSTANT TOTAL SEDIMENT MASS ARMORING LAYER
*   IALSTUP: 1 CREATE ARMORING LAYER FROM INITIAL TOP LAYER AT START UP
*   ISEDEFF: 1 MODIFY NONCOHESIVE RESUSPENSION TO ACCOUNT FOR COHESIVE EFFECTS
*              USING MULTIPLICATION FACTOR: EXP(-COEHEFF*FRACTION COHESIVE)
*            2 MODIFY NONCOHESIVE CRITICAL STRESS TO ACCOUNT FOR COHESIVE EFFECTS
```

```
*             USING MULT FACTOR: 1+(COEHEFF2-1)*(1-EXP(-COEHEFF*FRACTION COHESIVE))
*   HBEDAL:   ACTIVE ARMORING LAYER THICKNESS
*   COEHEFF:  COHESIVE EFFECTS COEFFICIENT
*   COEHEFF2:  COHESIVE EFFECTS COEFFICIENT
*                  1
C36B  ISEDAL ISNDAL IALTYP  IALSTUP ISEDEFF  HBEDAL   COEHEFF  COEHEFF2
 -------------------------------------------------------------------------------
C37 BED MECHANICAL PROPERTIES PARAMETER SET 1
*  DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0
*
*  ISEDDT:   NUMBER OF SED/TOX BED PROCESSES STEPS PER HYDRO/WC TRANS STEPS
*  IBMECH: 0 TIME INVARIANT CONSTANT BED MECHANICAL PROPERITES
*          1 SIMPLE CONSOLIDATION CALCULATION WITH CONSTANT COEFFICIENTS
*          2 SIMPLE CONSOLIDATION WITH VARIABLE COEFFICIENTS DETERMINED
*            EFDC FUNCTIONS CSEDCON1,2,3(IBMECH)
*          3 COMPLEX CONSOLIDATION WITH VARIABLE COEFFICIENTS DETERMINED
*            EFDC FUNCTIONS CSEDCON1,2,3(IBMECH). IBMECH > 0 SETS THE
*            C38 PARAMETER ISEDBINT=1 AND REQUIRES INITIAL CONDITIONS
*            FILES BEDLAY.INP, BEDBDN.INP AND BEDDDN.IN
*          9 TYPE OF CONSOLIDATION VARIES BY CELL WITH IBMECH FOR EACH
*            DEFINED IN INPUT FILE CONSOLMAP.INP
*  IMORPH: 0 CONSTANT BED MORPHOLOGY (IBMECH=0, ONLY)
*          1 ACTIVE BED MORPHOLOGY: NO WATER ENTRAIN/EXPULSION EFFECTS
*          2 ACTIVE BED MORPHOLOGY: WITH WATER ENTRAIN/EXPULSION EFFECTS
*  HBEDMAX:  TOP BED LAYER THICKNESS (M) AT WHICH NEW LAYER IS ADDED OR IF
*            KBT(I,J)=KB, NEW LAYER ADDED AND LOWEST TWO LAYERS COMBINED
*  BEDPORC:  CONSTANT BED POROSITY (IBMECH=0, OR NSED=0)
*            ALSO USED AS POROSITY OF DEPOSITIN NON-COHESIVE SEDIMENT
*  SEDMDMX:  MAXIMUM FLUID MUD COHESIVE SEDIMENT CONCENTRATION (MG/L)
*  SEDMDMN:  MINIMUM FLUID MUD COHESIVE SEDIMENT CONCENTRATION (MG/L)
*  SEDVDRD:  VOID RATIO OF DEPOSITING COHESIVE SEDIMENT
*  SEDVDRM:  MINIMUM COHESIVE SEDIMENT BED VOID RATIO (IBMECH > 0)
*  SEDVDRT:  BED CONSOLIDATION RATED CONSTANT (1/SEC) (IBMECH = 1,2)
*              GT 0 CONSOLIDATE OVER TIME TO SEDVDRM
             EQ 0 CONSOLIDATE INSTANTANEOUSLY TO SEDVDRM
             LT 0 CONSOLIDATE TO INITIAL VOID RATIOS
C
C37 ISEDDT IBMECH IMORPH HBEDMAX BEDPORC SEDMDMX SEDMDMN SEDVDRD SEDVDRM SEDVRDT
-------------------------------------------------------------------------------
 C38 BED MECHANICAL PROPERTIES PARAMETER SET 2 (CONSOLIDATION COEFFICIENTS)    |
 C   DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0                        |
 C                                                                              |
     IBMECHK: 0 FOR HYDRAULIC CONDUCTIVITY, K, FUNCTION K=KO*EXP((E-EO)/EK)    |
              1 FOR HYD COND/(1+VOID RATIO),K', FUNCTION K'=KO'*EXP((E-EO)/EK) |
      BMECH1:   REFERENCE EFFECTIVE STRESS/WATER SPECIFIC WEIGHT, SEO (M)      |
                IF BMECH1<0 USE INTERNAL FUNCTION, BMECH1,BMECH2,BMECH3 NOT USED
      BMECH2:   REFERENCE VOID RATIO FOR EFFECTIVE STRESS FUNCTION, EO         |
      BMECH3:   VOID RATIO RATE TERM ES IN SE=SEO*EXP(-(E-EO)/ES)              |
```

```
      BMECH4:   REFERENCE HYDRAULIC CONDUCTIVITY, KO (M/S)                  |
                IF BMECH4<0 USE INTERNAL FUNCTION, BMECH1,BMECH2,BMECH3 NOT USED
      BMECH5:   REFERENCE VOID RATIO FOR HYDRAULIC CONDUCTIVITY, EO         |
      BMECH6:   VOID RATIO RATE TERM EK IN (K OR K')=(KO OR KO')*EXP((E-EO)/EK)|
C            1.35  1.033   1.033        0.0607  3.8     3.8                 |
 C38  IBMECHK BMECH1  BMECH2  BMECH3   BMECH4  BMECH5   BMECH6              |
 ------------------------------------------------------------------------------
 C39 COHESIVE SEDIMENT PARAMETER SET 1 REPEAT DATA LINE NSED TIMES          |
 C   DATA REQUIRED EVEN IF ISTRAN(6) AND ISTRAN(7) ARE 0                    |
 C                                                                          |
       SEDO:    CONSTANT INITIAL COHESIVE SEDIMENT CONC IN WATER COLUMN     |
                 (mg/liter=gm/m**3)                                         |
       SEDBO:   CONSTANT INITIAL COHESIVE SEDIMENT IN BED PER UNIT AREA     |
                 (gm/sq meter)  IE 1CM THICKNESS BED WITH SSG=2.5 AND       |
                 N=.6,.5 GIVES SEDBO 1.E4, 1.25E4                           |
       SDEN:    SEDIMENT SPEC VOLUME (IE 1/2.25E6 m**3/gm)                  |
       SSG:     SEDIMENT SPECIFIC GRAVITY                                   |
       WSEDO:   CONSTANT OR REFERENCE SEDIMENT SETTLING VELOCITY            |
                IN FORMULA WSED=WSEDO*( (SED/SEDSN)**SEXP )                 |
       SEDSN:   NOT USED                                                    |
       SEXP:    NOT USED                                                    |
       TAUD:    BOUNDARY STRESS BELOW WHICH DEPOSITION TAKES PLACE ACCORDING |
                TO (TAUD-TAU)/TAUD                                          |
    ISEDSCOR: 1 TO CORRECT BOTTOM LAYER CONCENTRATION TO NEAR BED CONC      |
*  ISPROBDEP: 0 KRONE PROBABILITY OF DEPOSTION USING COHESIVE GRAIN STRESS
*             1 KRONE PROBABILITY OF DEPOSTION USING TOTAL BED STRESS
*             2 PARTHEN PROBABILITY OF DEPOSTION USING COHESIVE GRAIN STRESS
*             3 PARTHEN PROBABILITY OF DEPOSTION USING TOTAL BED STRESS
* 0.00005                                                                   |
 #C39  SEDO   SEDBO    SDEN    SSG    WSEDO   SEDSN   SEXP   TAUD    ISEDSCOR |
 ------------------------------------------------------------------------------
C40 COHESIVE SEDIMENT PARAMETER SET 2 REPEAT DATA LINE NSED TIMES
*   DATA REQUIRED EVEN IT ISTRAN(6) AND ISTRAN(7) ARE 0
*
*  IWRSP: 0 USE RESUSPENSION RATE AND CRITICAL STRESS BASED ON PARAMETERS
*           ON THIS DATA LINE
*        >1 USE BED PROPERTIES DEPENDEDNT RESUSPENSION RATE AND CRITICAL
*           STRESS GIVEN BY EFDC FUNCTIONS CSEDRESS AND CSEDTAUS
*           FUNCTION ARGUMENSTS ARE (BDENBED,IWRSP)
*         1 HWANG AND METHA - LAKE OKEECHOBEE
*         2 HAMRICK'S MODIFICATION OF SANFORD AND MAA USING ACTUAL VOID RATIO
*         3 SAME AS 2 EXCEPT VOID RATIO OF COHESIVE SEDIMENT FRACTION IS USED
*       >99 SITE SPECIFIC
*  IWRSPB:0 NO BULK EROSION
*         1 USE BULK EORSION CRITICAL STRESS AND RATE IN FUNCTIONS
*           CSEDTAUB AND CSEDRESSB
*  WRSPO:   REF SURFACE EROSION  RATE IN FORMULA
*           WRSP=WRSPO*( ((TAU-TAUR)/TAUN)**TEX ) (GM/M**2-SEC)
```

```
*  TAUR:    BOUNDARY STRESS ABOVE WHICH SURFACE EROSION OCCURS (M/S)**2
*  TAUN:    NORMALIZING STRESS (EQUAL TO TAUR FOR COHESIVE SED TRANS)
*  TEXP:    EXPONENTIAL (COH SED)
*  VDRRSPO: REFERENCE VOID RATIO FOR CRITICAL STRESS AND RESUSPENSION RATE
*           IWRSP=2,3
*  COSEDHID: COHESIVE SEDIMENT RESUSPENSION HIDING FACTOR TO REDUCE COHESIVE
*            RESUSPENSION BY FACTOR = (COHESIVE FRACTION OF SEDIMENT)**COSEDHID
*
C40  IWRSP  WRSPO    TAUR    TAUN    TEXP  VDRRSPO  COSEDHID
 -------------------------------------------------------------------------------
 C41 NONCOHESIVE SEDIMENT PARAMETER SET 1 REPEAT DATA LINE NSND TIMES           |
 C   DATA REQUIRED EVEN IT ISTRAN(6) AND ISTRAN(7) ARE 0                        |
 C                                                                              |
       SNDO:    CONSTANT INITIAL NONCOHESIVE SEDIMENT CONC IN WATER COLUMN      |
                 (mg/liter=gm/m**3)                                             |
       SNDBO:   CONSTANT INITIAL NONCOHESIVE SEDIMENT IN BED PER UNIT AREA      |
                 (gm/sq meter)  IE 1CM THICKNESS BED WITH SSG=2.5 AND           |
                 N=.6,.5 GIVES SNDBO 1.E4, 1.25E4                               |
       SDEN:    SEDIMENT SPEC VOLUME (IE 1/2.65E6 m**3/gm)                      |
       SSG:     SEDIMENT SPECIFIC GRAVITY                                       |
       SNDDIA:  REPRESENTATIVE DIAMETER OF SEDIMENT CLASS                       |
       WSNDO:   CONSTANT OR REFERENCE SEDIMENT SETTLING VELOCITY                |
                   IF WSNDO < 0, SETTLING VELOCITY INTERNALLY COMPUTED          |
       SNDN:    MAX MASS/TOT VOLUME IN BED (NONCOHESIVE SED TRANS) (gm/m**3)    |
       SEXP:    DIMENSIONLESS RESUSPENSION PARAMETER GAMMA ZERO                 |
       TAUD:    DUNE BREAK POINT STRESS  (m/s)**2                               |
    ISNDSCOR: 1 TO CORRECT BOTTOM LAYER CONCENTRATION TO NEAR BED CONC          |
 C                                                                              |
 #C41 SNDO  SNDBO   SDEN    SSG   SNDDIA  WSNDO  SNDN   SEXP   TAUD   ISNDSCOR |
 -------------------------------------------------------------------------------
C42 NON-COHESIVE SEDIMENT PARAMETER SET 2 REPEAT DATA LINE NSND TIMES
*   DATA REQUIRED EVEN IT ISTRAN(6) AND ISTRAN(7) ARE 0
*
*    ISNDEQ: >1 CALCULATE ABOVE BED REFERENCE NON-COHESIVE SEDIMENT
*               EQUILIBRIUM CONCENTRATION USING EFDC FUNCTION
*               CSNDEQC(SNDDIA,SSG,WS,TAUR,TAUB,SIGPHI,SNDDMX,IOTP)
*               WHICH IMPLEMENT FORMULATIONS OF
*             1 GARCIA AND PARKER
*             2 SMITH AND MCLEAN
*             3 VAN RIJN
*    ISBDLD:  0 BED LOAD PHI FUNCTION IS CONSTANT,MEYER-PETER & MUELLER,BAGNOLD
*             1 VAN RIJN PHI FUNCTION
*             2 MODIFIED ENGULAND-HANSEN
*             3 WU, WANG, AND JIA
*             4 not active

*     TAUR:     CRITICAL STRESS IN (m/s)**2
*               NOTE: IF TAUR < 0, THEN TAUR, TAUN, AND TEXP ARE INTERNALLY
```

```
*               COMPUTED USING VAN RIJN'S FORMULAS
*     TAUN:     EQUAL TO TAUR FOR NON-COHESIVE SED TRANS
*  TCSHIELDS:   CRITICAL SHIELDS STRESS (DIMENSIONLESS)
*    ISLTAUC: 1 TO IMPLEMENT SUSP LOAD ONLY WHEN STRESS EXCEEDS TAUC FOR EACH GRAIN
*             2 TO IMPLEMENT SUSP LOAD ONLY WHEN STRESS EXCEEDS TAUCD50
*             3 TO USE TAUC FOR NONUNIFORM BEDS, THESE APPLY ONLY TO RESUSPENSION
*               FORMULAS NOT EXPLICITLY CONTAINING CRITICAL SHIELDS STRESS SUCH AS G-P
*    IBLTAUC: 1 TO IMPLEMENT BEDLOAD ONLY WHEN STRESS EXCEEDS TAUC FOR EACH GRAIN
*             2 TO IMPLEMENT BEDLOAD ONLY WHEN STRESS EXCEEDS TAUCD50
*             3 TO USE TAUC FOR NONUNIFORM BEDS, THESE APPLY ONLY TO BED LOAD
*               FORMULAS NOT EXPLICITLY CONTAINING CRITICAL SHIELDS STRESS SUCH AS E-H
*    IROUSE:  0 USE TOTAL STRESS FOR CALCULATING ROUSE NUMBER
*                 1 USE GRAIN STRESS FOR ROUSE NUMBER
*   ISNDM1:   0 SET BOTH BEDLOAD AND SUSPENDED LOAD FRACTIONS TO 1.0
*             1 SET BEDLOAD FRACTION TO 1. USE BINARY RELATIONSHIP FOR SUSPENDED
*             2 SET BEDLOAD FRACTION TO 1, USE LINEAR RELATIONSHIP FOR SUSPENDED
*             3 USE BINARY RELATIONSHIP FOR BEDLOAD AND SUSPENDED LOAD
*             4 USE LINEAR RELATIONSHIP FOR BEDLOAD AND SUSPENDED LOAD
*   ISNDM2:   0 USE TOTAL SHEAR VELOCITY IN USTAR/WSET RATIO
*             1 USE GRAIN SHEAR VELOCITY IN USTAR/WSET RATIO
*   RSNDM:      VALUE OF USTAR/WSET FOR BINARY SWITHCH BETWEEN BEDLOAD AND SUSPENDED
LOAD
*
C42  ISNDEQ ISBDLD  TAUR    TAUN   TCSHIELDS ISLTAUC IBLTAUC IROUSE ISNDM1  ISNDM2
RSNDM
 -------------------------------------------------------------------------------
C42A NON-COHESIVE SEDIMENT PARAMETER SET 3 (BED LOAD FORMULA PARAMETERS)
     DATA REQUIRED EVEN IT ISTRAN(6) AND ISTRAN(7) ARE 0

*     IBEDLD:  0 DISABLE BEDLOAD
*              1 ACTIVATE BEDLOAD OPTION.  MUST USE SEDBLBC.INP
*    SBDLDA:ALPHA EXPONENTIAL FOR BL FORMULA,MPM=1.5,BAG=1,VR=2.1,EH=2.5,WWJ=2.2
*    SBDLDB:BETA EXPONENTIAL FOR BED LOAD FORMULA,BAG=1.0,MPM=VR=EH=WWJ=0.0
*    SBDLDG1:GAMMA1 CONSTANT FOR BED LOAD FORMULA,BAG=MPM=VR=EH=WWJ=1.0
*    SBDLDG2:GAMMA2 CONSTANT FOR BED LOAD FORMULA,EH=0.0,BAG=MPM=VR=WWJ=1.0
*    SBDLDG3:GAMMA3 CONSTANT FOR BED LOAD FORMULA,BAG=MPM=VR=EH=WWJ=1.0
*    SBDLDG4:GAMMA4 CONSTANT FOR BED LOAD FORMULA,BAG=1.0,MPM=VR=EH=WWJ=0.0
*    SBDLDP:CONSTANT PHI FOR BED LOADFORMULA,BAG=CONST,MPM=7.6,VR=EH=WWJ=INTERNALY
*    ISBLFUC: BED LOAD FACE FLUX , 0 FOR DOWN WIND PROJECTION,1 FOR DOWN WIND
*             WITH CORNER CORRECTION,2 FOR CENTERED AVERAGING
*    BLBSNT: ADVERSE BED SLOOP (POSITIVE VALUE) ACROSS A CELL FACE ABOVE
*            WHICH NO BED LOAD TRANSPORT CAN OCCUR.  NOT ACTIVE FOR BLBSNT=0.0
c
C42a IBEDLD SBDLDA SBDLDB SBDLDG1 SBDLDG2 SBDLDG3 SBDLDG4 SBDLDP ISBLFUC BLBSNT
 -------------------------------------------------------------------------------
 C43 TOXIC CONTAMINANT INITIAL CONDITIONS AND PARAMETERS                        |
 C   USER MAY CHANGE UNITS OF WATER AND SED PHASE TOX CONCENTRATION             |
 C   AND PARTIATION COEFFICIENT ON C44 - C46 BUT CONSISTENT UNITS MUST          |
```

```
 C   MUST BE USED FOR MEANINGFUL RESULTS                                       |
 C   DATA REQUIRED EVEN IT ISTRAN(5)  IS 0                                     |
 C                                                                             |
       NTOXN:   TOXIC CONTAMINANT NUMBER ID (1 LINE OF DATA BY DEFAULT)        |
      ITXINT:   0 FOR SPATIALLY CONSTANT WATER COL AND BED INITIAL CONDITIONS  |
                1 FOR SPATIALLY VARIABLE WATER COLUMN INITIAL CONDITIONS       |
                2 FOR SPATIALLY VARIABLE BED INITIAL CONDITIONS                |
                3 FOR SPATIALLY VARIABLE WATER COL AND BED INITIAL CONDITION   |
     ITXBDUT:   SET TO 0 FOR CONST INITIAL BED GIVEN BY TOTAL TOX (ugm/litr)  |
                SET TO 1 FOR CONST INITIAL BED GIVEN BY                        |
                  SORBED MASS TOX/MASS SED(mg/kg)                              |
     TOXINTW:   INIT WATER COLUNM TOT TOXIC VARIABLE CONCENTRATION (ugm/litr)  |
     TOXINTB:   INIT SED BED TOXIC CONC SEE ITXBDUT                            |
      RKTOXW:   FIRST ORDER WATER COL DECAY RATE FOR TOX VARIABLE IN 1/SEC     |
      TKTOXW:   REF TEMP FOR 1ST ORDER WATER COL DECAY DEG C                   |
      RKTOXB:   FIRST ORDER SED BED DECAY RATE FOR TOX VARIABLE IN 1/SEC       |
      TKTOXB:   REF TEMP FOR 1ST ORDER SED BED DECAY DEG C                     |
 C                       ck blw kevin uses 6.0                                 |
 #C43 NTOXN ITXINT ITXBDUT TOXINTW TOXINTB RKTOXW TKTOXW RKTOXB TRTOXB COMMENTS |
 -------------------------------------------------------------------------------
C44 ADDITIONAL TOXIC CONTAMINANT PARAMETERS
*   DATA REQUIRED EVEN IT ISTRAN(5)  IS 0
*
*    NTOXN: TOXIC CONTAMINANT NUMBER ID (1 LINE OF DATA BY DEFAULT)
*    ISTOC: 1 FOR DISS AND PART ORGANIC CARBON SORPTION
*           2 FOR DISS ORGANIC CARBON SORPTION AND POC FRACTIONALLY
*             DISTRIBUTED TO INORGANIC SEDIMENT CLASSES
*           3 FOR NO DISS ORGANIC CARBON SORPTION AND POC FRACTIONALLY
*             DISTRIBUTED TO INORGANIC SEDIMENT CLASSES
*   VOLTOX:   WATER SURFACE VOLITIALIZATION RATE MULTIPLIER (0. OR 1.)
*   RMOLTX:   MOLECULAR WEIGHT FOR DETERMINING VOLATILIZATION RATE
*   RKTOXP:   REFERENCE PHOTOLOYSIS DECAY RATE 1/SEC
*   SKTOXP:   REFERENCE SOLAR RADIATION FOR PHOTOLOYSIS (WATTS/M**2)
    DIFTOX:   DIFFUSION COEFF FOR TOXICANT IN SED BED PORE WATER (M**2/S)
    DIFTOXS:  TRANSFER COEFF FOR TOXICANT BETWEEN WATER COLUMN AND
              PORE WATER IN TOP LAYER OF THE BED
              > 0.0 INTERPRET AS DIFFUSION COEFFICIENT(M**2/S)
              < 0.0 INTERPRET AS FLUX VELOCITY (M/S)
    PDIFTOX:  PARTICLE MIXING DIFFUSION COEFF FOR TOXICANT IN SED BED (M**2/S)
              (if negative use zonal files PARTMIX.INP and PMXMAP.INP
    DPDIFTOX: DEPTH IN BED OVER WHICH PARTICLE MIXING IS ACTIVE (M)
C
C44 NTOXN ISTOC VOLTOX RMOLTX RKTOXP SKTOXP DIFTOX DIFTOXS PDIFTOX DPDIFTOX COMMENTS
 -------------------------------------------------------------------------------
C44A POREWATER TOXICS ADVECTION AND DIFFUSION SOLUTION SWITCHES
C    AND DIAGNOSTIC/MASS BALANCE FLUX SWITHCHES
C
       IADTOXDP:  0 FOR STANDARD SINGLE PRECISION SOLUTION
```

```
                 1 FOR DOUBLE PRECISION SOLUTION
      IADTOXCOR:  0 NOT CORRECTION OF SINGLE PRECISION SOLUTION
                  1 MASS WEIGHTED CORRECTION OF SINGLE PRECISION SOLUTION
                  2 MASS CHANGE WEIGHTED CORRECTION OF SINGLE PRECISION SOLUTION
      ISTOXALL    1 TO ACTIVATE ACCUMULATION OF TOXIC FLUXES
      NSTOXALL      NUMBER OF WRITES OF ACCUMULATED FLUXES PER REFERENCE TIME PERIOD
C
C44A IADTOXDP  IADTOXCOR    ISTOXALL    NSTOXALL
 -------------------------------------------------------------------------------
 C45 TOXIC CONTAMINANT SEDIMENT INTERACTION PARAMETERS                          |
 C   2 LINES OF DATA REQUIRED EVEN IT ISTRAN(5) IS 0                            |
 C                                                                              |
      NTOXC: TOXIC CONTAMINANT NUMBER ID.  NSEDC+NSEDN LINES OF DATA            |
               FOR EACH TOXIC CONTAMINANT (DEFAULT = 2)                         |
   NSEDN/NSNDN: FIRST NSED LINES COHESIVE, NEXT NSND LINES NON-COHESIVE.        |
             REPEATED FOR EACH CONTAMINANT                                      |
    ITXPARW: EQUAL 1 FOR SOLIDS DEPENDENT PARTITIONING (WC) GIVEN BY            |
             TOXPAR=PARO*(CSED**CONPAR)                                         |
    TOXPARW: WATER COLUMN PARO (ITXPARW=1) OR EQUIL TOX CON PART COEFF BETWEEN  |
             EACH TOXIC IN WATER AND ASSOCIATED SEDIMENT PHASES (liters/mg)     |
    CONPARW: EXPONENT IN  TOXPAR=PARO*(CSED**CONPARW) IF ITXPARW=1              |
    ITXPARB: EQUAL 1 FOR SOLIDS DEPENDENT PARTITIONING (BED)                    |
    TOXPARB: SEDIMENT BED PARO (ITXPARB=1) OR EQUIL TOX CON PART COEFF BETWEEN  |
             EACH TOXIC IN WATER AND ASSOCIATED SEDIMENT PHASES (liters/mg)     |
    CONPARB: EXPONENT IN  TOXPAR=PARO*(CSED**CONPARB) IF ITXPARB=1              |
 C              1       0.8770  -0.943          0.025                           |
 C45 NTOXN NSEDN ITXPARW TOXPARW CONPARW ITXPARB TOXPARB CONPARB  COMMENTS      |
-------------------------------------------------------------------------------
C45A TOXIC CONTAMINANT ORGANIC CARBON INTERACTION PARAMETERS
C
   ISTDOCW: 0 CONSTANT DOC IN WATER COLUMN OF STDOCWC (DEFAULT=0.)
            1 TIME CONSTANT, SPATIALLY VARYING DOC IN WATER COLUMN FROM docw.inp
   ISTPOCW: 0 CONSTANT POC IN WATER COLUMN OF STPOCWC (DEFAULT=0.)
            1 TIME CONSTANT, SPATIALLY VARYING POC IN WATER COLUMN FROM pocw.inp
            2 TIME CONSTANT, FPOC IN WATER COLUMN, SEE C45C
            3 TIME CONSTANT, SPATIALLY VARYING FPOC IN WATER COLUMN FORM fpocw.inp
            4 FUNTIONAL SPECIFICATION OF TIME AND SPATIALLY VARYING
                    FPOC IN WATER COLUMN
   ISTDOCB: 0 CONSTANT DOC IN BED OF STDOCBC (DEFAULT=0.)
            1 TIME CONSTANT, SPATIALLY VARYING DOC IN BED FROM docb.inp
   ISTPOCB: 0 CONSTANT POC IN BED OF STPOCBC (DEFAULT=0.)
            1 TIME CONSTANT, SPATIALLY VARYING POC IN BED FROM pocb.inp
            2 TIME CONSTANT, FPOC IN BED, SEE C45D
            3 TIME CONSTANT, SPATIALLY VARYING FPOC IN BED FROM fpocb.inp
            4 FUNTIONAL SPECIFICATION OF TIME AND SPATIALLY VARYING
                    FPOC IN BED
  STDOCWC:  CONSTANT WATER COLUMN DOC (ISTDOCW=0)
  STPOCWC:  CONSTANT WATER COLUMN POC (ISTPOCW=0)
```

```
  STDOCBC:  CONSTANT BED DOC (ISTDOCB=0)
  STPOCBC:  CONSTANT BED POC (ISTPOCB=0)
C
C45A ISTDOCW ISTPOCW ISTDOCB ISTPOCB STDOCWC STPOCWC STDOCBC STPOCBC
------------------------------------------------------------------------------
C45B TOXIC CONTAMINANT ORGANIC CARBON INTERACTION PARAMETERS
C
C
     NTOXC: TOXIC CONTAMINANT NUMBER ID.  NSEDC+NSEDN LINES OF DATA
              FOR EACH TOXIC CONTAMINANT (DEFAULT = 2)
      NOC : FIRST LINE FOR DISSOLVED ORGANIC CARBON, SECOND FOR PART OC
            REPEATED FOR EACH CONTAMINANT
   ITXPARW: -1 FOR NO ORGANIC CARBON, 0 FOR NORMAL PARTITION AND 1 FOR SOLIDS
            DEPENDENT TOXPAR=PARO*(CSED**CONPAR)
   TOXPARW: WATER COLUMN PARO (ITXPARW=1) OR EQUIL TOX CON PART COEFF BETWEEN
            EACH TOXIC IN WATER AND ASSOCIATED SEDIMENT PHASES (liters/mg)
   CONPARW: EXPONENT IN  TOXPAR=PARO*(CSED**CONPARW) IF ITXPARW=1
   ITXPARB: CONVENTION FOLLOWS ITXPARW (BED)
   TOXPARB: SEDIMENT BED PARO (ITXPARB=1) OR EQUIL TOX CON PART COEFF BETWEEN
            EACH TOXIC IN WATER AND ASSOCIATED SEDIMENT PHASES (liters/mg)
   CONPARB: EXPONENT IN  TOXPAR=PARO*(CSED**CONPARB) IF ITXPARB=1
C               1       0.8770  -0.943         0.025
C45B NTOXN  NOC ITXPARW TOXPARW CONPARW ITXPARB TOXPARB CONPARB  *CARBON*
------------------------------------------------------------------------------
C45C TOXIC CONTAMINANT POC FRACTIONAL DISTRIBUTIONS IN WATER COLUMN          |
C     1 LINE  OF DATA REQUIRED EVEN IT ISTRAN(5) IS 0. DATA USED WHEN       |
C       ISTOC(NT)=1 OR 2                                                    |
                                                                            |
      NTOXN:      TOXIC CONTAMINANT NUMBER ID.  NSEDC+NSEDN 1 LINE OF DATA  |
                  FOR EACH TOXIC CONTAMINANT (DEFAULT = 2)                  |
   FPOCSED1-NSED: FRACTION OF OC ASSOCIATED WITH SED CLASSES 1,NSED         |
   FPOCSND1-NSND: FRACTION OF OC ASSOCIATED WITH SND CLASSES 1,NSND         |
                                                                            |
C45C NTOXN  FPOCSED1   FPOCSND1     FPOCSND2     FPOCSND3                   |
 -----------------------------------------------------------------------------
C45D TOXIC CONTAMINANT POC FRACTIONAL DISTRIBUTIONS IN SEDIMENT BED         |
    1 LINE  OF DATA REQUIRED EVEN IT ISTRAN(5) IS 0. DATA USED WHEN         |
    ISTOC(NT)=1 OR 2                                                        |
                                                                            |
      NTOXN:      TOXIC CONTAMINANT NUMBER ID.  NSEDC+NSEDN 1 LINE OF DATA  |
                 FOR EACH TOXIC CONTAMINANT (DEFAULT = 2)                   |
  FPOCSED1-NSED: FRACTION OF OC ASSOCIATED WITH SED CLASSES 1,NSED          |
  FPOCSND1-NSND: FRACTION OF OC ASSOCIATED WITH SND CLASSES 1,NSND          |
                                                                            |
C45D NTOXN  FPOCSED1   FPOCSND1     FPOCSND2     FPOCSND3                   |
 ------------------------------------------------------------------------------
 C46  BUOYANCY, TEMPERATURE, DYE DATA AND CONCENTRATION BC DATA              |
 C                                                                           |
```

```
      BSC:    BUOYANCY INFLUENCE COEFFICIENT 0 TO 1, BSC=1. FOR REAL PHYSICS  |
      TEMO:   REFERENCE, INITIAL, EQUILIBRUM AND/OR ISOTHERMAL TEMP IN DEG C  |
      HEQT:   EQUILIBRUM TEMPERTURE TRANSFER COEFFICIENT M/SEC
 ISBEDTEMI: 0 READ INTIAL BED TEMPERATURE FROM TEMPB.INP                      |
            1 INITIALIZE AT START OF COLD RUN                                 |
      KBH:    NUMBER OF BED THERMAL LAYERS                                    |
      RKDYE:  FIRST ORDER DECAY RATE FOR DYE VARIABLE IN 1/SEC                |
      NCBS:   NUMBER OF CONCENTRATION BOUNDARY CONDITIONS ON SOUTH OPEN       |
              BOUNDARIES                                                      |
      NCBW:   NUMBER OF CONCENTRATION BOUNDARY CONDITIONS ON WEST OPEN        |
              BOUNDARIES                                                      |
      NCBE:   NUMBER OF CONCENTRATION BOUNDARY CONDITIONS ON EAST OPEN        |
              BOUNDARIES                                                      |
      NCBN:   NUMBER OF CONCENTRATION BOUNDARY CONDITIONS ON NORTH OPEN       |
              BOUNDARIES                                                      |
C                                                                             |
C46   BSC  TEMO  HEQT  ISBEDTEMI KBH RKDYE  NCBS  NCBW  NCBE  NCBN            |
       1.0  35.00  0.E-6   1       21   0.0    1     0     0     1
-------------------------------------------------------------------------------
C46A  ICE EFFECTS
C
      ISICE:      1 FOR ICE EFFECTS ACTIVE
      ISICECOV:   0 USE START AND STOP JULIAN DAYS
                    1 READ ICE COVER FROM FILE ICECOVER.INP
                    2 SIMPLE CALCUATION USING AIR TEMPERATURE
                              3 COMPLEX CALCULATION (NOT ACTIVE)
      ISICETHK:   0 USE START AND STOP JULIAN DAYS AND MAX ICE THICKNESS
                    1 READ ICE THICKNESS FROM FILE ICECOVER.INP
                    2 SIMPLE CALCUATION USING AIR TEMPERATURE
                              3 COMPLEX CALCULATION (NOT ACTIVE)
      NISER:        NUMBER OF ICE TIME SEREIS
      ICETHKFUN:  0 CONSTANT AT RICETHKMAX
                    1 LINEAR TO DYICEM1, LINEAR FROM DYICEM2
                              2 HALF COS WAVE TO TO DYICEM1,  HALF COS FROM DYICEM2
      DYICEBEG:    DAY ICE COVER BEGINS
         DYICEEND:    DAY ICE COVER ENDS
         DYICEM1:     DAY MAXIMUM ICE COVER IS REACHED
         DYICEM2:     DAY MAXIMUM ICE THICKNESS STARTS TO DECAY
         RICETHKMAX:   MAX ICE COVER THICKNESS, METERS
         TEMPICE:      WATER TEMPERATURE AT WATER ICE INTERFACE FOR ISICECOV.LE.2
C
C46A ISICE ISICECOV ISICETHK NISER ICETHKFUN DYICEBEG DYICEEND DYICEM1 DYICEM2
RICETHKMAX TEMPICE
    0     0        0        0     0         304      120      30      30    1.   0.1
-------------------------------------------------------------------------------
C47  LOCATION OF CONC BC'S ON SOUTH BOUNDARIES                                |
C                                                                             |
      ICBS:    I CELL INDEX                                                   |
```

```
      JCBS:    J CELL INDEX                                                |
      NTSCRS:  NUMBER OF TIME STEPS TO RECOVER SPECIFIED VALUES ON CHANGE  |
               TO INFLOW FROM OUTFLOW                                      |
      NSSERS:  SOUTH BOUNDARY CELL SALINITY TIME SERIES ID NUMBER          |
      NTSERS:  SOUTH BOUNDARY CELL TEMPERATURE TIME SERIES ID NUMBER       |
      NDSERS:  SOUTH BOUNDARY CELL DYE CONC TIME SERIES ID NUMBER          |
      NSFSERS: SOUTH BOUNDARY CELL SHELLFISH LARVAE TIME SERIES ID NUMBER  |
      NTXSERS: SOUTH BOUNDARY CELL TOXIC CONTAMINANT CONC TIME SERIES ID NUM. |
      NSDSERS: SOUTH BOUNDARY CELL COHESIVE SED CONC TIME SERIES ID NUMBER |
      NSNSERS: SOUTH BOUNDARY CELL NONCOHESIVE SED CONC TIME SERIES ID NUMBER |
C                                                                          |
#C47 IBBS  JBBS  NTSCRS NSSERS NTSERS NDSERS NSFSERS NTXSERS NSDSERS NSNSERS |
     7      2      0      0      1      0      0      0      0      0
-------------------------------------------------------------------------------
C48 TIME CONSTANT BOTTOM CONC ON SOUTH CONC BOUNDARIES                      |
C                                                                          |
      SAL:  ULTIMATE INFLOWING BOTTOM LAYER SALINITY                        |
      TEM:  ULTIMATE INFLOWING BOTTOM LAYER TEMPERATURE                     |
      DYE:  ULTIMATE INFLOWING BOTTOM LAYER DYE CONCENTRATION               |
      SFL:  ULTIMATE INFLOWING BOTTOM LAYER SHELLFISH LARVAE CONCENTRAION   |
      TOX:  NTOX ULTIMATE INFLOWING BOTTOM LAYER TOXIC CONTAMINANT          |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                     |
C                                                                          |
#C48 SAL   TEM   DYE   SFL    TOX1                                          |
     0      0      0      0      0
-------------------------------------------------------------------------------
C49 TIME CONSTANT BOTTOM CONC ON SOUTH CONC BOUNDARIES                      |
C                                                                          |
      SED:  NSED ULTIMATE INFLOWING BOTTOM LAYER COHESIVE SEDIMENT          |
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND               |
      SND:  NSND ULTIMATE INFLOWING BOTTOM LAYER NONCOHESIVE SEDIMENT       |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND                |
C                                                                          |
#C49 SED1  SND1  SND2   SND3                                                |
     0      0      0      0
-------------------------------------------------------------------------------
C50 TIME CONSTANT SURFACE CONC ON SOUTH CONC BOUNDARIES                     |
C                                                                          |
      SAL:  ULTIMATE INFLOWING SURFAC LAYER SALINITY                        |
      TEM:  ULTIMATE INFLOWING SURFAC LAYER TEMPERATURE                     |
      DYE:  ULTIMATE INFLOWING SURFAC LAYER DYE CONCENTRATION               |
      SFL:  ULTIMATE INFLOWING SURFAC LAYER SHELLFISH LARVAE CONCENTRAION   |
      TOX:  NTOX ULTIMATE INFLOWING SURFAC LAYER TOXIC CONTAMINANT          |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                     |
C                                                                          |
#C50 SAL   TEM   DYE   SFL    TOX1                                          |
     0      0      0      0      0
-------------------------------------------------------------------------------
```

```
C51 TIME CONSTANT SURFACE CONC ON SOUTH CONC BOUNDARIES                       |
C                                                                             |
      SED:  NSED ULTIMATE INFLOWING SURFAC LAYER COHESIVE SEDIMENT            |
            CONCENTRAIONS  FIRST NSED VALUES SED(N),  N=1,NSND                |
      SND:  NSND ULTIMATE INFLOWING SURFAC LAYER NONCOHESIVE SEDIMENT         |
            CONCENTRATIONS LAST NSND VALUES SND(N),  N=1,NSND                 |
C                                                                             |
#C51 SED1  SND1  SND2   SND3                                                  |
     0      0      0      0
-------------------------------------------------------------------------------
C52 LOCATION OF CONC BC'S ON WEST BOUNDARIES AND SERIES IDENTIFIERS            |
C                                                                             |
      ICBW:     I CELL INDEX                                                  |
      JCBW:     J CELL INDEX                                                  |
      NTSCRW:   NUMBER OF TIME STEPS TO RECOVER SPECIFIED VALUES ON CHANGE    |
                TO INFLOW FROM OUTFLOW                                        |
      NSSERW:   WEST BOUNDARY CELL SALINITY TIME SERIES ID NUMBER             |
      NTSERW:   WEST BOUNDARY CELL TEMPERATURE TIME SERIES ID NUMBER          |
      NDSERW:   WEST BOUNDARY CELL DYE CONC TIME SERIES ID NUMBER             |
      NSFSERW:  WEST BOUNDARY CELL SHELLFISH LARVAE TIME SERIES ID NUMBER     |
      NTXSERW:  WEST BOUNDARY CELL TOXIC CONTAMINANT CONC TIME SERIES ID NUM. |
      NSDSERW:  WEST BOUNDARY CELL COHESIVE SED CONC TIME SERIES ID NUMBER    |
      NSNSERW:  WEST BOUNDARY CELL NONCOHESIVE SED CONC TIME SERIES ID NUMBER |
C                                                                             |
#C52 IBBW  JBBW  NTSCRW NSSERW NTSERW NDSERW NSFSERW NTXSERW NSDSERW NSNSERW  |
-------------------------------------------------------------------------------
C53 TIME CONSTANT BOTTOM CONC ON WEST CONC BOUNDARIES                         |
C                                                                             |
      SAL:  ULTIMATE INFLOWING BOTTOM LAYER SALINITY                          |
      TEM:  ULTIMATE INFLOWING BOTTOM LAYER TEMPERATURE                       |
      DYE:  ULTIMATE INFLOWING BOTTOM LAYER DYE CONCENTRATION                 |
      SFL:  ULTIMATE INFLOWING BOTTOM LAYER SHELLFISH LARVAE CONCENTRAION     |
      TOX:  NTOX ULTIMATE INFLOWING BOTTOM LAYER TOXIC CONTAMINANT            |
            CONCENTRATIONS NTOX VALUES TOX(N),  N=1,NTOX                      |
C                                                                             |
#C53 SAL   TEM   DYE   SFL    TOX1                                            |
-------------------------------------------------------------------------------
C54 TIME CONSTANT BOTTOM CONC ON WEST CONC BOUNDARIES                         |
C                                                                             |
      SED:  NSED ULTIMATE INFLOWING BOTTOM LAYER COHESIVE SEDIMENT            |
            CONCENTRAIONS  FIRST NSED VALUES SED(N),  N=1,NSND                |
      SND:  NSND ULTIMATE INFLOWING BOTTOM LAYER NONCOHESIVE SEDIMENT         |
            CONCENTRATIONS LAST NSND VALUES SND(N),  N=1,NSND                 |
C                                                                             |
#C54  SED1  SND1                                                              |
-------------------------------------------------------------------------------
C55 TIME CONSTANT SURFACE CONC ON WEST CONC BOUNDARIES                        |
C                                                                             |
```

```
      SAL:  ULTIMATE INFLOWING SURFAC LAYER SALINITY                       |
      TEM:  ULTIMATE INFLOWING SURFAC LAYER TEMPERATURE                    |
      DYE:  ULTIMATE INFLOWING SURFAC LAYER DYE CONCENTRATION              |
      SFL:  ULTIMATE INFLOWING SURFAC LAYER SHELLFISH LARVAE CONCENTRAION  |
      TOX:  NTOX ULTIMATE INFLOWING SURFAC LAYER TOXIC CONTAMINANT         |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                    |
C                                                                          |
#C55 SAL   TEM   DYE   SFL    TOX1                                         |
------------------------------------------------------------------------------
C56 TIME CONSTANT SURFACE CONC ON WEST CONC BOUNDARIES                     |
C                                                                          |
      SED:  NSED ULTIMATE INFLOWING SURFAC LAYER COHESIVE SEDIMENT         |
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND              |
      SND:  NSND ULTIMATE INFLOWING SURFAC LAYER NONCOHESIVE SEDIMENT      |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND               |
C                                                                          |
#C56  SED1  SND1                                                           |
------------------------------------------------------------------------------
C57 LOCATION OF CONC BC'S ON EAST BOUNDARIES AND SERIES IDENTIFIERS        |
C                                                                          |
      ICBE:    I CELL INDEX                                                |
      JCBE:    J CELL INDEX                                                |
      NTSCRE:  NUMBER OF TIME STEPS TO RECOVER SPECIFIED VALUES ON CHANGE  |
               TO INFLOW FROM OUTFLOW                                      |
      NSSERE:  EAST BOUNDARY CELL SALINITY TIME SERIES ID NUMBER           |
      NTSERE:  EAST BOUNDARY CELL TEMPERATURE TIME SERIES ID NUMBER        |
      NDSERE:  EAST BOUNDARY CELL DYE CONC TIME SERIES ID NUMBER           |
      NSFSERE: EAST BOUNDARY CELL SHELLFISH LARVAE TIME SERIES ID NUMBER   |
      NTXSERE: EAST BOUNDARY CELL TOXIC CONTAMINANT CONC TIME SERIES ID NUM. |
      NSDSERE: EAST BOUNDARY CELL COHESIVE SED CONC TIME SERIES ID NUMBER  |
      NSNSERE: EAST BOUNDARY CELL NONCOHESIVE SED CONC TIME SERIES ID NUMBER |
C                                                                          |
#C57 IBBE  JBBE  NTSCRE NSSERE NTSERE NDSERE NSFSERE NTXSERE NSDSERE NSNSERE |
------------------------------------------------------------------------------
C58 TIME CONSTANT BOTTOM CONC ON EAST CONC BOUNDARIES                      |
C                                                                          |
      SAL:  ULTIMATE INFLOWING BOTTOM LAYER SALINITY                       |
      TEM:  ULTIMATE INFLOWING BOTTOM LAYER TEMPERATURE                    |
      DYE:  ULTIMATE INFLOWING BOTTOM LAYER DYE CONCENTRATION              |
      SFL:  ULTIMATE INFLOWING BOTTOM LAYER SHELLFISH LARVAE CONCENTRAION  |
      TOX:  NTOX ULTIMATE INFLOWING BOTTOM LAYER TOXIC CONTAMINANT         |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                    |
C                                                                          |
#C58 SAL   TEM   DYE   SFL    TOX1                                         |
------------------------------------------------------------------------------
C59 TIME CONSTANT BOTTOM CONC ON EAST CONC BOUNDARIES                      |
C                                                                          |
      SED:  NSED ULTIMATE INFLOWING BOTTOM LAYER COHESIVE SEDIMENT         |
```

```
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND                  |
      SND:  NSND ULTIMATE INFLOWING BOTTOM LAYER NONCOHESIVE SEDIMENT         |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND                  |
C                                                                             |
#C59  SED1  SND1                                                              |
 -------------------------------------------------------------------------------
C60 TIME CONSTANT SURFACE CONC ON EAST CONC BOUNDARIES                        |
C                                                                             |
      SAL:  ULTIMATE INFLOWING SURFAC LAYER SALINITY                          |
      TEM:  ULTIMATE INFLOWING SURFAC LAYER TEMPERATURE                       |
      DYE:  ULTIMATE INFLOWING SURFAC LAYER DYE CONCENTRATION                 |
      SFL:  ULTIMATE INFLOWING SURFAC LAYER SHELLFISH LARVAE CONCENTRAION     |
      TOX:  NTOX ULTIMATE INFLOWING SURFAC LAYER TOXIC CONTAMINANT            |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                       |
C                                                                             |
#C60 SAL   TEM   DYE   SFL    TOX1                                            |
 -------------------------------------------------------------------------------
C61 TIME CONSTANT SURFACE CONC ON EAST CONC BOUNDARIES                        |
C                                                                             |
      SED:  NSED ULTIMATE INFLOWING SURFAC LAYER COHESIVE SEDIMENT            |
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND                  |
      SND:  NSND ULTIMATE INFLOWING SURFAC LAYER NONCOHESIVE SEDIMENT         |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND                  |
C                                                                             |
#C61  SED1  SND1                                                              |
-------------------------------------------------------------------------------
C62 LOCATION OF CONC BC'S ON NORTH BOUNDARIES AND SERIES IDENTIFIERS           |
C                                                                             |
      ICBN:    I CELL INDEX                                                   |
      JCBN:    J CELL INDEX                                                   |
      NTSCRN:  NUMBER OF TIME STEPS TO RECOVER SPECIFIED VALUES ON CHANGE     |
               TO INFLOW FROM OUTFLOW                                         |
      NSSERN:  NORTH BOUNDARY CELL SALINITY TIME SERIES ID NUMBER             |
      NTSERN:  NORTH BOUNDARY CELL TEMPERATURE TIME SERIES ID NUMBER          |
      NDSERN:  NORTH BOUNDARY CELL DYE CONC TIME SERIES ID NUMBER             |
      NSFSERN: NORTH BOUNDARY CELL SHELLFISH LARVAE TIME SERIES ID NUMBER     |
      NTXSERN: NORTH BOUNDARY CELL TOXIC CONTAMINANT CONC TIME SERIES ID NUM. |
      NSDSERN: NORTH BOUNDARY CELL COHESIVE SED CONC TIME SERIES ID NUMBER    |
      NSNSERN: NORTH BOUNDARY CELL NONCOHESIVE SED CONC TIME SERIES ID NUMBER |
C                                                                             |
#C62 IBBN  JBBN  NTSCRN NSSERN NTSERN NDSERN NSFSERN NTXSERN NSDSERN NSNSERN
      6     16    10     0      1      0      0      0     0     0
-------------------------------------------------------------------------------
C63 TIME CONSTANT BOTTOM CONC ON NORTH CONC BOUNDARIES                        |
C                                                                             |
      SAL:  ULTIMATE INFLOWING BOTTOM LAYER SALINITY                          |
      TEM:  ULTIMATE INFLOWING BOTTOM LAYER TEMPERATURE                       |
      DYE:  ULTIMATE INFLOWING BOTTOM LAYER DYE CONCENTRATION                 |
```

```
      SFL:  ULTIMATE INFLOWING BOTTOM LAYER SHELLFISH LARVAE CONCENTRAION      |
      TOX:  NTOX ULTIMATE INFLOWING BOTTOM LAYER TOXIC CONTAMINANT             |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                        |
C                                                                              |
#C63 SAL  TEM  DYE SFL TOX1-20
      0    0    0   0   0
-------------------------------------------------------------------------------
C64 TIME CONSTANT BOTTOM CONC ON NORTH CONC BOUNDARIES                         |
C                                                                              |
      SED:  NSED ULTIMATE INFLOWING BOTTOM LAYER COHESIVE SEDIMENT             |
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND                  |
      SND:  NSND ULTIMATE INFLOWING BOTTOM LAYER NONCOHESIVE SEDIMENT          |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND                   |
C                                                                              |
#C64  SED1  SED2  SND1  SND2  SND3
       0     0     0     0     0
 -------------------------------------------------------------------------------
C65 TIME CONSTANT SURFACE CONC ON NORTH CONC BOUNDARIES                        |
C                                                                              |
      SAL:  ULTIMATE INFLOWING SURFAC LAYER SALINITY                           |
      TEM:  ULTIMATE INFLOWING SURFAC LAYER TEMPERATURE                        |
      DYE:  ULTIMATE INFLOWING SURFAC LAYER DYE CONCENTRATION                  |
      SFL:  ULTIMATE INFLOWING SURFAC LAYER SHELLFISH LARVAE CONCENTRAION      |
      TOX:  NTOX ULTIMATE INFLOWING SURFAC LAYER TOXIC CONTAMINANT             |
            CONCENTRATIONS NTOX VALUES TOX(N), N=1,NTOX                        |
C                                                                              |
#C65 SAL  TEM  DYE SFL TOX1-20
     0    0    0    0    0
-------------------------------------------------------------------------------
C66 TIME CONSTANT SURFACE CONC ON NORTH CONC BOUNDARIES                        |
C                                                                              |
      SED:  NSED ULTIMATE INFLOWING SURFAC LAYER COHESIVE SEDIMENT             |
            CONCENTRAIONS  FIRST NSED VALUES SED(N), N=1,NSND                  |
      SND:  NSND ULTIMATE INFLOWING SURFAC LAYER NONCOHESIVE SEDIMENT          |
            CONCENTRATIONS LAST NSND VALUES SND(N), N=1,NSND                   |
C                                                                              |
C66  SED1  SED2  SND1  SND2  SND3
     0      0     0     0     0
-------------------------------------------------------------------------------
C66a CONCENTRATION DATA ASSIMILATION                                           |
C                                                                              |
      NLCDA:  NUMBER OF HORIZONTAL LOCATIONS FOR DATA ASSIMILATION             |
      TSCDA:  WEIGHTING FACTOR, 0.-1., 1. = FULL ASSIMILATION                  |
      ISCDA:  1 FOR CONCENTRATION DATA ASSIMILATION (NC=1.7 VALUES)            |
C                                                                               |
C66A  NLCDA  TSCDA   ISCDA                                                      |
       0      0.5      0    0    0    0    0    0     0
-------------------------------------------------------------------------------
```

```
C66B CONCENTRATION DATA ASSIMILATION
C
   ITPCDA: 0 ASSIMILATE DATA FROM TIME SERIES
           1 ASSIMIATED DATA FROM ANOTHER CELL IN GRID
     ICDA: I INDEX OF CELL ASSIMILATING DATA
     JCDA: J INDEX OF CELL ASSIMILATING DATA
    ICCDA: I INDEX OF CELL PROVIDING DATA, ITPCDA=1
    JCCDA: J INDEX OF CELL PROVIDING DATA, ITPCDA=1
  IDIRCDA: 0 NO DIRECTIONAL ASSIMILATION EFFECT
           1 POSITIVE EAST-WEST, 2 NEGATIVE EAST-WEST VELOCITY
                 3 POSITIVE NORTH-SOUTH, 4 NEGTIVE NORTH-SOUTH VELOCITY
   NCSERA:   ID OF TIME SERIES PROVIDING DATA
C       1      10    5    10      4    0   0   0   0   0   0   0
C66B ITPCDA  ICDA JCDA ICCDA  JCCDA  NCSERA(NS=1,7)
 -------------------------------------------------------------------------------
 C67 DRIFTER DATA (FIRST 4 PARAMETER FOR SUB DRIFER, SECOND 6 FOR SUB LAGRES)  |
 C                                                                             |
       ISPD:   1 TO ACTIVE SIMULTANEOUS RELEASE AND LAGRANGIAN TRANSPORT OF    |
                 NEUTRALLY BUOYANT PARTICLE DRIFTERS AT LOCATIONS INPUT ON C44 |
       NPD:      NUMBER OF PARTICLE DIRIFERS                                   |
       NPDRT:    TIME STEP AT WHICH PARTICLES ARE RELEASED                     |
       NWPD:     NUMBER OF TIME STEPS BETWEEN WRITING TO TRACKING FILE         |
                 drifter.out                                                   |
       ISLRPD: 1 TO ACTIVATE CALCULATION OF LAGRANGIAN MEAN VELOCITY OVER TIME |
                 INTERVAL TREF AND SPATIAL INTERVAL ILRPD1<I<ILRPD2,           |
                 JLRPD1<J<JLRPD2, 1<K<KC, WITH MLRPDRT RELEASES.  ANY AVERGE   |
                 OVER ALL RELEASE TIMES IS ALSO CALCULATED                     |
               2 SAME BUT USES A HIGER ORDER TRAJECTORY INTEGRATION            |
       ILRPD1    WEST BOUNDARY OF REGION                                       |
       ILRPD2    EAST BOUNDARY OF REGION                                       |
       JLRPD1    NORTH BOUNDARY OF REGION                                      |
       JLRPD2    SOUTH BOUNDARY OF REGION                                      |
       MLRPDRT   NUMBER OF RELEASE TIMES                                       |
       IPLRPD    1,2,3 WRITE FILES TO PLOT ALL,EVEN,ODD HORIZ LAG VEL VECTORS  |
 C                                                                             |
 #C67 ISPD NPD NPDRT NWPD ISLRPD ILRPD1 ILRPD2 JLRPD1  JLRPD2  MLRPDRT IPLRPD  |
     0     0   0    12    0     6      47     6       17      12      1
 -------------------------------------------------------------------------------
 C68 INITIAL DRIFTER POSITIONS (FOR USE WITH SUB DRIFTER)                      |
 C                                                                             |
       RI:  I CELL INDEX IN WHICH PARTICLE IS RELEASED IN                      |
       RJ:  J CELL INDEX IN WHICH PARTICLE IS RELEASED IN                      |
       RK:  K CELL INDEX IN WHICH PARTICLE IS RELEASED IN                      |
 C                                                                             |
 #C68   RI   RJ   RK                                                           |
 -------------------------------------------------------------------------------
 C69 CONSTANTS FOR CARTESION GRID CELL CENTER LONGITUDE AND LATITUDE           |
 C                                                                             |
```

```
      CDLON1:  6 CONSTANTS TO GIVE CELL CENTER LAT AND LON OR OTHER          |
      CDLON2:    COORDINATES FOR CARTESIAN GRIDS USING THE FORMULAS          |
      CDLON3:    DLON(L)=CDLON1+(CDLON2*FLOAT(I)+CDLON3)/60.                 |
      CDLAT1:    DLAT(L)=CDLAT1+(CDLAT2*FLOAT(J)+CDLAT3)/60.                 |
      CDLAT2:                                                                |
      CDLAT3:                                                                |
C                                                                            |
#C69 CDLON1  CDLON2   CDLON3   CDLAT1  CDLAT2   CDLAT3                       |
      0.0    0.0      0.0      0.0     0.0      0.0
-----------------------------------------------------------------------------
C70 CONTROLS FOR WRITING ASCII OR BINARY DUMP FILES                          |
C                                                                            |
    ISDUMP: GREATER THAN 0 TO ACTIVATE                                       |
            1 SCALED ASCII INTERGER (0<VAL<65535)                            |
            2 SCALED 16BIT BINARY INTEGER (0<VAL<65535) OR (-32768<VAL<32767) |
            3 UNSCALED ASCII FLOATING POINT                                  |
            4 UNSCALED BINARY FLOATING POINT                                 |
    ISADMP: GREATER THAN 0 TO APPEND EXISTING DUMP FILES                     |
    NSDUMP: NUMBER OF TIME STEPS BETWEEN DUMPS                               |
    TSDUMP: STARTING TIME FOR DUMPS (NO DUMPS BEFORE THIS TIME)              |
    TEDUMP: ENDING TIME FOR DUMPS (NO DUMPS AFTER THIS TIME)                 |
    ISDMPP: GREATER THAN 0 FOR WATER SURFACE ELEVATION DUMP                  |
    ISDMPU: GREATER THAN 0 FOR HORIZONTAL VELOCITY DUMP                      |
    ISDMPW: GREATER THAN 0 FOR VERTICAL VELOCITY DUMP                        |
    ISDMPT: GREATER THAN 0 FOR TRANSPORTED VARIABLE DUMPS                    |
   IADJDMP: 0 FOR SCALED BINARY INTEGERS (0<VAL<65535)                       |
            -32768 FOR SCALED BINARY INTEGERS (-32768<VAL<32767)             |
C                                                                            |
#C70 ISDUMP ISADMP NSDUMP TSDUMP TEDUMP ISDMPP ISDMPU ISDMPW ISDMPT IADJDMP   |
     1      0      180    1.0   10000  0      0      0      0      -32768
-----------------------------------------------------------------------------
C71 CONTROLS FOR HORIZONTAL PLANE SCALAR FIELD CONTOURING                    |
C                                                                            |
      ISSPH:  1 TO WRITE FILE FOR SCALAR FIELD CONTOURING IN HORIZONTAL PLANE |
              2 WRITE ONLY DURING LAST REFERENCE TIME PERIOD                 |
      NPSPH:    NUMBER OF WRITES PER REFERENCE TIME PERIOD                   |
      ISRSPH: 1 TO WRITE FILE FOR RESIDUAL SALINITY PLOTTING IN              |
                HORIZONTAL                                                   |
      ISPHXY: 0 DOES NOT WRITE I,J,X,Y IN ***cnh.out and r***cnh.out FILES   |
              1 WRITES I,J ONLY IN ***cnh.out and r***cnh.out FILES          |
              2 WRITES I,J,X,Y  IN ***cnh.out and r***cnh.out FILES          |
              3 WRITES EFDC EXPLORER BINARY FORMAT FILES                     |
      DATA LINE REPEATS 7 TIMES FOR SAL,TEM,DYE,SFL,TOX,SED,SND              |
C                                                                            |
C71 ISSPH   NPSPH   ISRSPH   ISPHXY                                          |
     0      0       0        1     !SAL
     0      0       0        1     !TEM
     0      0       0        1     !DYE
```

```
      0      6      0      1    !SFL
      0      6      0      1    !TOX
      0      0      0      1    !SED
      0      0      0      1    !SND
 -------------------------------------------------------------------------------
 C71A CONTROLS FOR HORIZONTAL PLANE SEDIMENT BED PROPERTIES CONTOURING          |
C                                                                              |
      ISBPH:  1 TO WRITE FILES FOR SED BED PROPERTY CONTOURING IN HORIZONTAL    |
              2 WRITE ONLY DURING LAST REFERENCE TIME PERIOD                   |
     ISBEXP:  0 ASCII FORMAT,  1 EXPLORER BINARY FORMAT                        |
      NPBPH:    NUMBER OF WRITES PER REFERENCE TIME PERIOD                     |
     ISRBPH:  1 TO WRITE FILES FOR RESIDUAL SED BED PROPERTY CONTOURING        |
     ISBBDN:  1 WRITE LAYER BULK DENSITY                                       |
     ISBLAY:  1 WRITE LAYER THICKNESSES                                        |
     ISBPOR:  1 WRITE LAYER POROSITY                                           |
     ISBSED:  1 WRITE COHESIVE SEDIMENT (MASS PER UNIT AREA)                   |
              2 WRITE COHESIVE SEDIMENT (FRACTION OF TOTAL SEDIMENT)           |
              3 WRITE COHESIVE SEDIMENT (FRACTION OF TOTAL SEDIMENT+WATER)     |
     ISBSED:  1 WRITE NONCOHESIVE SEDIMENT (MASS PER UNIT AREA)                |
              2 WRITE NONOOHESIVE SEDIMENT (FRACTION OF TOTAL SEDIMENT)        |
              3 WRITE NONCOHESIVE SEDIMENT (FRACTION OF TOTAL SEDIMENT+WATER)  |
     ISBVDR:  1 WRITE LAYER VOID RATIOS                                        |
     ISBARD:  1 WRITES ACCUMMULATED MASS/AREA RESUSPENSION AND DEPOSITION FOR  |
                EACH SEDIMENT CLASS TO ASCII FILE BEDARD.OUT FOR ISBEXP=0 OR 1 |
C                                                                              |
C71A ISBPH ISBEXP NPBPH ISRBPH ISBBDN ISBLAY ISBPOR ISBSED ISBSND ISBVDR ISBARD |
      0       0      1      0     1      1      1      1       1      1     0
 -------------------------------------------------------------------------------
C71B FOOD CHAIN MODEL OUTPUT CONTROL
C
     ISFDCH: 1 TO WRITE OUTPUT FOR HOUSATONIC RIVER FOOD CHAIN MODEL
     NFDCHZ: NUMBER OF SPATIAL ZONES
     HBFDCH: AVERAGING DEPTH FOR TOP PORTION OF BED (METERS)
     TFCAVG: TIME AVERAGING INTERVAL FOR FOOD CHAIN OUTPUT (SECONDS)
C
C71B ISFDCH   NFDCHZ   HBFDCH    TFCAVG
     0         5       0.1524    86400.
 -------------------------------------------------------------------------------
 C72 CONTROLS FOR HORIZONTAL SURFACE ELEVATION OR PRESSURE CONTOURING         |
 C                                                                            |
       ISPPH:  1 TO WRITE FILE FOR SURF ELEVATION CONTOURING                  |
               2 WRITE ONLY DURING LAST REFERENCE TIME PERIOD                 |
       NPPPH:    NUMBER OF WRITES PER REFERENCE TIME PERIOD                   |
       ISRPPH: 1 TO WRITE FILE FOR RESIDUAL SURFACE ELEVATION  CONTOURNG IN   |
                 HORIZONTAL PLANE                                             |
       IPPHXY: 0 DOES NOT WRITE I,J,X,Y IN surfplt.out and rsurfplt.out FILES |
               1 WRITES I,J ONLY IN surfplt.out and rsurfplt.out FILES        |
               2 WRITES I,J,X,Y  IN surfplt.out and rsurfplt.out FILES        |
```

```
              3 WRITES EFDC EXPLORER BINARY FORMAT FILES                     |
C                                                                            |
C72 ISPPH   NPPPH   ISRPPH  IPPHXY                                           |
     0      0      0            0
-------------------------------------------------------------------------------
C73 CONTROLS FOR HORIZONTAL PLANE VELOCITY VECTOR PLOTTING                   |
C                                                                            |
      ISVPH:  1 TO WRITE FILE FOR VELOCITY PLOTTING IN HORIZONTAL PLANE      |
              2 WRITE ONLY DURING LAST REFERENCE TIME PERIOD                 |
      NPVPH:    NUMBER OF WRITES PER REFERENCE TIME PERIOD                   |
      ISRVPH: 1 TO WRITE FILE FOR RESIDUAL VELOCITY PLOTTIN IN               |
                HORIZONTAL PLANE                                             |
      IVPHXY: 0 DOES NOT WRITE I,J,X,Y IN velplth.out and rvelplth.out FILES |
              1 WRITES I,J ONLY IN velplth.out and rvelplth.out FILES        |
              2 WRITES I,J,X,Y  IN velplth.out and rvelplth.out FILES        |
              3 WRITES EFDC EXPLORER BINARY FORMAT FILES                     |
C                                                                            |
C73 ISVPH   NPVPH   ISRVPH  IVPHXY                                           |
    0       24      0         0
-------------------------------------------------------------------------------
C74 CONTROLS FOR VERTICAL PLANE SCALAR FIELD CONTOURING                      |
C                                                                            |
      ISECSPV:  N AN INTEGER NUMBER OF VERTICAL SECTIONS (N.LE.9) TO WRITE   |
                  N FILES FOR SCALAR  FIELD CONTOURING                       |
      NPSPV:      NUMBER OF WRITES PER REFERENCE TIME PERIOD                 |
      ISSPV:    1 TO ACTIVATE INSTANTANEOUS SCALAR FIELDS                    |
                2 TO WRITE ONLY DURING LAST REFERENCE TIME PERIOD            |
      ISRSPV:   1 TO ACTIVATE FOR RESIDUAL SCALAR FIELDS                     |
      ISHPLTV:  1 FOR VERTICAL PLANE PLOTTING FOR MSL DATUMS,  ZERO OTHERWISE |
      DATA LINE REPEATS 7 TIMES FOR SAL,TEM,DYE,SFL,TOX,SED,SND              |
      ISECSPV IS DETERMINED FOR ALL 7 VARIABLES BY VALUE ON FIRST DATA LINE  |
C                                                                            |
C74 ISECSPV   NPSPV  ISSPV  ISRSPV  ISHPLTV                                  |
     0      0      0      0      1   !SAL
     0      0      0      0      1   !TEM
     0      0      0      0      1   !DYE
     0      6      0      0      1   !SFL
     0      6      0      0      1   !TOX
     0      0      0      0      1   !SED
     0      0      0      0      1   !SND
-------------------------------------------------------------------------------
C75 MORE CONTROLS FOR VERTICAL PLANE SCALAR FIELD CONTOURING                 |
C                                                                            |
      ISECSPV:  SECTION NUMBER                                               |
      NIJSPV:   NUMBER OF CELLS OR I,J PAIRS IN SECTION                      |
      SEC ID:   CHARACTER FORMAT SECTION TITLE                               |
C                                                                            |
#C75 ISECSPV NIJSPV  SEC_ID                                                  |
```

```
------------------------------------------------------------------------------
C76 I,J LOCATIONS FOR VERTICAL PLANE SCALAR FIELD CONTOURING                 |
C                                                                            |
      ISECSPV: SECTION NUMBER                                                |
      ISPV:    I CELL                                                        |
      JSPV:    J CELL                                                        |
C                                                                            |
#C76 ISECSPV ISPV    JSPV                                                    |
------------------------------------------------------------------------------
C77 CONTROLS FOR VERTICAL PLANE VELOCITY VECTOR PLOTTING                     |
C                                                                            |
      ISECVPV:  N AN INTEGER NUMBER (N.LE.9) OF VERTICAL SECTIONS            |
                  TO WRITE N FILES FOR VELOCITY PLOTTING                     |
      NPVPV:      NUMBER OF WRITES PER REFERENCE TIME PERIOD                 |
      ISVPV:    1 TO ACTIVATE INSTANTANEOUS VELOCITY                         |
                2 TO WRITE ONLY DURING LAST REFERENCE TIME PERIOD            |
      ISRSPV:   1 TO ACTIVATE FOR RESIDUAL VELOCITY                          |
C                                                                            |
C77 ISECVPV   NPVPV  ISVPV  ISRSPV                                           |
      0          6         0      0
------------------------------------------------------------------------------
C78 MORE CONTROLS FOR VERTICAL PLANE VELOCITY VECTOR PLOTTING                |
C                                                                            |
      ISCEVPV:  SECTION NUMBER                                               |
      NIJVPV:   NUMBER IS CELLS OR I,J PAIRS IN SECTION                      |
      ANGVPV:   CCW POSITIVE ANGLE FROM EAST TO SECTION NORMAL               |
      SEC ID:   CHARACTER FORMAT SECTION TITLE                               |
C                                                                            |
#C78 ISECVPV   NIJVPV  ANGVPV  SEC_ID                                        |
------------------------------------------------------------------------------
C79 CONTROLS FOR VERTICAL PLANE VELOCITY PLOTTING                            |
C                                                                            |
      ISECVPV:  SECTION NUMBER (REFERENCE USE HERE)                          |
      IVPV:     I CELL INDEX                                                 |
      JVPV:     J CELL INDEX                                                 |
C                                                                            |
#C79 ISECVPV IVPV    JVPV                                                    |
------------------------------------------------------------------------------
C80 CONTROLS FOR 3D FIELD OUTPUT                                             |
C                                                                            |
      IS3DO:  1 TO WRITE TO 3D ASCI INTEGER FORMAT FILES, JS3Dvar.LE.2    SEE|
              1 TO WRITE TO 3D ASCI FLOAT POINT FORMAT FILES, JS3Dvar.EQ.3 C57|
              2 TO WRITE TO 3D CHARACTER ARRAY FORMAT FILES (NOT ACTIVE)     |
              3 TO WRITE TO 3D HDF IMAGE FORMAT FILES (NOT ACTIVE)           |
              4 TO WRITE TO 3D HDF FLOATING POINT FORMAT FILES (NOT ACTIVE)  |
      ISR3DO:   SAME AS IS3DO EXCEPT FOR RESIDUAL VARIABLES                  |
      NP3DO:    NUMBER OF WRITES PER LAST REF TIME PERIOD FOR INST VARIABLES |
      KPC:      NUMBER OF UNSTRETCHED PHYSICAL VERTICAL LAYERS               |
```

```
      NWGG:     IF NWGG IS GREATER THAN ZERO, NWGG DEFINES THE NUMBER OF !2877|
                WATER CELLS IN CARTESIAN 3D GRAPHICS GRID OVERLAY OF THE      |
                CURVILINEAR GRID.  FOR NWGG>0 AND EFDC RUNS ON A CURVILINEAR  |
                GRID,  I3DMI,I3DMA,J3DMI,J3DMA REFER TO CELL INDICES ON THE   |
                ON THE CARTESIAN GRAPHICS GRID OVERLAY DEFINED BY FILE        |
                gcell.inp.  THE FILE gcell.inp IS NOT USED BY EFDC,  BUT BY   |
                THE COMPANION GRID GENERATION CODE GEFDC.F.  INFORMATION      |
                DEFINING THE OVERLAY IS READ BY EFDC.F FROM THE FILE          |
                gcellmp.inp.  IF NWGG EQUALS 0,  I3DMI,I3DMA,J3DMI,J3DMA REFER|
                TO INDICES ON THE EFDC GRID DEFINED BY cell.inp.              |
                ACTIVATION OF THE REWRITE OPTION I3DRW=1 WRITES TO THE FULL   |
                GRID DEFINED BY cell.inp AS IF cell.inp DEFINES A CARTESIAN   |
                GRID.  IF NWGG EQ 0 AND THE EFDC COMP GRID IS CO,  THE REWRITE|
                OPTION IS NOT RECOMMENDED AND A POST PROCESSOR SHOULD BE USED |
                TO TRANSFER THE SHORT FORM,  I3DRW=0,  OUTPUT TO AN APPROPRIATE |
                FORMAT FOR VISUALIZATION.  CONTACT DEVELOPER FOR MORE DETAILS |
      I3DMI:    MINIMUM OR BEGINNING I INDEX FOR 3D ARRAY OUTPUT              |
      I3DMA:    MAXIMUM OR ENDING I INDEX FOR 3D ARRAY OUTPUT                 |
      J3DMI:    MINIMUM OR BEGINNING J INDEX FOR 3D ARRAY OUTPUT              |
      J3DMA:    MAXIMUM OR ENDING J INDEX FOR 3D ARRAY OUTPUT                 |
      I3DRW:  0 FILES WRITTEN FOR ACTIVE CO WATER CELLS ONLY                  |
              1 REWRITE FILES TO CORRECT ORIENTATION DEFINED BY gcell.inp     |
                AND gcellmp.inp FOR CO WITH NWGG.GT.0 OR BY cell.inp IF THE   |
                COMPUTATIONAL GRID IS CARTESIAN AND NWGG.EQ.0                 |
      SELVMAX:  MAXIMUM SURFACE ELEVATION FOR UNSTRETCHING (ABOVE MAX SELV )  |
      BELVMIN:  MINIMUM BOTTOM ELEVATION FOR UNSTRETCHING (BELOW MIN BELV)    |
C                                                                             |
#C80 IS3DO ISR3DO NP3DO KPC NWGG I3DMI I3DMA J3DMI J3DMA I3DRW SELVMAX BELVMIN|
    0     0      0      1   0    1     12     1     15   0    15.0     -315.
-------------------------------------------------------------------------------
C81 OUTPUT ACTIVATION AND SCALES FOR 3D FIELD OUTPUT                          |
C                                                                             |
      VARIABLE:      DUMMY VARIBLE ID (DO NOT CHANGE ORDER)                   |
      IS3(VARID):  1 TO ACTIVATE THIS VARIBLES                                |
      JS3(VARID):  0 FOR NO SCALING OF THIS VARIABLE                          |
                   1 FOR AUTO SCALING OF THIS VARIABLE OVER RANGE 0<VAL<255   |
                     AUTO SCALES FOR EACH FRAME OUTPUT IN FILES out3d.dia AND |
                     rout3d.dia  OUTPUT IN I4 FORMAT                          |
                   2 FOR SCALING SPECIFIED IN NEXT TWO COLUMNS WITH OUTPUT    |
                     DEFINED OVER RANGE  0<VAL<255 AND WRITTEN IN I4 FORMAT   |
                   3 FOR MULTIPLIER SCALING BY MAX SCALE VALUE WITH OUTPUT    |
                     WRITTEN IN F7.1 FORMAT (IS3DO AND ISR3DO MUST BE 1)      |
C                                                                             |
#C81 VARIABLE    IS3D(VARID)  JS3D(VARID)   MAX_SCALE_VALUE  MIN_SCALE_VALUE  |
    'U VEL'     0            3             100.0              -1.0
    'V VEL'     0            3             100.0              -1.0
    'W VEL'     0            0            1000.0          -1.0E-3
    'SALINITY'  0            3               1.0               0.0
```

```
    'TEMP'      0           3             1.0            10.0
    'DYE'       0           0          1000.0             0.0
    'COH SED'   0           3          1000.0             0.0
    'NCH SED'   0           3          1000.0             0.0
    'TOX CON'   0           3          1000.0             0.0
-------------------------------------------------------------------------------
C82 INPLACE HARMONIC ANALYSIS PARAMETERS                                       |
C                                                                              |
      ISLSHA:  1 FOR IN PLACE LEAST SQUARES HARMONIC ANALYSIS                  |
      MLLSHA:  NUMBER OF LOCATIONS FOR LSHA                                    |
      NTCLSHA: LENGTH OF LSHA IN INTEGER NUMBER OF REFERENCE TIME PERIODS      |
      ISLSTR:  1 FOR TREND REMOVAL                                             |
      ISHTA :  1 FOR SINGLE TREF PERIOD SURFACE ELEV ANALYSIS                  |
C                    90                                                        |
#C82 ISLSHA  MLLSHA   NTCLSHA  ISLSTR  ISHTA                                   |
      0       0       105        0       0
-------------------------------------------------------------------------------
C83 HARMONIC ANALYSIS LOCATIONS AND SWITCHES                                   |
C                                                                              |
      ILLSHA:   I CELL INDEX                                                   |
      JLLSHA:   J CELL INDEX                                                   |
      LSHAP:  1 FOR ANALYSIS OF SURFACE ELEVATION                              |
      LSHAB:  1 FOR ANALYSIS OF SALINITY                                       |
      LSHAUE: 1 FOR ANALYSIS OF EXTERNAL MODE HORIZONTAL VELOCITY              |
      LSHAU:  1 FOR ANALYSIS OF HORIZONTAL VELOCITY IN EVERY LAYER             |
      CLSL:     LOCATION AS A CHARACTER VARIALBLE                              |
C                                                                              |
#C83 ILLSHA   JLLSHA   LSHAP  LSHAB  LSHAUE LSHAU  CLSL
-------------------------------------------------------------------------------
C84 CONTROLS FOR WRITING TO TIME SERIES FILES                                  |
C                                                                              |
      ISTMSR:  1 OR 2 TO WRITE TIME SERIES OF SURF ELEV, VELOCITY, NET         |
               INTERNAL AND EXTERNAL MODE VOLUME SOURCE-SINKS, AND             |
               CONCENTRATION VARIABLES,  2 APPENDS EXISTING TIME SERIES FILES  |
      MLTMSR:  NUMBER HORIZONTAL LOCATIONS TO WRITE TIME SERIES OF SURF ELEV,  |
               VELOCITY, AND CONCENTRATION VARIABLES,  MAXIMUM LOCATIONS = 9   |
      NBTMSR:  TIME STEP TO BEGIN WRITING TO TIME SERIES FILES                 |
      NSTMSR:  TIME STEP TO STOP WRITING TO TIME SERIES FILES                  |
      NWTSER:  WRITE INTERVAL FOR WRITING TO TIME SERIES FILES                 |
     NTSSTSP:  NUMBER OF TIME SERIES START-STOP SCENARIOS,  1 OR GREATER       |
      TCTMSR:  UNIT CONVERSION FOR TIME SERIES TIME.  FOR SECONDS, MINUTES,    |
               HOURS,DAYS USE 1.0, 60.0, 3600.0, 86400.0 RESPECTIVELY          |
        IDUM:  2 DUMMY INTEGER VARIABLES REQUIRED, BOTH = 0                    |
C                                                                              |
#C84 ISTMSR  MLTMSR  NBTMSR  NSTMSR  NWTMSR  NTSSTSP  TCTMSR   IDUM1  IDUM2    |
       0       1       1      518400  60         1     86400.    0        0    |
-------------------------------------------------------------------------------
C85 CONTROLS FOR WRITING TO TIME SERIES FILES                                  |
```

```
C                                                                              |
     ITSSS:    START-STOP SCENARIO NUMBER 1.GE.ISSS.LE.NTSSTSP                 |
   MTSSTSP:    NUMBER OF STOP-START PAIRS FOR SCENARIO ISSS                    |
C                                                                              |
#C85 ITSSS  MTSSTSP                                                            |
      0      1    !FULL SAVE
-------------------------------------------------------------------------------
C86 CONTROLS FOR WRITING TO TIME SERIES FILES                                  |
C                                                                              |
     ITSSS:    START-STOP SCENARIO NUMBER 1.GE.ISSS.LE.NTSSTSP                 |
     MTSSS:    NUMBER OF STOP-START PAIRS FOR SCENARIO ISSS                    |
    TSSTRT:    STARTING TIME FOR SCENARIO ITSSS, SAVE INTERVAL MTSSS           |
    TSSTOP:    STOPING TIME FOR SCENARIO ITSSS, SAVE INTERVAL MTSSS            |
C                                                                              |
#C86 ISSS   MTSSS    TSSTRT    TSSTOP     USER_COMMENT                         |
      0      1      -1000.   10000.     ! FULL SAVE
-------------------------------------------------------------------------------
C87 CONTROLS FOR WRITING TO TIME SERIES FILES                                  |
C                                                                              |
      ILTS:    I CELL INDEX                                                    |
      JLTS:    J CELL INDEX                                                    |
    NTSSSS:    WRITE SCENARIO FOR THIS LOCATION                                |
      MTSP:  1 FOR TIME SERIES OF SURFACE ELEVATION                            |
      MTSC:  1 FOR TIME SERIES OF TRANSPORTED CONCENTRATION VARIABLES          |
      MTSA:  1 FOR TIME SERIES OF EDDY VISCOSITY AND DIFFUSIVITY               |
      MTSUE: 1 FOR TIME SERIES OF EXTERNAL MODE HORIZONTAL VELOCITY            |
      MTSUT: 1 FOR TIME SERIES OF EXTERNAL MODE HORIZONTAL TRANSPORT           |
      MTSU:  1 FOR TIME SERIES OF HORIZONTAL VELOCITY IN EVERY LAYER           |
      MTSQE: 1 FOR TIME SERIES OF NET EXTERNAL MODE VOLUME SOURCE/SINK         |
      MTSQ:  1 FOR TIME SERIES OF NET EXTERNAL MODE VOLUME SOURCE/SINK         |
      CLTS:    LOCATION AS A CHARACTER VARIALBLE                               |
C                                                                              |
#C87 ILTS JLTS NTSSSS MTSP MTSC MTSA MTSUE MTSUT MTSU MTSQE MTSQ  CLTS         |
     12     15    1   1     0     0     0     0     0     0     0    ''
-------------------------------------------------------------------------------
C88 CONTROLS FOR EXTRACTING INSTANTANEOUS VERTICAL SCALAR FIELD PROFILES      |
C                                                                              |
      ISVSFP: 1 FOR EXTRACTING INSTANTANEOUS VERTICAL FIELD PROFILES           |
      MDVSFP:   MAXIMUM NUMBER OF DEPTHS FOR SAMPLING VALUES                   |
      MLVSFP:   NUMBER OF HORIZONTAL SPACE-TIME LOCATION PAIRS TO BE SAMPLED   |
      TMVSFP:   MULTIPLIER TO CONVERT SAMPLING TIMES TO SECONDS                |
      TAVSFP:   ADDITIVE ADJUSTMENT TO SAMPLING TIME BEFORE CONVERSION TO SEC  |
C          200max   1600max                                                    |
#C88 ISVSFP  MDVSFP  MLVSFP  TMVSFP  TAVSFP                                    |
      0       0     0       86400.  0.0
-------------------------------------------------------------------------------
C89 SAMPLING DEPTHS FOR EXTRACTING INST VERTICAL SCALAR FIELD PROFILES         |
C                                                                              |
```

```
      MMDVSFP:  Mth SAMPLING DEPTH                                            |
      DMSFP:    SAMPLING DEPTH BELOW SURFACE,  IN METERS                      |
C                                                                             |
#C89 MMDVSFP  DMVSFP                                                          |
-------------------------------------------------------------------------------
C90 HORIZONTAL SPACE-TIME LOCATIONS FOR SAMPLING                              |
C                                                                             |
      MMLVSFP:  Mth SPACE TIME SAMPLING LOCATION                              |
      TIMVSFP:  SAMPLING TIME                                                 |
      IVSFP:    I HORIZONTAL LOCATON INDEX                                    |
      JVSFP:    J HORIZONTAL LOCATON INDEX                                    |
C                                                                             |
#C90 MMLVSFP  TIMVSFP  IVSFP  JVSFP                                           |
********************************************************************************
********************************************************************************
********************************************************************************
```

APPENDIX F

EFDC INPUT FILE PSER.INP SAMPLE

```
C       PSER.INP        file
C       At Ratliff ferry converted to metric
C
C
C
C       MPSER(NS)       TCPSER(NS)      TAPSER(NS)      RMULADJ(NS)     ADDADJ(NS)
C       TPSER(M,NS)     PSER(M,1,NS)
0.00    367     86400   0       1       0
1       90.22
2       90.21
3       90.23
4       90.23
5       90.23
6       90.22
7       90.21
8       90.22
9       90.24
10      90.23
11      90.24
12      90.22
13      90.22
14      90.23
15      90.23
16      90.22
17      90.23
18      90.21
19      90.21
20      90.19
21      90.18
22      90.19
23      90.26
24      90.25
25      90.25
26      90.22
27      90.24
28      90.27
29      90.30
30      90.29
31      90.29
32      90.27
```

APPENDIX G

EFDC INPUT FILE QSER.INP SAMPLE

```
C   qser.inp file, in free format across line, repeats nqser times
C
C   ISTYP   MQSER(NS)   TCQSER(NS)  TAQSER(NS)  RMULADJ(NS)  ADDADJ(NS)
C
C   if istyp.eq.1 then read depth weights and single value of QSER
c
C   (WKQ(K),K=1,KC)
c
C   TQSER(M,NS)  QSER(M,1,NS)   !(mqser(ns) pairs for ns=1,nqer series)
c
C   else read a value of qser for each layer
c
C   TQSER(M,NS)   (QSER(M,K,NS),K=1,KC)  !(mqser(ns) pairs)
C  Flow data are from PRVMD for inflow and outflow
1   911  86400.0   0.0   0.028316847  0.0     0  !ns=1 Pearl at Ratliff Ferry
0.2  0.2  0.2  0.2  0.2  0  0
0             1885
1.083333333   1885
1.125         1885
1.166666667   1885
1.208333333   1885
1.25          1885
1.833333333   1825
2.291666667   1765
2.833333333   1660
3.083333333   1665
3.333333333   1590
3.833333333   1535
4.083333333   1465
4.333333333   1425
4.833333333   1370
5.333333333   1305
5.833333333   1250
1   370  86400.0   0.0   0.028316847  0.0     0  !ns=2 Pelahatchie inflow
1   1   1
1      430.7063105
2      426.9164999
3      425.0341181
4      434.5297638
5      432.6138132
6      434.5297638
7      430.7063105
8      425.0341181
9      428.8072184
10     442.2787961
11     436.4541997
12     438.3871586
13     428.8072184
```

```
14       428.8072184
15       432.6138132
1    962  86400.0    0.0    0.028316847   0.0      0   !ns=3 Pearl River outflow
0   0.5   0.5   0   0   0
0               -1755
1               -1755
1.25            -1755
1.833333333     -1755
1.958333333     -1440
2.25            -1445
2.833333333     -1440
3.25            -1445
3.833333333     -1445
4.25            -1445
4.833333333     -1445
5.25            -1445
5.833333333     -1445
1    4  86400.0    0.0    0.028316847   0.0      0   !ns=4 OB Curtis   25 MGD
0   0.5   0.5   0   0   0
0.0     -38.63
1.0     -38.63
120     -38.68
10000.  -38.68
```

APPENDIX H

EFDC INPUT FILE TEMP.INP

```
C TEMP File
C Starting temperature for each cell
C
C
1
2       2       2       15      15      15      15      15      15       15      15      15
3       3       2       15      15      15      15      15      15       15      15      15
4       4       2       15      15      15      15      15      15       15      15      15
5       5       2       15      15      15      15      15      15       15      15      15
6       6       2       15      15      15      15      15      15       15      15      15
7       2       3       15      15      15      15      15      15       15      15      15
8       3       3       15      15      15      15      15      15       15      15      15
9       4       3       15      15      15      15      15      15       15      15      15
10      5       3       15      15      15      15      15      15       15      15      15
11      6       3       15      15      15      15      15      15       15      15      15
12      7       3       15      15      15      15      15      15       15      15      15
13      2       4       15      15      15      15      15      15       15      15      15
14      3       4       15      15      15      15      15      15       15      15      15
15      4       4       15      15      15      15      15      15       15      15      15
16      3       5       15      15      15      15      15      15       15      15      15
17      4       5       15      15      15      15      15      15       15      15      15
18      3       6       15      15      15      15      15      15       15      15      15
19      4       6       15      15      15      15      15      15       15      15      15
20      3       7       15      15      15      15      15      15       15      15      15
21      4       7       15      15      15      15      15      15       15      15      15
22      3       8       15      15      15      15      15      15       15      15      15
23      4       8       15      15      15      15      15      15       15      15      15
24      3       9       15      15      15      15      15      15       15      15      15
25      4       9       15      15      15      15      15      15       15      15      15
26      3       10      15      15      15      15      15      15       15      15      15
27      4       10      15      15      15      15      15      15       15      15      15
28      5       10      15      15      15      15      15      15        15     15      15
29      4       11      15      15      15      15      15      15        15     15      15
30      5       11      15      15      15      15      15      15        15     15      15
31      4       12      15      15      15      15      15      15        15     15      15
32      5       12      15      15      15      15      15      15        15     15      15
33      6       12      15      15      15      15      15      15        15     15      15
34      5       13      15      15      15      15      15      15        15     15      15
35      6       13      15      15      15      15      15      15        15     15      15
36      5       14      15      15      15      15      15      15        15     15      15
37      6       14      15      15      15      15      15      15        15     15      15
```

APPENDIX I

EFDC INPUT FILE TSER.INP SAMPLE

```
C  tser.inp   file
C  temp data from Allen Jackson Field Jackson Airport
C
C  ISTYP MCSER(NS1) TCCSER(NS1) TACSER(NS1) RMULADJ(NS1) ADDADJ(NS1)
C
C
C  TCSER(M     NS1) (CSER(MK  NS1) K=1 KC) !(mcser(ns1)pairs)
C
1.00    13745   86400   0       1       0       !ns=1
1.00    1.00    1       1       1
0.00    12.22
0.04    11.11
0.08    12.22
0.12    11.67
0.13    11.67
0.16    11.67
0.20    12.78
0.25    12.78
0.25    12.78
0.27    12.78
0.27    12.78
0.28    13.89
0.29    14.44
0.31    13.89
0.33    14.44
0.34    13.89
0.37    15.00
0.38    15.00
0.39    15.00
0.39    15.00
0.40    15.00
0.41    15.00
0.42    15.00
0.45    15.00
0.47    15.00
0.50    15.00
0.50    15.00
0.50    16.11
0.51    16.11
0.53    16.11
0.54    15.56
0.55    16.11
0.58    16.67
0.62    17.78
0.63    17.78
```

APPENDIX J

EFDC INPUT FILE WSER.INP SAMPLE

```
C       Julian Day     0       (Reference     Date)   =       12/31/2005
C       data    from   Jackson Field
C
C       MASER(NW)      ″=      OF TIME DATA POINTS
C       TCASER(NW)     ″=      TIME UNIT CONVERSION TO SECONDS
C       TAASER(NW)     ″=      ADJUSTMENT OF TIME VALUES SAME UNITS AS INPUTTIMES
C       WINDSCT(NW)    ″=      SPEED CONVERSION TO M/SEC
C       ISWDINT(NW)    ″=      CONVENTION
C       0       DIRECTION TO
C       1       DIRECTION FROM
C       2       WINDS IS EAST VELOCITY, WIND IS NORTH VELOCITY
C
C       MASER   TCASER  TAASER  WINDSCT ISWDINT
C
C       TASER(M)       WINDS(M)       WINDD(M)
C
14142   86400   0       1       1
0.0375          308     0
0.079166667     308     3
0.120833333     308     0
0.125           308     0
0.1625          308     0
0.204166667     308     0
0.215972222     108     3
0.232638889     108     3
0.245833333     308     0
0.249305556     308     0
0.25            308     0
0.252083333     308     0
0.254861111     308     0
0.2875  308     0
0.329166667     308     0
0.331944444     298     3
0.338194444     298     5
0.343055556     328     5
0.370833333     288     5
0.375           288     5
0.379861111     288     5
0.389583333     308     0
0.398611111     278     5
0.4125          308     0
0.422222222     268     3
0.427777778     308     0
0.434722222     308     0
0.440277778     308     0
```

APPENDIX K

2012 PROFILE DATA

Table K.1 Profile Sample Locations and Model Grid Cell

Date	Time	Latitude	Longitude	Grid Cell
5/29/2012	10:20	32 23 13.2N	90 02 52.32W	2,6a
5/29/2012	12:20	32 23 48.84N	90 01 48.84W	3,7
5/29/2012	13:50	32 23 34.98N	90 2 18.6W	2,6b
5/30/2012	10:34	32 29 53.7N	89 57 19.8W	5,9
5/30/2012	12:25	32 29 45.78N	89 58 26.4W	4,7
5/30/2012	13:32	32 29 30.91N	89 59 5.64W	4,8
6/1/2012	10:02	32 26 14.4N	90 01 53.2W	4,4
6/1/2012	11:18	32 24 36.432N	90 1 57.36W	3,5
6/1/2012	12:06	32 26 46.7N	90 01 41.7W	4,5
6/1/2012	12:25	32 27 22.032N	90 1 14.88W	4,5
6/1/2012	12:45	32 27 58.68N	90 0 47.52W	3,6
6/1/2012	12:57	32 28 34.68N	90 0 14.4W	3,7
9/7/2012	10:42	32 23 26.7N	90 02 41.4 W	2,6
9/7/2012	11:03	32 23 34.8N	90 03 03.2W	2,5
9/7/2012	11:14	32 23 42.9N	90 03 21.7W	2,5
9/7/2012	11:28	32 23 58.7N	90 03 44.3W	2,4
9/7/2012	11:56	32 24 19.8N	90 04 24.5W	2,3
9/7/2012	12:16	32 24 42.5N	90 04 50.3W	2,3
9/7/2012	12:41	32 26 16.2N	90 01 57.3W	4,4
9/7/2012	13:35	32 28 40.4N	89 59 15.6W	4,7
9/7/2012	13:52	32 29 41.7N	89 57 54.0W	5,9

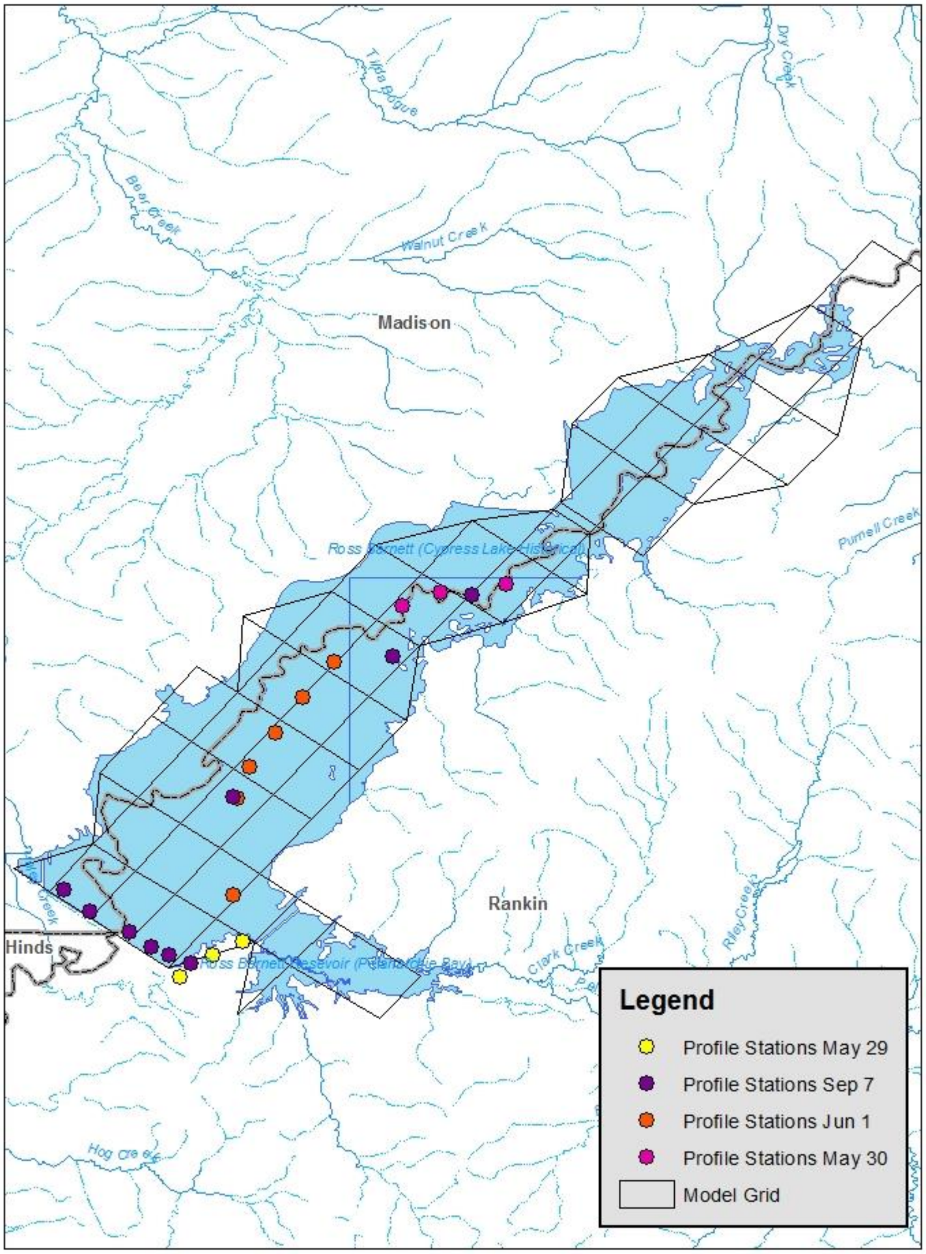


Figure K.1 Profile Station Location Map

Table K.2 Profile Data 5/29/2012 Cell 2,6a

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
3.28	29.45	49.3	126.6	9.59	9.12	0.032
6.56	29.12	47.6	115.7	8.81	8.72	0.030
9.84	29.03	48.6	107.2	8.03	8.00	0.031
13.12	27.60	46.8	81.1	6.10	7.23	0.030
16.40	26.65	47.2	60.0	4.72	6.80	0.030
19.69	25.55	48.6	41.8	3.32	6.57	0.031
22.97	24.80	52.7	15.2	1.17	6.50	0.034
26.25	24.38	55.5	2.7	0.21	6.52	0.035

Table K.3 Profile Data 5/29/2012 Cell 3,7

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
3.28	31.26	59.2	180.8	13.2	9.47	0.037
6.56	30.63	53.1	158.1	11.64	6.34	0.034
9.84	27.75	55.0	53.4	4.11	7.43	0.036
13.12	26.24	56.1	17.2	1.35	6.55	0.036

Table K.4 Profile Data 5/29/2012 Cell 2,6b

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
3.28	28.79	46.4	108.4	8.37	7.44	0.030
6.56	28.12	46.2	104.3	8.00	7.14	0.030
9.84	26.14	46.8	58.8	4.64	6.50	0.030
13.12	25.81	47.1	42.9	3.45	6.24	0.030
16.40	25.39	48.3	27.1	2.15	6.15	0.031
19.69	24.99	51.7	9.0	0.72	6.16	0.033

Table K.5 Profile Data 5/30/2012 Cell 5,9

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
1	30.36	55.7	117.9	8.8	8.18	0.0354
2	30.22	55.7	120.5	9.08	8.26	0.0356
3	29.88	56.1	118.7	8.9	8	0.0359
4	29.52	56.3	112.1	8.41	7.64	0.0363
5	29.22	56.7	105.4	7.97	7.47	0.0362
6	28.97	56.8	100	7.57	7.31	0.036
7	28.85	56.8	91.1	6.9	7.14	0.0362
8	28.46	57	72.5	5.37	6.86	0.0368
9	28.27	57.4	52.9	3.64	6.71	0.0368
10	27.78	59.3	34.8	2.66	6.61	0.0382
11	27.21	61.6	15.1	1.18	6.53	0.0394
12	26.65	62.9	4.4	0.33	6.5	0.0402
13	26.47	64.4	1.5	0.11	6.5	0.0414
14	26.38	65.3	0.6	0.04	6.5	0.0418
15	26.25	65.9	0.2	0.01	6.5	0.042

Table K.6 Profile Data 5/30/2012 Cell 4,7

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
1	31.93	50.9	145.3	10.54	8.84	0.0324
2	31.11	50.2	140.6	10.44	8.82	0.0320
3	30.46	49.8	136.4	10.17	8.77	0.0319
4	29.8	49.8	134.7	10.16	8.77	0.0317
5	29.6	49.3	126.4	9.55	8.42	0.0318
6	29.52	49.6	122	9.26	8.3	0.0318
7	29.42	49.9	116.8	8.88	7.98	0.0318
8	29.28	50.5	109	8.22	7.54	0.0322
9	28.95	52.7	87.4	6.64	6.98	0.0335
10	27.47	58	28.6	2.21	6.44	0.0373
11	26.65	60.1	9.7	0.62	6.38	0.0388
12	26.48	61.5	3.9	0.29	6.37	0.0391
13	26.44	61.5	2.2	0.17	6.37	0.0395
14	26.27	63.3	0.4	0.03	6.41	0.0409
15	26.11	64.2	0.3	0.02	6.43	0.0403
16	25.92	65.8	0.2	0.01	6.47	0.0420
17	25.84	66.5	0.2	0.01	6.49	0.0425
18	25.77	66.4	0.1	0.01	6.5	0.0426
19	25.75	66.6	0.1	0.01	6.51	0.0429
20	25.73	67	0.1	0.01	6.52	0.0429
21	25.71	66.9	0.1	0.01	6.53	0.0433

Table K.7 Profile Data 5/30/2012 Cell 4,8

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
1	32.97	57.3	179.4	12.84	9.94	0.0369
2	32.89	57.6	180.8	13.27	9.49	0.0368
3	30.14	50.7	151.9	11.13	9.15	0.0332
4	29.72	49.2	131.8	9.84	8.61	0.0314
5	29.53	48.3	122.0	9.19	8.58	0.0308
6	29.43	48.0	119.1	9.01	8.57	0.0310
7	29.27	47.9	114.0	8.66	8.36	0.0306
8	29.22	47.9	109.4	8.32	8.10	0.0304
9	29.00	48.3	106.5	8.15	7.84	0.0308
10	28.93	48.4	104.0	7.94	7.61	0.0312
11	28.73	50.4	79.2	6.08	6.93	0.0321
12	28.35	51.3	68.9	5.27	6.76	0.0329
13	28.19	51.9	60.2	4.66	6.69	0.0331
14	27.25	54.4	34.6	2.68	6.52	0.0352

Table K.8 Profile Data 6/1/2012 Cell 4,4

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	26.24	49.9	78.5	6.29	6.82	0.0321
1	26.27	50.2	76.9	6.16	6.81	0.0320
2	26.26	50.0	76.4	6.15	6.79	0.0320
3	26.27	50.0	76.6	6.15	6.79	0.0321
4	26.25	50.2	76.2	6.13	6.78	0.0321
5	26.28	49.8	76.1	6.13	6.79	0.0322
6	26.28	50.0	76.5	6.14	6.80	0.0323
7	26.27	50.2	76.6	6.18	6.81	0.0322
8	26.27	50.1	76.1	6.13	6.81	0.0321
9	26.27	50.1	75.9	6.09	6.82	0.0321
10	26.27	50.1	74.8	6.01	6.80	0.0322
11	26.26	50.1	74.1	5.94	6.79	0.0321
12	26.26	50.4	73.7	5.93	6.80	0.0323
13	26.27	50.5	73.6	5.93	6.81	0.0321

Table K.9 Profile Data 6/1/2012 Cell 3,5

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	25.74	48.9	106.4	8.63	8.51	0.0320
1	25.76	50.0	106.3	8.64	8.46	0.0323
2	25.77	50.3	106.6	8.66	8.44	0.0322

Table K.10 Profile Data 6/1/2012 Cell 4,5a

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	26.57	49.1	90.5	7.24	7.27	0.0314
1	26.56	48.8	90.1	7.22	7.22	0.0313
2	26.58	49.0	90.3	7.21	7.19	0.0313
3	26.57	49.0	90.4	7.22	7.16	0.0315
4	26.53	49.1	90.2	7.19	7.14	0.0313
5	26.51	49.1	88.7	7.10	7.12	0.0313
6	26.52	48.8	88.7	7.10	7.11	0.0315
7	26.50	49.1	88.4	7.08	7.10	0.0314
8	26.48	49.1	87.3	6.99	7.08	0.0313
9	26.42	49.2	85.5	6.84	7.03	0.0313
10	26.40	49.2	83.6	6.68	7.00	0.0316
11	26.48	49.1	85.4	6.84	7.03	0.0312
12	26.35	49.4	83.2	6.59	6.98	0.0314

Table K.11 Profile Data 6/1/2012 Cell 4,5b

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	26.73	48.8	97.8	7.79	7.3	0.0311
1	26.76	48.4	97.7	7.78	7.39	0.0310
2	26.77	48.5	97.6	7.77	7.41	0.0310
3	26.76	48.5	97.4	7.74	7.39	0.0311
4	26.72	48.8	96.3	7.66	7.35	0.0312
5	26.65	48.3	94.9	7.56	7.30	0.0312
6	26.68	48.6	95.1	7.57	7.30	0.0314
7	26.68	48.5	94.3	7.51	7.32	0.0311
8	26.74	48.5	96.7	7.70	7.38	0.0309
9	26.66	48.6	94.6	7.52	7.29	0.0310

Table K.12 Profile Data 6/1/2012 Cell 3,6

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	27.06	48.3	100.4	7.94	7.77	0.0310
1	27.08	48.3	99.8	7.90	7.74	0.0310
2	27.08	48.6	100.0	7.91	7.72	0.0310
3	27.08	48.8	100.0	7.92	7.69	0.0310
4	27.07	48.2	99.5	7.88	7.67	0.0310
5	27.05	48.7	99.2	7.85	7.61	0.0311
6	27.03	48.5	97.8	7.76	7.55	0.0312
7	27.02	48.6	97.2	7.71	7.53	0.0308
8	27.04	48.6	97.7	7.76	7.55	0.0311
9	27.00	48.6	97.1	7.70	7.52	0.0311

Table K.13 Profile Data 6/1/2012 Cell 3,7

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	26.92	48.0	100.9	7.98	8.25	0.0307
1	27.06	47.8	100.8	7.97	8.21	0.0305
2	27.08	47.7	99.9	7.91	8.18	0.0307
3	27.10	47.9	100.7	7.99	8.15	0.0306
4	27.06	47.8	100.1	7.93	8.13	0.0307
5	27.08	47.7	100.5	7.97	8.13	0.0307
6	27.02	47.5	99.5	7.91	8.07	0.0306
7	27.03	47.6	99.6	7.88	8.05	0.0306

Table K.14 Profile Data 9/7/2012 Cell 2,6

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	31.06	70.3	151.9	11.23	9.43	0.0450
1	31.03	70.6	155.3	11.45	9.44	0.0451
2	30.26	70.0	158.2	11.80	9.43	0.0450
3	29.68	66.7	148.1	11.16	9.23	0.0431
4	29.17	61.9	131.3	9.90	8.82	0.0394
5	28.74	61.1	113.0	8.61	8.42	0.0392
6	28.69	60.9	106.4	8.17	8.18	0.0389
7	28.49	61.2	96.9	7.50	7.86	0.0391
8	28.46	61.3	94.1	7.28	7.73	0.0392
9	28.50	61.1	95.8	7.40	7.66	0.0396
10	28.56	61.5	98.1	7.56	7.63	0.0394
11	28.60	61.0	100.0	7.72	7.35	0.0392
12	28.63	62.1	101.3	7.80	7.41	0.0390
13	28.63	61.4	100.6	7.73	7.62	0.0393

Table K.15 Profile Data 9/7/2012 Cell 2,5a

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	31.82	71.8	159.7	11.70	9.55	0.0459
1	31.68	71.9	159.4	11.74	9.55	0.0460
2	30.89	72.3	162.0	12.08	9.56	0.0463
3	29.24	63.4	142.5	10.85	9.01	0.0410
4	28.44	61.3	121.4	9.32	8.57	0.0392
5	28.09	60.2	98.5	7.65	8.06	0.0387
6	27.93	60.3	80.3	6.15	7.68	0.0389
7	27.83	60.8	68.9	5.37	7.43	0.0391
8	27.74	61.1	67.6	5.29	7.30	0.0390
9	27.71	60.7	67.4	5.26	7.20	0.0388
10	27.70	61.0	66.5	5.20	7.13	0.0388
11	27.62	61.9	62.3	4.81	7.03	0.0389
12	27.58	61.0	56.6	4.40	6.95	0.0391
13	27.55	61.2	54.1	4.18	6.90	0.0391
14	27.50	61.1	61.0	3.96	6.84	0.0392
15	27.47	61.4	46.3	3.63	6.79	0.0395
16	27.45	61.1	42.5	3.29	6.72	0.0395

Table K.16 Profile Data 9/7/2012 Cell 2,5b

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	31.96	72.2	151.8	11.26	9.58	0.0461
1	31.90	71.8	160.5	11.70	9.57	0.0461
2	31.60	72.0	164.8	12.16	9.58	0.0463
3	30.69	71.9	164.8	12.25	9.57	0.0460
4	29.89	66.9	155.3	11.46	9.27	0.0436
5	28.67	62.2	134.6	10.04	8.74	0.0397
6	28.44	61.2	116.8	8.89	8.36	0.0392
7	28.24	61.1	106.7	8.22	8.04	0.0392
8	28.06	61.0	96.2	7.49	7.80	0.0391
9	27.92	60.7	84.6	6.53	7.59	0.0388
10	27.85	61.0	76.0	5.89	7.42	0.0388
11	27.77	60.7	61.8	4.80	7.25	0.0390
12	27.62	60.5	58.3	4.52	7.10	0.0392
13	27.44	61.4	49.0	3.83	6.99	0.0395
14	27.39	61.9	45.5	3.57	6.91	0.0394
15	27.38	61.6	44.8	3.53	6.87	0.0396
16	27.38	61.9	44.8	3.53	6.82	0.0396
17	27.37	61.6	43.6	3.43	6.79	0.0397
18	27.29	62.2	38.6	3.06	6.75	0.0397
19	27.23	62.4	36.0	2.77	6.71	0.0399
20	27.15	63.4	28.5	2.25	6.67	0.0406
21	27.14	64.7	25.6	2.01	6.65	0.0414

Table K.17 Profile Data 9/7/2012 Cell 2,4

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	32.16	72.7	160.7	11.66	9.62	0.0466
1	32.12	72.7	164.1	11.87	9.69	0.0464
2	31.99	73.2	165.2	12.03	9.65	0.0467
3	30.93	73.3	166.0	12.26	9.65	0.0466
4	30.49	71.0	163.0	11.95	9.58	0.0455
5	29.76	66.0	152.5	11.32	9.35	0.0424
6	29.21	62.8	135.0	10.17	9.05	0.0403
7	28.99	62.2	124.2	9.34	8.76	0.0397
8	28.58	61.3	107.3	8.16	8.24	0.0392
9	28.10	61.4	89.5	6.90	7.88	0.0390
10	27.84	61.6	78.6	6.05	7.62	0.0394
11	27.68	61.2	71.1	5.45	7.44	0.0393
12	27.57	61.2	64.2	5.01	7.24	0.0393
13	27.48	61.5	59.0	4.61	7.13	0.0390
14	27.44	61.0	57.2	4.49	7.04	0.0390
15	27.40	61.1	54.8	4.31	6.97	0.0392
16	27.36	61.2	53.4	4.21	6.92	0.0392
17	27.34	61.5	51.7	4.07	6.88	0.0393
18	27.32	61.6	50.4	3.96	6.84	0.0392
19	27.27	62.1	45.2	3.57	6.79	0.0401
20	27.19	63.0	35.5	2.80	6.74	0.0403
21	27.18	63.3	23.8	1.89	6.76	0.0408

Table K.18 Profile Data 9/7/2012 Cell 2,3a

Depth ft	Temp C	Cond	DO%	DO mg/l	pH	TDS
0	32.35	73.3	161.4	11.68	9.54	0.0471
1	32.31	73.5	163.2	11.79	9.55	0.0470
2	31.97	74.0	165.0	12.01	9.54	0.0470
3	30.77	73.3	164.7	12.20	9.51	0.0470
4	30.43	71.2	160.3	11.89	9.43	0.0455
5	30.23	69.5	151.7	11.38	9.35	0.0445
6	30.02	67.6	146.8	10.92	9.26	0.0437
7	29.89	66.1	142.4	10.69	9.19	0.0420
8	29.31	63.0	129.9	9.82	8.94	0.0407
9	29.22	62.4	124.1	9.41	8.80	0.0401
10	29.14	62.7	117.5	8.95	8.74	0.0401
11	28.32	61.5	96.3	7.39	8.08	0.0394
12	28.04	61.3	81.5	6.30	7.78	0.0396
13	28.01	61.3	84.4	6.50	7.78	0.0391
14	27.89	61.1	76.4	5.91	7.48	0.0392
15	27.75	61.1	63.3	4.94	7.30	0.0388
16	27.57	61.0	57.2	4.43	7.18	0.0388
17	27.46	61.0	50.4	3.94	7.00	0.0390
18	27.37	61.2	43.2	3.38	6.91	0.0393
19	27.31	63.2	35.4	2.75	6.80	0.0401
20	27.16	64.7	20.9	1.63	6.75	0.0417
21	27.13	66.1	16.1	1.25	6.64	0.0425
22	27.12					

Table K.19 Profile Data 9/7/2012 Cell 2,3b

Depth ft	Temp C	DO%	DO mg/l	pH
0	32.21	157.2	11.37	9.59
1	32.41	155.9	11.35	9.55
2	32.47	157.3	11.34	9.54
3	32.00	161.2	11.76	9.55
4	30.88	163.5	12.10	9.51
5	30.21	155.3	11.37	9.37
6	29.60	135.8	9.93	9.04
7	29.35	126.0	9.57	8.97
8	29.08	110.9	8.45	8.55
9	28.98	103.4	7.81	8.21
10	28.63	95.1	7.19	7.95
11	28.52	88.8	6.86	7.74
12	28.38	84.4	6.54	7.60
13	28.12	80.6	6.26	7.50
14	27.86	77.6	6.01	7.39
15	27.72	62.0	4.86	7.25
16	27.66	56.4	4.40	7.13
17	27.61	51.1	4.01	7.01
18	27.55	46.2	3.58	6.91
19	27.49	42.1	3.31	6.87
20	27.36	37.2	2.93	6.81
21	27.22	27.2	2.12	6.76
22	27.09	16.2	1.26	6.71
23	26.87	3.8	0.28	6.87

The conductivity sensor failed at this point for the remainder of these monitoring events.

Table K.20 Profile Data 9/7/2012 Cell 4,4

Depth ft	Temp C	DO%	DO mg/l	pH
0	29.76	144.4	10.09	9.24
1	31.18	141.7	10.45	9.24
2	29.75	141.3	10.59	9.11
3	29.23	128.6	9.71	8.94
4	29.10	120.7	9.21	8.67
5	28.96	115.7	8.82	8.84
6	28.91	108.6	8.33	8.48
7	28.88	104.9	8.06	8.39
8	28.87	103.2	7.90	8.31
9	28.80	101.5	7.78	8.18
10	28.76	98.7	7.57	8.09
11	28.53	80.5	6.20	7.79
12	28.22	63.3	4.91	7.52
13	28.06	50.5	3.93	7.30
14	28.03	47.0	3.64	7.19
15	28.00	44.6	3.46	7.11

Table K.21 Profile Data 9/7/2012 Cell 4,7

Depth ft	Temp C	DO%	DO mg/l	pH
0	35.95	135.5	9.13	8.62
1	32.88	141.8	10.16	8.75
2	32.17	142.6	10.36	8.79
3	31.69	143.0	10.42	8.77
4	31.37	138.4	10.17	8.71
5	31.33	136.8	10.05	8.71
6	30.88	122.8	9.12	8.48
7	30.29	95.0	7.15	8.10

Table K.22 Profile Data 9/7/2012 Cell 5,9

Depth ft	Temp C	DO%	DO mg/l	pH
0	33.00	145.7	10.43	9.07
1	32.97	147.9	10.58	9.08
2	32.13	147.7	10.72	9.08
3	30.16	145.5	10.83	9.03
4	29.86	141.3	10.66	8.86
5	29.01	109.8	8.41	7.77
6	28.91	88.4	6.72	7.57
7	28.84	78.4	5.98	7.40
8	28.79	70.6	5.43	7.24
9	28.77	62.2	4.76	7.08
10	28.73	59.5	4.57	7.01
11	28.67	57.8	4.45	6.93
12	28.61	54.3	4.19	6.86
13	28.54	47.1	3.63	6.81
14	28.52	46.3	3.58	6.76
15	28.44	45.1	3.49	6.72
16	28.45	44.0	3.40	6.70
17	28.52	45.1	3.49	6.69
18	28.48	45.2	3.48	6.67
19	28.35	43.1	3.31	6.64
20	28.21	38.5	2.96	6.59
21	28.22	36.7	2.85	6.57
22	28.20	35.5	2.75	6.56
23	28.02	30.2	2.33	6.51
24	27.89	22.1	1.72	6.78