Southwest Florida Water Management District

APPENDICES for The Determination of Minimum Flows for the Lower Alafia River Estuary

December 2008

Southwest Florida
Water Management District

APPENDICES 2A through 8A

The Determination of Minimum flows for the Lower Alafia River Estuary

December 2008

Southwest Florida Water Management District,

Brooksville, FL

Appendices 1A and 1B are attached to the minimum flows report

1A - Report of the scientific review panel

1B - District responses to questions from scientific review panel

Appendices below are included in this document

2A – Regression to predict Buckhorn Springs Flows

2B - Regressions to predict ungaged flows from measured hydrologic data

2C - Time series of average monthly flows at the Alafia River at Lithia gage

2D - Hydrographs of yearly mean, minimum, and maximum flow values calculated over various intervals within each year (3, 10, 30, 60, 90, 120 days)

4A - Simulating hydrodynamics in the Lower Alafia River estuary

4B - A tracer model for narrow rivers and estuaries

5A - Alafia river salinity regressions - whole river model

5B - Alafia river salinity regressions - Isohaline locations

5C - Alafia River Salinity regressions – Fixed stations

5D - Residuals for regressions to predict dissolved oxygen concentrations listed in Table 5-1

5E - Statistics and residuals for piecewise regressions to predict DO concentrations at depths > 2 meters in segments 9-12 and 12-15 kilometers in Table 5-2

5F - Concordance tables for logistic regressions listed in Tables 5-3, 5-4, and 5-6

6A - Alafia River phytoplankton data collection and enumeration methods – enumeration conducted by City of Tampa Bay Studies Group

8A - Plots of regressions of fish and invertebrate taxa used as indicators in the minimum flows report, taken from Peebles (2005) and Matheson et al. (2005)

APPENDIX 2A
REGRESSION TO PREDICT BUCKHORN SPRINGS FLOW

Objective
The objective of this task was to develop a model to predict the total flow from Buckhorn Springs for two intervals of the HBMP baseline time period based on the historical data. The two intervals were January 1975 to April 1987, and January 1997 to August 2000.

Methods
Candidate explanatory variables were compiled from the historical data for:

- Lithia Springs flow,
- Alafia River flow at the Lithia gage,
- nearby well levels, and
- rainfall records.

A stepwise multiple regression analysis was used to select a regression model, and a multiple regression analysis was used to estimate the model parameters. Monthly-specific intercepts were applied to account for a confounding seasonal pattern in the variation of Buckhorn Springs flow. Two outlying Buckhorn Spring data point of less than 9-cfs were removed from the analyses.

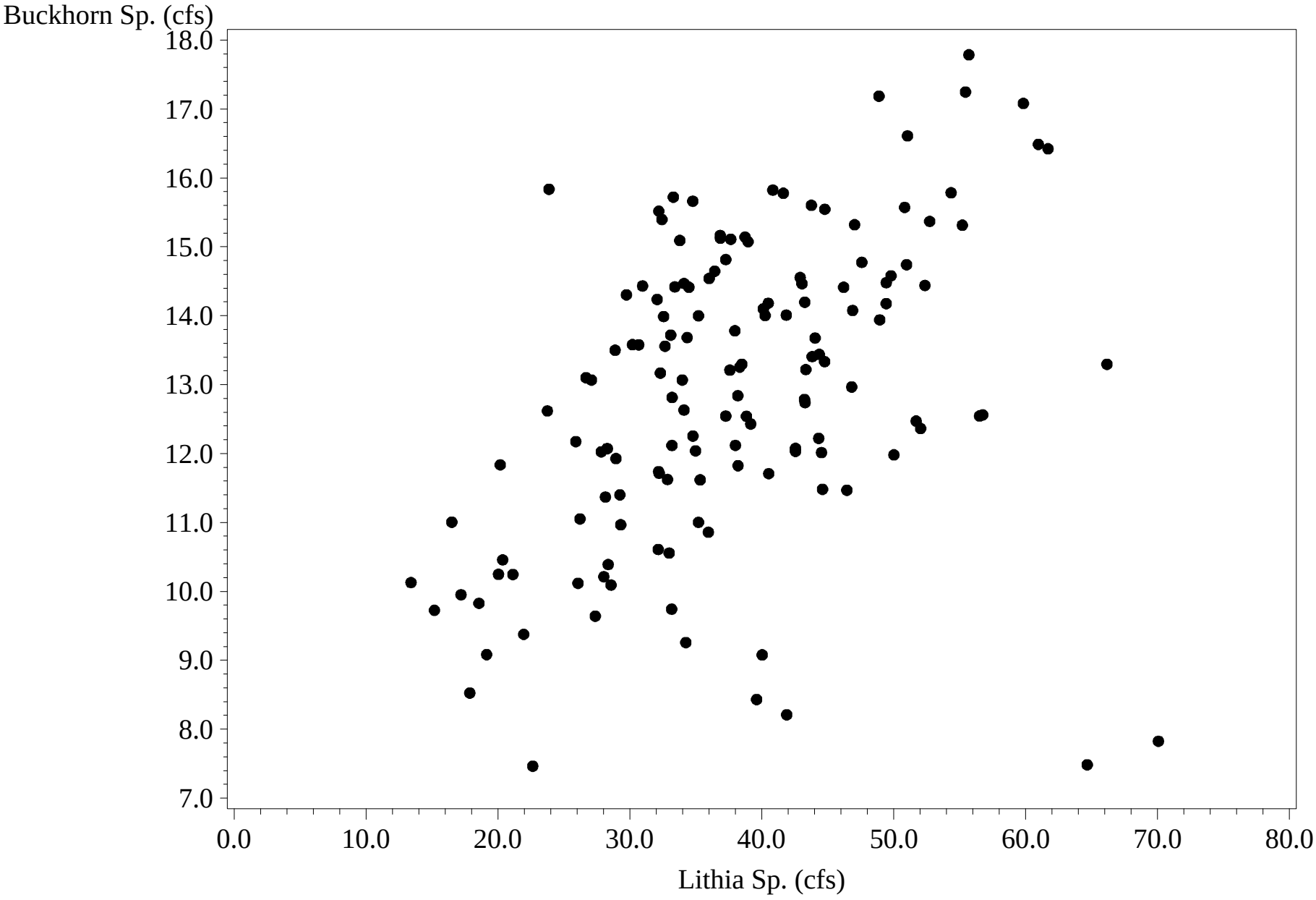
Results
The following model was found to fit the observed historical data:

Variable	Parameter Estimate
Intercept	7.89698
January	0.26138
February	0.44271
March	0.11147
April	0.10227
May	0.13218
June	0.03807
July	0.08928
August	0.01959
September	0.03160
October	0.02350
November	-0.02396
Lithia Springs Flow (cfs)	0.13449
Alafia River at Lithia Flow (cfs at month-3)	-0.00088778

The model explained 37% of the variation in total Buckhorn Springs flow (r^2=0.37), and the regression was highly significant ($p>F < 0.0001$, and all slopes were highly significantly different from zero). Model statistics and diagnostic plots follow.

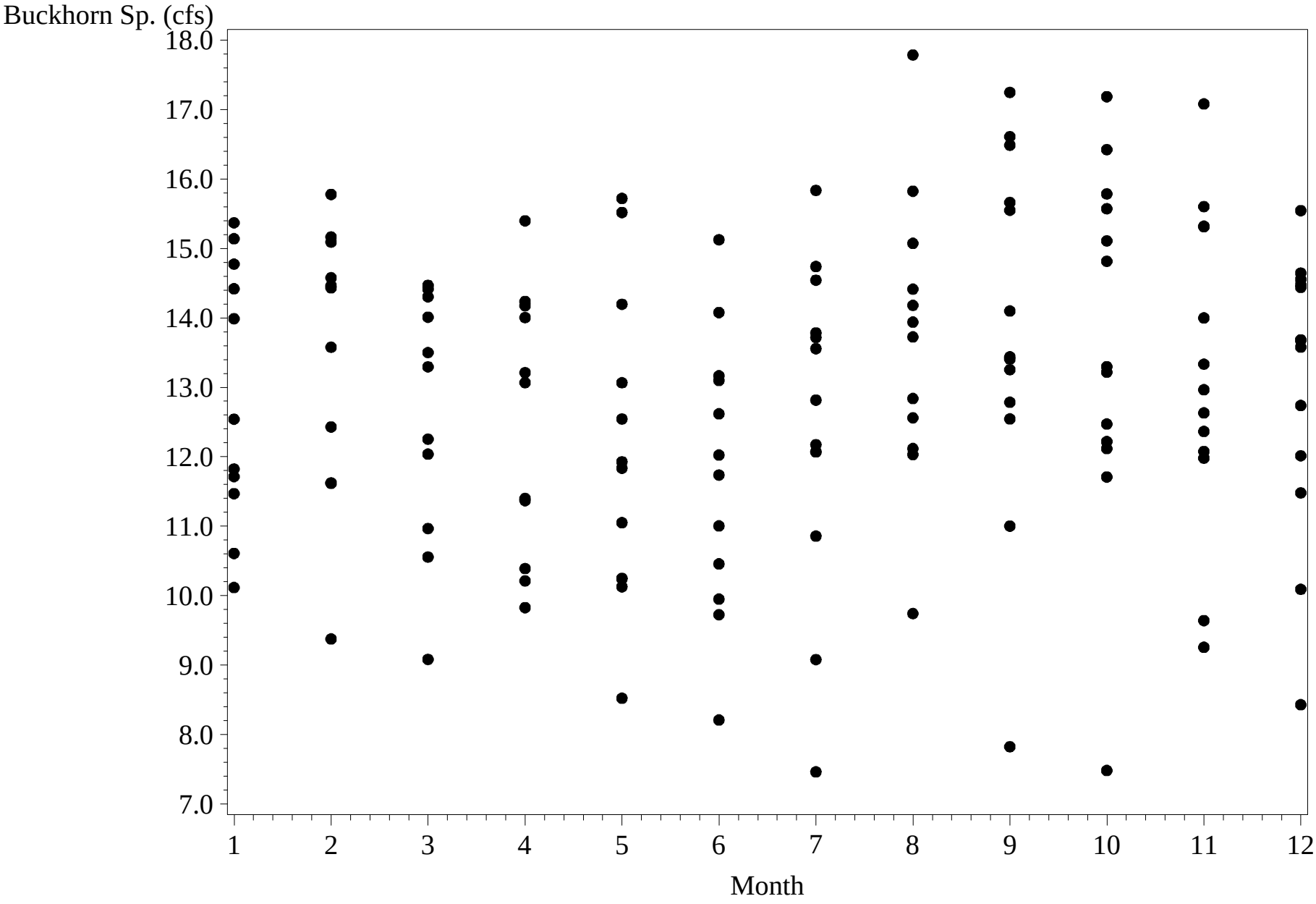
Display 1

Relationship of Buckhorn Springs Total Flow and Lithia Springs Total Flow



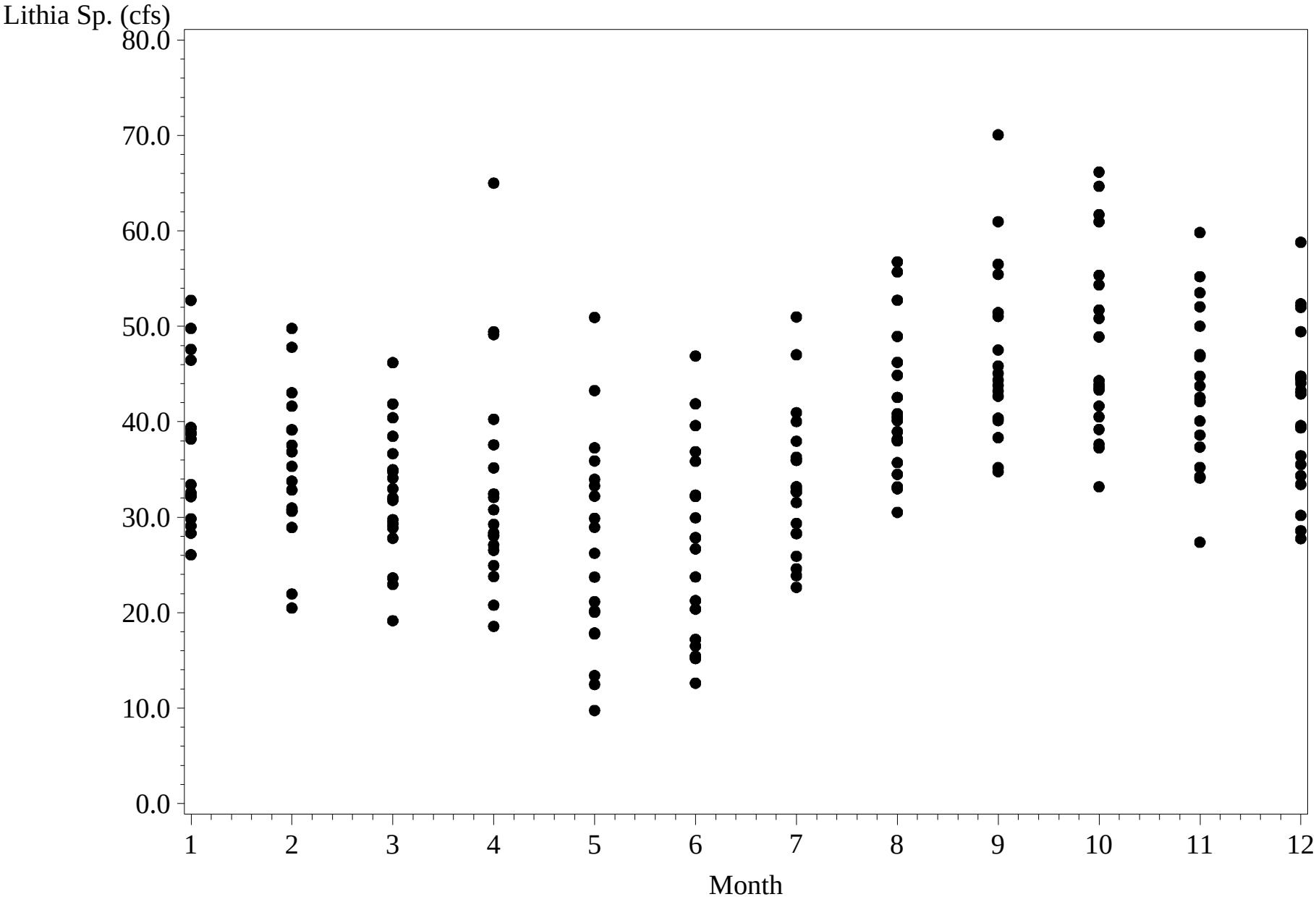
Display 2

Seasonal Signal in Buckhorn Springs Total Flow



Display 3

Seasonal Signal in Lithia Springs Total Flow



Multiple Regression Analysis to Explain Buckhorn Springs Flow

The REG Procedure
Model: MODEL1
Dependent Variable: BTOTAL Buckhorn Sp. (cfs)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	13	229.66026	17.66617	5.73	<.0001
Error	127	391.72562	3.08445		
Corrected Total	140	621.38589			

Root MSE	1.75626	**R-Square**	0.3696
Dependent Mean	13.00142	**Adj R-Sq**	0.3051
Coeff Var	13.50823		

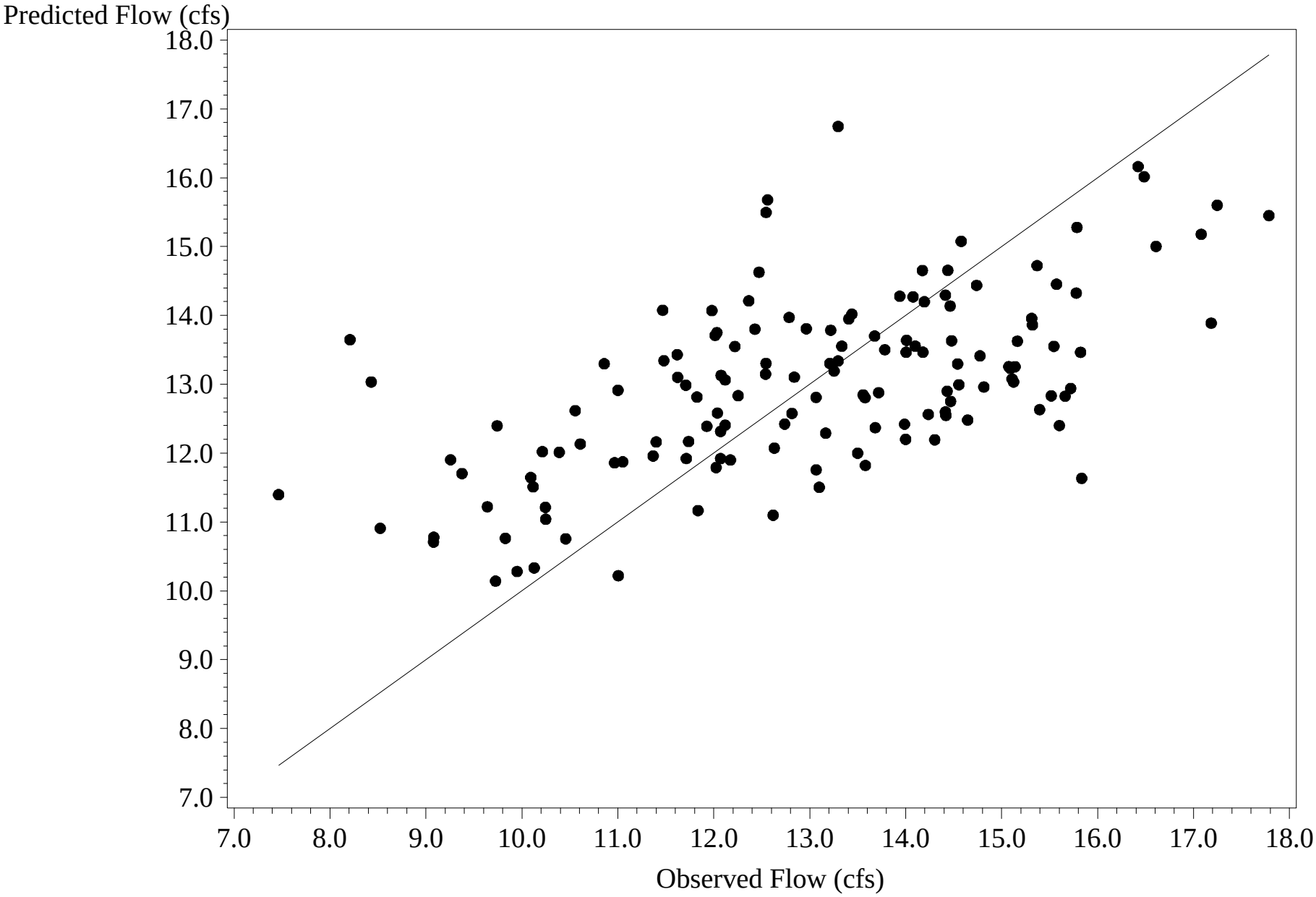
Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	7.89698	0.89543	8.82	<.0001
a1	January Intercept	1	0.26138	0.72168	0.36	0.7178
a2	February Intercept	1	0.44271	0.36563	1.21	0.2282
a3	March Intercept	1	0.11147	0.24588	0.45	0.6511
a4	April Intercept	1	0.10227	0.18598	0.55	0.5833
a5	May Intercept	1	0.13218	0.14967	0.88	0.3788
a6	June Intercept	1	0.03807	0.12398	0.31	0.7593

Multiple Regression Analysis to Explain Buckhorn Springs Flow

The REG Procedure
Model: MODEL1
Dependent Variable: BTOTAL Buckhorn Sp. (cfs)

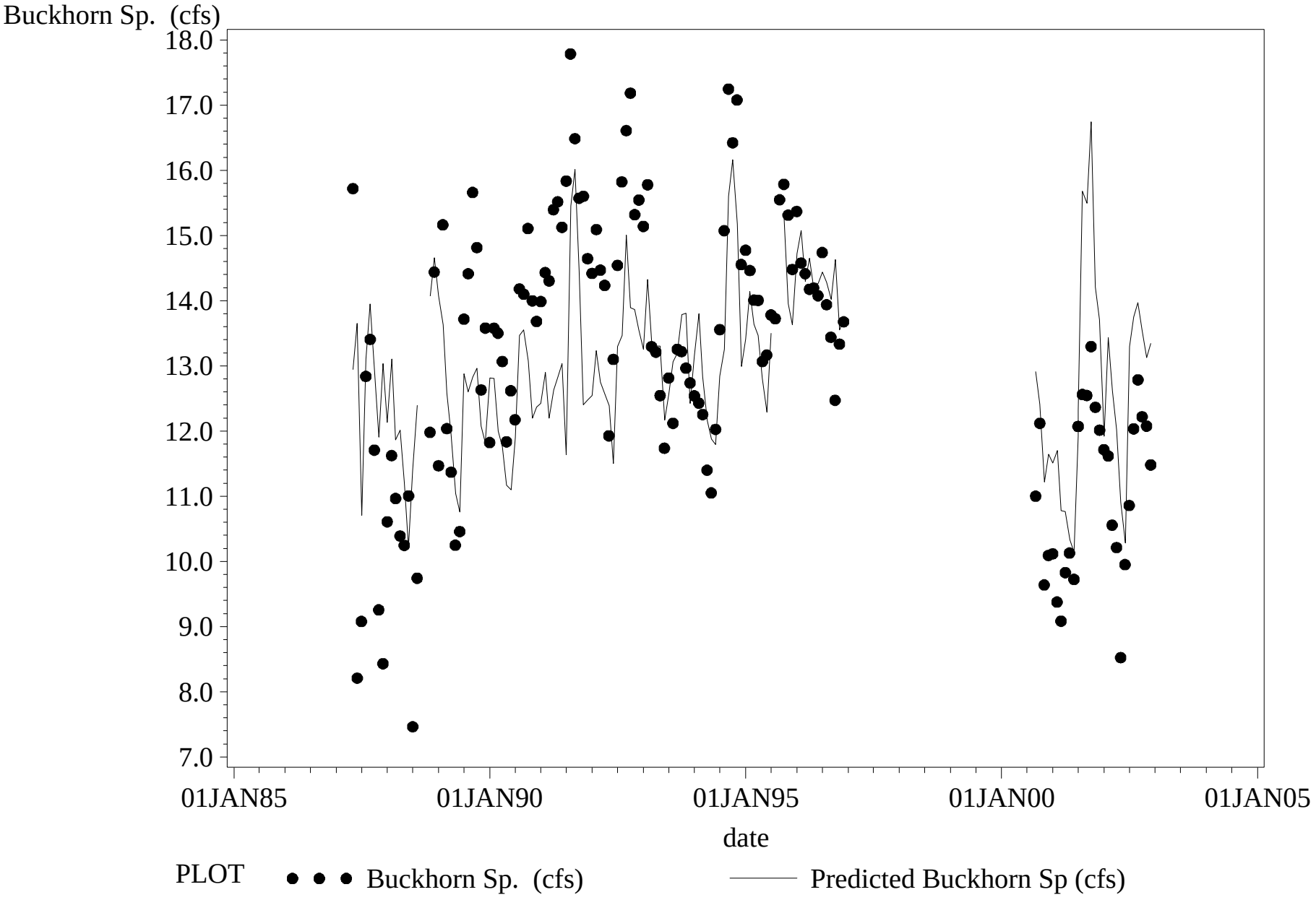
Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a7	July Intercept	1	0.08928	0.10111	0.88	0.3789
a8	August Intercept	1	0.01959	0.09217	0.21	0.8320
a9	September Intercept	1	0.03160	0.08268	0.38	0.7030
a10	October Intercept	1	0.02350	0.07149	0.33	0.7429
a11	November Intercept	1	-0.02396	0.06290	-0.38	0.7039
LTOTAL	Lithia Sp. (cfs)	1	0.13449	0.01911	7.04	<.0001
lar_flow3	Alafia River at Lithis Flow (cfs at month-3)	1	-0.00088778	0.00043147	-2.06	0.0417

Display 5
Diagnostic Plot for Buckhorn Springs Flow Model

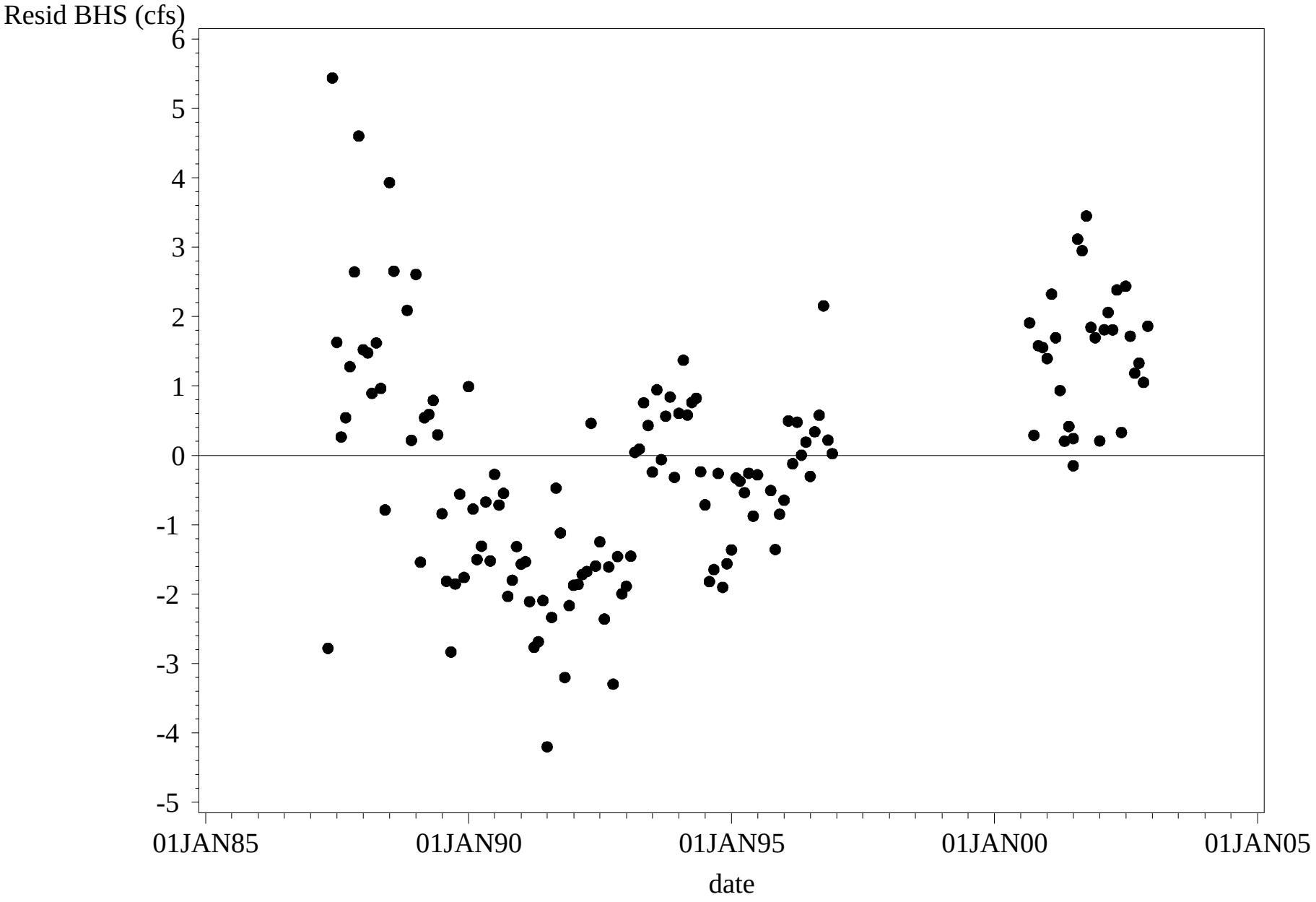


Display 6

Diagnostic Plot for Buckhorn Springs Flow Model

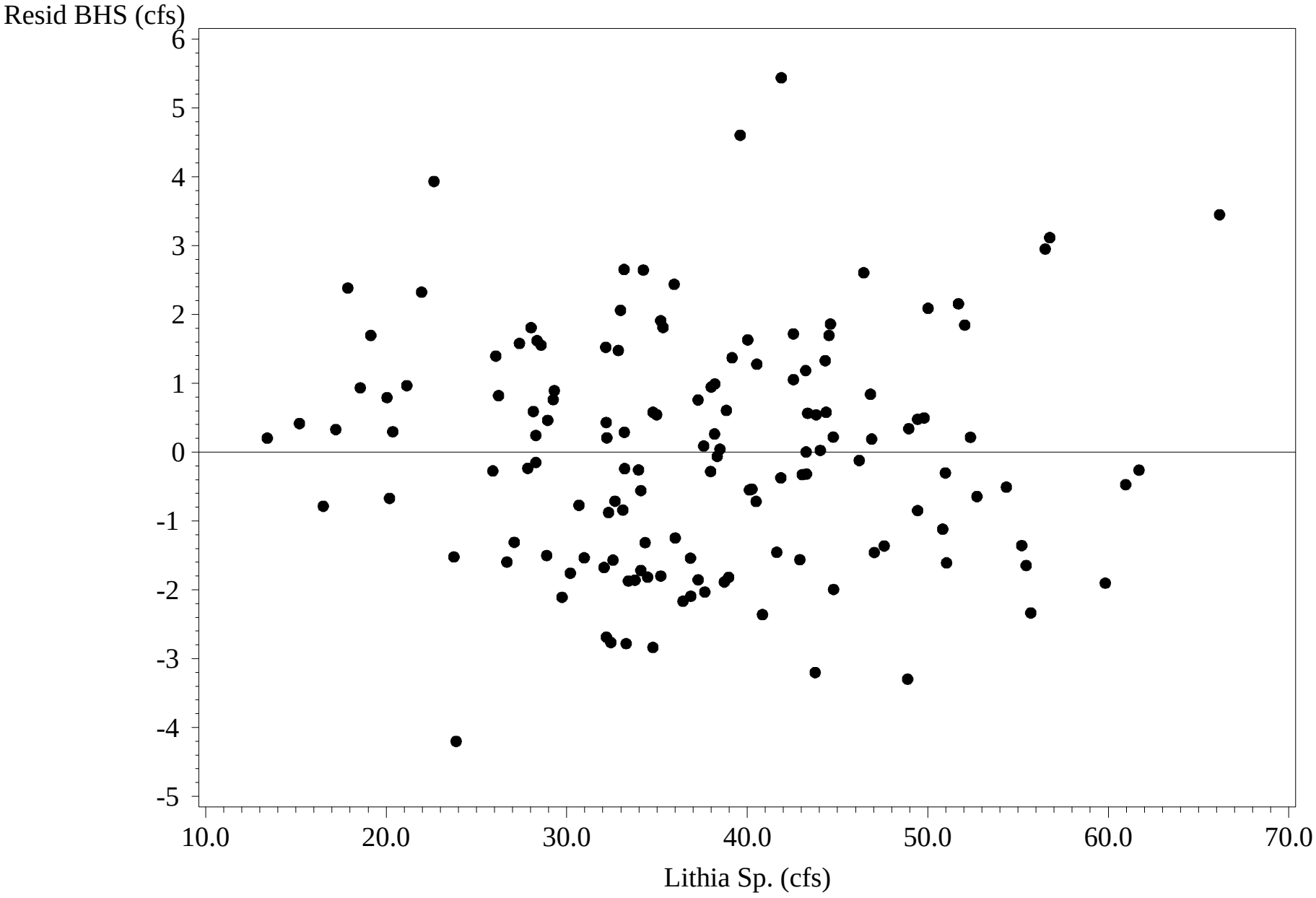


Display 7
Diagnostic Plot for Buckhorn Springs Flow Model



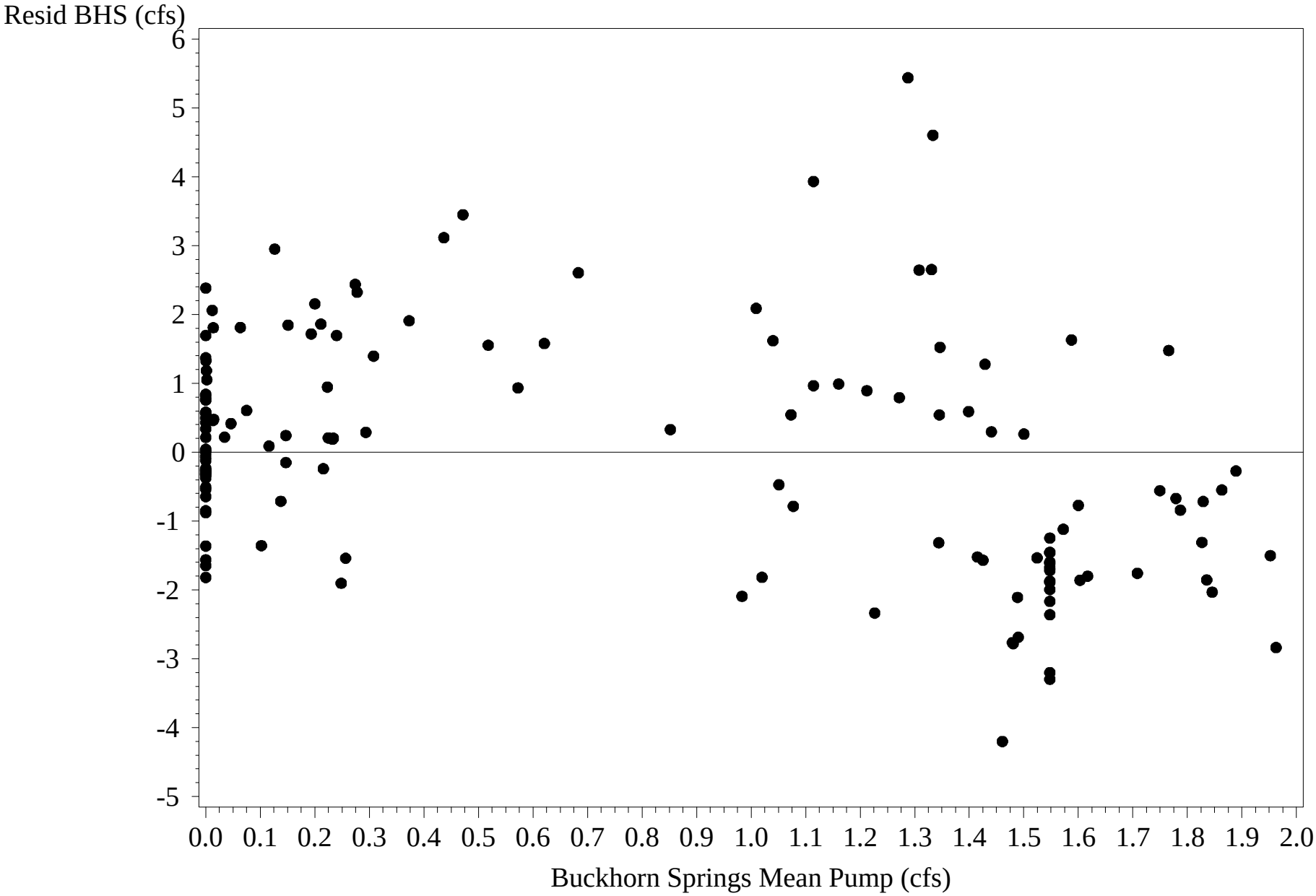
Display 8

Diagnostic Plot for Buckhorn Springs Flow Model



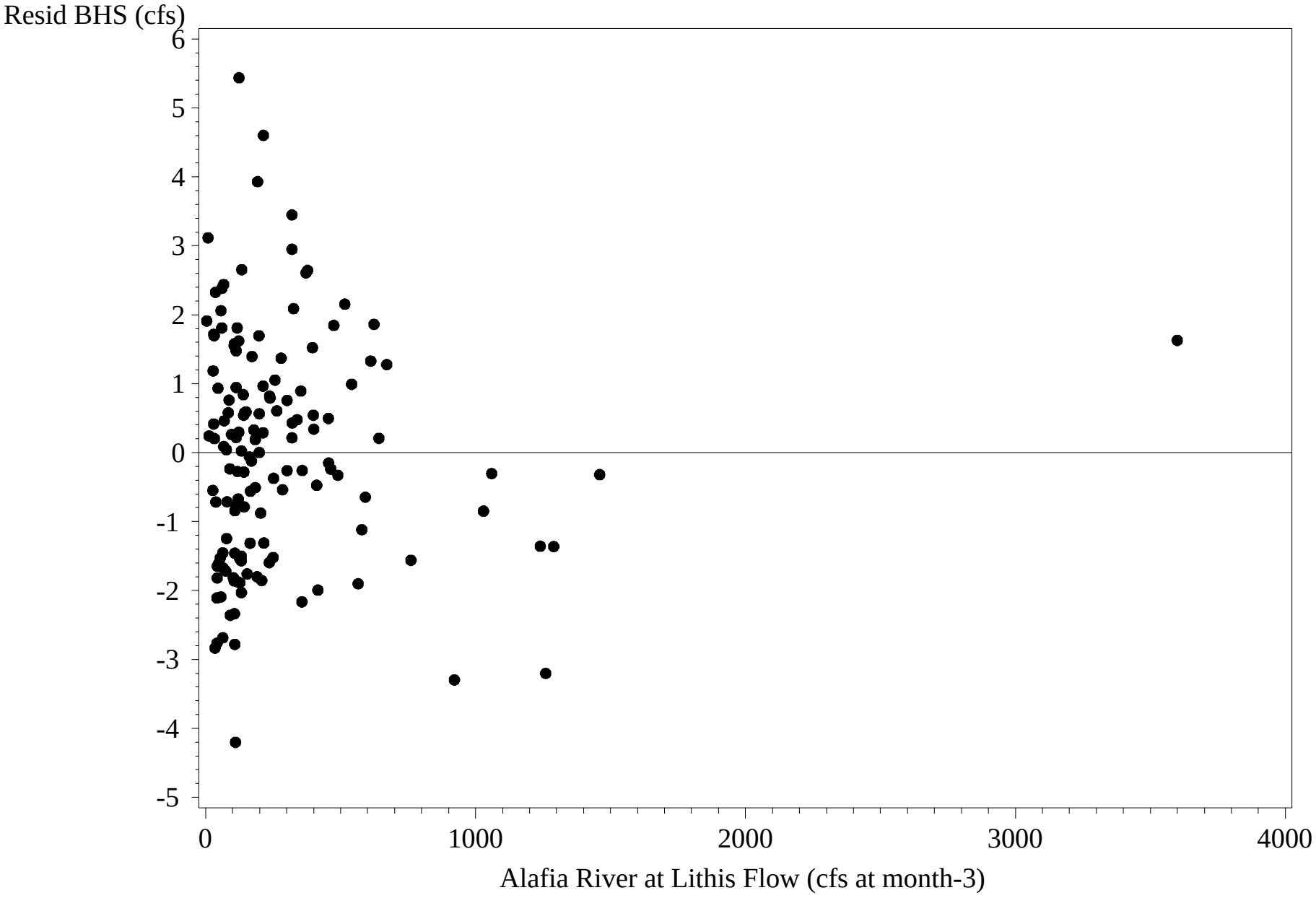
Display 9

Diagnostic Plot for Buckhorn Springs Flow Model



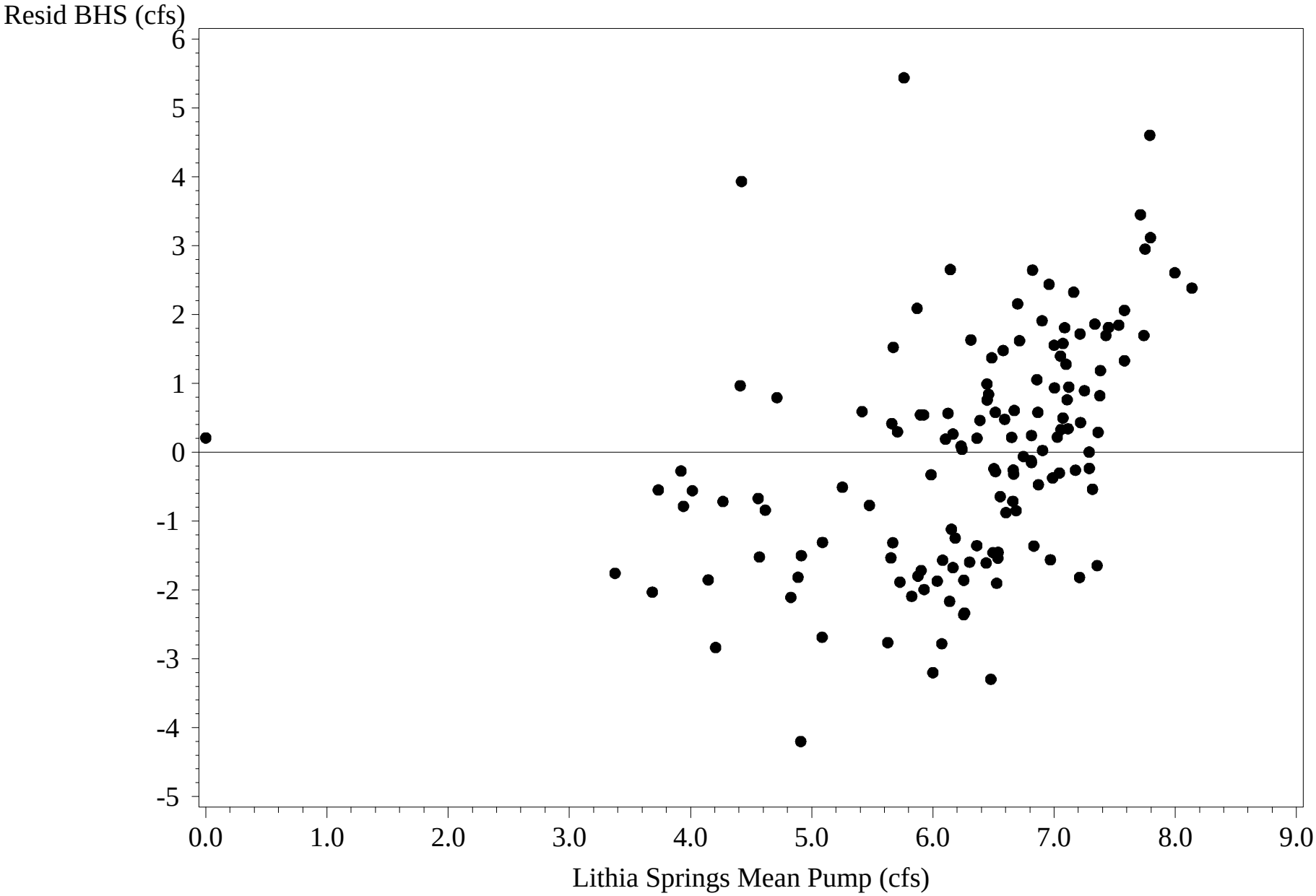
Display 10

Diagnostic Plot for Buckhorn Springs Flow Model



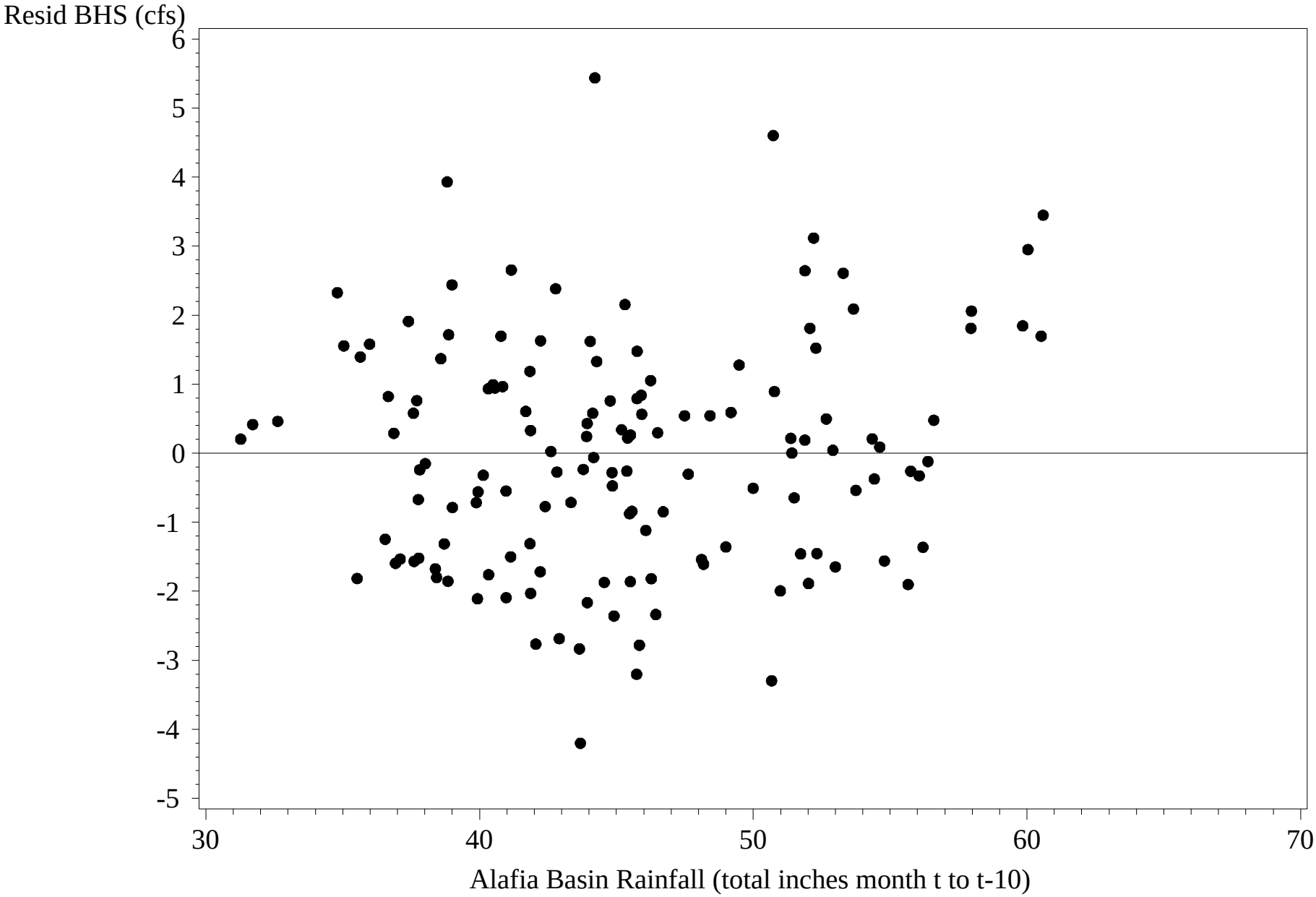
Display 11

Diagnostic Plot for Buckhorn Springs Flow Model



Display 12

Diagnostic Plot for Buckhorn Springs Flow Model



Appendix 2B
Regressions to predict ungaged flows from measured hydrologic data

Objective

The objective of this task was to develop a model to predict the ungaged flow to the lower Alafia River for four different zones (groups) based on the historical data (see Figure).

Methods

Candidate explanatory variables were compiled from the historical data for:

- Lithia Springs flow,
- Alafia River flow at the Lithia gage,
- nearby well levels, and
- rainfall records.

Stepwise multiple regression analyses were used to select regression models, and multiple regression analyses were used to estimate the model parameters. Numerous rainfall statistics were included in the analyses. Rainfall (in/day) from the South Central gage was used in the analyses. The regression parameters were defined as follows:

- srain_3 = rain on day t + rain on day (t-1) + … + rain on day (t-3)
- curain_1 = rain on day (t-1) raised to the third power
- lithia_flow = the gaged flow at the Lithia gage (cfs)
- srain_8 = rain on day t + rain on day (t-1) + … + rain on day (t-8)

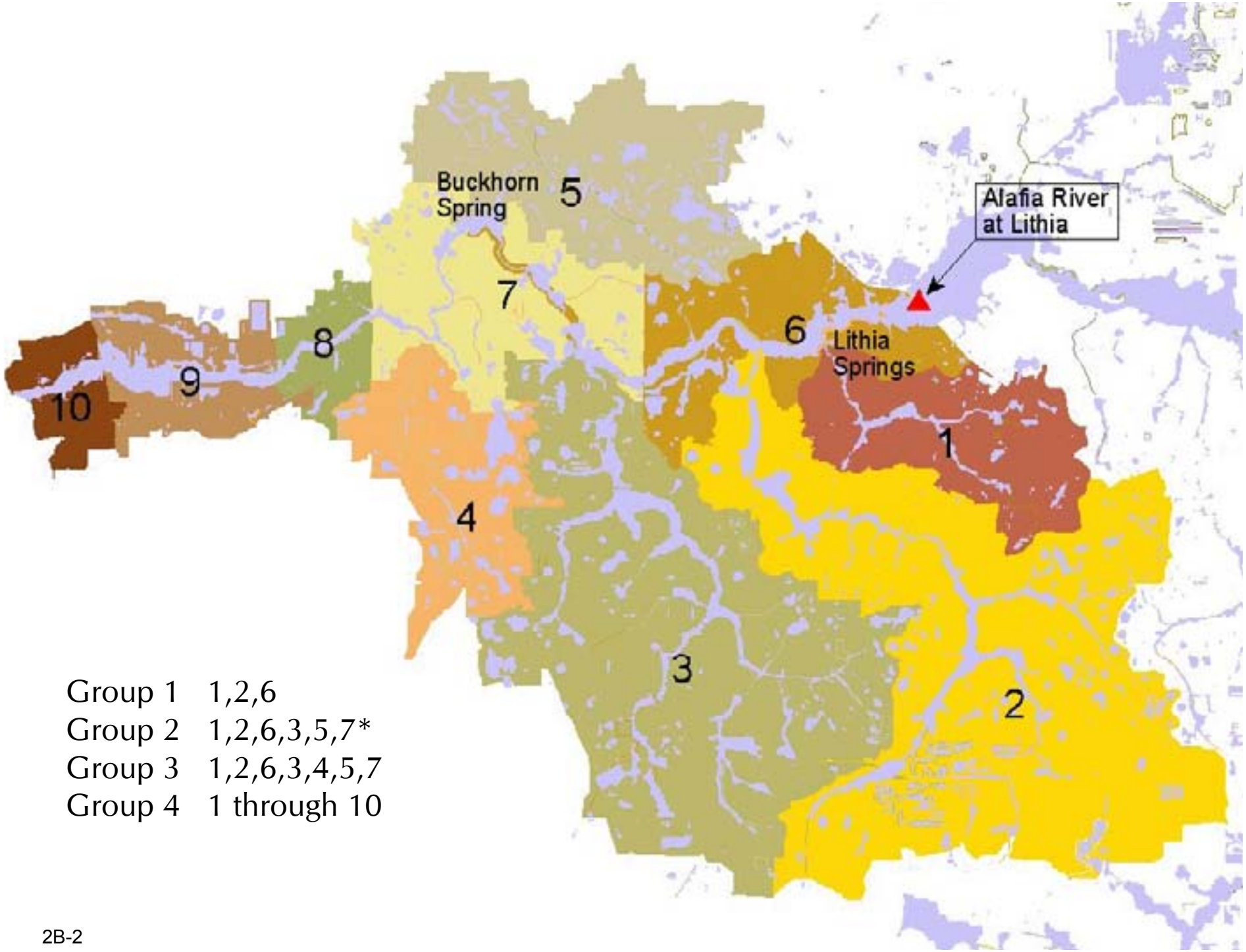
The groups are defined as follows (see map):

- Group 1 = subbasins 1, 2, and 6
- Group 2 = subbasins 1, 2, 6, 3, 5, and half of 7
- Group 3 = subbasins 1, 2, 6, 3, 5, 7, and 4
- Group 4 = subbasins 1 through 10

Results

The models explained 77-78% of the variation in total Buckhorn Springs flow (r^2=0.77-0.78), and the regressions were highly significant ($p>F < 0.0001$, and all slopes were highly significantly different from zero). Interaction terms and monthly specific intercepts did not improve the fit of the models.

Model statistics and diagnostic plots follow.



Group 1 1,2,6
Group 2 1,2,6,3,5,7*
Group 3 1,2,6,3,4,5,7
Group 4 1 through 10

The REG Procedure
Model: MODEL1
Dependent Variable: group1

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	4	20766708	5191677	3598.28	<.0001
Error	4312	6221456	1442.82371		
Corrected Total	4316	26988164			

Root MSE	37.98452	**R-Square**	0.7695
Dependent Mean	33.76265	**Adj R-Sq**	0.7693
Coeff Var	112.50456		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-7.16925	0.74889	-9.57	<.0001
srain_3	1	30.32997	0.87308	34.74	<.0001
curain_1	1	3.48114	0.07462	46.65	<.0001
lithia_flow	1	0.04184	0.00208	20.09	<.0001
srain_8	1	10.58909	0.55447	19.10	<.0001

The REG Procedure
Model: MODEL1
Dependent Variable: group2

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	4	88622251	22155563	3880.05	<.0001
Error	4312	24622069	5710.12726		
Corrected Total	4316	113244320			

Root MSE	75.56538	**R-Square**	0.7826
Dependent Mean	69.82990	**Adj R-Sq**	0.7824
Coeff Var	108.21350		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-14.79071	1.48982	-9.93	<.0001
srain_3	1	64.89720	1.73688	37.36	<.0001
curain_1	1	7.03830	0.14844	47.41	<.0001
lithia_flow	1	0.08364	0.00414	20.19	<.0001
srain_8	1	21.52122	1.10305	19.51	<.0001

The REG Procedure
Model: MODEL1
Dependent Variable: group3

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	4	121931887	30482972	3887.65	<.0001
Error	4312	33810262	7840.96993		
Corrected Total	4316	155742149			

Root MSE	88.54925	**R-Square**	0.7829
Dependent Mean	81.64522	**Adj R-Sq**	0.7827
Coeff Var	108.45614		

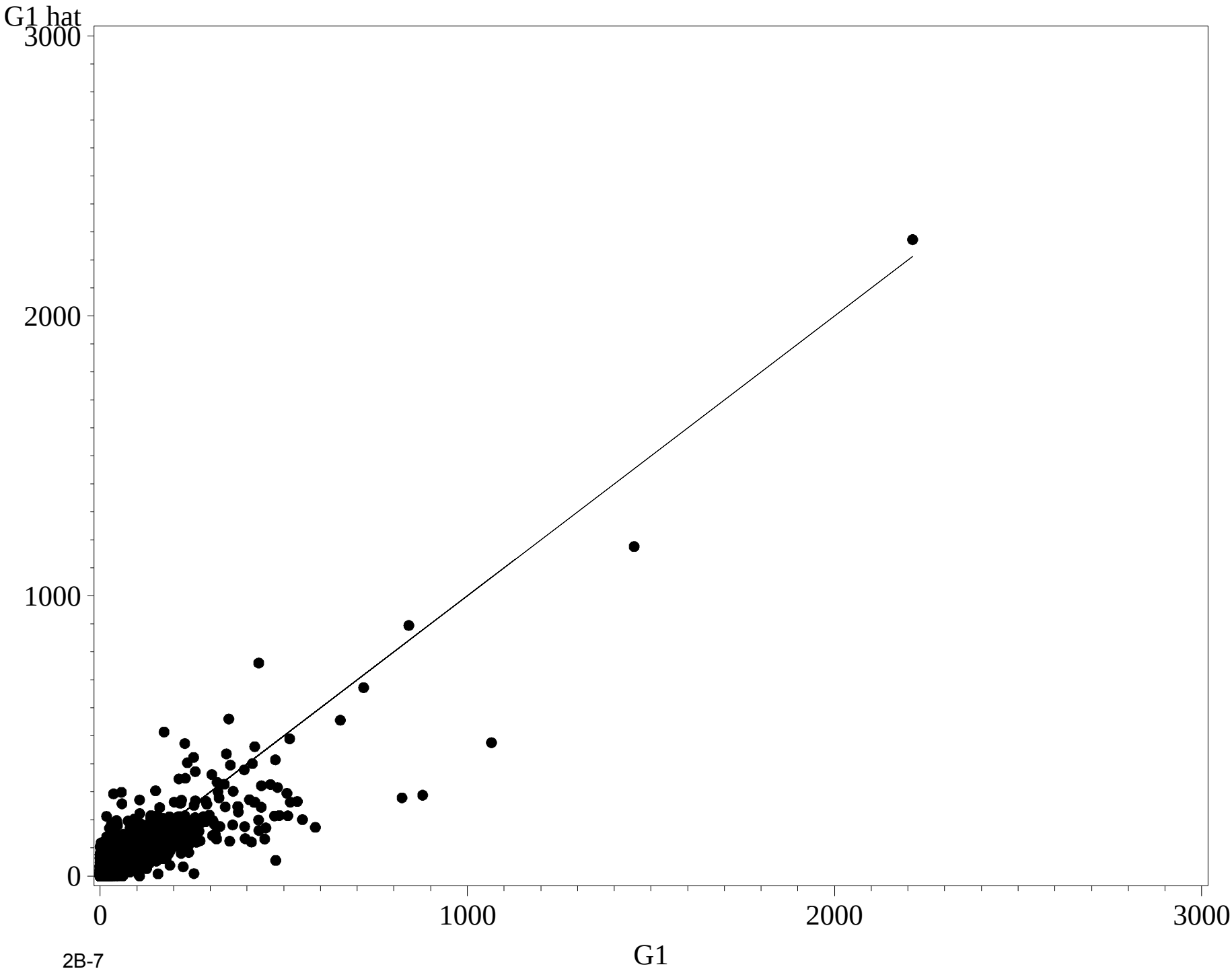
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-17.53673	1.74581	-10.05	<.0001
srain_3	1	76.23887	2.03531	37.46	<.0001
curain_1	1	8.26272	0.17395	47.50	<.0001
lithia_flow	1	0.09765	0.00485	20.11	<.0001
srain_8	1	25.21224	1.29258	19.51	<.0001

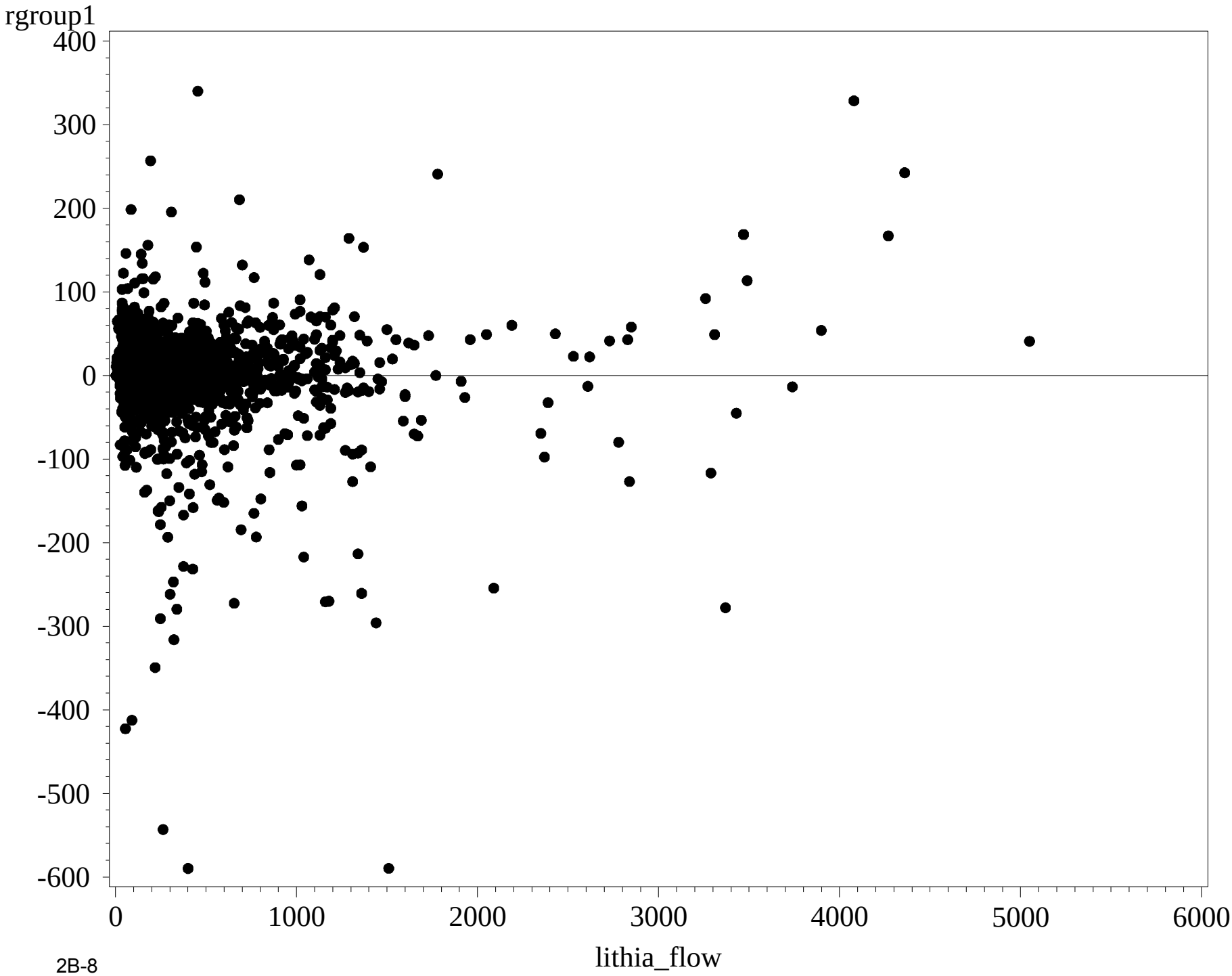
The REG Procedure
Model: MODEL1
Dependent Variable: group4

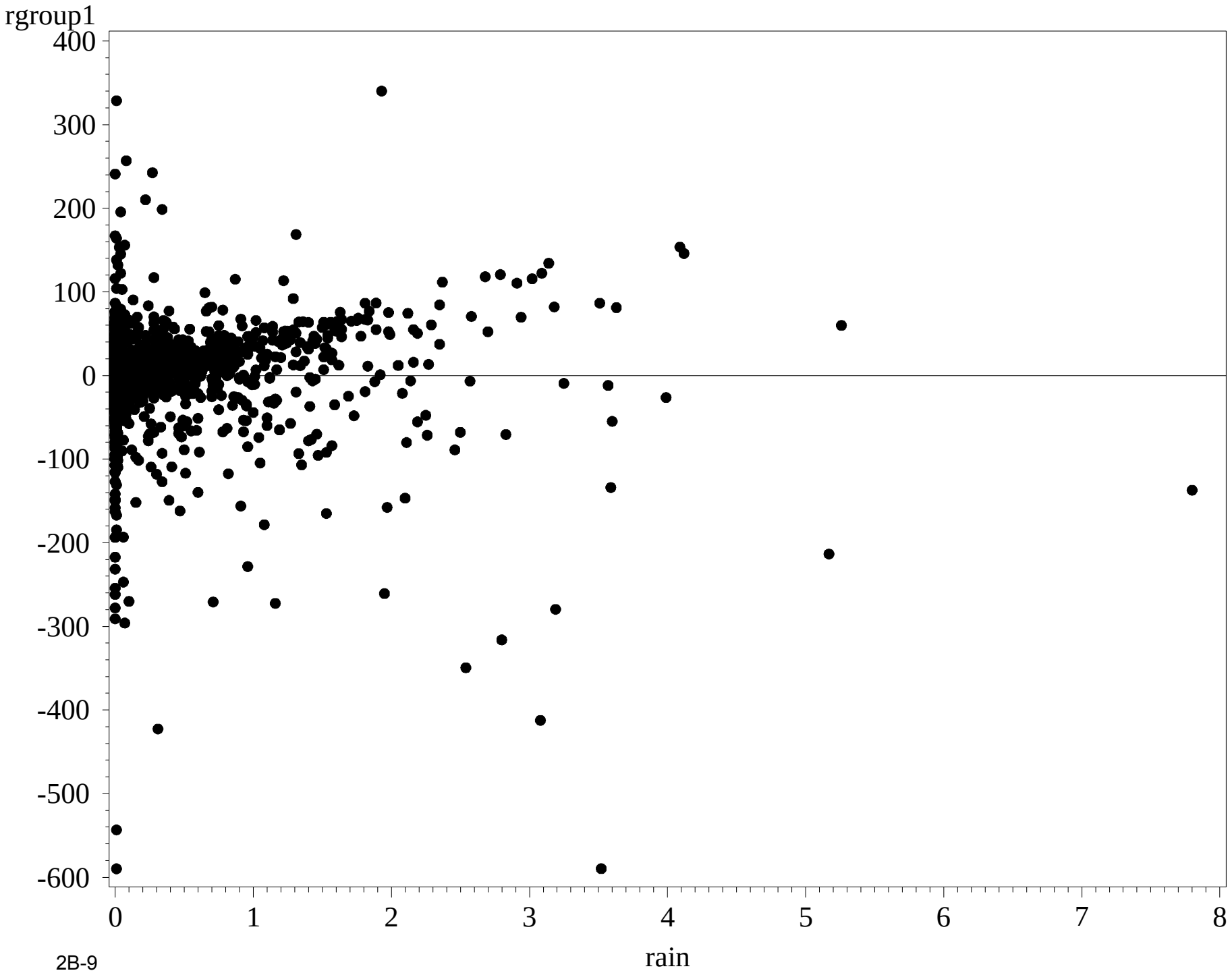
Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	4	136341481	34085370	3999.42	<.0001
Error	4312	36749368	8522.58080		
Corrected Total	4316	173090849			

Root MSE	92.31782	**R-Square**	0.7877
Dependent Mean	88.57717	**Adj R-Sq**	0.7875
Coeff Var	104.22305		

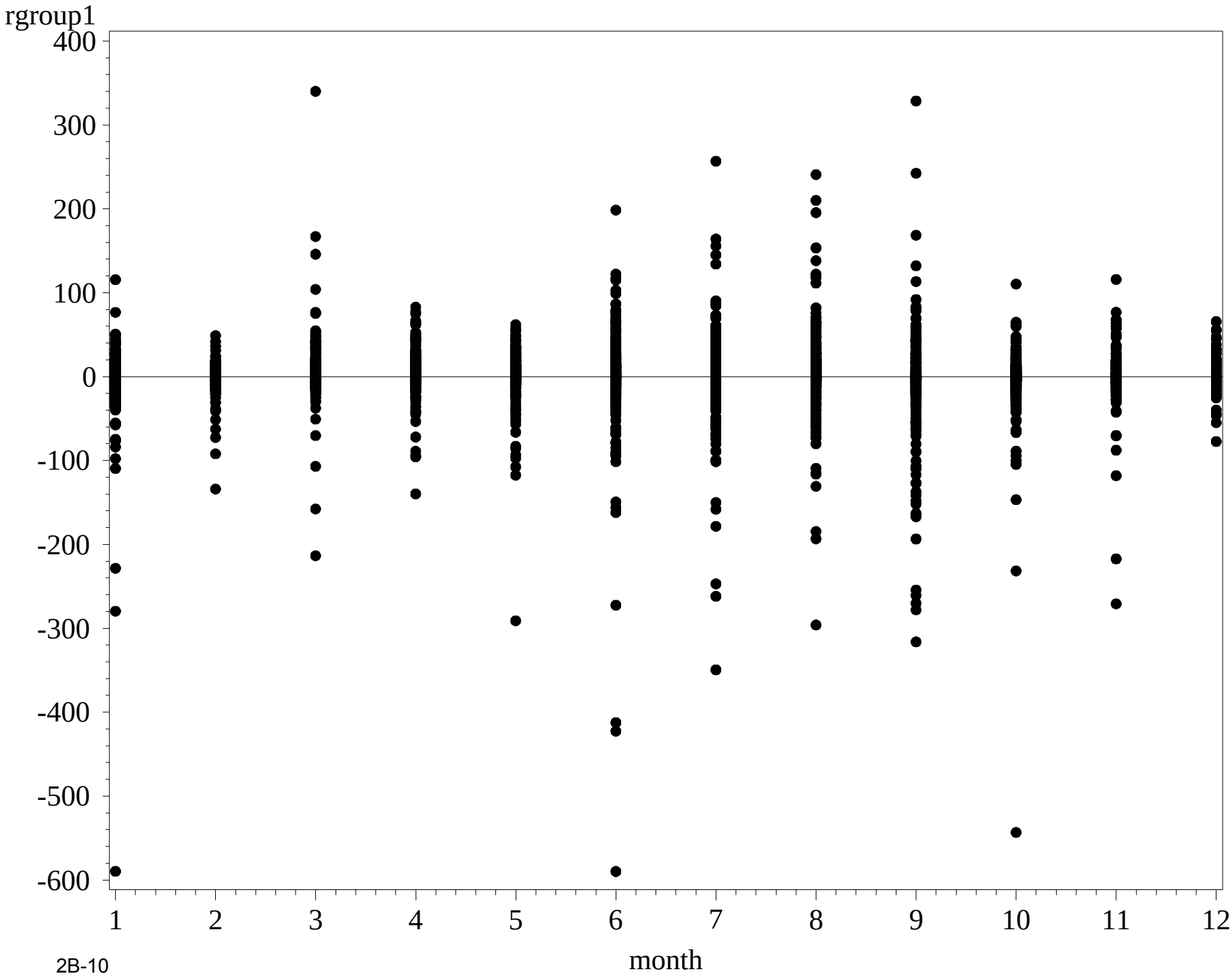
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-18.08167	1.82011	-9.93	<.0001
srain_3	1	78.50117	2.12193	37.00	<.0001
curain_1	1	8.52481	0.18135	47.01	<.0001
lithia_flow	1	0.10930	0.00506	21.59	<.0001
srain_8	1	28.01751	1.34759	20.79	<.0001


G1 hat
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2000
1000
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G1
2B-7

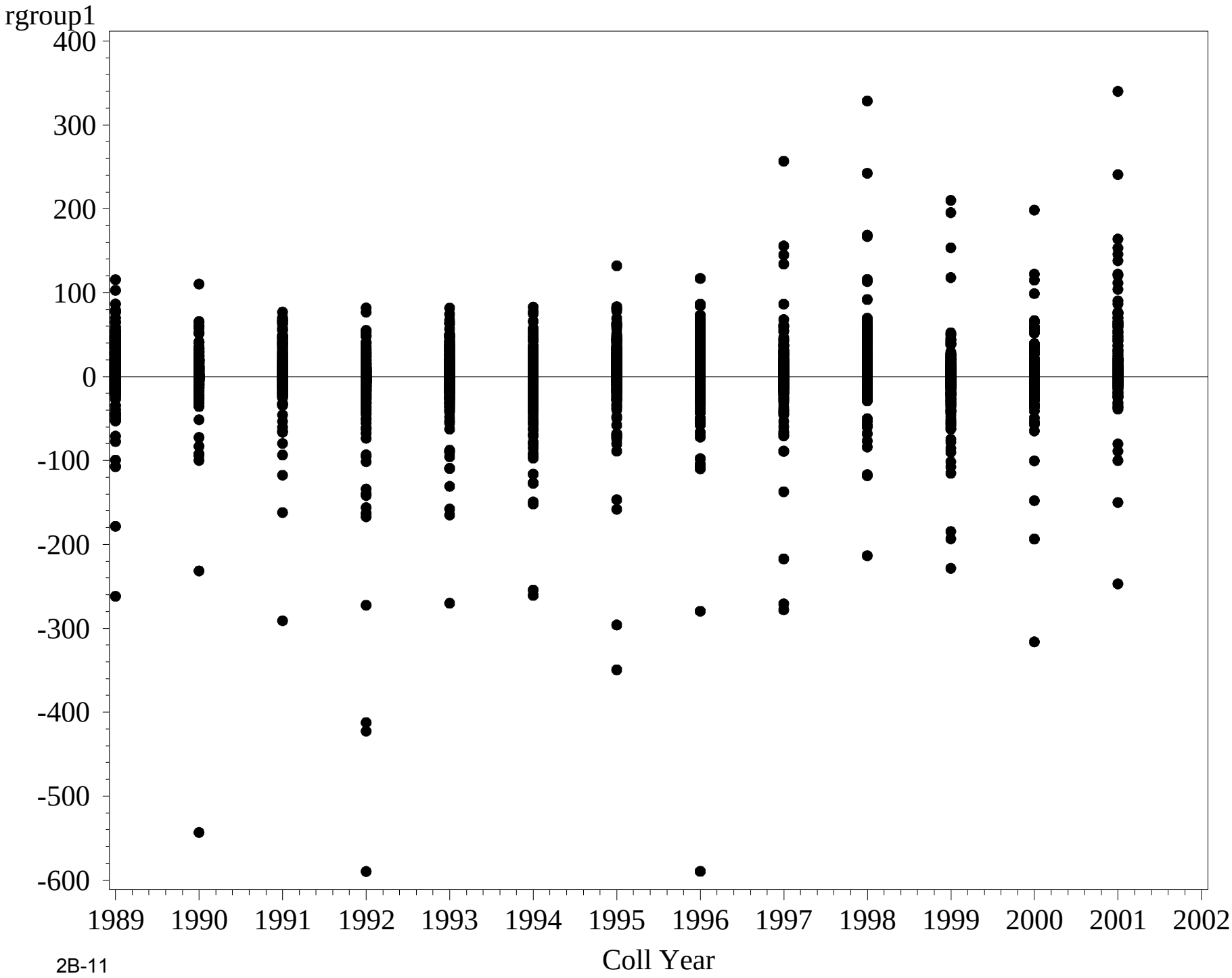

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-500
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2000
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4000
5000
6000
lithia_flow


rgroup1
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300
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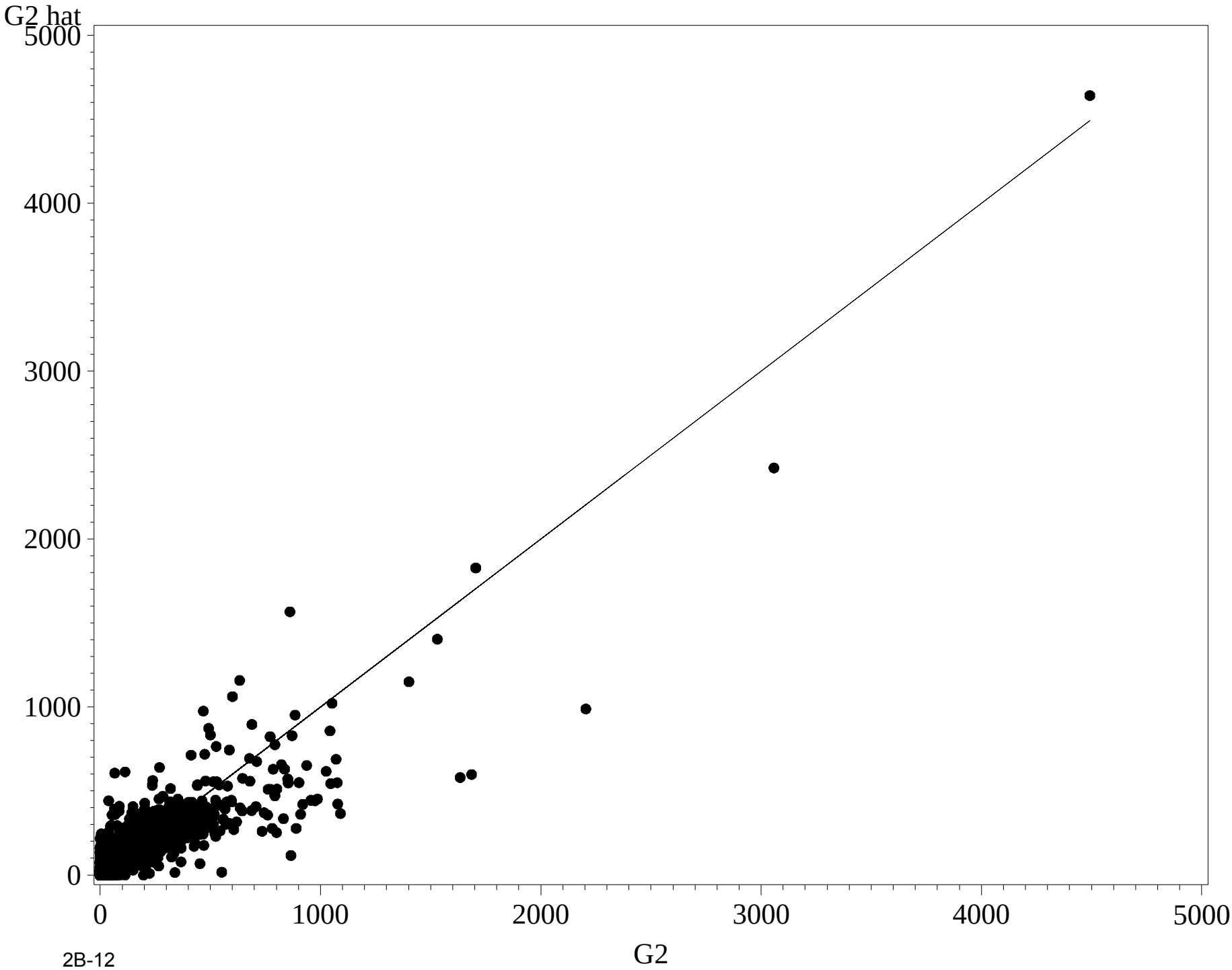
2B-9


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month

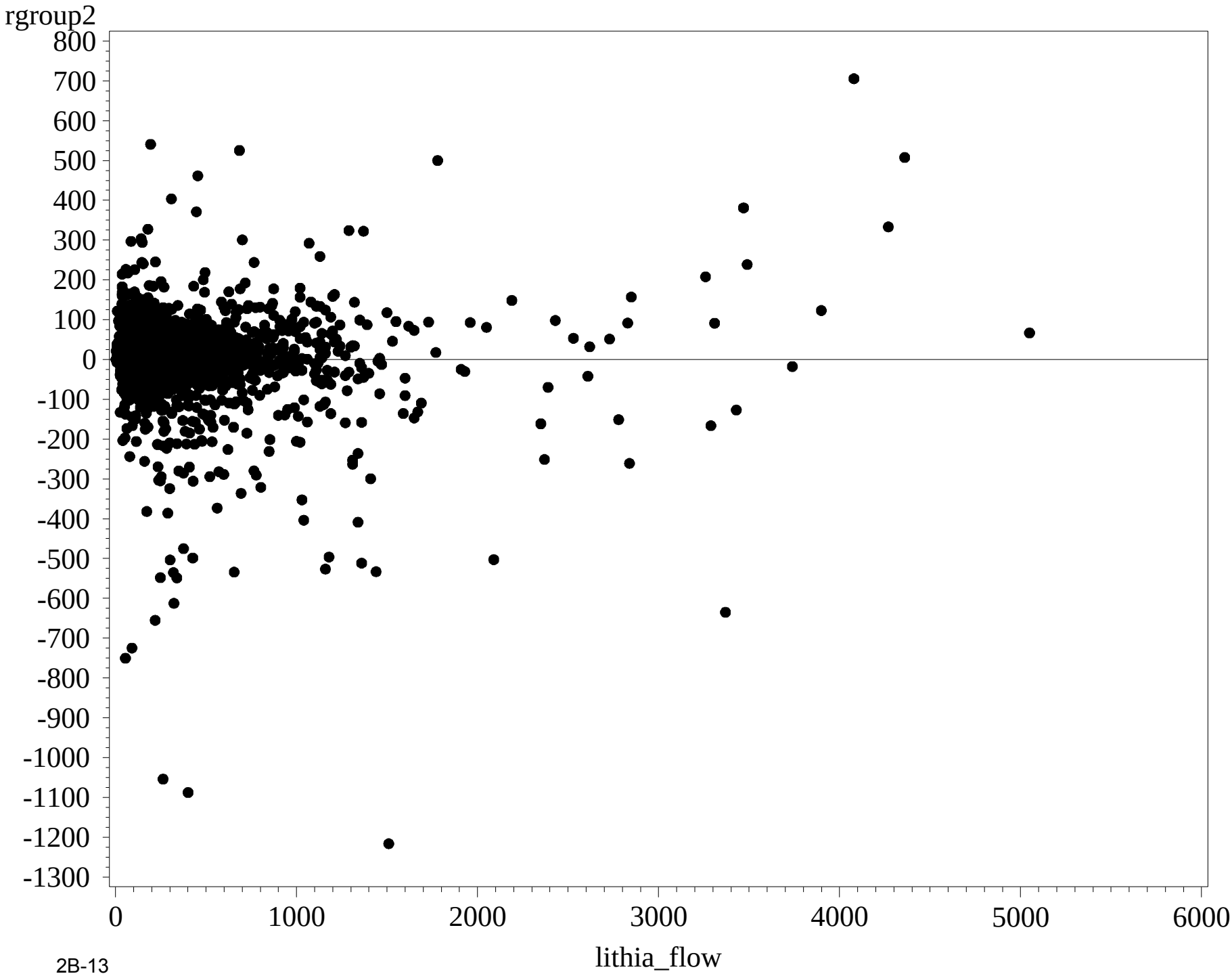
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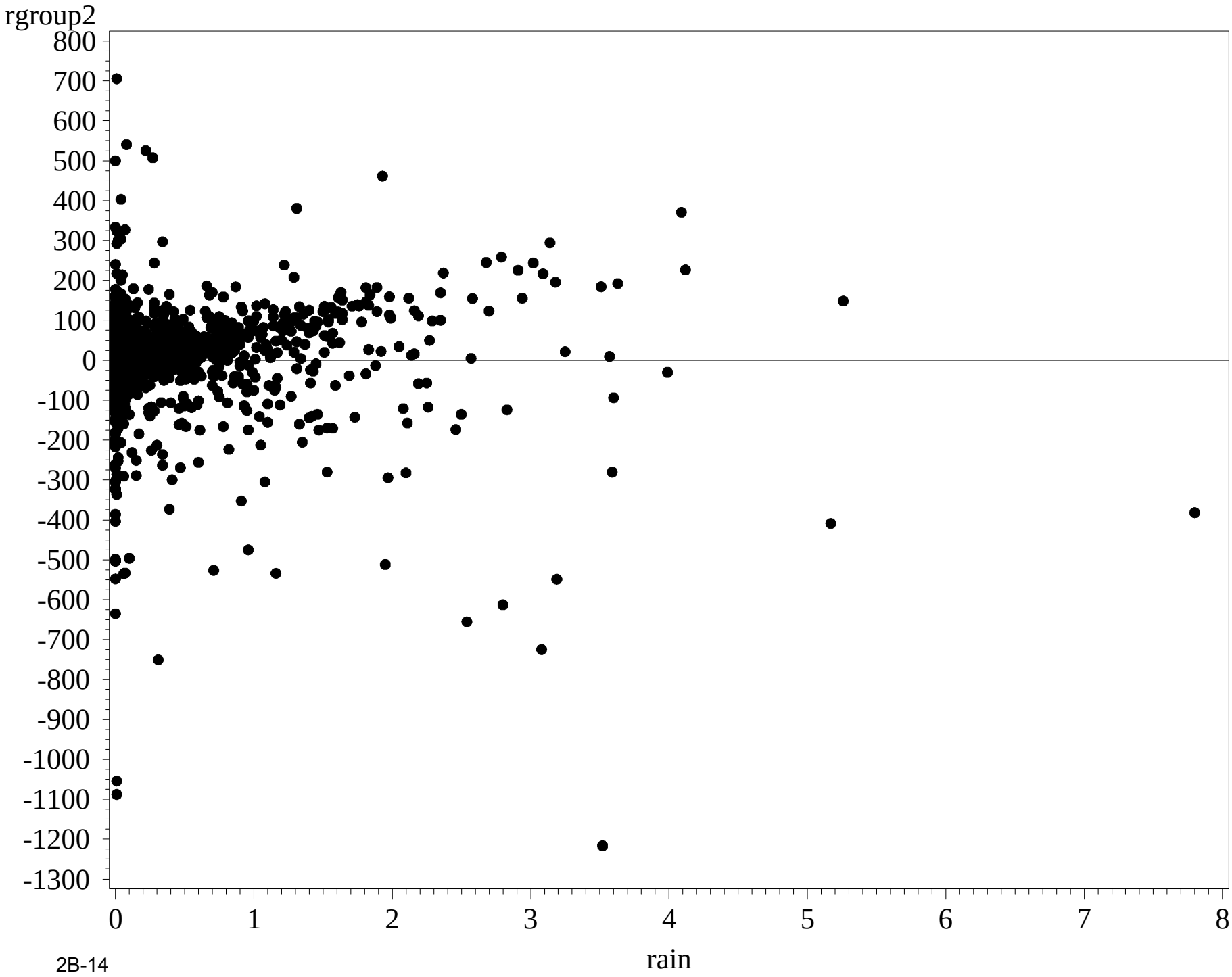

rgroup1
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1999
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2002
Coll Year

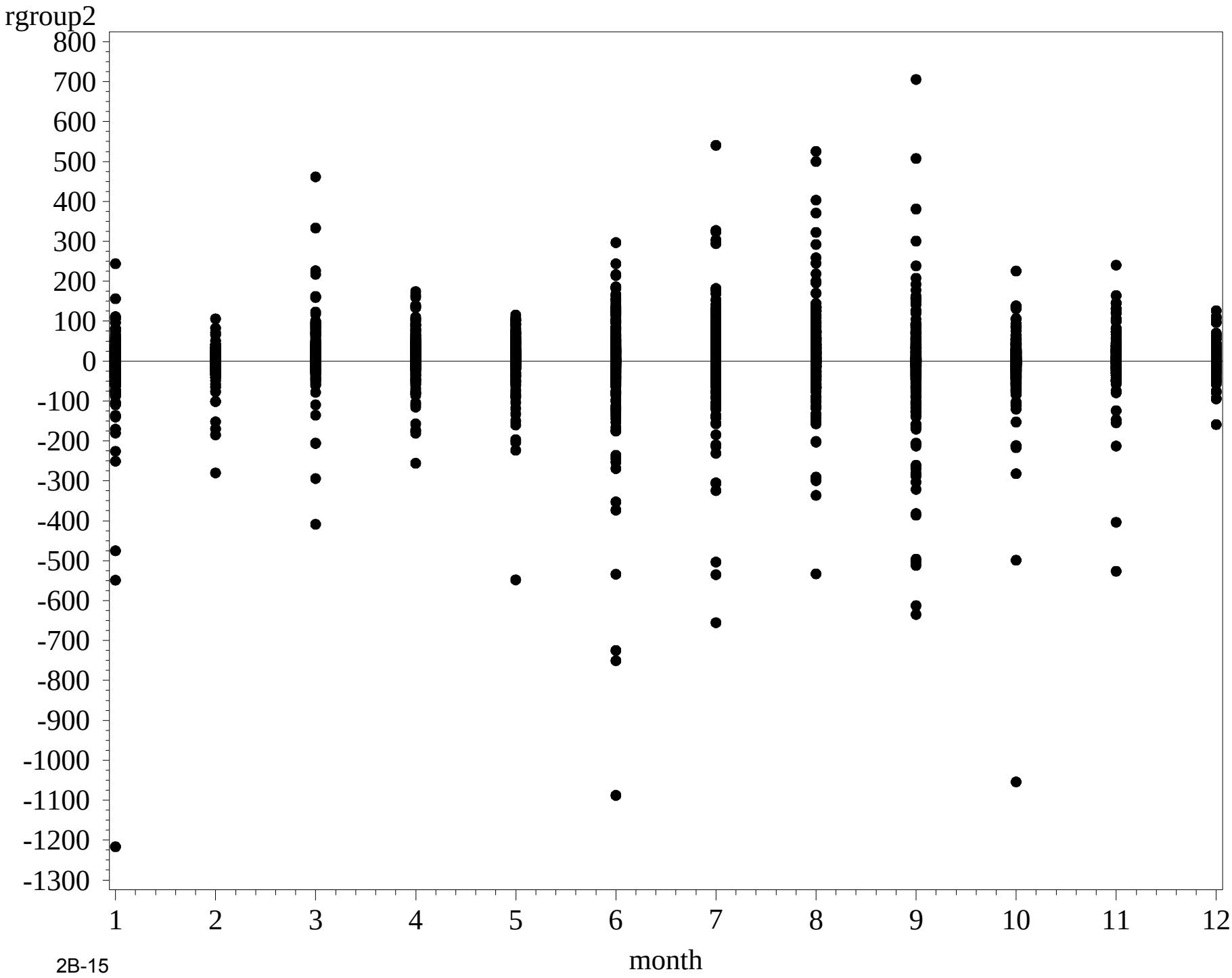
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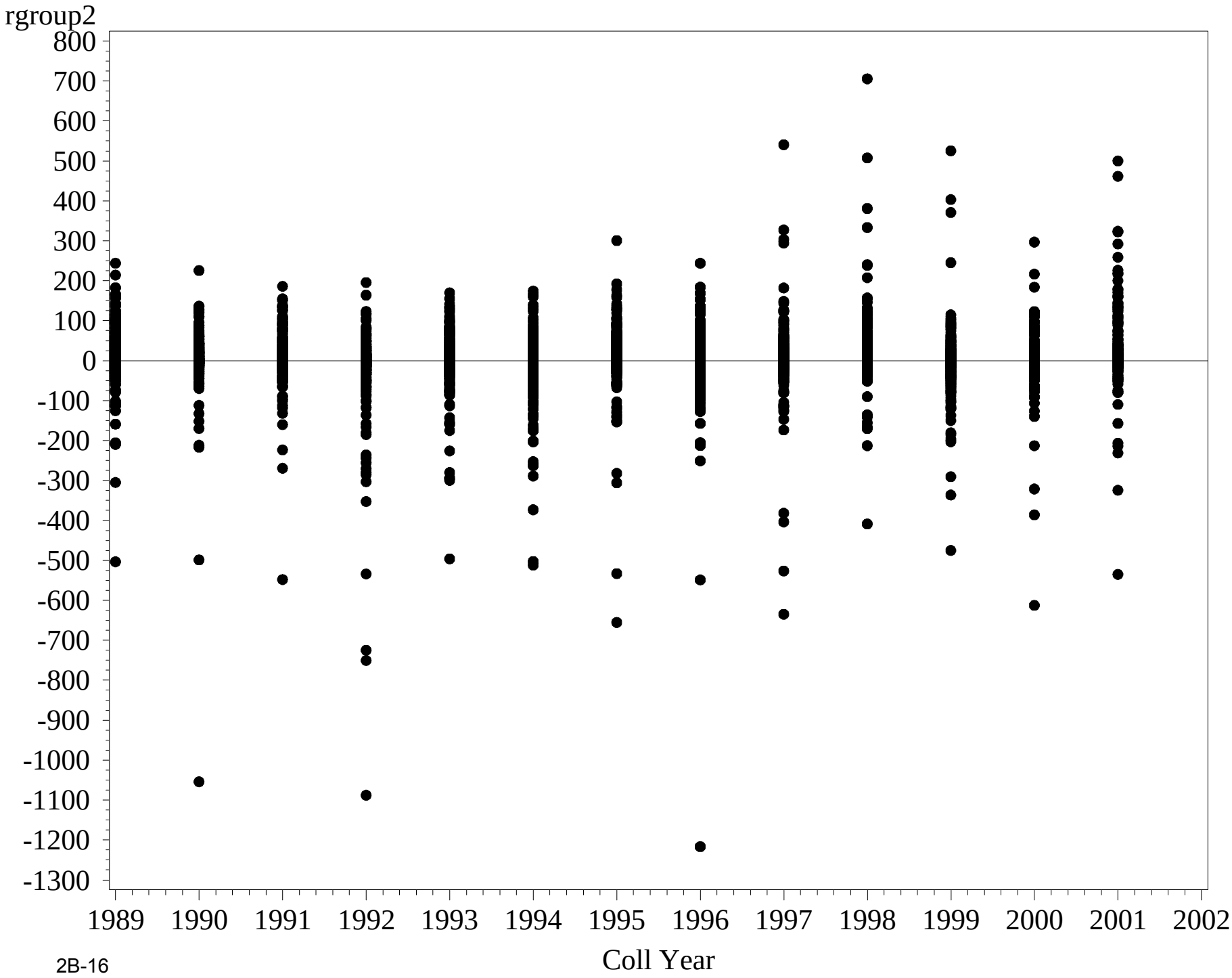


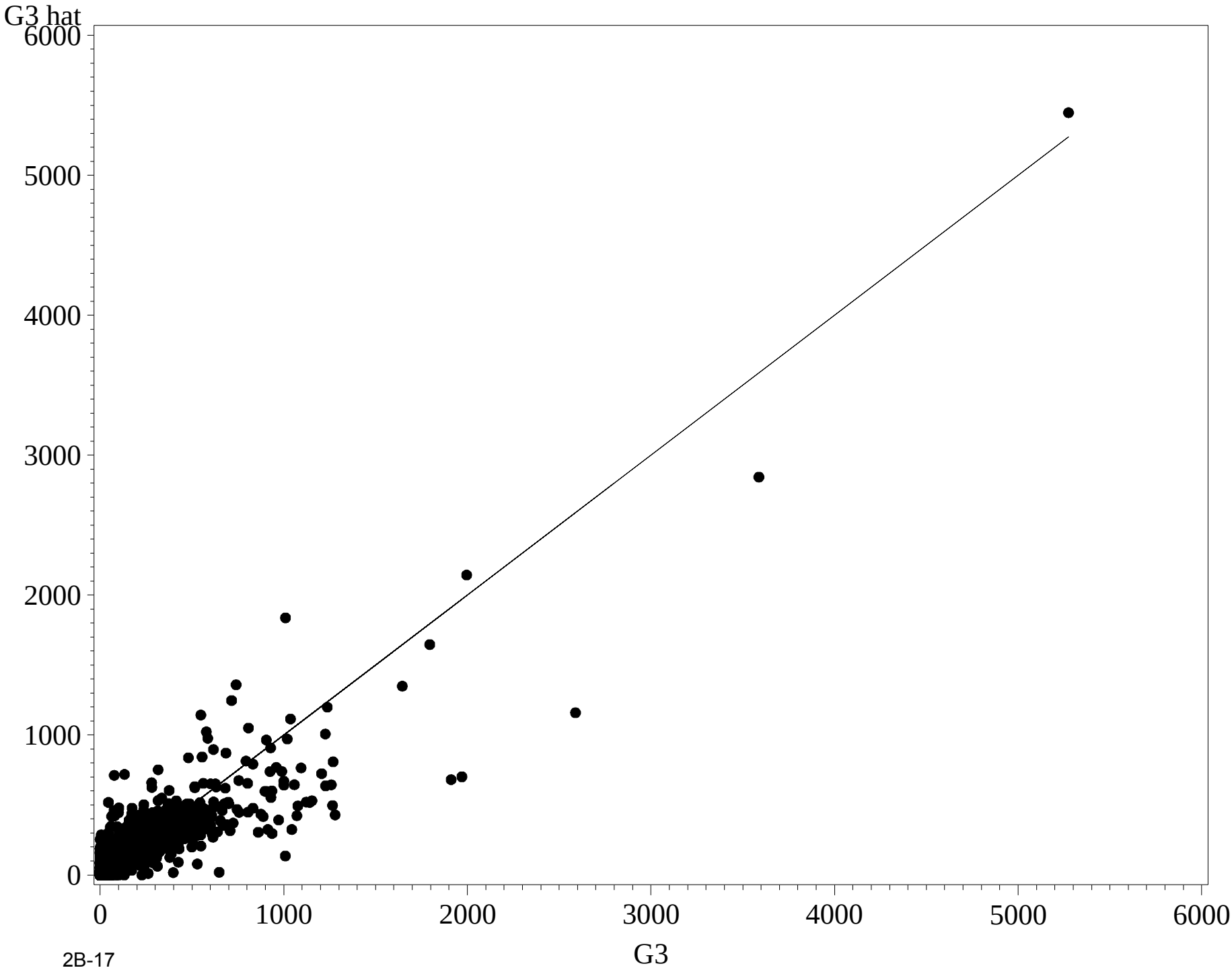
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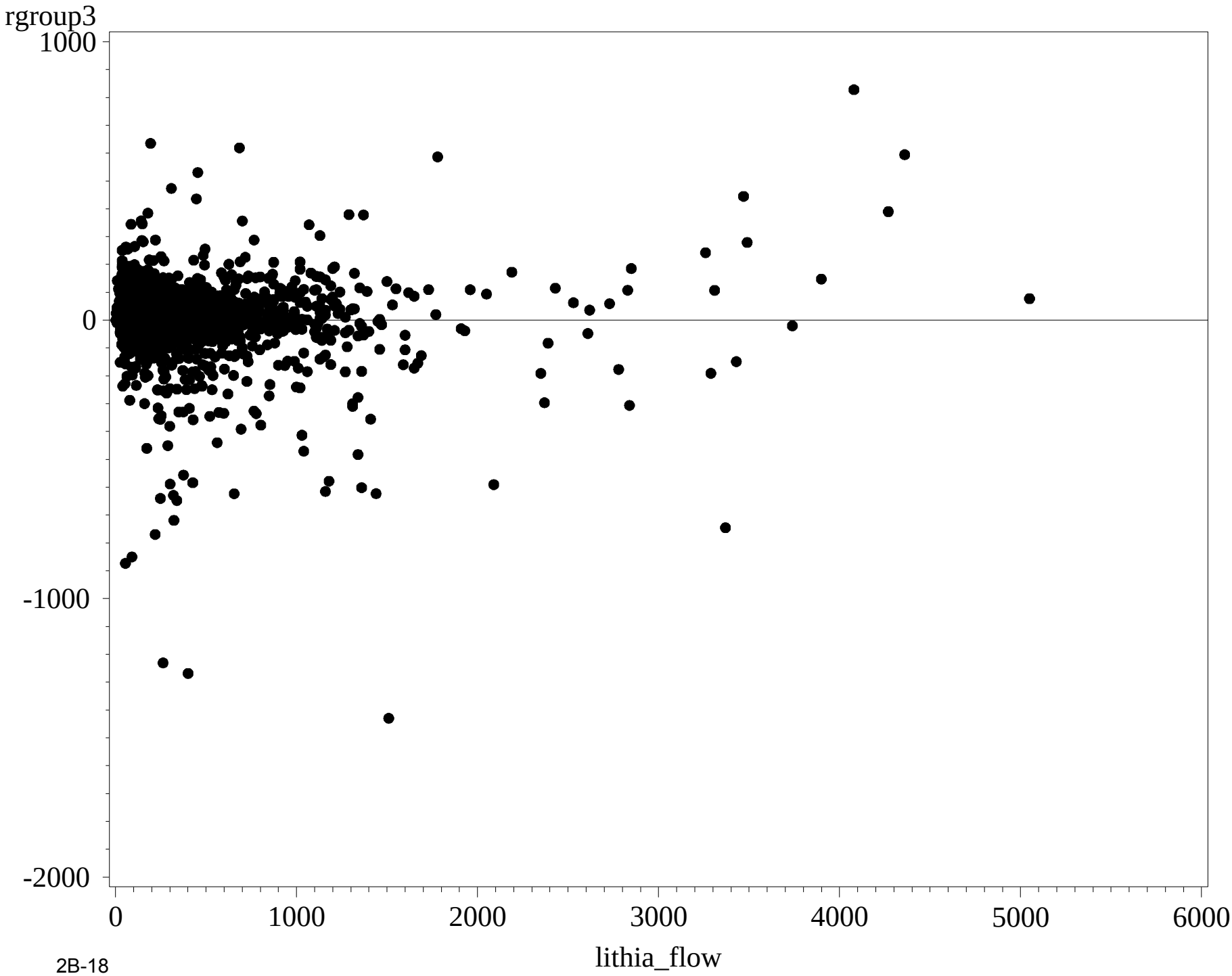

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-1300
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1000
2000
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4000
5000
6000
lithia_flow

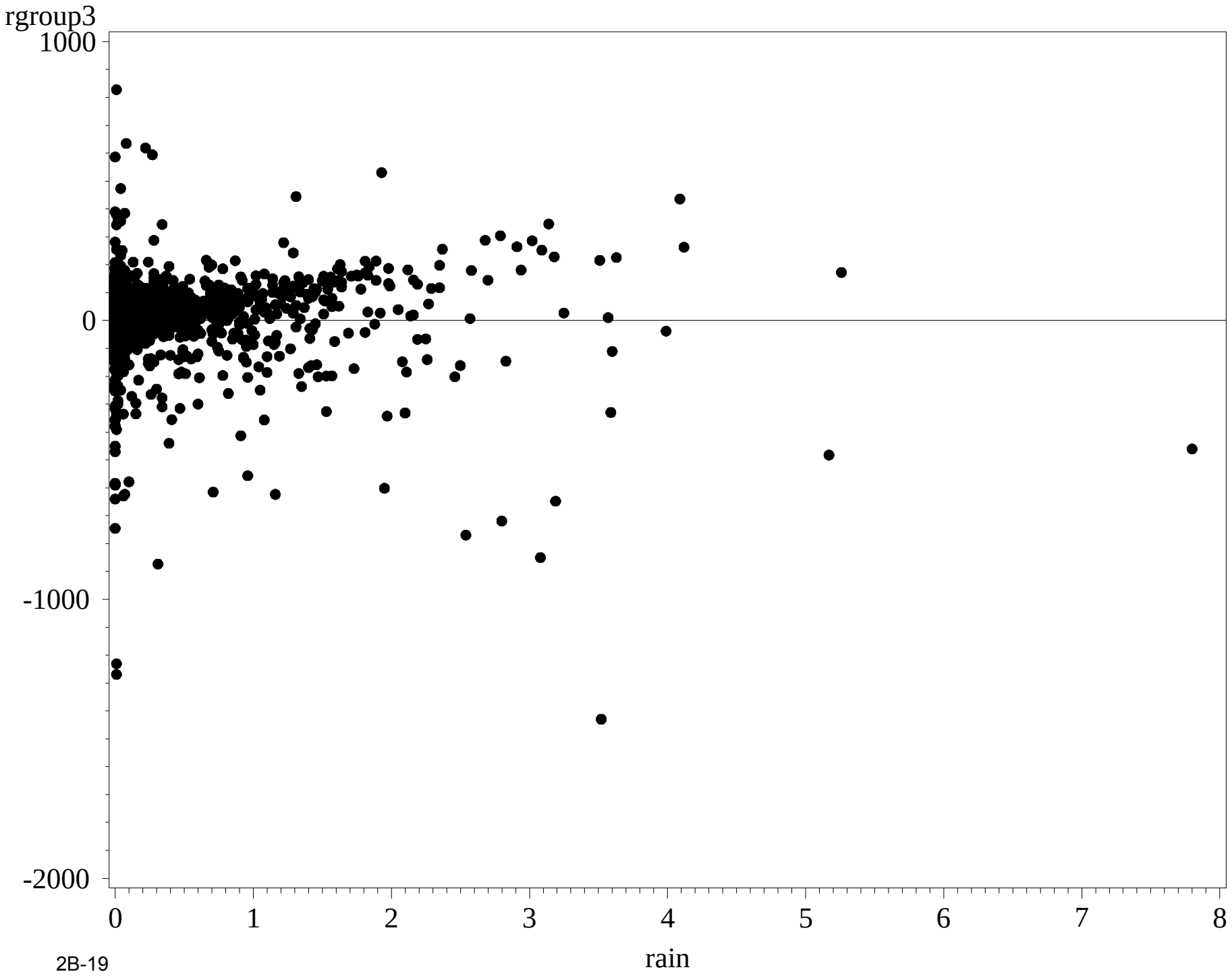

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-500
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-800
-900
-1000
-1100
-1200
-1300
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1
2
3
4
5
6
7
8
rain


rgroup2
800
700
600
500
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300
200
100
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-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
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2B-15

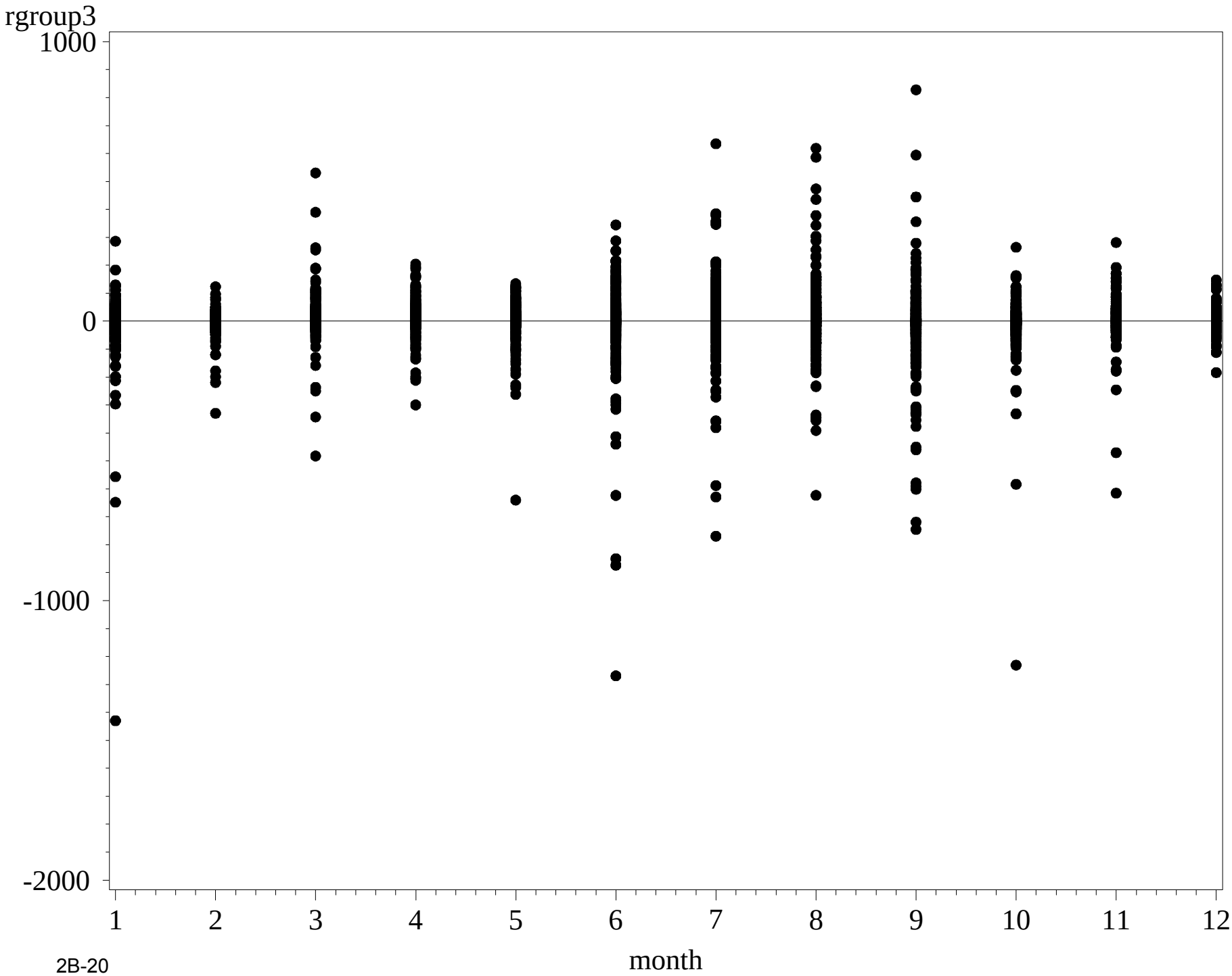

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-400
-500
-600
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-900
-1000
-1100
-1200
-1300
1989
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1991
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1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Coll Year


G3 hat
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6000
G3
2B-17

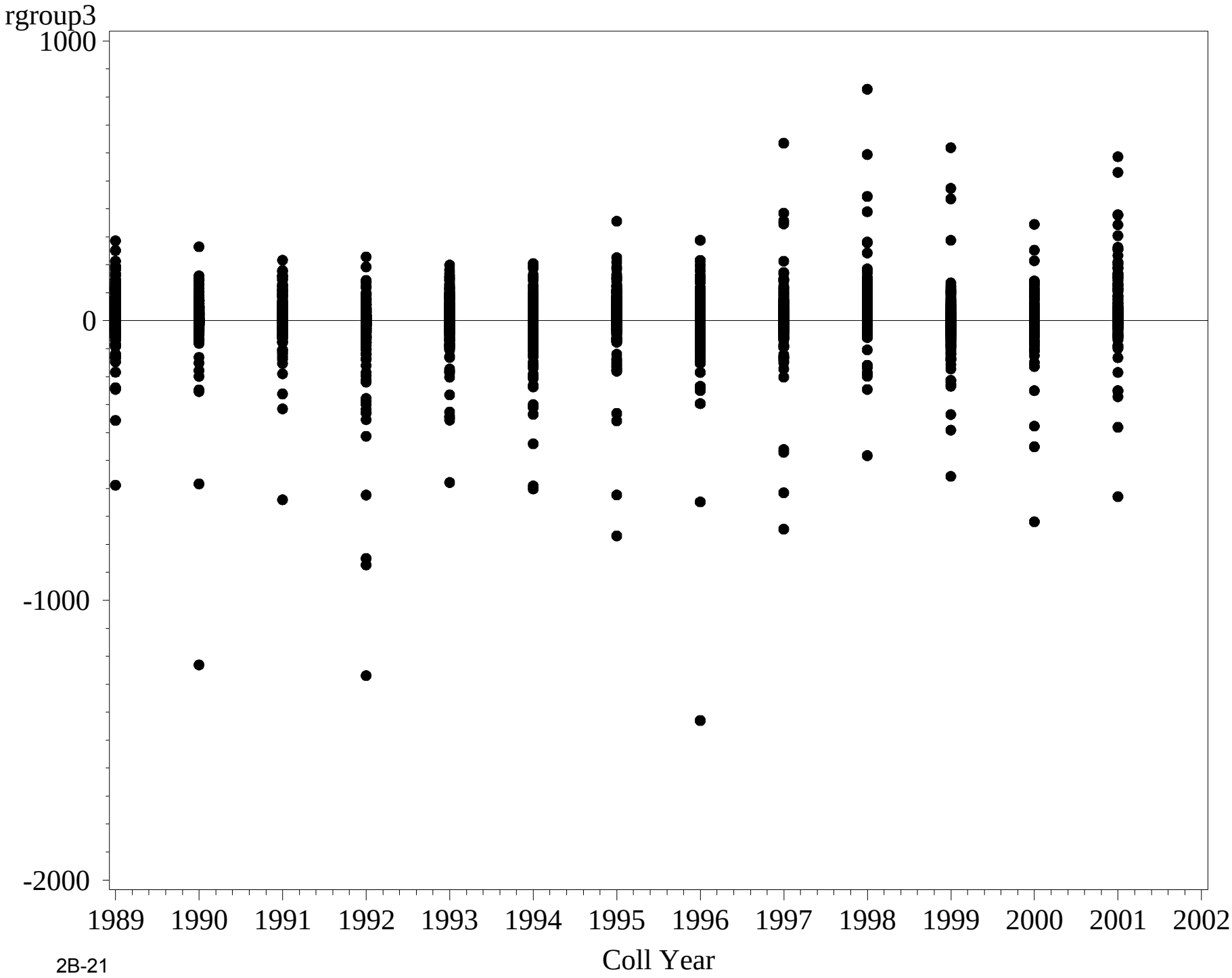

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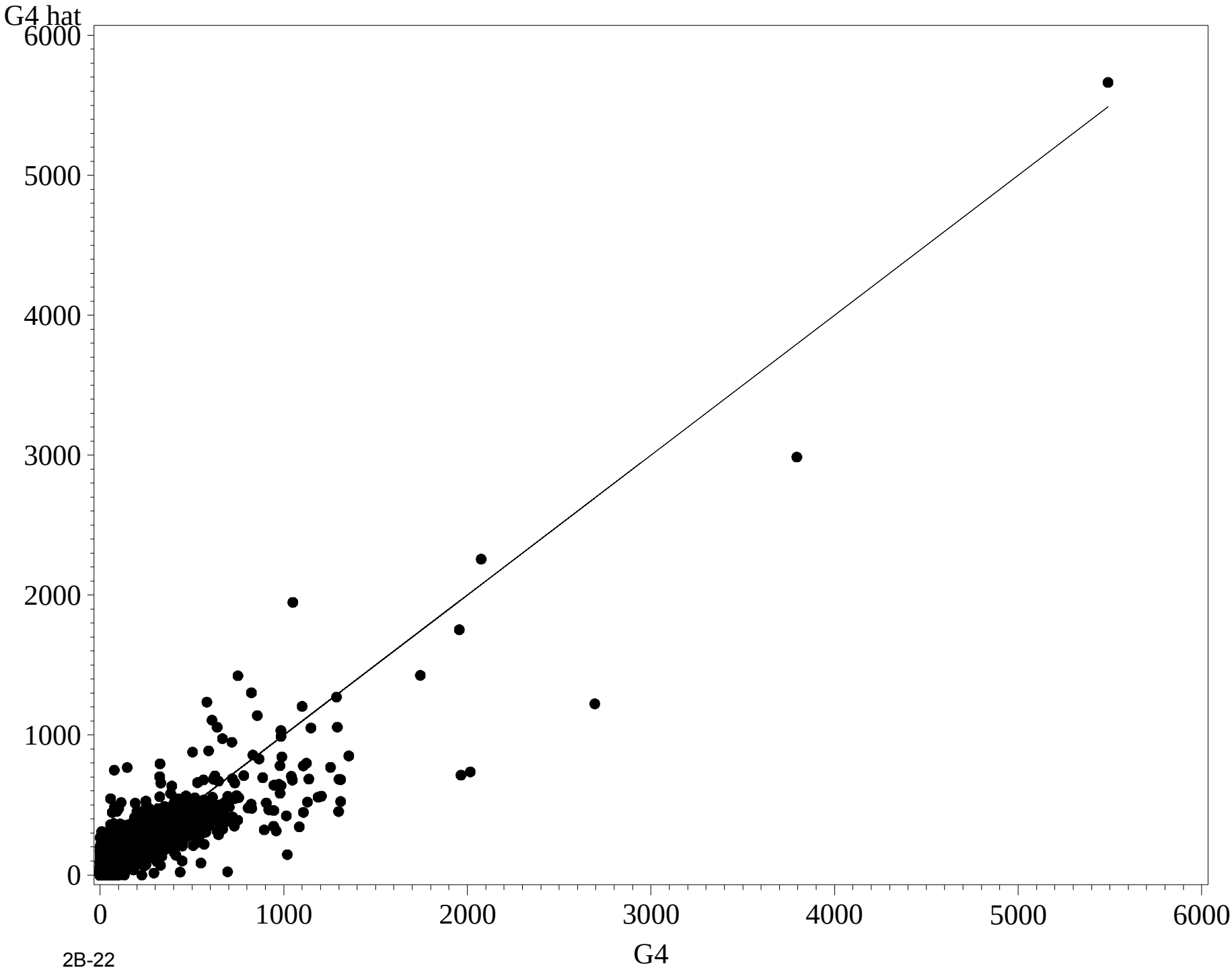


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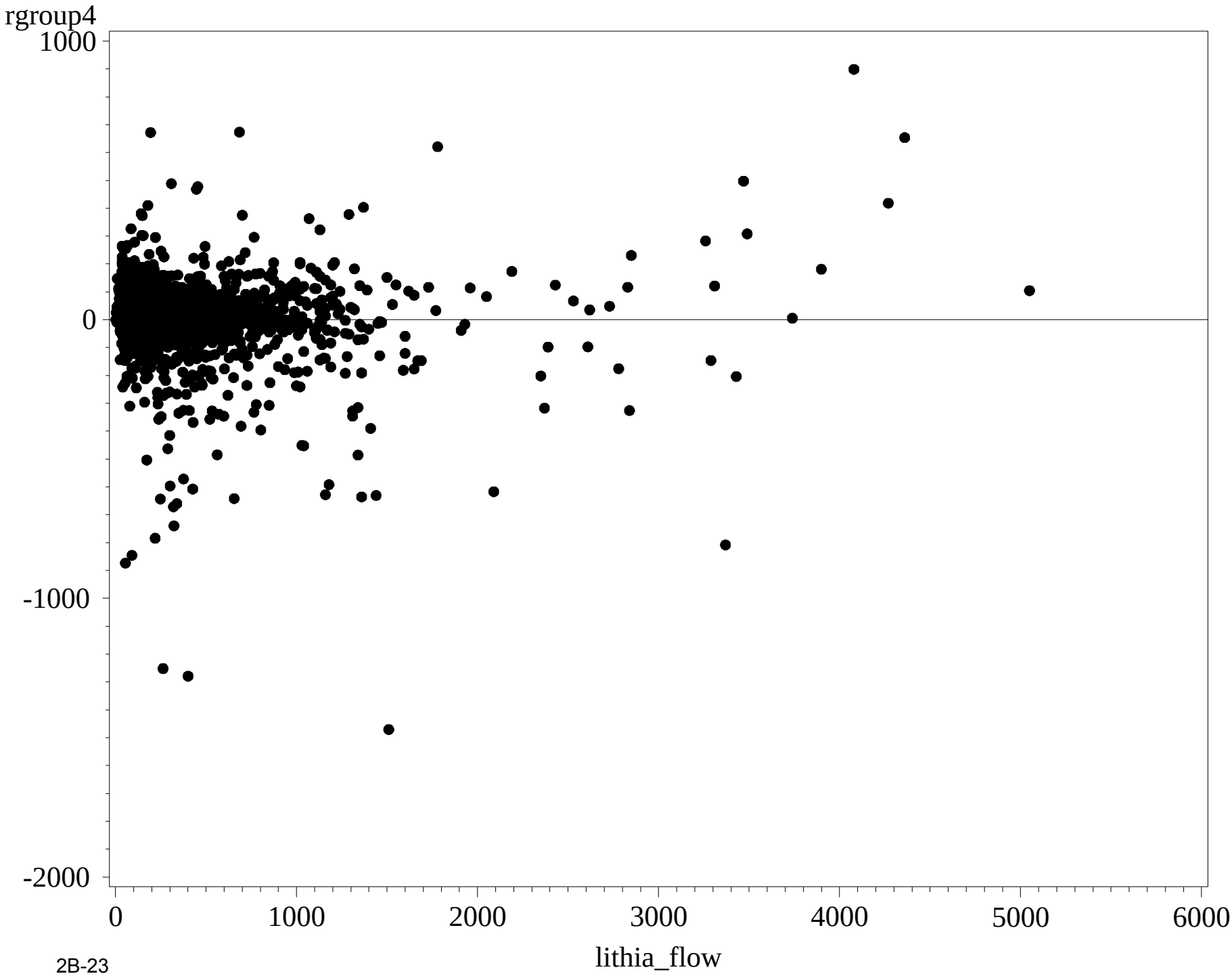


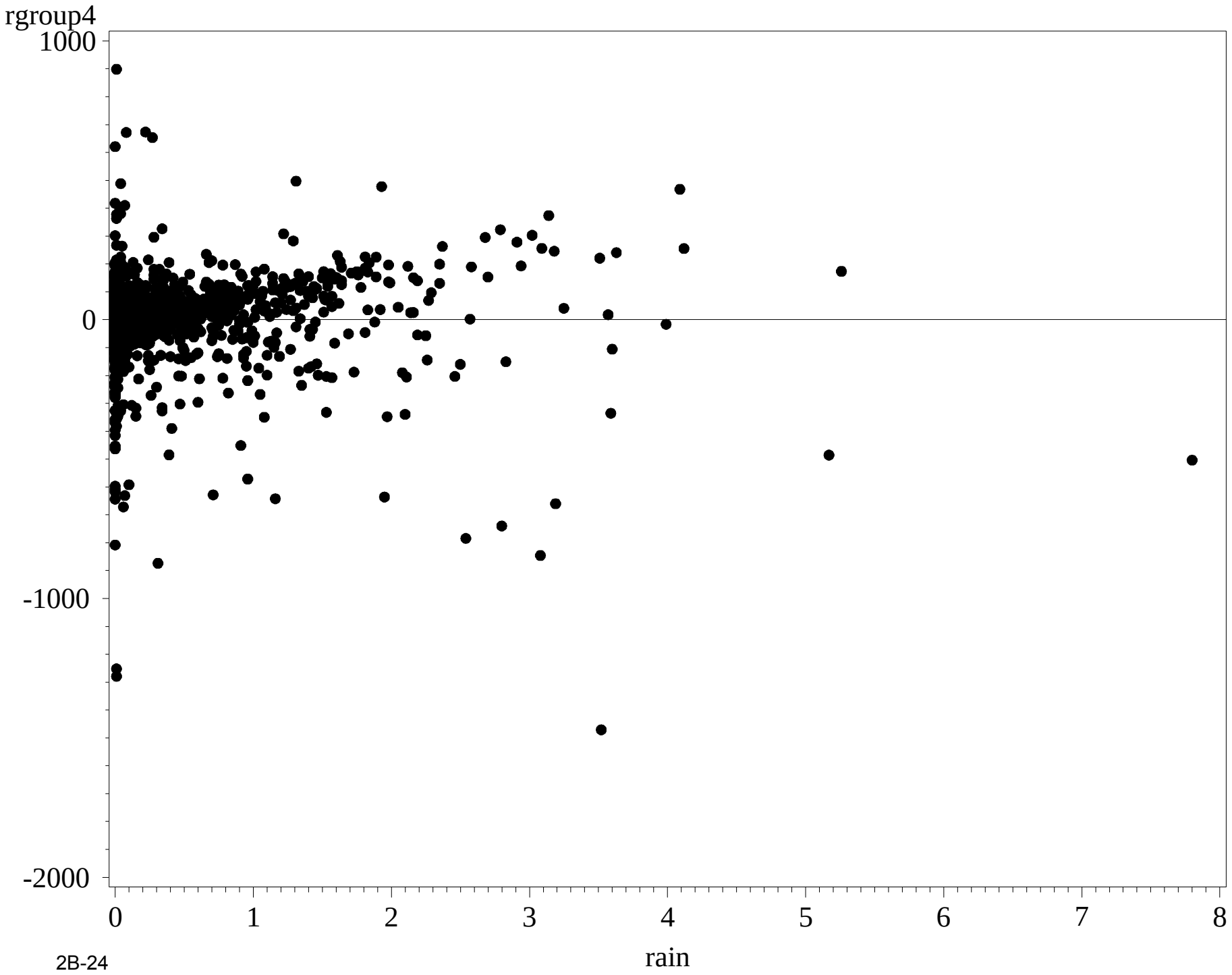
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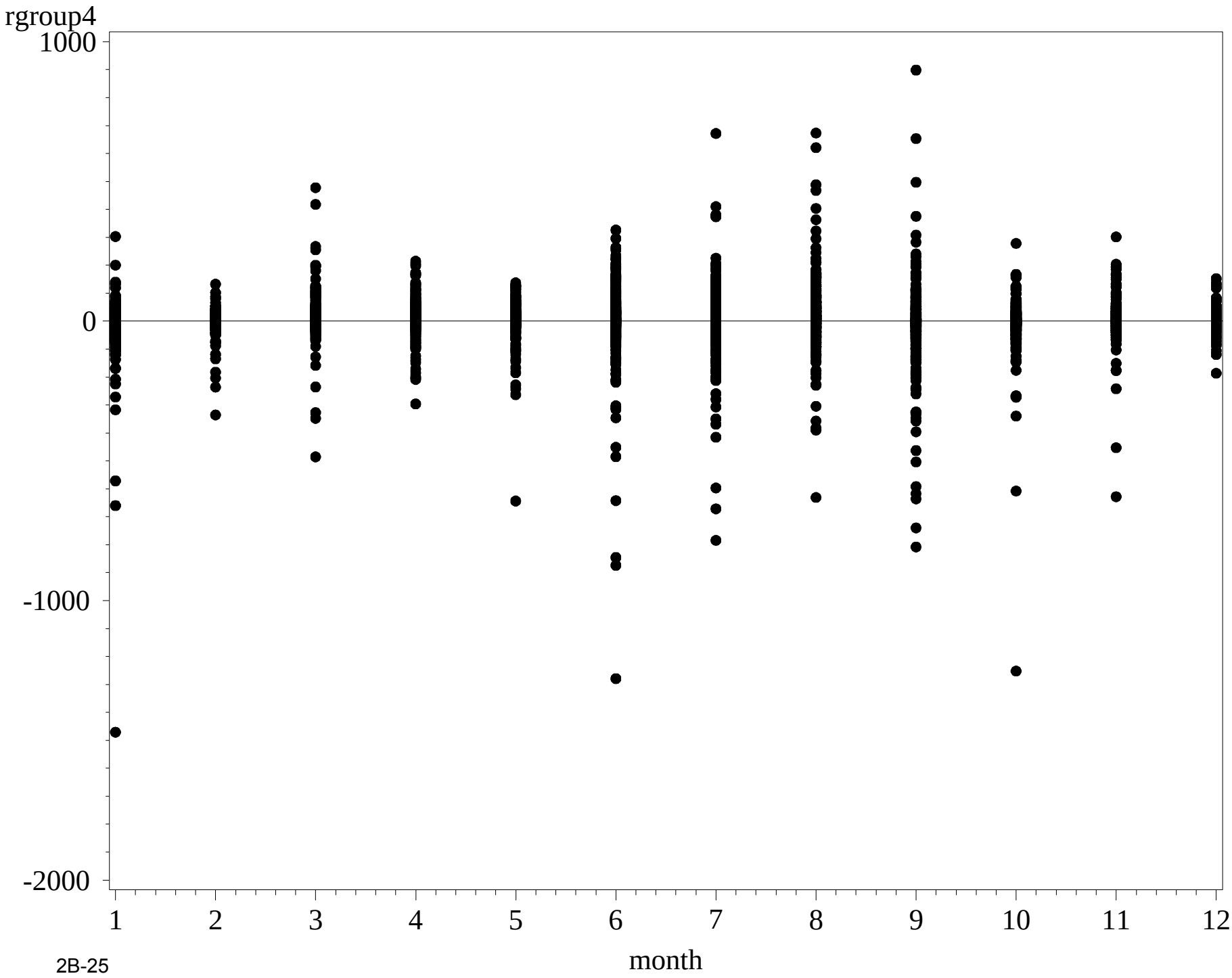

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2000
2001
2002
Coll Year

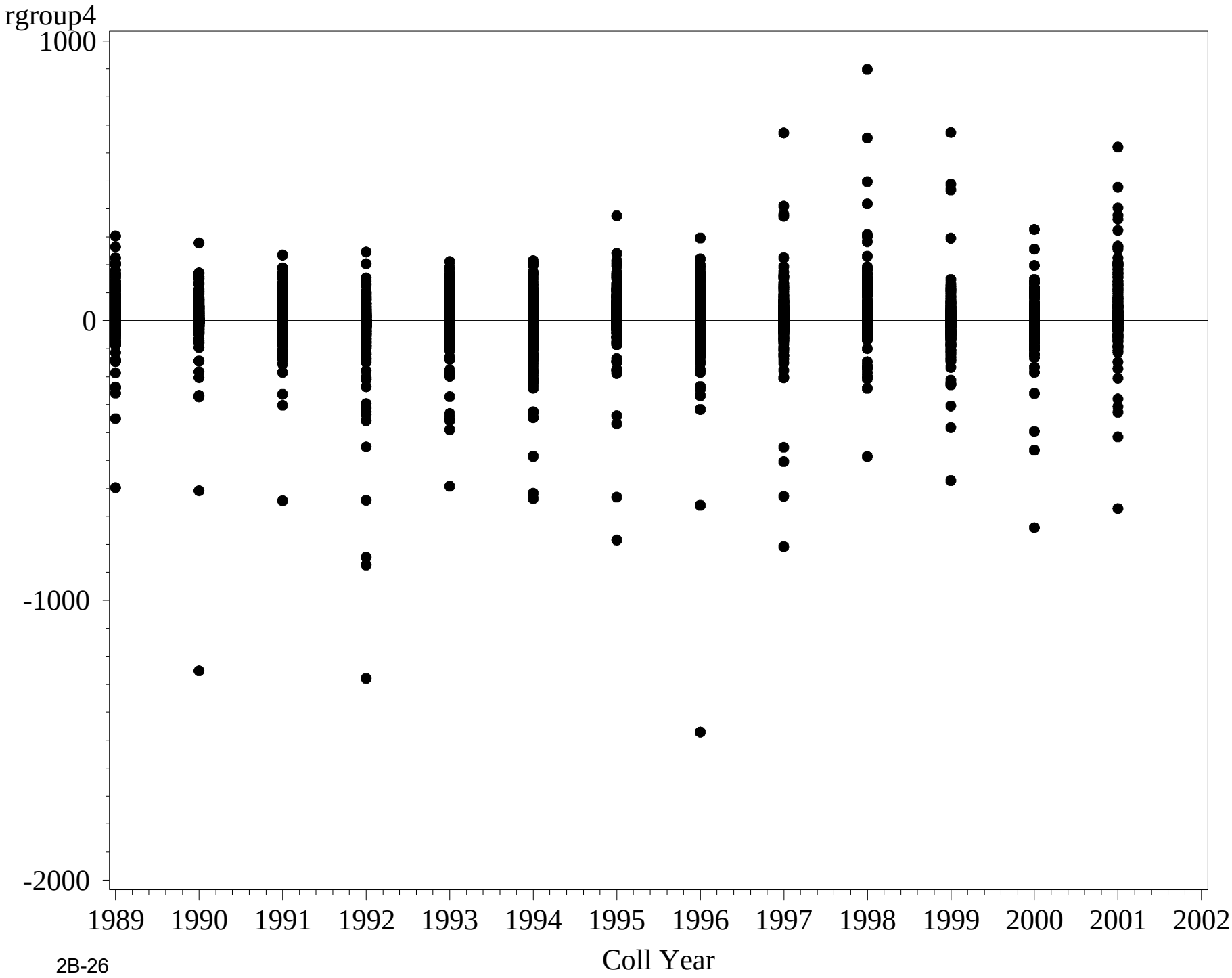

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G4

2B-22


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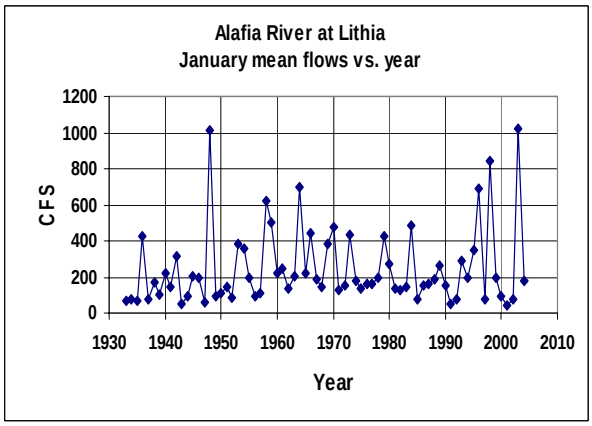

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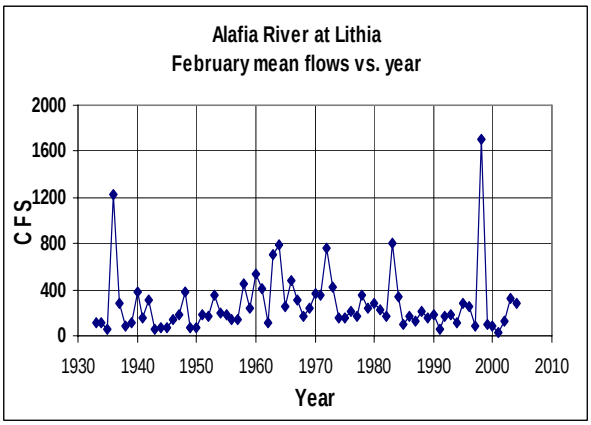

rgroup4
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6
7
8
9
10
11
12
month
2B-25

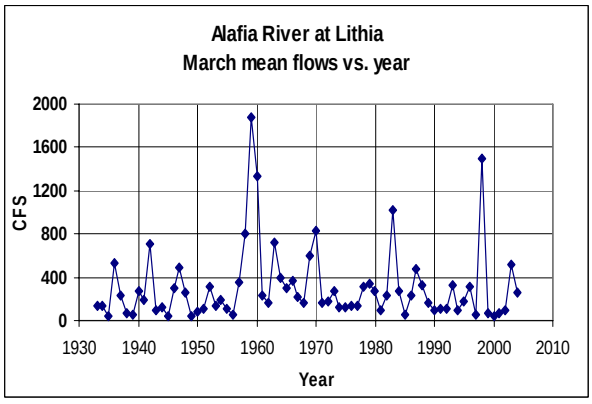

rgroup4
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2000
2001
2002
Coll Year

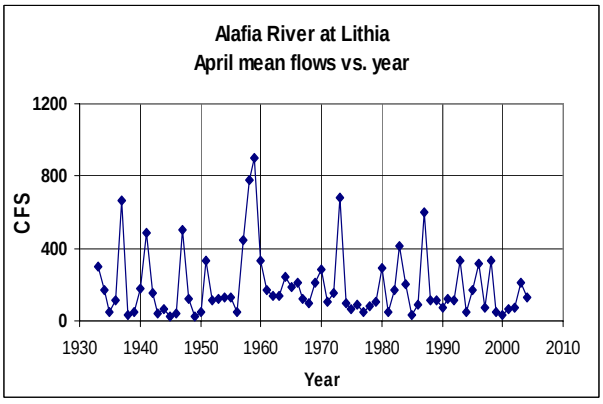
APPENDIX 2C

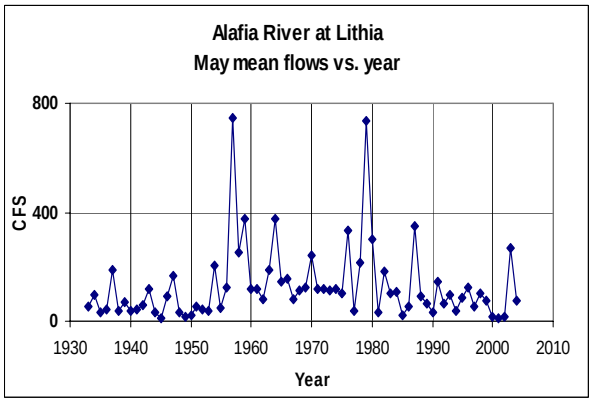
Time Series of Average Monthly flows at the Alafia River at Lithia gage (#02301500), 1932-2004

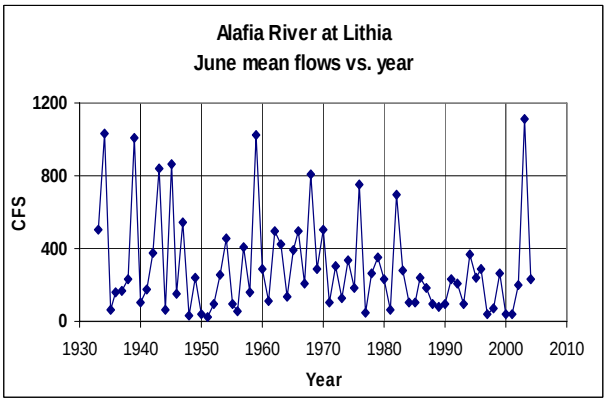


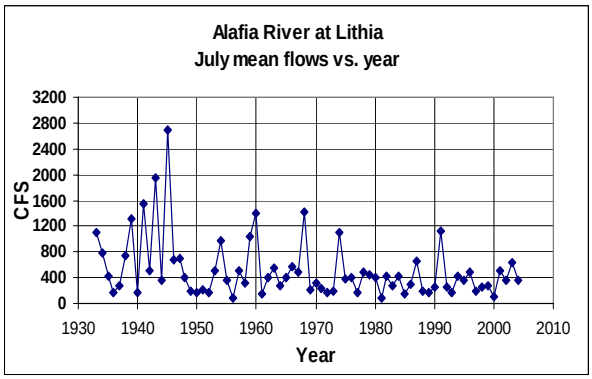


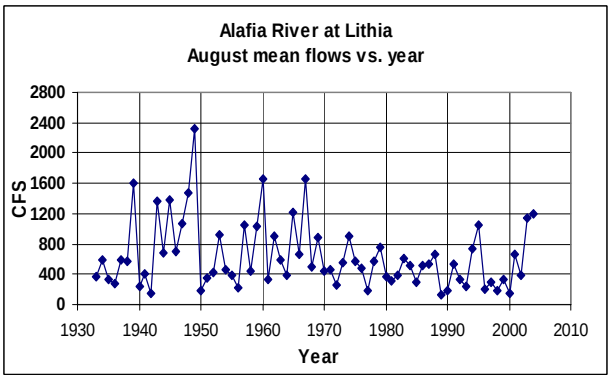


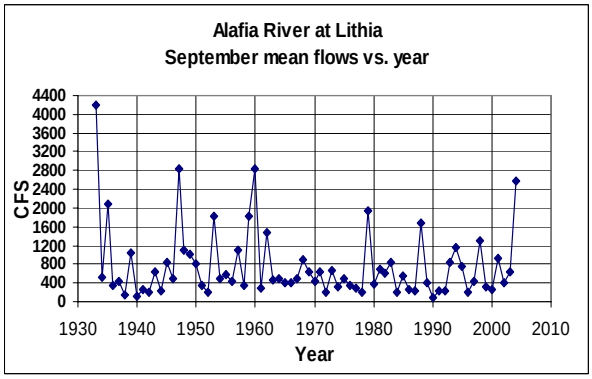


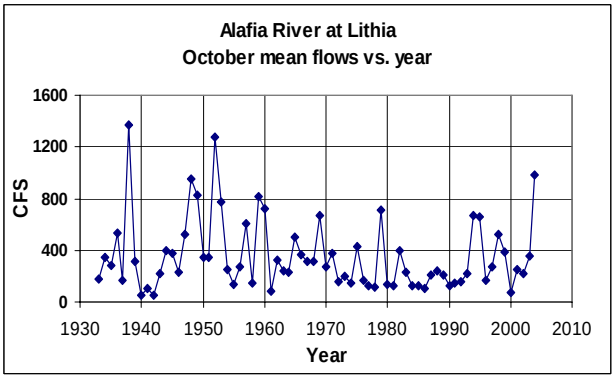


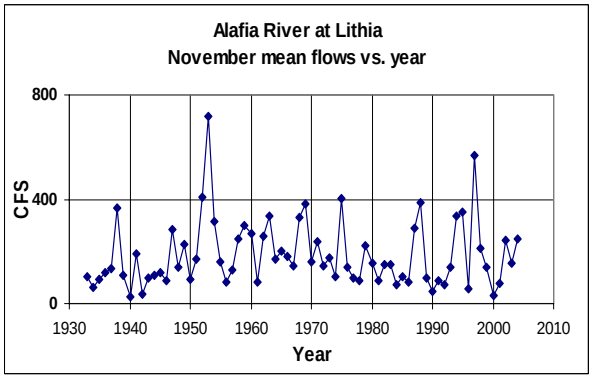


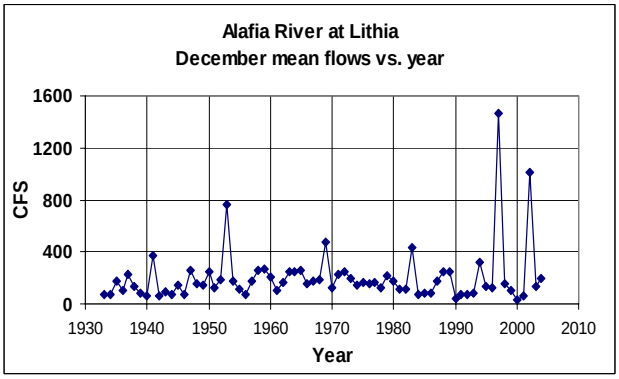

Alafia River at Lithia
July mean flows vs. year
CFS
Year


Alafia River at Lithia
August mean flows vs. year
CFS
Year


Alafia River at Lithia
September mean flows vs. year
CFS
Year

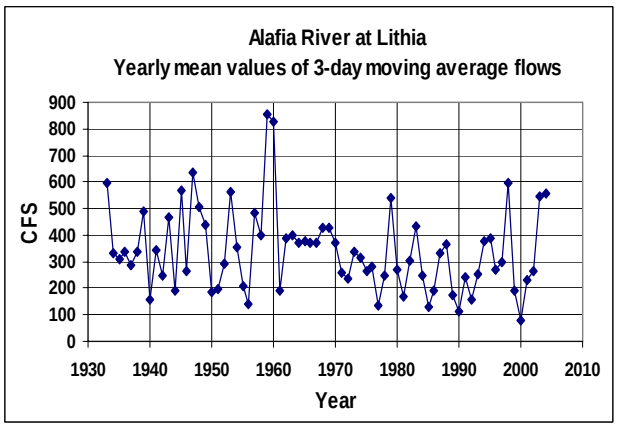

Alafia River at Lithia
October mean flows vs. year
CFS
Year

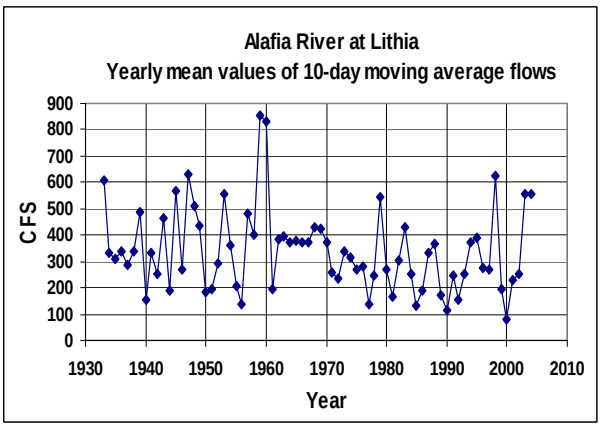

Alafia River at Lithia
November mean flows vs. year
CFS
Year

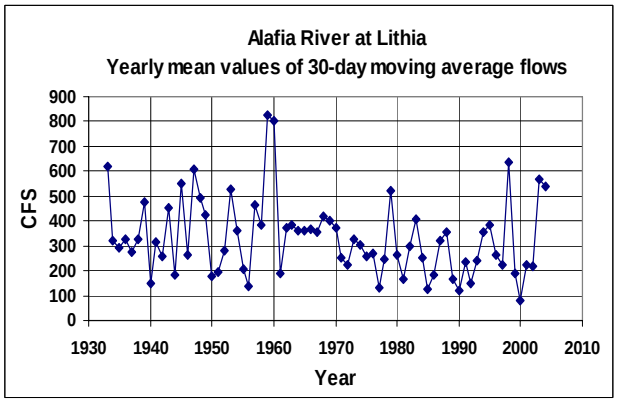

Alafia River at Lithia
December mean flows vs. year
CFS
Year

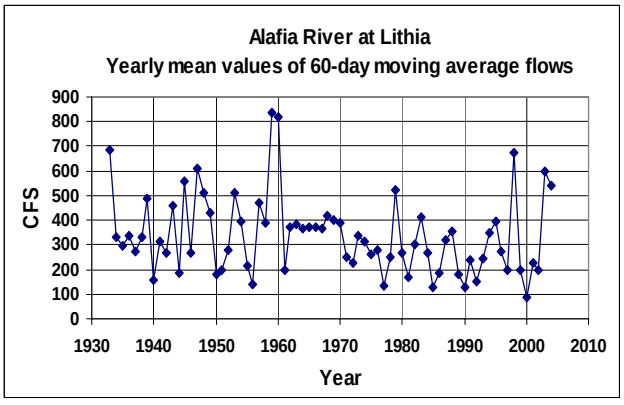
Appendix 2D

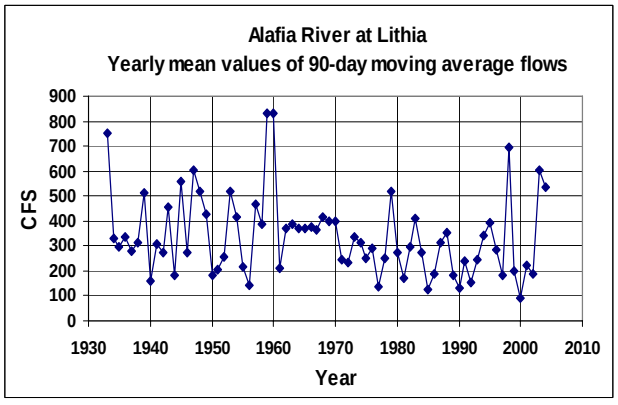
Hydrographs of yearly mean, minimum, and maximum values for flows calculated over various time intervals within each year (3, 10, 30, 60, 90, and 120 days)

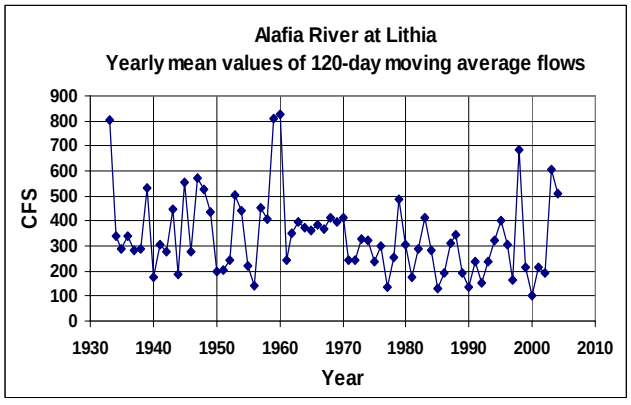


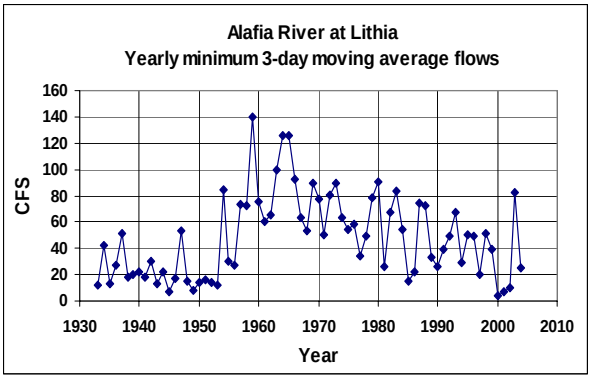


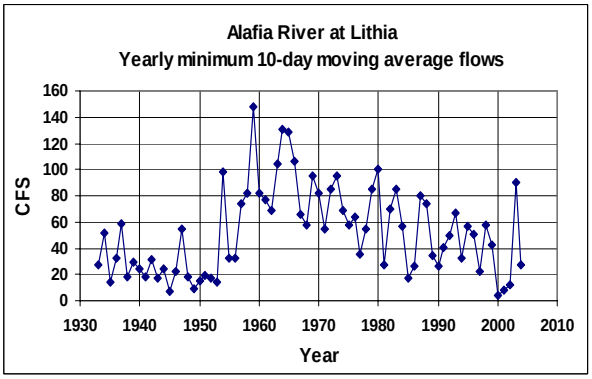


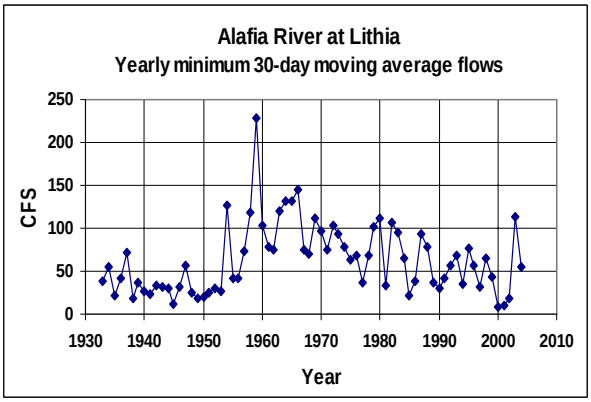


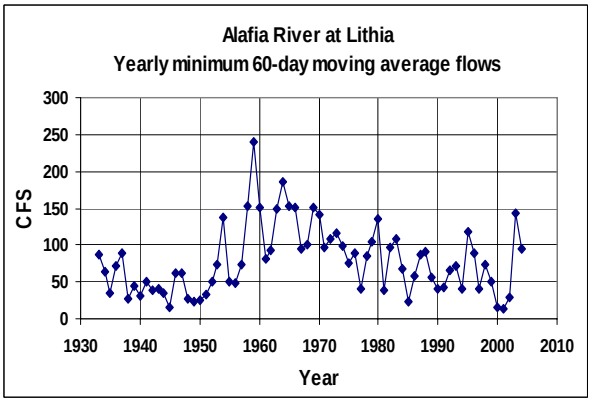


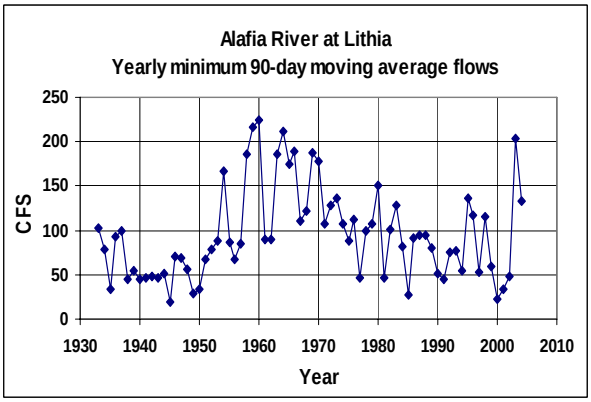


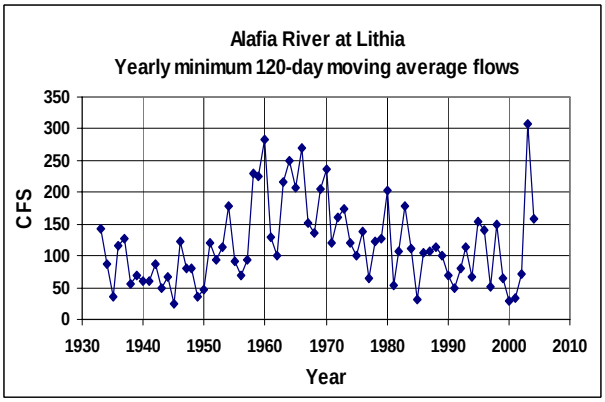

Alafia River at Lithia
Yearly minimum 3-day moving average flows
CFS
Year

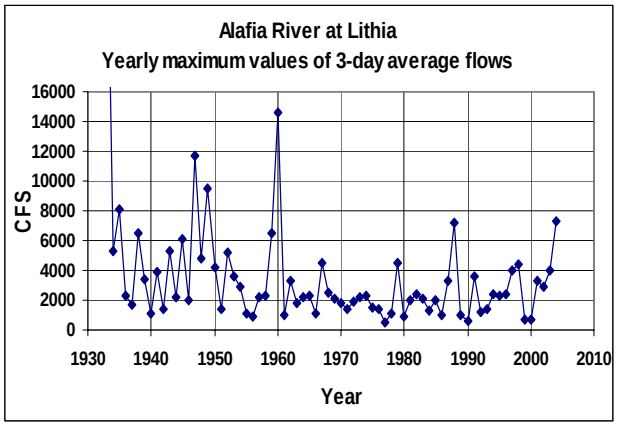

Alafia River at Lithia
Yearly minimum 10-day moving average flows
CFS
Year

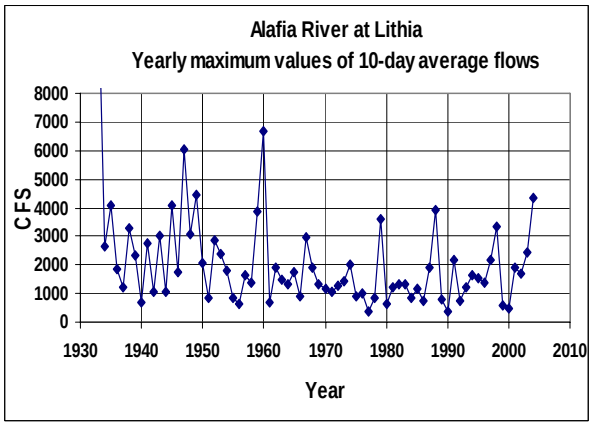

Alafia River at Lithia
Yearly minimum 30-day moving average flows
CFS
Year

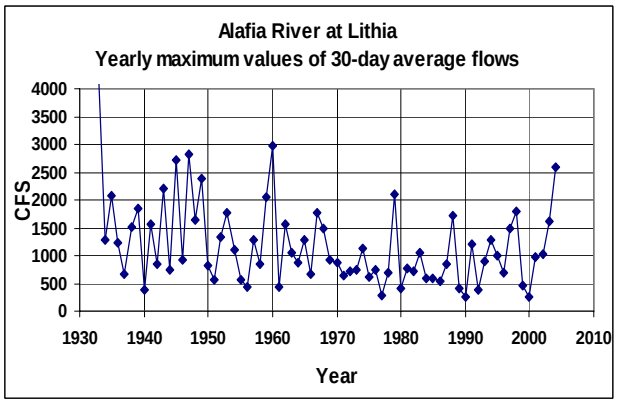

Alafia River at Lithia
Yearly minimum 60-day moving average flows
CFS
Year

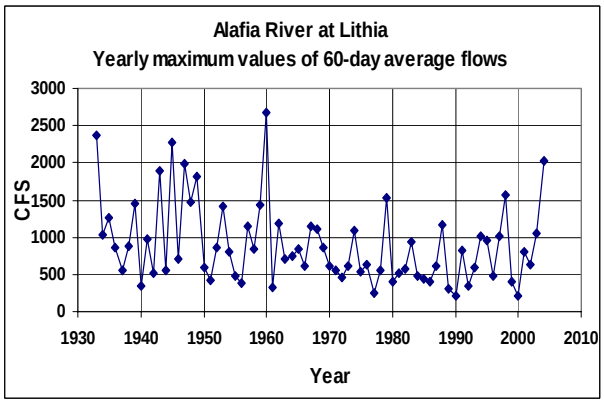

Alafia River at Lithia
Yearly minimum 90-day moving average flows
CFS
Year

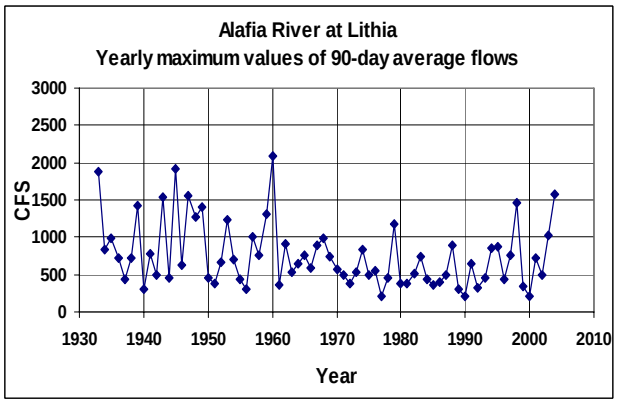

Alafia River at Lithia
Yearly minimum 120-day moving average flows
CFS
Year

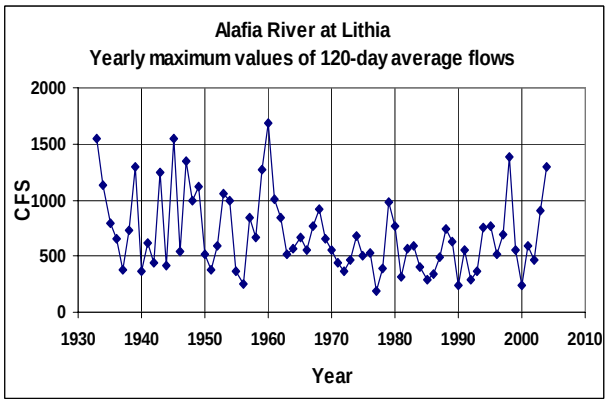

Alafia River at Lithia
Yearly maximum values of 3-day average flows
CFS
16000
14000
12000
10000
8000
6000
4000
2000
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Alafia River at Lithia
Yearly maximum values of 10-day average flows
CFS
8000
7000
6000
5000
4000
3000
2000
1000
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Alafia River at Lithia
Yearly maximum values of 30-day average flows
CFS
4000
3500
3000
2500
2000
1500
1000
500
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Alafia River at Lithia
Yearly maximum values of 60-day average flows
CFS
3000
2500
2000
1500
1000
500
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Alafia River at Lithia
Yearly maximum values of 90-day average flows
CFS
3000
2500
2000
1500
1000
500
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Alafia River at Lithia
Yearly maximum values of 120-day average flows
CFS
2000
1500
1000
500
0
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year

Appendix 4A

Simulating Hydrodynamics in the Lower Alafia River Estuary



XinJian Chen Ph.D.
Ecological Evaluation Section
Resource Projects Department
January 2009

Summary

This technical report describes a modeling study of hydrodynamics and salt transport processes in the Lower Alafia River (LAR) located in the southwest portion of Florida. The study is to support the determination of regulatory minimum freshwater inflows to the LAR. The numerical model used is a laterally averaged two-dimensional model named LAMFE that was originally developed to simulate hydrodynamics in another riverine estuary in the region.

About 79% of the Alafia River watershed was gauged, while the remaining 21% is not gauged due to the tidal influence. The Hydrological Simulation Program-Fortran (HSPF) model was used to estimate un-gauged freshwater runoff from the downstream 21% of the watershed. The simulation domain for the LAR LAMFE model is the downstream 24km of the river that contains the entire tidal reach and a portion of the upstream sloping channel where the riverbed is higher than the tidal water elevations. Boundary conditions at the upstream boundary are specified with measured freshwater inflow, while those at the downstream boundary are specified with measured real-time data of surface elevation and salinity profile. The model was calibrated and verified with water surface elevations and salinities measured at three stations within the simulation domain for the period between May 1999 and December 2003 (about 1648 days).

To investigate effects of various freshwater inflows on salinity distributions in the LAR, four flow conditions were run using calibrated model: (1) observed, (2) baseline, (3) maximum permit, and (4) 15% flow reduction. For each flow conditions, hourly salinity values for all cells between the downstream boundary and Bell Shoals Road were output and then reduced to daily average values in six vertical layer groups for the convenience of the statistical analysis. In addition, six simulation periods representing six percentiles of freshwater inflows for the LAR were run for each of the four flow conditions. Water volumes of various salinity ranges for a total of 24 flow scenarios were calculated and later used in determining the minimum flows for the river.

Introduction

The Alafia River drains to Tampa Bay in southwest Florida (Fig. 1). The river has an estimated drainage area of 1094 km^2 (SWFWMD, 2001) and a total length of 80 km. The downstream 18 km of the river is tidally influenced, with saline water normally limited only to the most downstream two thirds of the tidal reach. The upstream 62 km of the river is above the tidal prism and is generally not affected by tides. The river is one of the major freshwater sources for Tampa Bay (Stoker et al., 1996), with a long-term yearly average discharge of 9.63m^3sec^{-1} (340 cfs) at the U.S. Geological Survey (USGS) gauging station at Lithia (Fig. 1). This gauge is located 24km upstream from the river mouth and gauges about 79 percent of the watershed (864 km^2) (SWFWMD, 2001). The remaining 21 percent of the watershed (230km^2) is not gauged and could contribute a long-term yearly average discharge of about 2.55m^3sec^{-1} (90 cfs). The un-gauged portion of the watershed consists of 10 sub-basins (Fig. 2) that drain to the river either through creeks or directly from the riverbanks. In addition, Buckhorn Spring and Lithia Springs (Fig. 2) provide relatively steady freshwater flows to the river with long-term averages of 0.347m^3sec^{-1} (12.25 cfs) and 0.90m^3sec^{-1} (31.66 cfs), respectively.

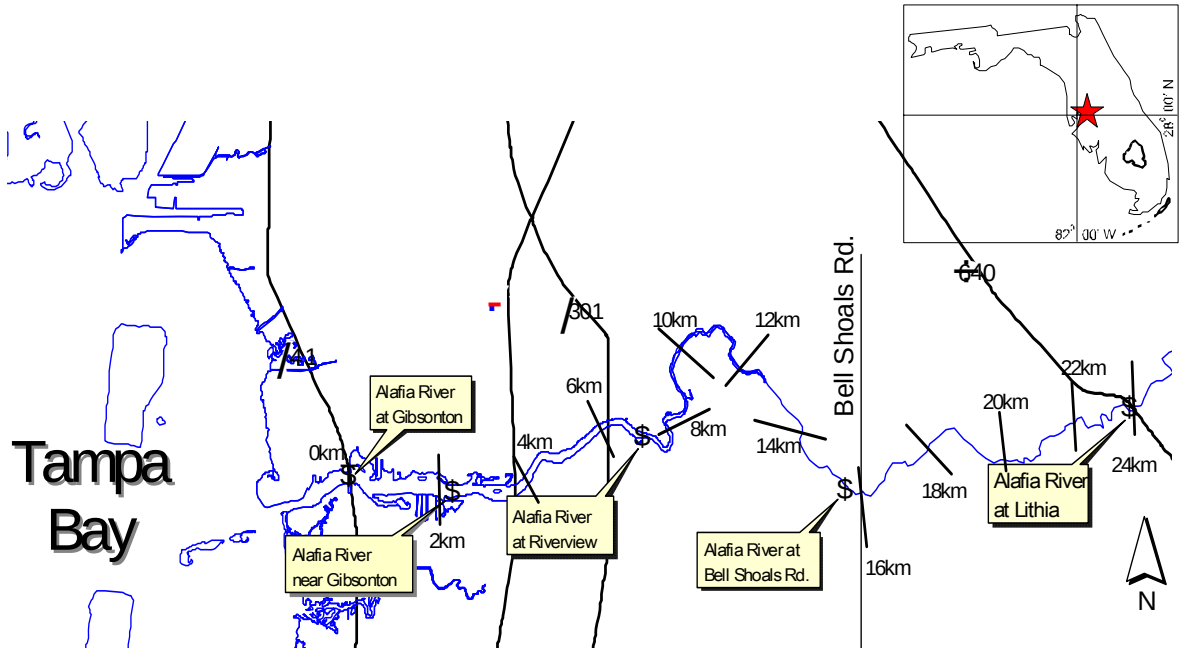


Figure 1. Location of the Lower Alafia River. The riverine estuary is a tributary to Tampa Bay in southwest Florida. There are five USGS continuous recording stations along the river.

Except for the area near the Buckhorn Spring (Fig. 2) where it is about seven meters deep, most areas within the tidal reach of the Alafia River are no deeper than four meters. The river is generally meandering and narrow except for the most downstream 4 km where it is wider and has a few islands. Most river segments upstream of the Interstate I-75 are less than 50m wide at

the mean water level. Above the tidal prism, the river is generally less than 20m wide except under a severe flood condition when the flood plains are inundated.

Because of rapid population growth in west-central Florida, water supply development is an important issue for the Alafia River watershed (Coates and Polmann, 2000; Wanakule and Shea, 2002). Surface water withdrawals from the Alafia River have the potential to adversely affect the river ecosystem (Simon, 1981) and Tampa Bay (Stoker et al., 1996). Therefore, it is necessary to evaluate the freshwater inflow requirements of the Alafia River and determine the limit at which withdrawals would be significantly harmful to the ecology of the river. Establishing freshwater regulations for the Alafia River will help to define the limits of the river to meet growing water supply needs, before significant harm to the ecology of the river occurs. Here, "significant harm" is an ecologic threshold that is quantified based on careful analyses of current and historical ecologic conditions.

To establish freshwater inflow regulations for the Alafia River, effects of freshwater inflows to the river on the salinity distribution need to be quantified, because many species and habitats can only survive within a certain range of salinity. For example, freshwater benthic animals may be able survive in the oligohaline (low salinity) zone for a short period of time, but will die in ocean water (Day et al., 1989). LaSalle and Bishop (1990) suggested that low salinity marsh habitats support a larger number of larval insects than higher salinity areas. Because many Florida riverine estuaries are short and narrow, salinity distributions in these riverine estuaries are very sensitive to changes in freshwater inflows (Liu, 1992, Smith, 1993, Chen et al., 2000). Early studies of the influence of freshwater inflows on salinity distributions in estuaries used either empirical theories (Ketchum, 1951; Dyer and Taylor, 1973) or simple box models (Robinson, 1983; Miller and McPherson, 1991). Since over two decades ago, more sophisticated computer models have been widely used to study hydrodynamics and salinity distributions in various estuaries (Perrels and Karelse, 1981; Uncles and Stephens, 1990). Hydrodynamic models are increasingly relied upon to provide currents and dispersion for water quality analyses (Blumberg and Pritchard, 1997). Successful simulations of hydrodynamics and salinity transport processes have helped understand, for example, nutrient dynamics (Vörösmarty and Loder, 1994), transport processes of larval organisms (Shen et al., 1999), and the seagrass growth (Sheng et al., 2001) in estuaries.

While complex 3-D hydrodynamic models are generally used for estuaries where currents and concentration distributions exhibit strong three-dimensional variations (e.g., Sheng et al. 2001), 2-D models (Bloss et al. 1988; Chen et al., 2000) or even 1-D models (e.g., Uncles and Stephens, 1990) are often used for estuaries where the flow and concentration distributions vary primarily only in one or two directions. Due to the narrowness of the river, currents and salinity distributions in the Alafia River generally exhibit two-dimensional patterns: longitudinal and vertical. Obviously, a simple box model similar to that used by Robinson (1983) or Miller and McPherson (1991) can only be used for some qualitative analyses of the Alafia River. The 1-D approach by Uncles and Stephens (1990) or Smith (1993) is not applicable to the Alafia River because of the relatively strong salinity stratification in the river, as can be seen from measured data discussed in the next section. On the other hand, the use of a 3-D model for the Alafia River is less efficient, because hydrodynamics and salinity transport processes in the river are mainly

two-dimensional. Therefore, this study used a laterally averaged model for estuaries named LAMFE (Chen, 1997; Chen and Flannery, 1998; Chen et al., 2000) to simulate hydrodynamics and salt transport in the Alafia River. The new version of the LAMFE model uses a new finite difference scheme based on a free-surface correction (FSC) method (Chen, 2003), which is very efficient and can be run with a Courant number (*Cr*, defined as $Cr = \Delta t\sqrt{gD} / \Delta x$, where Δt is the time step, Δx is the horizontal spacing, g is the gravitational acceleration, and D is the water depth) greater than 10. The simulation domain has a length of about 24km, of which about 6km is above the tidal reach and has bed elevations that are higher than the downstream tidal water elevation. This kind of simulation domain cannot be handled by the often-used CE-QUAL-W2 model (Cole and Buchak, 1995; Wells, 1999) with ease, because the CE-QUAL-W2 (version 2) model does not allow the bed elevation at one location to be higher than the water surface at another location. Although the new version of CE-QUAL-W2 (version 3) replaces the old hydrodynamic sub-model with a new one that considers the channel slope, the model has to treat the sloping channel as a separate branch (Wells, 2001; Wells and Cole, 2001), causing an extra internal boundary between the tidal reach and the sloping channel that could potentially introduce numerical errors if it is not treated properly. The LAMFE model can simulate this sloping channel along with the tidal reach of the river without separating them in the model simulation.

Measured Data

There are four USGS measurement stations in the estuarine portion of the Alafia River (Fig. 1): Alafia River at Gibsonton, near Gibsonton, at Riverview, and at Bell Shoals Road. The Alafia River at Gibsonton station is near the mouth of the river, while the Alafia River at Bell Shoals Road station is about 16 km upstream from the mouth. The Alafia River near Gibsonton and the Alafia River at Riverview stations are located 2.73km and 7.05km upstream of the Alafia River at Gibsonton station, respectively. Surface water elevations, salinity, and temperature data were collected at a frequency of 15 minutes at these four downstream stations. While salinity and temperature were measured at the top, middle and bottom layers at the most downstream station, they were only measured at one depth at the Alafia River near Gibsonton station. At both the Riverview station and the Bells Shoals Road station, salinity and temperature were measured at the top and bottom layers. At the most upstream station (Alafia River at Lithia), located about 24 km upstream from the mouth, water is always fresh and no tidal signal is detected because the bed elevation is more than 1m higher than the mean high tide. Average daily flow data are reported at this station. Although measured surface elevation data show strong tidal variations at the Bell Shoals Road station, saline water very rarely reaches that location. Table 1 lists elevations of all salinity/temperature sensors in the estuarine portion of the Alafia River. Bottom elevations at the five USGS stations (elevations of the lowest points of the five cross-sections) are also shown in Table 1.

USGS Measurement Station	Alafia R. at Gibsonton	Alafia R. near Gibsonton	Alafia R. at Riverview	Alafia R. at Bell Shoals Road
Lowest Bottom Elevation of the Cross-Section	-3.548	-1.966	-2.408	-1.939
Elevations of Salinity/Temperature Sensors	-0.335 -1.128 -1.981	-0.457	-0.457 -1.463	-0.152 -0.488

Table 1 Elevations of salinity/temperature sensors and lowest points of the cross-sections where the USGS measures salinities and water surface elevations in the tidal reach of the Alafia River. Units in the table are meters, NGVD. Mean water surface elevations at the four stations are all above 0m, NGVD.

The USGS has been measuring hydrological data at the Alafia River at Gibsonton station since early 1990's, but continuous data recordings at the other stations did not start until a few years ago. The most complete data available for this study were collected during the period May 1999 through December 2003 (the Alafia River near Gibsonton station was not available until early November 1999). In an early publication (Chen, 2004c), only portions of the USGS data at the Gibsonton and Lithia stations were presented and discussed. The report, however, shows the complete USGS dataset used for this study.

Measured surface elevations during May 1999 through December 2003 at four USGS stations are shown in Appendix A on Pages A-1 through A-20 with the units of meters, NGVD. On these pages, the top panel is at the Alafia River at Gibsonton (a.k.a., US 41) station, while the middle panel is at the Riverview and near Gibsonton stations and the bottom panel is at the Bell Shoals Road station. The units of the vertical axis are meters, NGVD (National Geodetic Vertical Datum of 1929). Water surface elevations at the Alafia River at Gibsonton station have a mean value of about 0.3m, NGVD, and contain strong diurnal tidal variations along with relatively weak semidiurnal tides. Spring and neap tides can be clearly seen in the measured surface elevations at these stations with a period of about 14 days. In addition to the astronomic constituents, freshwater inflows from the watershed and storm surges also affect the surface elevation in the river. The signal of storm is quite strong in measured surface elevation data at the Bell Shoals Road station due to the narrowness of the river upstream of the Buckhorn Springs. As the river becomes wider, the storm signal becomes weaker, but still can be seen near the mouth of the river.

Appendix B contains time series plots of measured salinity data at the USGS Alafia River at Gibsonton, near Gibsonton, at Riverview, and at Bell Shoals Road stations for the period from May 1999 to December 2003. Top panels on Pages B-2 through B-20 show salinities measured at the Gibsonton station at three depths (see Table 1). Middle panels on these pages are measured salinities at two depths at at the Bell Shoals Road station and at one depth at the near Gibsonton station. Measured salinities at two depths at the Riverview station are shown in the bottom panels. One thing that can be quickly noted is that measured salinities at the two depths at the Bell Shoals Road station were practically zero, indicating that water at the Bell Shoals Road station is fresh and the freshwater – saltwater interface is located downstream of the station. At the Riverview station, salinity exhibits a very dynamic nature. A few things can be seen from measured data at this station. One is that salinity at Riverview has a significant tidal variation. Another is that salinity at this site is strong affected by freshwater inflow. During the dry season when freshwater inflow is low for a long period of time, water at the site is generally salty with a daily minimum salinity of 5ppt or higher (see, for example, measured data during a 65-day period from October 15, 2000 through December 18, 2000). This means that the freshwater-saltwater interface is located somewhere between the Riverview station and the Bell Shoal Road station. During the wet season that normally starts in the middle of June every year and lasts about 4 – 5 months, freshwater runoff from the upstream watershed will push the interface downstream. When the freshwater inflow is high, Riverview can become fresh and the interface is at the downstream side of the station; however, when the flow is not very high for a certain period of time during the wet season, Riverview can be salty with salinity higher than 15ppt at the bottom layer (see, for example, around the end of August 2001) and the freshwater-saltwater interface comes back to the upstream side of the Riverview station. The up-and-down migration of the freshwater – saltwater interface near the Riverview station corresponds well with the freshwater inflow for the Alafia River. It should be pointed out that 2003 had a very wet spring. Salinity measured at Riverview often dropped down to zero during the spring which normally is the dry season for southwest Florida.

Similar to measured water elevations, measured salinity data at the downstream two stations (at Gibsonton and near Gibsonton) exhibit strong diurnal tidal variations along with relatively weak

semidiurnal tides. The tidal variations in measured salinity are modified by freshwater inflows. On a short time scale, a major storm event can quickly lower salinity near the mouth of the river and temporarily push the salt wedge downstream of the Alafa River at Gibsonton station. On a longer time scale, the salinity time series during the wet season has a different pattern from that during the dry season due to the fact that the river receives much more freshwater inflows during the wet season than in the dry season. During the wet season, salinity near the mouth of the river normally has a larger diurnal variation with a lower daily low because of high freshwater input from the watershed. During the dry season, the salinity diurnal variation is relatively smaller and the daily low of salinity is higher. For example, during the extreme dry period in May 2001, measured salinity at the top layer at the Alafia River at Gibsonton station was never lower than 20 parts per thousand. However, during the wet season, the daily low of top-layer salinity generally drops to less than 10ppt during the ebb tide, often even less than 5ppt. The daily high of salinity at the Gibsonton station is relatively more stable, but still contains a longer time scale freshwater signal. For example, during the dry year of 2000 and the first half of 2001, the daily high at the Gibsonton station was around 30ppt. It dropped about 10ppt to around 20ppt in the wet year in 2003. It should be noted that the daily maximum of salnity at the mouth of the river is also controlled by the salinity level in its downstream water body (Hillsborough Bay), which of course is affected by freshwater inflow from the entire watershed of the bay. Since the Alafia River watershed is just one portion of the Hillsborough Bay watershed, its long-term freshwater signal is highly correlated with that for the entire bay.

Appendix C presents time series of measured temperature at the four USGS stations at the same depths as those for the salinity measurements. Units are degrees Celsius. Top panels on Pages C-2 through C-20 show top-, middle-, and bottom-layer temperature values measured at the Gibsonton station (see Table 1 for the sensor elevations). Middle panels on pages are measured temperature data at the top and bottom layers of the Bell Shoals Road station and at the bottom layer at the near Gibsonton station. Top- and bottom-layer temperature data are plotted in the bottom panels. It can be seen from figures on Pages C-2 through C-20 that the temperature stratification is not significant. Measured temperature values at the top and bottom layers at the Bell Shoals station are practically identical. At Gibsonton and Riverview, the differences between top-layer temperature and bottom-layer temperature are small most of time. It is safe to say that because of the shallowness of the Lower Alafia River, temperature in the river is vertically well-mixed most of the time. On the other hand, it is interesting to see that temperature measured at the upstream portion of the Lower Alafia River is quite different from that measured near the mouth. From the middle panels, it can be seen that the difference between upstream temperature (at Bell Shoals Road) and downstream temperature (near Gibsonton) can be as large as 5 degrees Celsius. It appears that during the coldest months of the year (January and February), this kind of longitudinal difference is the smallest. The large longitudinal difference in temperature often occurs during summer months when it is hot. There may be several factors combined to cause this temperature phenomenon in the river. One of the factors could be the fact that there are a few spring systems along the upstream portion of the Alafia River that feed the river with relatively constant temperature.

The temporal variation in water temperature in the river is very evident and corresponds to the temporal variation in solar radiation and air temperature. In the coldest months, water

temperature in the river can be in the low 10's Celsius, while in the summer months, the water temperature rises to low 30's Celsius. Generally, water temperature varies in a smaller range in summer months than in the winter months when the Florida Peninsula routinely experiences cold fronts. On a smaller time scale, temperature measured in the river exhibits a diurnal variation corresponding to the diurnal variation of solar radiation and air temperature. Tides affect the temperature only when temperature has a significant spatial variation along the tidal excursion. The longitudinal difference in temperature in the Alafia River allows tides to affect water temperature dynamics in the river.

In Appendix D, a time series plot of in-stream flow rate gauged at the USGS Lithia station is presented. It represents runoff from about 79 percent of the entire Alafia River watershed. Flows from Buckhorn Springs and Lithia Springs as well as the withdrawal rate by Tampa Bay Water (TBW) are also shown in Appendix D. Units in the figures are cubic feet per second (cfs). The TBW withdrawal point is located just upstream of Bell Shoals Road. Because water is taken out of the river, withdrawals by the TBW are plotted as negative in the figure. From the two figures in Appendix, it can be seen that flow measured at the Lithia station has a very large range of variation. It can be as low as several cubic feet per second during the very dry time period, but can also increase to as high as > 5000 cfs after a very strong storm event. For the two spring flows, the rates are relatively steady. The Buckhorn Springs, located just upstream of the Riverview station, varies only slightly around10 cfs, while Lithia Springs, located between Bell Shoals Road and Lithia, varies from between about 2 cfs to about 65 cfs.

Modified LAMFE Model

The LAMFE model was originally developed to simulate hydrodynamics in the Lower Hillsborough River (Chen, 1997, Chen and Flannery, 1998, and Chen et al., 2000), another tributary to Tampa Bay in southwest Florida. The original LAMFE code was revised to employ an efficient finite difference scheme based on a FSC method (Chen, 2003). The LAMFE model is suitable for narrow rivers and estuaries where hydrodynamics exhibit vertically two-dimensional patterns. In other words, flows and water quality parameters vary in the vertical and the longitudinal directions, but are relatively homogeneous in the lateral direction. The model uses the hydrostatic pressure assumption and solves the following laterally averaged governing equations of hydrodynamics and salt transport processes (Chen and Flannery, 1998; Chen et al., 2000)

$$\frac{\partial ub}{\partial x} + \frac{\partial wb}{\partial z} = v \tag{1}$$

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + w\frac{\partial u}{\partial z} = -\frac{\tau_{wx}}{\rho b} - g\frac{\partial \eta}{\partial x} + \frac{g}{\rho}\int_z^\eta \frac{\partial \rho}{\partial x}d\zeta + \frac{1}{\rho b}\frac{\partial}{\partial x}(\rho b A_h \frac{\partial u}{\partial x}) + \frac{1}{\rho b}\frac{\partial}{\partial z}(\rho b A_z \frac{\partial u}{\partial z}) \tag{2}$$

$$b\frac{\partial S}{\partial t} + \frac{\partial ubS}{\partial x} + \frac{\partial wbS}{\partial z} = \frac{\partial}{\partial z}(B_h b\frac{\partial S}{\partial x}) + \frac{\partial}{\partial z}(B_v b\frac{\partial S}{\partial z}) + vS_t \tag{3}$$

where x is the horizontal coordinate along the river/estuary, z is the vertical coordinate, t is time, S represents concentration (e.g., salinity, temperature, pollutants, etc.), u and w represent velocities in x- and z-directions, respectively; v is the velocity for lateral input (direct runoff, tributary, etc.); b is the width of the estuary (a function of x and z); ρ, g, and η denote, density, gravitational acceleration, and the free surface elevation, respectively; τ_{wx} represents frictions at side walls (= $\rho C_w u[u^2+w^2]^{1/2}$, where C_w is a frictional coefficient for side walls); A_h and A_v are eddy viscosities in the x- and z-directions, respectively; B_h and B_v are horizontal and vertical eddy diffusivities, respectively, and S_t represents concentration in tributaries.

The equation for the free surface is obtained by integrating Equation (1) over the water depth

$$b_\eta \frac{\partial \eta}{\partial t} = -\frac{\partial}{\partial x}\int_{h_0}^{\eta} ubdz + \int_{h_0}^{\eta} vdz + rb_\eta \tag{4}$$

where h_o is the bottom elevation, b_0 is the width of the river/estuary at the free surface, and r is the net rain intensity (rainfall minus evaporation) in cm-sec^{-1}.

The LAMFE model uses a Cartesian grid system with a staggered arrangement of model variables: pressure, concentrations and density are calculated at the cell center; u- and w-velocities are calculated at the centers of the right and top faces of the cell, respectively; and surface elevation is computed at the center of horizontal cell. The horizontal eddy viscosity (A_h) and diffusivity (B_h) are calculated using the Sub-Grid Scale model of Smagorinsky (1963) in the LAMFE model. For the estimation of the vertical eddy viscosity (A_v) and vertical eddy diffusivity (B_v), the LAMFE model provides several options, including a simplified second order closure model and a turbulent kinetic energy (TKE) model that is similar to that of Sheng and Villaret (1989).

The FSC method used in the model is a predictor-corrector approach that involves two steps. In the first step, an intermediate velocity field is solved by treating the pressure gradient term and the convection terms explicitly and by treating the vertical eddy viscosity terms and bottom and sidewall frictions implicitly. An intermediate free surface is found from Equation (4) using the intermediate velocity field. The final free surface is obtained by solving an equation of free-surface correction that is derived from a semi-implicit treatment of the hydrostatic pressure term. After the final free surface is found, the final velocity field is calculated by adjusting the intermediate velocity field using the free-surface correction. The method is unconditionally stable with respect to gravity waves, bottom and wall frictions, and the vertical eddy viscosity term. In practical applications, it generally allows the model to run with a Courant number larger than 10. Details on the FSC method and its properties can be found in Chen (2003). Although the z-coordinate is used in the model without any transformation, the model is capable of fitting the bottom variation by using a piecewise linear bottom (Chen, 2001). The resulting grid cells are hybrid, including regular Cartesian grid cells and multi-face cells that are unstructured (Chen, 2004a). Details on the use the piecewise linear bottom to fit the bed variation in LAMFE are described in Chen (2004a).

Outputs of the LAMFE model include time series of water elevations, concentration profiles, and velocity profiles at selected sites along the river, time series of water volumes for various salinity ranges, time series of the locations of 0.5ppt for the surface layer and –1.0m, NGVD, and velocity and concentration fields during certain days.

There is a trajectory sub-model built in the LAMFE model for the LAR. Detailed description about the trajectory sub-model can be found in a separate report (Appendix 4B). Model results of the trajectory model were used to calculate the estuary residence times and pulse residence times under various flow scenarios, but are not included in this report.

Model Simulations

Model Calibration and Verification

Because saline water is only limited to the most downstream 12 km and the USGS Lithia station is the only flow station along the river, the LAMFE model was applied to the segment between Gibsonton and Lithia with a total simulation length of about 24km. Measured salinity and surface elevation at the Alafia River at Gibsonton station were used as the downstream boundary conditions, while measured flow at the Alafia River at Lithia station was distributed uniformly at the upstream boundary.

Because salinity was measured at the Alafia River at Gibsonton station at three depths, salinity values between two measurement depths were linearly interpolated. For cells that are above the top measurement depth, their salinity values were assumed to be the same as that measured at the top measurement depth. Similarly, for cells below the bottom measurement depth, salinities were assumed to be the same as that at the bottom measurement depth. Because water at Lithia is always fresh, salinity was set to 0 at the upstream boundary. Measured data at other three stations between the upstream and downstream (Fig. 1) were used for model calibrations and verifications.

Since not the entire watershed is gauged at Lithia, it is necessary to estimate freshwater inflow from the area downstream of the Lithia gauge. A watershed model, the Hydrological Simulation Program-Fortran (HSPF) (Bicknell et al., 1997), was used in this study for such estimates (Tara et al., 2001). Simulated runoff from the upstream 79% of the watershed was calibrated and validated using measured flow data at the Alafia River station and two other stations in the Alafia River watershed (Tara et al., 2001). Using measured rainfall and evaporation data and land information within the watershed, the HSPF model provided freshwater inflow estimates for each of the 10 sub-basins shown in Fig. 2. For sub-basins funneling to the river through creeks, freshwater inflows were added to the top cells of the corresponding grids. For sub-basins directly draining to the river from the banks, freshwater inflows were uniformly distributed to the top cells along the corresponding river segments. Measured spring flows from the Buckhorn Spring and Lithia Springs were added to the corresponding cells as tributaries from the lateral direction.

As mentioned in the previous section, temperature stratification is minor most of the time in the Alafia River. As such, temperature-induced density stratification is insignificant. Because temperature is not a criterion in the determination of minimum flows for the Alafia River, temperature equation was not solved in model runs. Nevertheless, effects of temperature on density was considered by inputting measured temperature data to the model and interpolating to all grid cells each time step during the model simulation. Because the Alafia River is narrow and meandering, wind only has minor effect on currents and salinity distributions in the river and thus not included in the simulation. Effects of direct rainfall/evaporation onto/from the water surface were included in the simulation; however, since the salinity distribution in the Alafia River is mainly controlled by the downstream and upstream boundary conditions, model results are similar with or without the consideration of the water exchange between the water body and the atmosphere.

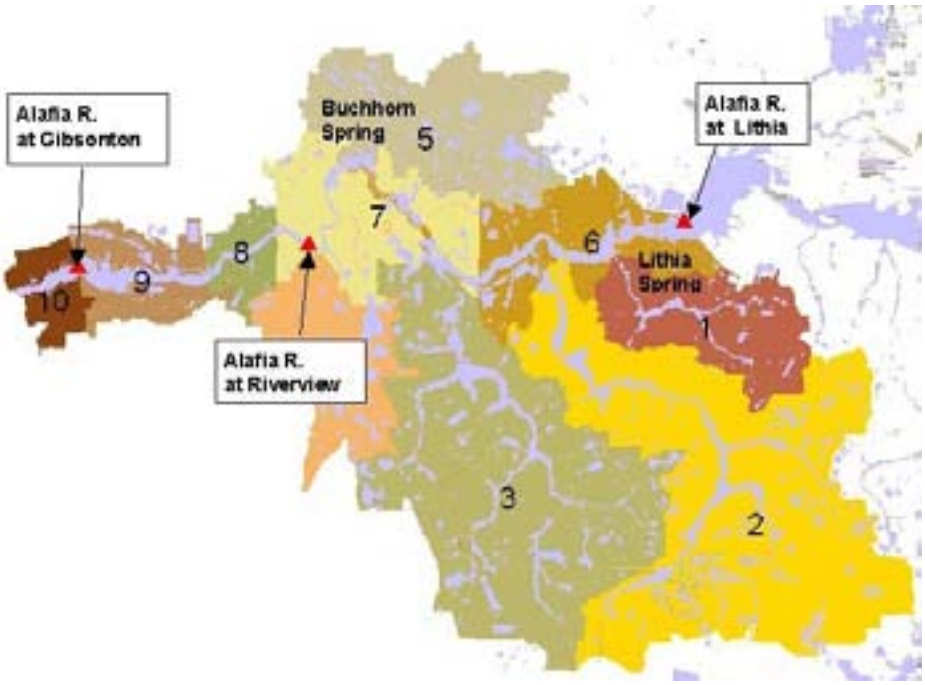


Figure 2 The USGS Alafia River at Lithia is the only site where flow is measured. This site gages about 79 percent of the watershed. The remaining 21 percent is un-gauged and has 10 sub-basins. Different colors represent different sub-basins.

The Cartesian grid system used to discretize the simulation domain consists of 84 horizontal grids and 22 vertical layers. The horizontal grid size varies between 100m to 400m, while the vertical spacing varies between 0.3m and 1.6m (Fig. 3). This grid resolution is can reasonably resolve physical characteristics of the Alafia River except for a few localized features (deep holes and shoals).

The time step used for the simulation was Δt = 240s. Measured salinities and water elevations within the simulation domain during a 900-day period from May 10, 1999 to October 25, 2001 were used for model calibration. In the model calibration process, model parameters (the friction coefficient of the sidewall, the bottom roughness, and two TKE model parameters) were adjusted until the best agreement between model results and measured data was achieved. After the model was calibrated, the model was then used to predict water elevations and salinities for a 780-day period from October 26, 2001 to December 14, 2003. Model predictions were compared with data measured during these 780 days to verify the performance of the model.

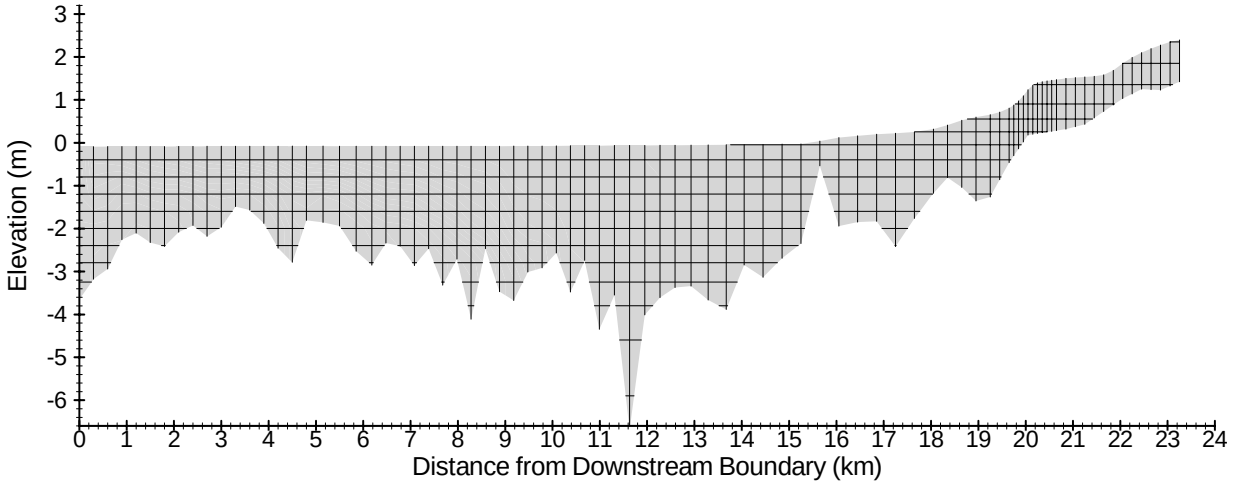


Figure 3 A Cartesian grid with a piecewise linear bottom were used for the Alafia River. The shaded area represents water at a certain time point.

Figures shown in Appendix E on Pages E-2 through E-20 are comparisons of simulated surface elevations with measured data at the three USGS water level recorders between the upstream and downstream boundaries. A skill assessment parameter introduced by Wilmott (1981) was used to judge the agreement between model results and measured data. This skill assessment parameter was also used by Warner et al. (2005) to assess the performance of an estuary hydrodynamic model for the Hudson River estuary. It takes the following form

$$\text{Skill} = 1 - \frac{\sum (y^M - y^D)^2}{\sum (|y^M - \overline{y^D}| + |y^D - \overline{y^D}|)^2} \tag{5}$$

where y^M and y^D are simulated and measured variables (surface elevation or salinity) and $\overline{y^D}$ and $\overline{y^M}$ are means of y_l^D and y_l^M, respectively. Skill in Equation (5) varies between 0 and 1: a perfect agreement between simulated results and measured data yields a skill of one and a complete disagreement yields a skill of zero.

Appendix E suggests that simulated water surface elevation time series at Riverview and near Gibsonton agree very well with field data. The skill values for the near Gibsonton station and the Riverview station are 0.995 and 0.989 (see table 2), respectively. For the Bell Shoals Road station, a good agreement between model results and field data was achieved most of time; however, during storm events or time periods with very low in-stream flows, there are some evident discrepancies between simulated and measured elevations. These discrepancies are most likely caused by errors in the bathymetry/topography data used in the model (there only exist limited information on the floodplain and localized shoals in the river). Because the discrepancies only occur on limited occasions, the model still has a high skill value of 0.976. Overall, the model skill for predicting water elevations at all three stations is 0.985.

Simulated time series of salinity at the bottom layer of the near Gibsonton station and at the top and bottom layers of the Riverview station are presented in Appendix F on Pages F2 through F-20. Measured field data of salinity at the two stations are also plotted in the figures for comparison. Simulated salinity is zero for both the top and bottom layers at the Bell Shoals Road station, which agrees with measured data. As such, comparisons between simulated and measured salinities at the Bell Shoals Road station were not plotted out in this report.

As can be seen from the figures in Appendix F, the LAMFE model simulates salinity variations at both the Riverview and near Gibsonton stations reasonably well, not to mention many uncertainties and errors involved in the data fed to the model (e.g., bathymetry/topography, estimated un-gauged flow, boundary conditions, etc.) The periodic over-predictions of salinity at Riverview were most likely caused by inaccurate (under-estimated) un-gauged flow estimates during these time periods. There could be also some localized phenomena at the Riverview station that causes the laterally averaged salinity during or right after a storm event to be higher than that at the measurement point which is generally not at the middle of the river. The model skill for the bottom-layer salinity at the near Gibsonton station is 0.944. At the Riverview station, the model skills are 0.915 and 0.916 for the top and bottom salinities, respectively. The overall model skill for predicting salinity is 0.946 (simulated and measured data at the Bell Shoals Road station are not included in the calculation of the skill).

Variable	**Model Skill**
Water Level near Gibsonton	0.995
Water Level at Riverview	0.989
Water Level at Bell Shoals Road	0.976
Overall Water Level	**0.985**
Bottom-Layer Salinity near Gibsonton	0.944
Top-Layer Salinity at Riverview	0.915
Bottom-Layer Salinity at Riverview	0.916
Overall Salinity	**0.946**

Table 2 Model skills for predicting water elevation and salinity in the Lower Alafia River.

Scenario Runs

After the LAR LAMFE model is calibrated and verified against observed field data, it was used to run several flow scenarios. Four flow conditions were run to investigate effects of various freshwater inflows on salinity distributions in the LAR. They are: (1) observed flow, (2) baseline flow (meaning putting flow withdrawals back to the system – assuming withdrawal never occurred), (3) maximum permit condition (assuming that fresh water were taken out of the system with the maximum permitted amount), and (4) 15% flow reduction (assuming that 15% of inflow were withdrawn). The four flow conditions were run for the entire period of 1680 days from May 10, 1999 through December 14, 2003, with salinities in all cells between the downstream boundary and Bell Shoals Road being output every hour. For the convenience of statistical analyses, these model results were later aggregated into daily averages in six vertical layer groups.

One of the ways to analyze effects of freshwater inflows on salinity distributions in the LAR is to use the calibrated model to calculate water volumes for various salinity ranges in the river with certain freshwater inflow rates. Based on a statistical analysis of period-of-record flow data measured at the USGS Lithia site, six characteristic percentiles of Lithia flow can be obtained. From Lithia flow data measured during the 1680 days from May 10, 1999 through December 14, 2003, six dates can be identified prior to which Lithia flow was very close to the six percentile flows for several days. These six dates are: (1) August 3, 1999, (2) January 31, 2000, (3) April 20, 2000, (4) April 7, 2002, (5) October 3, 2002, and (6) July 27, 2003. Table 3 lists their corresponding Lithia flow percentiles.

Run No.	Date	Percentile	Length of the Simulation Period (hour)
1	August 3, 1999	50	2076
2	January 31, 2000	25	6420
3	April 20, 2000	5	1920
4	April 7, 2002	15	2160
5	October 3, 2002	75	4296
6	July 27, 2003	90	2880

Table 3 Six simulation periods with the ending dates represent six Lithia flow percentiles.

Assuming that the total freshwater flow entering the LAR is proportional to measured Lithia flow, the six dates shown in Table 3 represent six characteristic percentiles of the total flow entering the LAR, including gauged and un-gauged flows. The LAR LAMFE model was run for six simulation periods with the six dates shown in Table 3 as the ending dates. As can be seen, the minimum length among the six simulation periods is 1920 hours (80 days). In these simulations, Run #'s 3 and 5 were hot start, while the others were cold start. In any case, all periods were long enough so that initial conditions would not affect model results during the last couple of days of the simulation periods. The six simulation periods were run under aforementioned four flow conditions, i.e., a total of 24 model simulations were run. Model results of water volumes for various salinity ranges during the last 24 hours were averaged. The

resulting daily averaged water volumes for various salinity ranges corresponding to six characteristic percentiles of the total freshwater inflow under four flow conditions are presented in Tables 4 through 7. Units in these tables are 1000 cubic meters.

Salinity Range (ppt)	Ending Dates					
	4/20/2000	4/7/2002	1/31/2000	8/3/1999	10/3/ 2002	7/27/2003
0 - 0.5	179.63	413.58	454.11	588.60	719.76	1545.51
0.5 - 1	40.36	40.64	42.22	64.92	87.74	105.04
1 - 2	75.05	65.68	71.12	120.43	138.06	168.29
2- 3	70.23	68.78	75.36	117.89	99.39	141.03
3 - 4	74.85	65.98	74.65	106.79	81.53	140.20
4 - 5	65.04	71.26	78.76	90.88	77.40	125.42
5 - 6	65.83	67.80	74.08	90.08	78.95	147.10
6 - 7	53.96	60.12	66.49	93.90	88.77	140.80
7 - 8	62.37	57.95	63.85	104.89	90.10	109.72
8 - 9	67.12	61.99	70.88	125.47	83.42	91.49
9 - 10	67.27	69.90	73.02	139.87	97.69	90.31
10 - 11	80.14	74.13	89.25	158.48	114.65	91.00
11 - 12	79.74	81.53	100.60	191.23	127.91	74.71
12 - 13	78.49	90.04	115.22	235.17	145.61	83.42
13 - 14	86.88	92.61	110.76	230.03	163.56	82.59
14 - 15	105.38	96.81	126.15	192.28	167.70	89.07
15 - 16	118.04	101.08	128.52	192.81	153.60	130.65
16 - 17	120.23	128.66	153.80	145.81	154.45	275.07
17 - 18	121.73	111.40	168.91	122.86	131.70	1.67
18 - 19	132.43	125.87	110.00	138.94	108.51	0.00
19 - 20	160.81	117.56	134.62	106.51	116.91	0.00
20 - 21	176.10	111.35	141.18	107.06	126.12	0.00
21 - 22	193.46	120.53	89.97	79.99	113.67	0.00
22 - 25	597.13	341.34	261.76	193.33	409.08	0.00
25 - 28	420.61	314.31	225.03	0.00	285.41	0.00
>28	276.79	90.69	5.98	0.00	0.00	0.00

Table 4 Daily averaged water volumes (in 1000 cubic meters) for various salinity ranges under the observed flow conditions.

Salinity Range (ppt)	Ending Dates					
	4/20/2000	4/7/2002	1/31/2000	8/3/1999	10/3/ 2002	7/27/2003
0 - 0.5	201.43	429.23	467.76	603.21	728.32	1557.85
0.5 - 1	44.61	40.80	40.97	67.41	90.54	112.39
1 - 2	82.98	69.71	72.53	127.01	139.68	162.99
2- 3	71.88	71.75	80.41	117.90	100.14	145.46
3 - 4	75.34	68.66	78.62	103.99	80.65	132.38
4 - 5	63.26	69.76	77.48	86.92	79.15	130.01
5 - 6	58.58	66.51	72.23	94.65	78.63	147.43
6 - 7	57.27	56.95	64.80	94.68	86.58	137.81
7 - 8	64.43	57.86	63.34	107.45	89.57	106.48
8 - 9	67.24	62.38	73.10	124.73	84.34	89.63
9 - 10	73.31	71.81	71.02	146.93	99.31	90.40
10 - 11	74.64	78.54	91.14	152.19	116.08	86.99
11 - 12	78.48	80.59	106.63	196.32	132.31	76.35
12 - 13	78.79	90.16	114.86	233.43	140.06	80.83
13 - 14	88.79	92.95	113.04	222.80	169.30	84.99
14 - 15	106.32	93.75	115.43	176.80	158.88	85.76
15 - 16	119.58	100.22	130.37	196.00	154.26	132.74
16 - 17	120.99	129.64	156.59	140.72	150.52	272.22
17 - 18	117.33	105.66	156.04	120.79	130.19	1.67
18 - 19	133.68	122.53	113.11	137.03	105.20	0.00
19 - 20	161.61	114.70	128.79	106.83	116.43	0.00
20 - 21	168.48	109.37	138.62	105.72	126.73	0.00
21 - 22	187.88	118.80	89.58	80.25	112.77	0.00
22 - 25	581.18	335.37	258.94	194.37	407.42	0.00
25 - 28	414.41	311.94	225.50	0.00	285.16	0.00
>28	277.50	90.96	5.92	0.00	0.00	0.00

Table 5 Daily averaged water volumes (in 1000 cubic meters) for various salinity ranges under the baseline flow conditions.

Salinity Range (ppt)	Ending Dates					
	4/20/2000	4/7/2002	1/31/2000	8/3/1999	10/3/ 2002	7/27/2003
0 - 0.5	176.27	399.53	419.69	558.75	670.01	1499.85
0.5 - 1	39.69	42.01	47.12	57.93	76.23	100.12
1 - 2	74.40	63.65	65.98	105.79	130.98	164.35
2- 3	68.37	65.58	68.78	112.79	103.00	134.61
3 - 4	73.59	65.96	73.27	110.83	84.71	146.73
4 - 5	67.45	69.76	73.24	94.97	74.99	124.98
5 - 6	65.95	66.99	72.78	87.49	74.55	146.78
6 - 7	53.97	62.18	72.63	95.85	87.13	146.49
7 - 8	62.44	60.01	64.38	100.14	87.21	128.06
8 - 9	66.20	62.95	67.28	117.37	85.23	91.96
9 - 10	67.48	64.72	75.78	137.12	92.21	97.81
10 - 11	78.78	77.91	74.80	161.90	107.16	98.25
11 - 12	82.28	79.11	100.26	178.93	125.78	78.78
12 - 13	78.20	91.29	115.30	249.16	138.59	82.45
13 - 14	87.04	89.38	115.64	247.97	161.65	84.42
14 - 15	102.79	97.85	122.04	215.08	189.04	95.24
15 - 16	120.61	100.71	130.88	189.17	168.41	132.44
16 - 17	117.62	126.44	159.30	163.33	154.43	276.43
17 - 18	122.09	120.02	181.88	124.70	149.94	1.67
18 - 19	130.50	123.39	128.82	142.59	127.27	0.00
19 - 20	164.84	125.99	130.73	107.48	112.09	0.00
20 - 21	176.77	113.68	151.77	107.52	137.10	0.00
21 - 22	196.38	121.96	93.22	79.53	118.29	0.00
22 - 25	597.47	345.11	267.23	191.40	419.29	0.00
25 - 28	422.16	315.90	226.04	0.00	283.82	0.00
>28	276.22	89.33	5.92	0.00	0.00	0.00

Table 6 Daily averaged water volumes (in 1000 cubic meters) for various salinity ranges under the maximum permit flow conditions.

Salinity Range (ppt)	Ending Dates					
	4/20/2000	4/7/2002	1/31/2000	8/3/1999	10/3/ 2002	7/27/2003
0 - 0.5	176.40	395.32	399.06	544.44	645.16	1480.30
0.5 - 1	39.83	42.22	53.30	54.71	74.90	94.99
1 - 2	74.22	62.78	66.65	100.23	125.33	163.83
2- 3	68.59	64.32	67.01	109.16	103.45	137.80
3 - 4	73.59	67.05	69.19	107.74	85.00	142.99
4 - 5	67.23	67.75	72.88	101.43	72.31	130.83
5 - 6	65.88	68.84	71.25	87.07	77.98	141.21
6 - 7	53.99	62.90	73.08	97.46	78.38	149.45
7 - 8	62.35	58.72	67.90	97.84	91.65	133.92
8 - 9	66.26	63.32	64.70	111.63	87.66	95.26
9 - 10	67.42	64.20	73.73	137.27	87.65	102.03
10 - 11	79.15	76.40	75.62	163.60	99.44	98.97
11 - 12	81.59	81.62	96.32	175.00	127.68	77.92
12 - 13	78.53	88.98	117.36	251.21	137.24	82.48
13 - 14	86.84	89.54	119.47	253.92	159.04	90.60
14 - 15	103.34	97.54	117.59	225.88	197.60	94.85
15 - 16	119.70	104.92	138.05	189.20	167.96	132.62
16 - 17	118.37	124.43	152.53	170.98	168.38	278.04
17 - 18	122.43	119.65	187.83	129.64	158.55	1.67
18 - 19	130.29	122.17	135.03	143.04	126.00	0.00
19 - 20	165.46	126.72	132.53	108.92	117.55	0.00
20 - 21	177.00	117.83	154.41	106.02	140.81	0.00
21 - 22	195.27	121.04	95.62	79.81	121.86	0.00
22 - 25	597.48	347.83	271.10	190.76	422.96	0.00
25 - 28	421.92	315.90	226.35	0.00	283.16	0.00
>28	276.46	89.33	5.92	0.00	0.00	0.00

Table 7 Daily averaged water volumes (in 1000 cubic meters) for various salinity ranges under the maximum permit flow conditions.

Conclusions

The new version of the LAMFE model was used to simulate hydrodynamics and salt transport in the LAR. The simulation domain of the LAMFE model is about 24 km and covers the entire tidal reach of the river and a portion of the upstream sloping channel where no tidal influence exists. Although the upstream bed elevation is higher than the downstream water surface elevation, the LAMFE model is able to simulate hydrodynamics for the entire simulation domain without splitting the upstream sloping channel as a separate branch. The model is very efficient with a Courant number greater than 10. For the Alafia River simulation, the smallest grid size was Δx = 100m where the water depth was 2.5m or deeper and the time step used was 240 seconds. This corresponds to a Courant number of 12 or higher.

Model applications have shown that the LAMFE model is able to simulate hydrodynamics and salinity transport processes in the Lower Alafia River. Reasonably good agreements between model results and measured data were achieved. Simulated salinity in the river exhibits similar long-term (days) and short-term (less than one day) variations and stratifications as measured data. In an early documentation (Chen, 2004c), it was demonstrated that freshwater inflow from the un-gauged portion of the river watershed is very important for a good simulation of hydrodynamics and salt transport in the Lower Alafia River. Although the USGS measurement station at the upstream boundary gauges a majority of the entire watershed, model results with and without the inclusion of freshwater inflow from the un-gauged portion of the watershed are significantly different. Reasonably good agreements between model results and measured data were achieved. Even with many uncertainties and possible errors associated with the estimate of un-gauged flow and bathymetry/topography data, the LAR LAMFE model still achieved high model skills based on Wilmott's skill formula. It can be concluded that LAMFE is a good tool for simulating salinity transport process in the LAR.

The calibrated LAMFE was used to run four flow conditions, including observed flow condition, baseline condition, withdrawal with maximum permitted rate, and 15% freshwater flow reduction. For grids between Bell Shoals Road and Gibsonton, modeled daily salinities in six vertical layer groups during the entire 1680 days for the four flow conditions were obtained. Due to the large size of these model results, they are not presented in this report but are valuable datasets for determining minimum flows for the LAR.

The model was also used to simulate a total of 24 flow scenarios (six simulation periods corresponding to six characteristic percentiles of freshwater inflows entering the LAR for four aforementioned flow conditions). Daily averaged water volumes for 26 salinity ranges were obtained for the 24 scenarios. These water volume values were valuable datasets for determining minimum flows for the riverine estuary.

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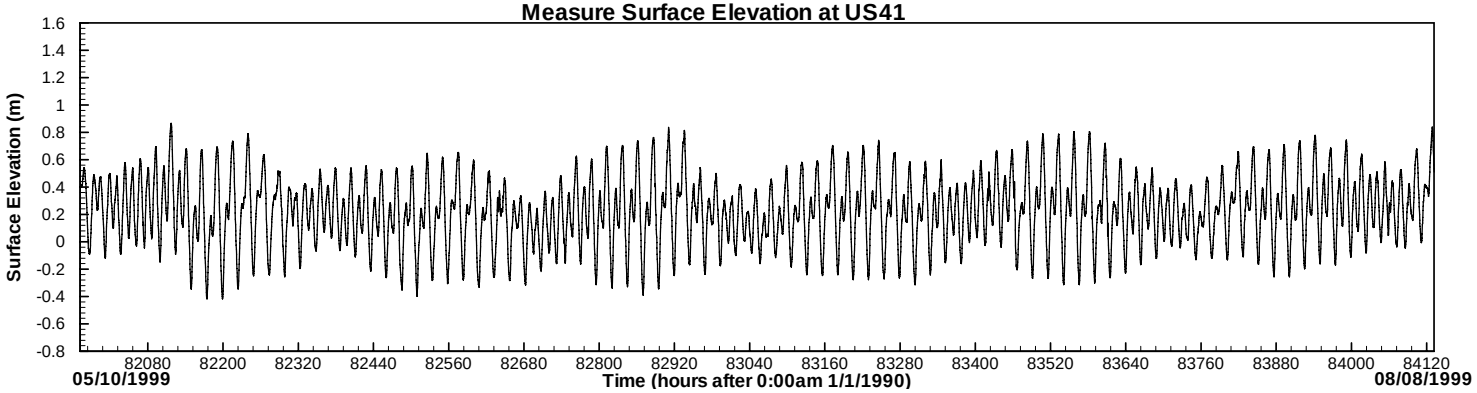
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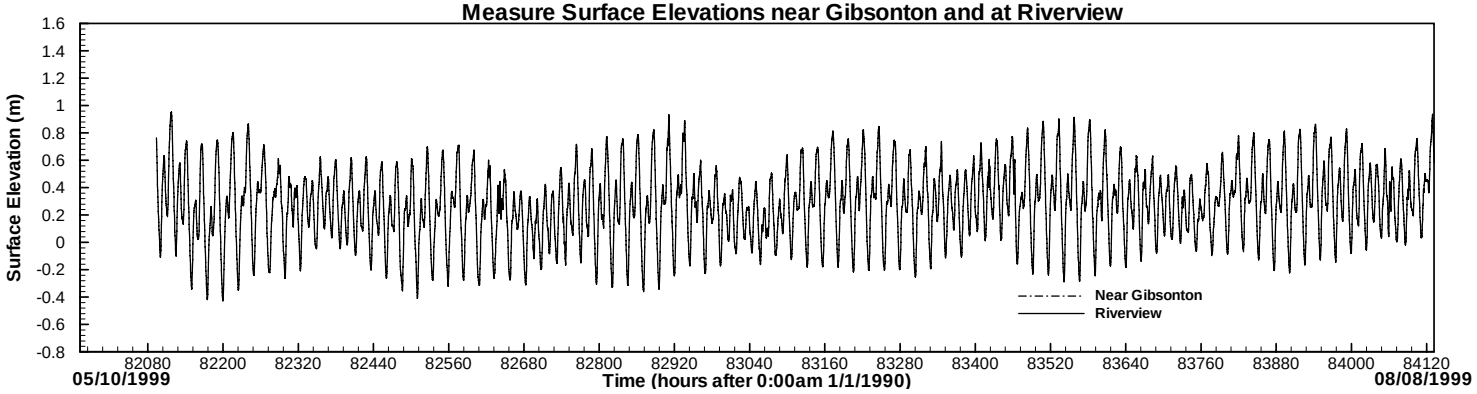
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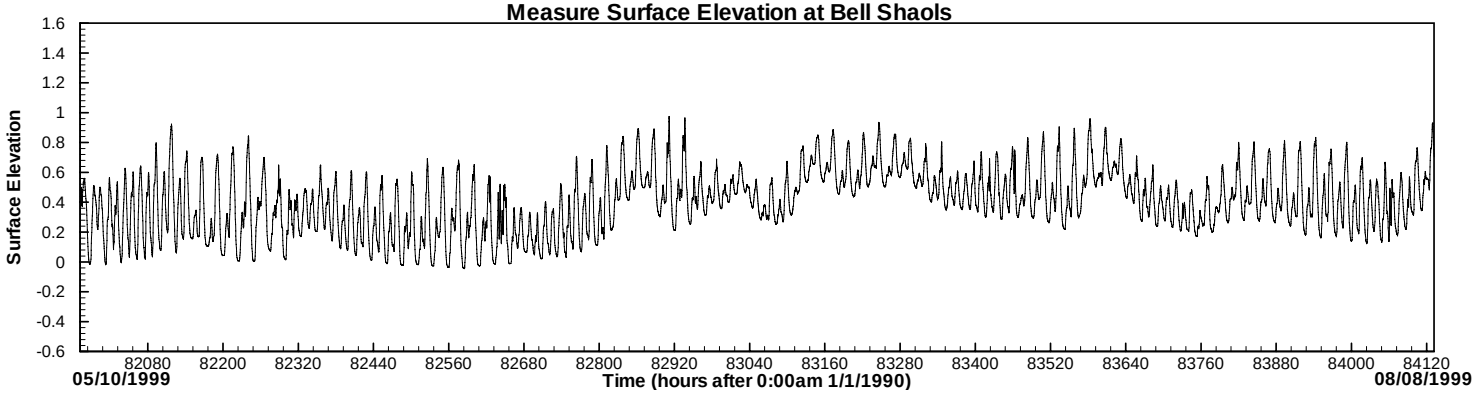
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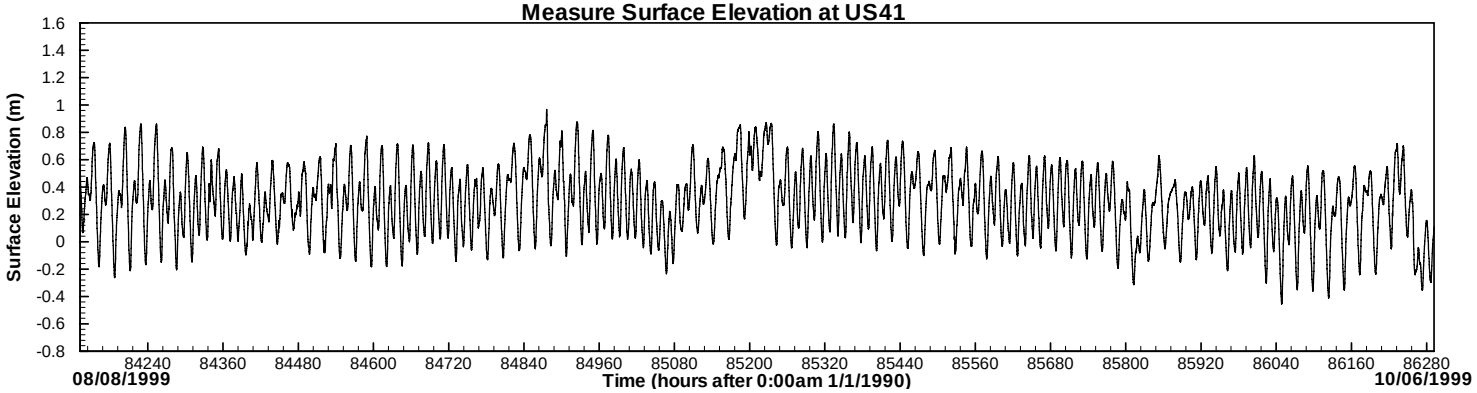
Appendix A
Measured Water Elevations in the Lower Alafia River

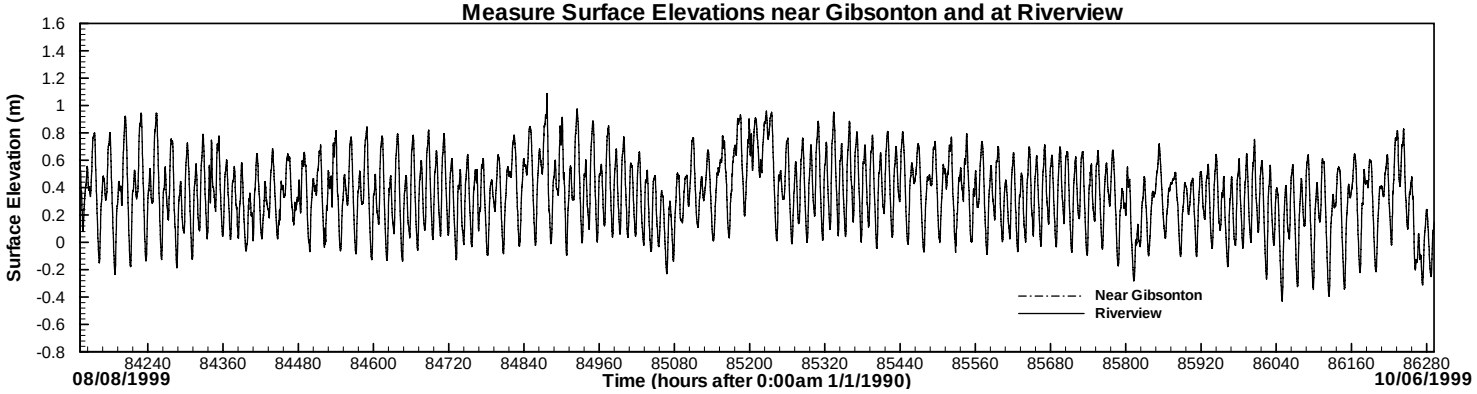
The following 19 pages show plots of measured water elevations during May 1999 through December 2003 at the USGS Alafia River at Gibsonton, Alafia River near Gibsonton, Alafia River at Riverview, and Alafia River at Bell Shoals Road stations.

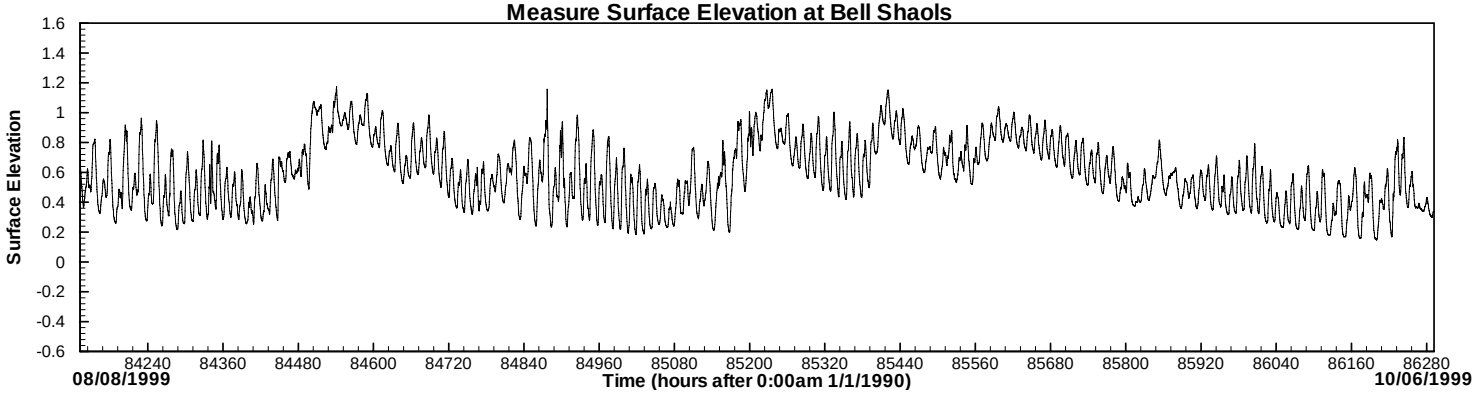

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
82080 82200 82320 82440 82560 82680 82800 82920 83040 83160 83280 83400 83520 83640 83760 83880 84000 84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

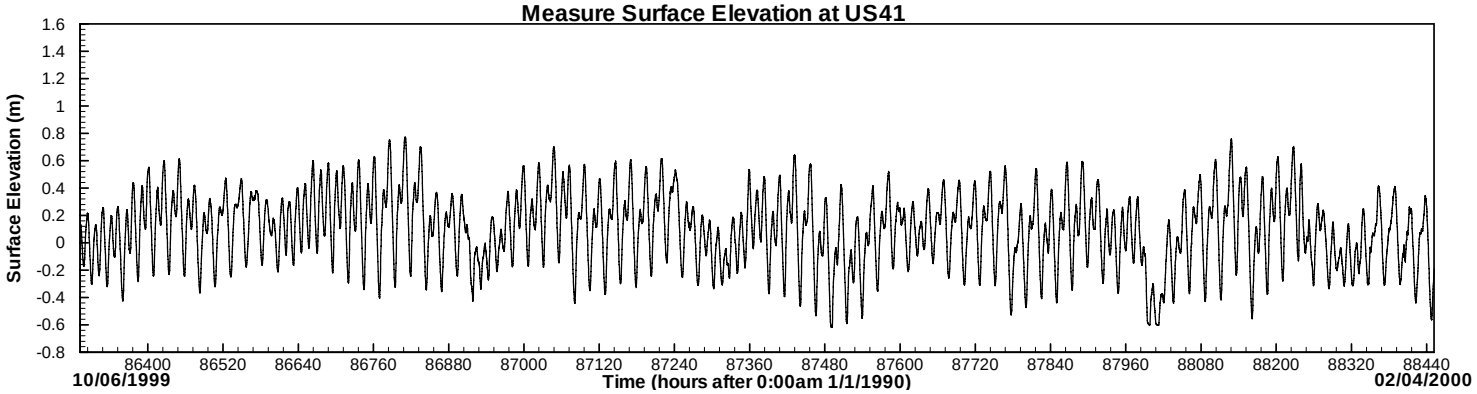

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
Near Gibsonton
Riverview
82080 82200 82320 82440 82560 82680 82800 82920 83040 83160 83280 83400 83520 83640 83760 83880 84000 84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

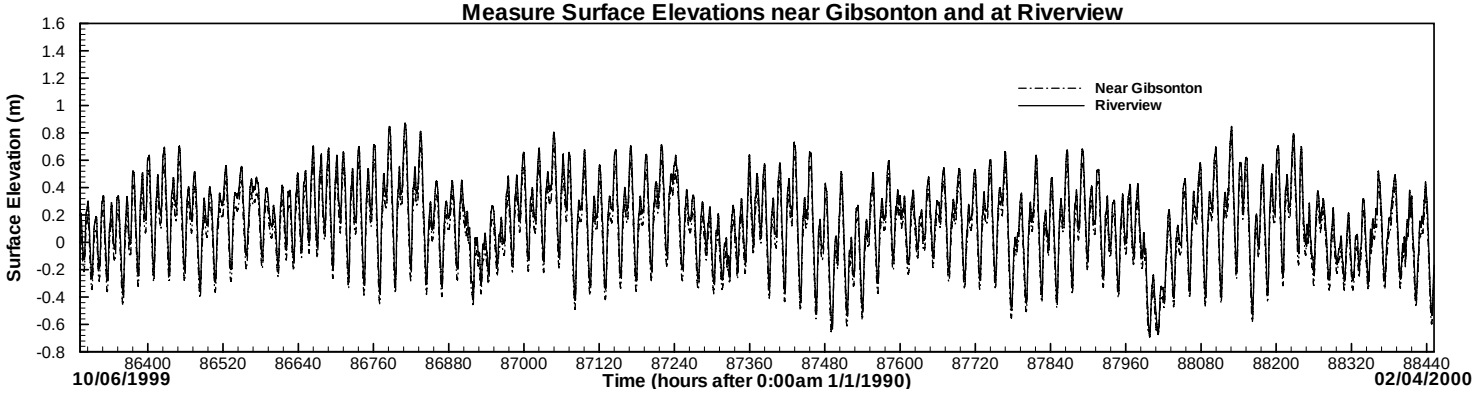

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
82080 82200 82320 82440 82560 82680 82800 82920 83040 83160 83280 83400 83520 83640 83760 83880 84000 84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

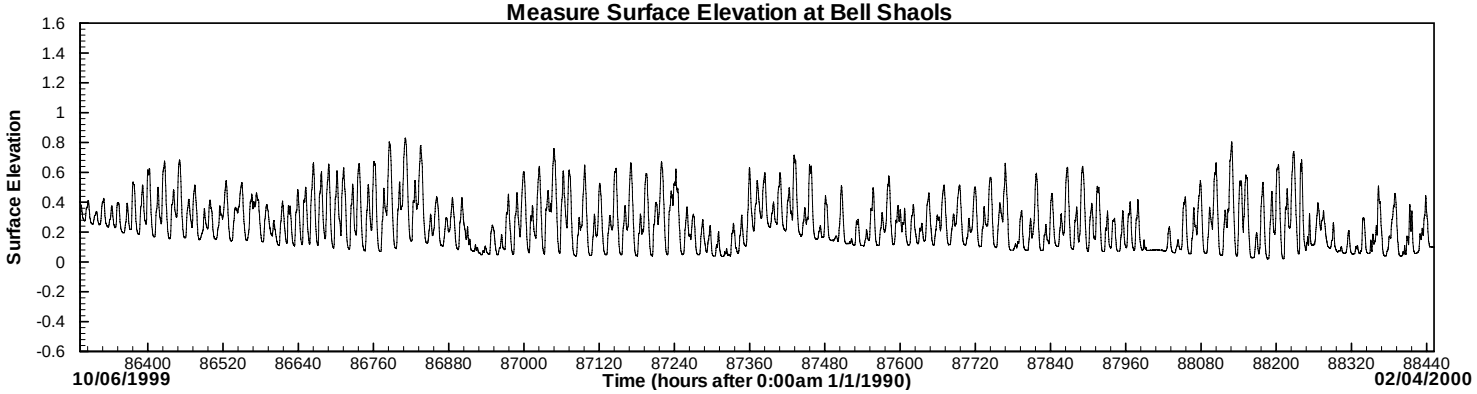

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
10/06/1999

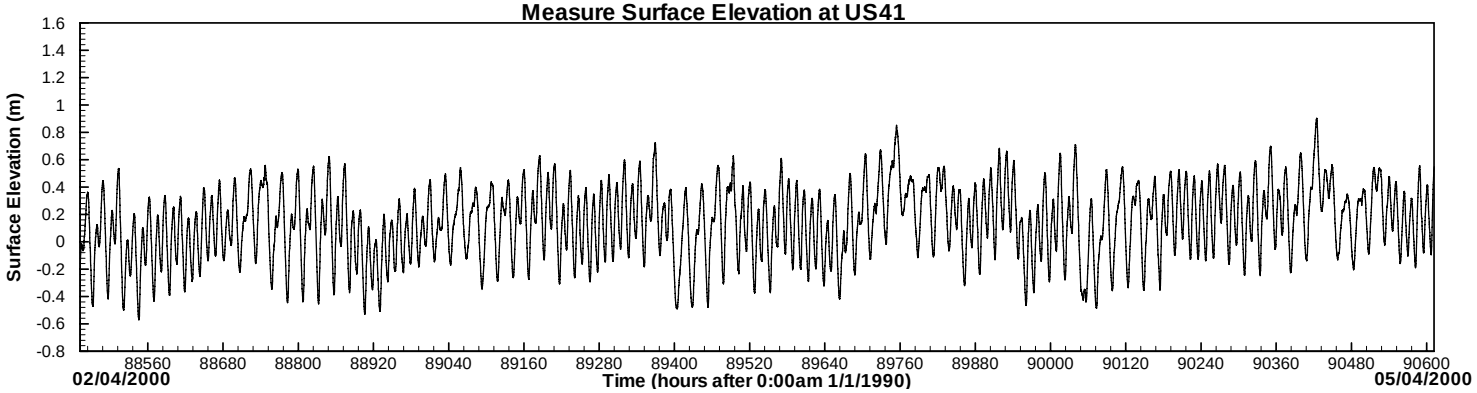

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
Near Gibsonton
Riverview
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
10/06/1999

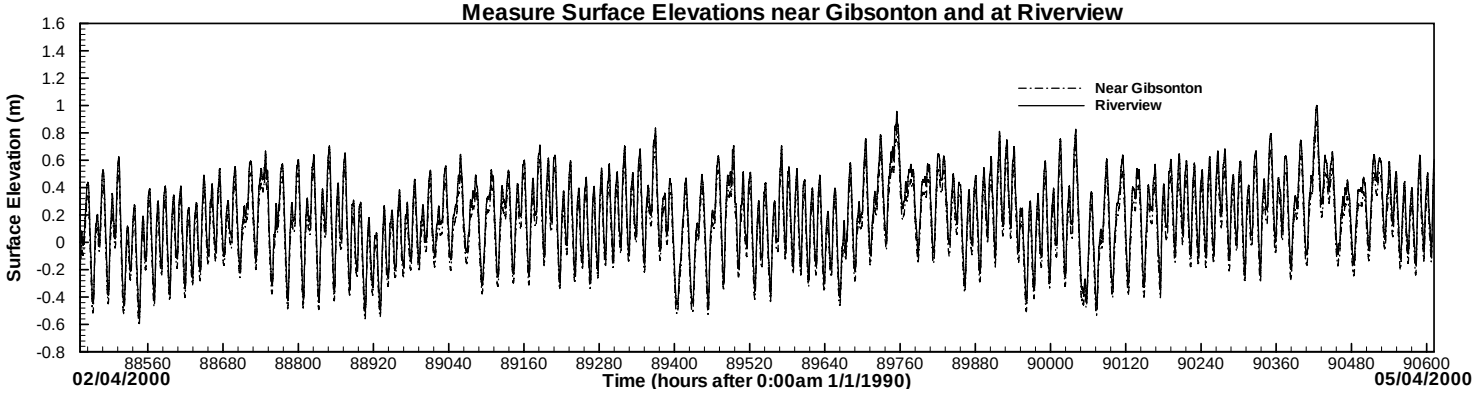

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
10/06/1999

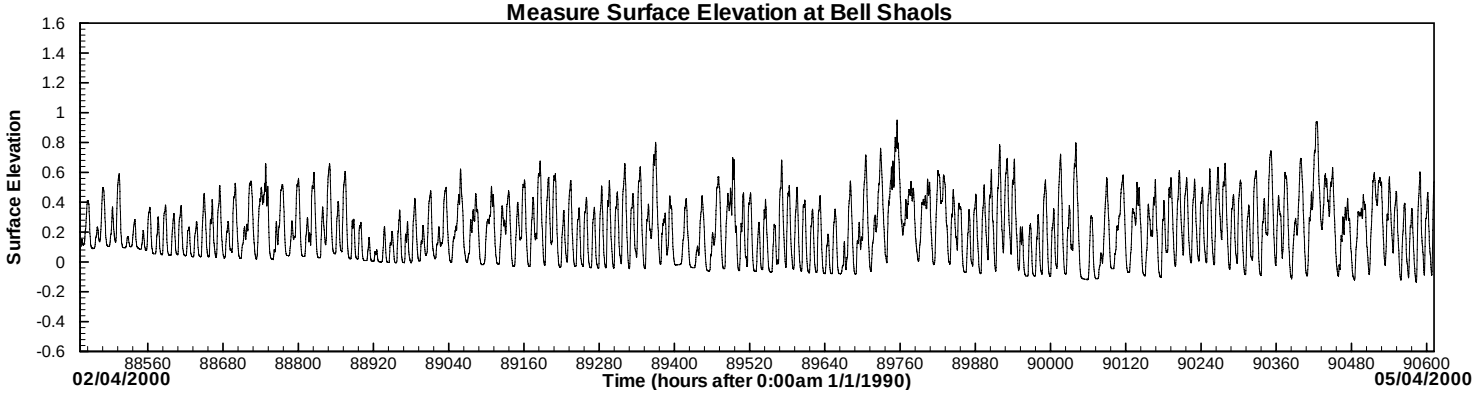

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
10/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

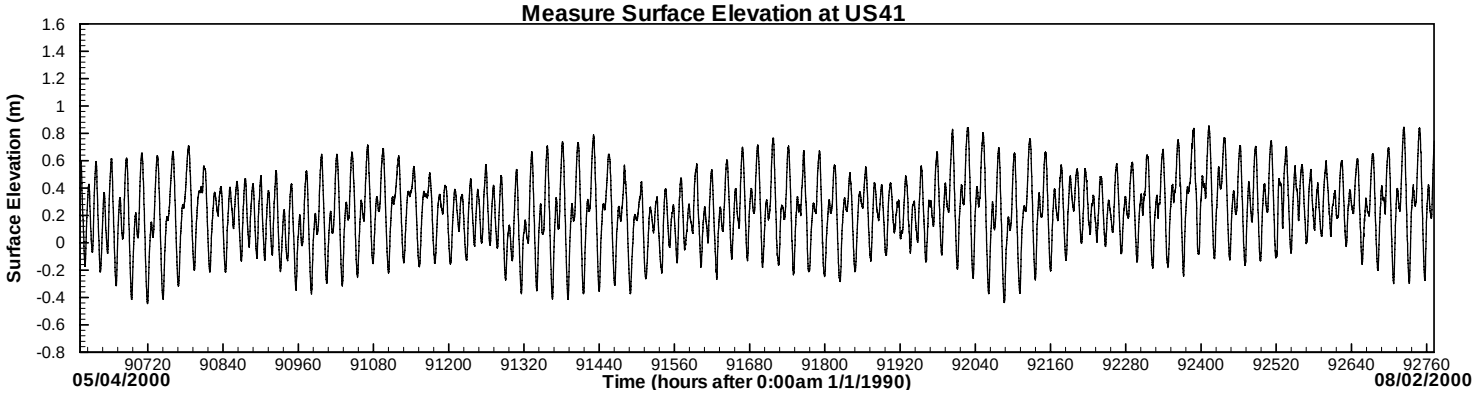

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
10/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

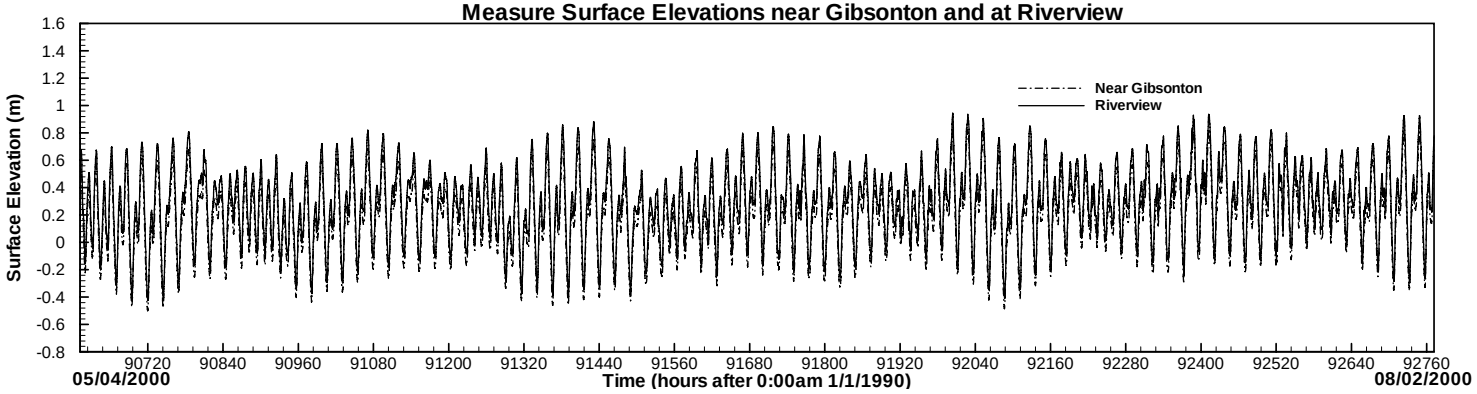

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
10/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

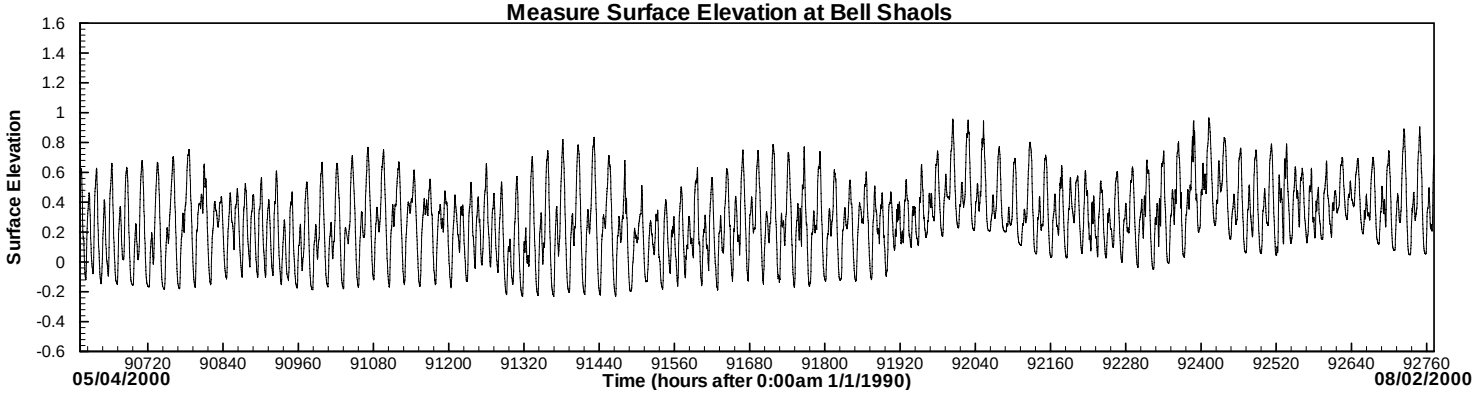

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
88560 88680 88800 88920 89040 89160 89280 89400 89520 89640 89760 89880 90000 90120 90240 90360 90480 90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

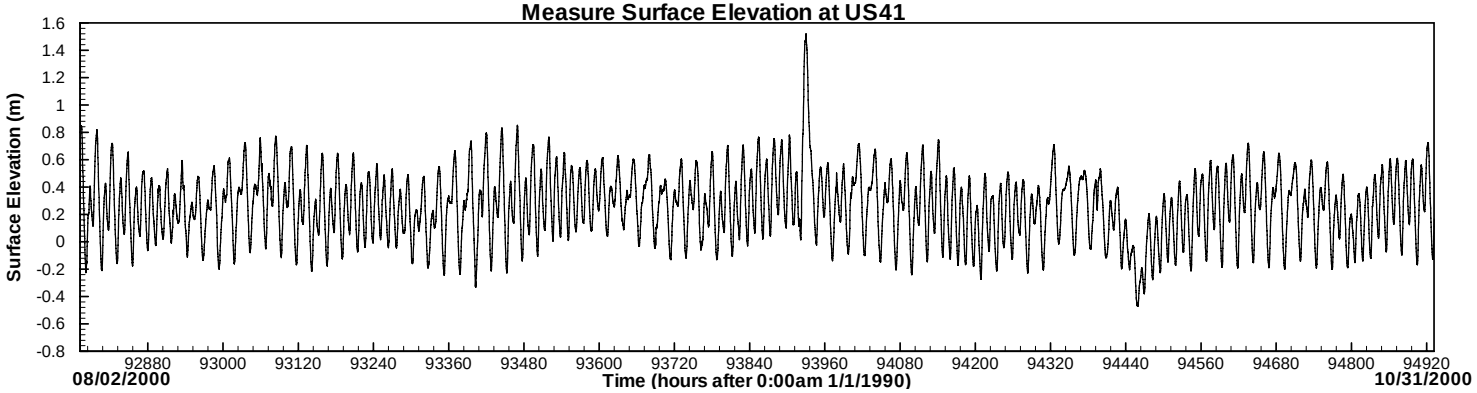

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
88560 88680 88800 88920 89040 89160 89280 89400 89520 89640 89760 89880 90000 90120 90240 90360 90480 90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

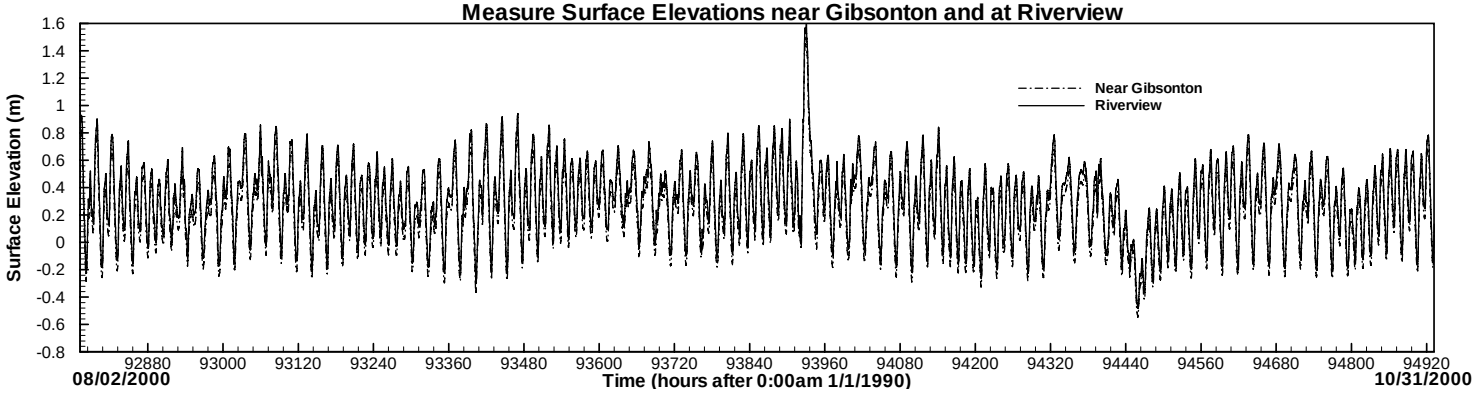

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
88560 88680 88800 88920 89040 89160 89280 89400 89520 89640 89760 89880 90000 90120 90240 90360 90480 90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

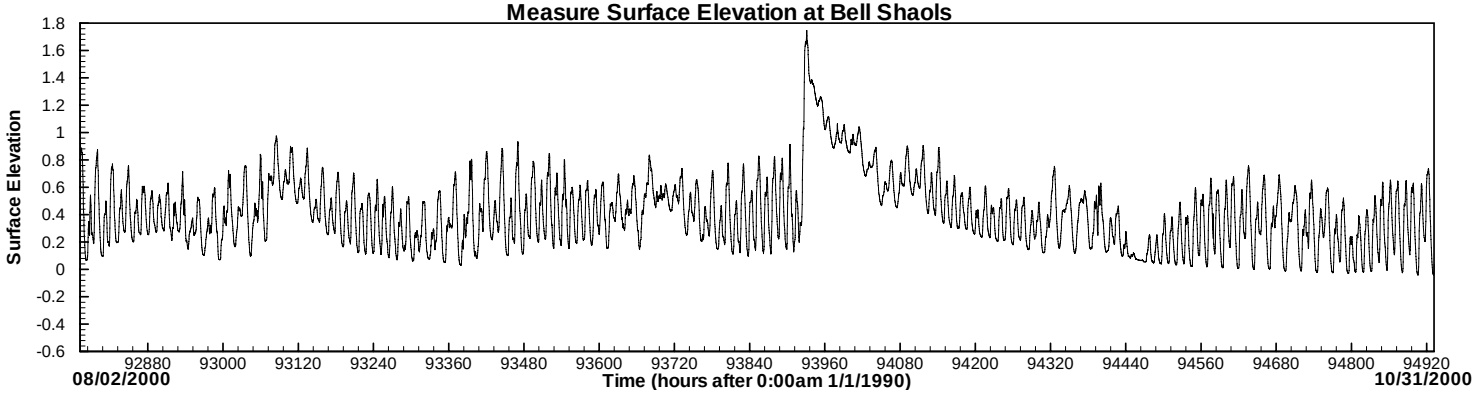

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
90720 90840 90960 91080 91200 91320 91440 91560 91680 91800 91920 92040 92160 92280 92400 92520 92640 92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

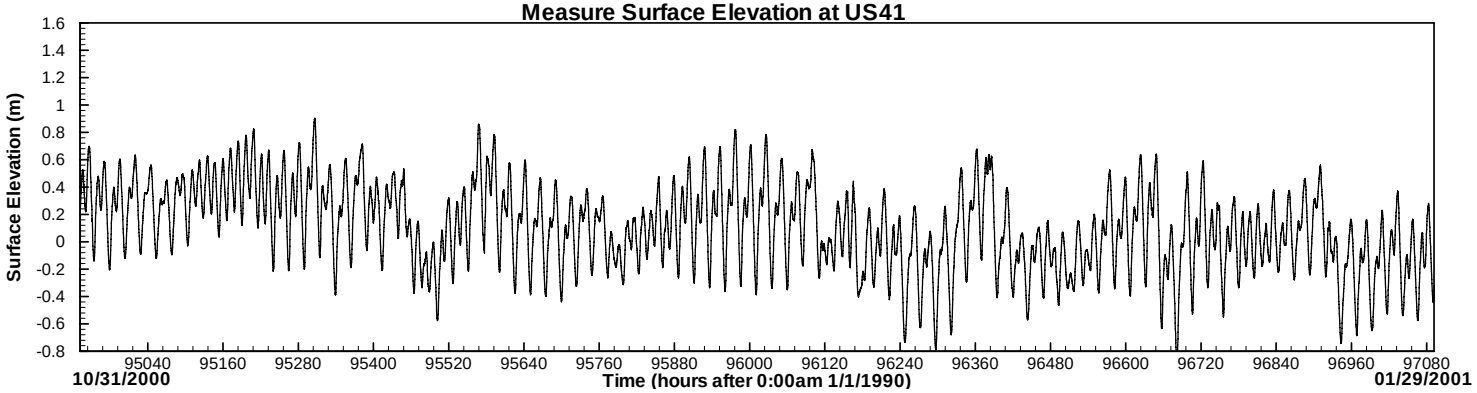

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
90720 90840 90960 91080 91200 91320 91440 91560 91680 91800 91920 92040 92160 92280 92400 92520 92640 92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

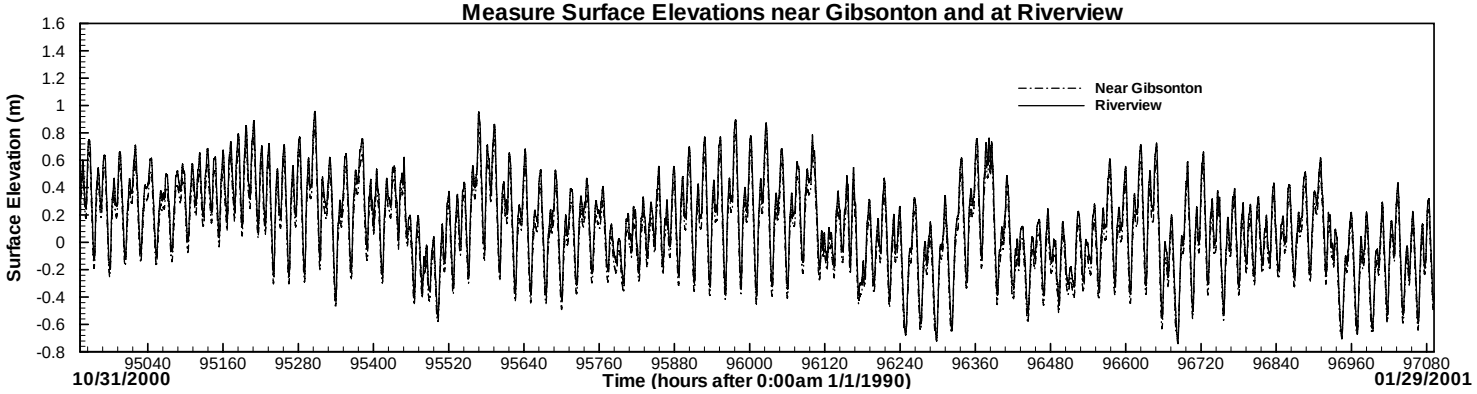

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
90720 90840 90960 91080 91200 91320 91440 91560 91680 91800 91920 92040 92160 92280 92400 92520 92640 92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

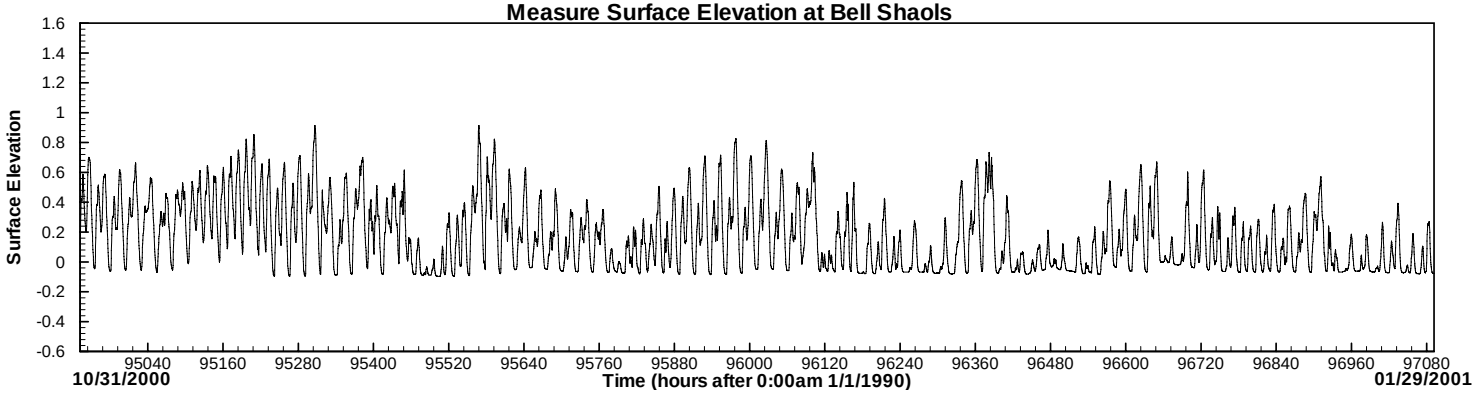

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
92880 93000 93120 93240 93360 93480 93600 93720 93840 93960 94080 94200 94320 94440 94560 94680 94800 94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

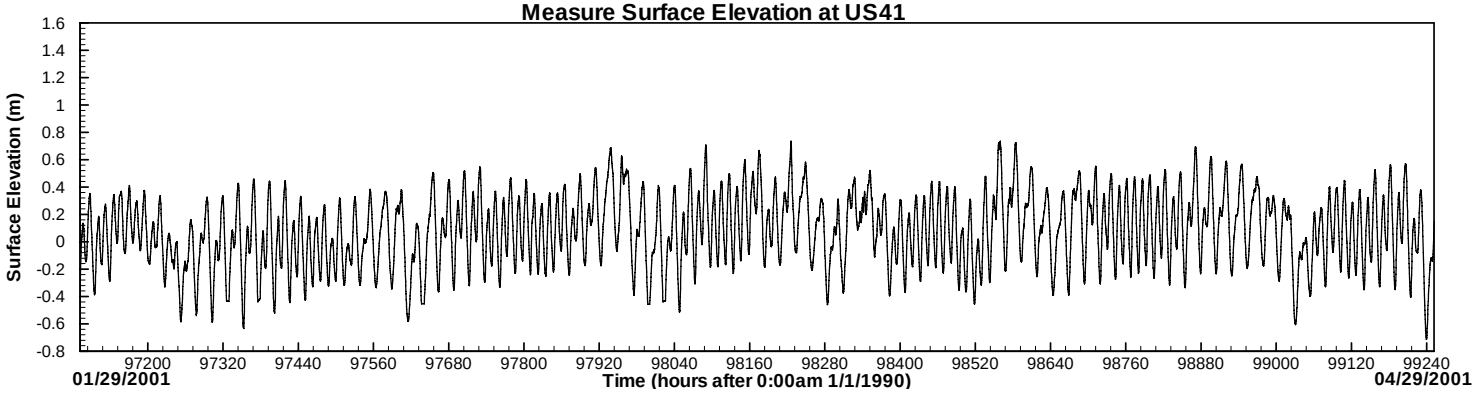

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
92880 93000 93120 93240 93360 93480 93600 93720 93840 93960 94080 94200 94320 94440 94560 94680 94800 94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

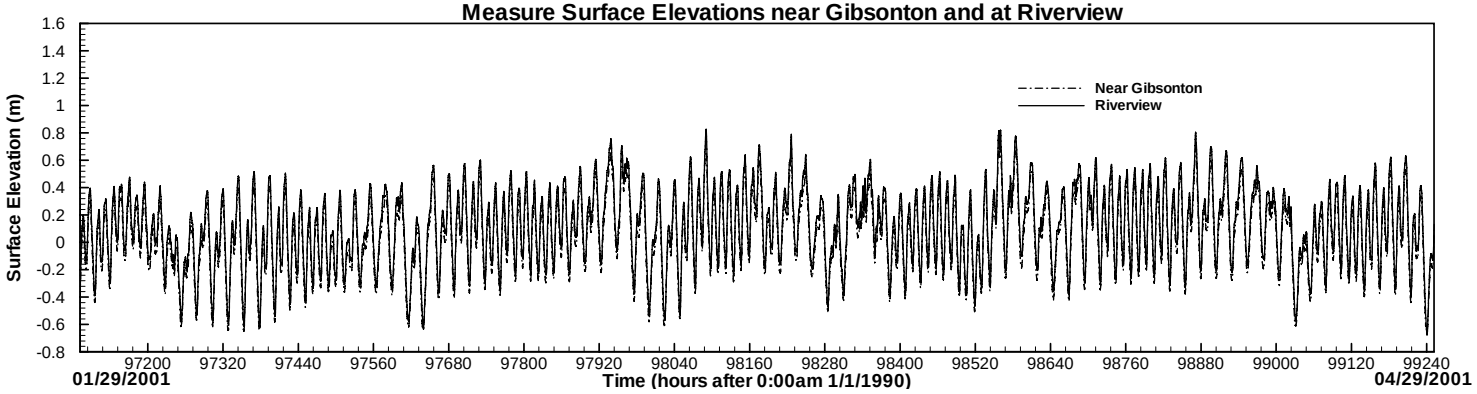

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
92880 93000 93120 93240 93360 93480 93600 93720 93840 93960 94080 94200 94320 94440 94560 94680 94800 94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

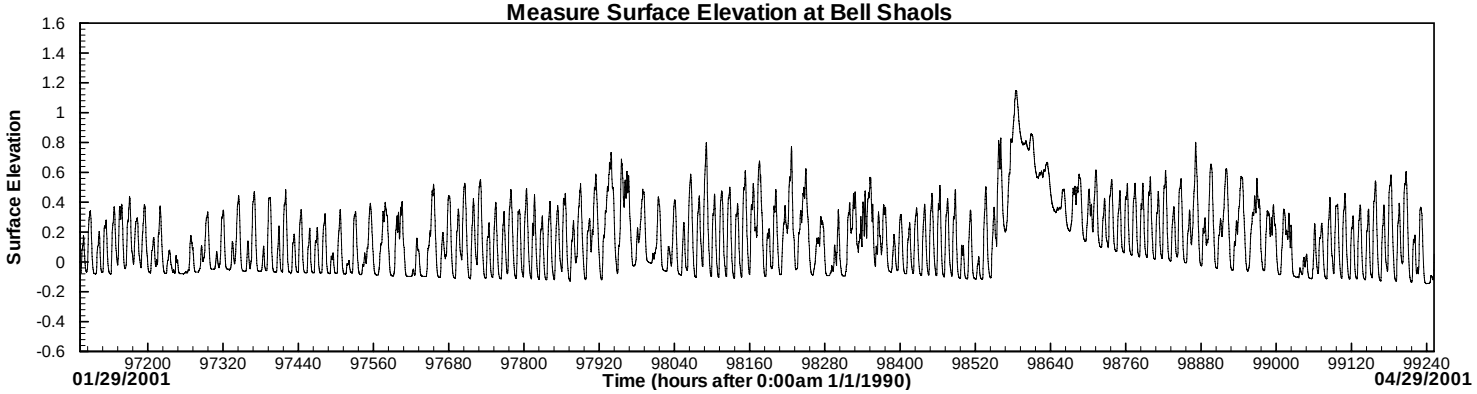

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

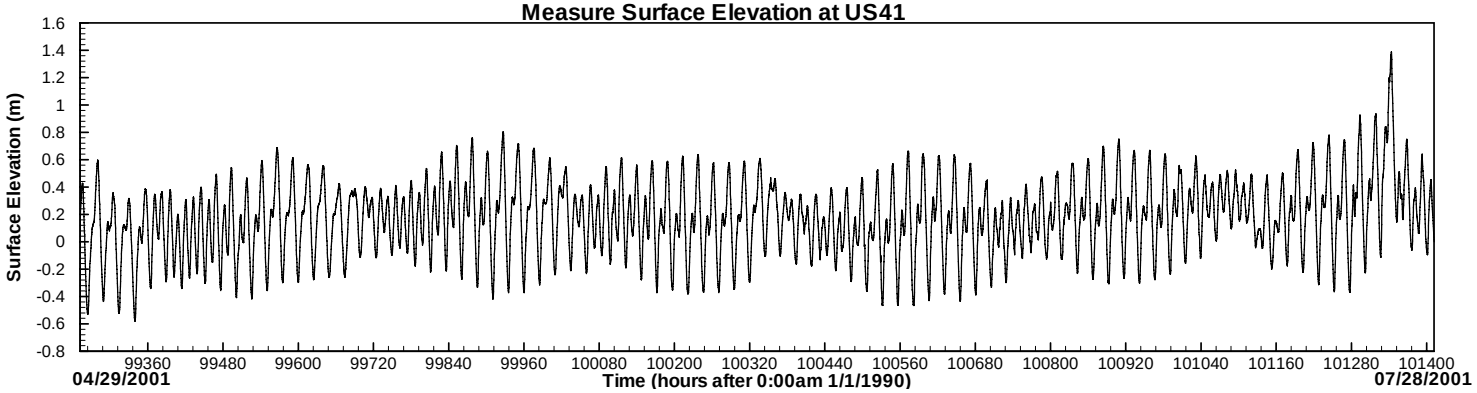

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

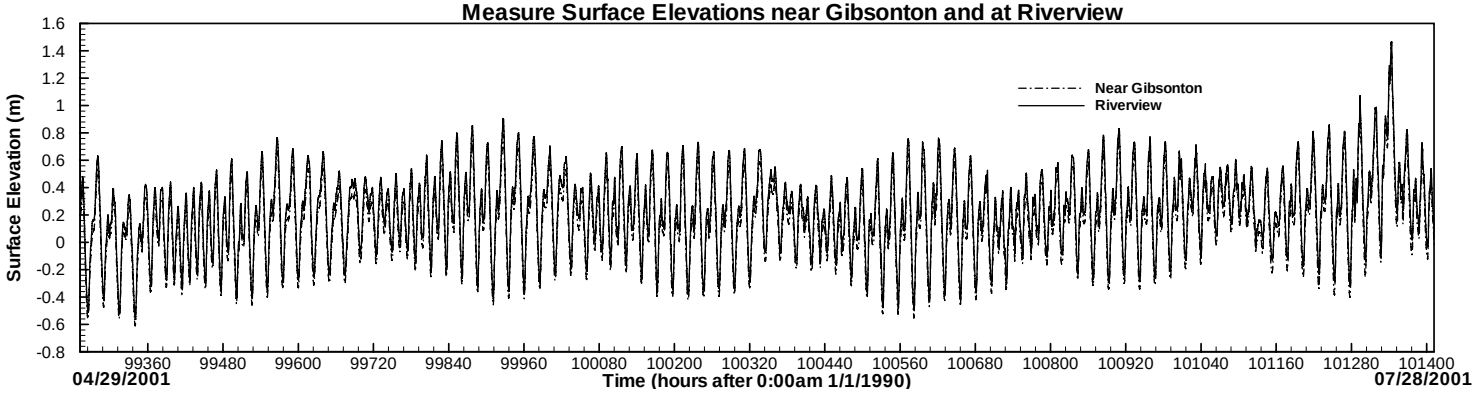

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

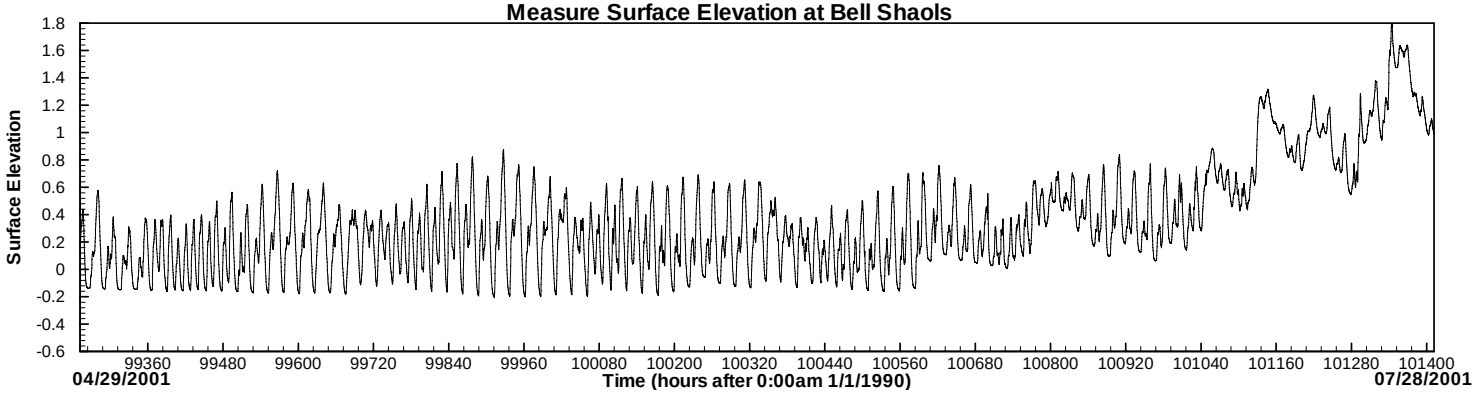

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
97200 97320 97440 97560 97680 97800 97920 98040 98160 98280 98400 98520 98640 98760 98880 99000 99120 99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

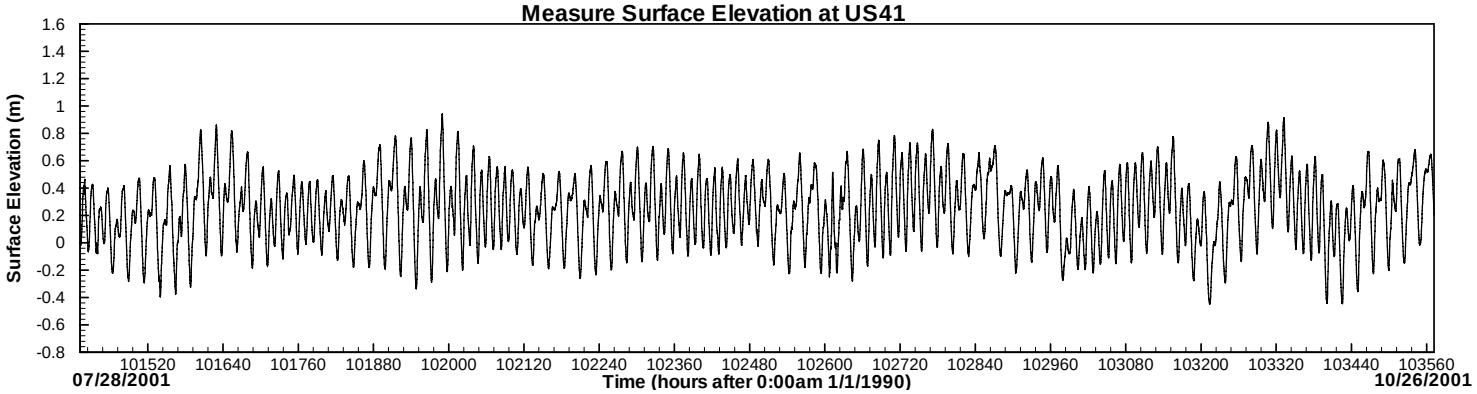

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
97200 97320 97440 97560 97680 97800 97920 98040 98160 98280 98400 98520 98640 98760 98880 99000 99120 99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

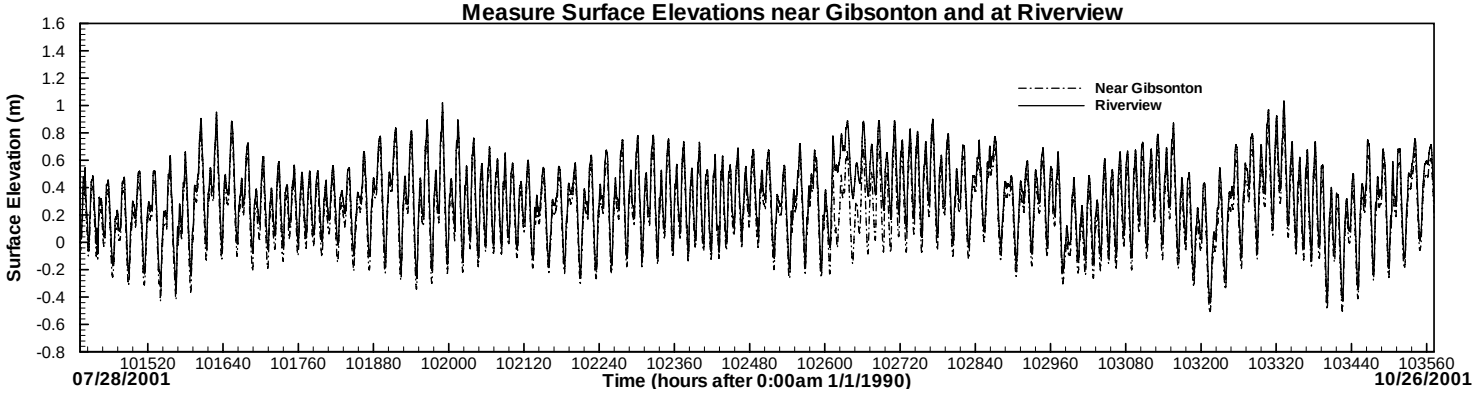

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
97200 97320 97440 97560 97680 97800 97920 98040 98160 98280 98400 98520 98640 98760 98880 99000 99120 99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

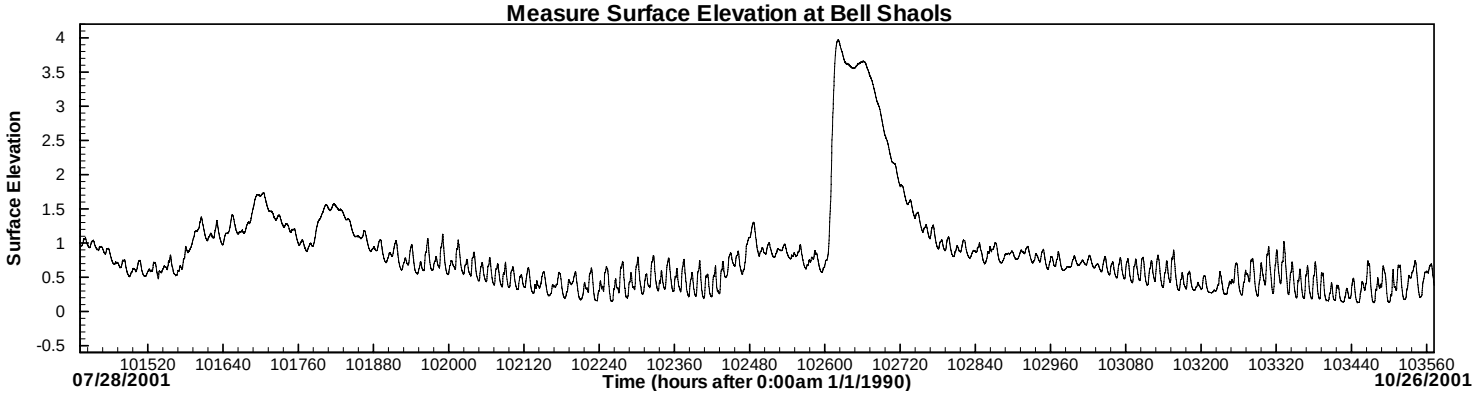

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
99360 99480 99600 99720 99840 99960 100080 100200 100320 100440 100560 100680 100800 100920 101040 101160 101280 101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

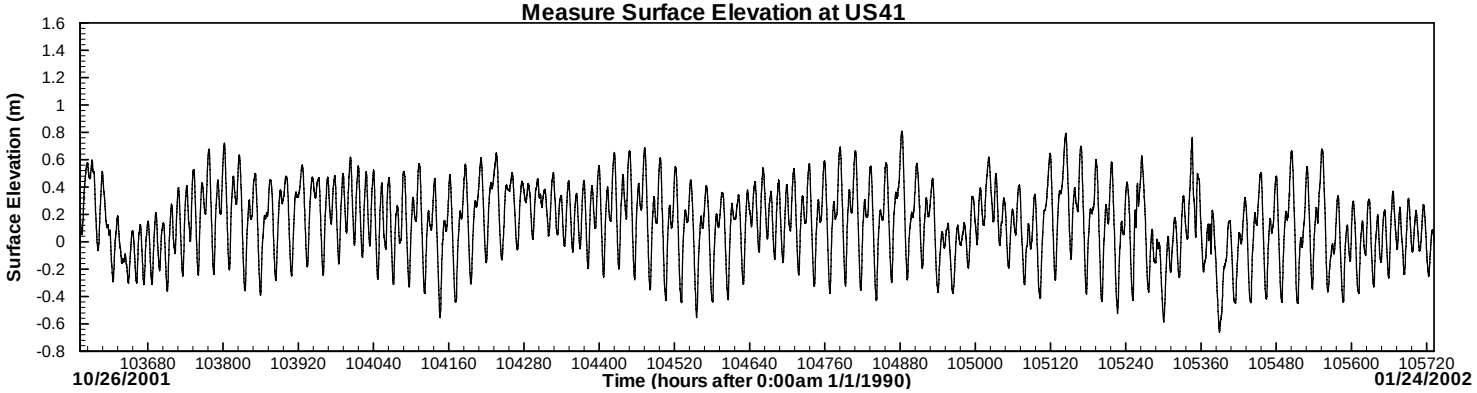

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
99360 99480 99600 99720 99840 99960 100080 100200 100320 100440 100560 100680 100800 100920 101040 101160 101280 101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

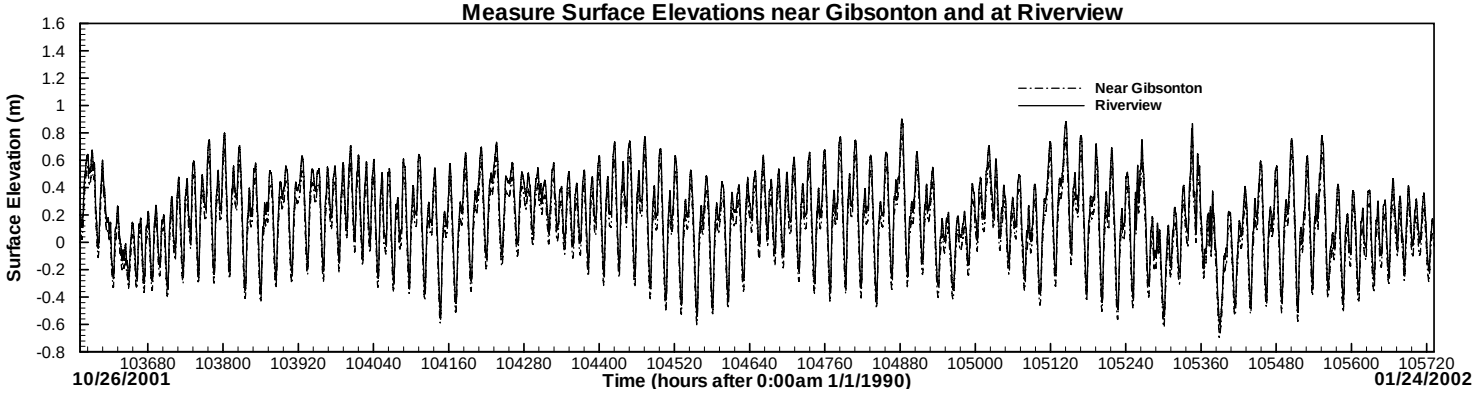

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
99360 99480 99600 99720 99840 99960 100080 100200 100320 100440 100560 100680 100800 100920 101040 101160 101280 101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

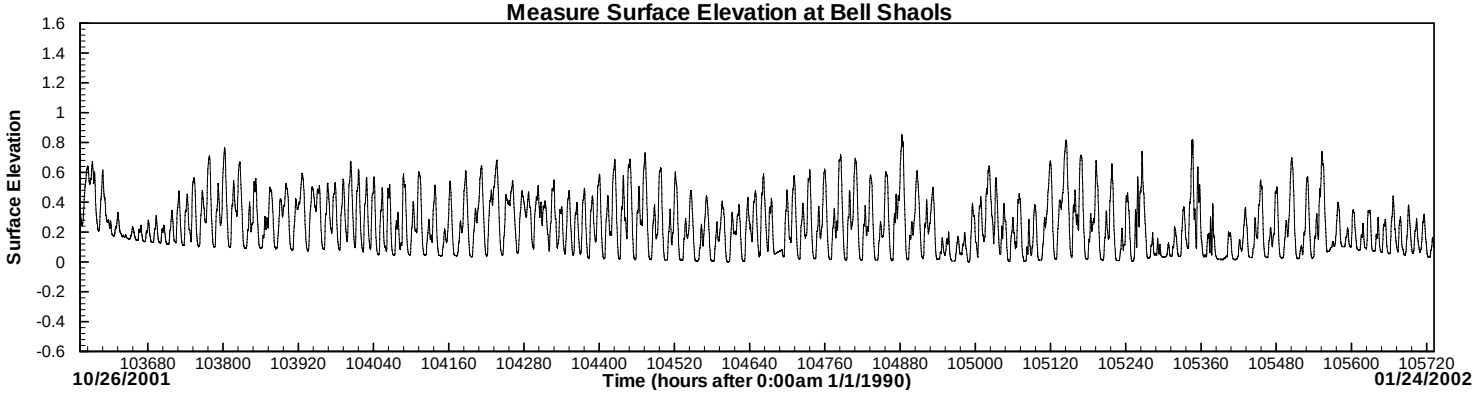

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
101520 101640 101760 101880 102000 102120 102240 102360 102480 102600 102720 102840 102960 103080 103200 103320 103440 103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

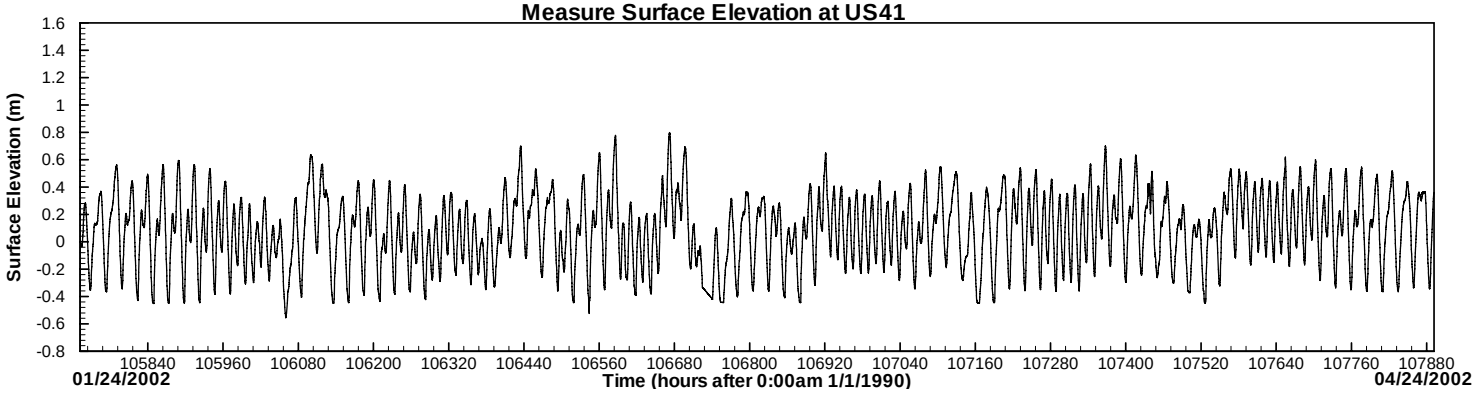

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
101520 101640 101760 101880 102000 102120 102240 102360 102480 102600 102720 102840 102960 103080 103200 103320 103440 103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

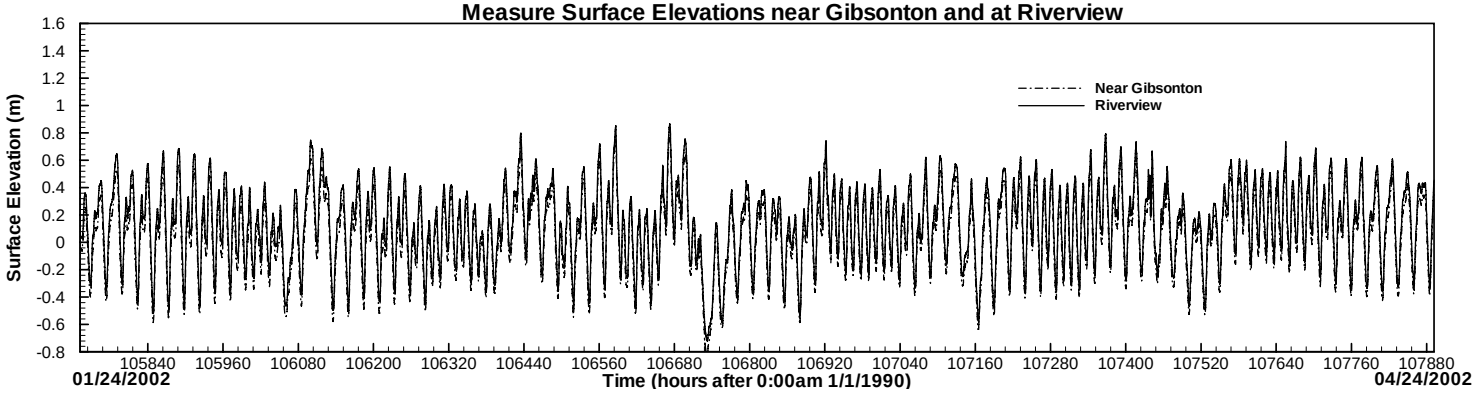

Measure Surface Elevation at Bell Shaols
Surface Elevation
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
101520 101640 101760 101880 102000 102120 102240 102360 102480 102600 102720 102840 102960 103080 103200 103320 103440 103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

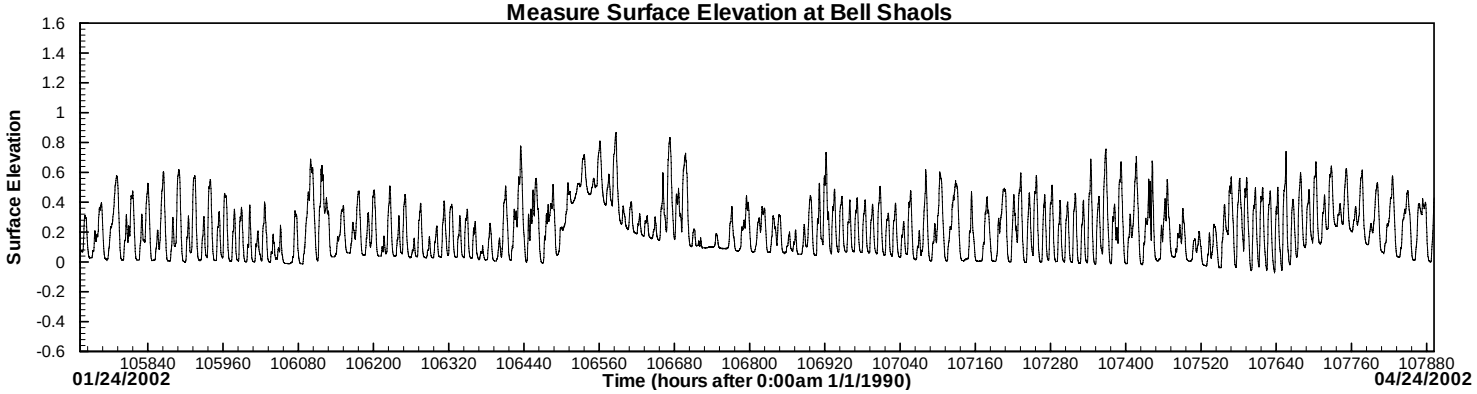

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
103680 103800 103920 104040 104160 104280 104400 104520 104640 104760 104880 105000 105120 105240 105360 105480 105600 105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

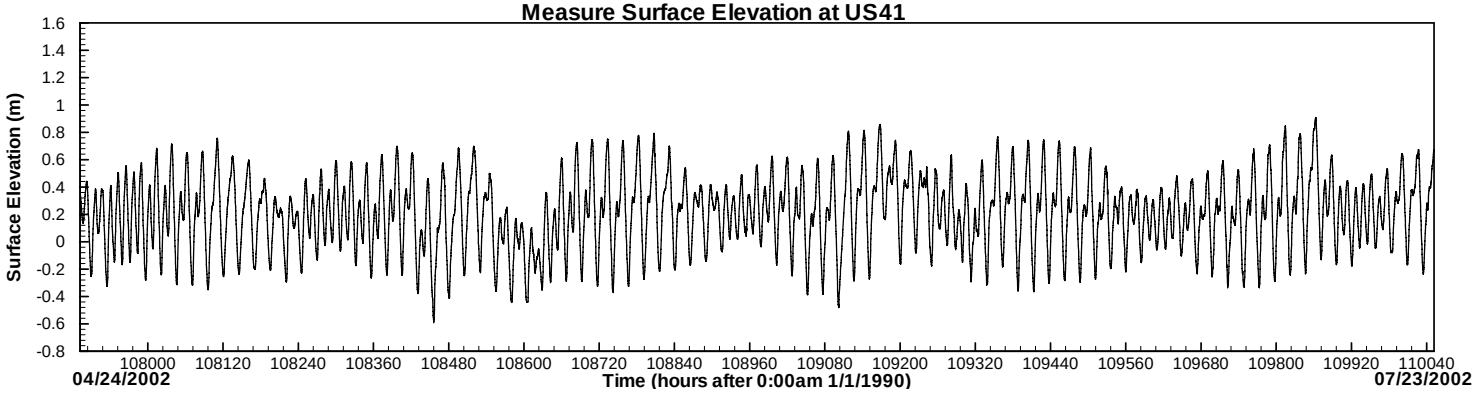

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
103680 103800 103920 104040 104160 104280 104400 104520 104640 104760 104880 105000 105120 105240 105360 105480 105600 105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

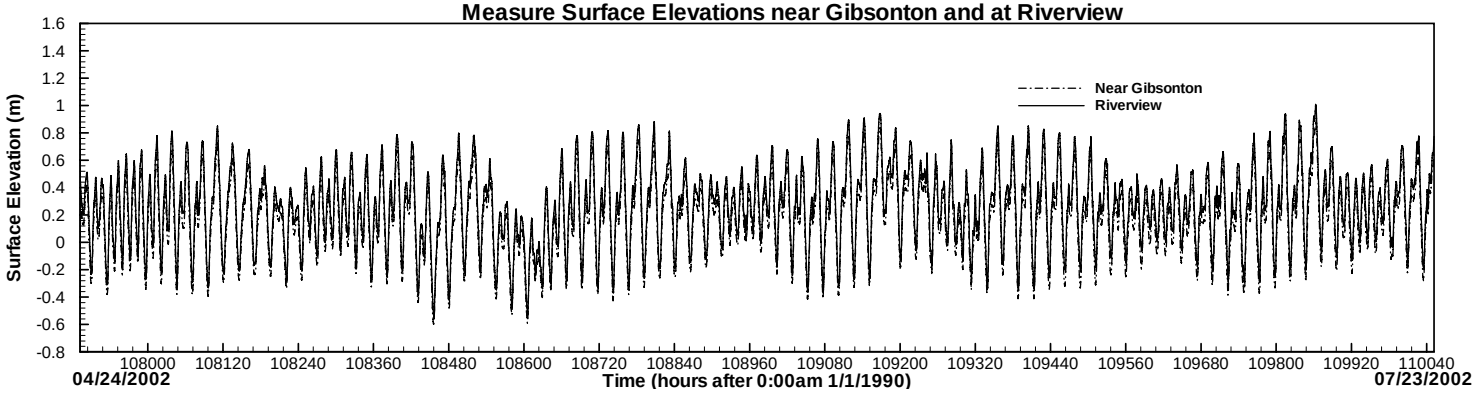

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
103680 103800 103920 104040 104160 104280 104400 104520 104640 104760 104880 105000 105120 105240 105360 105480 105600 105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

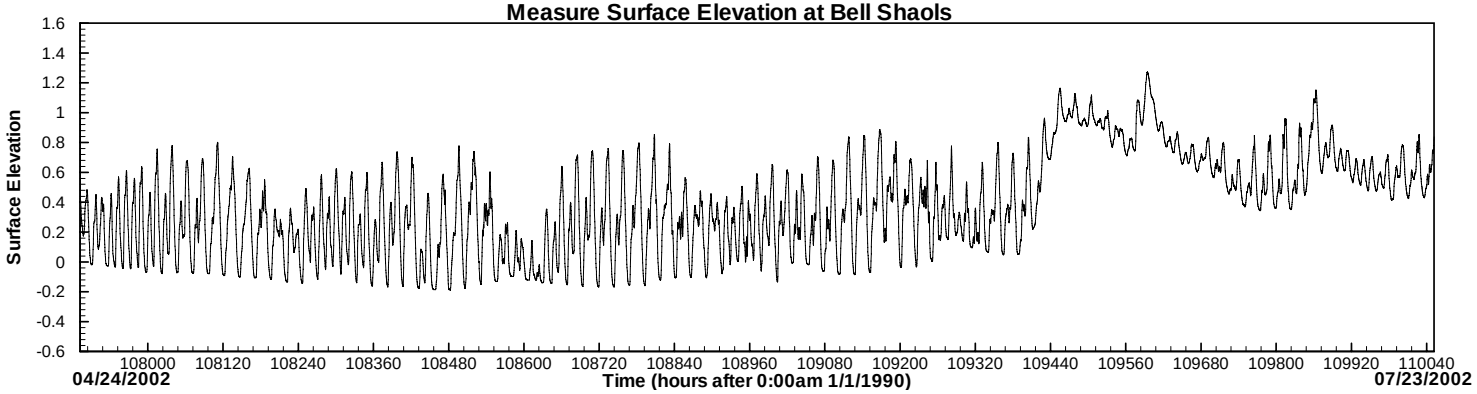

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

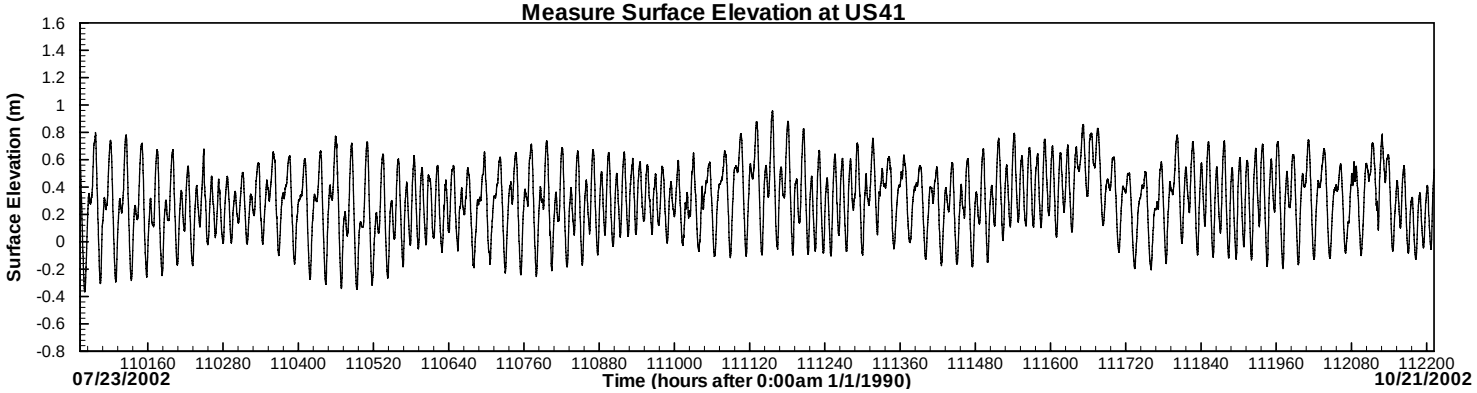

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

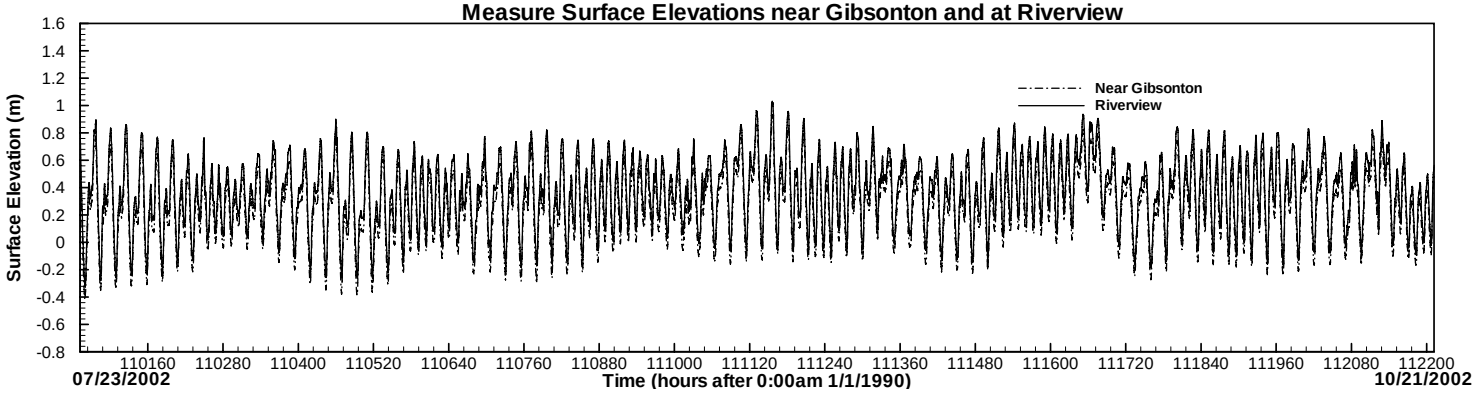

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

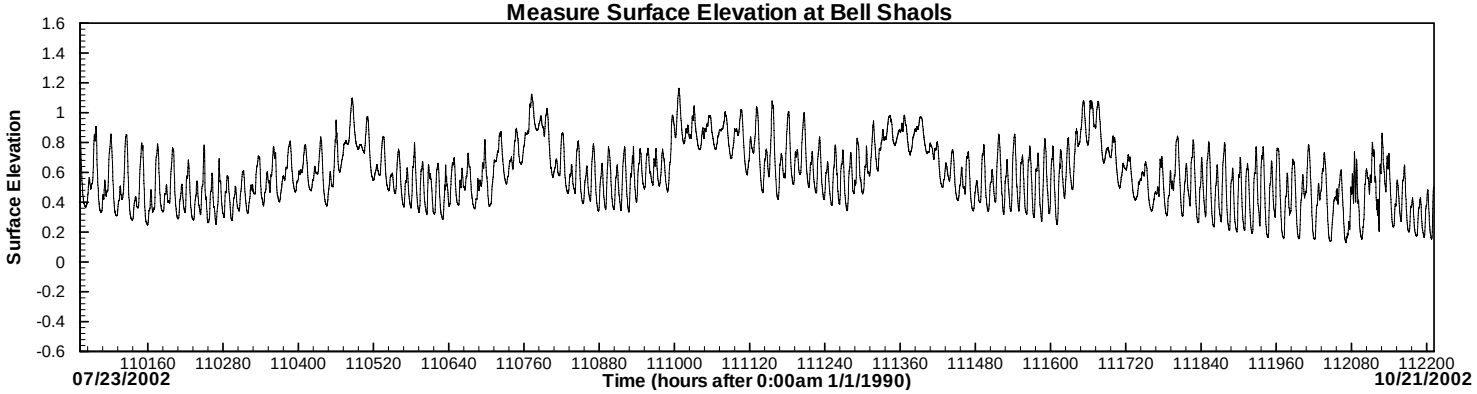

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

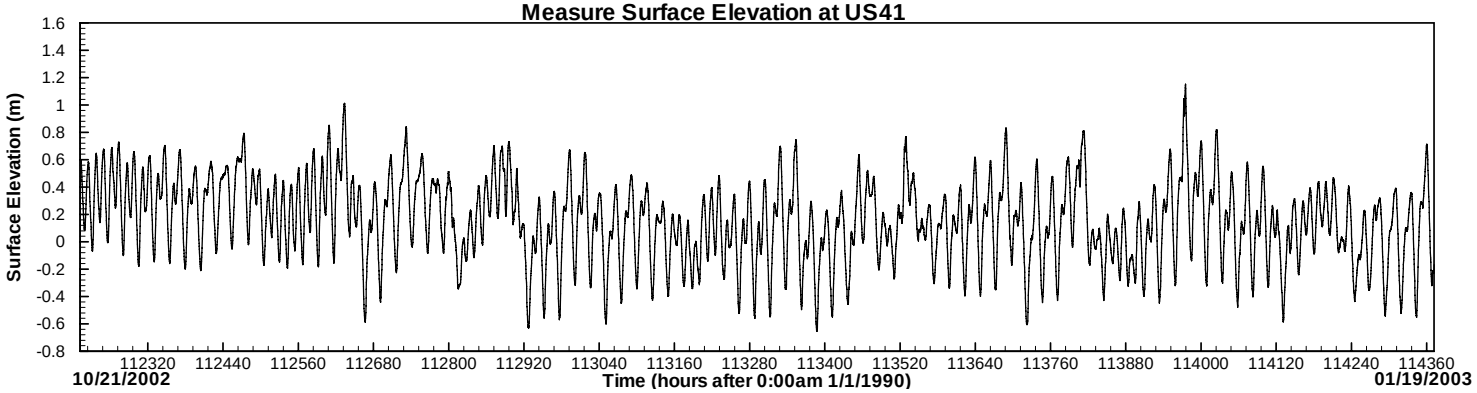

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

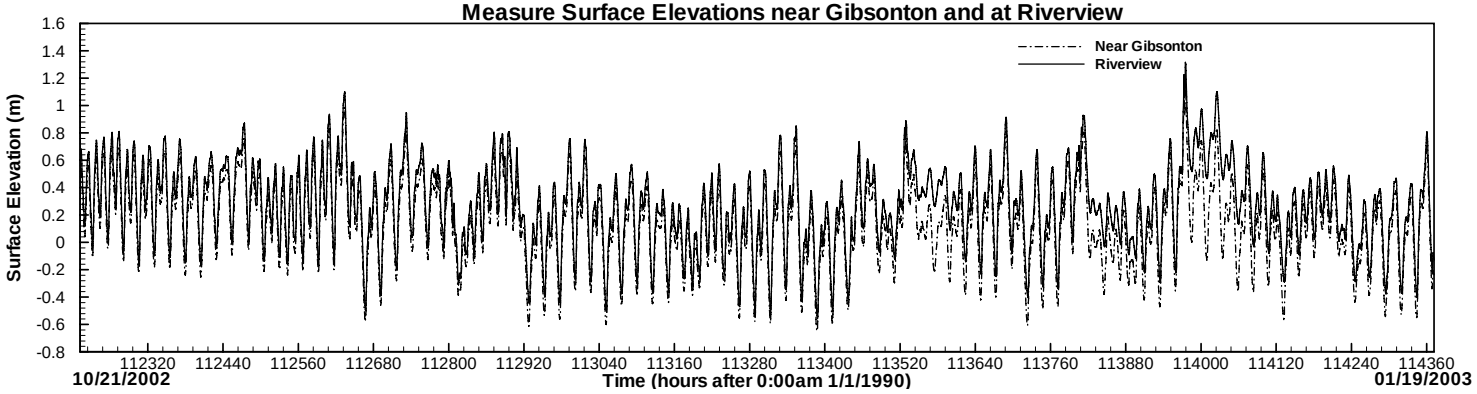

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

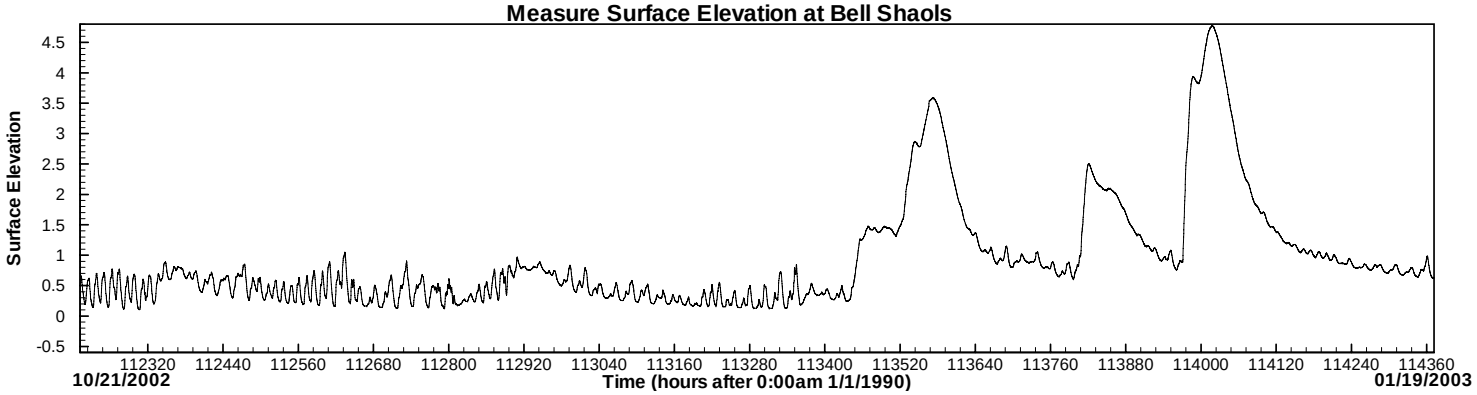

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

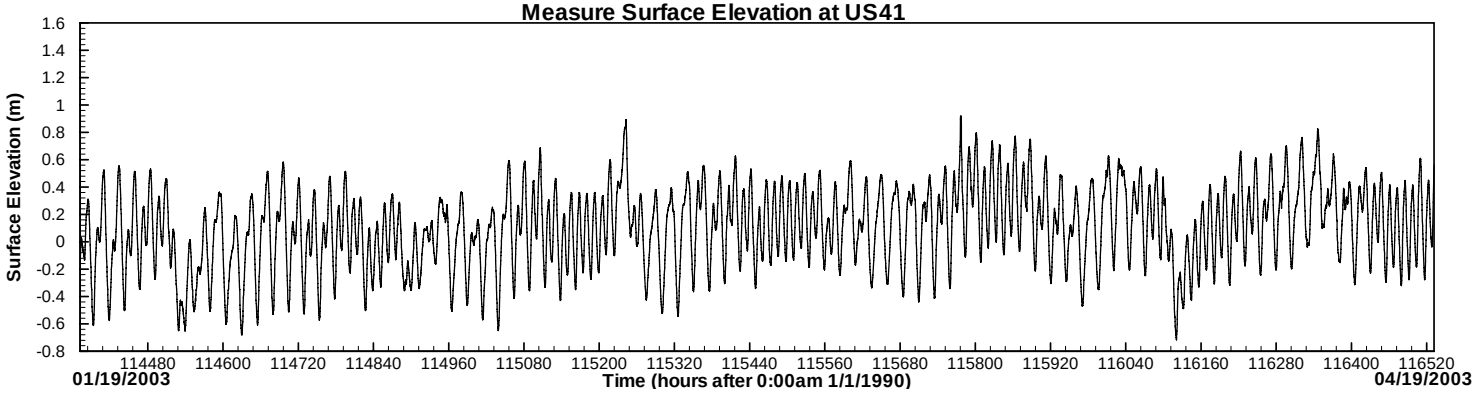

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

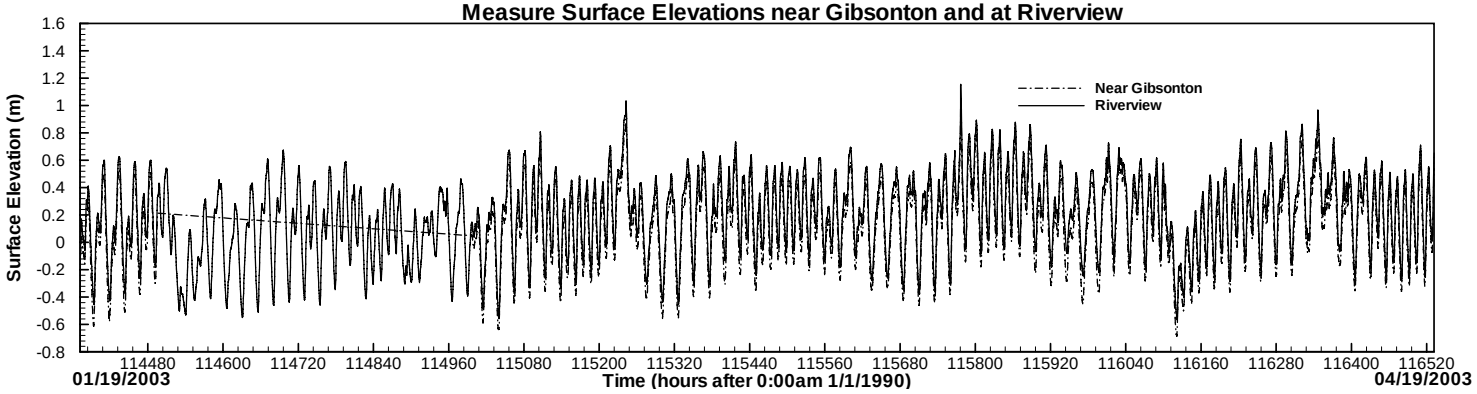

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

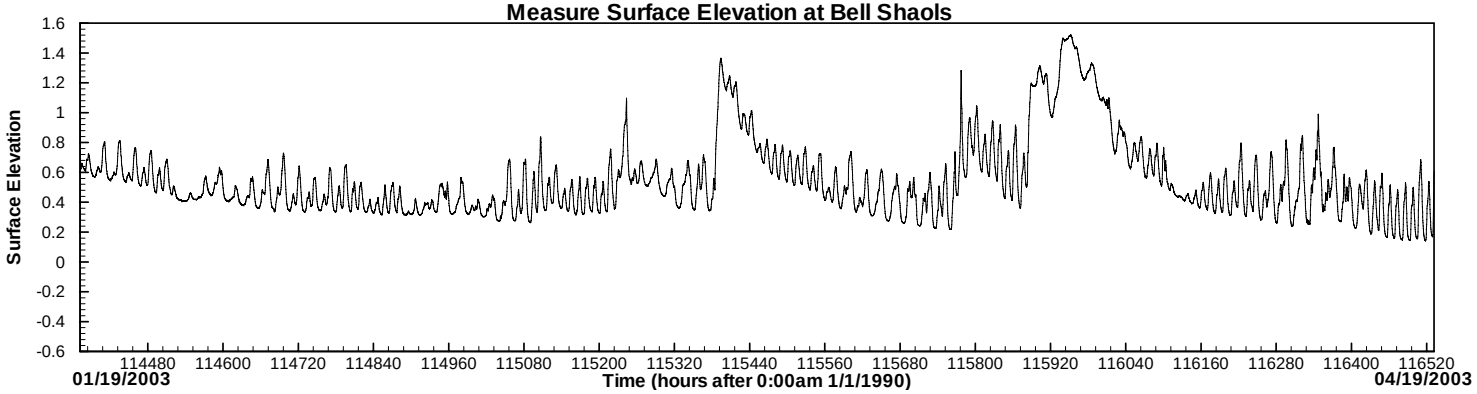

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

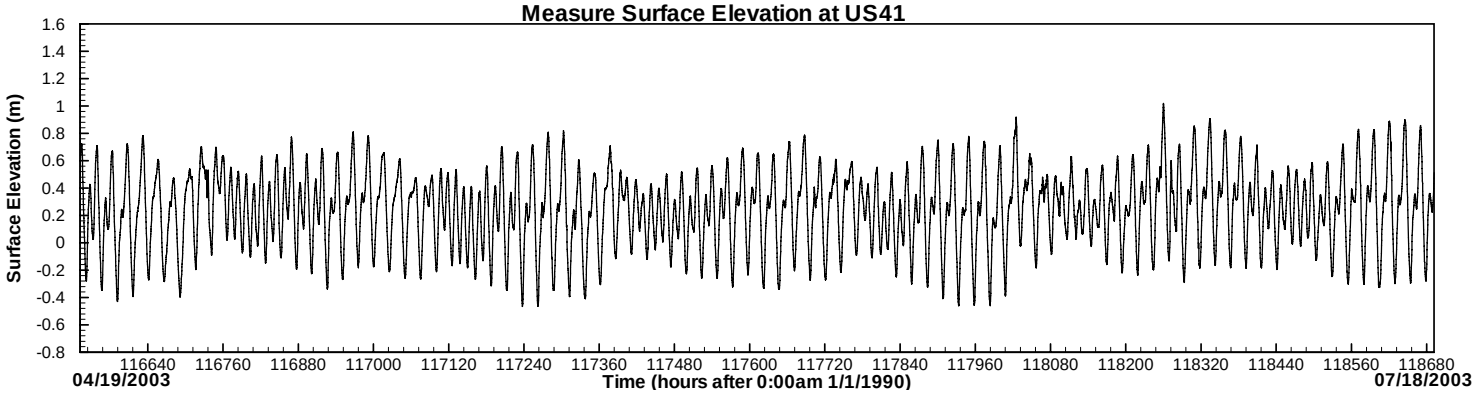

Measure Surface Elevations near Gibsonton and at Riverview
Near Gibsonton
Riverview
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

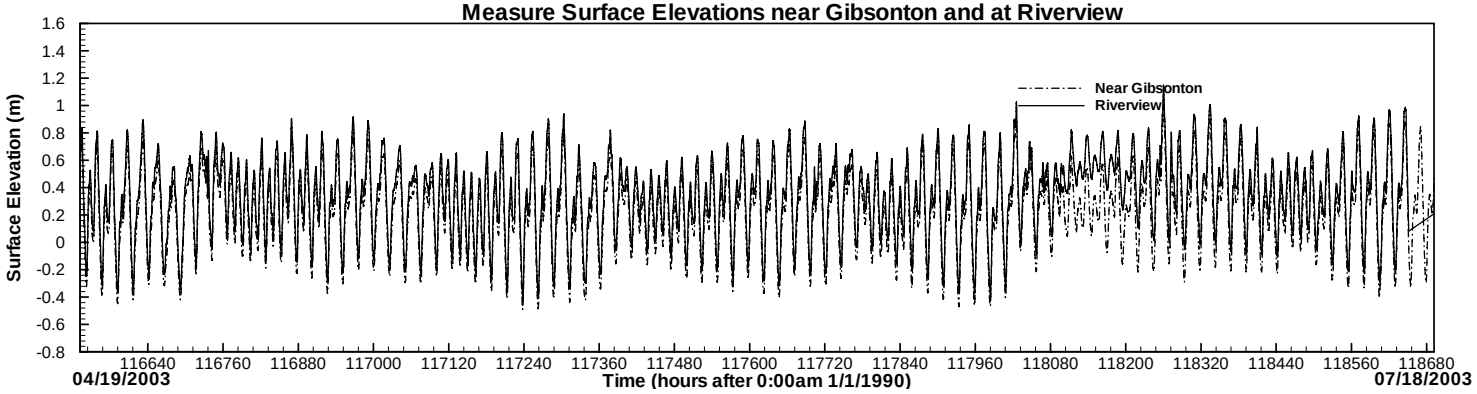

Measure Surface Elevation at Bell Shaols
Surface Elevation
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

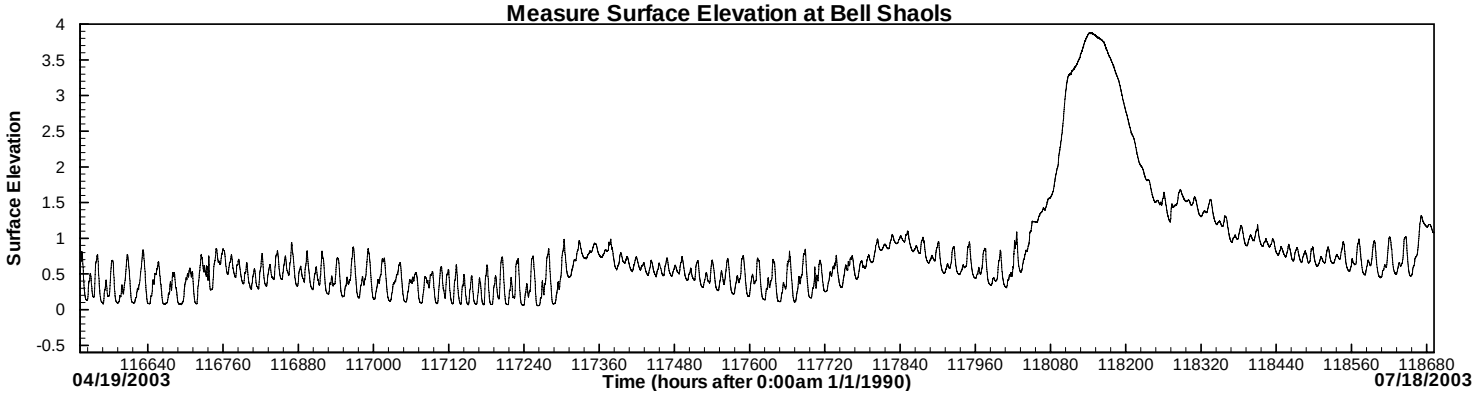

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
114480 114600 114720 114840 114960 115080 115200 115320 115440 115560 115680 115800 115920 116040 116160 116280 116400 116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

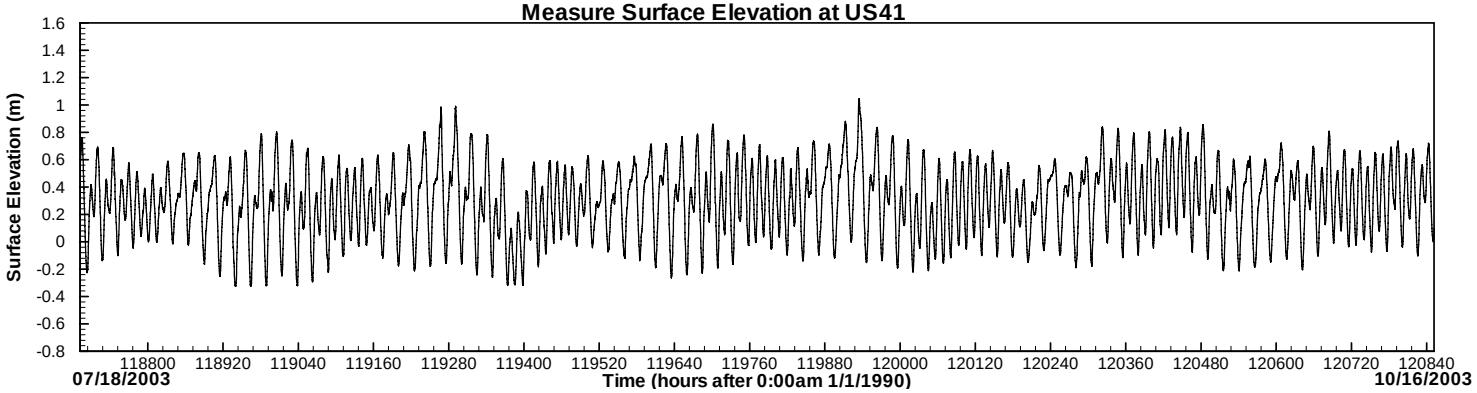

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
114480 114600 114720 114840 114960 115080 115200 115320 115440 115560 115680 115800 115920 116040 116160 116280 116400 116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

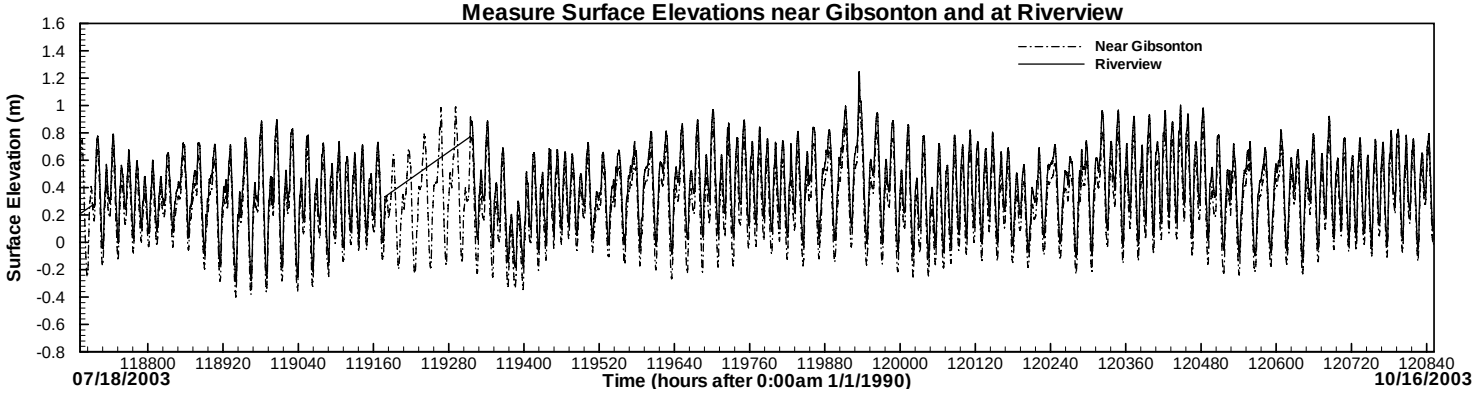

Measure Surface Elevation at Bell Shaols
Surface Elevation
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
114480 114600 114720 114840 114960 115080 115200 115320 115440 115560 115680 115800 115920 116040 116160 116280 116400 116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

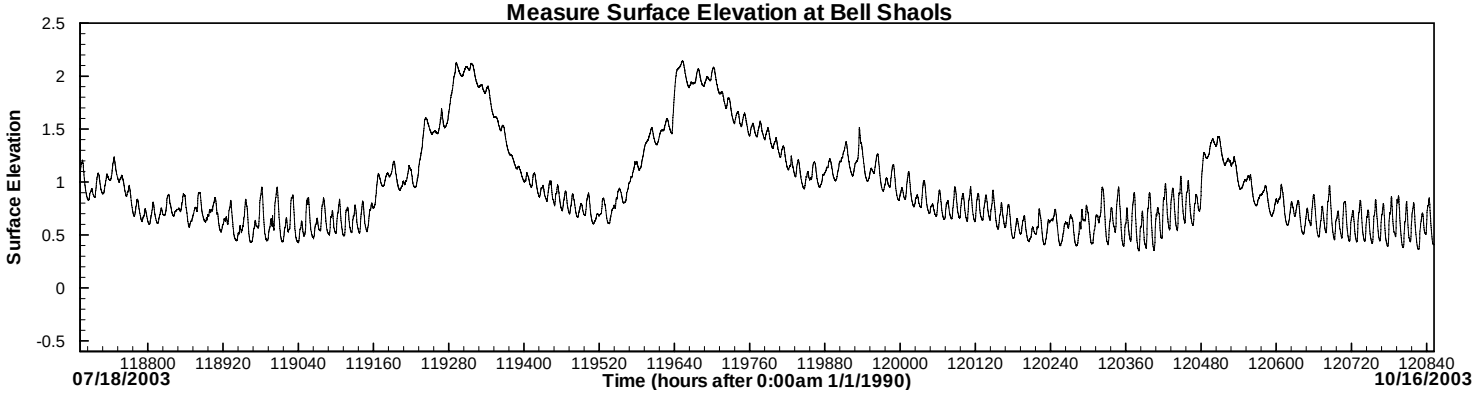

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
116640 116760 116880 117000 117120 117240 117360 117480 117600 117720 117840 117960 118080 118200 118320 118440 118560 118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

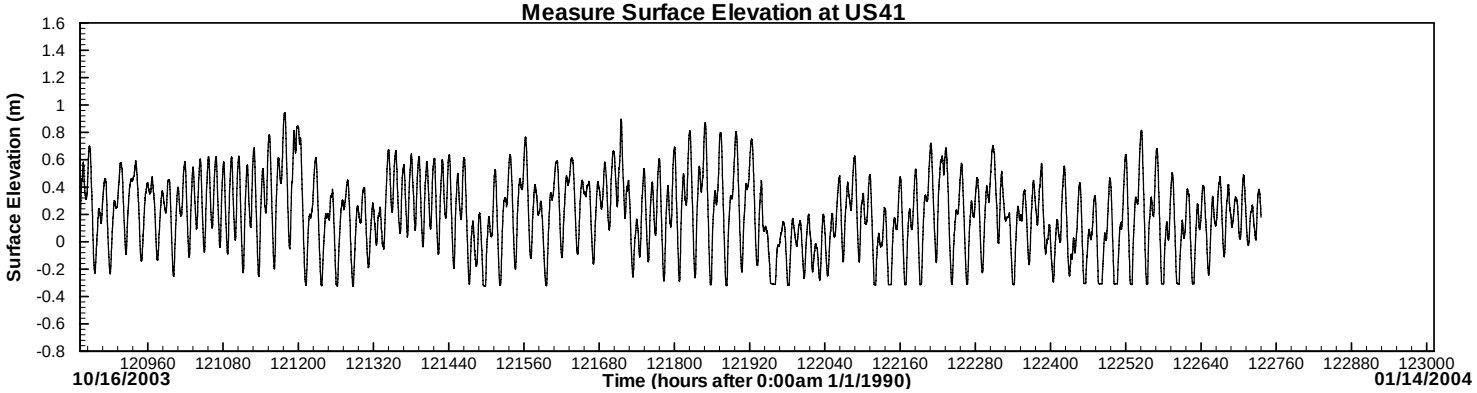

Measure Surface Elevations near Gibsonton and at Riverview
Surface Elevation (m)
Near Gibsonton
Riverview
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
116640 116760 116880 117000 117120 117240 117360 117480 117600 117720 117840 117960 118080 118200 118320 118440 118560 118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

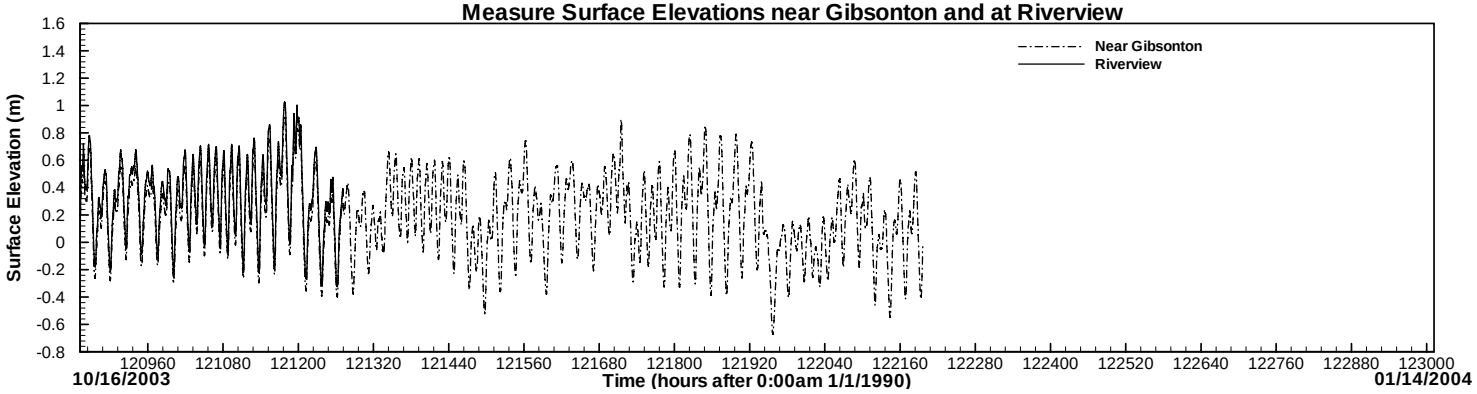

Measure Surface Elevation at Bell Shaols
Surface Elevation
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
116640 116760 116880 117000 117120 117240 117360 117480 117600 117720 117840 117960 118080 118200 118320 118440 118560 118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

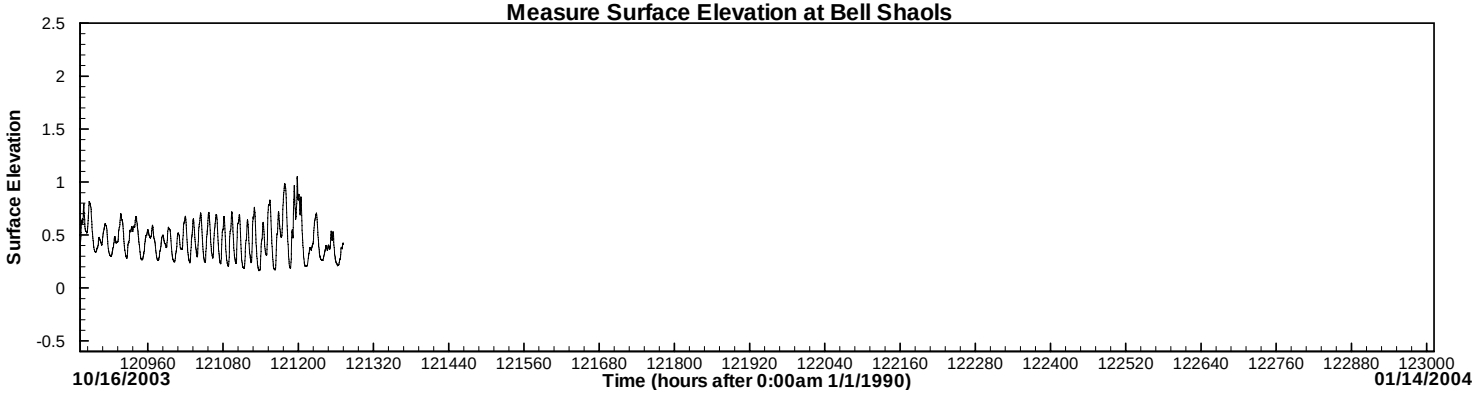

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003


Measure Surface Elevations near Gibsonton and at Riverview
Near Gibsonton
Riverview
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003


Measure Surface Elevation at Bell Shaols
Surface Elevation
2.5
2
1.5
1
0.5
0
-0.5
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003

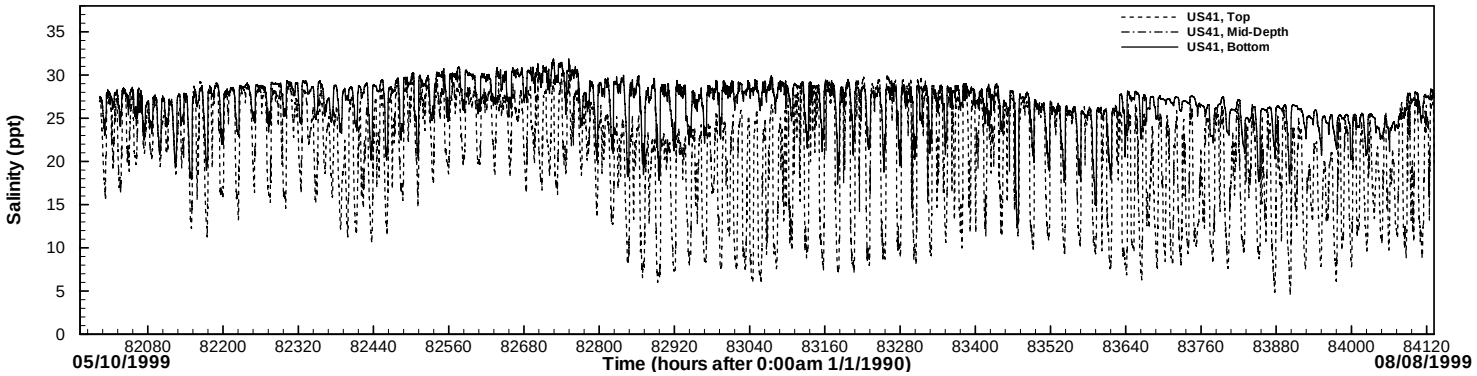

Measure Surface Elevation at US41
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
120960 121080 121200 121320 121440 121560 121680 121800 121920 122040 122160 122280 122400 122520 122640 122760 122880 123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

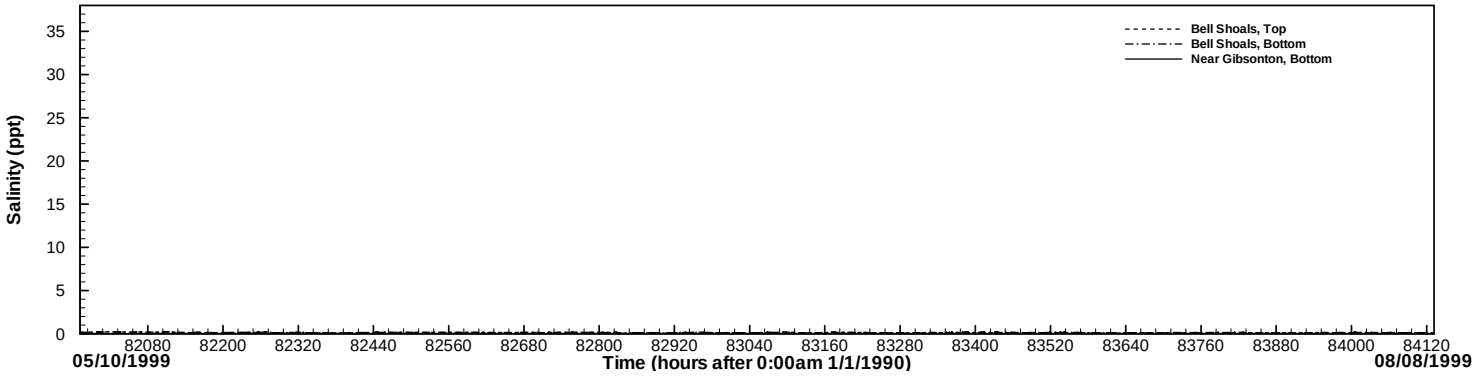

Measure Surface Elevations near Gibsonton and at Riverview
Near Gibsonton
Riverview
Surface Elevation (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
120960 121080 121200 121320 121440 121560 121680 121800 121920 122040 122160 122280 122400 122520 122640 122760 122880 123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

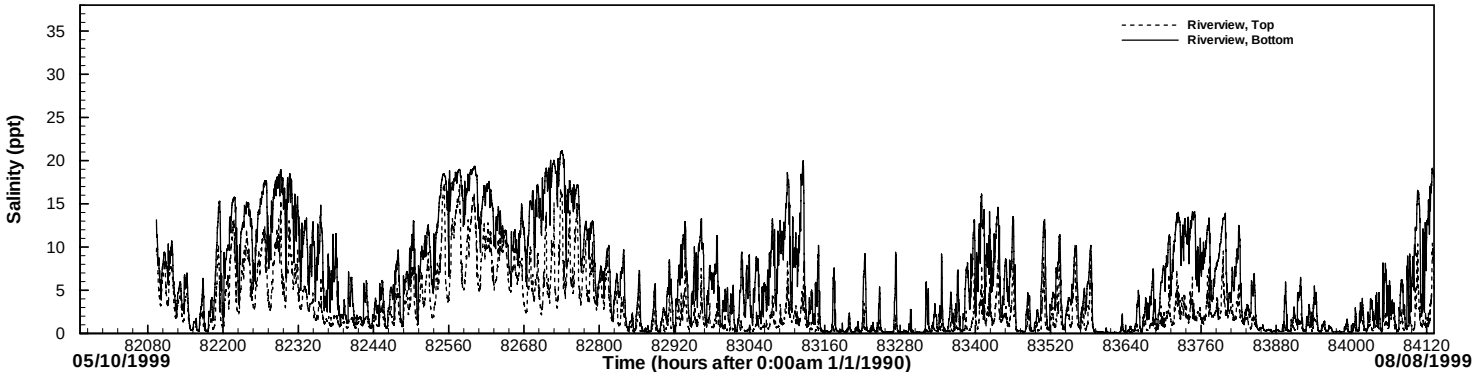

Measure Surface Elevation at Bell Shaols
Surface Elevation
2.5
2
1.5
1
0.5
0
-0.5
120960 121080 121200 121320 121440 121560 121680 121800 121920 122040 122160 122280 122400 122520 122640 122760 122880 123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

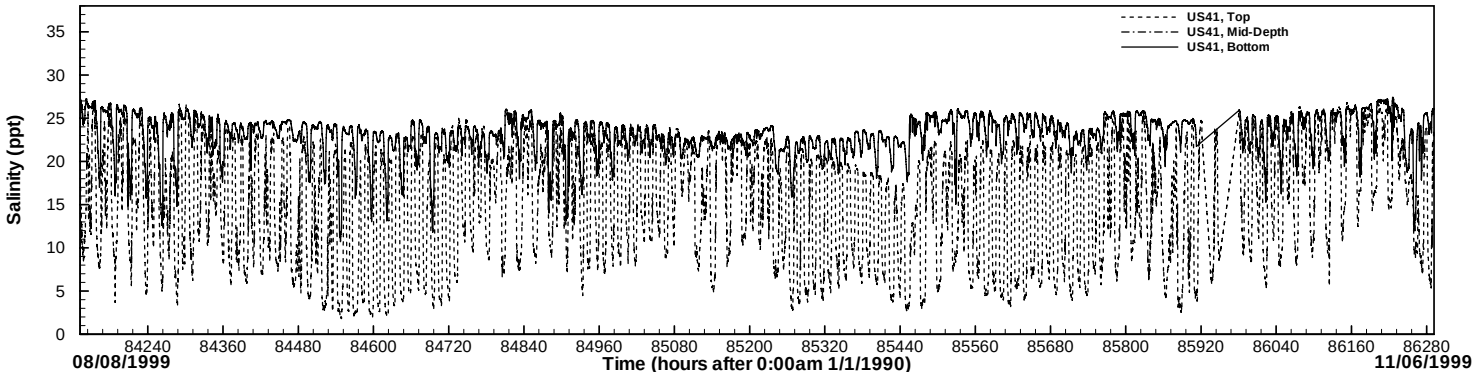
Appendix B
Measured Salinity Data in the Lower Alafia River

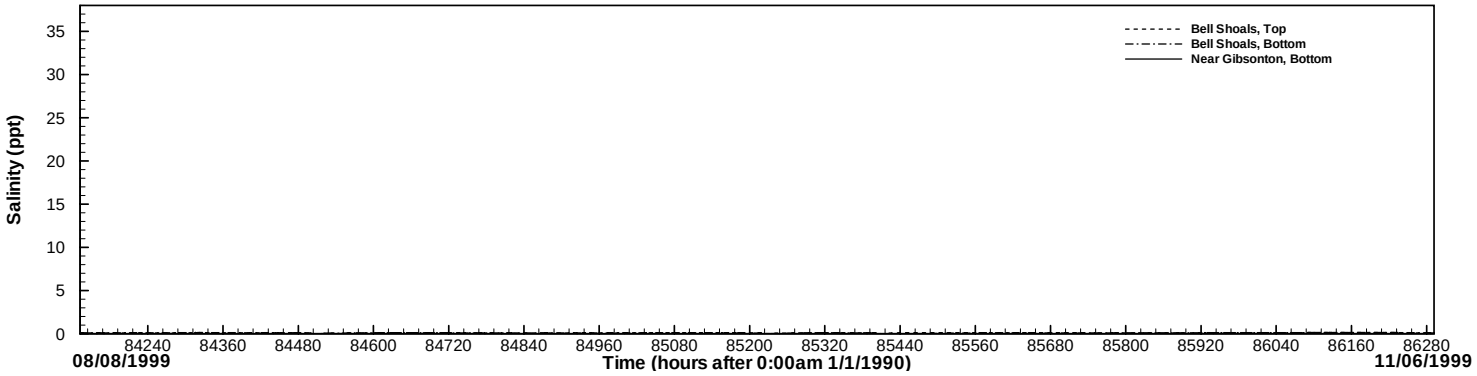
The following 19 pages show plots of measured salinity data during May 1999 through December 2003 at the USGS Alafia River at Gibsonton, Alafia River near Gibsonton, Alafia River at Riverview, and Alafia River at Bell Shoals Road stations.

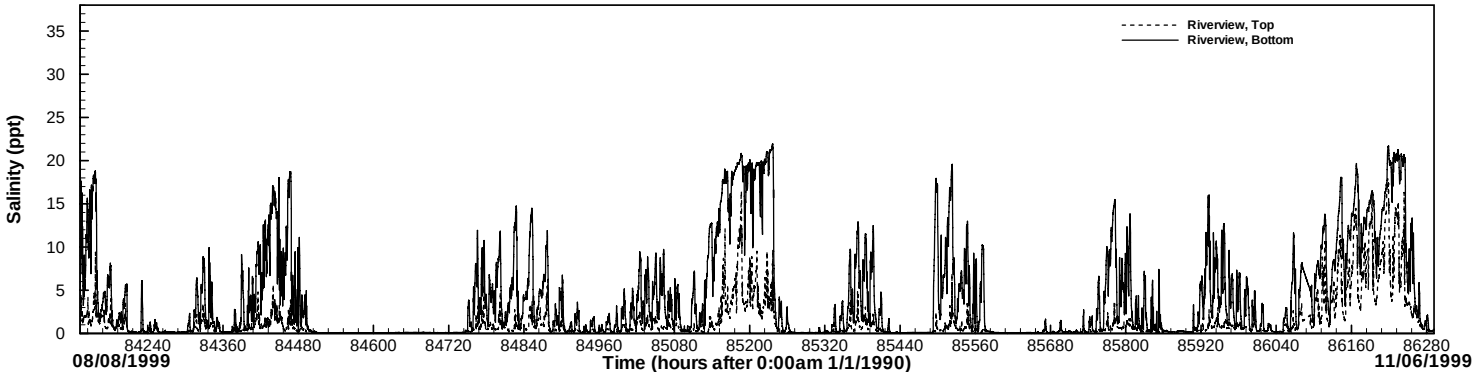

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

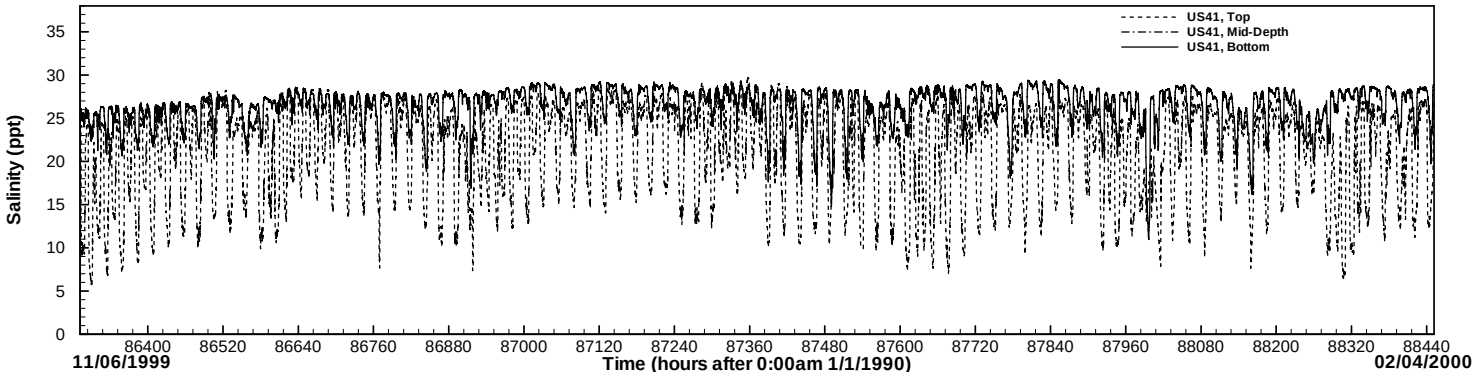

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

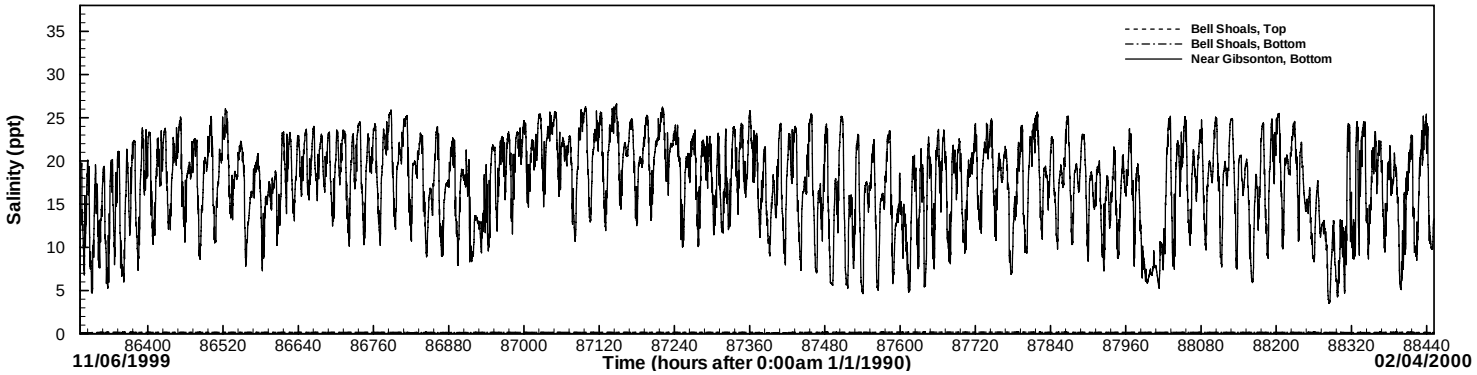

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

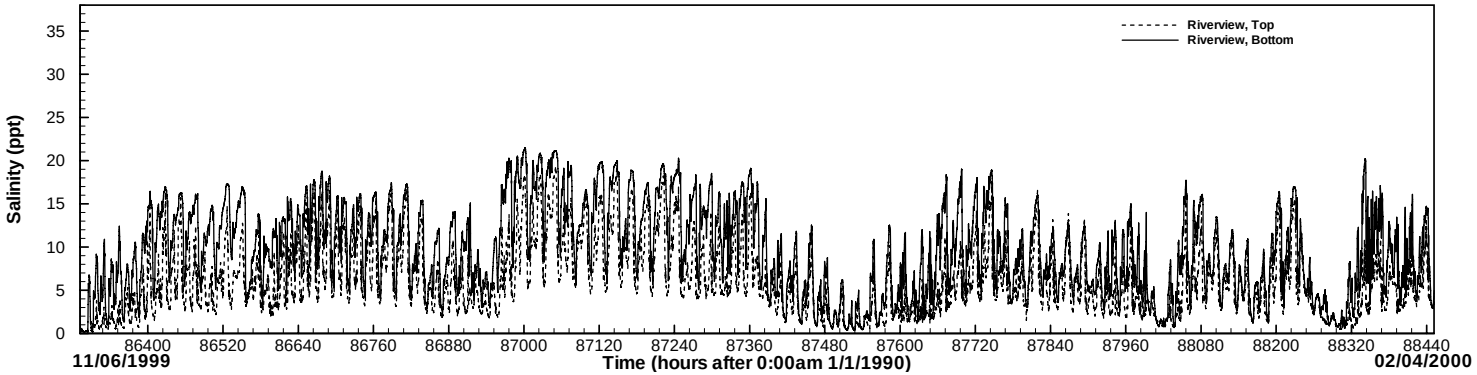

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
84240
84360
84480
84600
84720
84840
84960
85080
85200
85320
85440
85560
85680
85800
85920
86040
86160
86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

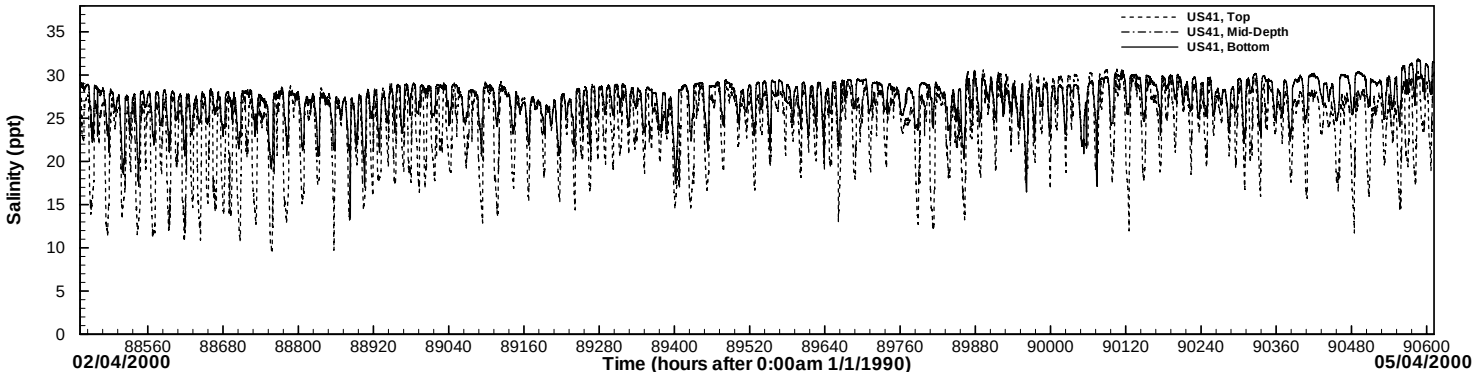

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
84240
84360
84480
84600
84720
84840
84960
85080
85200
85320
85440
85560
85680
85800
85920
86040
86160
86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

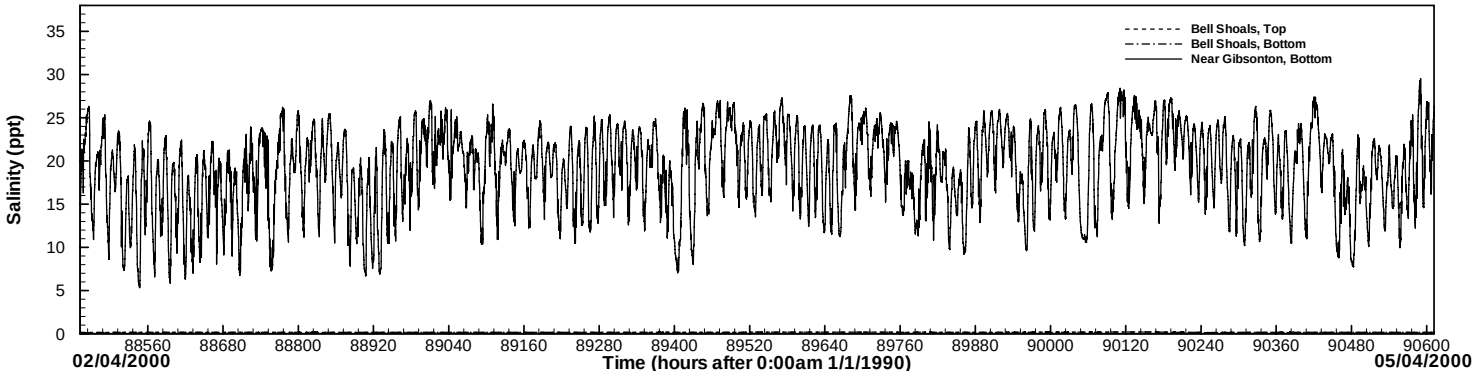

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
84240
84360
84480
84600
84720
84840
84960
85080
85200
85320
85440
85560
85680
85800
85920
86040
86160
86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

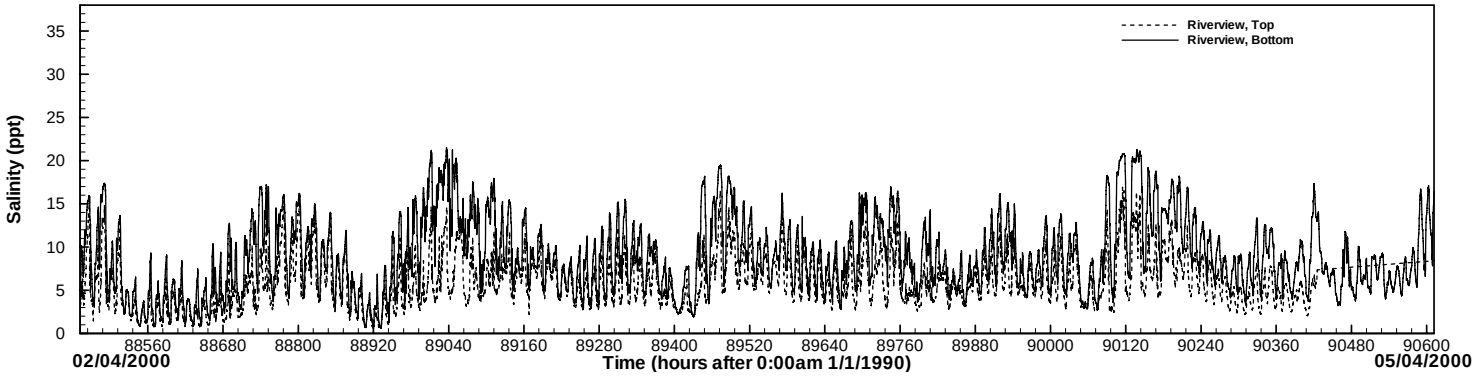

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
86400
86520
86640
86760
86880
87000
87120
87240
87360
87480
87600
87720
87840
87960
88080
88200
88320
88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

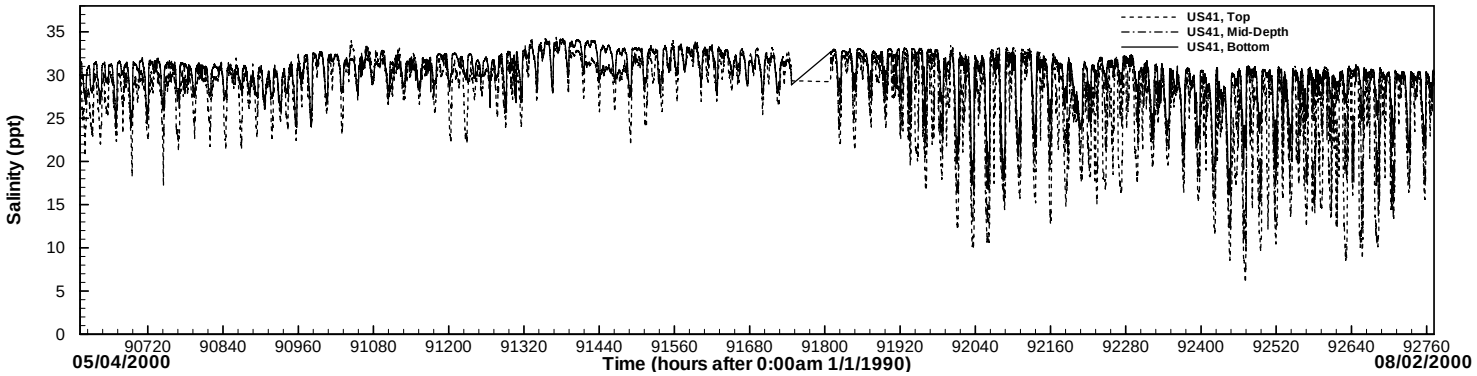

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
86400
86520
86640
86760
86880
87000
87120
87240
87360
87480
87600
87720
87840
87960
88080
88200
88320
88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

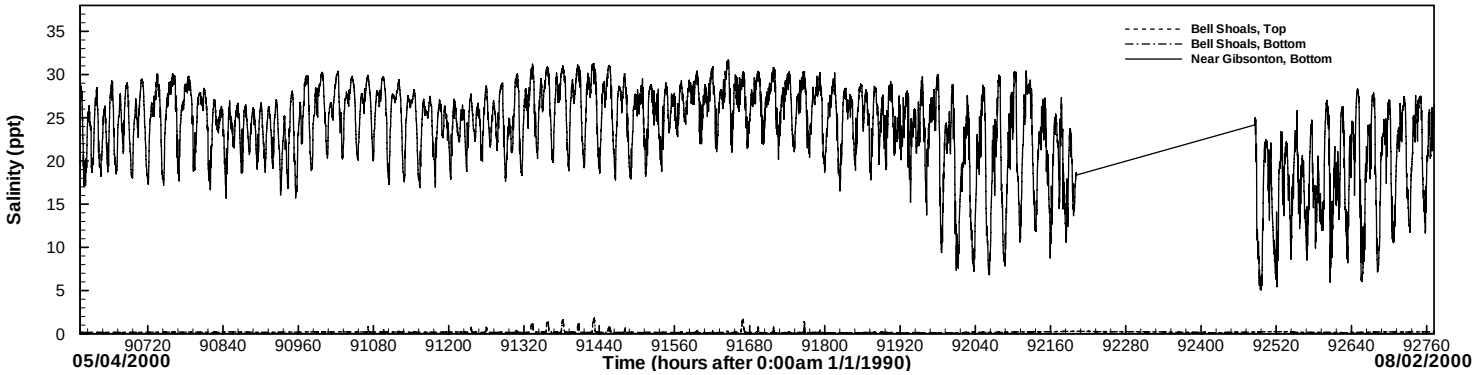

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
86400
86520
86640
86760
86880
87000
87120
87240
87360
87480
87600
87720
87840
87960
88080
88200
88320
88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

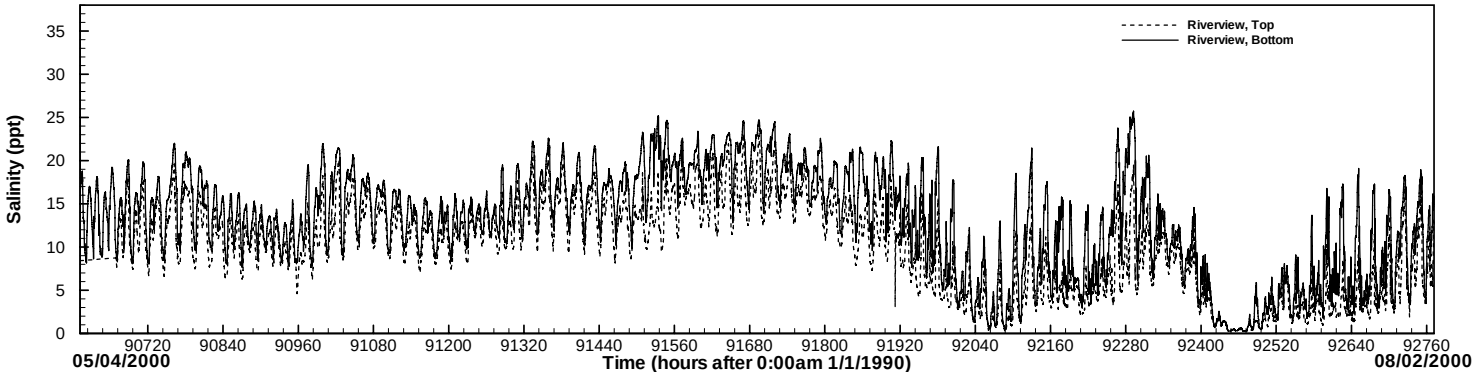

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
88560
88680
88800
88920
89040
89160
89280
89400
89520
89640
89760
89880
90000
90120
90240
90360
90480
90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

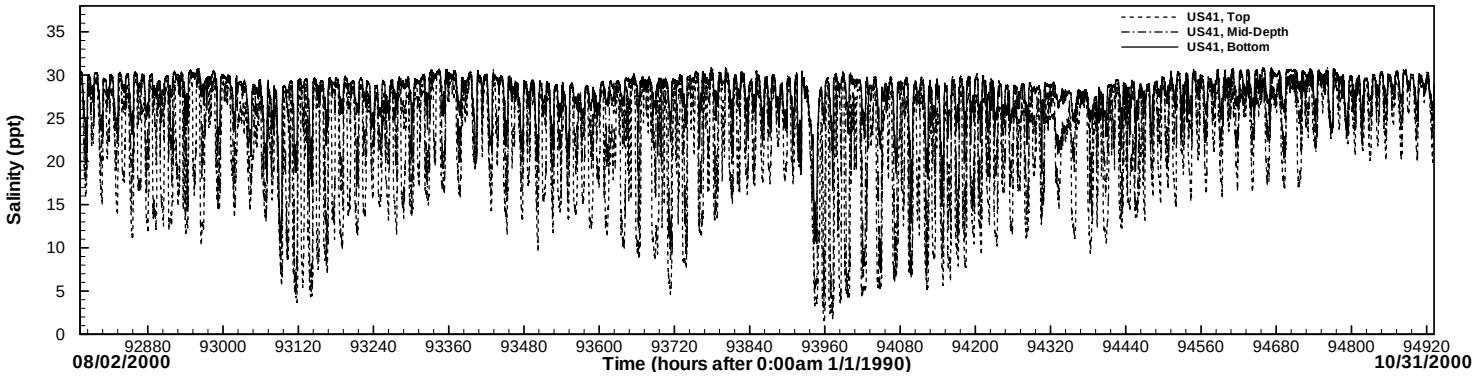

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
88560
88680
88800
88920
89040
89160
89280
89400
89520
89640
89760
89880
90000
90120
90240
90360
90480
90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

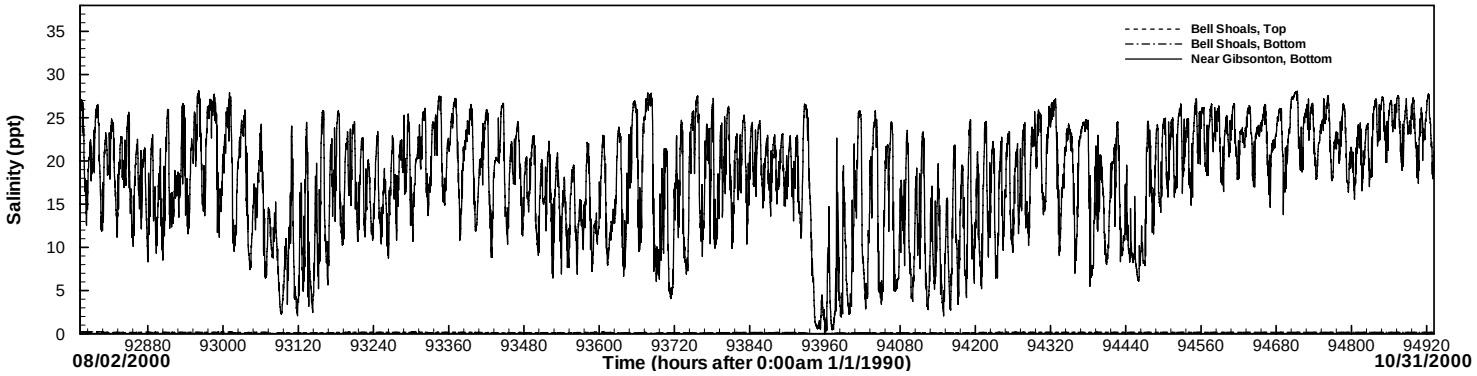

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
88560
88680
88800
88920
89040
89160
89280
89400
89520
89640
89760
89880
90000
90120
90240
90360
90480
90600
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

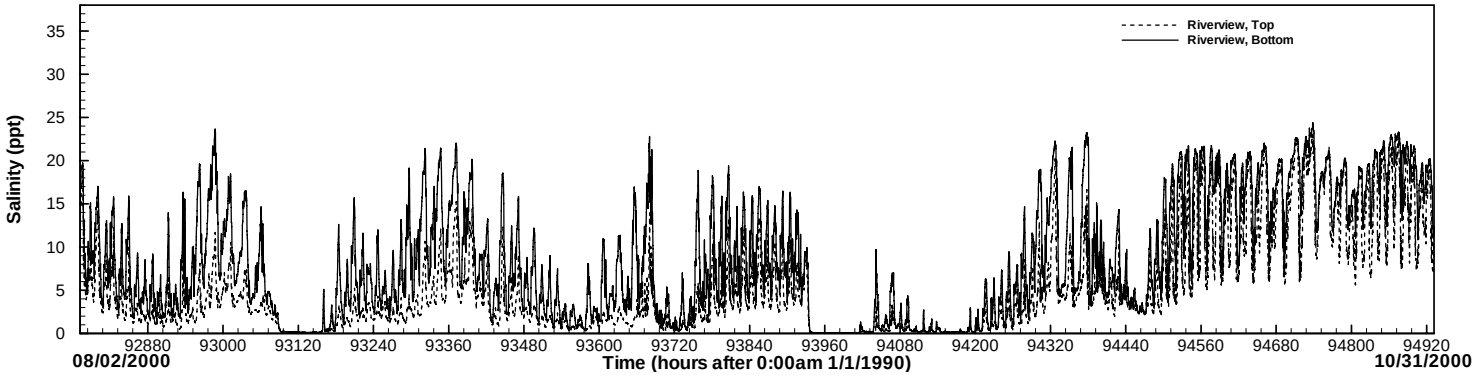

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
90720
90840
90960
91080
91200
91320
91440
91560
91680
91800
91920
92040
92160
92280
92400
92520
92640
92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

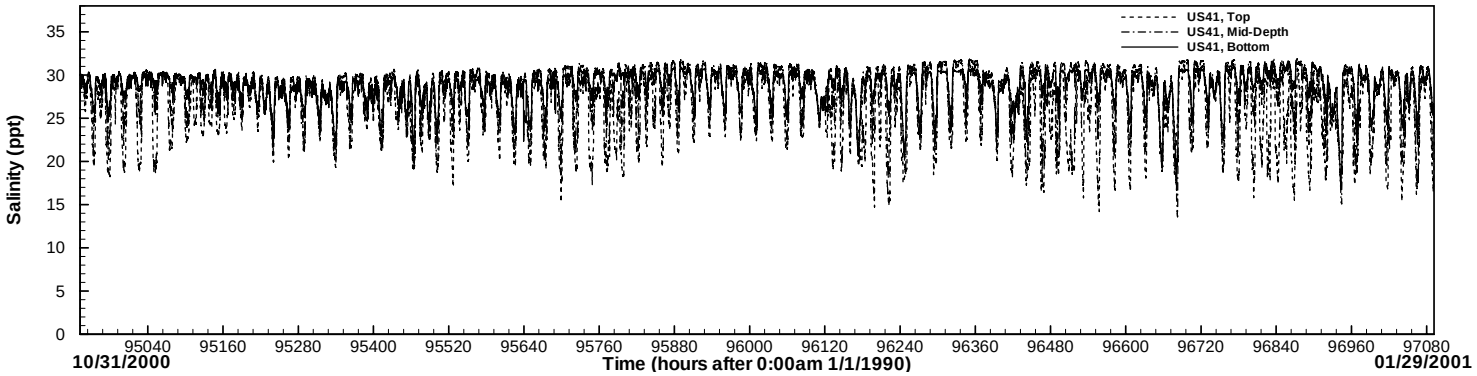

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
90720
90840
90960
91080
91200
91320
91440
91560
91680
91800
91920
92040
92160
92280
92400
92520
92640
92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

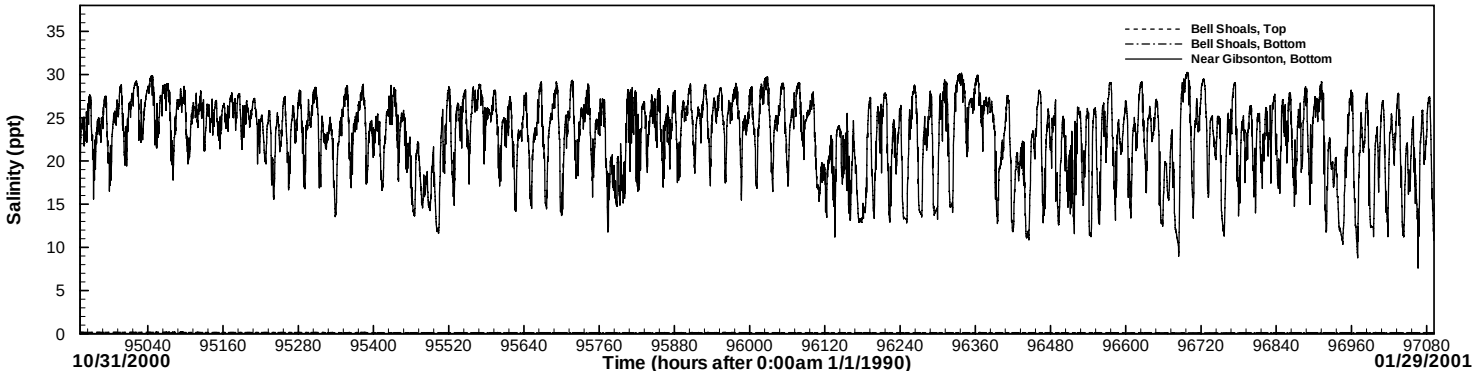

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
90720
90840
90960
91080
91200
91320
91440
91560
91680
91800
91920
92040
92160
92280
92400
92520
92640
92760
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

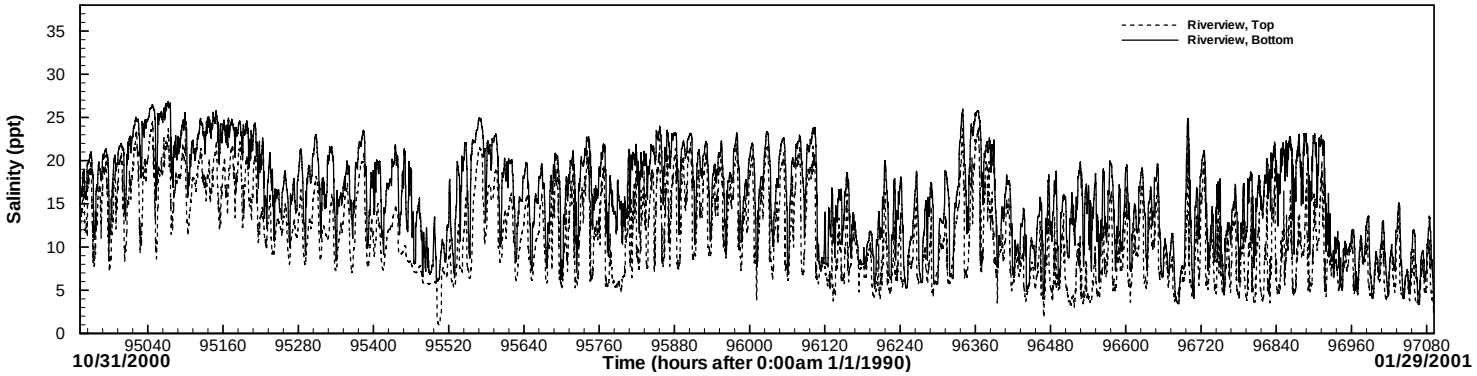

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
92880
93000
93120
93240
93360
93480
93600
93720
93840
93960
94080
94200
94320
94440
94560
94680
94800
94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

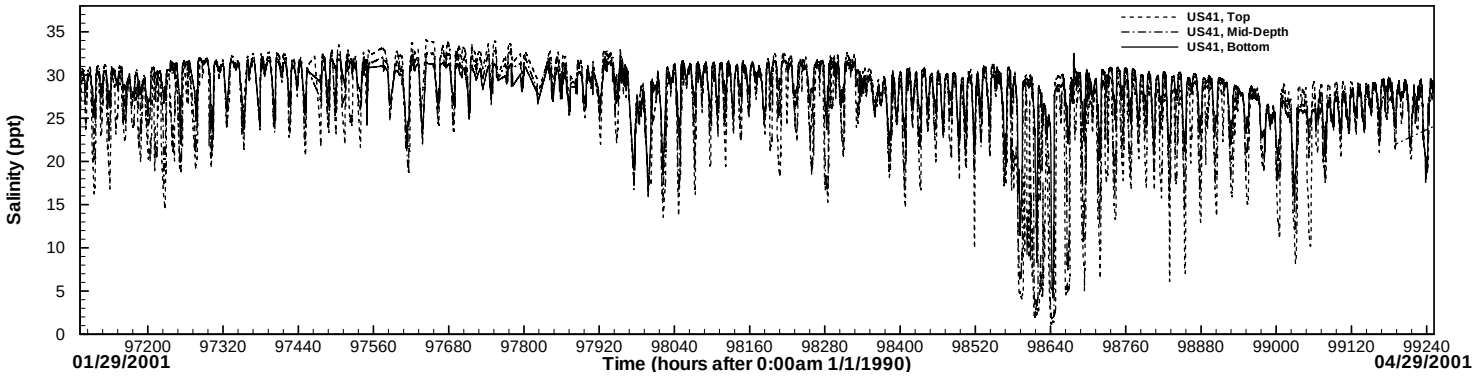

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
92880
93000
93120
93240
93360
93480
93600
93720
93840
93960
94080
94200
94320
94440
94560
94680
94800
94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

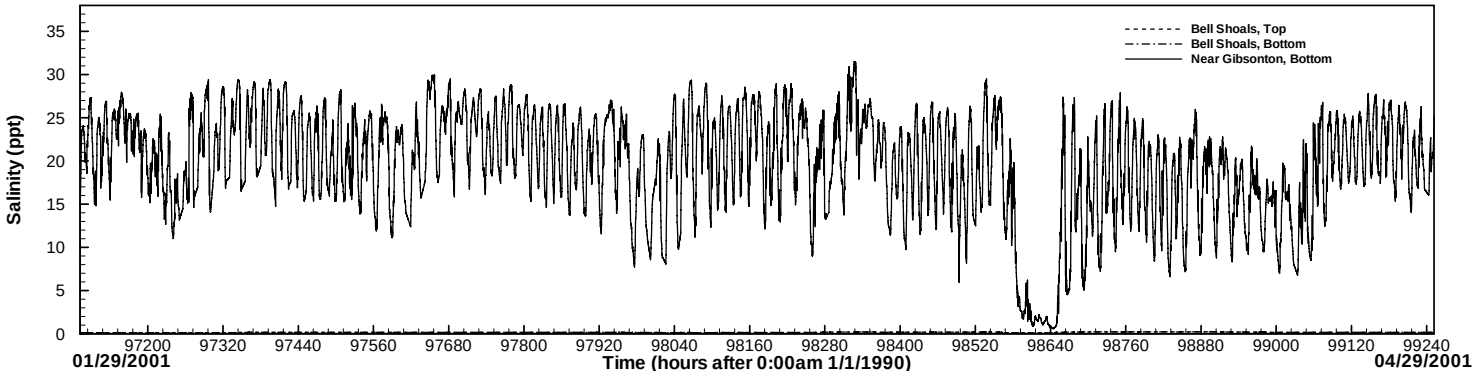

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
92880
93000
93120
93240
93360
93480
93600
93720
93840
93960
94080
94200
94320
94440
94560
94680
94800
94920
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

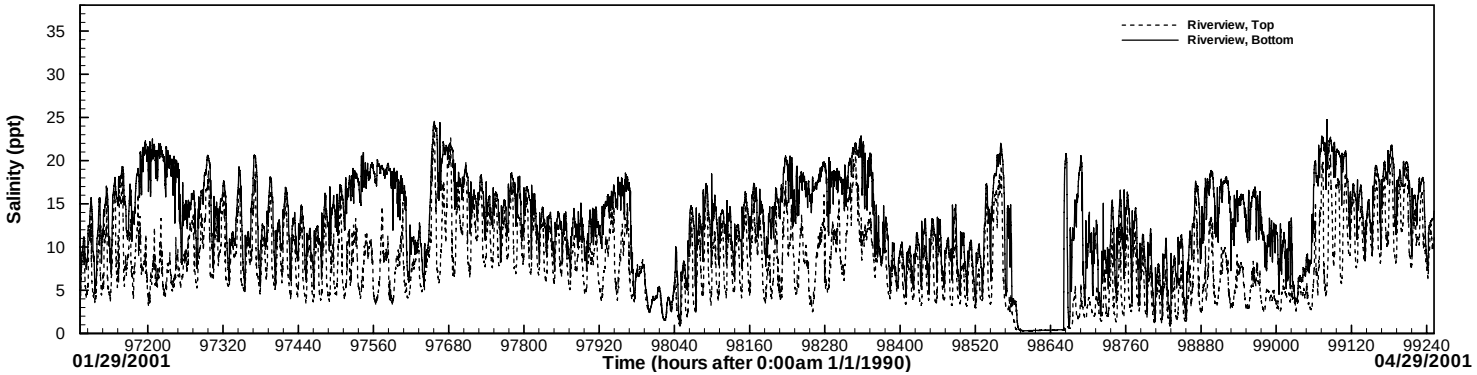

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
95040
95160
95280
95400
95520
95640
95760
95880
96000
96120
96240
96360
96480
96600
96720
96840
96960
97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

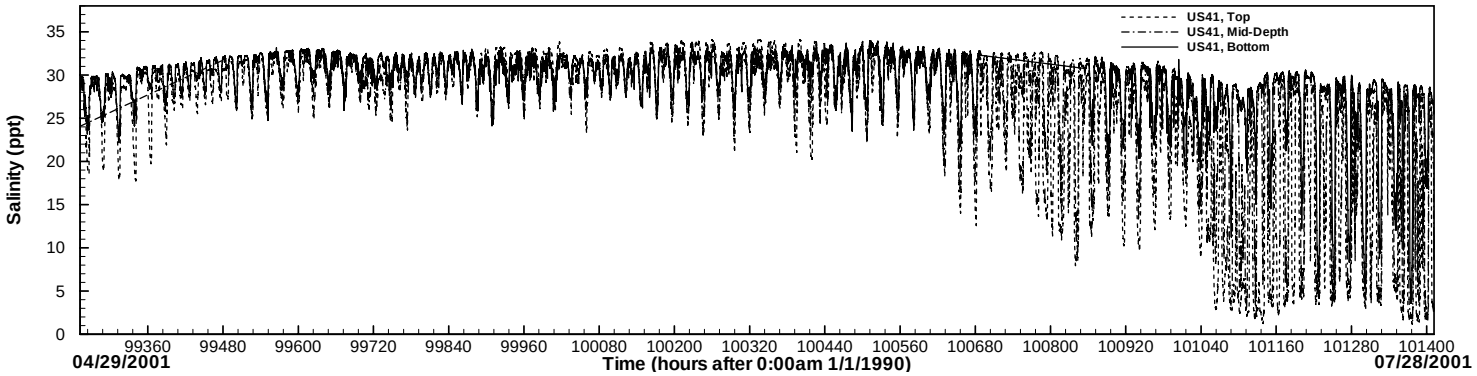

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
95040
95160
95280
95400
95520
95640
95760
95880
96000
96120
96240
96360
96480
96600
96720
96840
96960
97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

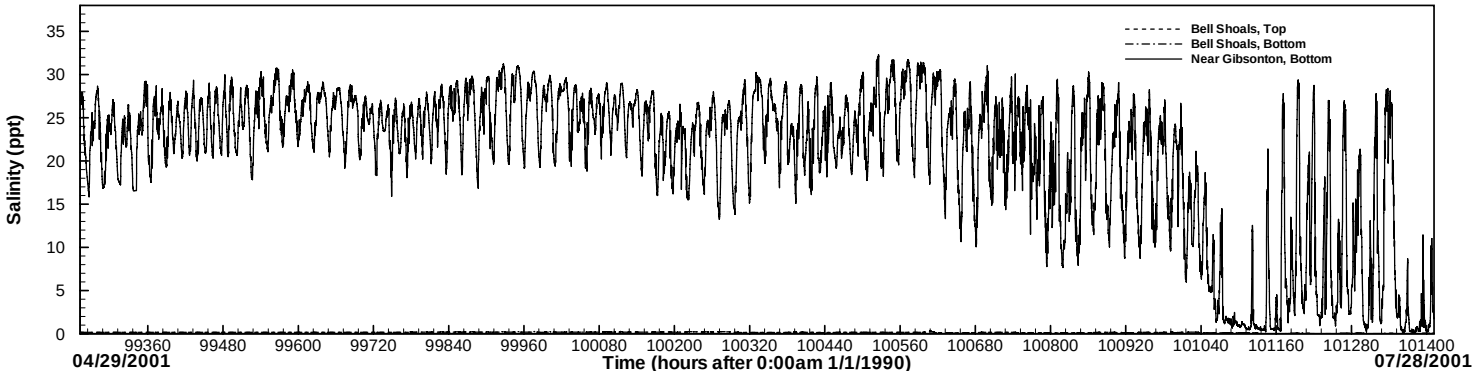

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
95040
95160
95280
95400
95520
95640
95760
95880
96000
96120
96240
96360
96480
96600
96720
96840
96960
97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

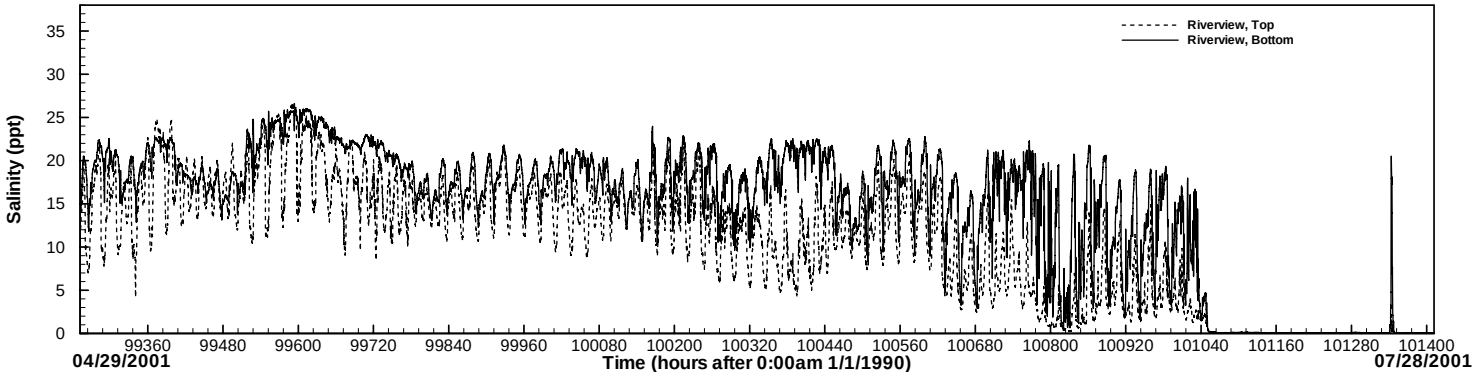

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

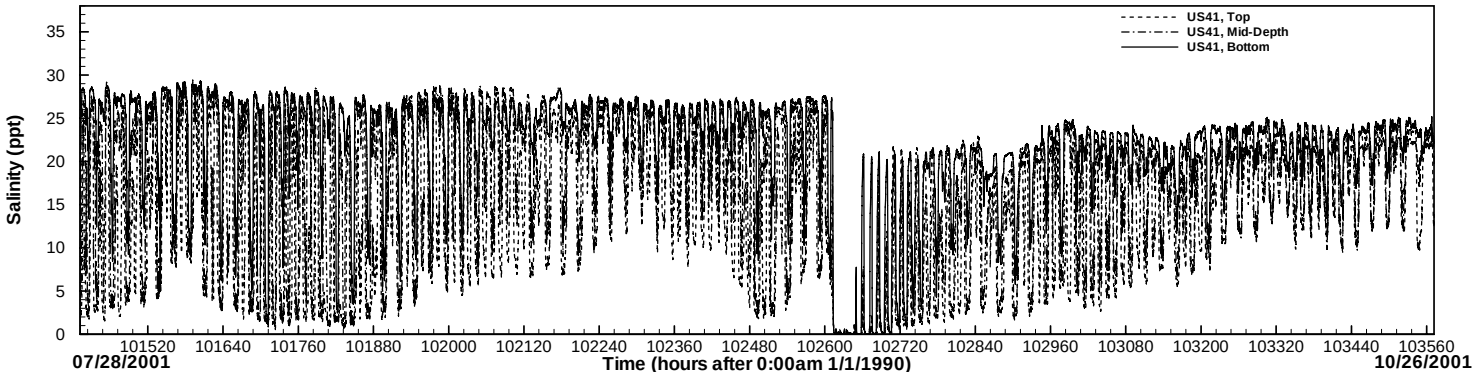

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

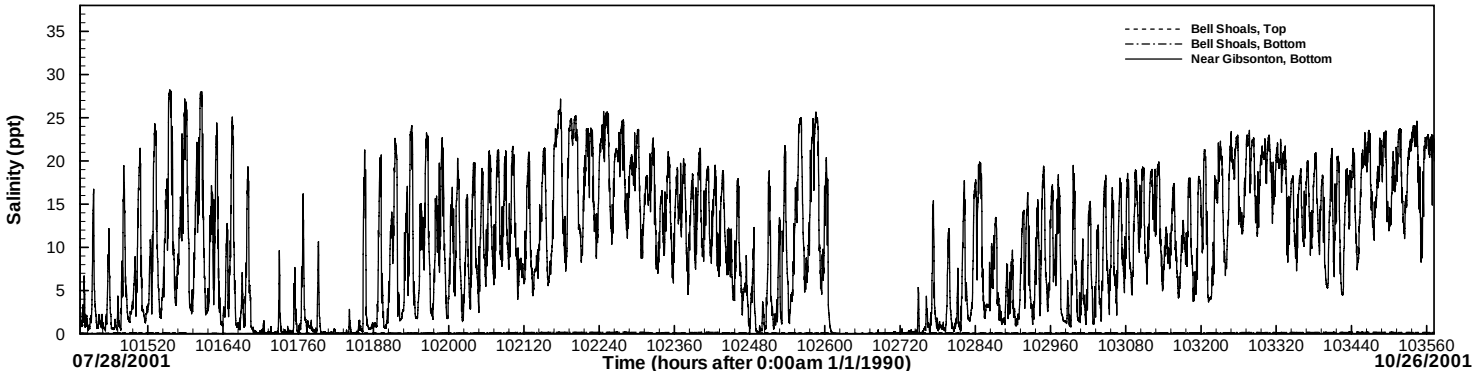

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

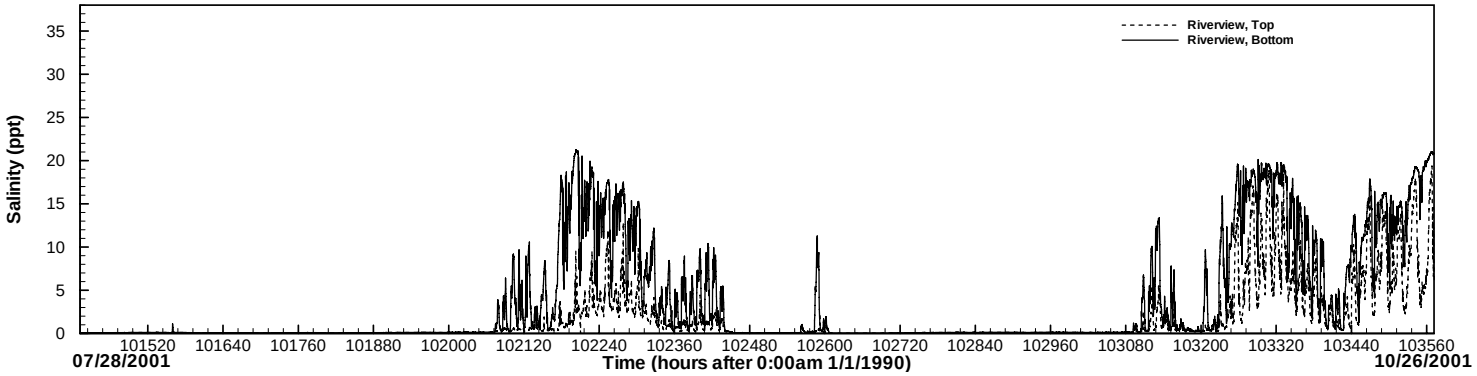

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
99360
99480
99600
99720
99840
99960
100080
100200
100320
100440
100560
100680
100800
100920
101040
101160
101280
101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

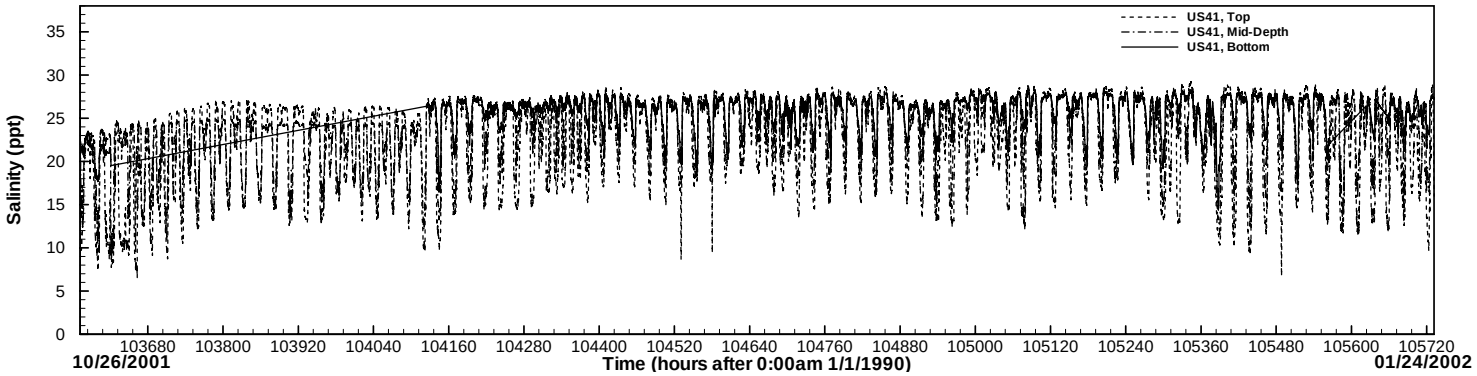

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
99360
99480
99600
99720
99840
99960
100080
100200
100320
100440
100560
100680
100800
100920
101040
101160
101280
101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

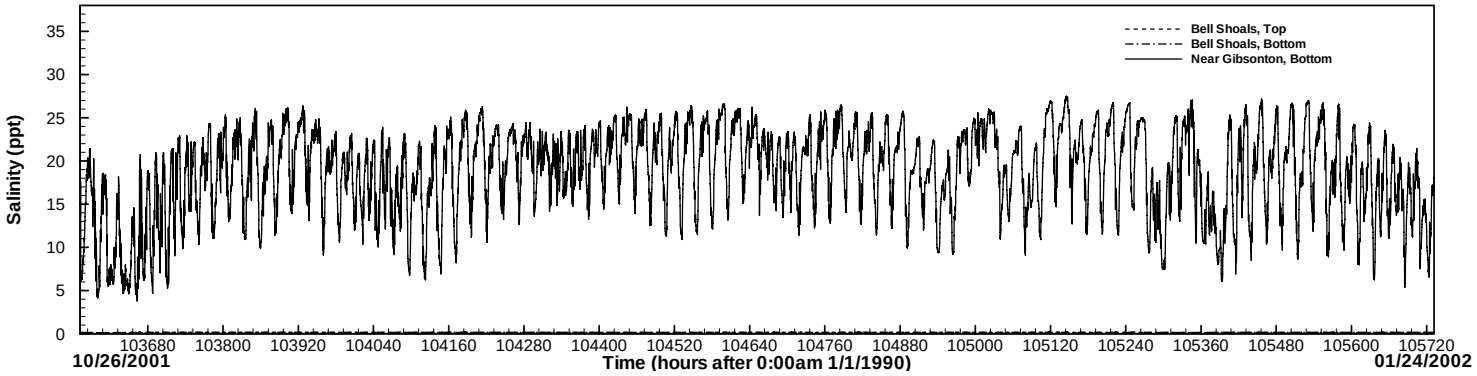

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
99360
99480
99600
99720
99840
99960
100080
100200
100320
100440
100560
100680
100800
100920
101040
101160
101280
101400
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

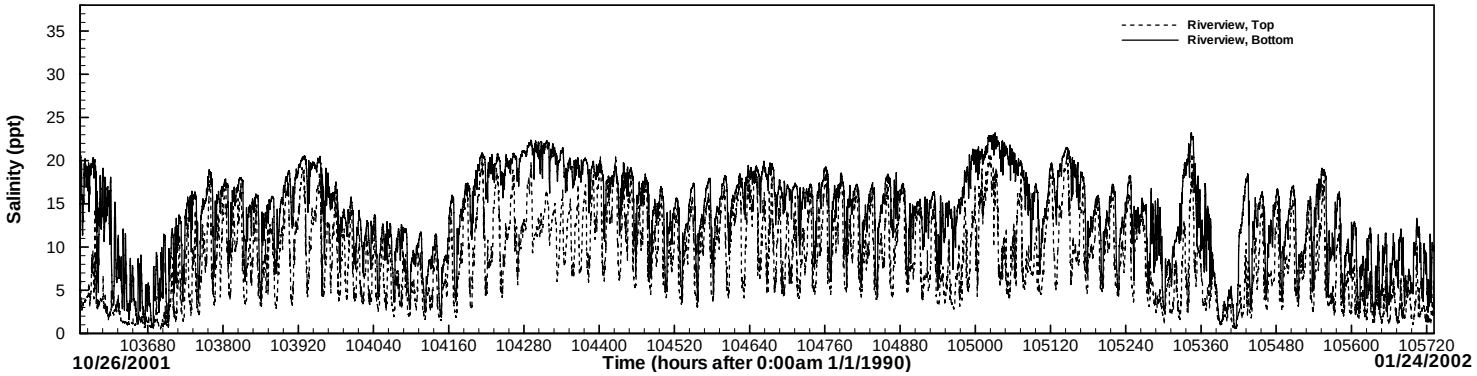

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
101520
101640
101760
101880
102000
102120
102240
102360
102480
102600
102720
102840
102960
103080
103200
103320
103440
103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

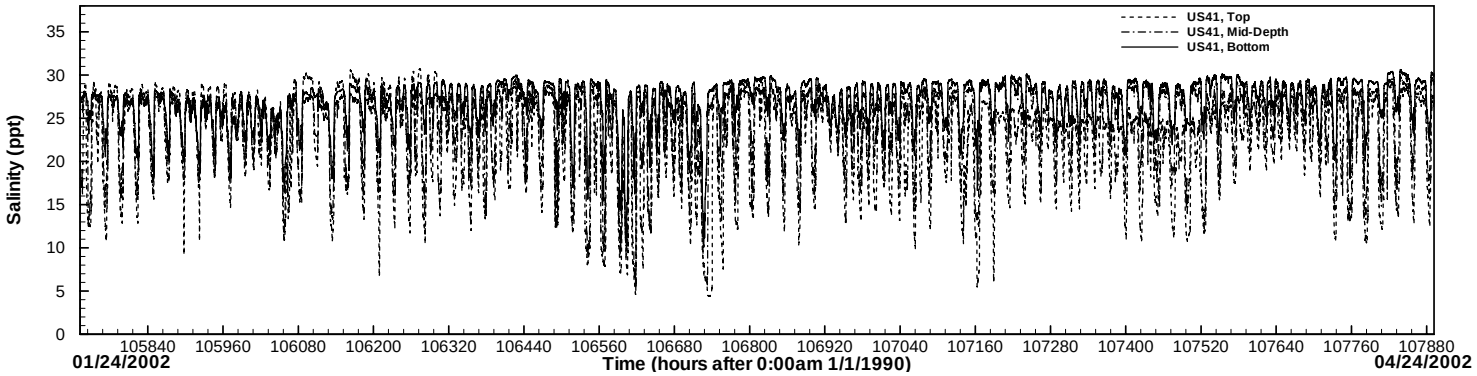

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
101520
101640
101760
101880
102000
102120
102240
102360
102480
102600
102720
102840
102960
103080
103200
103320
103440
103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

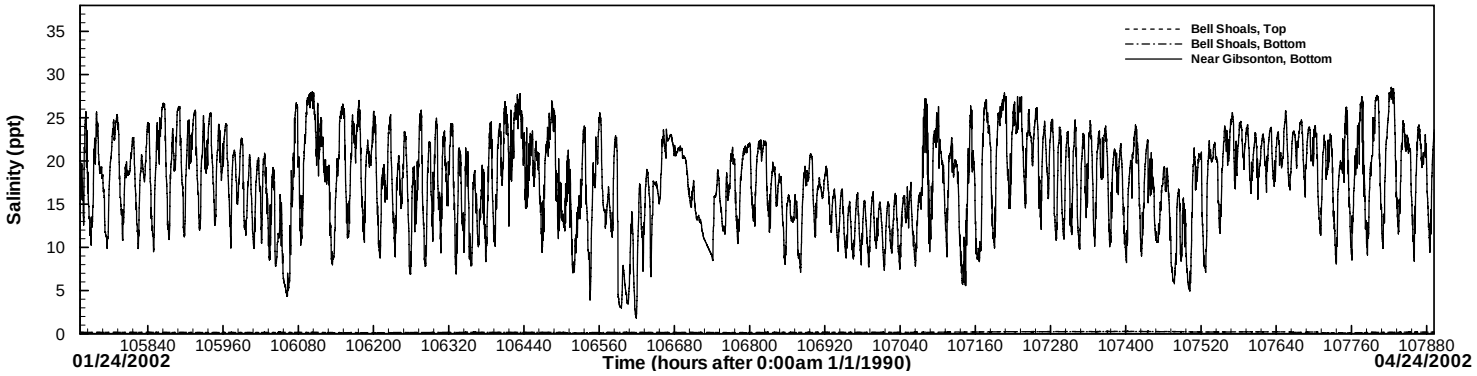

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
101520
101640
101760
101880
102000
102120
102240
102360
102480
102600
102720
102840
102960
103080
103200
103320
103440
103560
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

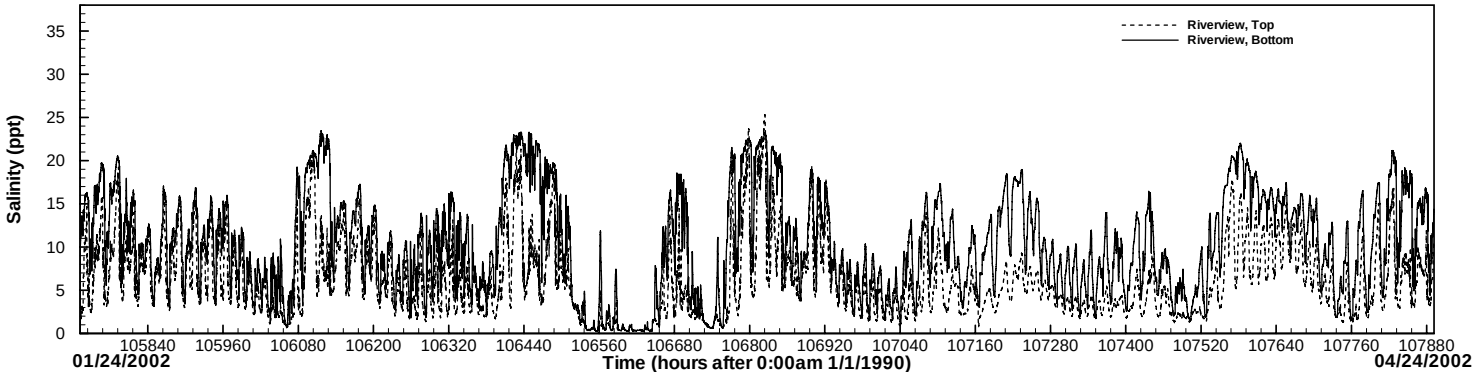

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
103680
103800
103920
104040
104160
104280
104400
104520
104640
104760
104880
105000
105120
105240
105360
105480
105600
105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

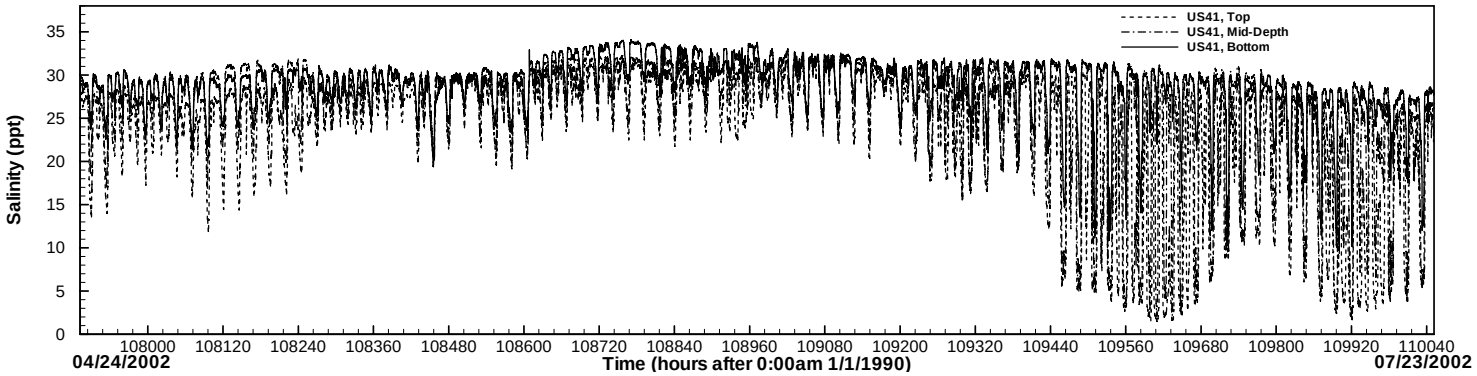

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
103680
103800
103920
104040
104160
104280
104400
104520
104640
104760
104880
105000
105120
105240
105360
105480
105600
105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

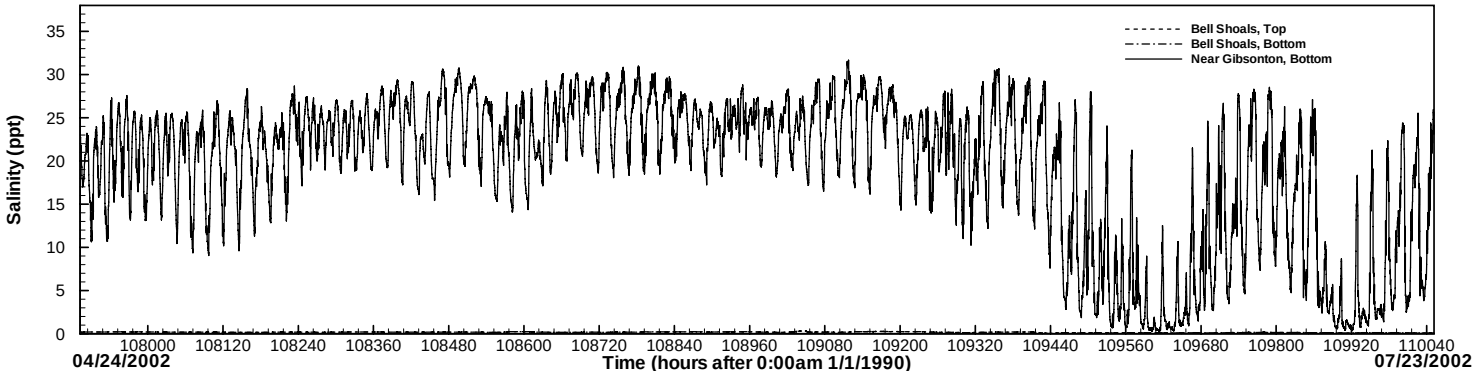

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
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103680
103800
103920
104040
104160
104280
104400
104520
104640
104760
104880
105000
105120
105240
105360
105480
105600
105720
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

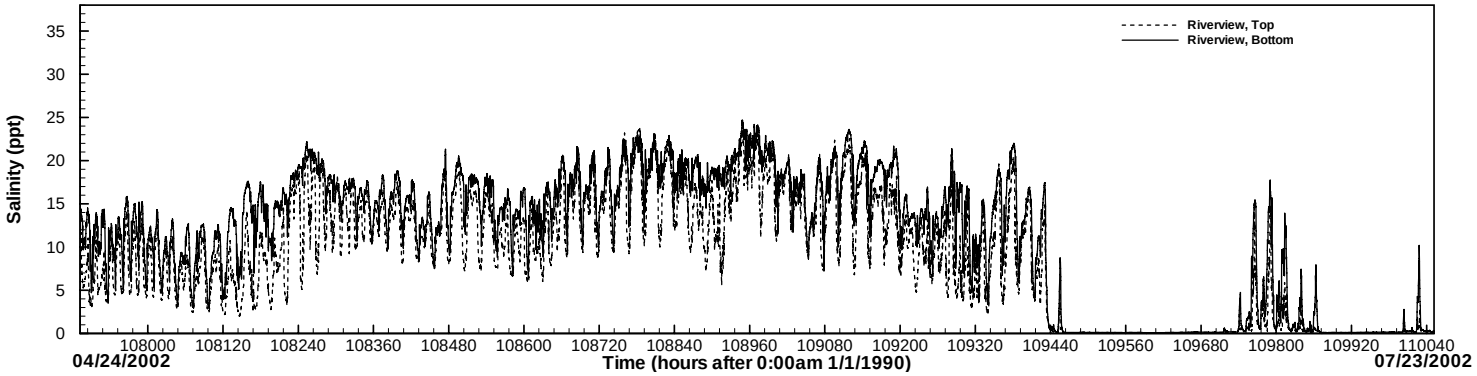

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
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105840
105960
106080
106200
106320
106440
106560
106680
106800
106920
107040
107160
107280
107400
107520
107640
107760
107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

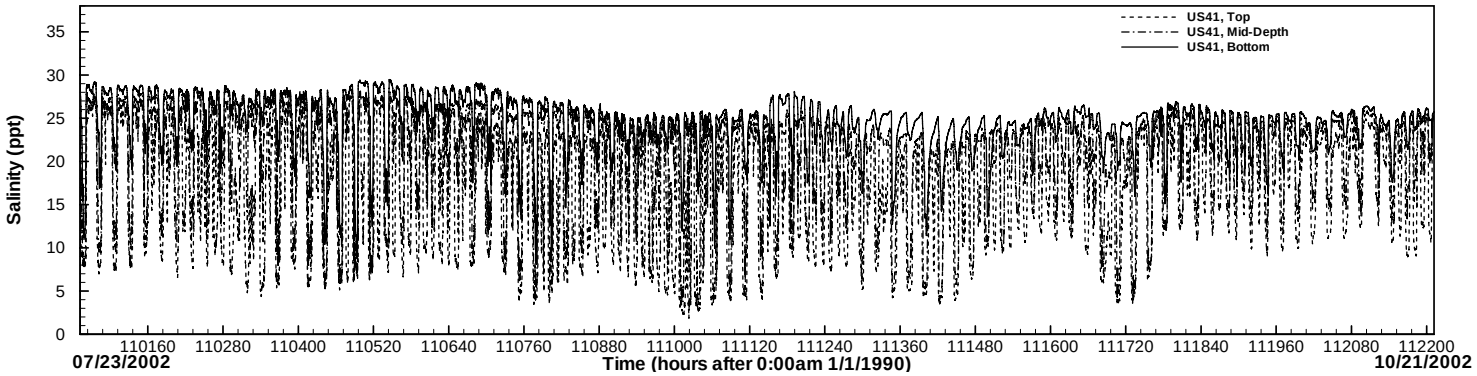

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
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105840
105960
106080
106200
106320
106440
106560
106680
106800
106920
107040
107160
107280
107400
107520
107640
107760
107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

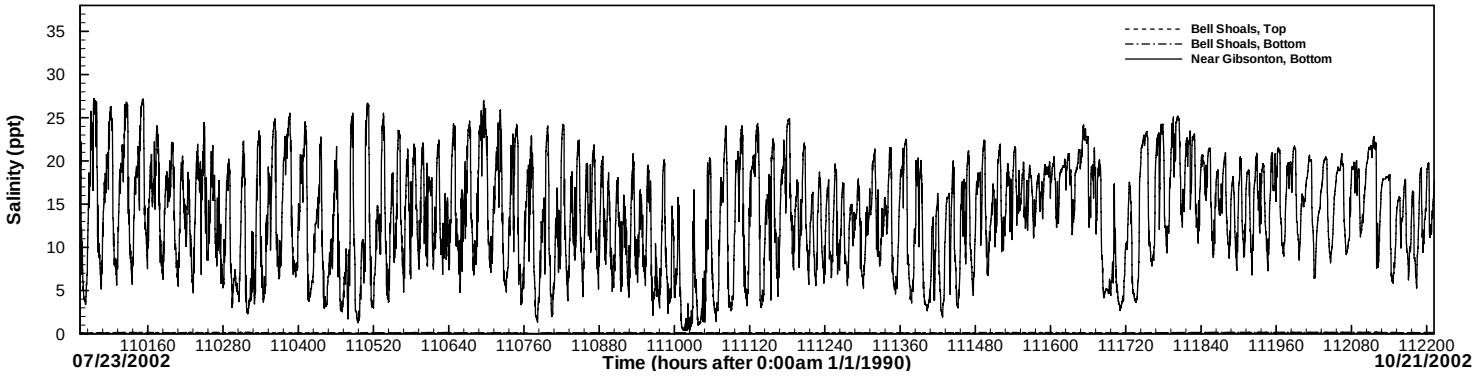

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
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105840
105960
106080
106200
106320
106440
106560
106680
106800
106920
107040
107160
107280
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107520
107640
107760
107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

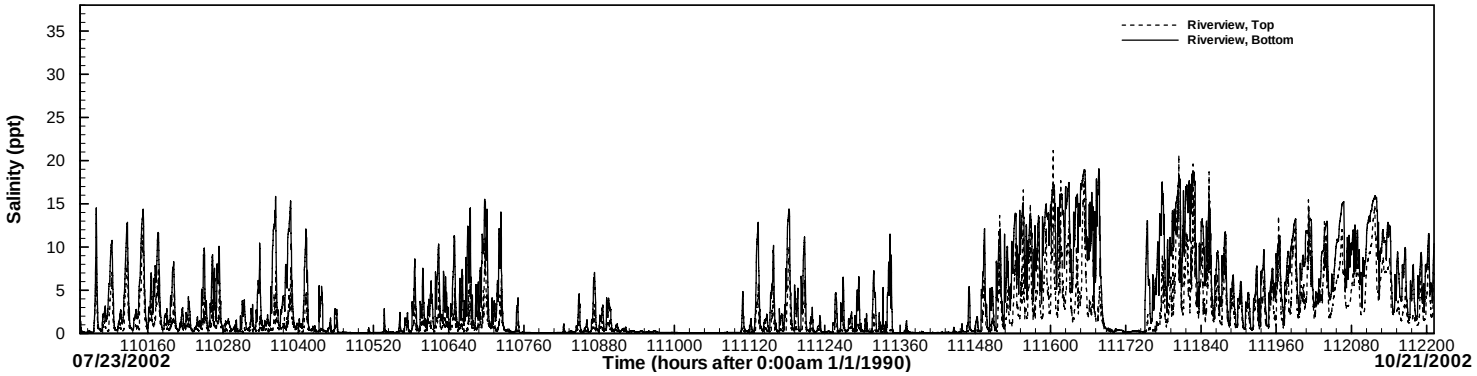

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
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25
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108000
108120
108240
108360
108480
108600
108720
108840
108960
109080
109200
109320
109440
109560
109680
109800
109920
110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

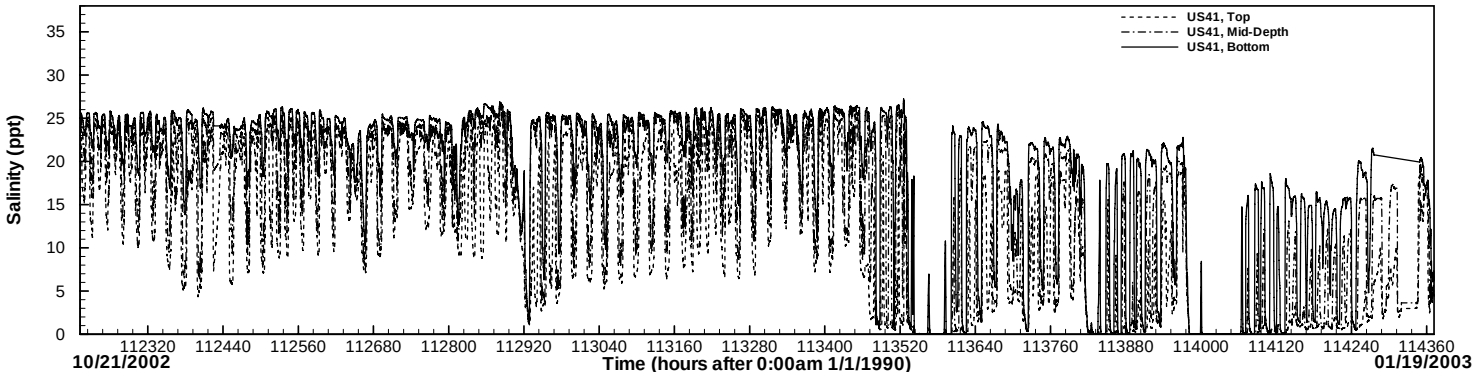

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
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20
25
30
35
108000
108120
108240
108360
108480
108600
108720
108840
108960
109080
109200
109320
109440
109560
109680
109800
109920
110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

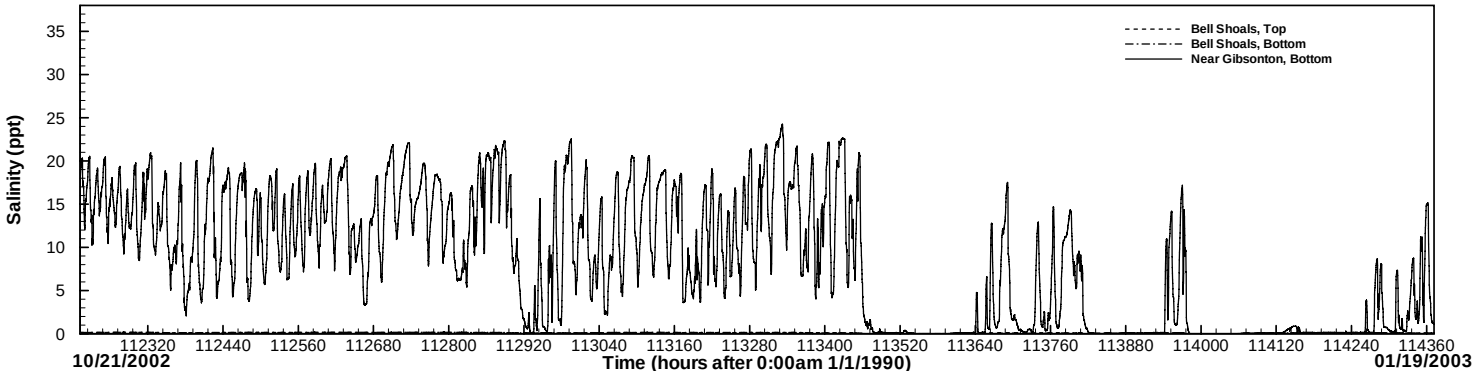

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
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108000
108120
108240
108360
108480
108600
108720
108840
108960
109080
109200
109320
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109560
109680
109800
109920
110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

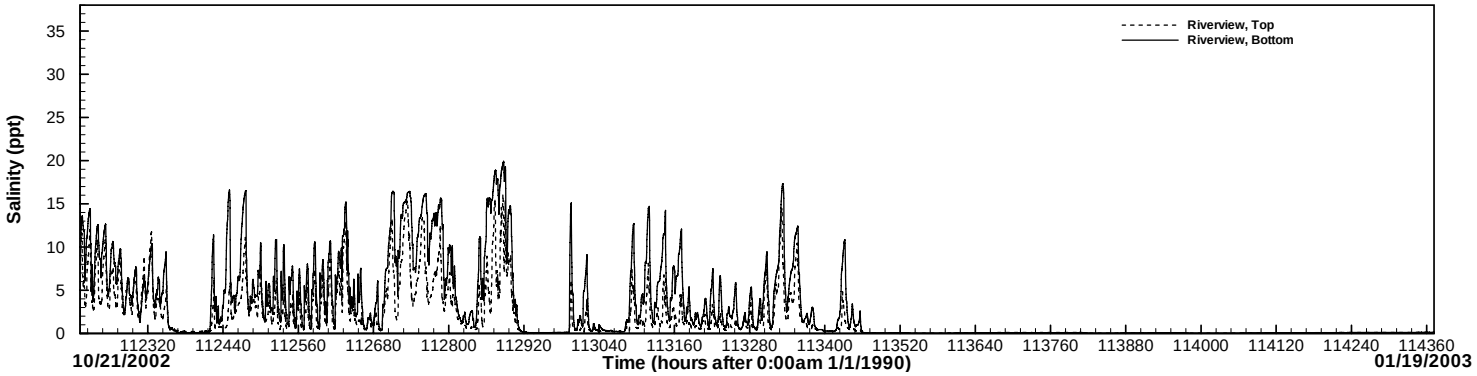

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
110160
110280
110400
110520
110640
110760
110880
111000
111120
111240
111360
111480
111600
111720
111840
111960
112080
112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

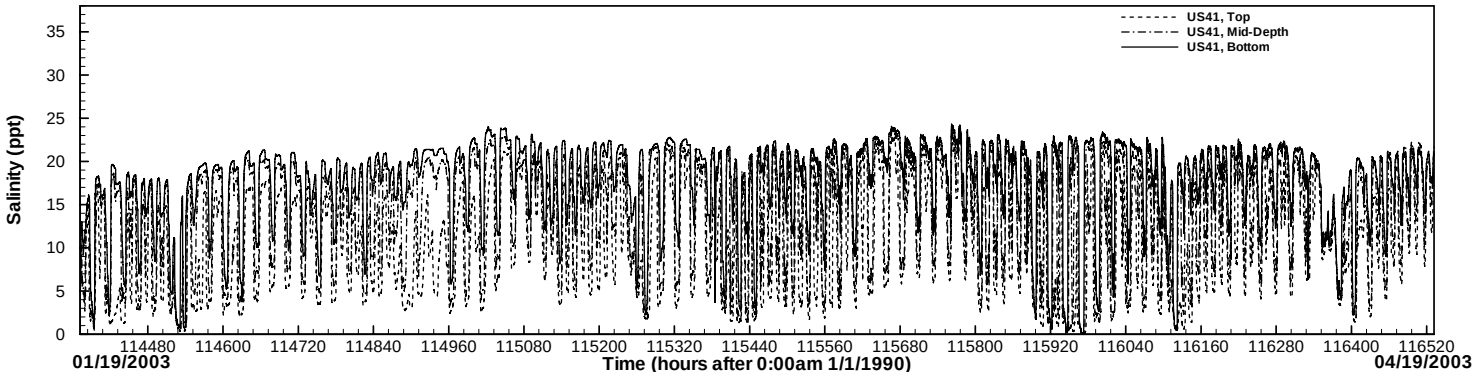

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
110160
110280
110400
110520
110640
110760
110880
111000
111120
111240
111360
111480
111600
111720
111840
111960
112080
112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

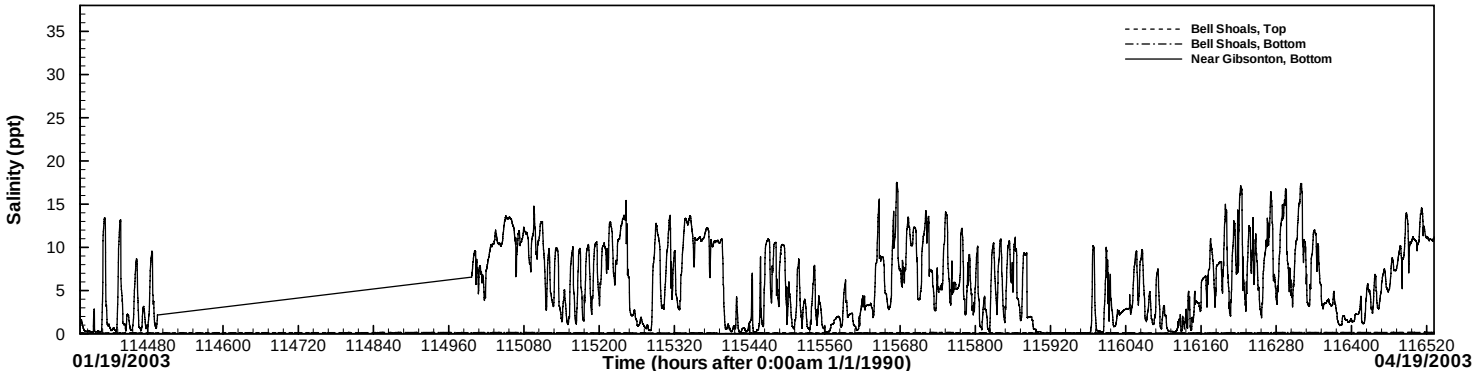

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
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20
25
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35
110160
110280
110400
110520
110640
110760
110880
111000
111120
111240
111360
111480
111600
111720
111840
111960
112080
112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

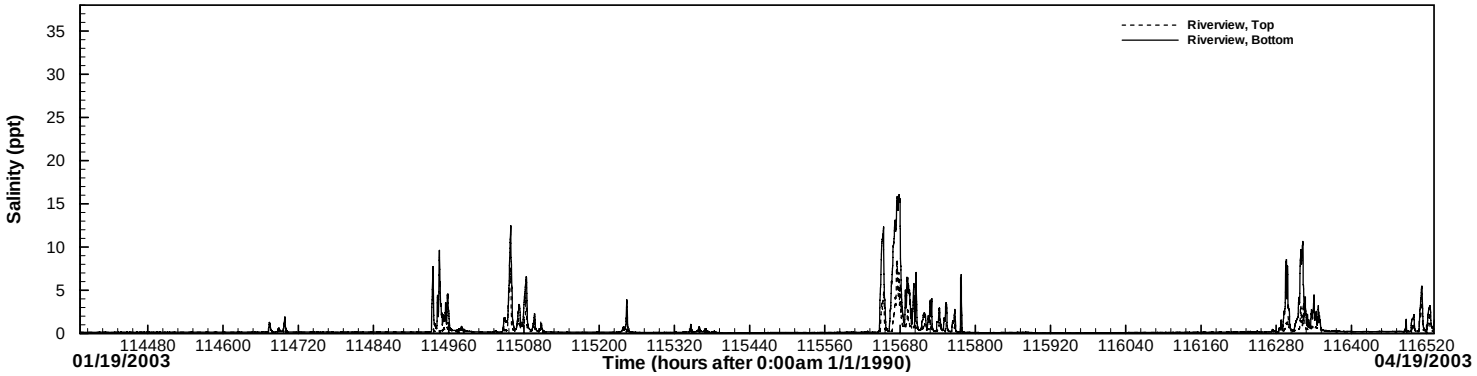

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
112320
112440
112560
112680
112800
112920
113040
113160
113280
113400
113520
113640
113760
113880
114000
114120
114240
114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

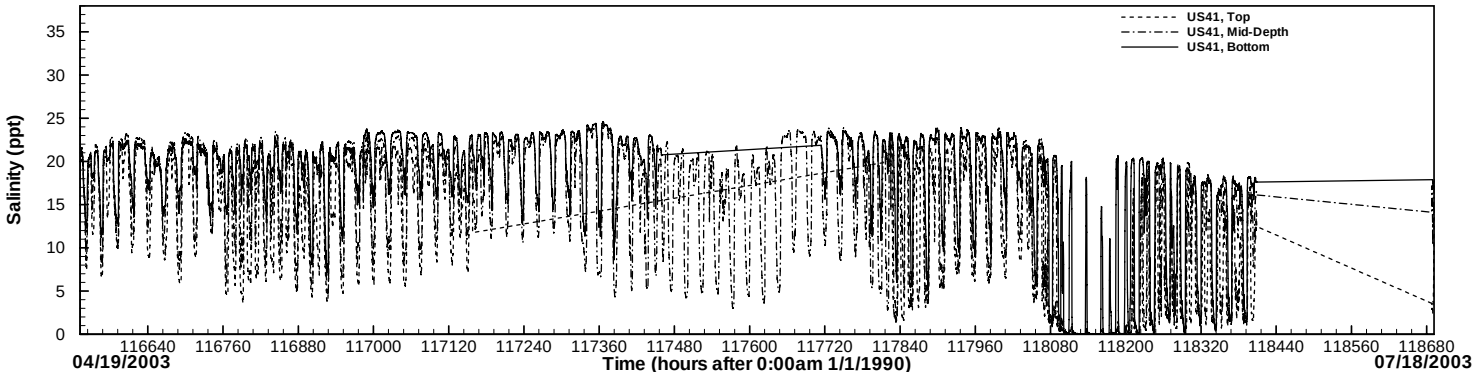

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
112320
112440
112560
112680
112800
112920
113040
113160
113280
113400
113520
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113760
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114000
114120
114240
114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

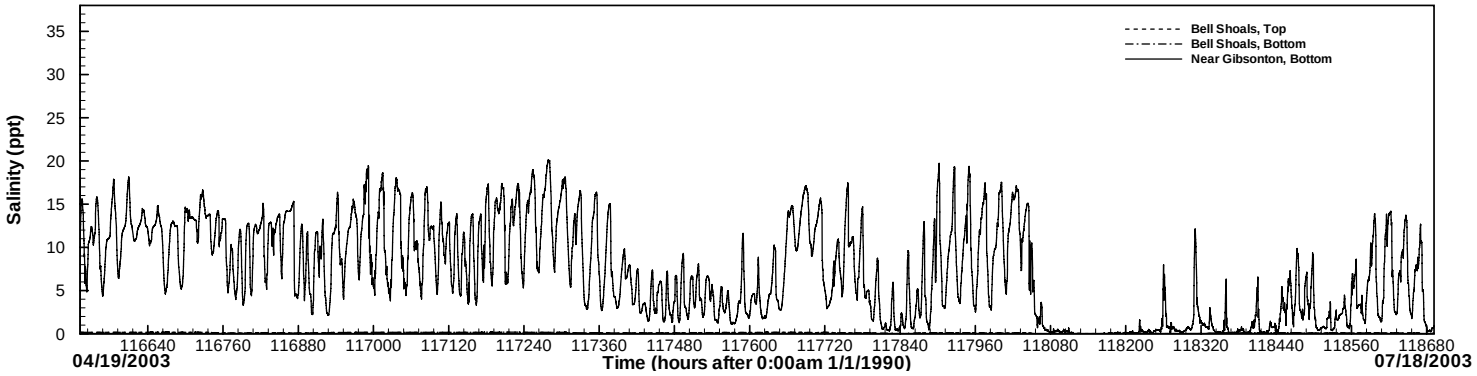

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
112320
112440
112560
112680
112800
112920
113040
113160
113280
113400
113520
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113760
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114120
114240
114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

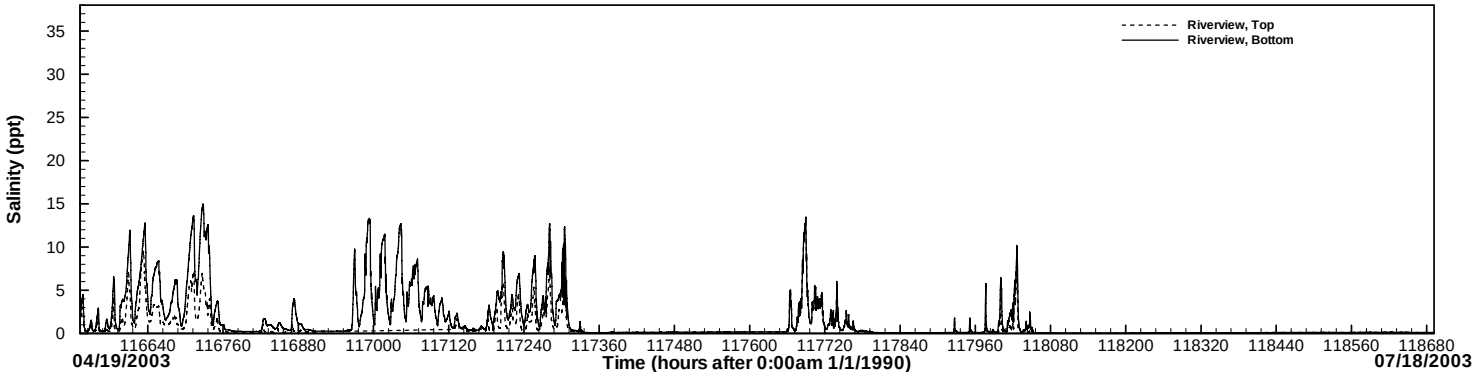

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
114480
114600
114720
114840
114960
115080
115200
115320
115440
115560
115680
115800
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116400
116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

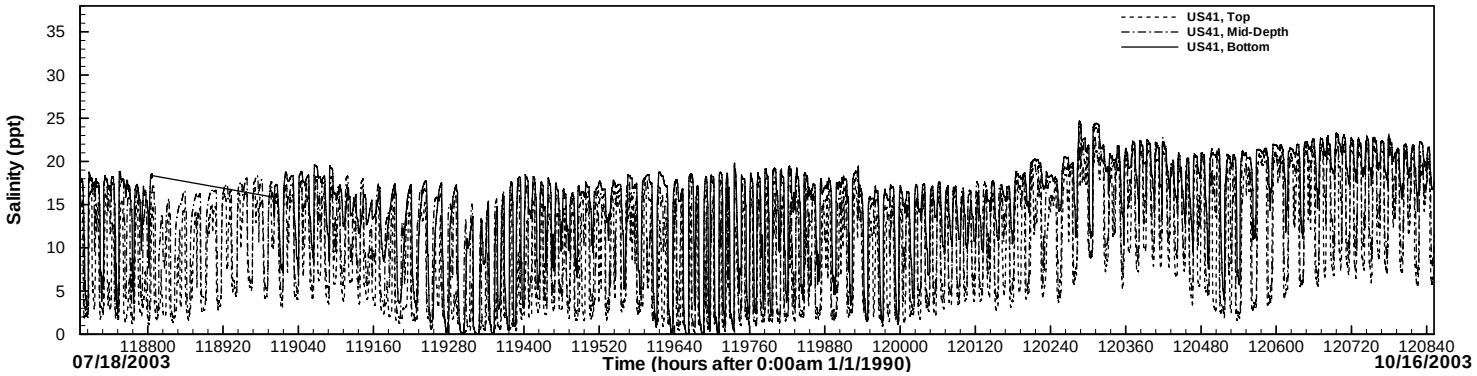

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
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20
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114480
114600
114720
114840
114960
115080
115200
115320
115440
115560
115680
115800
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116160
116280
116400
116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

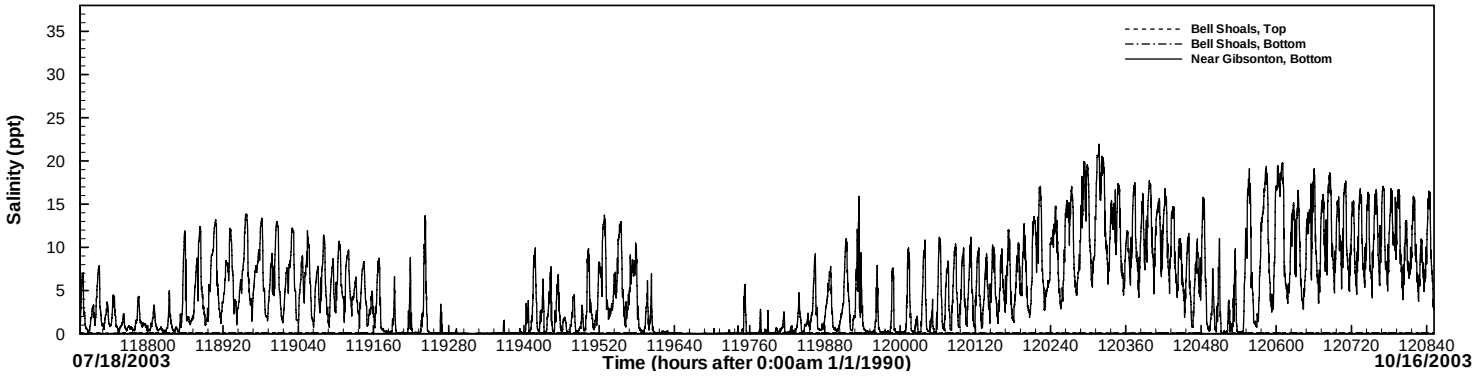

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
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114480
114600
114720
114840
114960
115080
115200
115320
115440
115560
115680
115800
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116520
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

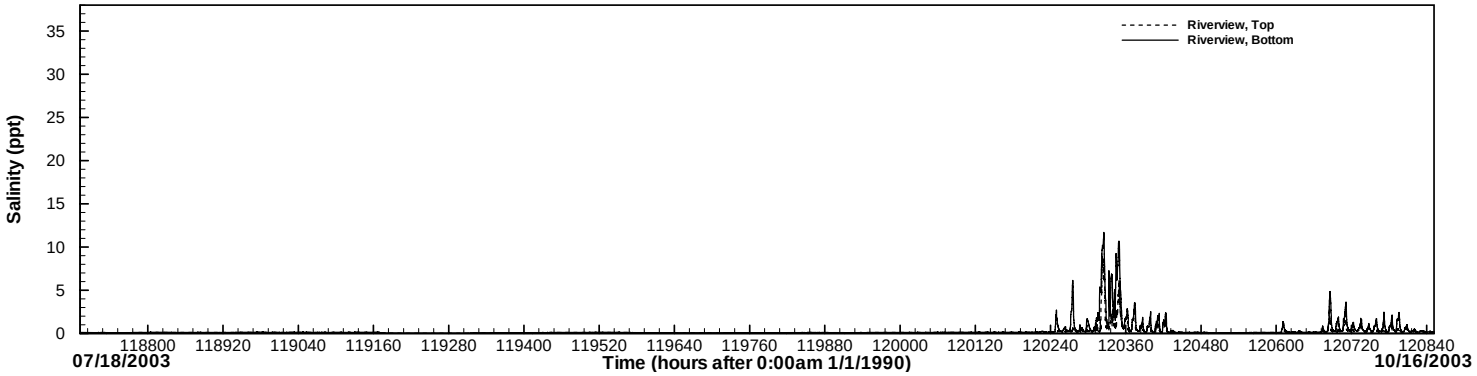

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
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116640
116760
116880
117000
117120
117240
117360
117480
117600
117720
117840
117960
118080
118200
118320
118440
118560
118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

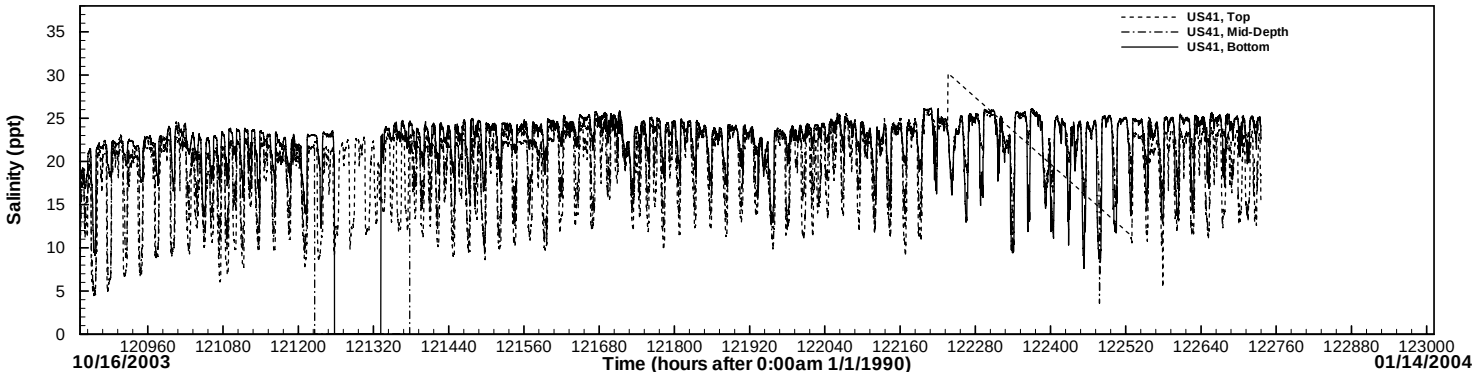

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
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116640
116760
116880
117000
117120
117240
117360
117480
117600
117720
117840
117960
118080
118200
118320
118440
118560
118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

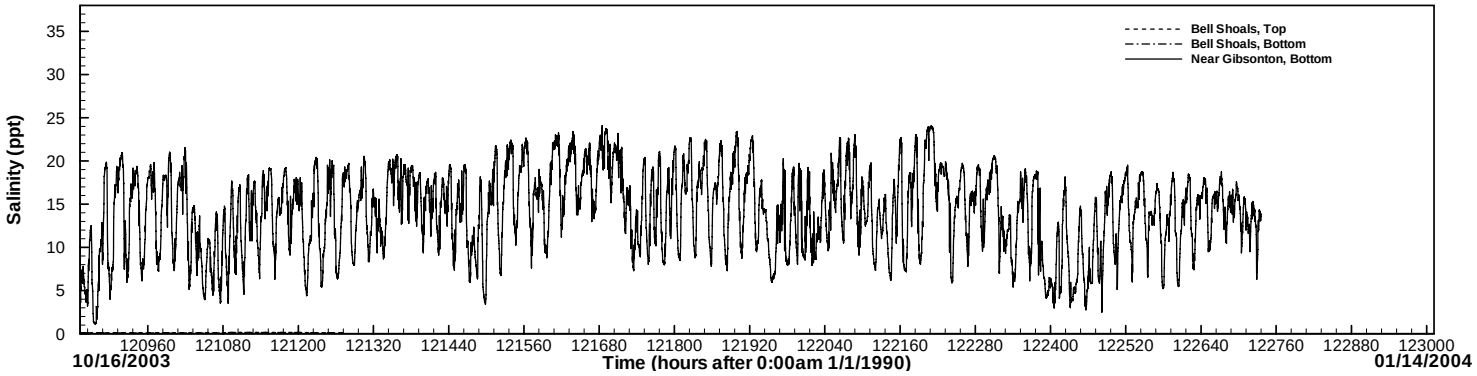

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
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15
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25
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35
116640
116760
116880
117000
117120
117240
117360
117480
117600
117720
117840
117960
118080
118200
118320
118440
118560
118680
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

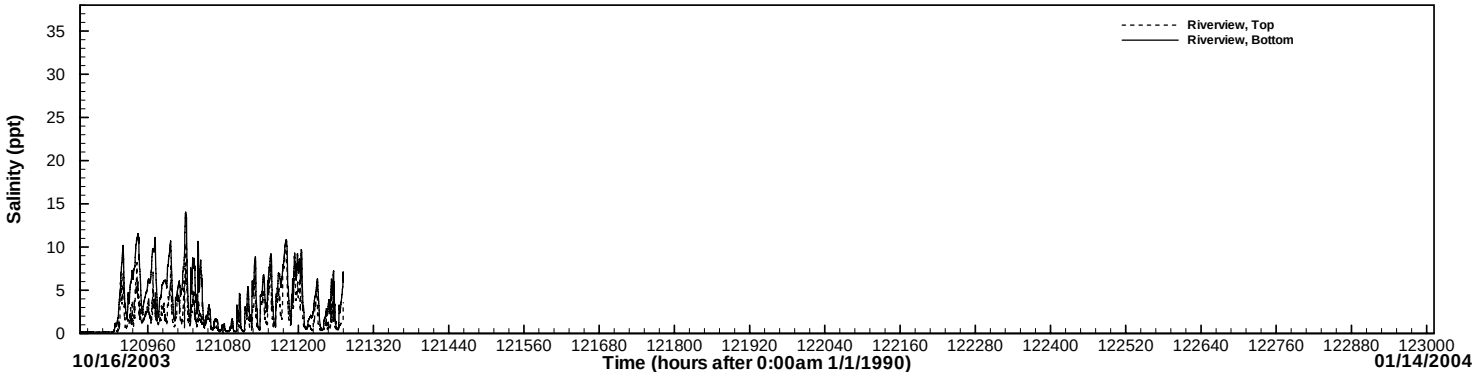

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
118800
118920
119040
119160
119280
119400
119520
119640
119760
119880
120000
120120
120240
120360
120480
120600
120720
120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003


Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
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118800
118920
119040
119160
119280
119400
119520
119640
119760
119880
120000
120120
120240
120360
120480
120600
120720
120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003


Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
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118800
118920
119040
119160
119280
119400
119520
119640
119760
119880
120000
120120
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120480
120600
120720
120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003

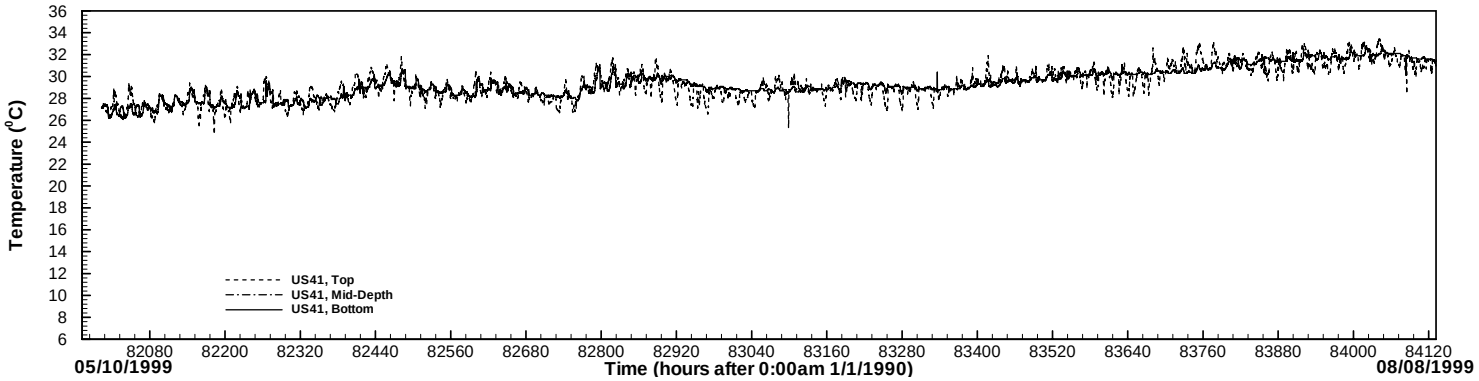

US41, Top
US41, Mid-Depth
US41, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
120960
121080
121200
121320
121440
121560
121680
121800
121920
122040
122160
122280
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122760
122880
123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

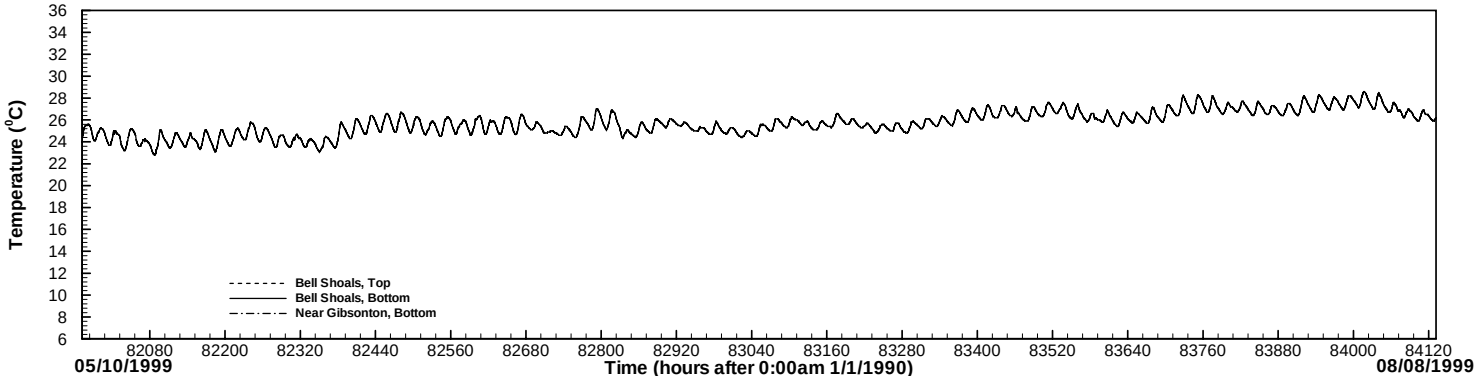

Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
Salinity (ppt)
0
5
10
15
20
25
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120960
121080
121200
121320
121440
121560
121680
121800
121920
122040
122160
122280
122400
122520
122640
122760
122880
123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

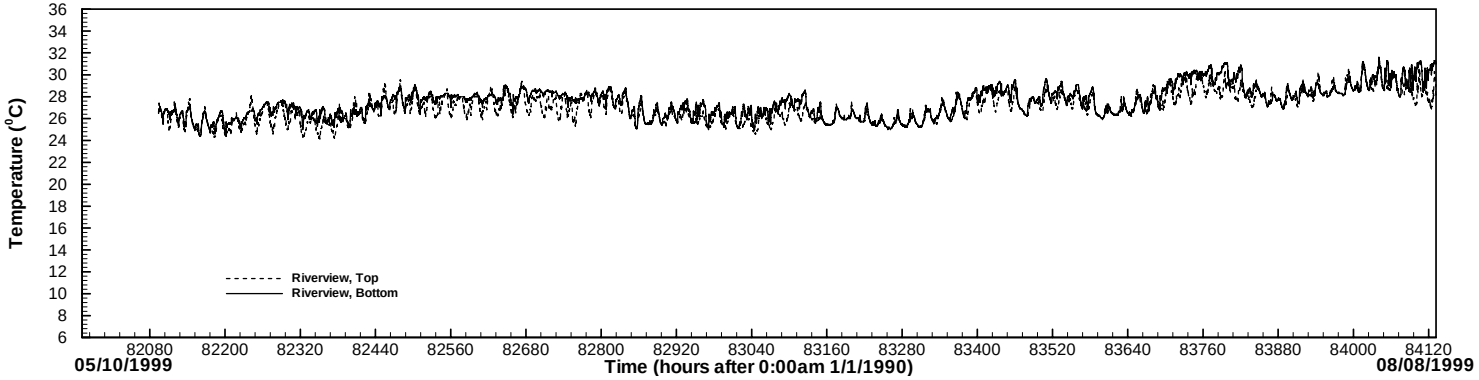

Riverview, Top
Riverview, Bottom
Salinity (ppt)
0
5
10
15
20
25
30
35
120960
121080
121200
121320
121440
121560
121680
121800
121920
122040
122160
122280
122400
122520
122640
122760
122880
123000
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

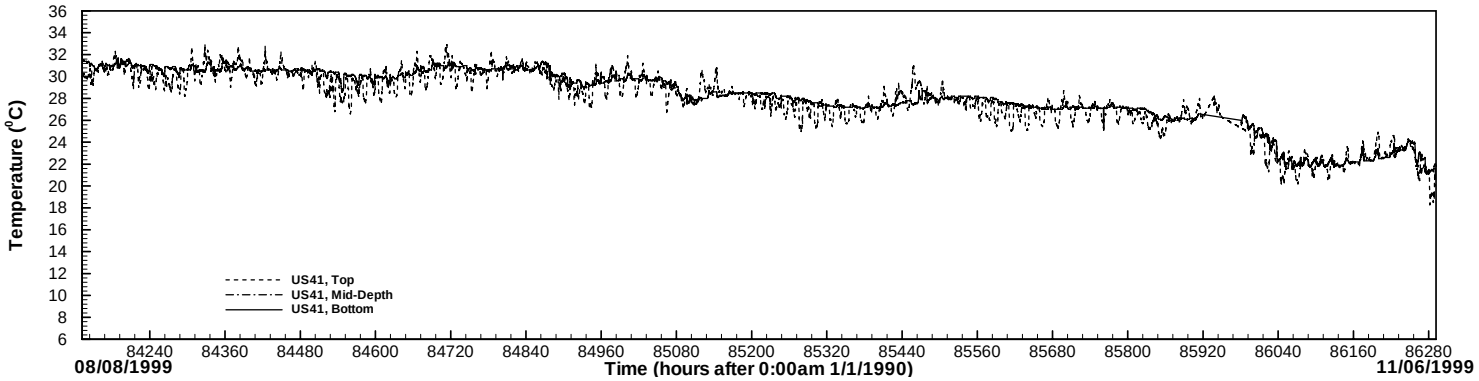
Appendix C
Measured Temperature Data in the Lower Alafia River

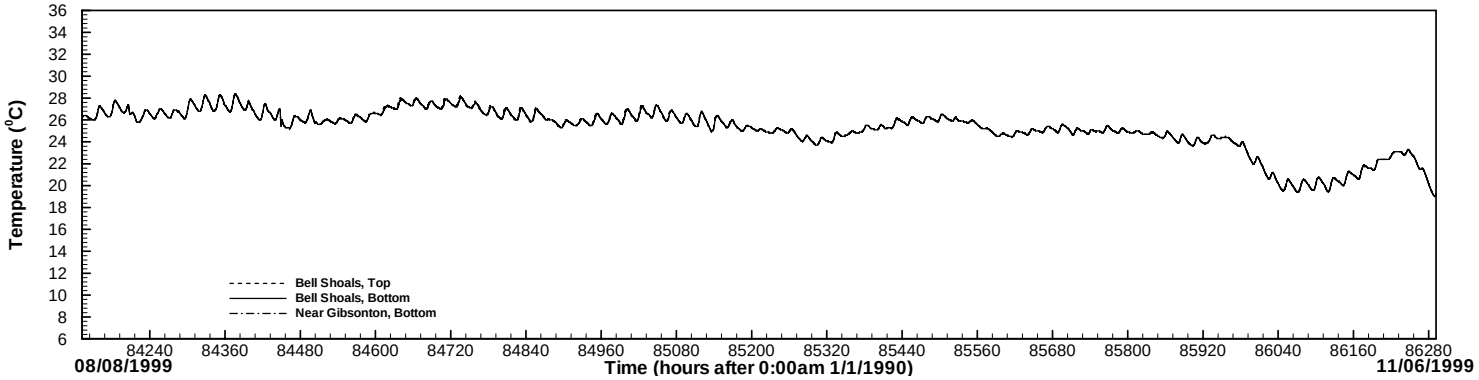
The following 19 pages show plots of measured temperature data during May 1999 through December 2003 at the USGS Alafia River at Gibsonton, Alafia River near Gibsonton, Alafia River at Riverview, and Alafia River at Bell Shoals Road stations.

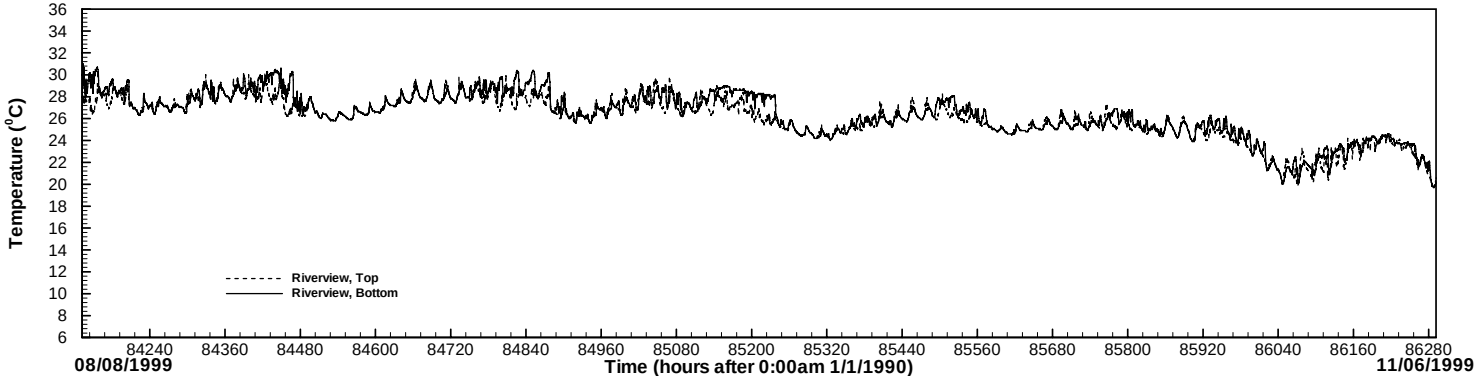

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
US41, Top
US41, Mid-Depth
US41, Bottom
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

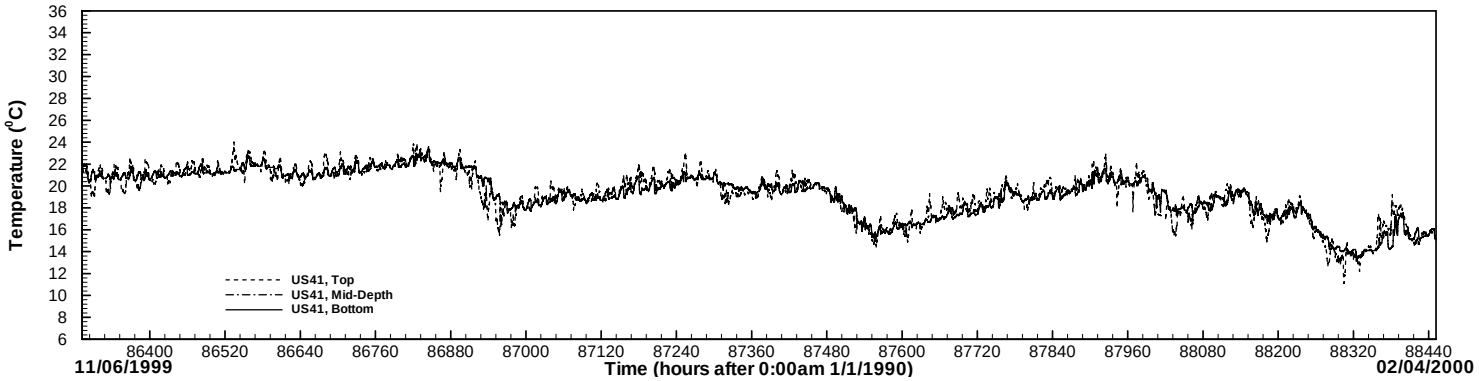

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

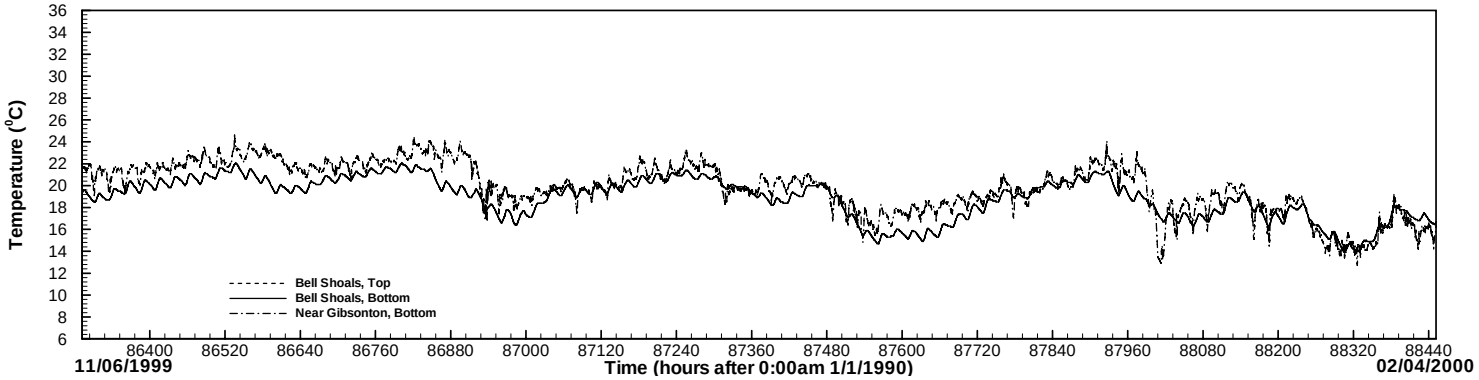

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Riverview, Top
Riverview, Bottom
82080
82200
82320
82440
82560
82680
82800
82920
83040
83160
83280
83400
83520
83640
83760
83880
84000
84120
05/10/1999
Time (hours after 0:00am 1/1/1990)
08/08/1999

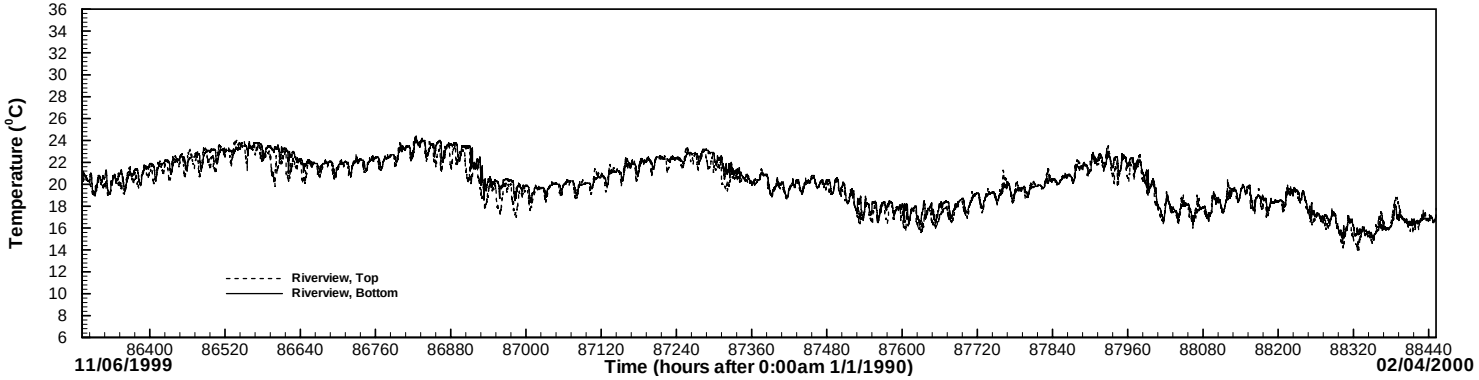

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
US41, Top
US41, Mid-Depth
US41, Bottom
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

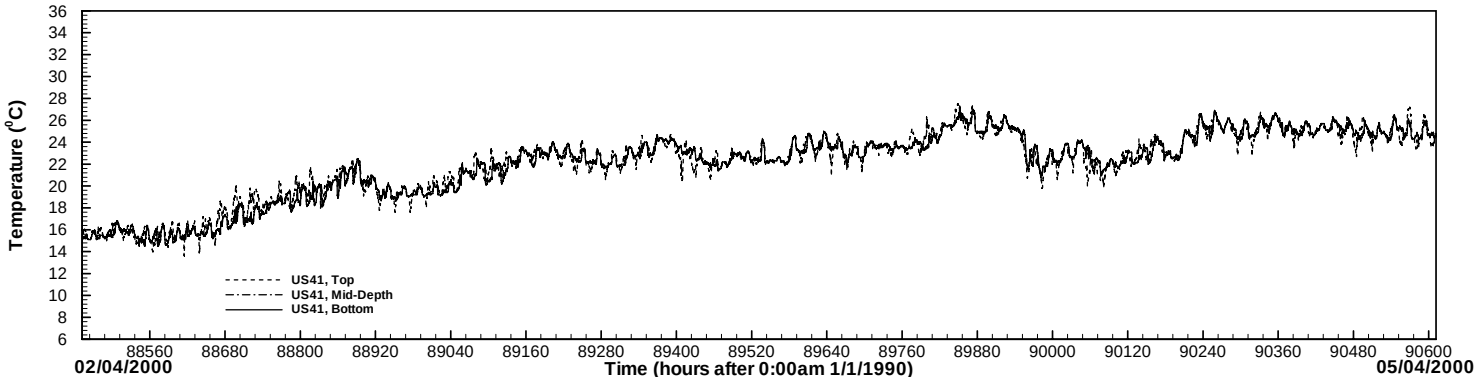

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

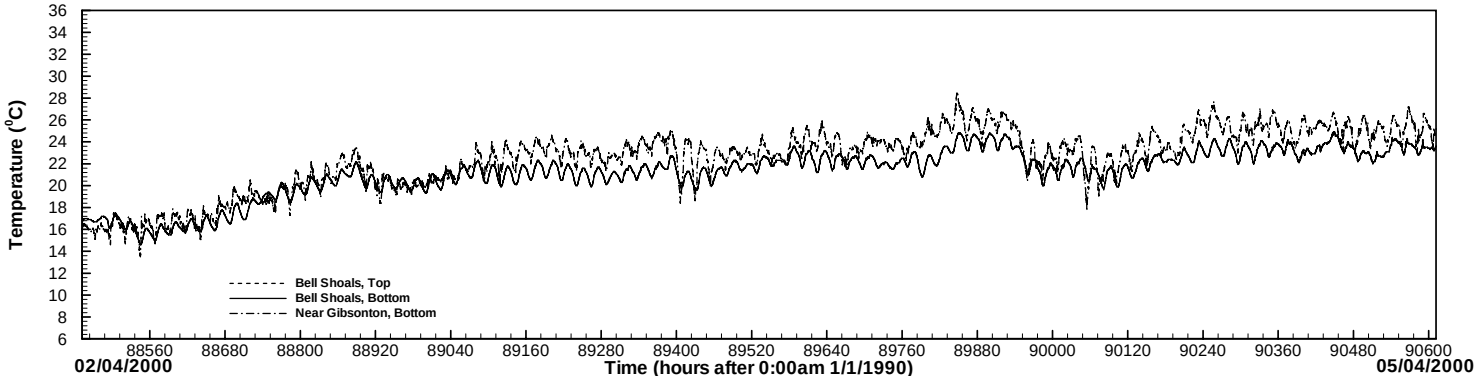

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Riverview, Top
Riverview, Bottom
84240 84360 84480 84600 84720 84840 84960 85080 85200 85320 85440 85560 85680 85800 85920 86040 86160 86280
08/08/1999
Time (hours after 0:00am 1/1/1990)
11/06/1999

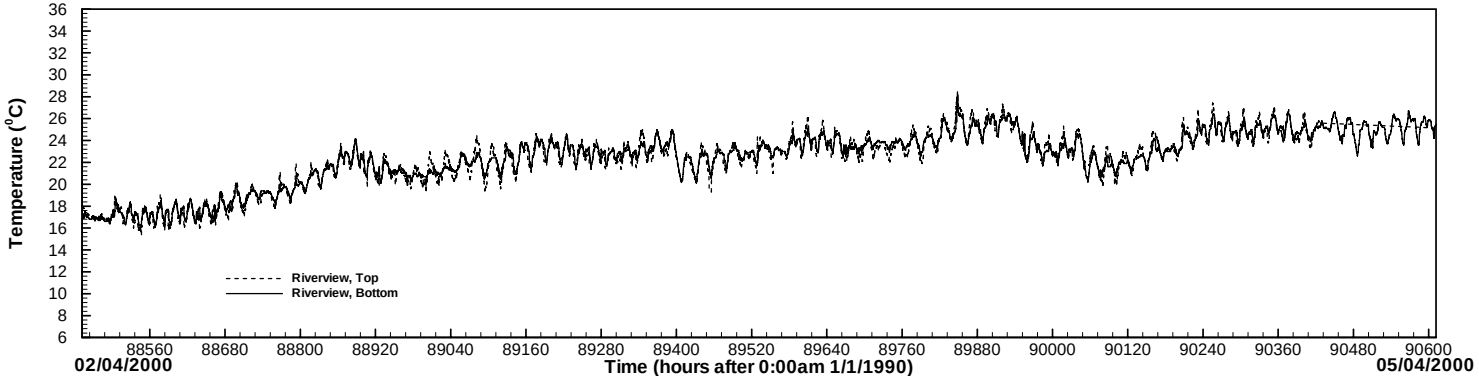

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
US41, Top
US41, Mid-Depth
US41, Bottom
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

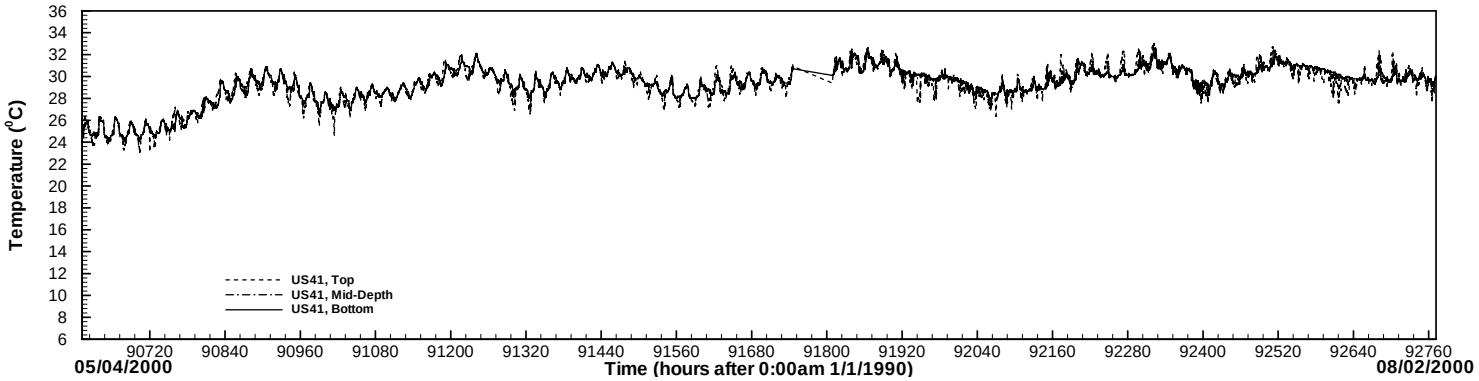

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

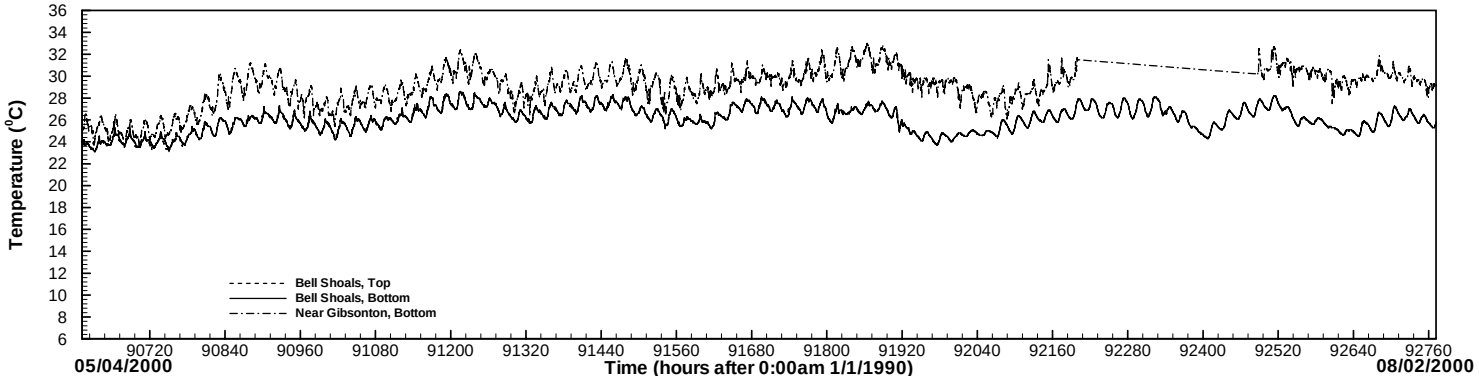

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Riverview, Top
Riverview, Bottom
86400 86520 86640 86760 86880 87000 87120 87240 87360 87480 87600 87720 87840 87960 88080 88200 88320 88440
11/06/1999
Time (hours after 0:00am 1/1/1990)
02/04/2000

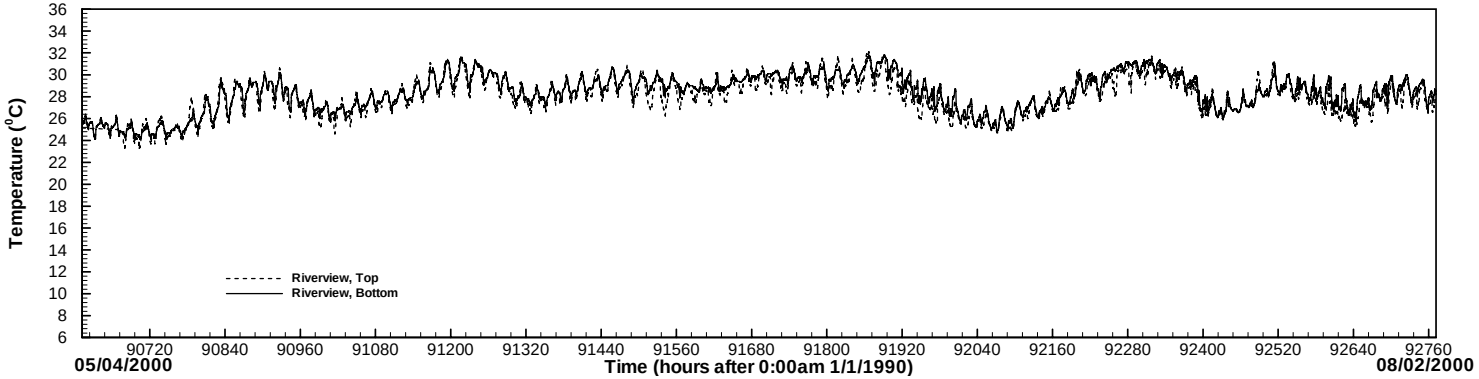

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

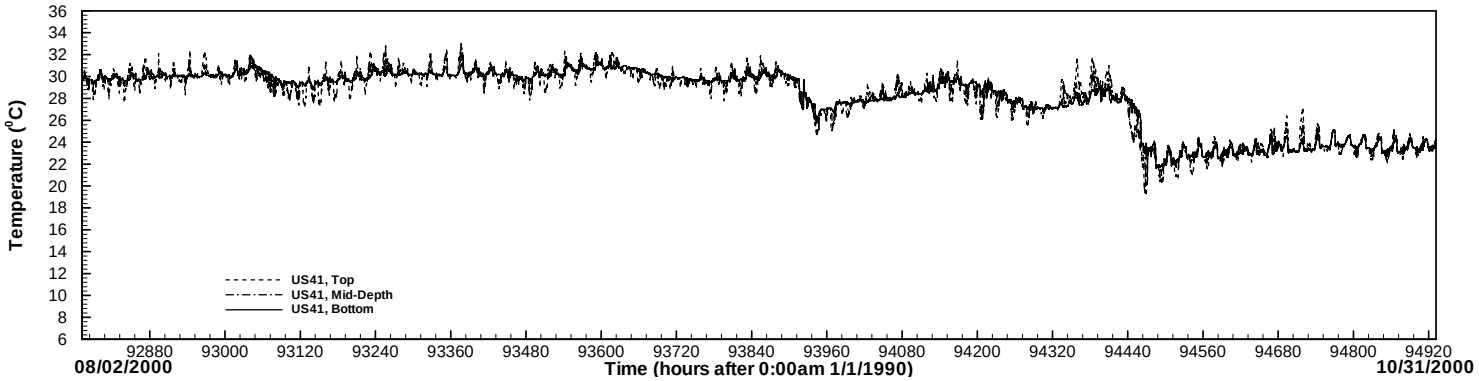

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

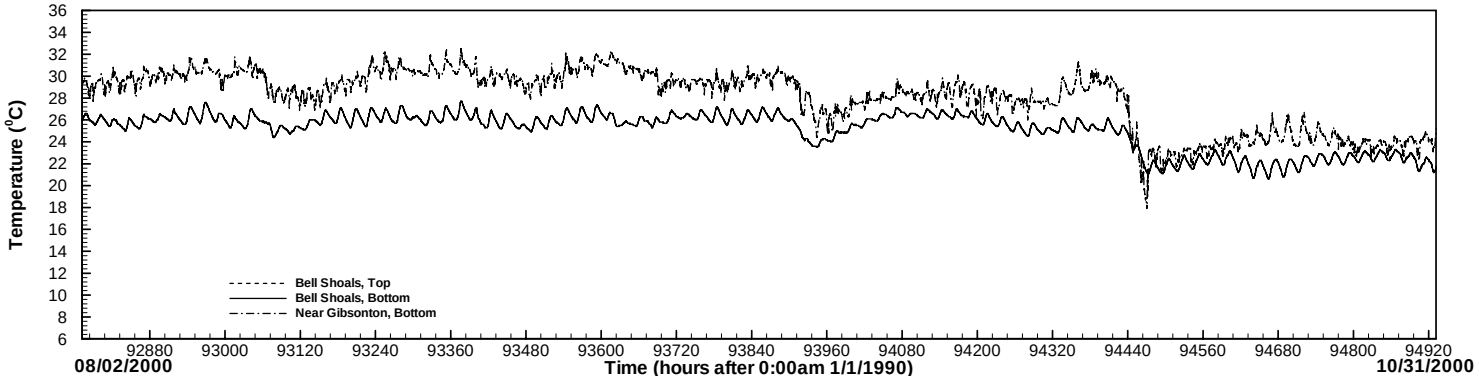

Temperature (°C)
Riverview, Top
Riverview, Bottom
02/04/2000
Time (hours after 0:00am 1/1/1990)
05/04/2000

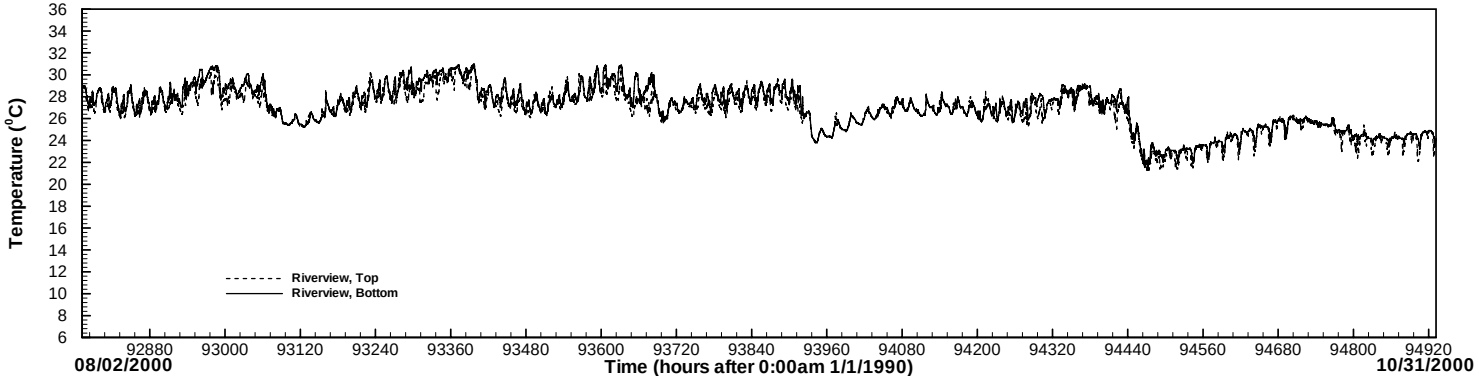

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

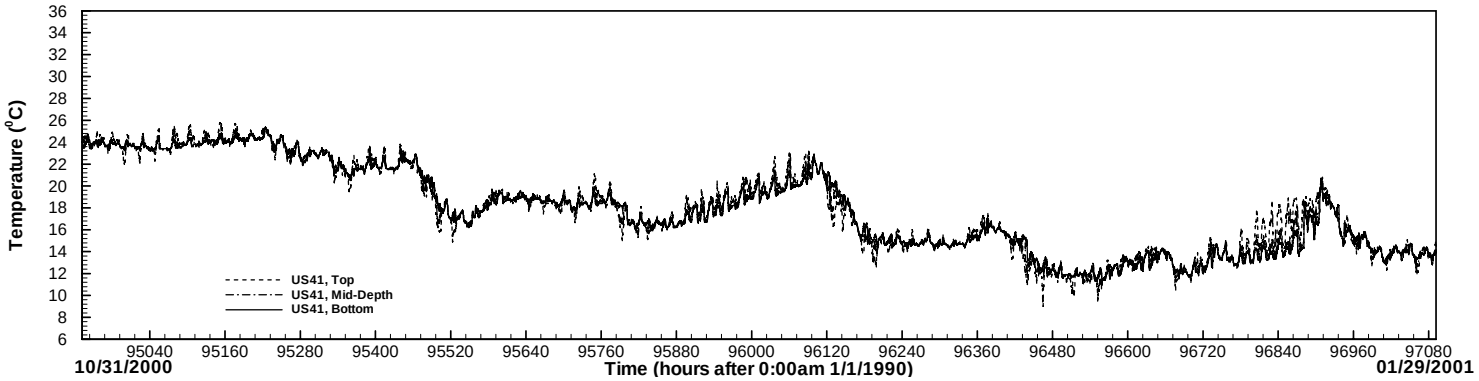

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

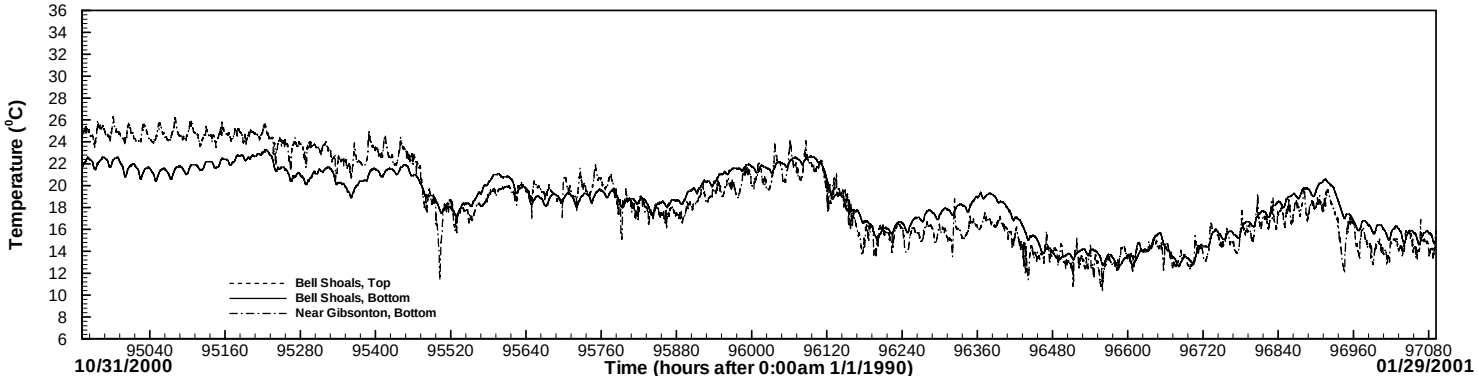

Temperature (°C)
Riverview, Top
Riverview, Bottom
05/04/2000
Time (hours after 0:00am 1/1/1990)
08/02/2000

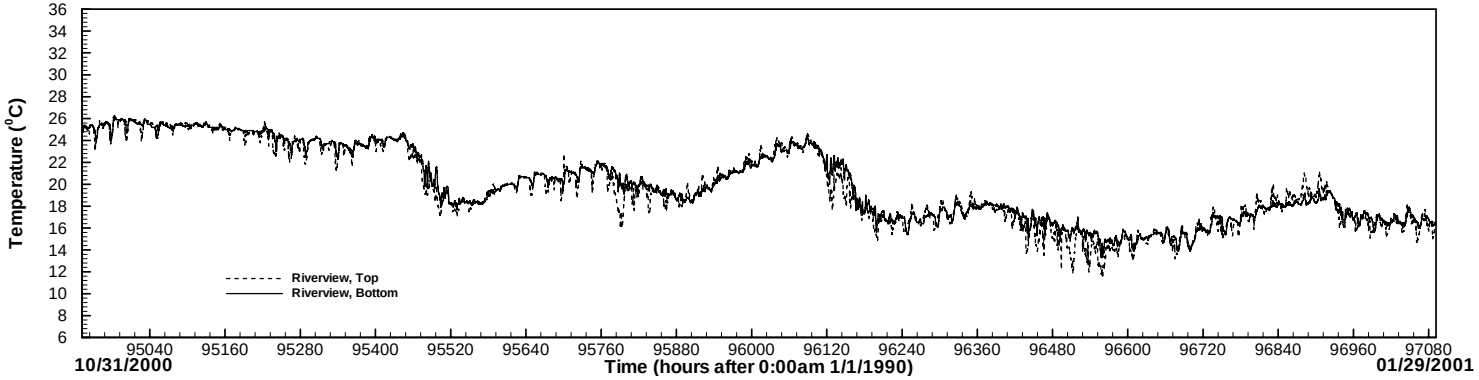

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

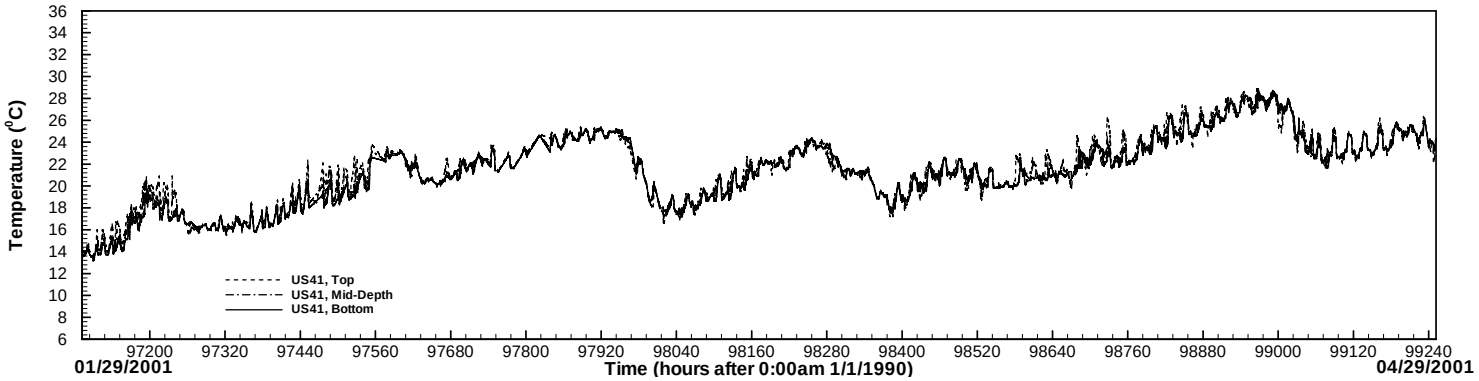

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

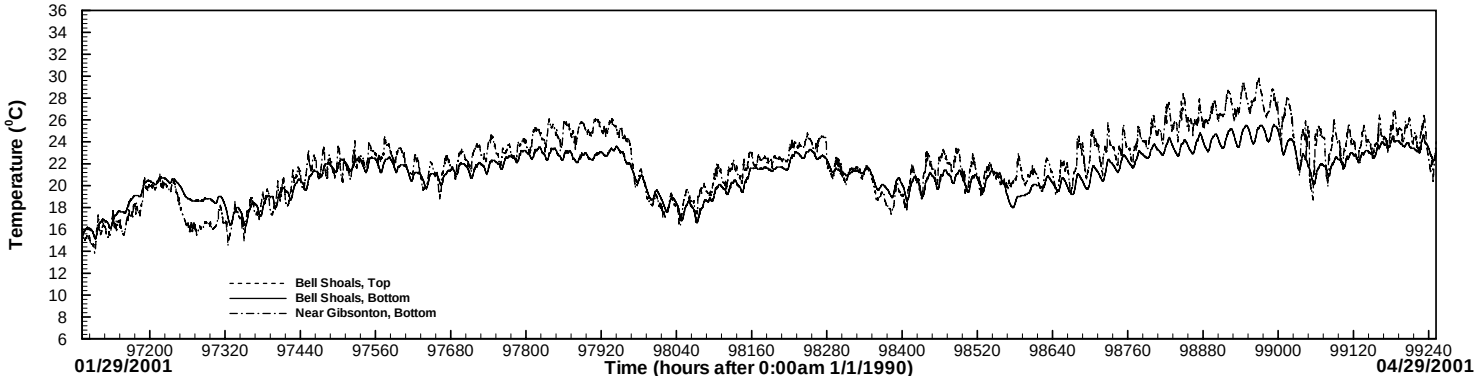

Temperature (°C)
Riverview, Top
Riverview, Bottom
08/02/2000
Time (hours after 0:00am 1/1/1990)
10/31/2000

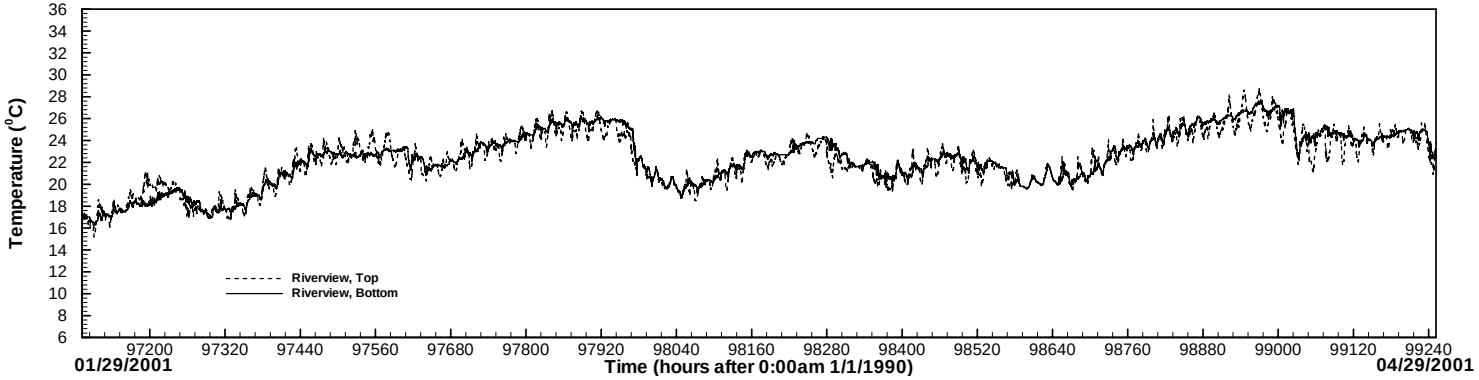

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
US41, Top
US41, Mid-Depth
US41, Bottom
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

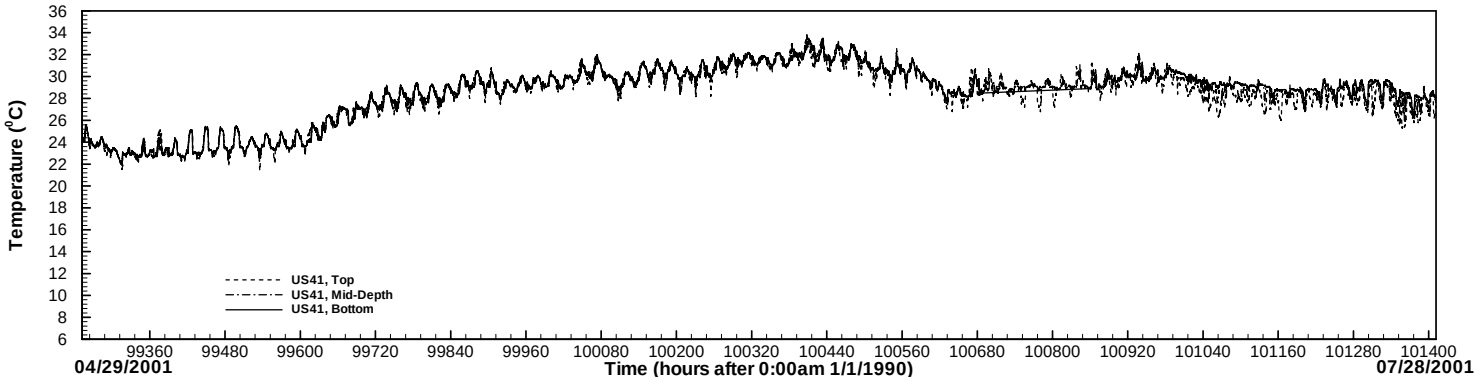

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

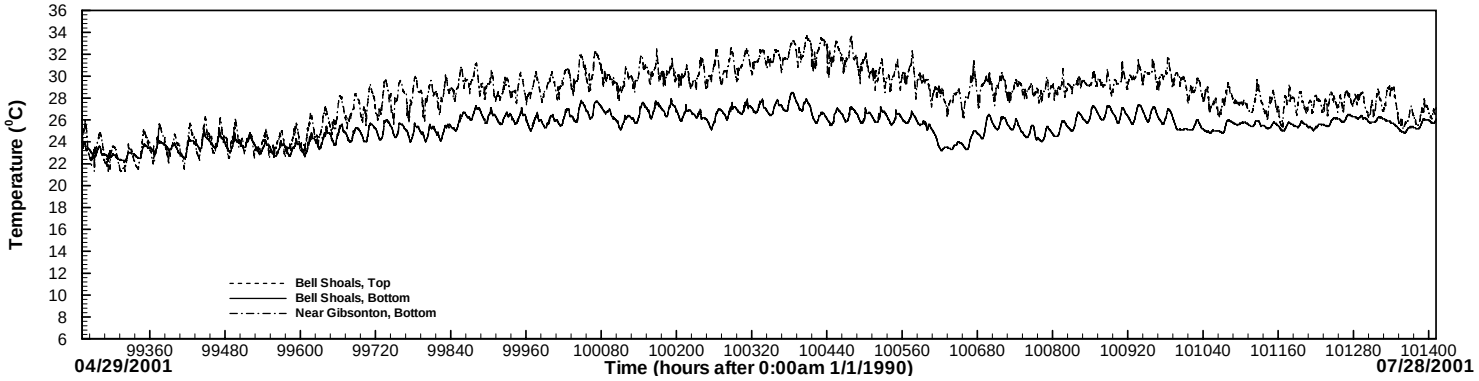

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Riverview, Top
Riverview, Bottom
95040 95160 95280 95400 95520 95640 95760 95880 96000 96120 96240 96360 96480 96600 96720 96840 96960 97080
10/31/2000
Time (hours after 0:00am 1/1/1990)
01/29/2001

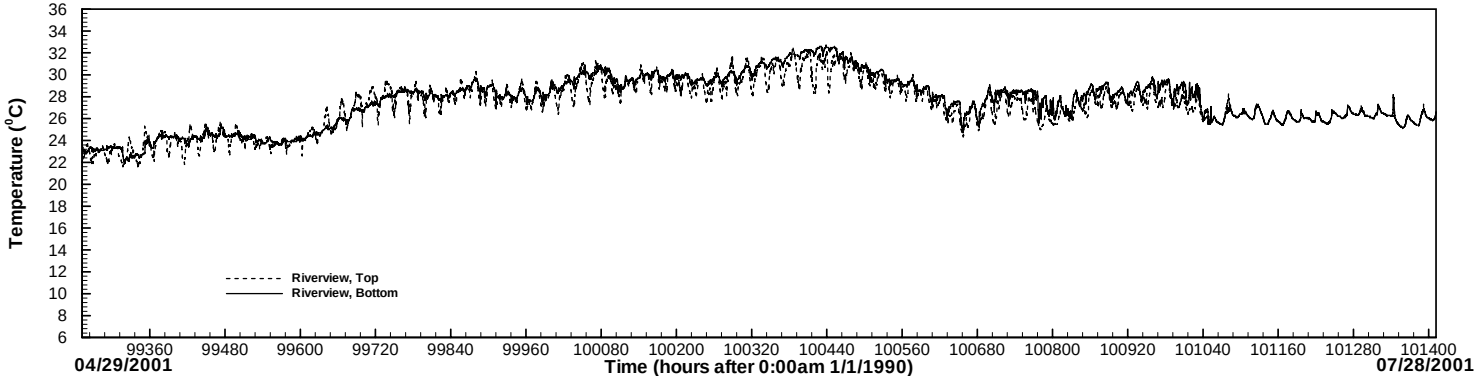

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
US41, Top
US41, Mid-Depth
US41, Bottom
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

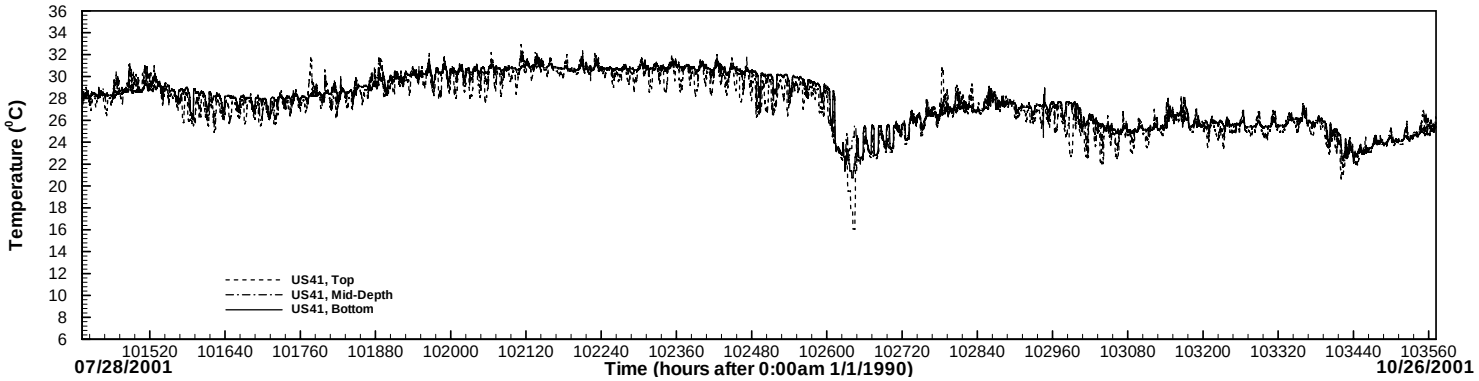

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

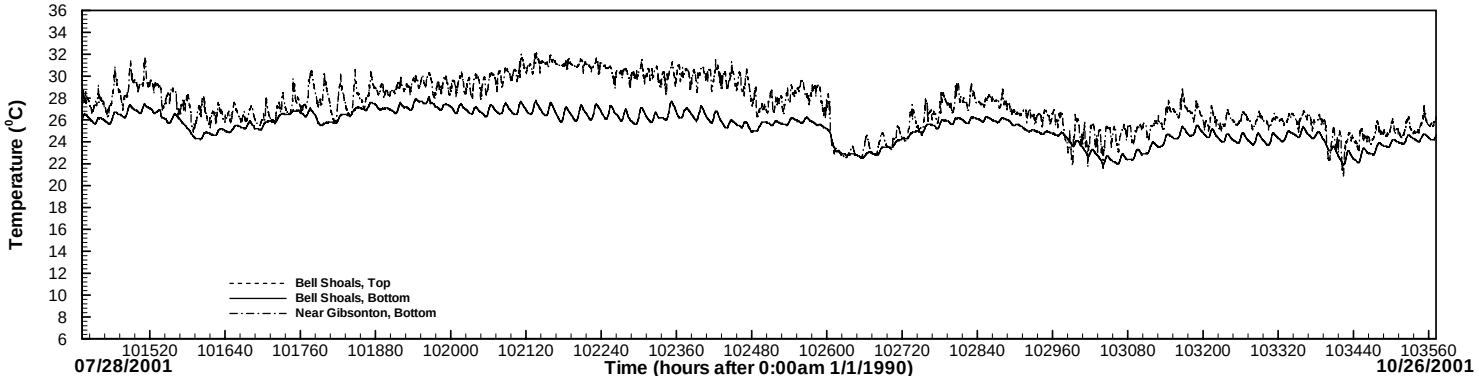

Temperature (°C)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
Riverview, Top
Riverview, Bottom
97200
97320
97440
97560
97680
97800
97920
98040
98160
98280
98400
98520
98640
98760
98880
99000
99120
99240
01/29/2001
Time (hours after 0:00am 1/1/1990)
04/29/2001

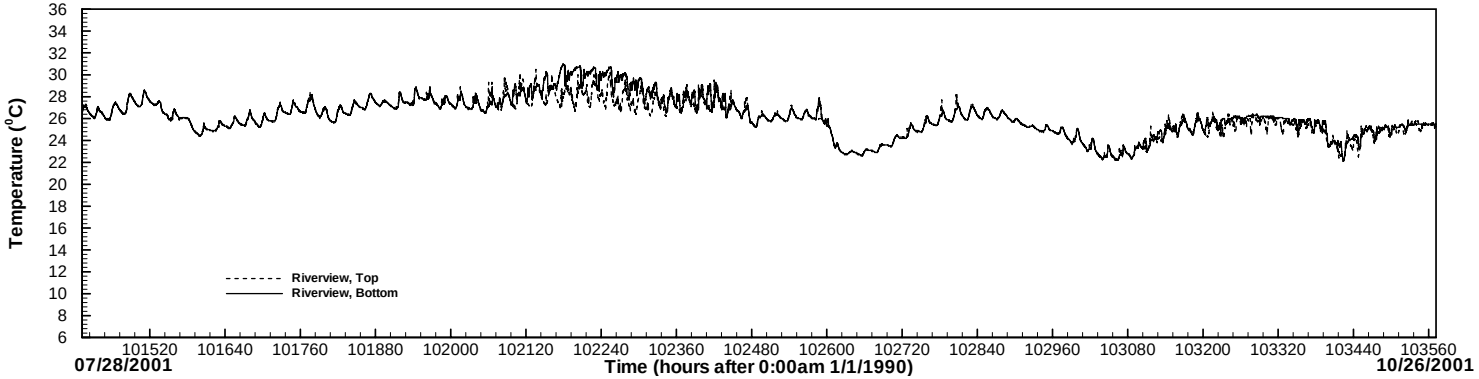

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

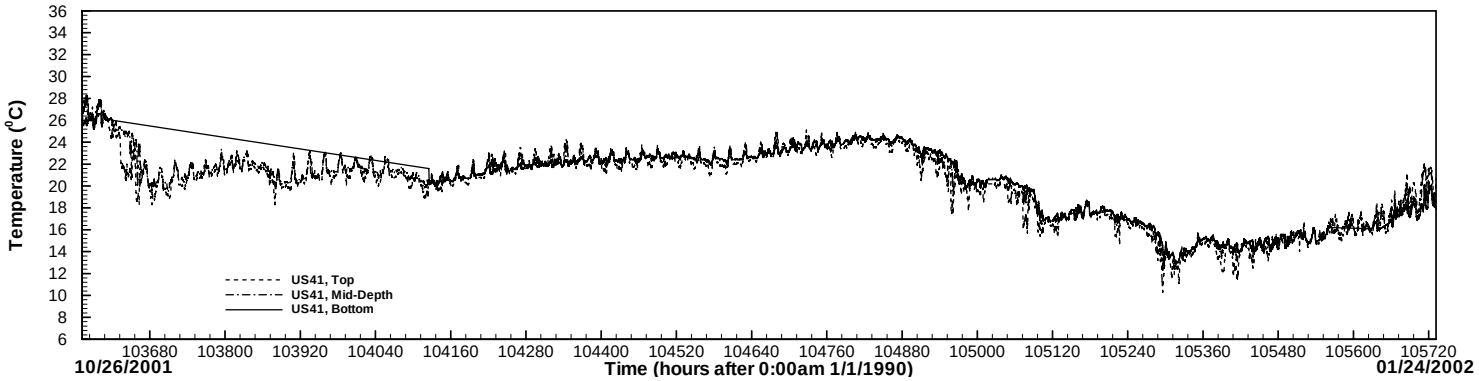

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

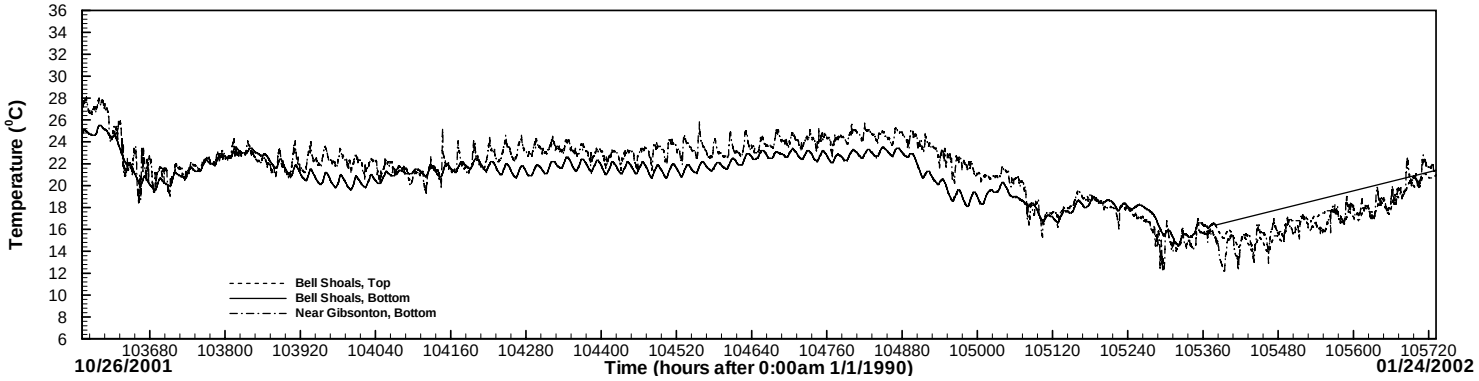

Temperature (°C)
Riverview, Top
Riverview, Bottom
04/29/2001
Time (hours after 0:00am 1/1/1990)
07/28/2001

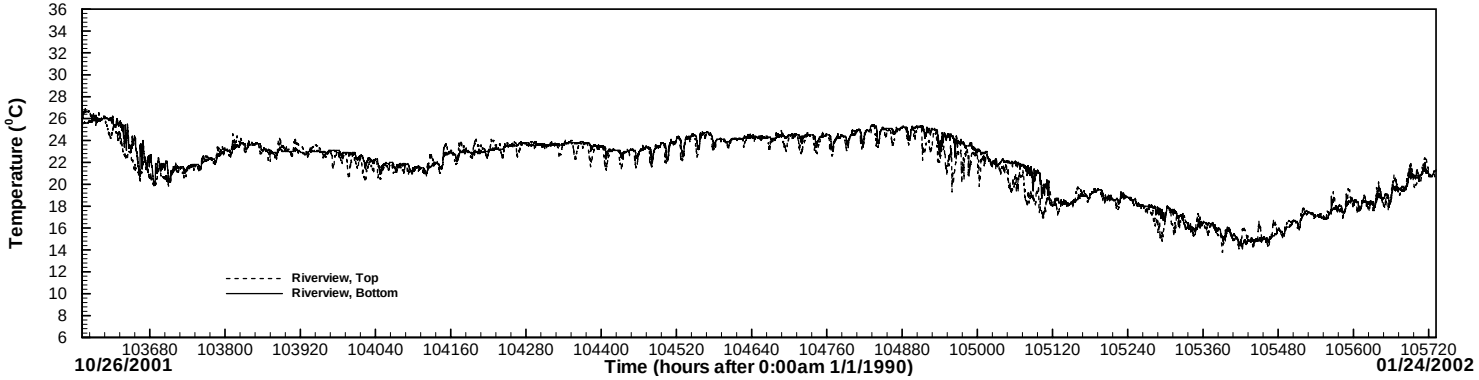

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

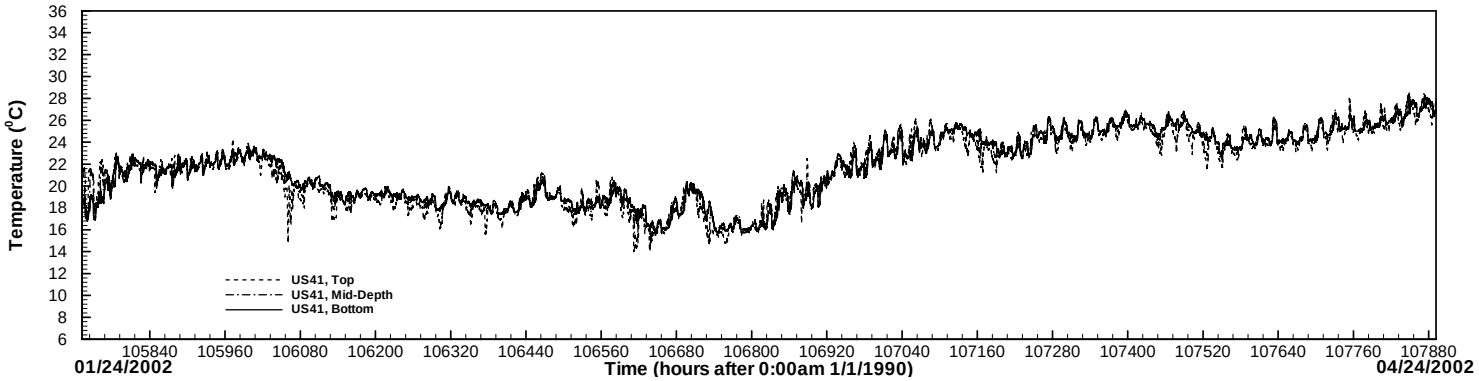

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

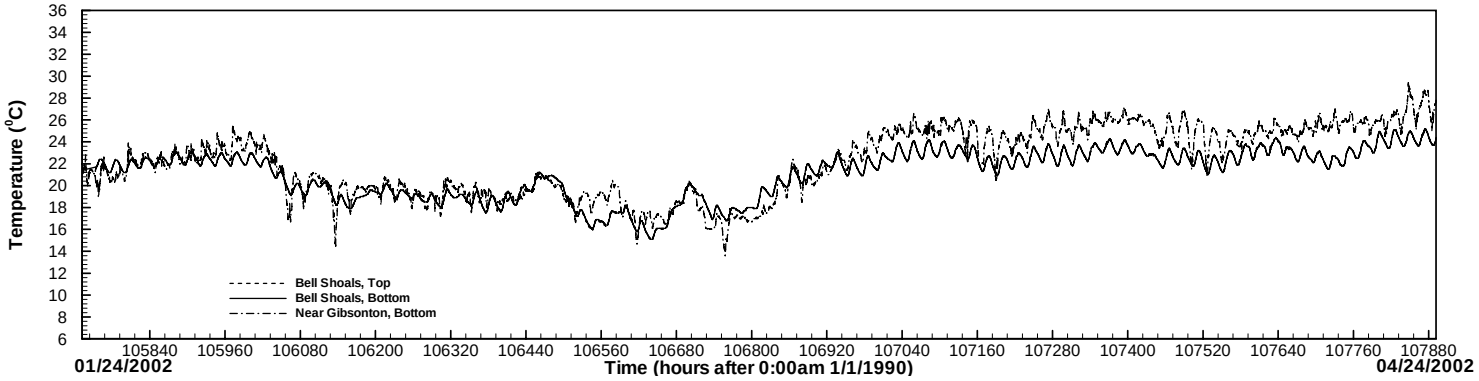

Temperature (°C)
Riverview, Top
Riverview, Bottom
07/28/2001
Time (hours after 0:00am 1/1/1990)
10/26/2001

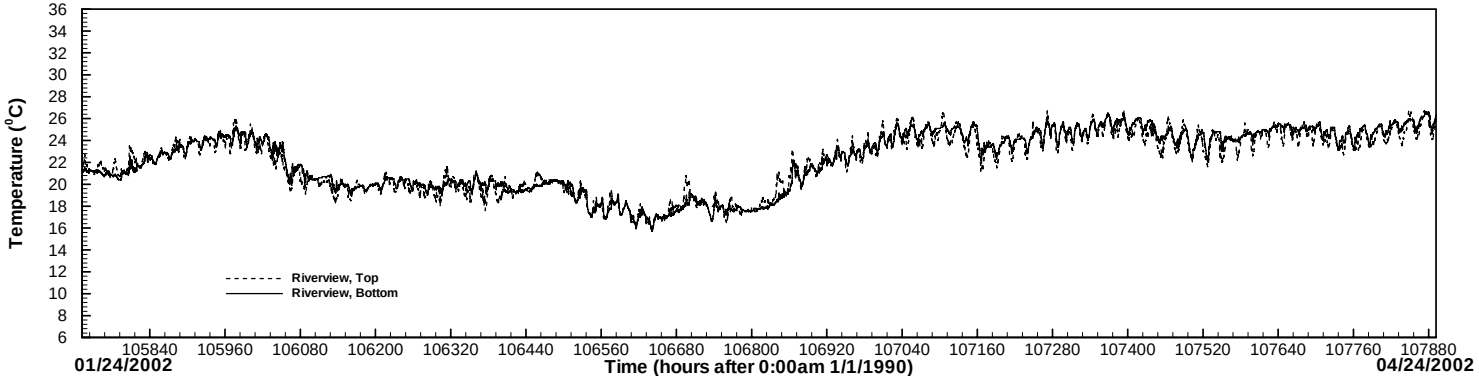

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

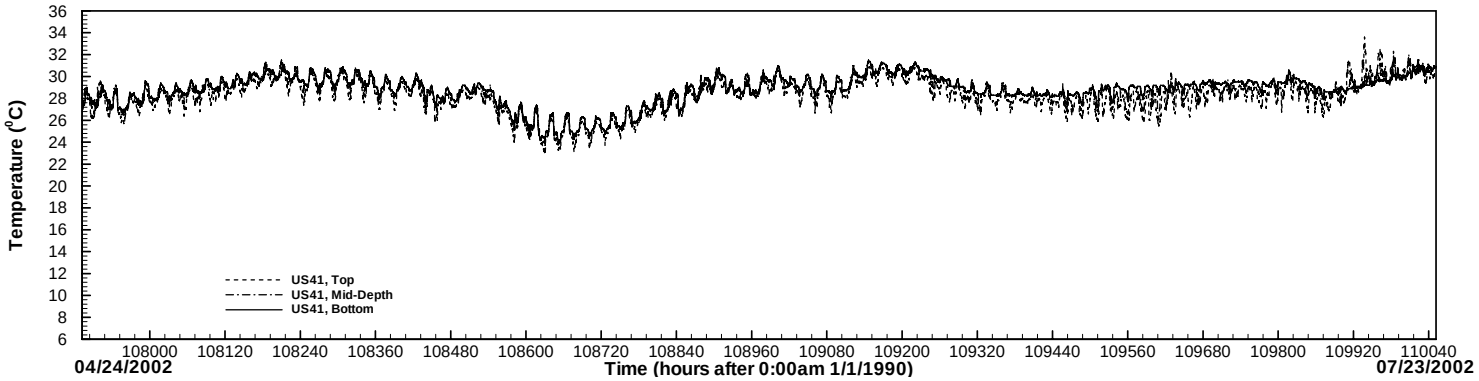

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

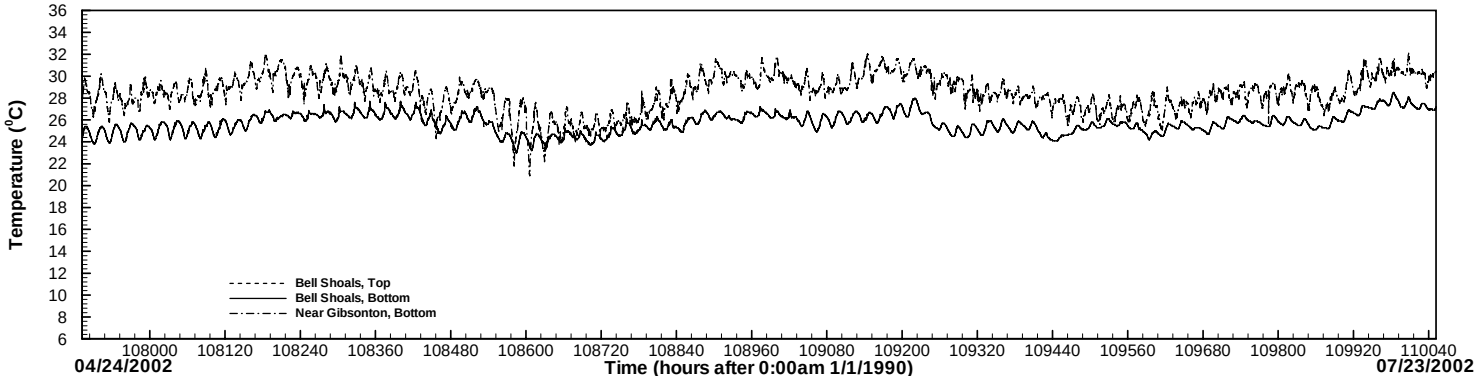

Temperature (°C)
Riverview, Top
Riverview, Bottom
10/26/2001
Time (hours after 0:00am 1/1/1990)
01/24/2002

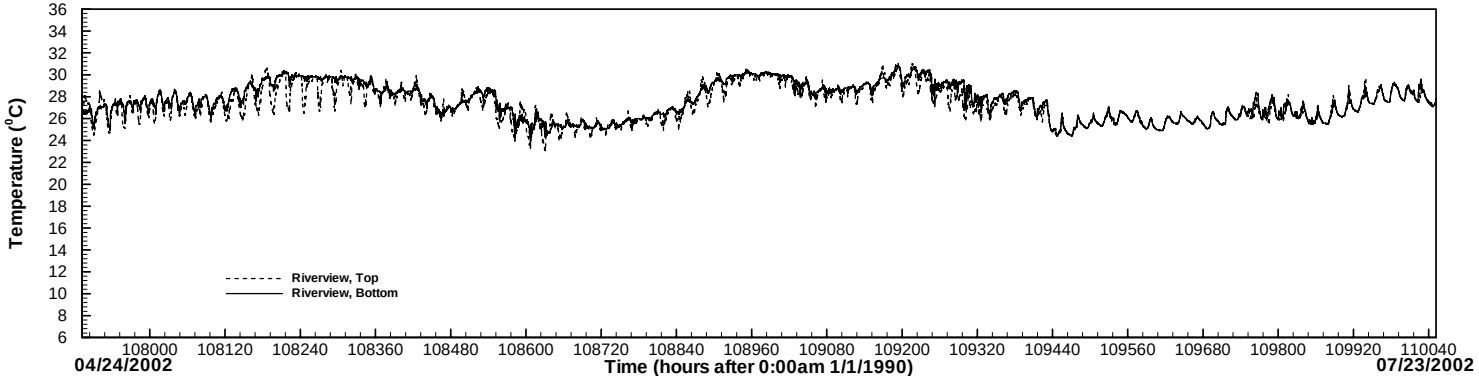

Temperature (°C)
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US41, Top
US41, Mid-Depth
US41, Bottom
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

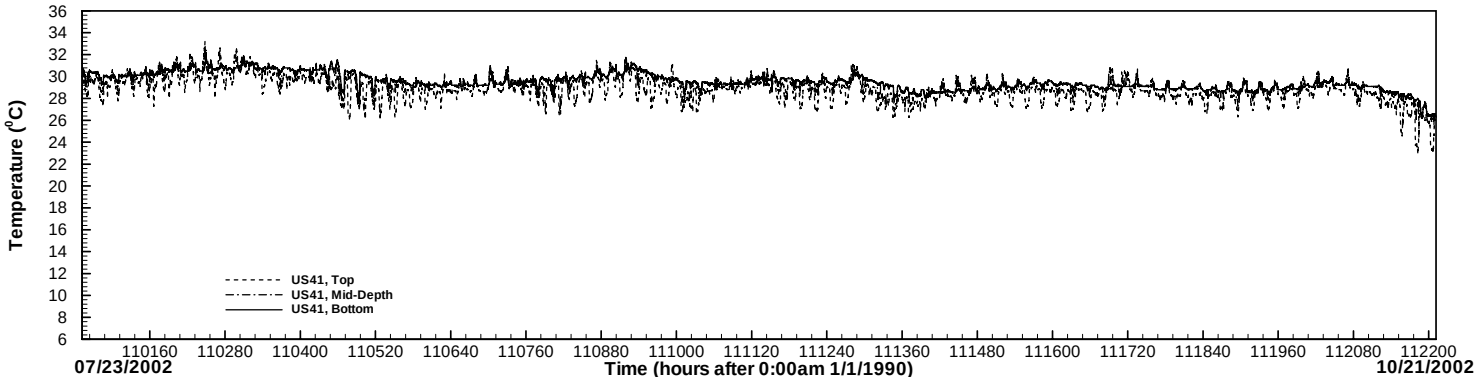

Temperature (°C)
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Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

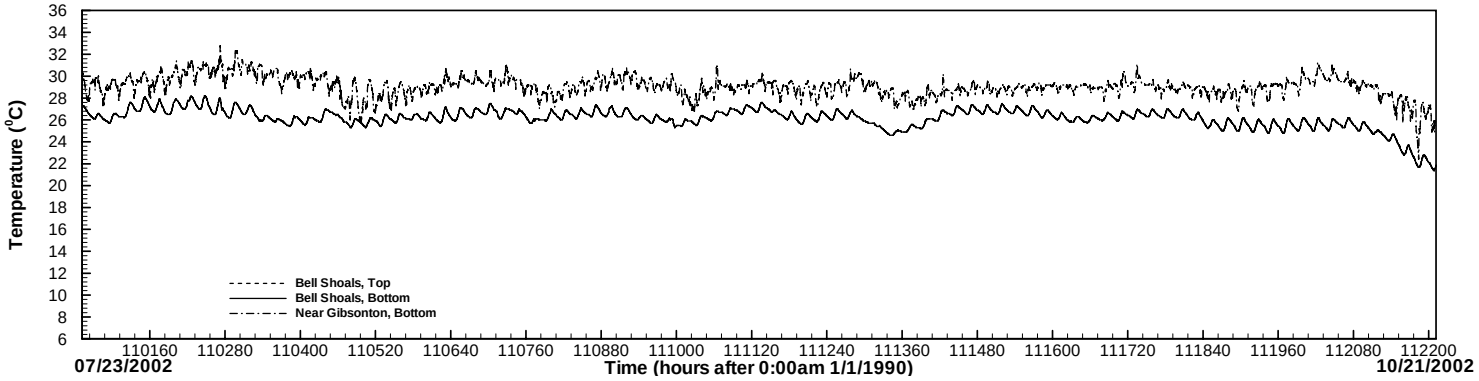

Temperature (°C)
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Riverview, Top
Riverview, Bottom
105840 105960 106080 106200 106320 106440 106560 106680 106800 106920 107040 107160 107280 107400 107520 107640 107760 107880
01/24/2002
Time (hours after 0:00am 1/1/1990)
04/24/2002

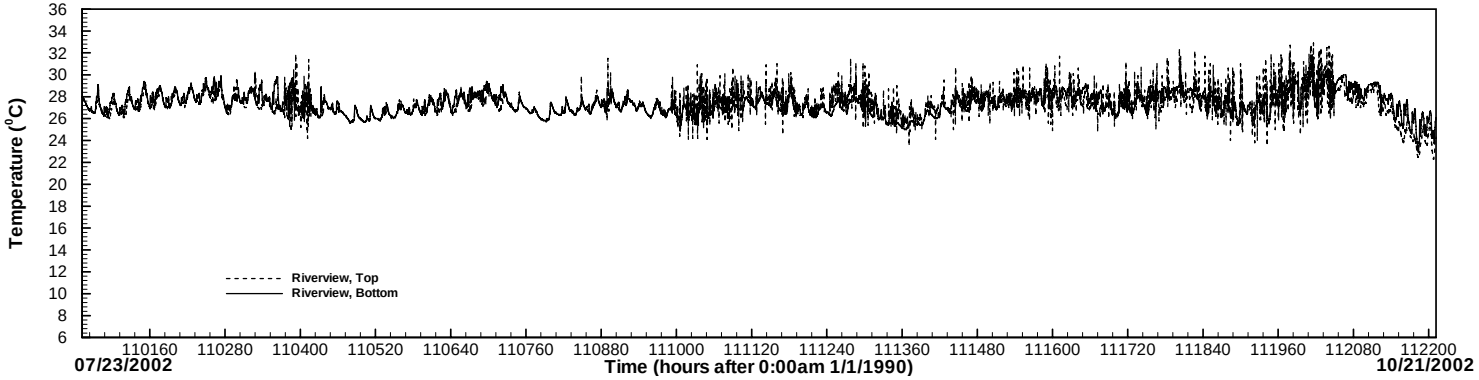

Temperature (°C)
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US41, Top
US41, Mid-Depth
US41, Bottom
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

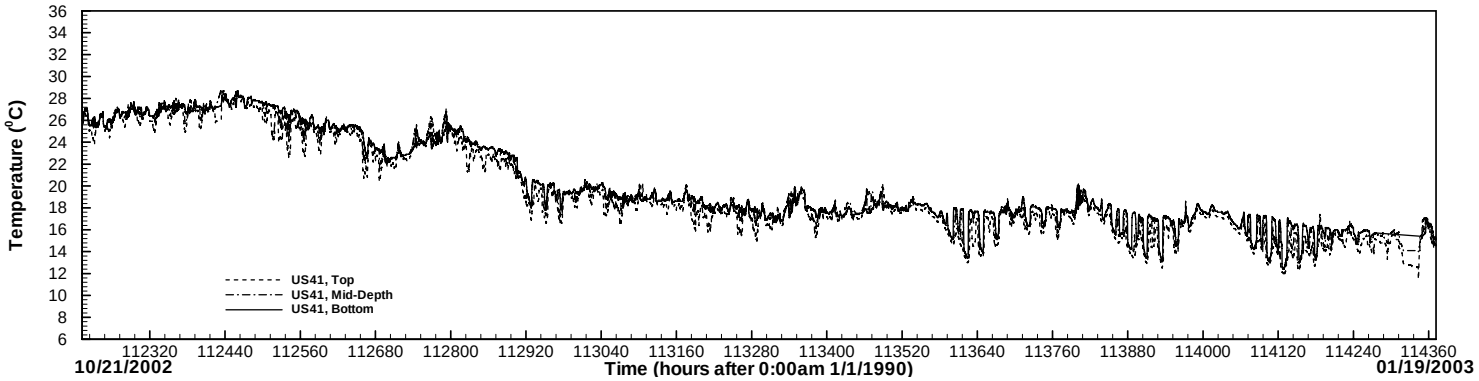

Temperature (°C)
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Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

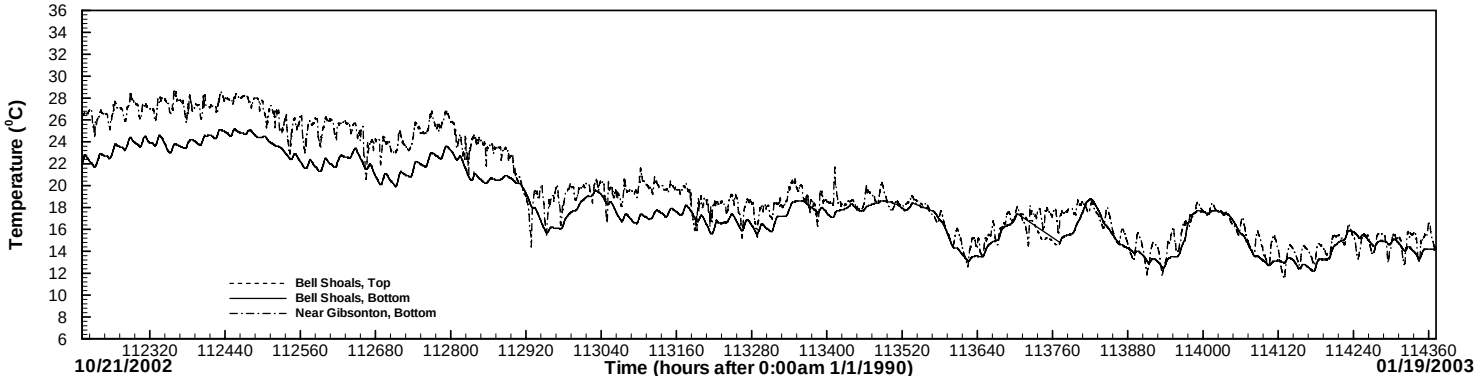

Temperature (°C)
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Riverview, Top
Riverview, Bottom
108000 108120 108240 108360 108480 108600 108720 108840 108960 109080 109200 109320 109440 109560 109680 109800 109920 110040
04/24/2002
Time (hours after 0:00am 1/1/1990)
07/23/2002

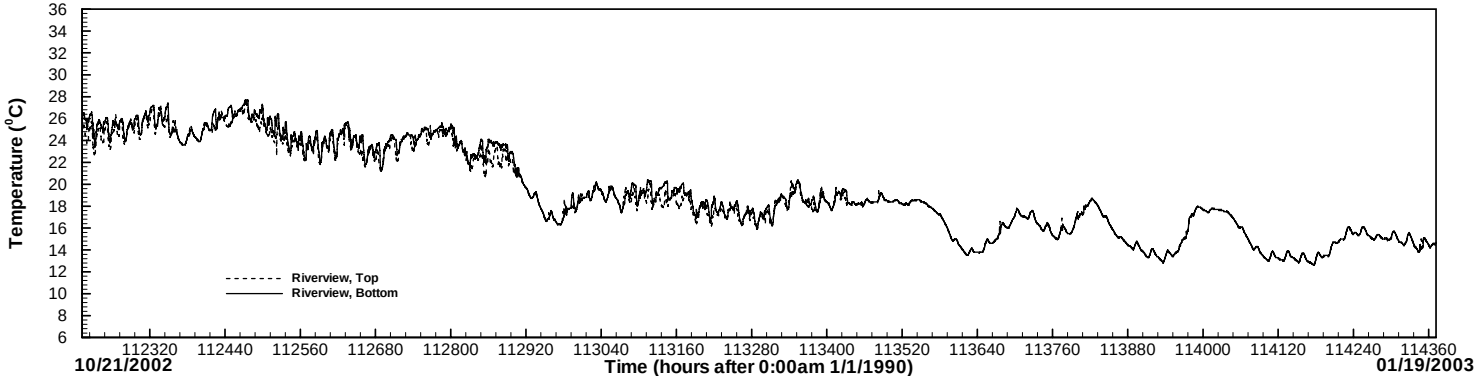

Temperature (°C)
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US41, Top
US41, Mid-Depth
US41, Bottom
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

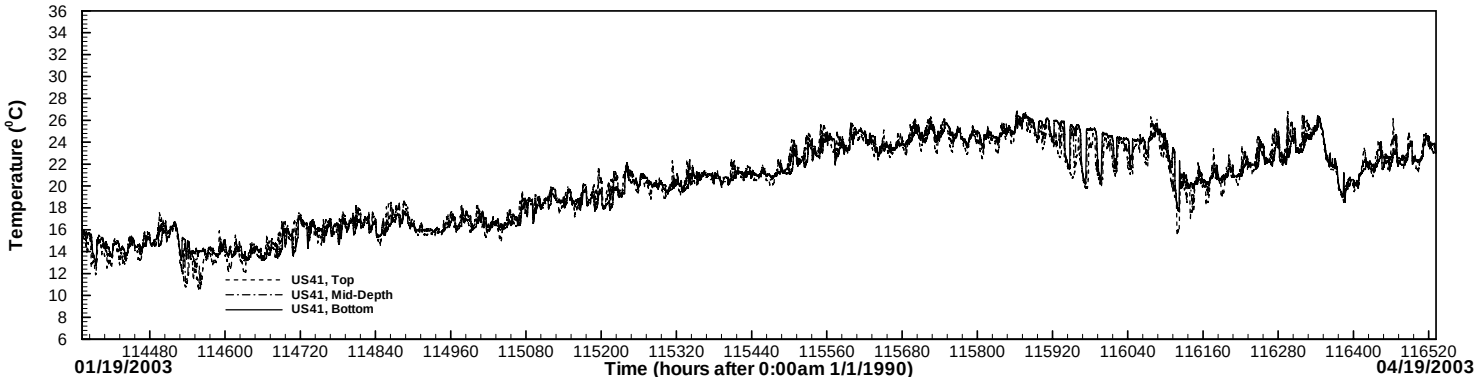

Temperature (°C)
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Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

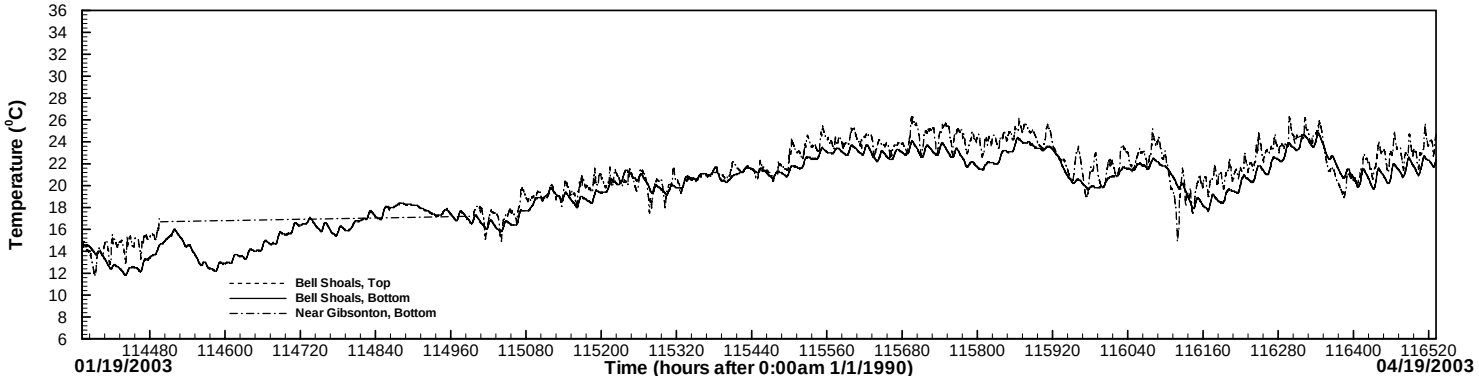

Temperature (°C)
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Riverview, Top
Riverview, Bottom
110160 110280 110400 110520 110640 110760 110880 111000 111120 111240 111360 111480 111600 111720 111840 111960 112080 112200
07/23/2002
Time (hours after 0:00am 1/1/1990)
10/21/2002

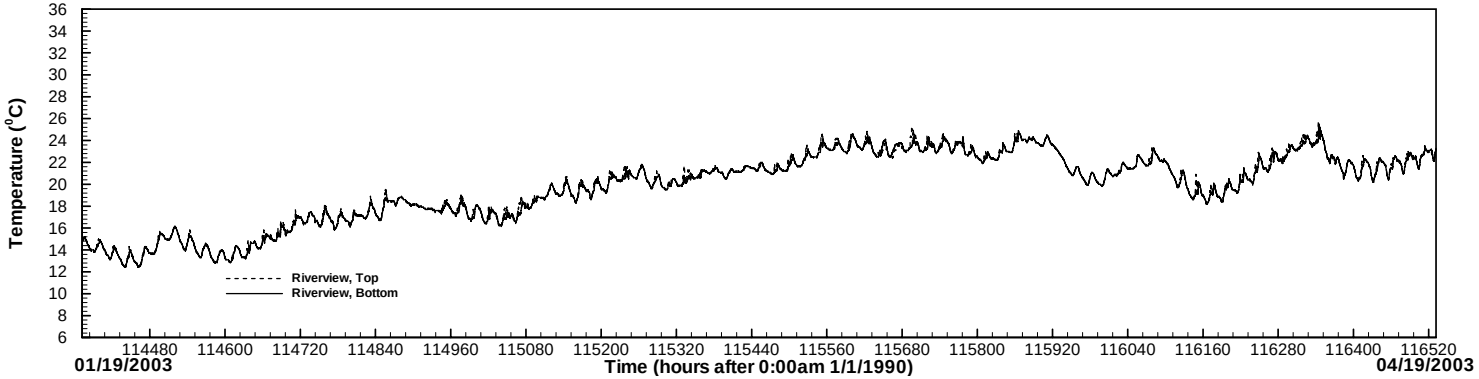

Temperature (°C)
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US41, Top
US41, Mid-Depth
US41, Bottom
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

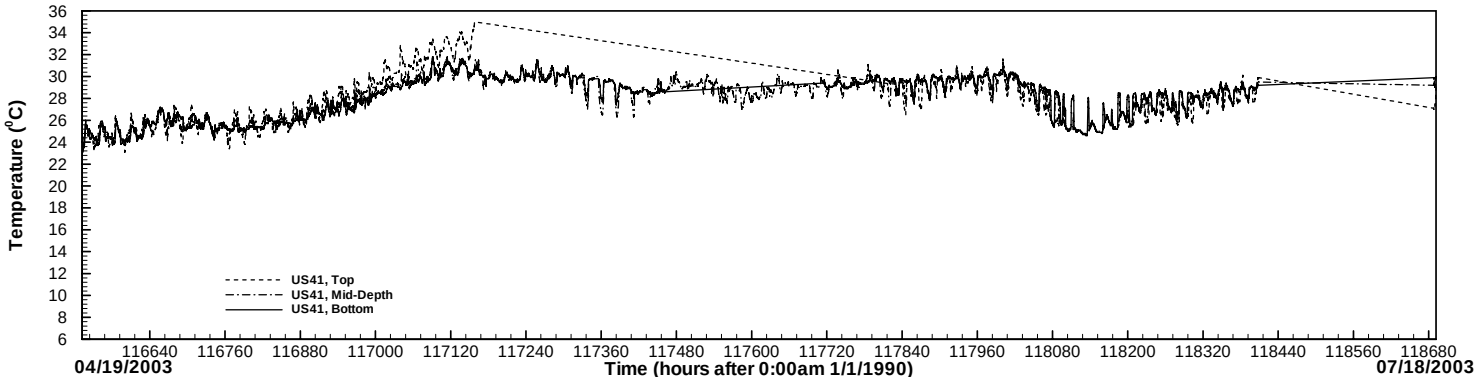

Temperature (°C)
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Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

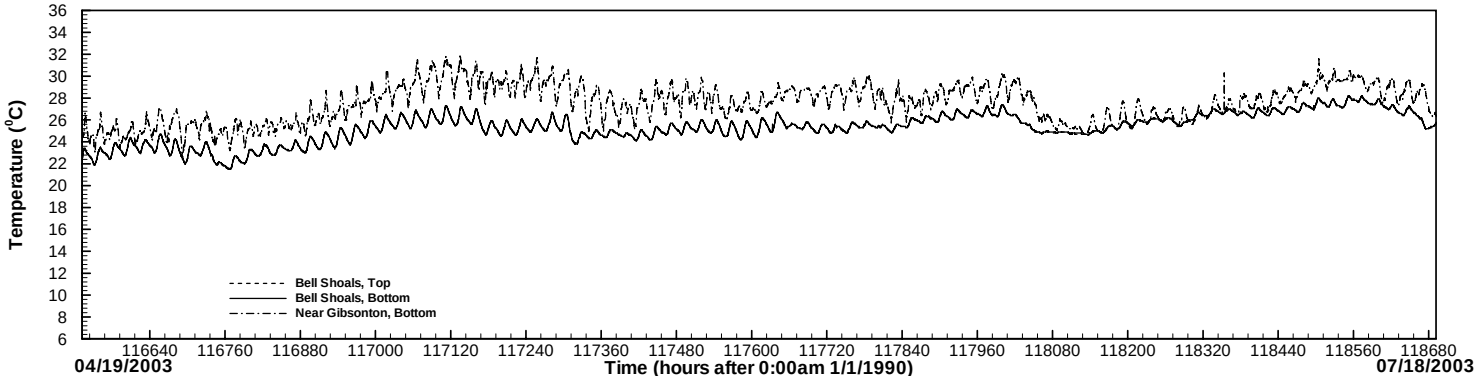

Temperature (°C)
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Riverview, Top
Riverview, Bottom
112320 112440 112560 112680 112800 112920 113040 113160 113280 113400 113520 113640 113760 113880 114000 114120 114240 114360
10/21/2002
Time (hours after 0:00am 1/1/1990)
01/19/2003

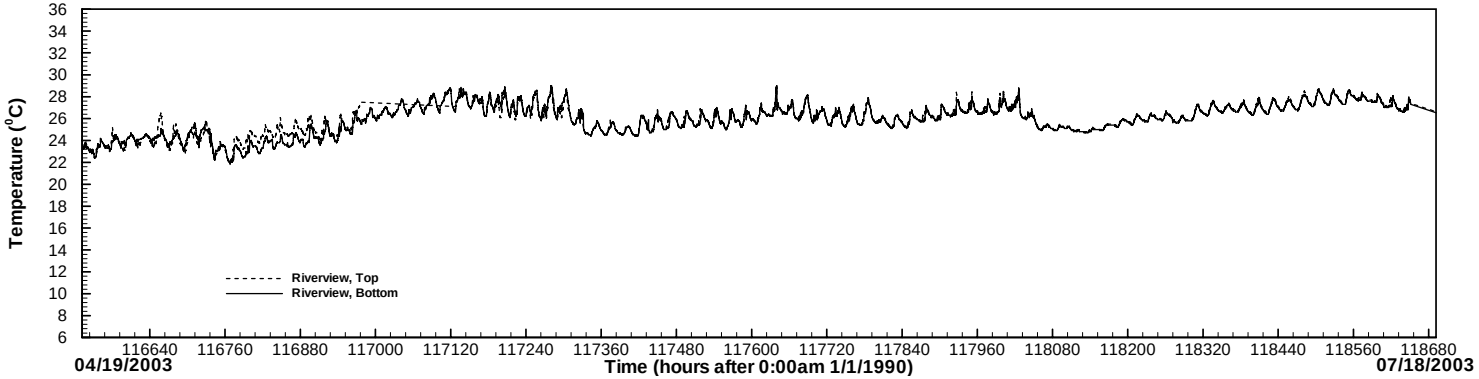

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

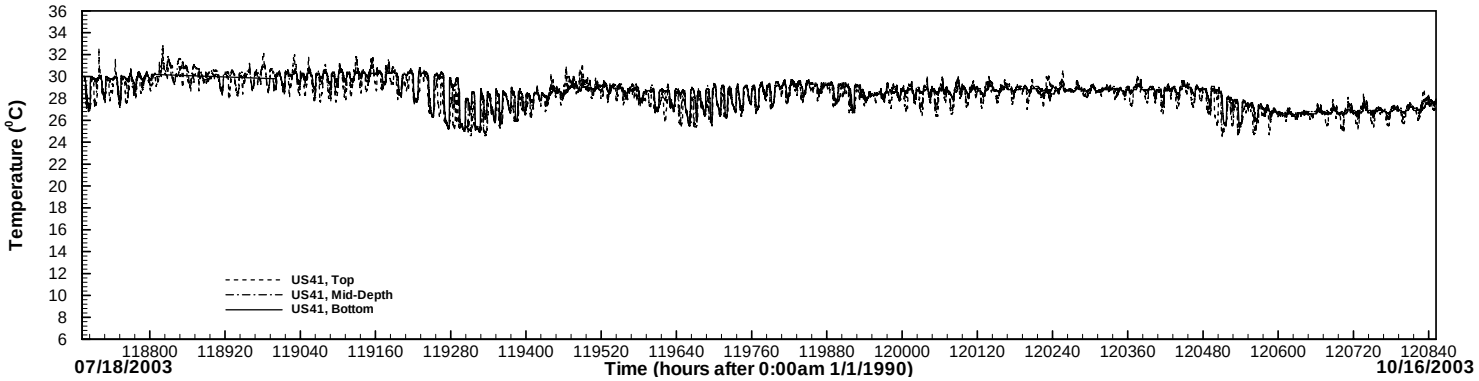

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

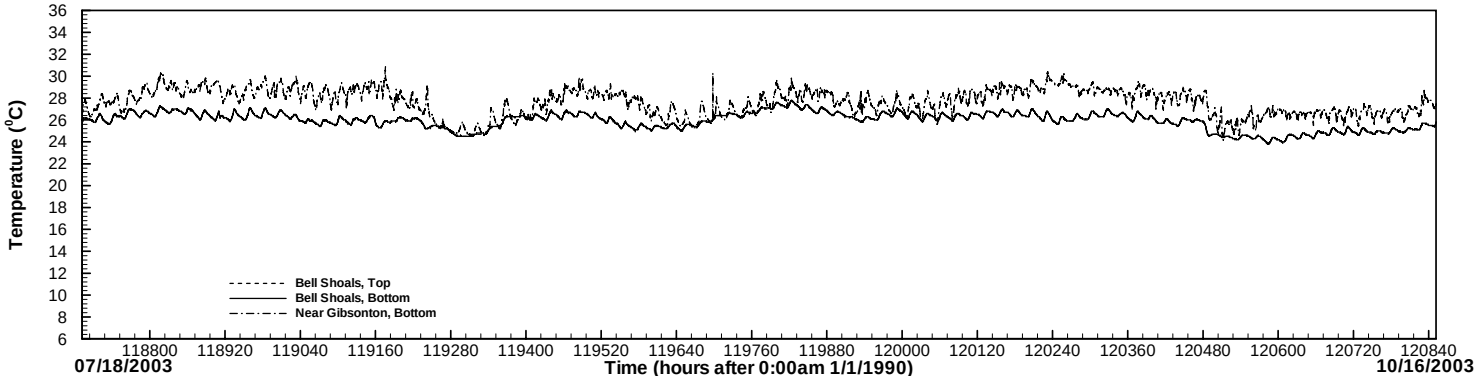

Temperature (°C)
Riverview, Top
Riverview, Bottom
01/19/2003
Time (hours after 0:00am 1/1/1990)
04/19/2003

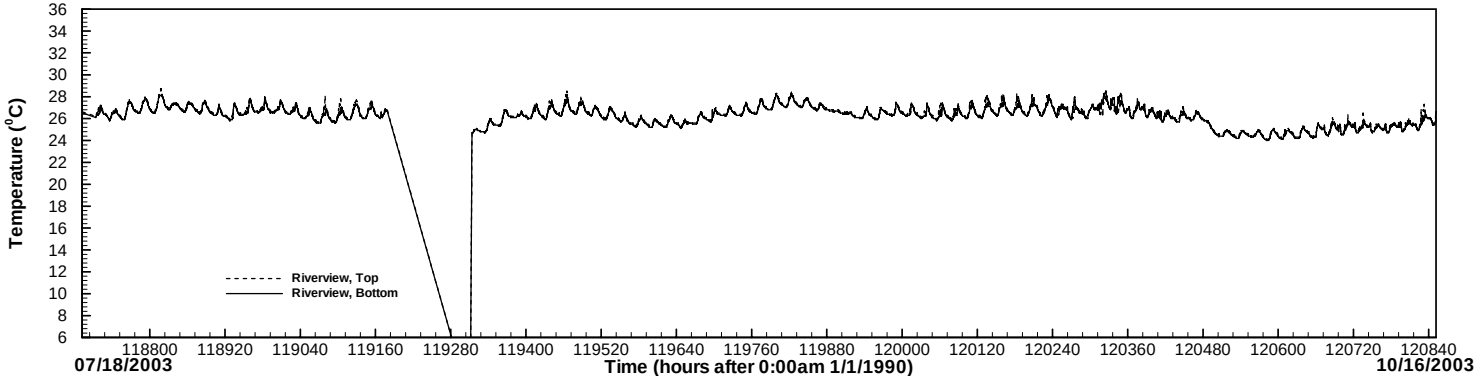

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

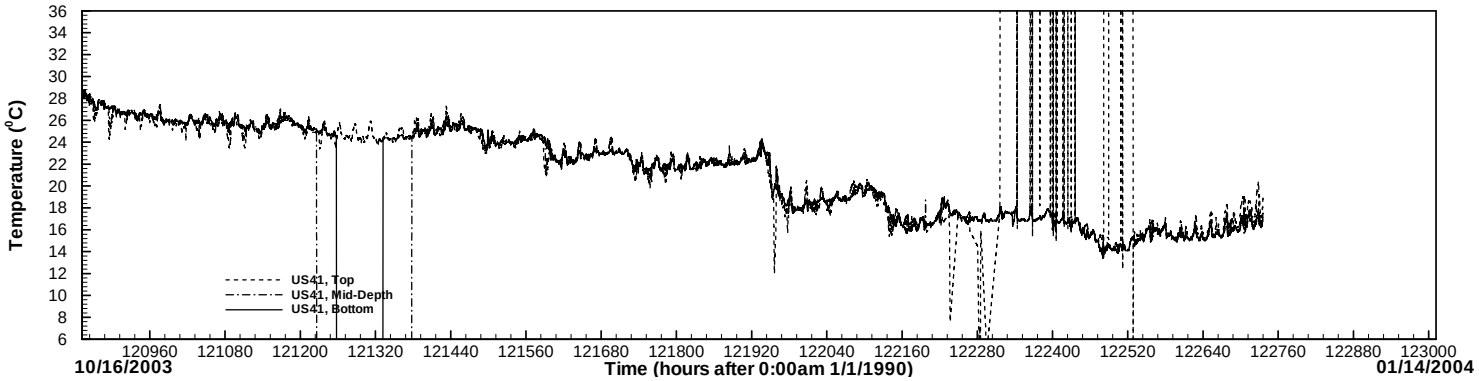

Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

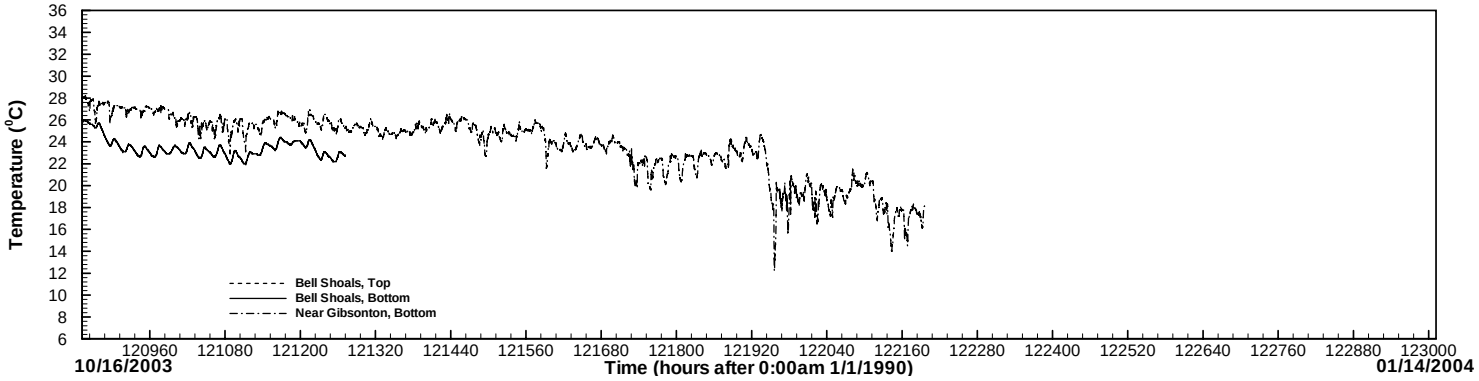

Temperature (°C)
Riverview, Top
Riverview, Bottom
04/19/2003
Time (hours after 0:00am 1/1/1990)
07/18/2003

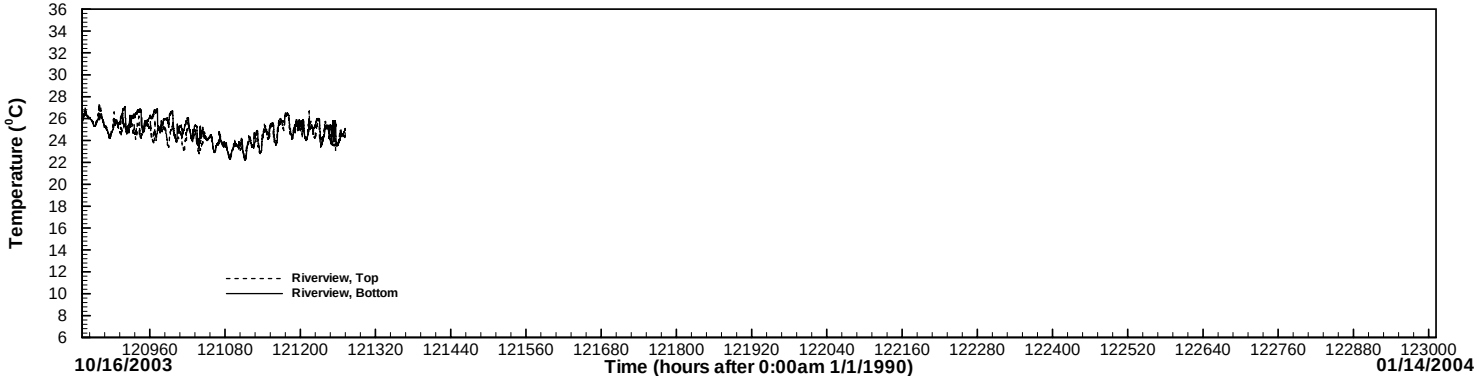

Temperature (°C)
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US41, Top
US41, Mid-Depth
US41, Bottom
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003


Temperature (°C)
36
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20
18
16
14
12
10
8
6
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003

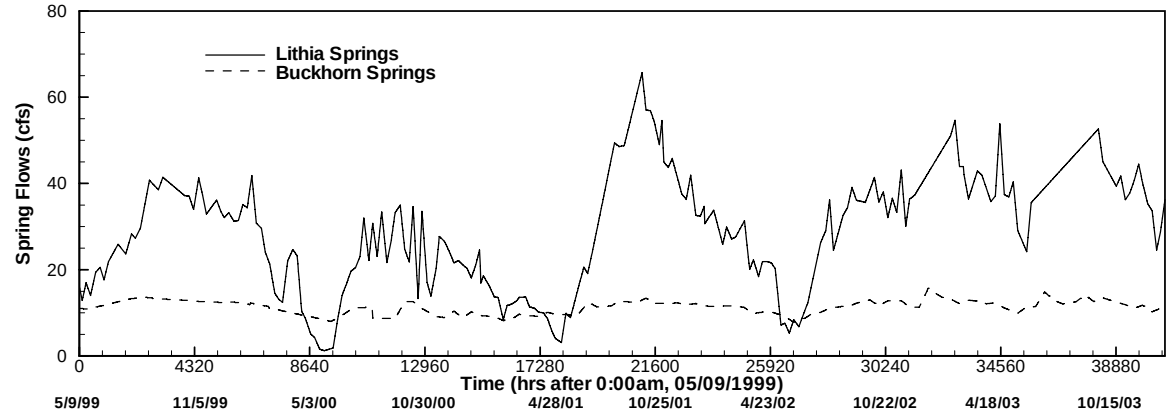

Temperature (°C)
36
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12
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8
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Riverview, Top
Riverview, Bottom
118800 118920 119040 119160 119280 119400 119520 119640 119760 119880 120000 120120 120240 120360 120480 120600 120720 120840
07/18/2003
Time (hours after 0:00am 1/1/1990)
10/16/2003

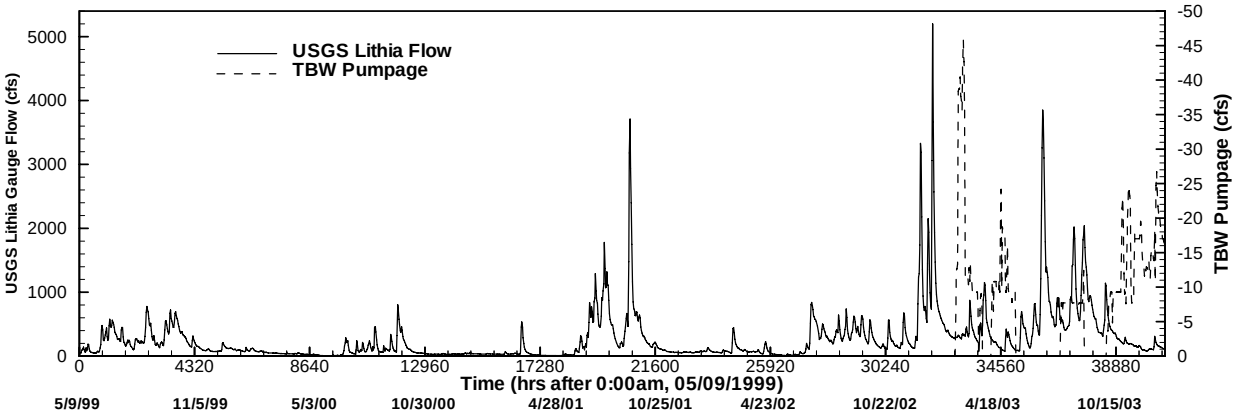

Temperature (°C)
US41, Top
US41, Mid-Depth
US41, Bottom
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004


Temperature (°C)
Bell Shoals, Top
Bell Shoals, Bottom
Near Gibsonton, Bottom
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004


Temperature (°C)
Riverview, Top
Riverview, Bottom
10/16/2003
Time (hours after 0:00am 1/1/1990)
01/14/2004

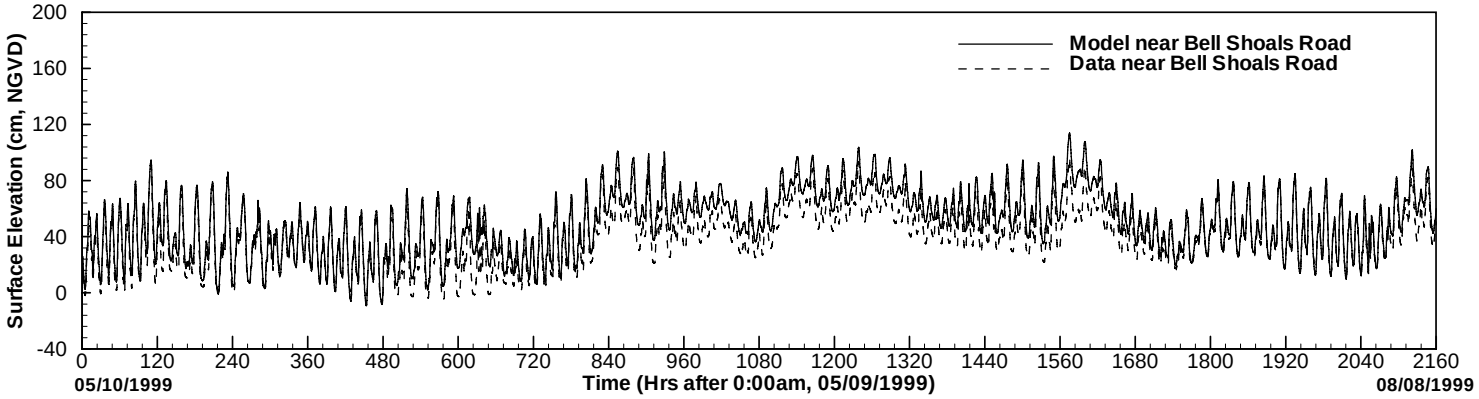
Appendix D
Gauged River Flow, Spring Flows, and TBW Pumpage

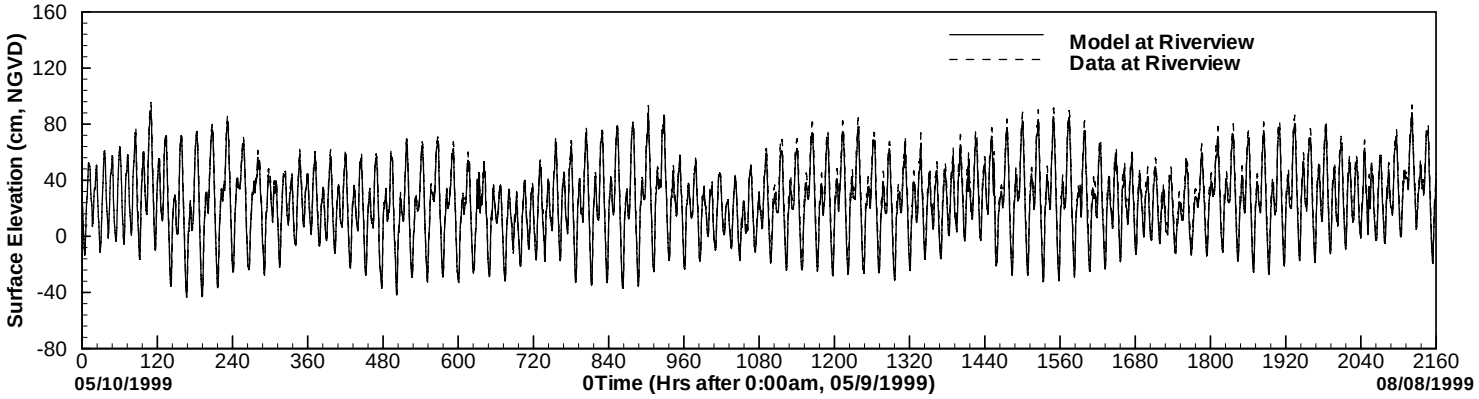


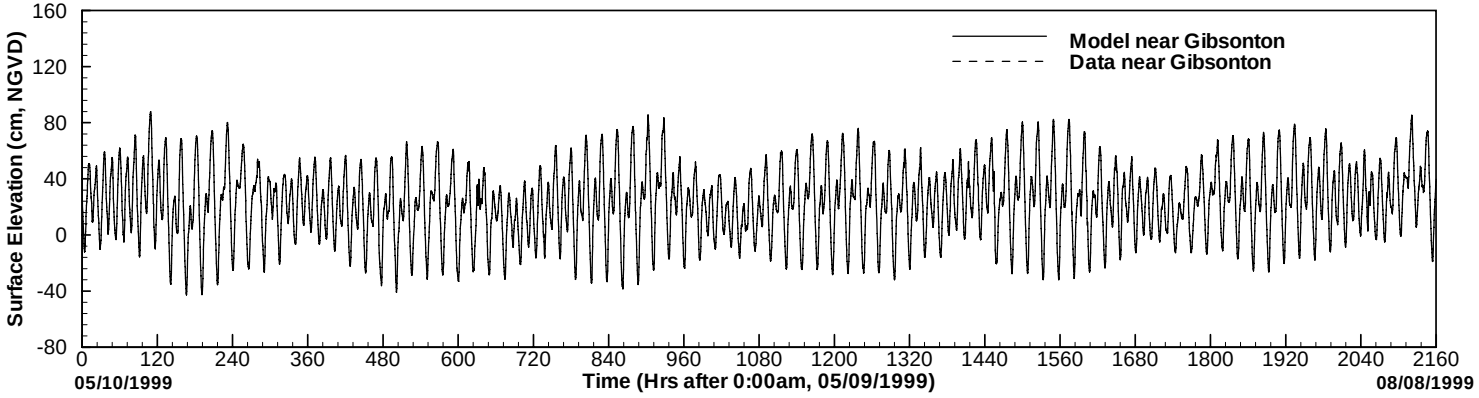


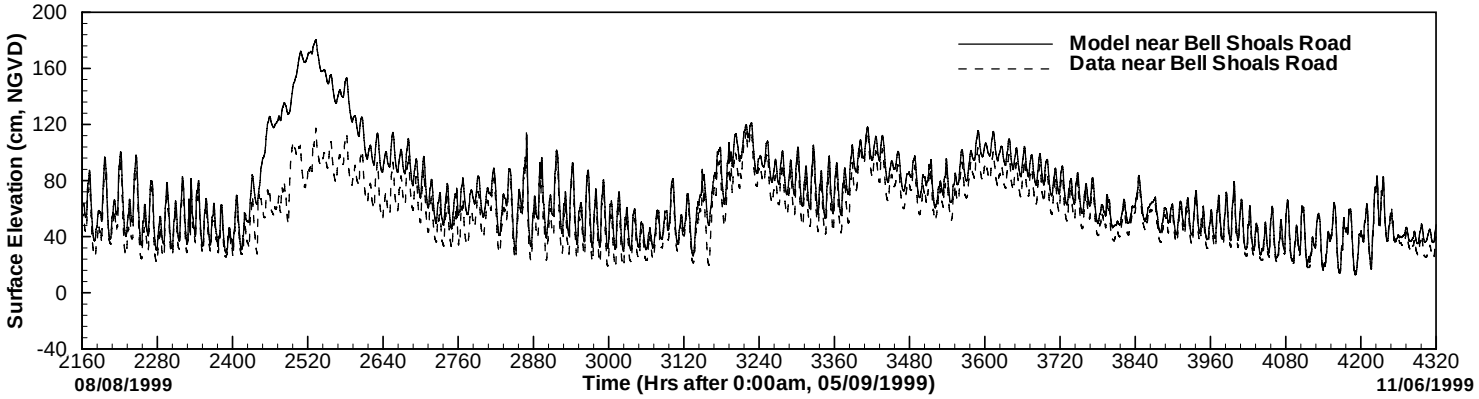
Appendix E
Comparisons of Simulated Water Elevation Results with Field Data

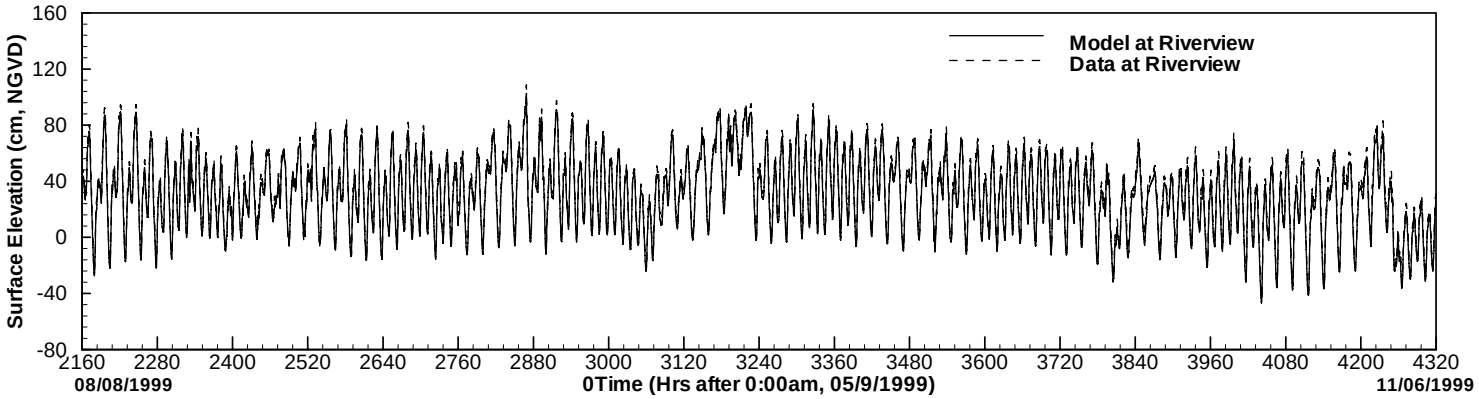
The following 19 pages show plots of comparisons of model results of free surface elevation with measured data during May 1999 through December 2003 at the USGS Alafia River near Gibsonton, Alafia River at Riverview, and Alafia River at Bell Shoals Road stations.

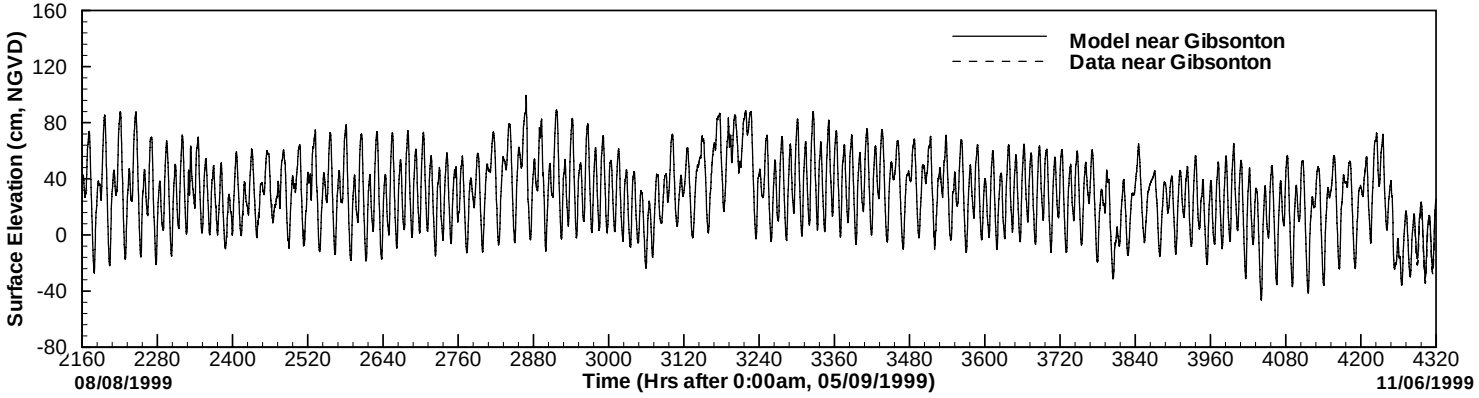

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560 1680 1800 1920 2040 2160
05/10/1999
Time (Hrs after 0:00am, 05/09/1999)
08/08/1999

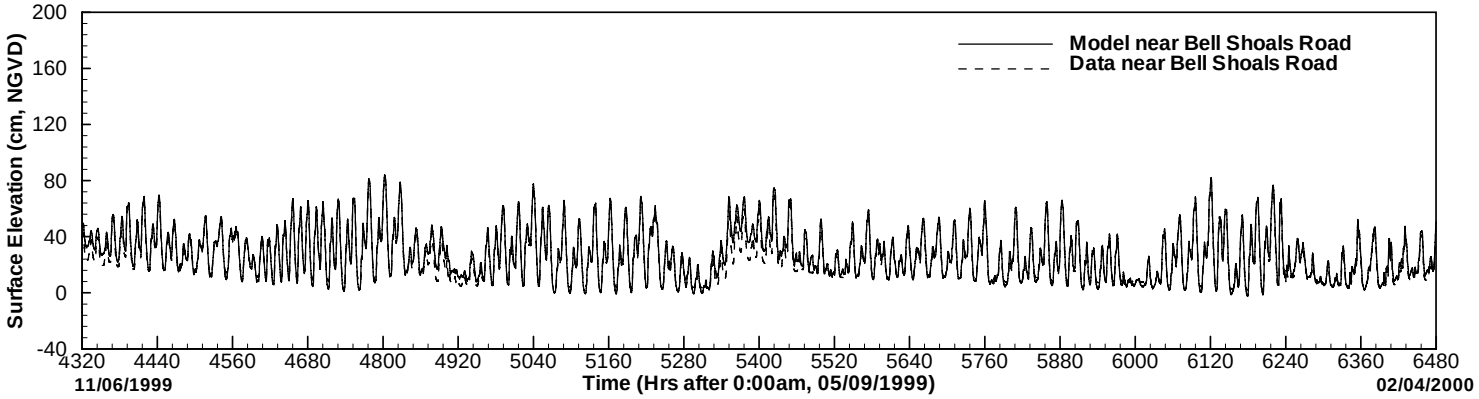

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560 1680 1800 1920 2040 2160
05/10/1999
0Time (Hrs after 0:00am, 05/9/1999)
08/08/1999

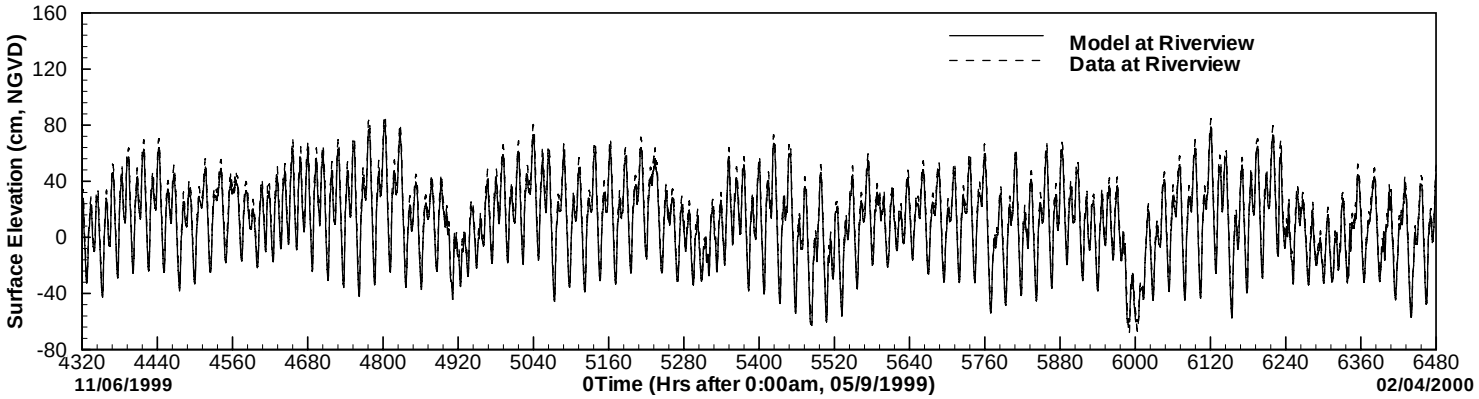

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
0 120 240 360 480 600 720 840 960 1080 1200 1320 1440 1560 1680 1800 1920 2040 2160
05/10/1999
Time (Hrs after 0:00am, 05/09/1999)
08/08/1999

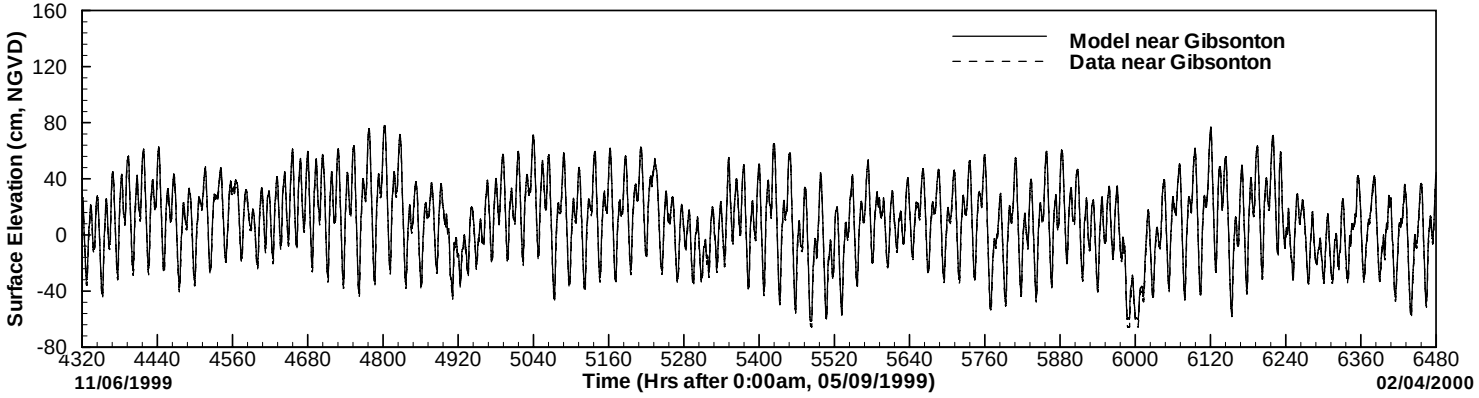

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
08/08/1999
Time (Hrs after 0:00am, 05/09/1999)
11/06/1999

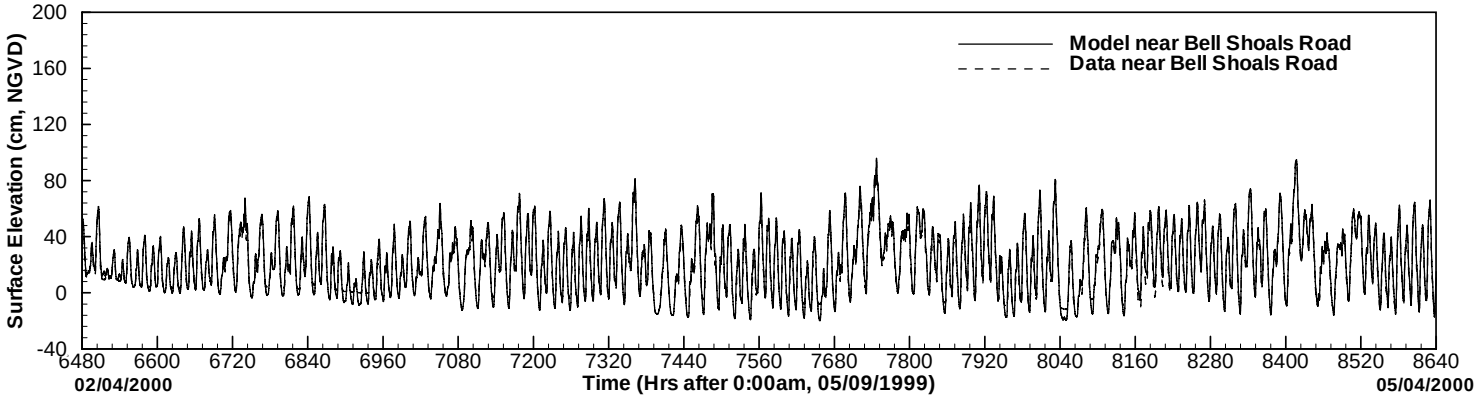

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
08/08/1999
0Time (Hrs after 0:00am, 05/9/1999)
11/06/1999

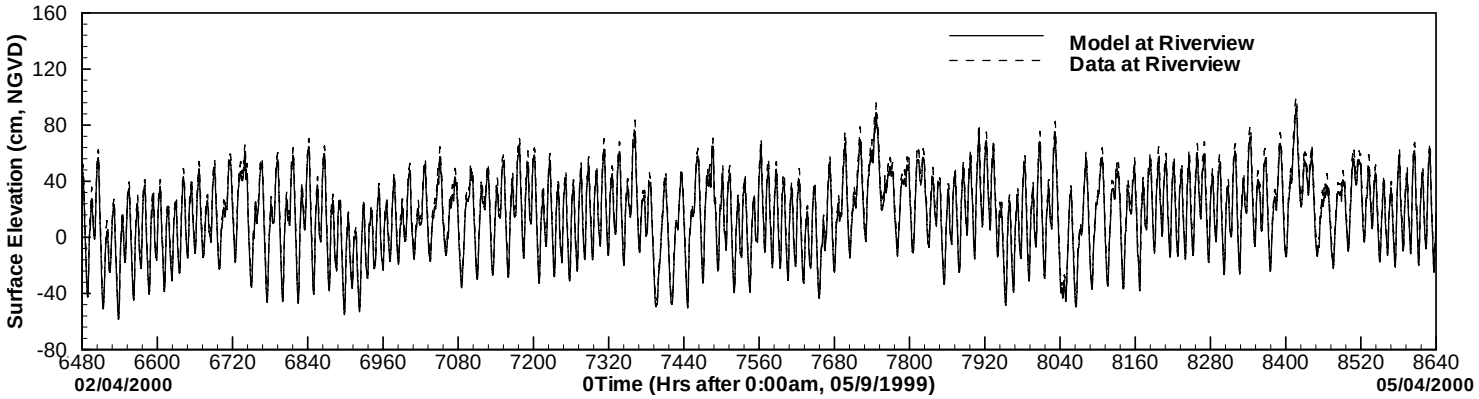

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
08/08/1999
Time (Hrs after 0:00am, 05/09/1999)
11/06/1999

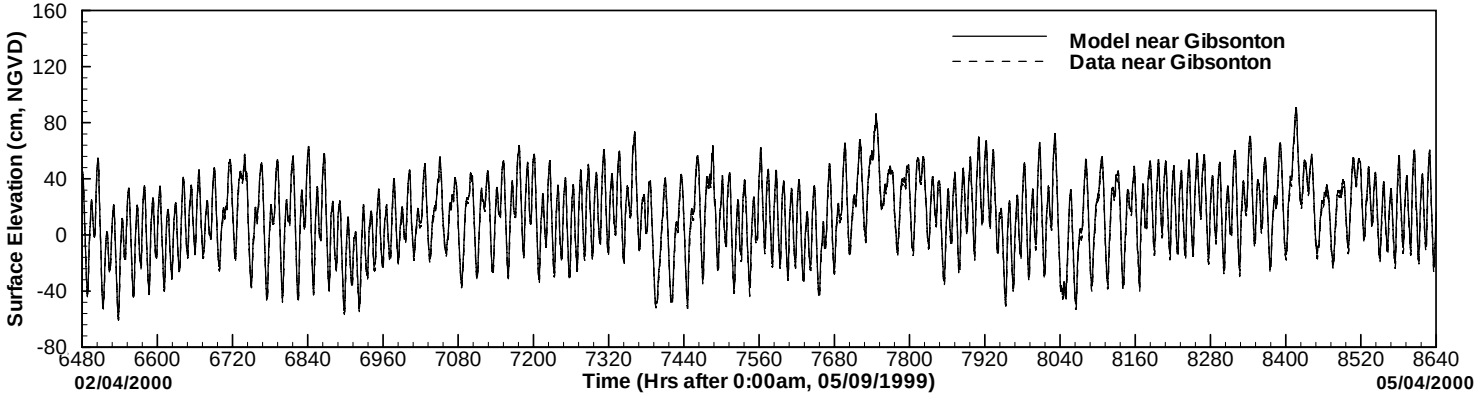

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
4320 4440 4560 4680 4800 4920 5040 5160 5280 5400 5520 5640 5760 5880 6000 6120 6240 6360 6480
11/06/1999
Time (Hrs after 0:00am, 05/09/1999)
02/04/2000

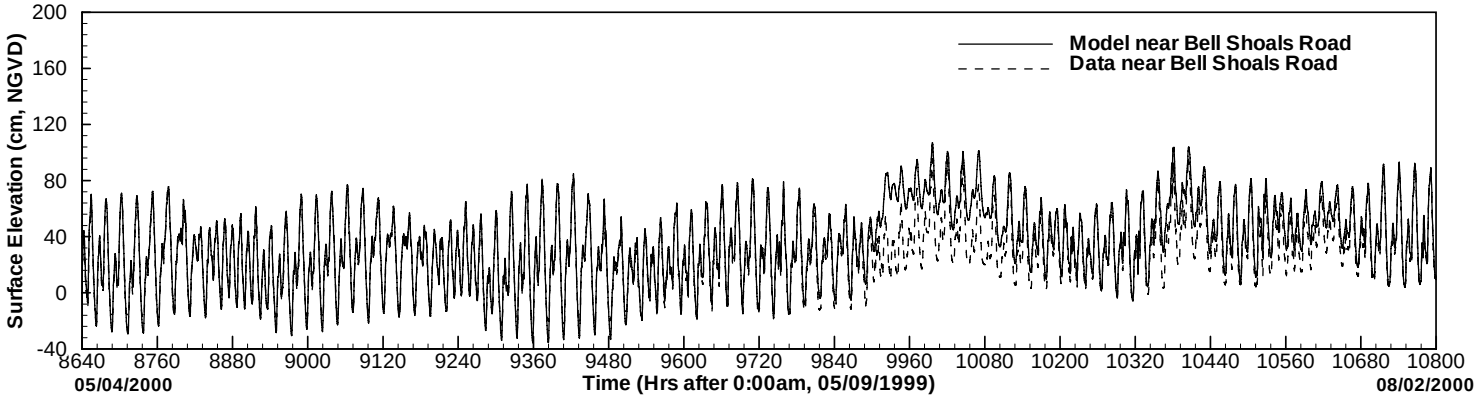

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
4320 4440 4560 4680 4800 4920 5040 5160 5280 5400 5520 5640 5760 5880 6000 6120 6240 6360 6480
11/06/1999
0Time (Hrs after 0:00am, 05/9/1999)
02/04/2000

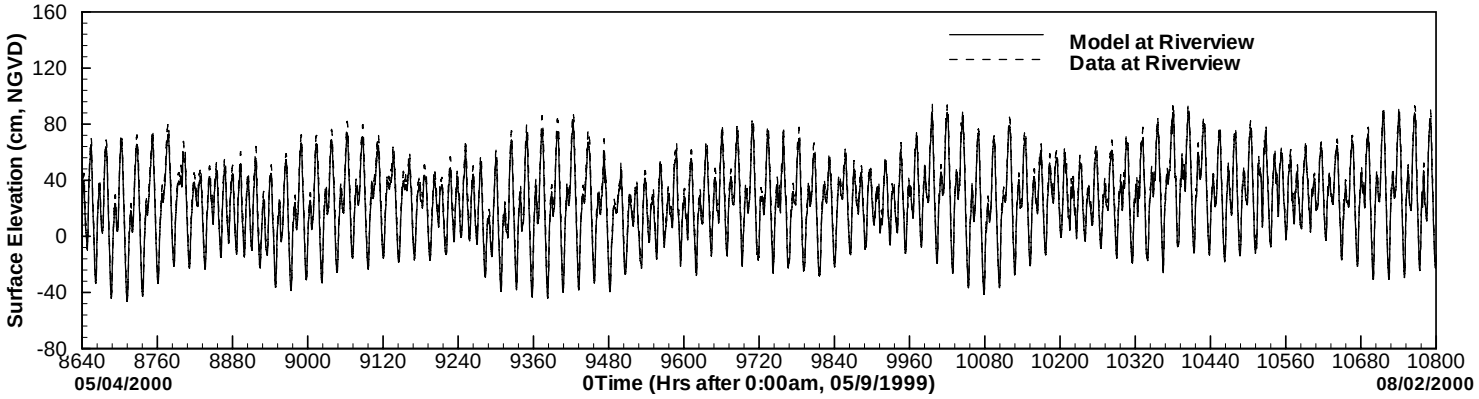

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
4320 4440 4560 4680 4800 4920 5040 5160 5280 5400 5520 5640 5760 5880 6000 6120 6240 6360 6480
11/06/1999
Time (Hrs after 0:00am, 05/09/1999)
02/04/2000

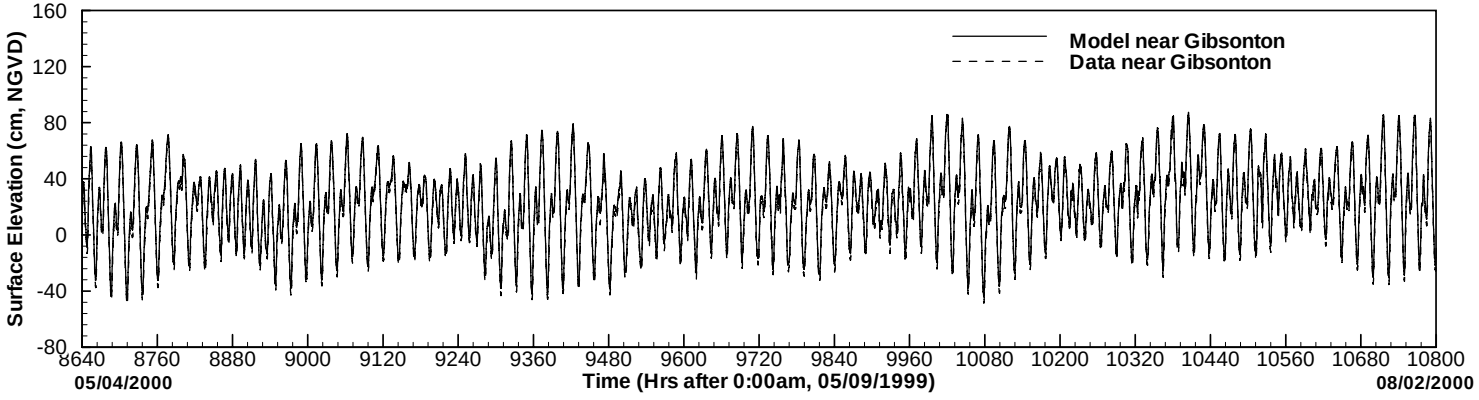

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
6480 6600 6720 6840 6960 7080 7200 7320 7440 7560 7680 7800 7920 8040 8160 8280 8400 8520 8640
02/04/2000
Time (Hrs after 0:00am, 05/09/1999)
05/04/2000

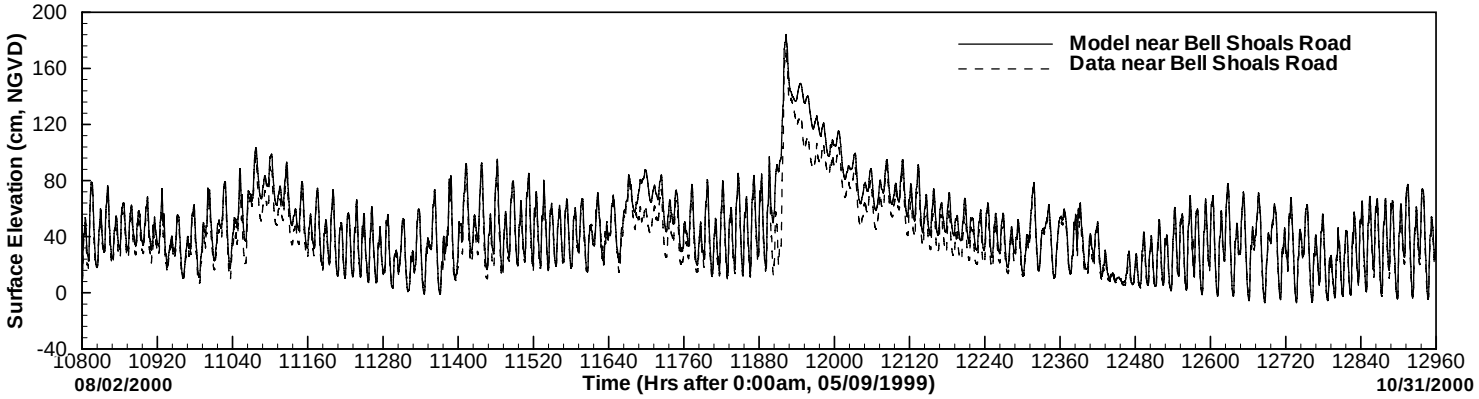

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
6480 6600 6720 6840 6960 7080 7200 7320 7440 7560 7680 7800 7920 8040 8160 8280 8400 8520 8640
02/04/2000
0Time (Hrs after 0:00am, 05/9/1999)
05/04/2000

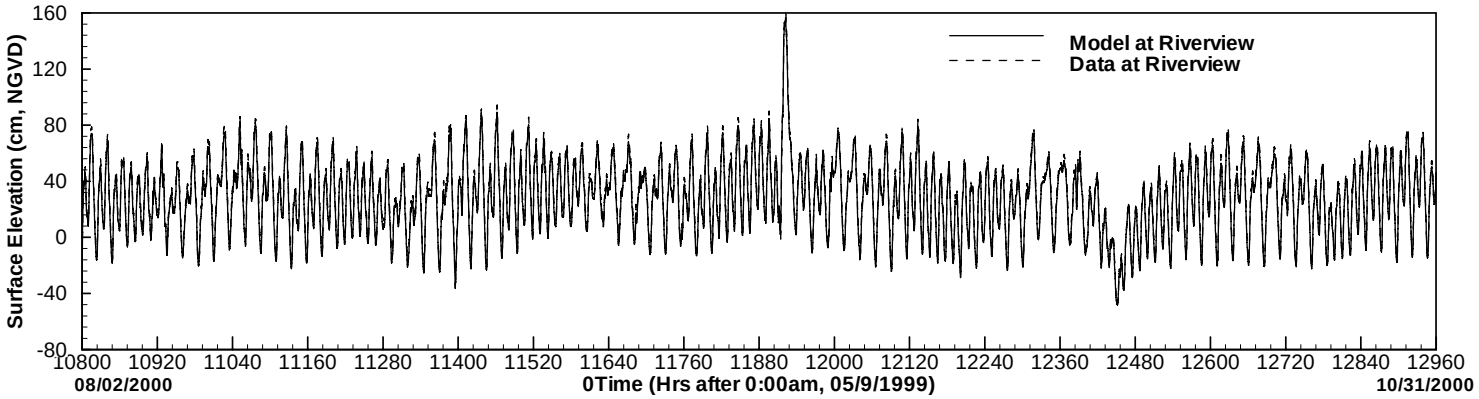

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
6480 6600 6720 6840 6960 7080 7200 7320 7440 7560 7680 7800 7920 8040 8160 8280 8400 8520 8640
02/04/2000
Time (Hrs after 0:00am, 05/09/1999)
05/04/2000

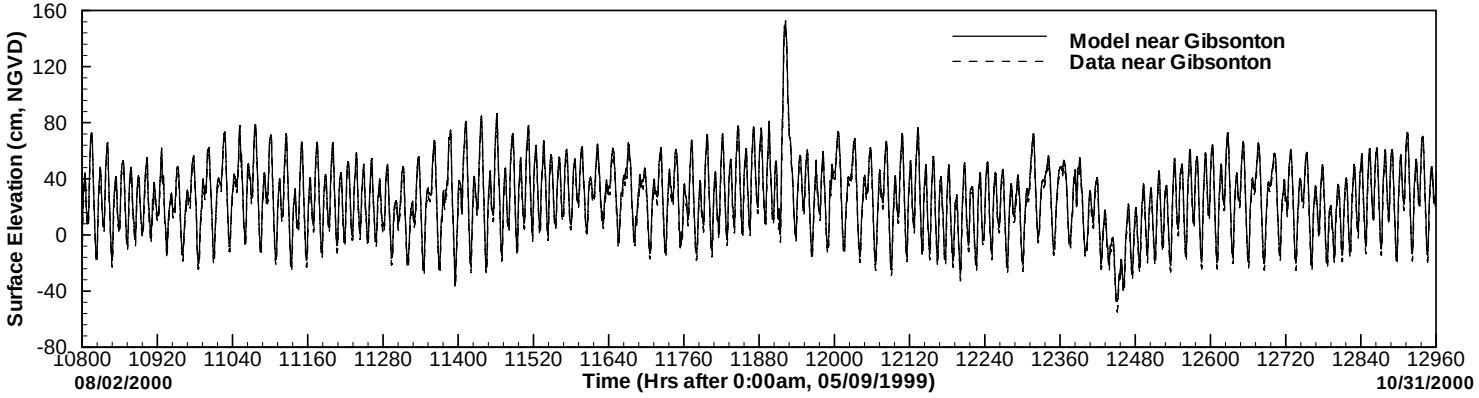

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
8640 8760 8880 9000 9120 9240 9360 9480 9600 9720 9840 9960 10080 10200 10320 10440 10560 10680 10800
05/04/2000
Time (Hrs after 0:00am, 05/09/1999)
08/02/2000

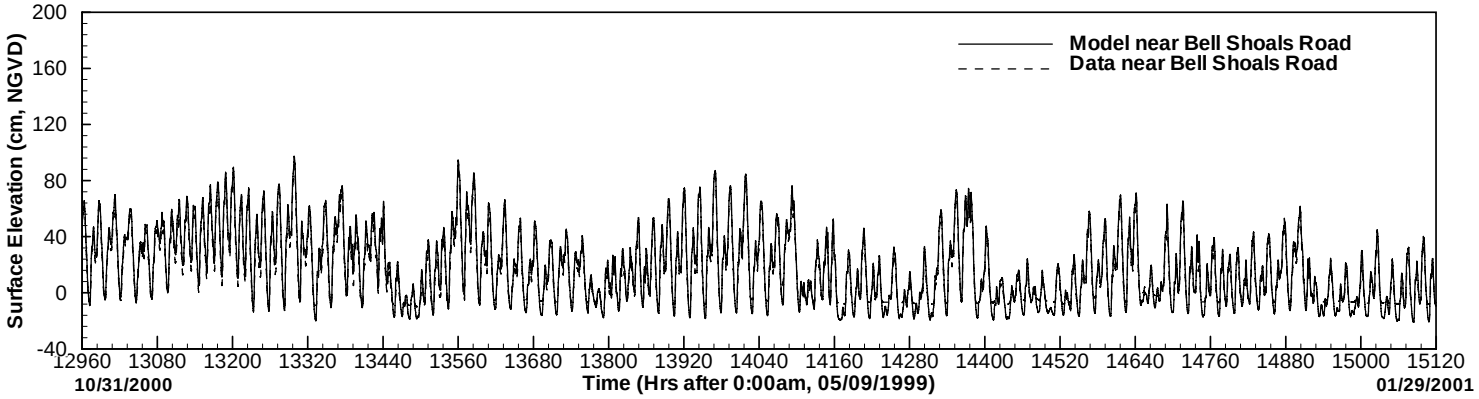

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
8640 8760 8880 9000 9120 9240 9360 9480 9600 9720 9840 9960 10080 10200 10320 10440 10560 10680 10800
05/04/2000
0Time (Hrs after 0:00am, 05/9/1999)
08/02/2000

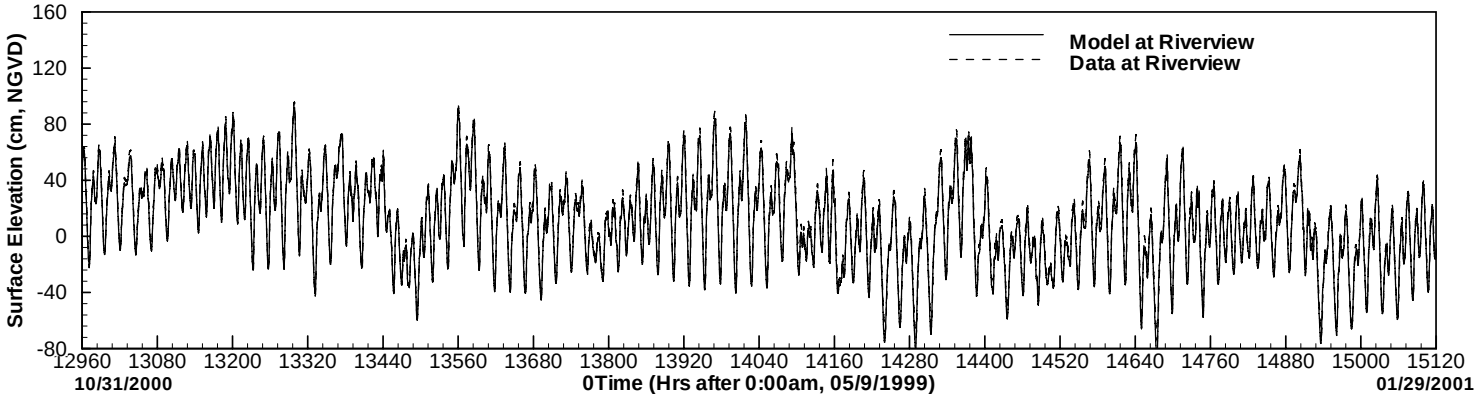

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
8640 8760 8880 9000 9120 9240 9360 9480 9600 9720 9840 9960 10080 10200 10320 10440 10560 10680 10800
05/04/2000
Time (Hrs after 0:00am, 05/09/1999)
08/02/2000

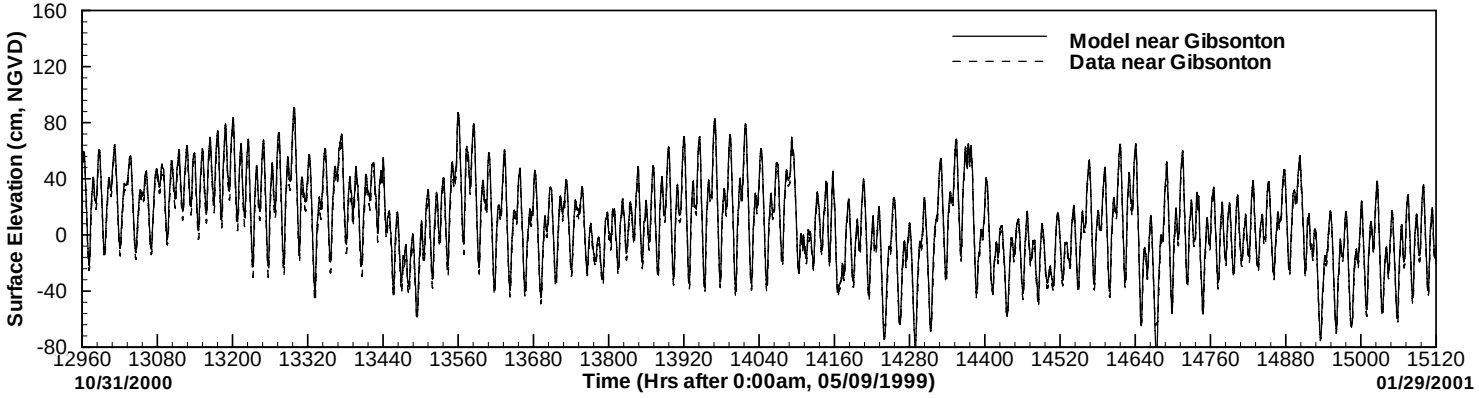

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
08/02/2000
Time (Hrs after 0:00am, 05/09/1999)
10/31/2000

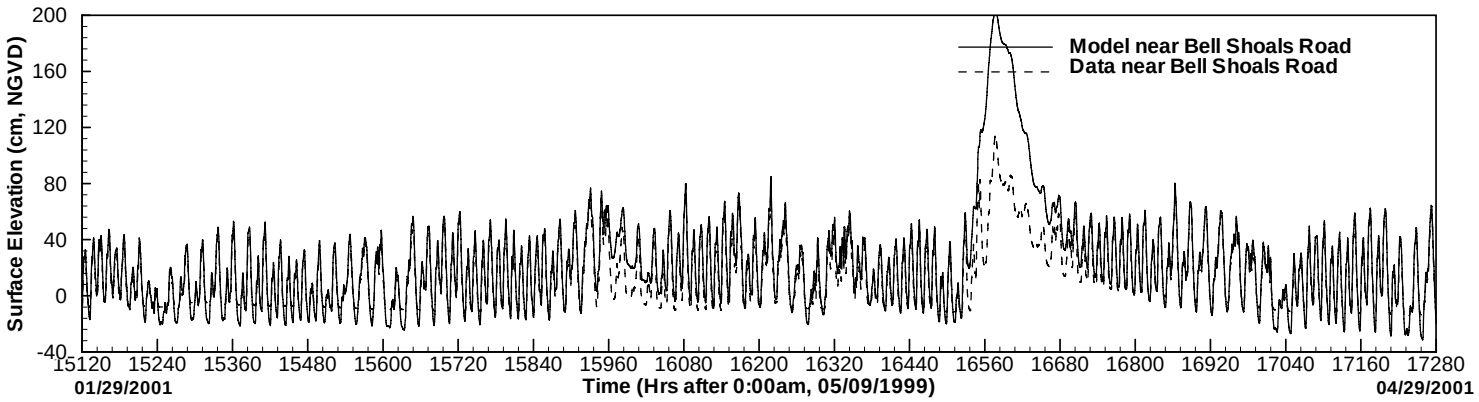

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
08/02/2000
0Time (Hrs after 0:00am, 05/9/1999)
10/31/2000

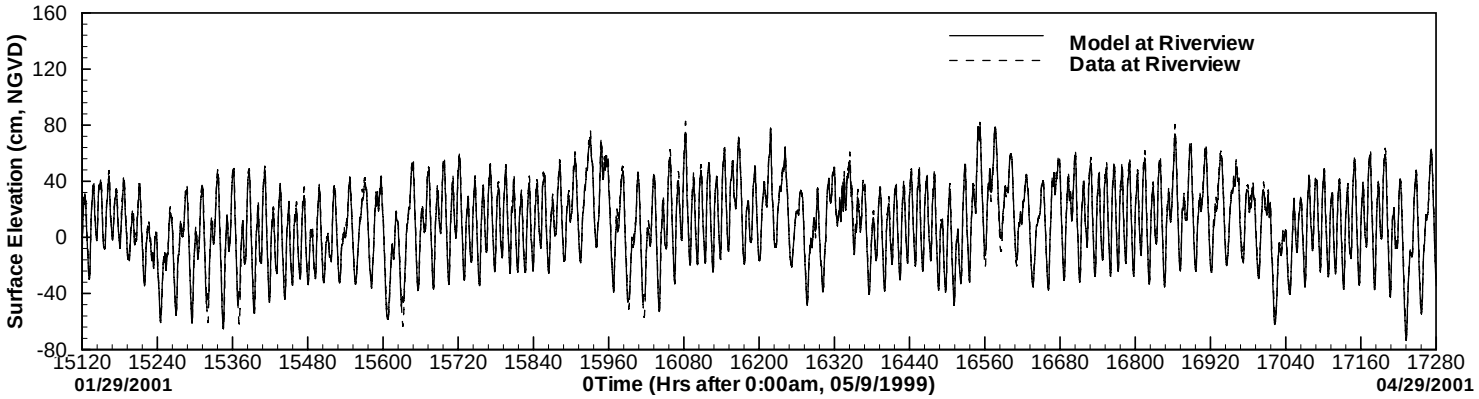

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
08/02/2000
Time (Hrs after 0:00am, 05/09/1999)
10/31/2000

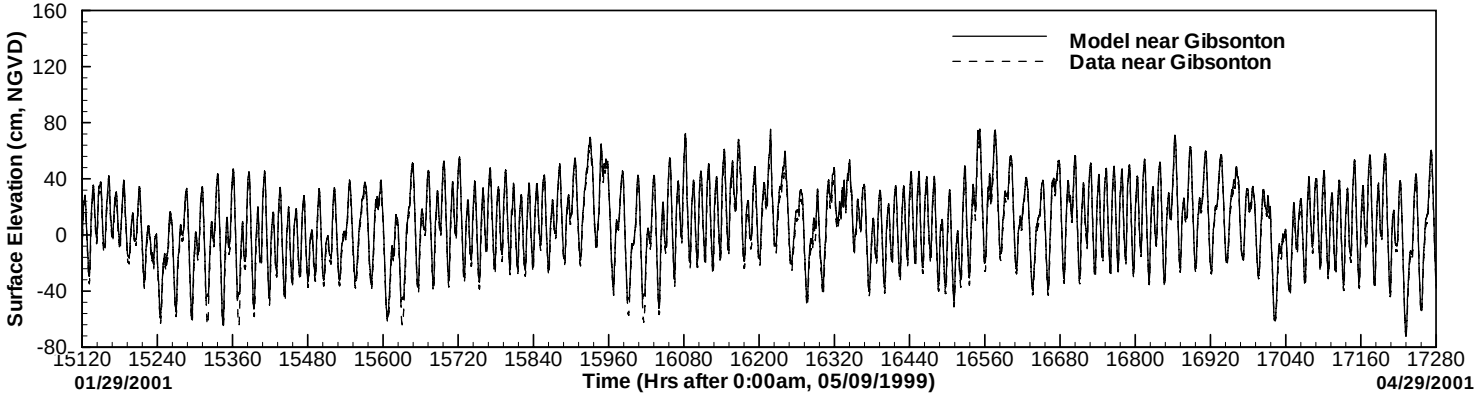

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
Time (Hrs after 0:00am, 05/09/1999)
01/29/2001

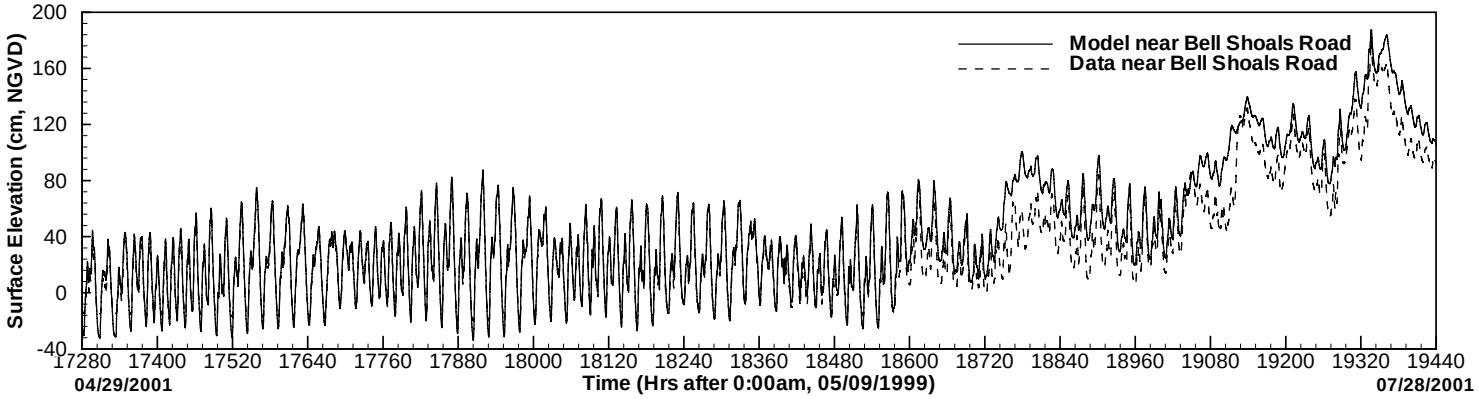

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
0Time (Hrs after 0:00am, 05/9/1999)
01/29/2001

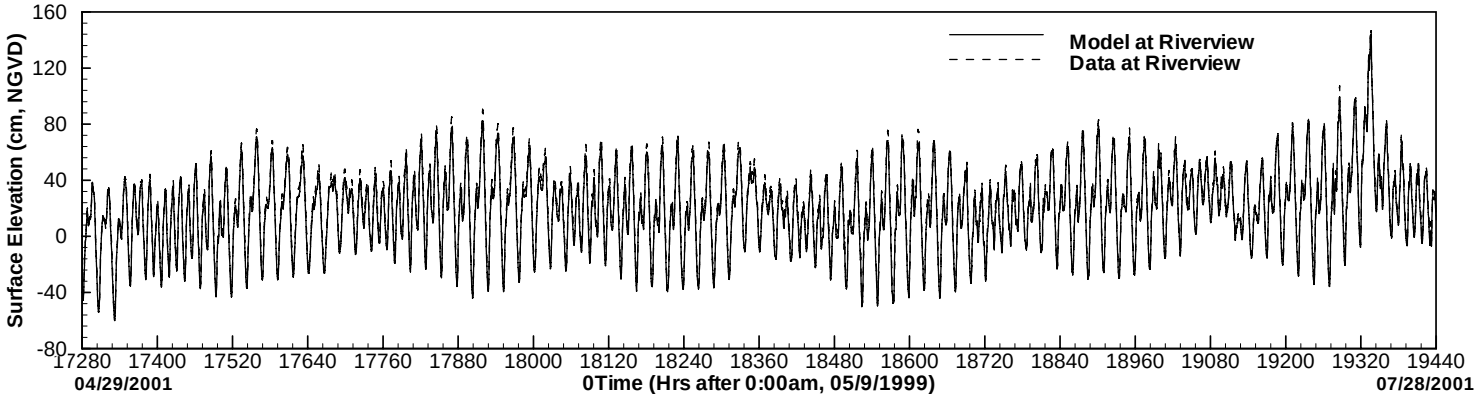

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
Time (Hrs after 0:00am, 05/09/1999)
01/29/2001

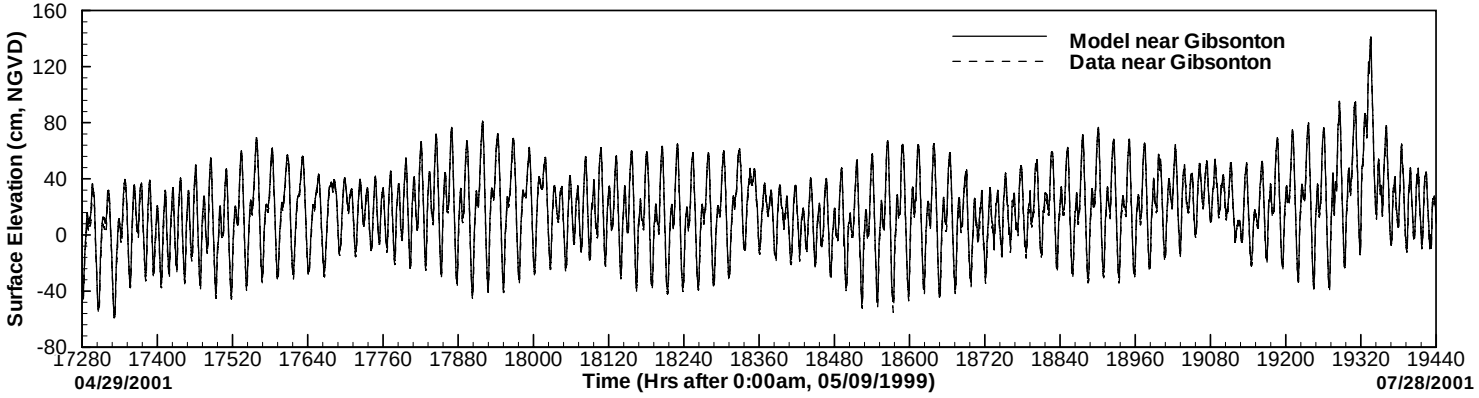

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
Time (Hrs after 0:00am, 05/09/1999)
04/29/2001

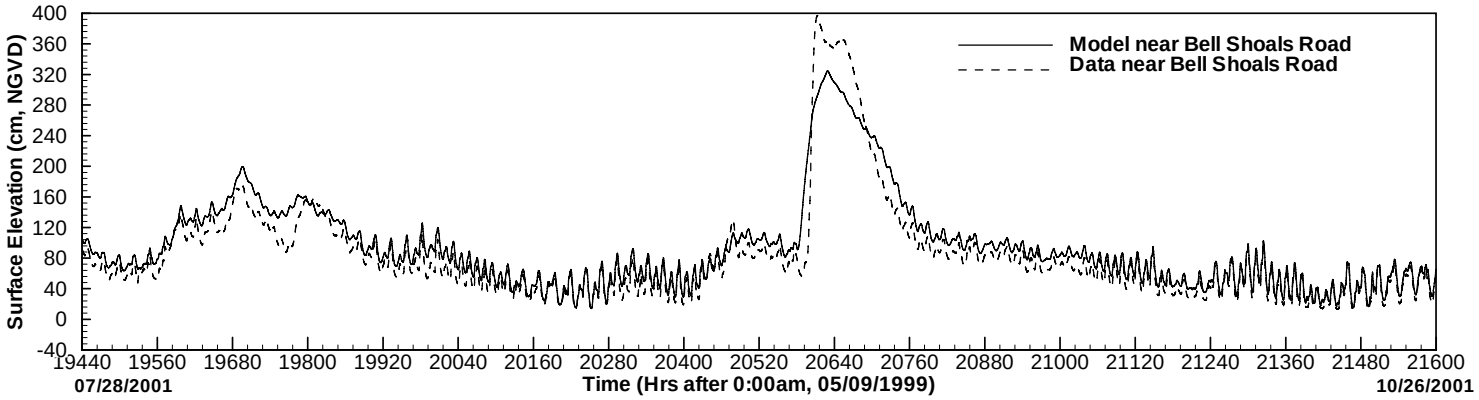

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
0Time (Hrs after 0:00am, 05/9/1999)
04/29/2001

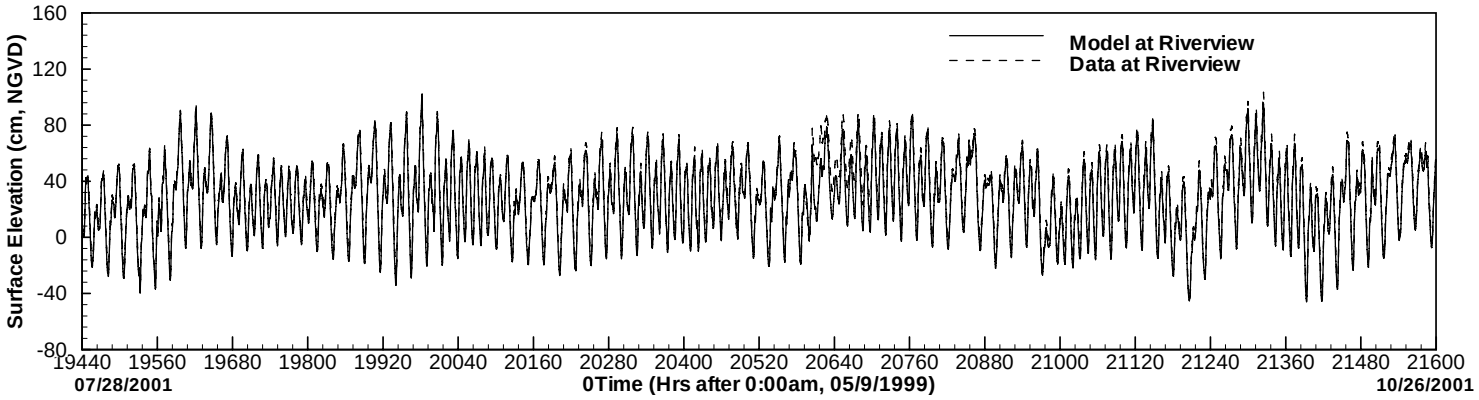

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
Time (Hrs after 0:00am, 05/09/1999)
04/29/2001

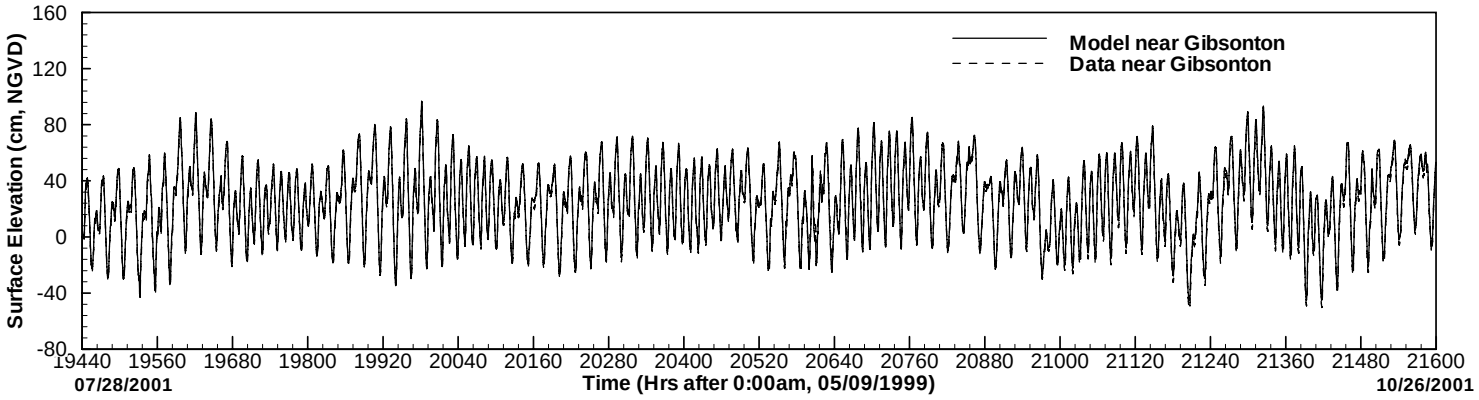

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
Time (Hrs after 0:00am, 05/09/1999)
07/28/2001

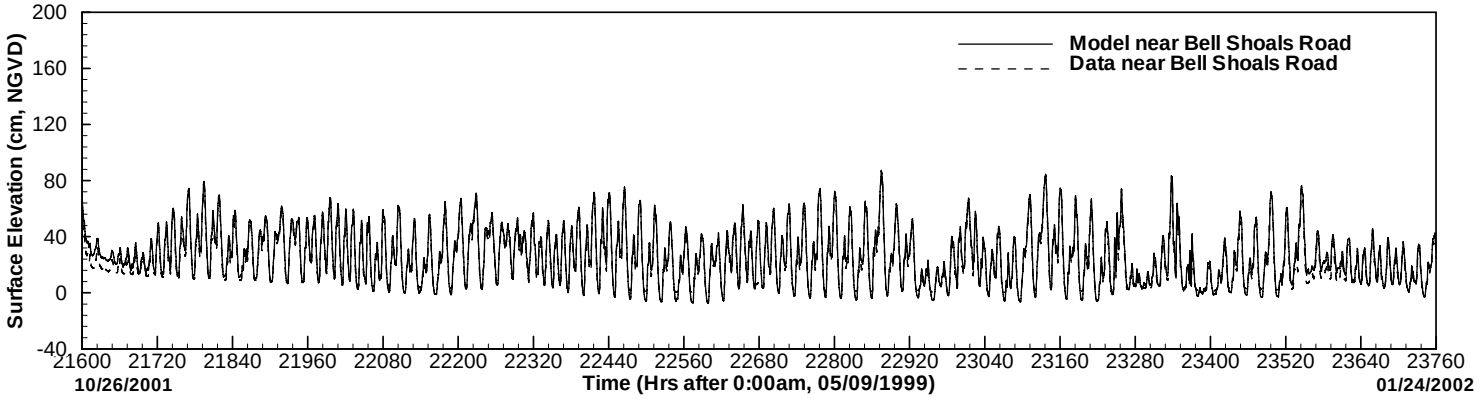

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
0Time (Hrs after 0:00am, 05/9/1999)
07/28/2001

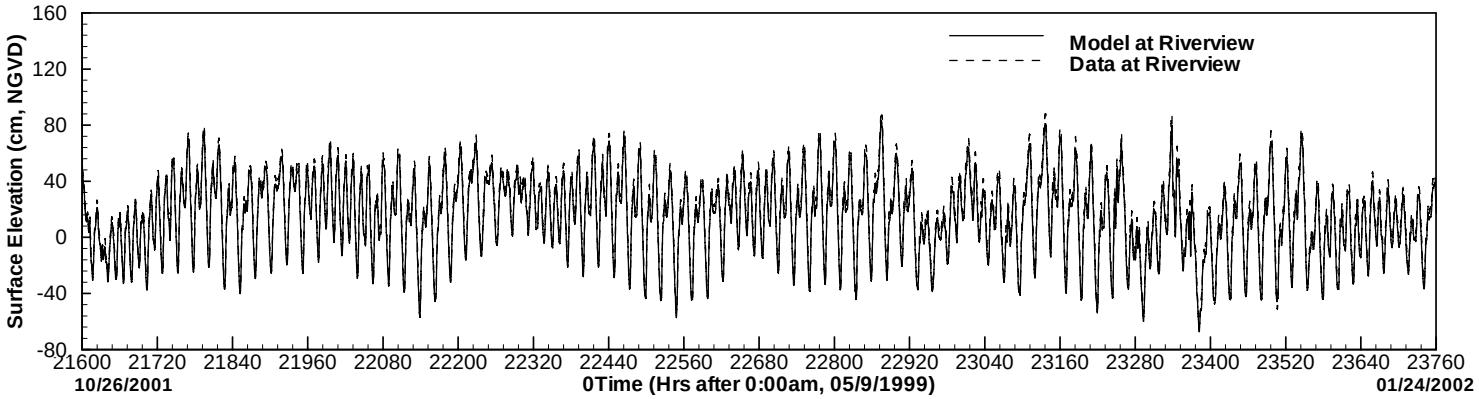

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
Time (Hrs after 0:00am, 05/09/1999)
07/28/2001

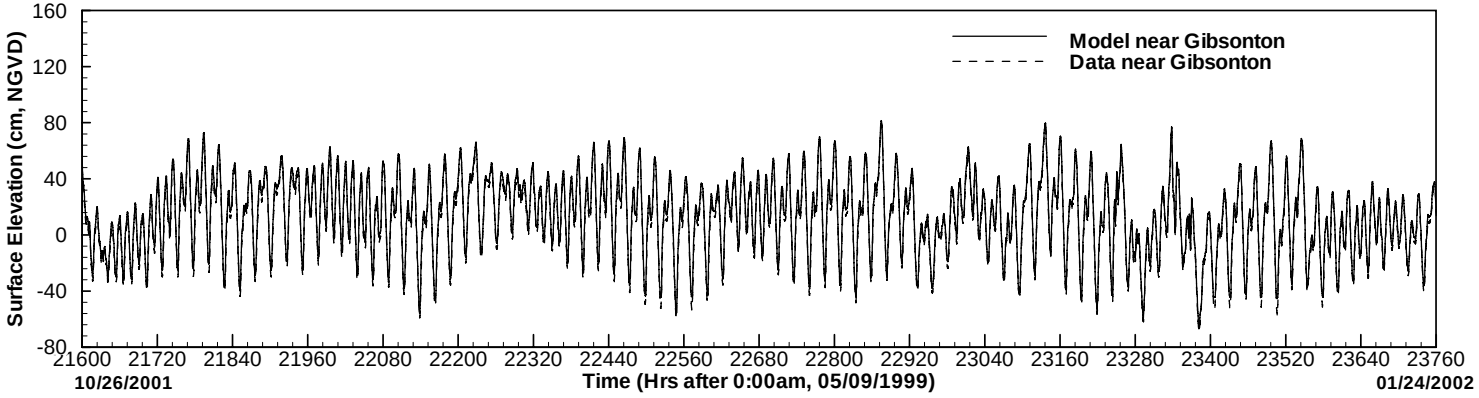

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
400
360
320
280
240
200
160
120
80
40
0
-40
19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
Time (Hrs after 0:00am, 05/09/1999)
10/26/2001

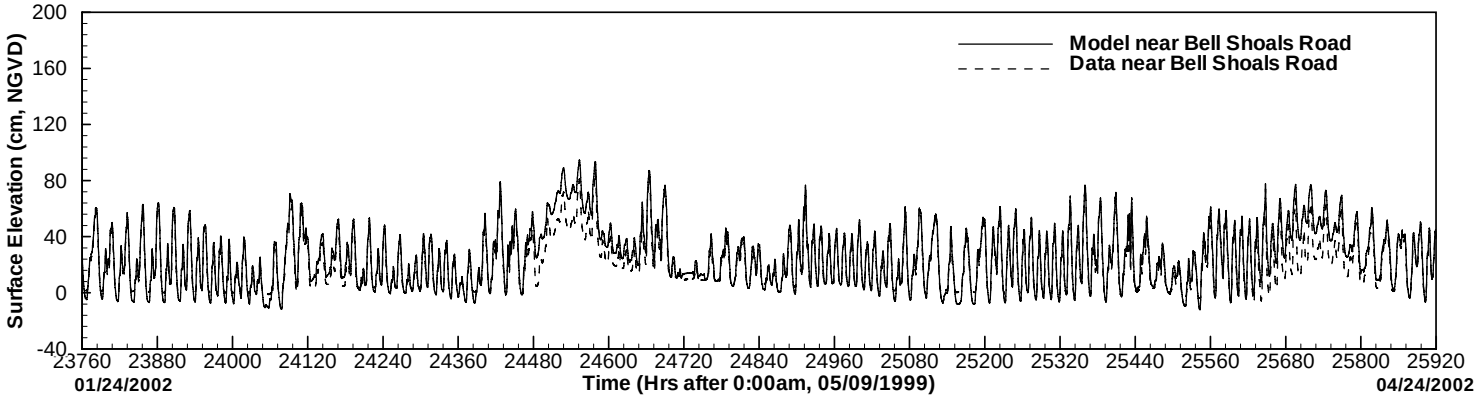

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
0Time (Hrs after 0:00am, 05/9/1999)
10/26/2001

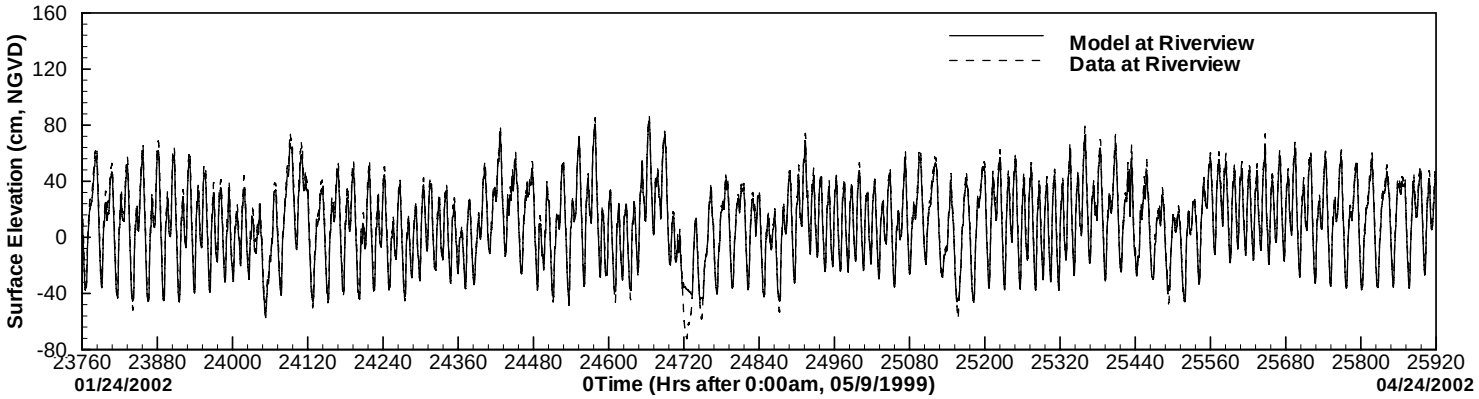

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
Time (Hrs after 0:00am, 05/09/1999)
10/26/2001

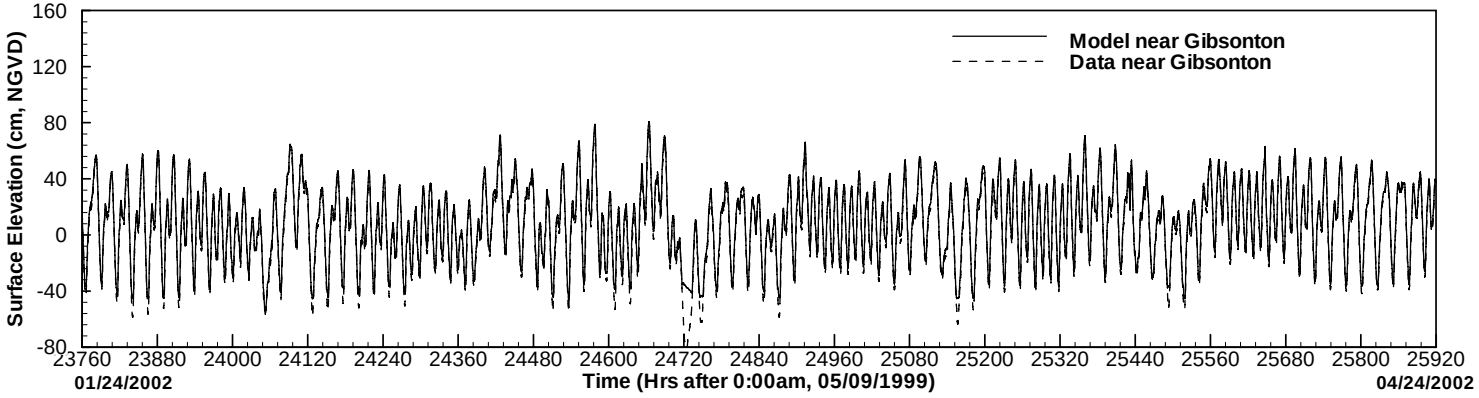

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
Time (Hrs after 0:00am, 05/09/1999)
01/24/2002

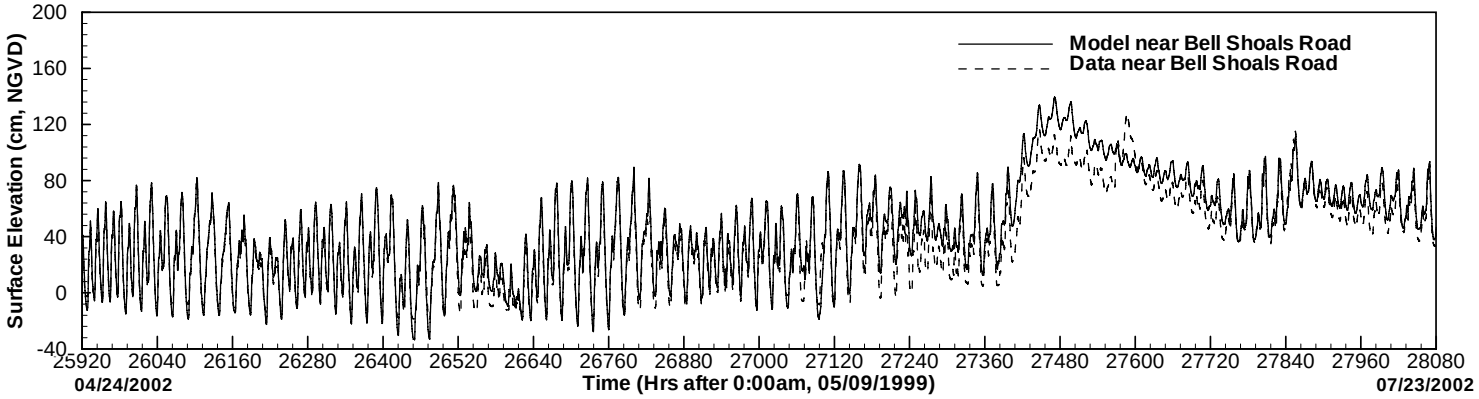

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
0Time (Hrs after 0:00am, 05/9/1999)
01/24/2002

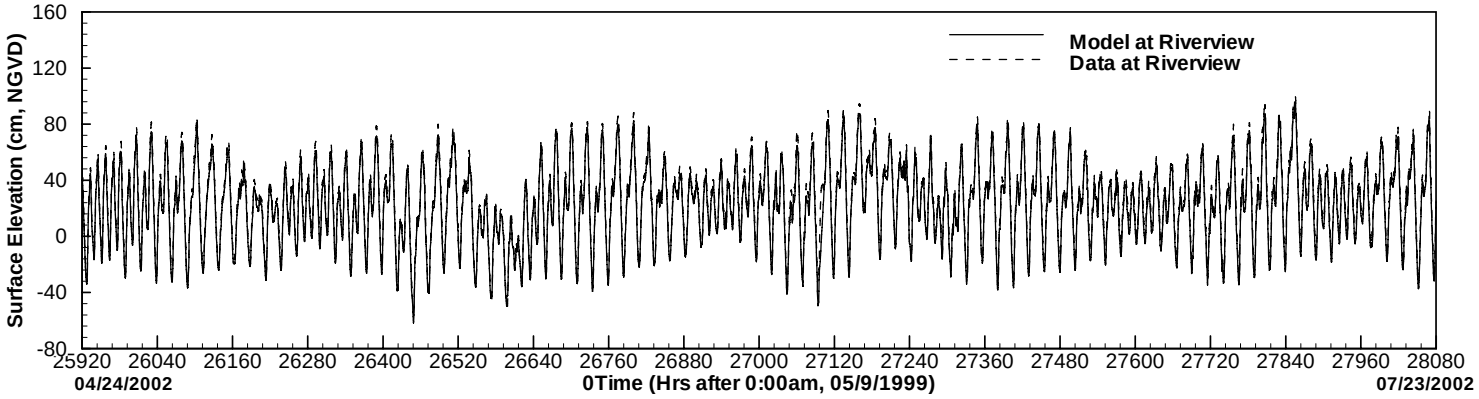

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
Time (Hrs after 0:00am, 05/09/1999)
01/24/2002

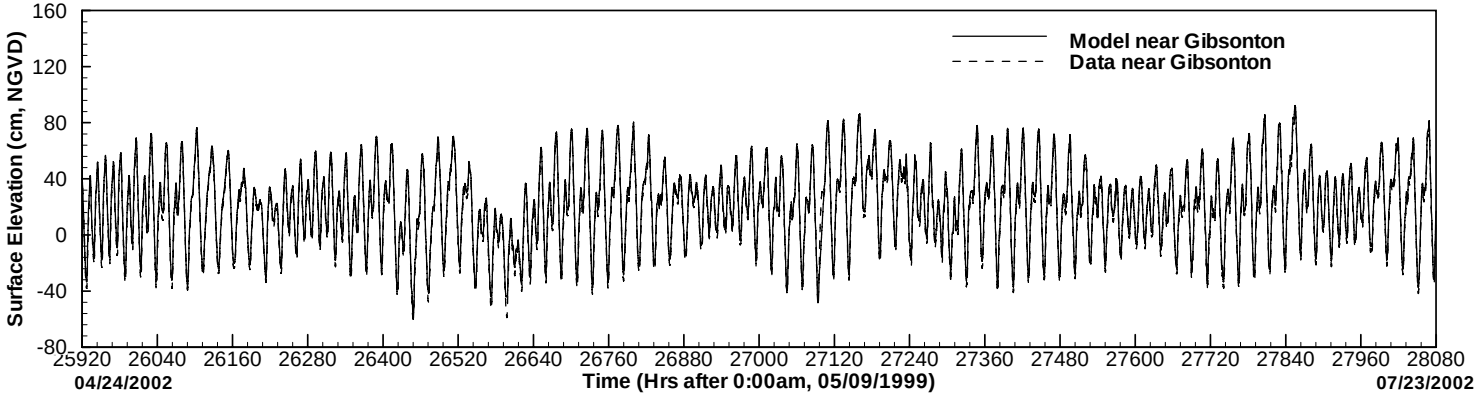

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
Time (Hrs after 0:00am, 05/09/1999)
04/24/2002

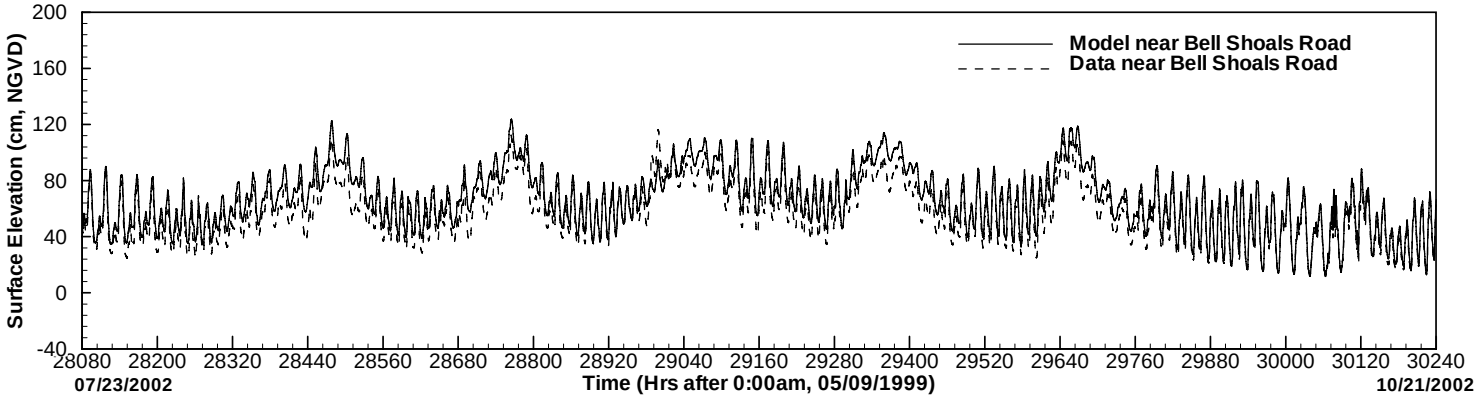

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
0Time (Hrs after 0:00am, 05/9/1999)
04/24/2002

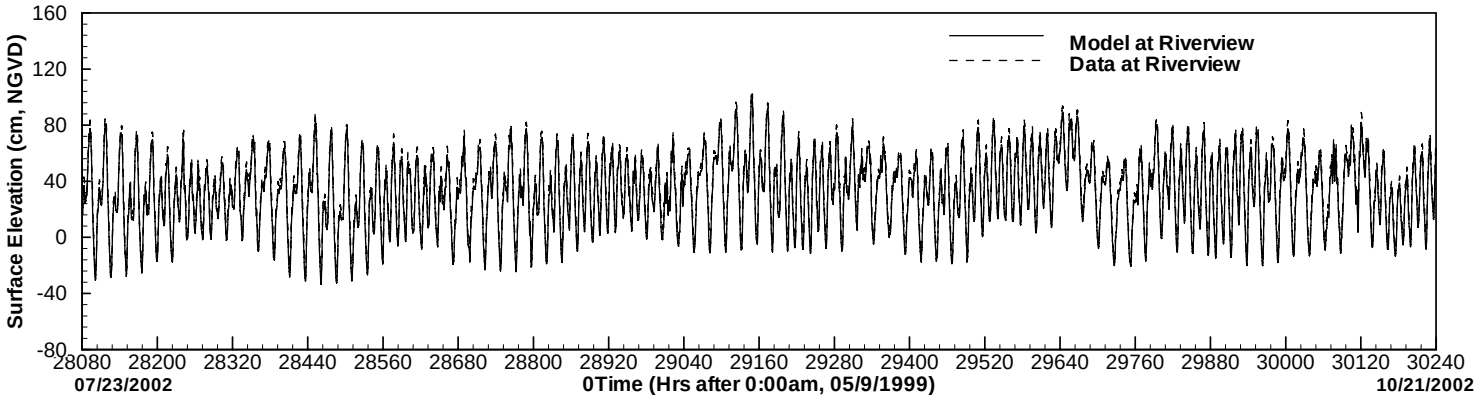

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
Time (Hrs after 0:00am, 05/09/1999)
04/24/2002

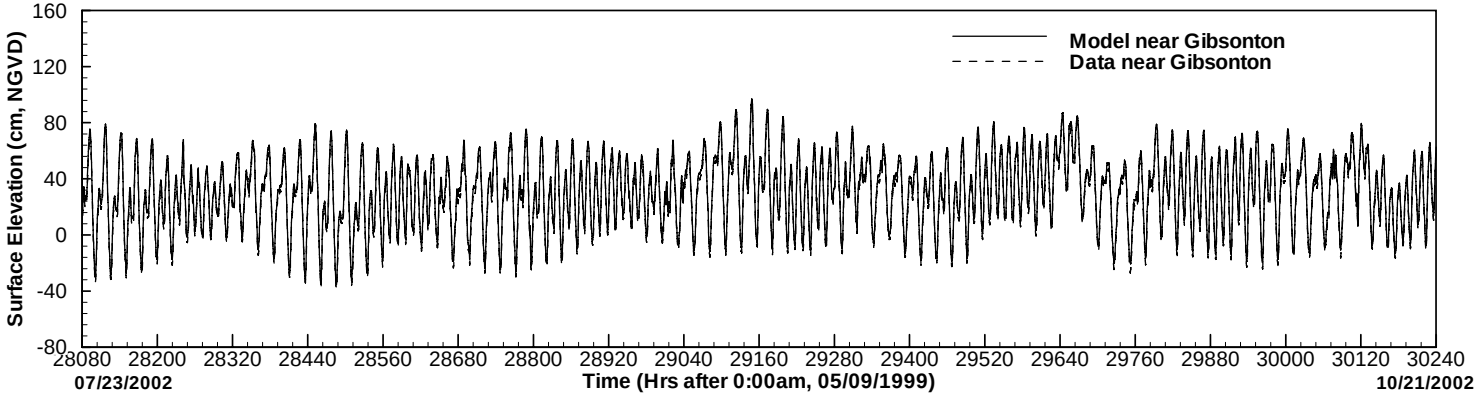

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
Time (Hrs after 0:00am, 05/09/1999)
07/23/2002

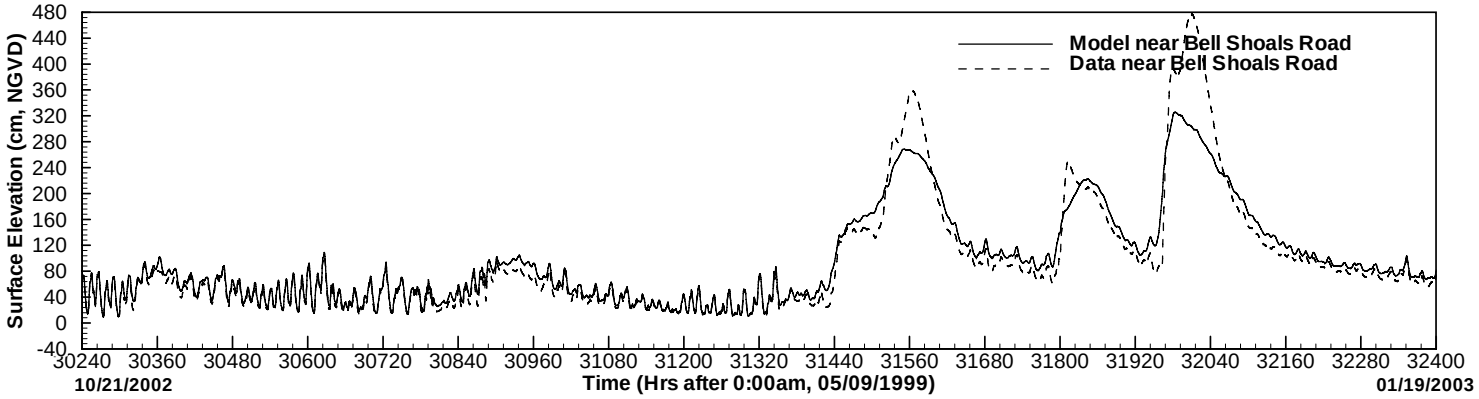

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
0Time (Hrs after 0:00am, 05/9/1999)
07/23/2002

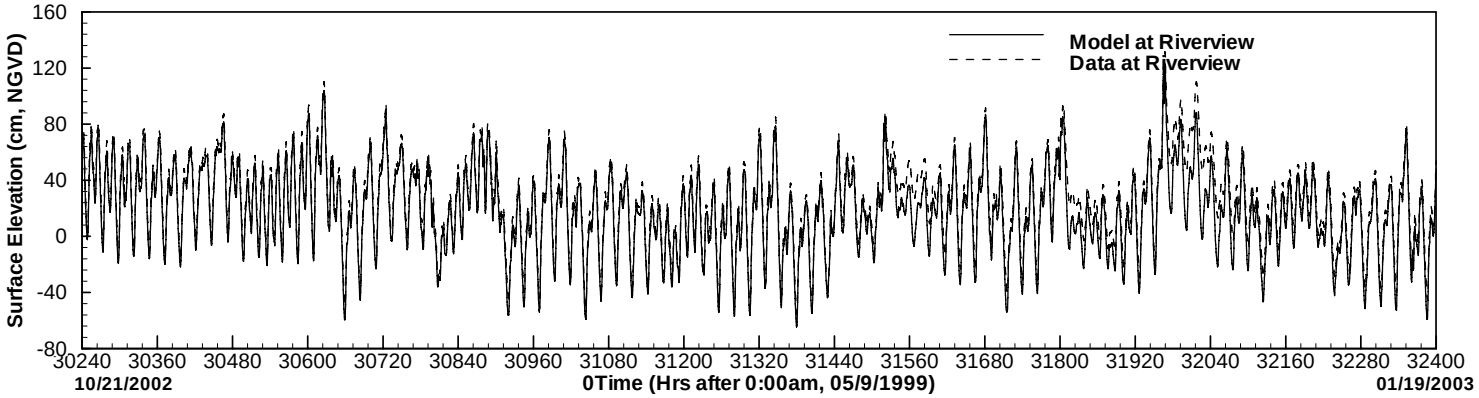

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
Time (Hrs after 0:00am, 05/09/1999)
07/23/2002

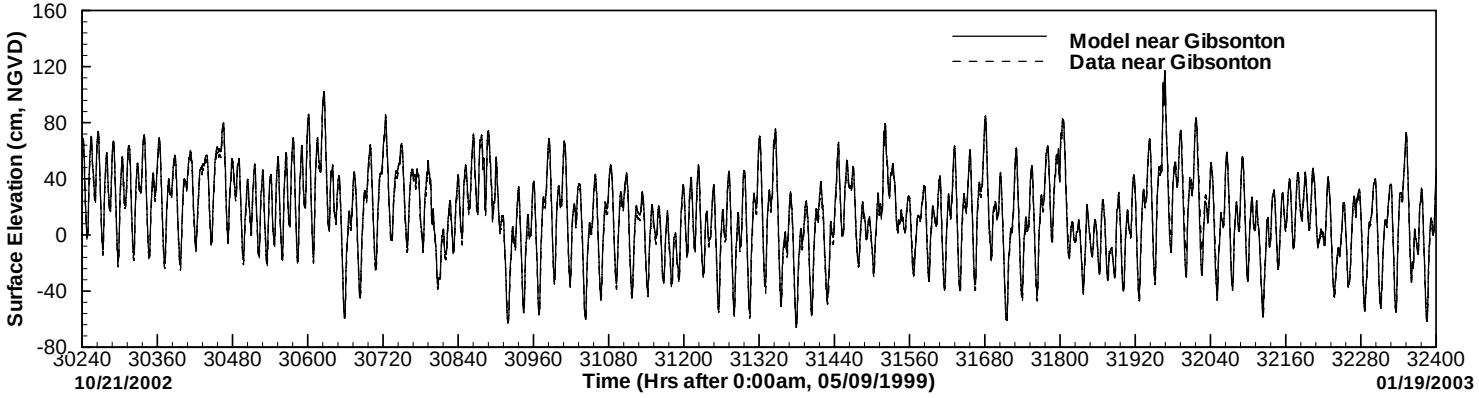

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
28080 28200 28320 28440 28560 28680 28800 28920 29040 29160 29280 29400 29520 29640 29760 29880 30000 30120 30240
07/23/2002
Time (Hrs after 0:00am, 05/09/1999)
10/21/2002

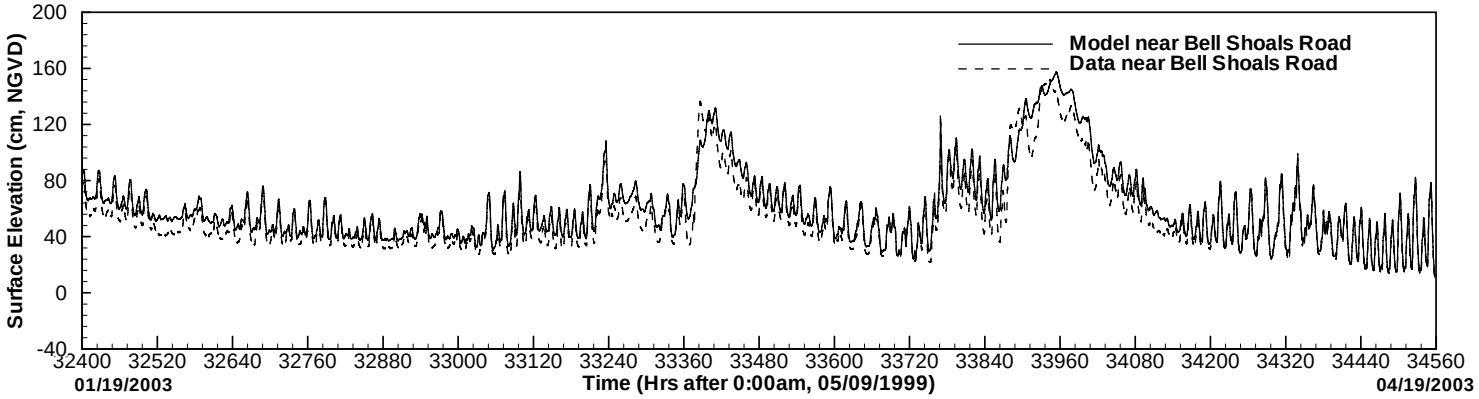

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
28080 28200 28320 28440 28560 28680 28800 28920 29040 29160 29280 29400 29520 29640 29760 29880 30000 30120 30240
07/23/2002
0Time (Hrs after 0:00am, 05/9/1999)
10/21/2002

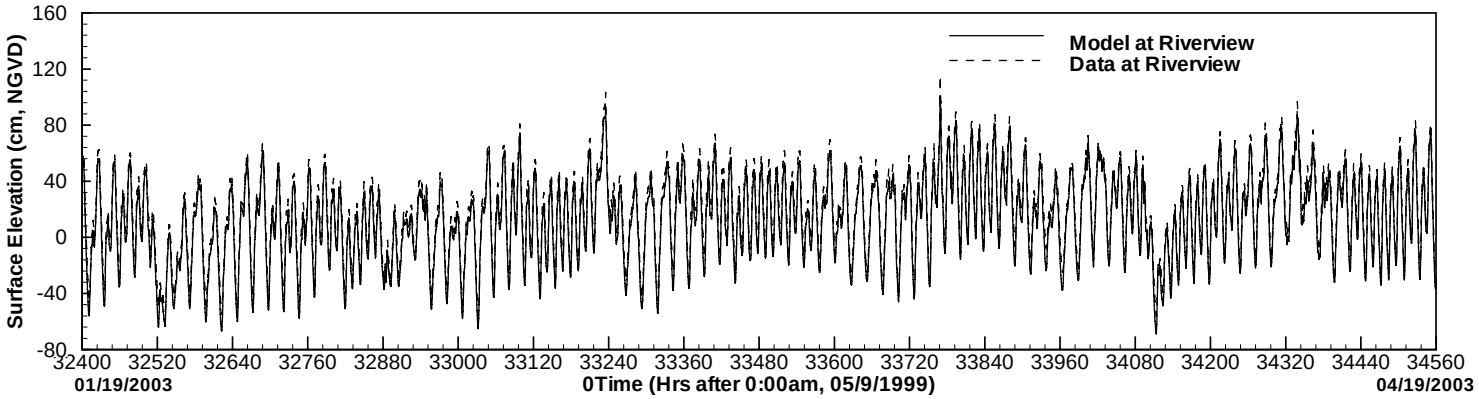

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
28080 28200 28320 28440 28560 28680 28800 28920 29040 29160 29280 29400 29520 29640 29760 29880 30000 30120 30240
07/23/2002
Time (Hrs after 0:00am, 05/09/1999)
10/21/2002

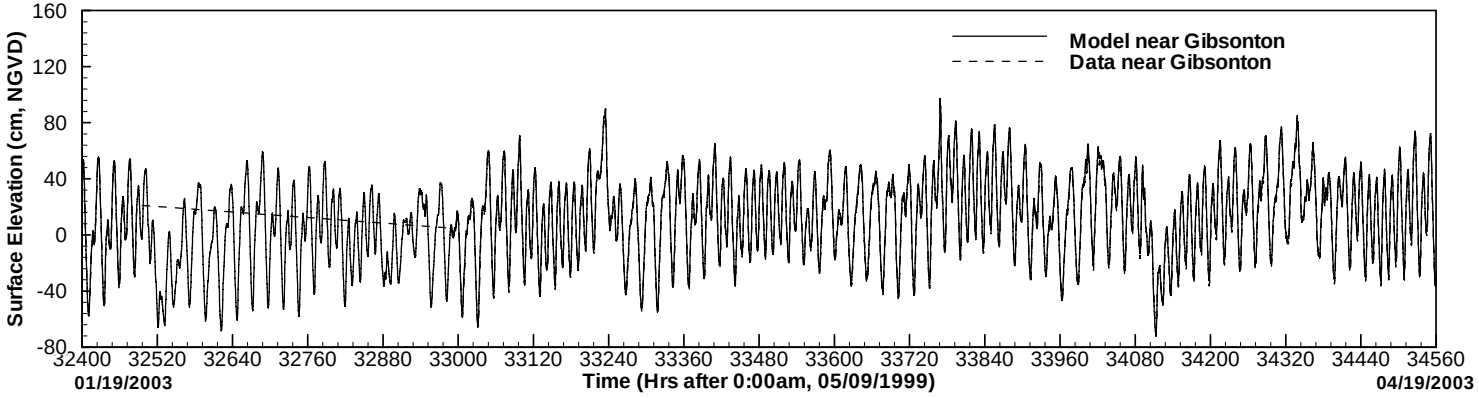

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
480
440
400
360
320
280
240
200
160
120
80
40
0
-40
30240 30360 30480 30600 30720 30840 30960 31080 31200 31320 31440 31560 31680 31800 31920 32040 32160 32280 32400
10/21/2002
Time (Hrs after 0:00am, 05/09/1999)
01/19/2003

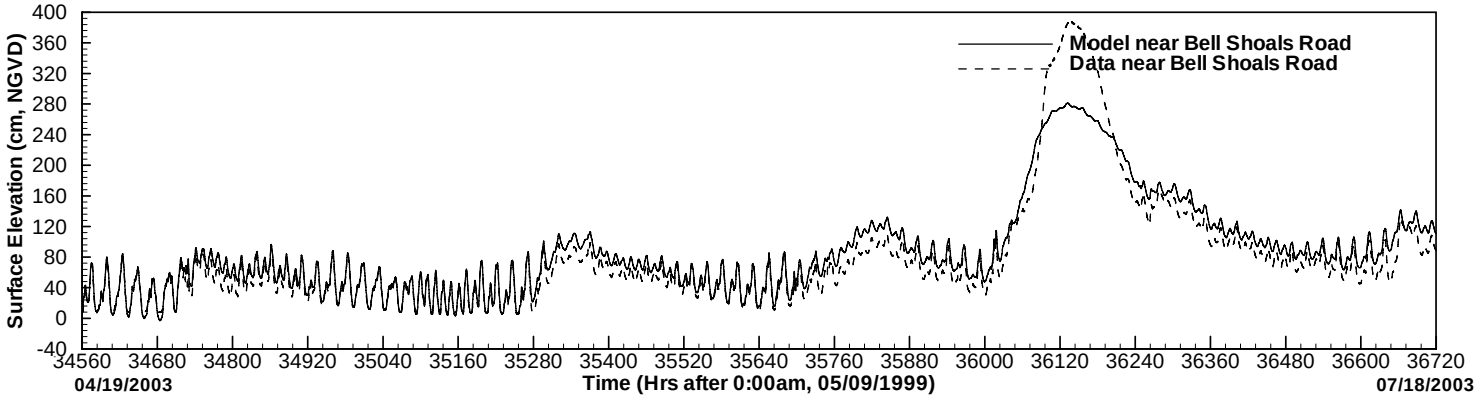

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
30240 30360 30480 30600 30720 30840 30960 31080 31200 31320 31440 31560 31680 31800 31920 32040 32160 32280 32400
10/21/2002
0Time (Hrs after 0:00am, 05/9/1999)
01/19/2003

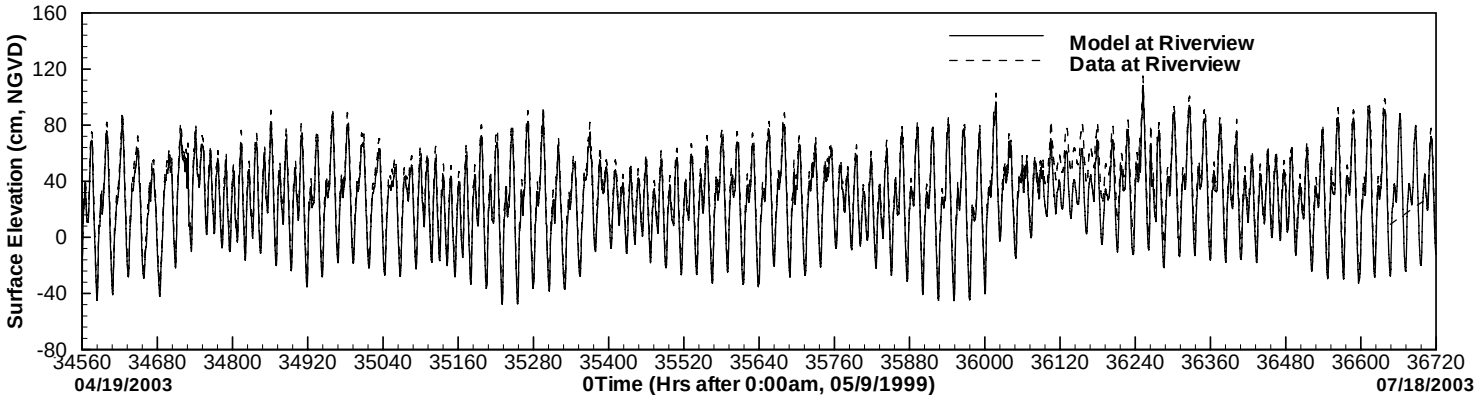

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
30240 30360 30480 30600 30720 30840 30960 31080 31200 31320 31440 31560 31680 31800 31920 32040 32160 32280 32400
10/21/2002
Time (Hrs after 0:00am, 05/09/1999)
01/19/2003

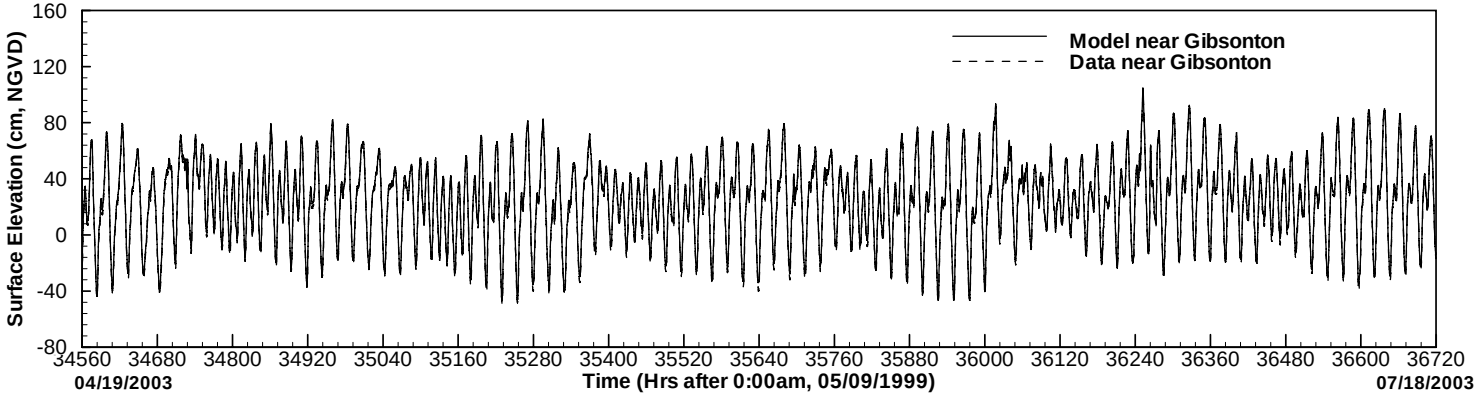

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
32400 32520 32640 32760 32880 33000 33120 33240 33360 33480 33600 33720 33840 33960 34080 34200 34320 34440 34560
01/19/2003
Time (Hrs after 0:00am, 05/09/1999)
04/19/2003

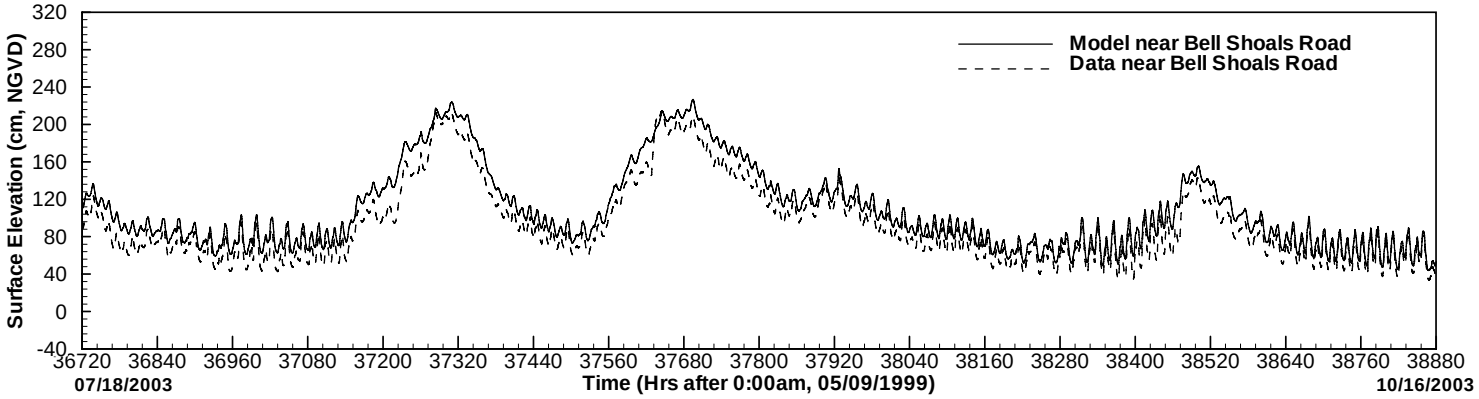

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
32400 32520 32640 32760 32880 33000 33120 33240 33360 33480 33600 33720 33840 33960 34080 34200 34320 34440 34560
01/19/2003
0Time (Hrs after 0:00am, 05/9/1999)
04/19/2003

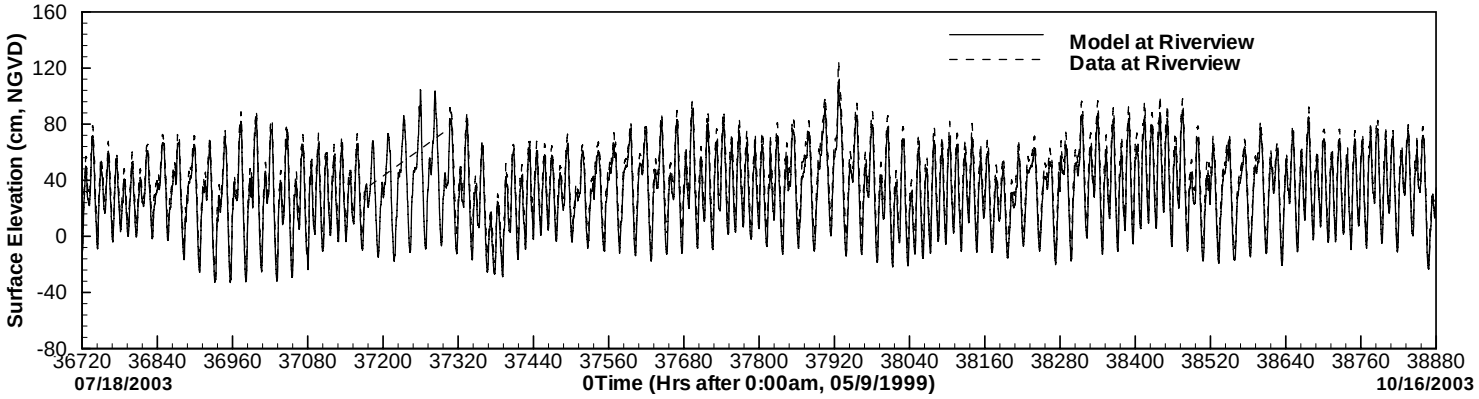

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
32400 32520 32640 32760 32880 33000 33120 33240 33360 33480 33600 33720 33840 33960 34080 34200 34320 34440 34560
01/19/2003
Time (Hrs after 0:00am, 05/09/1999)
04/19/2003

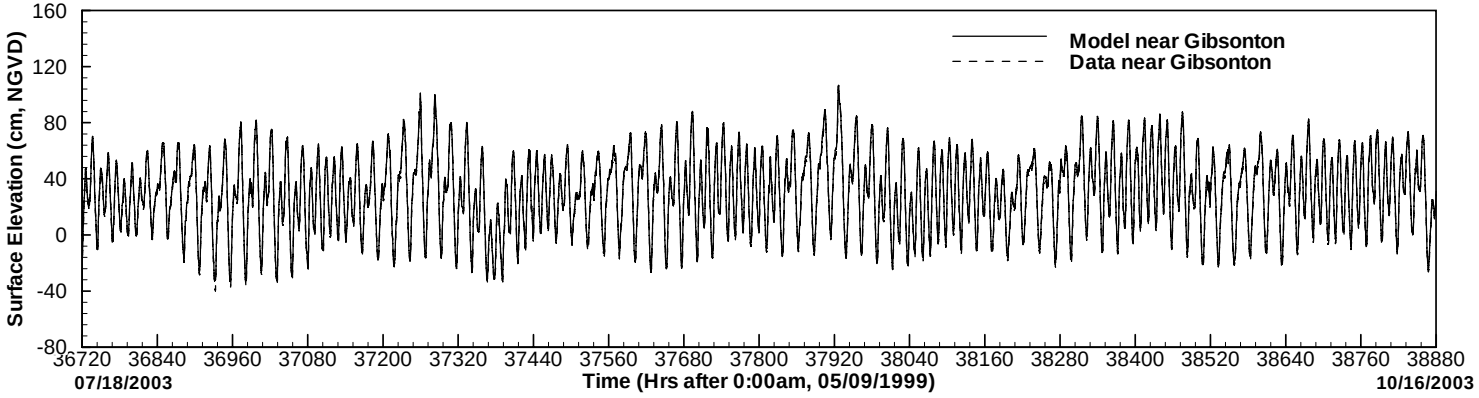

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
400
360
320
280
240
200
160
120
80
40
0
-40
34560 34680 34800 34920 35040 35160 35280 35400 35520 35640 35760 35880 36000 36120 36240 36360 36480 36600 36720
04/19/2003
Time (Hrs after 0:00am, 05/09/1999)
07/18/2003

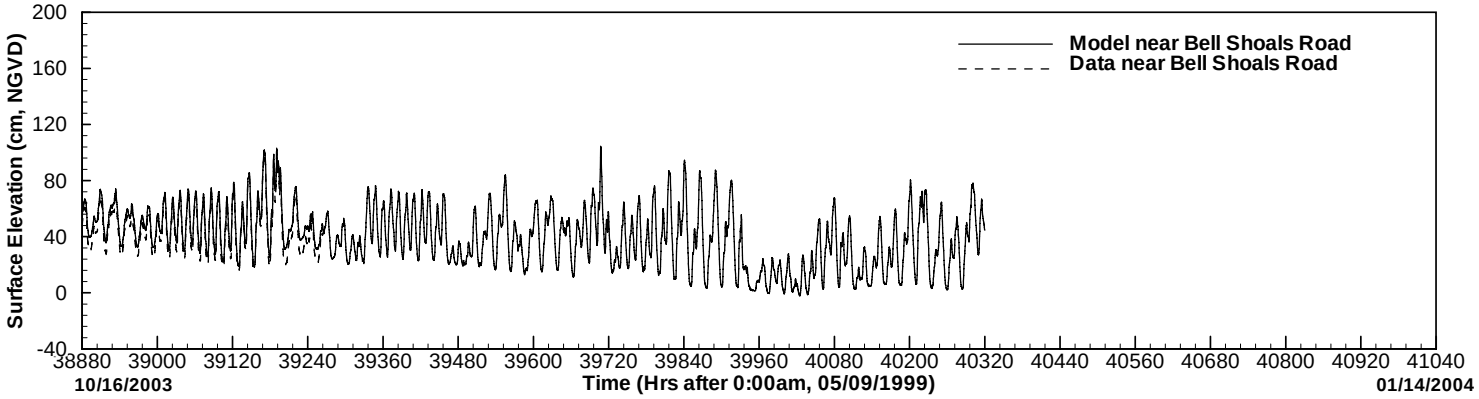

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
34560 34680 34800 34920 35040 35160 35280 35400 35520 35640 35760 35880 36000 36120 36240 36360 36480 36600 36720
04/19/2003
0Time (Hrs after 0:00am, 05/9/1999)
07/18/2003

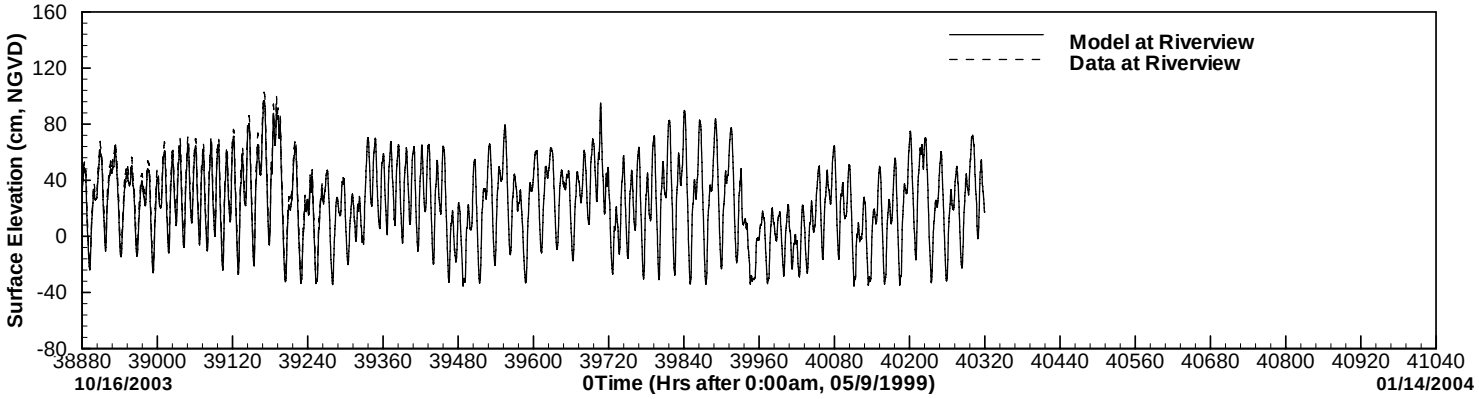

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
34560 34680 34800 34920 35040 35160 35280 35400 35520 35640 35760 35880 36000 36120 36240 36360 36480 36600 36720
04/19/2003
Time (Hrs after 0:00am, 05/09/1999)
07/18/2003

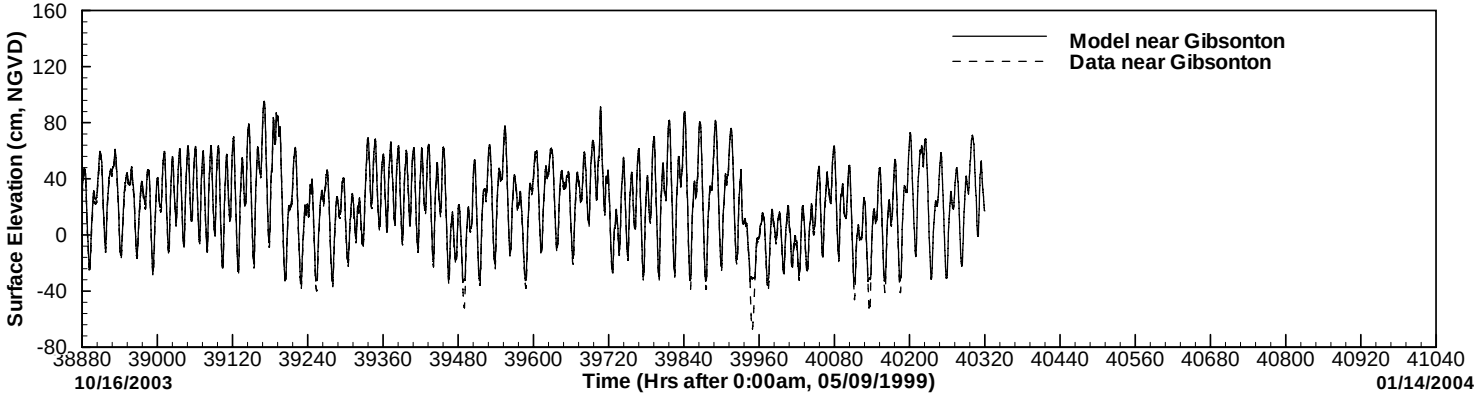

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
320
280
240
200
160
120
80
40
0
-40
36720 36840 36960 37080 37200 37320 37440 37560 37680 37800 37920 38040 38160 38280 38400 38520 38640 38760 38880
07/18/2003
Time (Hrs after 0:00am, 05/09/1999)
10/16/2003


Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
36720 36840 36960 37080 37200 37320 37440 37560 37680 37800 37920 38040 38160 38280 38400 38520 38640 38760 38880
07/18/2003
0Time (Hrs after 0:00am, 05/9/1999)
10/16/2003


Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
36720 36840 36960 37080 37200 37320 37440 37560 37680 37800 37920 38040 38160 38280 38400 38520 38640 38760 38880
07/18/2003
Time (Hrs after 0:00am, 05/09/1999)
10/16/2003

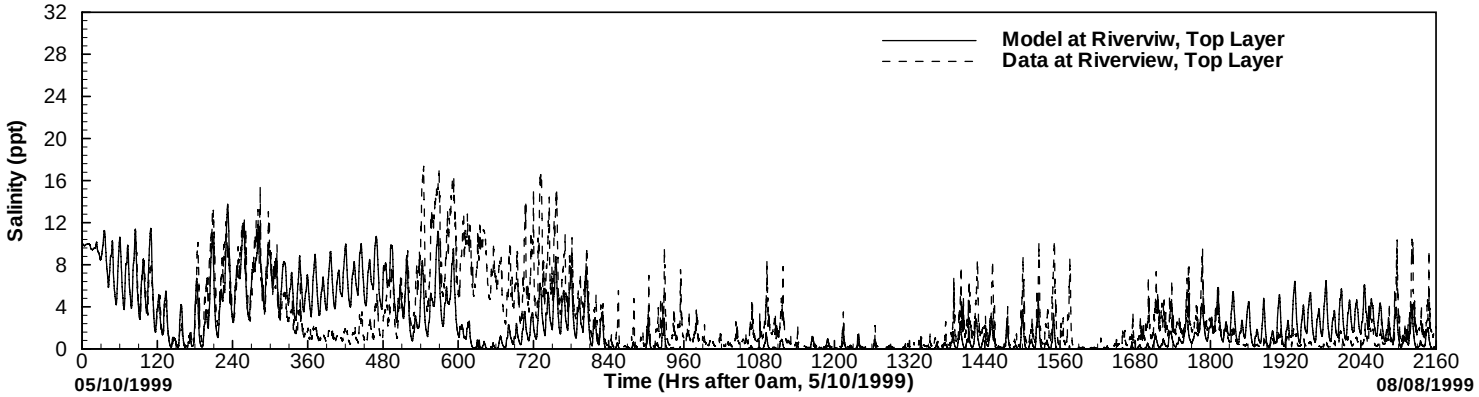

Model near Bell Shoals Road
Data near Bell Shoals Road
Surface Elevation (cm, NGVD)
200
160
120
80
40
0
-40
38880 39000 39120 39240 39360 39480 39600 39720 39840 39960 40080 40200 40320 40440 40560 40680 40800 40920 41040
10/16/2003
Time (Hrs after 0:00am, 05/09/1999)
01/14/2004

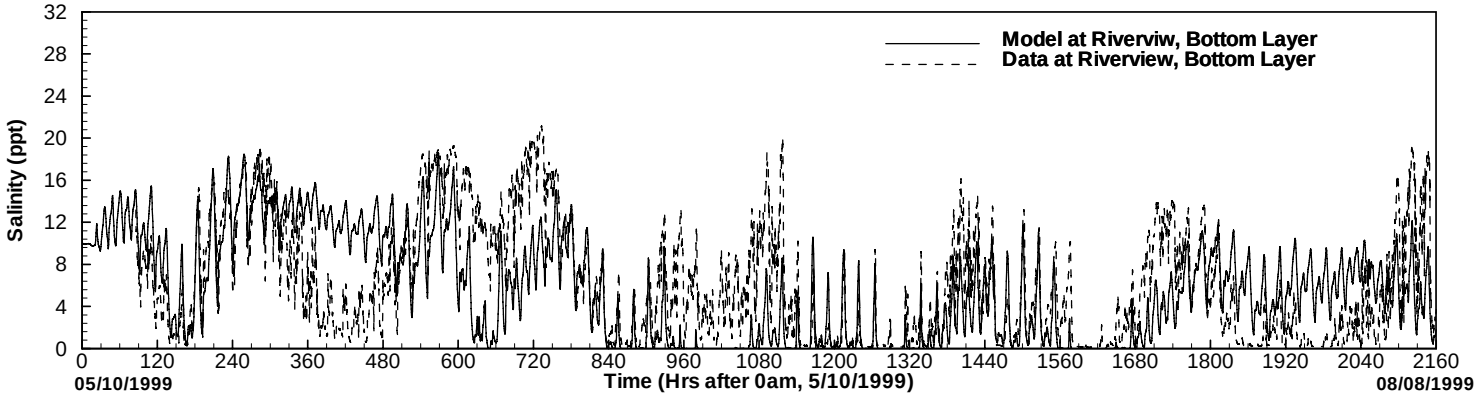

Model at Riverview
Data at Riverview
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
38880 39000 39120 39240 39360 39480 39600 39720 39840 39960 40080 40200 40320 40440 40560 40680 40800 40920 41040
10/16/2003
0Time (Hrs after 0:00am, 05/9/1999)
01/14/2004

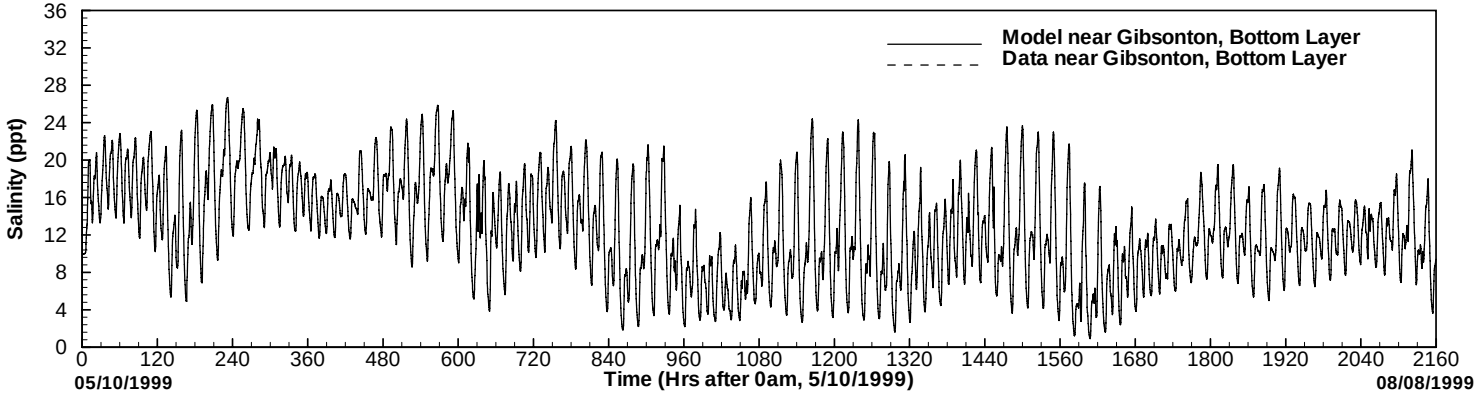

Model near Gibsonton
Data near Gibsonton
Surface Elevation (cm, NGVD)
160
120
80
40
0
-40
-80
38880 39000 39120 39240 39360 39480 39600 39720 39840 39960 40080 40200 40320 40440 40560 40680 40800 40920 41040
10/16/2003
Time (Hrs after 0:00am, 05/09/1999)
01/14/2004

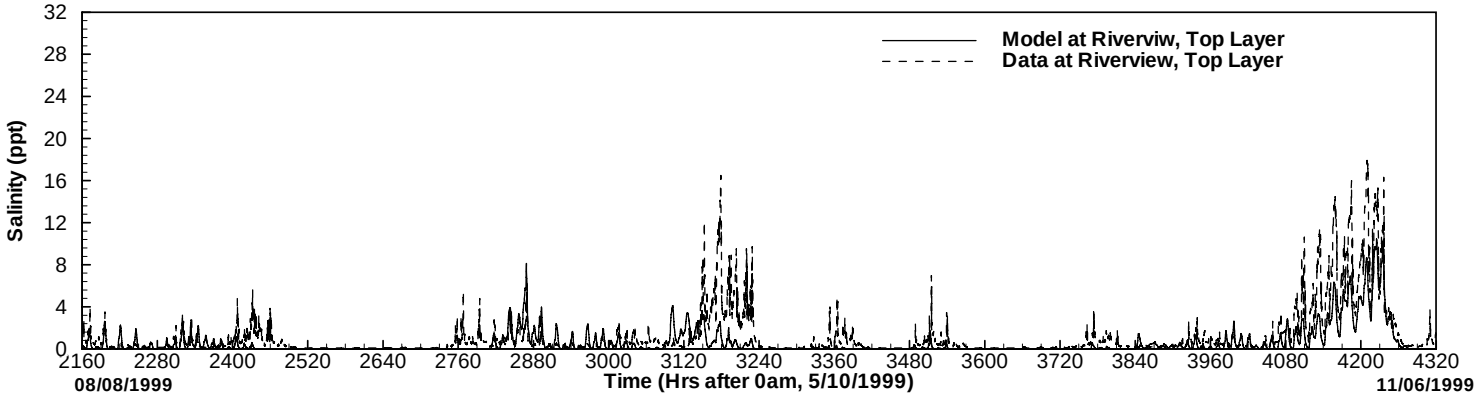
Appendix F
Comparisons of Simulated Salinity Results with Field Data

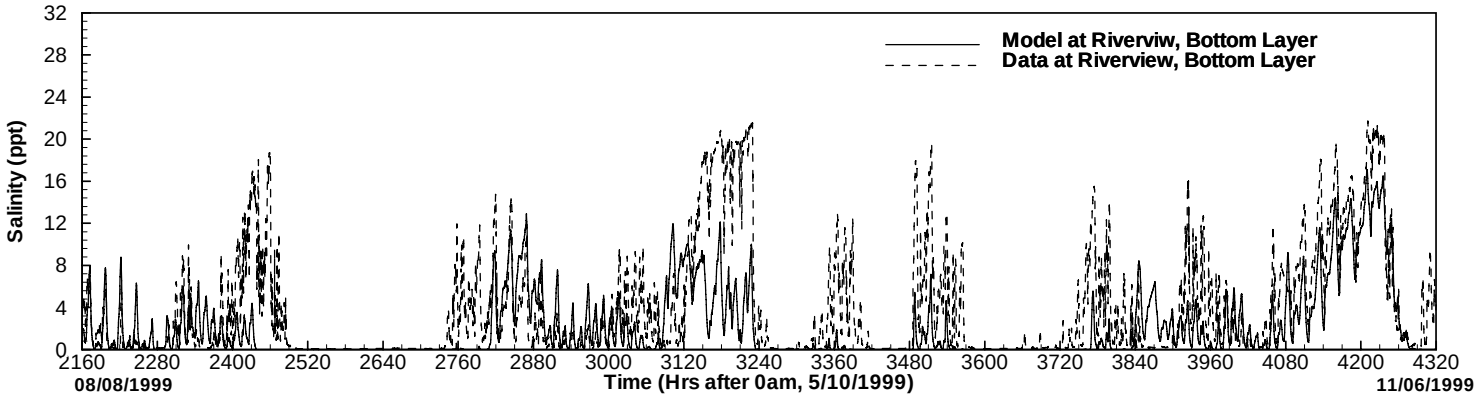
The following 19 pages show plots of comparisons of simulated salinities to measured data during May 1999 through December 2003 at the USGS Alafia River near Gibsonton, Alafia River at Riverview, and Alafia River at Bell Shoals Road stations.

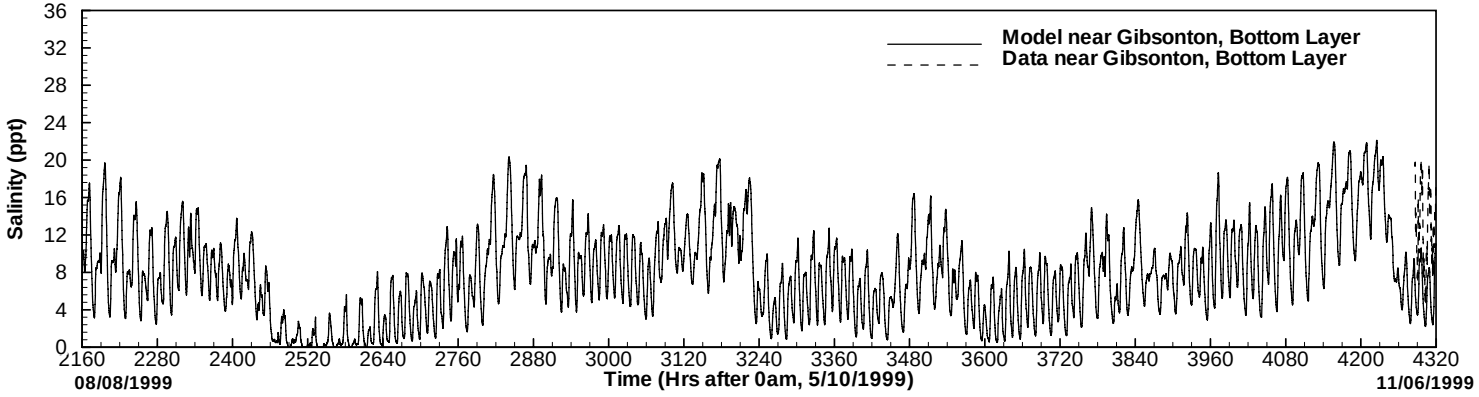

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
1560
1680
1800
1920
2040
2160
05/10/1999
Time (Hrs after 0am, 5/10/1999)
08/08/1999

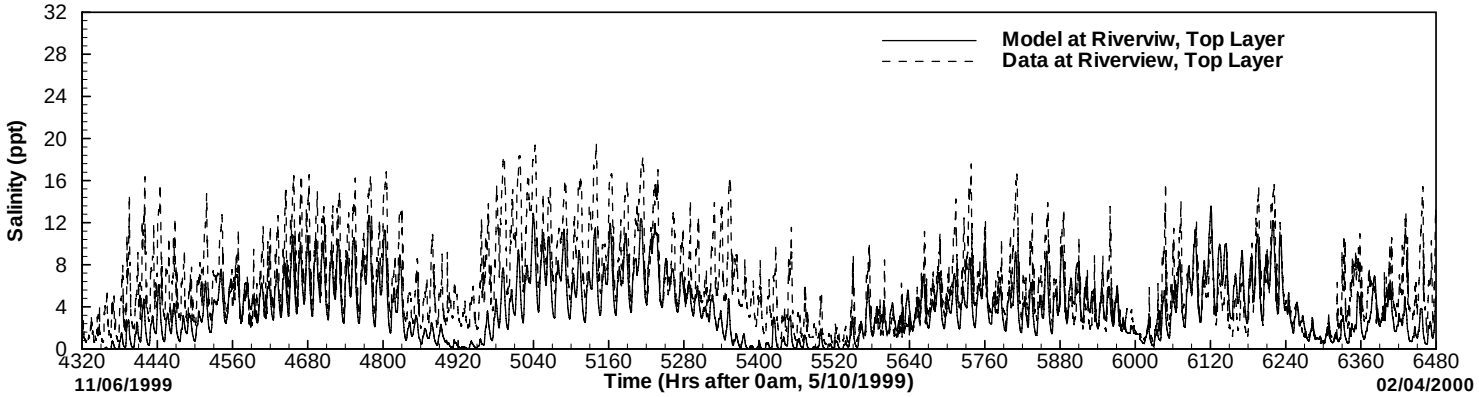

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
1560
1680
1800
1920
2040
2160
05/10/1999
Time (Hrs after 0am, 5/10/1999)
08/08/1999

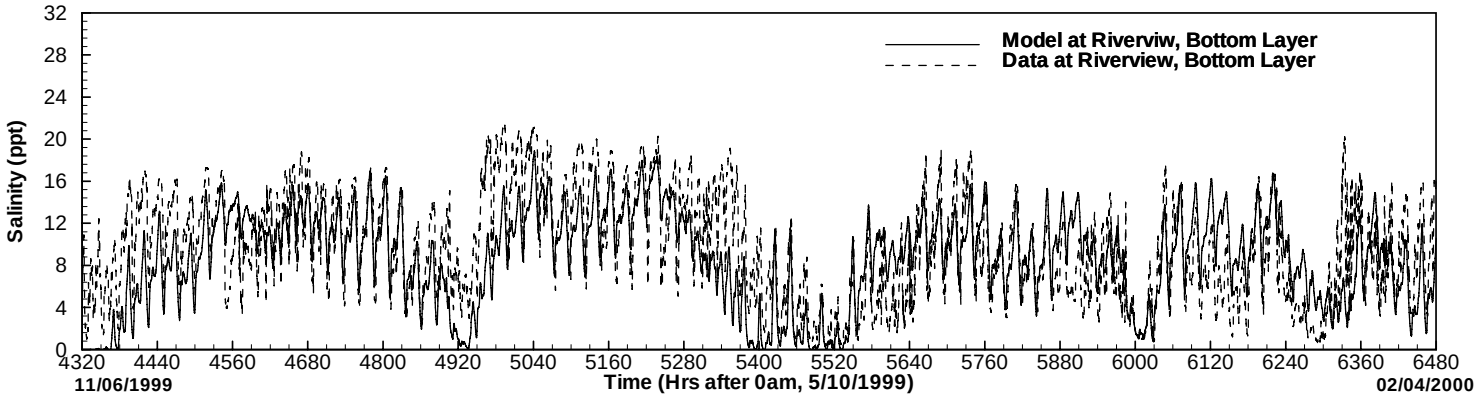

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
36
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
1560
1680
1800
1920
2040
2160
05/10/1999
Time (Hrs after 0am, 5/10/1999)
08/08/1999

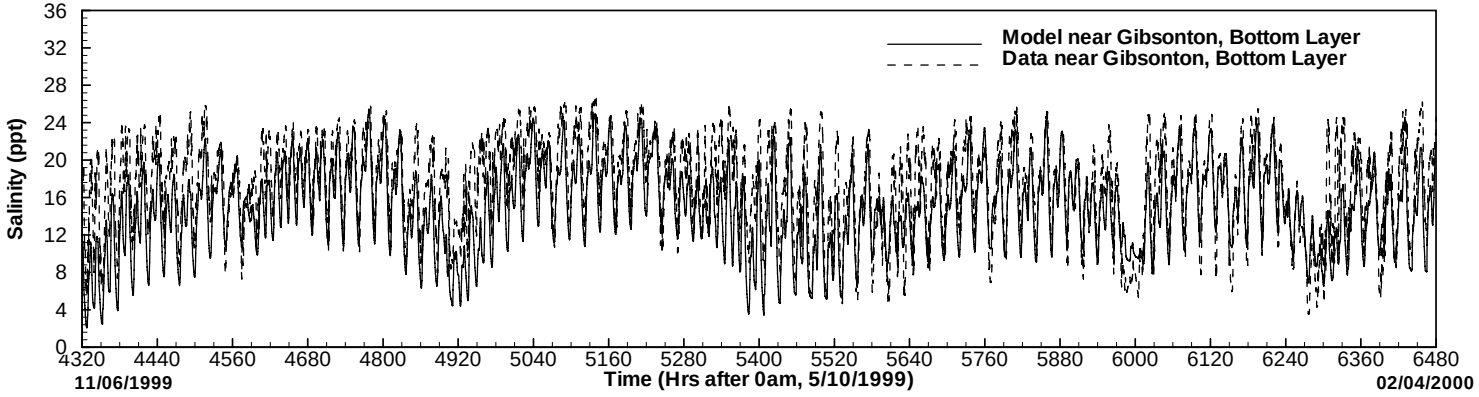

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
Time (Hrs after 0am, 5/10/1999)
08/08/1999
11/06/1999

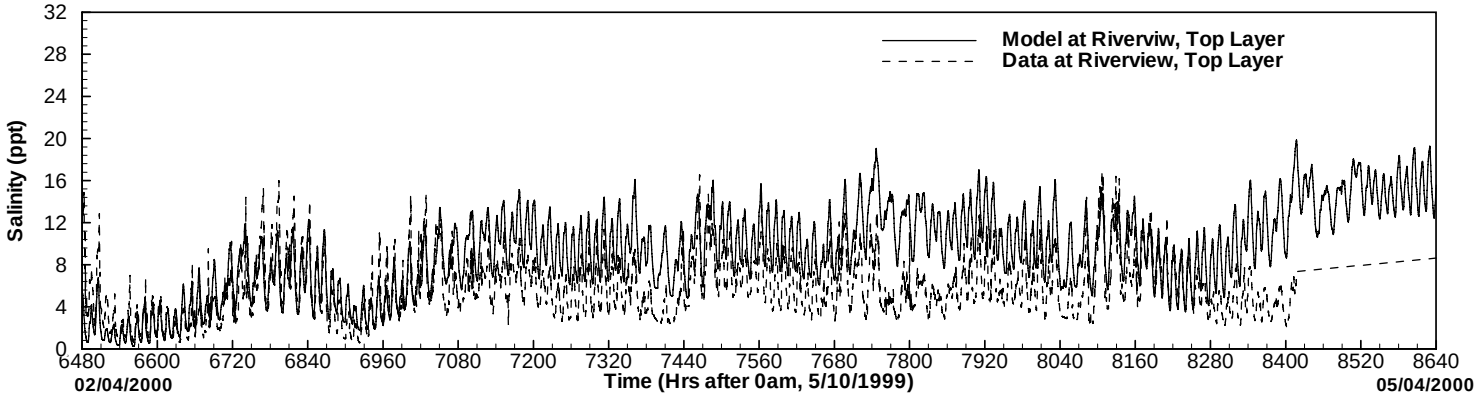

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
Time (Hrs after 0am, 5/10/1999)
08/08/1999
11/06/1999

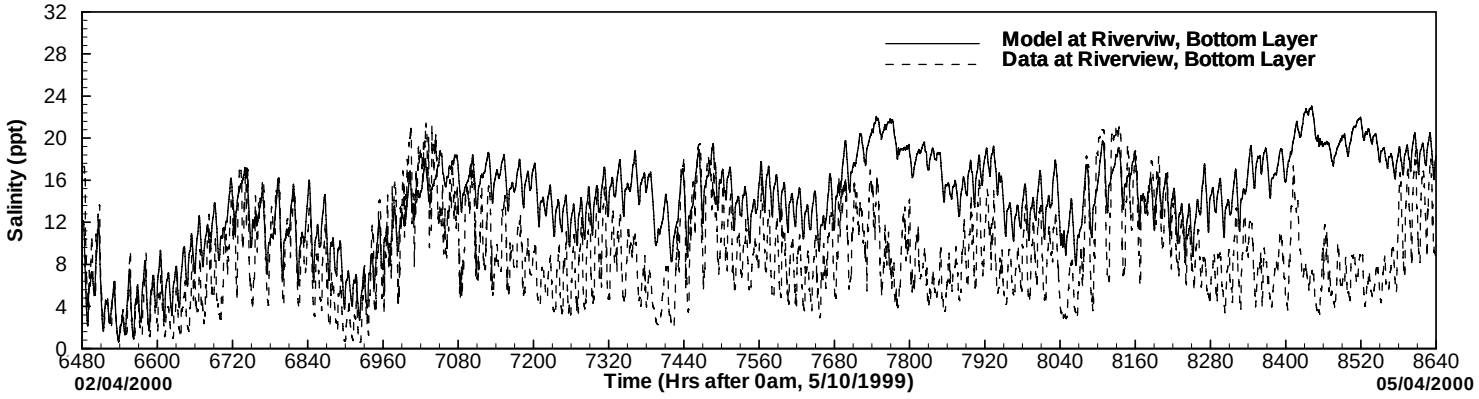

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
36
2160 2280 2400 2520 2640 2760 2880 3000 3120 3240 3360 3480 3600 3720 3840 3960 4080 4200 4320
Time (Hrs after 0am, 5/10/1999)
08/08/1999
11/06/1999

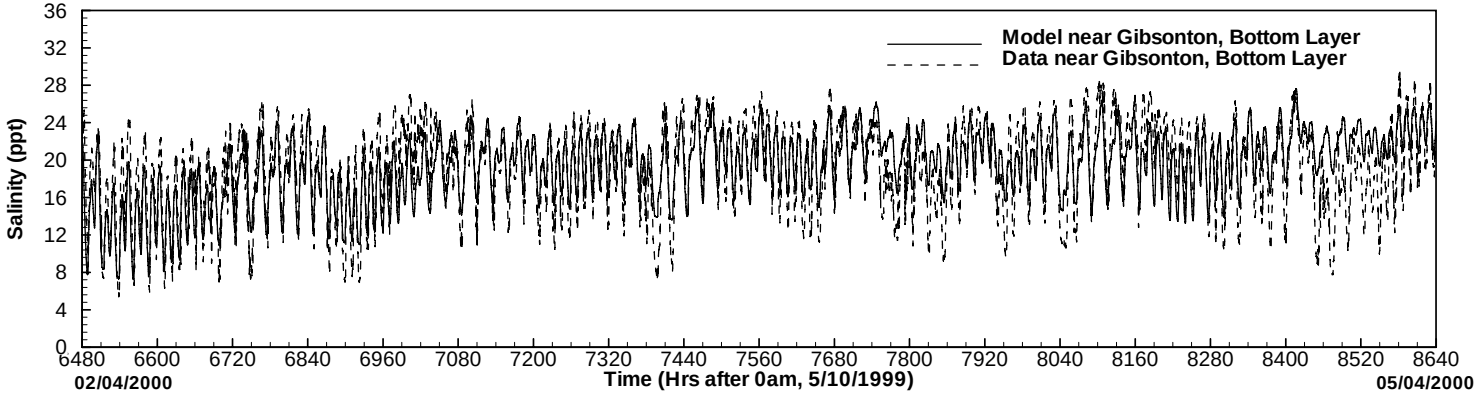

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
4320
4440
4560
4680
4800
4920
5040
5160
5280
5400
5520
5640
5760
5880
6000
6120
6240
6360
6480
11/06/1999
Time (Hrs after 0am, 5/10/1999)
02/04/2000

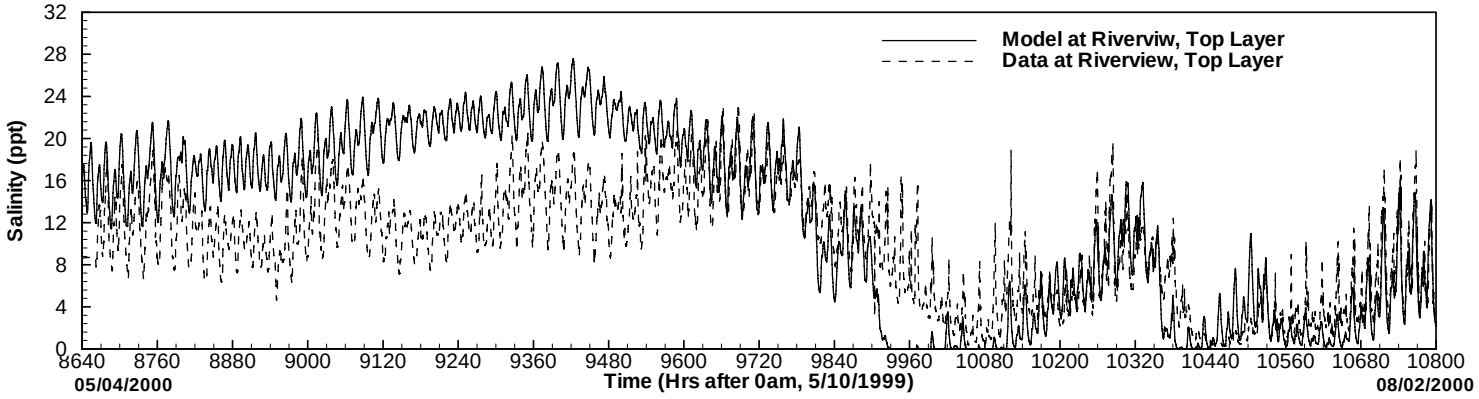

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
4320
4440
4560
4680
4800
4920
5040
5160
5280
5400
5520
5640
5760
5880
6000
6120
6240
6360
6480
11/06/1999
Time (Hrs after 0am, 5/10/1999)
02/04/2000

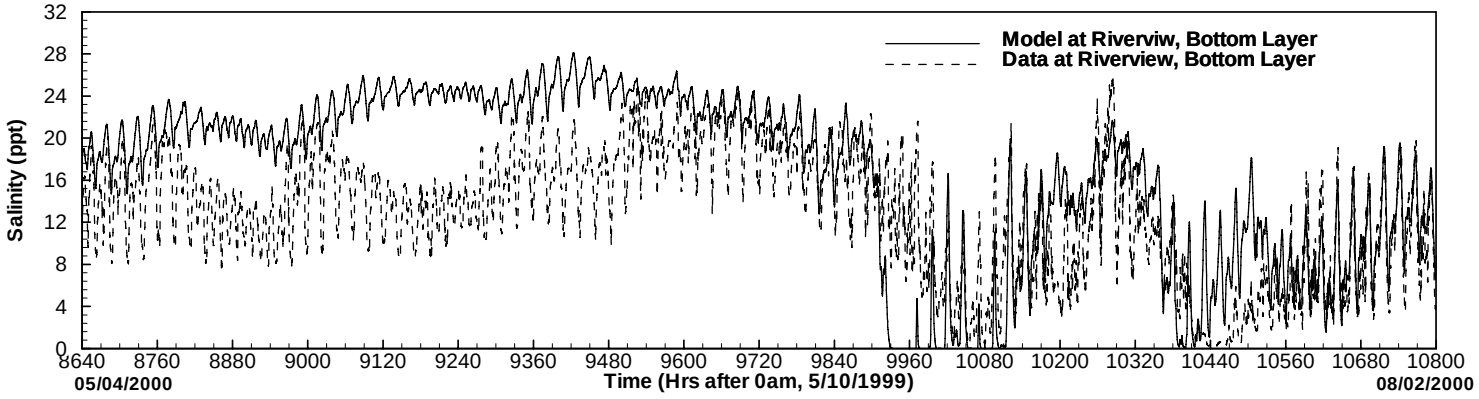

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
36
4320
4440
4560
4680
4800
4920
5040
5160
5280
5400
5520
5640
5760
5880
6000
6120
6240
6360
6480
11/06/1999
Time (Hrs after 0am, 5/10/1999)
02/04/2000

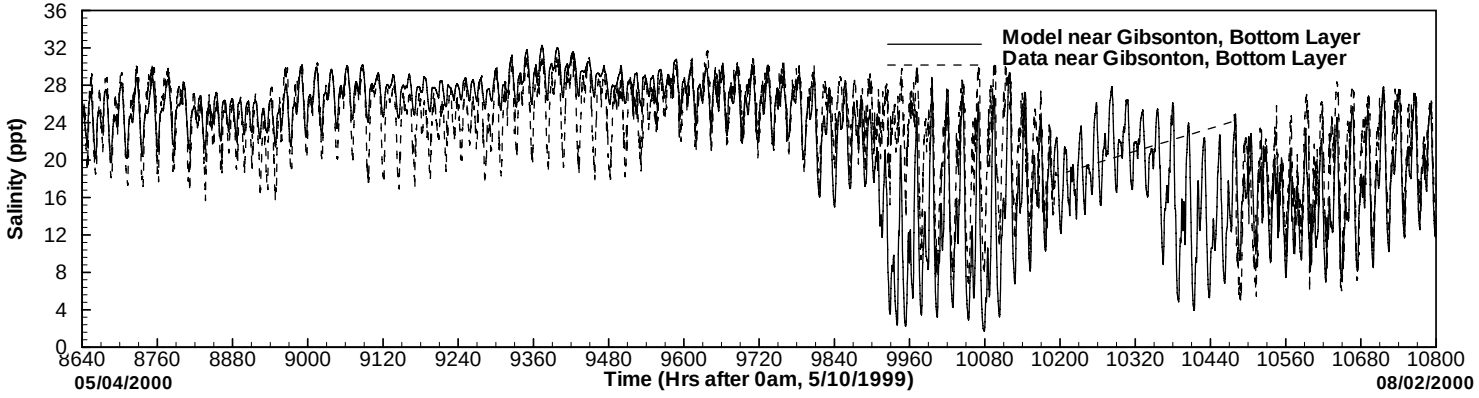

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
6480
6600
6720
6840
6960
7080
7200
7320
7440
7560
7680
7800
7920
8040
8160
8280
8400
8520
8640
02/04/2000
Time (Hrs after 0am, 5/10/1999)
05/04/2000

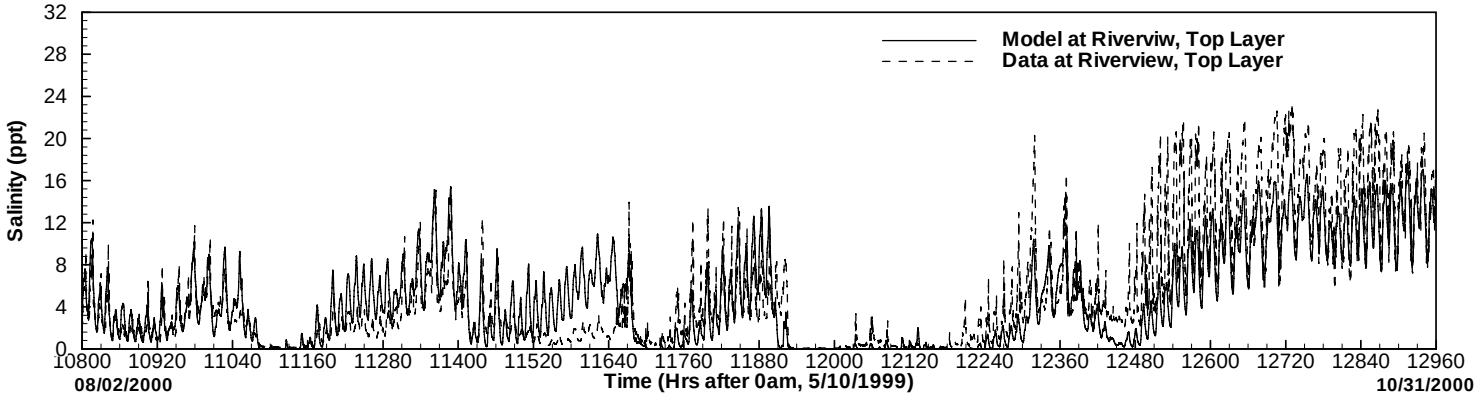

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
6480
6600
6720
6840
6960
7080
7200
7320
7440
7560
7680
7800
7920
8040
8160
8280
8400
8520
8640
02/04/2000
Time (Hrs after 0am, 5/10/1999)
05/04/2000

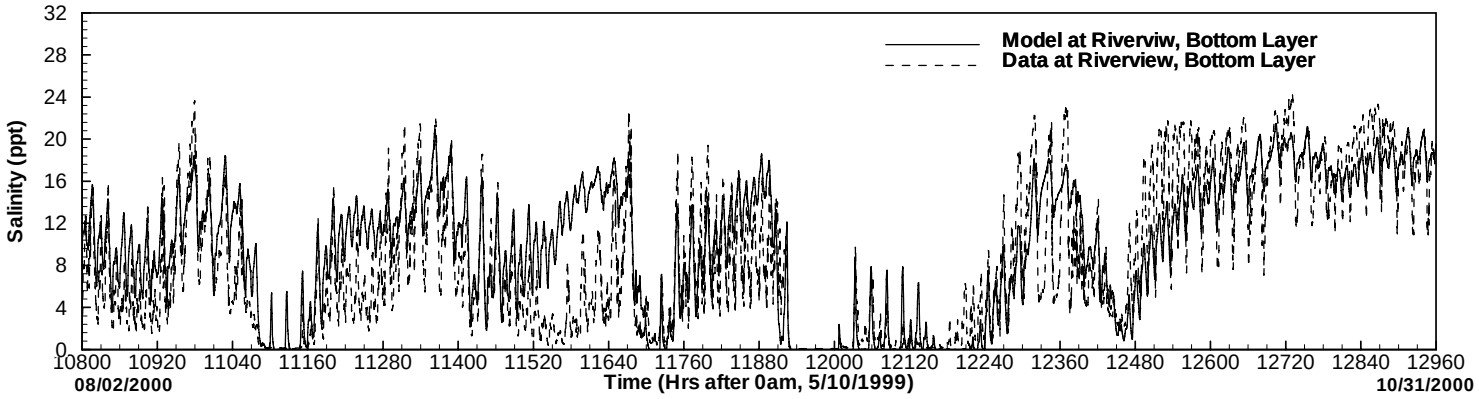

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
36
6480
6600
6720
6840
6960
7080
7200
7320
7440
7560
7680
7800
7920
8040
8160
8280
8400
8520
8640
02/04/2000
Time (Hrs after 0am, 5/10/1999)
05/04/2000

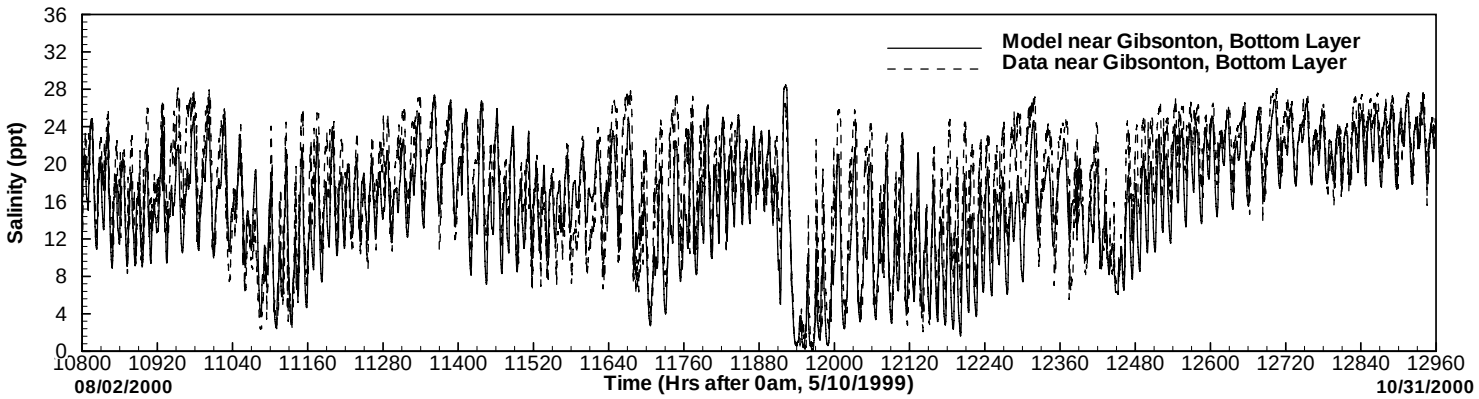

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
8640
8760
8880
9000
9120
9240
9360
9480
9600
9720
9840
9960
10080
10200
10320
10440
10560
10680
10800
05/04/2000
Time (Hrs after 0am, 5/10/1999)
08/02/2000

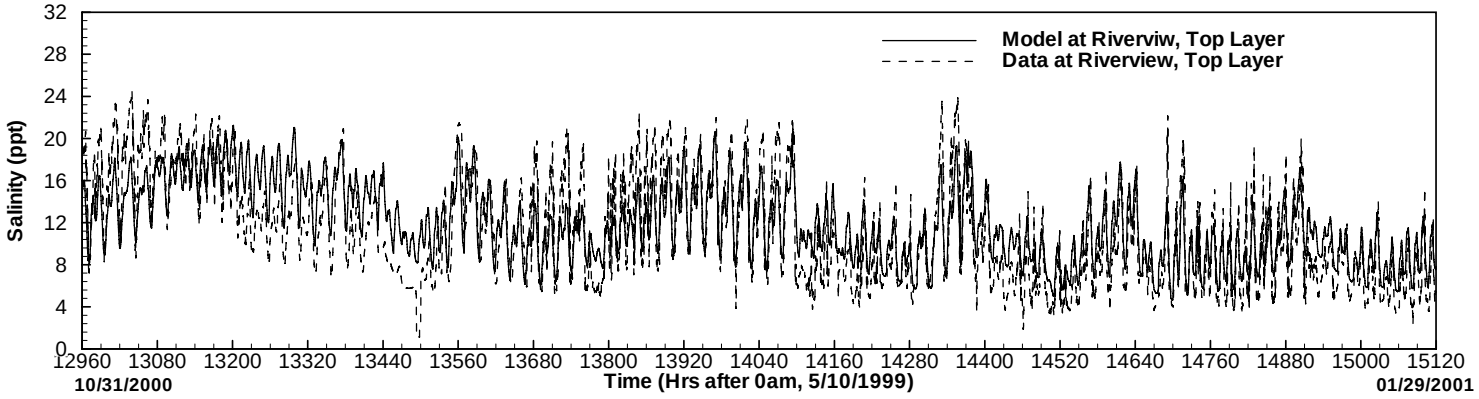

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
8640
8760
8880
9000
9120
9240
9360
9480
9600
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10080
10200
10320
10440
10560
10680
10800
05/04/2000
Time (Hrs after 0am, 5/10/1999)
08/02/2000

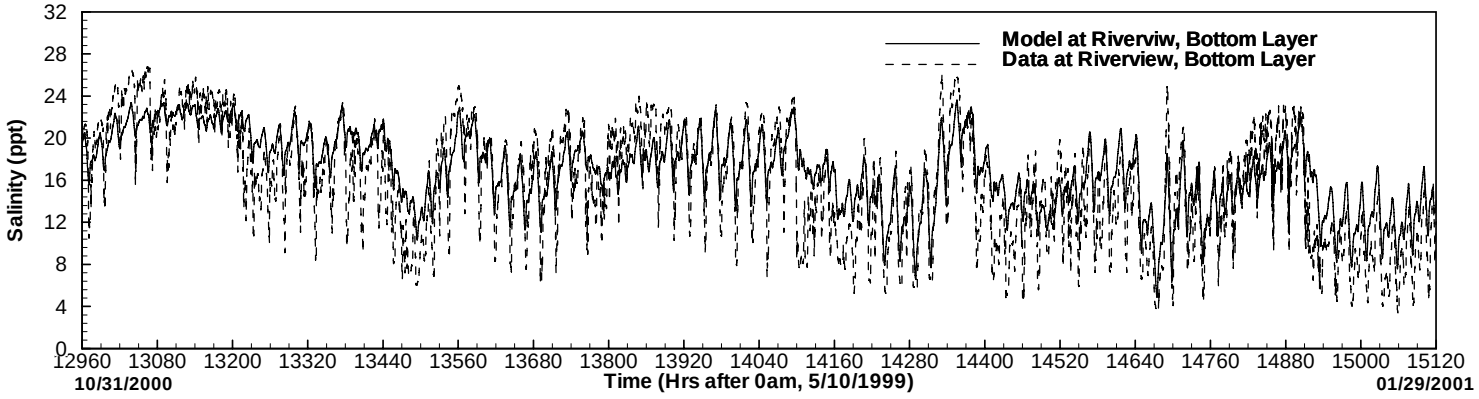

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
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8640
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10440
10560
10680
10800
05/04/2000
Time (Hrs after 0am, 5/10/1999)
08/02/2000

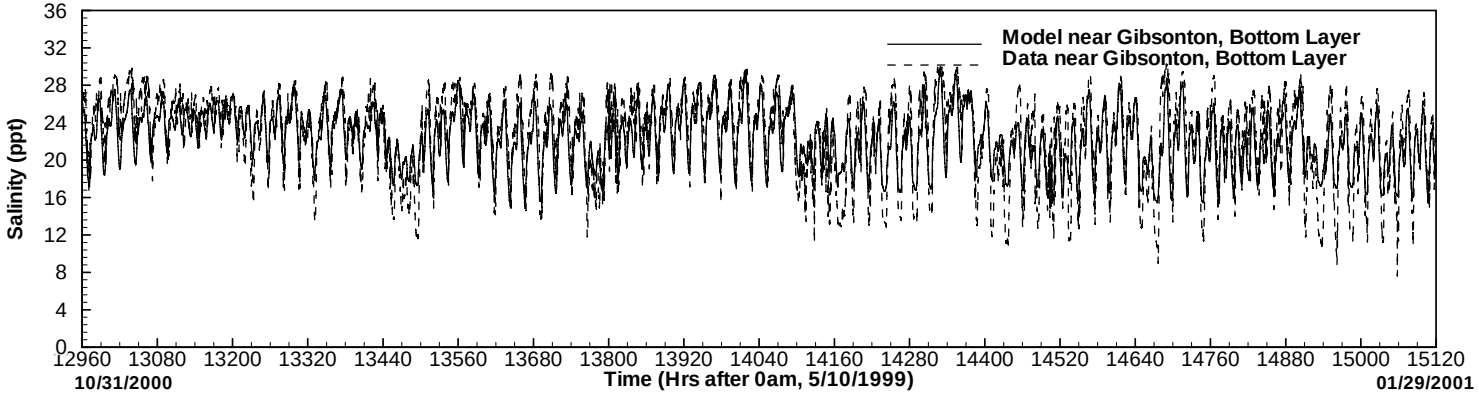

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
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10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
Time (Hrs after 0am, 5/10/1999)
08/02/2000
10/31/2000

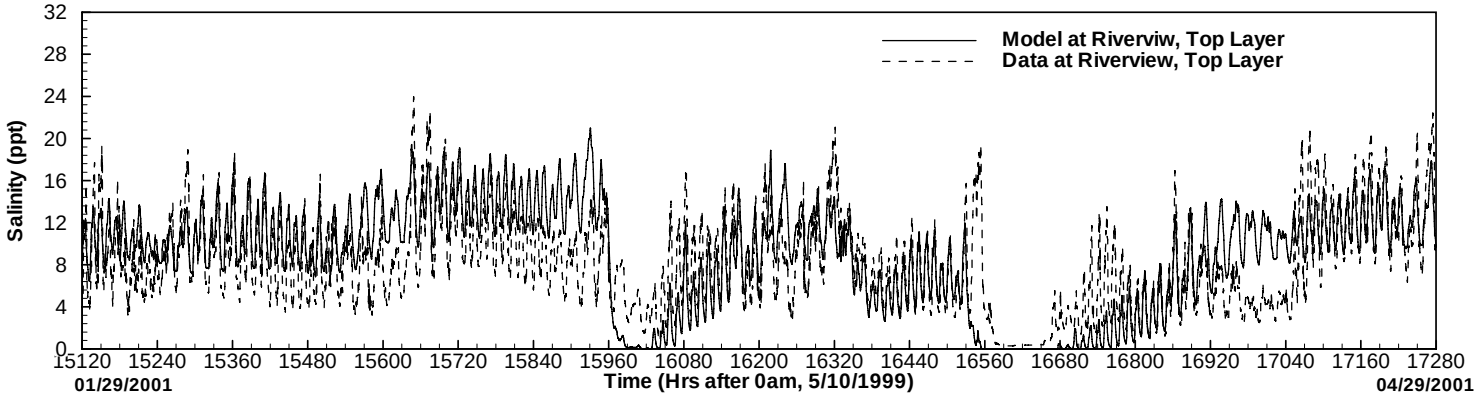

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
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10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
Time (Hrs after 0am, 5/10/1999)
08/02/2000
10/31/2000

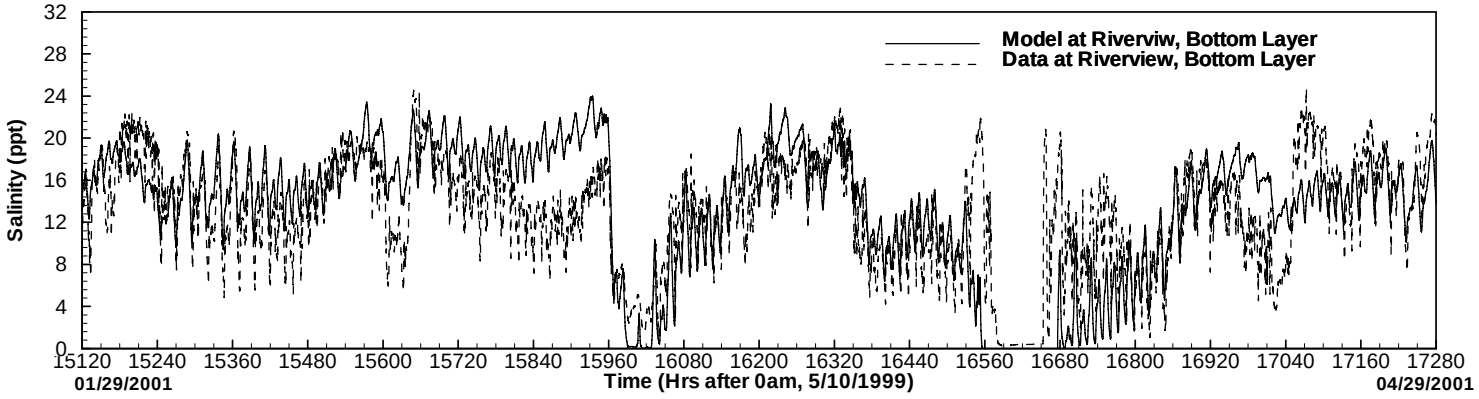

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
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10800 10920 11040 11160 11280 11400 11520 11640 11760 11880 12000 12120 12240 12360 12480 12600 12720 12840 12960
Time (Hrs after 0am, 5/10/1999)
08/02/2000
10/31/2000

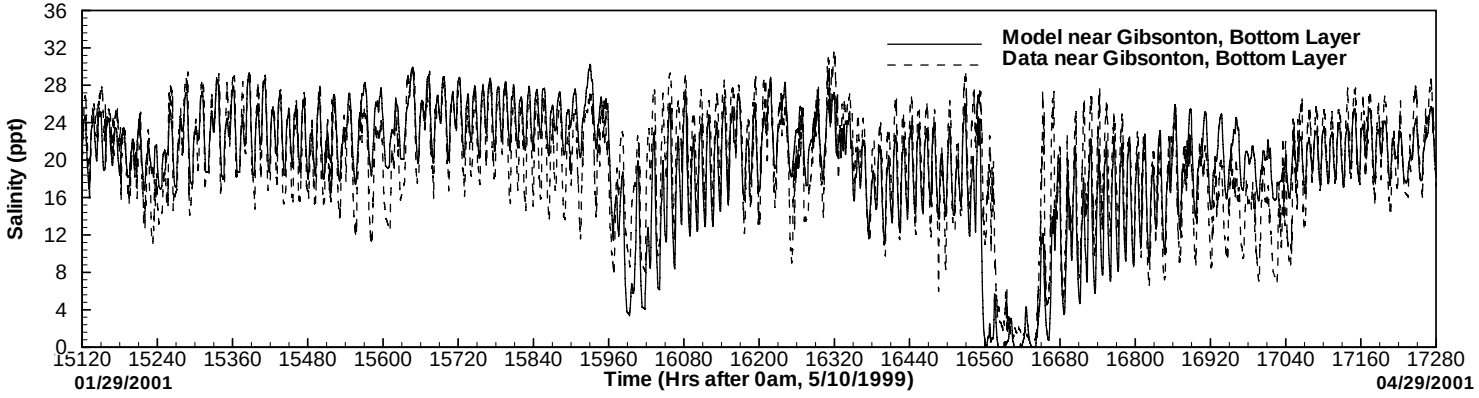

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
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12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
Time (Hrs after 0am, 5/10/1999)
01/29/2001

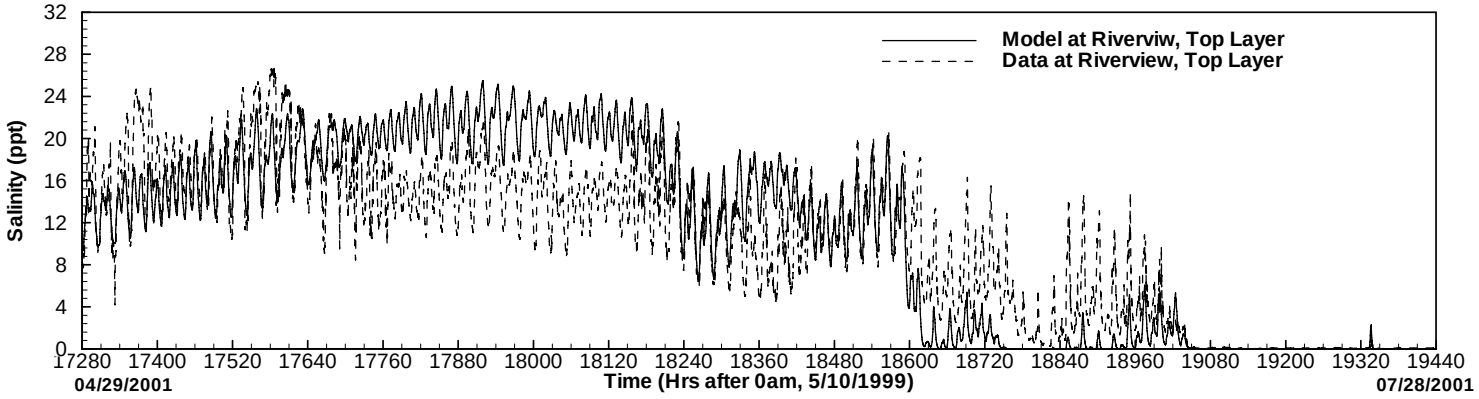

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
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12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
Time (Hrs after 0am, 5/10/1999)
01/29/2001

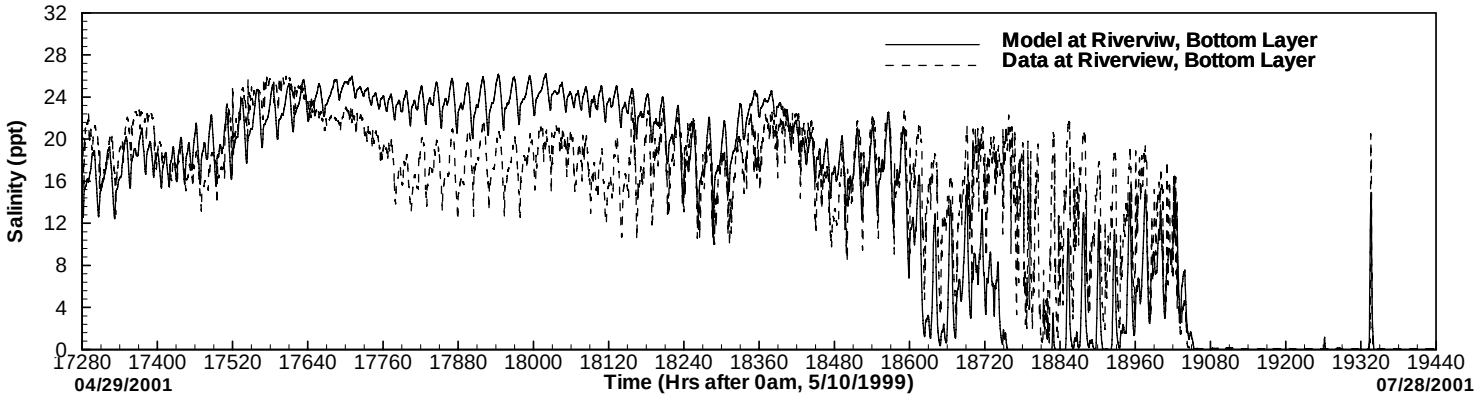

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
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12960 13080 13200 13320 13440 13560 13680 13800 13920 14040 14160 14280 14400 14520 14640 14760 14880 15000 15120
10/31/2000
Time (Hrs after 0am, 5/10/1999)
01/29/2001

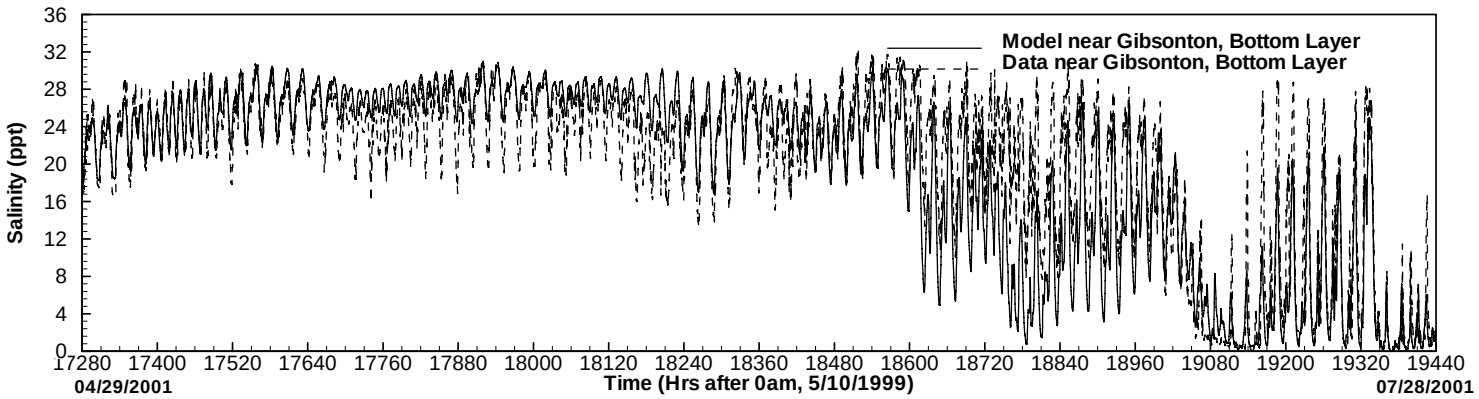

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
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15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
Time (Hrs after 0am, 5/10/1999)
04/29/2001

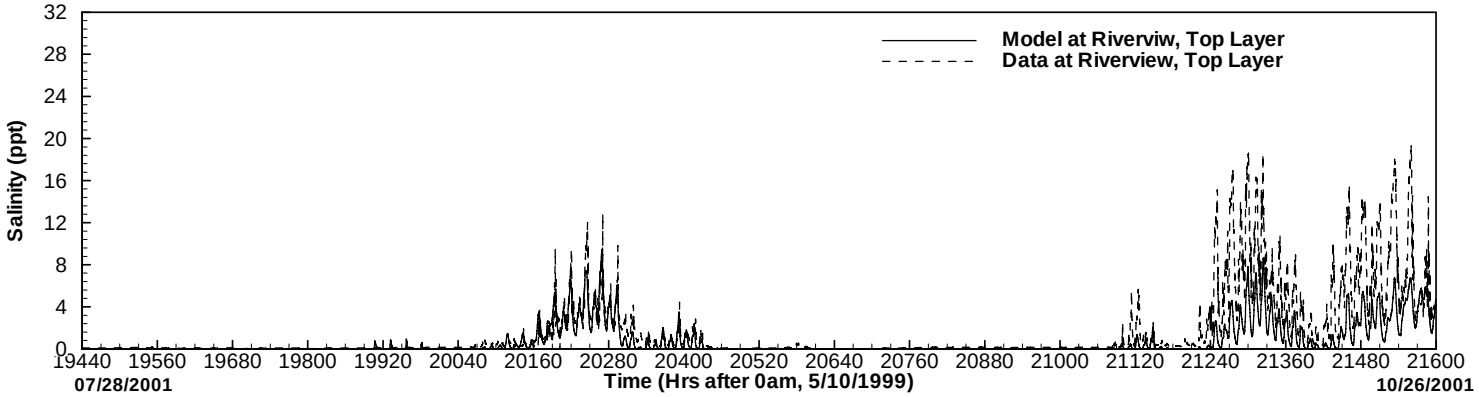

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
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15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
Time (Hrs after 0am, 5/10/1999)
04/29/2001

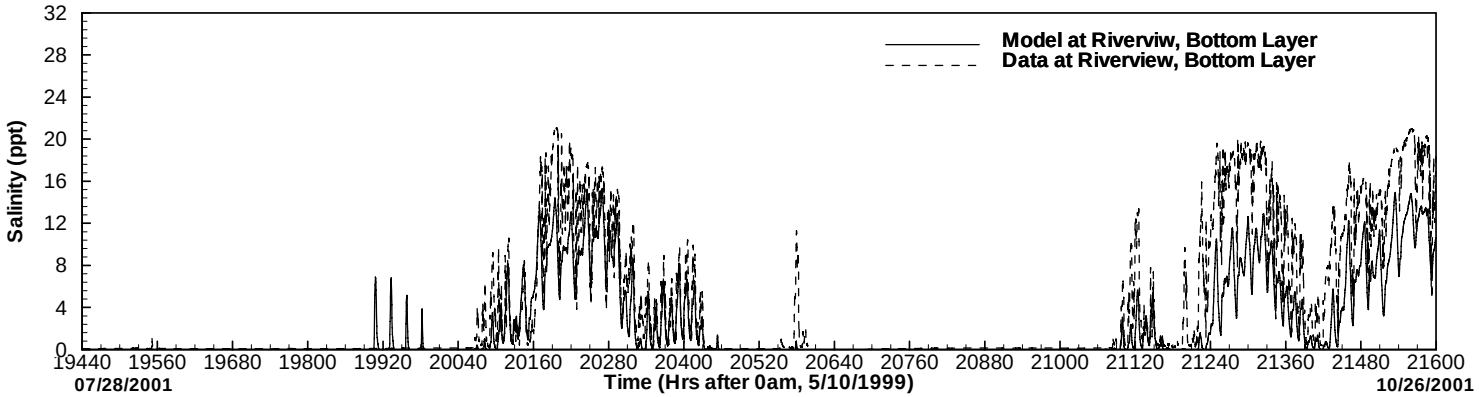

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
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15120 15240 15360 15480 15600 15720 15840 15960 16080 16200 16320 16440 16560 16680 16800 16920 17040 17160 17280
01/29/2001
Time (Hrs after 0am, 5/10/1999)
04/29/2001

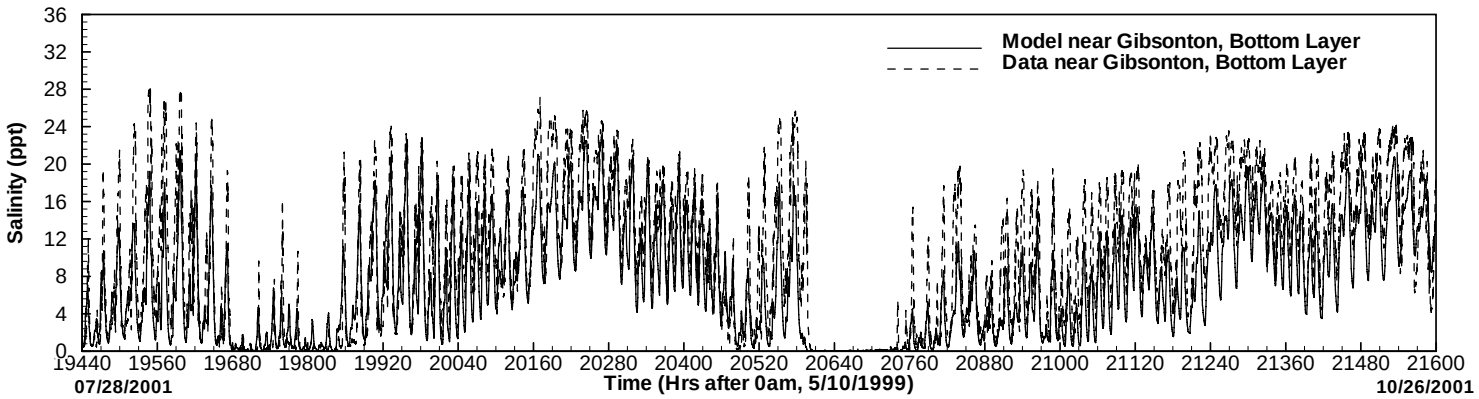

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
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17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
Time (Hrs after 0am, 5/10/1999)
07/28/2001

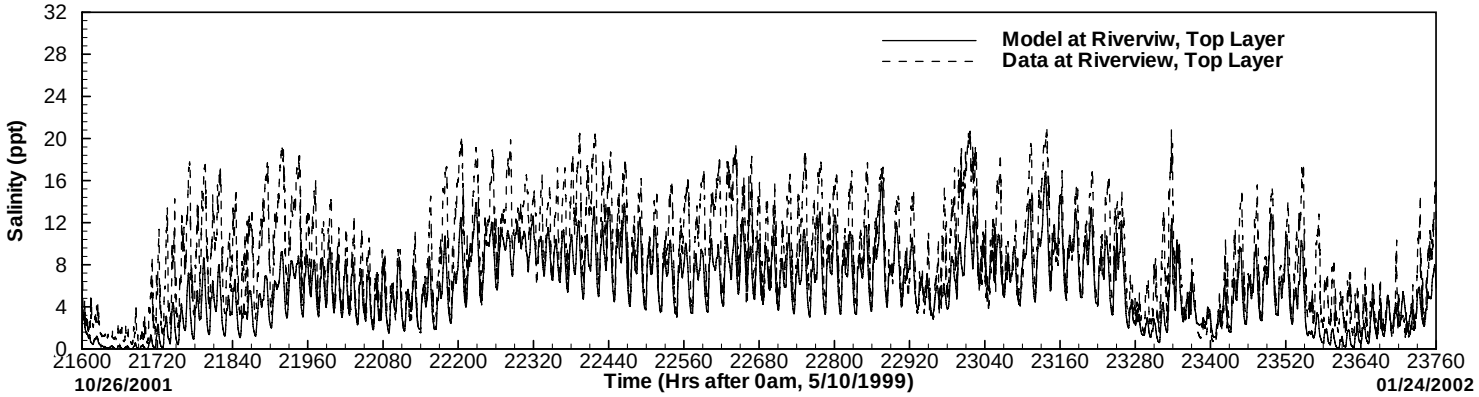

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
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32
17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
Time (Hrs after 0am, 5/10/1999)
07/28/2001

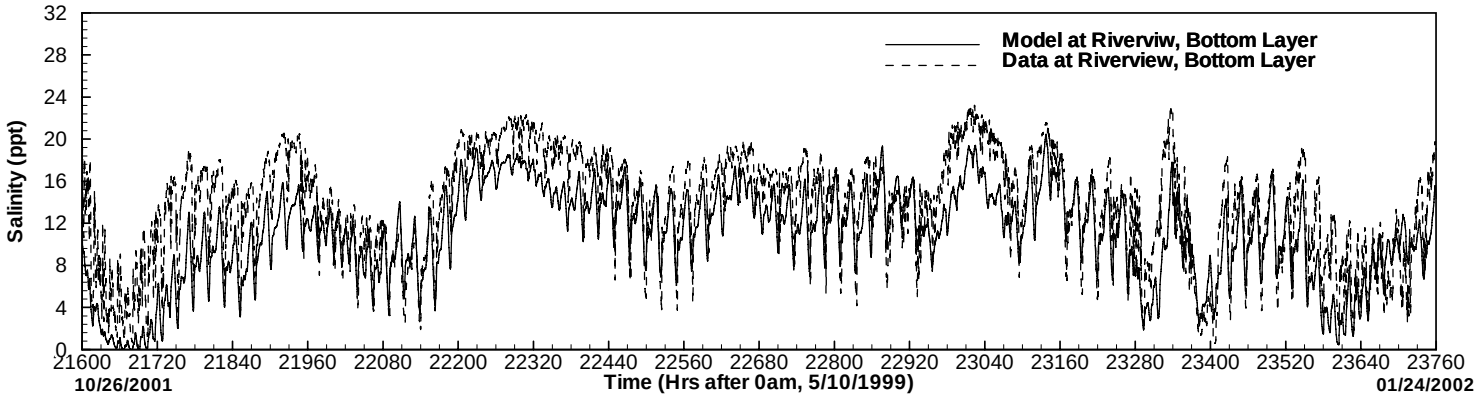

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
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24
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36
17280 17400 17520 17640 17760 17880 18000 18120 18240 18360 18480 18600 18720 18840 18960 19080 19200 19320 19440
04/29/2001
Time (Hrs after 0am, 5/10/1999)
07/28/2001

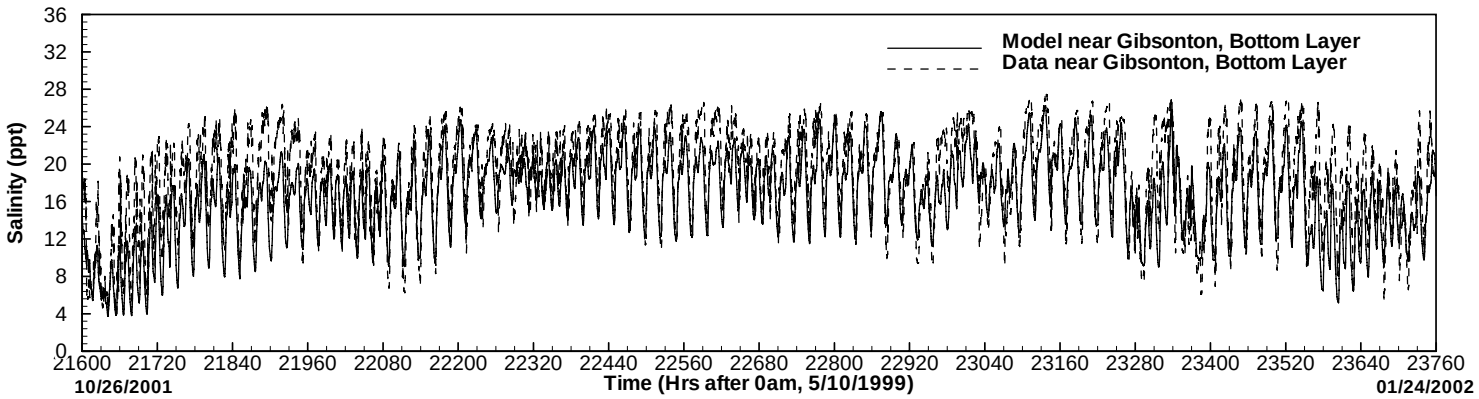

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
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28
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19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
Time (Hrs after 0am, 5/10/1999)
10/26/2001

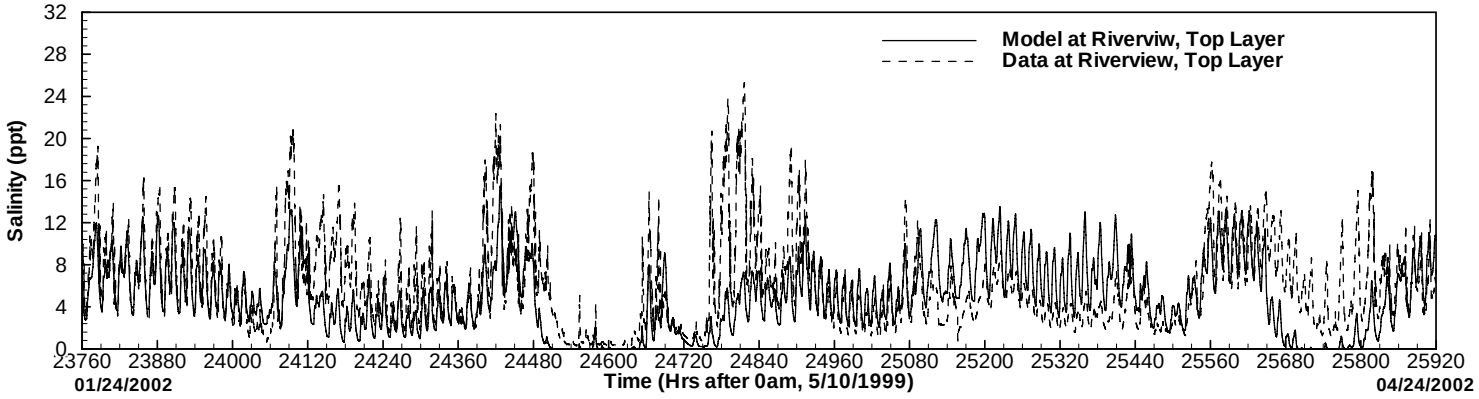

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
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32
19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
Time (Hrs after 0am, 5/10/1999)
10/26/2001

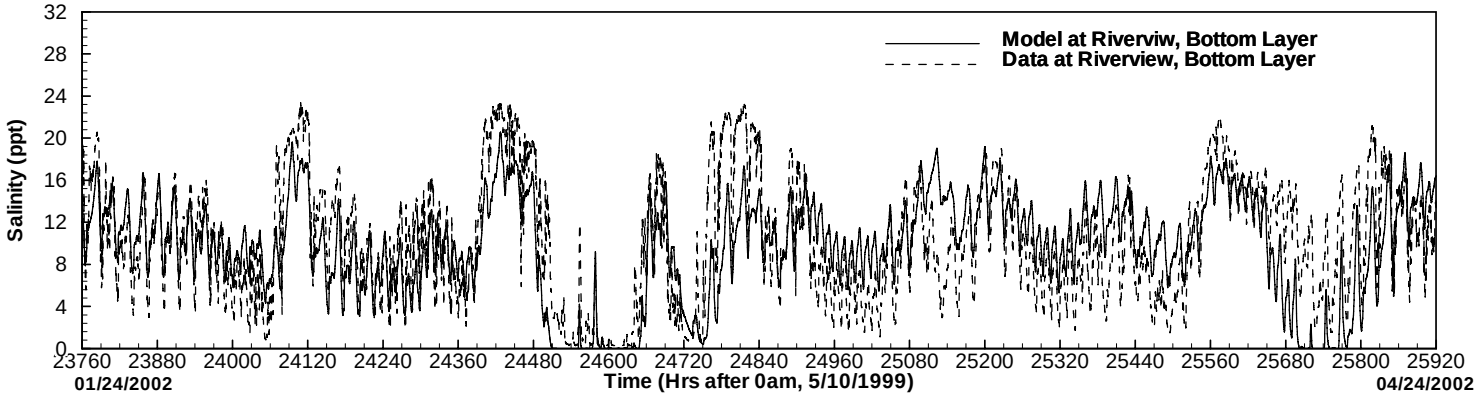

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
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19440 19560 19680 19800 19920 20040 20160 20280 20400 20520 20640 20760 20880 21000 21120 21240 21360 21480 21600
07/28/2001
Time (Hrs after 0am, 5/10/1999)
10/26/2001

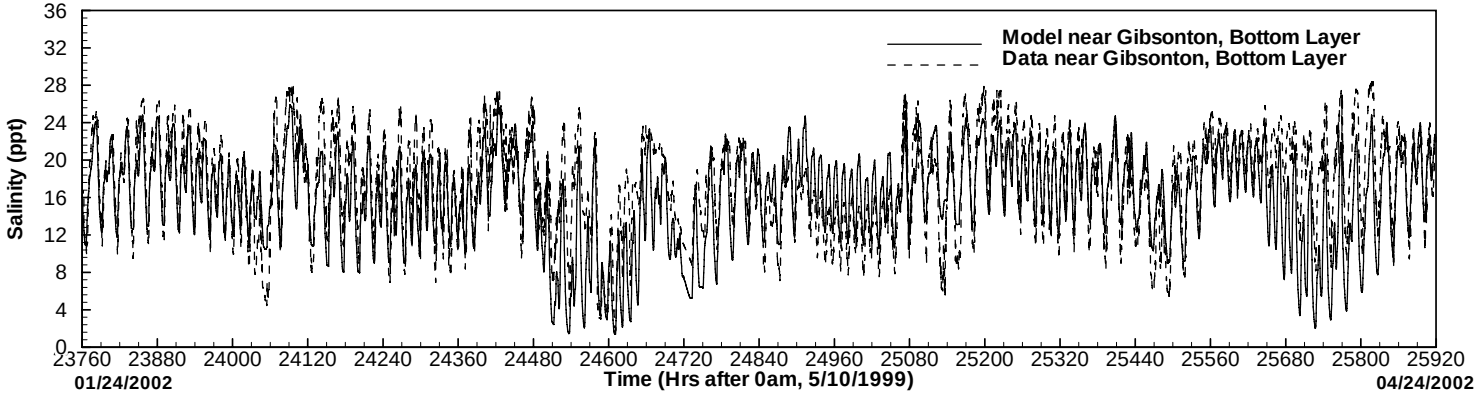

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
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28
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21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
Time (Hrs after 0am, 5/10/1999)
01/24/2002

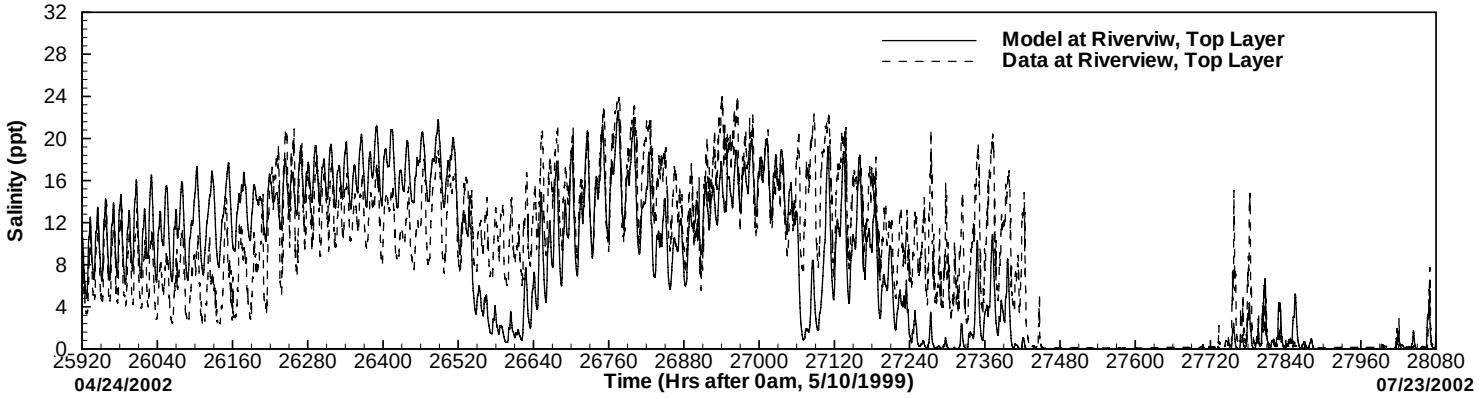

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
16
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32
21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
Time (Hrs after 0am, 5/10/1999)
01/24/2002

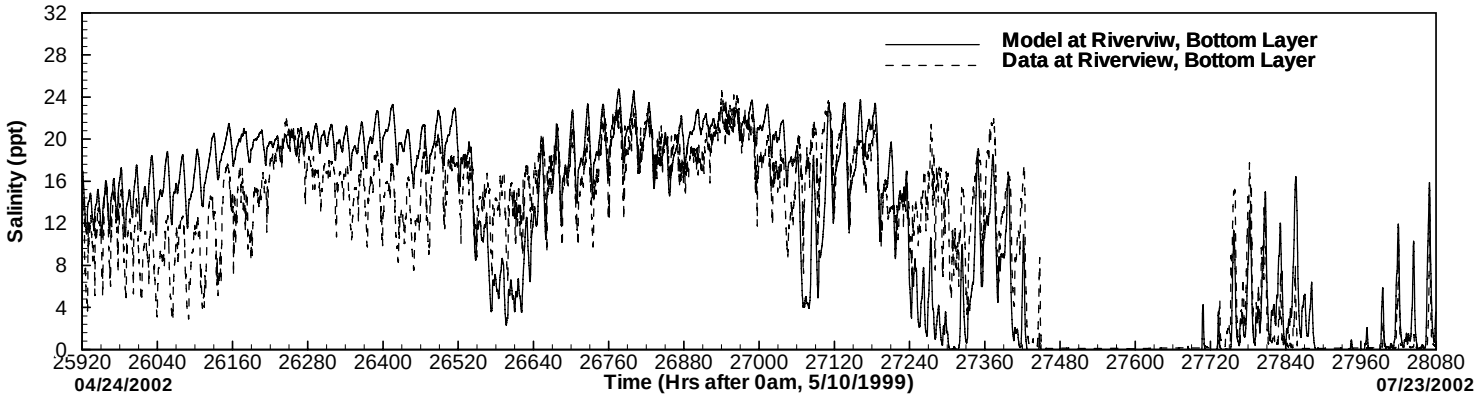

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
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21600 21720 21840 21960 22080 22200 22320 22440 22560 22680 22800 22920 23040 23160 23280 23400 23520 23640 23760
10/26/2001
Time (Hrs after 0am, 5/10/1999)
01/24/2002

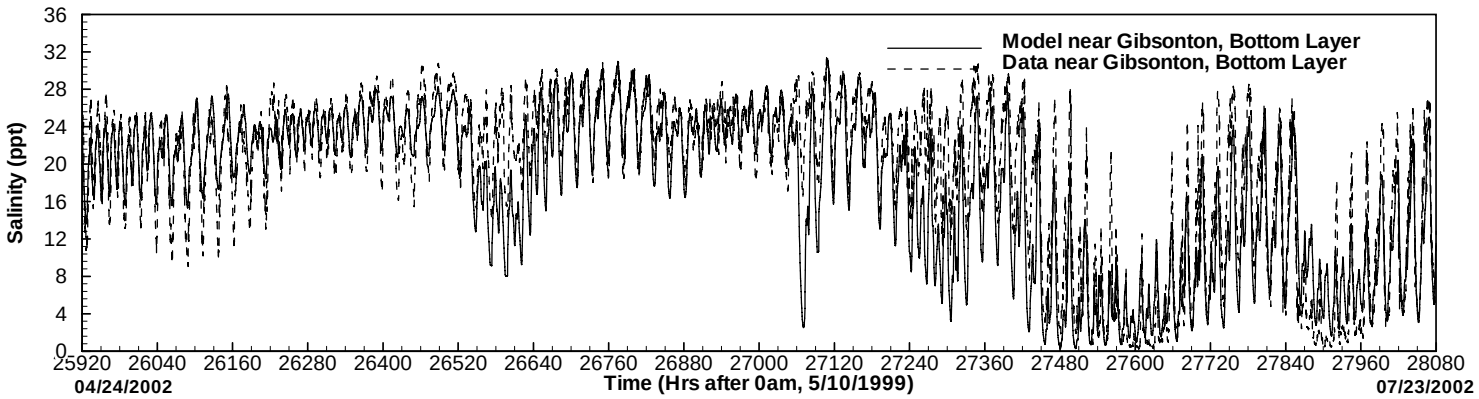

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
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24
28
32
23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
Time (Hrs after 0am, 5/10/1999)
04/24/2002

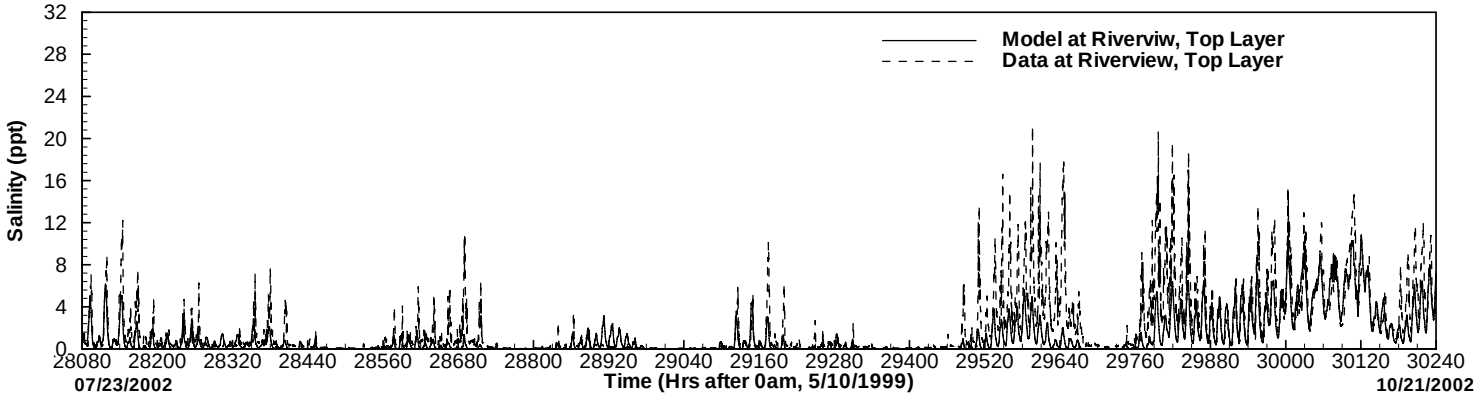

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
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23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
Time (Hrs after 0am, 5/10/1999)
04/24/2002

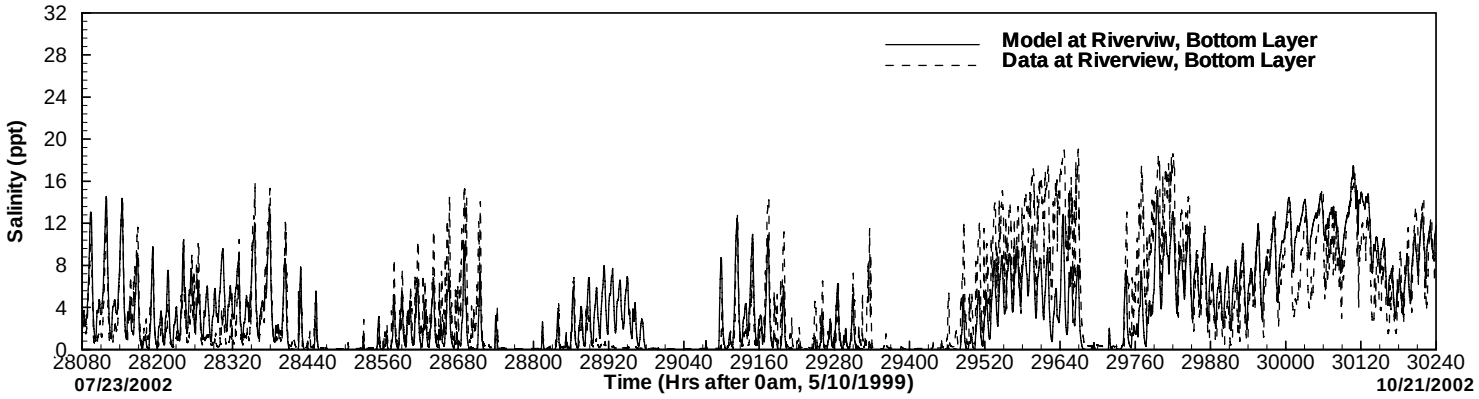

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
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23760 23880 24000 24120 24240 24360 24480 24600 24720 24840 24960 25080 25200 25320 25440 25560 25680 25800 25920
01/24/2002
Time (Hrs after 0am, 5/10/1999)
04/24/2002

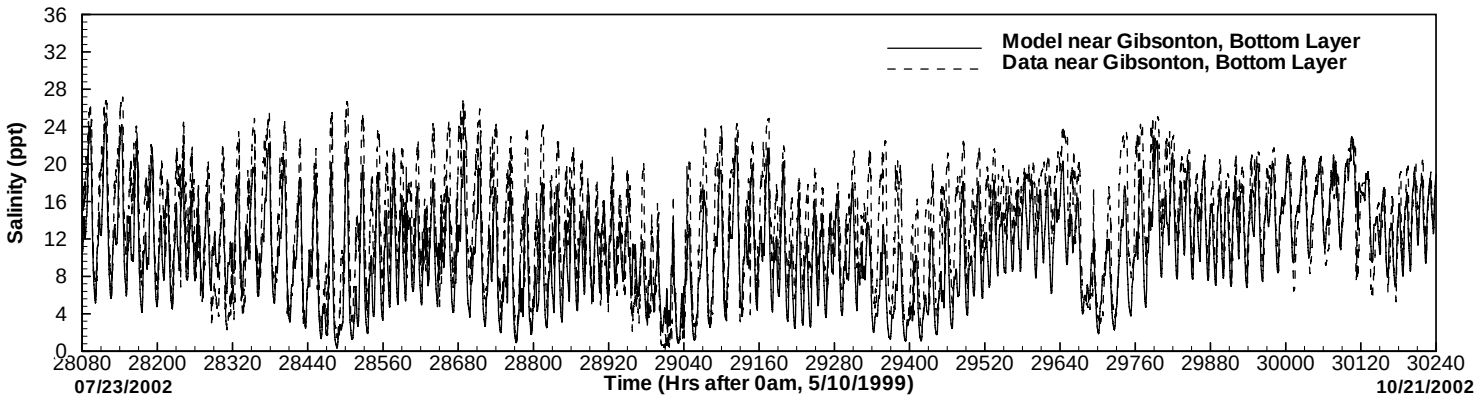

Model at Riverviw, Top Layer
Data at Riverview, Top Layer
Salinity (ppt)
0
4
8
12
16
20
24
28
32
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
Time (Hrs after 0am, 5/10/1999)
07/23/2002

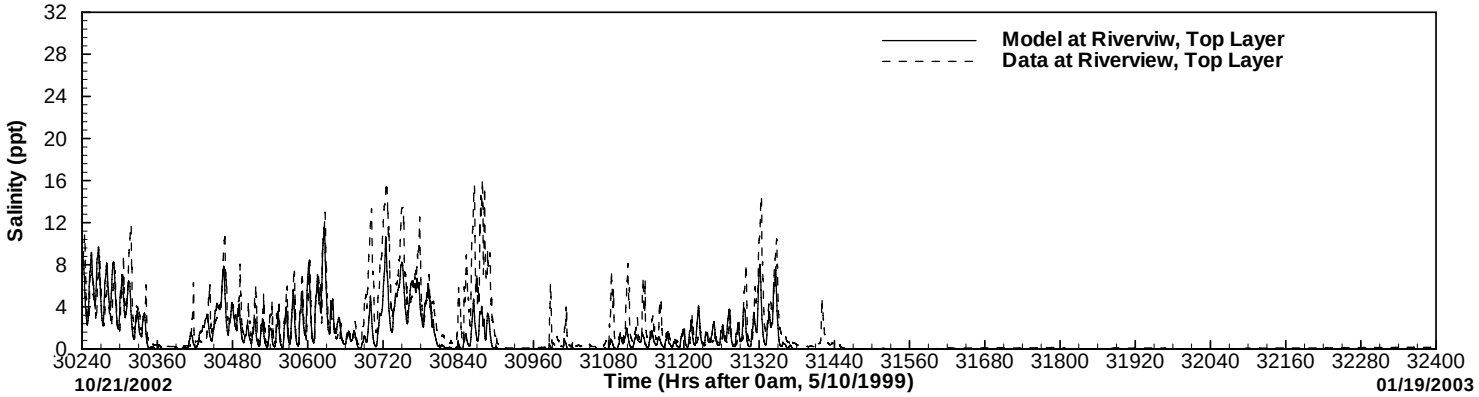

Model at Riverviw, Bottom Layer
Data at Riverview, Bottom Layer
Salinity (ppt)
0
4
8
12
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28
32
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
Time (Hrs after 0am, 5/10/1999)
07/23/2002

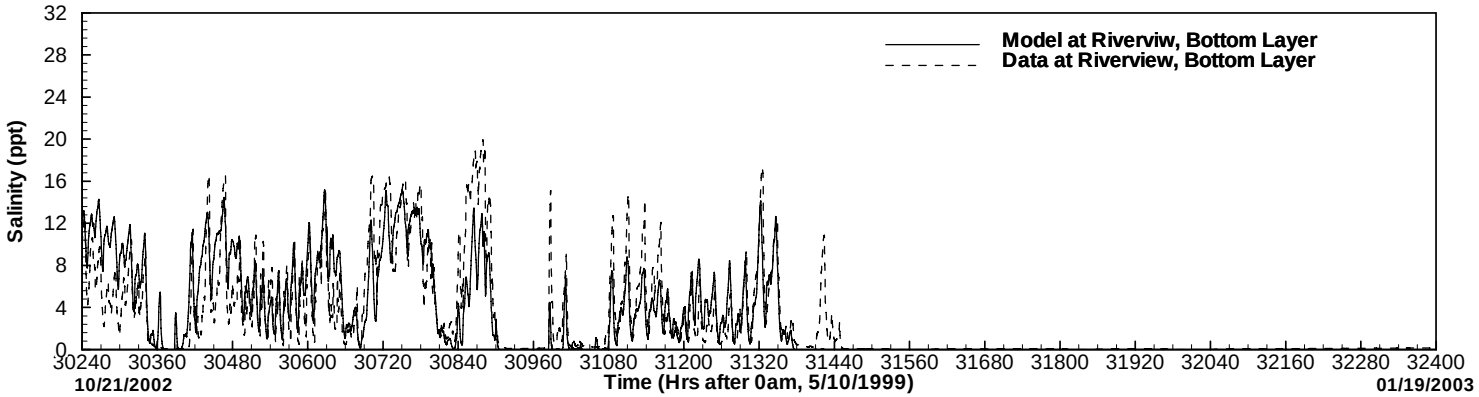

Model near Gibsonton, Bottom Layer
Data near Gibsonton, Bottom Layer
Salinity (ppt)
0
4
8
12
16
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24
28
32
36
25920 26040 26160 26280 26400 26520 26640 26760 26880 27000 27120 27240 27360 27480 27600 27720 27840 27960 28080
04/24/2002
Time (Hrs after 0am, 5/10/1999)
07/23/2002

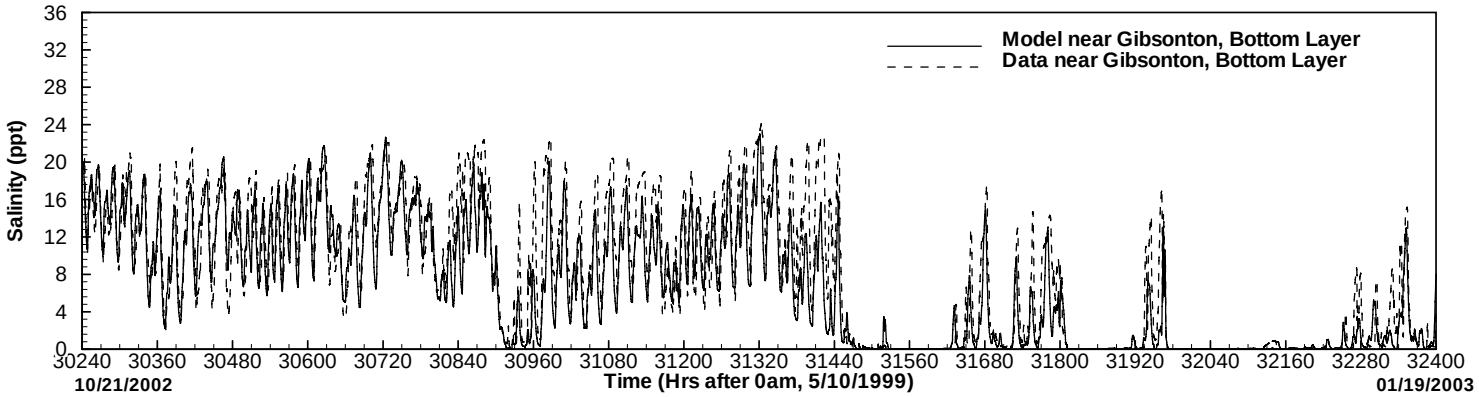

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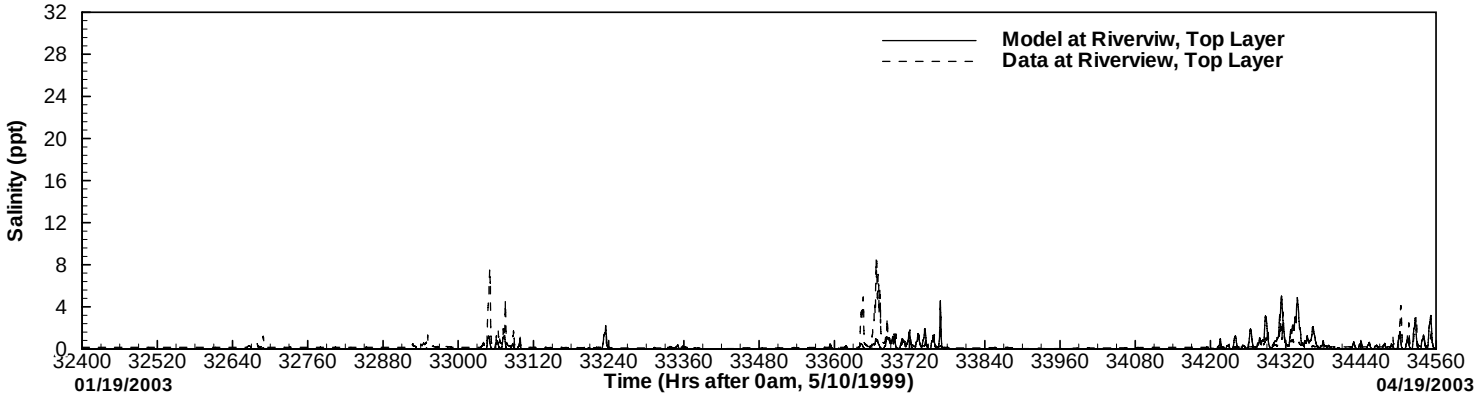

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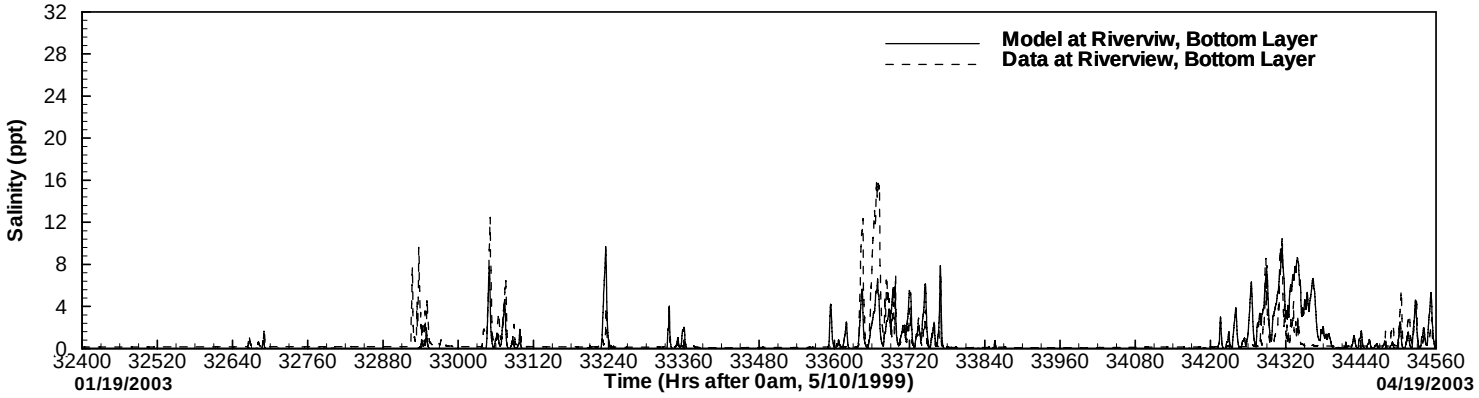

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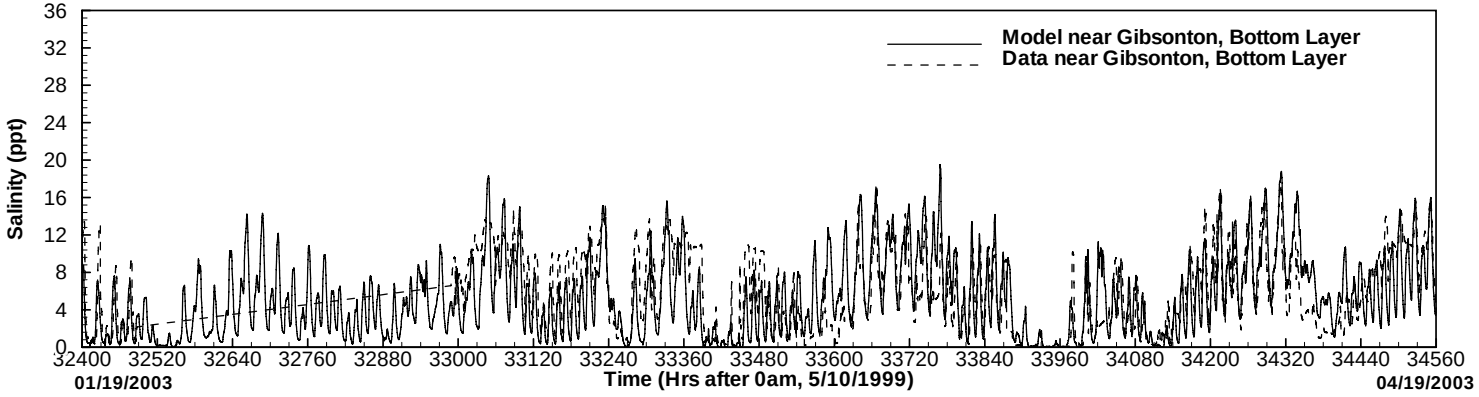

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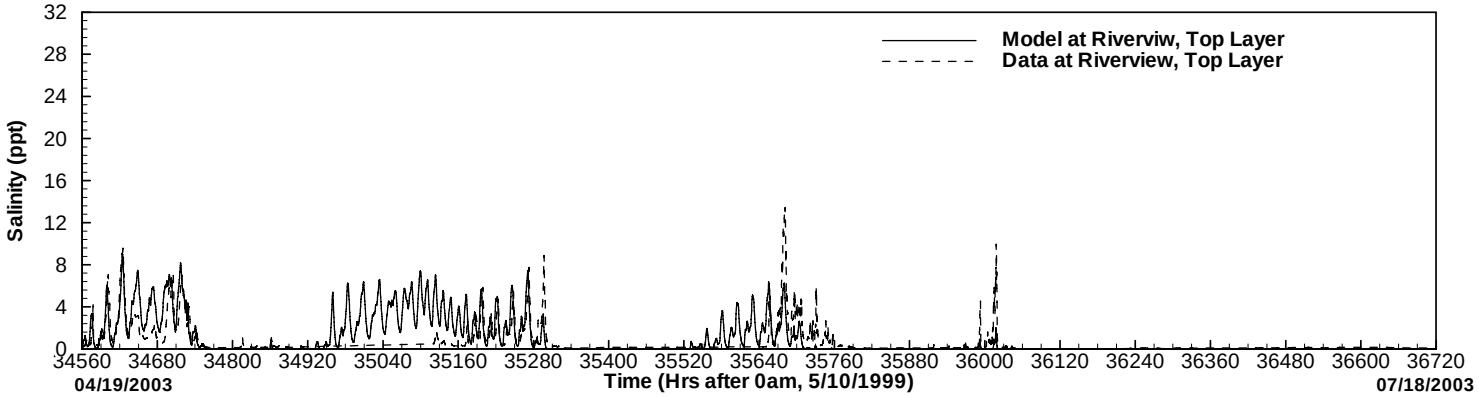

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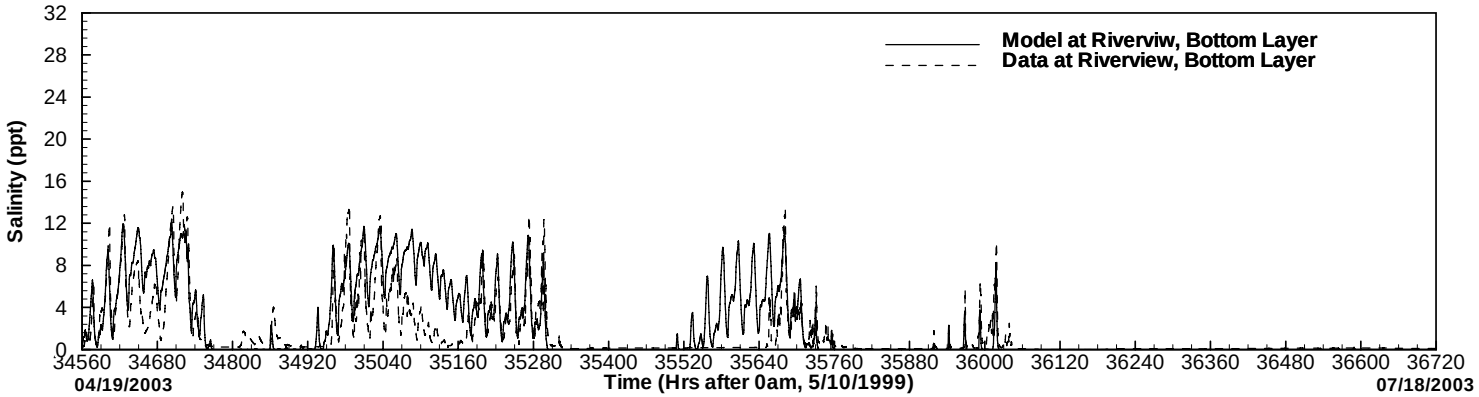

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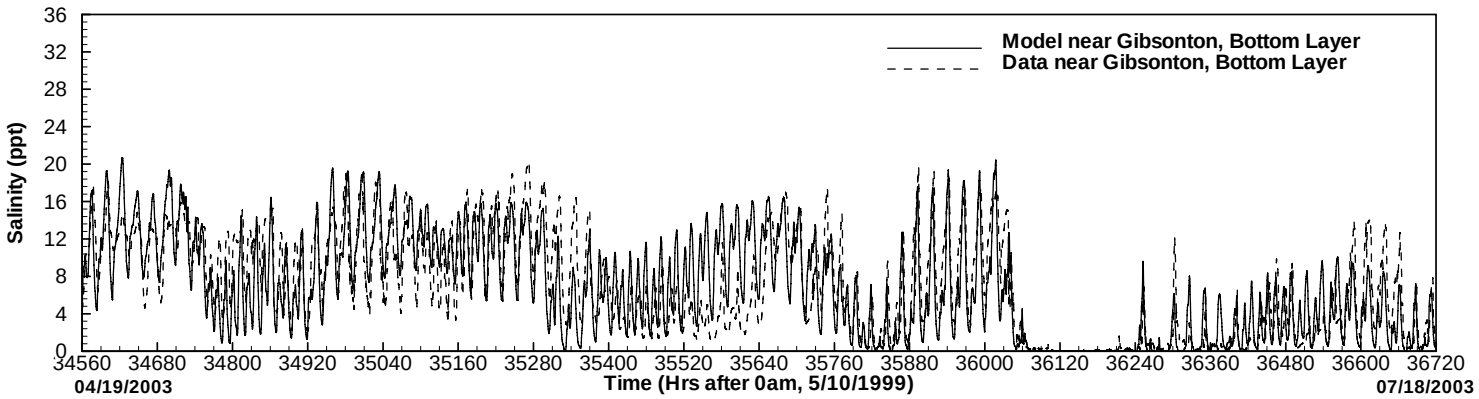

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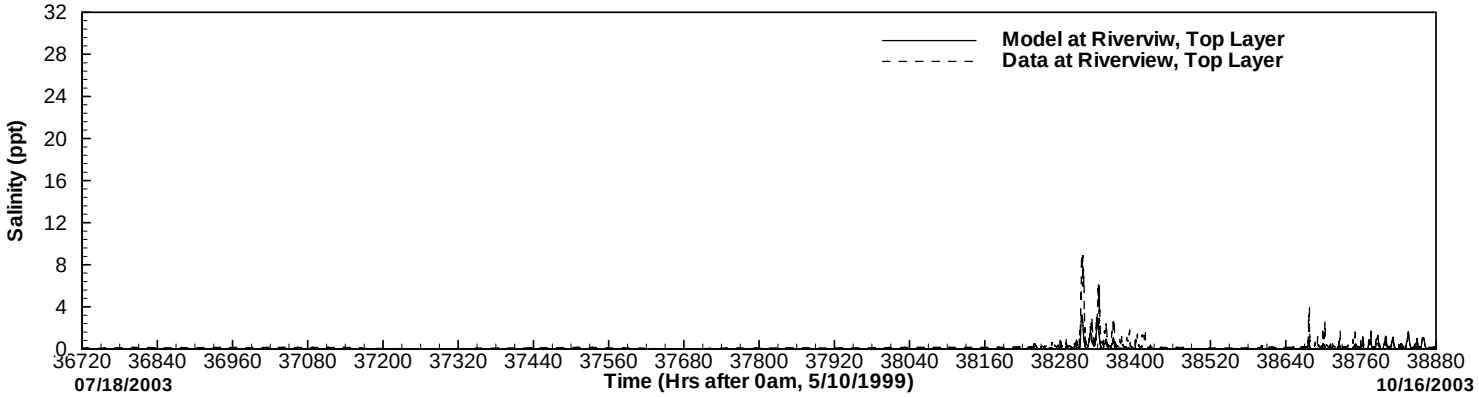

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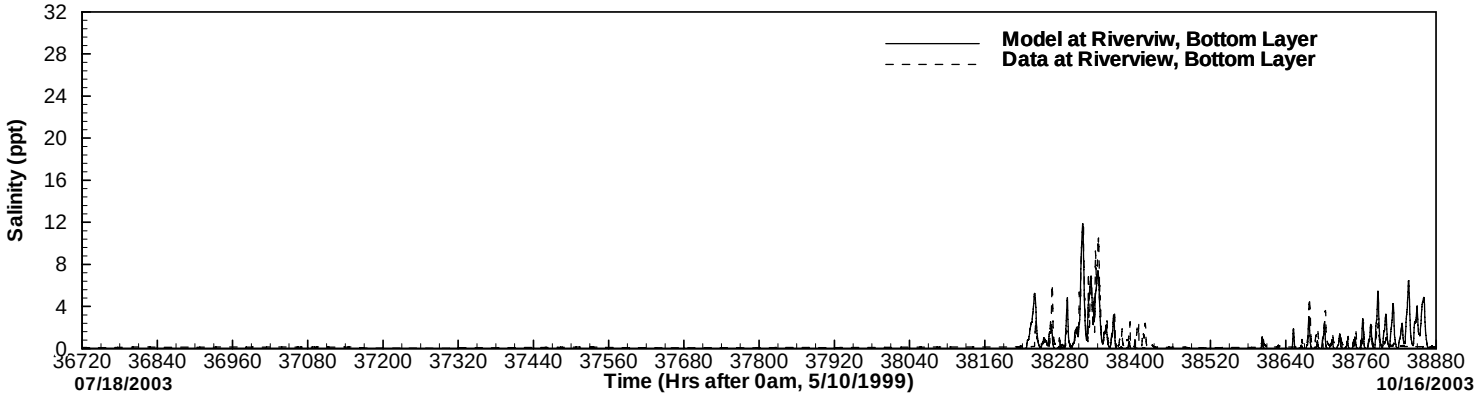

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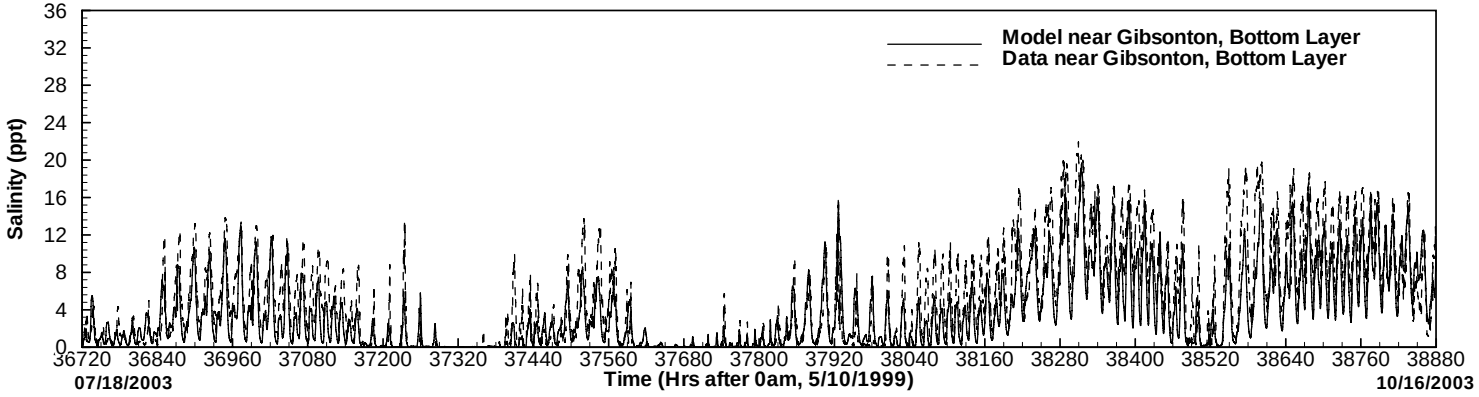

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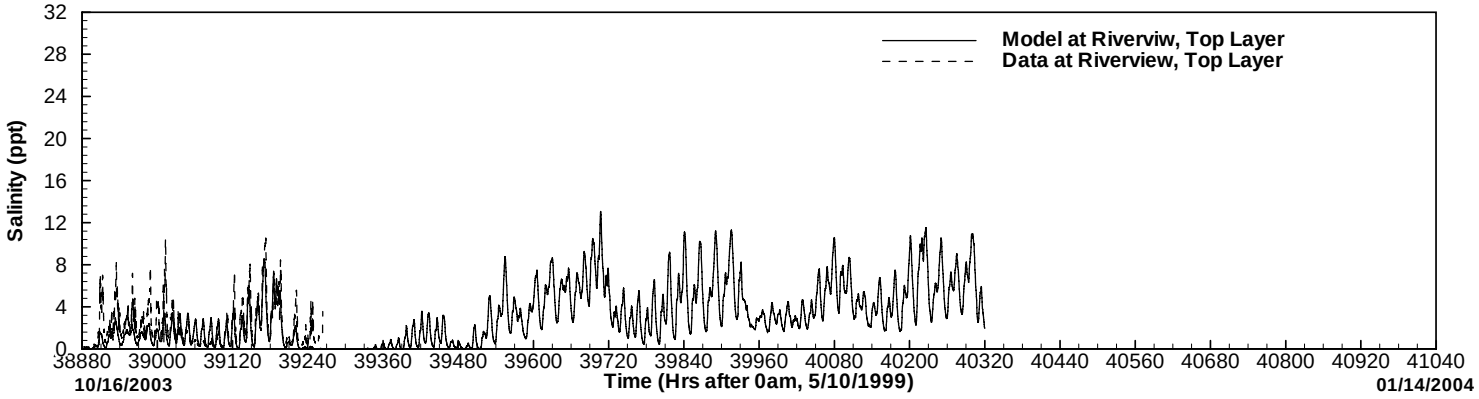

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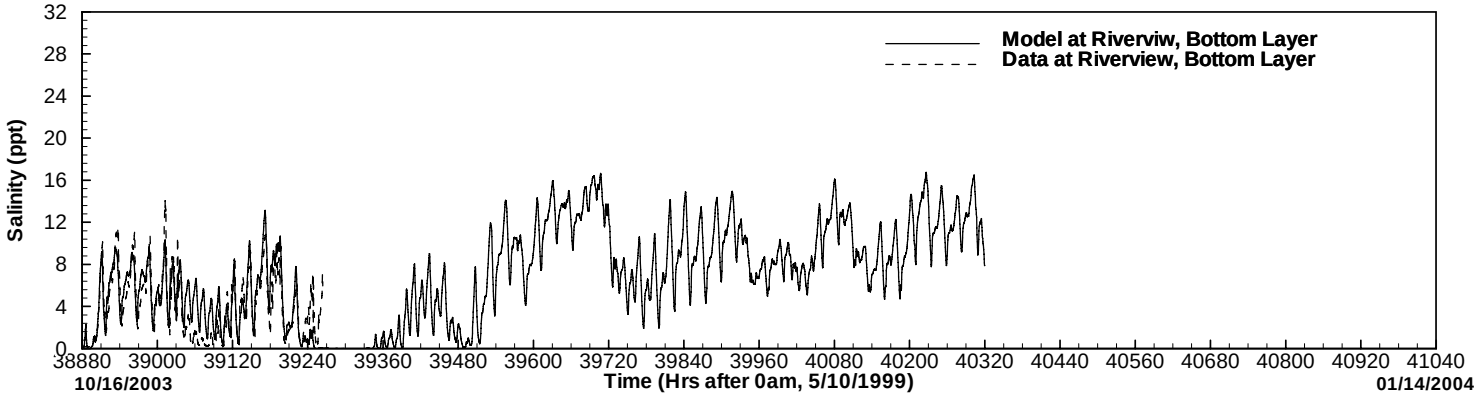

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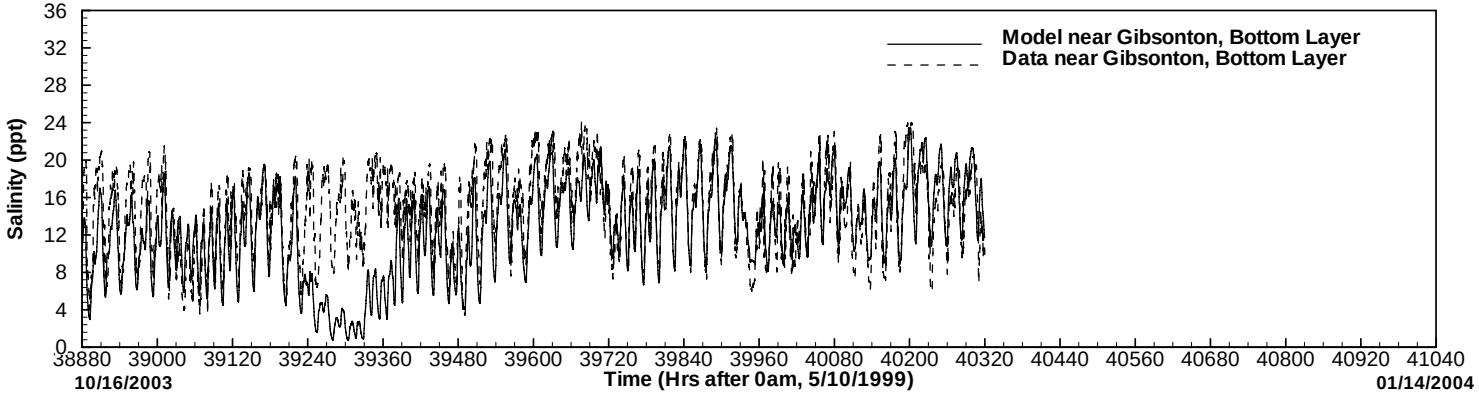

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Appendix 4B

A Tracer Model for Narrow Rivers and Estuaries



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January 10, 2009

Summary

This document describes a tracer sub-model that is included in the LAMFE (Laterally Averaged Model for Estuaries) model. This sub-model allows the LAMFE model to simulate trajectories of conservative particles in narrow rivers and estuaries, and thus provides a tool for estimating various transport time scales in these water bodies. The tracer module uses a random walk method to simulate the diffusion process. The displacement of the particle due to the advective transport and random walk is tracked each time step. If the particle hits the bottom or the free surface, it bounces back. If it migrates outside the simulation domain, it is assumed to be gone and will not be included in the simulation in the subsequent time steps.

Several tracer simulations have been conducted for the Lower Alafia River, Florida. The LAMFE model was run for six constant freshwater flow rate at the USGS Lithia station, including 5, 10, 15, 20, 50, and 100 cfs. It was found that the transit time for the river segment between Lithia and the US41 bridge varies between 4 to about 10 days when the flow rate at Lithia varies between 100 and 5 cfs.

Introduction

In analyzing ecological characteristics and water quality dynamics of a water body, it is generally necessary to have a sound understanding of important transport process in the water body. Ecologists often use time scales such as residence time, flushing time, transit time, and freshwater age to characterize complicated transport process in the water body and try to find the linkage among some water quality parameters with these transport time scales. For example, in an early empirical lake eutrophication study, Vollenweider (1976) used the hydraulic residence time to investigate algal biomass dynamics in the lake. Monsen et al. (2002) reviewed the use of flushing time, residence time, and age as transport time scales for various water bodies by different researchers.

There are several simple models that can be used to estimate transport time scales in rivers, lakes, and estuaries. Sheldon and Alber (2002) conducted a literature review on this topic, including publications by, among others, Zimmerman (1976), Eriksson (1971), Takeoka (1984), Vallino and Hopkinson (1998), Bolin and Rodhe (1973), Dyer (1973), and Miller and McPherson (1991). Based on Miller and McPherson's work on Charlotte Harbor, Florida, Sheldon and Alber (2002) developed a so-called SqueezeBox model for the Atlamaha River estuary, Georgia. While these simple models are easy to use and provide some qualitative estimates of various transport time scales, they are often not sophisticated enough to provide accurate and quantitative time scales in the estuary.

To accurately estimate important transport time scales such as residence time, transit time, and freshwater ages in estuaries, a tracer model should be used to simulate the trajectories of conservative tracers. For this purpose, a tracer sub-model has been recently added to the two-dimensional hydrodynamic model LAMFE (Chen, 1997; Chen and Flannery, 1997; Chen et al., 2000; Chen, 2003; Chen, 2004). The tracer routine uses a random walk method to simulate the diffusion process. It is called in the LAMFE model after the new velocity field at the new time

step is calculated. The averaged of the new velocity field and the velocity field at the previous time step is used to find u- and w-velocities of the particle during the time step)*t* using a bilinear interpolation. The new location of the particle is estimated after the displacement of the particle due to advection and diffusion is calculated. If the particle migrates beyond the bed and the free surface, it will bounce back to the water column.

To obtain information on transport time scales in the Lower Alafia River, Florida, the tracer model was applied for the river segment between the USGS Lithia station and the USGS US41 station. The total length of the simulation domain is about 23.25km. Particles are released from the upstream boundary that is above the tidal reach. To find out how the freshwater flow rate at the USGS Lithia station affects the transport process in the river, tracer simulations were conducted for various flow rates at Lithia, including 5, 10, 15, 20, 50, and 100 cfs. It was found that the transit time for the Lower Alafia River is about 10 days when the freshwater inflow at Lithia is very low.

In the following, theories of the tracer simulation implemented in the LAMFE model are described, followed by a description of model applications to the Lower Alafia River. Source code of the tracer sub-model, along with that of the post-program, is then briefly explained, before conclusions are drawn. All source codes are attached in the Appendix A. Particle distributions at different time points for a total of six flow rates at Lithia are included in the Appendixes B through G.

Theories

The LAMFE model uses the Cartesian coordinates without any transformations. The model can fit the bottom topography using a piecewise linear bottom, resulting a hybrid grid system that contains both rectangular interior cells and unstructured surface and bottom cells (Chen, 2004). Figure 1 shows the grid cells used in the LAMFE model. The thick line in Figure 1 is the piecewise linear bottom.

As shown in the figure, a staggered arrangement of model variables is used in the LAMFE model: the horizontal velocity (u) is defined at the center of the east face of the grid cell, the vertical velocity is defined at the center of the top face of the grid cell, and scalar variable such as density, pressure, and concentrations are defined at the center of the grid cell. The surface elevation is a one-dimensional variable and is defined at the center of the grid.

The main body of the tracer sub-model in LAMFE the subroutine TRACER. A random walk method similar to that used in Chen (1989, 1990a and 1990b) has been implemented in the TRACER routine to simulate the particle movement due to the diffusion processes. For each particle, the TRACER routine first finds out the grid cell in which it is located. At the same time, it also figures out which four u-velocity points and which four w-velocity points it will use to estimate the u- and w-velocities of the particles. This process can be explained with help of two particles shown in Figure 1. The first particle is shown with the red dot, while the other with the blue dot. At time = *t*, both particles are located in grid cell (i, k). In other words, they are located between lines I_1 and I_2 in the x-direction and between lines $K_1$and K_2 in the z-direction. Note that

I_1 (K_1) for the red dot is I_2 (K_2) for the blue dot, and vise verse. The program first finds out I_1(K_1), and then I_2 (K_2) based on the relative locations of the particle and the I_1 (K_1) line. I_1 and I_2 tell the program that u(I_1, k) and u(I_2, k) will be used for the bilinear interpolation of u, while K_1 and K_2 tell the program that w(i, K_1) and w(i, K_2) will be used for the bilinear interpolation of w. The program then figures out whether u(I_1, k+1) and u(I_2, k+1) or u(I_1, k-1) and u(I_2, k-1) should be used for the interpolation of u by determining which quarter of the grid cell the particle resides. If it is in the first or second quarter, then u(I_1, k+1) and u(I_2, k+1) are used. Otherwise u(I_1, k-1) and u(I_2, k-1) are used for interpolating u. Similarly for w, if the particle is in the first or fourth quarter, w(i+1, K_1) and w(i+1, K_2) will be used for the w interpolation. Otherwise, w(i-1, K_1) and w(i-1, K_2) will be used for the w interpolation.

Once the four u-points and the four w-points are determined, the subroutine will do a bilinear interpolation to get the u- and w-velocities of the particle. The displacement of the particle due to advection within the time step)t will be

$$\begin{aligned} \Delta x_{adv} &= \frac{u^n + u^{n+1}}{2}\Delta t \\ \Delta z_{adv} &= \frac{w^n + w^{n+1}}{2}\Delta t \end{aligned} \tag{1}$$

where u^n and u^{n+1} are u-velocities of the particle at the previous and current time points, respectively; w^n and w^{n+1} are w-velocities of the particle at the previous and current time points, respectively; and Δx_{adv} and Δz_{adv} are projections of the displacement of the particle due to advection in the x- and z-directions, respectively. Note that the bilinear interpolation is performed using the average of the velocity fields at the previous and current time points.

The displacement of the particle due to the diffusion process during the time step)t is

$$\begin{aligned} \Delta x_{diff} &= R_x\sqrt{2\Delta t B_h} \\ \Delta z_{diff} &= R_z\sqrt{2\Delta t B_v} \end{aligned} \tag{2}$$

where R_x and R_z are two random variables; B_h abd B_v are diffusivities in the horizontal and vertical directions, respectively; and Δx_{diff} and Δz_{diff} are respectively projections of the displacement of the particle due to diffusion in the x- and z-directions. Two options are available for the random distribution. One is the Gaussian distribution, and the other is a uniform distribution.

The new position of the particle will then be

$$\begin{aligned} x' &= x^n + \Delta x_{adv} + \Delta x_{diff} \\ z' &= z^n + \Delta z_{adv} + \Delta z_{diff} \end{aligned} \tag{3}$$

The above expression of the particle location is not necessarily final. Due to the large the time step used in the model run, the particle may hit the bottom and bounce back to the water column. Because of the use of the piecewise linear bottom in LAMFE, the bouncing of the particle from the bottom is somewhat complicated and is described here. In the following, the lowest cross-sectional bottom elevation at the interface between two grids (HBU) is given and the lowest cross-sectional bottom elevation at the center of the grid (HB) is calculated from

HBU. Therefore, the bottom of the grid is one single straight line defined by [XX(I-1), HBU(I-1)] and [XX(I), HBU(I)] shown in Figure 1.

Figure 2 and 3 illustrate six scenarios of particle bouncing back from the bottom. The bottom slope in Figure 2 is positive, while it is negative in Figure 3. Relationships among various angles (incident angle, reflection angle, angle of the bottom, etc.) are also shown in the figures. It is found that the reflection angle of the particle is related to the angle of the bottom and the incident angle as follows

$$\alpha^* = 2\alpha_w - \alpha_p \tag{4}$$

where α^* is the reflection angle of the particle, α_w is the angle of the bottom, and α_p is the incident angle of the particle. All these three angles are measured in relationship with the x-axis (red lines shown in Figures 2 and 3). It is assumed that the angle between particle's approaching path and the sloping bottom (α) is the same as the angle between particles' bouncing path and the bottom.

It may be possible that the particle migrates a few grids in the horizontal direction during one time step. In this case, the subroutine checks, starting from the grid where the particle is located at the previous time step, each grid the particle passes to see if it will hit any of the bottom segments. Once it hit the bottom in one of the grids, it bounces back to the water. It is assumed that the particle can only bounce back from the bottom one time during the time step. After checking the bottom, the subroutine checks the free surface to decide if the particle will bounce back from the free surface, too.

Let the particle displacement during the time step)t be expressed with the following linear equation

$$A_1 z + B_1 x + C_1 = 0 \tag{5}$$

where A_1, B_1, and C_1 can be calculated as follows

$$\begin{aligned} A_1 &= z^n - z' \\ B_1 &= x' - x^n \\ C_1 &= -z^n B_1 - x^n A_1 \end{aligned} \tag{6}$$

Similarly, let the bottom segment be expressed with the following linear equation

$$A_2 z + B_2 x + C_2 = 0 \tag{7}$$

where A_2, B_2, and C_2 can be calculated as follows

$$\begin{aligned} A_2 &= HBU(I_1) - HBU(I_2) \\ B_2 &= XX(I_2) - XX(I_1) \\ C_2 &= -HBU(I_1)B_2 - XX(I_1)A_2 \end{aligned} \tag{8}$$

If the particle hits the bottom, the two lines will intersect. The intersection point can be calculated using the following equation

$$x_{hit} = -\frac{\begin{vmatrix} C_1 & B_1 \\ C_2 & B_2 \end{vmatrix}}{\begin{vmatrix} A_1 & B_1 \\ A_2 & B_2 \end{vmatrix}}, \qquad z_{hit} = -\frac{\begin{vmatrix} B_1 & C_1 \\ B_2 & C_2 \end{vmatrix}}{\begin{vmatrix} A_1 & B_1 \\ A_2 & B_2 \end{vmatrix}}, \qquad \begin{vmatrix} A_1 & B_1 \\ A_2 & B_2 \end{vmatrix} \neq 0 \tag{9}$$

where x_{hit} and z_{hit} are respectively x- and z-coordinates of the intersection point.

The final location of the particle, after bouncing back from the bottom, can be calculated as follows

$$\begin{aligned} s_r &= \sqrt{(x'-x^n)^2 + (z'-z^n)^2} - \sqrt{(x_{hit} - x^n)^2 + (z_{hit} - z^n)^2} \\ x^{n+1} &= x_{hit} + s_r \cos\alpha^* \\ z^{n+1} &= z_{hit} + s_r \sin\alpha^* \end{aligned} \tag{10}$$

If the particle never hit the bottom or the free surface, then Equation (3) is the expression for the final location of the particle, or

$$\begin{aligned} x^{n+1} &= x' \\ z^{n+1} &= z' \end{aligned} \tag{11}$$

The above bouncing procedure can also be used for the free surface. However, because of the length scale in the vertical direction is much smaller than that in the horizontal direction, the free surface can be treated as horizontal, or $\alpha^* \cong \alpha_p$. As a result, Equation is much simpler and take the following form.

$$\begin{aligned} x^{n+1} &= x' \\ z^{n+1} &= 2H_p - z' \end{aligned} \tag{12}$$

where H_p is the free-surface elevation at $x = x'$.

Source Code

Same as the LAMFE code, the tracer sub-model is written using FORTRAN 90/95, and resides in the same directory as other LAMFE subroutines. The source code of the TRACER subroutine is included in Appendix A.1. A subroutine named BOUNCE is called by the TRACER subroutine to deal with the bouncing of the particle from the bottom. The source code of BOUNCE can be found in Appendix A.2.

Model results of the tracer simulation are output to a file named lamfe.tra in the AUSGABE subroutine of the LAMFE model. To plot out the model results using a commercial plot package named TecPlot, a post-program needs to be used to convert the model results to a format that TecPlot recognizes. This post-program is also written in FORTRAN 90/95 and shown in Appendix A.3.

When using TecPlot to generate an animation of the particle movement in the water body, a macro file was created that can be used to produce the movie. This macro file is named tracer.mcr and is included in Appendix A.4.

Application to the Alafia River

Tracer simulations were conducted for the lower portion of the Alafia River, Florida from the USGS Lithia station to the USGS US41 station. Particles were released from the upstream boundary where the bottom elevation is about 1.42m, NGVD. In the simulation, 200 conservative particles were released from Lithia three times, and each release events are separated by 24 hours. As thus, a total of 600 conservative particles were tracked as they migrate downstream.

To find out how the freshwater flow rate at the USGS Lithia station affects the transport process in the river, tracer simulations were conducted for various Lithia flow rates, including 5, 10, 15, 20, 50, and 100 cfs. Figures B-1 through B-11 in Appendix B are plots of simulated particle distributions at time = 0, 24, 48, 72, 96, 120, 144, 168, 192, 216, and 240 hours, respectively, corresponding to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 days after the first group of 200 particles were released at the Lithia station ($x = 0$). In these figures, particles in red were released at time = 0 hour, while those in green and blue were released at time = 24 and 48 hours, respectively. From these figure, it can be seen that due to the dispersion process, particles spread out as they are transported downstream. At a low flow rate of 5 cfs at the Lithia station, particles migrate about 5.5 km during the first 24 hours. Then, they slow down quite a bit. During the second and the third 24 hours, they migrate about 2.5 and 2 km, respectively. Before reaching the salinity wedge, particles are almost uniformly distributed over the water column. As they migrate further downstream and reach the salinity wedge, the particles are gradually transported to the top layer of the water column. This is consistent with the typical estuarine residual flow pattern that forces materials coming from the upstream to be transported to the upper layer due to the upward flow near the wedge.

Plots of simulated particle distributions at different time points for other flow rates at the Lithia station are shown in Appendix C through Appendix G, in the same order as these in Appendix B. Form all the figures shown in Appendix B through Appendix G, it is clear that even for a low flow rate of 5 cfs at Lithia, the transport time scale is relatively short for the first 8 km downstream from Lithia due to the sloping bed and the fact that part of the segment is above the tidal reach. Further downstream, the transport time scale becomes larger and larger. Once the particles reach the salinity wedge, they spread out and move to the top layer of the water column. The transit time for the Lower Alafia River should be about 4 days or less when the flow rate at Lithia is over 100 cfs. When the flow rate is reduced to 5 cfs, the transit time increases to about 10 days.

Conclusions

A tracer sub-model has been added to the LAMFE model, allowing the LAMFE model to simulate trajectories of conservative particles in narrow rivers and estuaries. Using the bilinear

interpolation, the tracer sub-model first estimates u- and w-velocities of each particles based on the average of the velocity fields at the previous and current time steps. The displacement of the particle due to advection is then calculated once the particle velocity is calculated. The displacement of the particle due to diffusion is modeled using a random walk method. If the particle migrates beyond the free surface and the bottom, it bounces back to the water column. A sophisticated procedure has been developed to calculate the bouncing of the particle from the bottom or from the free surface.

Tracer simulations have been conducted for the Lower Alafia River, Florida using the LAMFE model. Particles were released from the USGS Lithia station three times, each being apart by 24 hours. The model was run for constant freshwater flow rates of 5, 10, 15, 20, 50, and 100 cfs at Lithia. It was found that in the upstream portion of the river where the riverbed is above the tidal prism and has a relatively large slope, the transport process is generally simple and the transport time scale is relatively short even when the flow rate at Lithia is low. In the downstream portion of the river, the transport process is more complex and the speed of particle migration is much slower. Most of the transit time is spent in the downstream half of the simulation domain. Generally speaking, the transit time for the Lower Alafia River should be 10 days or less. When the flow rate at Lithia is 100 cfs or above, the transit time should be about 4 days or less.

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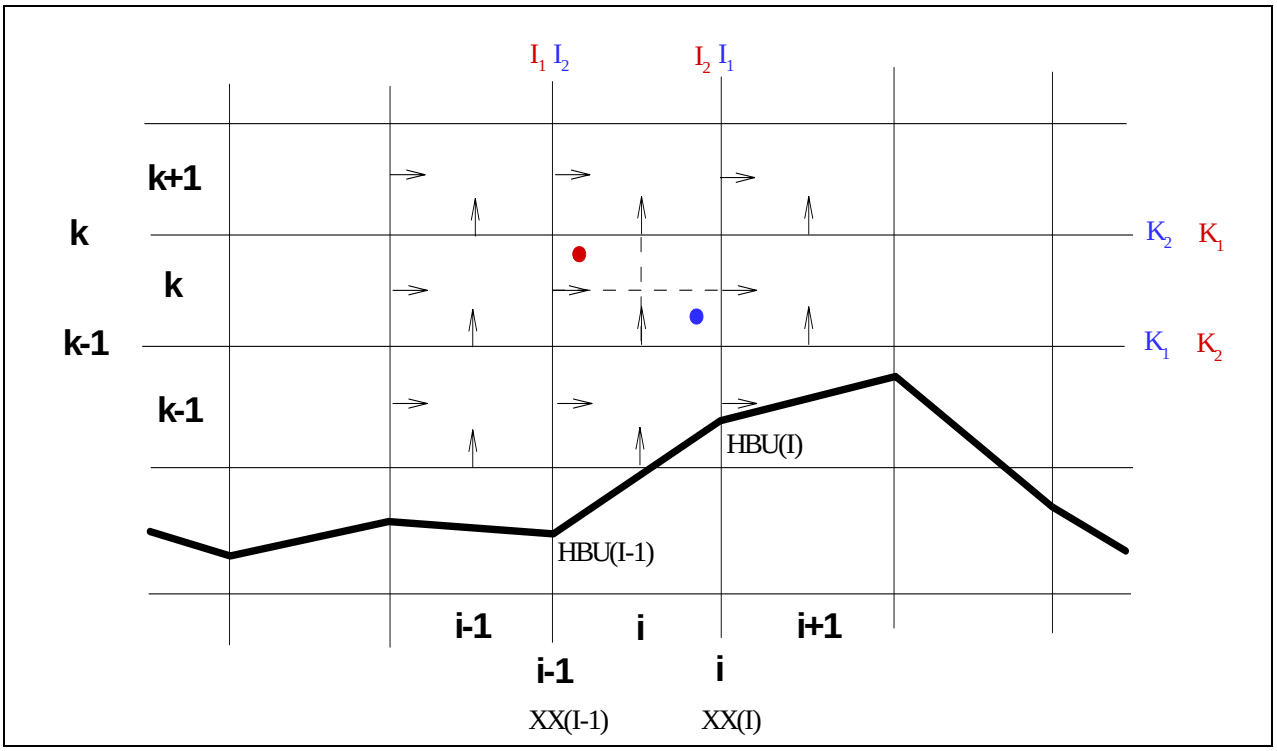


Figure 1 A piecewise linear bottom is used in the Cartesian grid model LAMFE to fit the bottom topography. The model uses a staggered arrangement of model parameters. Particles are U and w velocities

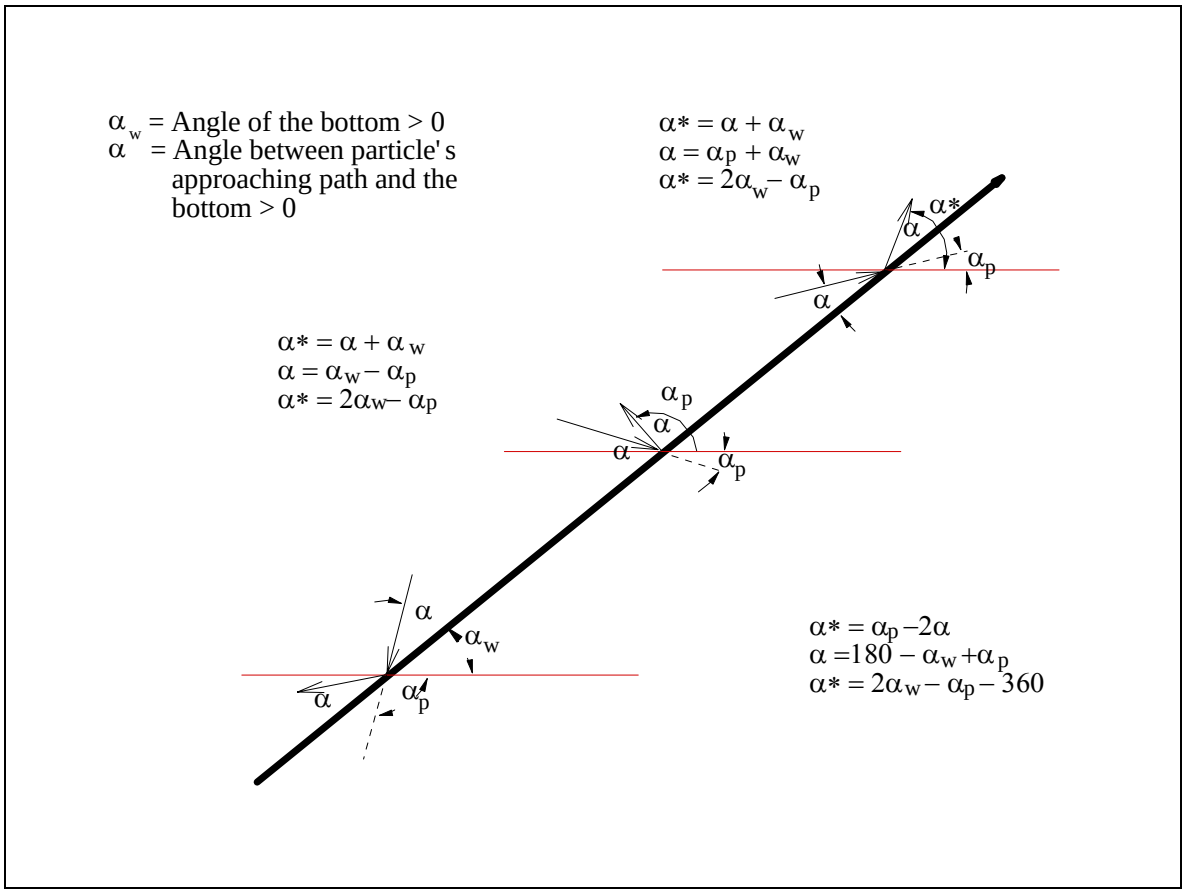


Figure 2 Three scenarios of particle bouncing back from a bottom segment with a positive slope.

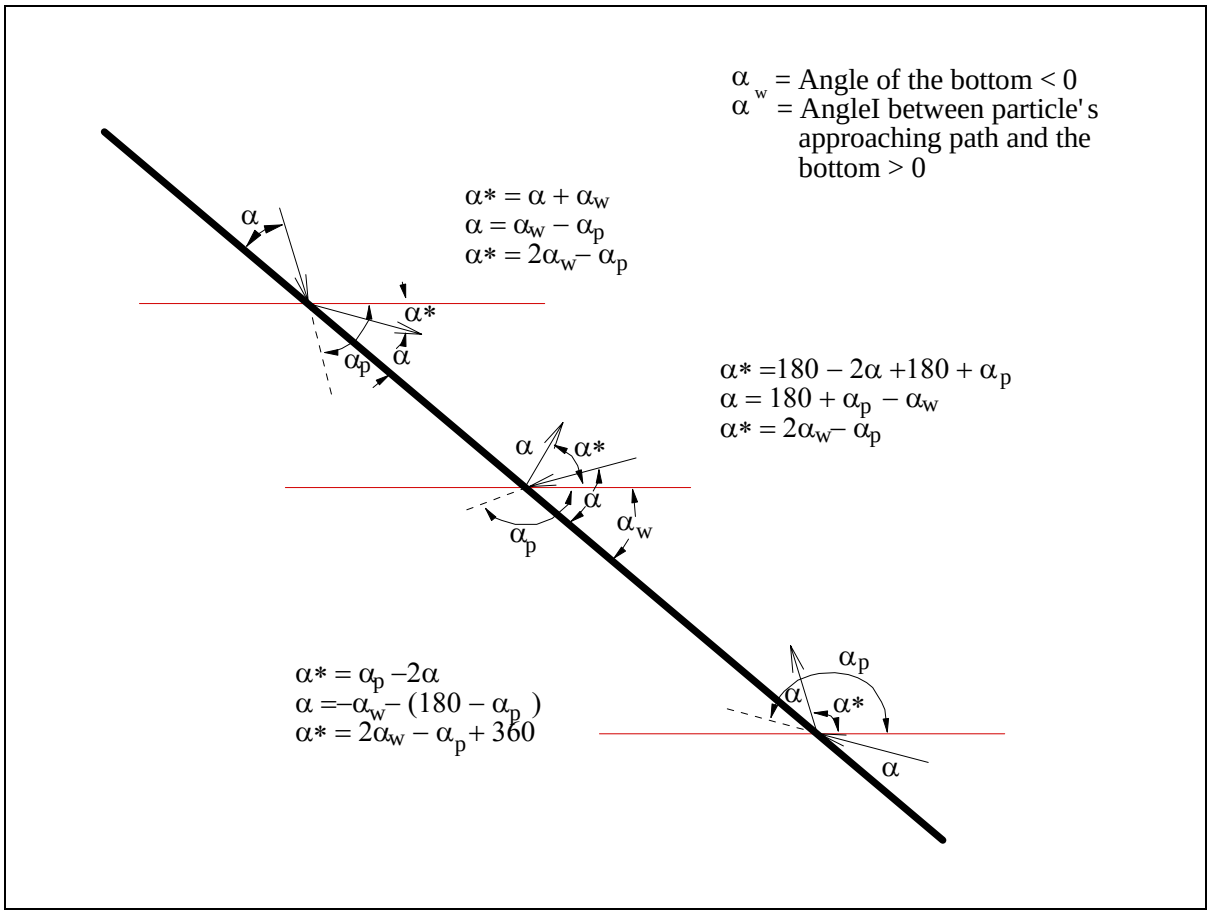


Figure 3 Three scenarios of particle bouncing back from a bottom segment with a negative slope.

Appendix A

A.1 Source code of TRACER

```
   SUBROUTINE TRACER
**********************************************************************
* --- This subroutine tracks trajectories of conservative tracers
*     IGUS  = 1: Gaussian distribution for the random variable
*           = 0: Uniform distribution for the random variable
*
* --- Written by XinJian Chen, 2004
**********************************************************************
      PARAMETER(IGAUS=0)
      INCLUDE 'LAMFE.INC'
      DIMENSION XWEG(0:MX),ZWEG(0:MZ)

      SR12=SQRT(12.0)
      IRN=IT*2+999

      IPE=0
      DO ISR=1,NSR
       IPS=IPE+1
       IPE=IPE+NTR(ISR)
       IF (TIME.LE.TREL(ISR)) CYCLE
       DO ITR=IPS,IPE
        IF (XTR(ITR).GE.XX(NX).OR.XTR(ITR).LE.XX(0)) CYCLE
        XWEG(0:NX)=XTR(ITR)-XX(0:NX)
        I1=MINLOC(ABS(XWEG(0:NX)),DIM=1)-1
        I2=I1+INT(SIGN(1.0,XWEG(I1)))
        I0=MAX(I1,I2)
         ALPU2=ABS(XWEG(I1))/DX(I0)
         ALPU1=1.-ALPU2

         ZWEG(0:NZ)=ZTR(ITR)-ZZ(0:NZ)
        K1=MINLOC(ABS(ZWEG(0:NZ)),DIM=1)-1
        K2=K1+INT(SIGN(1.0,ZWEG(K1)))
        K0=MAX(K1,K2)
         GARW2=ABS(ZWEG(K1))/DZ(K0)
         GARW1=1.-GARW2

        IF (ZWEG(K1).GT.0.0) THEN
         KU1=K1
         KU2=K2
         GARU2=(ZTR(ITR)-Z(KU1))/DZZ(KU1)
         GARU1=1.-GARU2
        ELSE
         KU1=K1+1
         KU2=K2+1
         GARU2=(Z(KU1)-ZTR(ITR))/DZZ(KU2)
         GARU1=1.-GARU2
```

```
        END IF

        IF (XWEG(I1).GT.0.0) THEN
         IW1=I1
         IW2=I2
         ALPW2=(XTR(ITR)-X(I1))/DXX(I1)
         ALPW1=1.-ALPW2
        ELSE
         IW1=I1+1
         IW2=I2+1
         ALPW2=(X(IW1)-XTR(ITR))/DXX(IW2)
         ALPW1=1.-ALPW2
        END IF

* --- Velocity of the particle
        IF (KU1.GT.0) THEN
         U11=U(KU1,I1)
         U12=U(KU1,I2)
        ELSE
         U11=0.0
         U12=0.0
        END IF
        IF (KU2.GT.0) THEN
         U21=U(KU2,I1)
         U22=U(KU2,I2)
        ELSE
         U21=0.0
         U22=0.0
        END IF

        W11=0.0
        W12=0.0
        W21=0.0
        W22=0.0
        IF (K1.GT.0.AND.IW1.GT.0) W11=W(K1,IW1)
        IF (K1.GT.0.AND.IW2.GT.0) W12=W(K1,IW2)
        IF (K2.GT.0.AND.IW1.GT.0) W21=W(K2,IW1)
        IF (K2.GT.0.AND.IW2.GT.0) W22=W(K2,IW2)
        UTRA=GARU1*ALPU1*U11+GARU1*ALPU2*U12
     +      +GARU2*ALPU1*U21+GARU2*ALPU2*U22
        WTRA=GARW1*ALPW1*W11+GARW1*ALPW2*W12
     +      +GARW2*ALPW1*W21+GARW2*ALPW2*W22
* --- Location of the particle at the new time step after advection
         XNEW=XTR(ITR)+UTRA*DT
        ZNEW=ZTR(ITR)+WTRA*DT

* --- Use a random walk method to model the diffusion
        RWKX=RAN(IRN)
        RWKZ=RAN(IRN)

        IF (IGAUS.EQ.1) THEN
*      die Zufallszahl ist ein Elemet der Gauss'schen Verteilung
```

```
          ZUX=SQRT(-2.0*LOG(RWKX))*COS(2.0*3.1415926*RWKX)
          ZUZ=SQRT(-2.0*LOG(RWKZ))*COS(2.0*3.1415926*RWKZ)
         ELSE
*       die Zufallszahl ist ein Elemet der Gleichverteilung [0.0,1.0]
          ZUX=SR12*(RWKX-0.5)
          ZUZ=SR12*(RWKZ-0.5)
        END IF

        WLKX=ZUX*SQRT(2.0*DT*BH(K0,I0))
         WLKZ=ZUZ*SQRT(2.0*DT*BV(K0,I0))

        TIEF=ALPU1*(HU(I1)-HBU(I1))+ALPU2*(HU(I2)-HBU(I2))
        WLKZ=SIGN(AMIN1(ABS(WLKZ),TIEF/2.0),WLKZ)

        XNEW=XNEW+WLKX
        ZNEW=ZNEW+WLKZ

*      Check to see if the particle hits the bottom and bounces back
         XWEG(0:NX)=XNEW-XX(0:NX)
         I1=MINLOC(ABS(XWEG(0:NX)),DIM=1)-1
         I2=I1+INT(SIGN(1.0,XWEG(I1)))
         INEW=MAX(I1,I2)

         IF (INEW.LT.1) GOTO 35

         I1=MIN(I0,INEW)
         I2=MAX(I0,INEW)

         IF (IABS(INEW-I0).GT.1) WRITE(LLIS,*)
     +   'Warning: Particle moves more than one grid during DT!'

         IF (INEW.EQ.I0) THEN
          ALPH=(XX(INEW)-XNEW)/DX(INEW)
          HBTRA=ALPH*HBU(INEW-1)+(1.-ALPH)*HBU(INEW)
          IF (ZNEW.GE.HBTRA) GOTO 35
         END IF

         IF (MIN(ZTR(ITR),ZNEW).LT.MAXVAL(HBU(I1-1:I2))) THEN
          INCR=INT(SIGN(1.0,FLOAT(INEW-I0)))
          XSTART=XTR(ITR)
          ZSTART=ZTR(ITR)
          BNC_LOOP: DO I=I0,INEW,INCR
           CALL BOUNCE(XSTART,ZSTART,XNEW,ZNEW,
     +        XX(I-1),HBU(I-1),XX(I),HBU(I),XHIT,ZHIT,IBNC,IT,ITR)
           IF (IBNC.EQ.1) THEN
            XSTART=XHIT
            ZSTART=ZHIT
           END IF
          END DO BNC_LOOP
         END IF

35       CONTINUE
```

```
        IF (XNEW.LT.XX(NX).AND.XNEW.GT.XX(0)) THEN
         ALPH=(XX(INEW)-XNEW)/DX(INEW)
         HTRA=ALPH*HU(INEW-1)+(1.-ALPH)*HU(INEW)
         ZOUT=ZNEW-HTRA
         IF (ZOUT.GT.0.0) ZNEW=HTRA-ZOUT
         HBTRA=ALPH*HBU(INEW-1)+(1.-ALPH)*HBU(INEW)

         IF (ZNEW.LT.HBTRA) THEN
          WRITE(LLIS,*) IT,INEW,K1,K2,I0,ITR,UTRA,WTRA,HTRA,BV(K0,I0)
          WRITE(LLIS,*) HBTRA,XNEW,ZNEW,ZOUT,WLKZ,ZUZ,XTR(ITR),ZTR(ITR)
          WRITE(LLIS,*) X(INEW),W(K1,IW1),W(K1,IW2),W(K2,IW1),W(K2,IW2)
          WRITE(LLIS,*) ALPW1,ALPW2,GARW1,GARW2,IW1,IW2,ALPH
          ZNEW=HBTRA+Z0(I)
         END IF
        END IF

        XTR(ITR)=XNEW
        ZTR(ITR)=ZNEW

        IF (XNEW.GE.XX(NX).OR.XNEW.LE.XX(0)) THEN
         XTR(ITR)=X(NX1)
         ZTR(ITR)=HBU(NX)
        END IF
       END DO
      END DO

*      WRITE(*,*) 'Tracer routine is done'
       RETURN

       END
```

A.2 Source Code of BOUNCE

```
       SUBROUTINE BOUNCE(X0,Z0,X1,Z1,X2,Z2,X3,Z3,XHIT,ZHIT,IBNC,IT,ITR)
*****************************************************************
* --- This subroutine calculates the reflection of a particle (wave)
*     from a wall (bottom)
*
*     (X0,Z0) is the location of the particle at the old time step
*     (X1,Z1) is the location of the particle at the new time step
*     The wall runs from  (X2,Z2) to (X3,Z3)
*
* --- Written by XinJian Chen, 2004
*****************************************************************
      PARAMETER(PI=3.141592654)
      IBNC=0

      A1=Z0-Z1
```

```
      B1=X1-X0
      C1=-Z0*B1-X0*A1

      A2=Z2-Z3
      B2=X3-X2
      C2=-Z2*B2-X2*A2

      CC=A1*B2-A2*B1


      IF (CC.EQ.0) RETURN

      XHIT=-(C1*B2-C2*B1)/CC

      IF (XHIT.GT.X3.OR.XHIT.LT.X2) RETURN
      IF (XHIT.GT.AMAX1(X0,X1).OR.XHIT.LT.AMIN1(X0,X1)) RETURN

      ZHIT=-(A1*C2-A2*C1)/CC

      IF (IT.EQ.266.AND.ITR.EQ.436) THEN
       WRITE(*,*) X0,Z0,X1,Z1,X2,Z2,X3,Z3,XHIT,ZHIT
      END IF

      DIS_B=SQRT((X1-XHIT)**2+(Z1-ZHIT)**2)

      WANG=ATAN(-A2/B2)
      PANG=ATAN(-A1/B1)
      IF(B1.LT.0.0)PANG=SIGN(1.0,-PANG)*(PI-ABS(PANG)) !!!!<<<<<PROBLEM
      ALPHA=2.0*WANG-PANG

      IF (IT.EQ.266.AND.ITR.EQ.436) THEN
       WRITE(*,*) DIS_B,PANG,WANG,ALPHA
       PAUSE
      END IF

      X1=XHIT+DIS_B*COS(ALPHA)
      Z1=ZHIT+DIS_B*SIN(ALPHA)
      IBNC=1

      RETURN
      END
```

A.3 Source Code of the Post-Program

```
************************************************************************
* --- This program converts lamfe.tra to the TecPlot format, so
*     that TecPlot can read
*
* --- Written by XinJian Chen, 2004
```

```
*********************************************************************
      PARAMETER (NX=84,NX1=NX+1,NSR=3,MTRA=9999,NDAY=10.0)
      DIMENSION XTR(MTRA),ZTR(MTRA),NTR(NSR)
      DIMENSION DX(NX1),XX(0:NX),HU(0:NX),HBU(0:NX)
     LOGICAL ERST
      CHARACTER*80 CARD

     DATA NTR/3*200/
     DATA ERST/.TRUE./

     NTRA=SUM(NTR)

     Card='..\modelRUN\lamfe.'
      OPEN(1,FILE=Card(1:18)//'LIS',STATUS='OLD')
      OPEN(2,FILE=Card(1:18)//'TRA',FORM='UNFORMATTED',STATUS='OLD')
      OPEN(9,FILE='SURFACE.TEC',STATUS='UNKNOWN')
      WRITE(9,*) 'TITLE="LAMFE Model Results for the Alafia River"'
      WRITE(9,*) 'VARIABLES=X,H'
      OPEN(10,FILE='Bottom.Dat',STATUS='UNKNOWN')
      WRITE(10,*) 'TITLE="LAMFE Model Results for the Alafia River"'
      WRITE(10,*) 'VARIABLES=X,H'

     CARD(1:12)='TRACER00.TEC'
     DO ISR=1,NSR
      LOG=10+ISR
      WRITE(CARD(7:8),'(I2)') ISR
      IF (ISR.LT.10) CARD(7:7)='0'
       OPEN(LOG,FILE=CARD(1:12),STATUS='UNKNOWN')
       WRITE(LOG,*) 'TITLE="LAMFE Model Results for the Alafia River"'
       WRITE(LOG,*) 'VARIABLES=X,Z'
     END DO

     READ(1,*) CARD(1:6),HBMAX
11    READ(1,'(A)') CARD
      IF (CARD(1:7).NE.'* I  KN') GOTO 11
      DO I=1,NX1
       READ(1,*) IDUM,IDUM,IDUM,IDUM,DX(I),DUM,HBU(I-1)
      END DO

     XX(0)=0.0
     DO I=1,NX
      XX(I)=XX(I-1)+DX(I)
     END DO

     WRITE(10,'(A4)') 'ZONE'
     DO I=0,NX
      WRITE(10,'(2F10.3)') XX(I)/1000.0,HBU(I)-HBMAX/100.0
     END DO

     WRITE(10,'(A4)') 'ZONE'
     DO ID=0,NDAY
      WRITE(10,'(2F10.3)') FLOAT(ID),3.0
```

```
      END DO

22    READ(2,END=99) TIME
      READ(2) (XTR(I),ZTR(I),I=1,NTRA)
      READ(2) (HU(I),I=0,NX)

      IF (ERST) THEN
       T0=TIME
       ERST=.FALSE.
      END IF

      TIME=TIME-T0

      WRITE(9,'(A8,F10.2,A)') 'ZONE T="',TIME,'"'
      DO I=0,NX
       WRITE(9,'(2F10.3)') XX(I)/1000.0,(HU(I)-HBMAX)/100.0
      END DO

      WRITE(10,'(A8,F10.2,A)') 'ZONE T="',TIME,'"'
      WRITE(10,'(2F10.3)') TIME/24.0,2.8
      WRITE(10,'(2F10.3)') TIME/24.0,2.8

      IPE=0
      DO ISR=1,NSR
       LOG=10+ISR
       WRITE(LOG,'(A8,F10.2,A)') 'ZONE T="',TIME,'"'
       IPS=IPE+1
       IPE=IPE+NTR(ISR)
       DO I=IPS,IPE
        WRITE(LOG,'(2F10.3)') XTR(I)/100000.0,(ZTR(I)-HBMAX)/100.0
       END DO
      END DO

      GOTO 22

99    END
```

A.4 A Macro for Generating an Animation Using TecPlot

```
#!MC 750
## This is a macro file for generating a film for TRACER
$!EXPORTSETUP
  EXPORTFORMAT=AVI
$!EXPORTSETUP IMAGEWIDTH = 860
  EXPORTFNAME="D:\Lamfe\LowerAlafiaRiver\Tracer\Alafia_Tracer.avi"
  BITDUMPREGION=ALLFRAMES
$!EXPORTSTART
$!VARSET |Q1| = 1
$!VARSET |Q2| = 3
```

```
$!LOOP 240
$!FRAMECONTROL POP
$!ACTIVEXYMAPS = [1,2,|Q2|]
$!FRAMECONTROL POP
$!ACTIVEXYMAPS = [|Q1|]
$!FRAMECONTROL POP
$!ACTIVEXYMAPS = [|Q1|]
$!FRAMECONTROL POP
$!ACTIVEXYMAPS = [|Q1|]
$!FRAMECONTROL POP
$!ACTIVEXYMAPS = [|Q1|]
$!REDRAWALL
$!EXPORTNEXTFRAME
$!VARSET |Q1| += 1
$!VARSET |Q2| += 1
$!ENDLOOP
$!EXPORTFINISH
##
```

Appendix B

Particle Distributions
(Flow Rate at the Lithia Station = 5cfs)

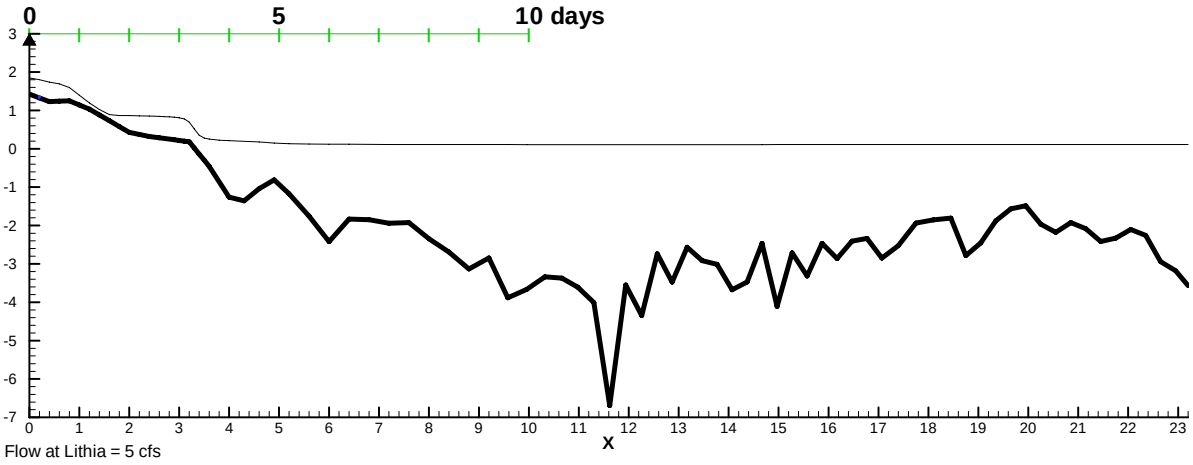


Figure B- 1 At time = 0, 200 red particles are released at the Lithia station (x = 0).

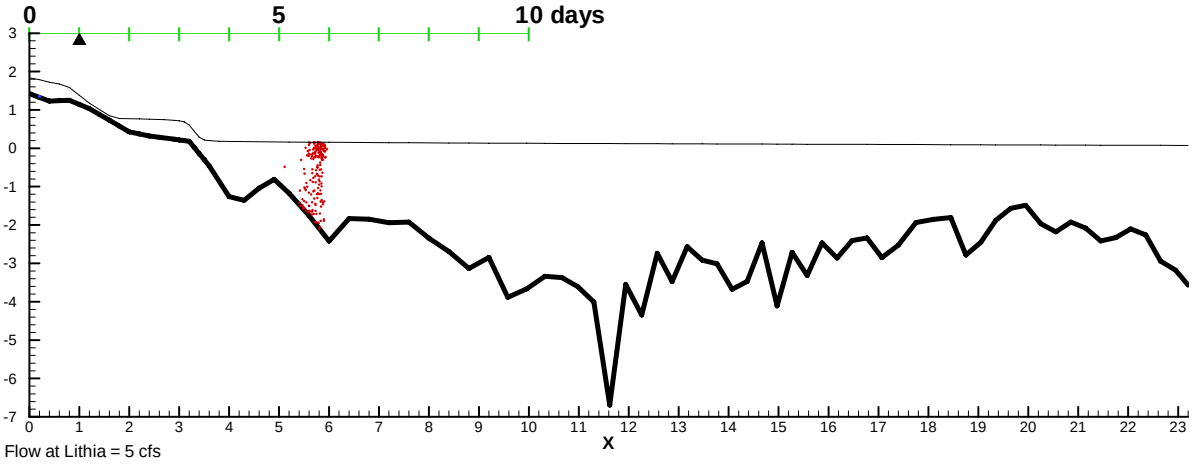


Figure B- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

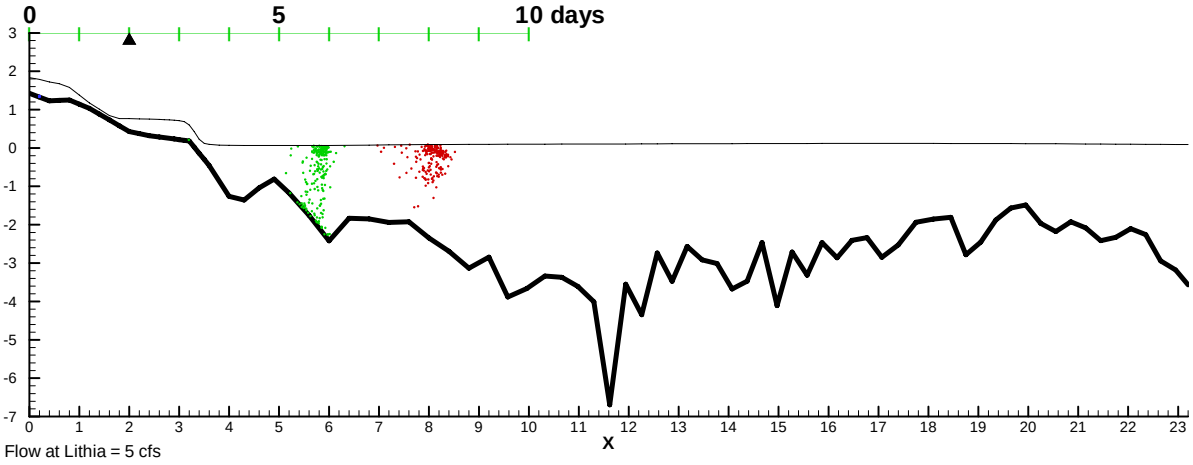


Figure B- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

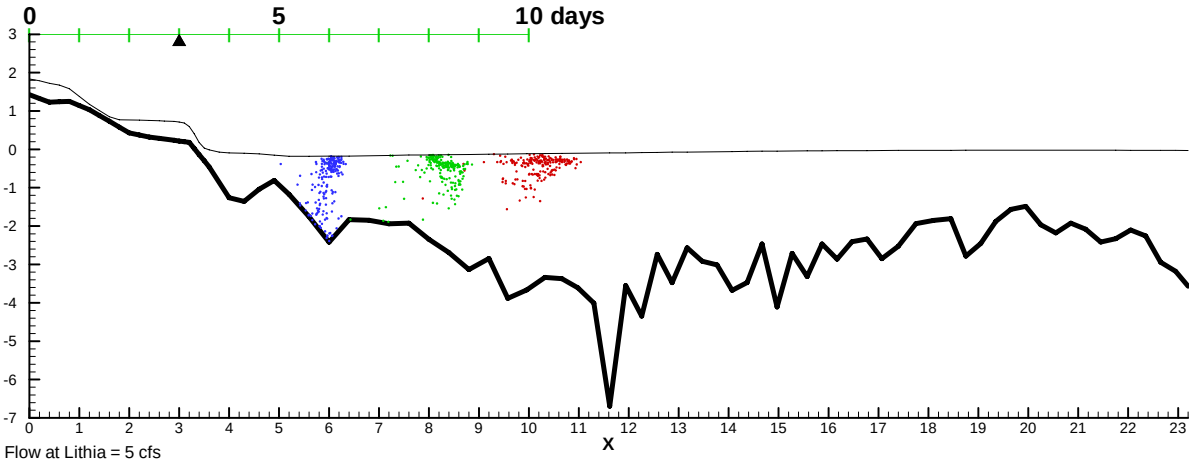


Figure B- 4 Particle distributions at time = 72 hours (3 days).

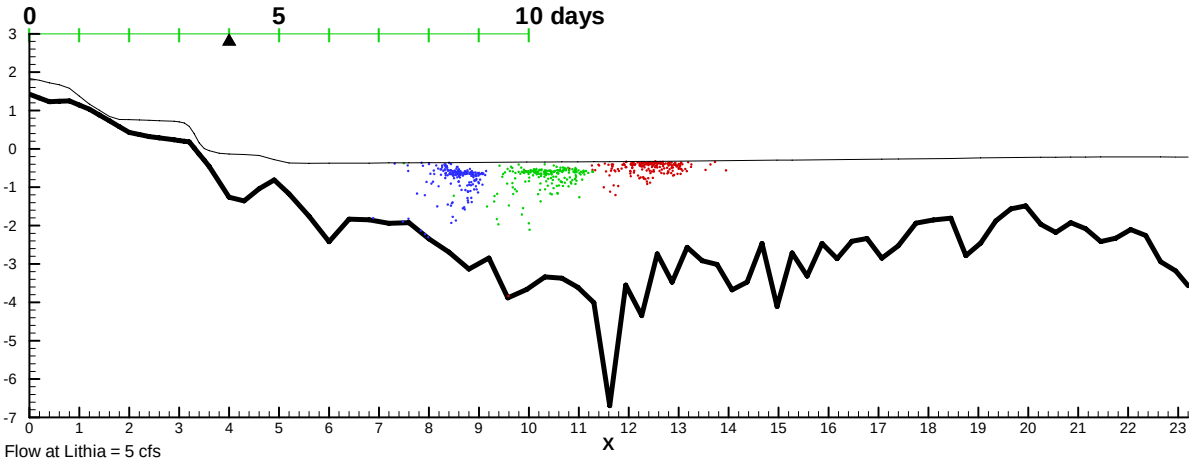


Figure B- 5 Particle distributions at time = 96 hours (4 days).

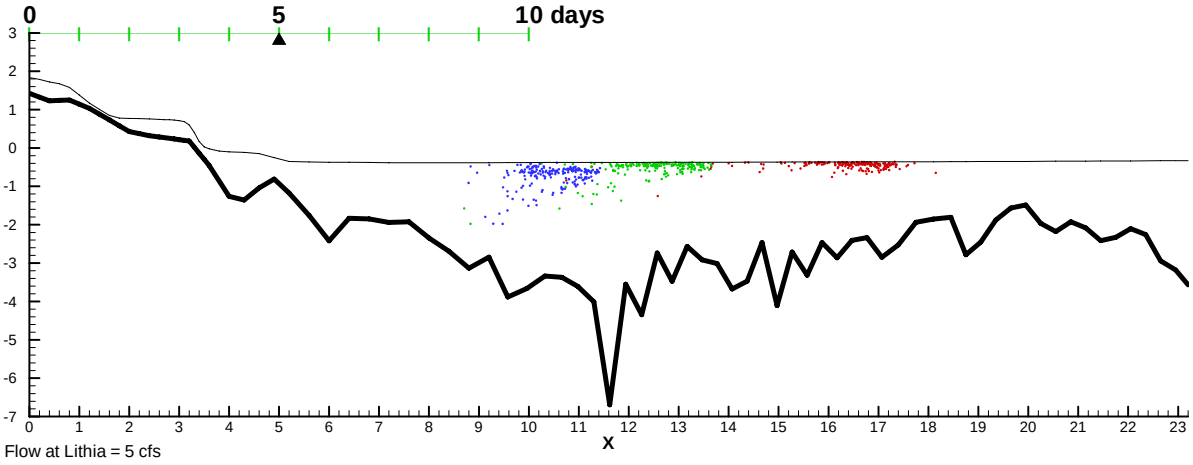


Figure B- 6 Particle distributions at time = 120 hours (5 days).

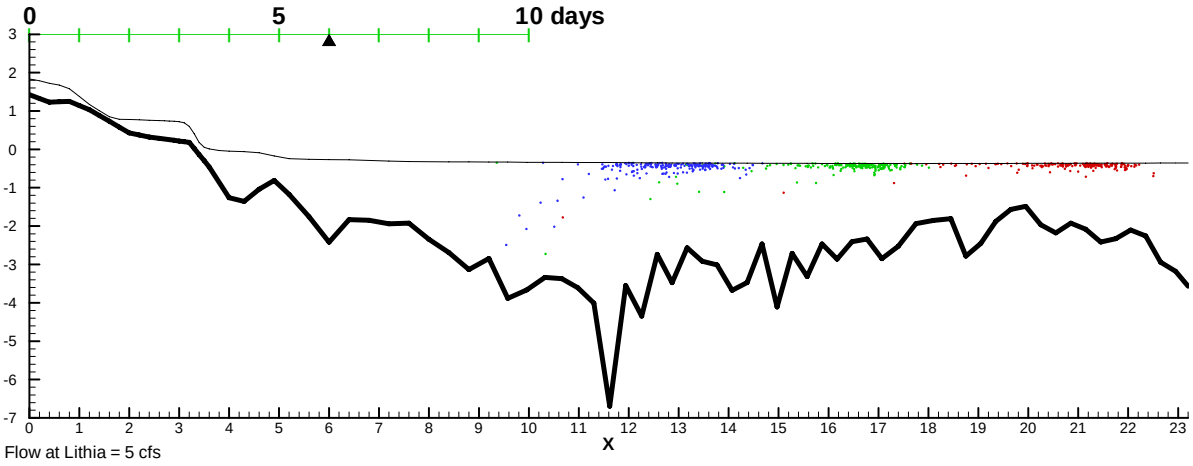


Figure B- 7 Particle distributions at time = 144 hours (6 days).

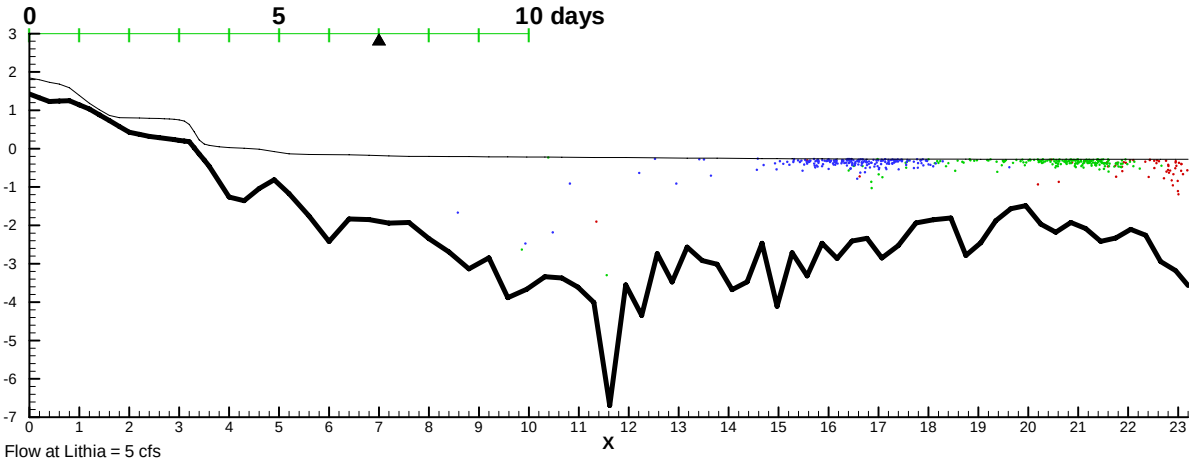


Figure B- 8 Particle distributions at time = 168 hours (7 days).

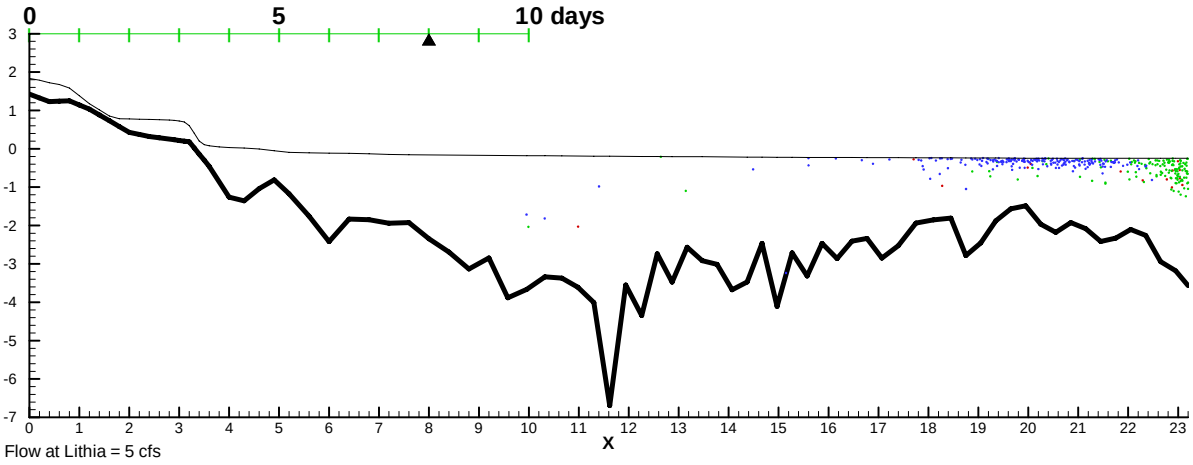


Figure B- 9 Particle distributions at time = 192 hours (8 days).

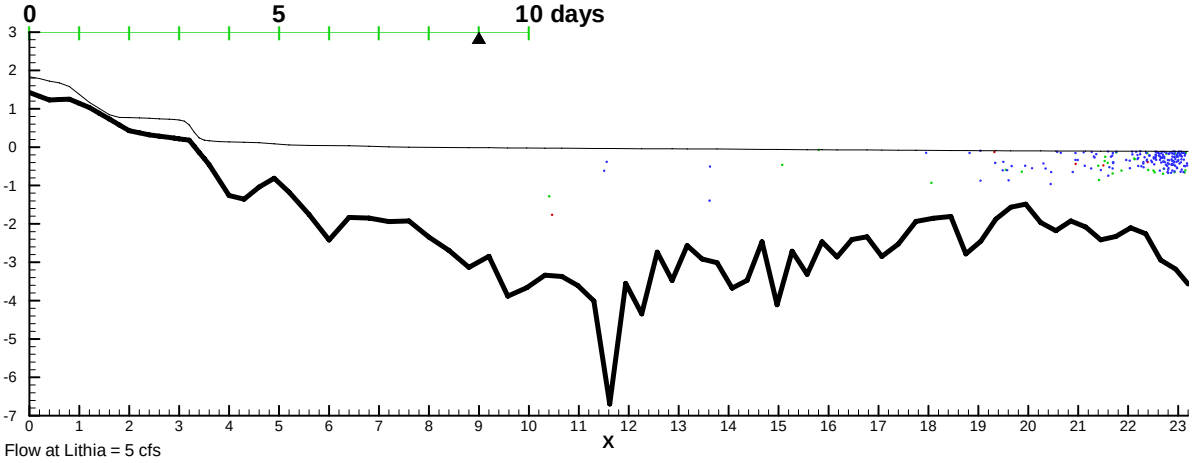


Figure B- 10 Particle distributions at time = 216 hours (9 days).

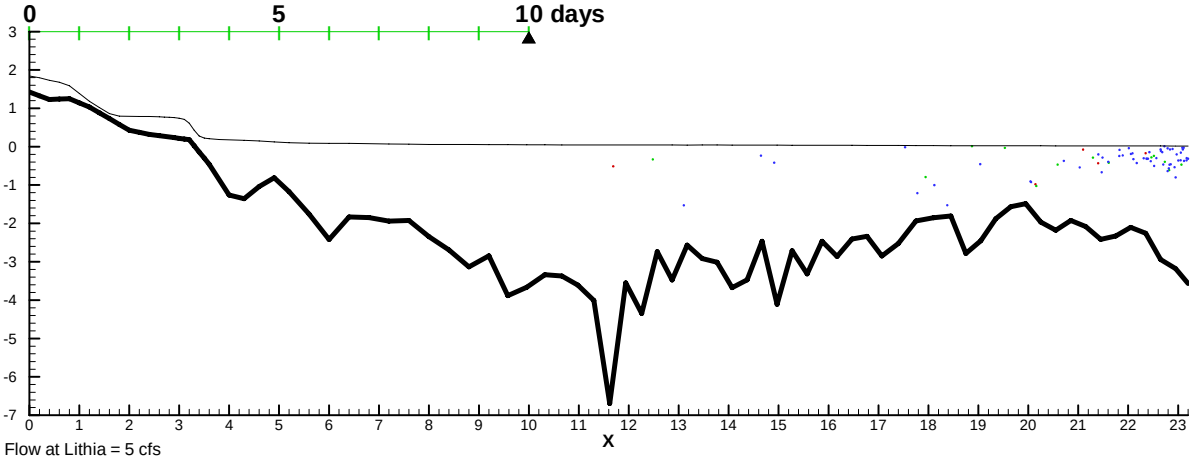


Figure B- 11 Particle distributions at time = 240 hours (10 days)

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Appendix C

Particle Distributions
(Flow Rate at the Lithia Station = 10cfs)

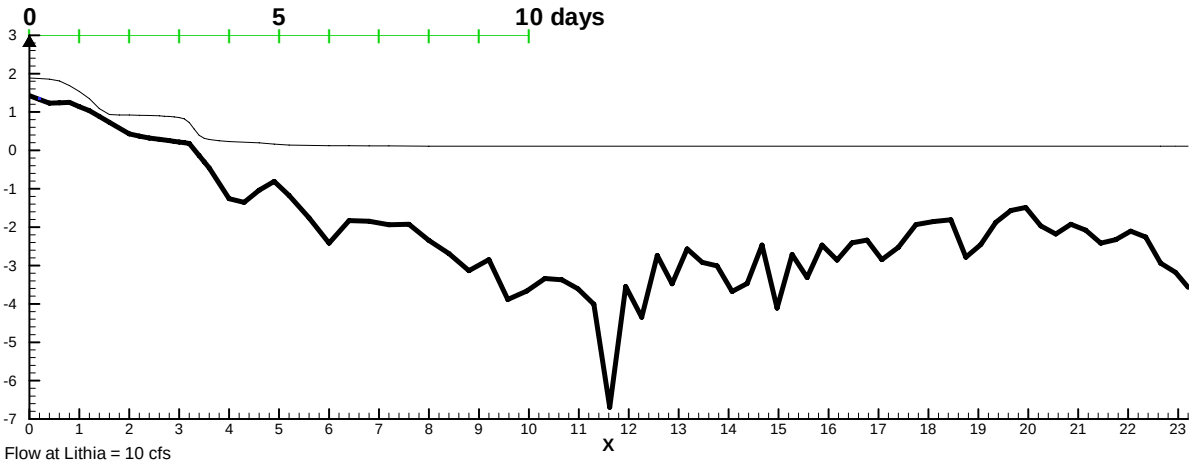


Figure C- 1 At time = 0 hours, 200 green particles are released at the Lithia station (x = 0).

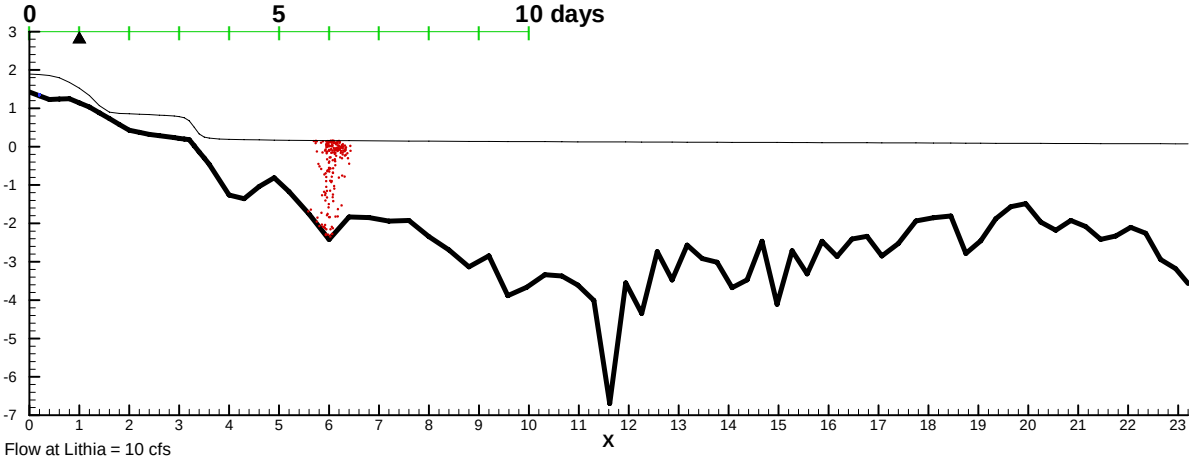


Figure C- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

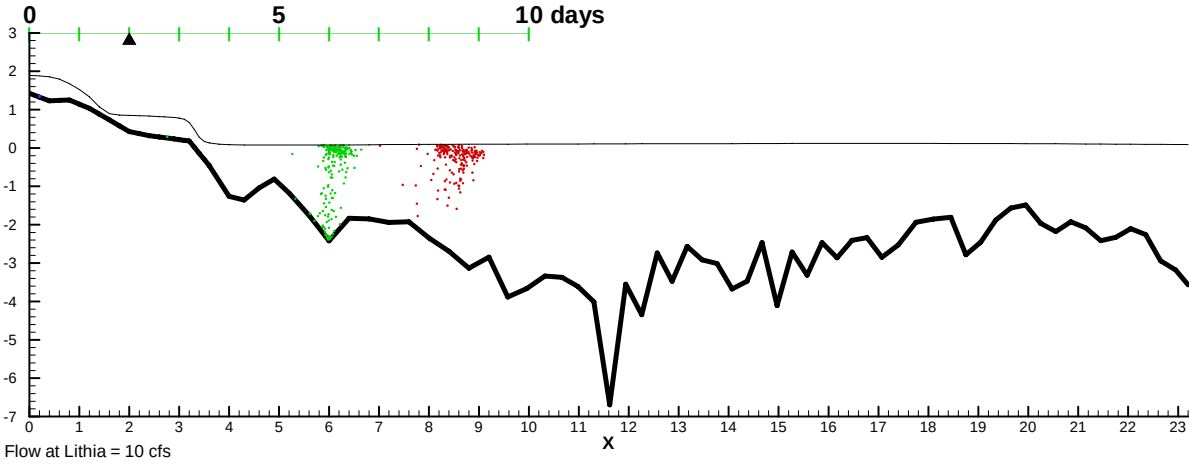


Figure C- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

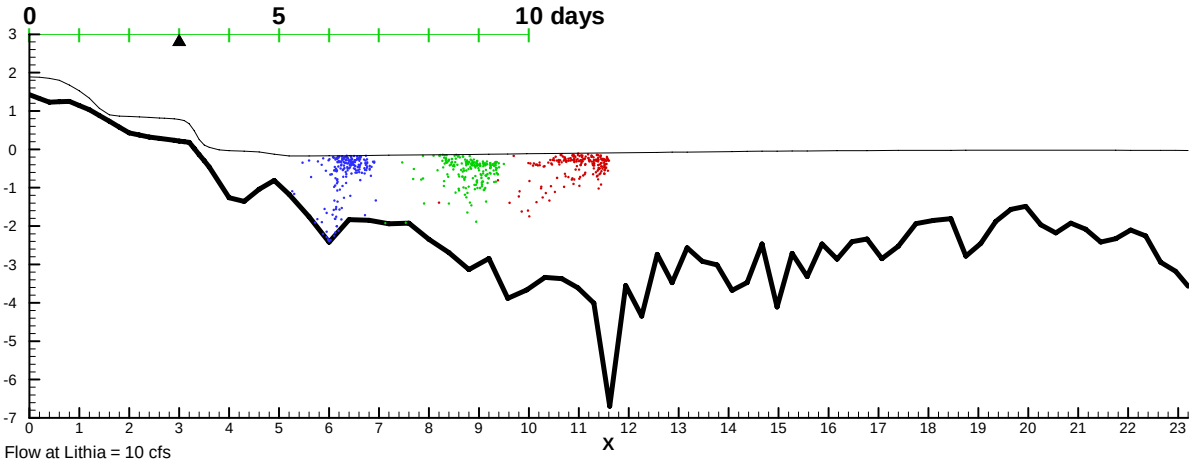


Figure C- 4 Particle distributions at time = 72 hours (3 days).

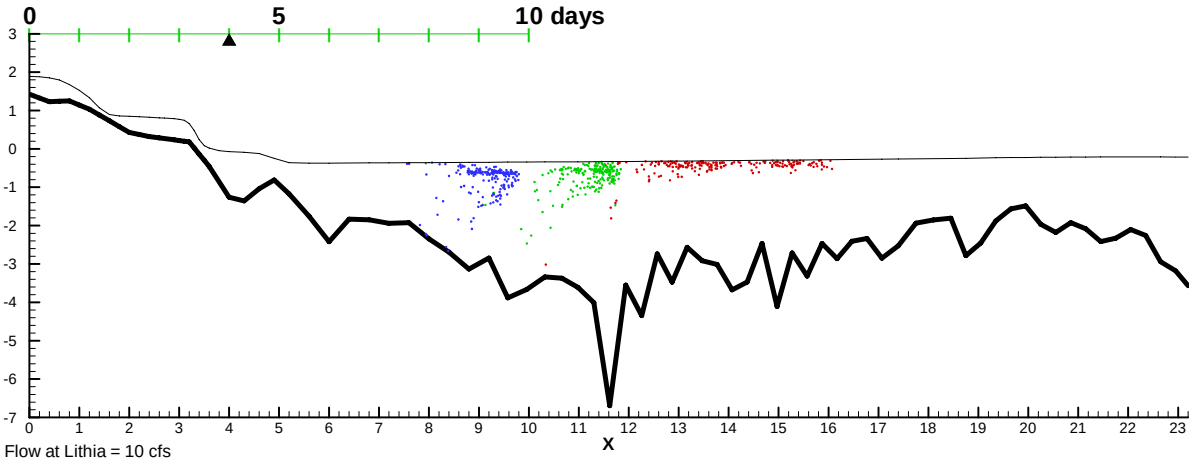


Figure C- 5 Particle distributions at time = 96 hours (4 days).

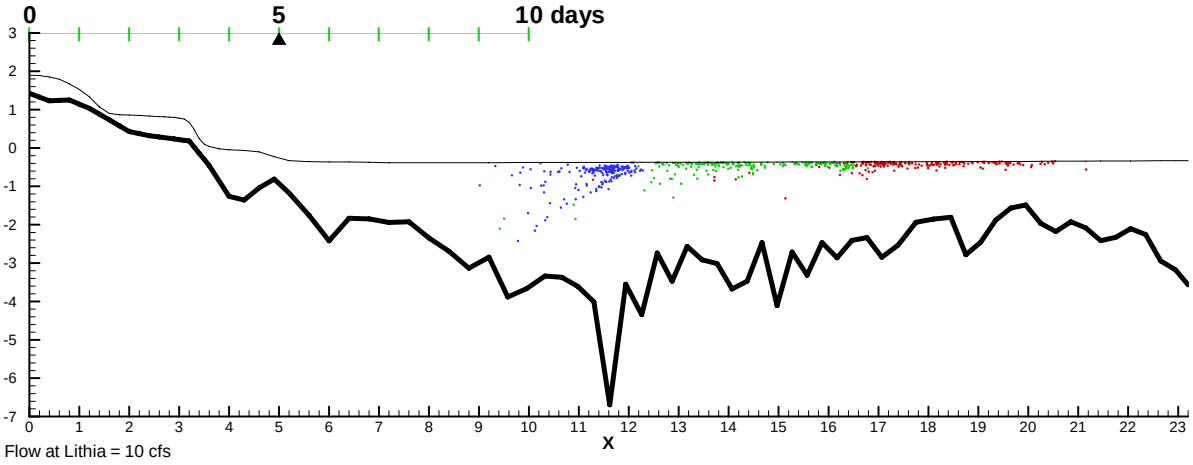


Figure C- 6 Particle distributions at time = 120 hours (5 days).

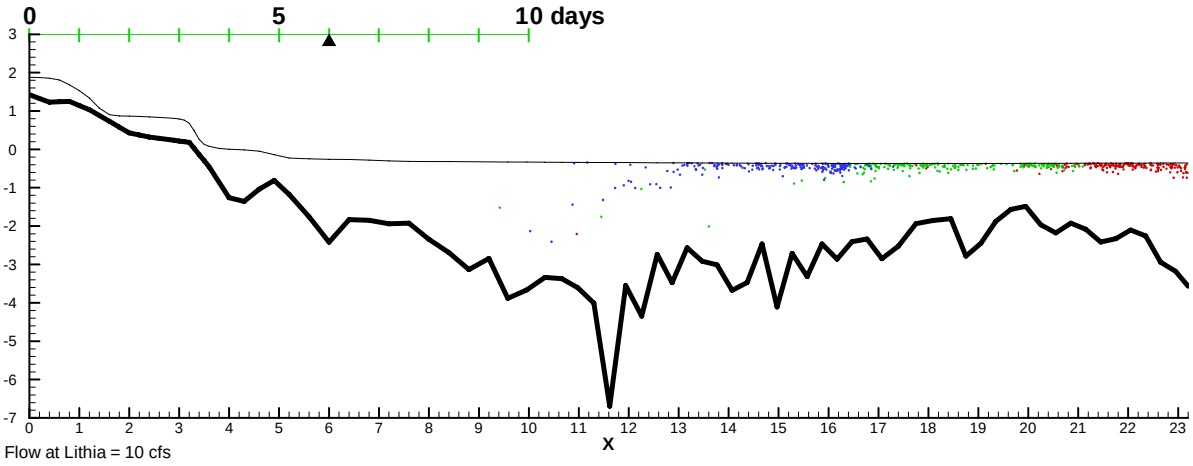


Figure C- 7 Particle distributions at time = 144 hours (6 days).

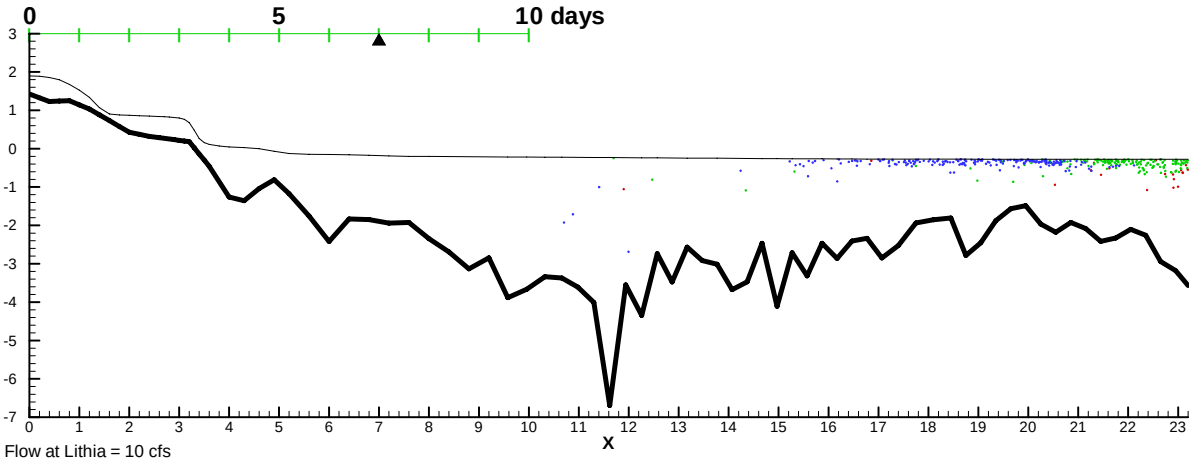


Figure C- 8 Particle distributions at time = 168 hours (7 days).

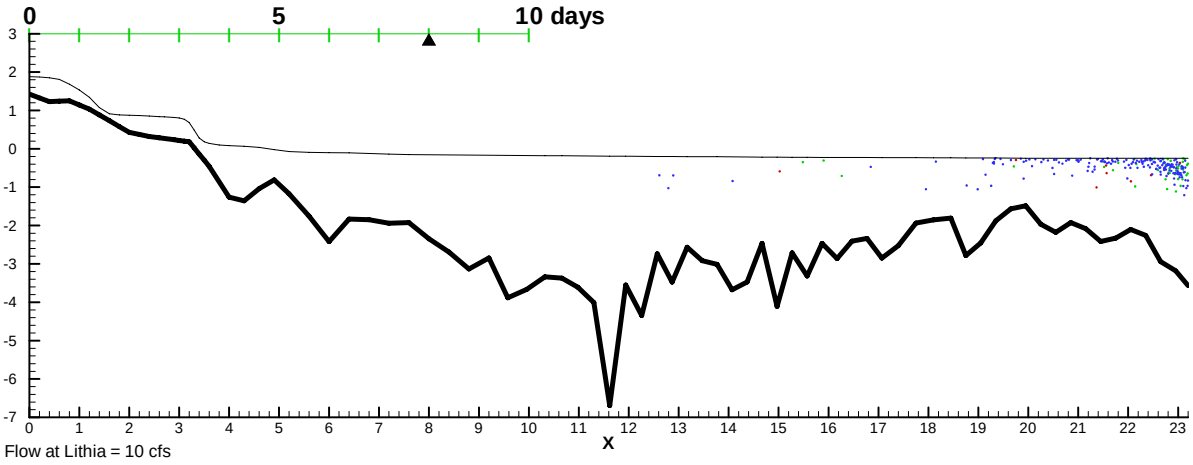


Figure C- 9 Particle distributions at time = 192 hours (8 days).

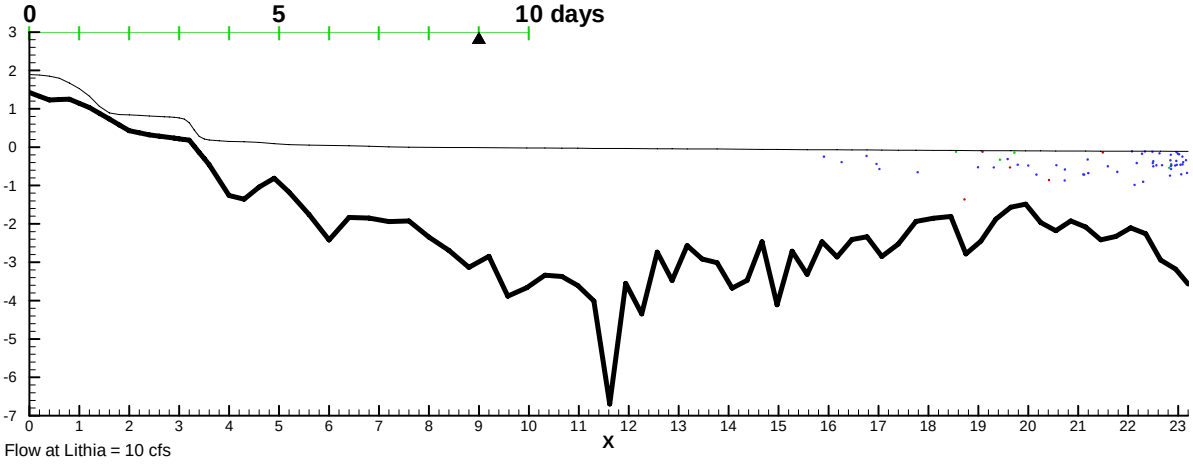


Figure C- 10 Particle distributions at time = 216 hours (9 days).

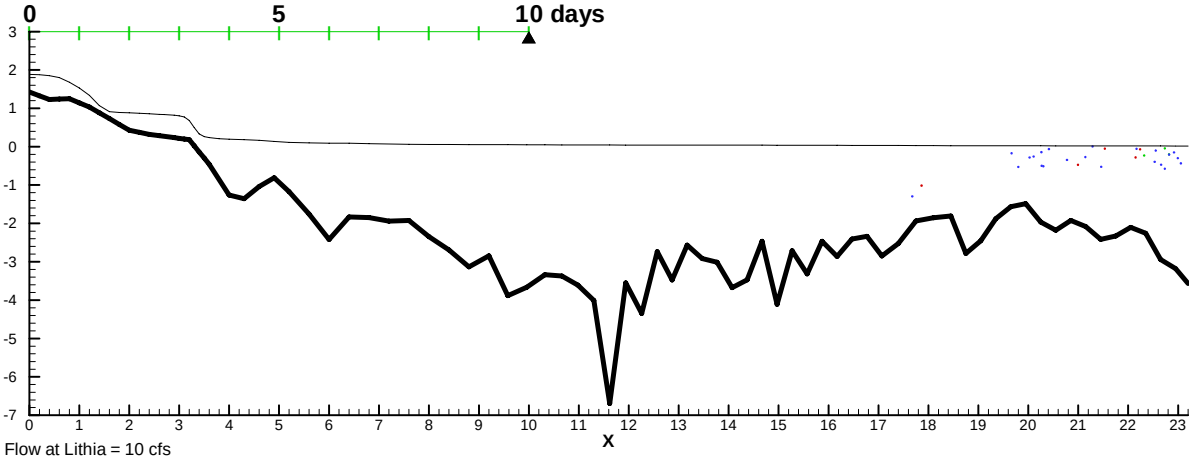


Figure C- 11 Particle distributions at time = 240 hours (10 days).

Appendix D

Particle Distributions
(Flow Rate at the Lithia Station = 15cfs)

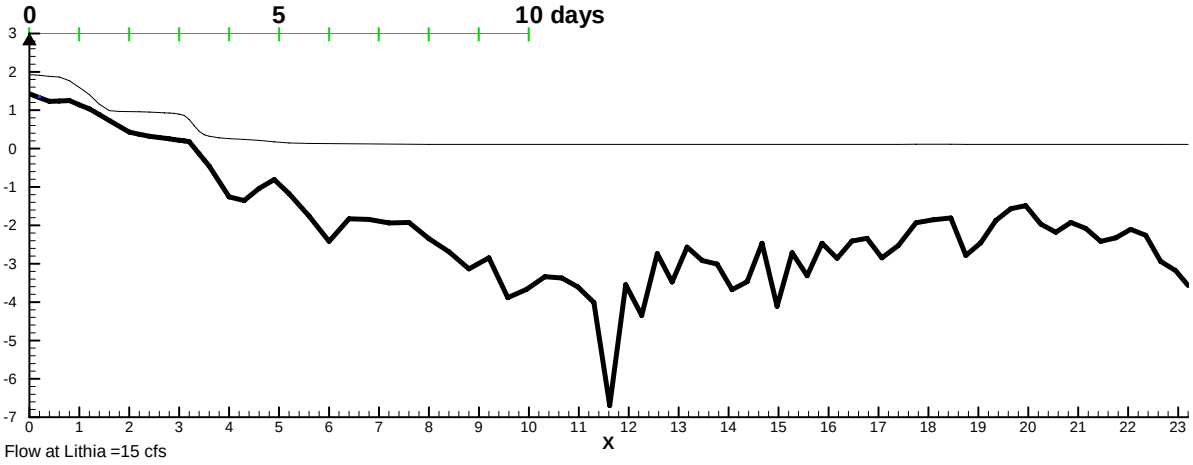


Figure D- 1 At time = 0 hours, 200 green particles are released at the Lithia station (x = 0).

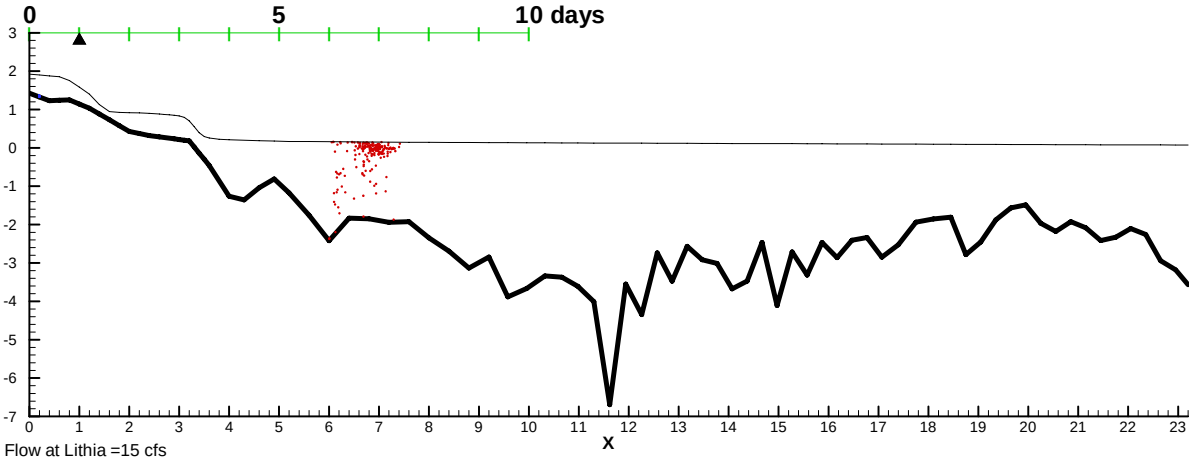


Figure D- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

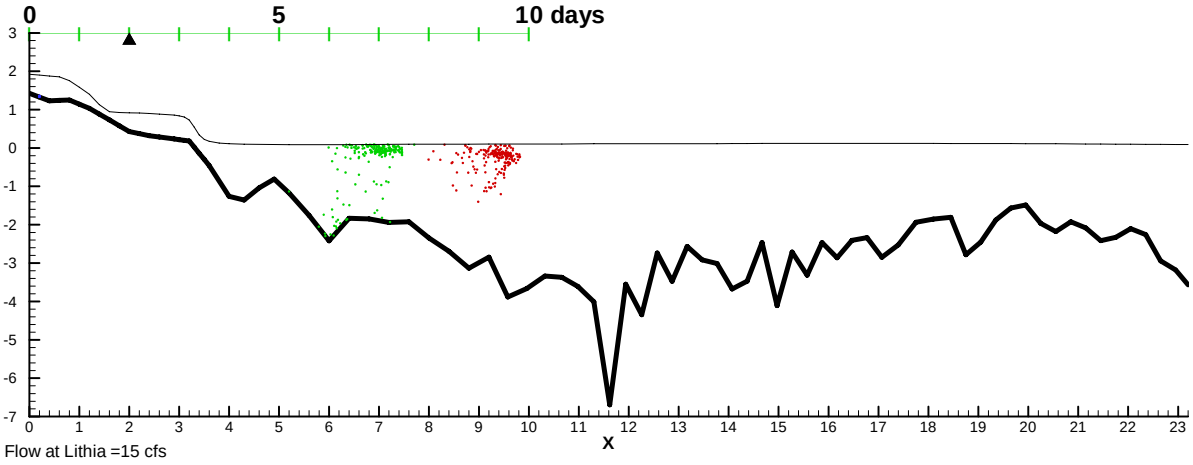


Figure D- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

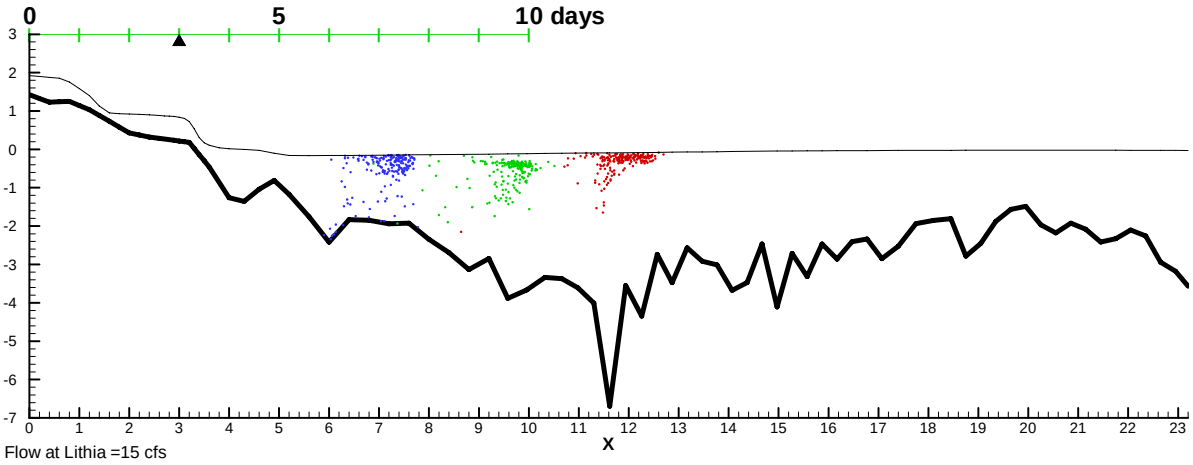


Figure D- 4 Particle distributions at time = 72 hours (3 days).

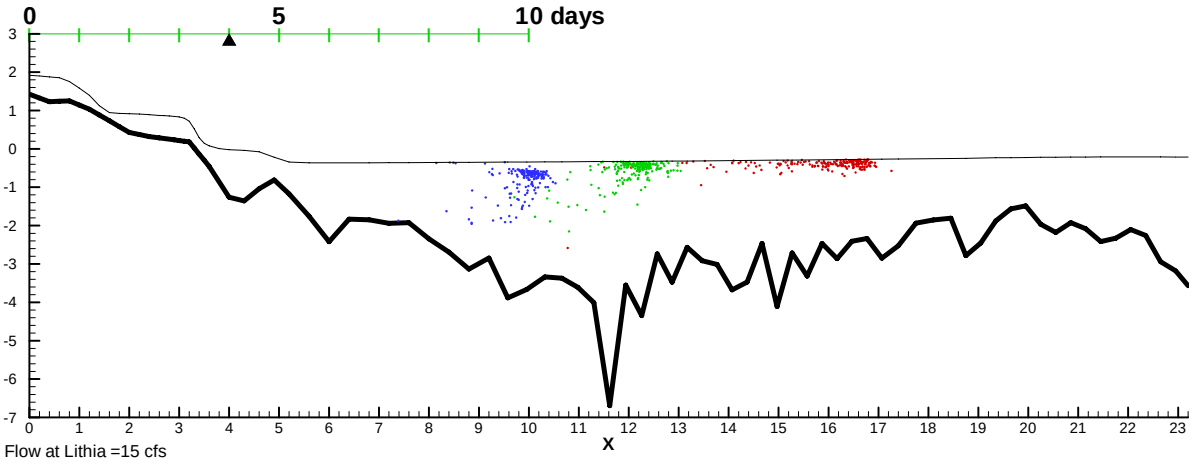


Figure D- 5 Particle distributions at time = 96 hours (4 days).

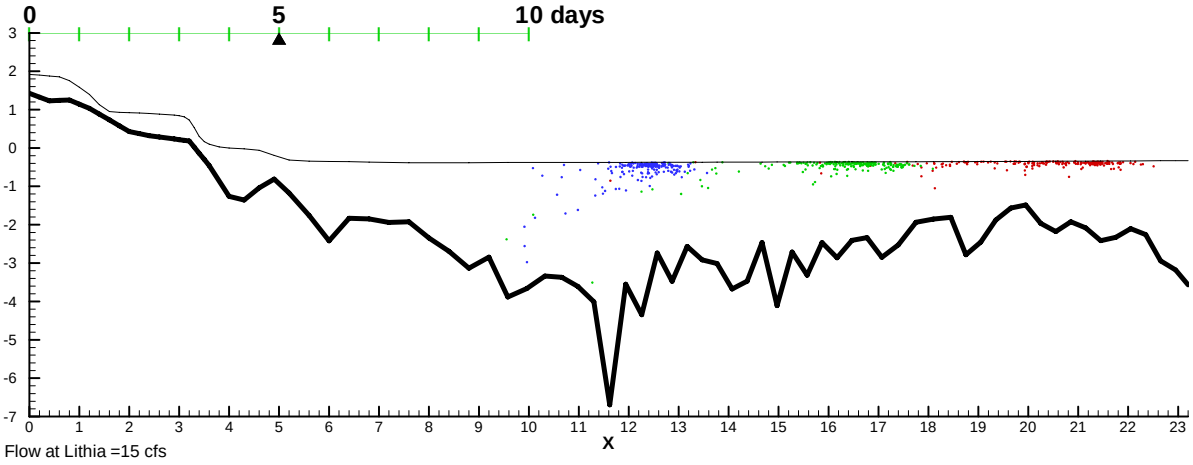


Figure D- 6 Particle distributions at time = 120 hours (5 days).

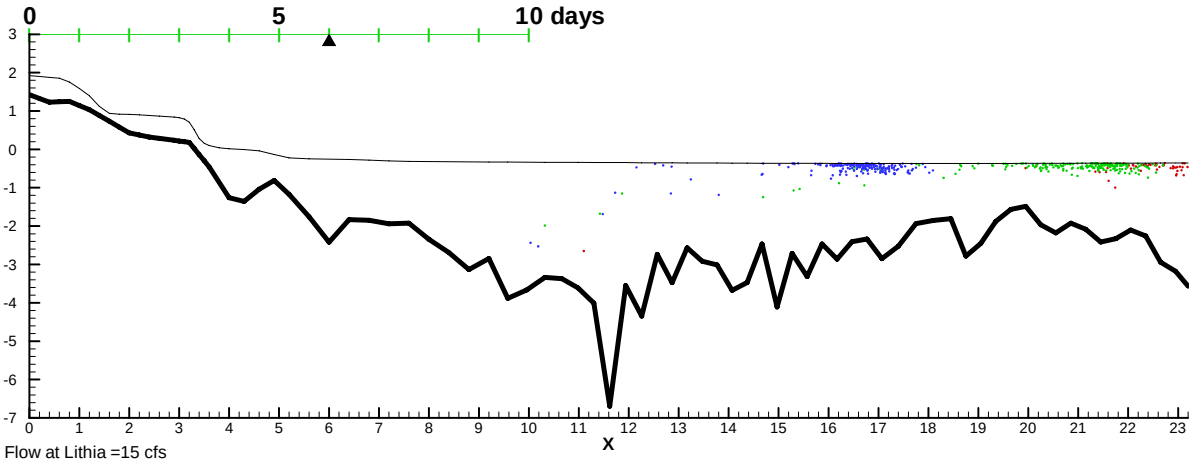


Figure D- 7 Particle distributions at time = 144 hours (6 days).

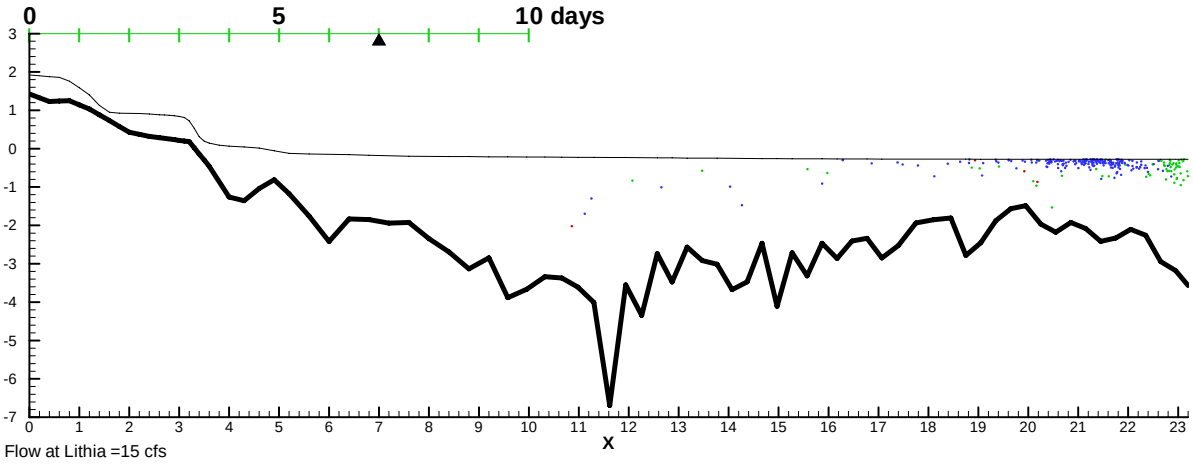


Figure D- 8 Particle distributions at time = 168 hours (7 days).

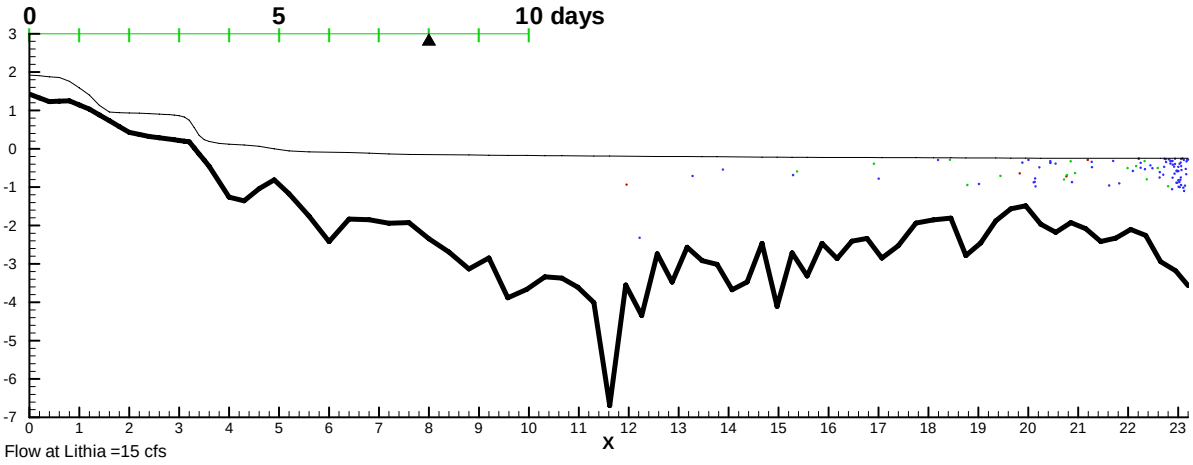


Figure D- 9 Particle distributions at time = 192 hours (8 days).

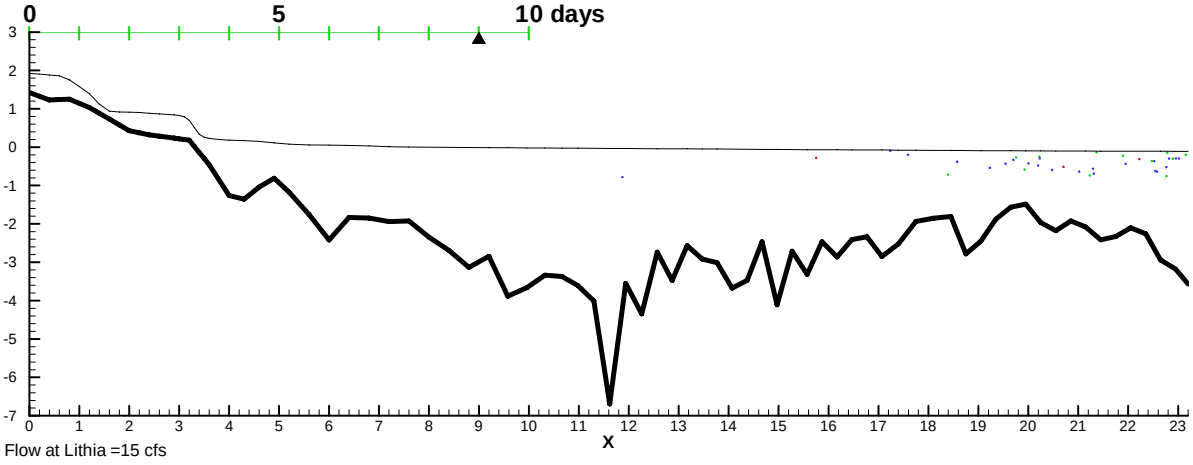


Figure D- 10 Particle distributions at time = 216 hours (9 days).

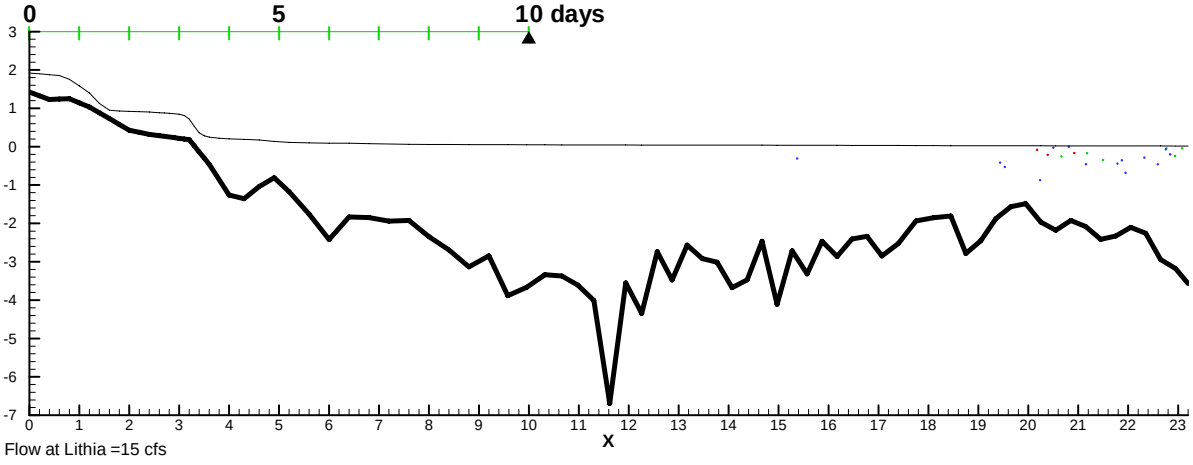


Figure D- 11 Particle distributions at time = 240 hours (10 days).

Appendix E

Particle Distributions
(Flow Rate at the Lithia Station = 20cfs)

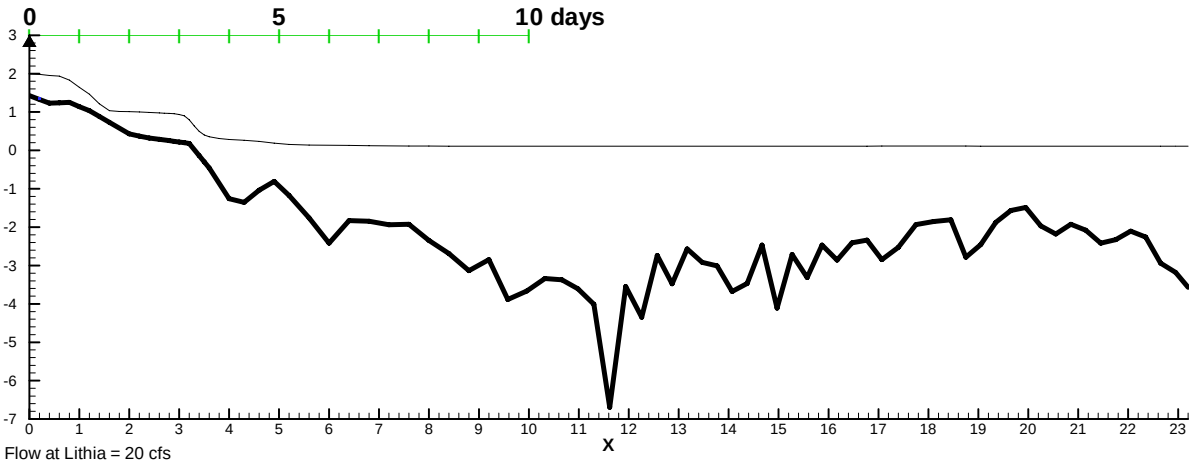


Figure E- 1 At time = 0 hours, 200 green particles are released at the Lithia station (x = 0).

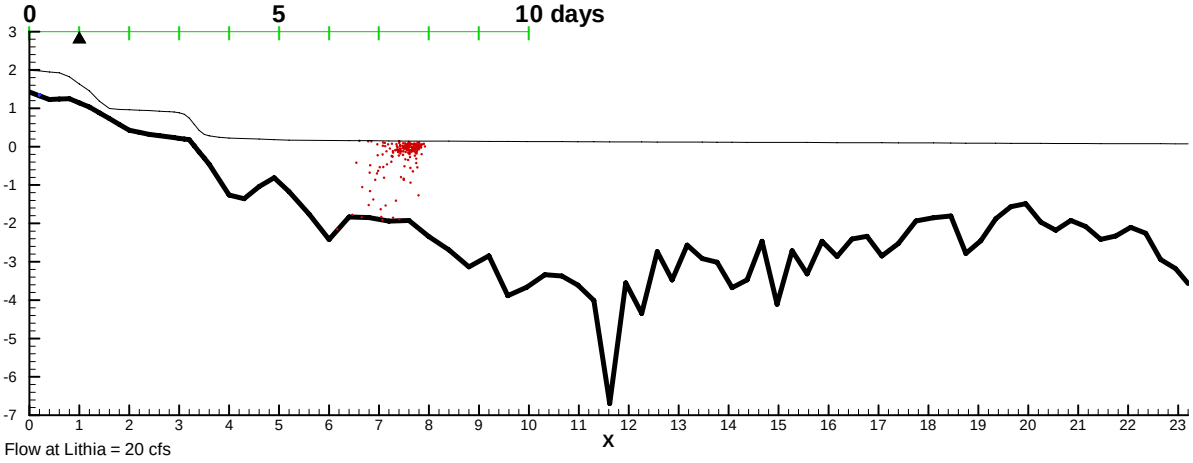


Figure E- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

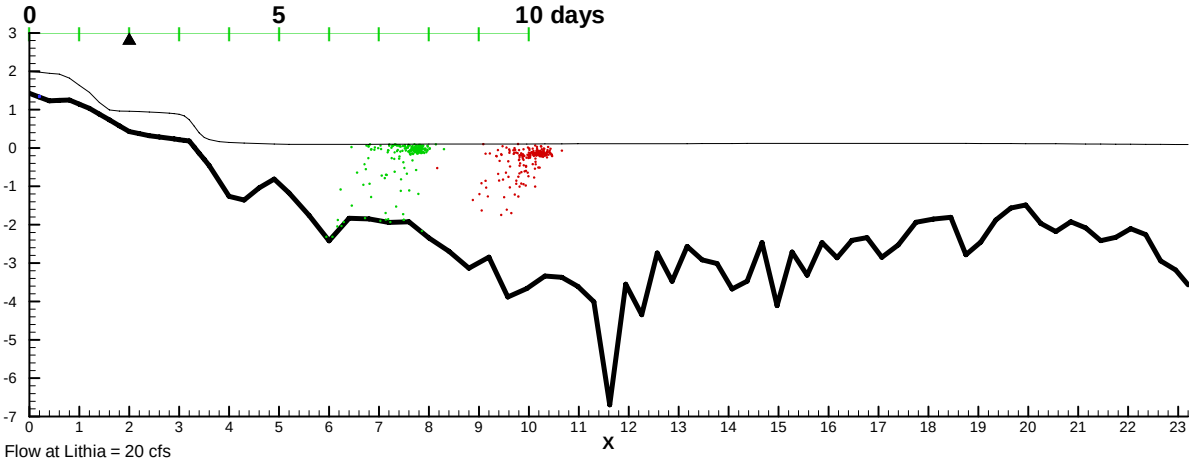


Figure E- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

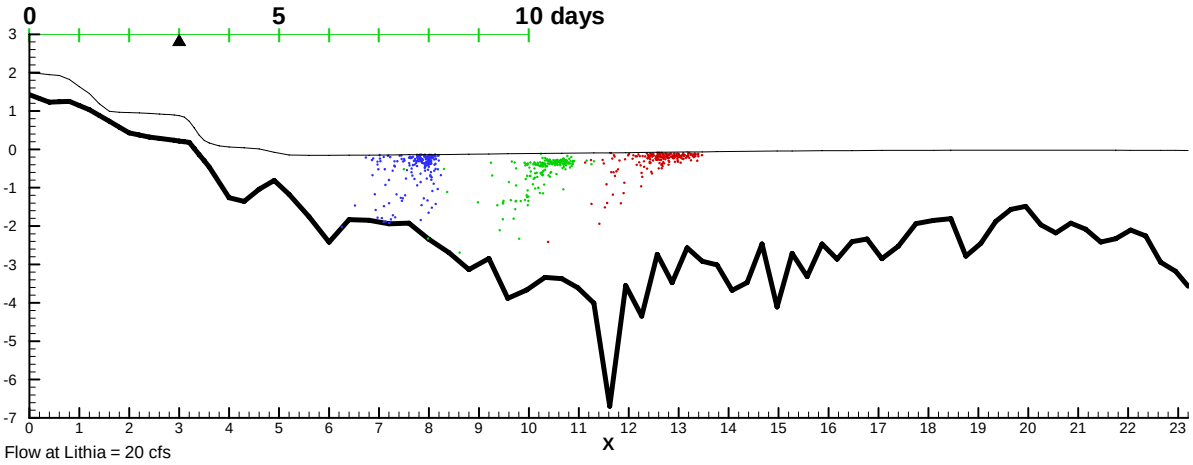


Figure E- 4 Particle distributions at time = 72 hours (3 days).

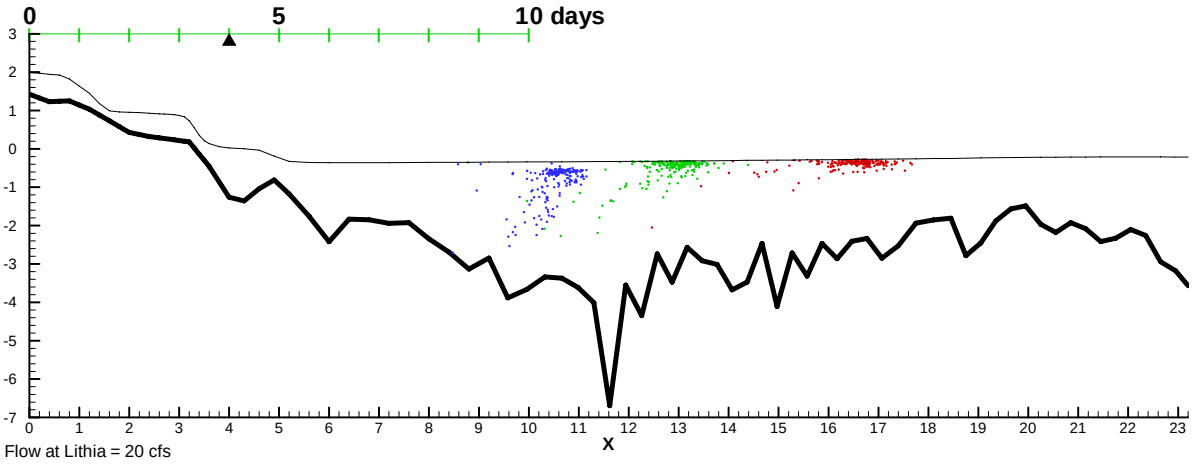


Figure E- 5 Particle distributions at time = 96 hours (4 days).

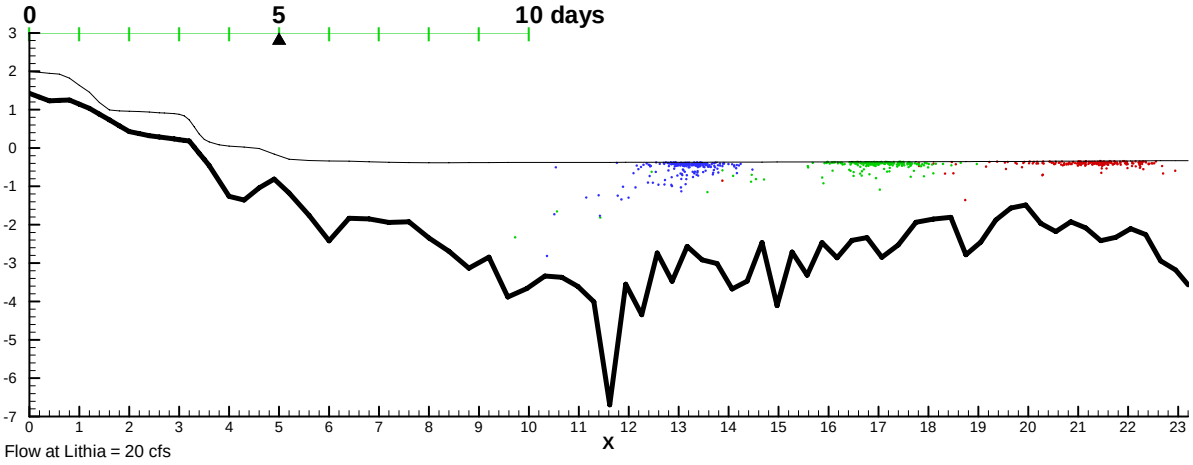


Figure E- 6 Particle distributions at time = 120 hours (5 days).

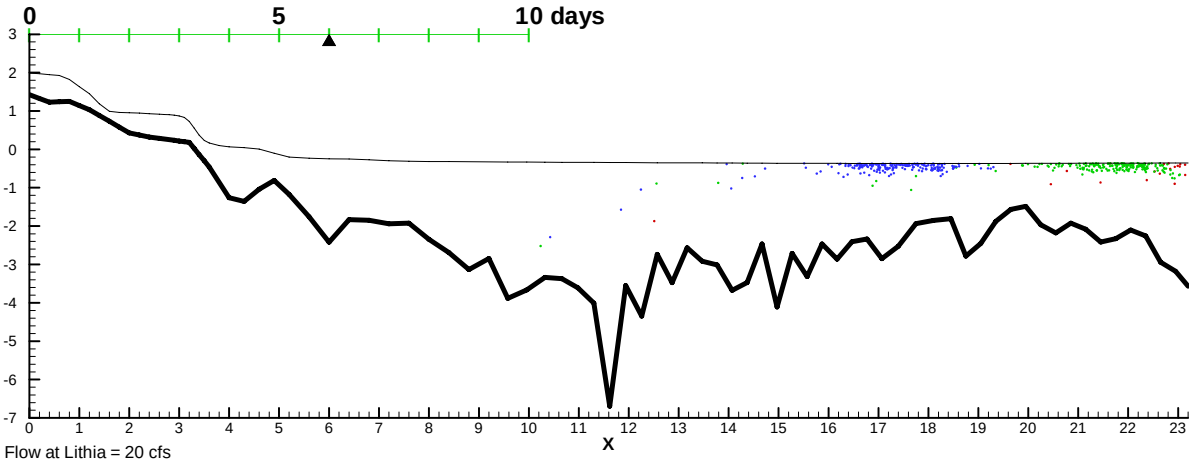


Figure E- 7 Particle distributions at time = 144 hours (6 days).

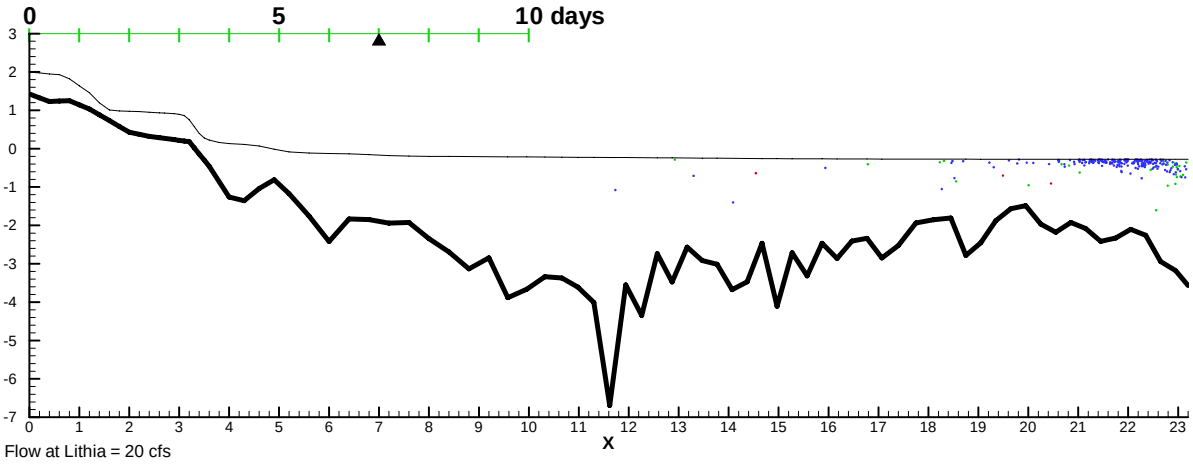


Figure E- 8 Particle distributions at time = 168 hours (7 days).

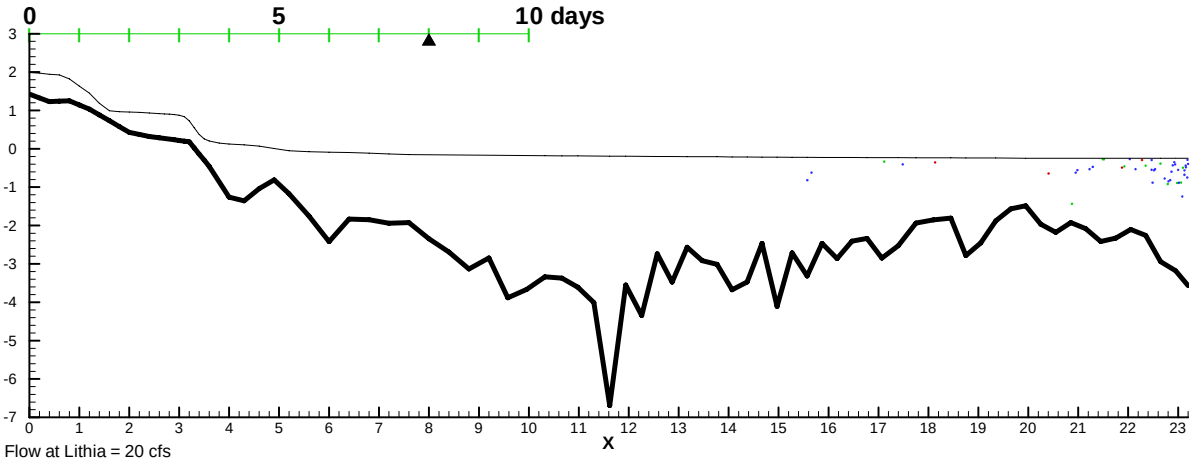


Figure E- 9 Particle distributions at time = 192 hours (8 days).

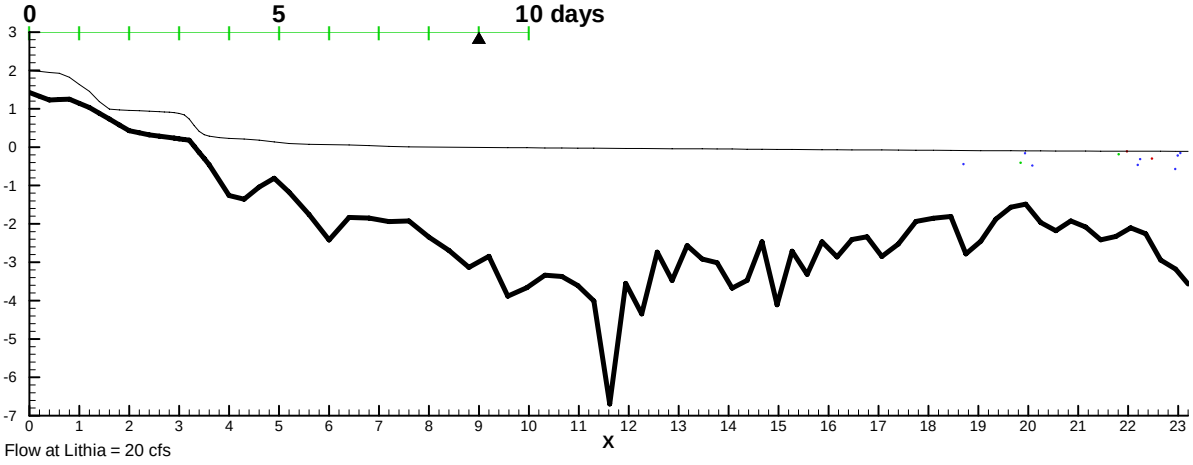


Figure E- 10 Particle distributions at time = 216 hours (9 days).

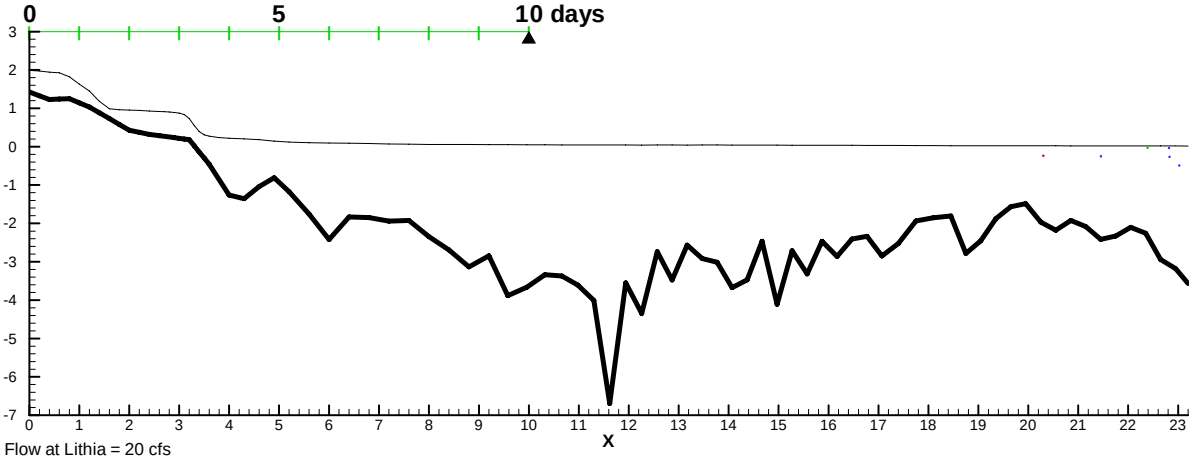


Figure E- 11 Particle distributions at time = 240 hours (10 days).

Appendix F

Particle Distributions
(Flow Rate at the Lithia Station = 50cfs)

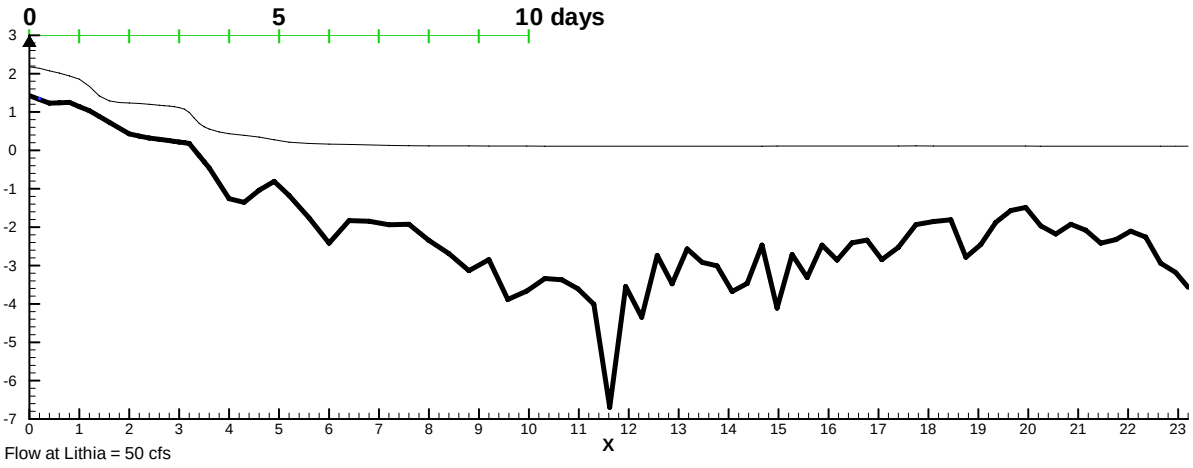


Figure F- 1 At time = 0 hours, 200 green particles are released at the Lithia station (x = 0).

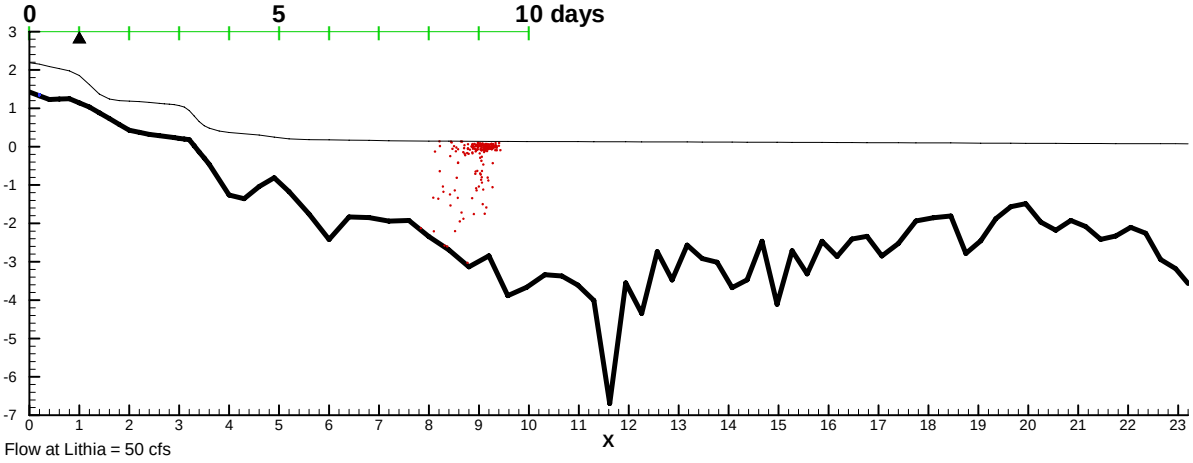


Figure F- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

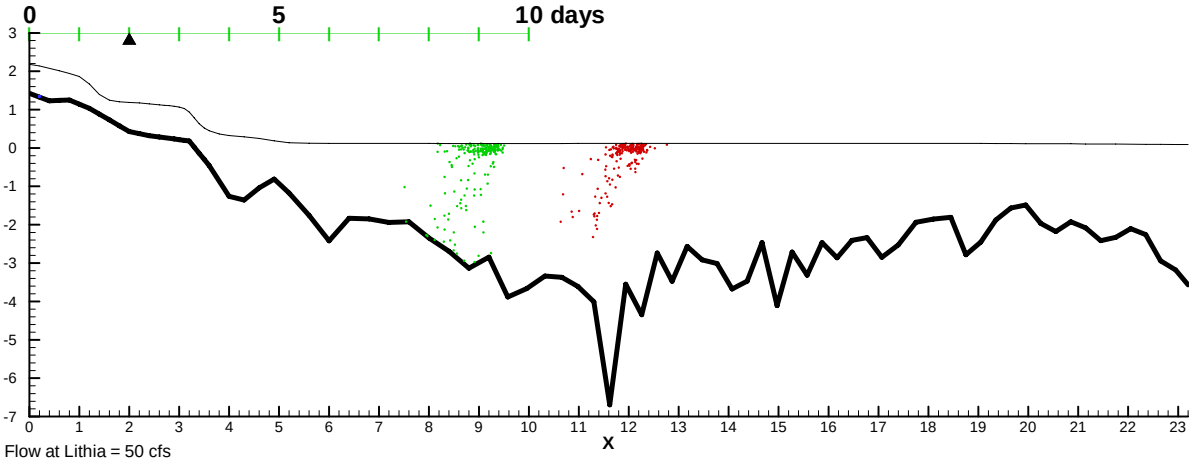


Figure F- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

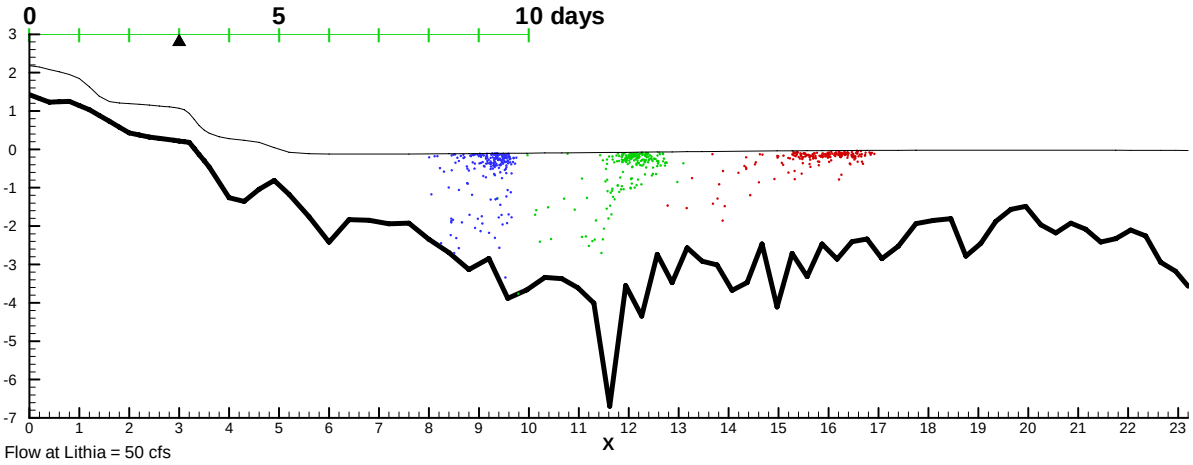


Figure F- 4 Particle distributions at time = 72 hours (3 days).

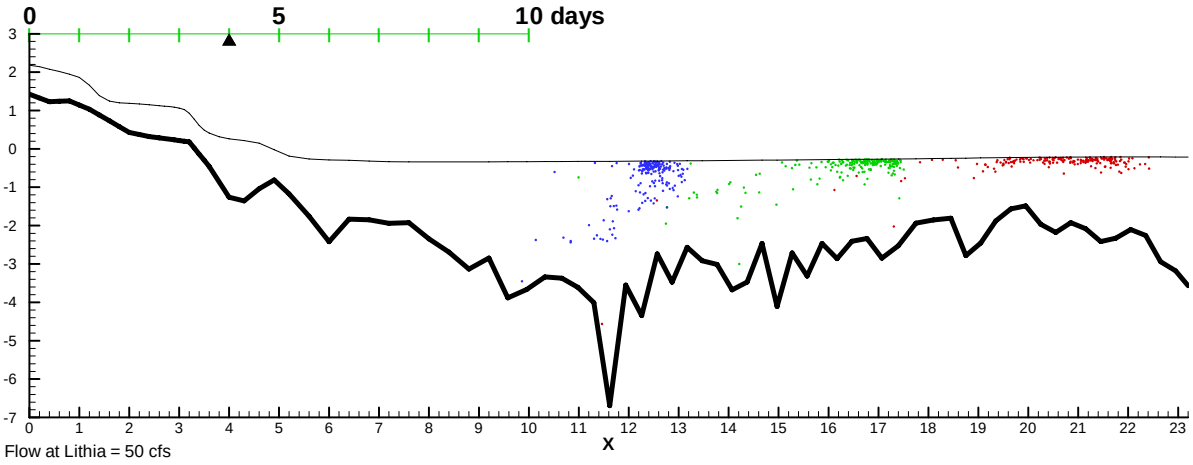


Figure F- 5 Particle distributions at time = 96 hours (4 days).

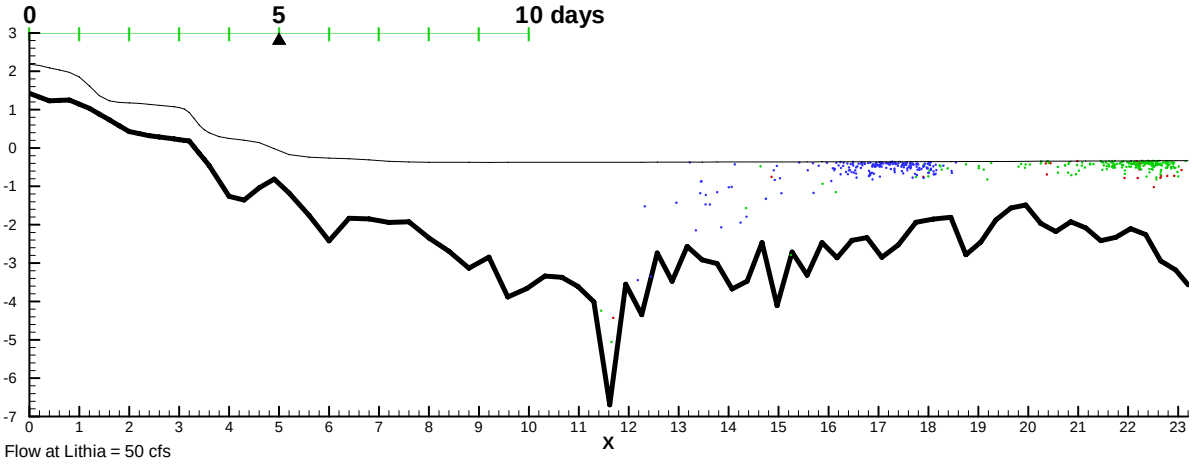


Figure F- 6 Particle distributions at time = 120 hours (5 days).

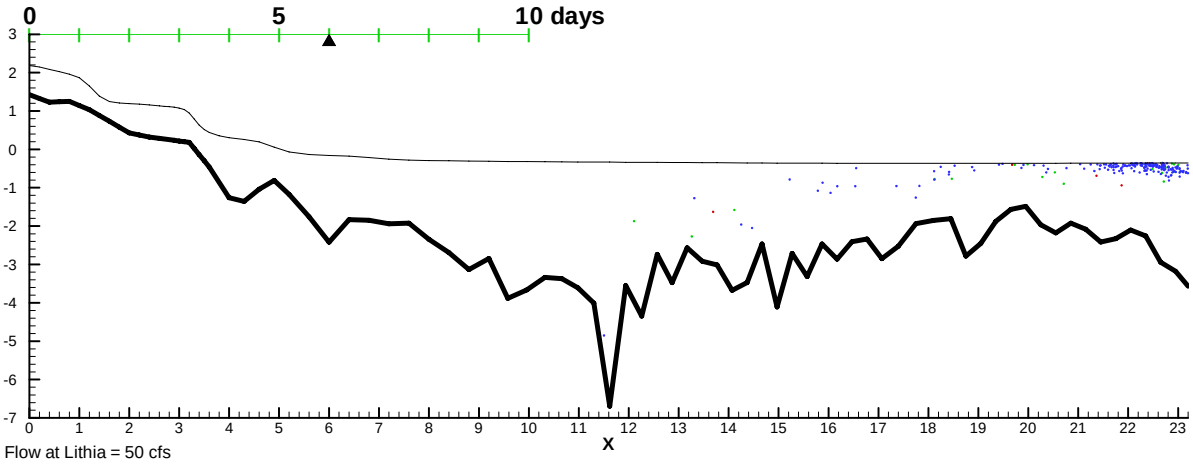


Figure F- 7 Particle distributions at time = 144 hours (6 days).

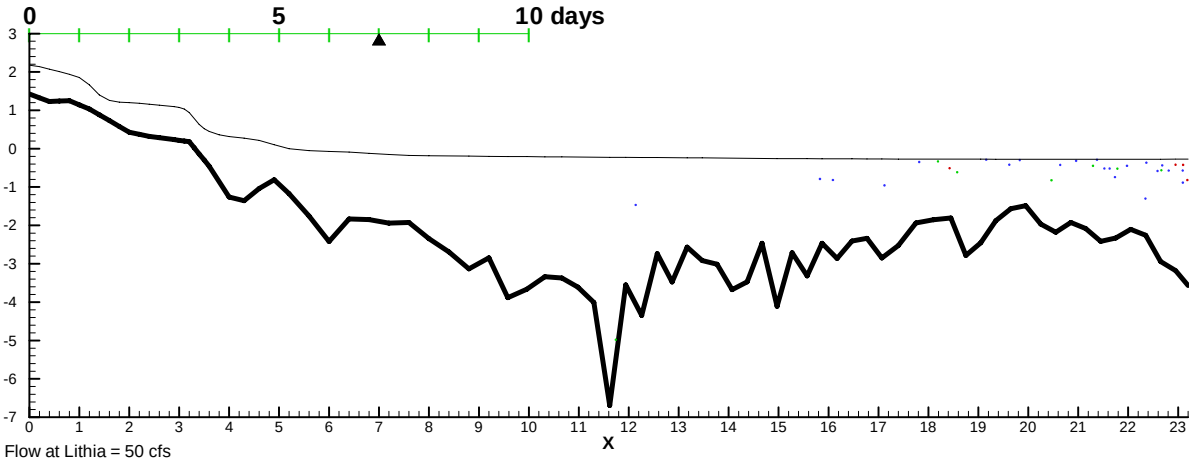


Figure F- 8 Particle distributions at time = 168 hours (7 days).

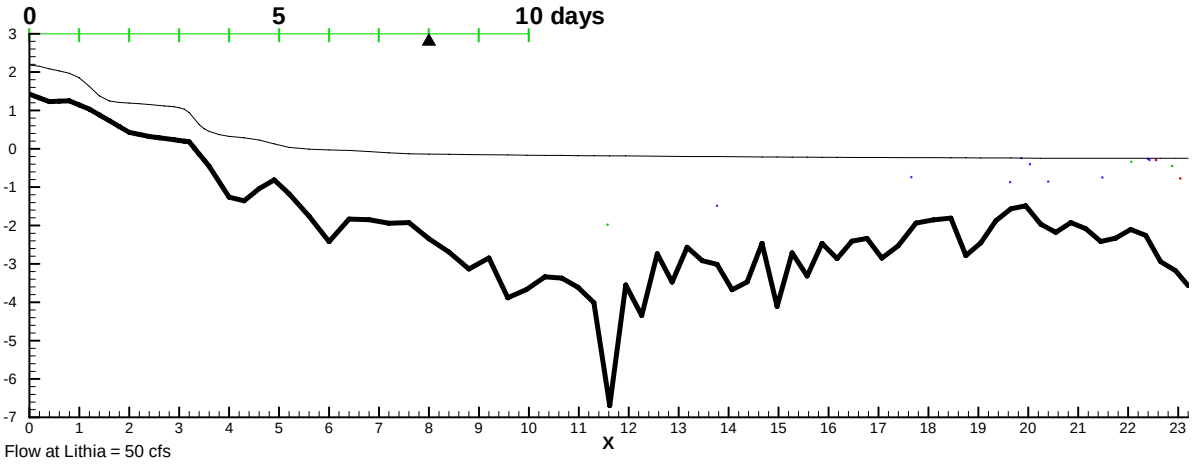


Figure F- 9 Particle distributions at time = 192 hours (8 days).

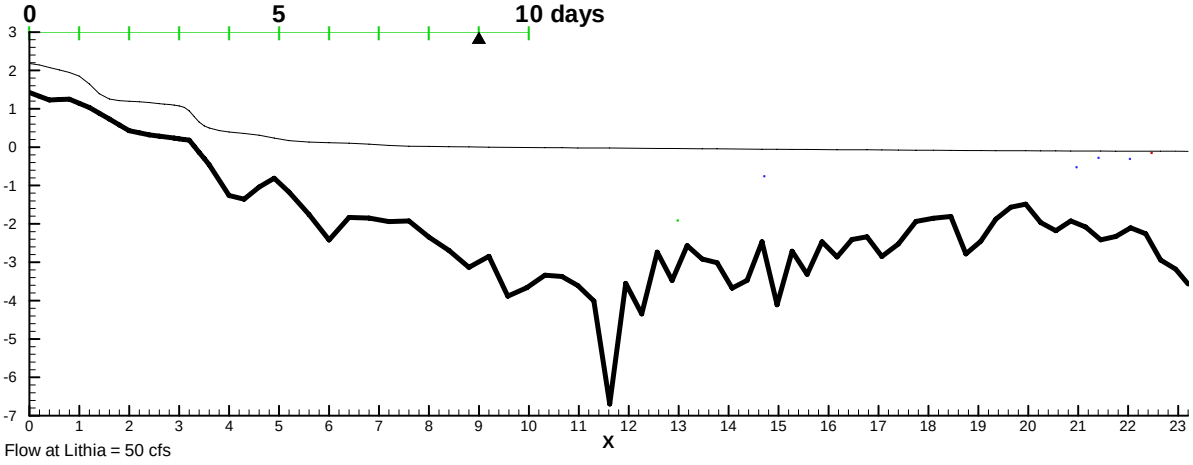


Figure F- 10 Particle distributions at time = 216 hours (9 days).

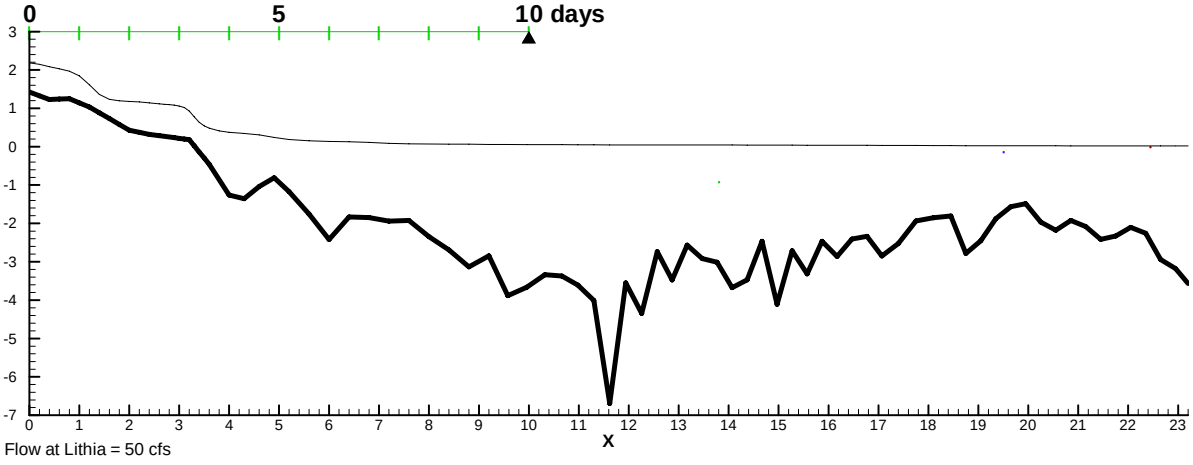


Figure F- 11 Particle distributions at time = 240 hours (10 days).

Appendix G

Particle Distributions
(Flow Rate at the Lithia Station = 100cfs)

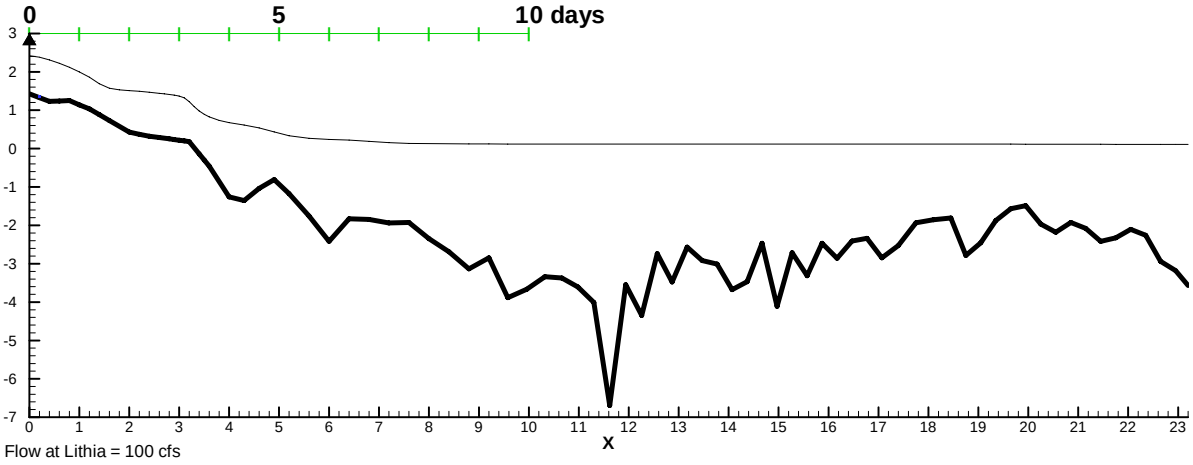


Figure G- 1 At time = 0 hours, 200 green particles are released at the Lithia station (x = 0).

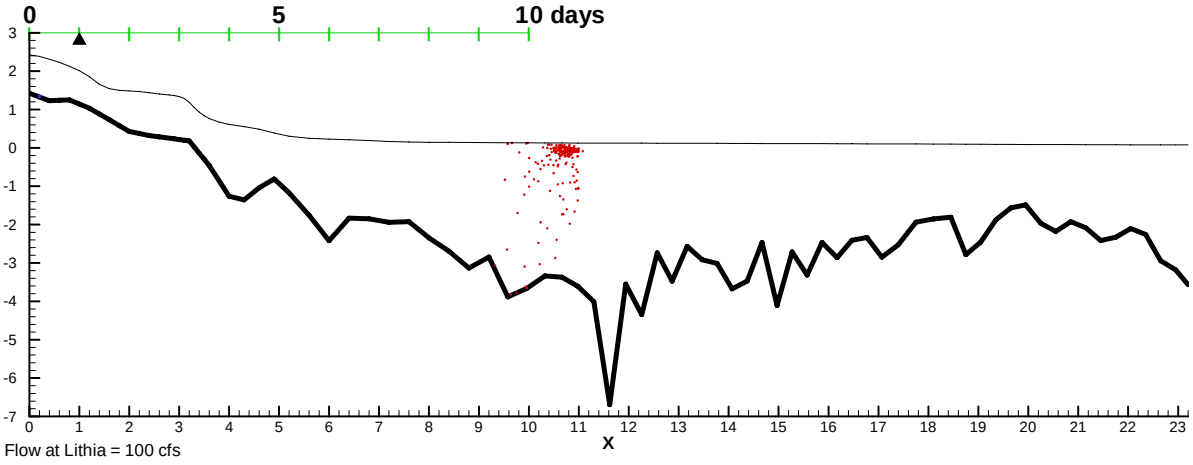


Figure G- 2 At time = 24 hours, 200 green particles are released at the Lithia station (x = 0).

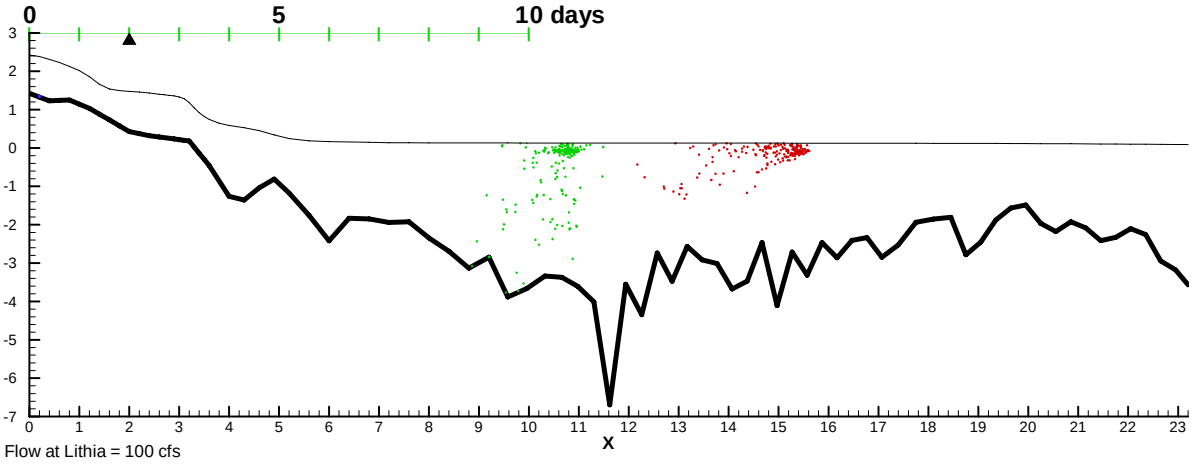


Figure G- 3 At time = 48 hours, 200 blue particles are released at the Lithia station (x = 0).

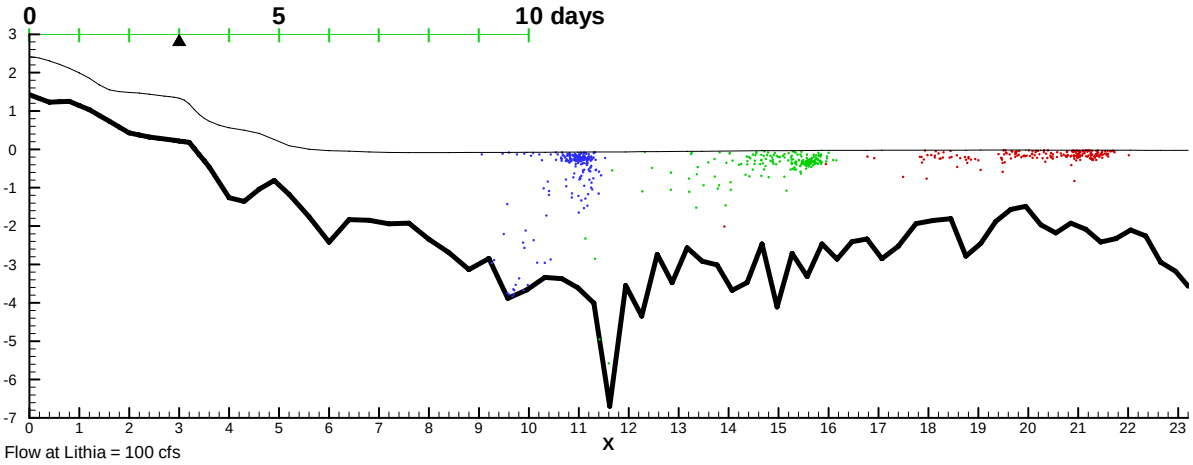


Figure G- 4 Particle distributions at time = 72 hours (3 days).

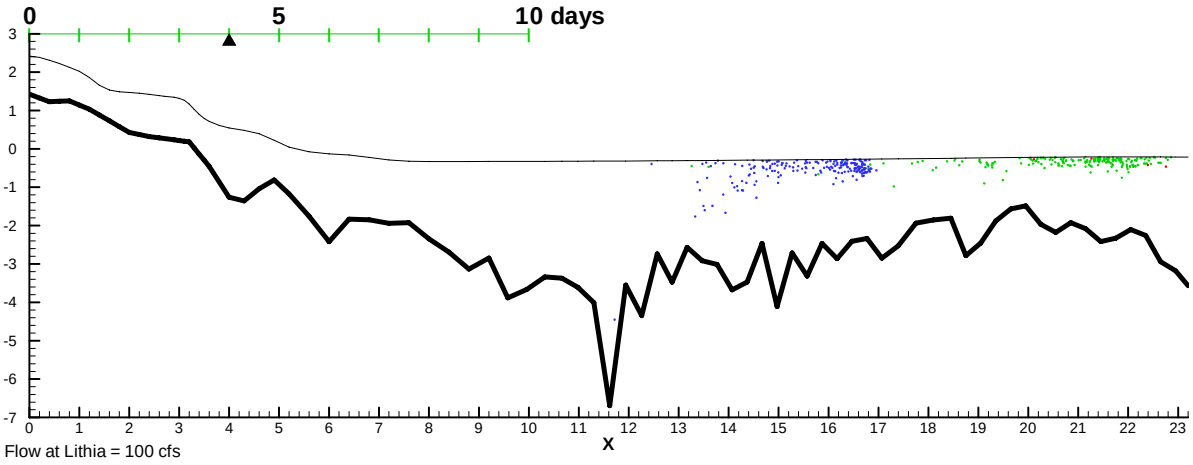


Figure G- 5 Particle distributions at time = 96 hours (4 days).

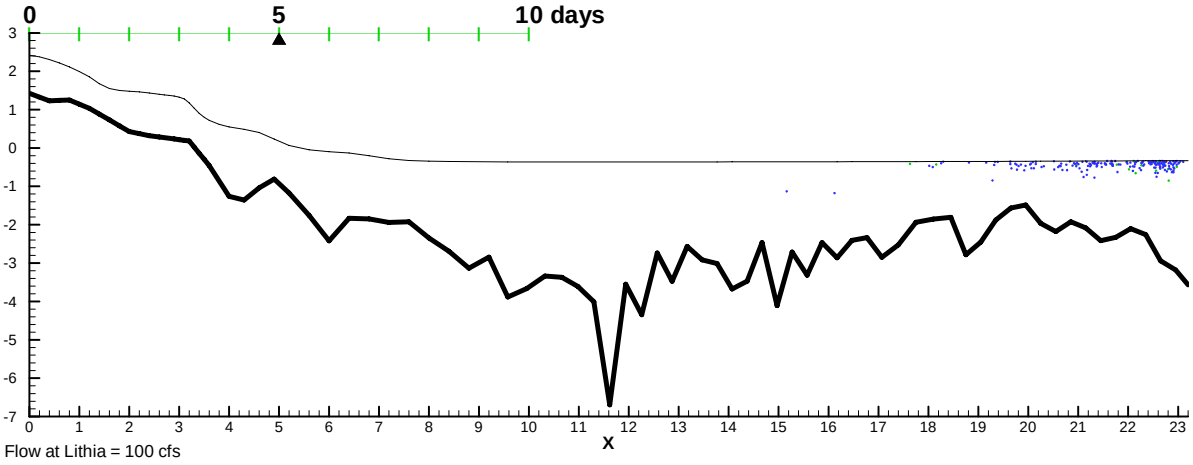


Figure G- 6 Particle distributions at time = 120 hours (5 days).

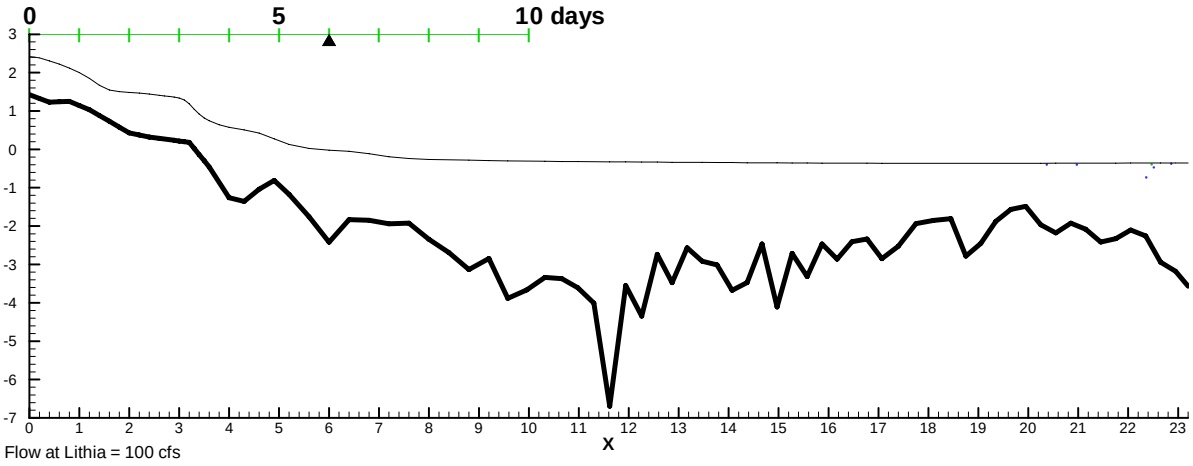


Figure G- 7 Particle distributions at time = 144 hours (6 days).

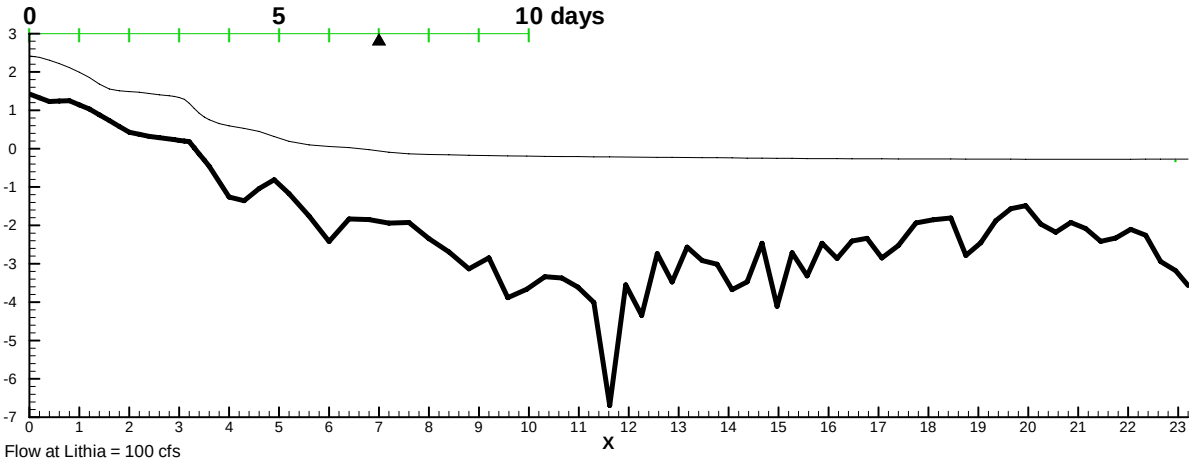


Figure G- 8 Particle distributions at time = 168 hours (7 days).

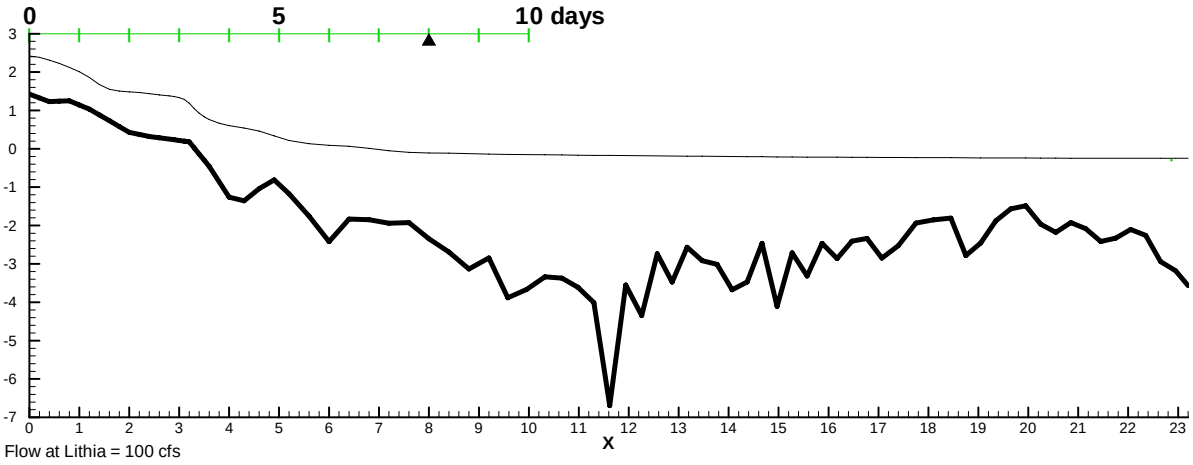


Figure G- 9 Particle distributions at time = 192 hours (8 days).

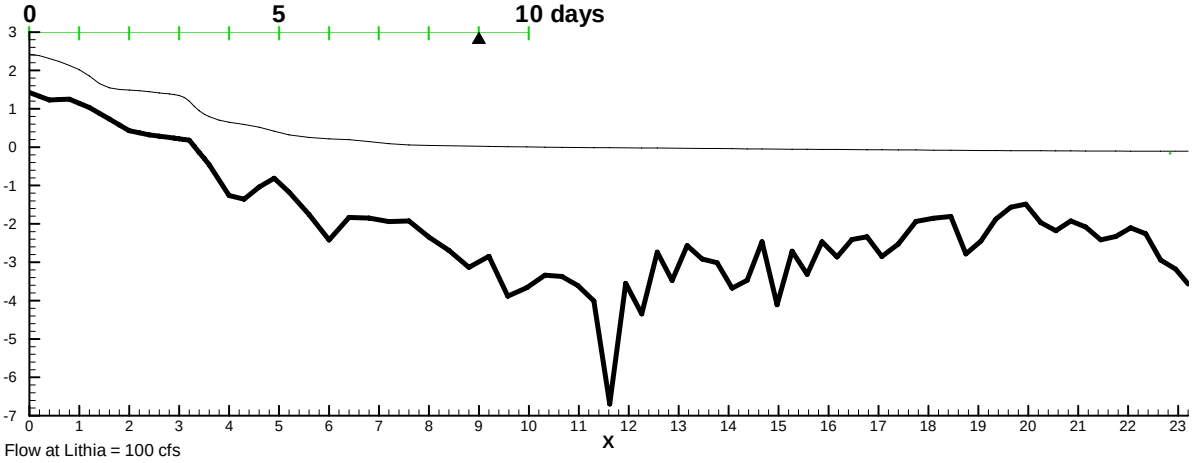


Figure G- 10 Particle distributions at time = 216 hours (9 days).

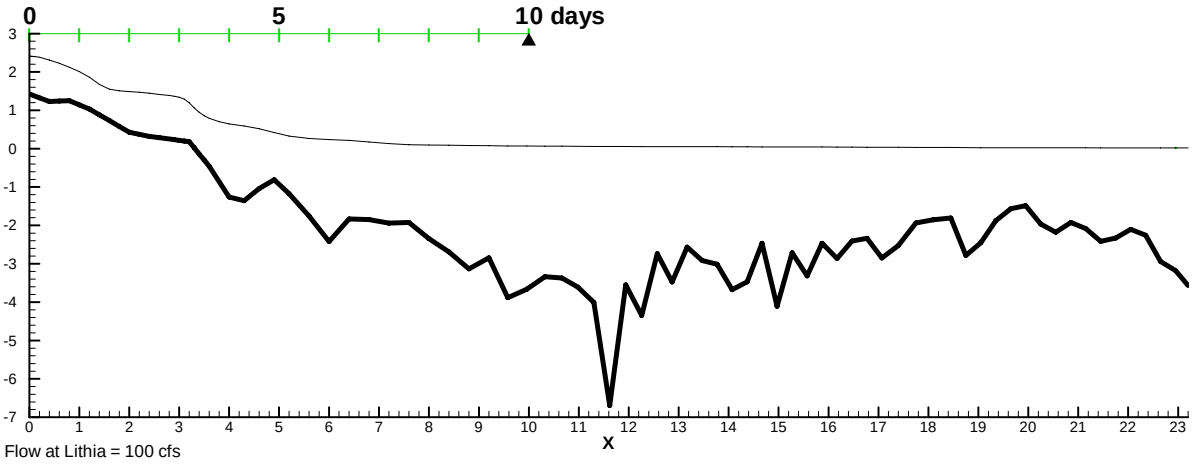


Figure G- 11 Particle distributions at time = 240 hours (10 days).

Appendix 5A

Alafia River Salinity Regressions

Whole River

Objective

The objective was to develop a series of regressions to predict salinity at longitudinal intervals and depths as a function of flow.

Data Sources

Flow

Flow data (cfs) were obtained from U.S. Geological Survey for Alafia River at Lithia gage. Additional flow data were obtained from Tampa Bay Water for Buckhorn Springs and Lithia Springs.

Salinity

A comprehensive set of salinity profile measurements was compiled to provide the data to develop the salinity concentration. Data were compiled from observations reported by:

- Tampa Bay Water HBMP Program, Environmental Protection Commission of Hillsborough County Ambient Water Quality Monitoring Program
- Environmental Protection Commission of Hillsborough County Independent Monitoring Program
- Southwest Florida Water Management District Program
- SWFWMD at USF Program
- Tampa Bay Estuary Program Benthic Monitoring Program
- Tampa Bay Hydro biological Monitoring Program
- Florida Marine Research Laboratory Fisheries Independent Monitoring Program.

Approach

Flow

Flow data were compiled from USGS/SWFWMD flow monitoring gages and Tampa Bay Water flow monitoring gages. Missing flow observations from the period of record were interpolated between the observations before and after the missing period, and a relatively large data gap for Buckhorn Springs flow was filled using an empirical regression model that predicted Buckhorn Springs flow as a function of two indicator variables, Lithia Springs Flow and Alafia River flow at Lithia.

The flows (cfs) used to predict salinity at longitudinal intervals were calculated using the following equation:

$$\text{Alafia River flow}_{\text{Bell Shoals}} = \text{Flow}_{\text{Lithia}} \times [(335\ \text{mi}^2 + 39.2\ \text{mi}^2)/335\ \text{mi}^2] + \text{Flow}_{\text{Lithia Springs}} + \text{Flow}_{\text{Buckhorn Springs}}$$

Salinity

The original temperature corrected conductivity observations from the USGS program were used to calculate salinity values by using the following equation (Hydrolab® Corp.).

$$\begin{aligned}\text{Salinity} = {} & (20.0 + ((0.69608) \times \text{Conductivity} - 32.188)) \\ & + (0.0013904 \times (\text{Conductivity} - 32.188)^2) \\ & + (0.000011918 \times (\text{Conductivity} - 32.188)^3) \\ & + (0.00000017392 \times (\text{Conductivity} - 32.188)^4) \\ & + (0.0000000031112 \times (\text{Conductivity} - 32.188)^5)\end{aligned}$$

Overall Approach

For the fundamental approach to this model, a series of polynomial curves were fit in order to model salinity as a response to total flow. Slightly different curve shapes were used according to the water column depth and river kilometer of the salinity estimates. The observed data were used to select the most unbiased curve shapes. Figure 1 presents a conceptual diagram of the generalized relationship between total flow and salinity for Alafia River.

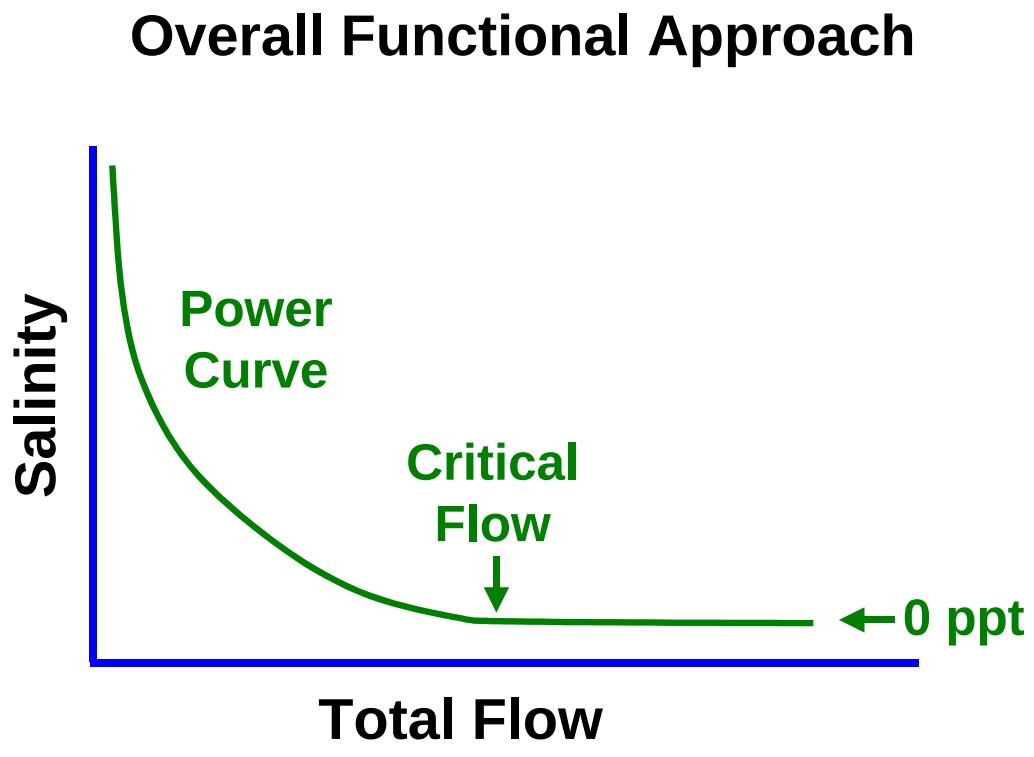


Figure 1. Conceptual diagram of fundamental approach to the baseline model.

The curve presented in Figure 1 represents a simplified example for one location in space

(i.e., a single reporting unit, river kilometer location, and water column depth location). In the final model constructed for this project, equations to predict salinity as a function of flow were assigned parameters to describe how the conceptual curve shown in Figure 1 is shaped differently for different locations in space. A two-step approach was used to fit the general model presented in Figure 1 to the observed data for the Alafia Reporting Unit. The first step models the freshwater responses in the estuary, and the second step models the brackish water responses in the estuary. The first step of the approach was to identify the critical flow (Figure 1) at which point higher flows result in near zero salinity conditions. Above this critical flow point, there was little or no explainable variation in observed salinity, and only very rare, if any, higher salinity values were observed. Because of this essential lack of variation, an Analysis of Variance method could not be used to directly describe the relationship between salinity and flow above this critical flow value. Thus, a regression relationship was defined to predict the location of the critical flow point as a function of total flow for each water column depth class (Surface, 1-Meter, 2-Meter, Bottom). The near zero salinity critical flow point was operationally defined for each 1 kilometer interval as the highest flow (95th percentile of total flow) at which salinities greater than 0.5-ppt were observed over the period of record. These models fit the observed data extremely well, and they described a response that as flow increases in a river at a particular depth, the critical flow point for near zero salinity values moves farther downstream in a curvilinear fashion. As one moves from upstream to downstream in any of the river systems examined, increasingly greater changes in flow are required to achieve an equivalent near zero salinity critical point movement. The r^2 values for these relationships ranged from 0.95 to 0.99 for the Alafia River.

The second step of the approach was to model salinity as a function of total flow for the flows less than the near zero salinity critical flow point. It should be noted that like the observed salinities used in the first step, the observed salinities used in this second step also included many zero and near zero observations. The distinction between the first step of the approach and this step was that in the first step the observed salinities were essentially always near zero, and in the second step there was a range of salinity variation between zero and Gulf salinities which could be modeled using an Analysis of Variance method.

Salinity models were developed for each reporting unit, depth level (Surface, 1 Meter, 2 Meter, Bottom), and river kilometer zones. The models were developed independently for different geographic zones because near the river mouths the ambient Tampa Bay salinity was observed to be a relatively more important explanatory variable compared to river flow.

The final baseline salinity models were integrated by combining the models from steps 1 and 2. The final model for each reporting unit predicts salinity as a function of total flow, antecedent flow conditions, depth level, river kilometer, time of year, and ambient Tampa Bay salinity.

The regression model equation using monthly intercept terms is as follows:

$$Salinity_t = \alpha + \sum_{i=1}^{11} \alpha_i \rho_i + \beta_1 \left[\sum_{j=0}^{L_1} flow_{t-j} \right]^{\varepsilon_1} + \beta_2 \left[Sal_{55} \right]^{\varepsilon_2} + \beta_3 \left[Rkm \right]^{\varepsilon_3} + \beta_4 \left[Depth \right]$$

Where:

$Salinity_t$	= *Salinity on day t (ppt),*
α	= *Intercept parameter,*
i	= *index of calendar month (e.g., January = 1),*
α_i	= *Intercept parameter for month I,*
ρ_i	= *a decision variable (1 if i=month, else 0),*
$\beta_1, \beta_2, \beta_3, \beta_4$	= *regression parameters,*
L_1	= *Lag interval constant (days),*
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	= *exponent constants to establish curve shape,*
$flow_{t-j}$	= *total flow at day t-j (cfs),*
Sal_{55}	= *Salinity at HBMP station 55 in Hillsborough Bay,*
Rkm	= *river kilometer, and*
Depth	= *sample depth.*

Results

A comprehensive set of curve shapes was made available, the model was forced to select 11 monthly factor variables first and another one to three best-fit flow related variables or ambient background salinity in Tampa Bay (EPCHC station 55) variables were selected. If sample sizes were not sufficient to permit a full rank regression model to be applied, then another alternative model was used, which was, the model will be forced to select one seasonal variable (dry season) first and another one to two best fitted flow related variables or ambient background salinity in Tampa Bay variable will be selected. Explanatory variables were selected by the regression analysis from the following set of candidate variables:

- total flow,
- antecedent flow (1 to 7 day lag flows),
- monthly factor,
- seasonal factor (dry season and wet season),
- ambient background salinity in Tampa Bay (EPCHC Station 55 – in the center of Hillsborough Bay), and
- Un-gaged flow.

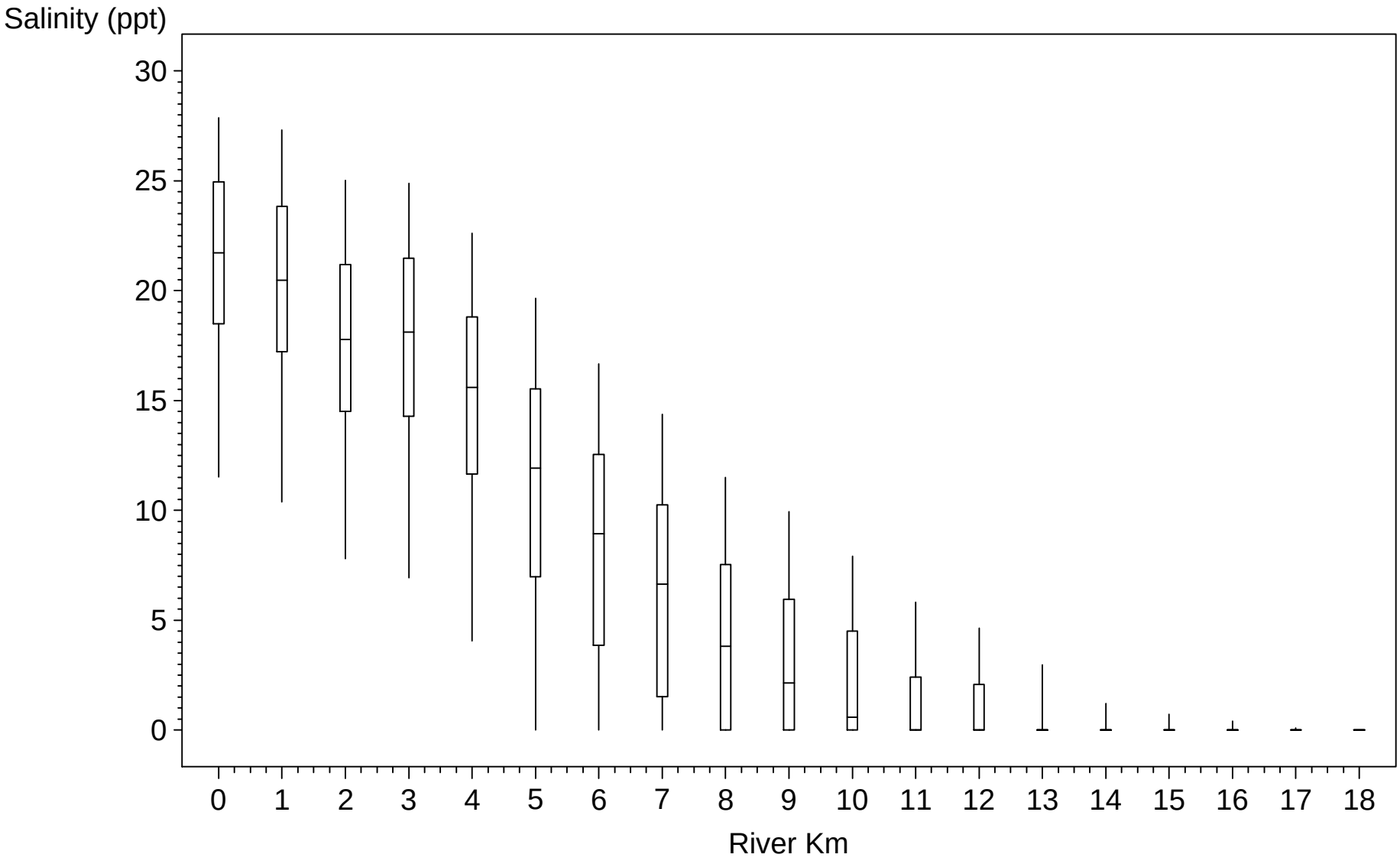
The stepwise regression occasionally selected the location parameters such as sample depth even though each model was fit for a particular region in space (e.g., bottom samples). Thus, additional salinity variation could be explained in the region in space (e.g., observed sample depth within the bottom sample group of observations).

The models were highly statistically significant, and they fit the observed data very well. The r^2 values by reporting unit and water column level ranged from 0.88 to 0.93, and they were frequently reported to be greater than 0.90. The slope parameter estimates were typically highly significant ($p<0.0001$), and the Analyses of Variance explained significant portions of the total variation in salinity ($p>|F|$ generally < 0.0001). In keeping with the objectives of the approach, the salinities estimated were observed to be unbiased. A large part of the remaining unexplained variation in salinity is expected to be a function of the daily tide incursion effects on salinity observations reported from any one location. Summaries of the predicted salinities are presented in the plots that follow.

Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

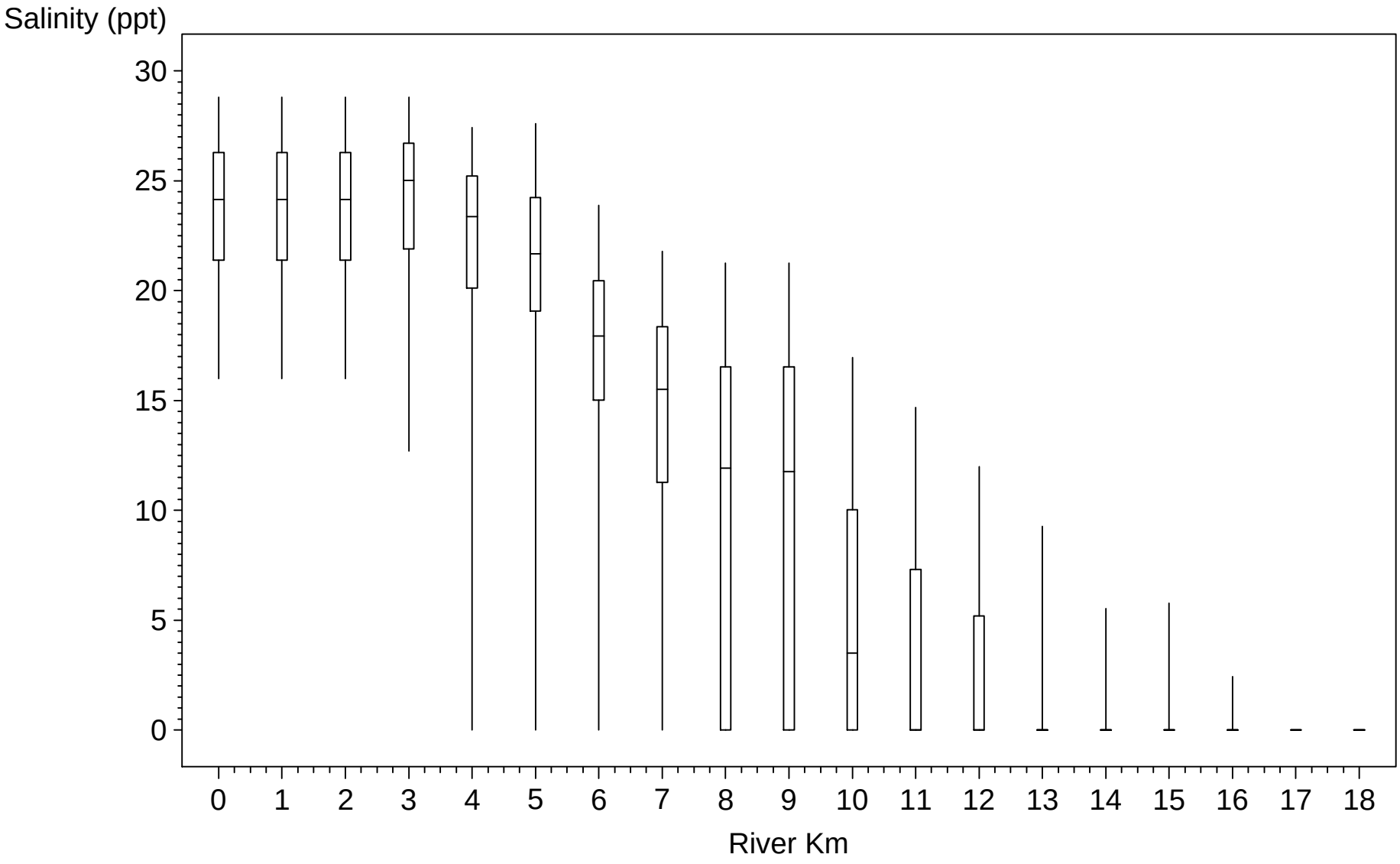
Time Period from 1980 - 2003



Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

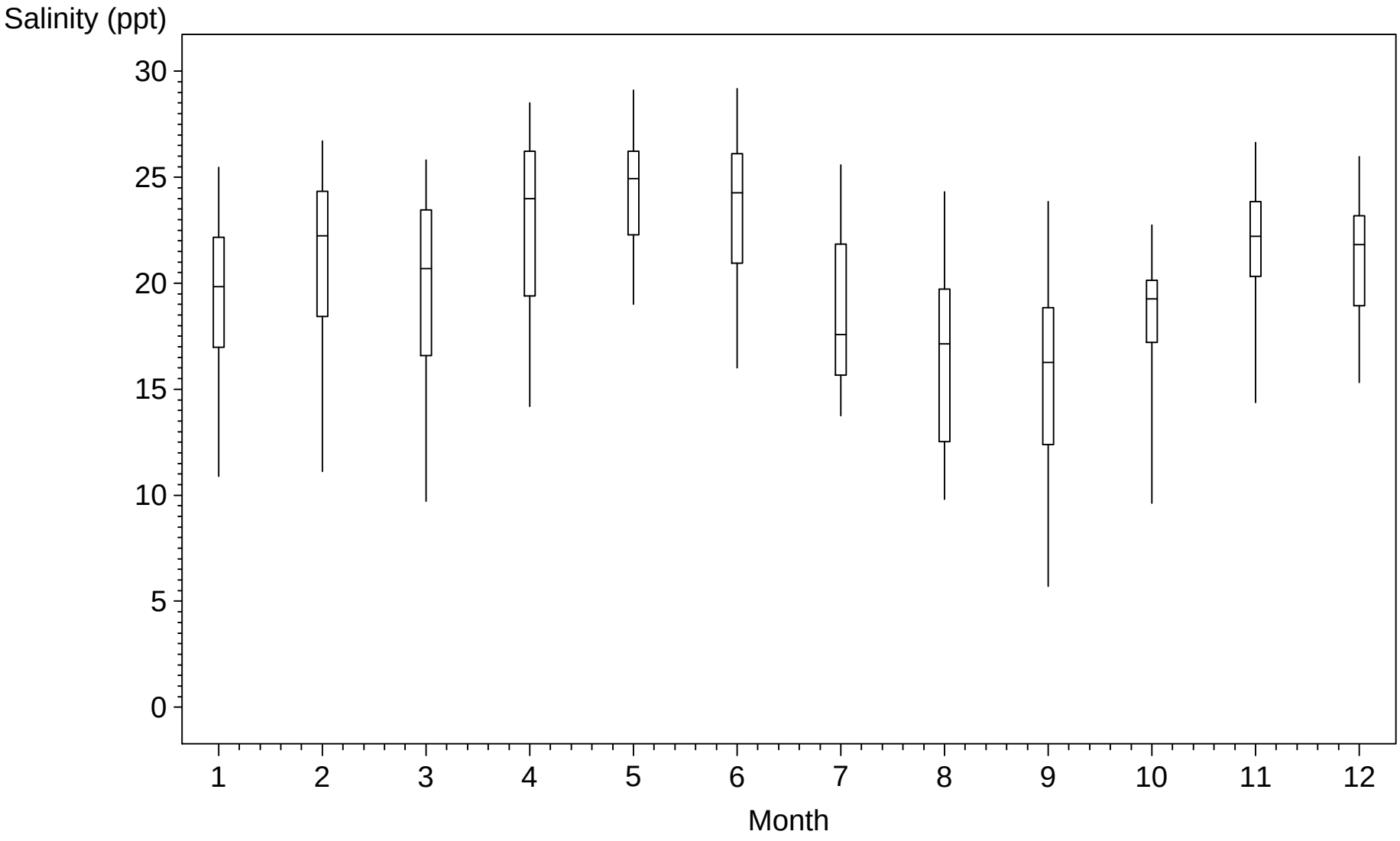


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=1

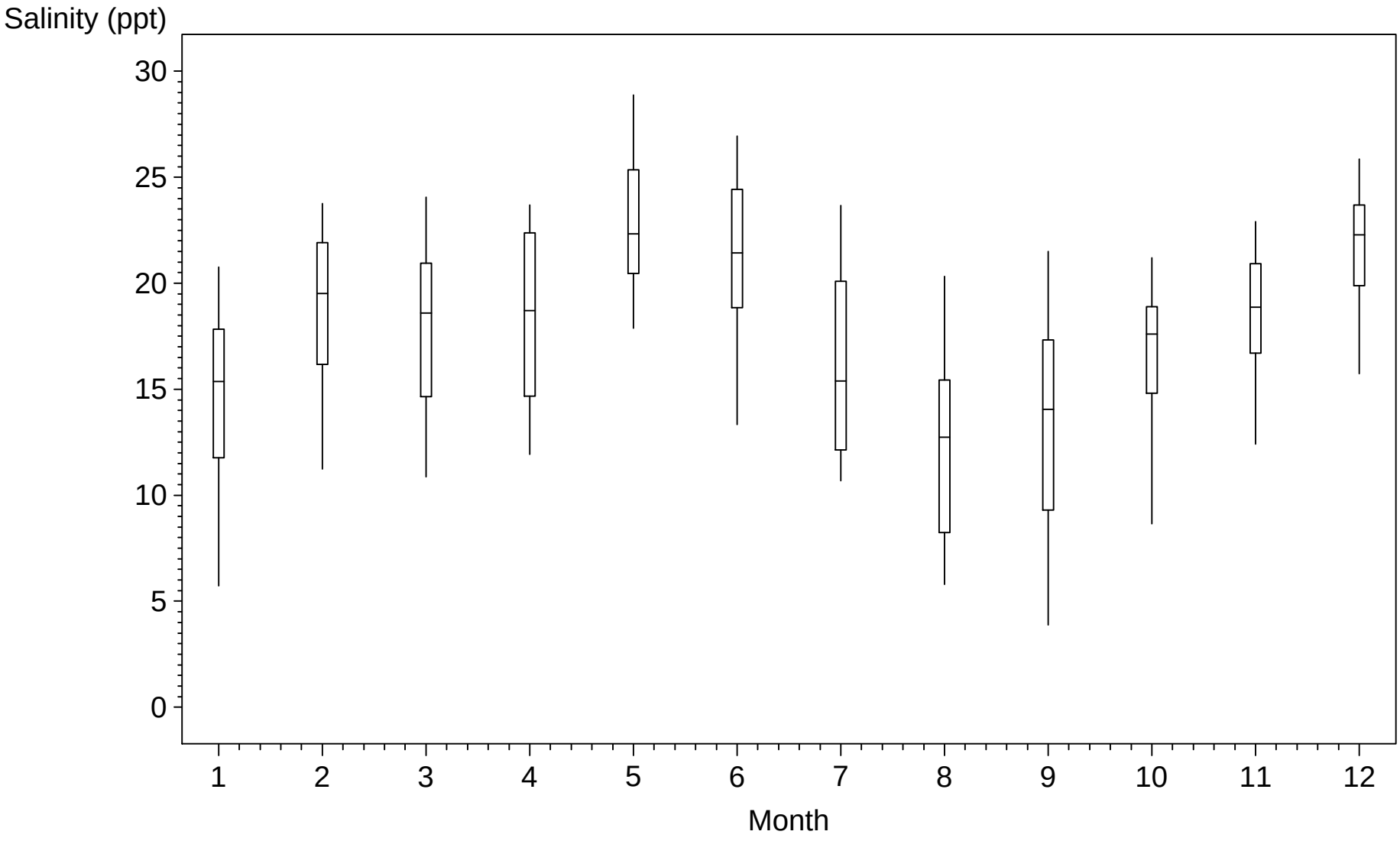


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=3

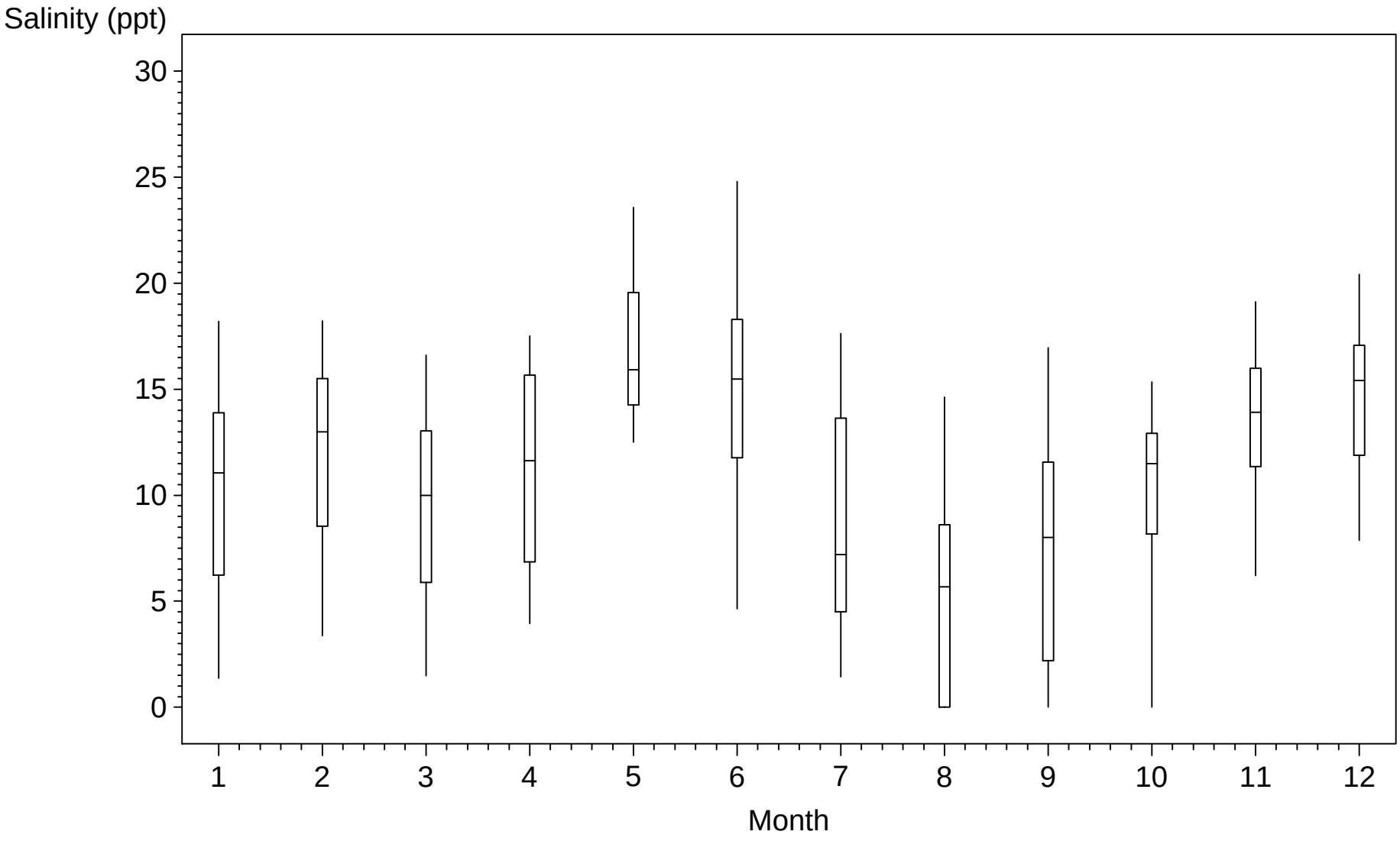


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=5

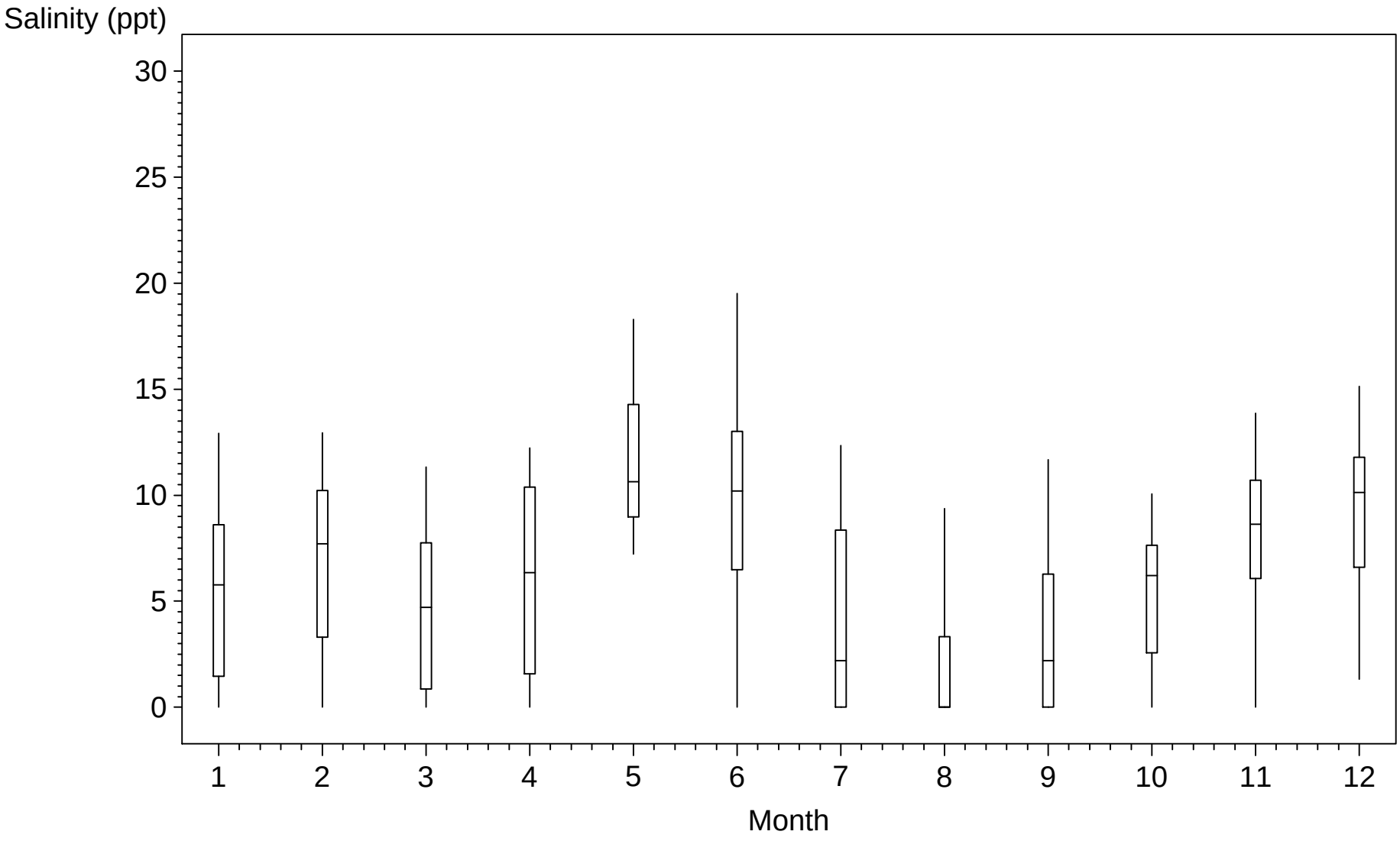


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=7

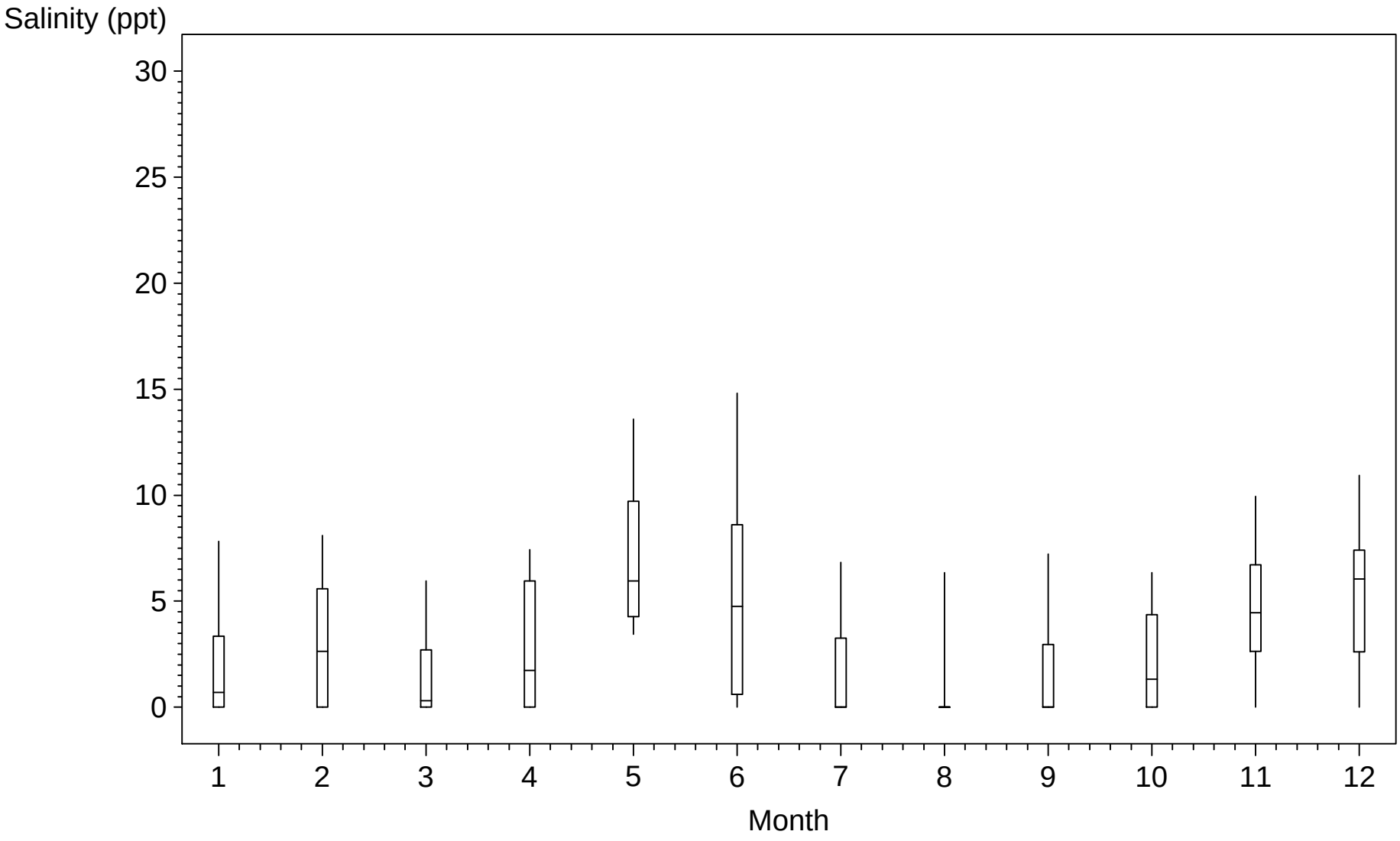


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=9

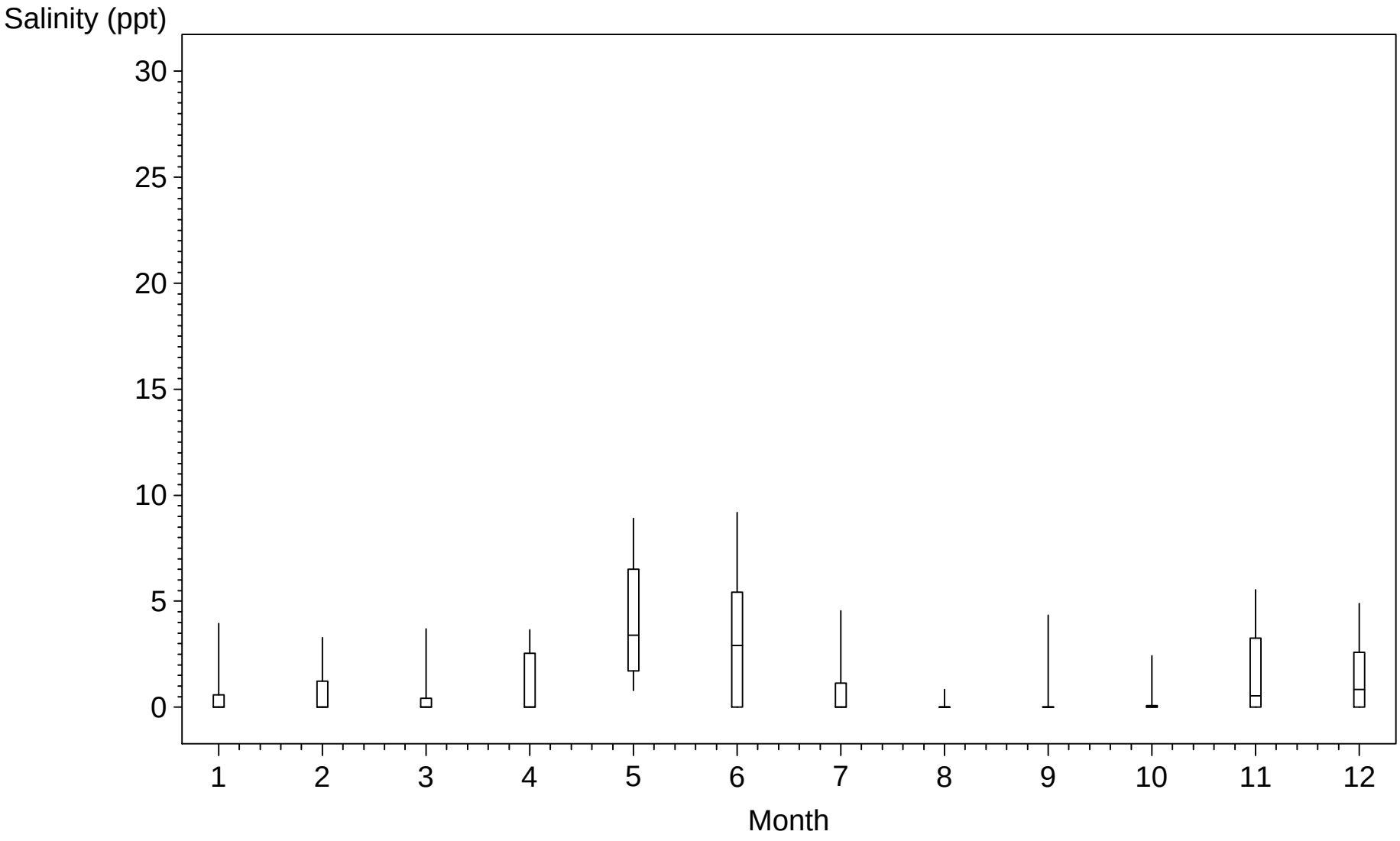


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=11

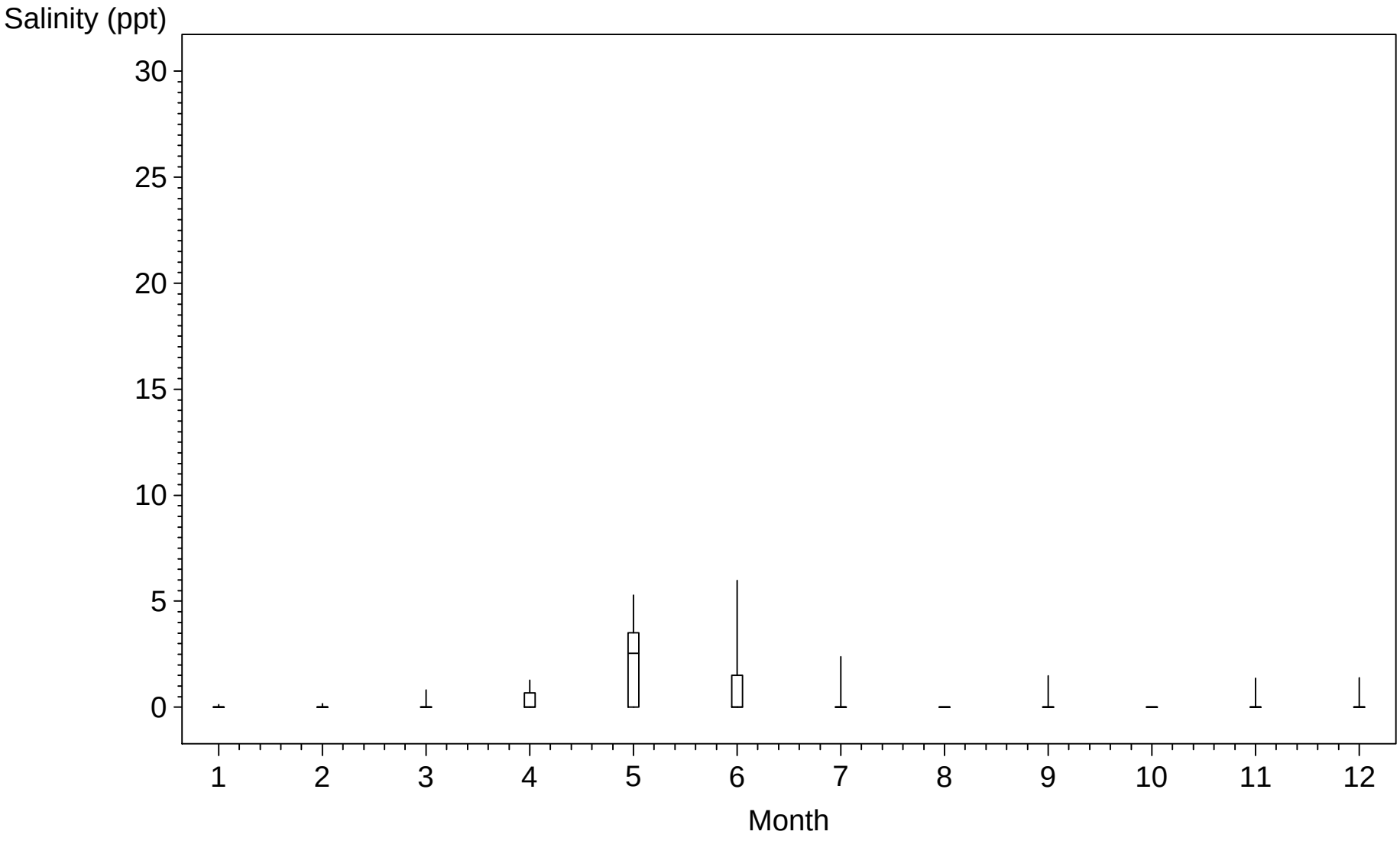


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=13

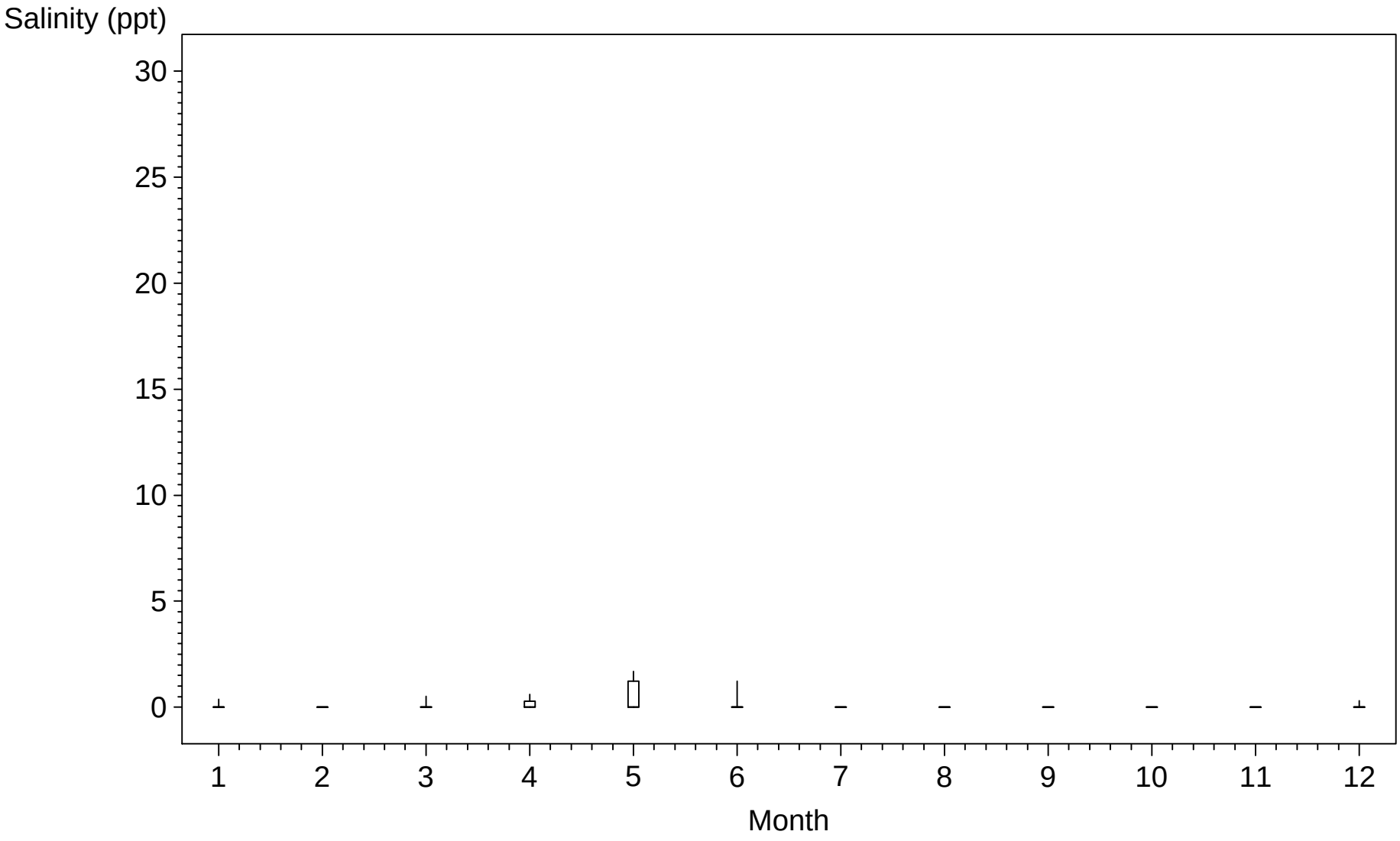


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=15

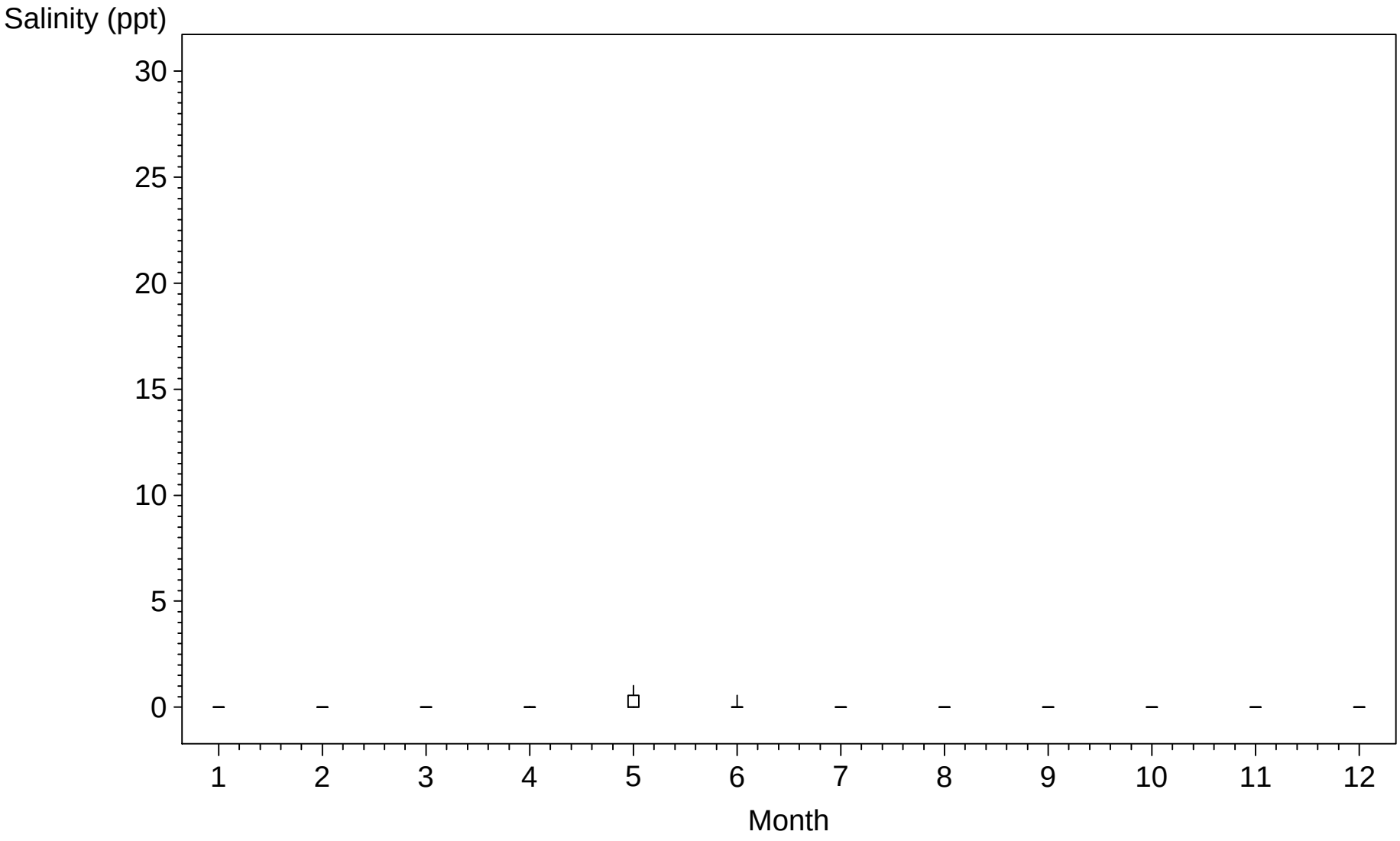


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=17

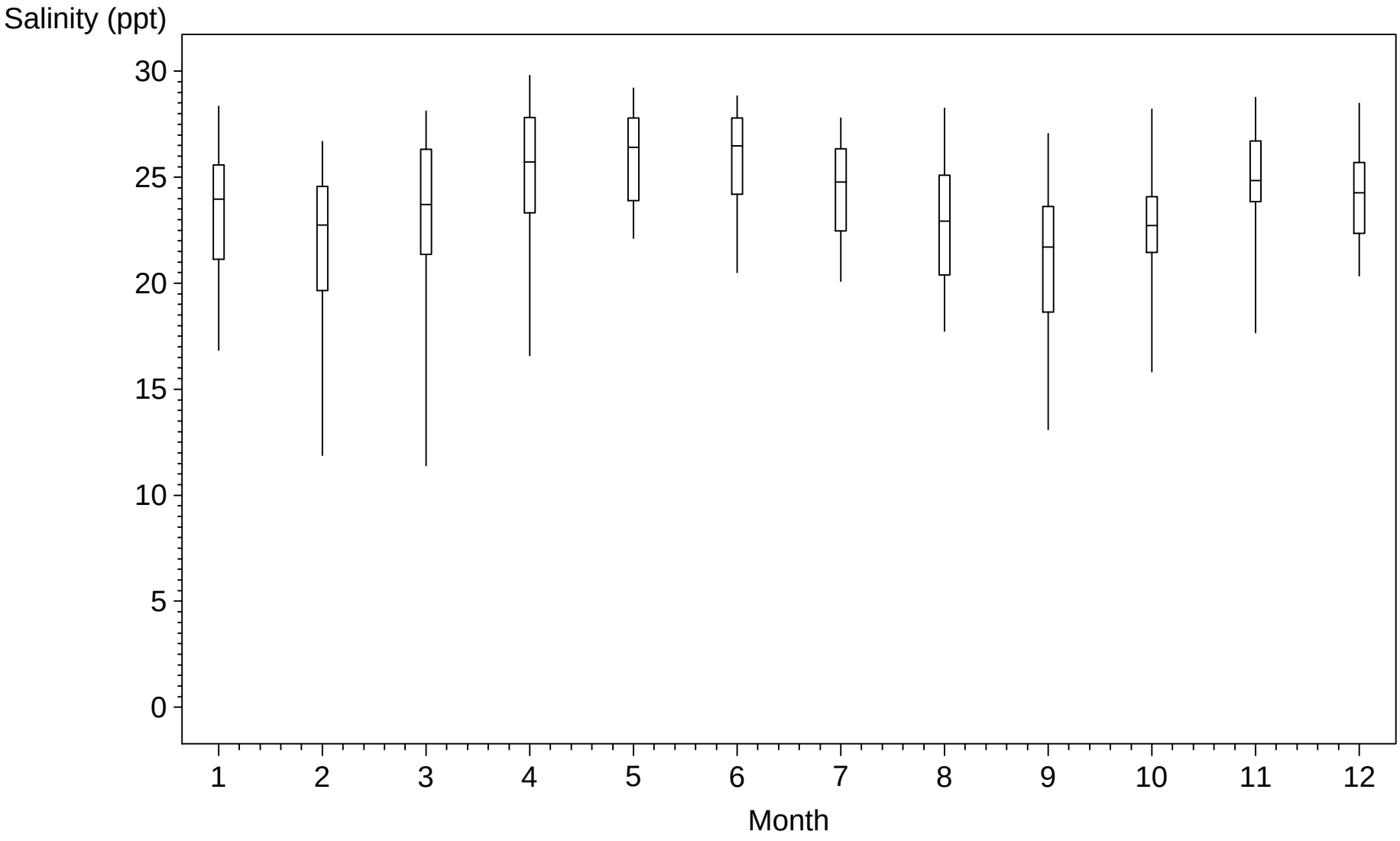


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=1

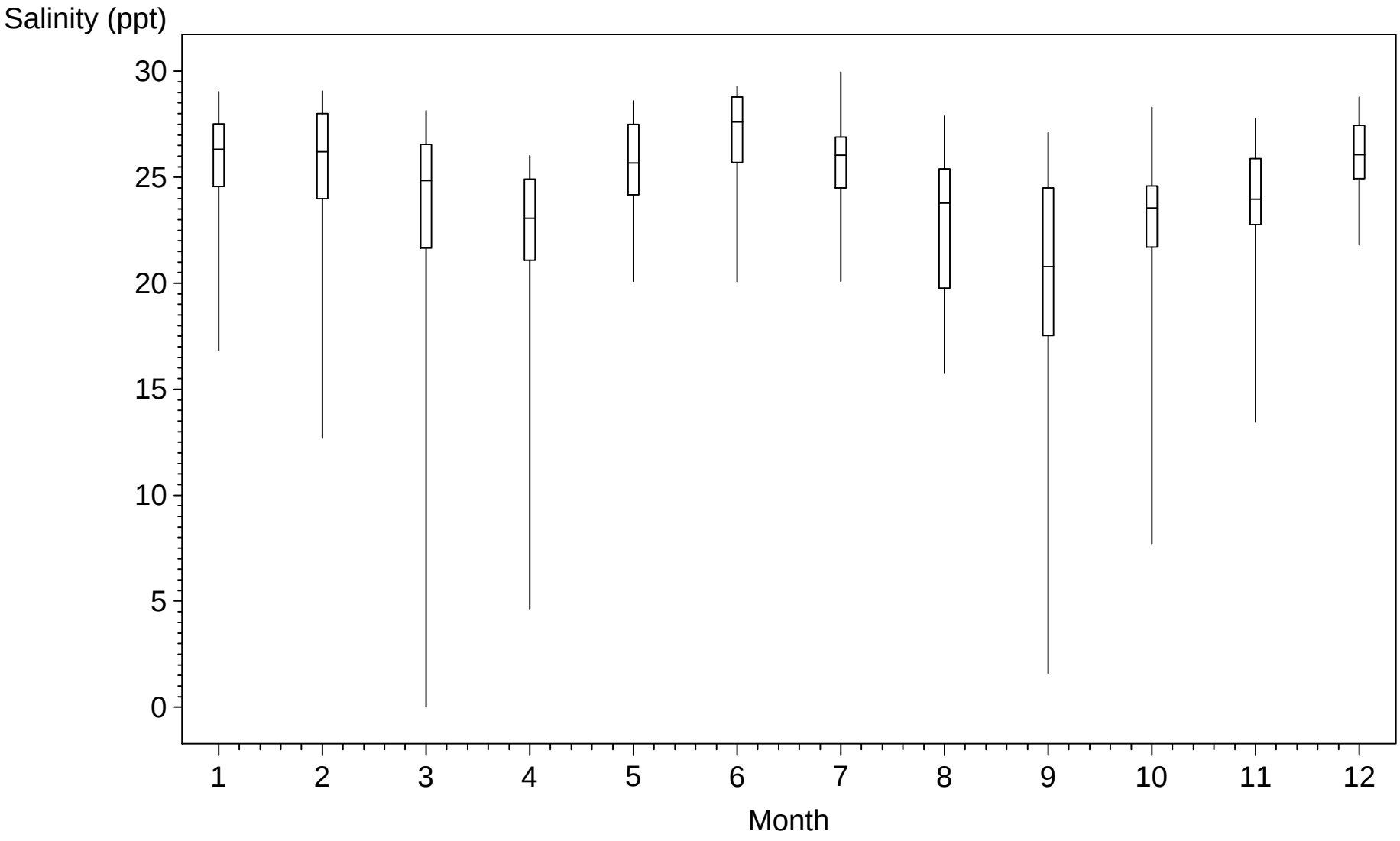


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=3

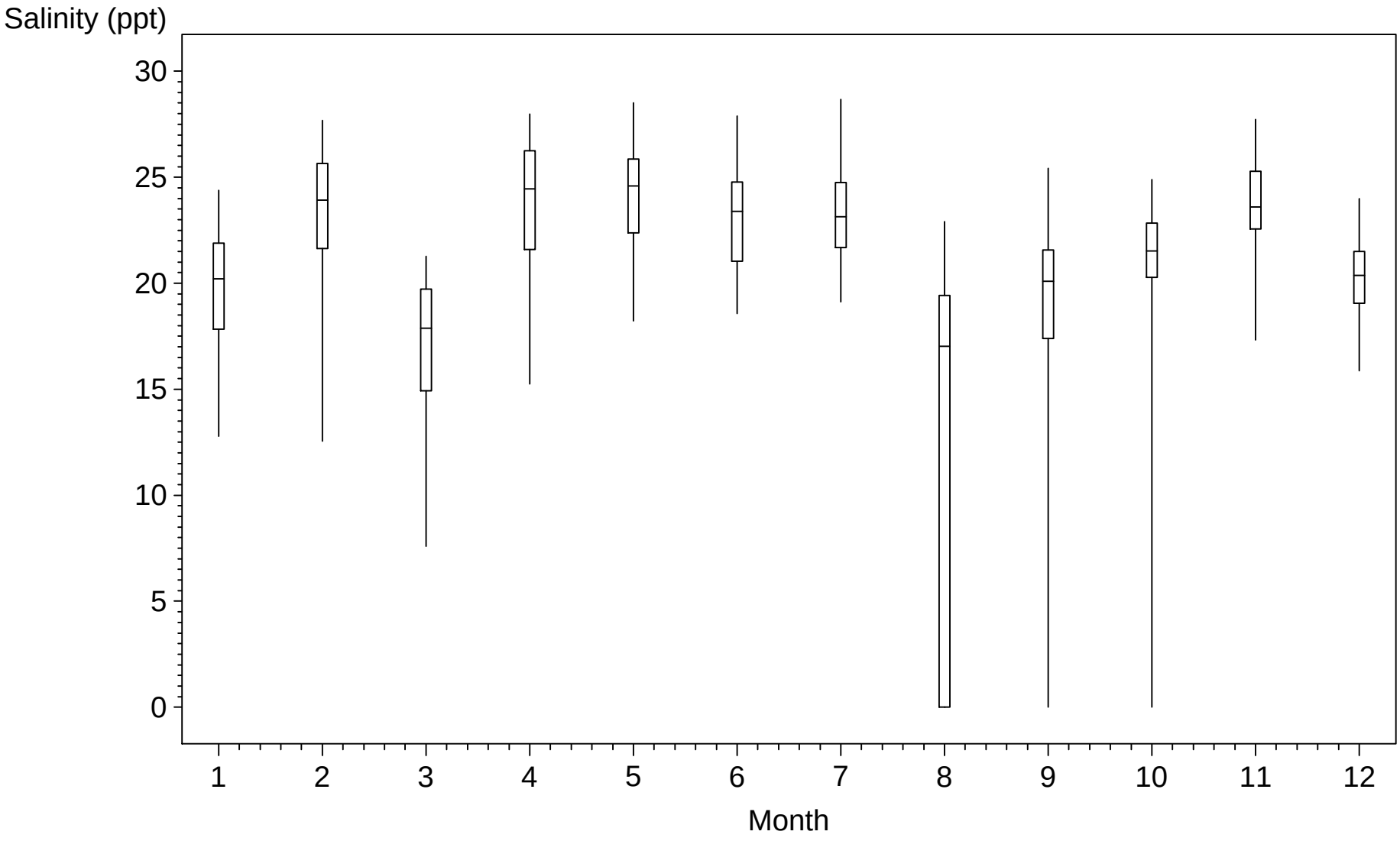


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=5

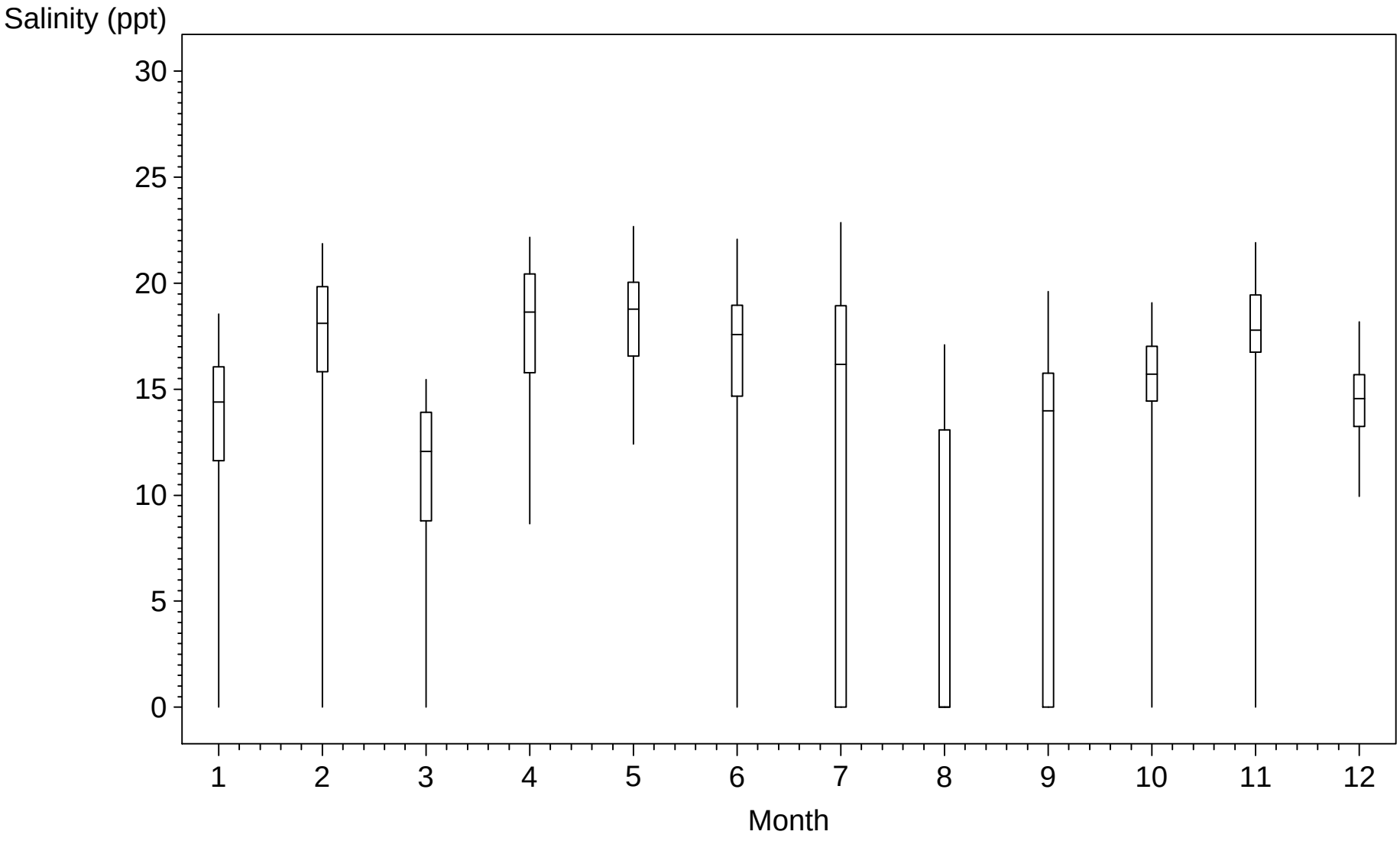


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=7

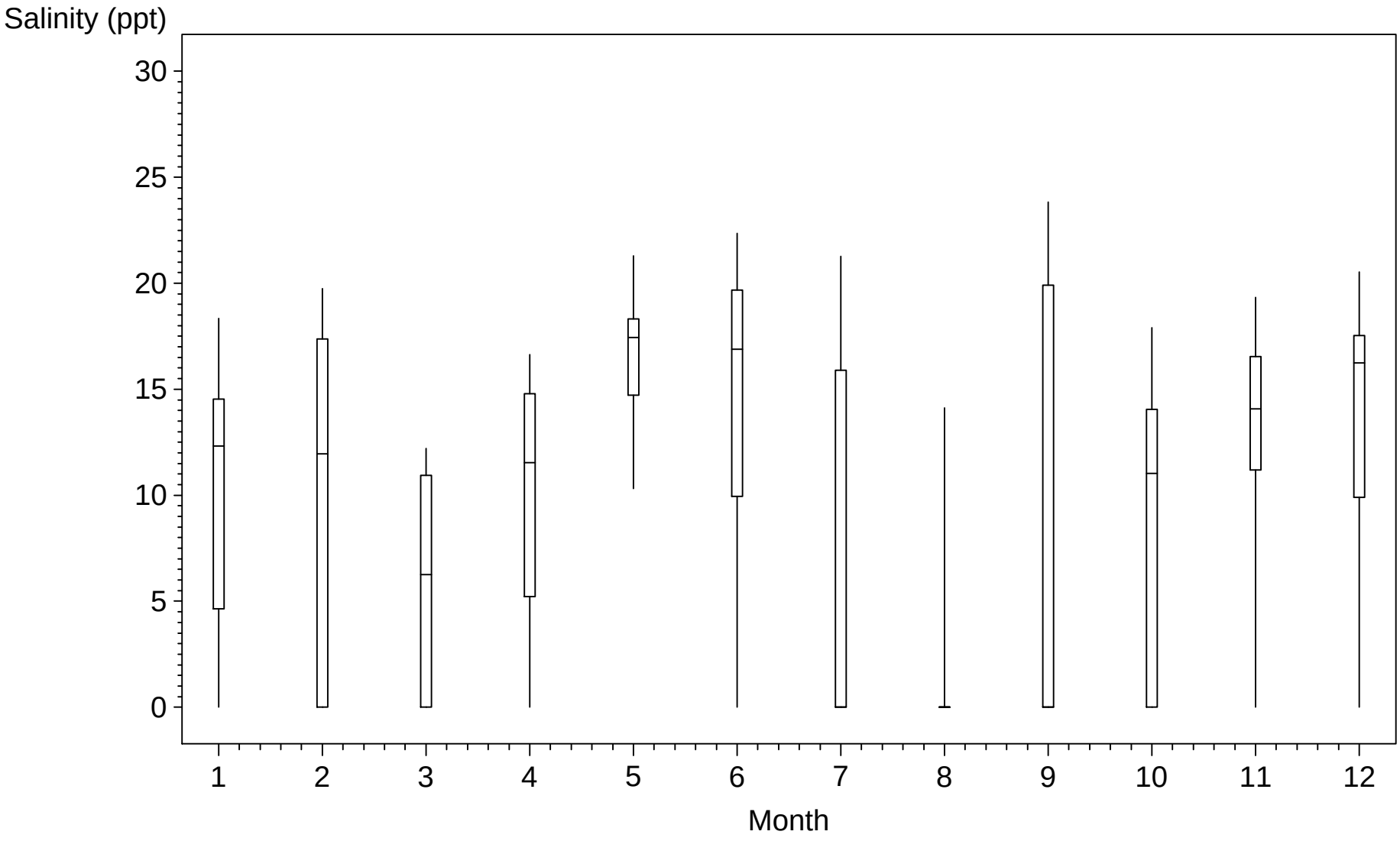


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=9

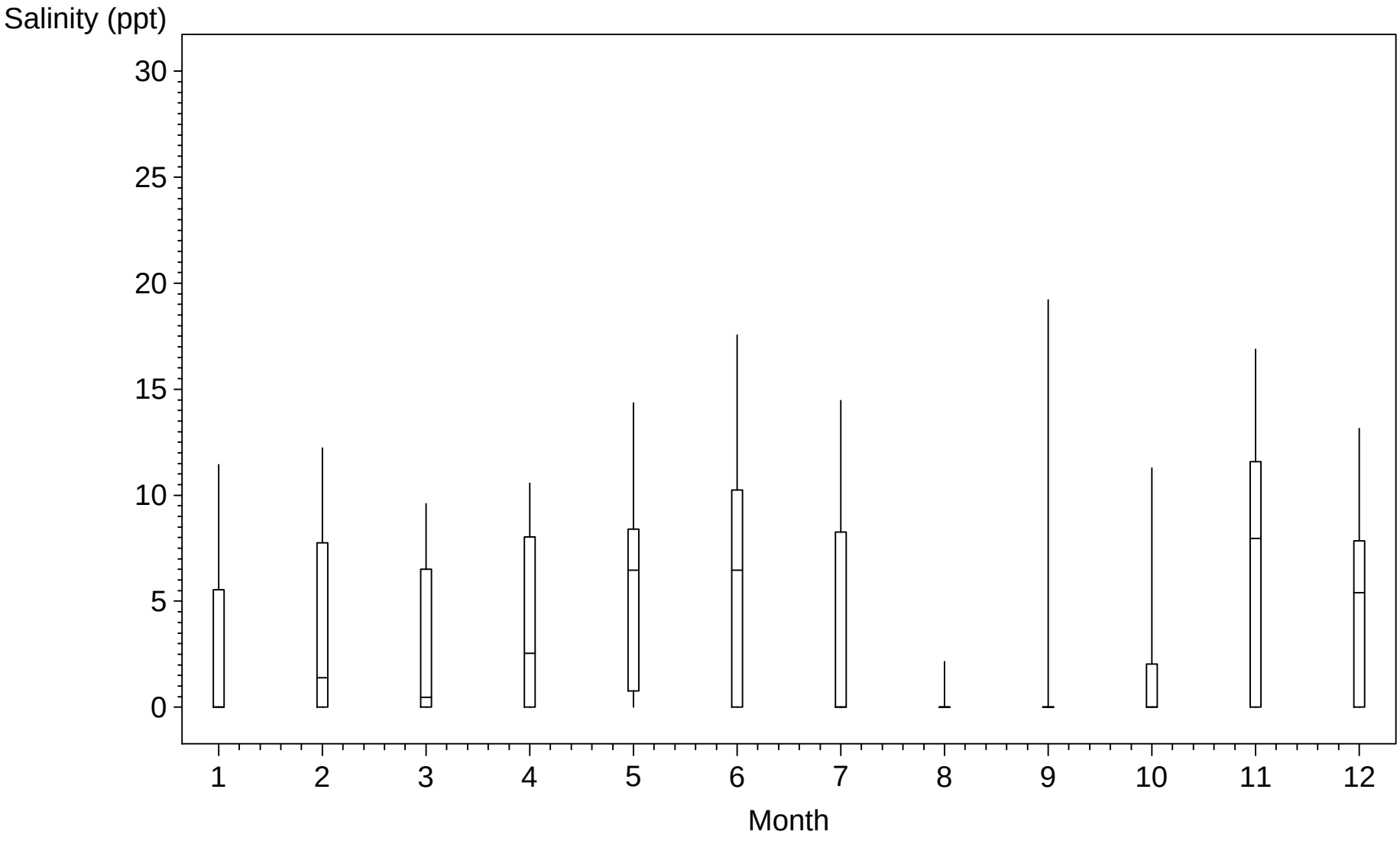


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=11

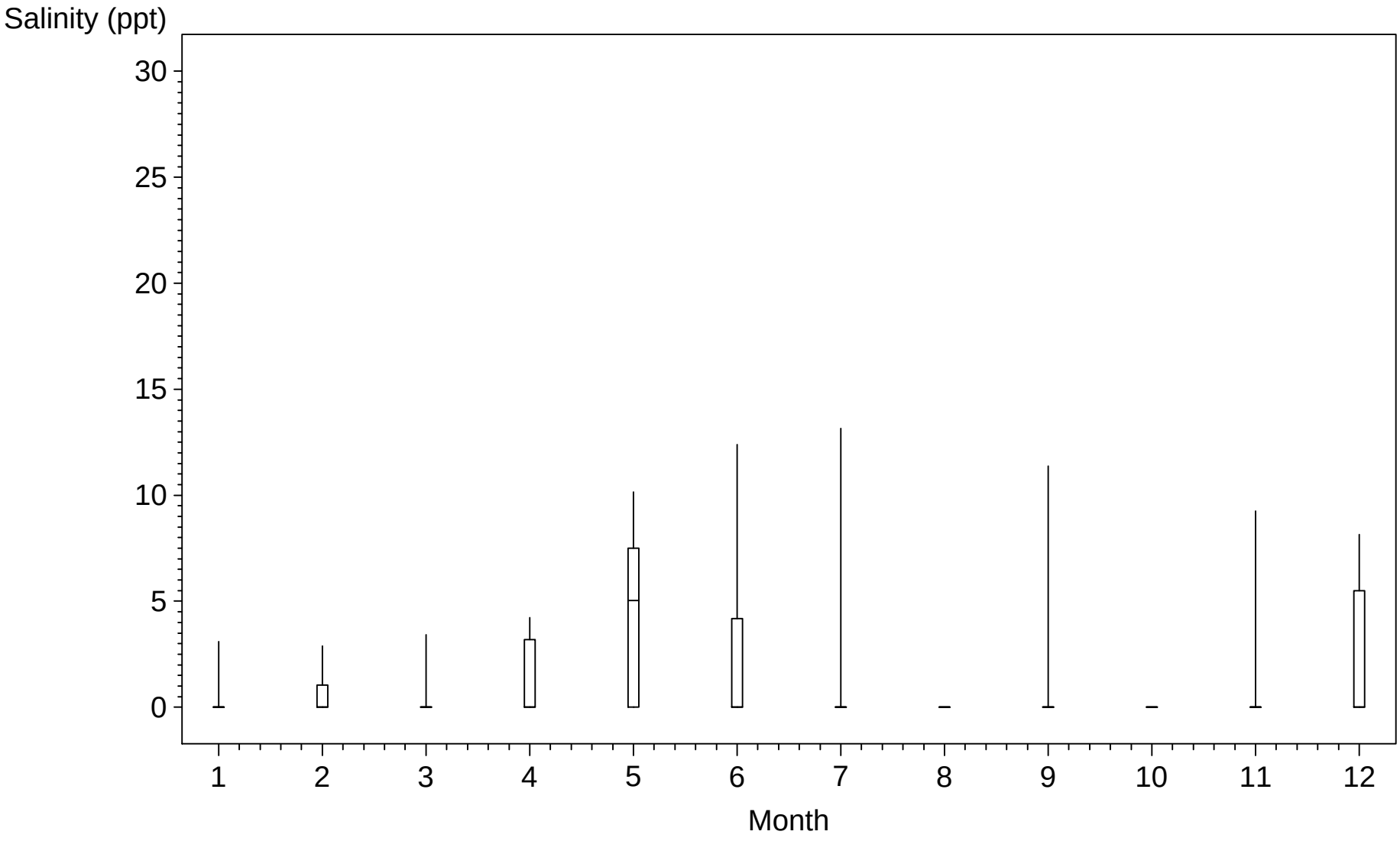


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=13

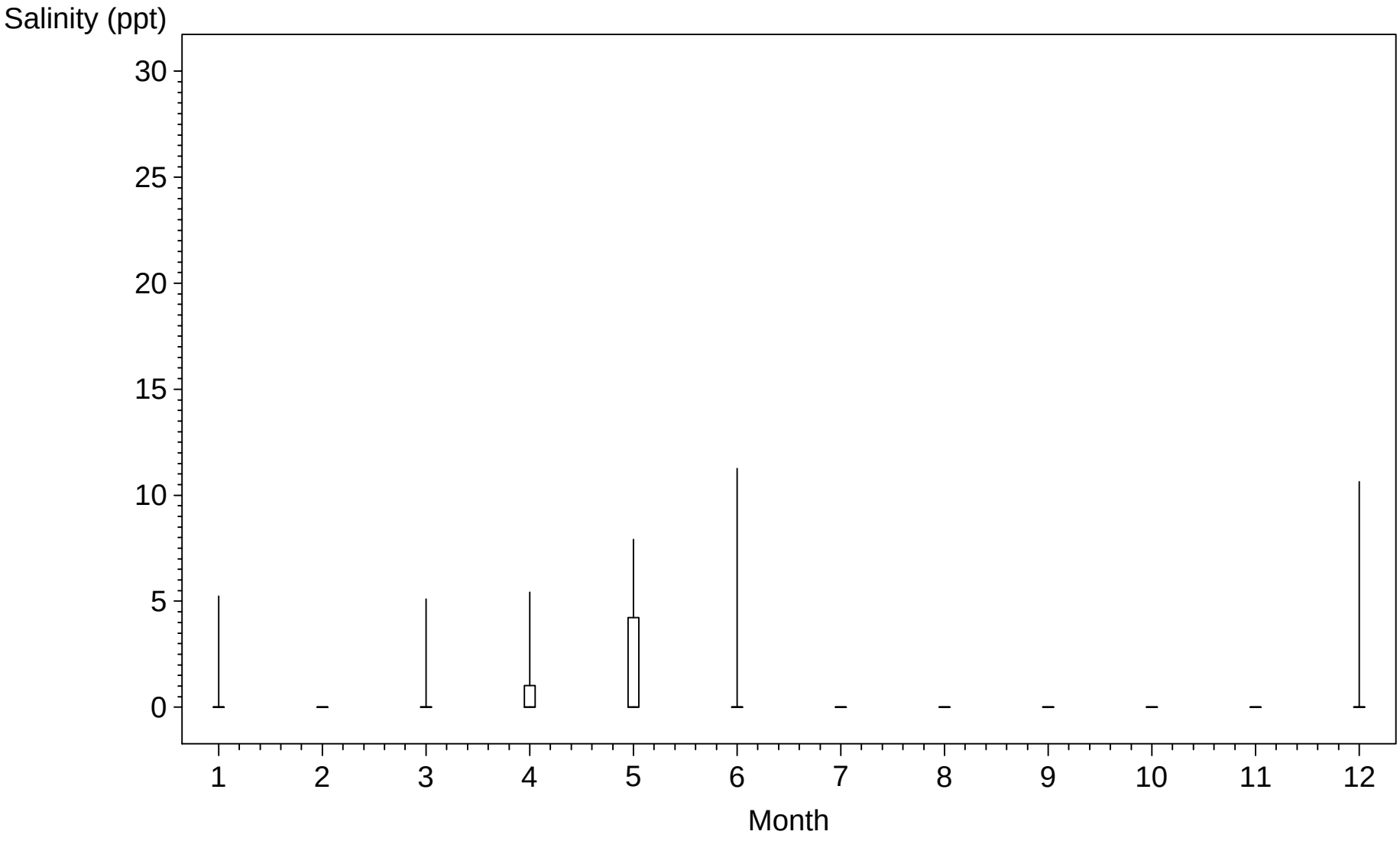


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=15

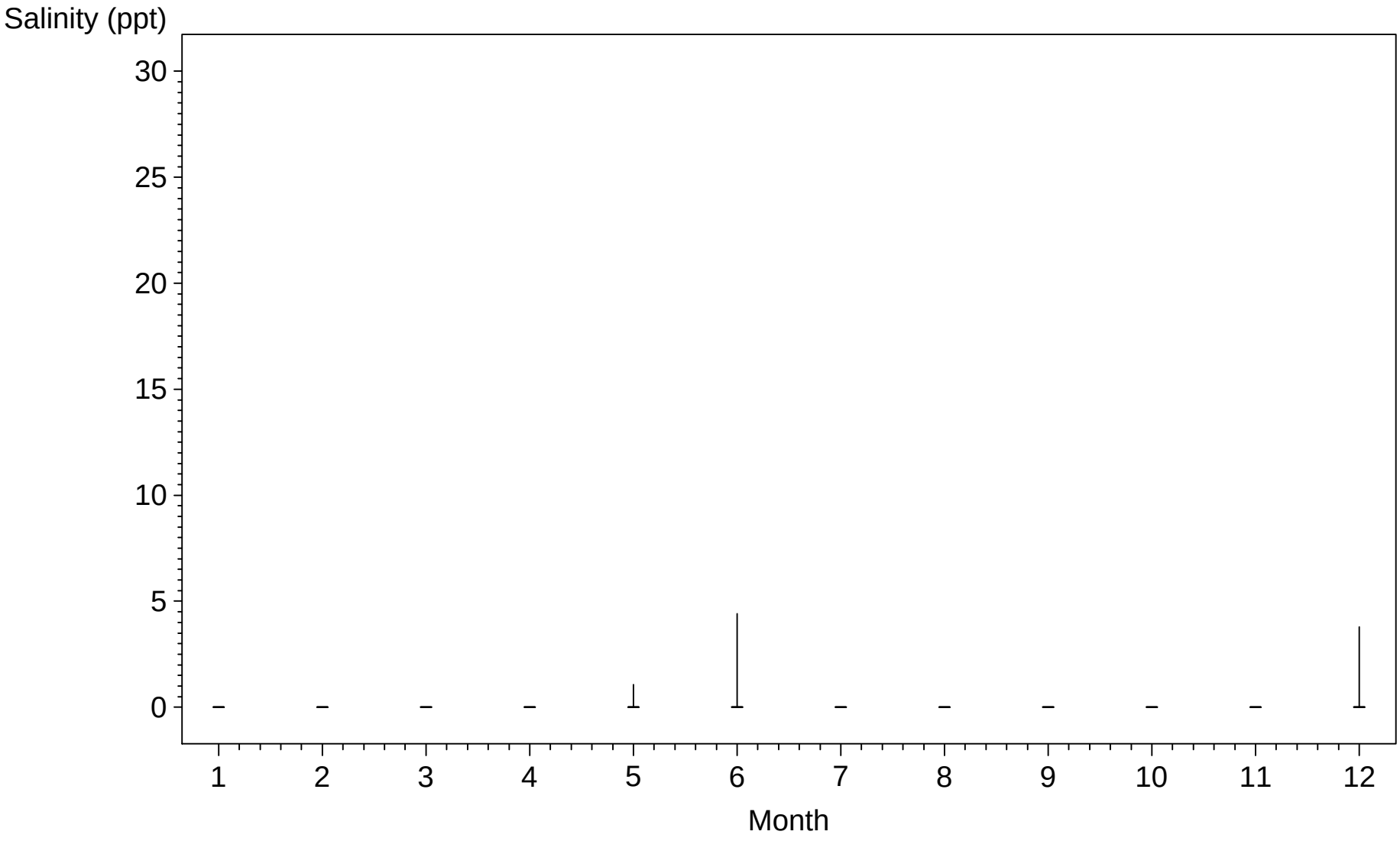


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=17

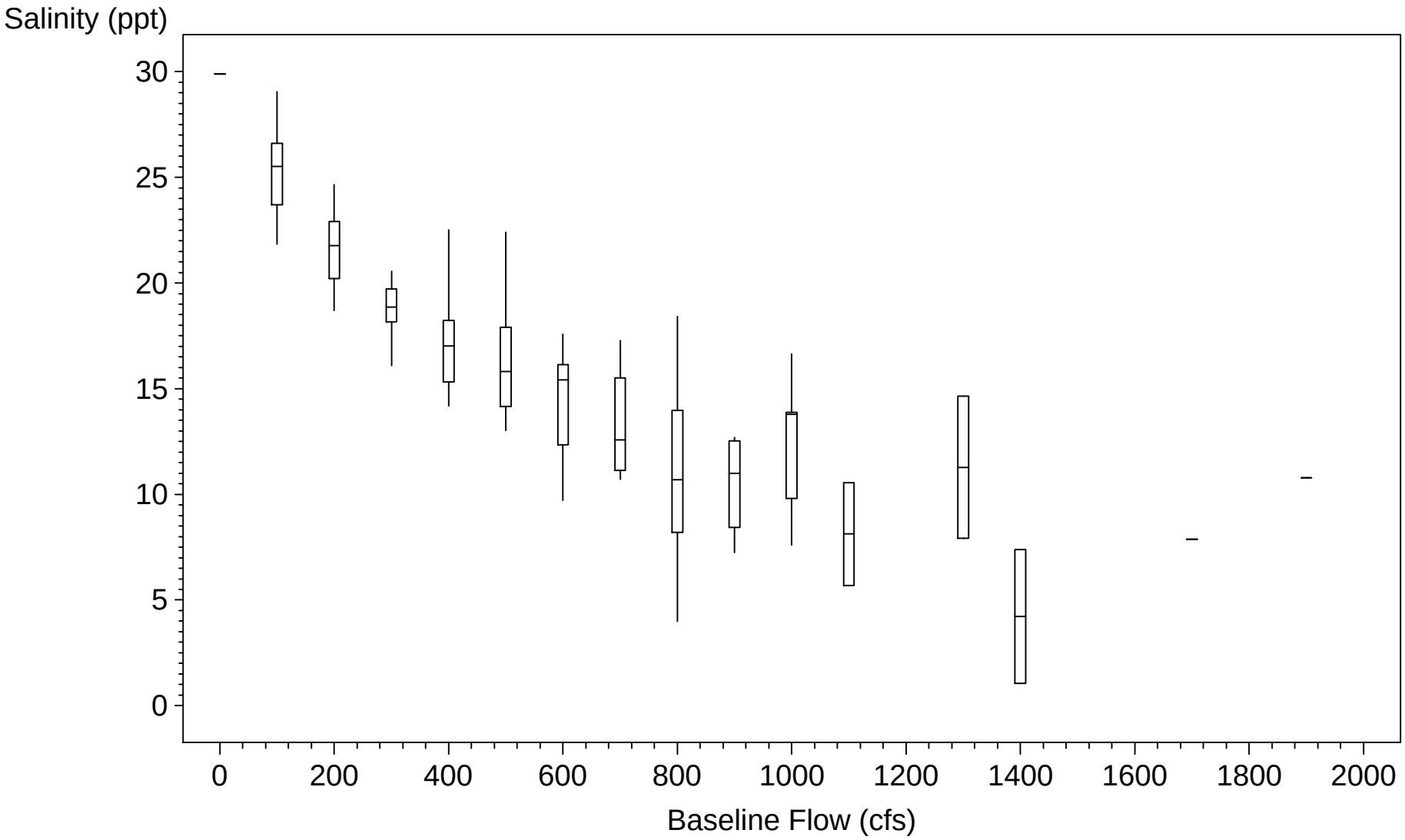


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=1

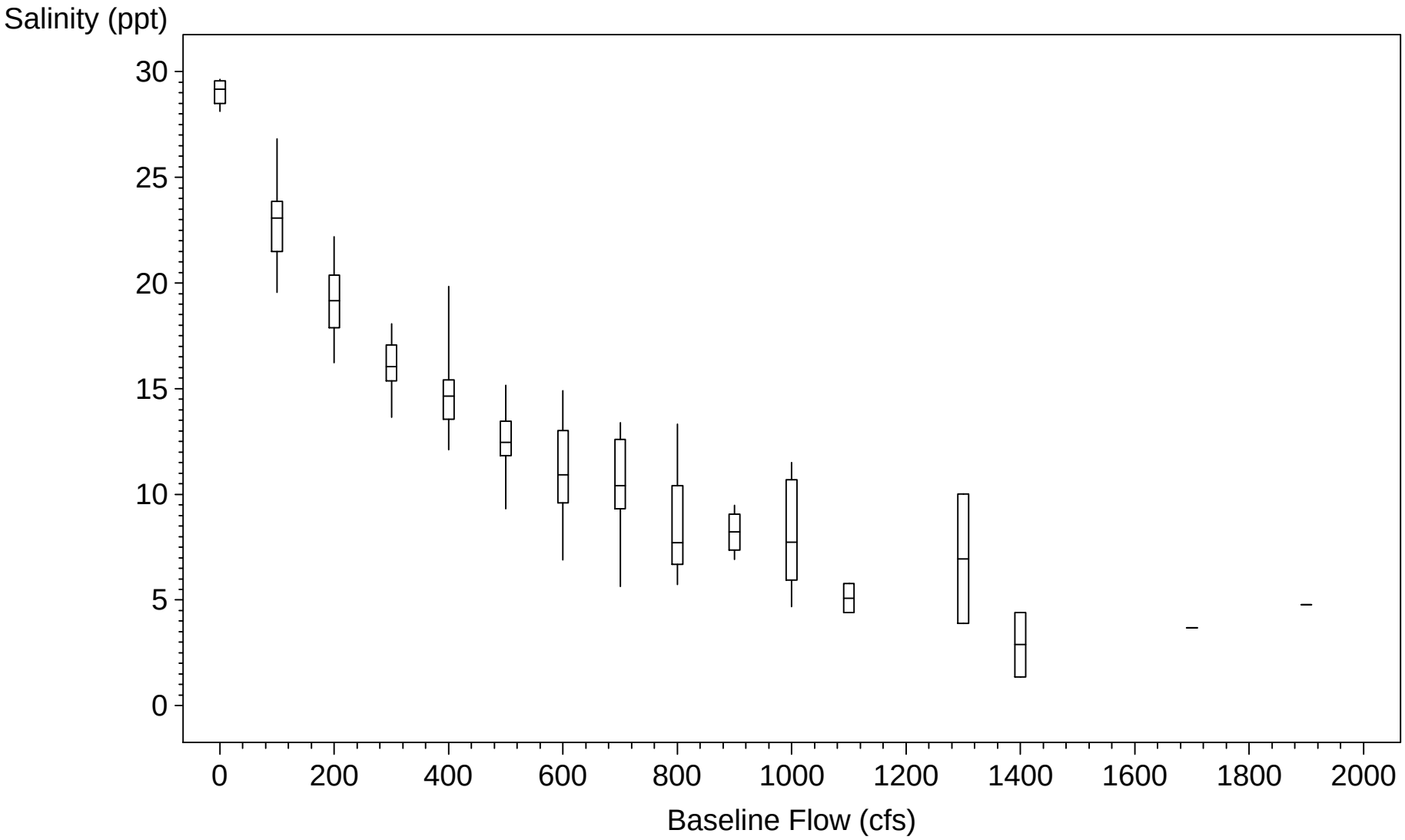


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=3

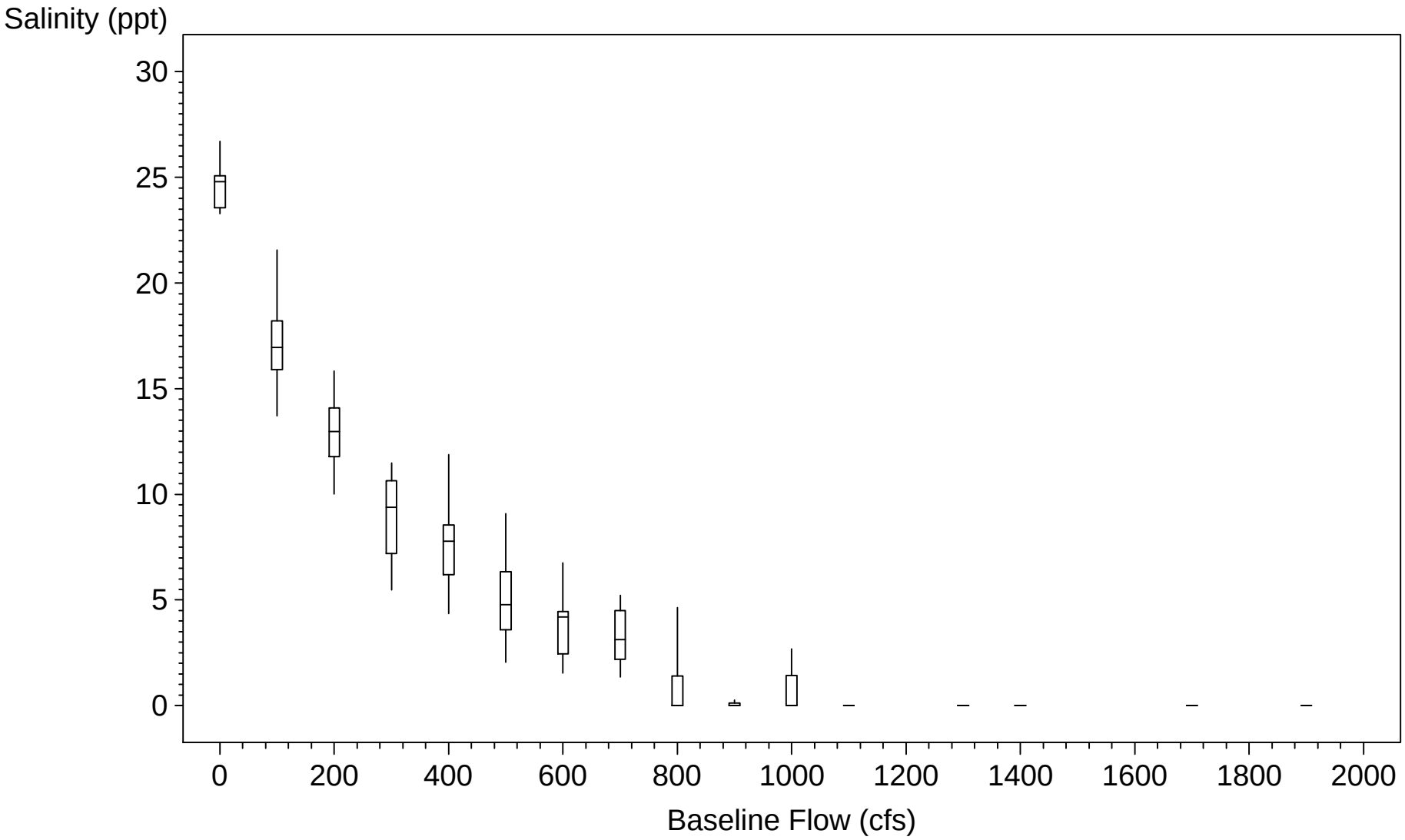


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=5

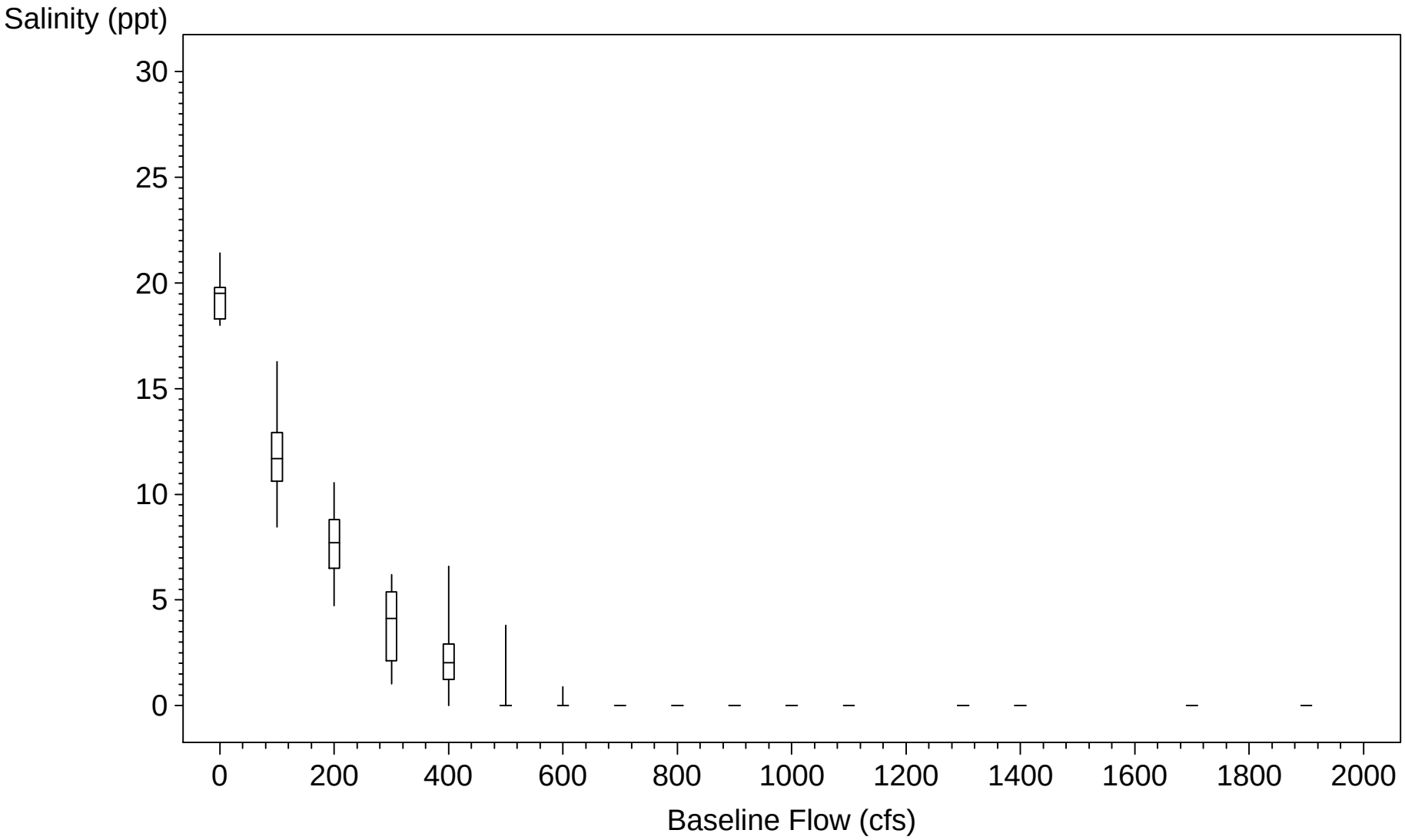


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=7

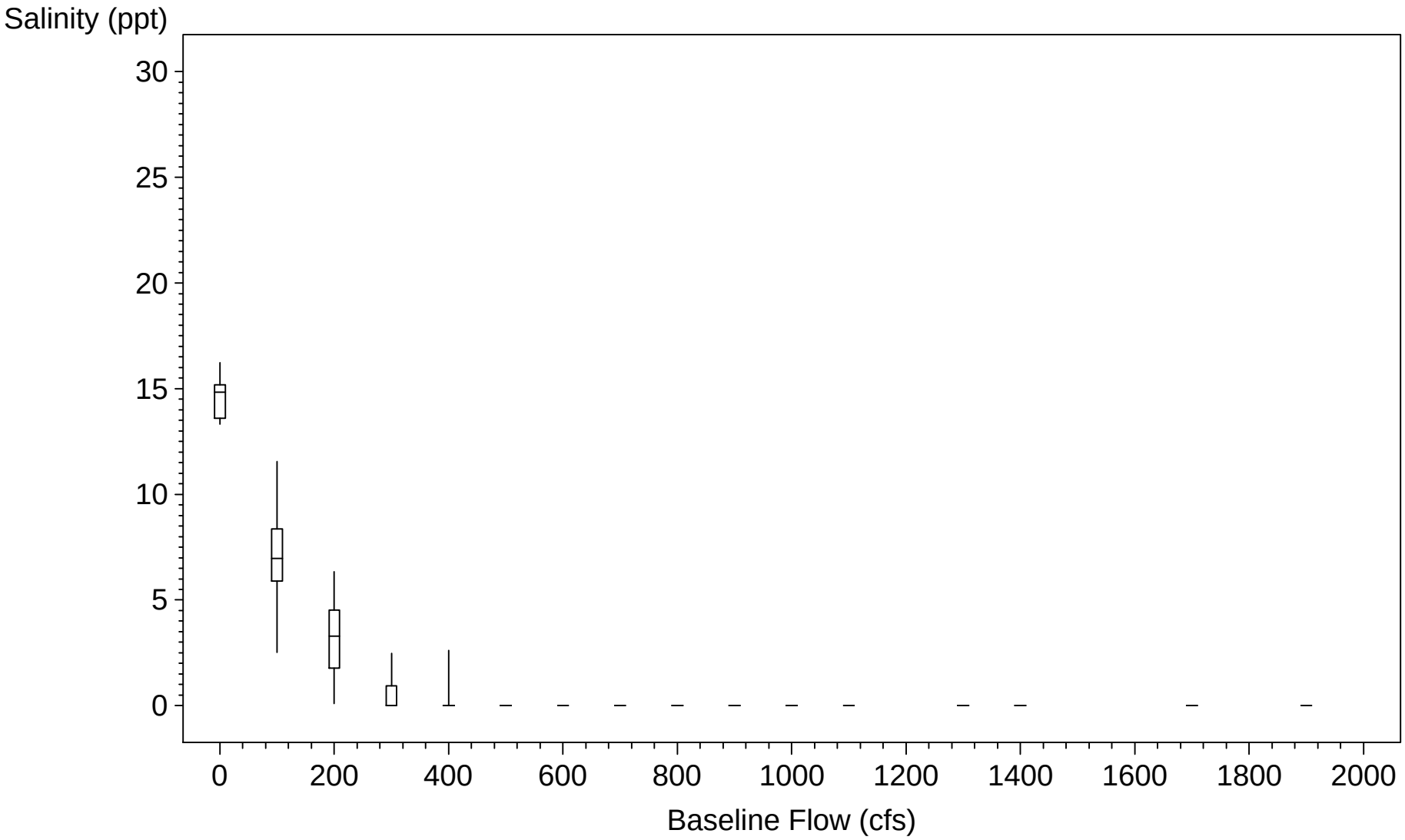


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=9

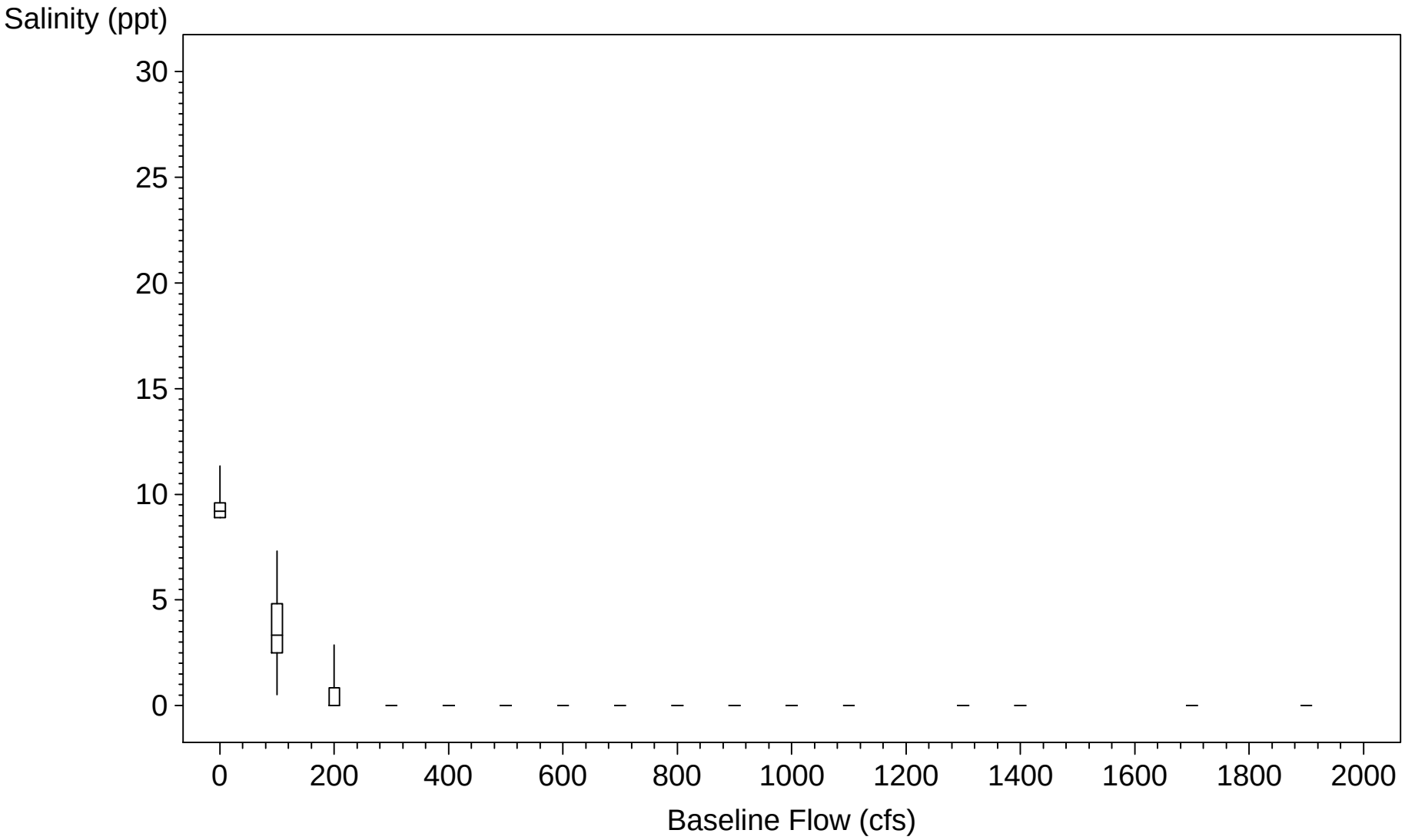


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=11

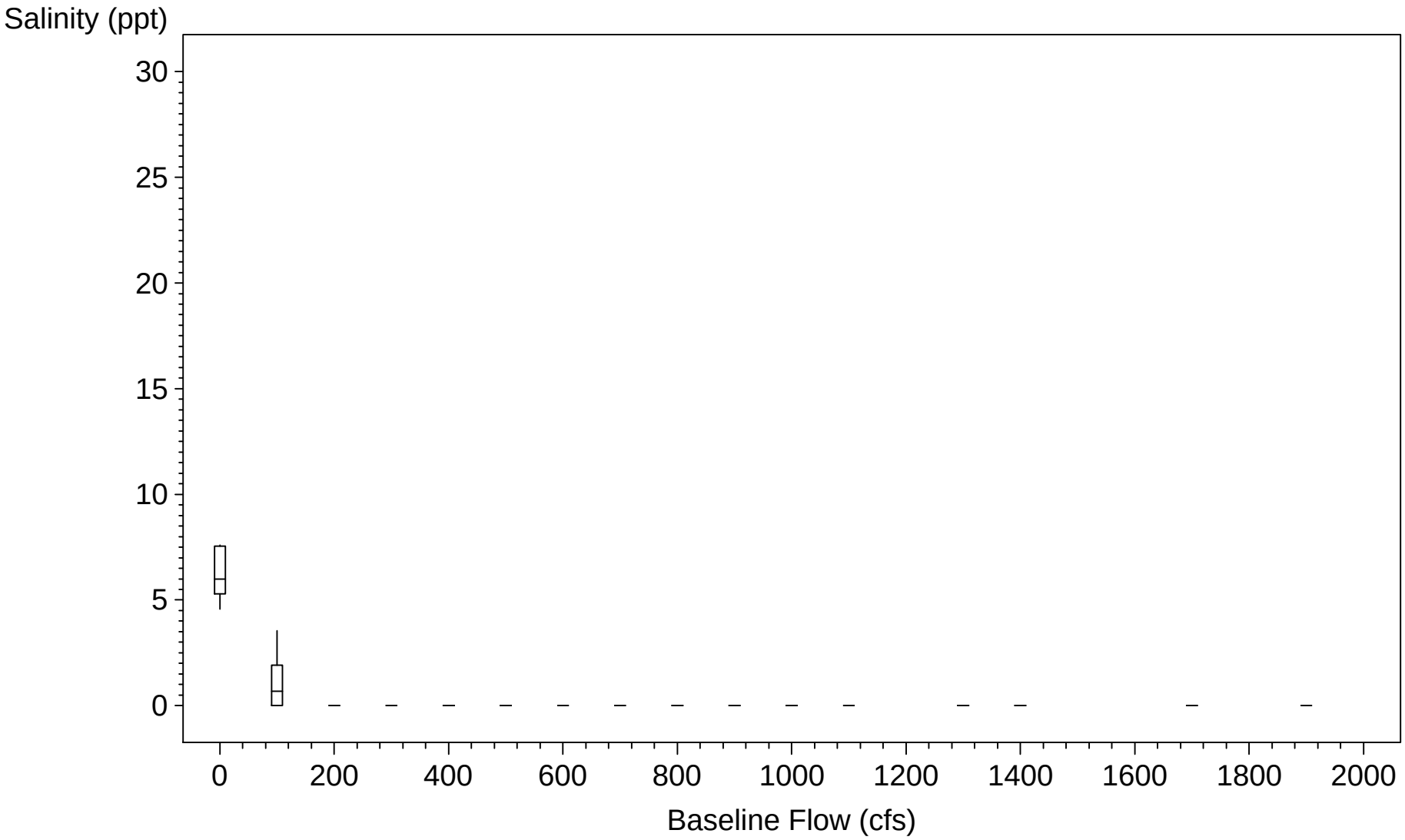


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=13

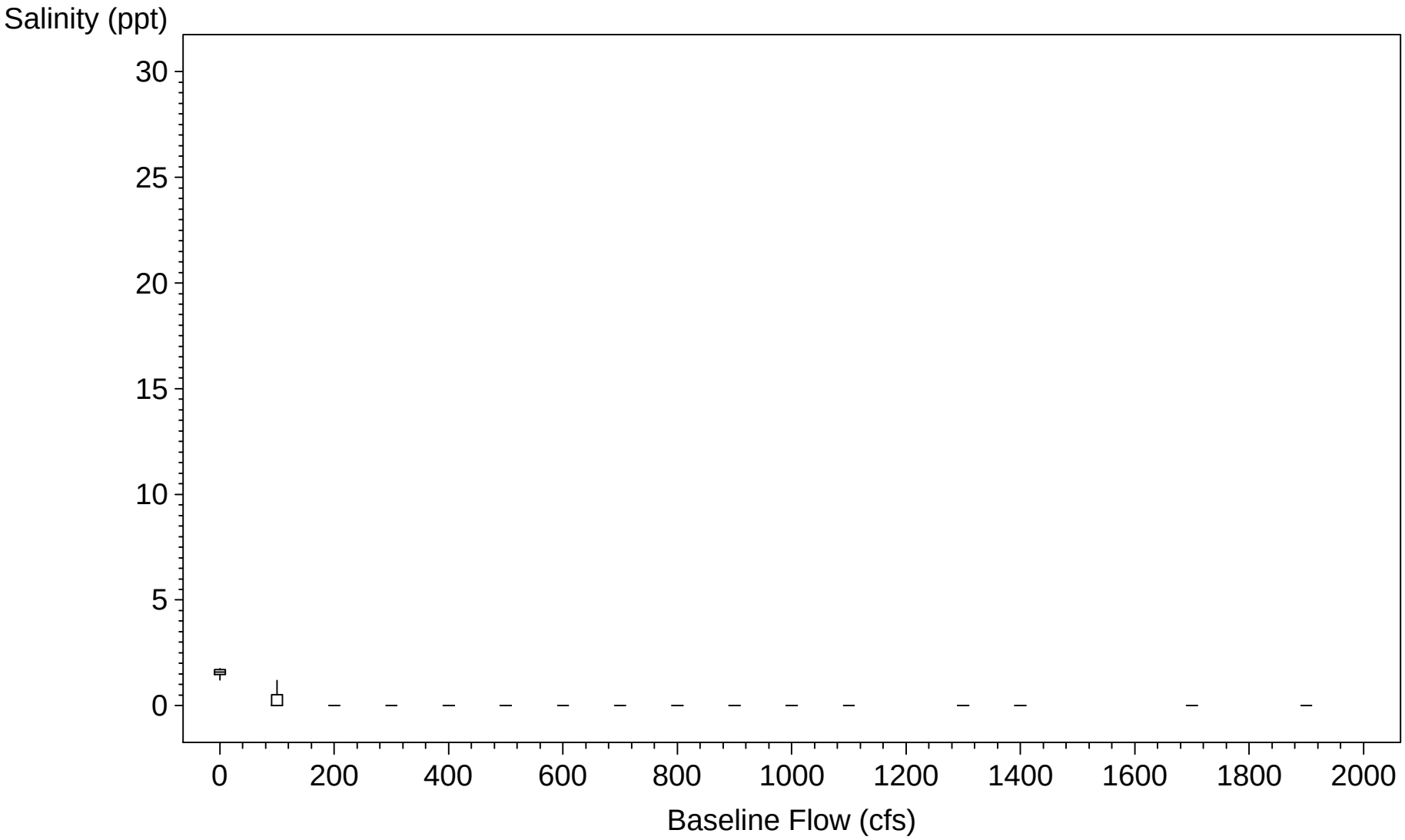


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=15

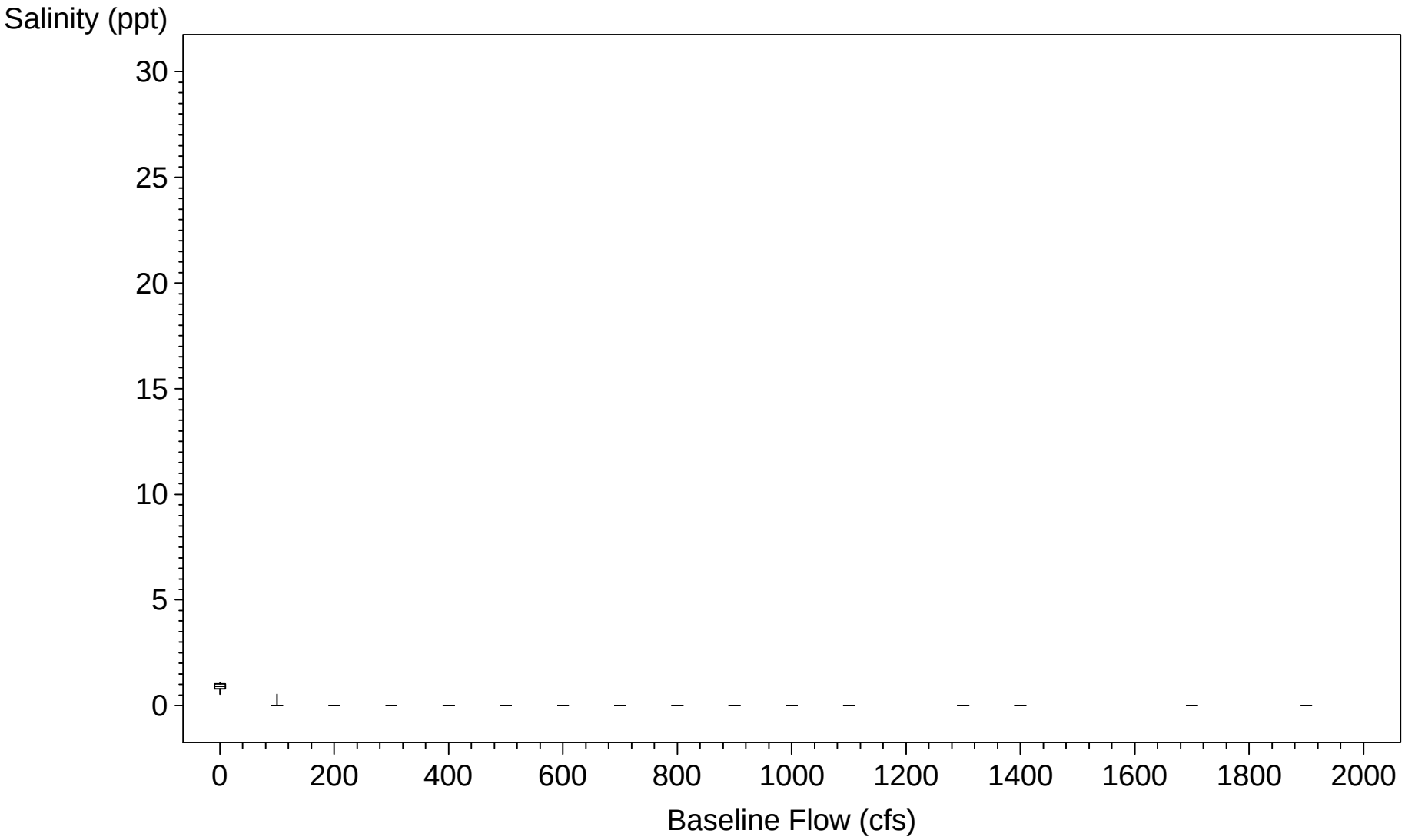


Task 4.4 River Model

Predicted Surface-1m Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=17

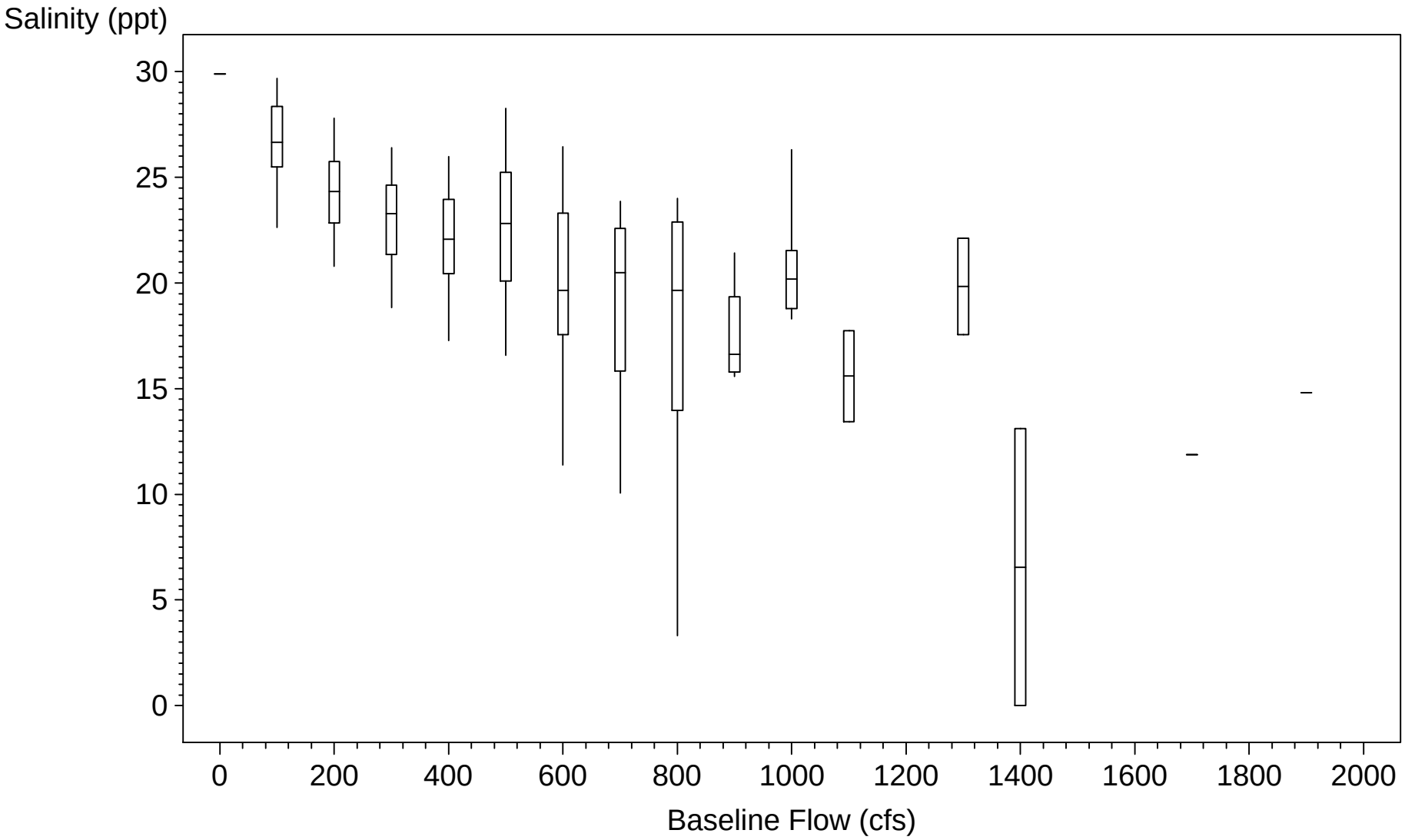


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=1

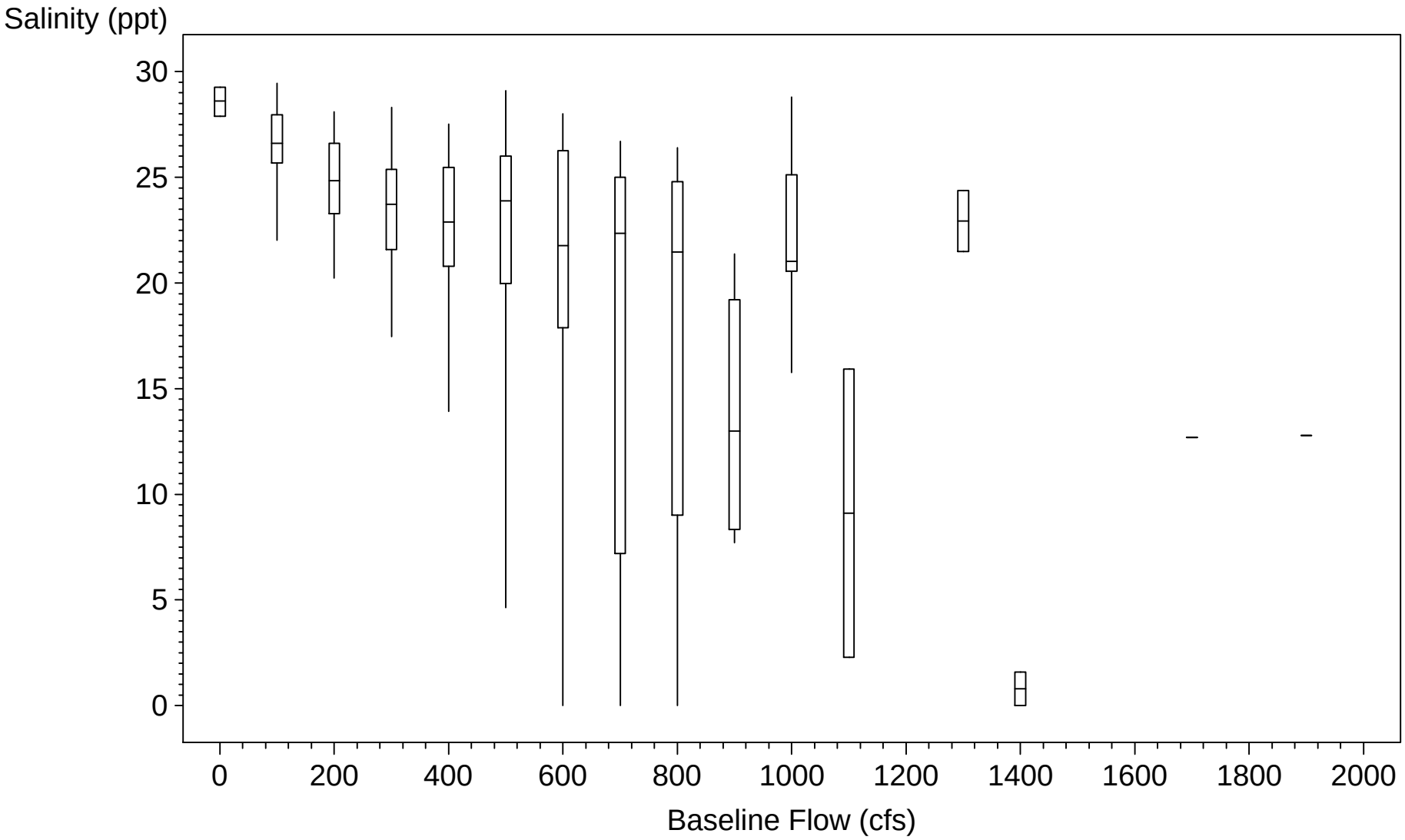


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=3

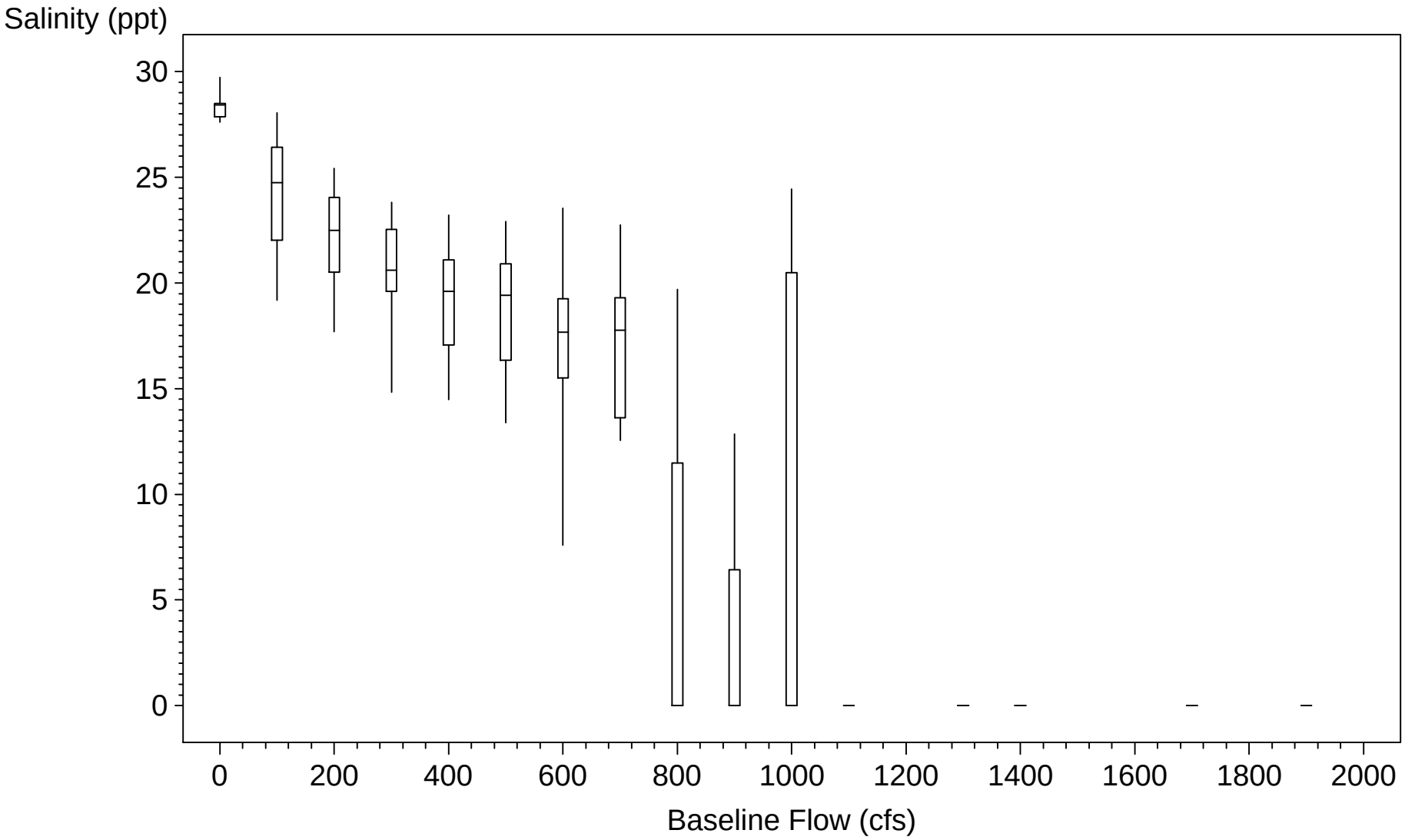


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=5

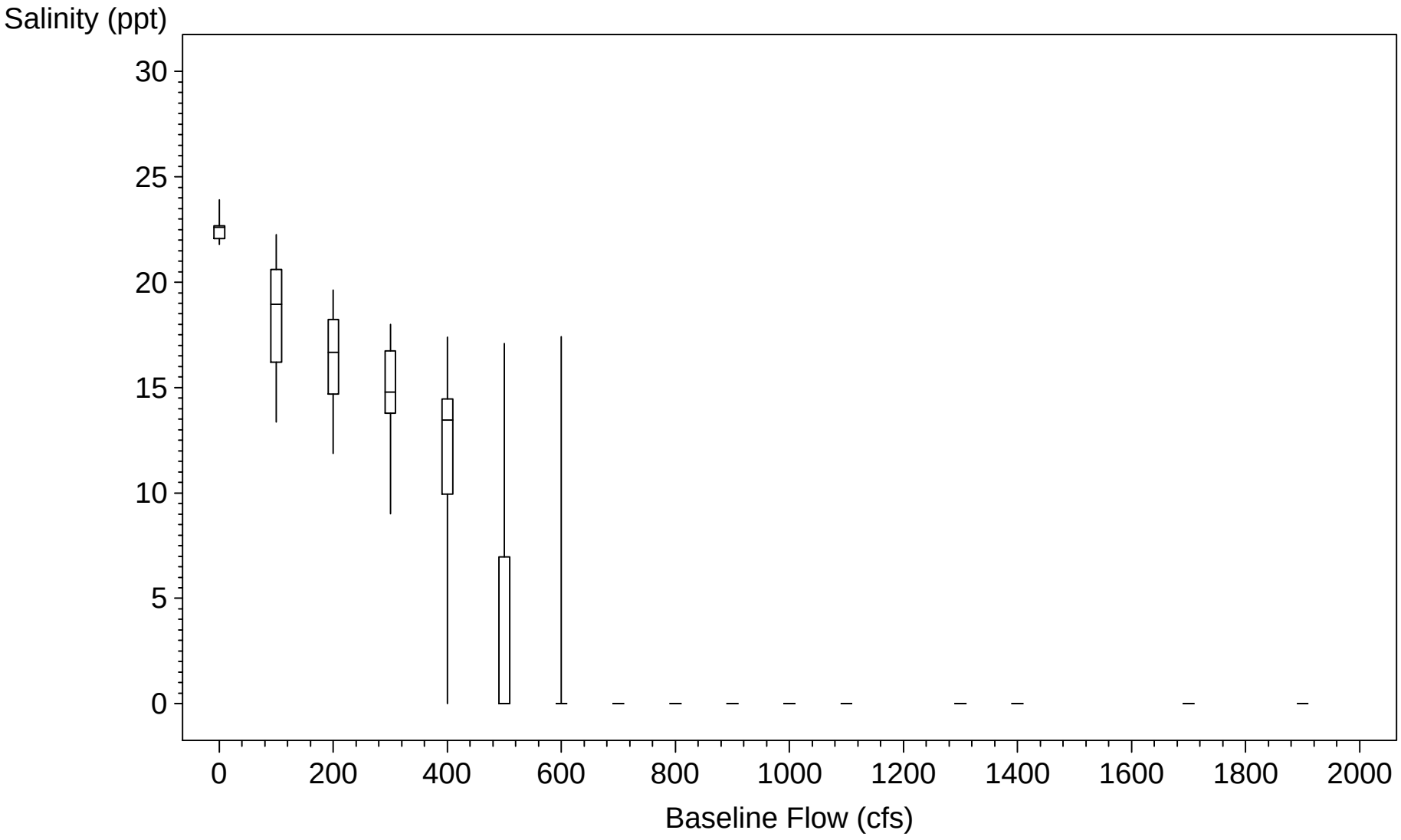


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=7

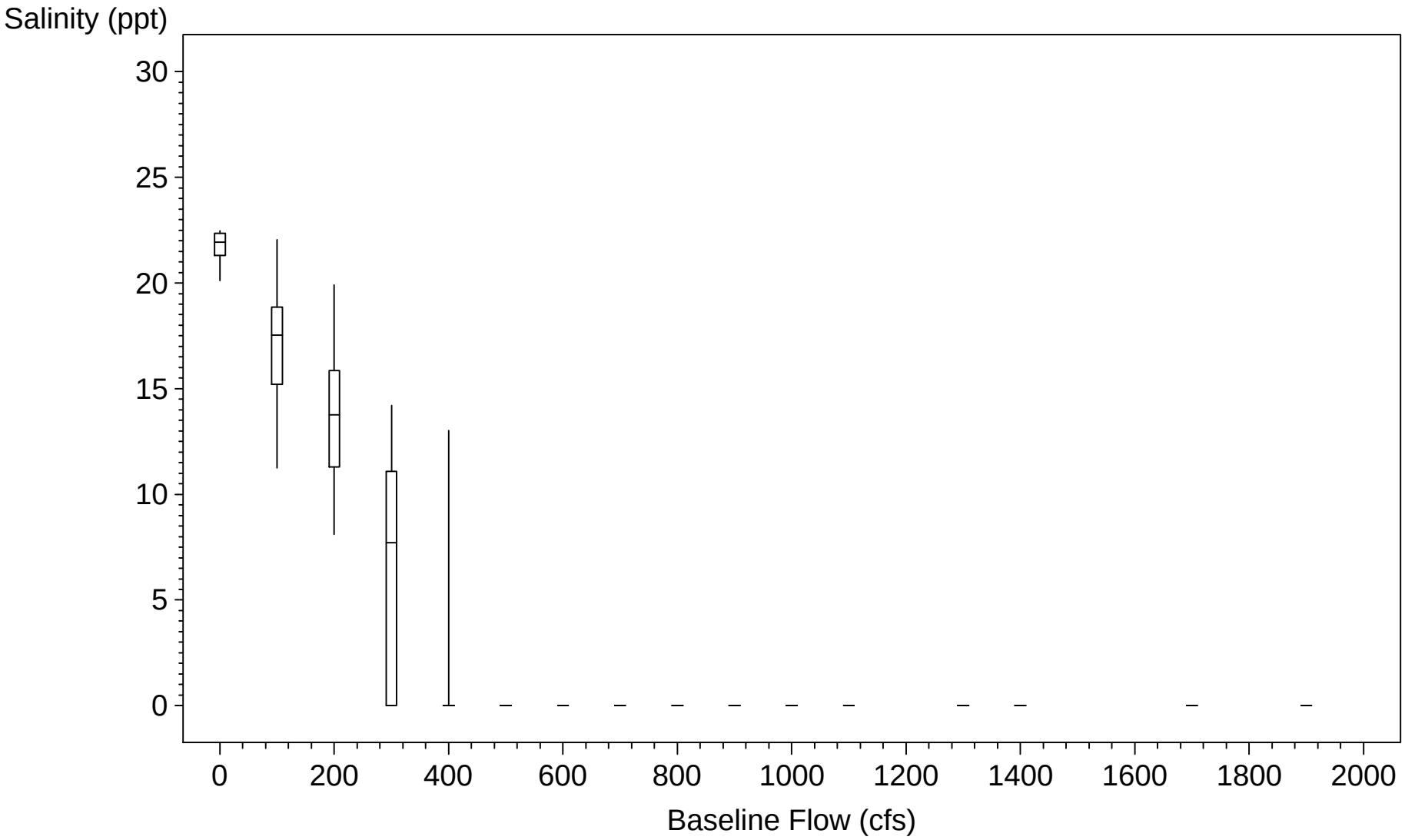


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=9

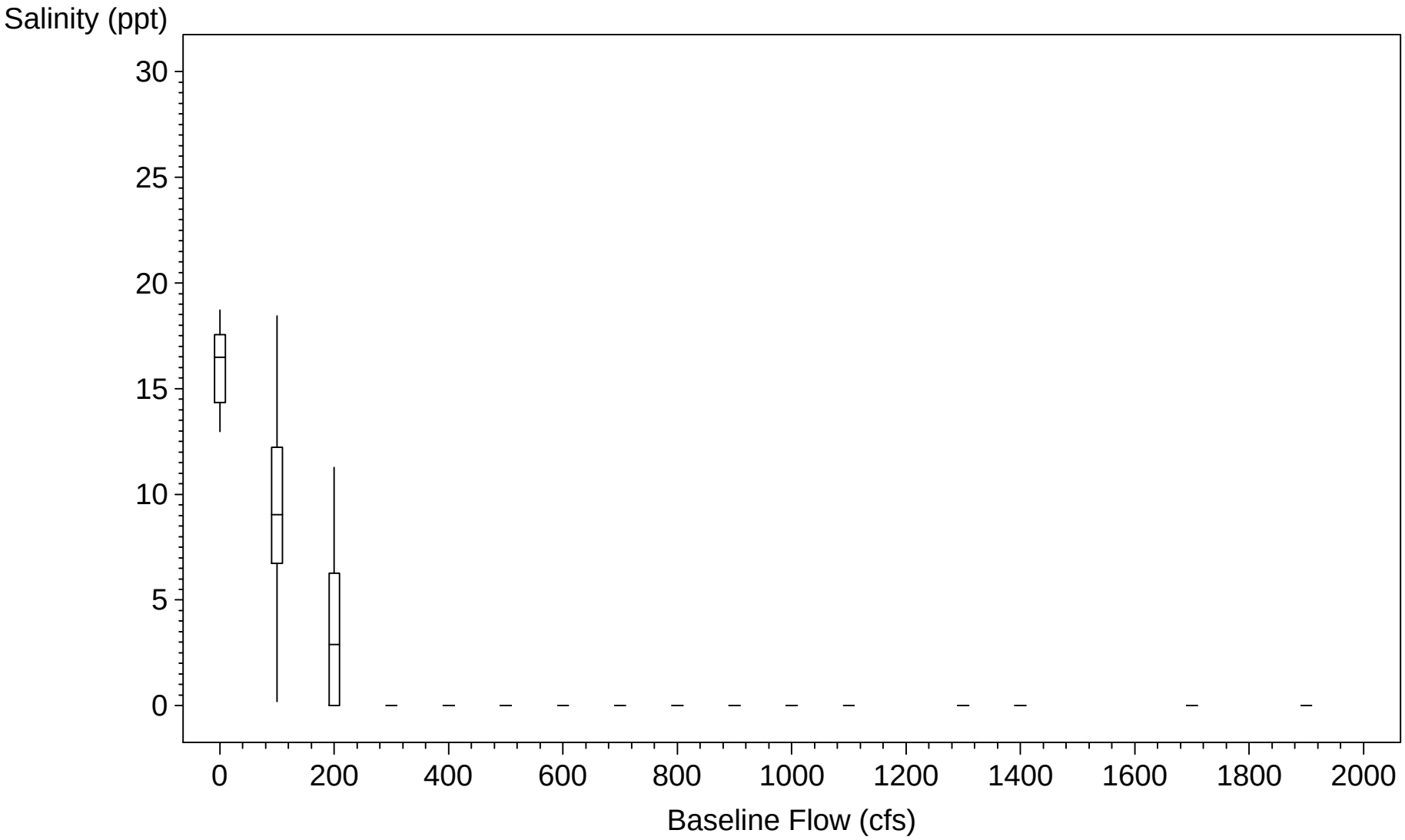


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=11

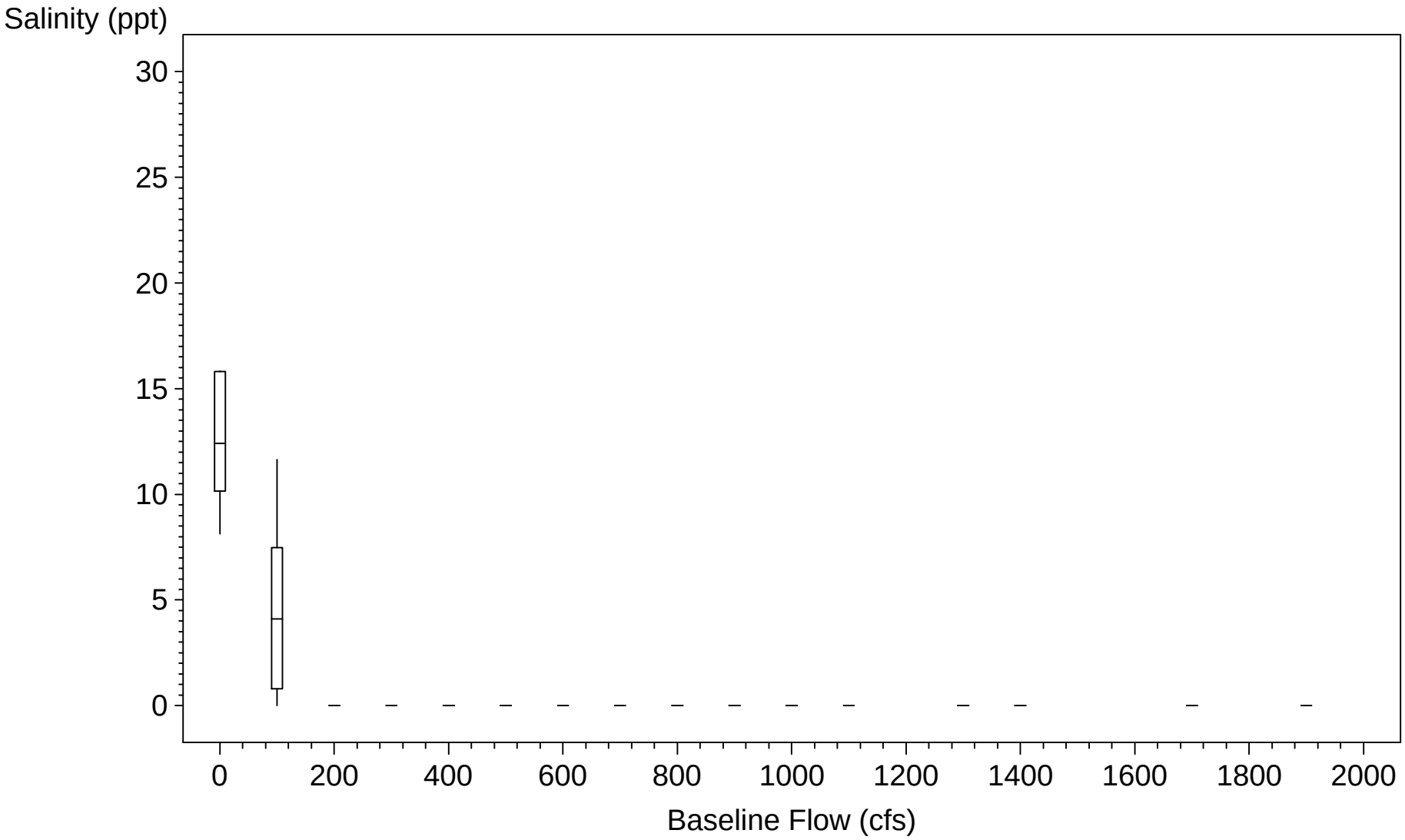


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=13

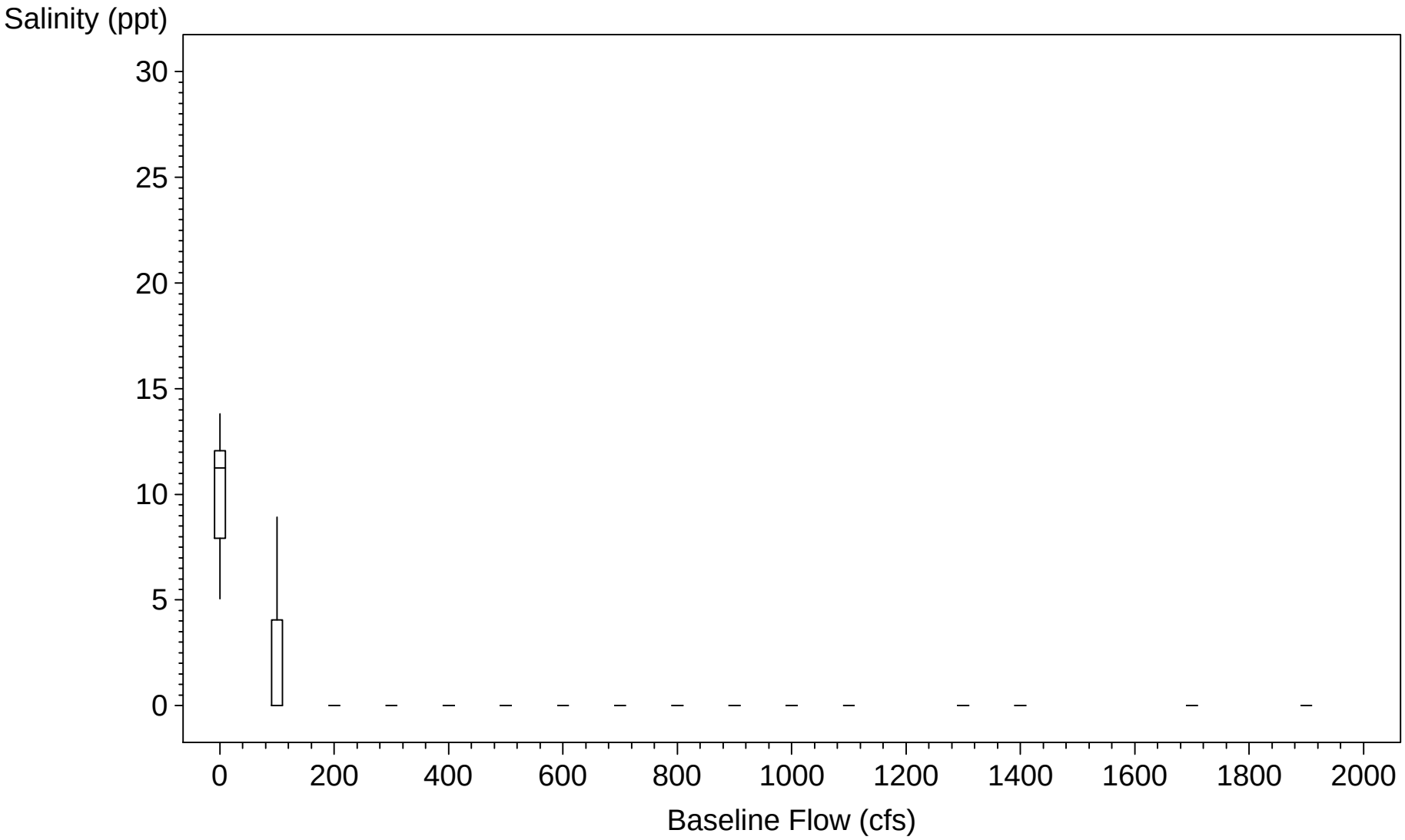


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=15

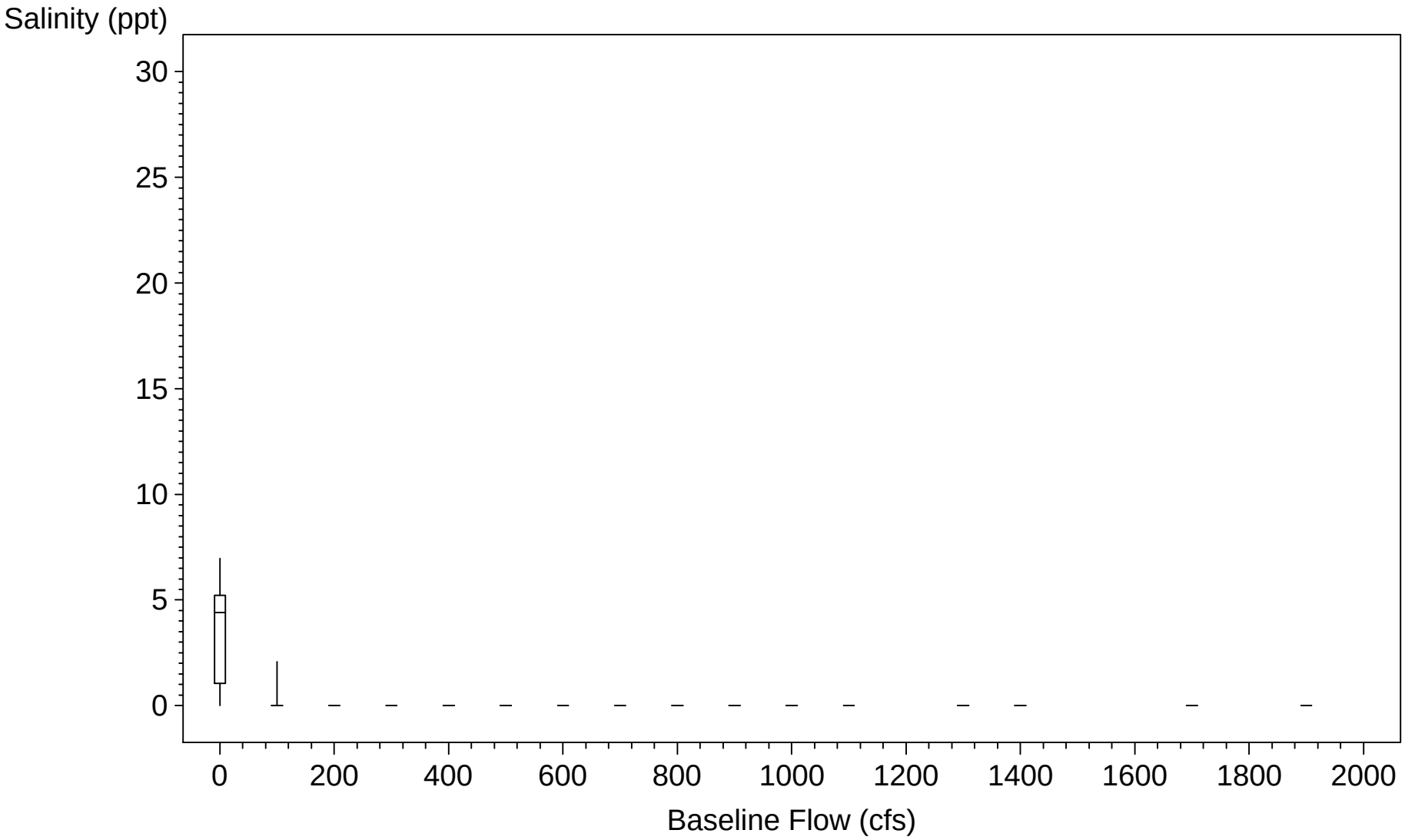


Task 4.4 River Model

Predicted 2 Meter Salinity Response to Baseline Flows less than 3000 cfs

Time Period from 1980 - 2003

River Km=17



Appendix 5B

Alafia River Salinity Regressions

Isohaline Locations

Objective

The objective was to develop a series of regressions to predict isohaline locations for two prescribed depths. Isohaline location regression models were developed for each isohaline value and for two operationally defined depth categories (surface and 2-meter).

Data Sources

Flow

Flow data (cfs) were obtained from U.S. Geological Survey for Alafia River at Lithia gage. Additional flow data were obtained from Tampa Bay Water for Buckhorn Springs and Lithia Springs. Lastly, surface water withdrawals were obtained from Tampa Bay Water.

Salinity

A comprehensive set of salinity profile measurements was compiled to provide the data to develop the salinity concentration. Data were compiled from observations reported by:

- Tampa Bay Water HBMP Program, Environmental Protection Commission of Hillsborough County Ambient Water Quality Monitoring Program
- Environmental Protection Commission of Hillsborough County Independent Monitoring Program
- Southwest Florida Water Management District
- Tampa Bay Estuary Program Benthic Monitoring Program
- Tampa Bay Hydrobiological Monitoring Program
- Florida Wildlife Research Institute (FWRI) Fisheries Independent Monitoring Program.

Tide

Tide stage data were obtained from USGS for the Alafia River at Riverview gage.

Approach

Isohalines

The initial step requires observed isohaline locations based on existing ambient salinity data for the two prescribed depths. These two depths were operationally defined as:

- Surface level – defined as any sampling depth between surface and 1.1 m; and
- 2 – meter – defined as all observations between 1.8 and 2.2 m.

A linear interpolation approach was used to define isohaline position. Isohalines that were interpolated from discrete observations greater than 3 river kilometers apart were censored from the regression analyses.

Flow

The flows (cfs) used to predict isohaline location are calculated using the following equation:

$$\text{Alafia River flow}_{\text{Bell Shoals}} = \text{Flow}_{\text{Lithia}} \times [(335\ \text{mi}^2 + 39.2\ \text{mi}^2)/335\ \text{mi}^2] + \text{Flow}_{\text{Lithia Springs}} + \text{Flow}_{\text{Buckhorn Springs}} - \text{Withdrawal flow by TBW}$$

Estimation of isohaline location based on flow

A stepwise regression analysis was used to identify the flow variables for the best fit curve shape for each isohaline model. Models were first constructed using data from all tide stages. These initial results indicated that isohaline location during slack tides provided the best data for model fitting, and a second set of models as fit using only data from slack tides. The tide stage information was determined by analyzing a time series of tide stage data from the Riverview gage on the Alafia River. Gage height data were available for a 1999 to 2003 time period. Both sets of regression results for all tides and for slack tides only are included in the tabulated results.

The isohalines and depths modeled included:

- 0.5 ppt at surface and 2 meters,
- 2 ppt at surface and 2 meters,
- 4 ppt at surface and 2 meters,
- 11 ppt at surface and 2 meters, and
- 18 ppt at surface and 2 meters.

Results

The following tables summarize the individual regression models, with total degrees of freedom (df), p>f value, and r^2 value for each isohaline and sample depth. Table 1 is for the regression results for all tide stages, and Table 2 is for the regression results for slack tide observations only.

The models fit the observed data well in most cases. For the analyses with all data, the r^2 values ranged from 0.45 to 0.94, and were frequently reported to be greater than 0.70; for the analyses using slack tide data, the r^2 values ranged from 0.60 to 0.94, and were frequently reported to be greater than 0.80 The slope parameter estimates were typically highly significant ($p<0.0001$). Detailed regression results are presented in the tables and plots that follow. Examination of the residual plots indicates no apparent bias in the regressions.

Table 1 Isohaline location vs. river flow regression results at each isohaline and sample level by using data from all tide stages.

Isohaline	Sample Depth	Flow Variable	Flow Variable	df	p > f	r^2
0.5	Surface	Flopower04_avg2		175	<.0001	0.81
0.5	2-meter	Flopowerm02_sum2		47	<.0001	0.70
2	Surface	Flopower07_avg2		179	<.0001	0.79
2	2-meter	Flopowerm02_avg2		51	<.0001	0.72
4	Surface	Flopower05_avg3	Flow6	188	<.0001	0.83
4	2-meter	Logavg2flow		50	<.0001	0.70
11	Surface	Logavg4flow		164	<.0001	0.73
11	2-meter	Logavg2flow		43	<.0001	0.45
18	Surface	Flopowerm03_avg8		140	<.0001	0.65
18	2-meter	Flopowerm02_avg8		24	<.0001	0.60

Table 2 Isohaline location vs. river flow regression results at each isohaline and sample level by using observations from slack tides only.

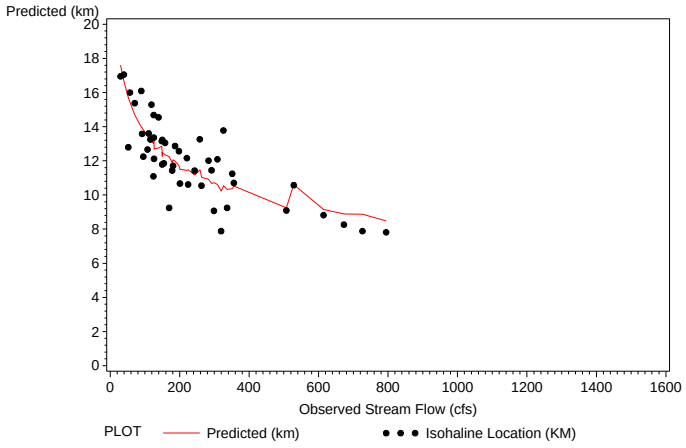
Isohaline	Sample Depth	Flow Variable	df	p > f	r^2
0.5	Surface	Flopower02	35	<.0001	0.93
0.5	2-meter	Flopowerm03	6	<.0001	0.86
2	Surface	Flopower02	42	<.0001	0.92
2	2-meter	Flopower05	6	<.0001	0.95
4	Surface	Logavg4flow	40	<.0001	0.90
4	2-meter	Flopower05	9	<.0001	0.89
11	Surface	Flopowerm03_avg5	25	<.0001	0.77
11	2-meter	Flopower02	9	<.0001	0.81
18	Surface	Flopowerm03_avg5	33	<.0001	0.69
18	2-meter	Flopowerm02_sum8	7	<.0001	0.60

Definition of flow variables:

Flow Variable	Label
Flopower02	flow raised to a power of 0.2
Flopowerm03	flow raised to a power of -0.3
Flopower05	flow raised to a power of 0.5
Flopower04_avg2	average of 2 days flow raised to a power of 0.4
Flopowerm02_sum2	sum of 2 days flow raised to a power of -0.2
Flopower07_avg2	average of 2 days flow raised to a power of 0.7
Flopowerm02_avg2	average of 2 days flow raised to a power of -0.2
Flopower05_avg3	average of 3 days flow raised to a power of 0.5
Logavg2flow	ln of average of 2 days flow
Logavg4flow	ln of average of 4 days flow
Logavg2flow	ln of average of 2 days flow
Flopowerm03_avg5	average 5 days flow raised to a power of -0.3
Flopowerm03_avg5	average 5 days flow raised to a power of -0.3
Flopowerm03_avg8	for average 8 days flow raised to a power of -0.3
Flopowerm02_avg8	for average 8 days flow raised to a power of -0.2
flow6	flow raised to a power of 6

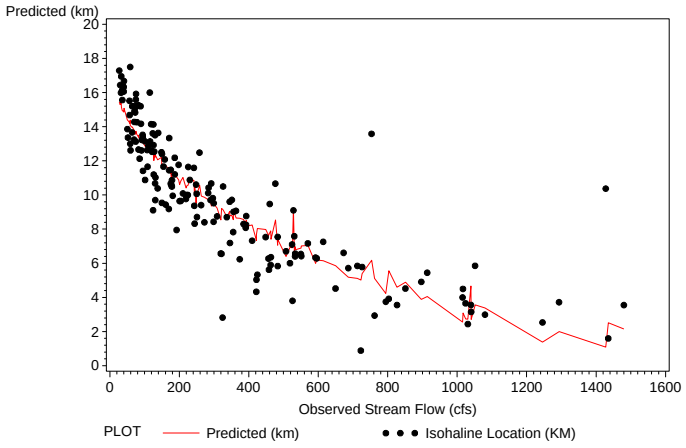
Comparison of Observed Isohaline Location with Predicted Isohaline Location

For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter



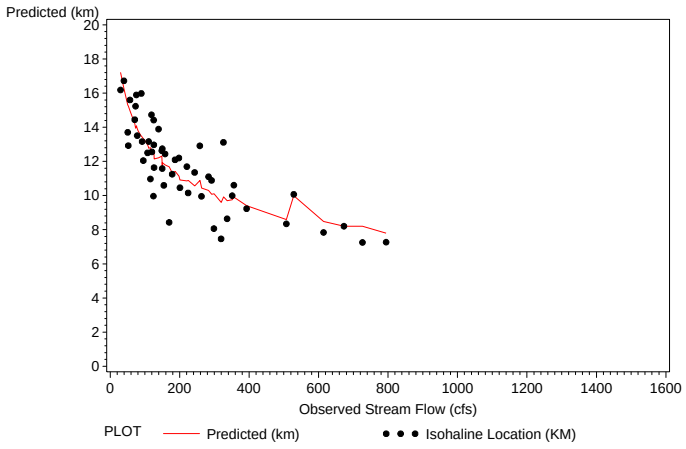
Comparison of Observed Isohaline Location with Predicted Isohaline Location

For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface



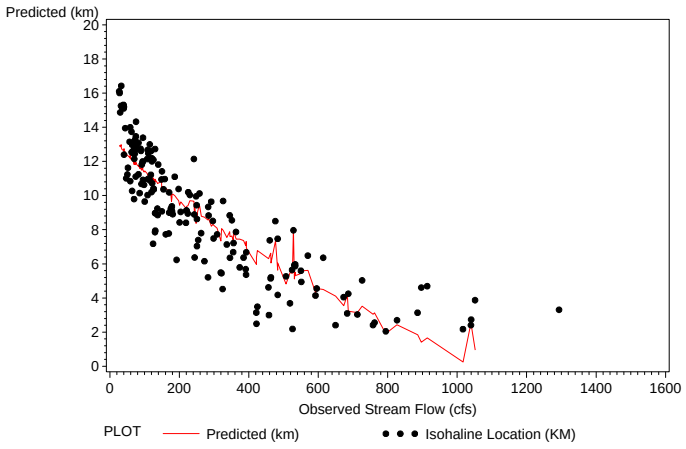
Comparison of Observed Isohaline Location with Predicted Isohaline Location

For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter



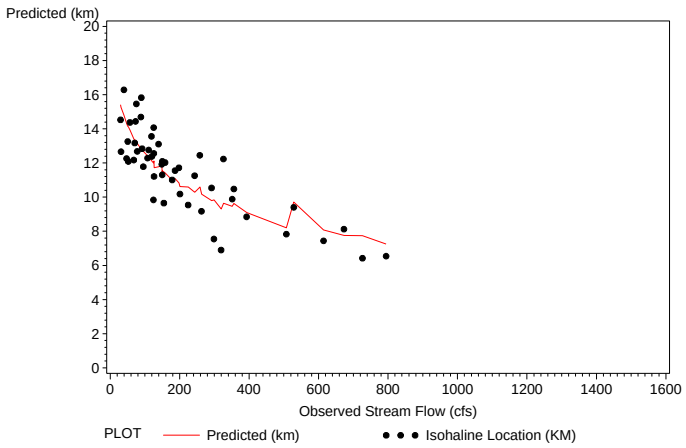
Comparison of Observed Isohaline Location with Predicted Isohaline Location

For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface



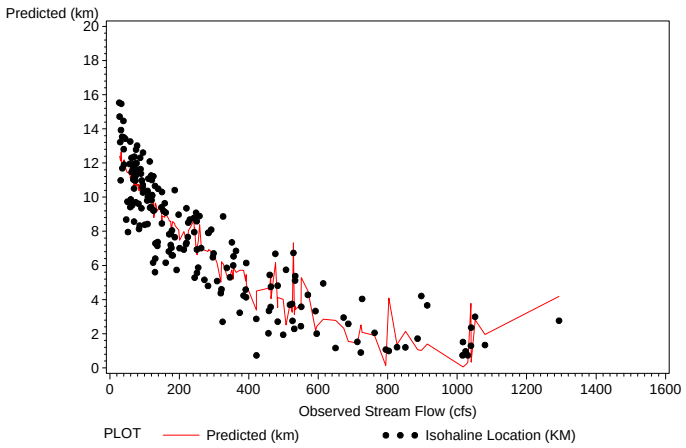
Comparison of Observed Isohaline Location with Predicted Isohaline Location

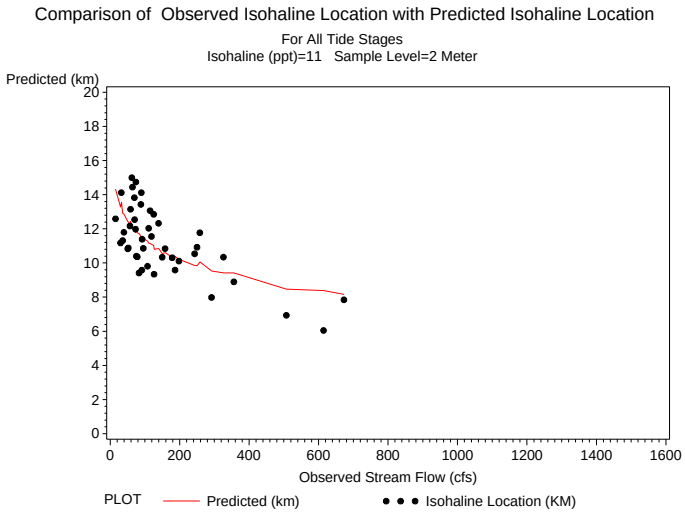
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter

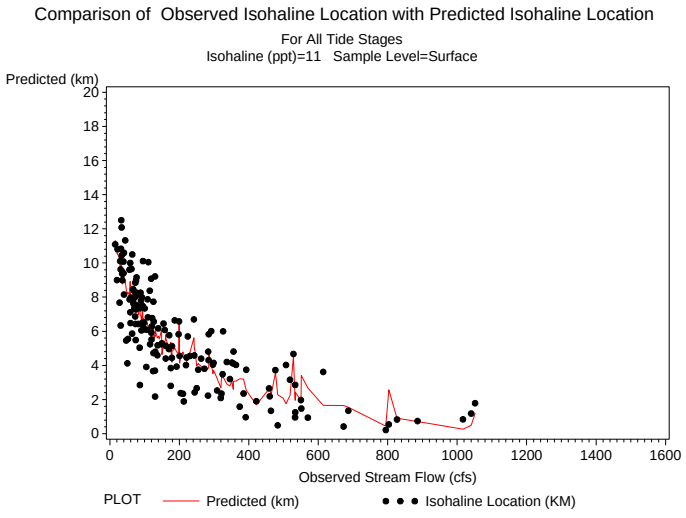


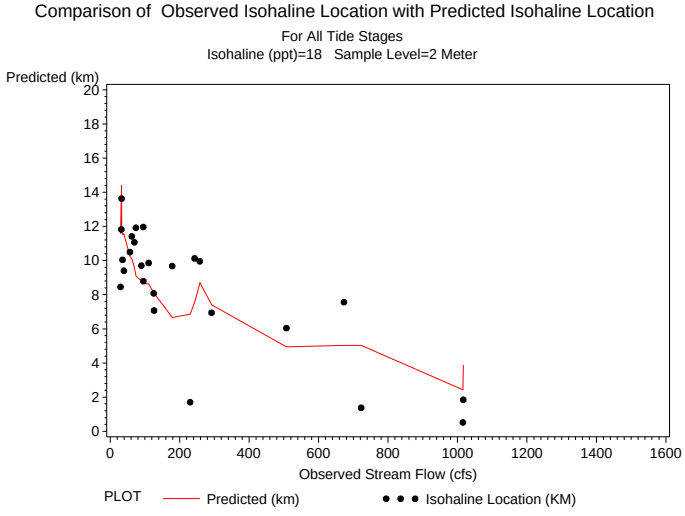
Comparison of Observed Isohaline Location with Predicted Isohaline Location

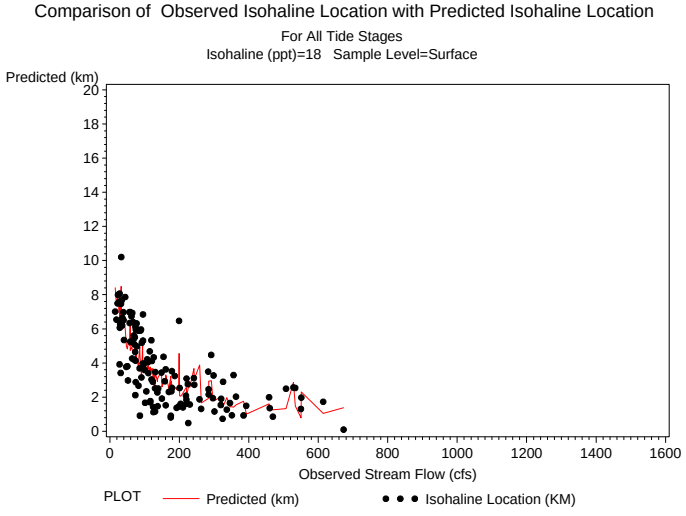
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface

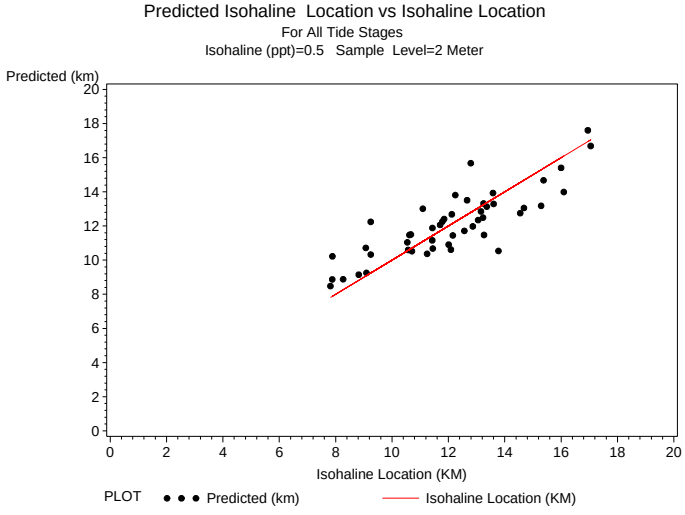


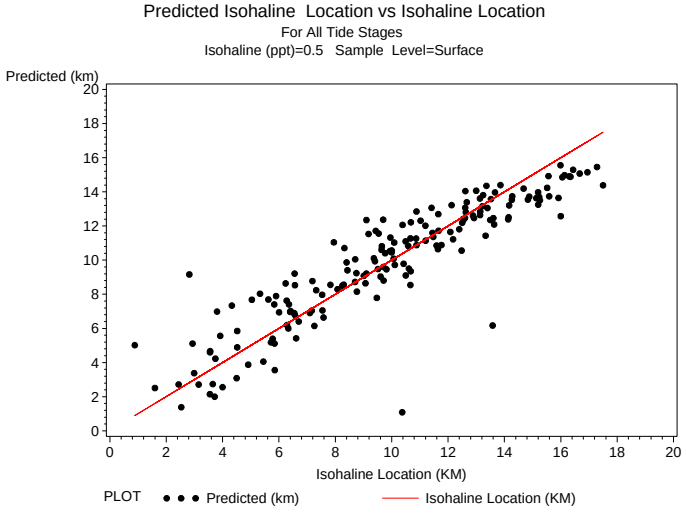

Comparison of Observed Isohaline Location with Predicted Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Predicted (km)
Observed Stream Flow (cfs)
PLOT Predicted (km) Isohaline Location (KM)

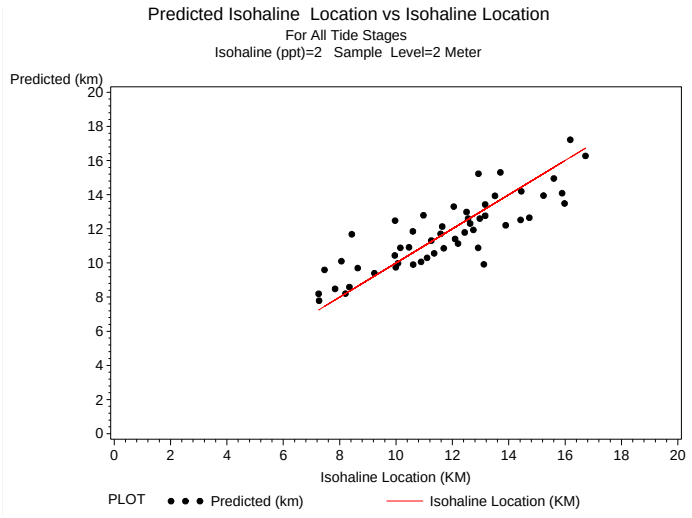

Comparison of Observed Isohaline Location with Predicted Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Predicted (km)
Observed Stream Flow (cfs)
PLOT Predicted (km) Isohaline Location (KM)

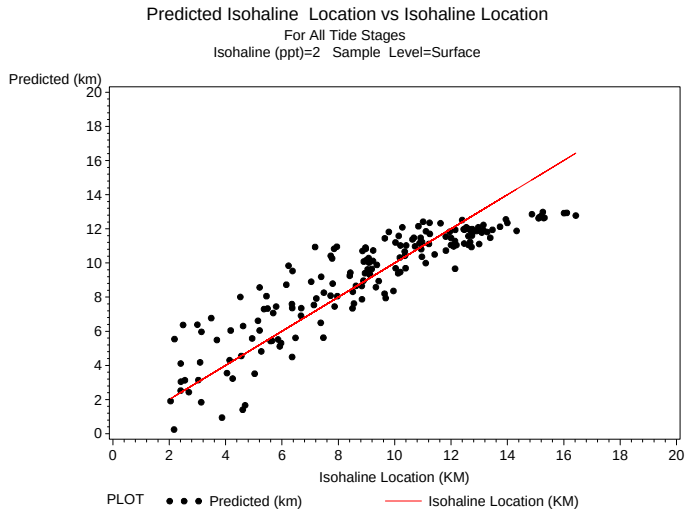

Comparison of Observed Isohaline Location with Predicted Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Predicted (km)
Observed Stream Flow (cfs)
PLOT Predicted (km) Isohaline Location (KM)

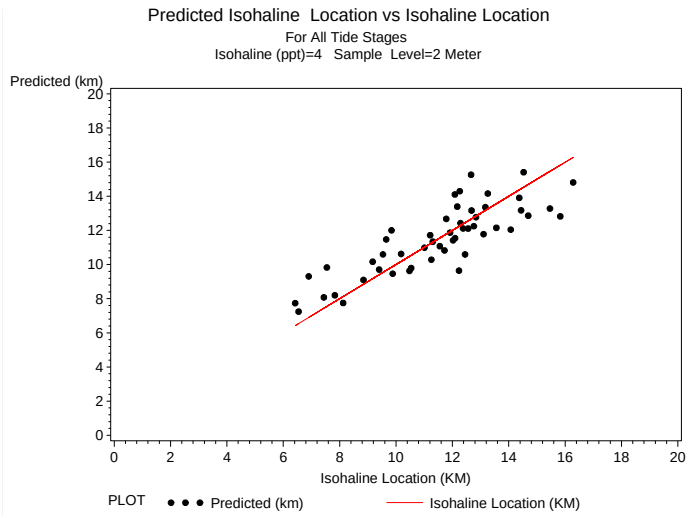

Comparison of Observed Isohaline Location with Predicted Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Predicted (km)
Observed Stream Flow (cfs)
PLOT Predicted (km) Isohaline Location (KM)

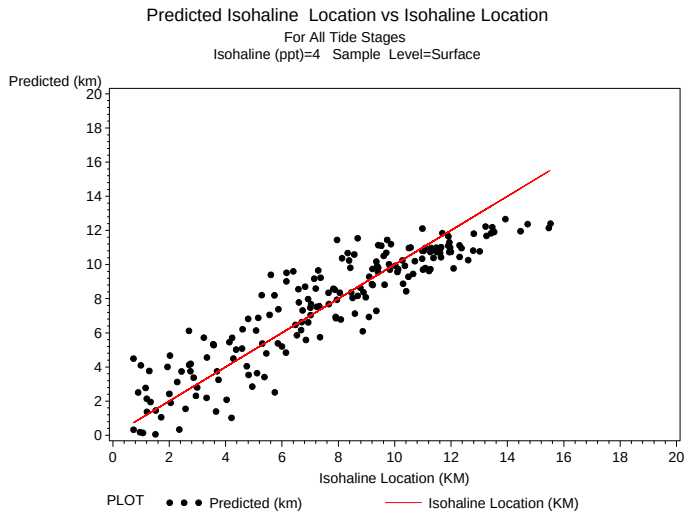

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT Predicted (km) Isohaline Location (KM)

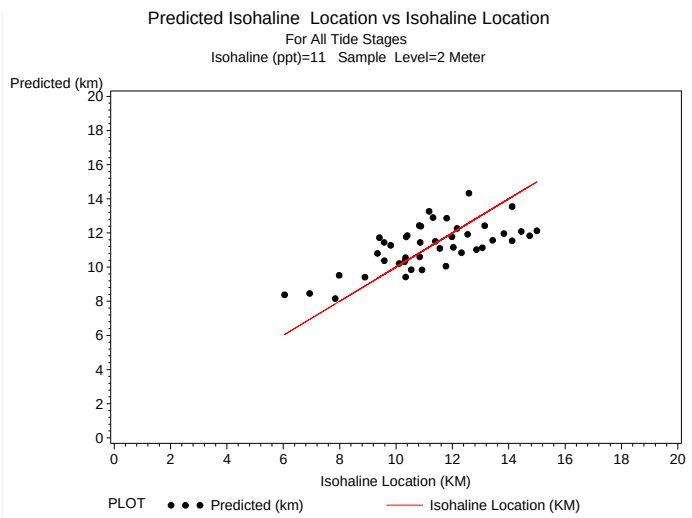

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT Predicted (km) Isohaline Location (KM)

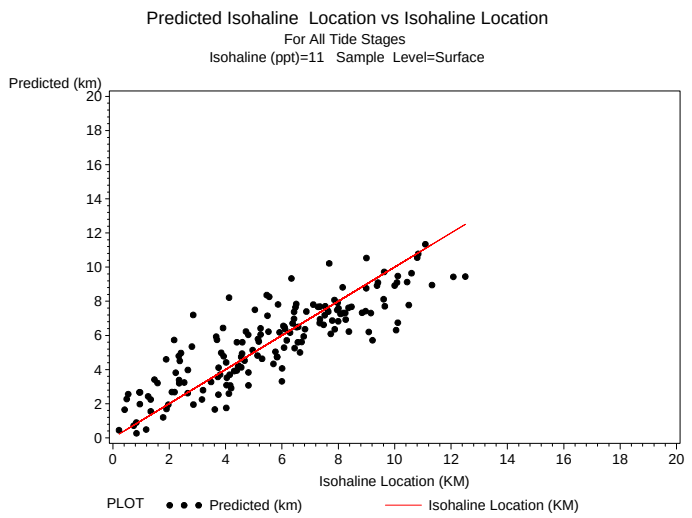

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

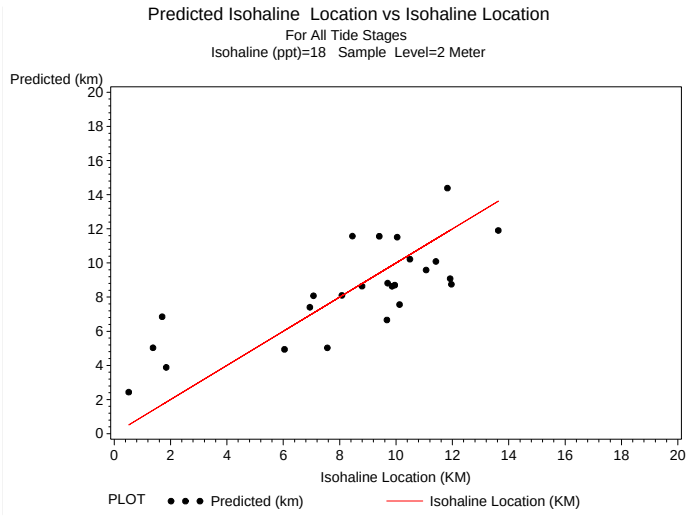

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

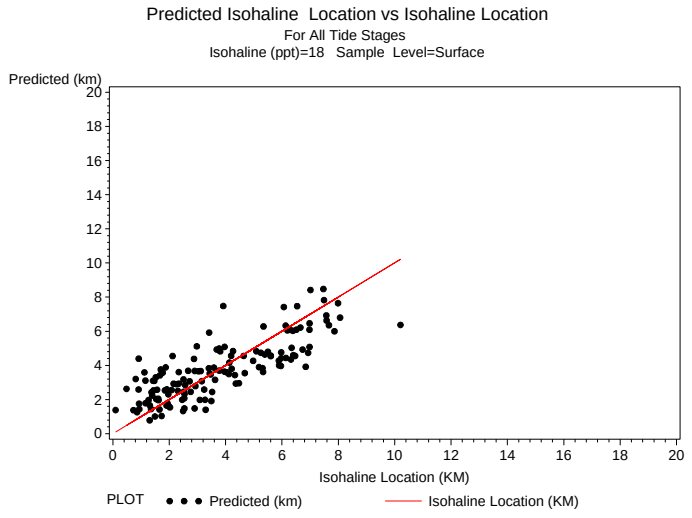

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

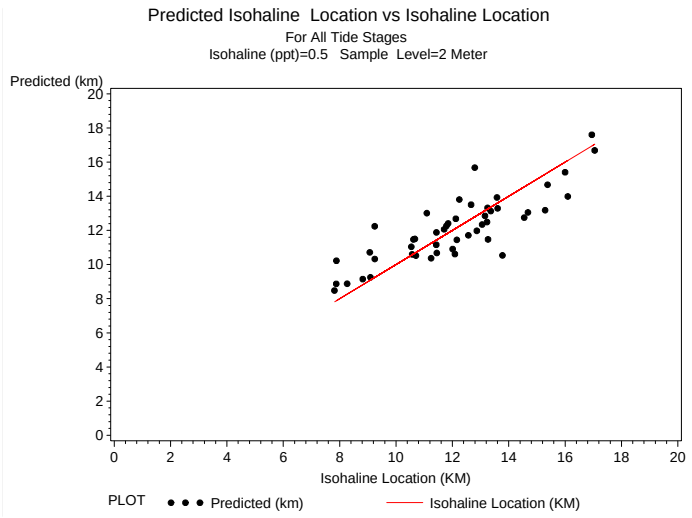

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

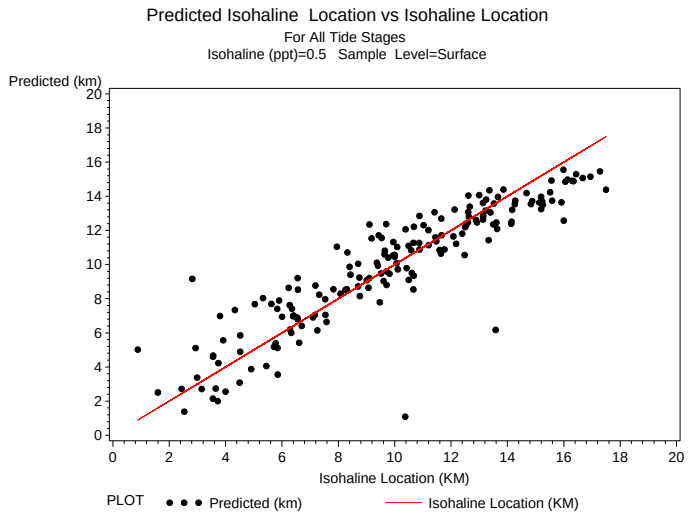

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

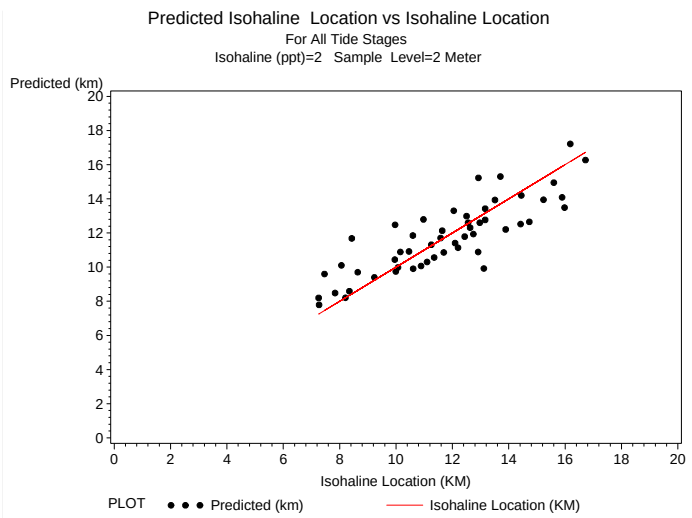

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

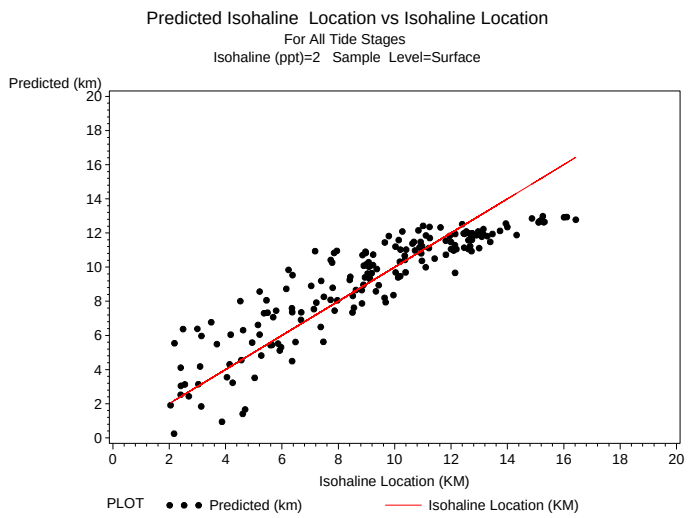

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

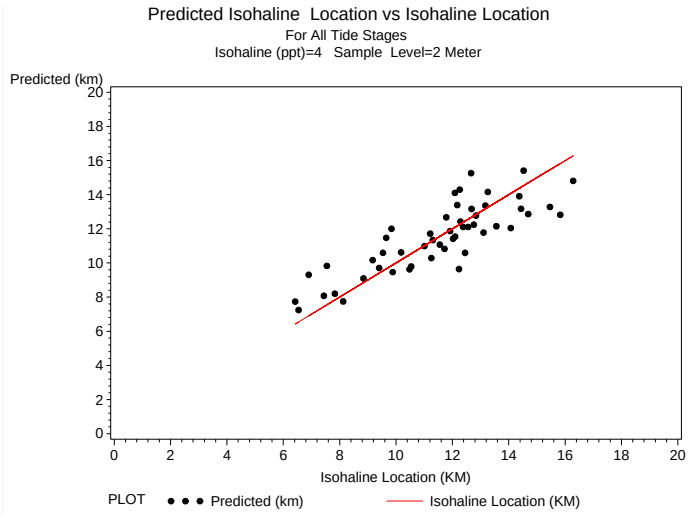

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

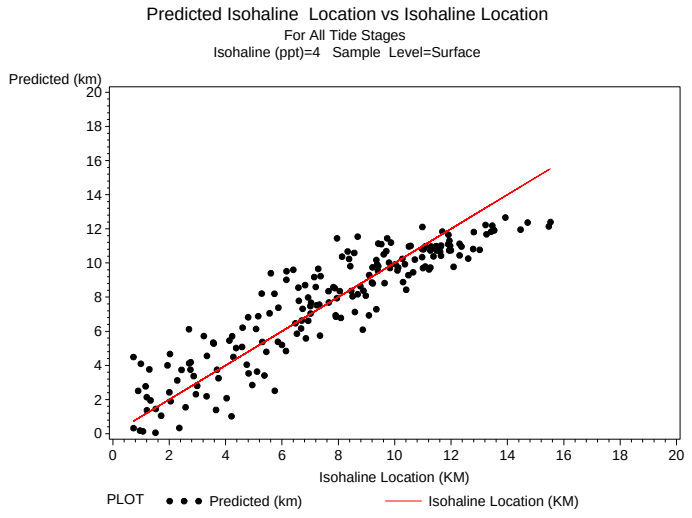

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

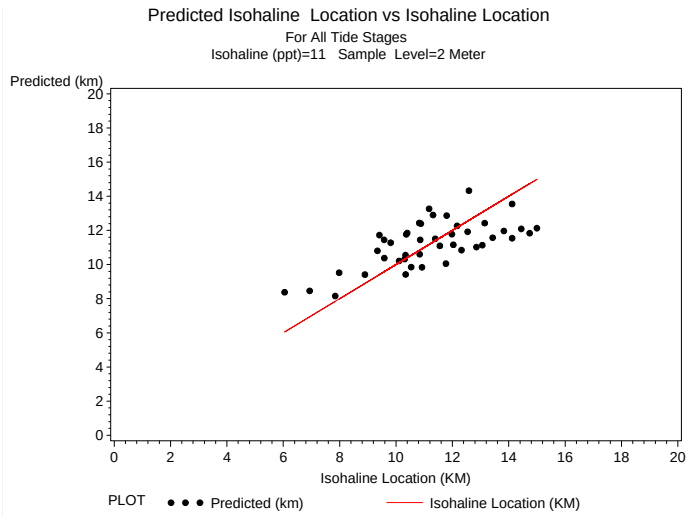

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

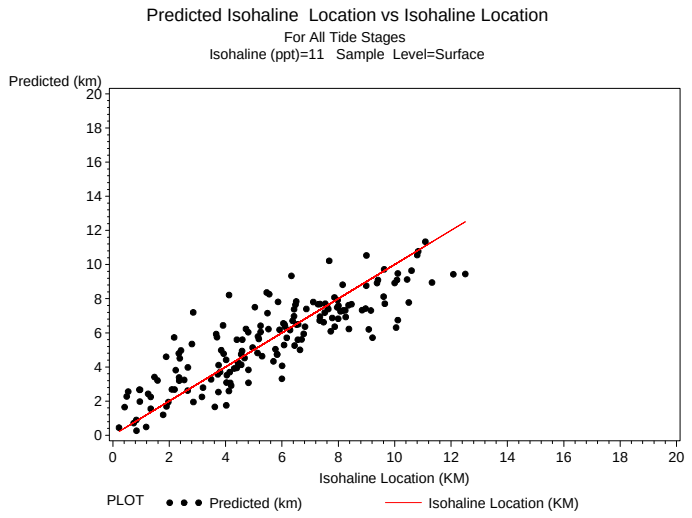

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

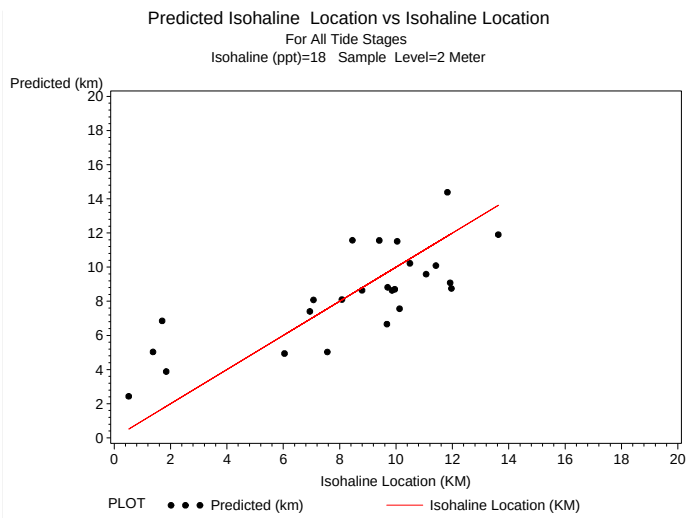

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

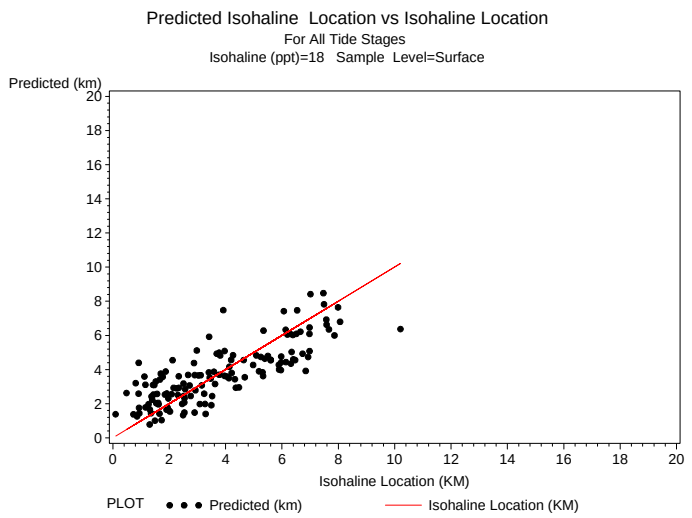

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

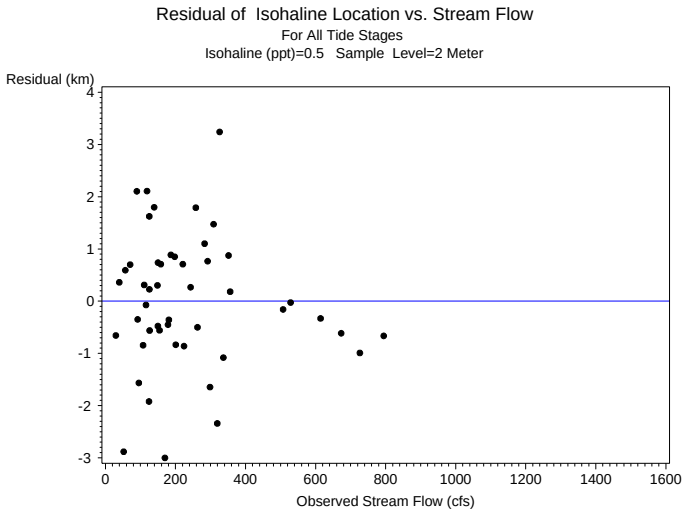

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

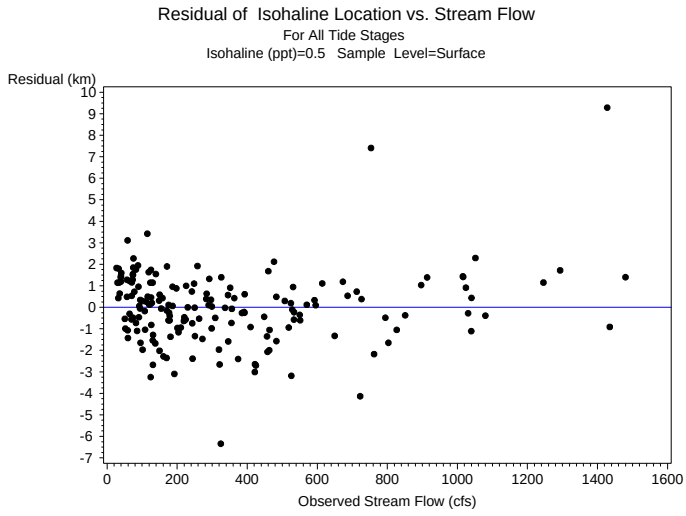

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

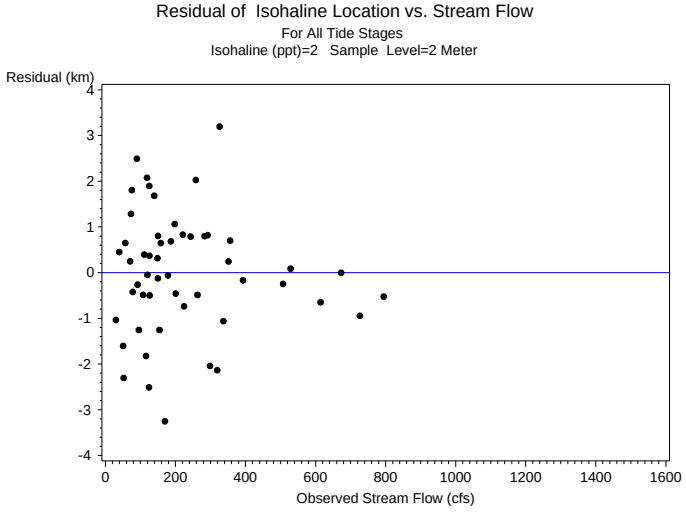

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

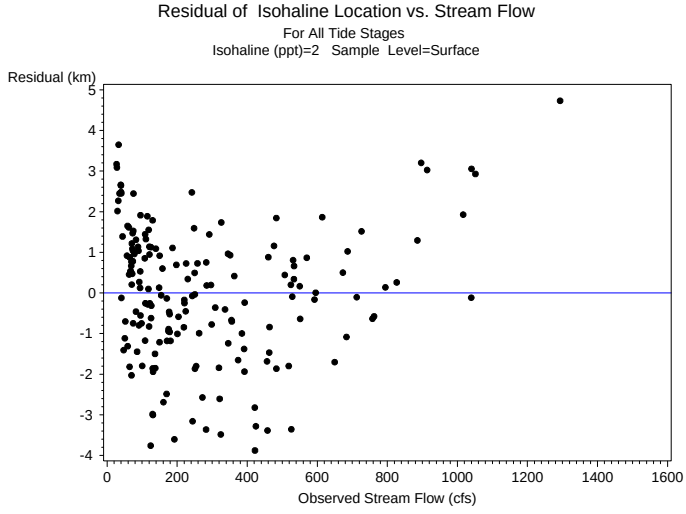

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

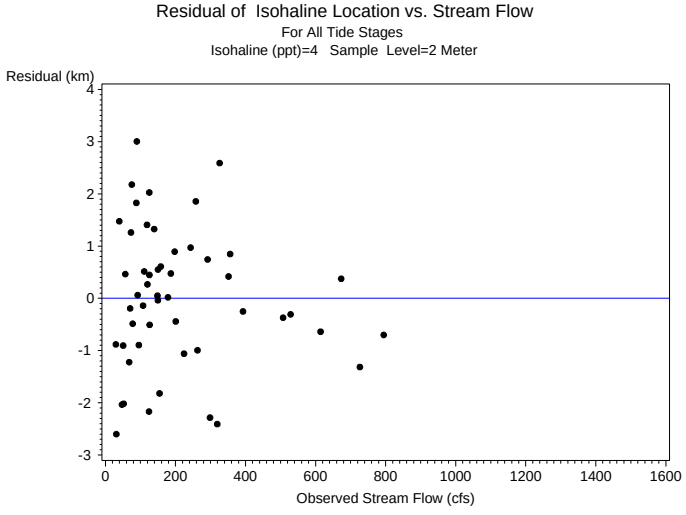

Predicted Isohaline Location vs Isohaline Location
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Predicted (km)
Isohaline Location (KM)
PLOT
Predicted (km)
Isohaline Location (KM)

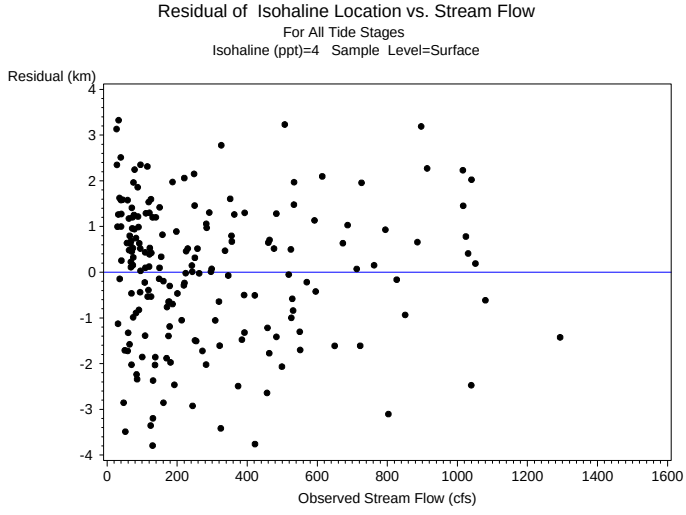

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

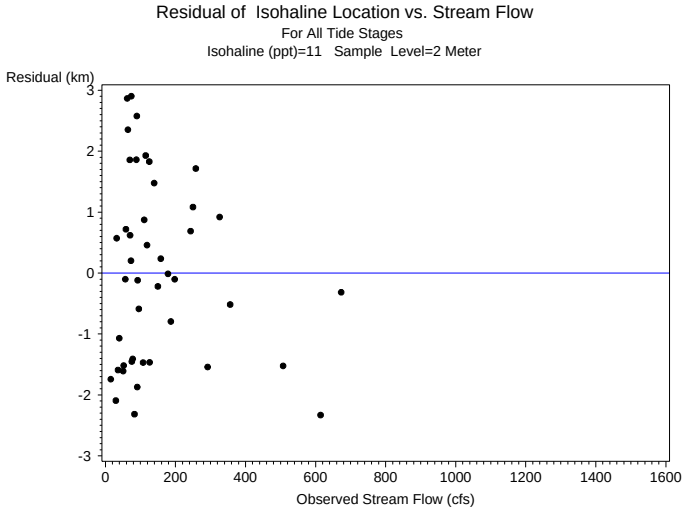

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

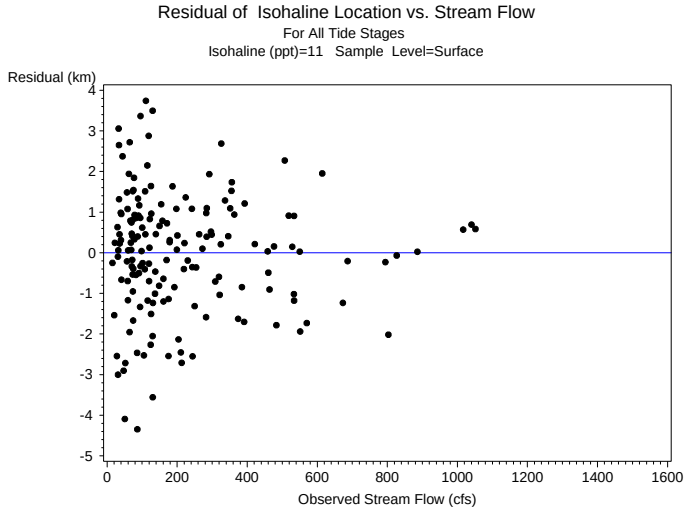

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

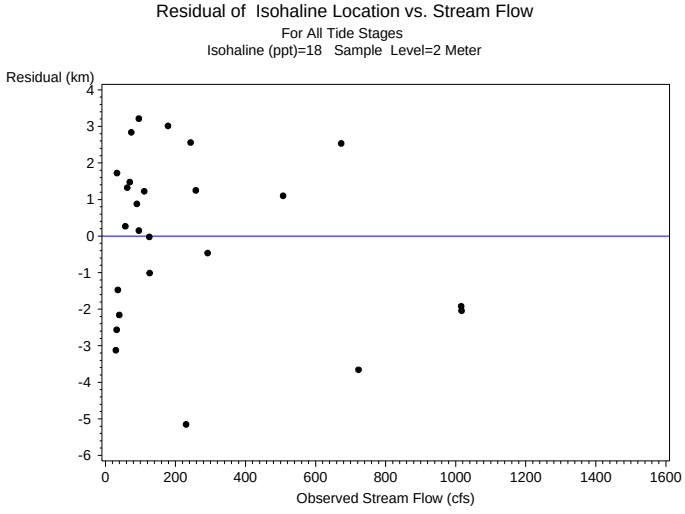

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

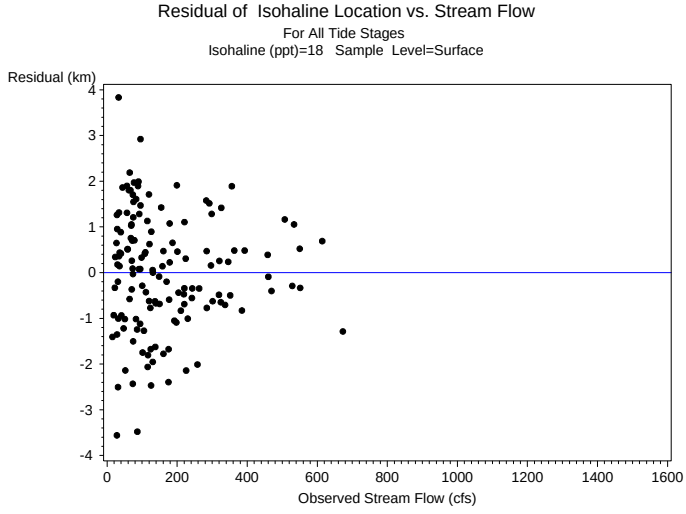

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

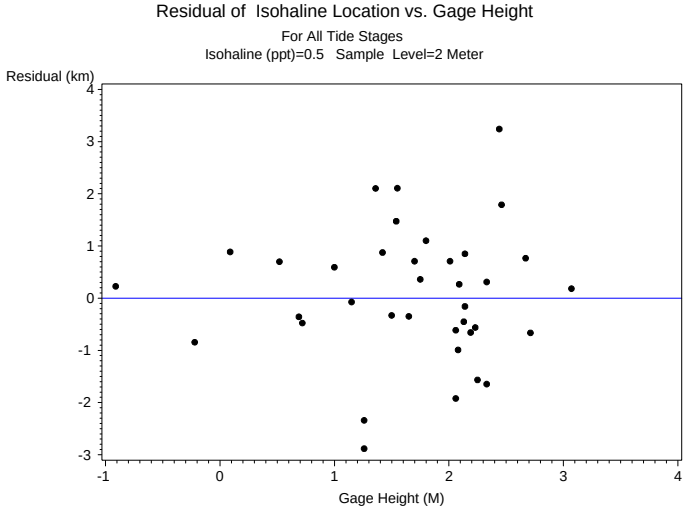

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

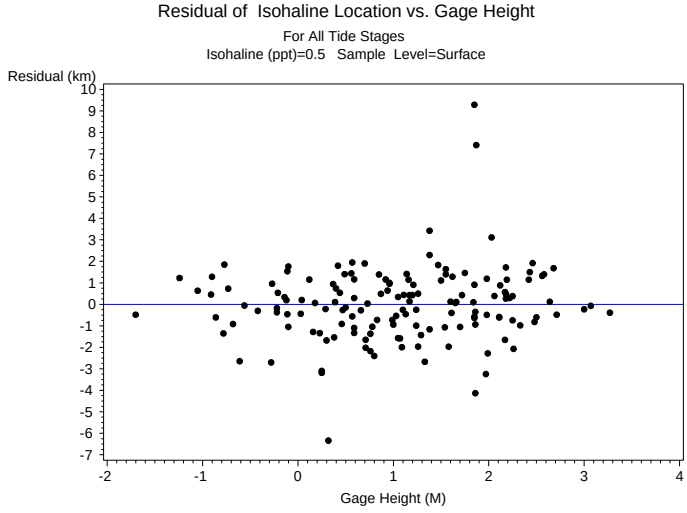

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

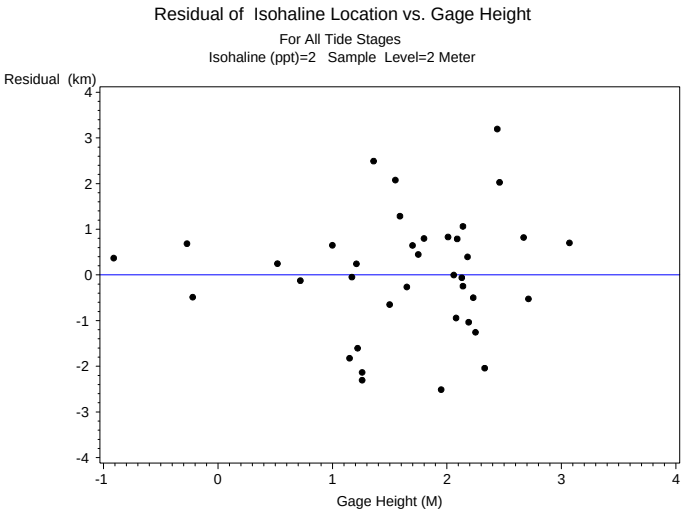

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

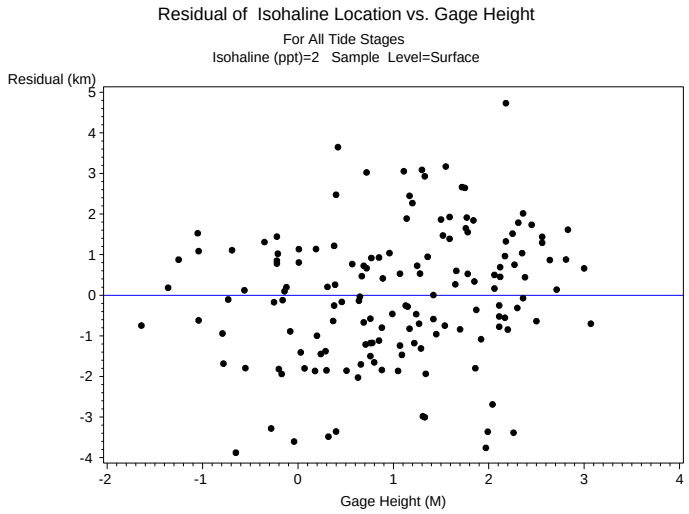

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

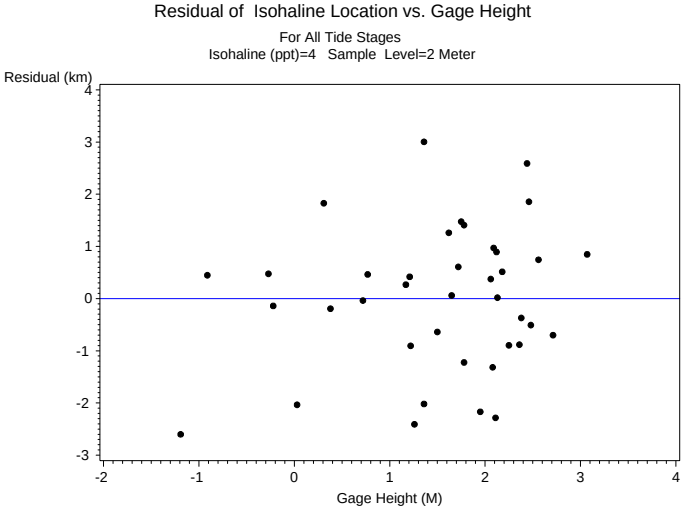

Residual of Isohaline Location vs. Stream Flow
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

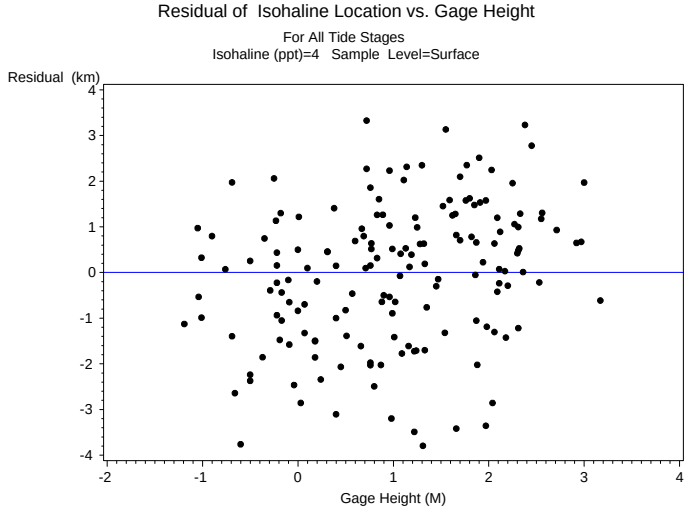

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Gage Height (M)

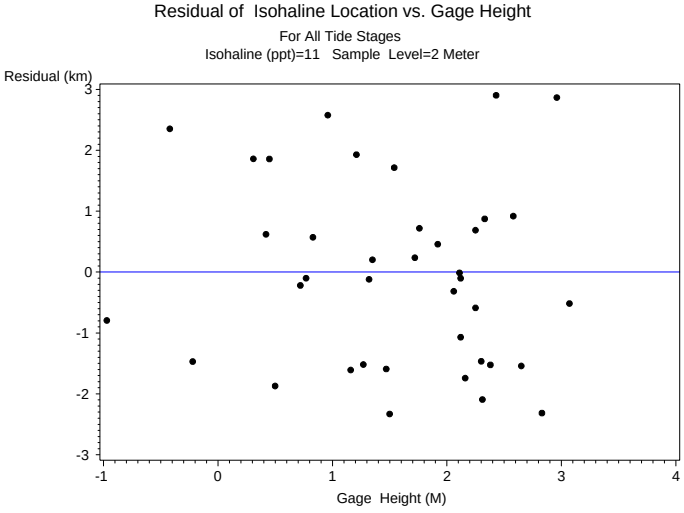

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Gage Height (M)

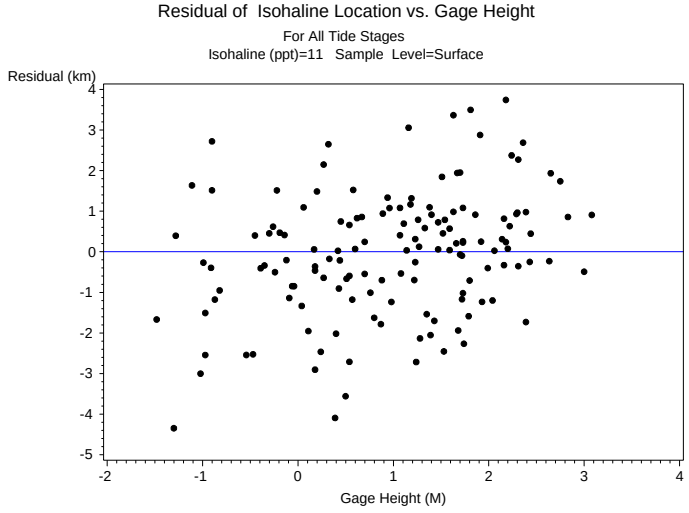

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
Gage Height (M)

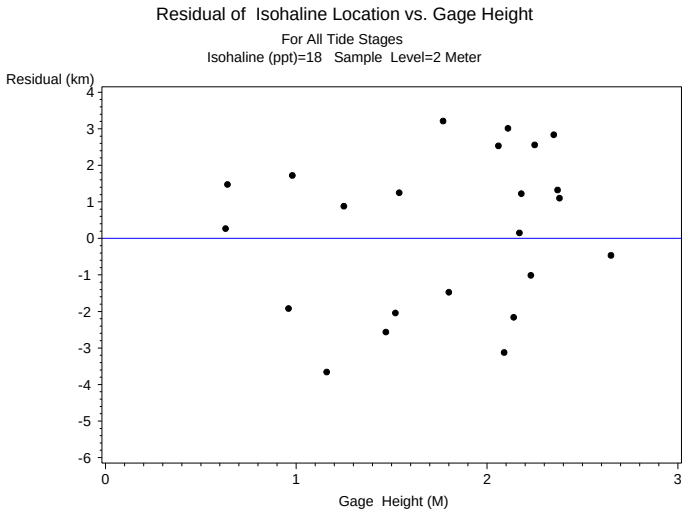

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
Gage Height (M)

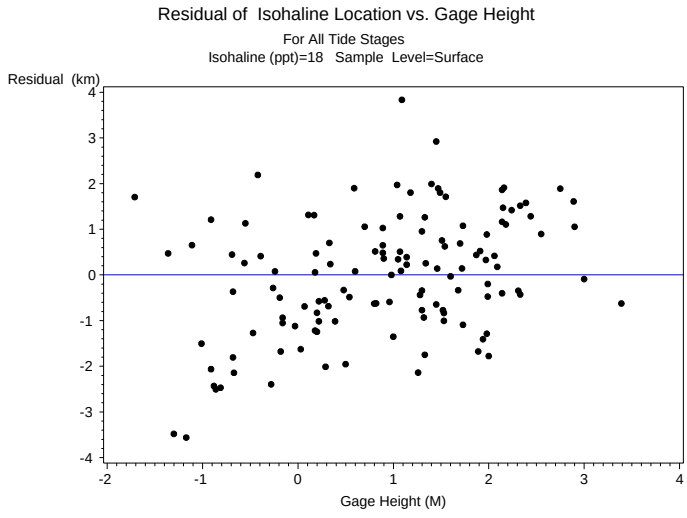

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
Gage Height (M)

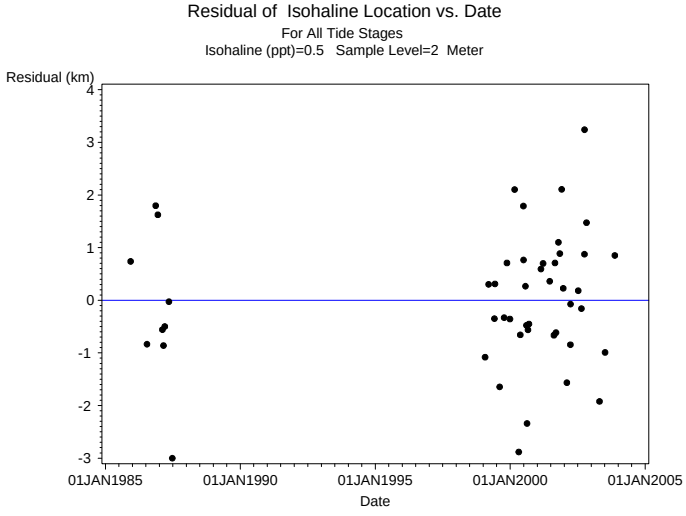

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
Gage Height (M)

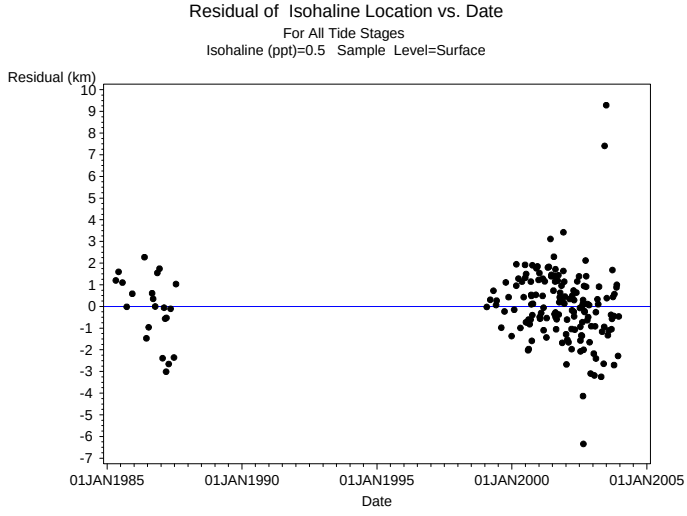

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
Gage Height (M)

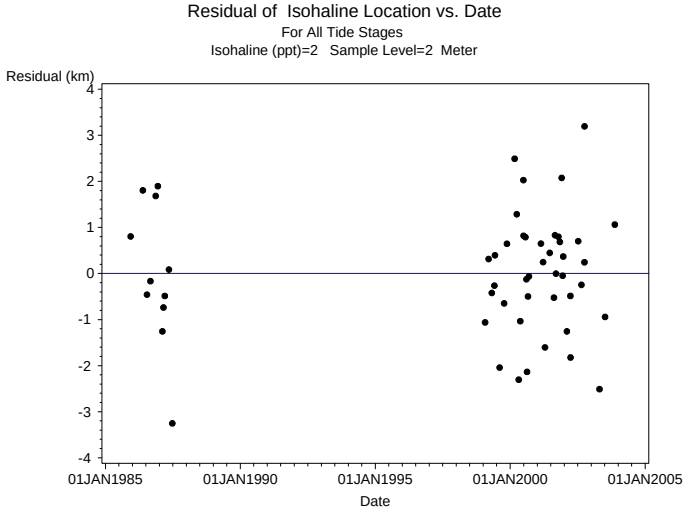

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
Gage Height (M)

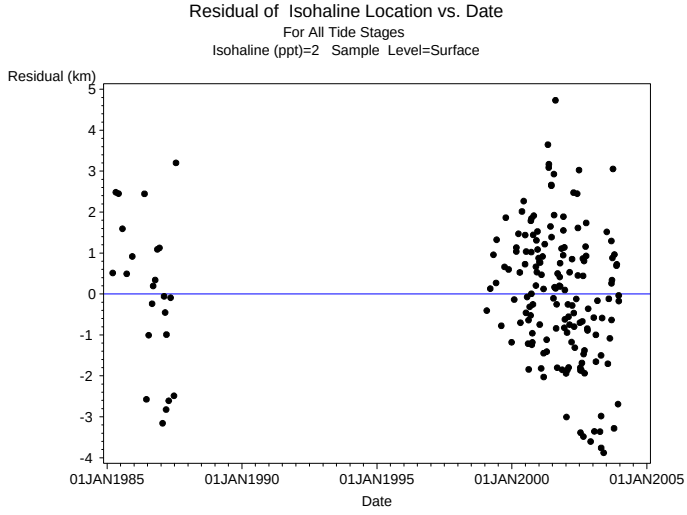

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
Gage Height (M)

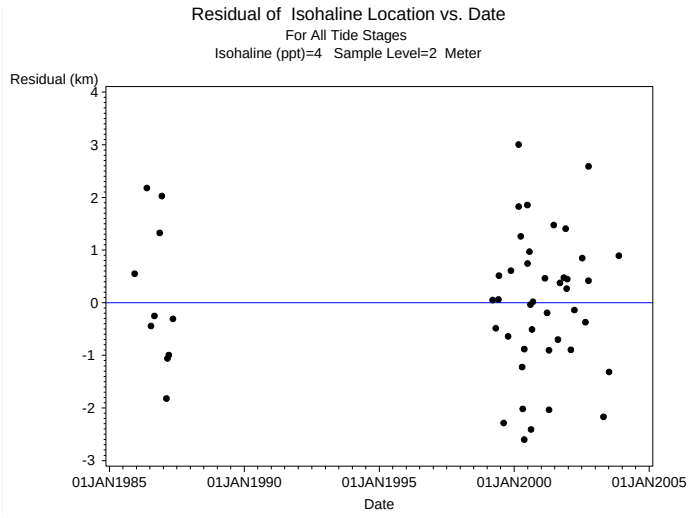

Residual of Isohaline Location vs. Gage Height
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
Gage Height (M)

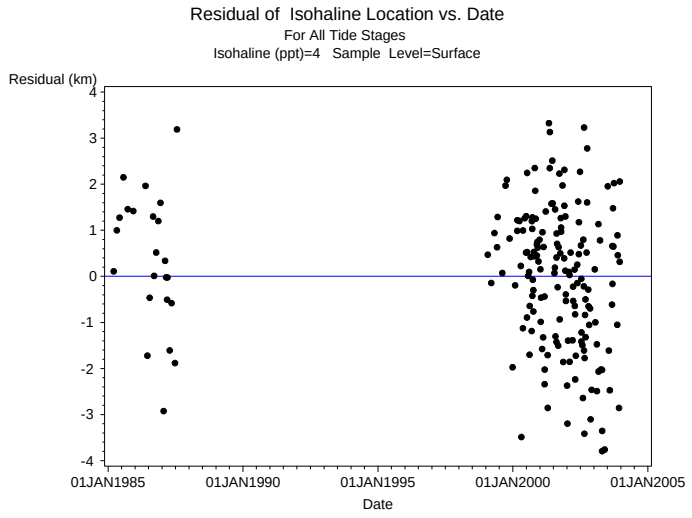

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

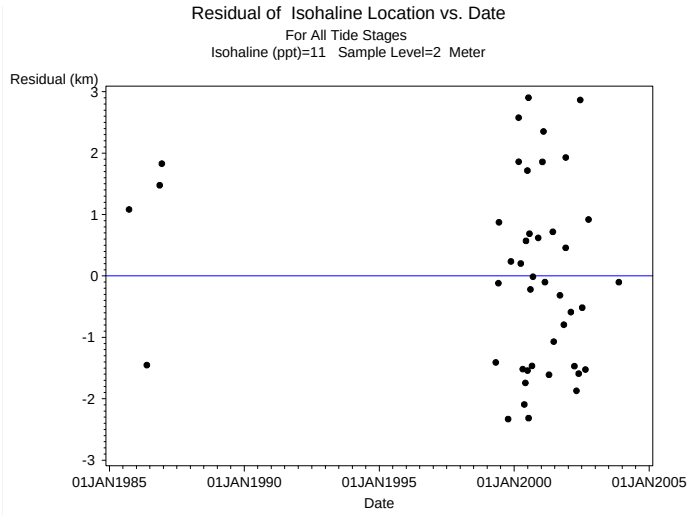

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

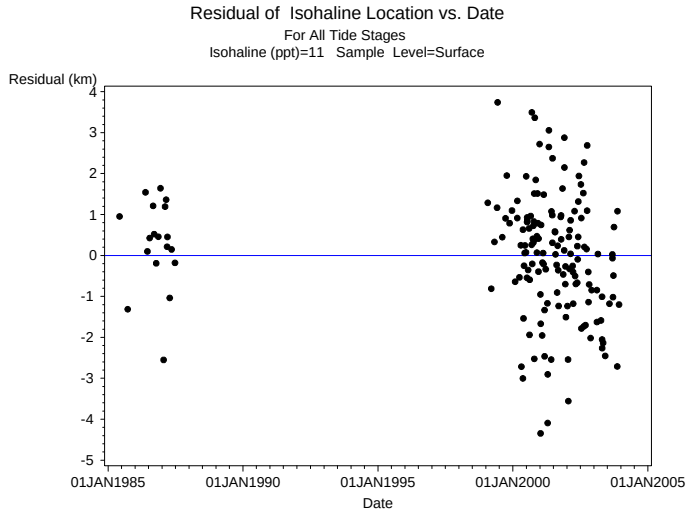

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

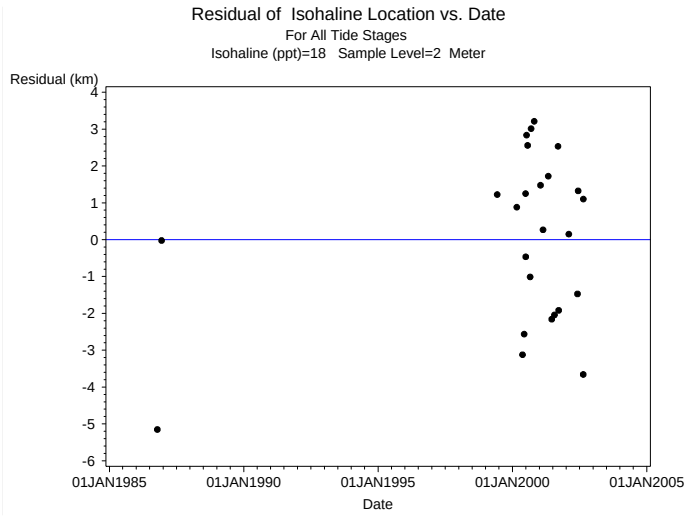

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

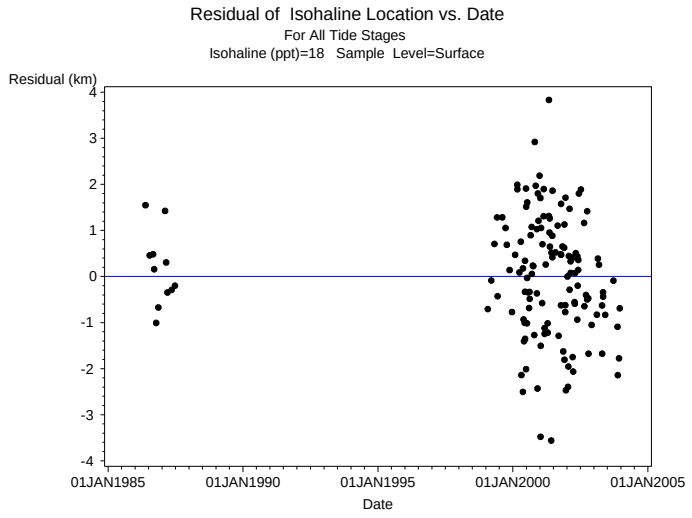

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

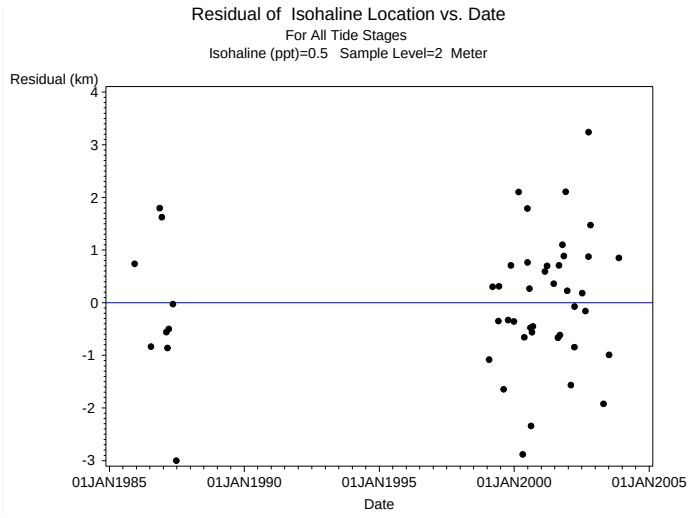

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

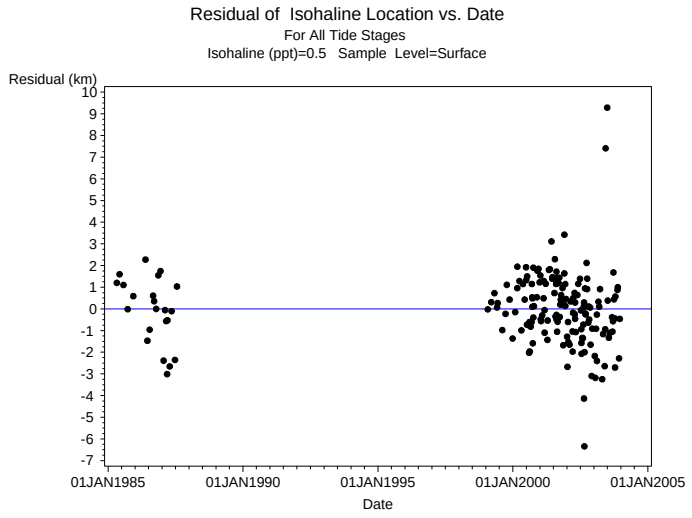

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

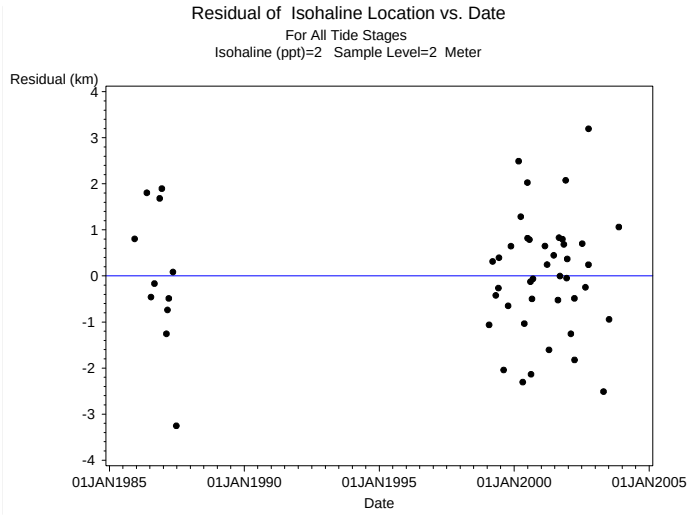

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

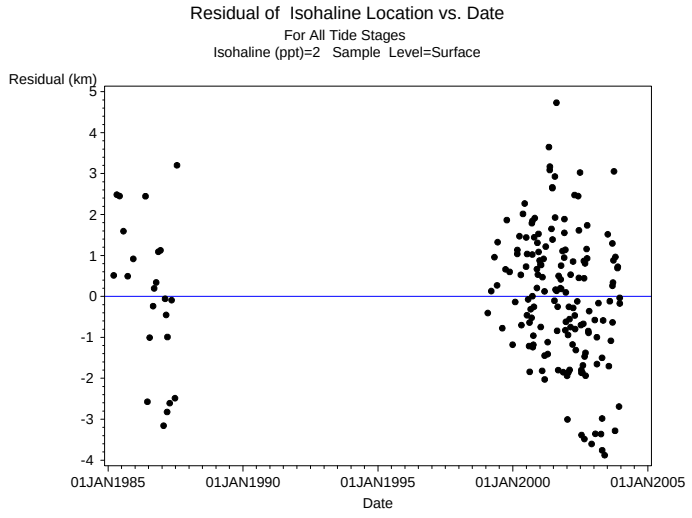

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

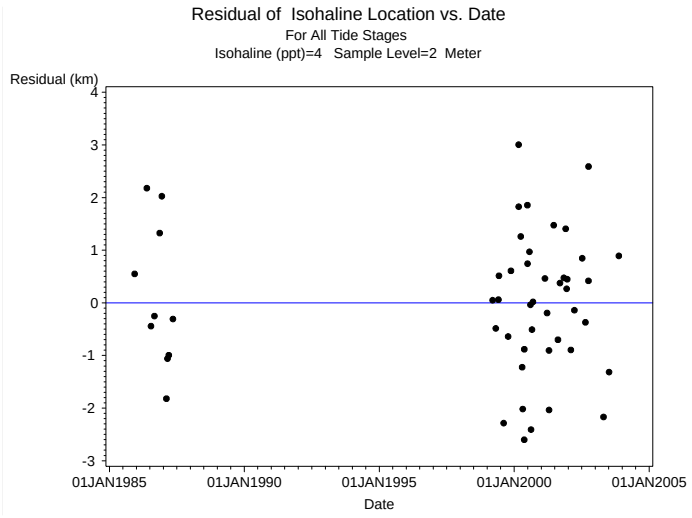

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

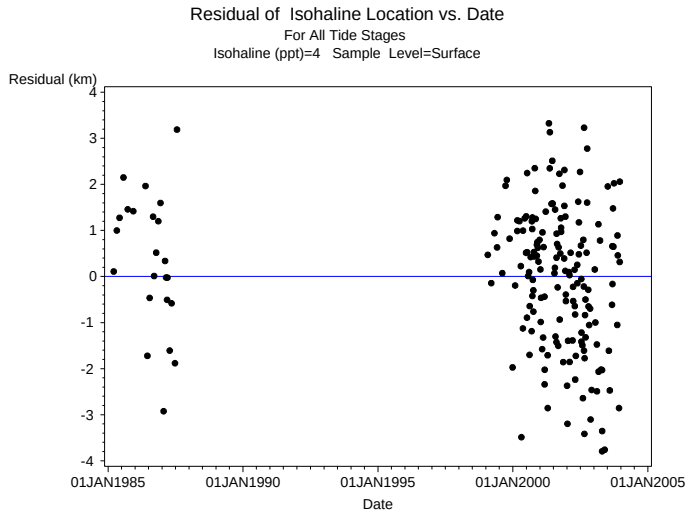

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

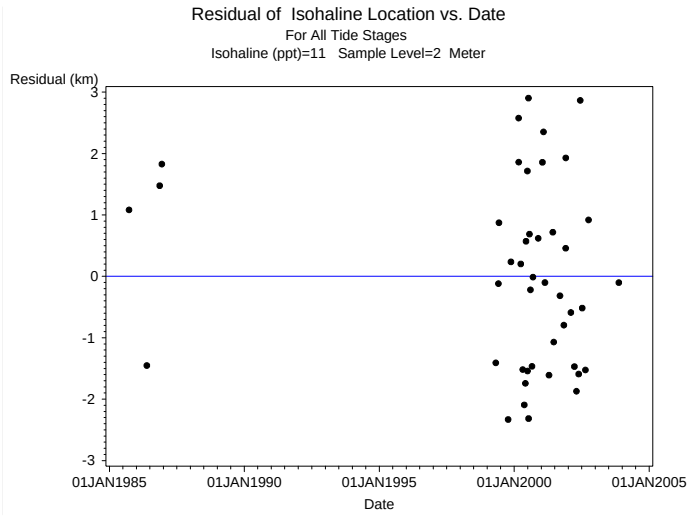

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

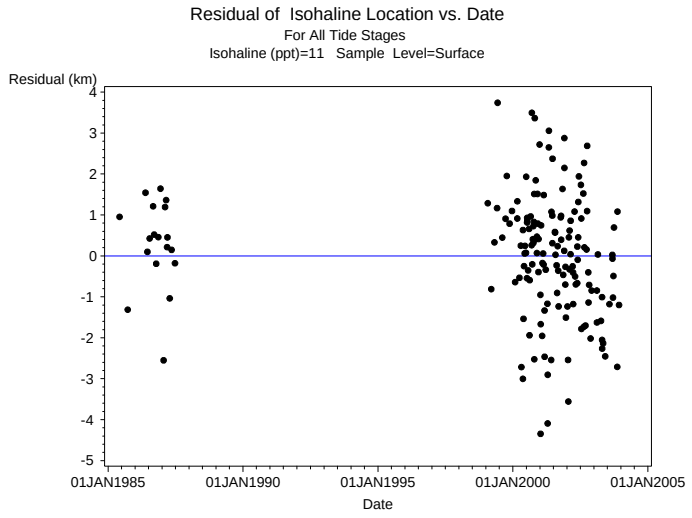

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

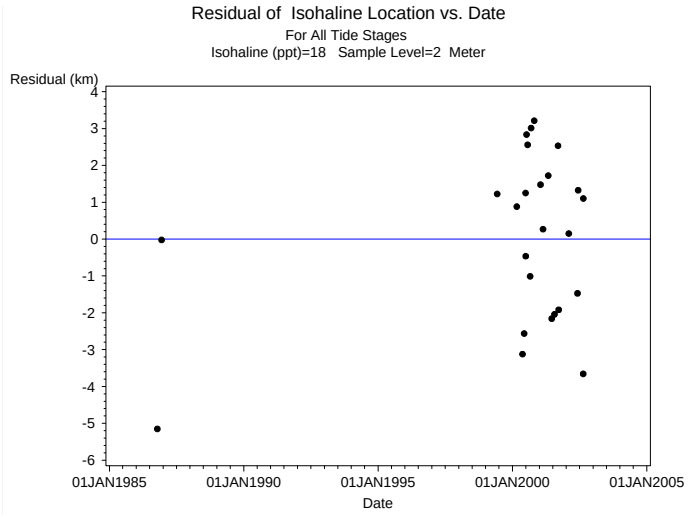

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
5
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

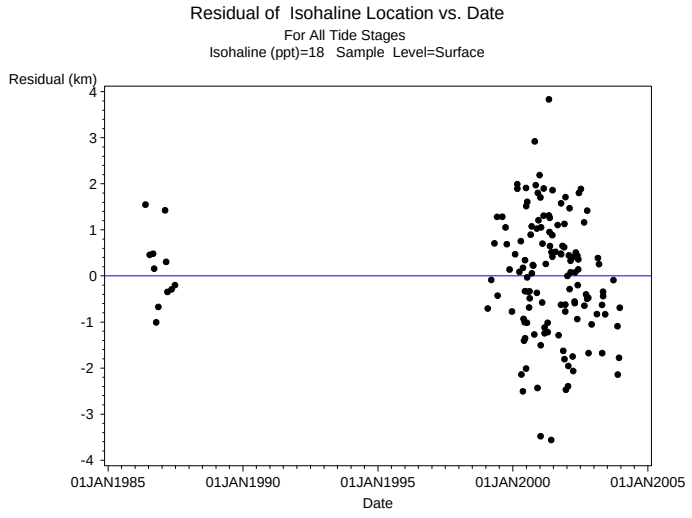

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

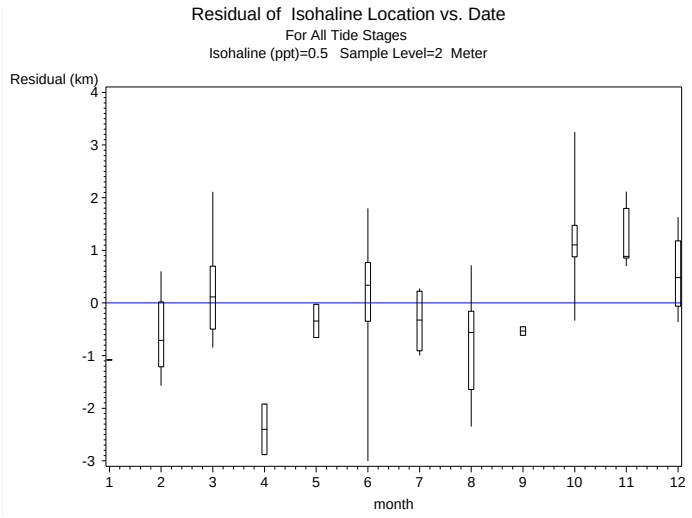

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

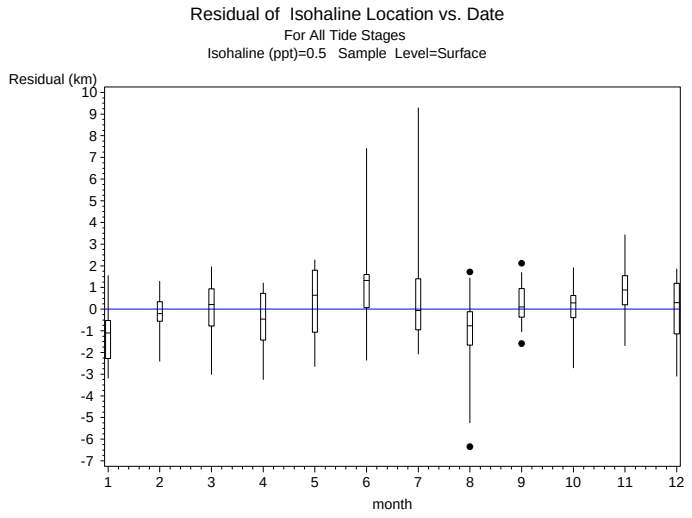

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

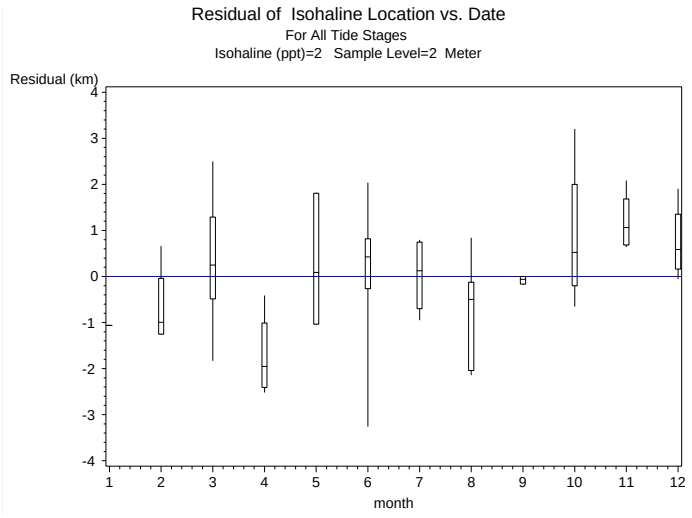

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

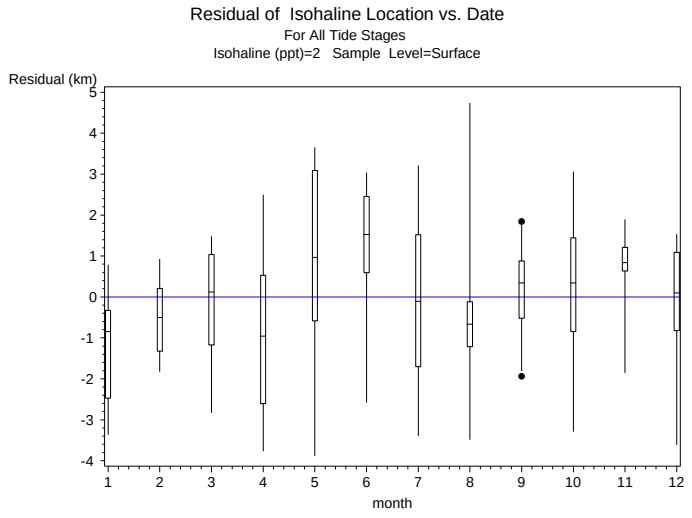

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

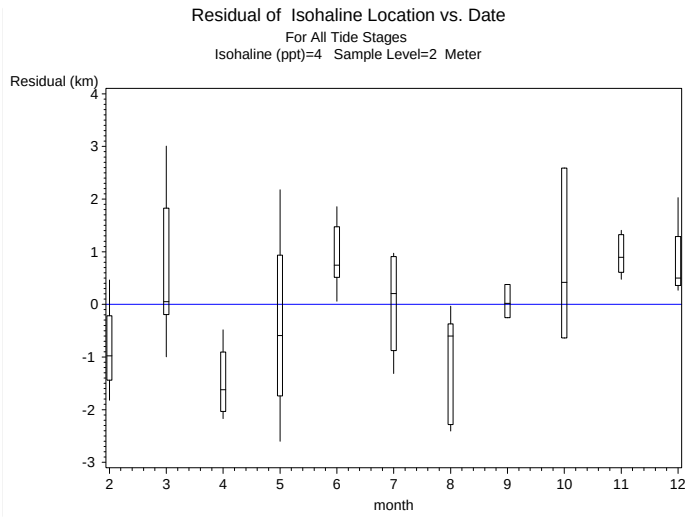

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
01JAN1985
01JAN1990
01JAN1995
01JAN2000
01JAN2005
Date

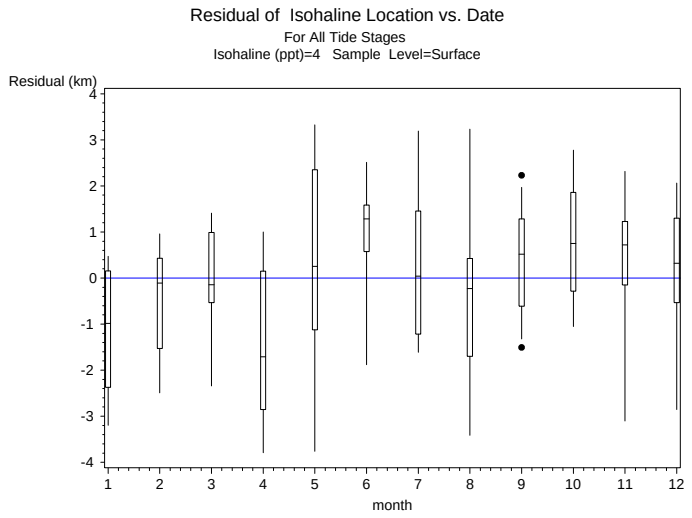

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
1
2
3
4
5
6
7
8
9
10
11
12
month

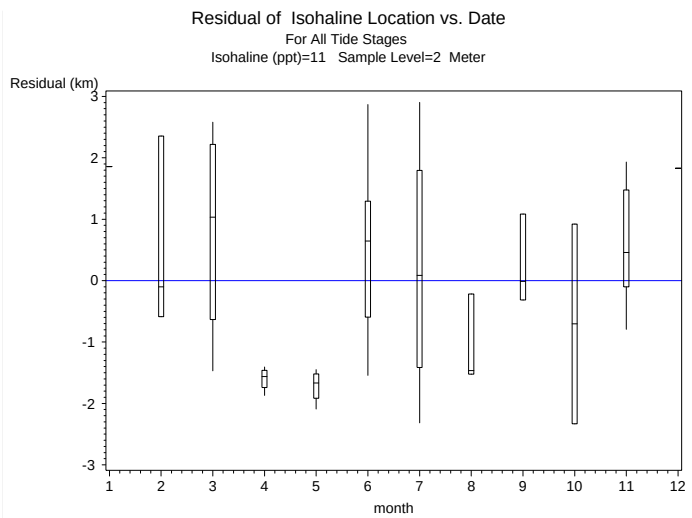

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
1
2
3
4
5
6
7
8
9
10
11
12
month

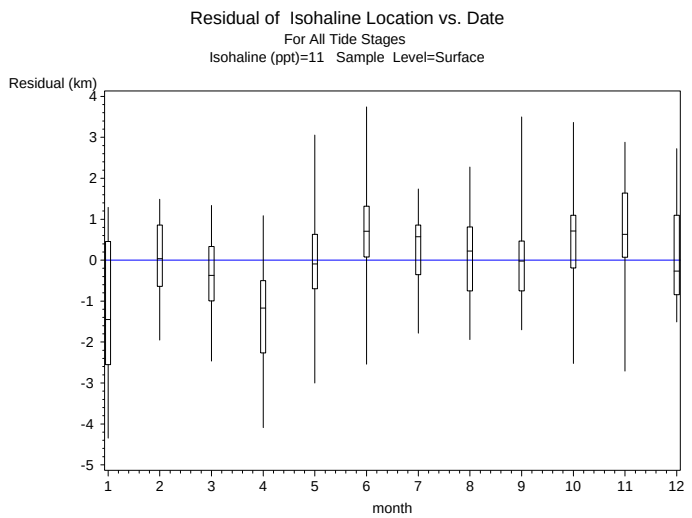

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
month

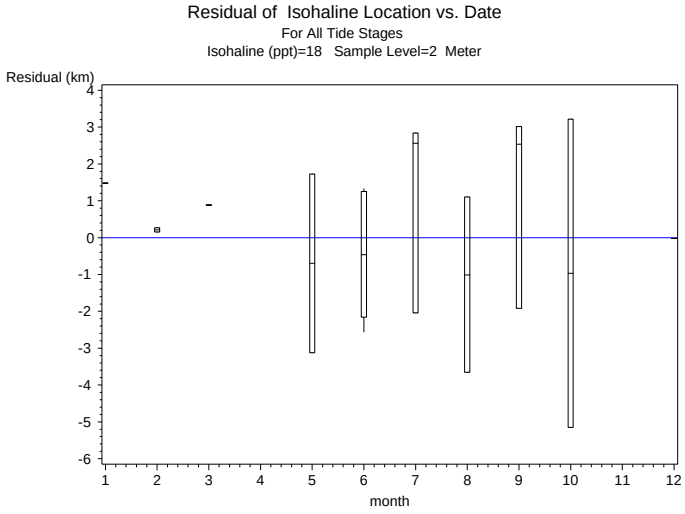

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
month

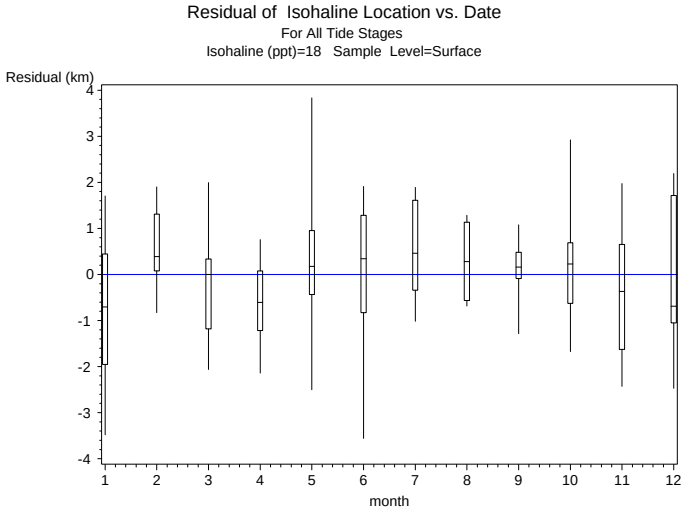

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
month

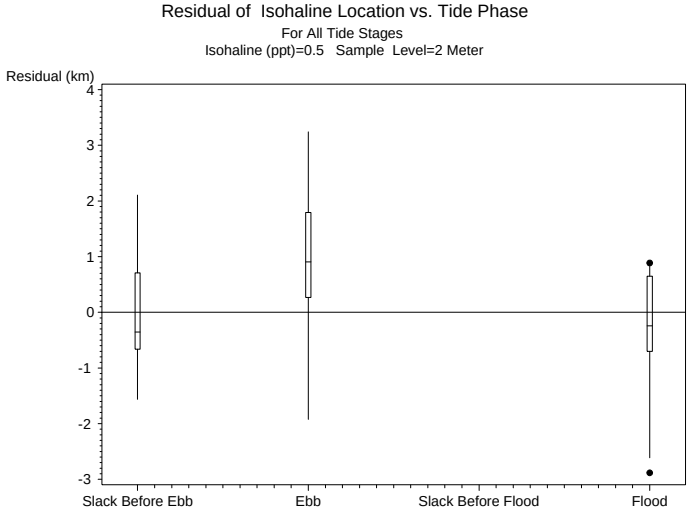

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
month

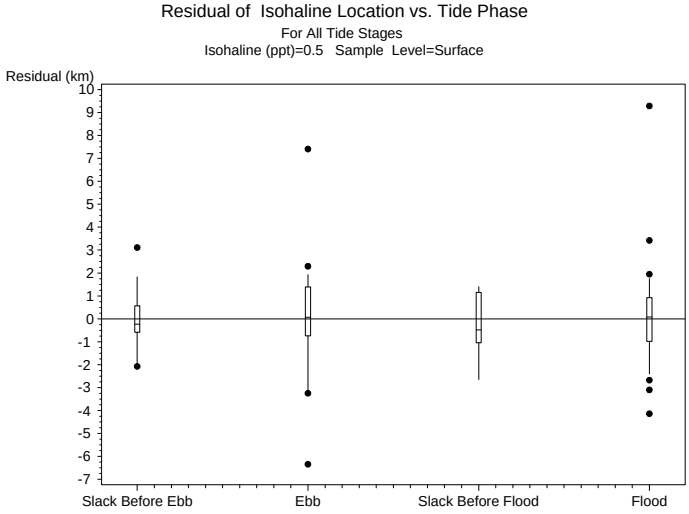

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
month

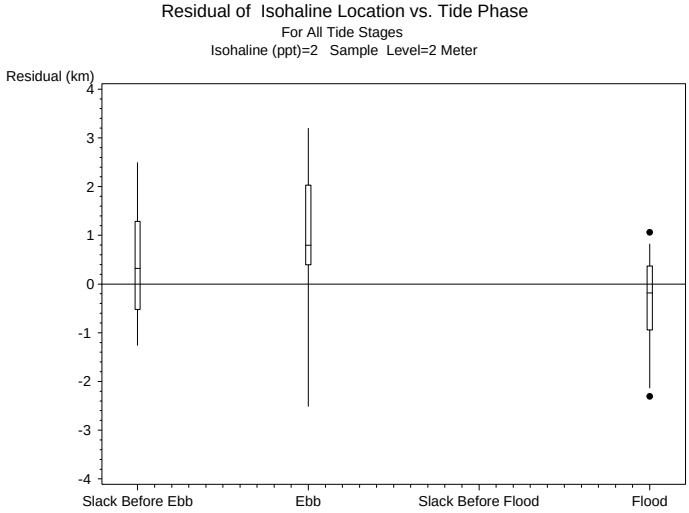

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
month

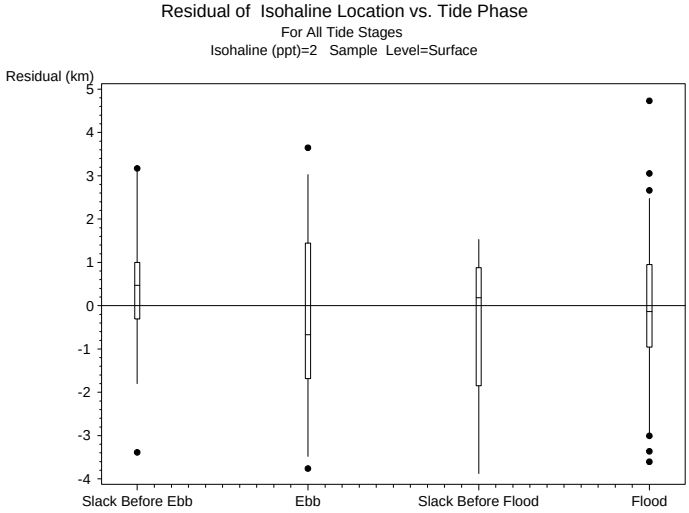

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
month

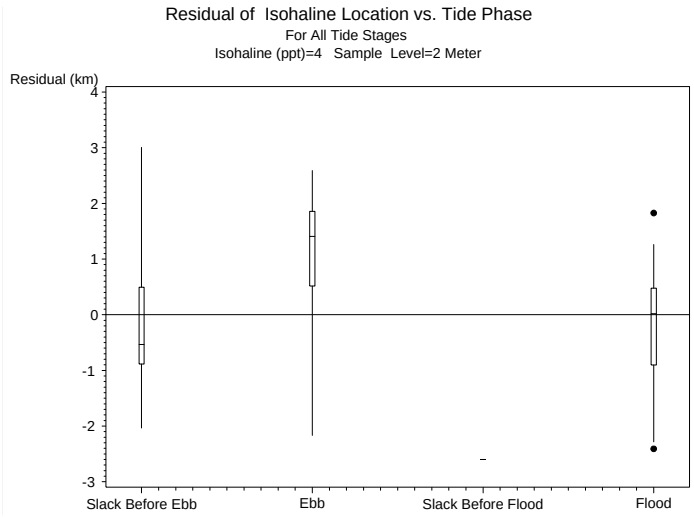

Residual of Isohaline Location vs. Date
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
month

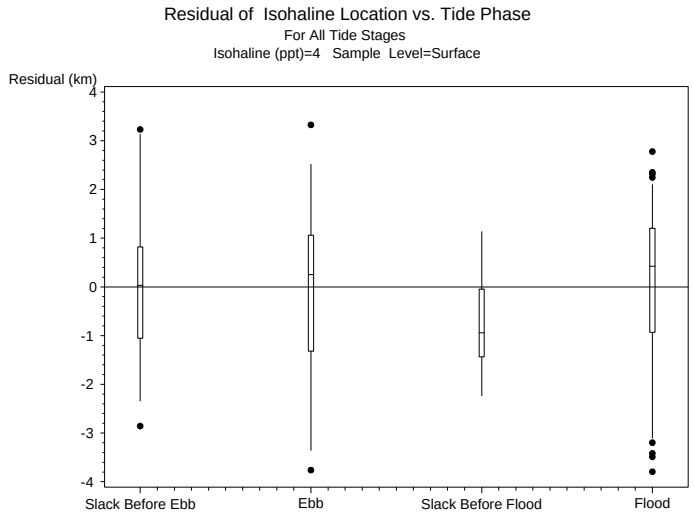

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Slack Before Ebb
Ebb
Slack Before Flood
Flood

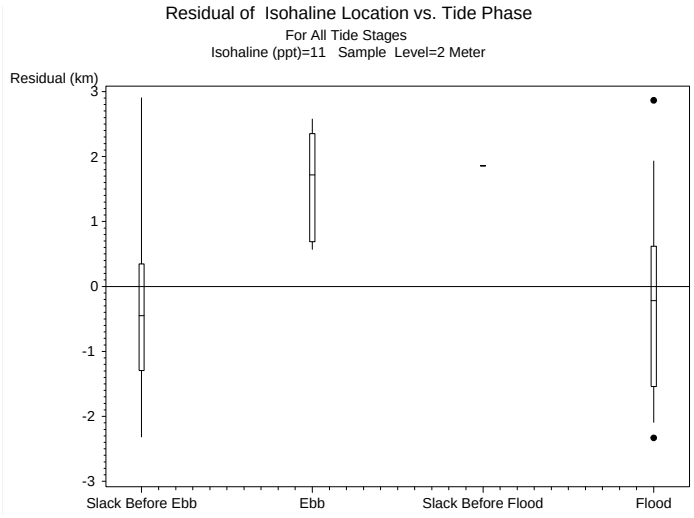

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Slack Before Ebb
Ebb
Slack Before Flood
Flood

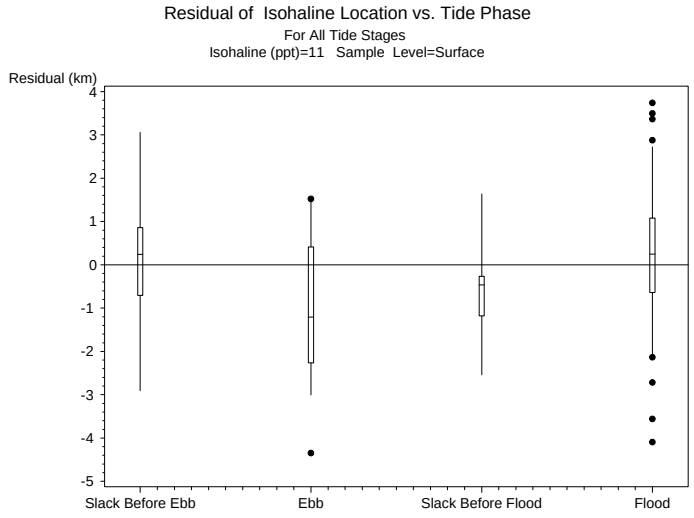

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
Slack Before Ebb
Ebb
Slack Before Flood
Flood

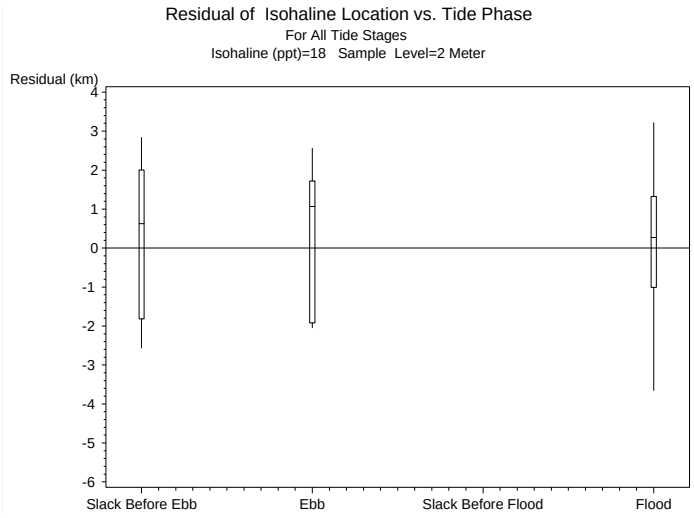

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
Slack Before Ebb
Ebb
Slack Before Flood
Flood

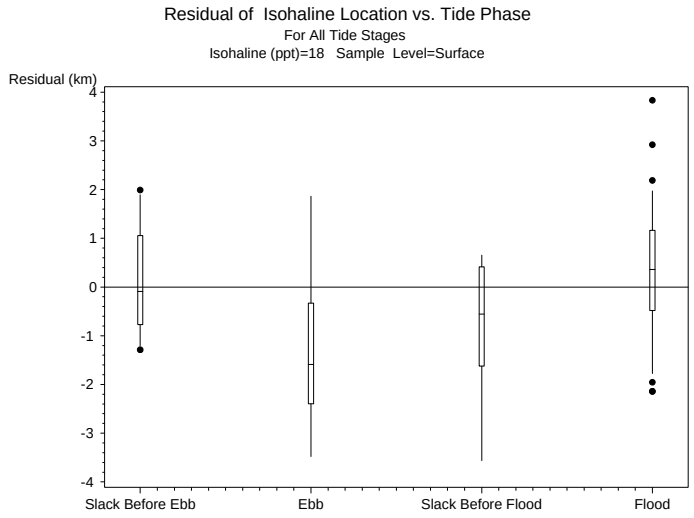

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
Slack Before Ebb
Ebb
Slack Before Flood
Flood

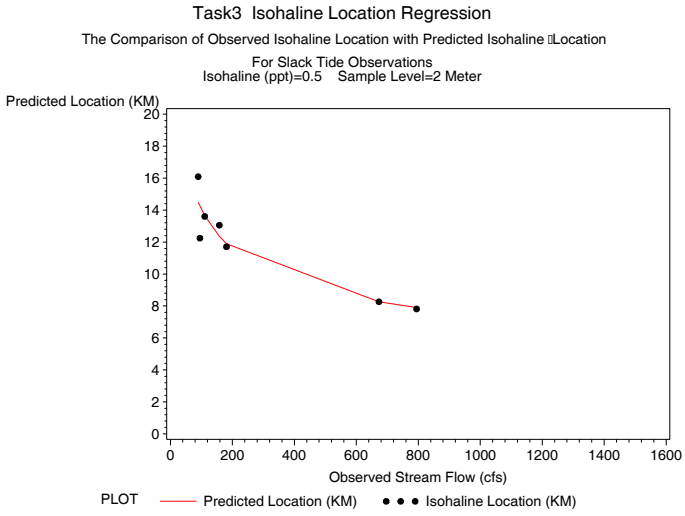

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
Slack Before Ebb
Ebb
Slack Before Flood
Flood

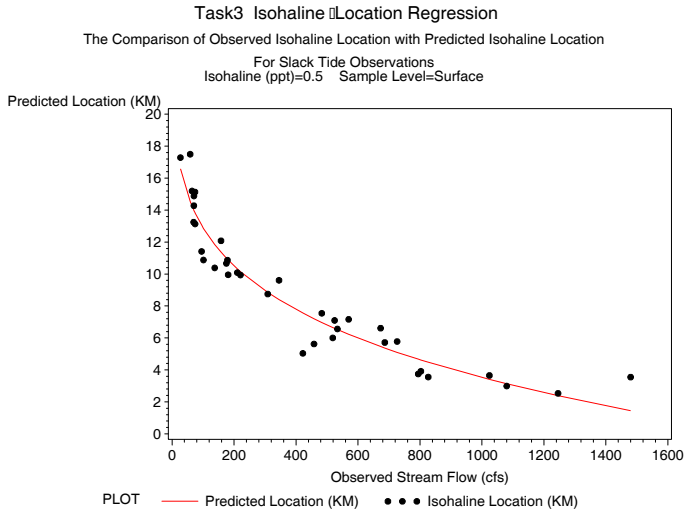

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
Slack Before Ebb
Ebb
Slack Before Flood
Flood

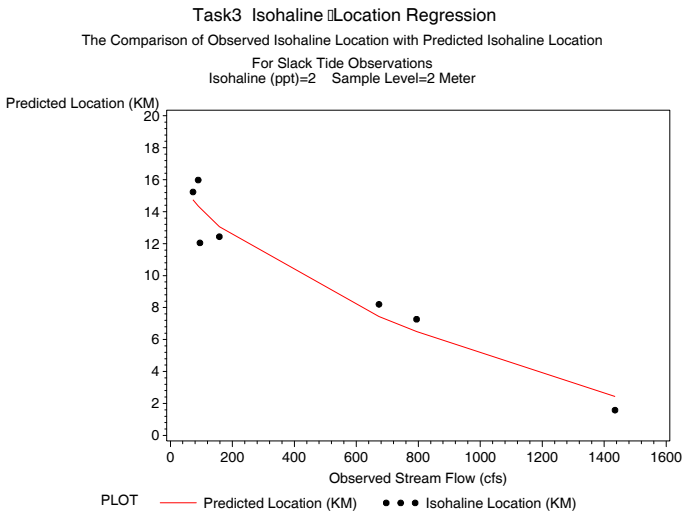

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
Slack Before Ebb
Ebb
Slack Before Flood
Flood

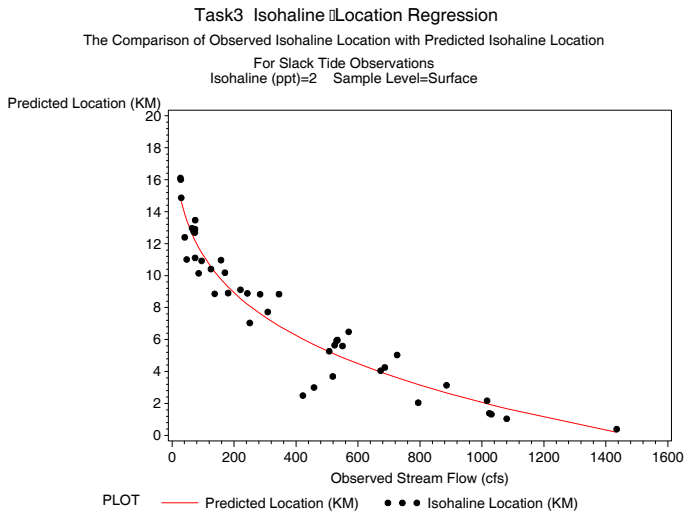

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
-5
-6
Slack Before Ebb
Ebb
Slack Before Flood
Flood

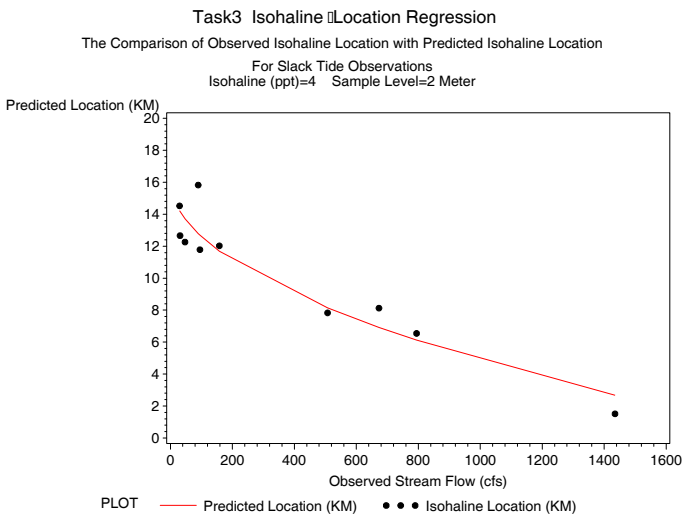

Residual of Isohaline Location vs. Tide Phase
For All Tide Stages
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
-4
Slack Before Ebb
Ebb
Slack Before Flood
Flood

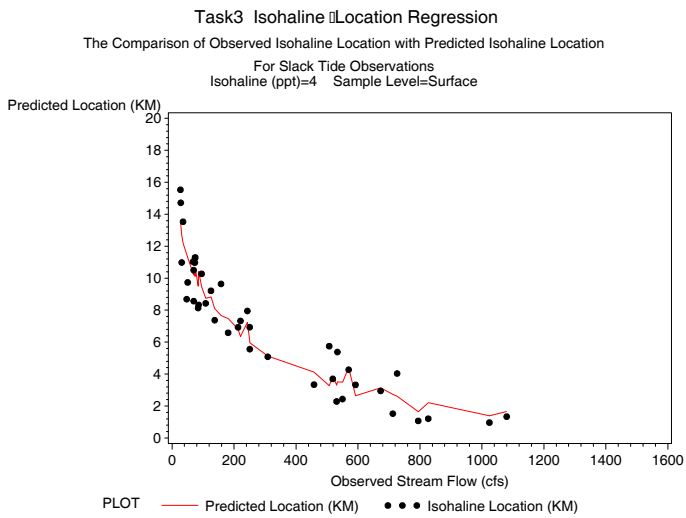

Task3 Isohaline Location Regression
The Comparison of Observed Isohaline Location with Predicted Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

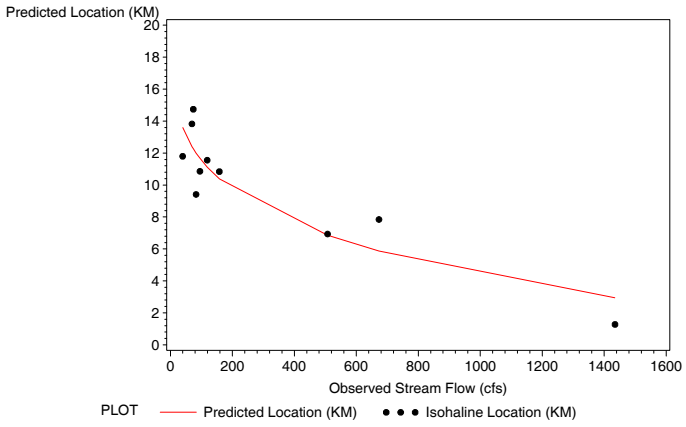

Task3 Isohaline Location Regression
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For Slack Tide Observations
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Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

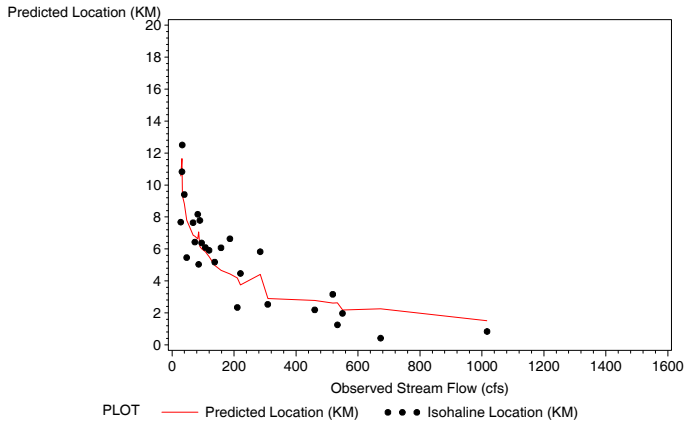

Task3 Isohaline Location Regression
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For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

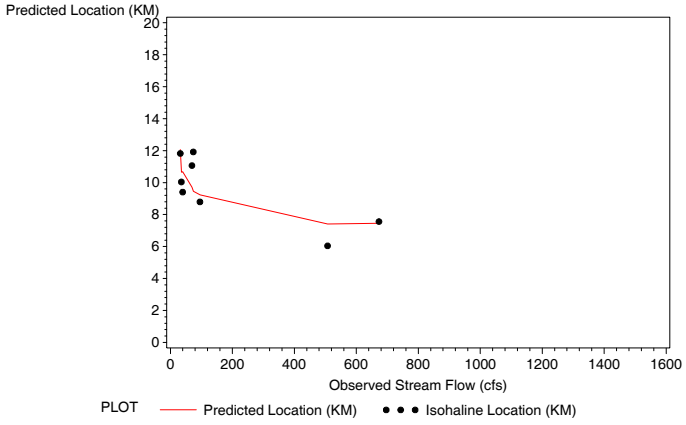

Task3 Isohaline Location Regression
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For Slack Tide Observations
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PLOT
Predicted Location (KM)
Isohaline Location (KM)

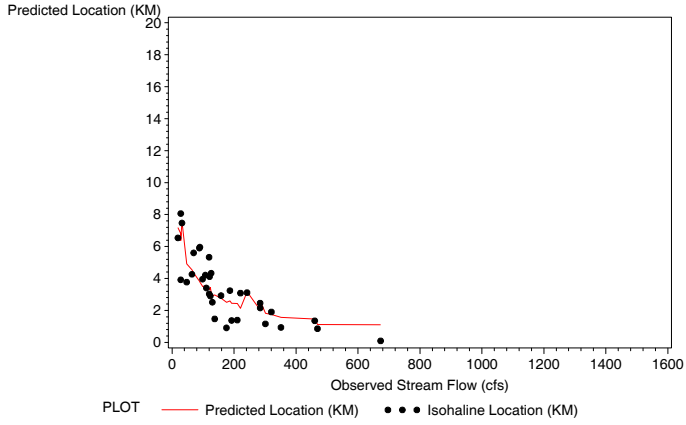

Task3 Isohaline Location Regression
The Comparison of Observed Isohaline Location with Predicted Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

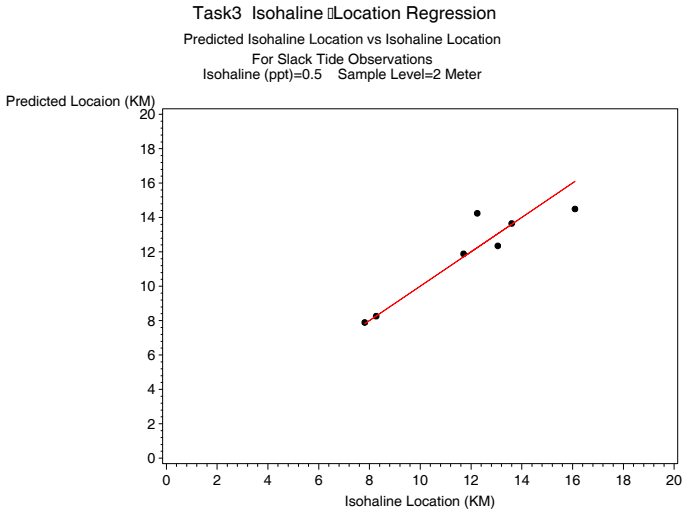

Task3 Isohaline Location Regression
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Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

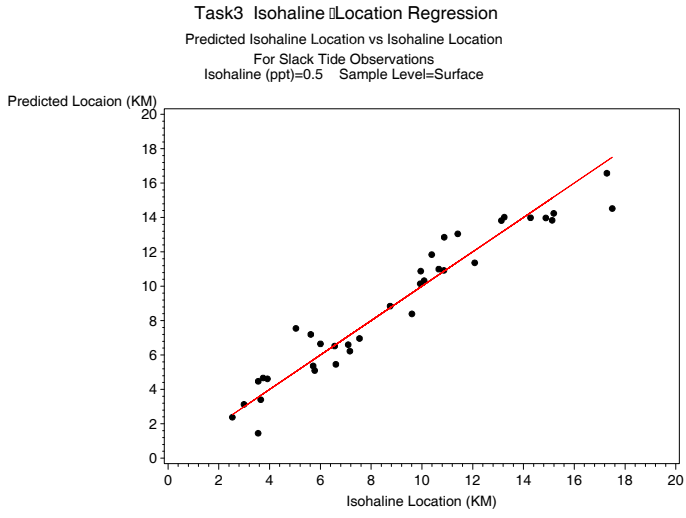

Task3 Isohaline Location Regression
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For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
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Isohaline Location (KM)

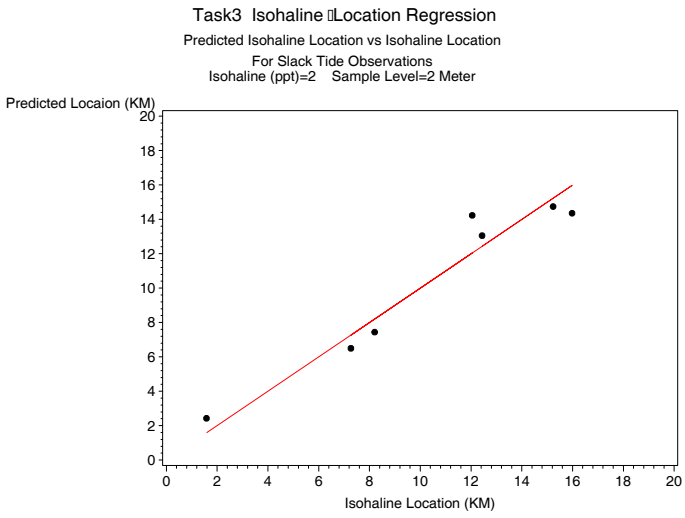

Task3 Isohaline Location Regression
The Comparison of Observed Isohaline Location with Predicted Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
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Isohaline Location (KM)

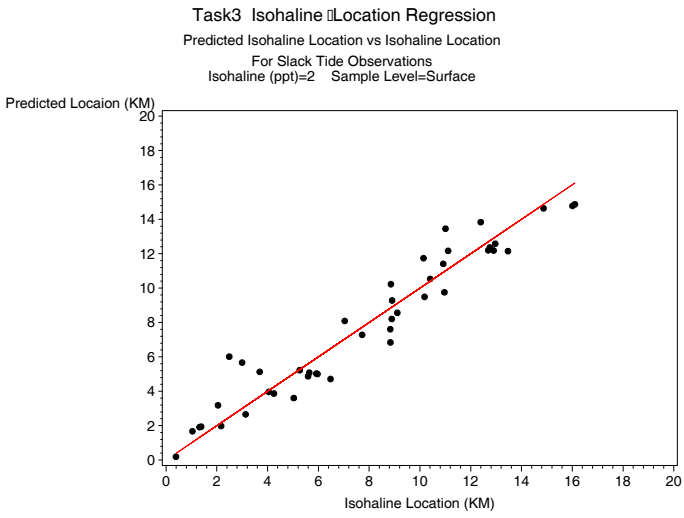

Task3 Isohaline Location Regression
The Comparison of Observed Isohaline Location with Predicted Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

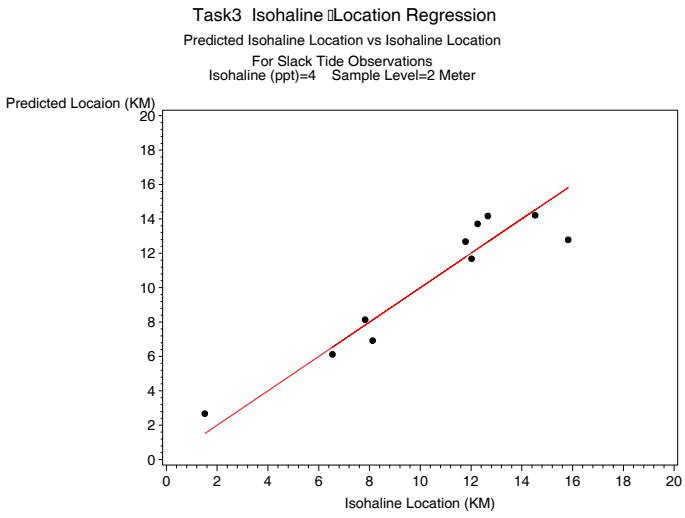

Task3 Isohaline Location Regression
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For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Predicted Location (KM)
Observed Stream Flow (cfs)
PLOT
Predicted Location (KM)
Isohaline Location (KM)

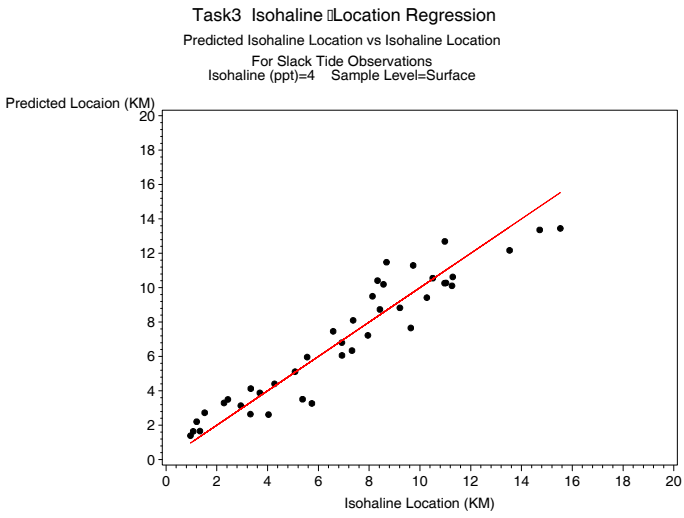

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Predicted Locaion (KM)
Isohaline Location (KM)

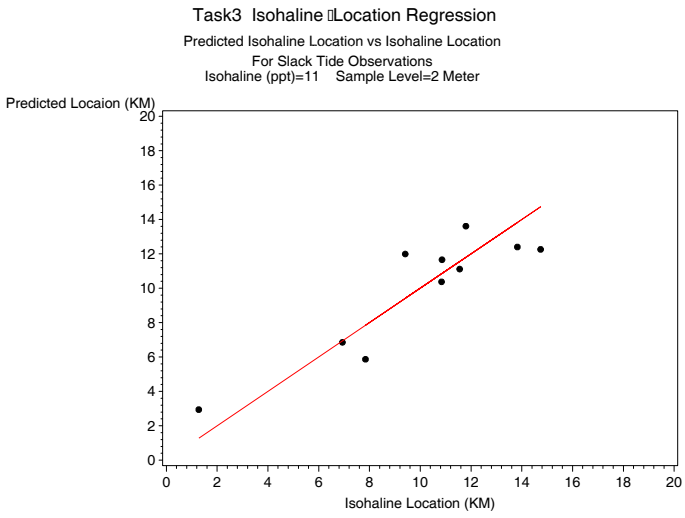

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Predicted Locaion (KM)
Isohaline Location (KM)

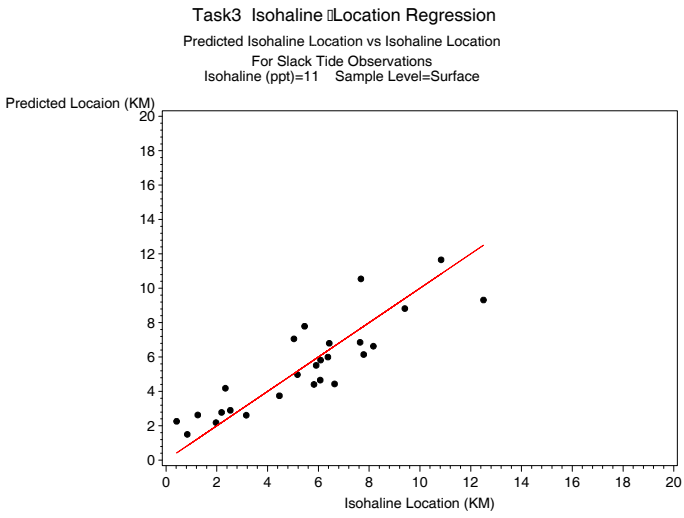

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Predicted Locaion (KM)
Isohaline Location (KM)

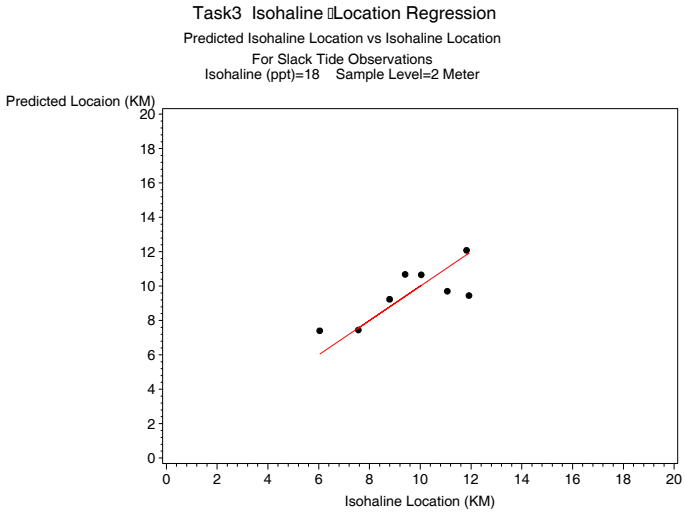

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Predicted Locaion (KM)
Isohaline Location (KM)

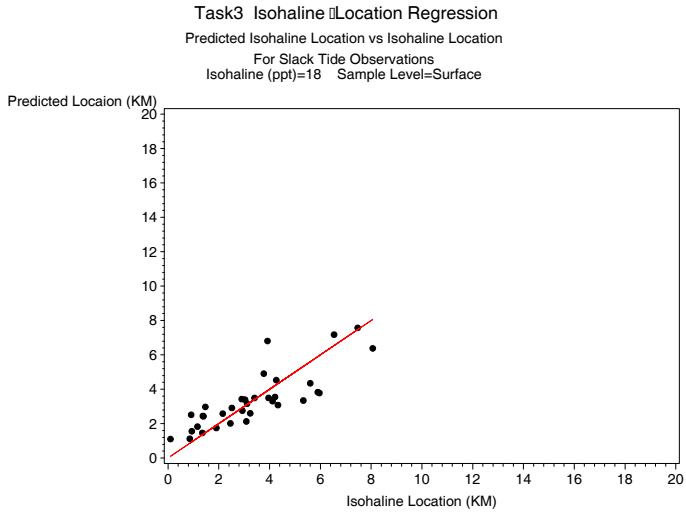

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Predicted Locaion (KM)
Isohaline Location (KM)

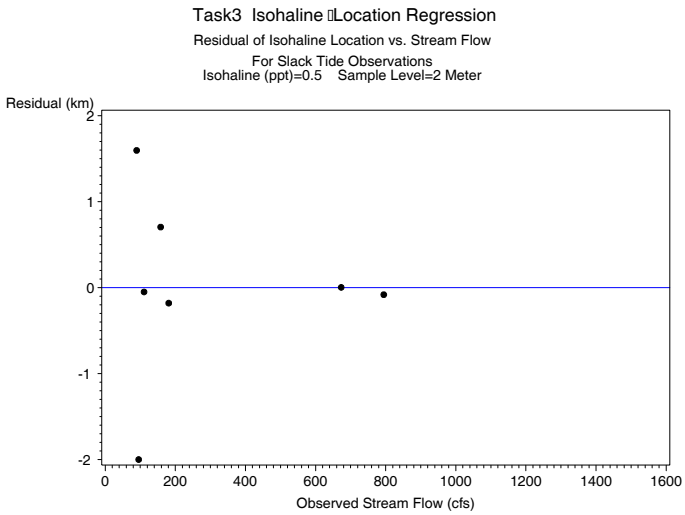

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Predicted Locaion (KM)
Isohaline Location (KM)

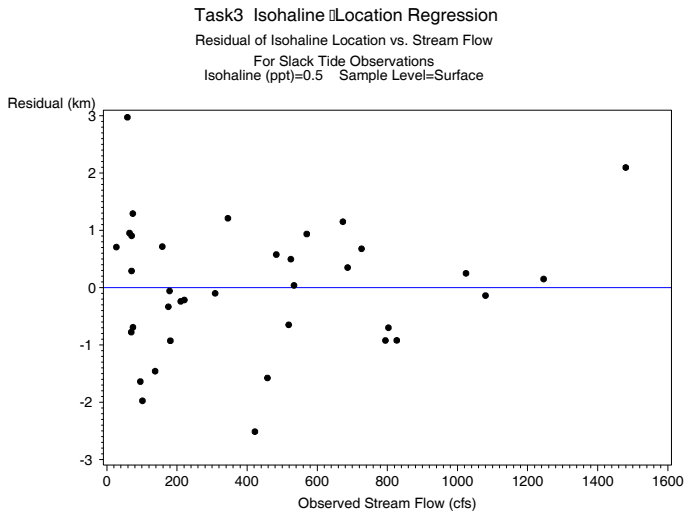

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Predicted Locaion (KM)
Isohaline Location (KM)

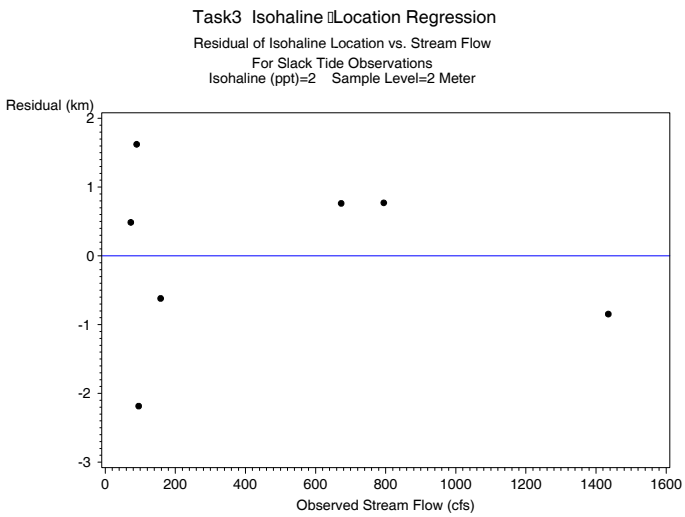

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Predicted Locaion (KM)
Isohaline Location (KM)

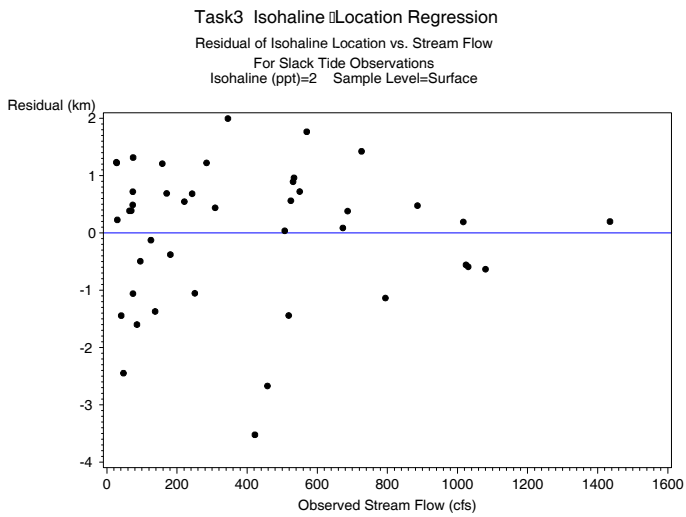

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Predicted Locaion (KM)
Isohaline Location (KM)

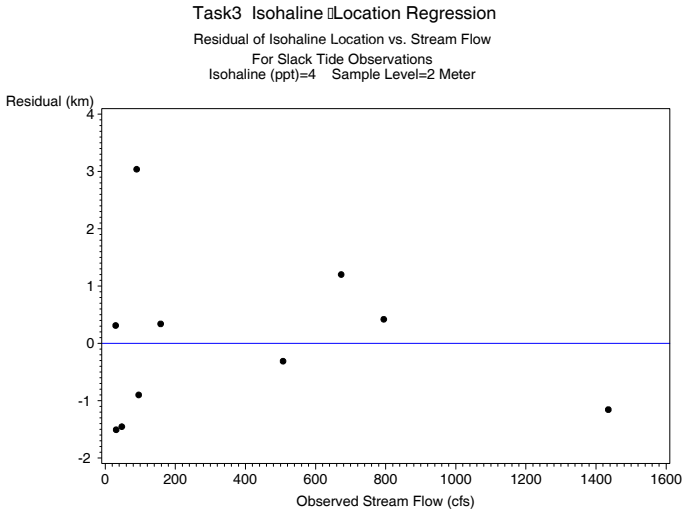

Task3 Isohaline Location Regression
Predicted Isohaline Location vs Isohaline Location
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Predicted Locaion (KM)
Isohaline Location (KM)

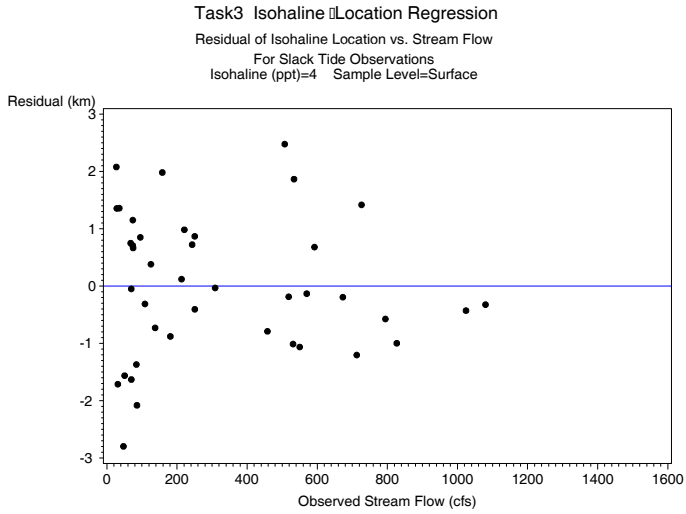

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

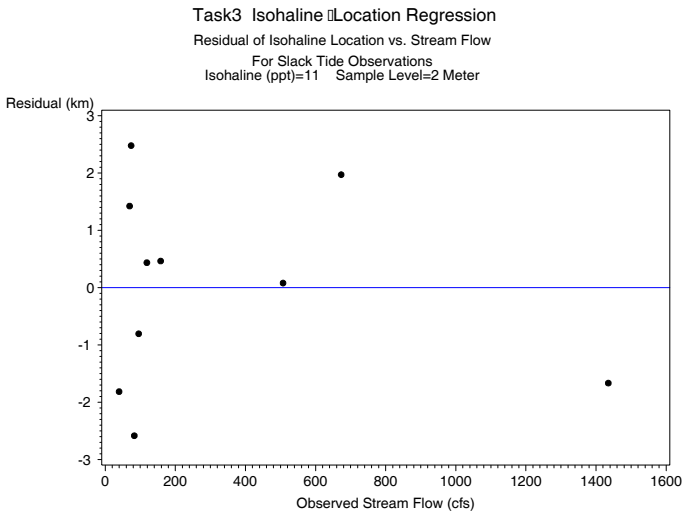

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

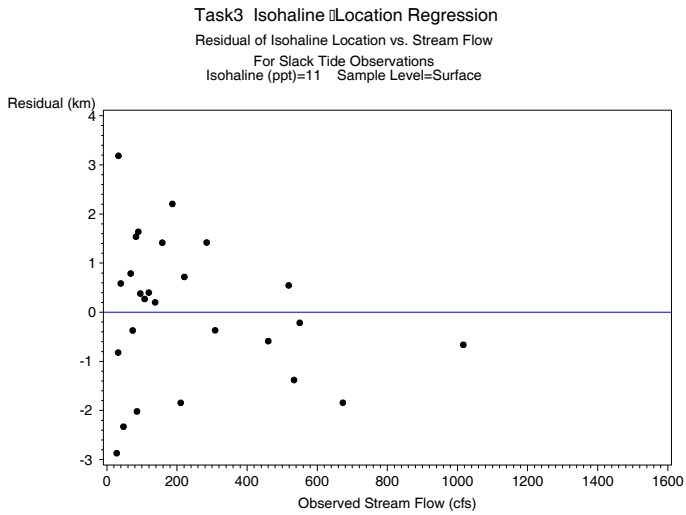

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

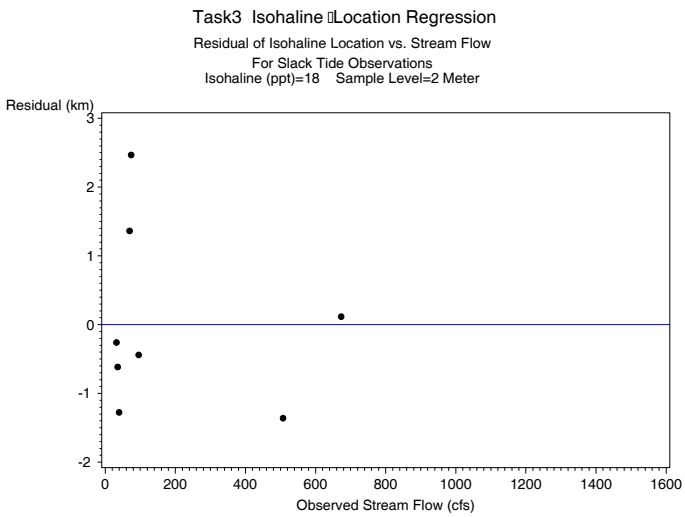

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

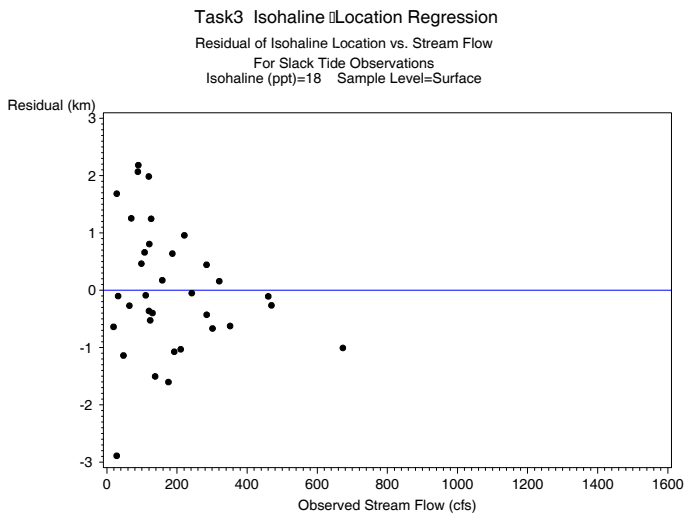

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

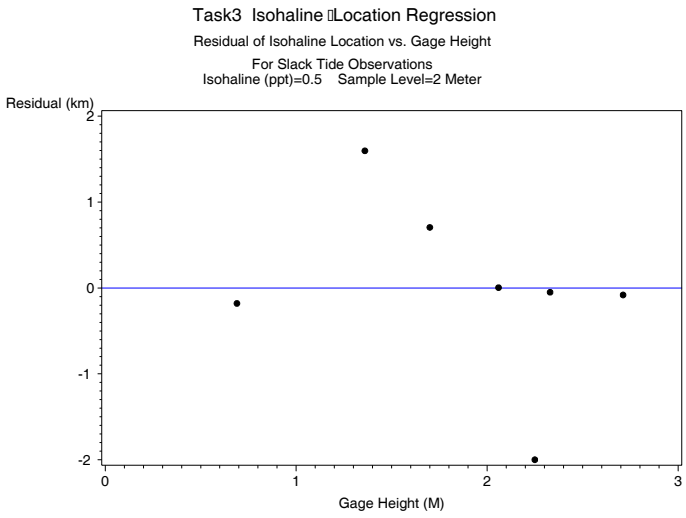

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

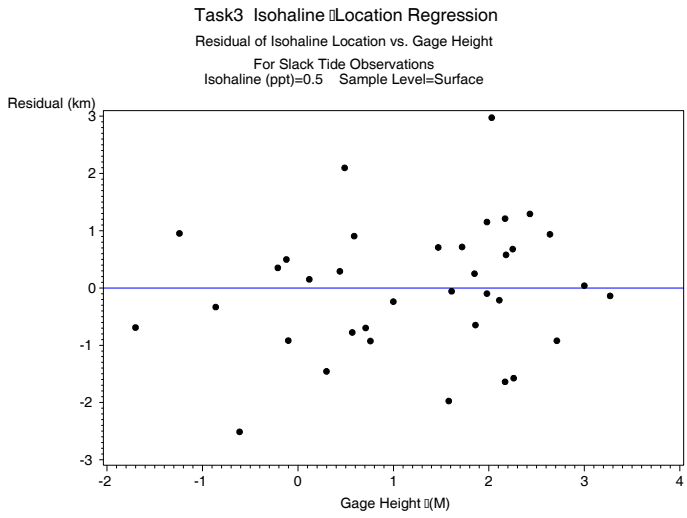

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

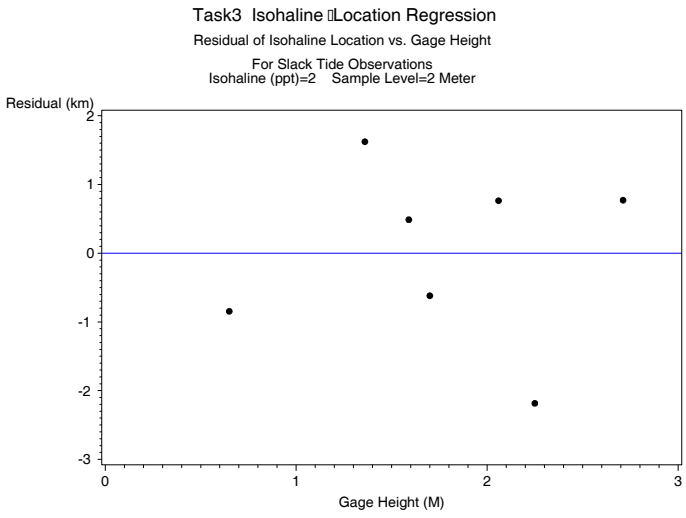

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
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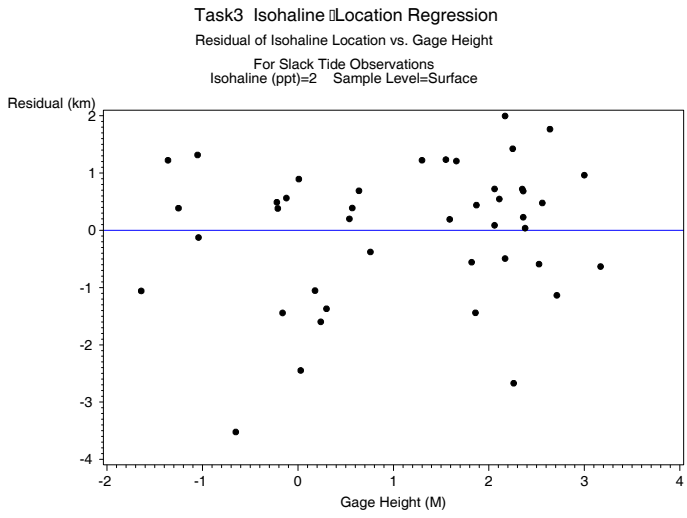

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
Observed Stream Flow (cfs)

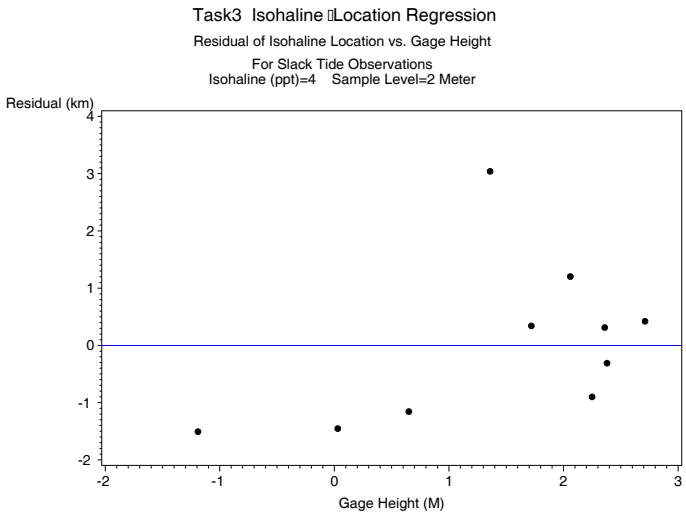

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Stream Flow
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
Observed Stream Flow (cfs)

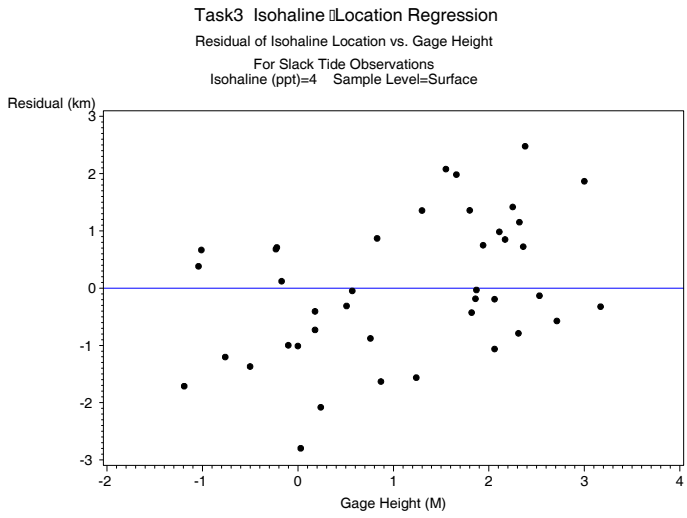

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Gage Height (M)

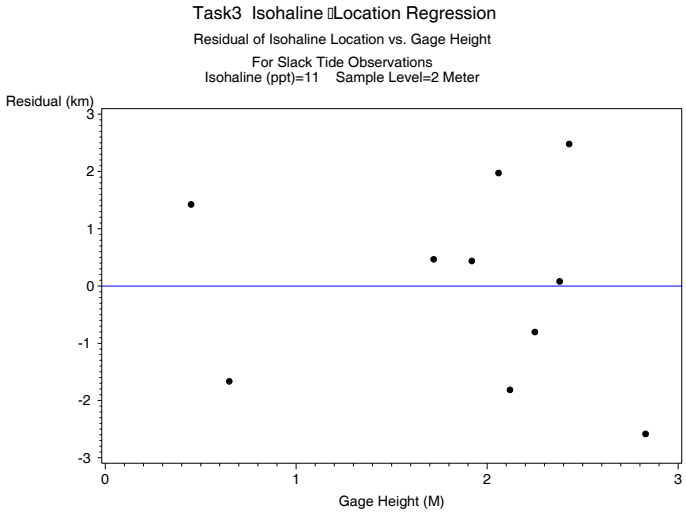

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Gage Height (M)

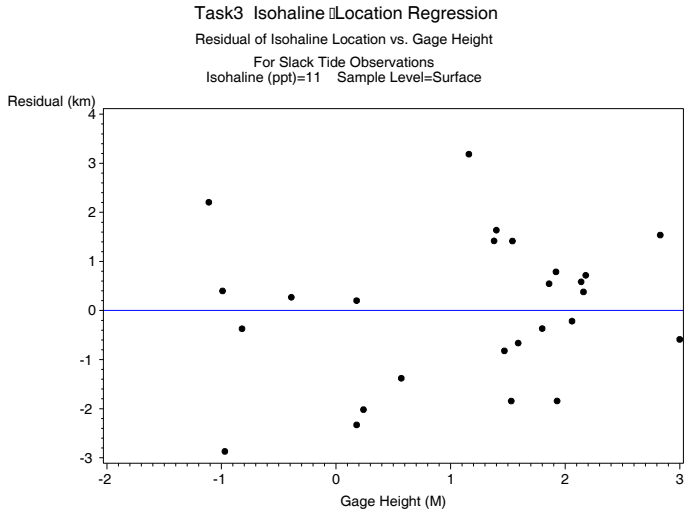

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
Gage Height (M)

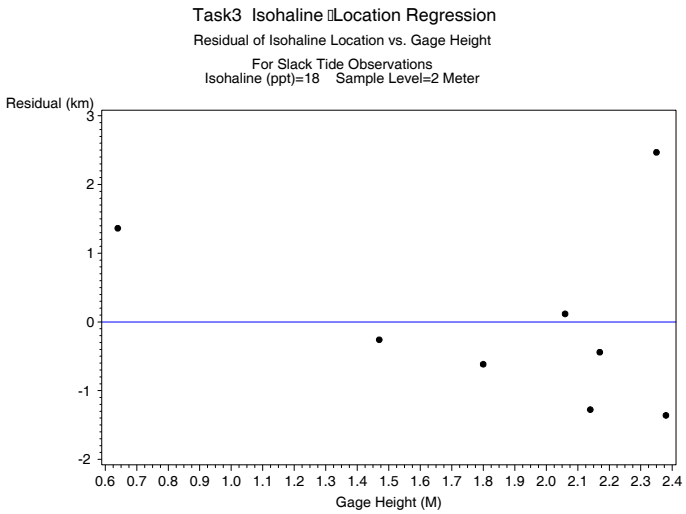

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
Gage Height (M)

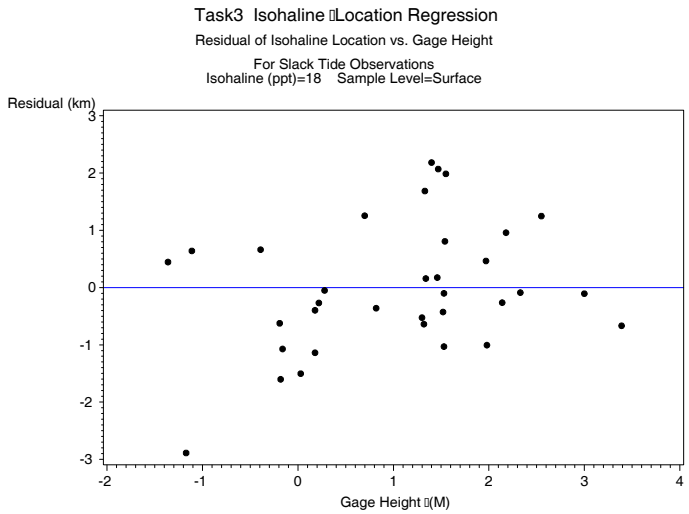

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
Gage Height (M)

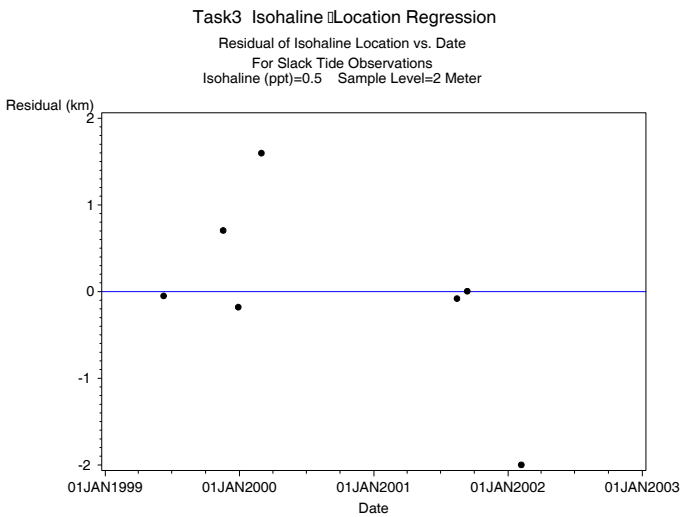

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
Gage Height (M)

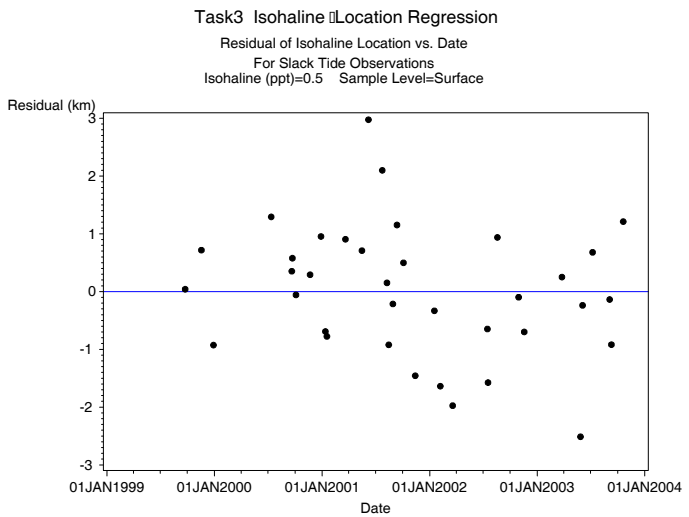

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
Gage Height (M)

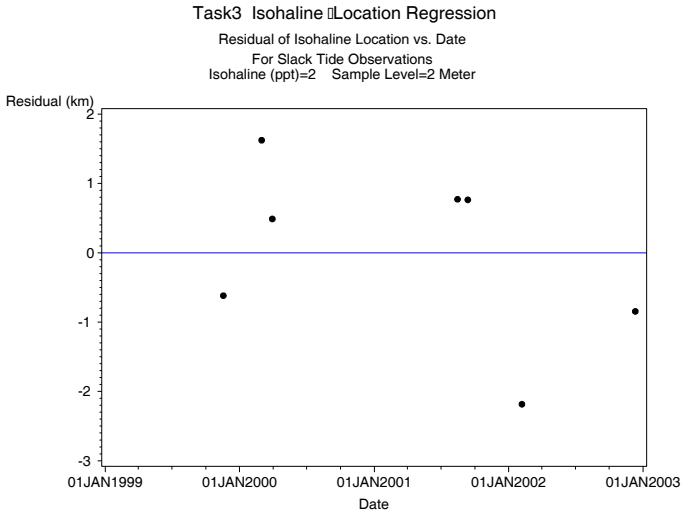

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
Gage Height (M)

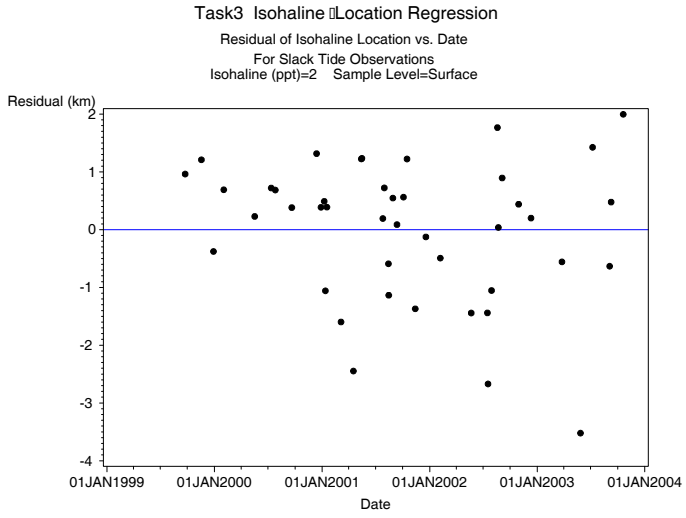

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
Gage Height (M)

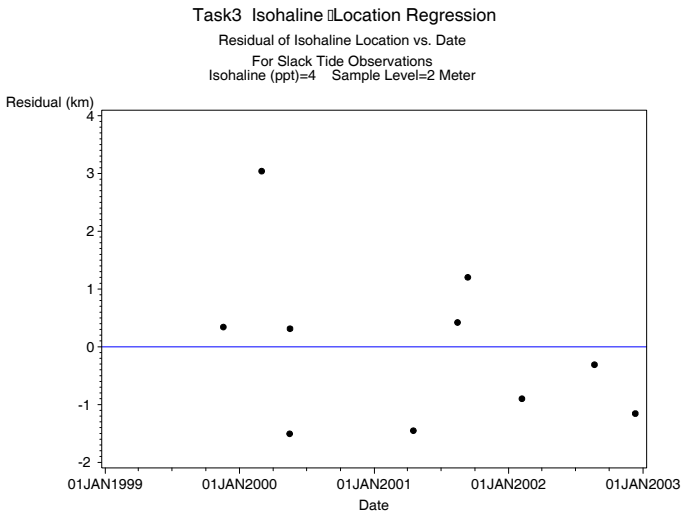

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Gage Height
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
Gage Height (M)

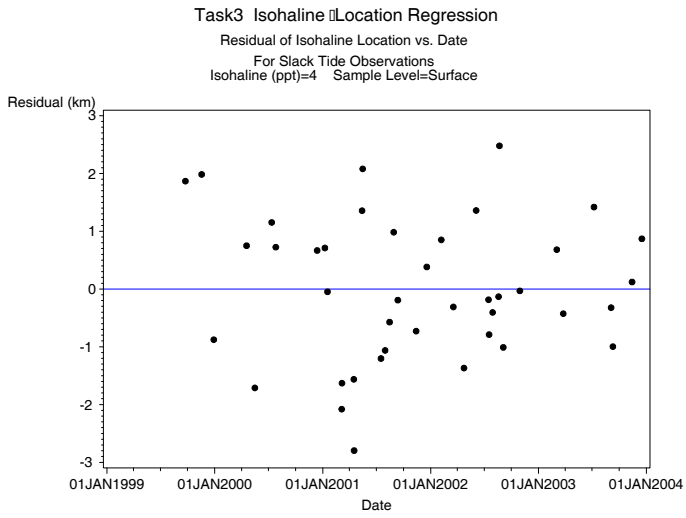

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Date

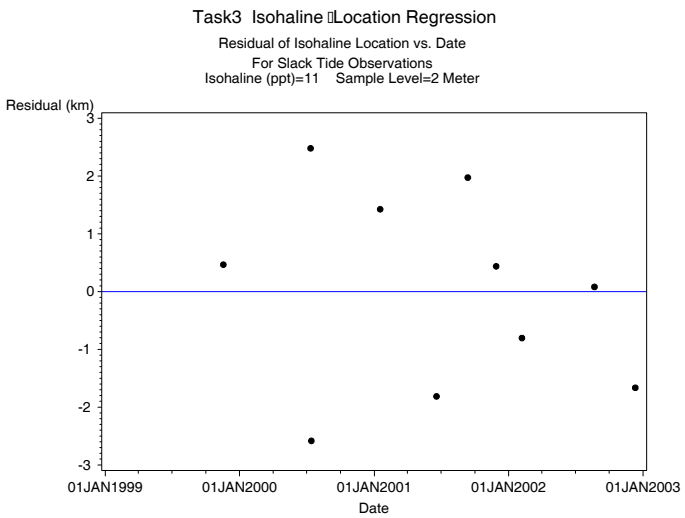

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Date

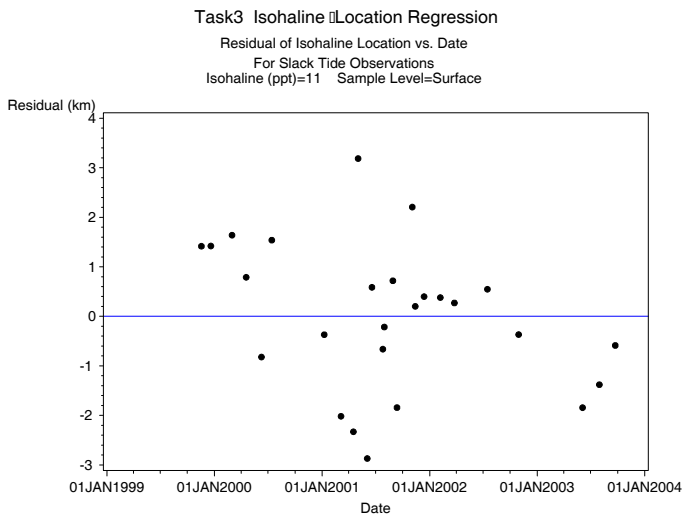

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

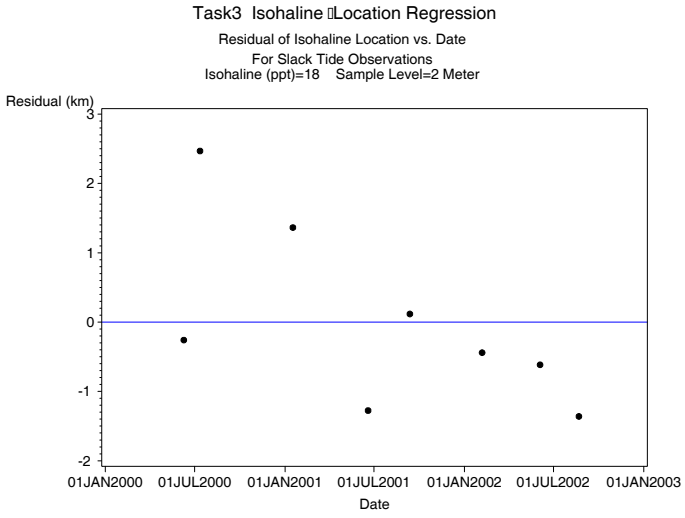

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
2
1
0
-1
-2
-3
-4
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

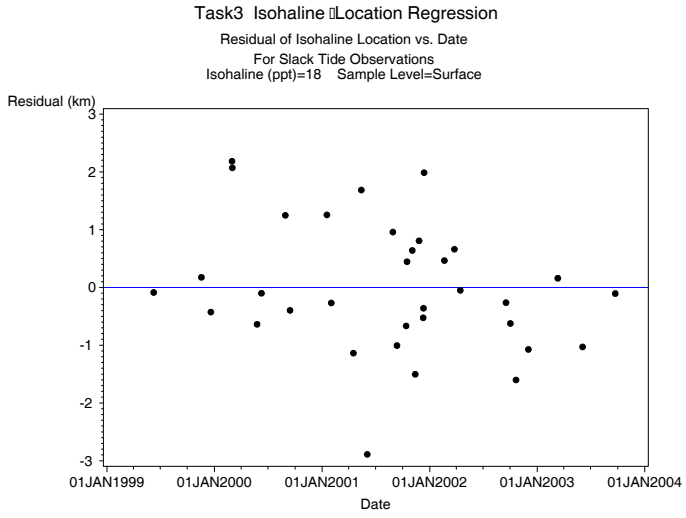

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

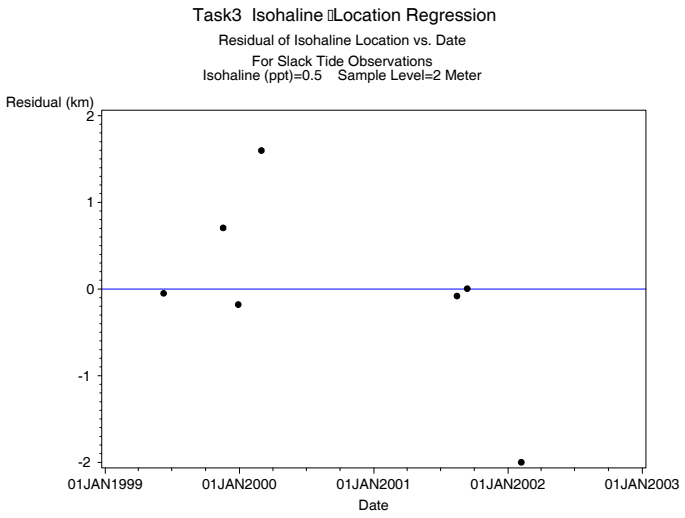

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

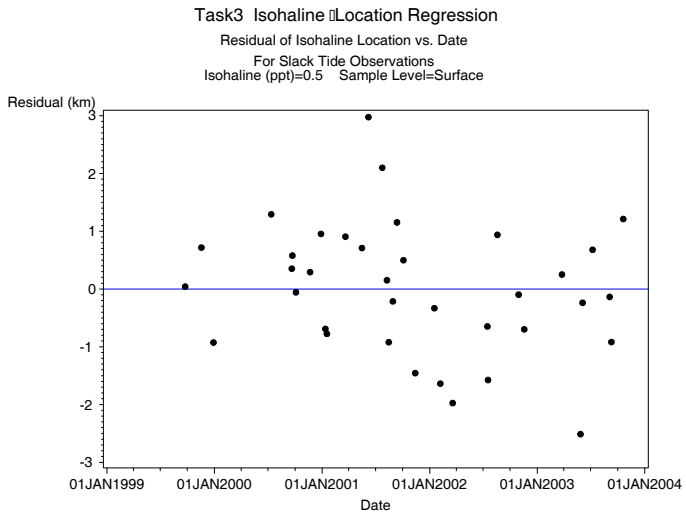

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

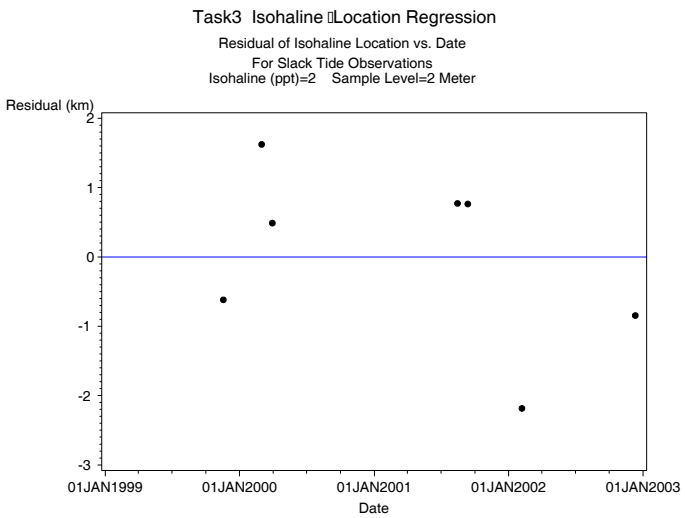

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

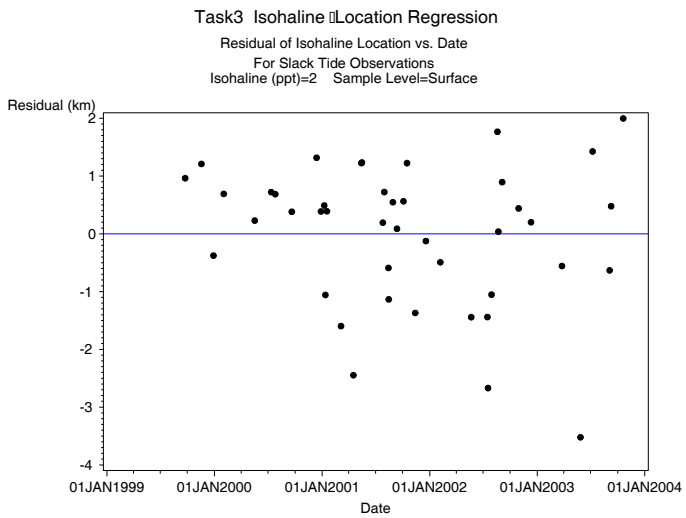

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
01JAN2000
01JUL2000
01JAN2001
01JUL2001
01JAN2002
01JUL2002
01JAN2003
Date

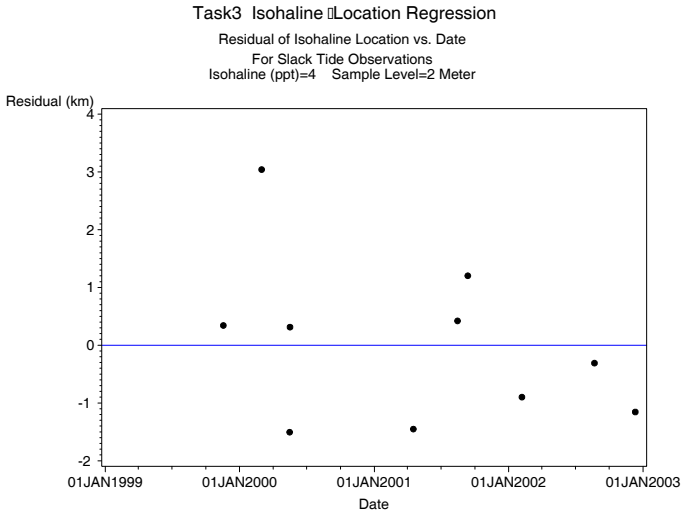

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

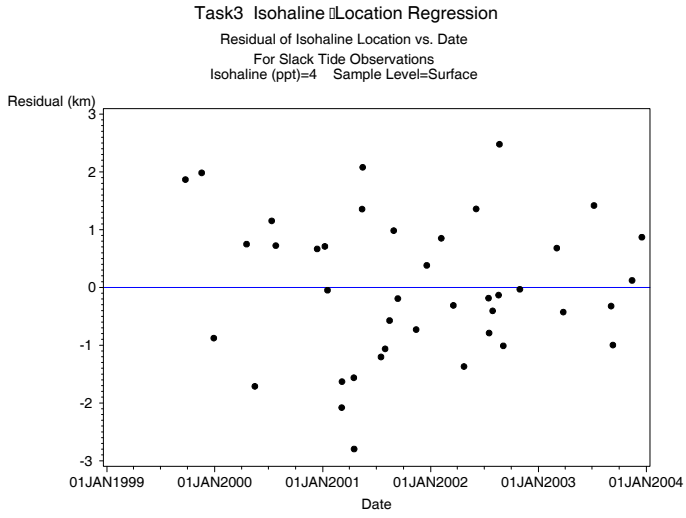

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
2
1
0
-1
-2
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

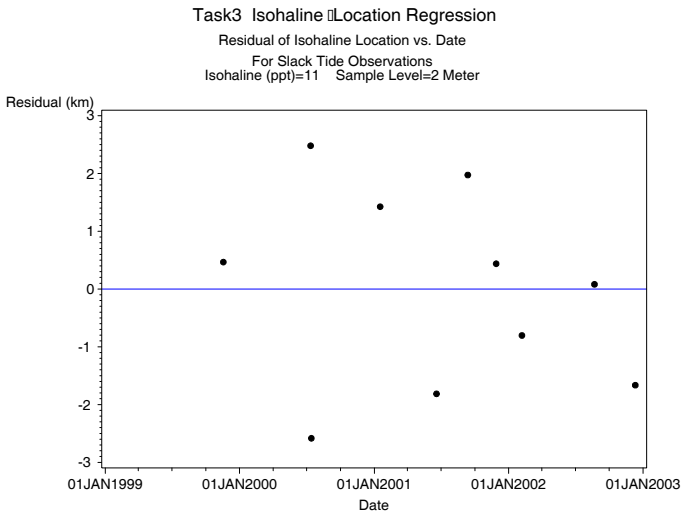

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

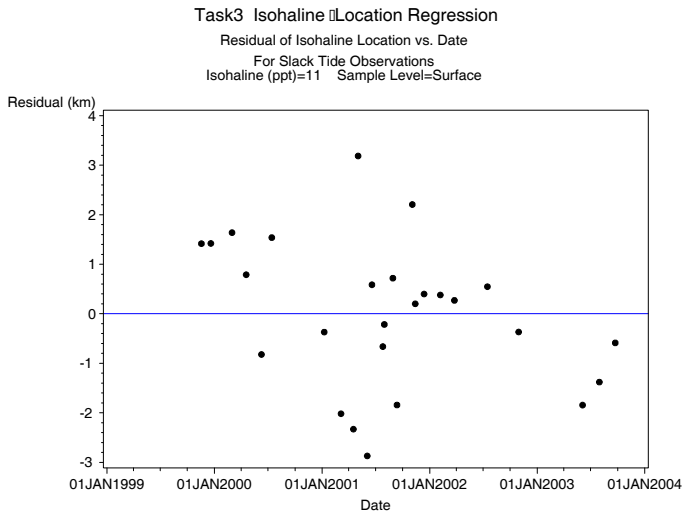

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

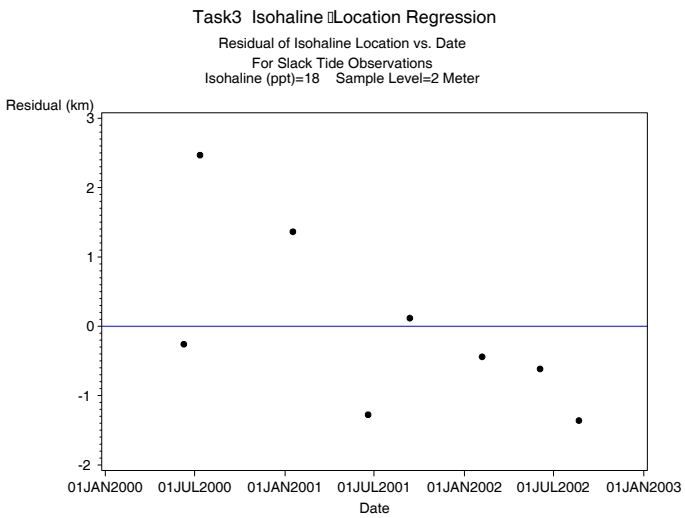

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
2
1
0
-1
-2
-3
-4
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

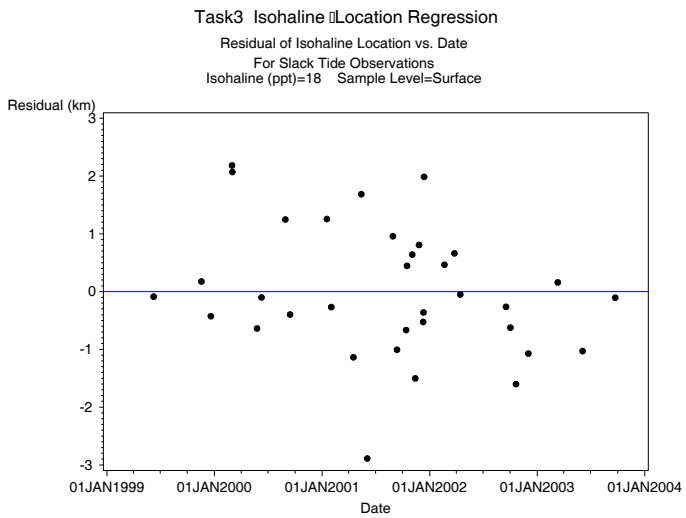

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

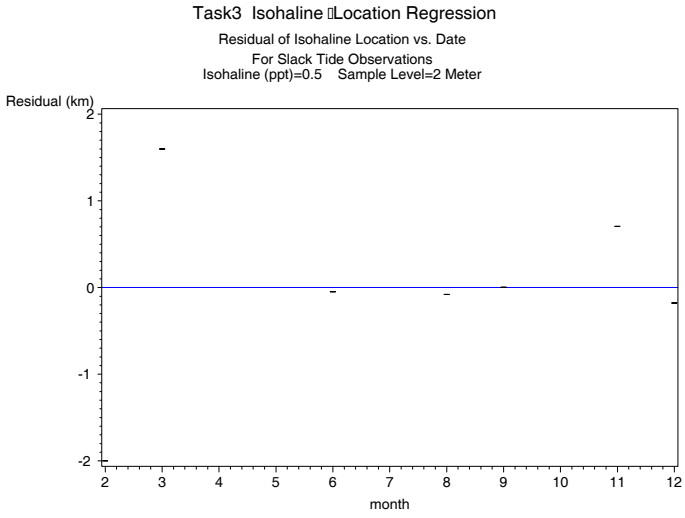

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

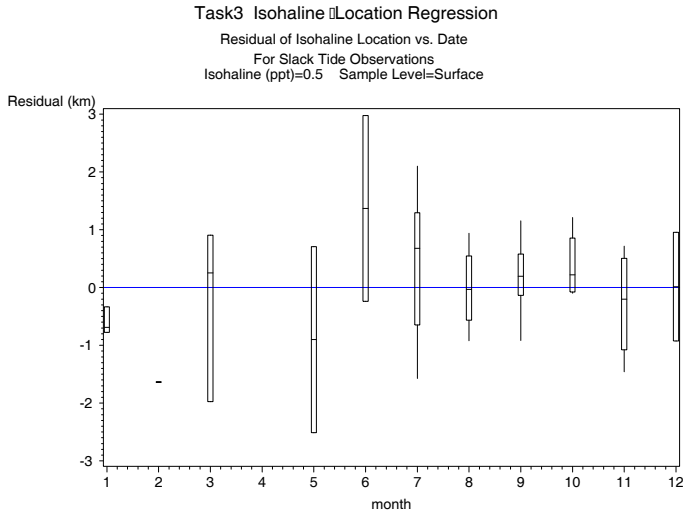

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
Date

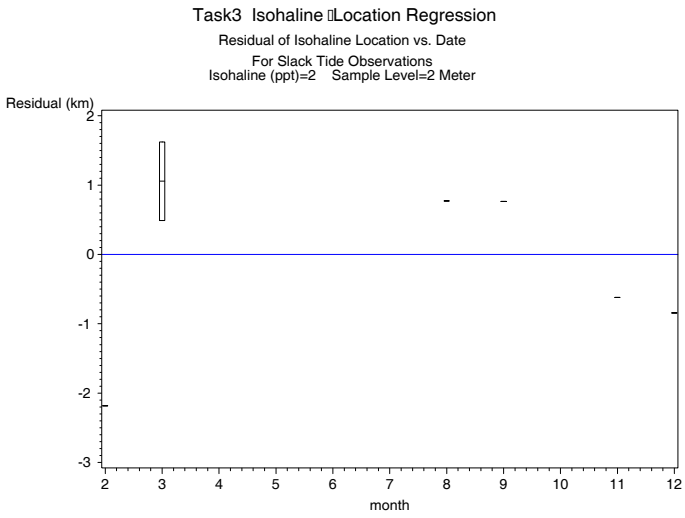

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

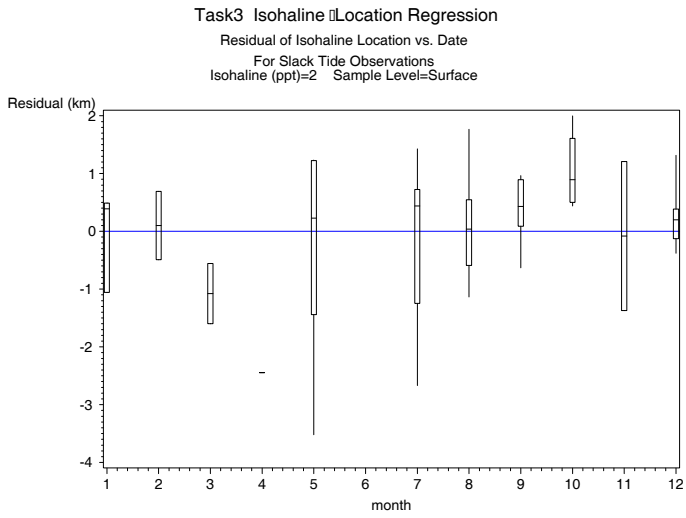

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
01JAN2000
01JUL2000
01JAN2001
01JUL2001
01JAN2002
01JUL2002
01JAN2003
Date

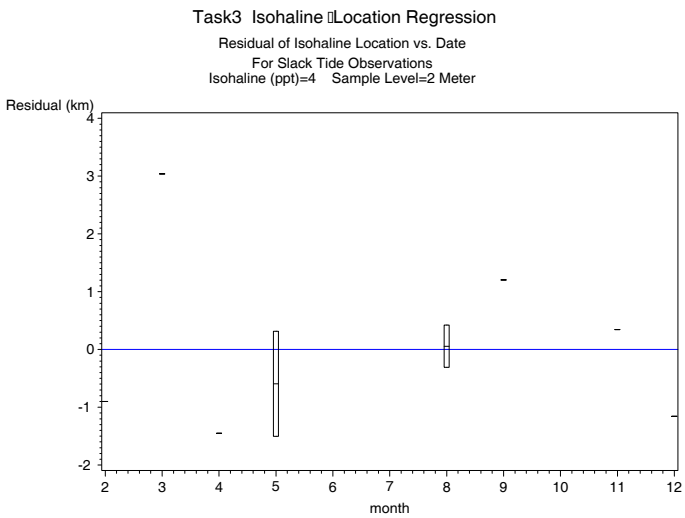

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
01JAN1999
01JAN2000
01JAN2001
01JAN2002
01JAN2003
01JAN2004
Date

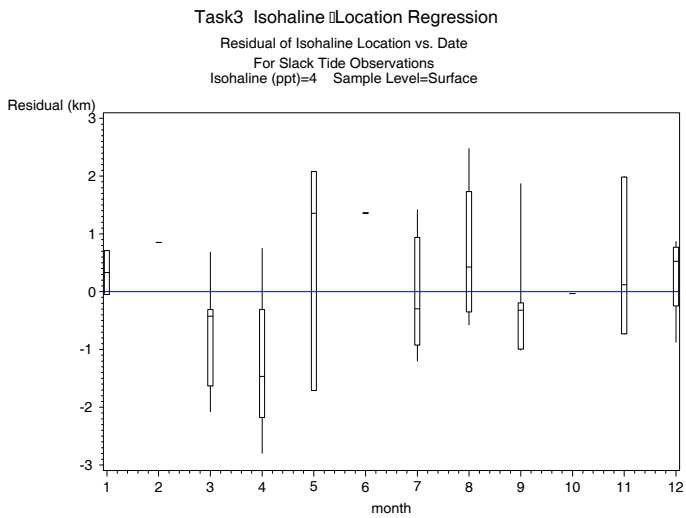

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
month

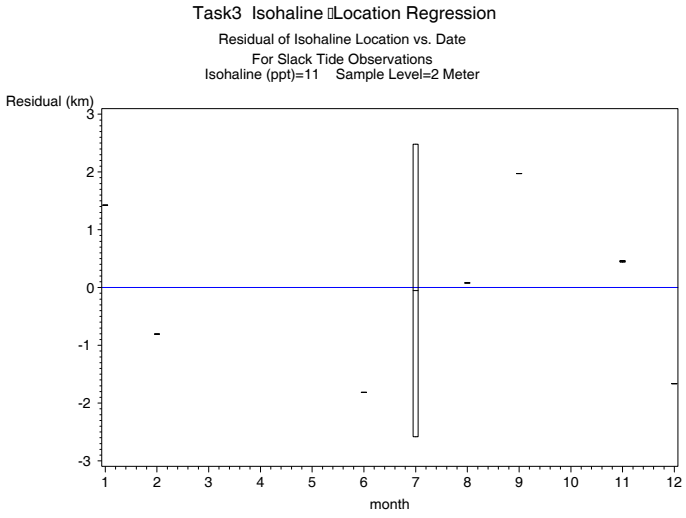

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
month

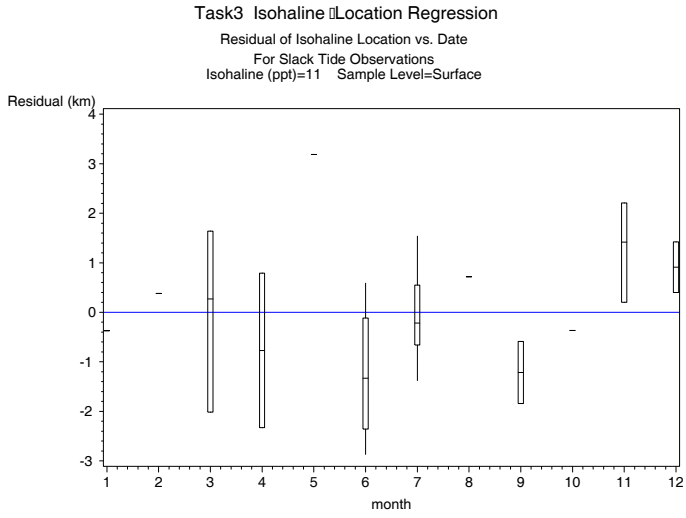

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
month

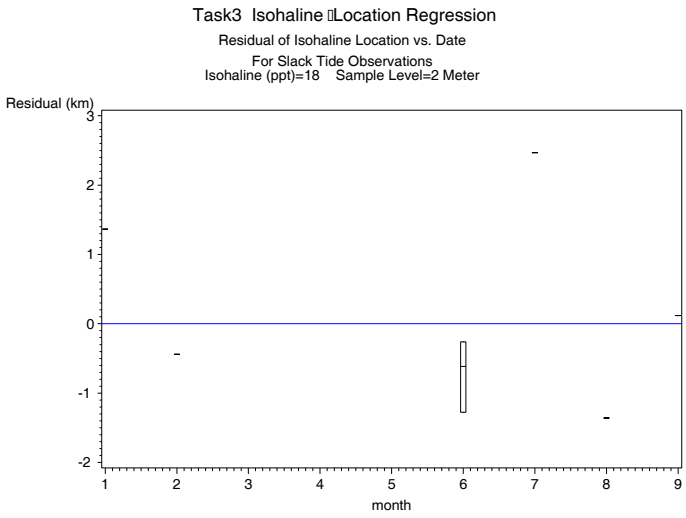

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
month

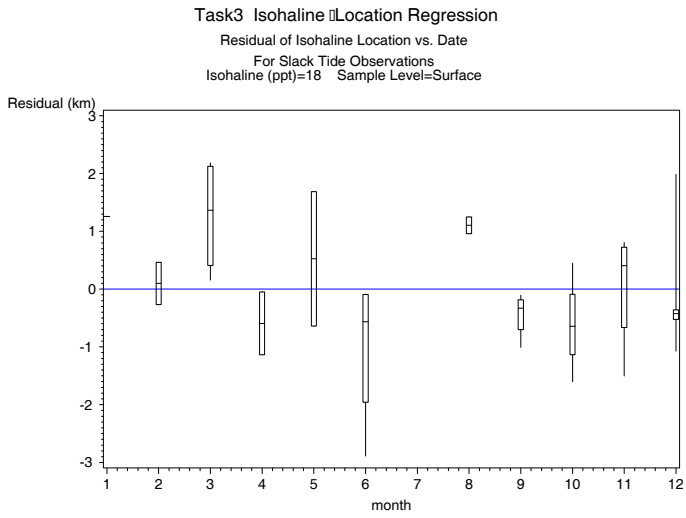

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
month

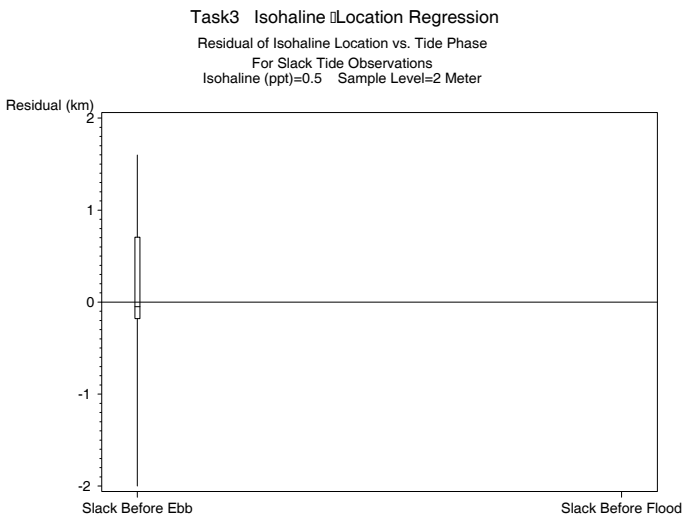

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
month

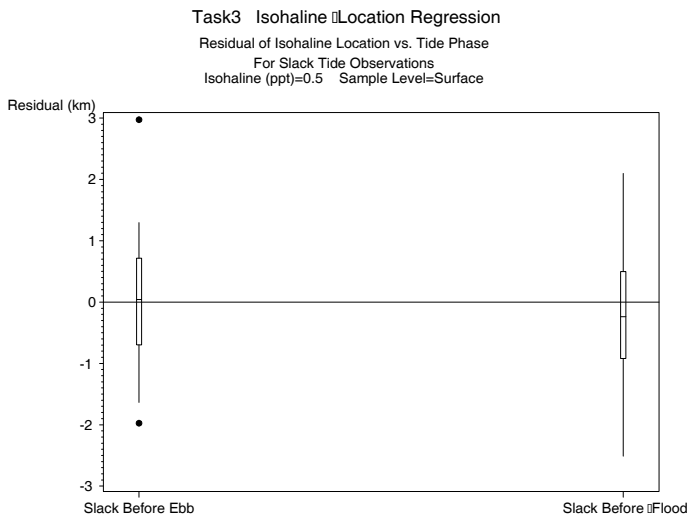

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
month

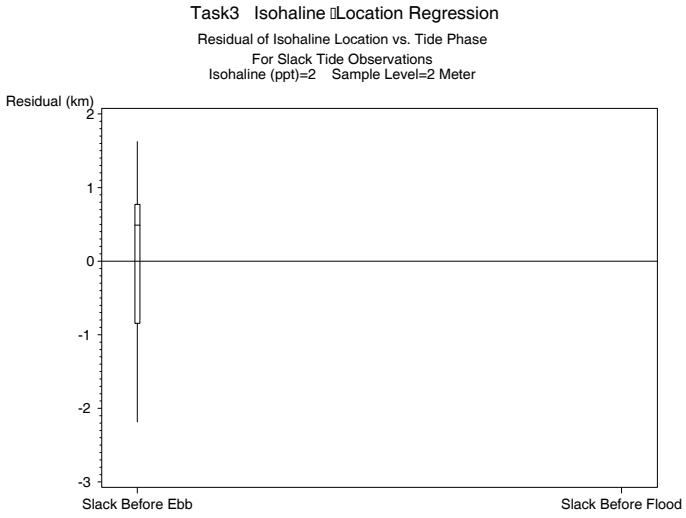

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
month

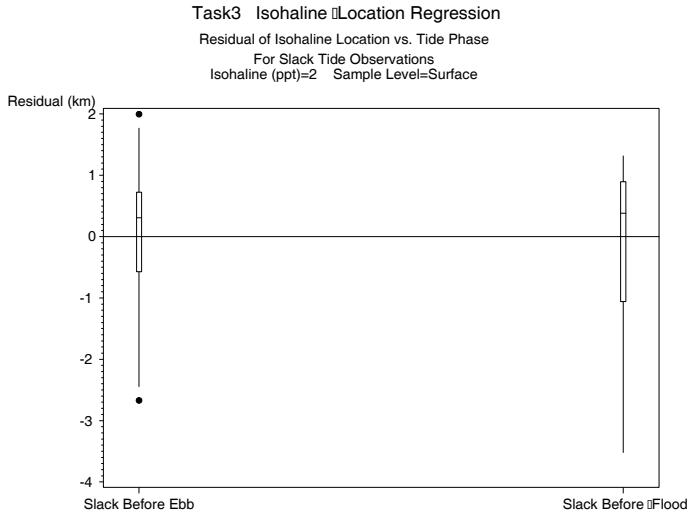

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
month

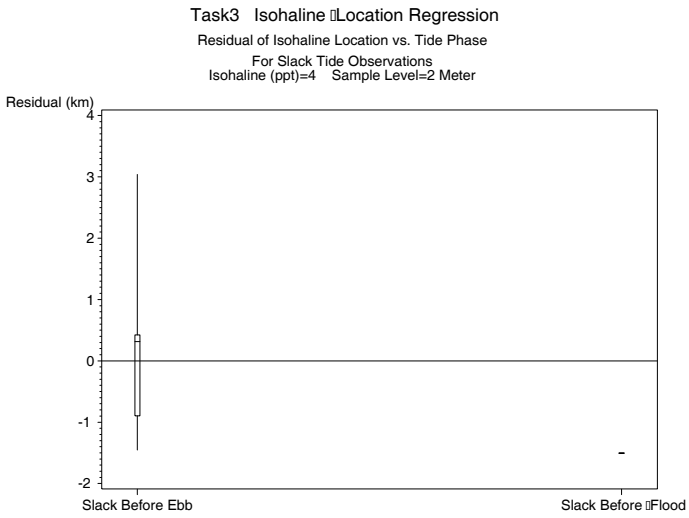

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Date
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
month

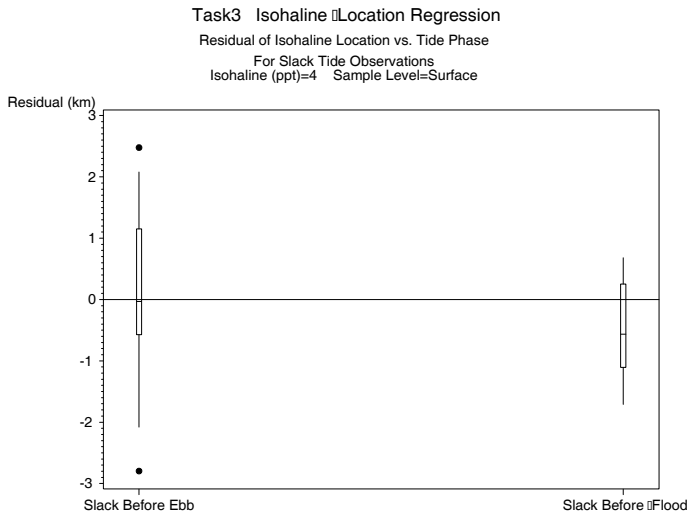

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=2 Meter
Residual (km)
Slack Before Ebb
Slack Before Flood

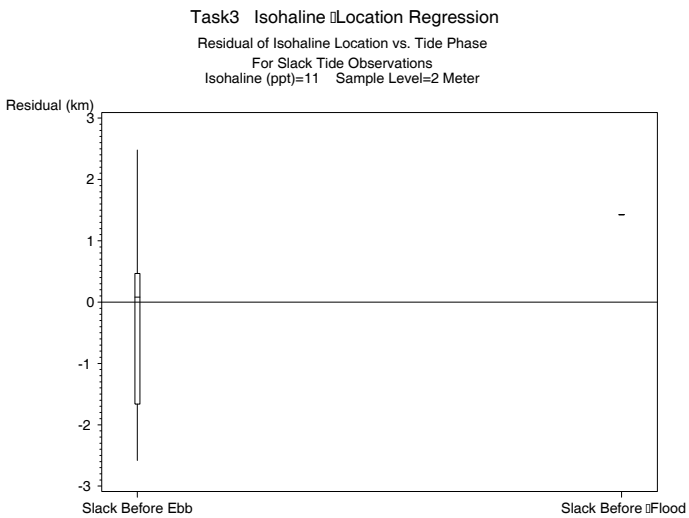

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=0.5 Sample Level=Surface
Residual (km)
Slack Before Ebb
Slack Before Flood

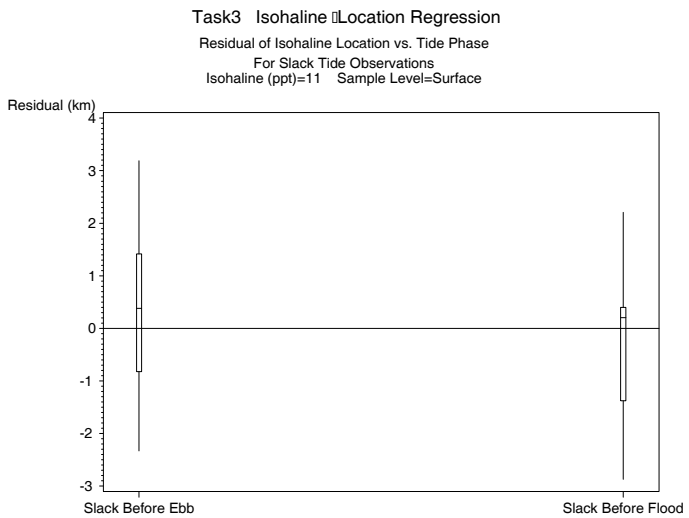

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=2 Meter
Residual (km)
2
1
0
-1
-2
-3
Slack Before Ebb
Slack Before Flood

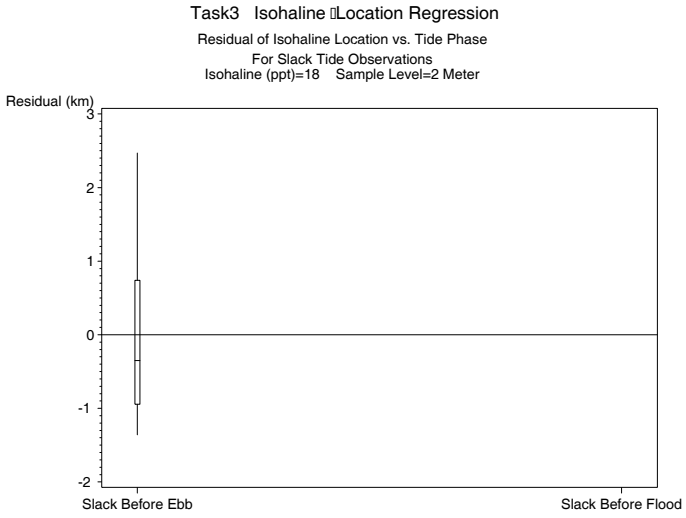

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=2 Sample Level=Surface
Residual (km)
2
1
0
-1
-2
-3
-4
Slack Before Ebb
Slack Before Flood

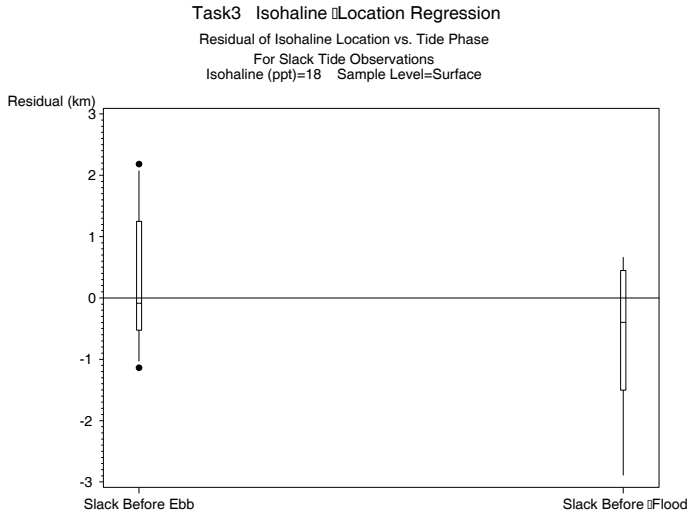

Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=2 Meter
Residual (km)
4
3
2
1
0
-1
-2
Slack Before Ebb
Slack Before Flood


Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=4 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
Slack Before Ebb
Slack Before Flood


Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
-3
Slack Before Ebb
Slack Before Flood


Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=11 Sample Level=Surface
Residual (km)
4
3
2
1
0
-1
-2
-3
Slack Before Ebb
Slack Before Flood


Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=2 Meter
Residual (km)
3
2
1
0
-1
-2
Slack Before Ebb
Slack Before Flood


Task3 Isohaline Location Regression
Residual of Isohaline Location vs. Tide Phase
For Slack Tide Observations
Isohaline (ppt)=18 Sample Level=Surface
Residual (km)
3
2
1
0
-1
-2
-3
Slack Before Ebb
Slack Before Flood

Appendix 5C

Alafia River Salinity Regressions

Fixed Stations

Objective

The objective was to develop a series of regressions to predict salinity at fixed locations in the Alafia River. Salinity regression models were developed that predict salinity in the Alafia River at:

- 15 SWFWMD fixed stations (surface, 1-meter, 2-meter, and bottom),
- three USGS continuous recorders (surface, middle, and bottom), and
- EPCHC stations 74, 153, and 8 (surface, 1-meter, 2-meter, and bottom).

Data Sources

Flow

Flow data (cfs) were obtained from USGS for Alafia River at Lithia gage. Additional flow data were obtained from Tampa Bay Water for Buckhorn Springs and Lithia Springs.

Salinity

A comprehensive set of salinity measurements was compiled to provide the data to develop the salinity concentration. Data were compiled from observations reported by:

- Environmental Protection Commission of Hillsborough County Independent Monitoring Program
- Southwest Florida Water Management District
- USGS

Approach

Flow

Flow data were compiled from USGS/SWFWMD flow monitoring gages and Tampa Bay Water flow monitoring of Buckhorn Springs. Missing flow observations from the period of record were interpolated between the observations before and after the missing period, and a relatively large data gap for Buckhorn Springs flow was filled using an empirical regression model that predicted Buckhorn Springs flow as a function of two indicator variables, Lithia Springs Flow and Alafia River flow at Lithia.

The flows (cfs) used to predict salinity at fixed locations were calculated using the following equation:

$$\text{Alafia River flow}_{\text{Bell Shoals}} = \text{Flow}_{\text{Lithia}} \times [(335\ \text{mi}^2 + 39.2\ \text{mi}^2)/335\ \text{mi}^2] + \text{Flow}_{\text{Lithia Springs}} + \text{Flow}_{\text{Buckhorn Springs}}$$

This is the equation used by Tampa Bay Water to estimate flow at Bell Shoals Road for permitting purposes.

Salinity

The original temperature corrected conductivity observations from the USGS program were used to calculate salinity values by using the following equation (Hydrolab® Corp.).

$$\begin{aligned}\text{Salinity} = \quad & (20.0 + ((0.69608) \times \text{Conductivity} - 32.188)) \\ & + (0.0013904 \times (\text{Conductivity} - 32.188)^2) \\ & + (0.000011918 \times (\text{Conductivity} - 32.188)^3) \\ & + (0.00000017392 \times (\text{Conductivity} - 32.188)^4) \\ & + (0.0000000031112 \times (\text{Conductivity} - 32.188)^5)\end{aligned}$$

Overall Approach

A series of polynomial curves were fit in order to model salinity as a response to total flow. Slightly different curve shapes were used according to the sampling level and location. The observed data were used to select the most unbiased curve shapes. Figure 1 presents a conceptual diagram of the generalized relationship between total flow and salinity.

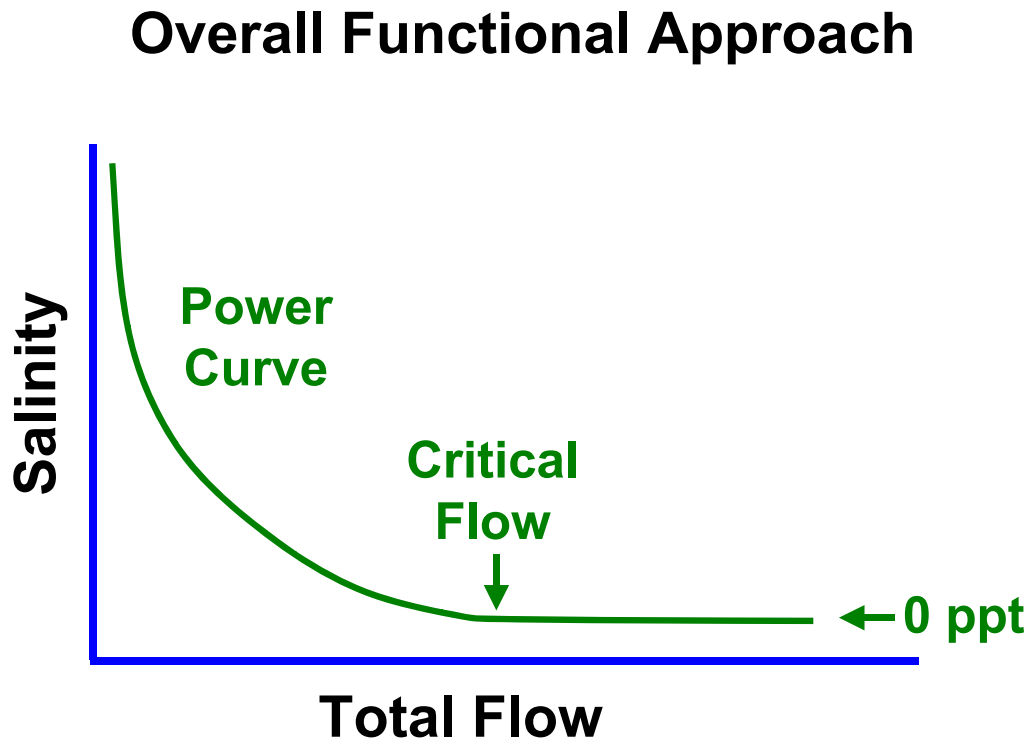


Figure 1. Conceptual diagram of fundamental approach to the baseline model.

The curve presented in Figure 1 represents a simplified example for one location in space (i.e., a single reporting unit, sampling location, and water column depth).

Estimation of salinity at SWFWMD and EPCHC fixed locations based on flow

A two-step approach was used to fit the general model presented in Figure 1 to the observed data. The first step models the freshwater responses in the estuary, and the second step models the brackish water responses in the estuary.

The first step of the approach was to identify the critical flow (Figure 1) at which higher flows were expected to result in near-zero salinity conditions. Above this critical flow point, there was little or no explainable variation in observed salinity, and only very rare, if any, higher salinity metric values were observed. Because of this essential lack of variation, an Analysis of Variance method could not be used to directly describe the relationship between salinity and flow above this critical flow value. The near-zero salinity critical flow point was operationally defined for each location and each water column depth class as the highest flow (95^{th} percentile of total flow) at which salinities greater than 0.5 ppt were observed over the period of record. The critical flow values for the SWFWMD and EPCHC stations and daily salinity values are presented in Table 1 and, Table 2, respectively.

The second step of the approach was to model salinity as a function of total flow for the flows less than the near-zero salinity critical flow point. It should be noted that like the observed salinities used in the first step, the observed salinities used in this second step also included many zero and near-zero observations. The distinction between the first step of the approach and this step was that in the first step the observed salinities were essentially always near zero, and in the second step there was a range of salinity variation between zero and Gulf salinities which could be modeled using an Analysis of Variance method.

Salinity models were developed for each depth level (surface, 1-meter, 2-meter, bottom) and sampling location. The final model for each reporting unit predicts salinity as a function of total flow, antecedent flow conditions, depth level, location (station), time of year, and ambient Tampa Bay salinity.

Table 1. Critical flow values for salinity observed at SWFWMD station locations on the Alafia River.

Station, Location	Probe Depth	Critical Flow, Daily Salinity (cfs)
SWFWMD 1, River Km 0.78	surface 1 M 2 M bottom	794.62 896.89 896.89 896.89
SWFWMD 2, River Km 1.73	surface 1 M 2 M bottom	913.82 794.62 794.62 794.62
SWFWMD 3, River Km 3.24	surface 1 M bottom	794.62 896.89 794.62
SWFWMD 4, River Km 5.01	surface bottom	614.05 614.37
SWFWMD 5, River Km 6.70	surface bottom	392.96 507.41
SWFWMD 6, River Km 8.00	surface 1 M 2 M bottom	374.62 374.62 528.87 528.87
SWFWMD 7, River Km 9.41	surface 1 M 2 M bottom	292.02 292.02 334.02 356.27
SWFWMD 8, River Km 10.11	surface 1 M bottom	230.31 250.07 292.02
SWFWMD 9, River Km 10.74	surface 1 M 2 M bottom	186.89 254.12 248.46 283.33
SWFWMD 10, River km 11.45	surface 1 M bottom	158.86 186.89 283.33
SWFWMD 11, River km 12.31	surface 1 M 2 M bottom	139.39 148.74 126.43 220.97
SWFWMD 13, River km 13.76	bottom	150.32
SWFMWD 14, River km 14.68	bottom	139.39
SWFMWD B, River km 2.54	surface bottom	614.37 614.37
SWFMWD C, River km 5.89	surface 1 M bottom	533.96 574.16 614.37

Table 2. Critical flow values for salinity observed at EPCHC station locations on the Alafia River.

Station, Location	Probe Depth	Critical Flow, Daily Salinity (cfs)
EPCHC 153, River Km 7.0	surface	257.42
	1 M	410.33
	bottom	511.46
EPCHC 74, River Km 1.6	surface	795.11
	1 M	571.82
	2 M	1177.70
	bottom	829.95
EPCHC 8, River Km 0.0	surface	971.78
	1 M	969.81
	bottom	969.81

A stepwise regression analysis was used to identify the variables to be used to fit the curve presented in Figure 1 for the Alafia River stations sampled in the SWFWMD monitoring programs at each station and sampling depth (surface, 1-meter, 2-meter, and bottom). A set of curve shapes was derived. Initially, each model was defined to include monthly-specific intercept parameters, and stepwise regression analysis was used to select one, two, or three slope parameters based on flow variables or ambient background salinity in Tampa Bay (EPCHC Station 55). If sample sizes were not sufficient to permit monthly-specific intercepts, then an alternative model was fit using dry season (November-June) and wet season (July-October) intercept parameters instead of the monthly intercepts. Explanatory variables were selected by the regression analysis from the following set of candidate variables:

- daily flow,
- ungaged flow,
- antecedent flow (1 to 7 day lag flows), and
- ambient background salinity in Tampa Bay (EPCHC Station 55 – in the center of Hillsborough Bay).

Estimation of salinity at USGS fixed locations based on flow

A three step approach was used to fit the general model. The first step of the approach was to construct a daily time series of the salinity metrics to be predicted from flow. For each day of the continuous recorder period of record, the daily mean, daily 5^{th} percentile, and daily 95^{th} percentile were calculated.

The second step was to identify the critical flow (Figure 1) at which higher flows were expected to result in near-zero salinity conditions for each of the daily salinity metrics developed in the first step. Above this critical flow point, there was little or no explainable variation in the observed salinity metric, and only very rare, if any, higher salinity metric values were observed. Initially, these critical flow values were operationally defined for each station location, probe depth, and daily salinity metric as the 95^{th} percentile of flow for a subset of flow values where the daily salinity metrics were greater than 0.5 ppt. The critical flow values were then tuned as calibration constants during the regression fitting process in order to minimize bias in the salinity predictions near the critical flow values. The final tuned critical flow values for these stations and daily salinity metrics are presented in Table 3.

The third step of the approach was to model each daily salinity metric as a response to total flow for the data where flows were less than the critical flow. It should be noted that like the observed salinities used in the second step, the observed salinities used in this third step also included many zero and near-zero salinity observations. The distinction between the second step of the approach and this third step was that in the second step the observed salinities were essentially always near zero, and in the second step there was a range of salinity variation between zero and Gulf salinities which could be modeled using an Analysis of Variance method. Salinity models were developed for each station, depth, and daily salinity metric.

Two methods were used to apply these models to predict daily salinity metrics for a particular station and depth. If flow on a day was greater than the critical flow for the metric, then the daily salinity metric was predicted to be 0.5 ppt. If flow on a day was less than or equal to the critical flow for the metric, the daily salinity metric was predicted using the regression equation for the station, depth, and metric.

Table 3. Critical flow values for several daily salinity metrics observed at USGS continuous recorder locations on the Alafia River. No critical flows existed at the 5th percentile level.

Continuous Recorder ID and Location	Probe Depth	Critical Flow, Mean Daily Salinity (cfs)	Critical Flow, 95th Percentile Daily Salinity (cfs)
02301718, River km 8.0	surface bottom	542.22 687.35	646.61 774.36
02301719, River km 4.5	bottom	1069.15	1120.20
02301721, River km 1.5	surface Middle bottom	905.20 750.47 905.20	935.37 775.48 935.37

A stepwise regression analysis was used to identify the variables to be used to fit the curve presented in Figure 1 for daily average, 95th percentile, and 5th percentile salinity at each of three stations and different sampling depths (surface, Middle, and bottom). A set of curve shapes was derived. Initially, each model was defined to include monthly-specific intercept parameters, and stepwise regression analysis was used to select one, two, or three slope parameters based on flow variables or ambient background salinity in Tampa Bay (EPCHC station 55). If sample sizes were not sufficient to permit monthly-specific intercepts, then an alternative model was fit using dry season (November-June) and wet season (July-October) intercept parameters instead of the monthly intercepts. Explanatory variables were selected by the regression analysis from the following set of candidate variables:

- daily flow,
- ungaged flow,
- antecedent flow (1 to 7 day lag flows), and
- ambient background salinity in Tampa Bay (EPCHC Station 55 – in the center of Hillsborough Bay).

Results

SWFWMD and EPCHC fixed locations

The regression model equation using monthly intercept terms is as follows:

$$Salinity_t = \alpha + \sum_{i=1}^{11} \alpha_i \rho_i + \beta_1 \left[\sum_{j=0}^{L_1} flow_{t-j} \right]^{\varepsilon_1} + \beta_2 \left[\sum_{j=0}^{L_2} flow_{t-j} \right]^{\varepsilon_2} + \beta_3 \left[\sum_{j=0}^{L_3} flow_{t-j} \right]^{\varepsilon_3}$$

Where:

$Salinity_t$ = Salinity on day t (ppt),
α = Intercept parameter,
i = index of calendar month (e.g., January = 1),
α_i = Intercept parameter for month I,
ρ_i = a decision variable (1 if i=month, else 0),
$\beta_1, \beta_2, \beta_3$ = regression parameters,
L_1, L_2, L_3 = Lag interval constants (days),
$\varepsilon_1, \varepsilon_2, \varepsilon_3$ = exponent constants to establish curve shape, and
$flow_{t-j}$ = total flow at day t-j (cfs).

The models fit the observed data well in most cases. The r^2 values ranged from 0.18 to 0.95, and were frequently reported to be greater 0.70. The slope parameter estimates were typically highly significant ($p<0.0001$), and the Analyses of Variance explained significant portions of the total variation in salinity ($p>|F|$ generally < 0.0001).

A summary of the individual regression models (total degrees of freedom [df], p>f value, and r^2) for SWFWMD and EPCHC for each station and sample depth are presented in Table 4 and Table 5, respectively.

Table 4. SWFWMD regression results at each station and sample level.

Station	Sample Depth	$L_1(\varepsilon_1)$	$L_2(\varepsilon_2)$	$L_3(\varepsilon_3)$	df	p > f	r^2
SWFWMD 1	1-meter	8(0.7)			46	<.0001	0.67
SWFWMD 1	2-meter	8(0.2)			40	<.0001	0.48
SWFWMD 1	bottom	1(0.2)	2(0.2)		50	<.0001	0.51
SWFWMD 1	surface	**l5_flow	*flow1	*flow3	31	<.0001	0.97
SWFWMD 2	1-meter	8(0.6)		8(0.2)	50	<.0001	0.72
SWFWMD 2	2-meter	8(-0.2)			25	<.0001	0.47
SWFWMD 2	bottom	8(0.2)			60	<.0001	0.6
SWFWMD 2	surface	2(0.7)			53	<.0001	0.8
SWFWMD 3	1-meter	8(-0.3)			17	<.0001	0.62
SWFWMD 3	bottom	8(0.5)			64	<.0001	0.5
SWFWMD 3	surface	2(0.6)			50	<.0001	0.81
SWFWMD 4	1-meter	**l5_flow			7	<.0001	0.28
SWFWMD 4	bottom	**l6_flow			49	<.0001	0.77
SWFWMD 4	surface	7(0.5)			46	<.0001	0.84
SWFWMD 5	1-meter	2(-0.9)			11	<.0001	0.79
SWFWMD 5	bottom	**l3_flow	**l2_flow		46	<.0001	0.63
SWFWMD 5	surface	3(-0.2)	***sal_55b_p09		34	<.0001	0.84
SWFWMD 6	1-meter	1(0.4)			39	<.0001	0.72
SWFWMD 6	2-meter	4(0.9)			25	<.0001	0.54
SWFWMD 6	bottom	2(0.9)			48	<.0001	0.46
SWFWMD 6	surface	4(-0.2)	***sal_55b_m1		39	<.0001	0.77
SWFWMD 7	1-meter	8(-0.2)			33	<.0001	0.68
SWFWMD 7	2-meter	3(0.9)			20	<.0001	0.57
SWFWMD 7	bottom	8(0.9)	**l4_flow		47	<.0001	0.73
SWFWMD 7	surface	5(-0.3)	***sal_55b_m1		36	<.0001	0.76
SWFWMD 8	1-meter	1(0.3)			32	<.0001	0.67
SWFWMD 8	2-meter	**l2_flow			12	<.0001	0.8
SWFWMD 8	bottom	7(0.9)			51	<.0001	0.76
SWFWMD 8	surface	3(0.3)	***sal_55b_p08		34	<.0001	0.81
SWFWMD 9	1-meter	4(-0.2)			29	<.0001	0.74
SWFWMD 9	2-meter	8(-0.2)			26	<.0001	0.51
SWFWMD 9	bottom	**l2_flow			39	<.0001	0.6
SWFWMD 9	surface	2(-0.2)			23	<.0001	0.63
SWFWMD 10	1-meter	5(-1)			20	<.0001	0.67
SWFWMD 10	bottom	8(0.9)			39	<.0001	0.61
SWFWMD 10	surface	5(-0.2)			18	<.0001	0.6
SWFWMD 11	1-meter	8(0.7)			22	<.0001	0.69
SWFWMD 11	2-meter	**l2_flow			16	<.0001	0.35
SWFWMD 11	bottom	3(0.9)			36	<.0001	0.39
SWFWMD 11	surface	3(0.3)			21	<.0001	0.63
SWFWMD 12	1-meter	3(0.4)			15	<.0001	0.79
SWFWMD 12	2-meter	**l2_flow			14	0.0081	0.55
SWFWMD 12	bottom	**l2_flow	***sal_55b_m1		17	0.0063	0.64
SWFWMD 12	surface	3(0.2)			15	<.0001	0.77
SWFWMD 13	1-meter	1(-1)			18	<.0001	0.7
SWFWMD 13	2-meter	**l2_flow			17	0.0039	0.52
SWFWMD 13	bottom	**l2_flow	***sal_55b_m1		22	0.0021	0.59
SWFWMD B	1-meter	7(-0.7)			10	0.0026	0.77
SWFWMD B	surface	8(0.6)			26	<.0001	0.95
SWFWMD C	1-meter	1(0.5)			18	<.0001	0.92
SWFWMD C	2-meter	**l5_flow			11	<.0001	0.72
SWFWMD C	bottom	**l6_flow	**l4_flow	**l7_flow	33	<.0001	0.92
SWFWMD C	surface	1(-0.3)			20	<.0001	0.85

Table 5. EPCHC regression results at each station and sample level.

Station	Sample Depth	$L_1(\varepsilon_1)$	$L_2(\varepsilon_2)$	$L_3(\varepsilon_3)$	df	p > f	r^2
EPCHC 153	1-meter	4(0.2)			30	<.0001	0.73
EPCHC 153	bottom	**l2_flow	**l4_flow		32	<.0001	0.45
EPCHC 153	surface	8(-0.4)			26	<.0001	0.8
EPCHC 74	1-meter	8(0.2)			145	<.0001	0.35
EPCHC 74	2-meter	1(1)	**l1_flow	6(0.7)	150	<.0001	0.37
EPCHC 74	bottom	8(0.2)	4(0.4)		246	<.0001	0.4
EPCHC 74	surface	4(0.2)			244	<.0001	0.49
EPCHC 8	1-meter	8(0.3)	**l7_flow	1(-0.4)	245	<.0001	0.65
EPCHC 8	bottom	8(0.2)	6(0.3)		287	<.0001	0.51
EPCHC 8	surface	8(0.4)	*flow3		131	<.0001	0.71

*** please see the notes section 3
** please see the notes section 2
* please see the notes section 1

USGS fixed locations

The regression model equation using monthly intercept terms is as follows:

$$Salinity_t = \alpha + \sum_{i=1}^{11} \alpha_i \rho_i + \beta_1 \left[\sum_{j=0}^{L_1} flow_{t-j} \right]^{\varepsilon_1} + \beta_2 \left[\sum_{j=0}^{L_2} flow_{t-j} \right]^{\varepsilon_2} + \beta_3 \left[\sum_{j=0}^{L_3} flow_{t-j} \right]^{\varepsilon_3}$$

Where:

$Salinity_t$ = Salinity on day t (ppt),
α = Intercept parameter,
i = index of calendar month (e.g., January = 1),
α_i = Intercept parameter for month I,
ρ_i = a decision variable (1 if i=month, else 0),
$\beta_1, \beta_2, \beta_3$ = regression parameters,
L_1, L_2, L_3 = Lag interval constants (days),
$\varepsilon_1, \varepsilon_2, \varepsilon_3$ = exponent constants to establish curve shape, and
$flow_{t-j}$ = total flow at day t-j (cfs).

The derived relationships were statistically significant. The models fit the observed data well in many cases, although in some cases the relationships were not strong. The R^2 values typically ranged from 0.42 to 0.85. The slope parameter estimates were typically highly significant (p<0.0001), and the Analyses of Variance explained significant portions of the total variation in salinity (p>|F| generally < 0.0001).

A summary of the individual regression models (total degrees of freedom [df], p>f value, and r^2) for USGS stations and sample depths are presented in Table 6 thru 8, respectively.

Table 6. USGS continuous daily average salinity vs. river flow regression results at each station and sample level.

Station	Sample Depth	$L_1(\varepsilon_1)$	$L_2(\varepsilon_2)$	$L_3(\varepsilon_3)$	df	p > f	r^2
USGS 0230178	B	3(0.3)	*flow1	**l3_flow	1158	<.0001	0.66
USGS 0230178	S	3(0.2)	3(0.9)	1(-1)	1087	<.0001	0.75
USGS 02301719	B	2(04)			1032	<.0001	0.74
USGS 02301721	B	1(0.2)	**l7_flow	1(1)	548	<.0001	0.68
USGS 02301721	S	3(0.2)	**l7_flow		550	<.0001	0.81
USGS 02301721	M	2(0.2)	***sal_55b_p09		143	<.0001	0.59

Table 7. USGS continuous daily 95% salinity vs. river flow regression result at each station and sample level.

Station	Sample Depth	$L_1(\varepsilon_1)$	$L_2(\varepsilon_2)$	$L_3(\varepsilon_3)$	df	p > f	r^2
USGS 02301718	B	3(0.6)	*flow3	4(0.6)	1180	<.0001	0.61
USGS 02301718	S	3(0.3)			1137	<.0001	0.67
USGS 02301719	B	2(0.3)	**l7_flow	**l2_flow	1032	<.0001	0.47
USGS 02301721	B	8(0.3)	1(0.2)	7(0.3)	549	<.0001	0.66
USGS 02301721	S	8(0.2)	1(0.4)	*flow3	551	<.0001	0.62
USGS 02301721	M	***sal_55b_p09	**l7_flow		143	<.0001	0.42
USGS 02301638	B	2(-1)	2(-0.9)	2(-0.8)	136	<.0001	0.54
USGS 02301638	S	2(-1)	2(-0.9)	2(-0.8)	136	<.0001	0.53

Table 8. USGS continuous daily 05% salinity vs. river flow regression result at each station and sample level.

Station	Sample Depth	$L_1(\varepsilon_1)$	$L_2(\varepsilon_2)$	$L_3(\varepsilon_3)$	df	p > f	r^2
USGS 02301718	B	4(-0.2)	***sal_55b_m1	***sal_55t_p09	1236	<.0001	0.61
USGS 02301718	S	6(-0.4)	***sal_55b_m1	***sal_55t_p09	1227	<.0001	0.77
USGS 02301719	B	3(0.2)	3(0.9)	***sal_55b_m1	1050	<.0001	0.75
USGS 02301721	B	1(-0.2)	*flow1	*flow2	550	<.0001	0.47
USGS 02301721	S	3(0.2)	4(0.9)	4(0.6)	552	<.0001	0.85
USGS 02301721	M	2(0.5)			145	<.0001	0.8
USGS 02301638	B	1(0.4)	7(-1)	1(0.3)	1486	<.0001	0.02
USGS 02301638	S	2(0.2)	7(-1)	3(-0.2)	1610	<.0001	0.02

*** please see the notes section 3
** please see the notes section 2
* please see the notes section 1.

Detailed regression results and diagnostic plots are presented in the tables and figures that follow.

Notes Section:

1. The variables annotated with * are exceptions to the general selected variable equation. The variable "flow*i*" represents the ungaged flow from subbasin group *i*.

2. The variables annotated with ** are exceptions to the general selected variable equation. The variables "l*i*_flow" represents the total flow on day *t-i*.

3. The variables annotated with *** are exceptions to the general selected variable equation. The variables are

   A) "sal_55m_m*i*". This variable is the monthly mid-depth salinity at EPCHC station 55, raised to the minus *i* power

   B) "sal_55t_m*i*". This variable is the monthly surface salinity at EPCHC station 55, raised to the minus *i* power.

   C) "sal_55b_*mi*". This variable is the monthly bottom salinity at EPCHC station 55, raised to the minus *i* power.

   D) "sal_55m_p*i*". This variable is the monthly mid-depth salinity at EPCHC station 55, raised to the positive *i* power.

   E) "sal_55t_p*i*". This variable is the monthly surface salinity at EPCHC station 55, raised to the positive *i* power.

   F) "sal_55b_pi". This variable is the monthly bottom salinity at EPCHC station 55, raised to the positive *i* power.

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=1 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	12	904.58118	75.38176	5.80	<.0001
Error	34	442.18042	13.00531		
Corrected Total	46	1346.76160			

Root MSE	3.60629	**R-Square**	0.6717
Dependent Mean	25.64149	**Adj R-Sq**	0.5558
Coeff Var	14.06427		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	31.38568	2.70132	11.62	<.0001
a1		1	3.39091	3.60921	0.94	0.3541
a2		1	0.53365	3.01754	0.18	0.8607
a3		1	0.20681	3.01751	0.07	0.9458
a4		1	-1.39270	3.29305	-0.42	0.6750
a5		1	-0.17261	3.14028	-0.05	0.9565

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=1 Meter

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	2.50623	2.90334	0.86	0.3941
a7		1	10.15334	3.45013	2.94	0.0058
a8		1	3.88732	3.50191	1.11	0.2748
a9		1	7.98445	3.14184	2.54	0.0158
a10		1	2.95642	3.30085	0.90	0.3767
a11		1	-1.20285	3.29209	-0.37	0.7171
flopower07_sum8		1	-0.04455	0.00622	-7.16	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=2 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	12	264.64450	22.05371	2.17	0.0445
Error	28	284.16330	10.14869		
Corrected Total	40	548.80780			

Root MSE	3.18570	**R-Square**	0.4822
Dependent Mean	27.50732	**Adj R-Sq**	0.2603
Coeff Var	11.58128		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	44.21737	5.36712	8.24	<.0001
a1		1	1.63925	3.90198	0.42	0.6776
a2		1	0.19132	3.57241	0.05	0.9577
a3		1	0.48214	3.73679	0.13	0.8983
a4		1	1.00268	4.58707	0.22	0.8286
a5		1	-1.13234	3.63357	-0.31	0.7576

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=2 Meter

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	1.30721	3.46554	0.38	0.7089
a7		1	5.85298	3.75168	1.56	0.1300
a8		1	4.26280	3.76617	1.13	0.2673
a9		1	4.30000	3.56419	1.21	0.2377
a10		1	1.48908	3.68055	0.40	0.6889
a11		1	0.75053	3.68025	0.20	0.8399
flopower02_sum8		1	-4.35630	1.01616	-4.29	0.0002

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	391.52245	27.96589	2.64	0.0095
Error	36	380.91441	10.58096		
Corrected Total	50	772.43686			

Root MSE	3.25284	R-Square	0.5069
Dependent Mean	27.47451	Adj R-Sq	0.3151
Coeff Var	11.83948		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	65.40877	16.40227	3.99	0.0003
a1		1	0.99285	3.28279	0.30	0.7641
a2		1	-0.48771	2.64144	-0.18	0.8546
a3		1	-1.00218	2.75078	-0.36	0.7177
a4		1	-4.61340	3.00908	-1.53	0.1340
a5		1	-0.66121	3.11162	-0.21	0.8329

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	0.48316	2.70626	0.18	0.8593
a7		1	3.81754	3.03641	1.26	0.2168
a8		1	3.68013	3.16783	1.16	0.2530
a9		1	3.95580	2.72043	1.45	0.1546
a10		1	1.75510	2.97078	0.59	0.5584
a11		1	1.15393	2.98074	0.39	0.7009
flopower02		1	-15.89830	10.56610	-1.50	0.1411
flopower02_sum2		1	-5.38513	10.87375	-0.50	0.6234
int		1	2.45660	1.72145	1.43	0.1622

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	1265.87554	84.39170	30.15	<.0001
Error	16	44.77915	2.79870		
Corrected Total	31	1310.65469			

Root MSE	1.67293	R-Square	0.9658
Dependent Mean	25.92188	Adj R-Sq	0.9338
Coeff Var	6.45374		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	32.31095	2.15615	14.99	<.0001
a1		1	0.00122	2.26038	0.00	0.9996
a2		1	-2.31639	2.27369	-1.02	0.3235
a3		1	-2.53492	2.08153	-1.22	0.2410
a4		1	-3.32858	2.43198	-1.37	0.1900
a5		1	-0.39635	2.43405	-0.16	0.8727

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 1 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=1 Sample Level=Surface

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	0.96985	1.99368	0.49	0.6332
a7		1	15.32778	2.56159	5.98	<.0001
a8		1	2.43603	2.19467	1.11	0.2834
a9		1	5.41044	2.13293	2.54	0.0220
a10		1	1.67416	2.36951	0.71	0.4900
a11		1	-3.05302	2.40953	-1.27	0.2233
l5_flow		1	-0.02519	0.00189	-13.29	<.0001
flow1		1	-0.33512	0.11059	-3.03	0.0080
flow3		1	0.12501	0.04144	3.02	0.0082
int		1	-0.00015761	0.00005899	-2.67	0.0167

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	1324.46320	110.37193	8.34	<.0001
Error	38	502.79680	13.23149		
Corrected Total	50	1827.26000			

Root MSE	3.63751	R-Square	0.7248
Dependent Mean	24.60000	Adj R-Sq	0.6379
Coeff Var	14.78663		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	21.64635	3.83057	5.65	<.0001
a1		1	9.42157	4.20061	2.24	0.0308
a2		1	10.58943	4.06884	2.60	0.0131
a3		1	11.31773	4.07191	2.78	0.0084
a4		1	8.57583	4.20211	2.04	0.0483
a5		1	11.97177	3.93755	3.04	0.0043

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=1 Meter

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	12.23358	3.91519	3.12	0.0034
a7		1	19.75780	4.28616	4.61	<.0001
a8		1	12.58219	4.04304	3.11	0.0035
a9		1	14.27298	3.99942	3.57	0.0010
a10		1	14.98965	4.08445	3.67	0.0007
a11		1	12.72460	4.06831	3.13	0.0034
flopower06_sum8		1	-0.10698	0.01452	-7.37	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	203.16362	101.58181	10.29	0.0006
Error	23	227.15484	9.87630		
Corrected Total	25	430.31846			

Root MSE	3.14266	R-Square	0.4721
Dependent Mean	26.99231	Adj R-Sq	0.4262
Coeff Var	11.64279		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	13.00813	3.14662	4.13	0.0004
wetseason		1	-2.69264	1.55229	-1.73	0.0962
flopowerm02_sum8		1	65.55629	14.94465	4.39	0.0002

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	735.29843	61.27487	6.10	<.0001
Error	48	481.94419	10.04050		
Corrected Total	60	1217.24262			

Root MSE	3.16868	R-Square	0.6041
Dependent Mean	26.67213	Adj R-Sq	0.5051
Coeff Var	11.88010		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	37.43618	3.84963	9.72	<.0001
a1		1	4.05843	2.89320	1.40	0.1671
a2		1	6.21902	2.58830	2.40	0.0202
a3		1	6.48372	2.58768	2.51	0.0157
a4		1	3.16938	2.89335	1.10	0.2788
a5		1	6.51073	2.64855	2.46	0.0176

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	8.27907	2.51249	3.30	0.0019
a7		1	15.00716	2.98312	5.03	<.0001
a8		1	11.43371	2.71878	4.21	0.0001
a9		1	9.93315	2.64285	3.76	0.0005
a10		1	9.11732	2.64349	3.45	0.0012
a11		1	8.02397	2.65190	3.03	0.0040
flopower02_sum8		1	-4.33482	0.75445	-5.75	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	3109.33545	259.11129	13.27	<.0001
Error	41	800.77465	19.53109		
Corrected Total	53	3910.11010			

Root MSE	4.41940	R-Square	0.7952
Dependent Mean	19.42019	Adj R-Sq	0.7353
Coeff Var	22.75673		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	21.01776	3.30106	6.37	<.0001
a1		1	8.81962	4.04337	2.18	0.0350
a2		1	9.99628	3.69852	2.70	0.0100
a3		1	9.28954	3.70468	2.51	0.0162
a4		1	8.43431	4.03471	2.09	0.0428
a5		1	12.82978	3.63157	3.53	0.0010

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 2 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=2 Sample Level=Surface

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	11.46831	3.55208	3.23	0.0025
a7		1	9.13718	4.08839	2.23	0.0309
a8		1	10.91049	3.81694	2.86	0.0067
a9		1	8.29378	3.69935	2.24	0.0304
a10		1	10.80318	3.87715	2.79	0.0080
a11		1	9.69484	3.82732	2.53	0.0152
flopower07_sum2		1	-0.16575	0.01955	-8.48	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 3 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=3 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	216.17256	108.08628	12.30	0.0007
Error	15	131.85189	8.79013		
Corrected Total	17	348.02444			

Root MSE	2.96481	R-Square	0.6211
Dependent Mean	23.74444	Adj R-Sq	0.5706
Coeff Var	12.48635		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	9.34293	3.19854	2.92	0.0105
wetseason		1	-4.11853	1.52760	-2.70	0.0166
flopowerm03_sum8		1	150.13248	30.73641	4.88	0.0002

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 3 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=3 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	1076.26552	89.68879	4.29	0.0001
Error	52	1086.69509	20.89798		
Corrected Total	64	2162.96062			

Root MSE	4.57143	R-Square	0.4976
Dependent Mean	24.12462	Adj R-Sq	0.3816
Coeff Var	18.94924		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	30.48962	2.97252	10.26	<.0001
a1		1	-2.41045	3.73684	-0.65	0.5217
a2		1	1.71181	3.15468	0.54	0.5897
a3		1	0.20347	3.15847	0.06	0.9489
a4		1	-2.98753	3.73535	-0.80	0.4275
a5		1	0.71831	3.51133	0.20	0.8387

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 3 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=3 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	3.57586	2.99275	1.19	0.2376
a7		1	7.60604	3.63748	2.09	0.0414
a8		1	2.42057	3.46601	0.70	0.4881
a9		1	4.47027	3.47972	1.28	0.2046
a10		1	4.35072	3.44683	1.26	0.2125
a11		1	1.97020	3.15778	0.62	0.5354
flopower05_sum8		1	-0.21136	0.04096	-5.16	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 3 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=3 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	2538.99442	211.58287	14.14	<.0001
Error	38	568.50244	14.96059		
Corrected Total	50	3107.49686			

Root MSE	3.86789	R-Square	0.8171
Dependent Mean	16.77451	Adj R-Sq	0.7593
Coeff Var	23.05815		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	29.74182	2.59902	11.44	<.0001
a1		1	0.85914	3.16200	0.27	0.7873
a2		1	3.51521	2.83065	1.24	0.2219
a3		1	1.09651	2.82693	0.39	0.7003
a4		1	0.40005	3.53180	0.11	0.9104
a5		1	3.88673	2.97919	1.30	0.1999

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 3 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=3 Sample Level=Surface

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	1.85595	2.63150	0.71	0.4849
a7		1	-0.43850	3.03117	-0.14	0.8857
a8		1	4.17552	3.09152	1.35	0.1848
a9		1	-0.70663	2.88158	-0.25	0.8076
a10		1	4.27740	2.99325	1.43	0.1612
a11		1	0.68982	2.95541	0.23	0.8167
flopower06_sum2		1	-0.40142	0.04031	-9.96	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 4 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=4 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	45.27335	22.63667	0.99	0.4353
Error	5	114.69540	22.93908		
Corrected Total	7	159.96875			

Root MSE	4.78948	R-Square	0.2830
Dependent Mean	12.38750	Adj R-Sq	-0.0038
Coeff Var	38.66378		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	13.35323	5.00384	2.67	0.0444
wetseason		1	3.87951	4.69442	0.83	0.4462
l5_flow		1	-0.00537	0.01098	-0.49	0.6454

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 4 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=4 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	1673.79571	119.55684	8.25	<.0001
Error	35	507.33649	14.49533		
Corrected Total	49	2181.13220			

Root MSE	3.80727	R-Square	0.7674
Dependent Mean	20.96600	Adj R-Sq	0.6744
Coeff Var	18.15927		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	17.43833	2.98762	5.84	<.0001
a1		1	7.48068	3.85639	1.94	0.0605
a2		1	7.50592	3.57309	2.10	0.0429
a3		1	4.11234	3.30879	1.24	0.2222
a4		1	4.82015	3.61890	1.33	0.1915
a5		1	11.54408	3.47609	3.32	0.0021

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 4 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=4 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	12.46612	2.99979	4.16	0.0002
a7		1	28.87246	4.74837	6.08	<.0001
a8		1	12.95240	3.06795	4.22	0.0002
a9		1	11.14527	3.93548	2.83	0.0076
a10		1	11.18365	3.46853	3.22	0.0027
a11		1	7.18072	3.61855	1.98	0.0551
l6_flow		1	-0.02370	0.00722	-3.28	0.0023
flow1		1	-0.08223	0.04086	-2.01	0.0519
int		1	-0.00002783	0.00021311	-0.13	0.8968

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 4 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=4 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	1948.91950	162.40996	15.12	<.0001
Error	34	365.25795	10.74288		
Corrected Total	46	2314.17745			

Root MSE	3.27763	R-Square	0.8422
Dependent Mean	11.75106	Adj R-Sq	0.7865
Coeff Var	27.89223		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	22.52798	3.65846	6.16	<.0001
a1		1	0.16969	3.78470	0.04	0.9645
a2		1	5.63190	3.78473	1.49	0.1460
a3		1	4.09808	3.59174	1.14	0.2619
a4		1	0.10103	3.78716	0.03	0.9789
a5		1	6.61362	3.71028	1.78	0.0836

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 4 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=4 Sample Level=Surface

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	4.34047	3.48327	1.25	0.2212
a7		1	6.00633	3.94375	1.52	0.1370
a8		1	3.16962	3.63191	0.87	0.3889
a9		1	5.10770	3.71260	1.38	0.1779
a10		1	5.98904	3.78649	1.58	0.1230
a11		1	7.33624	3.78607	1.94	0.0610
flopower05_sum7		1	-0.40170	0.04589	-8.75	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 5 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=5 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	297.99877	148.99938	17.12	0.0009
Error	9	78.34373	8.70486		
Corrected Total	11	376.34250			

Root MSE	2.95040	R-Square	0.7918
Dependent Mean	8.02500	Adj R-Sq	0.7456
Coeff Var	36.76511		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1.57769	1.39794	1.13	0.2883
wetseason		1	1.20437	2.17723	0.55	0.5936
flopowerm09_sum2		1	940.65422	223.29432	4.21	0.0023

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 5 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=5 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1781.98312	445.49578	17.93	<.0001
Error	42	1043.50922	24.84546		
Corrected Total	46	2825.49234			

Root MSE	4.98452	R-Square	0.6307
Dependent Mean	14.01277	Adj R-Sq	0.5955
Coeff Var	35.57129		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	34.27556	3.11419	11.01	<.0001
wetseason		1	-9.12787	2.09727	-4.35	<.0001
l3_flow		1	-0.06884	0.01414	-4.87	<.0001
l2_flow		1	-0.01565	0.01656	-0.95	0.3500
int		1	0.00007115	0.00001784	3.99	0.0003

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 5 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=5 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	1115.59949	278.89987	40.81	<.0001
Error	30	205.03594	6.83453		
Corrected Total	34	1320.63543			

Root MSE	2.61429	R-Square	0.8447
Dependent Mean	7.48857	Adj R-Sq	0.8240
Coeff Var	34.91045		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-68.45766	66.85010	-1.02	0.3140
wetseason		1	1.04422	1.25489	0.83	0.4119
flopowerm02_sum3		1	316.52895	232.48233	1.36	0.1835
sal_55b_p09		1	2.19378	3.44410	0.64	0.5290
int		1	-10.72954	11.86417	-0.90	0.3730

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 6 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=6 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	940.95084	470.47542	46.63	<.0001
Error	37	373.27691	10.08857		
Corrected Total	39	1314.22775			

Root MSE	3.17625	R-Square	0.7160
Dependent Mean	8.13250	Adj R-Sq	0.7006
Coeff Var	39.05626		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	30.10455	3.14371	9.58	<.0001
wetseason		1	-0.99655	1.32737	-0.75	0.4575
flopower04		1	-2.76487	0.32310	-8.56	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 6 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=6 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	735.27942	367.63971	13.67	0.0001
Error	23	618.50520	26.89153		
Corrected Total	25	1353.78462			

Root MSE	5.18570	R-Square	0.5431
Dependent Mean	11.95385	Adj R-Sq	0.5034
Coeff Var	43.38105		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	29.23656	3.76247	7.77	<.0001
wetseason		1	-7.09496	2.56234	-2.77	0.0109
flopower09_sum4		1	-0.02533	0.00485	-5.22	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 6 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=6 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	956.60222	478.30111	19.85	<.0001
Error	46	1108.45125	24.09677		
Corrected Total	48	2065.05347			

Root MSE	4.90885	R-Square	0.4632
Dependent Mean	15.11837	Adj R-Sq	0.4399
Coeff Var	32.46942		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	27.01020	2.51401	10.74	<.0001
wetseason		1	-4.36036	1.85412	-2.35	0.0230
flopower09_sum2		1	-0.03768	0.00610	-6.18	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 6 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=6 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	421.65051	105.41263	29.71	<.0001
Error	35	124.18449	3.54813		
Corrected Total	39	545.83500			

Root MSE	1.88365	R-Square	0.7725
Dependent Mean	4.82500	Adj R-Sq	0.7465
Coeff Var	39.03933		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1.51710	34.39261	0.04	0.9651
wetseason		1	1.11641	0.96425	1.16	0.2548
flopowerm02_sum4		1	-22.28519	123.29056	-0.18	0.8576
sal_55t_m1		1	-464.28233	887.65632	-0.52	0.6042
int		1	2438.89662	3235.73950	0.75	0.4560

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 7 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=7 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	760.03414	380.01707	32.19	<.0001
Error	31	365.96027	11.80517		
Corrected Total	33	1125.99441			

Root MSE	3.43587	R-Square	0.6750
Dependent Mean	6.56765	Adj R-Sq	0.6540
Coeff Var	52.31501		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-27.27463	4.28522	-6.36	<.0001
wetseason		1	-2.00005	1.64221	-1.22	0.2325
flopowerm02_sum8		1	139.19336	17.67296	7.88	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 7 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=7 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	730.92804	365.46402	11.74	0.0005
Error	18	560.57481	31.14305		
Corrected Total	20	1291.50286			

Root MSE	5.58060	R-Square	0.5660
Dependent Mean	12.07143	Adj R-Sq	0.5177
Coeff Var	46.22978		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	28.07277	4.08402	6.87	<.0001
wetseason		1	-6.96154	3.15902	-2.20	0.0408
flopower09_sum3		1	-0.04437	0.00916	-4.84	0.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 7 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=7 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	2112.81425	150.91530	6.22	<.0001
Error	33	800.27554	24.25077		
Corrected Total	47	2913.08979			

Root MSE	4.92451	R-Square	0.7253
Dependent Mean	12.09792	Adj R-Sq	0.6087
Coeff Var	40.70542		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	29.55479	4.05513	7.29	<.0001
a1		1	-3.50925	4.05164	-0.87	0.3927
a2		1	-4.07528	3.49208	-1.17	0.2516
a3		1	-5.23918	3.82100	-1.37	0.1796
a4		1	-5.35498	3.90787	-1.37	0.1798
a5		1	-5.42438	4.09563	-1.32	0.1945

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 7 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=7 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	-3.44978	3.51292	-0.98	0.3332
a7		1	-1.15720	6.07032	-0.19	0.8500
a8		1	-0.26374	4.14464	-0.06	0.9496
a9		1	0.70357	4.98012	0.14	0.8885
a10		1	3.12561	4.14144	0.75	0.4558
a11		1	1.94699	3.59872	0.54	0.5921
flopower09_sum8		1	-0.03824	0.00742	-5.16	<.0001
l4_flow		1	0.02930	0.02258	1.30	0.2033
int		1	0.00003371	0.00001483	2.27	0.0297

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 7 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=7 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	400.17395	100.04349	25.80	<.0001
Error	32	124.07632	3.87738		
Corrected Total	36	524.25027			

Root MSE	1.96911	R-Square	0.7633
Dependent Mean	4.51622	Adj R-Sq	0.7337
Coeff Var	43.60083		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	6.42356	31.84785	0.20	0.8414
wetseason		1	-0.93956	0.93345	-1.01	0.3217
flopowerm03_sum5		1	-95.79821	225.44172	-0.42	0.6737
sal_55b_m1		1	-485.05021	848.42753	-0.57	0.5715
int		1	5547.03311	6065.29102	0.91	0.3673

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 8 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=8 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	787.57600	393.78800	30.68	<.0001
Error	30	385.00036	12.83335		
Corrected Total	32	1172.57636			

Root MSE	3.58237	R-Square	0.6717
Dependent Mean	6.76364	Adj R-Sq	0.6498
Coeff Var	52.96509		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	34.14970	4.62536	7.38	<.0001
wetseason		1	-0.55307	1.71884	-0.32	0.7499
flopower03		1	-6.57578	0.92685	-7.09	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 8 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=8 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	476.34466	238.17233	19.84	0.0003
Error	10	120.07226	12.00723		
Corrected Total	12	596.41692			

Root MSE	3.46514	R-Square	0.7987
Dependent Mean	11.91538	Adj R-Sq	0.7584
Coeff Var	29.08126		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	24.77438	2.78921	8.88	<.0001
wetseason		1	-6.50315	2.60460	-2.50	0.0316
l2_flow		1	-0.04445	0.00746	-5.96	0.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 8 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=8 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	2106.09347	175.50779	10.33	<.0001
Error	39	662.51172	16.98748		
Corrected Total	51	2768.60519			

Root MSE	4.12159	R-Square	0.7607
Dependent Mean	13.05962	Adj R-Sq	0.6871
Coeff Var	31.55979		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	16.48996	3.26187	5.06	<.0001
a1		1	3.56168	4.12914	0.86	0.3936
a2		1	7.10643	3.26155	2.18	0.0354
a3		1	4.10421	3.36894	1.22	0.2304
a4		1	4.61332	3.85038	1.20	0.2381
a5		1	4.33898	3.69987	1.17	0.2480

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 8 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=8 Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	7.00906	3.18768	2.20	0.0339
a7		1	16.19526	3.78886	4.27	0.0001
a8		1	6.74383	3.60685	1.87	0.0690
a9		1	23.82755	4.23486	5.63	<.0001
a10		1	14.53517	4.12189	3.53	0.0011
a11		1	13.24242	3.57054	3.71	0.0006
flopower09_sum7		1	-0.02387	0.00272	-8.76	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 8 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=8 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	352.69802	88.17451	32.10	<.0001
Error	30	82.40769	2.74692		
Corrected Total	34	435.10571			

Root MSE	1.65738	R-Square	0.8106
Dependent Mean	4.54286	Adj R-Sq	0.7854
Coeff Var	36.48330		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	59.26569	37.09389	1.60	0.1206
wetseason		1	-1.61535	0.84739	-1.91	0.0662
flopower03_sum3		1	-6.79823	5.98296	-1.14	0.2648
sal_55b_p08		1	-2.47694	2.63791	-0.94	0.3552
int		1	0.24172	0.42821	0.56	0.5766

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 9 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=9 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	418.31220	209.15610	38.65	<.0001
Error	27	146.09580	5.41096		
Corrected Total	29	564.40800			

Root MSE	2.32615	R-Square	0.7412
Dependent Mean	4.88000	Adj R-Sq	0.7220
Coeff Var	47.66693		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-20.17803	3.05822	-6.60	<.0001
wetseason		1	1.28341	1.21596	1.06	0.3006
flopowerm02_sum4		1	80.33810	11.30351	7.11	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 9 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=9 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	398.94090	199.47045	12.29	0.0002
Error	24	389.54873	16.23120		
Corrected Total	26	788.48963			

Root MSE	4.02880	R-Square	0.5060
Dependent Mean	9.49630	Adj R-Sq	0.4648
Coeff Var	42.42492		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-16.23519	5.26282	-3.08	0.0051
wetseason		1	-0.31143	2.18877	-0.14	0.8880
flopowerm02_sum8		1	99.93617	21.83170	4.58	0.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 9 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=9 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	961.69318	480.84659	28.15	<.0001
Error	37	631.92198	17.07897		
Corrected Total	39	1593.61516			

Root MSE	4.13267	R-Square	0.6035
Dependent Mean	12.23100	Adj R-Sq	0.5820
Coeff Var	33.78850		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	27.93564	2.67666	10.44	<.0001
wetseason		1	-7.35294	2.00241	-3.67	0.0008
l2_flow		1	-0.06792	0.00910	-7.46	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 9 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=9 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	108.19505	54.09753	18.12	<.0001
Error	21	62.68328	2.98492		
Corrected Total	23	170.87833			

Root MSE	1.72769	R-Square	0.6332
Dependent Mean	3.29167	Adj R-Sq	0.5982
Coeff Var	52.48683		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-13.96849	3.07246	-4.55	0.0002
wetseason		1	0.79566	1.78860	0.44	0.6610
flopowerm02_sum2		1	46.11993	7.88086	5.85	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 10 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=10 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	225.73381	112.86690	17.86	<.0001
Error	18	113.73571	6.31865		
Corrected Total	20	339.46952			

Root MSE	2.51369	R-Square	0.6650
Dependent Mean	4.36190	Adj R-Sq	0.6277
Coeff Var	57.62833		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.06229	1.86777	-0.03	0.9738
wetseason		1	-1.59753	1.92366	-0.83	0.4172
flopowerm1_sum5		1	2503.26989	420.93003	5.95	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 10 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=10 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1087.73310	543.86655	29.73	<.0001
Error	37	676.83465	18.29283		
Corrected Total	39	1764.56775			

Root MSE	4.27701	R-Square	0.6164
Dependent Mean	9.66750	Adj R-Sq	0.5957
Coeff Var	44.24113		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	24.93522	2.63835	9.45	<.0001
wetseason		1	-5.70017	1.91563	-2.98	0.0051
flopower09_sum8		1	-0.01767	0.00232	-7.60	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 10 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=10 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	40.42624	20.21312	11.75	0.0007
Error	16	27.52113	1.72007		
Corrected Total	18	67.94737			

Root MSE	1.31151	R-Square	0.5950
Dependent Mean	2.84737	Adj R-Sq	0.5443
Coeff Var	46.06058		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-9.13971	3.37606	-2.71	0.0155
wetseason		1	-2.76291	1.35177	-2.04	0.0578
flopowerm02_sum5		1	48.79208	10.73481	4.55	0.0003

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 11 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=11 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	208.21960	104.10980	21.87	<.0001
Error	20	95.20996	4.76050		
Corrected Total	22	303.42957			

Root MSE	2.18186	R-Square	0.6862
Dependent Mean	4.79565	Adj R-Sq	0.6548
Coeff Var	45.49656		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	14.33087	2.37126	6.04	<.0001
wetseason		1	-0.61171	1.67616	-0.36	0.7190
flopower07_sum8		1	-0.09829	0.01522	-6.46	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 11 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=11 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	194.94628	97.47314	3.71	0.0511
Error	14	368.16313	26.29737		
Corrected Total	16	563.10941			

Root MSE	5.12810	R-Square	0.3462
Dependent Mean	10.50588	Adj R-Sq	0.2528
Coeff Var	48.81166		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	21.65712	6.15584	3.52	0.0034
wetseason		1	-5.00180	4.74636	-1.05	0.3098
l2_flow		1	-0.08393	0.03161	-2.65	0.0188

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 11 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=11 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	559.43666	279.71833	10.87	0.0002
Error	34	874.63631	25.72460		
Corrected Total	36	1434.07297			

Root MSE	5.07194	R-Square	0.3901
Dependent Mean	8.57297	Adj R-Sq	0.3542
Coeff Var	59.16200		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	20.87952	4.21884	4.95	<.0001
wetseason		1	-3.67554	2.97843	-1.23	0.2256
flopower09_sum3		1	-0.05016	0.01142	-4.39	0.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 11 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=11 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	58.70865	29.35432	16.17	<.0001
Error	19	34.49726	1.81565		
Corrected Total	21	93.20591			

Root MSE	1.34746	R-Square	0.6299
Dependent Mean	2.58636	Adj R-Sq	0.5909
Coeff Var	52.09858		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	15.00542	2.48096	6.05	<.0001
wetseason		1	-1.63242	1.07379	-1.52	0.1449
flopower03_sum3		1	-2.16833	0.38339	-5.66	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 12 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=12 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	52.53605	26.26802	24.89	<.0001
Error	13	13.72145	1.05550		
Corrected Total	15	66.25750			

Root MSE	1.02737	R-Square	0.7929
Dependent Mean	2.61250	Adj R-Sq	0.7610
Coeff Var	39.32531		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	13.21306	1.81409	7.28	<.0001
wetseason		1	-1.57793	0.86390	-1.83	0.0908
flopower04_sum3		1	-1.06032	0.15309	-6.93	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 12 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=12 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	187.71032	93.85516	7.38	0.0081
Error	12	152.61901	12.71825		
Corrected Total	14	340.32933			

Root MSE	3.56627	R-Square	0.5516
Dependent Mean	6.17333	Adj R-Sq	0.4768
Coeff Var	57.76888		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	20.23458	4.30881	4.70	0.0005
wetseason		1	-7.73603	3.26093	-2.37	0.0353
l2_flow		1	-0.08506	0.02220	-3.83	0.0024

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 12 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=12 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	424.49751	106.12438	5.87	0.0063
Error	13	235.10249	18.08481		
Corrected Total	17	659.60000			

Root MSE	4.25262	R-Square	0.6436
Dependent Mean	9.26667	Adj R-Sq	0.5339
Coeff Var	45.89162		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	21.54475	41.95121	0.51	0.6162
wetseason		1	-5.68107	3.58271	-1.59	0.1368
l2_flow		1	-0.31872	0.32784	-0.97	0.3487
sal_55b_m1		1	38.12291	1124.77291	0.03	0.9735
int		1	5.61200	8.75511	0.64	0.5327

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 12 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=12 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	18.21504	9.10752	21.24	<.0001
Error	13	5.57496	0.42884		
Corrected Total	15	23.79000			

Root MSE	0.65486	R-Square	0.7657
Dependent Mean	1.67500	Adj R-Sq	0.7296
Coeff Var	39.09619		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	11.86048	1.90330	6.23	<.0001
wetseason		1	-0.22665	0.54595	-0.42	0.6848
flopower02_sum3		1	-3.40722	0.56109	-6.07	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 13 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=13 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	95.37664	47.68832	18.62	<.0001
Error	16	40.96757	2.56047		
Corrected Total	18	136.34421			

Root MSE	1.60015	R-Square	0.6995
Dependent Mean	2.03684	Adj R-Sq	0.6620
Coeff Var	78.56023		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-1.90432	1.20188	-1.58	0.1327
wetseason		1	-0.51111	1.25380	-0.41	0.6889
flopowerm1		1	261.78934	44.13230	5.93	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 13 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=13 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	201.22868	100.61434	8.23	0.0039
Error	15	183.28076	12.21872		
Corrected Total	17	384.50944			

Root MSE	3.49553	R-Square	0.5233
Dependent Mean	4.70556	Adj R-Sq	0.4598
Coeff Var	74.28513		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	19.14868	4.04548	4.73	0.0003
wetseason		1	-8.55667	3.11277	-2.75	0.0149
l2_flow		1	-0.08133	0.02035	-4.00	0.0012

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 13 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=13 Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	452.78486	113.19622	6.47	0.0021
Error	18	314.83166	17.49065		
Corrected Total	22	767.61652			

Root MSE	4.18218	R-Square	0.5899
Dependent Mean	7.44348	Adj R-Sq	0.4987
Coeff Var	56.18586		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	30.99146	38.23024	0.81	0.4282
wetseason		1	-6.90937	3.45322	-2.00	0.0607
l2_flow		1	-0.41889	0.30200	-1.39	0.1824
sal_55b_m1		1	-265.84504	1029.54184	-0.26	0.7992
in		1	8.61615	8.09548	1.06	0.3013

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 13 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=13 Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	22.34906	11.17453	14.08	0.0006
Error	13	10.31532	0.79349		
Corrected Total	15	32.66438			

Root MSE	0.89078	R-Square	0.6842
Dependent Mean	1.41875	Adj R-Sq	0.6356
Coeff Var	62.78614		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.59592	0.93486	-0.64	0.5349
wetseason		1	-0.67588	0.94907	-0.71	0.4890
flopowerm1		1	143.05448	27.12992	5.27	0.0002

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	35.25258	35.25258	5.12	0.0581
Error	7	48.18298	6.88328		
Corrected Total	8	83.43556			

Root MSE	2.62360	R-Square	0.4225
Dependent Mean	3.17778	Adj R-Sq	0.3400
Coeff Var	82.56087		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=1 Meter

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	B	32.85191	13.14148	2.50	0.0410
wetseason		0	0	.	.	.
flopower02		1	-13.84370	6.11723	-2.26	0.0581

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	152.73184	152.73184	8.48	0.0130
Error	12	216.03745	18.00312		
Corrected Total	13	368.76929			

Root MSE	4.24301	R-Square	0.4142
Dependent Mean	5.49286	Adj R-Sq	0.3653
Coeff Var	77.24593		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=2 Meter

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	B	12.16477	2.55598	4.76	0.0005
wetseason		0	0	.	.	.
l7_flow		1	-0.09034	0.03102	-2.91	0.0130

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=Bottom

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	2	183.66802	91.83401	2.60	0.1020
Error	18	636.06436	35.33691		
Corrected Total	20	819.73238			

Root MSE	5.94449	**R-Square**	0.2241
Dependent Mean	9.35238	**Adj R-Sq**	0.1378
Coeff Var	63.56120		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	-9.03380	8.22627	-1.10	0.2866
wetseason		1	0.14048	4.76127	0.03	0.9768
flopowerm03		1	63.68215	30.25537	2.10	0.0496

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=Surface

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	7.18166	7.18166	3.50	0.1037
Error	7	14.37834	2.05405		
Corrected Total	8	21.56000			

Root MSE	1.43320	**R-Square**	0.3331
Dependent Mean	1.66667	**Adj R-Sq**	0.2378
Coeff Var	85.99171		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 14 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=14 Sample Level=Surface

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	B	10.55516	4.77753	2.21	0.0629
wetseason		0	0	.	.	.
flopower03		1	-2.82760	1.51221	-1.87	0.1037

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=1 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	12.28109	12.28109	6.37	0.0325
Error	9	17.34618	1.92735		
Corrected Total	10	29.62727			

Root MSE	1.38829	**R-Square**	0.4145
Dependent Mean	1.85455	**Adj R-Sq**	0.3495
Coeff Var	74.85886		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=1 Meter

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	B	-2.35042	1.71759	-1.37	0.2044
wetseason		0	0	.	.	.
flopowerm09		1	122.38525	48.48319	2.52	0.0325

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=2 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	45.82861	45.82861	2.47	0.1469
Error	10	185.32055	18.53206		
Corrected Total	11	231.14917			

Root MSE	4.30489	**R-Square**	0.1983
Dependent Mean	6.35833	**Adj R-Sq**	0.1181
Coeff Var	67.70465		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=2 Meter

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	B	-42.08554	30.83084	-1.37	0.2022
wetseason		0	0	.	.	.
sal_55t_p09		1	2.57799	1.63936	1.57	0.1469

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=Surface

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	1	1.88447	1.88447	9.42	0.0134
Error	9	1.80098	0.20011		
Corrected Total	10	3.68545			

Root MSE	0.44734	**R-Square**	0.5113
Dependent Mean	0.86364	**Adj R-Sq**	0.4570
Coeff Var	51.79675		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station 15 and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=15 Sample Level=Surface

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	B	-0.63356	0.50619	-1.25	0.2423
wetseason		0	0	.	.	.
flopowerm1		1	63.11813	20.56803	3.07	0.0134

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=1 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	2	118.56192	59.28096	13.69	0.0026
Error	8	34.63990	4.32999		
Corrected Total	10	153.20182			

Root MSE	2.08086	**R-Square**	0.7739
Dependent Mean	26.22727	**Adj R-Sq**	0.7174
Coeff Var	7.93396		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	20.63642	1.24015	16.64	<.0001
wetseason		1	-2.56154	1.94955	-1.31	0.2253
flopowerm07_sum7		1	686.12700	160.45004	4.28	0.0027

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=2 Meter

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	0	0	.	.	.
Error	0	0	.		
Corrected Total	0	0			

Root MSE	.	**R-Square**	.
Dependent Mean	23.60000	**Adj R-Sq**	.
Coeff Var	.		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

wetseason =	0
flopowerm02_sum4 =	0.23974 * Intercept

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=2 Meter

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	B	23.60000	.	.	.
wetseason		0	0	.	.	.
flopowerm02_sum4		0	0	.	.	.

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=Bottom

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	405.89435	28.99245	12.26	<.0001
Error	28	66.19542	2.36412		
Corrected Total	42	472.08977			

Root MSE	1.53757	R-Square	0.8598
Dependent Mean	27.20233	Adj R-Sq	0.7897
Coeff Var	5.65235		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	29.19257	1.01505	28.76	<.0001
a1		1	1.94342	1.78885	1.09	0.2866
a2		1	-0.42678	1.10435	-0.39	0.7021
a3		1	1.74012	1.21216	1.44	0.1622
a4		1	1.87519	1.80190	1.04	0.3069
a5		1	3.07852	1.22570	2.51	0.0181

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=Bottom

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	3.01776	0.96798	3.12	0.0042
a7		1	14.20985	3.09532	4.59	<.0001
a8		1	3.33888	1.13529	2.94	0.0065
a9		1	1.50480	1.57252	0.96	0.3468
a10		1	4.11774	1.40765	2.93	0.0068
a11		1	-0.88780	1.42458	-0.62	0.5382
l6_flow		1	-0.01758	0.00342	-5.14	<.0001
flow1		1	-0.06404	0.02124	-3.02	0.0054
int		1	0.00012983	0.00009652	1.35	0.1894

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=Surface

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	1508.33476	125.69456	22.49	<.0001
Error	14	78.23190	5.58799		
Corrected Total	26	1586.56667			

Root MSE	2.36389	R-Square	0.9507
Dependent Mean	21.17778	Adj R-Sq	0.9084
Coeff Var	11.16214		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	27.31293	2.20002	12.41	<.0001
a1		1	4.21416	2.93447	1.44	0.1729
a2		1	5.61435	2.36648	2.37	0.0325
a3		1	8.57534	2.40221	3.57	0.0031
a4		1	1.62566	2.95966	0.55	0.5915
a5		1	8.37459	2.49818	3.35	0.0047

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station B and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=B Sample Level=Surface

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	6.61447	2.07520	3.19	0.0066
a7		1	9.22038	4.03912	2.28	0.0386
a8		1	7.95287	2.21622	3.59	0.0030
a9		1	8.99890	2.81840	3.19	0.0065
a10		1	9.58853	2.36584	4.05	0.0012
a11		1	8.07374	2.36701	3.41	0.0042
flopower06_sum8		1	-0.16607	0.02072	-8.01	<.0001

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=1 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	734.02750	66.72977	7.29	0.0073
Error	7	64.09250	9.15607		
Corrected Total	18	798.12000			

Root MSE	3.02590	R-Square	0.9197
Dependent Mean	14.70000	Adj R-Sq	0.7935
Coeff Var	20.58436		

NOTE: Model is not full rank. Least-squares solutions for the parameters are not unique. Some statistics will be misleading. A reported DF of 0 or B means that the estimate is biased.

NOTE: The following parameters have been set to 0, since the variables are a linear combination of other variables as shown.

a3 =	0

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and 1 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=1 Meter

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	26.08853	3.51267	7.43	0.0001
a1		1	4.78095	3.81385	1.25	0.2502
a2		1	1.57230	3.86000	0.41	0.6959
a3		0	0	.	.	.
a4		1	-4.21132	3.88063	-1.09	0.3138
a5		1	3.16103	3.99286	0.79	0.4545
a6		1	4.09444	2.77428	1.48	0.1835
a7		1	0.96498	3.77827	0.26	0.8058
a8		1	0.10156	2.78204	0.04	0.9719
a9		1	-3.79957	3.07834	-1.23	0.2569
a10		1	0.16797	3.84218	0.04	0.9664
a11		1	2.36557	3.70636	0.64	0.5436
flopower05		1	-0.89434	0.22571	-3.96	0.0054

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and 2 Meter Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=2 Meter

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	355.05616	177.52808	11.36	0.0035
Error	9	140.65051	15.62783		
Corrected Total	11	495.70667			

Root MSE	3.95321	R-Square	0.7163
Dependent Mean	19.06667	Adj R-Sq	0.6532
Coeff Var	20.73360		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	24.96356	2.17454	11.48	<.0001
wetseason		1	-1.55461	2.76740	-0.56	0.5880
l5_flow		1	-0.01656	0.00375	-4.41	0.0017

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=Bottom

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	707.84656	47.18977	14.65	<.0001
Error	18	57.99234	3.22180		
Corrected Total	33	765.83890			

Root MSE	1.79494	R-Square	0.9243
Dependent Mean	22.11029	Adj R-Sq	0.8612
Coeff Var	8.11810		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	24.49457	1.98956	12.31	<.0001
a1		1	2.89486	2.31554	1.25	0.2272
a2		1	0.13375	2.00043	0.07	0.9474
a3		1	-9.25273	2.36047	-3.92	0.0010
a4		1	-3.32300	2.37177	-1.40	0.1782
a5		1	3.64952	2.12671	1.72	0.1033

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and Bottom Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=Bottom

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	1.52670	1.76320	0.87	0.3980
a7		1	3.42115	1.83821	1.86	0.0791
a8		1	3.03430	1.74386	1.74	0.0989
a9		1	-7.00556	2.40995	-2.91	0.0094
a10		1	-0.61884	2.14834	-0.29	0.7766
a11		1	3.40613	1.82565	1.87	0.0785
l6_flow		1	-0.13255	0.01998	-6.63	<.0001
l4_flow		1	0.02925	0.00816	3.58	0.0021
l7_flow		1	0.07637	0.01446	5.28	<.0001
int		1	0.00002498	0.00001371	1.82	0.0852

Alafia River Analysis

Regression Procedure Results For SWFWMD Records at Station C and Surface Level

Source:Salinity Sampled by SWFWMD, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Station=C Sample Level=Surface

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	890.98334	445.49167	49.50	<.0001
Error	18	161.99476	8.99971		
Corrected Total	20	1052.97810			

Root MSE	2.99995	R-Square	0.8462
Dependent Mean	10.30952	Adj R-Sq	0.8291
Coeff Var	29.09884		

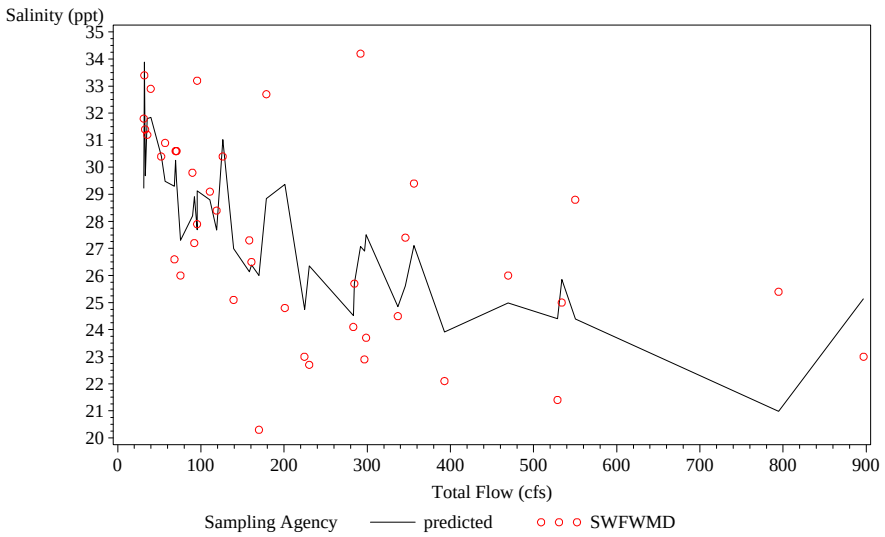
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-14.65774	2.83162	-5.18	<.0001
wetseason		1	-1.42757	1.86183	-0.77	0.4532
flopowerm03		1	107.72728	14.19687	7.59	<.0001

Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=2 Meter

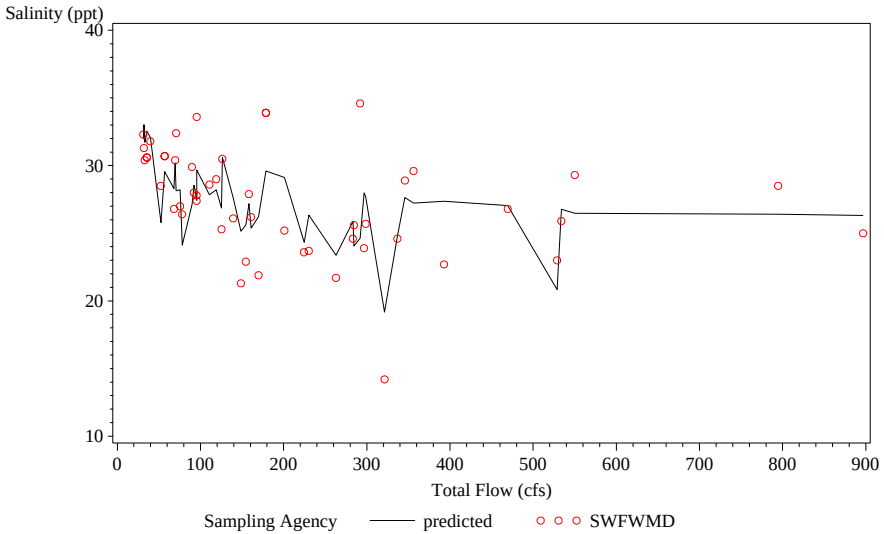


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=Bottom

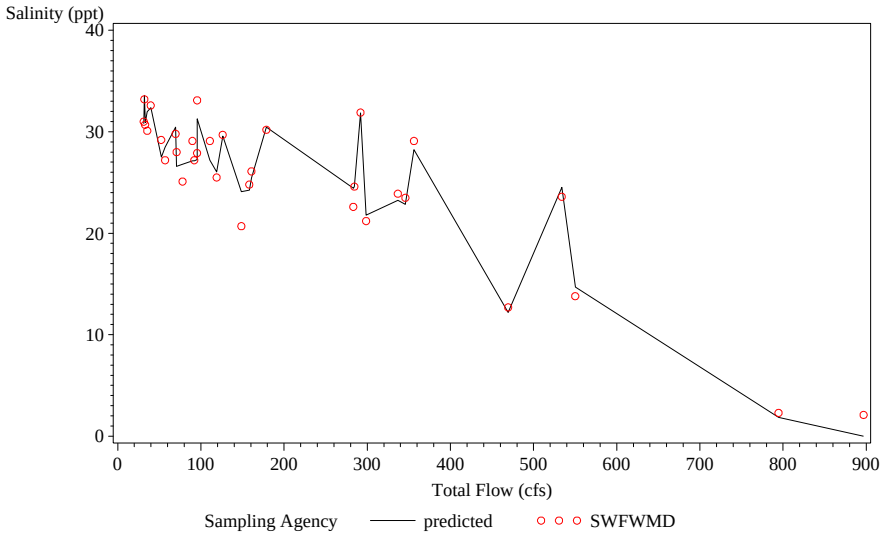


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=Surface

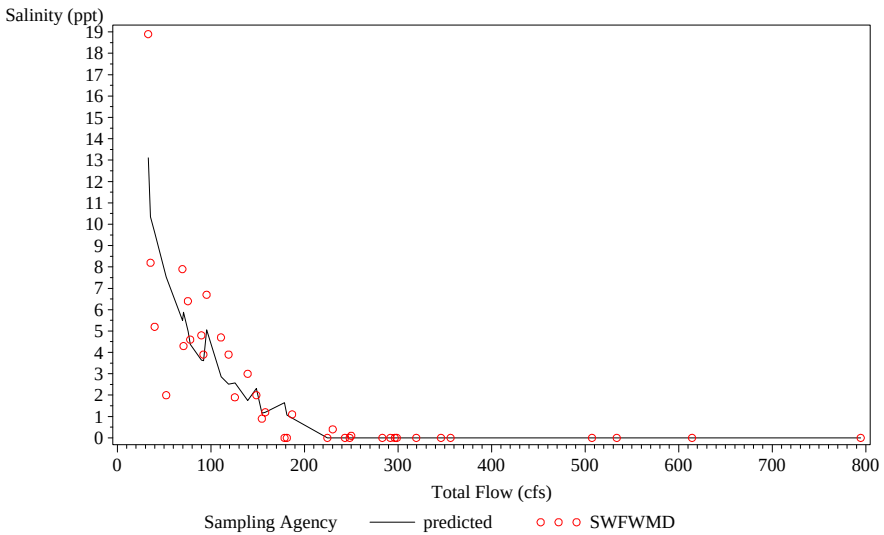


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=1 Meter

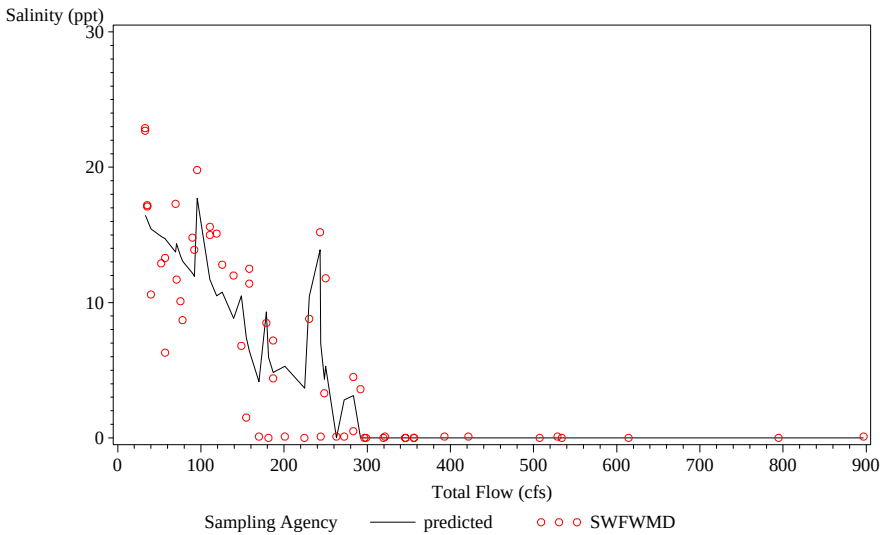


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=Bottom

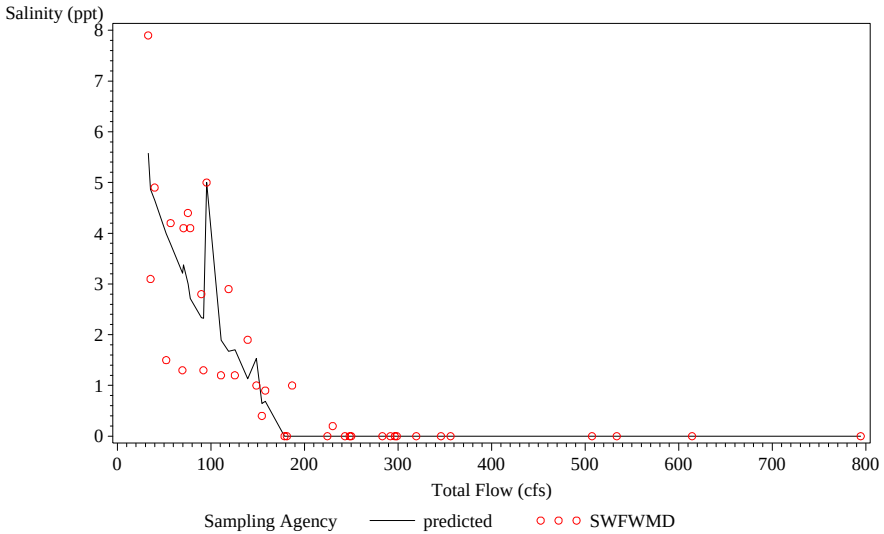


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=Surface

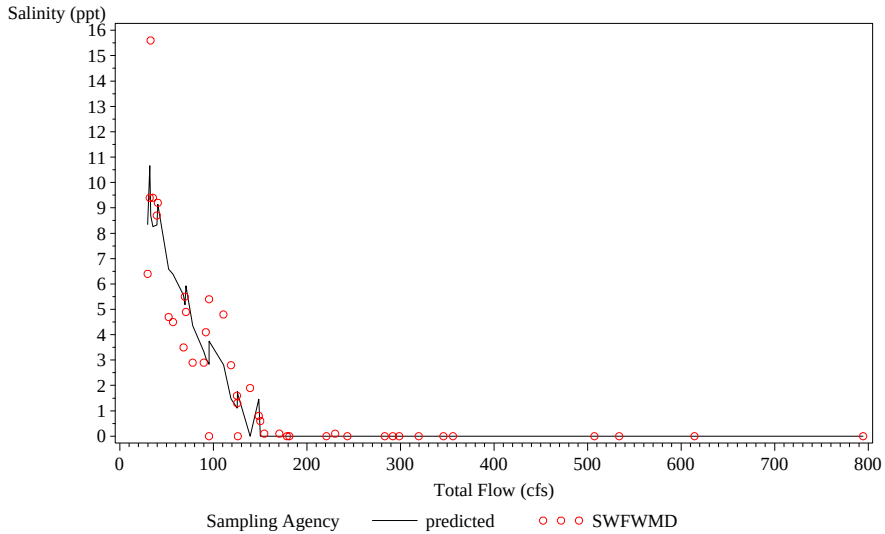


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=1 Meter

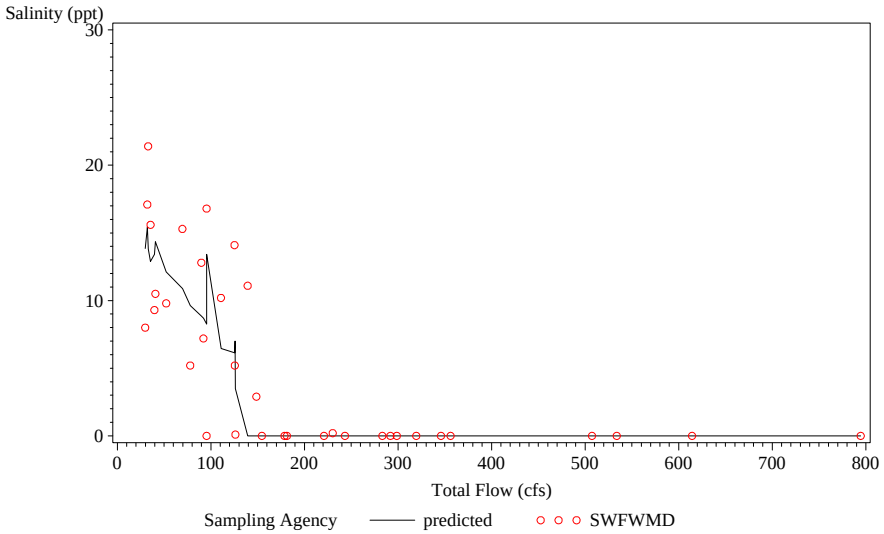


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=2 Meter

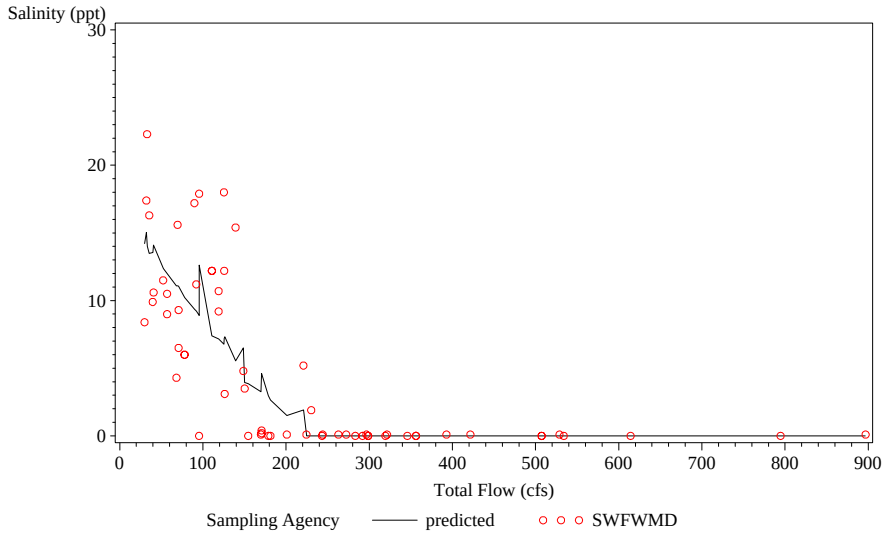


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=Bottom

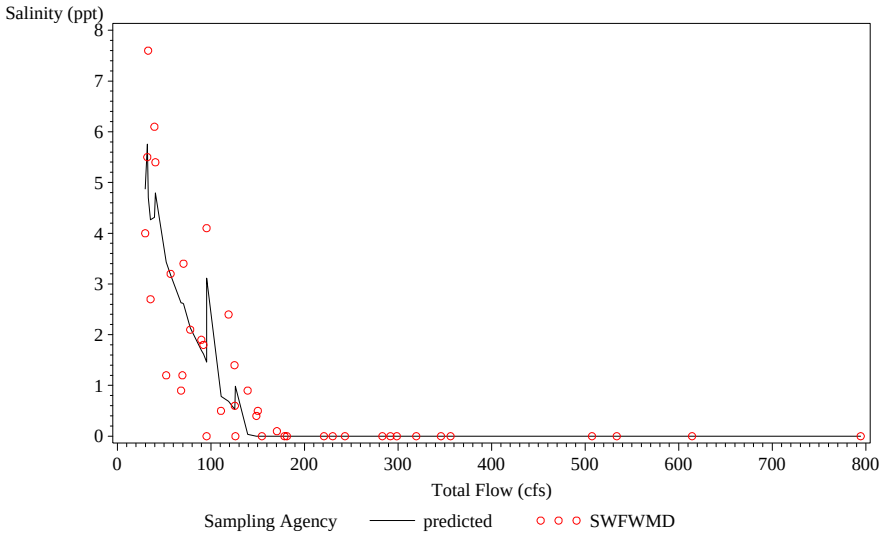


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=Surface

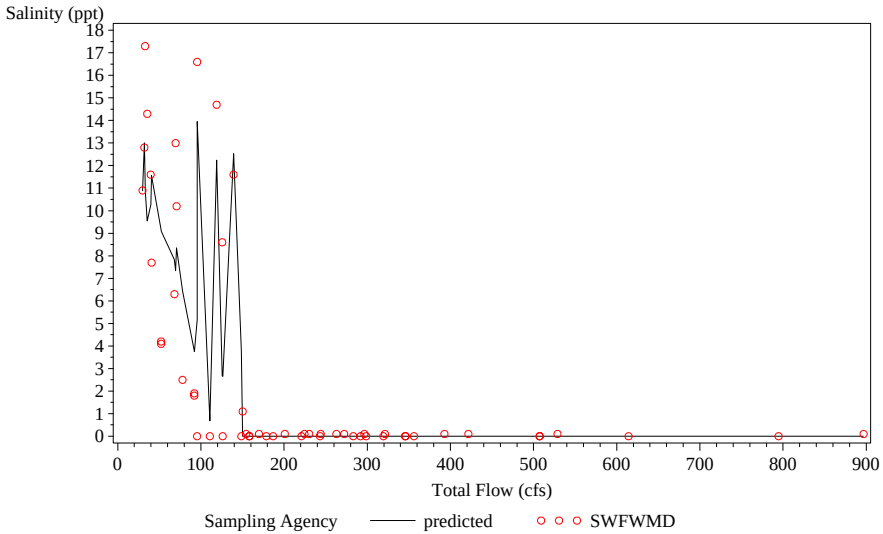


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=13 Sample Level=Bottom

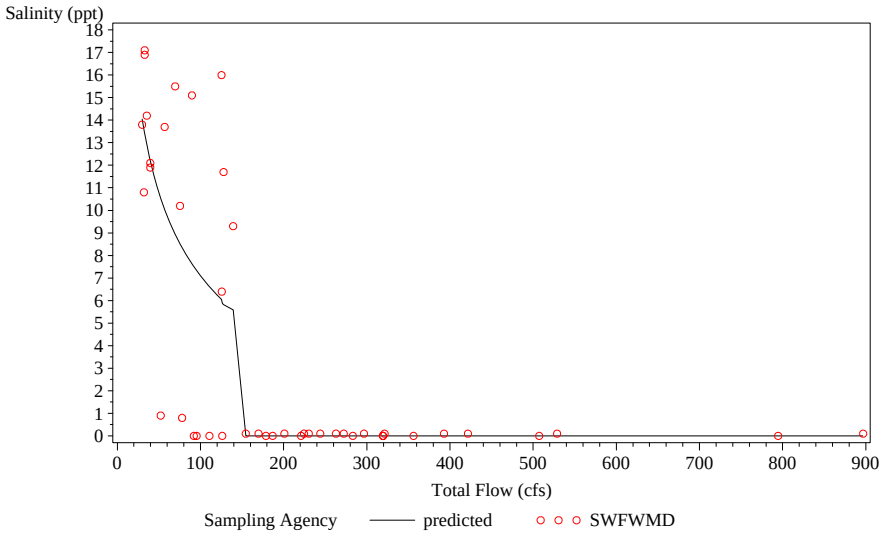


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=14 Sample Level=Bottom

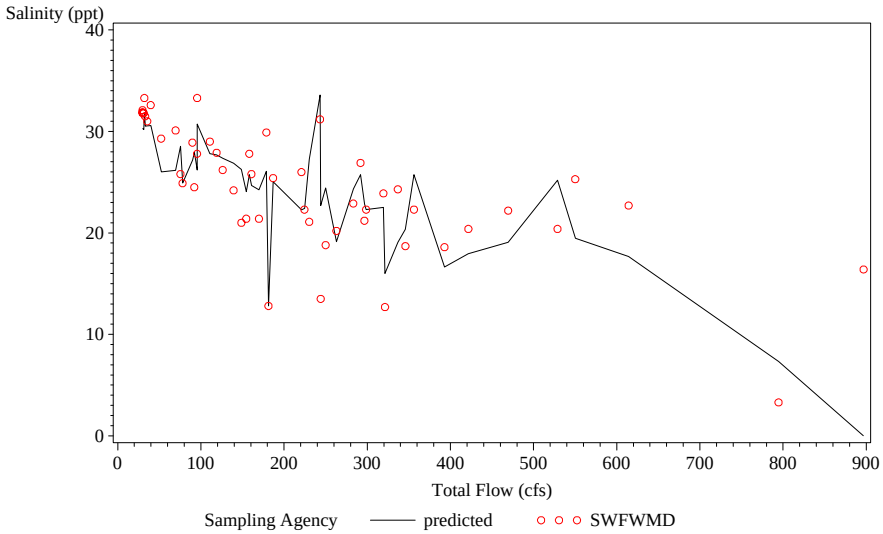


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=1 Meter

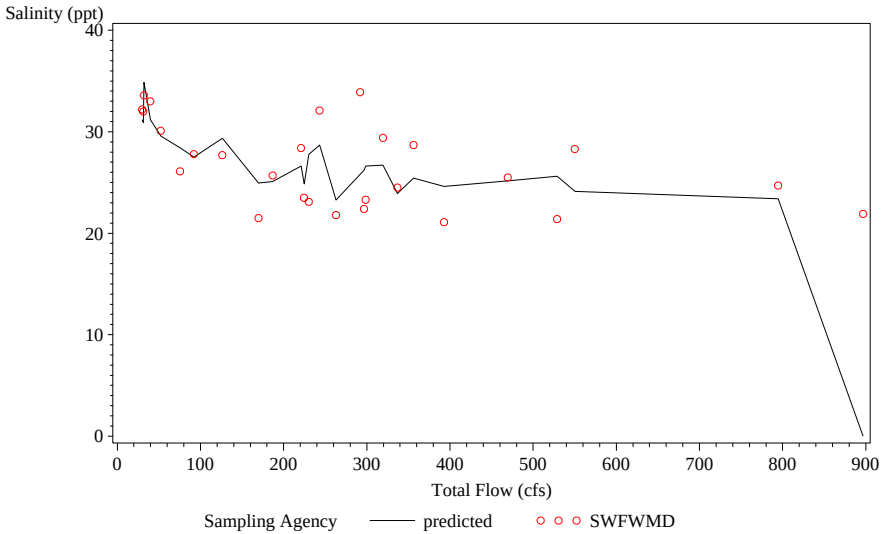


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=2 Meter

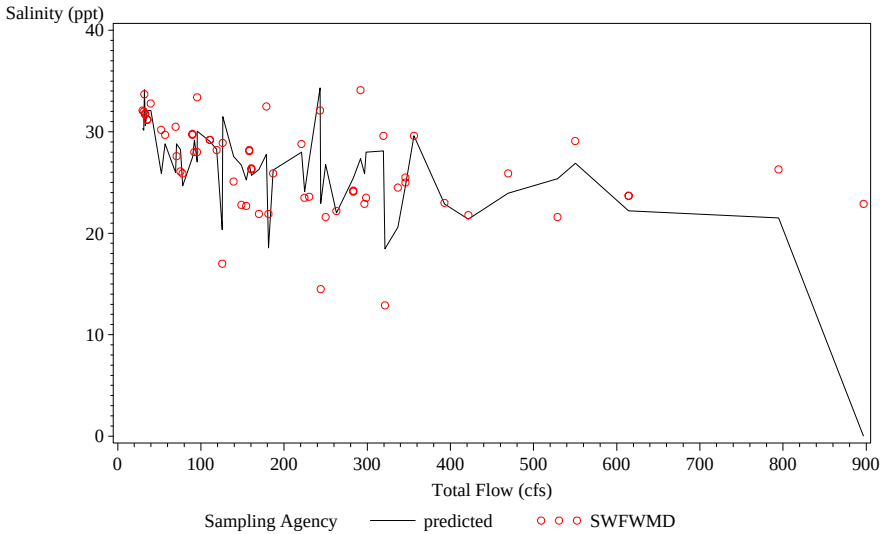


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=Bottom

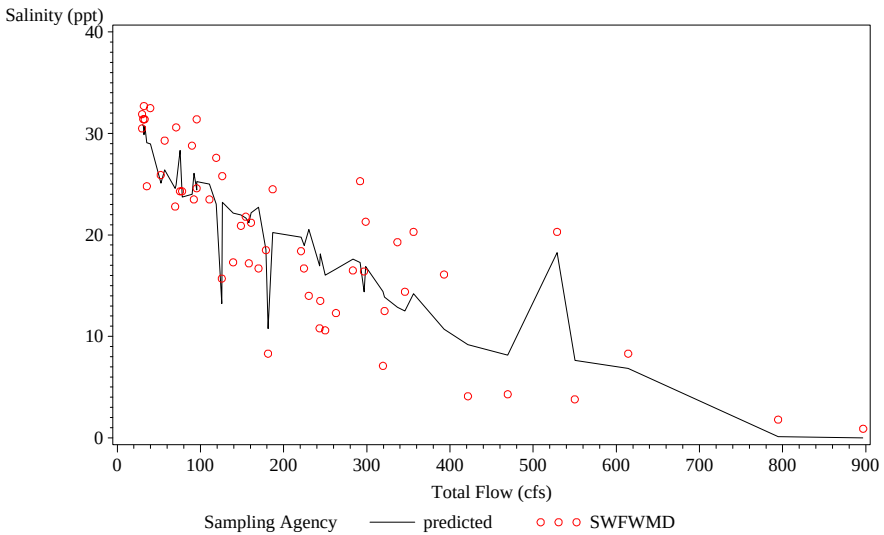


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=Surface

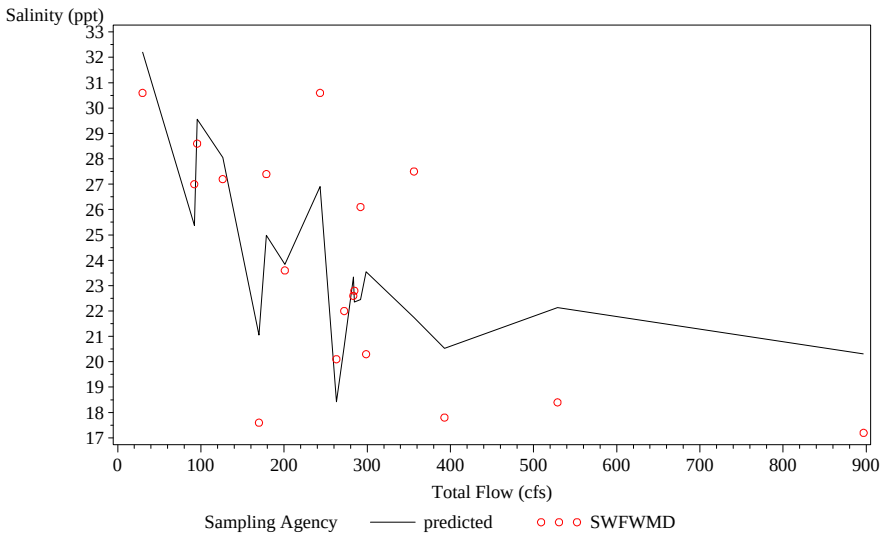


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=1 Meter

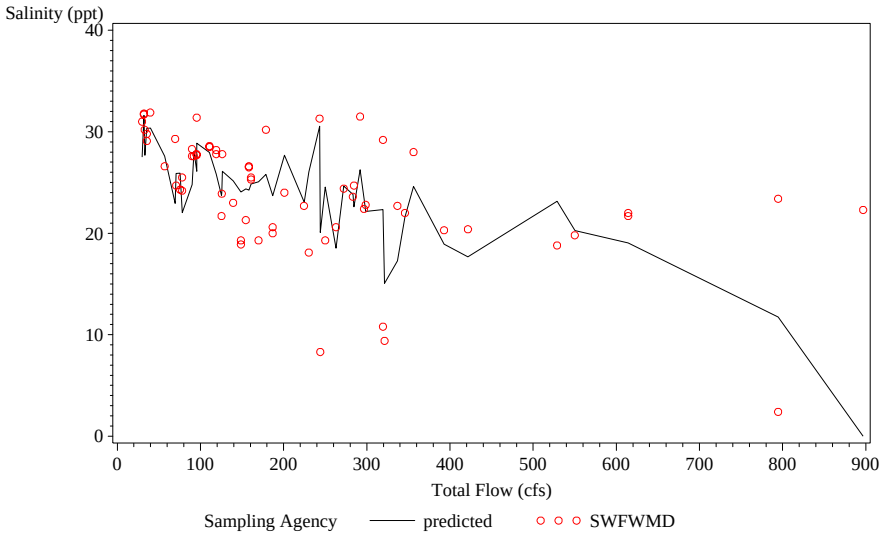


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=Bottom

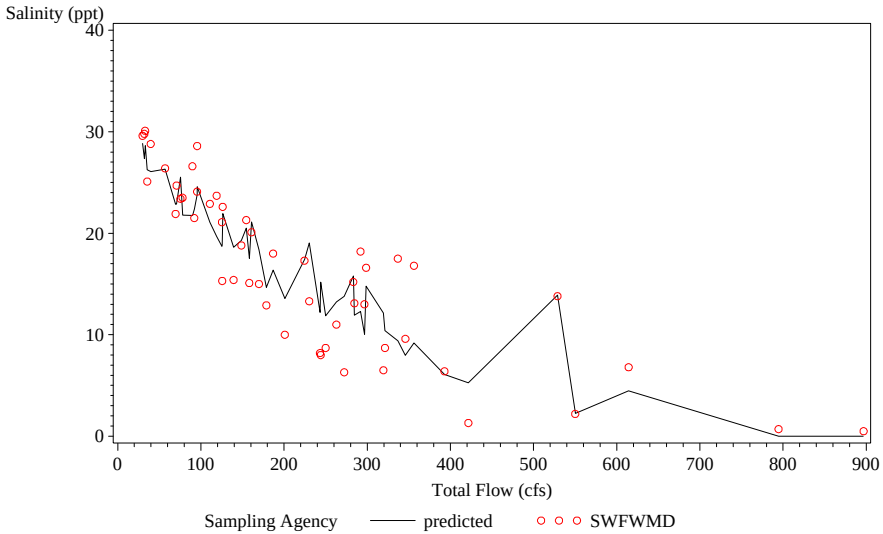


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=Surface

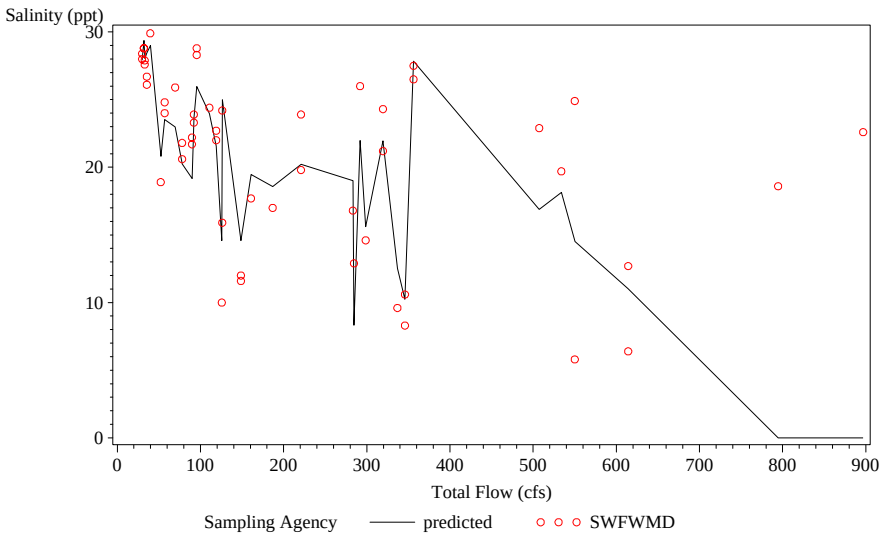


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=4 Sample Level=Bottom

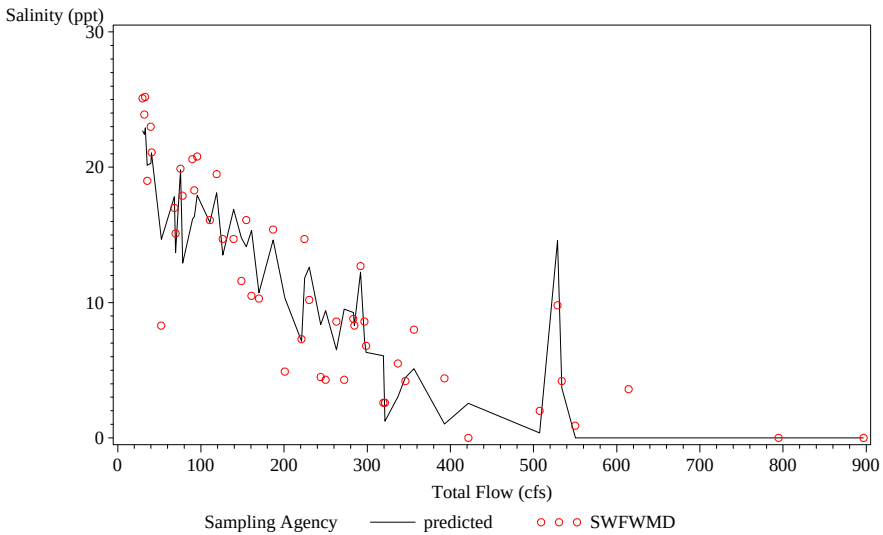


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=4 Sample Level=Surface

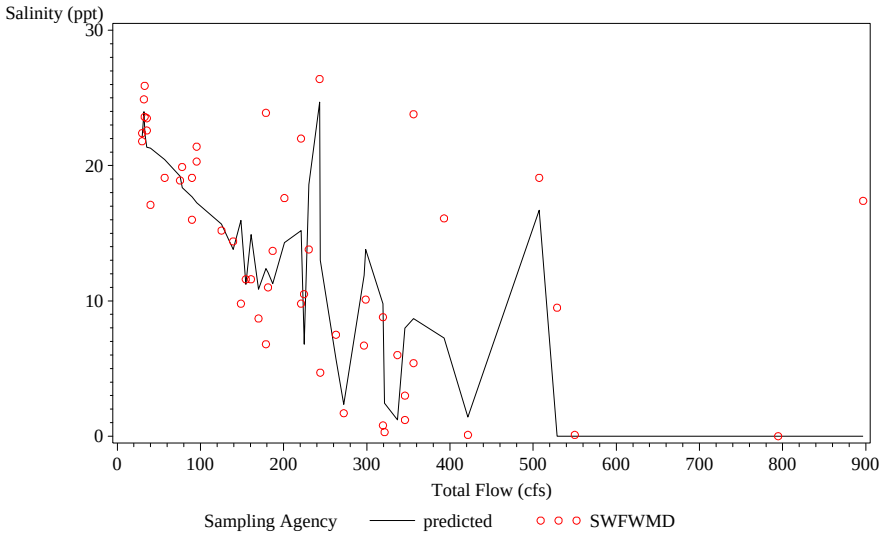


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=5 Sample Level=Bottom

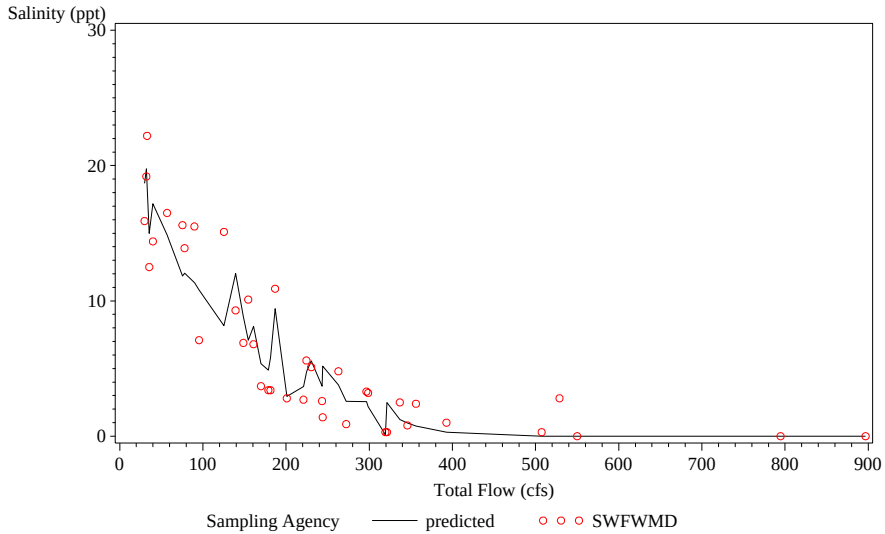


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=5 Sample Level=Surface

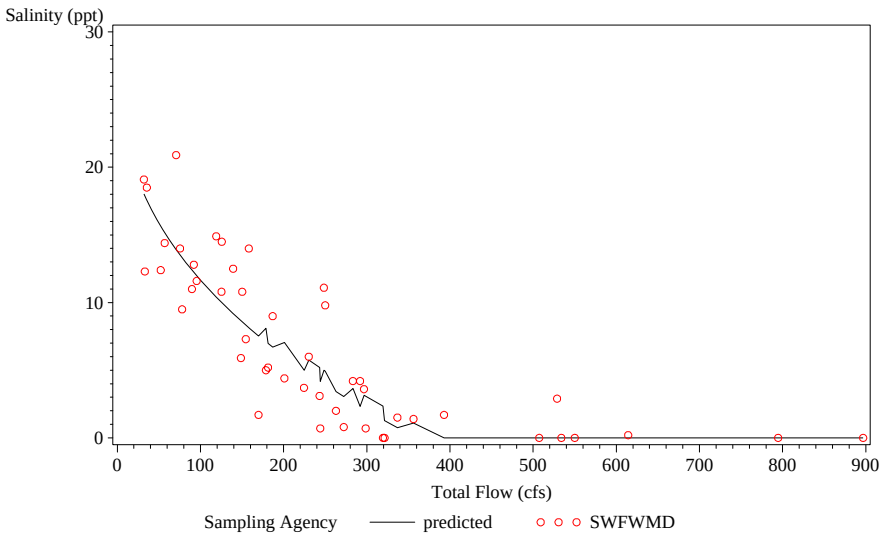


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=1 Meter

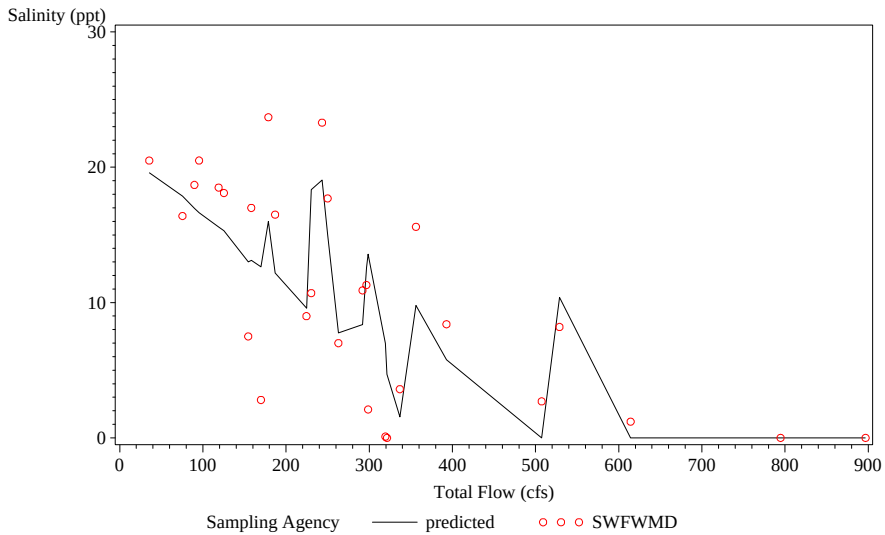


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=2 Meter

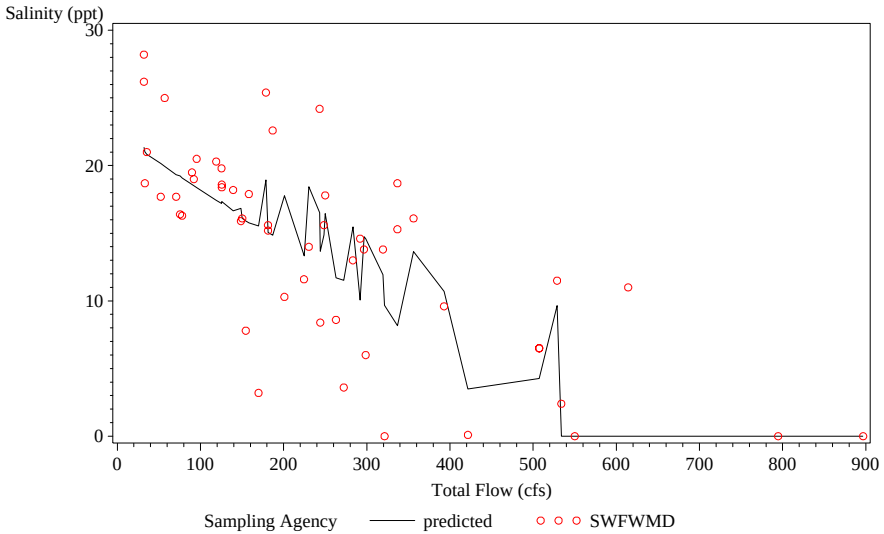


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=Bottom

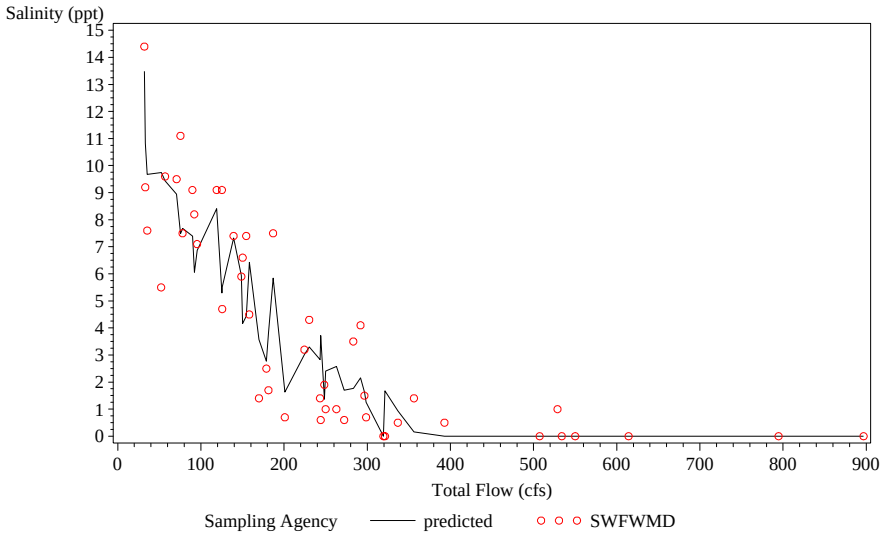


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=Surface

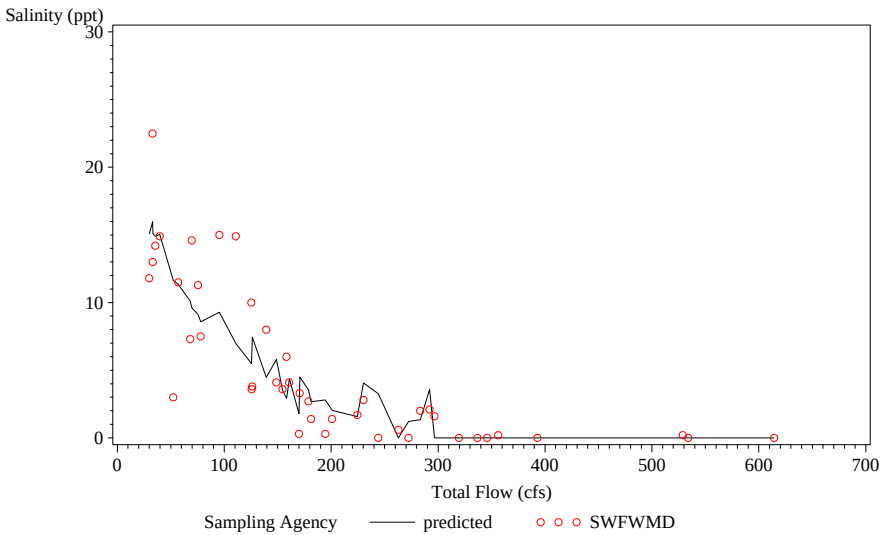


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=1 Meter

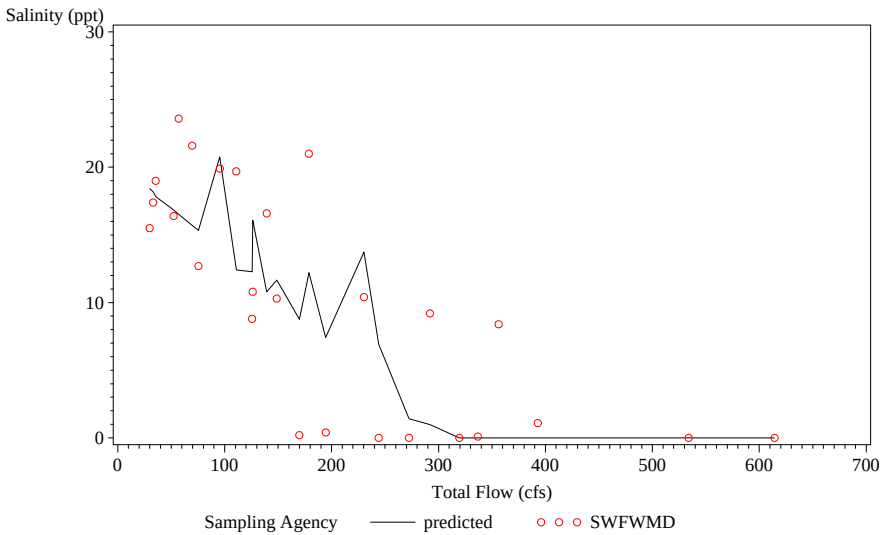


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=2 Meter

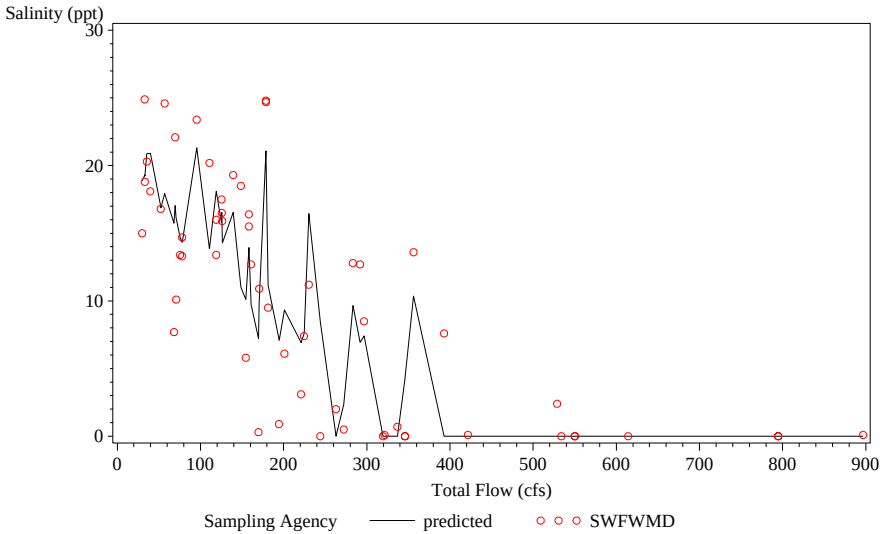


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=Bottom

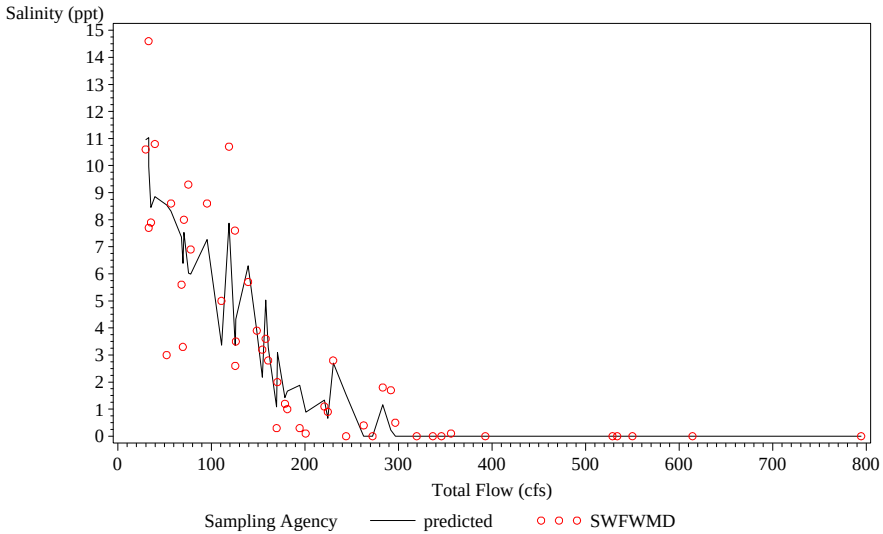


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=Surface

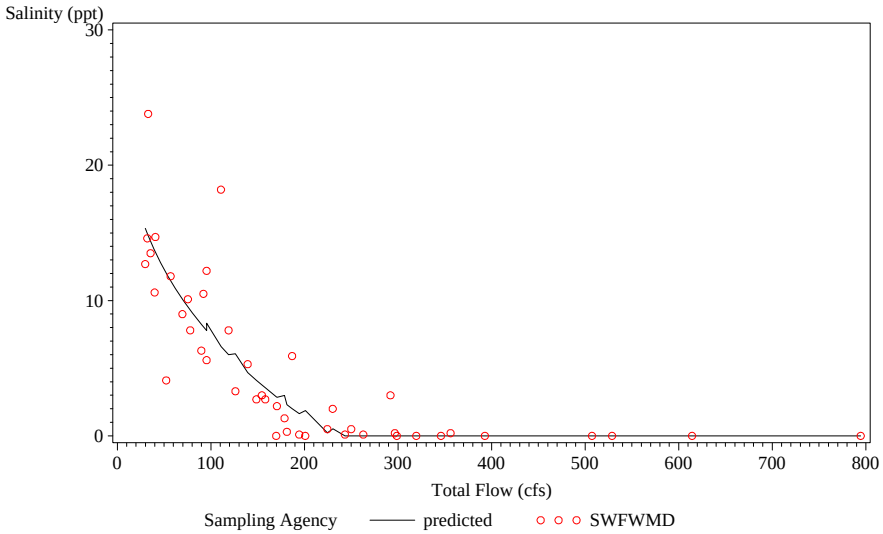


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=1 Meter

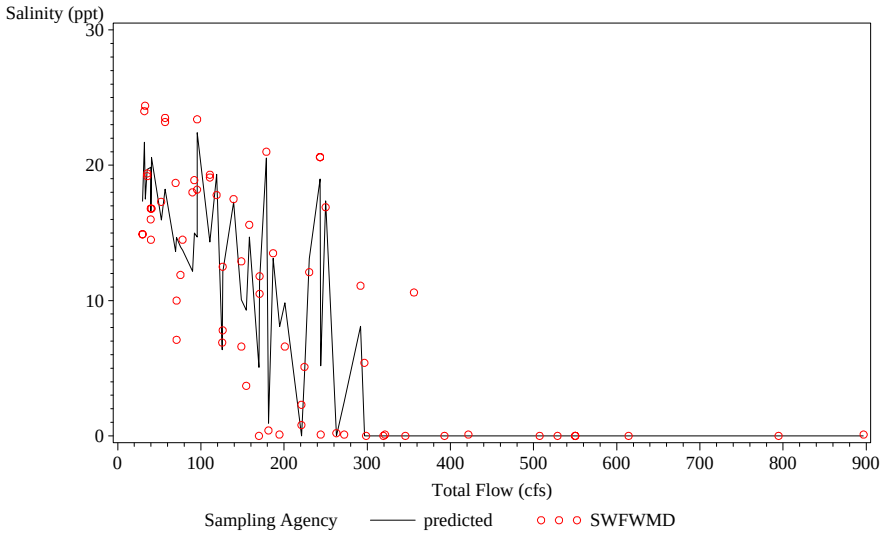


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=Bottom

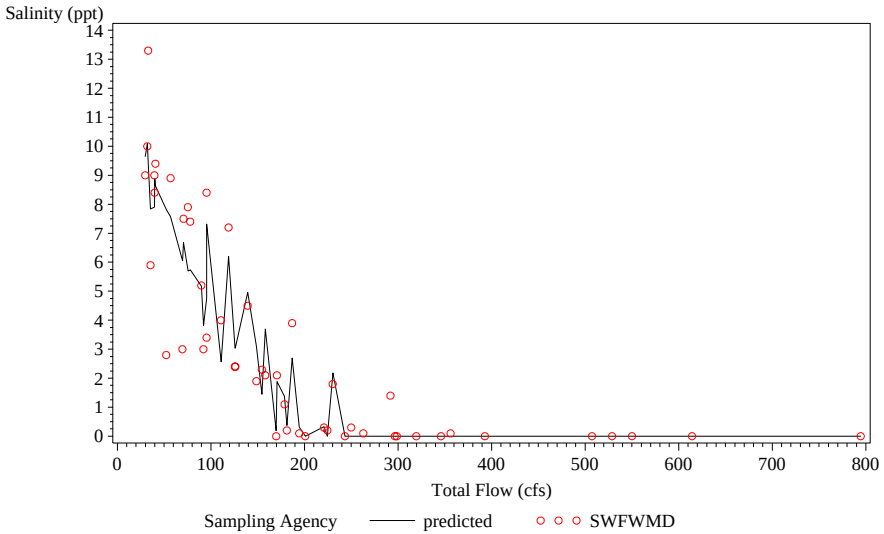


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=Surface

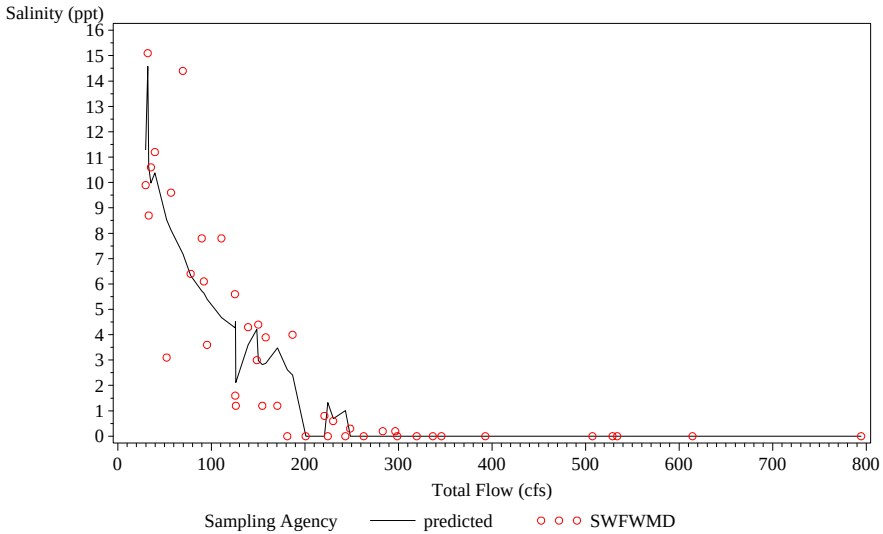


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=1 Meter

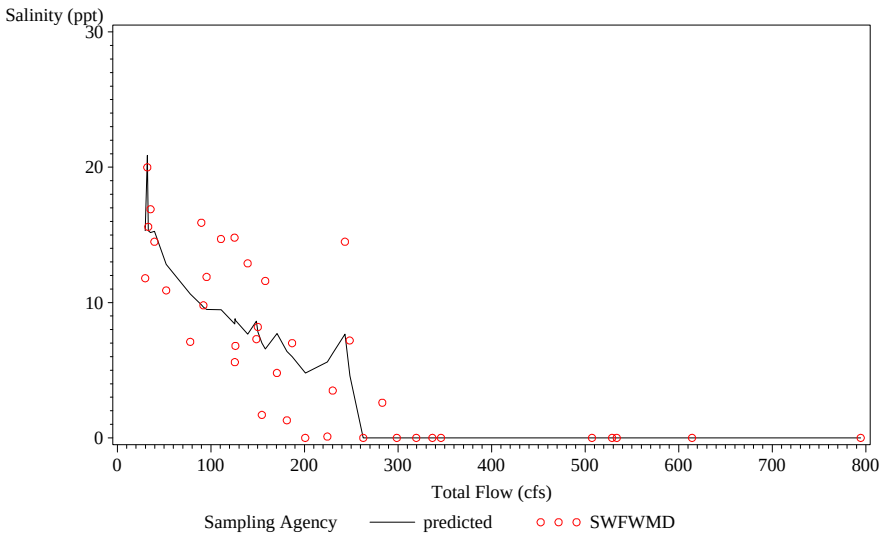


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=2 Meter

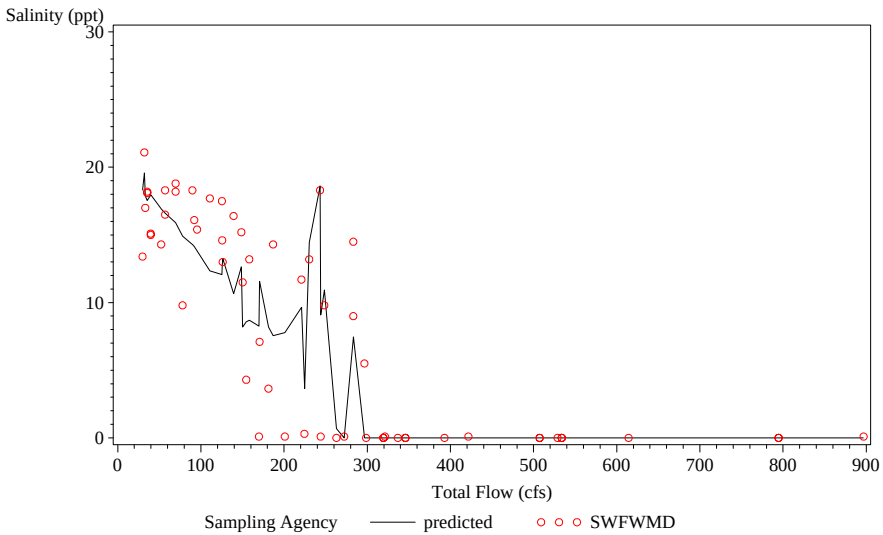


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=Bottom

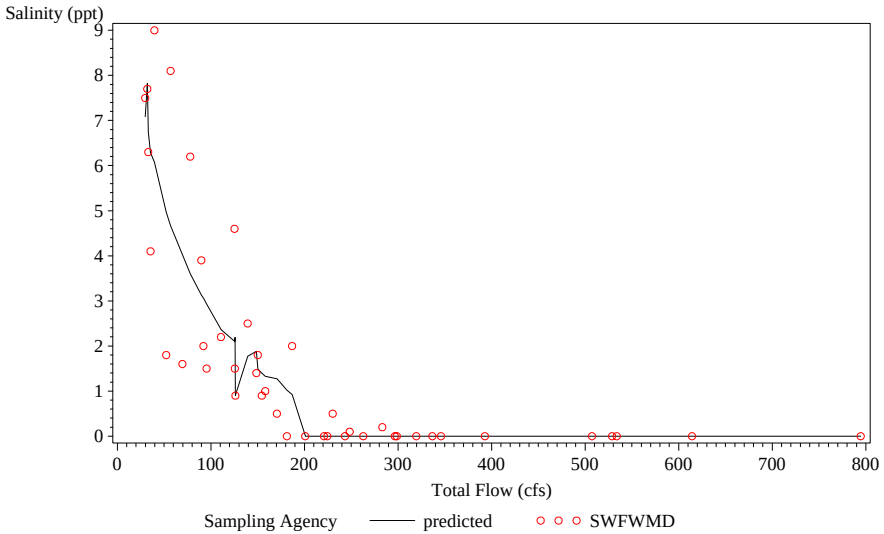


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=Surface

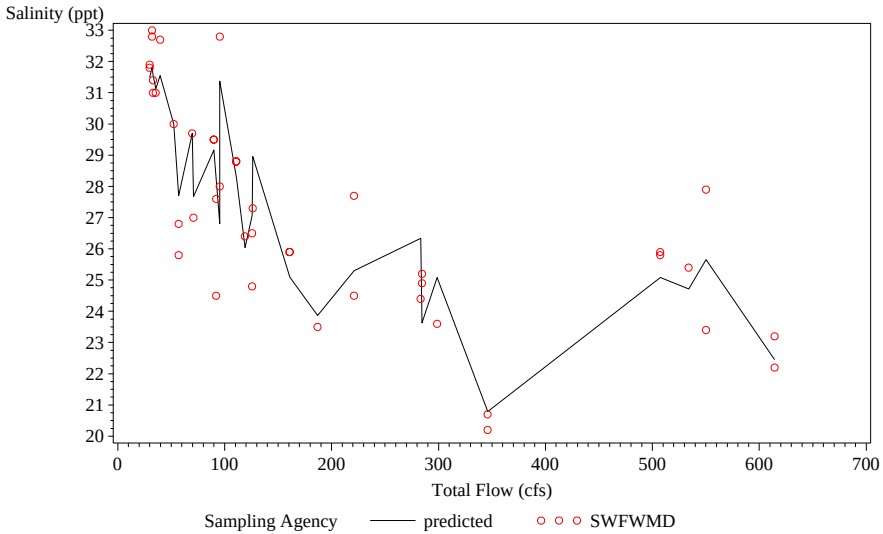


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=B Sample Level=Bottom

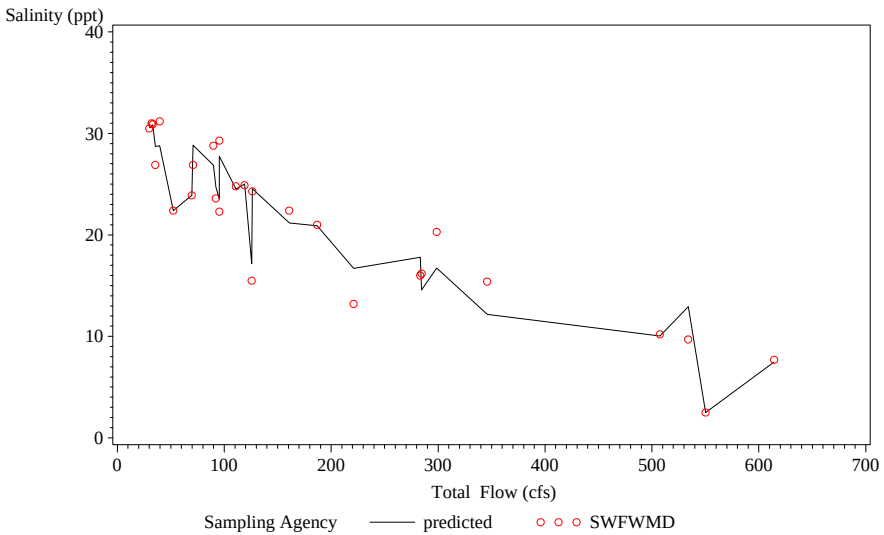


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=B Sample Level=Surface

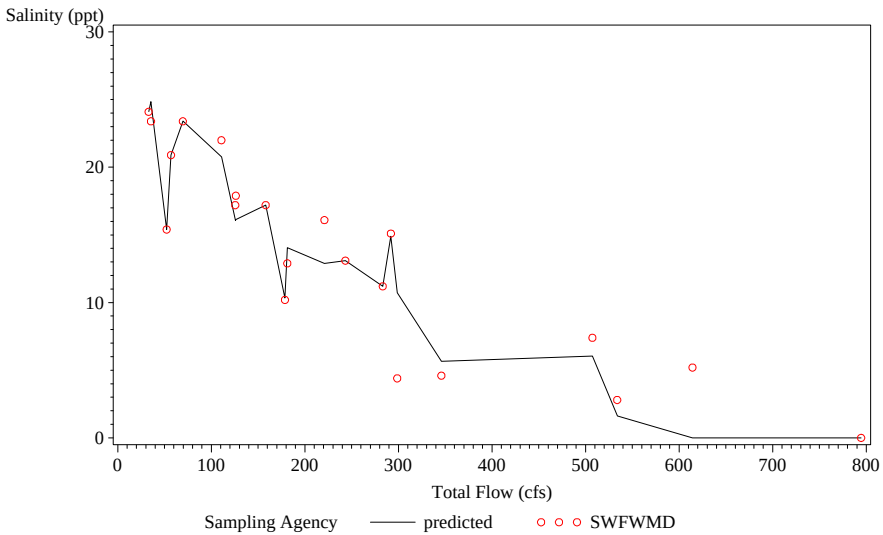


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=1 Meter

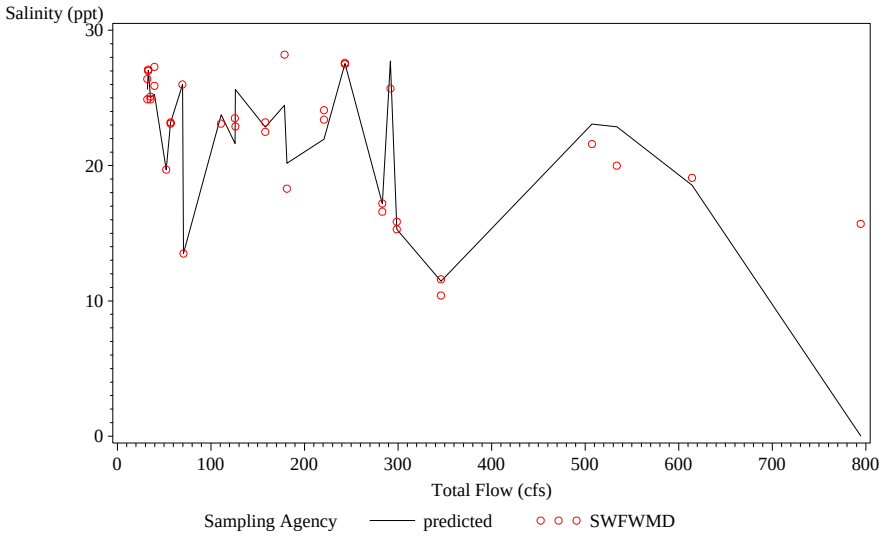


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=Bottom

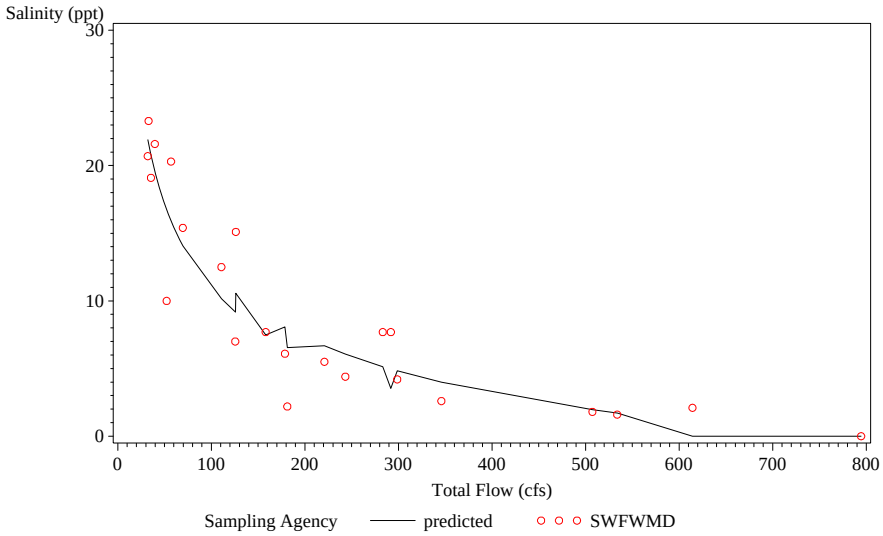


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=Surface



Alafia River Analyses

R Square Result for SWFWMD Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

Station	Sample Level	CSS Observed Salinity	USS Residual Salinity	Rsquare
1	1 Meter	1346.76	442.18	0.67167
1	2 Meter	548.81	284.16	0.48222
1	Bottom	772.44	380.91	0.50687
1	Surface	1860.94	49.19	0.97357
10	1 Meter	509.94	113.91	0.77663
10	Bottom	2836.62	642.73	0.77342
10	Surface	142.55	28.56	0.79965
11	1 Meter	531.18	94.33	0.82241
11	2 Meter	1509.07	499.82	0.66879
11	Bottom	2504.48	878.35	0.64929
11	Surface	159.02	34.92	0.78043
13	Bottom	1490.40	289.06	0.80605
14	Bottom	1767.48	636.20	0.64005
2	1 Meter	1893.21	771.76	0.59235
2	2 Meter	455.29	706.76	-0.55234
2	Bottom	1231.24	1006.35	0.18265
2	Surface	3910.11	786.57	0.79884
3	1 Meter	348.02	131.85	0.62114
3	Bottom	2166.24	1583.99	0.26879
3	Surface	3367.26	559.47	0.83385

Alafia River Analyses

R Square Result for SWFWMD Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

Station	Sample Level	CSS Observed Salinity	USS Residual Salinity	Rsquare
4	Bottom	2189.39	1364.06	0.37697
4	Surface	2636.75	372.57	0.85870
5	Bottom	3230.71	1436.53	0.55535
5	Surface	1533.04	212.97	0.86108
6	1 Meter	1700.94	384.62	0.77388
6	2 Meter	1713.79	609.68	0.64425
6	Bottom	2857.84	1235.21	0.56778
6	Surface	690.18	125.40	0.81831
7	1 Meter	1414.72	363.43	0.74311
7	2 Meter	1761.02	631.90	0.64117
7	Bottom	3981.84	807.80	0.79713
7	Surface	693.27	124.15	0.82092
8	1 Meter	1549.25	393.66	0.74590
8	Bottom	4561.31	751.78	0.83518
8	Surface	641.71	82.75	0.87105
9	1 Meter	777.75	145.28	0.81320
9	2 Meter	1464.81	396.31	0.72945
9	Bottom	3454.15	660.98	0.80864
9	Surface	283.13	62.98	0.77754
B	Bottom	472.09	66.20	0.85978

Alafia River Analyses

R Square Result for SWFWMD Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

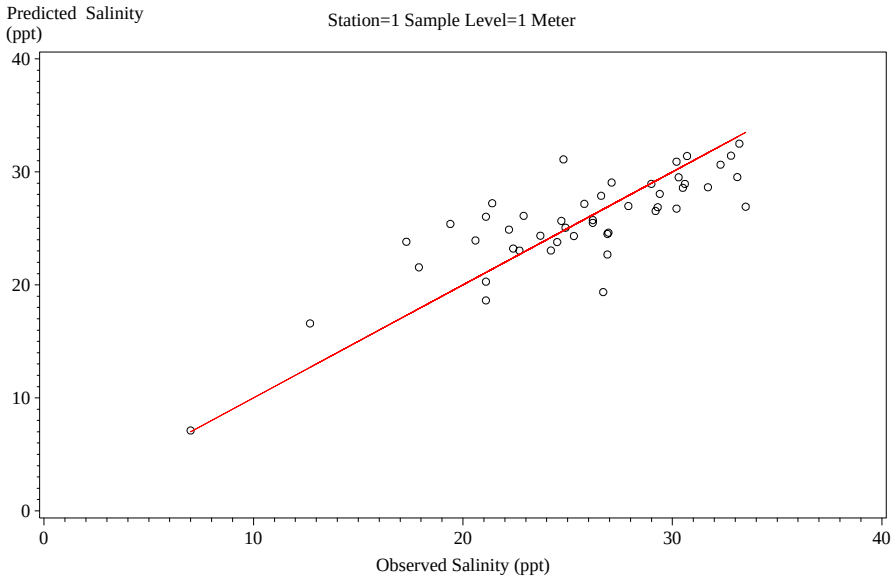
Station	Sample Level	CSS Observed Salinity	USS Residual Salinity	Rsquare
B	Surface	1586.57	78.23	0.95069
C	1 Meter	1076.57	91.13	0.91535
C	Bottom	805.76	304.48	0.62212
C	Surface	1211.75	166.40	0.86267

Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=1 Meter

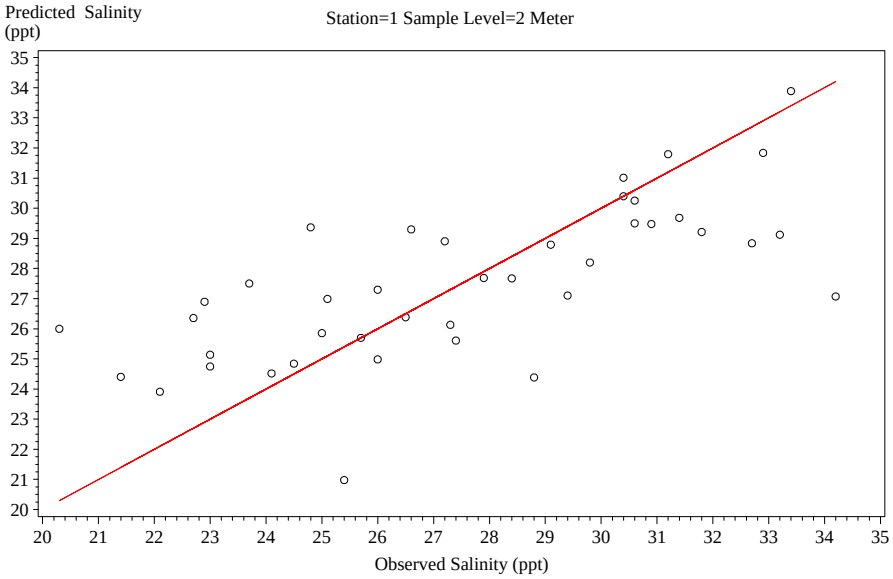


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=2 Meter

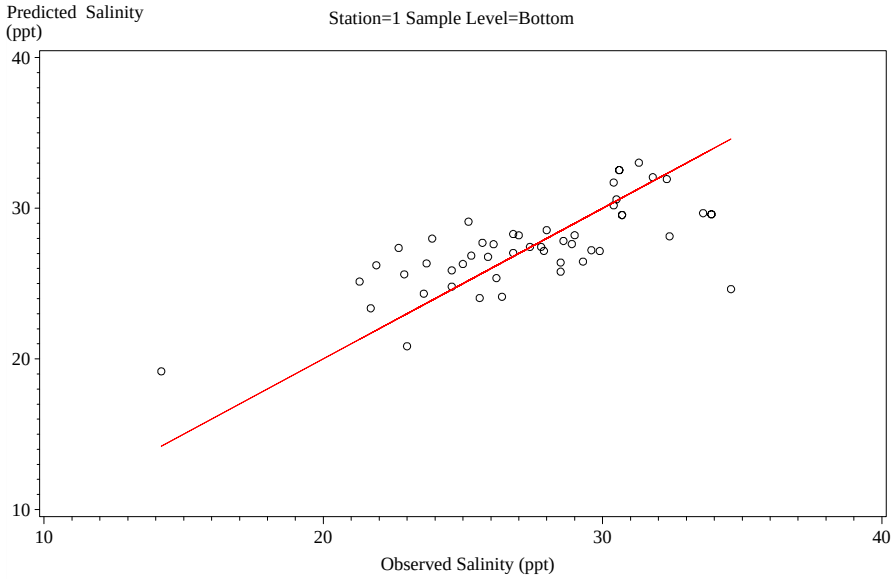


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=Bottom

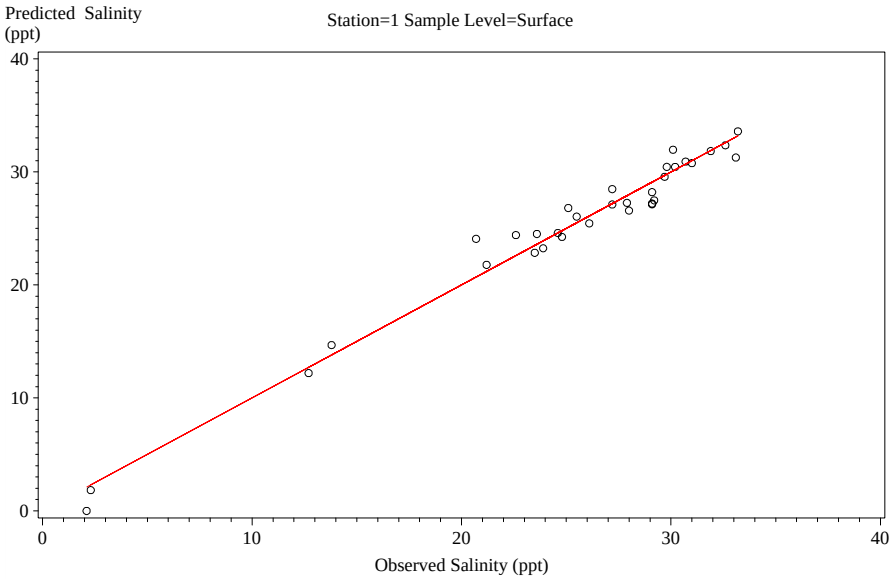


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=1 Sample Level=Surface

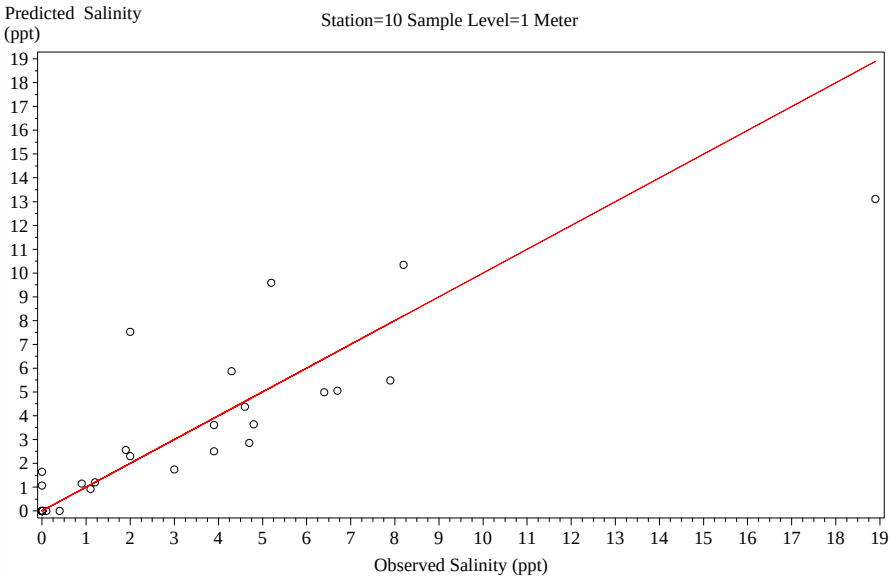


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=1 Meter

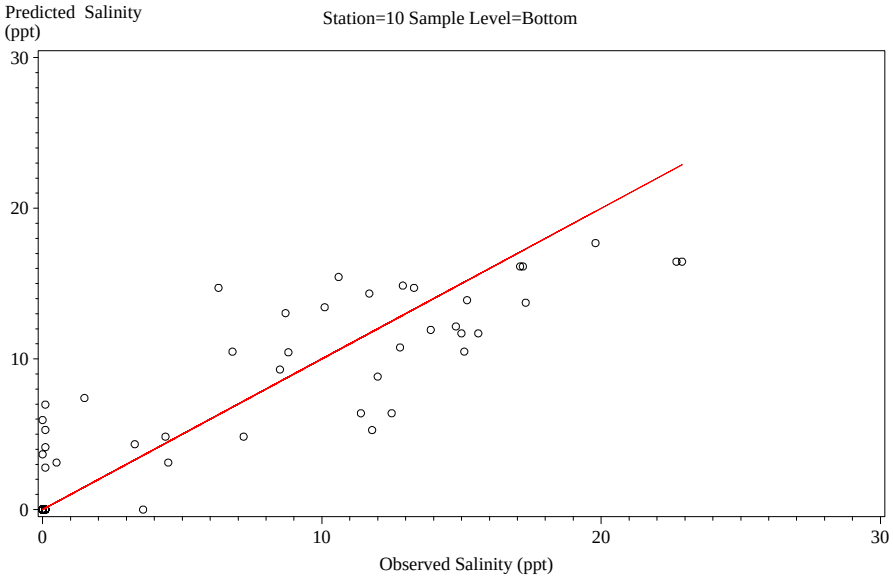


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=Bottom

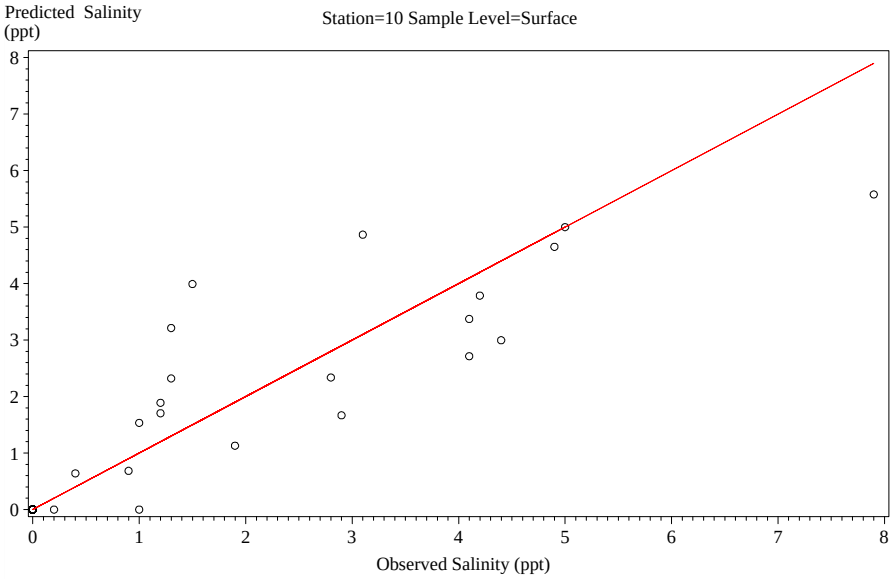


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=10 Sample Level=Surface

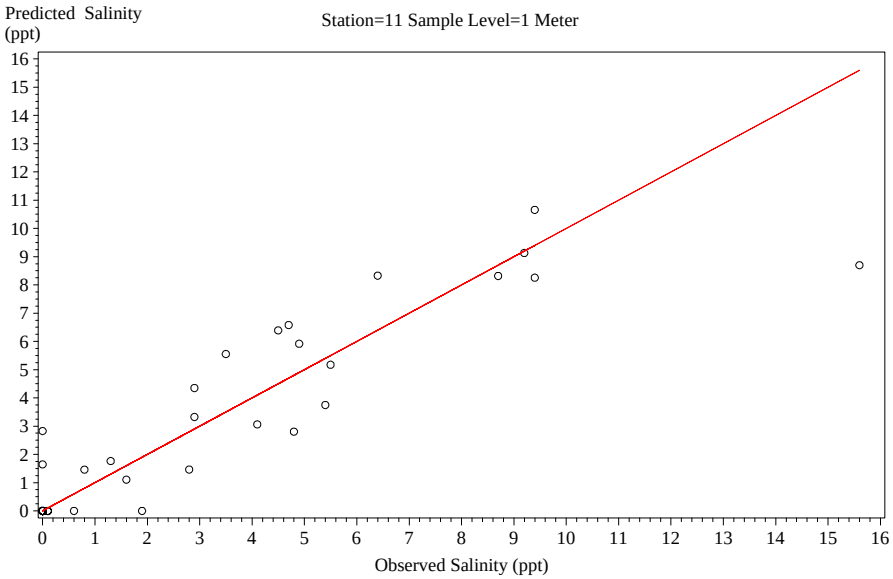


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=1 Meter

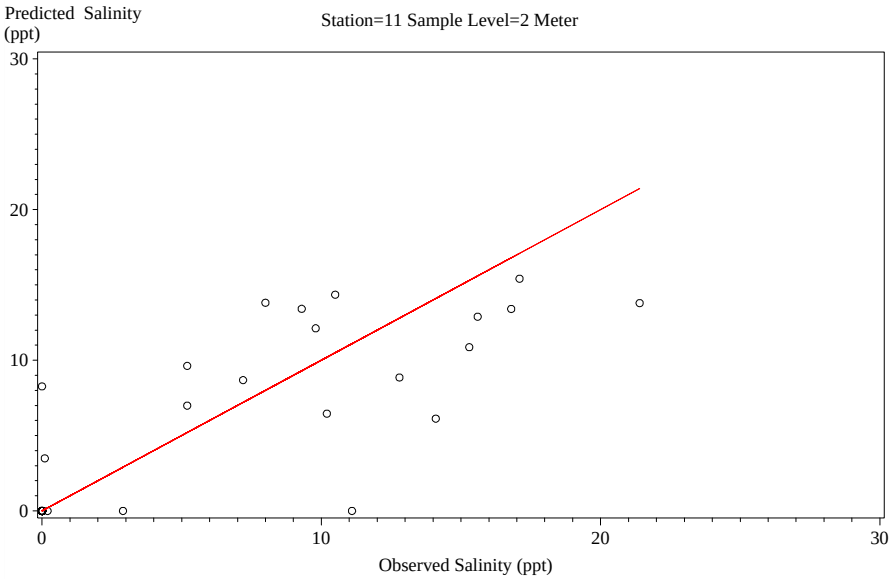


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=2 Meter

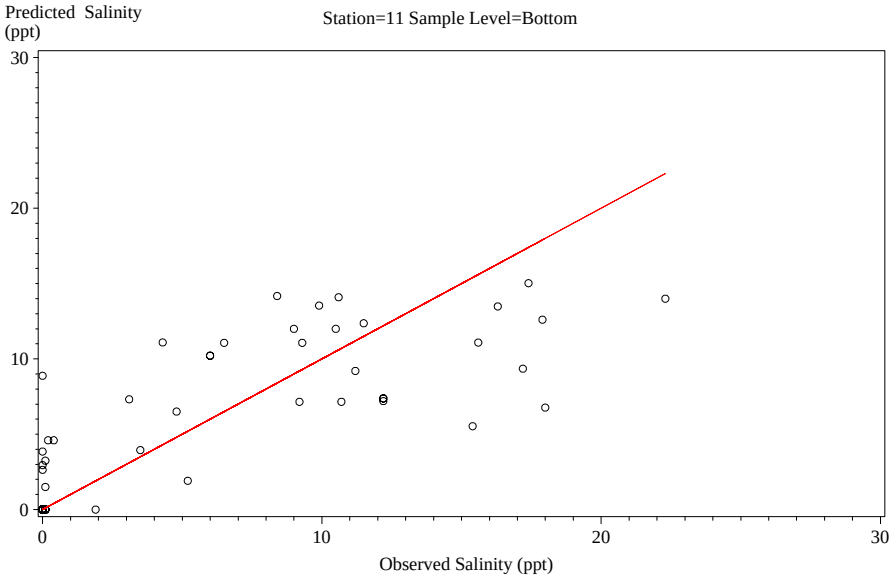


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=Bottom

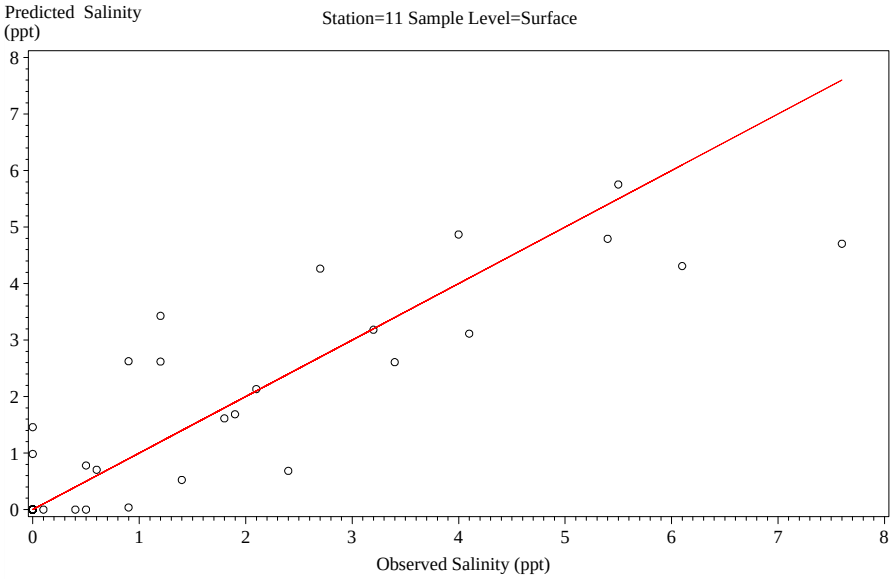


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=11 Sample Level=Surface

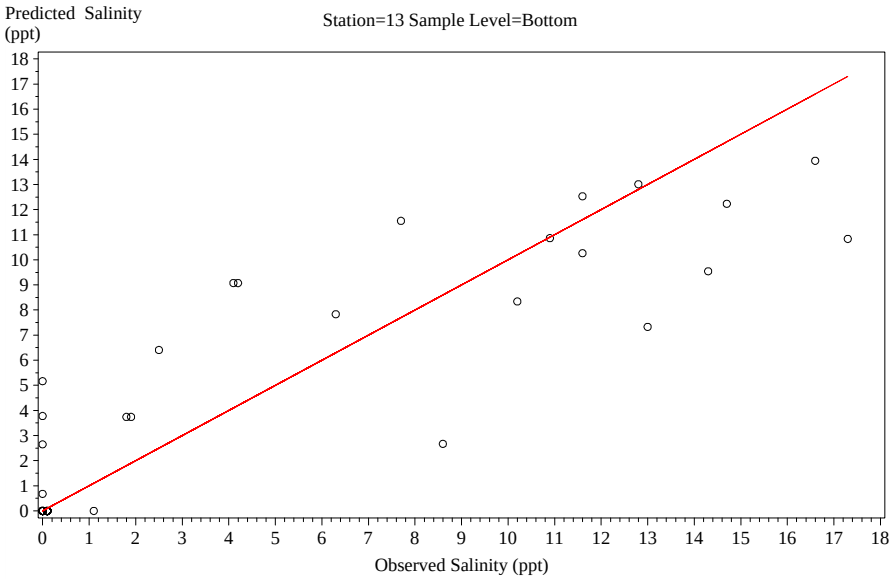


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=13 Sample Level=Bottom

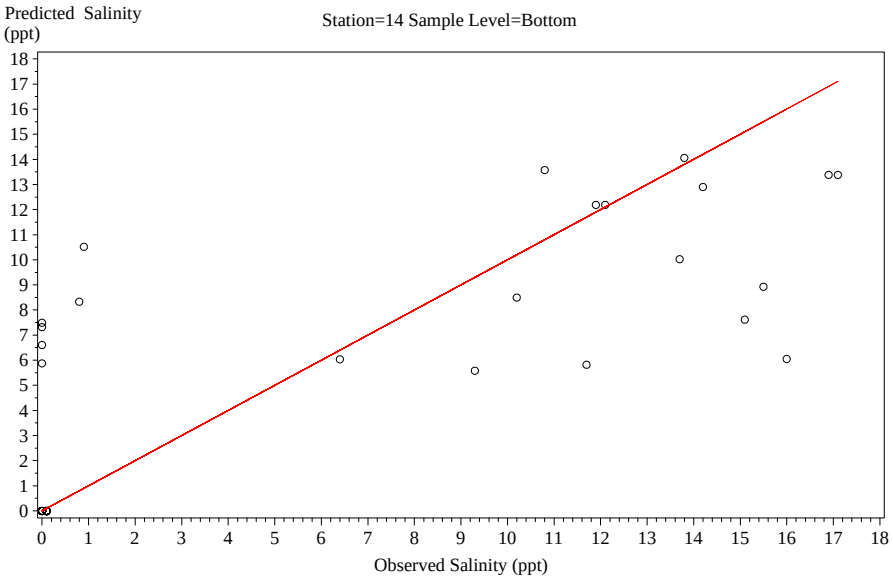


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=14 Sample Level=Bottom

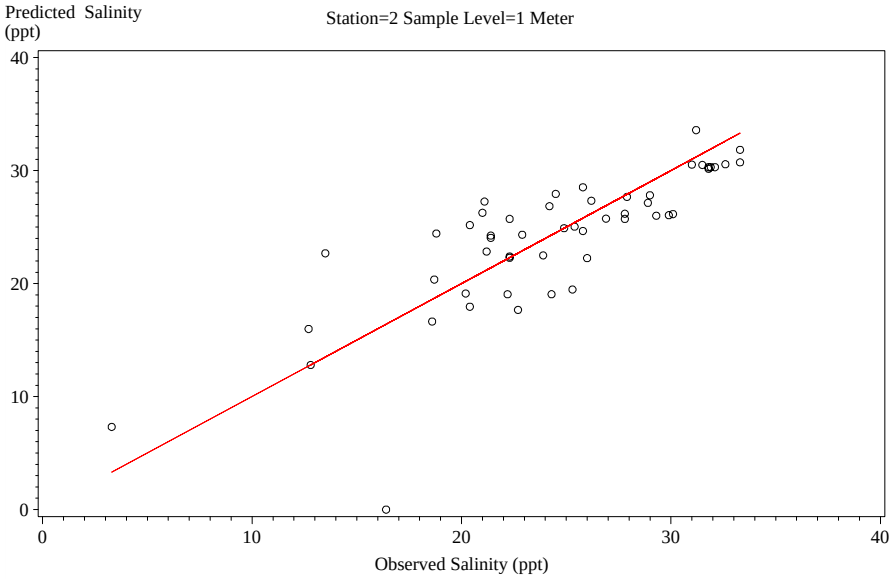


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=1 Meter

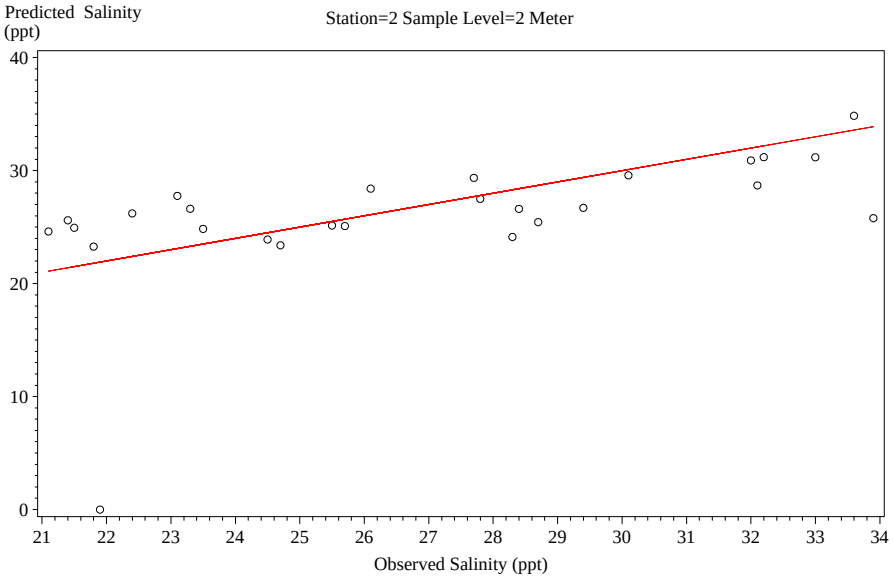


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=2 Meter

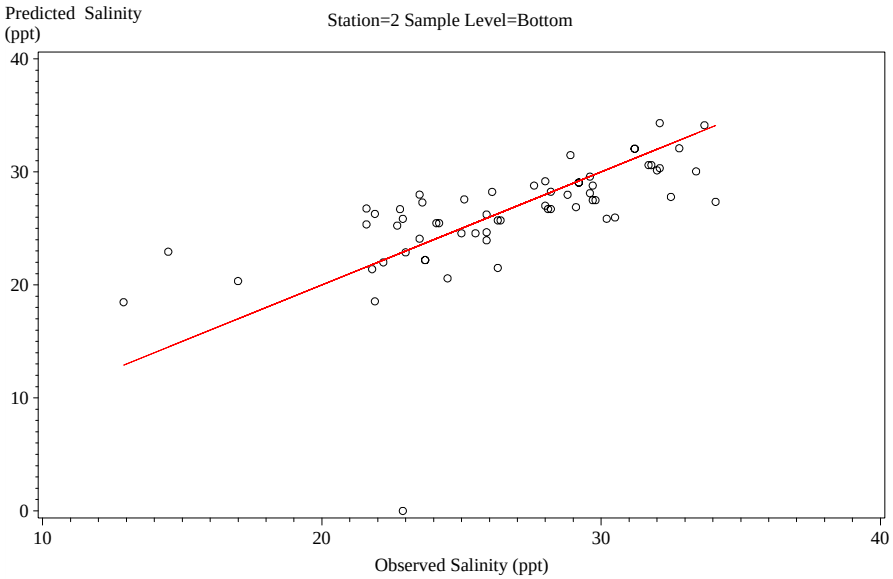


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=Bottom

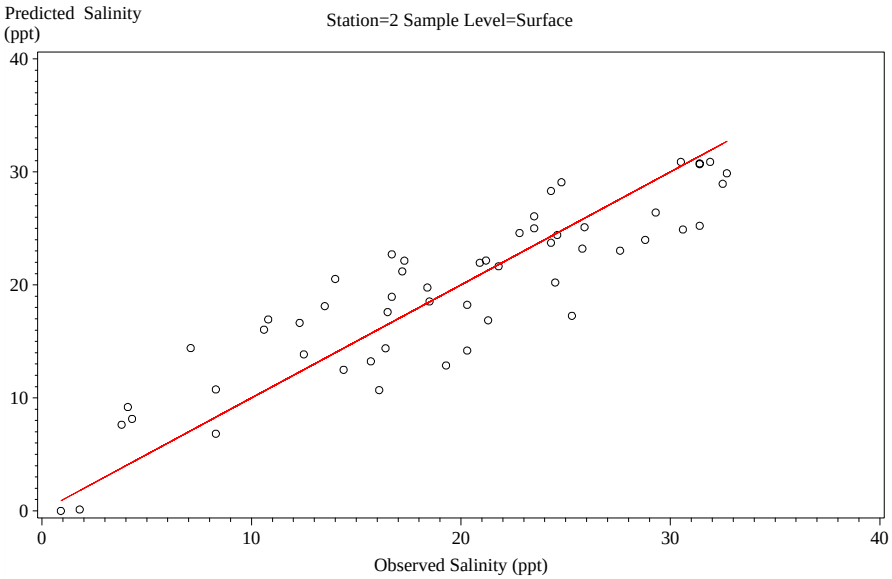


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=2 Sample Level=Surface

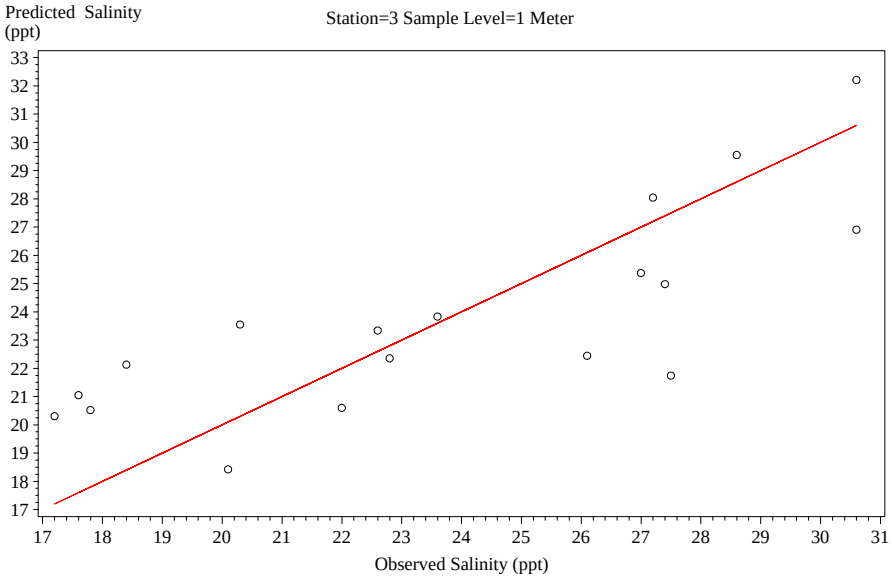


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=1 Meter

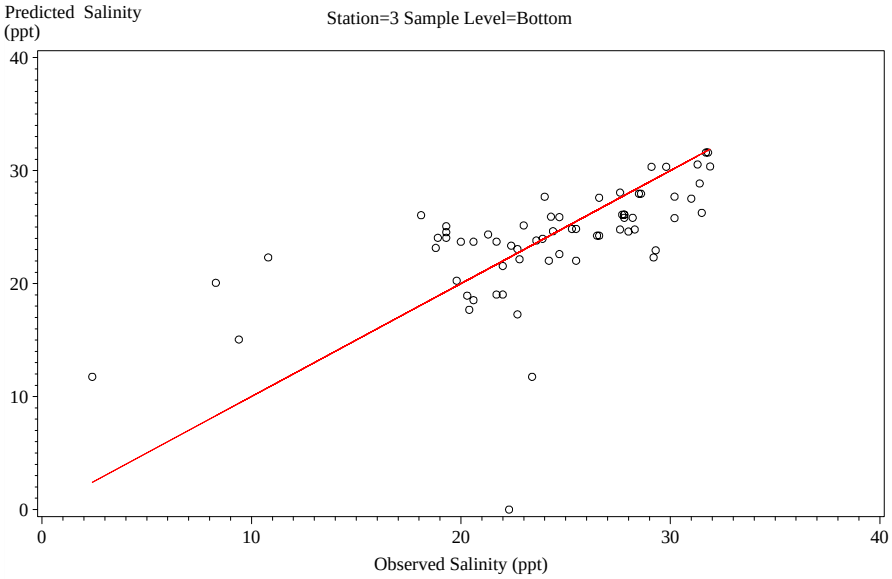


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=Bottom

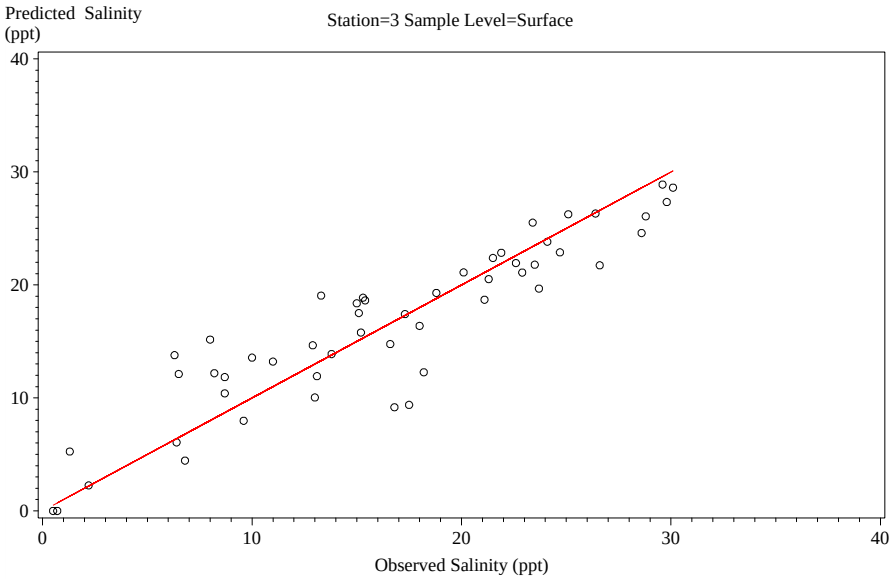


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=3 Sample Level=Surface

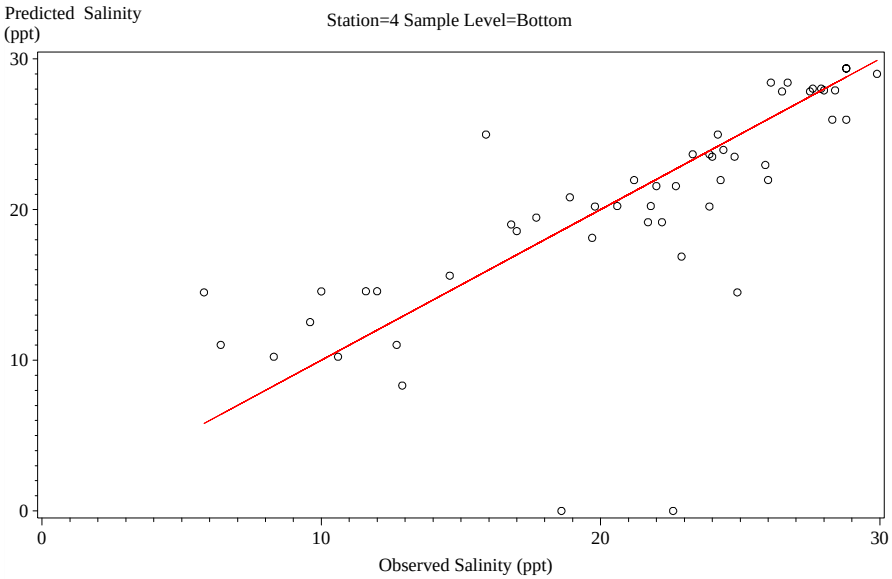


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=4 Sample Level=Bottom

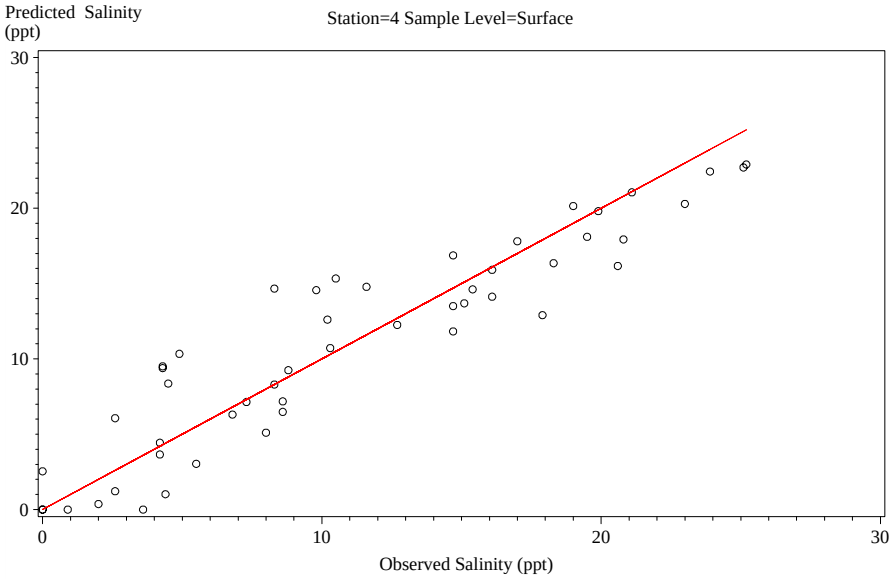


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=4 Sample Level=Surface

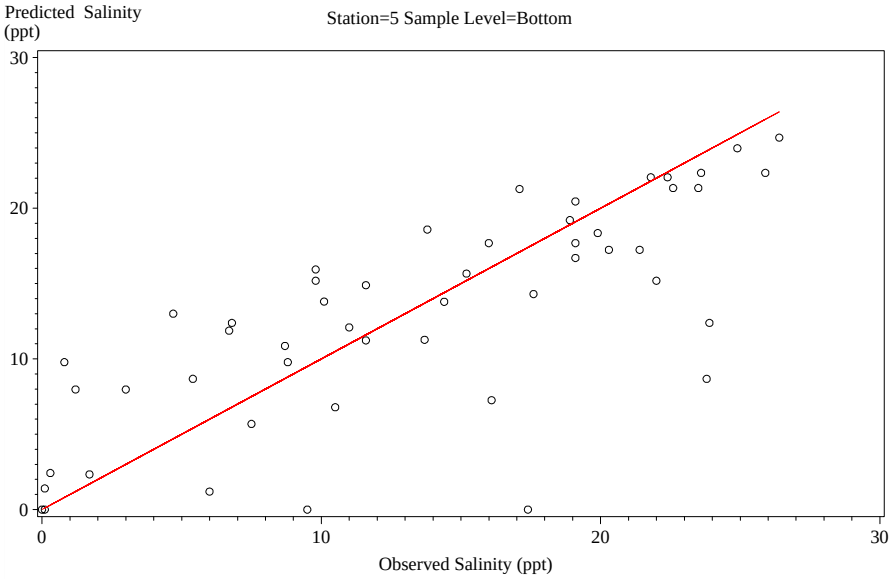


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=5 Sample Level=Bottom

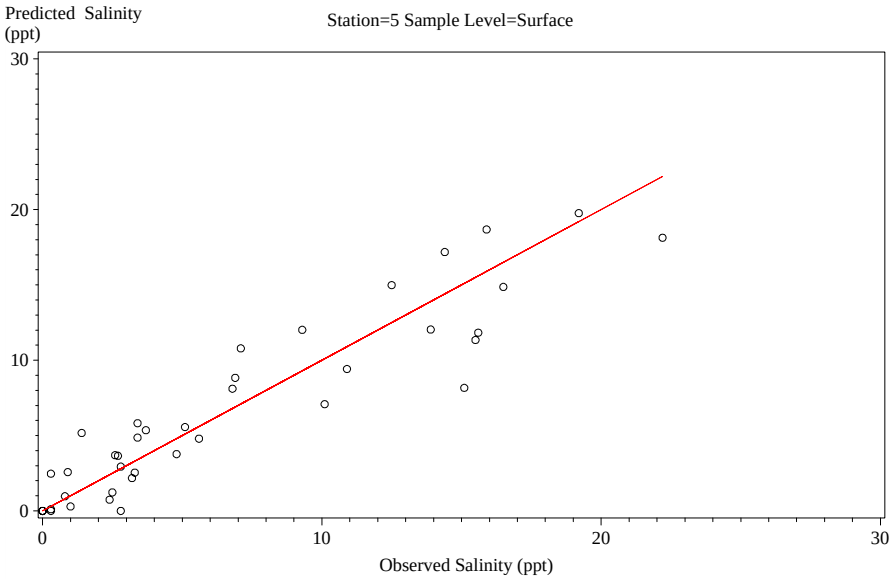


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=5 Sample Level=Surface

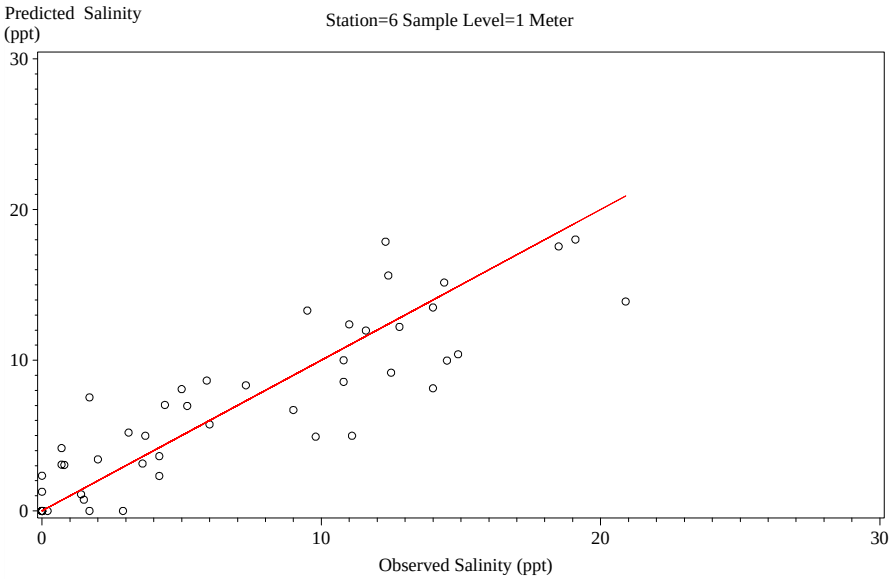


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=1 Meter

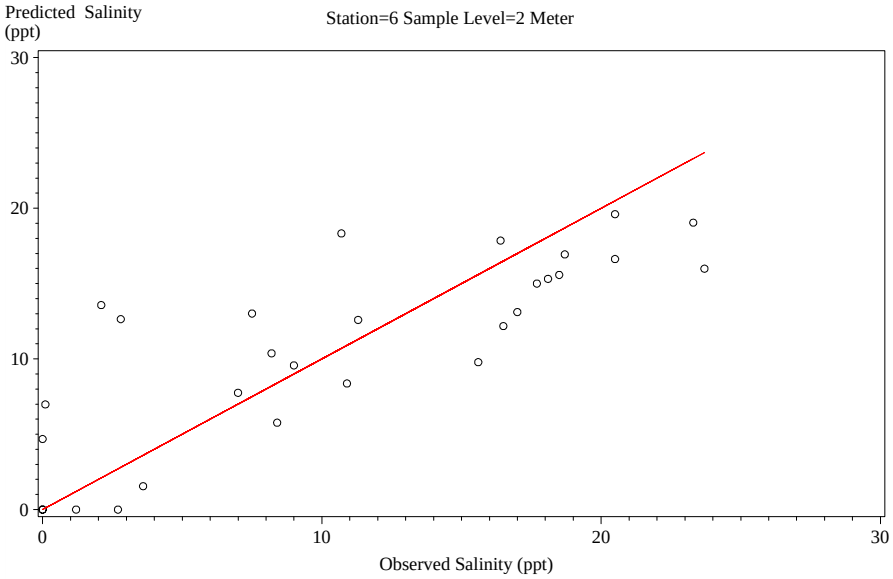


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=2 Meter

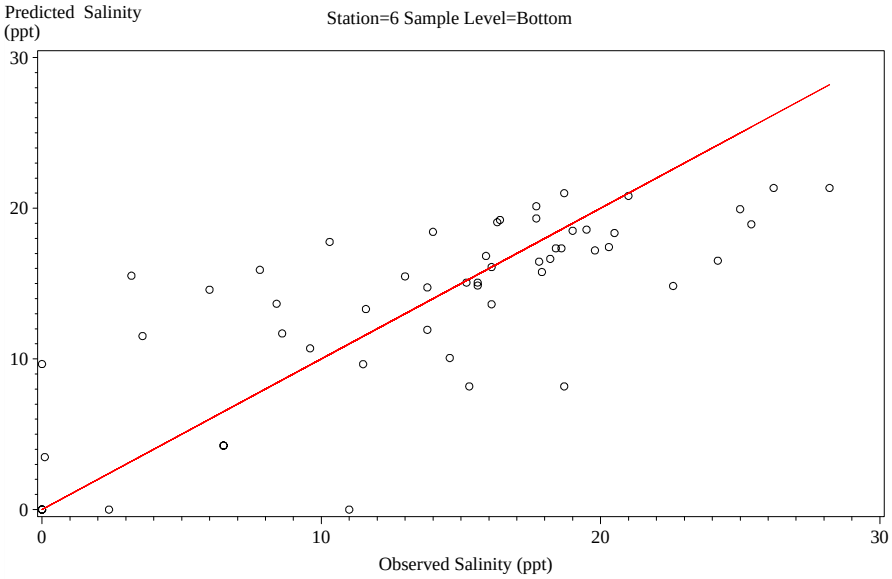


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=Bottom

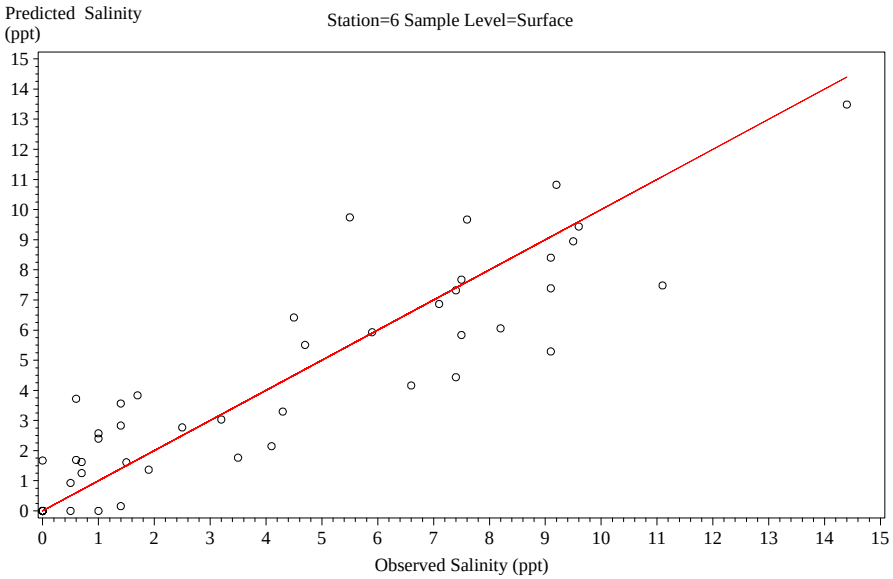


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=6 Sample Level=Surface

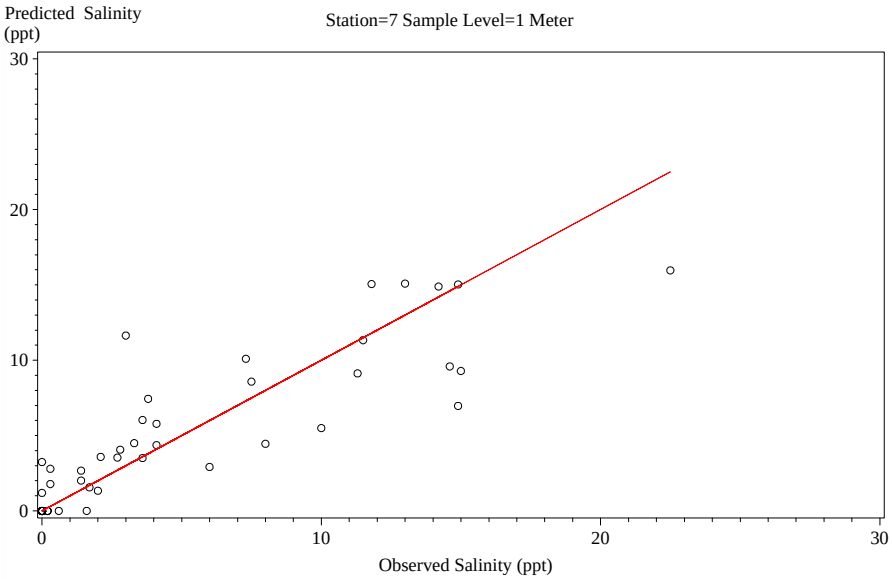


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=1 Meter

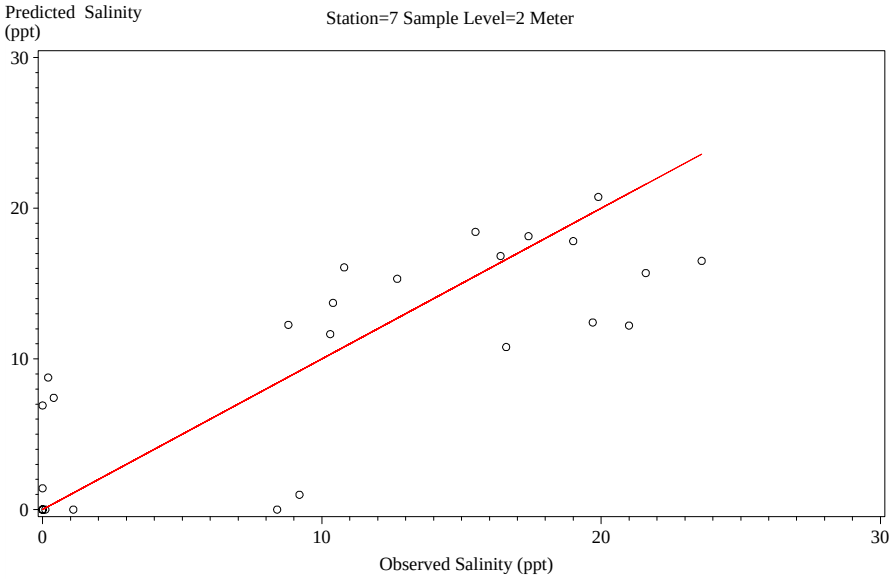


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=2 Meter

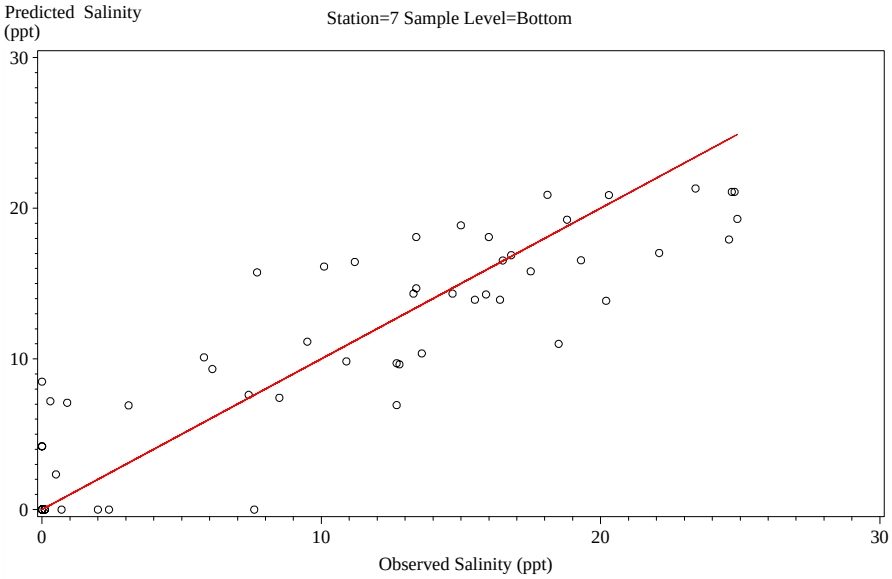


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=Bottom

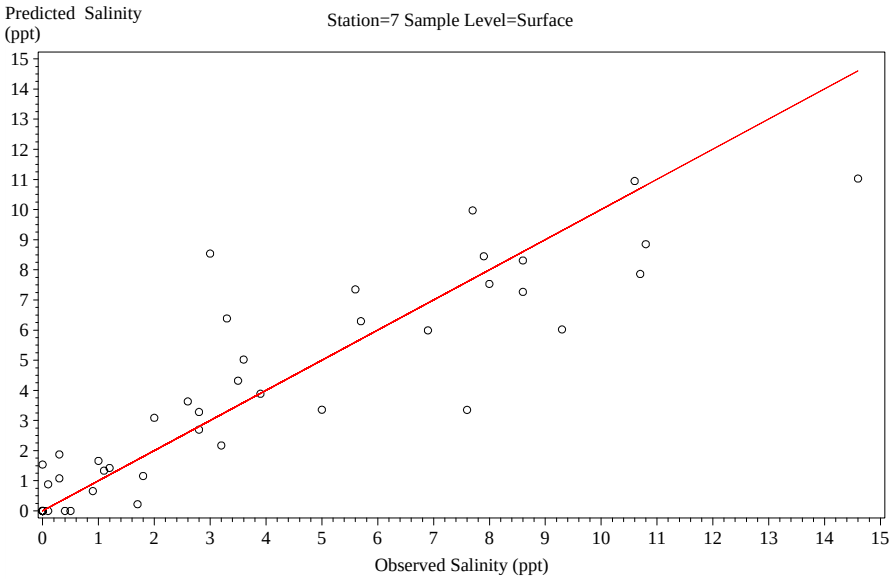


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=7 Sample Level=Surface

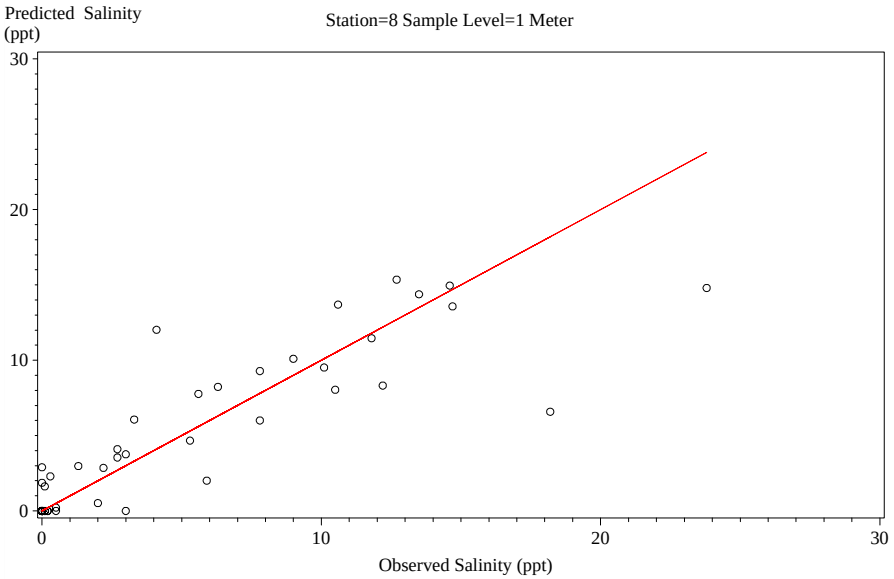


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=1 Meter

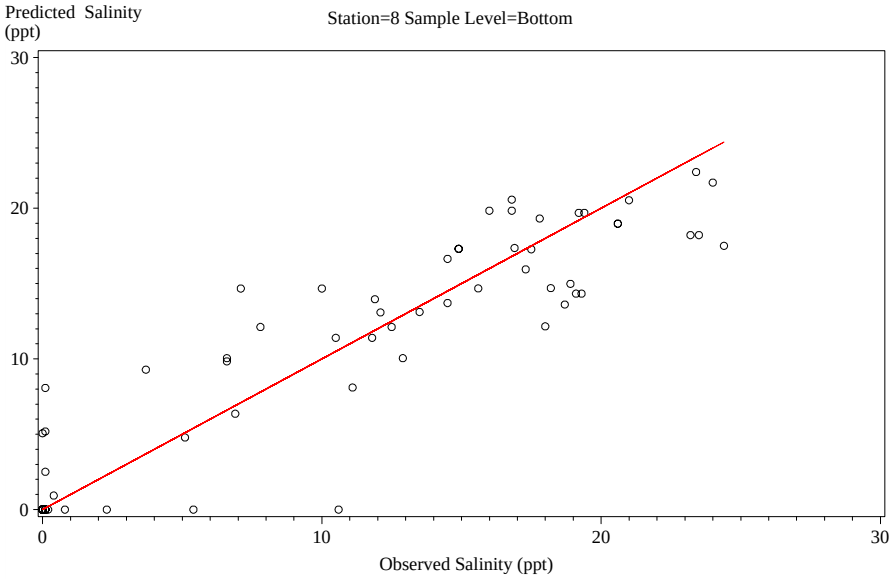


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=Bottom

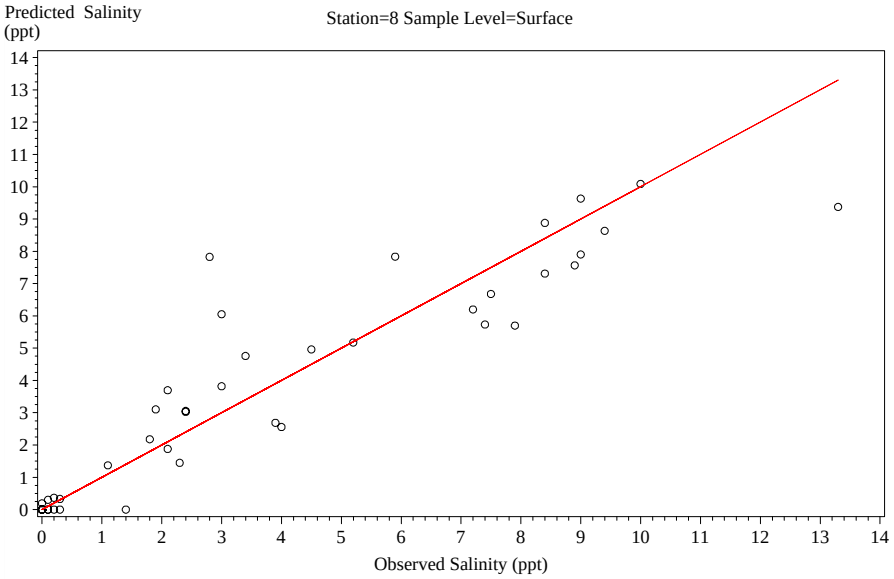


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=8 Sample Level=Surface

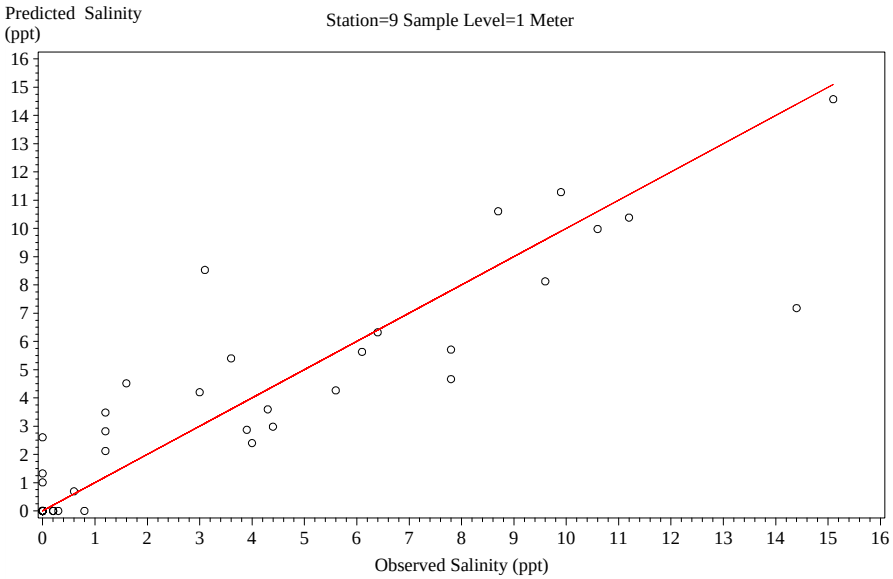


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=1 Meter

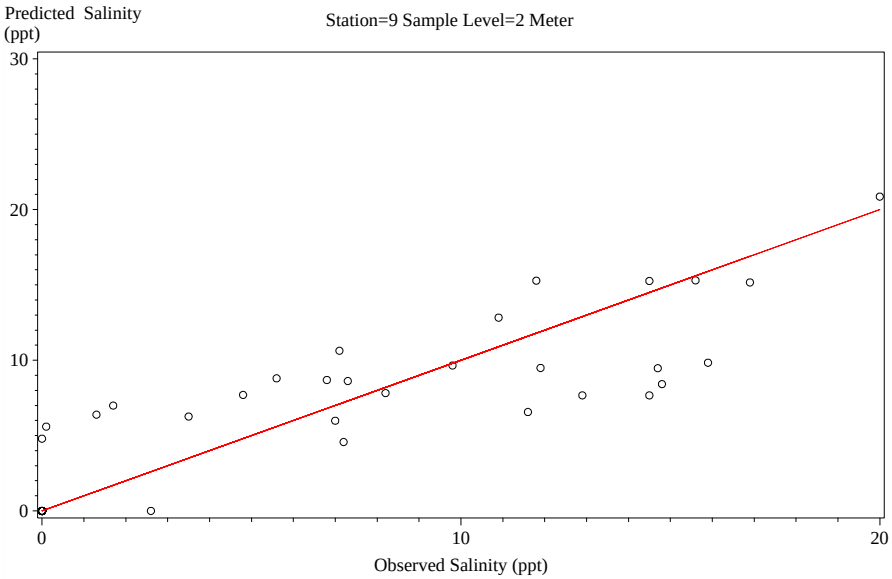


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=2 Meter

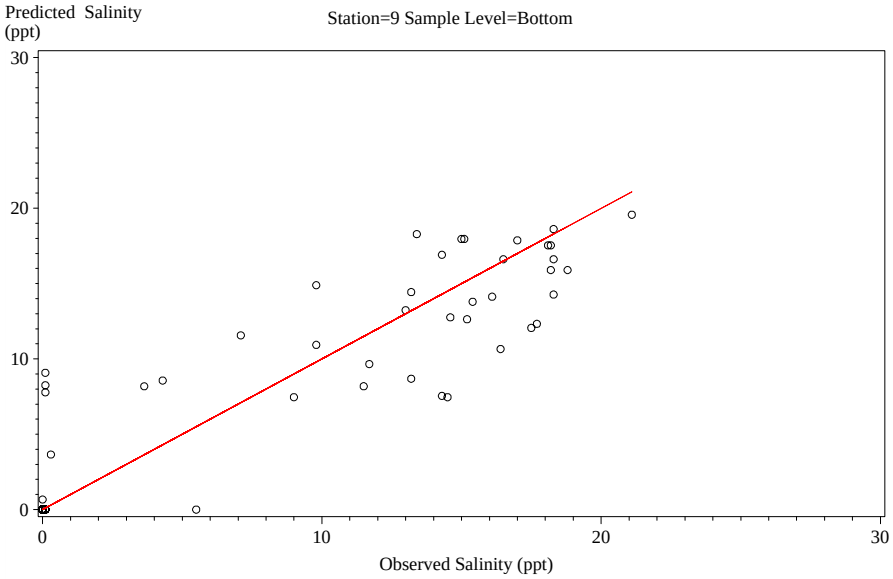


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=Bottom

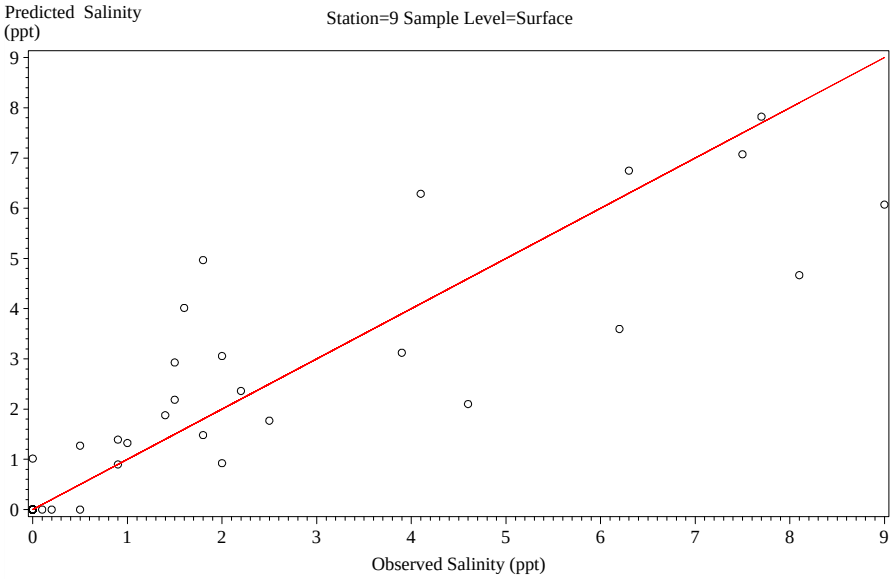


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=9 Sample Level=Surface

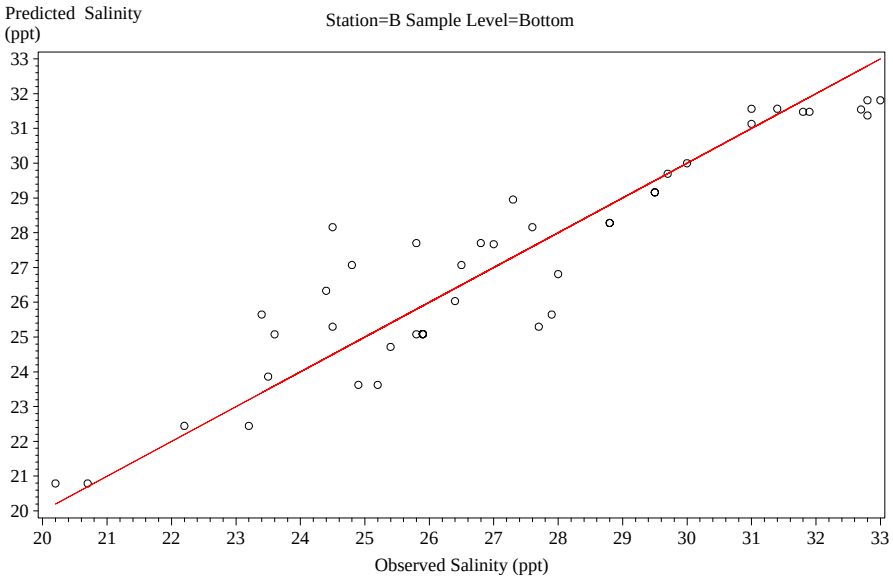


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=B Sample Level=Bottom

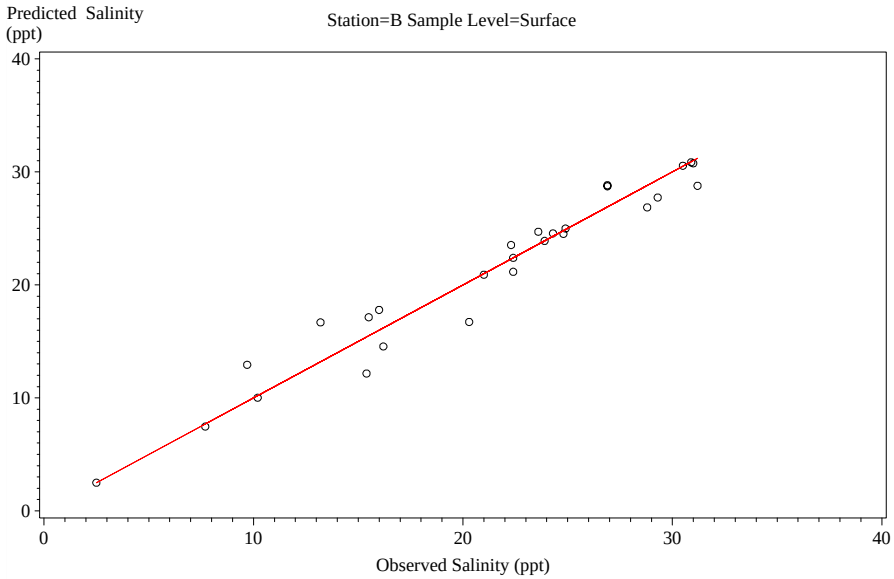


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=B Sample Level=Surface

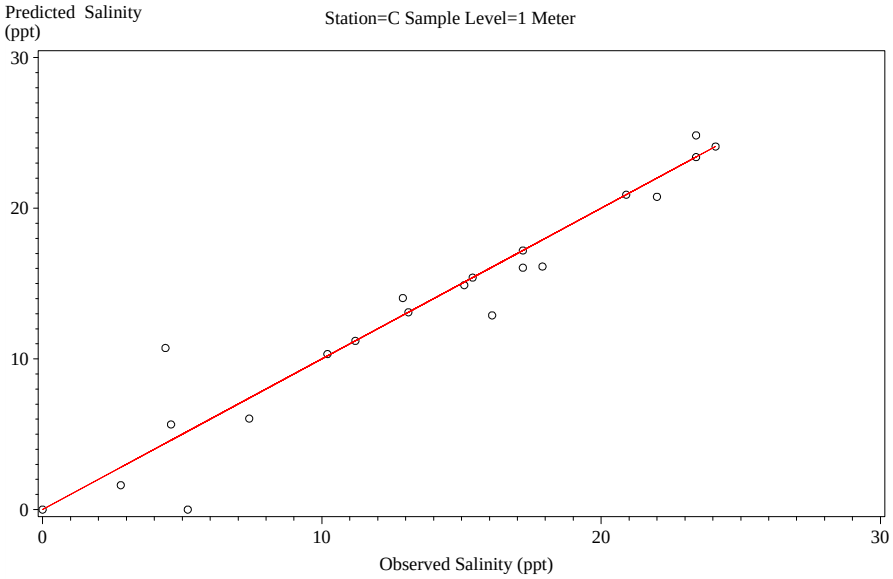


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=1 Meter

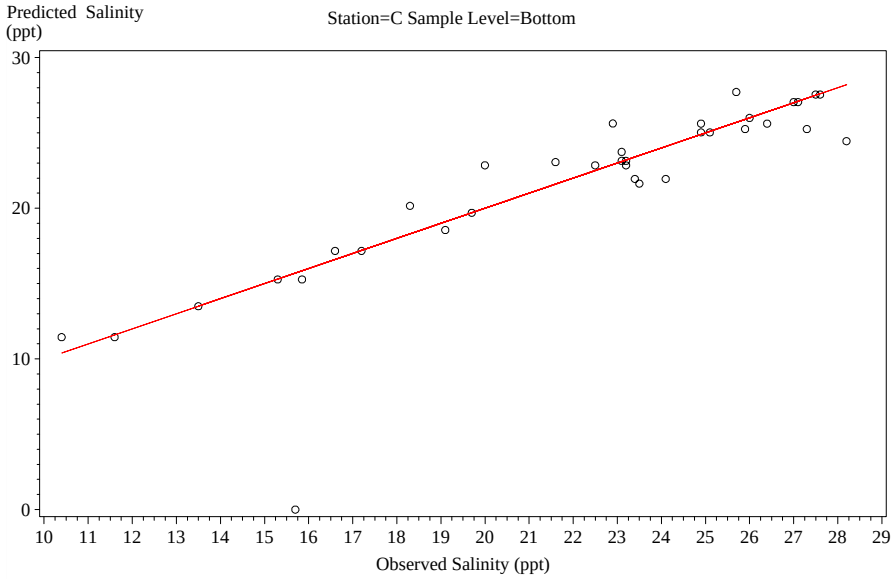


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=Bottom

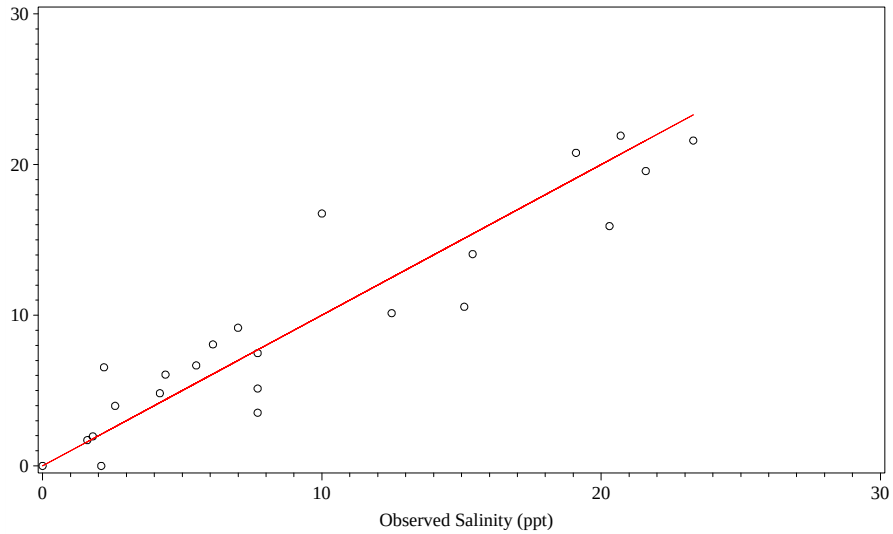


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: SWFWMD

Station=C Sample Level=Surface

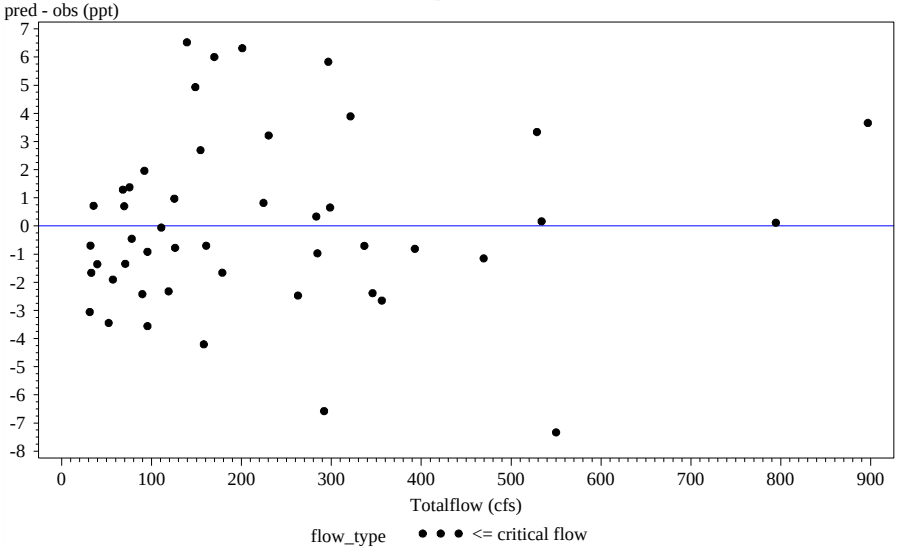


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=1 Meter

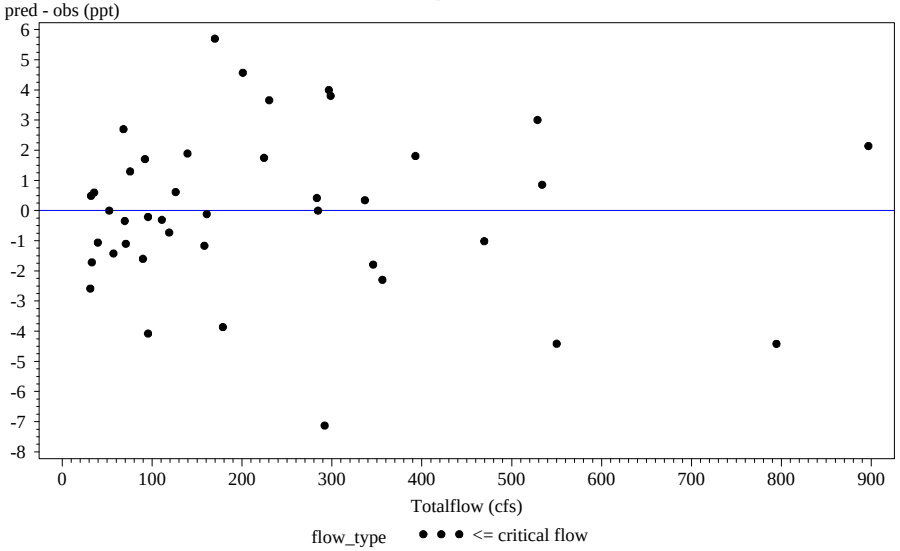


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=2 Meter

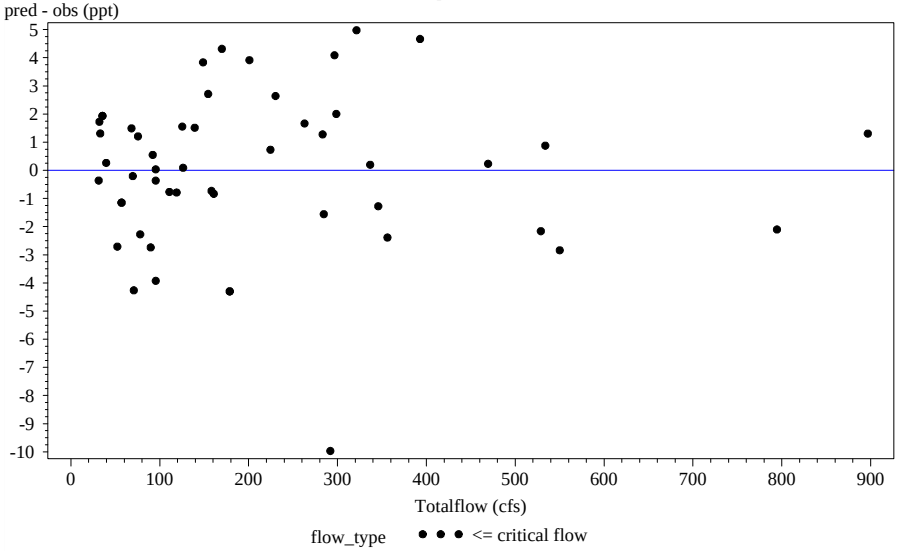


Alafia River Analysis

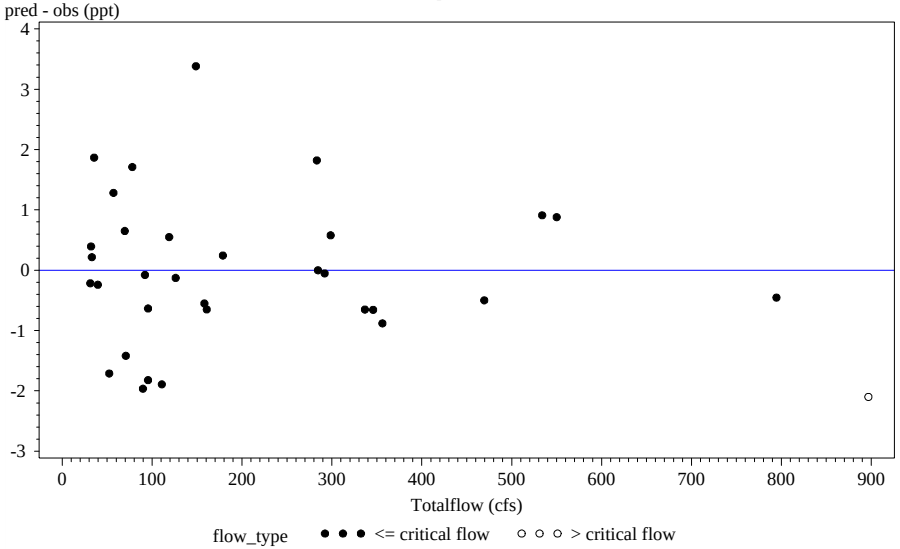
Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

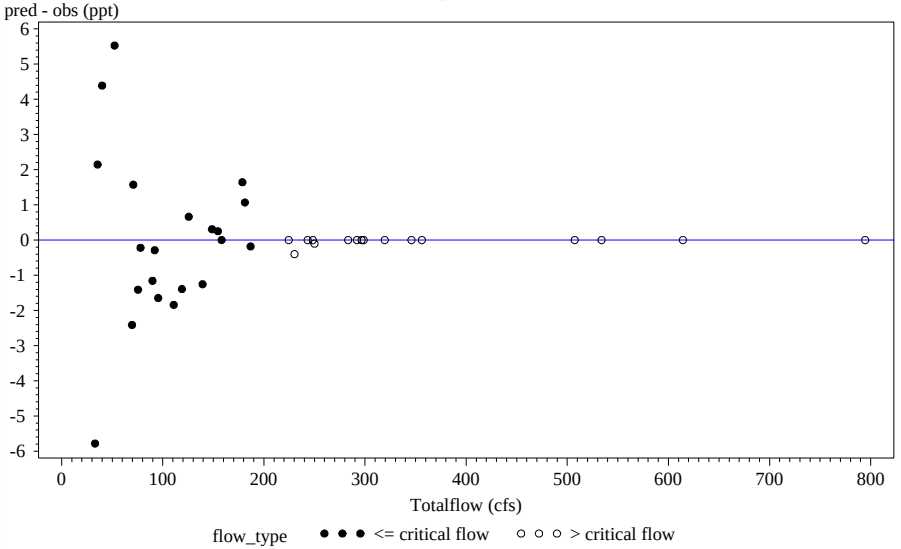
Station=1 Sample Level=Bottom



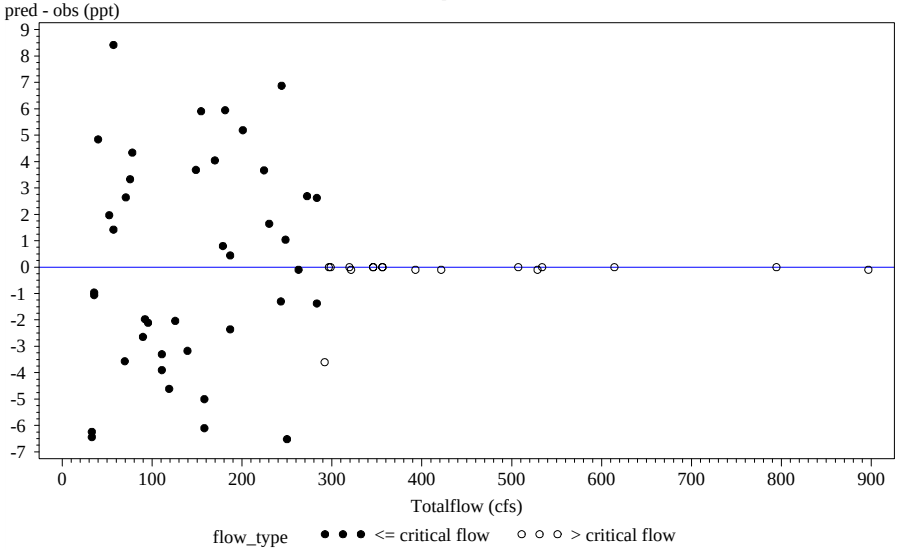
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=1 Sample Level=Surface



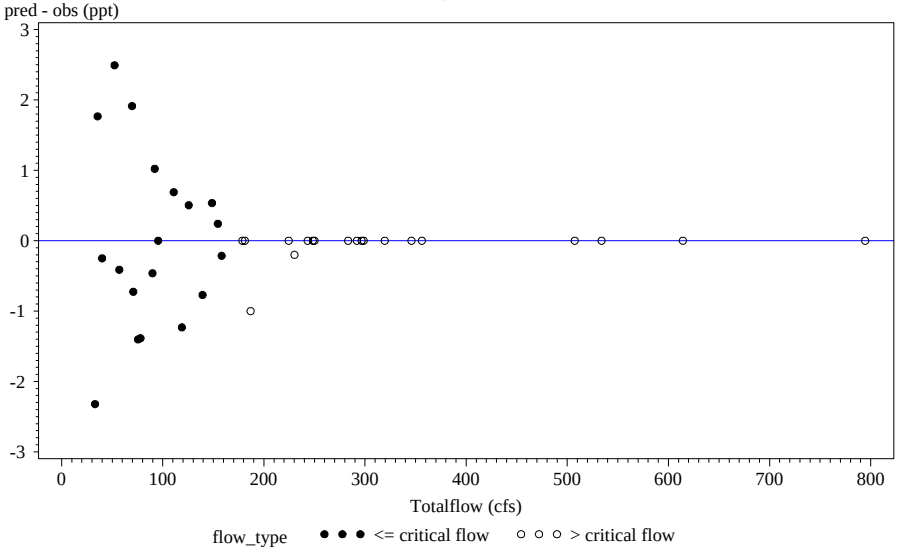
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=1 Meter

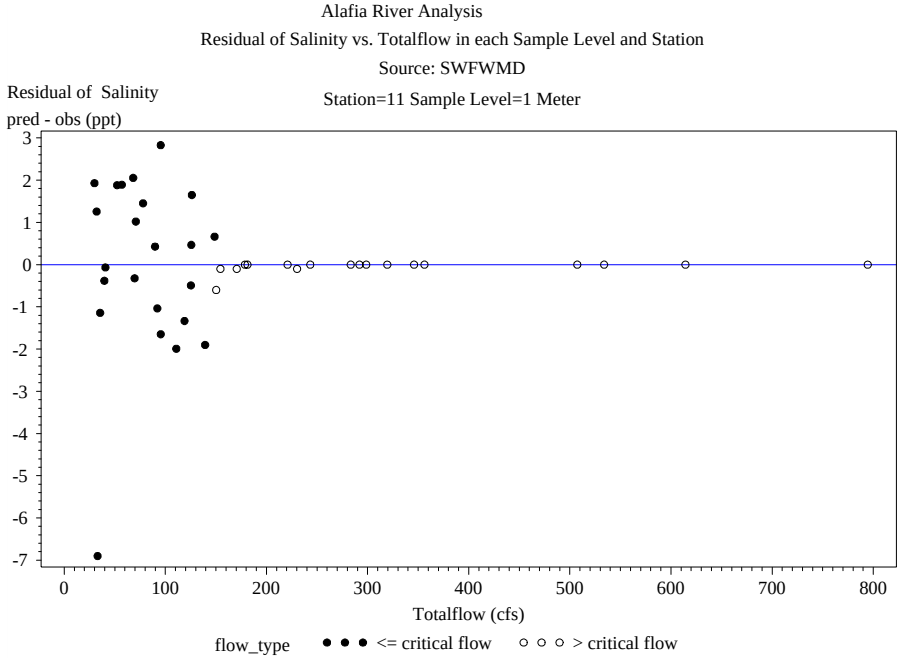


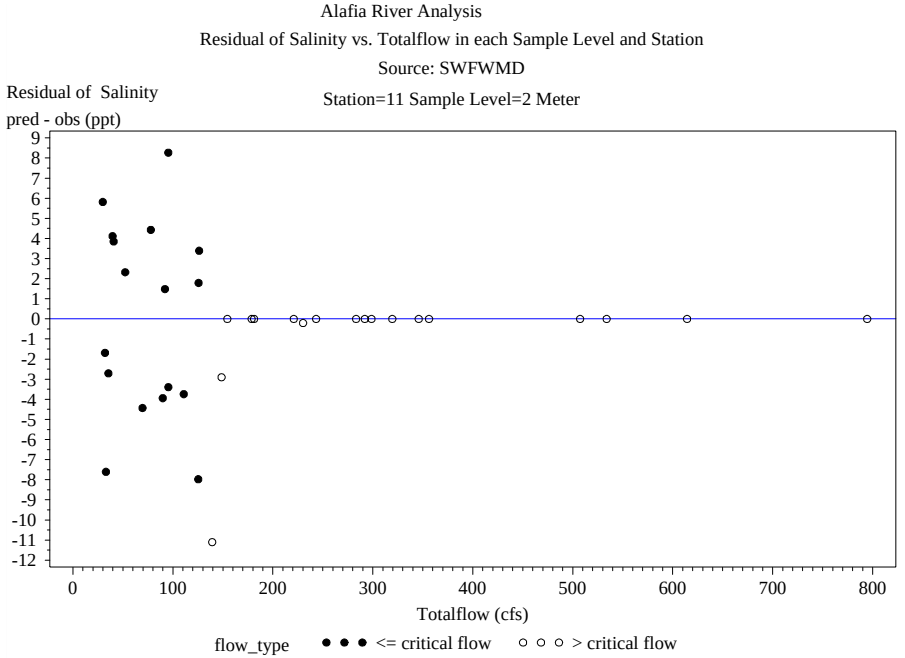
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=Bottom

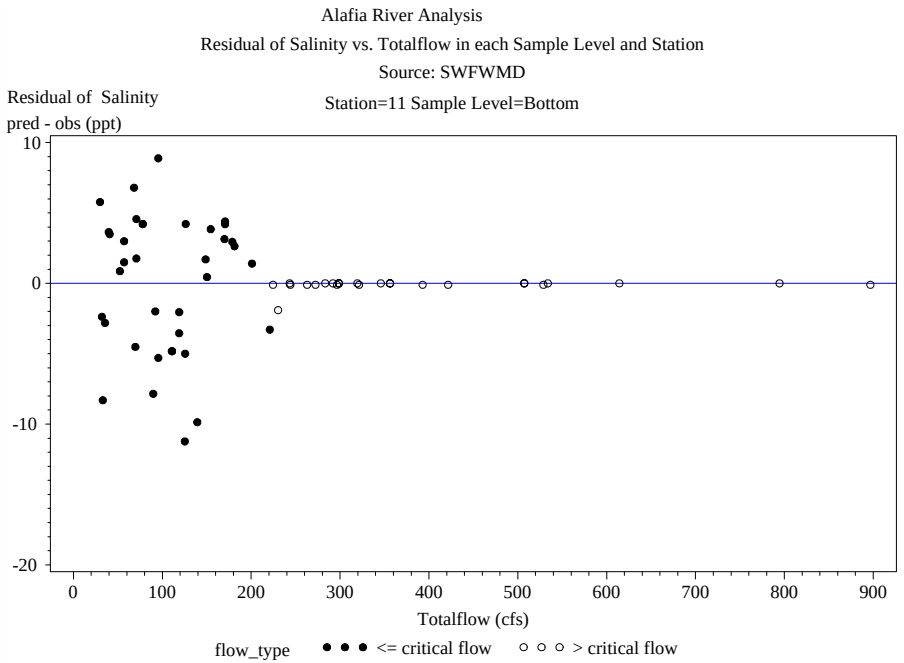


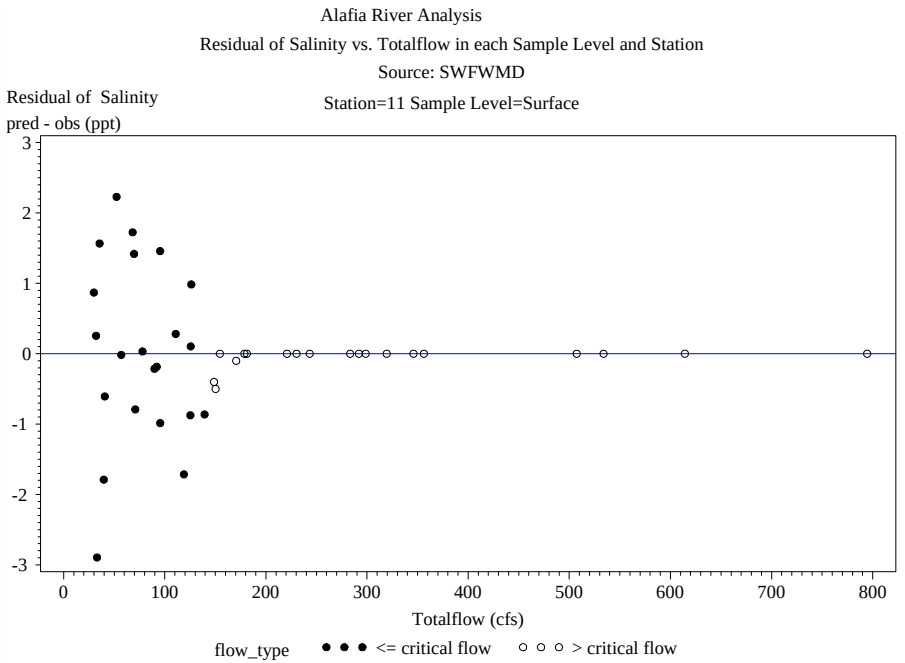
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=Surface

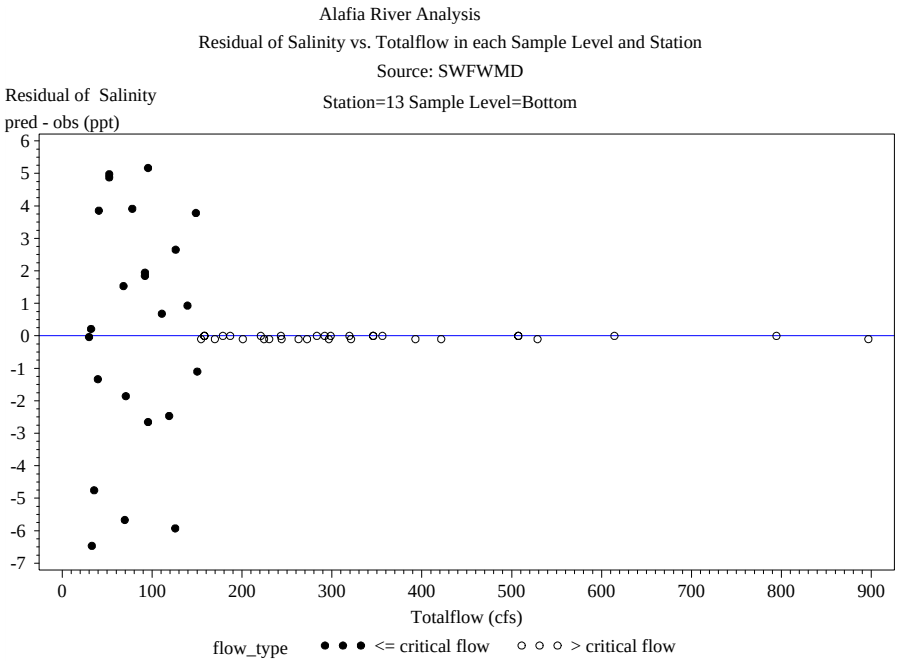


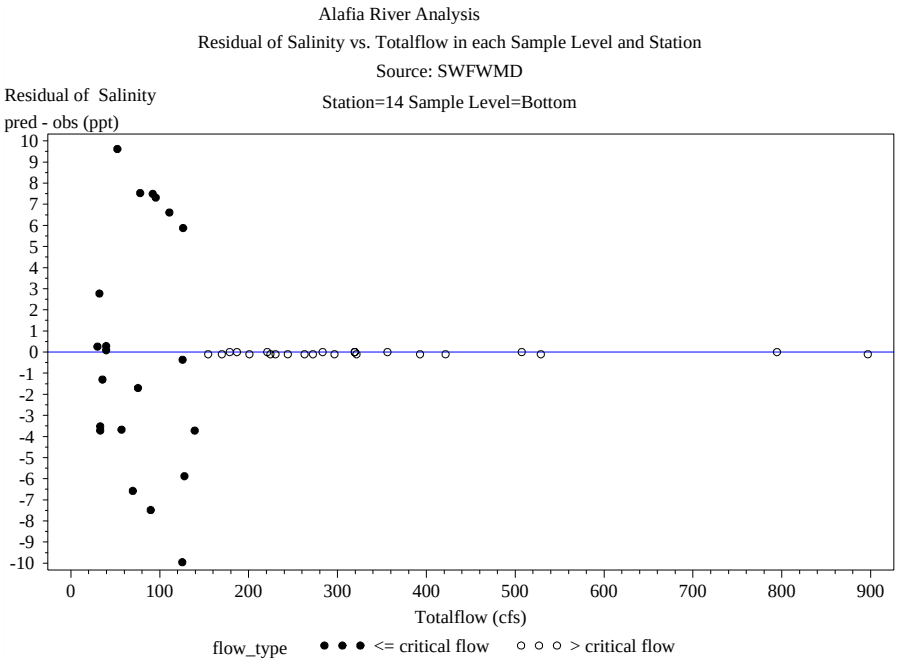

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

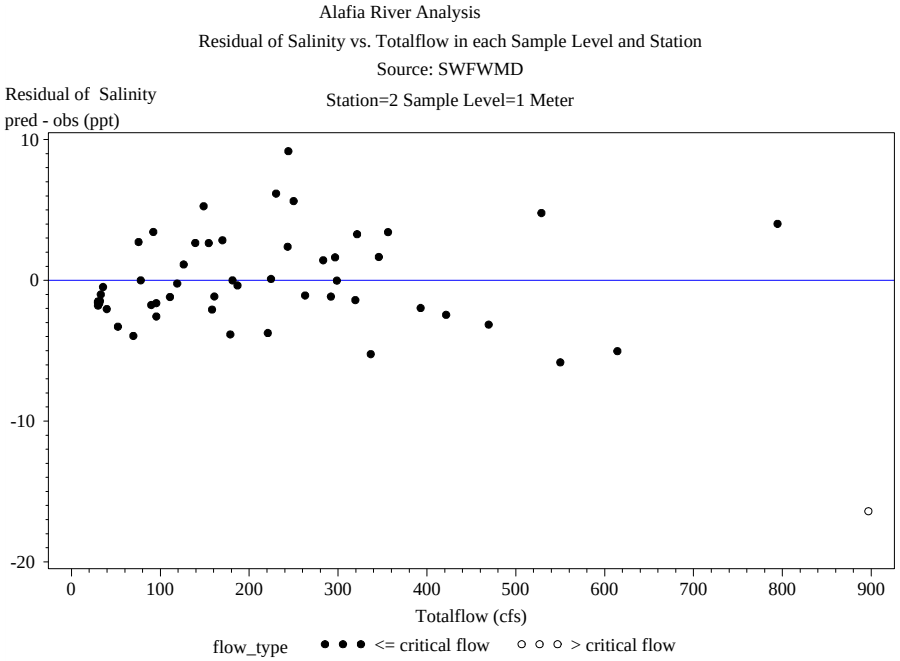

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=2 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

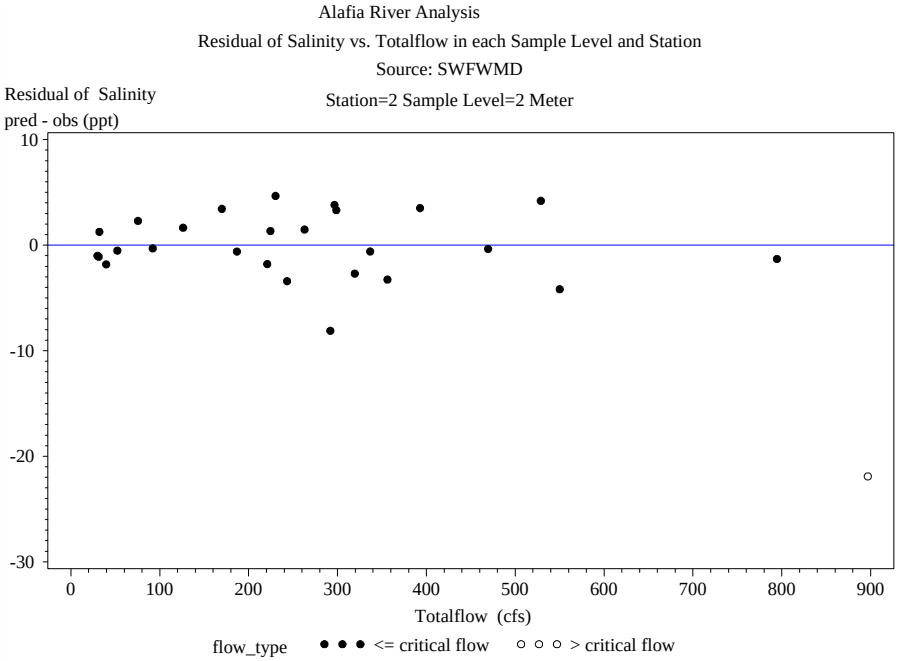

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

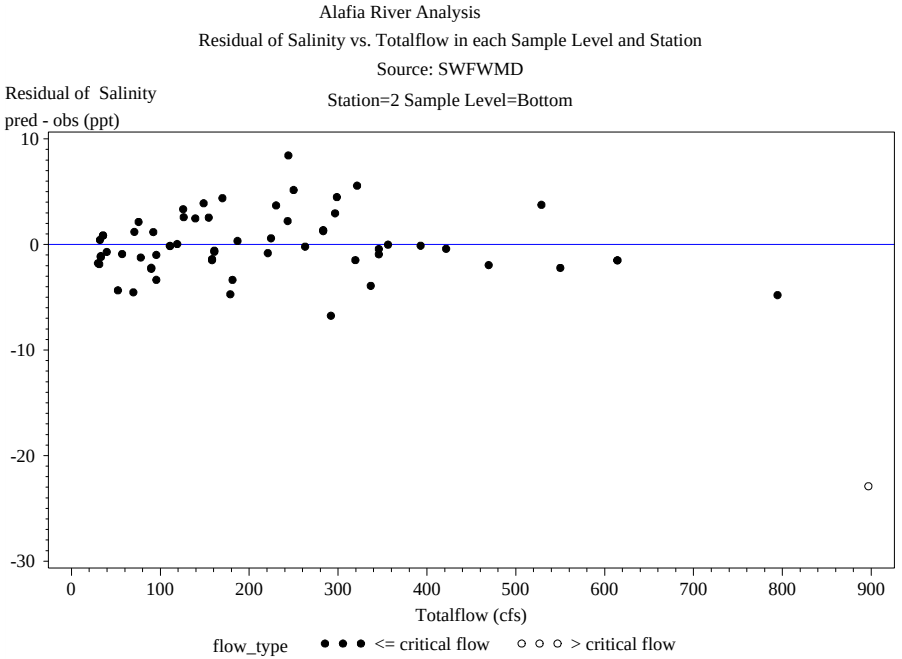

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

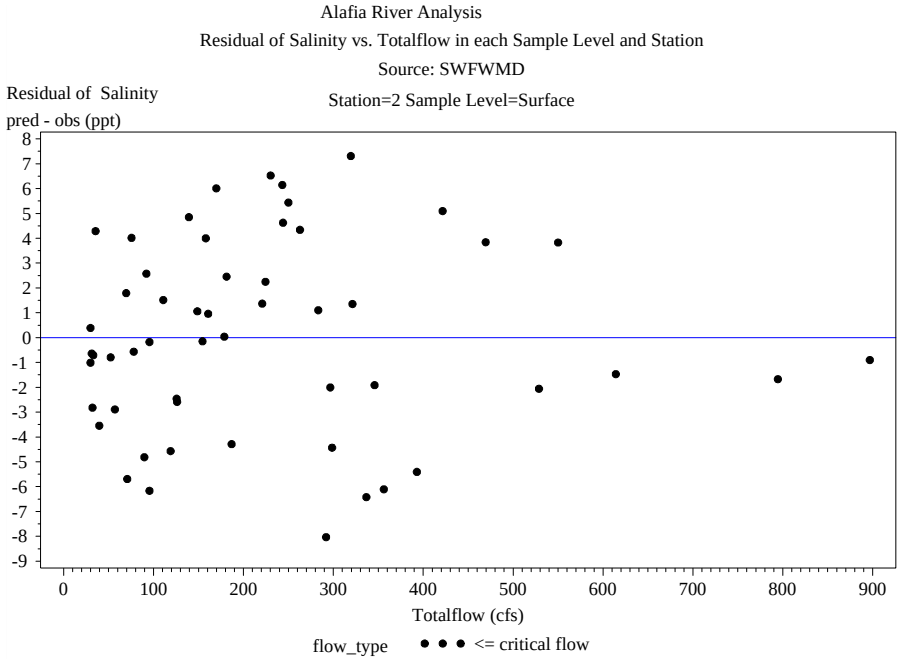

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=13 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

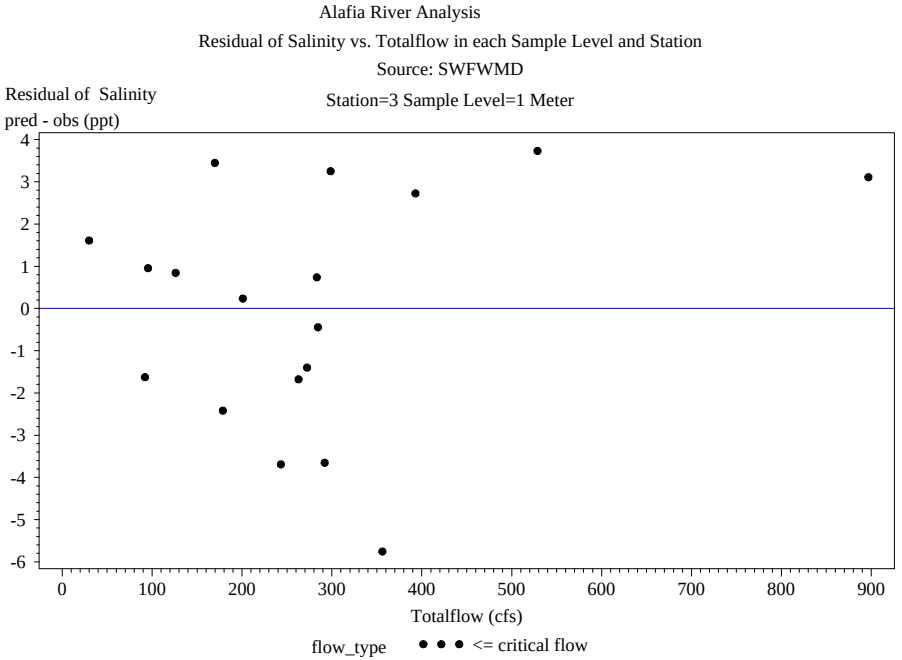

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=14 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

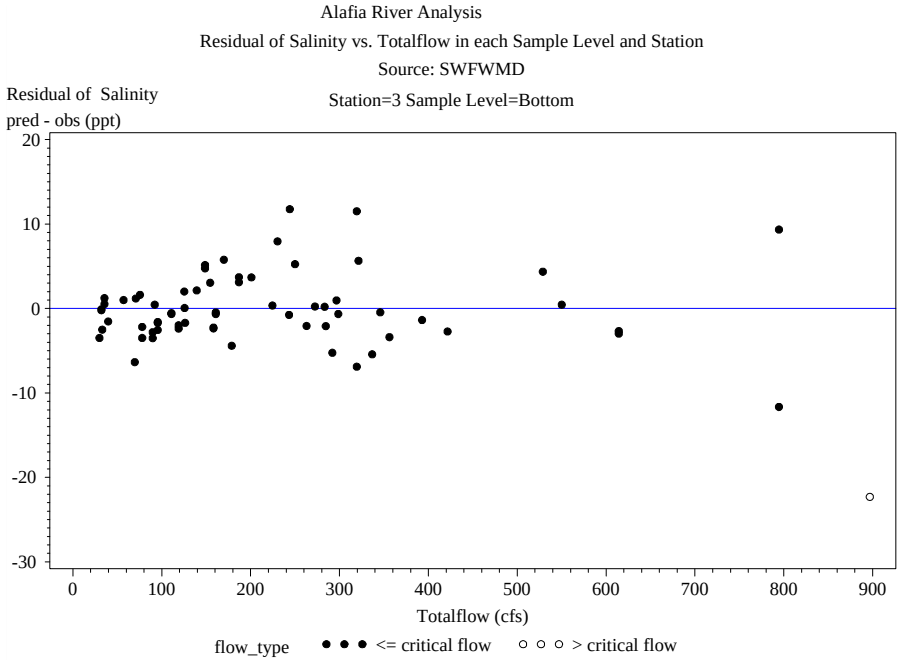

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

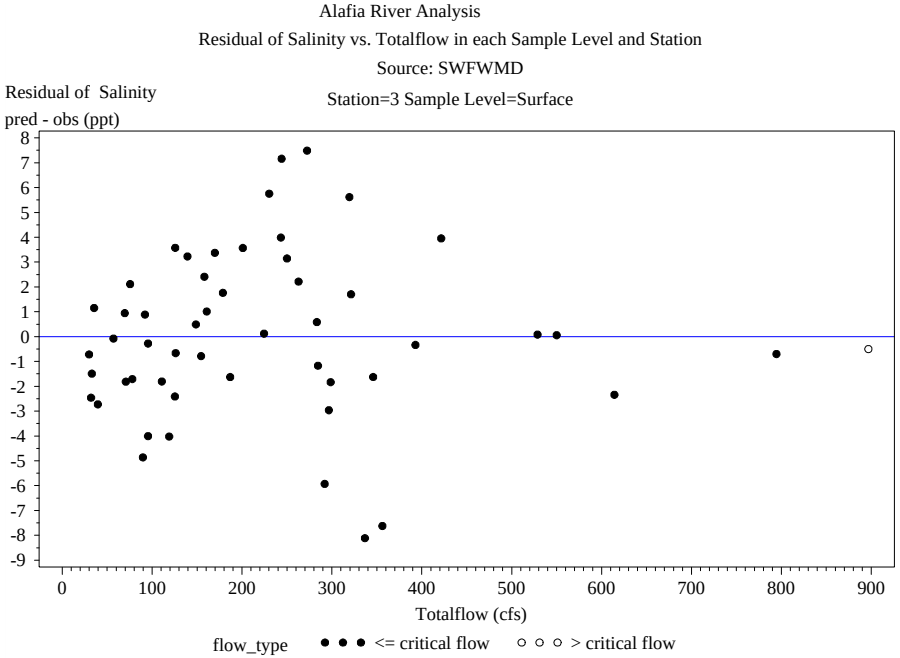

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=2 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

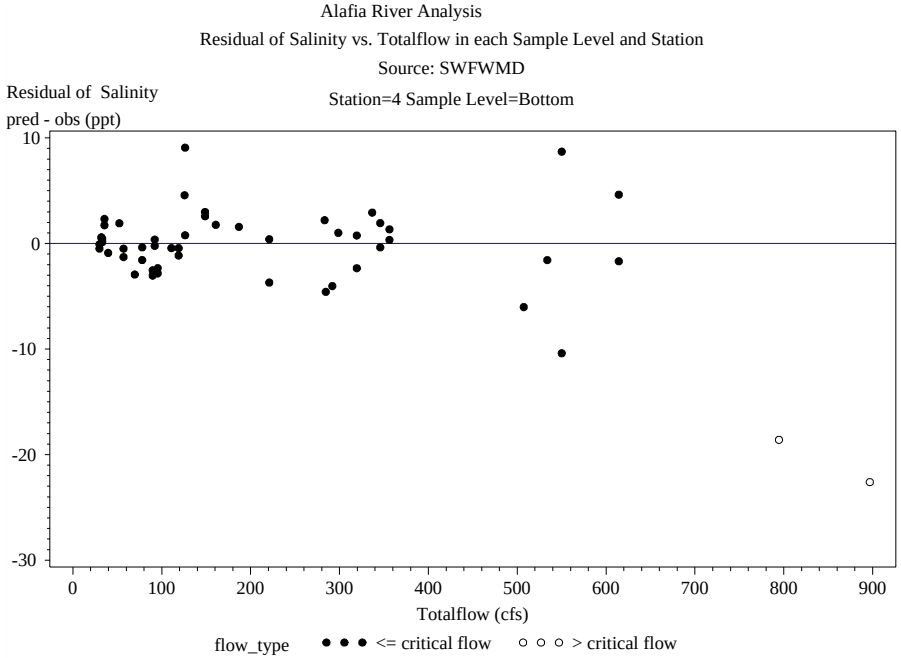

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

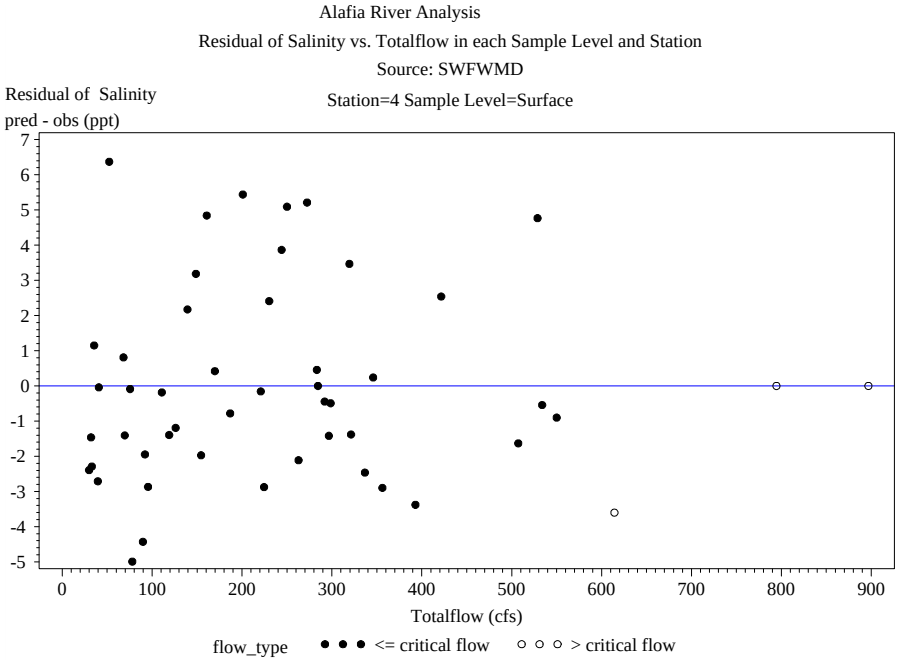

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow

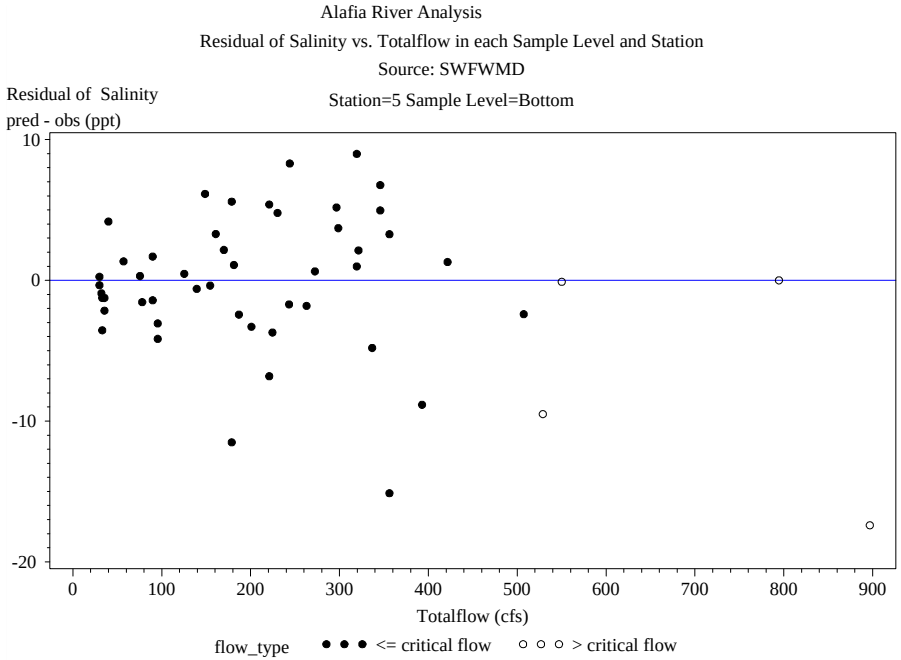

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=4 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=4 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow

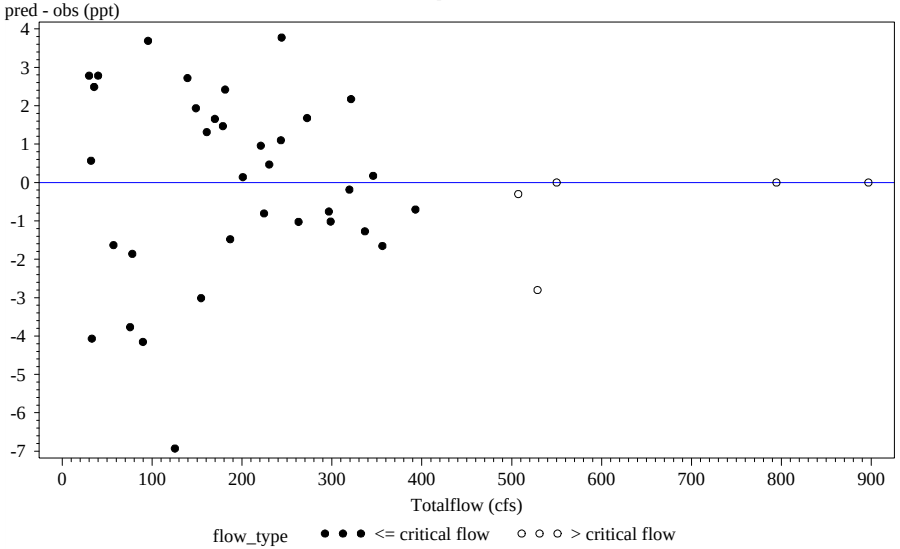

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=5 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow

Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=5 Sample Level=Surface

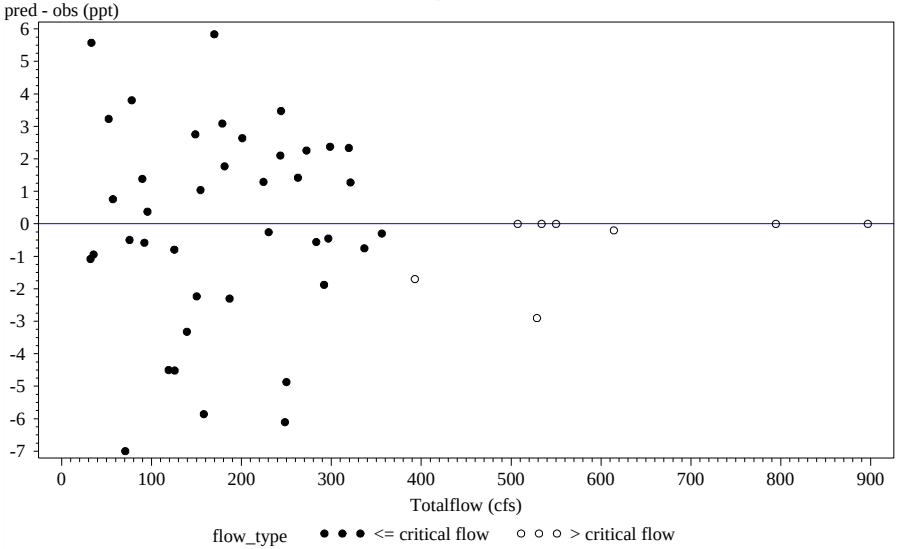


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=1 Meter

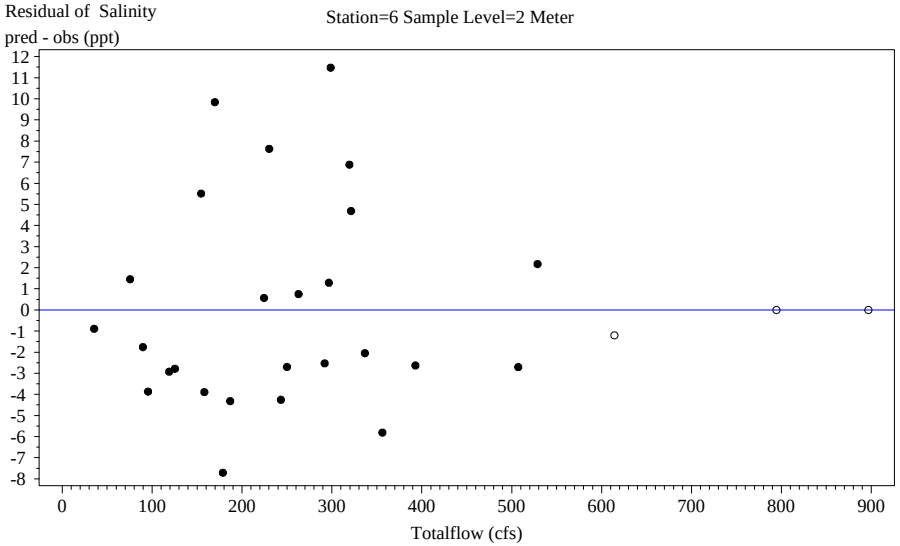


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=2 Meter

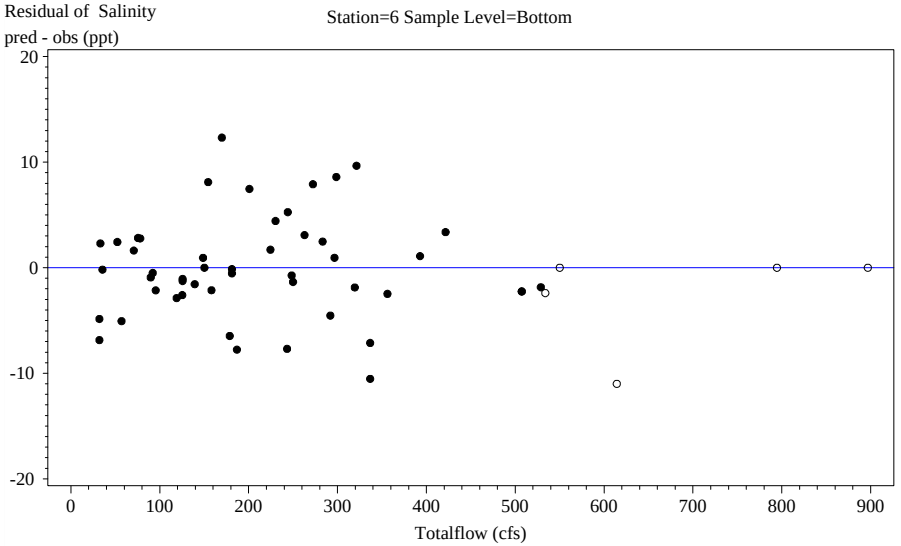


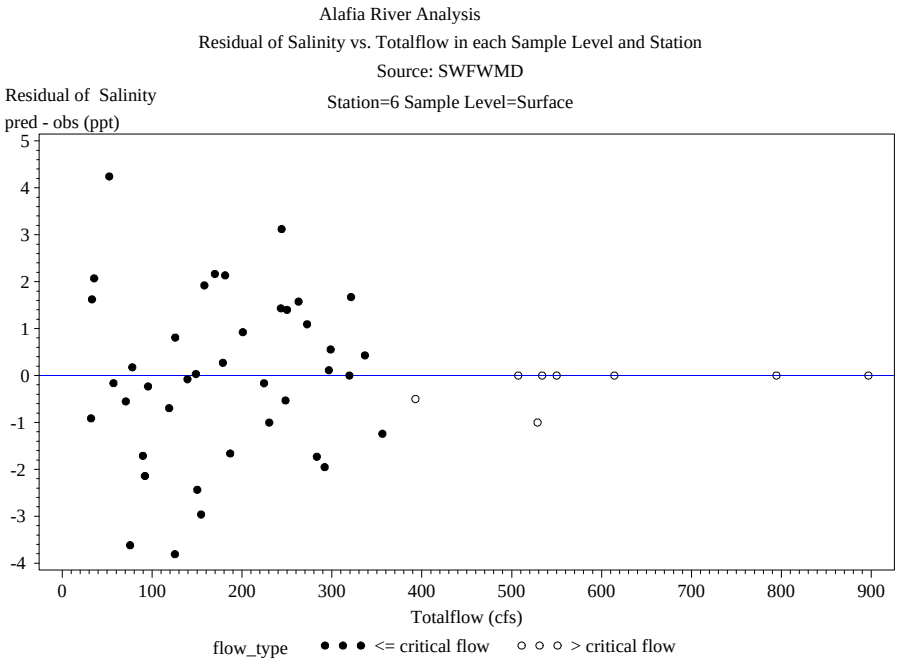
Alafia River Analysis

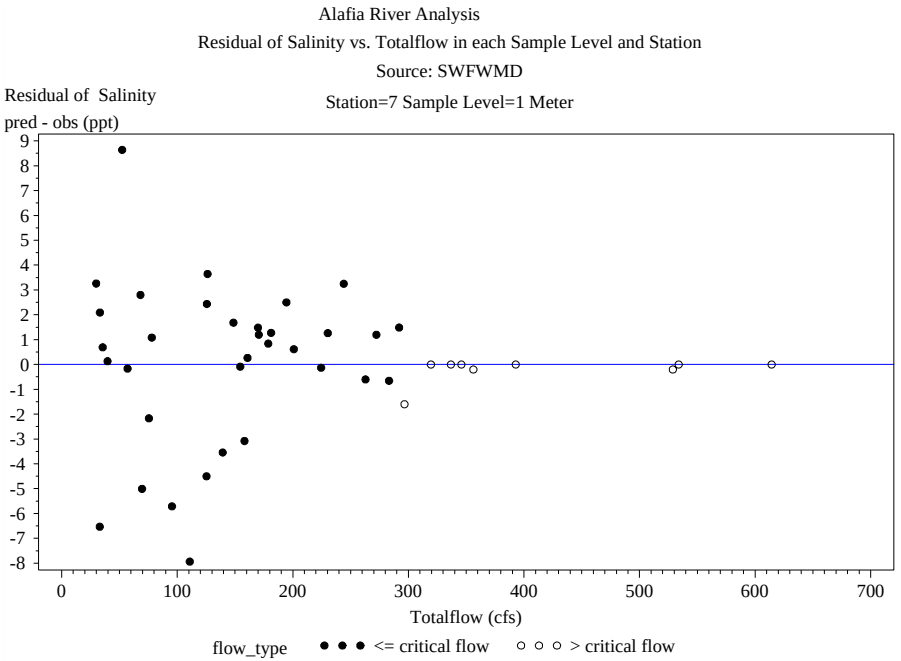
Residual of Salinity vs. Totalflow in each Sample Level and Station

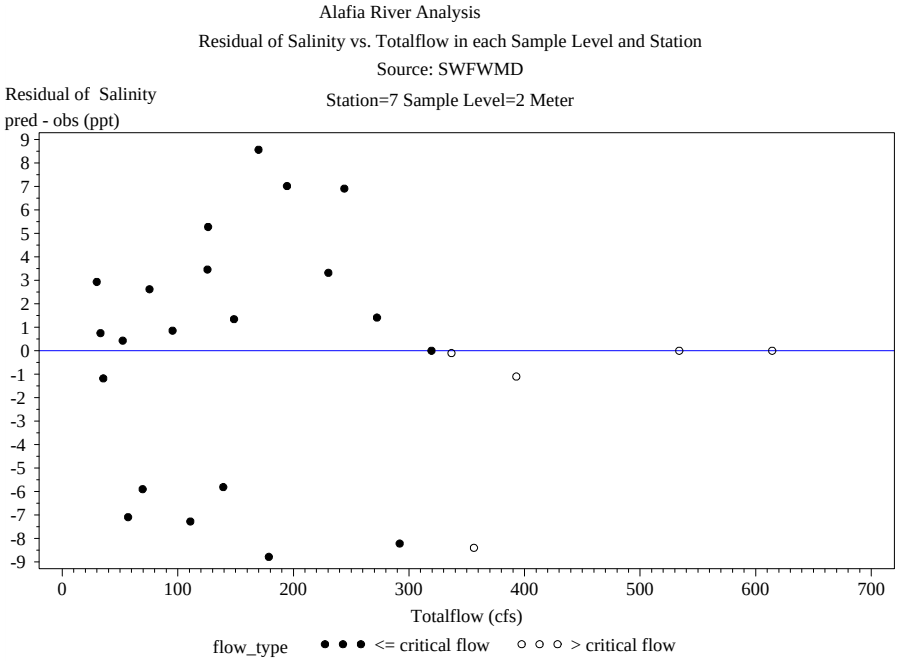
Source: SWFWMD

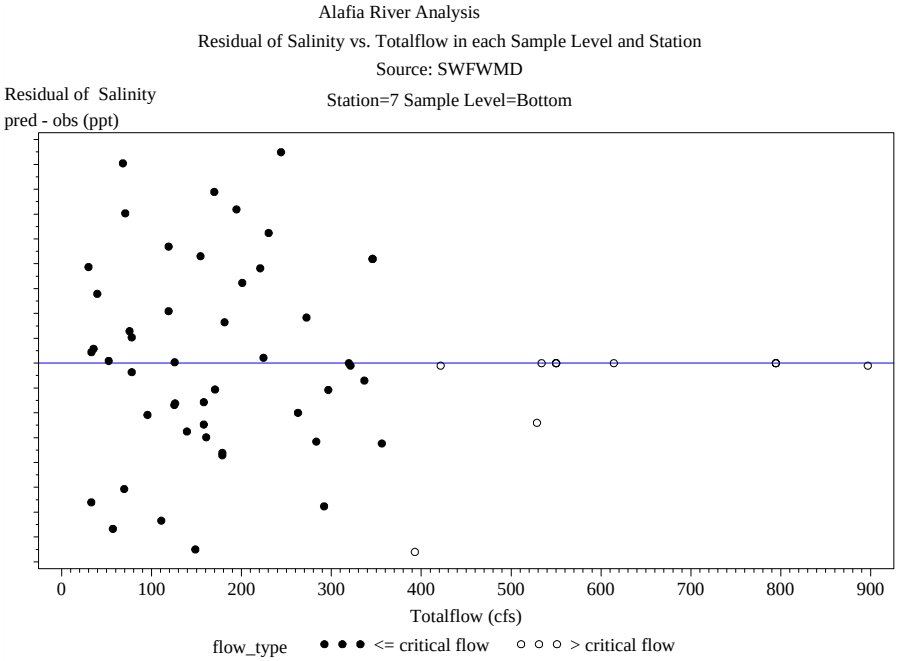
Station=6 Sample Level=Bottom

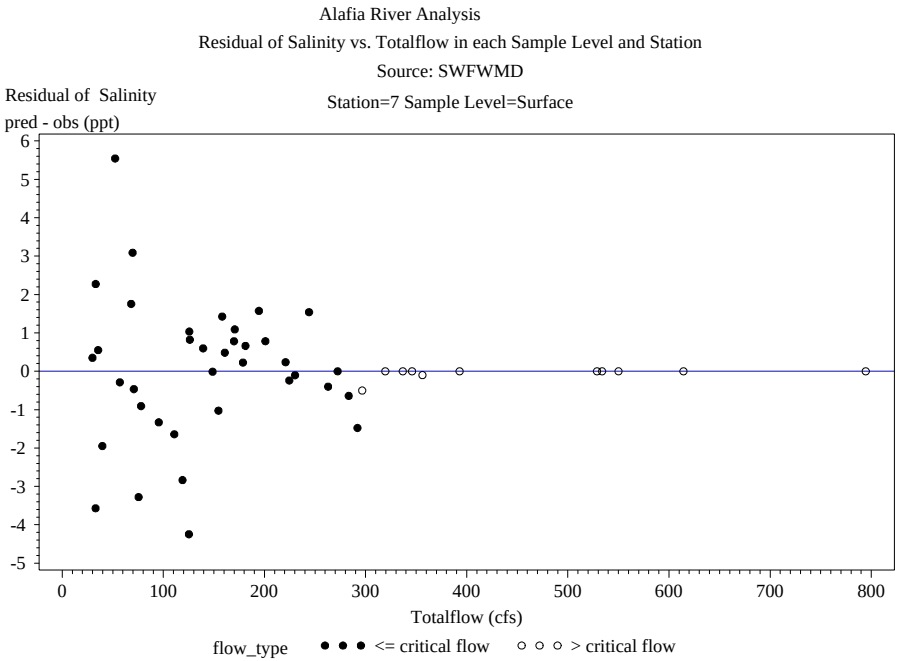


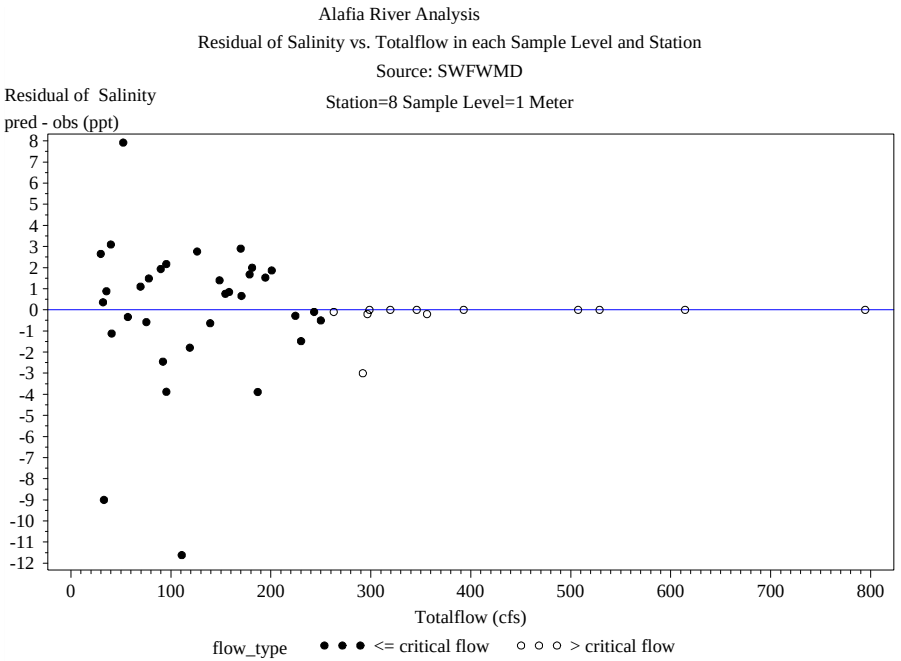

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=6 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

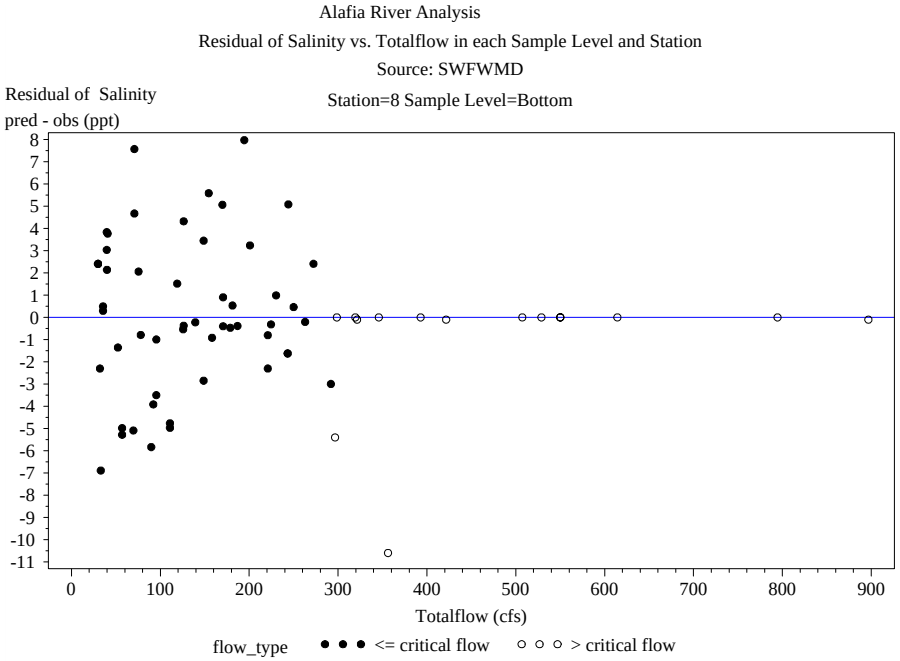

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

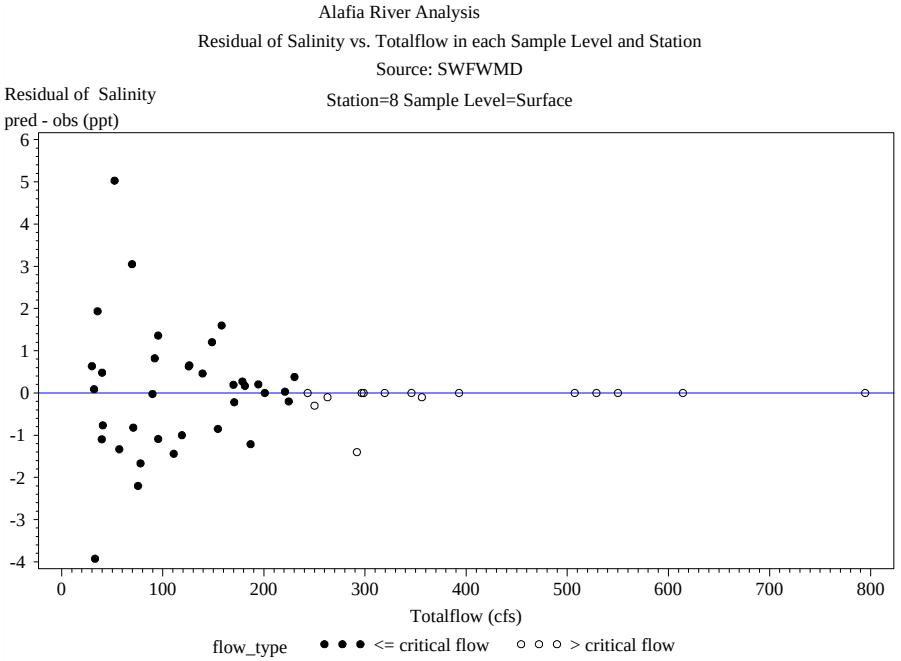

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=2 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

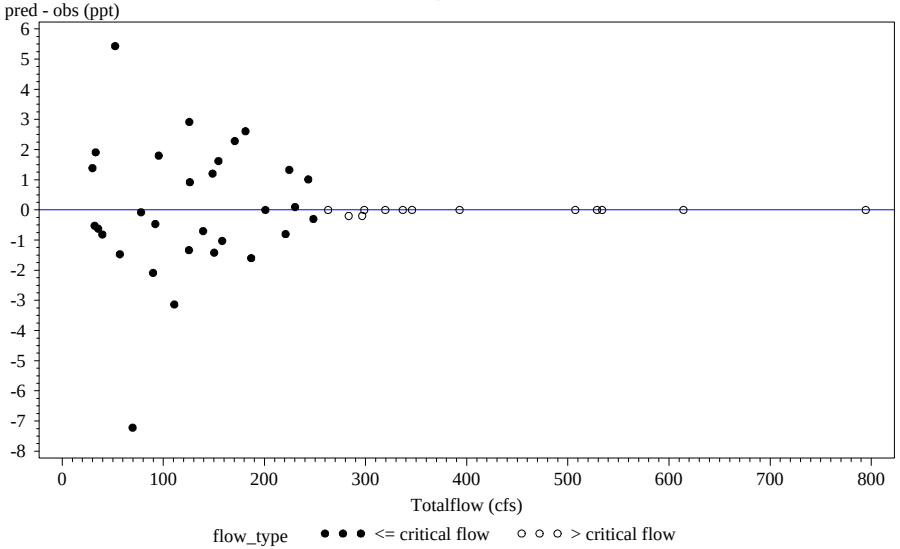

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow

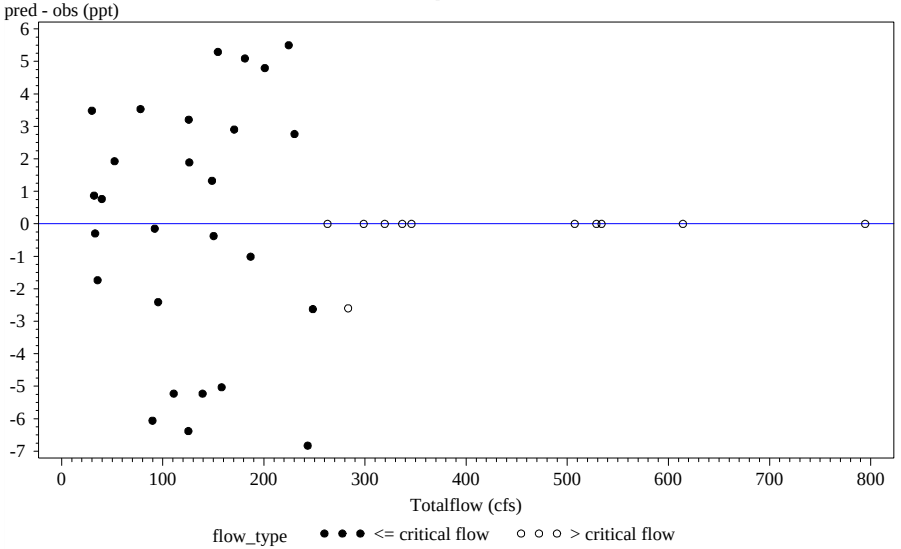

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type <= critical flow > critical flow

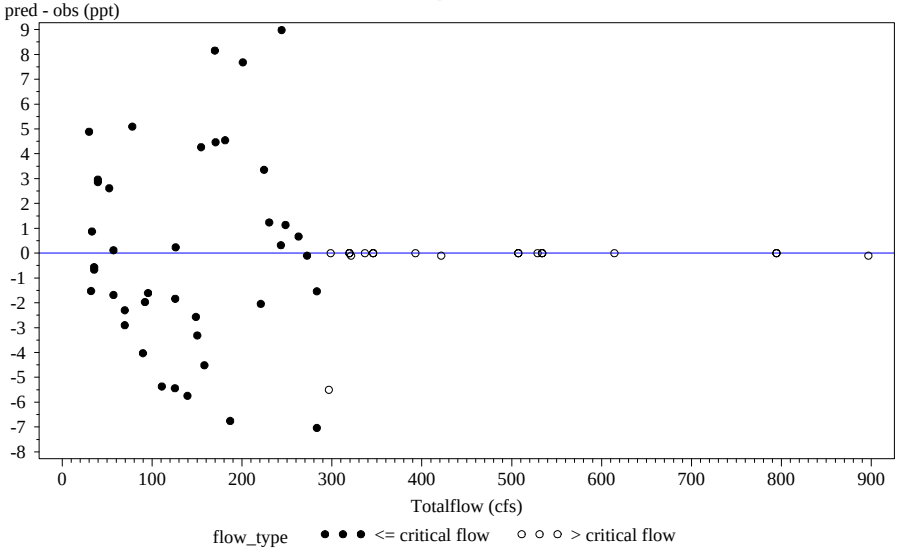
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=1 Meter



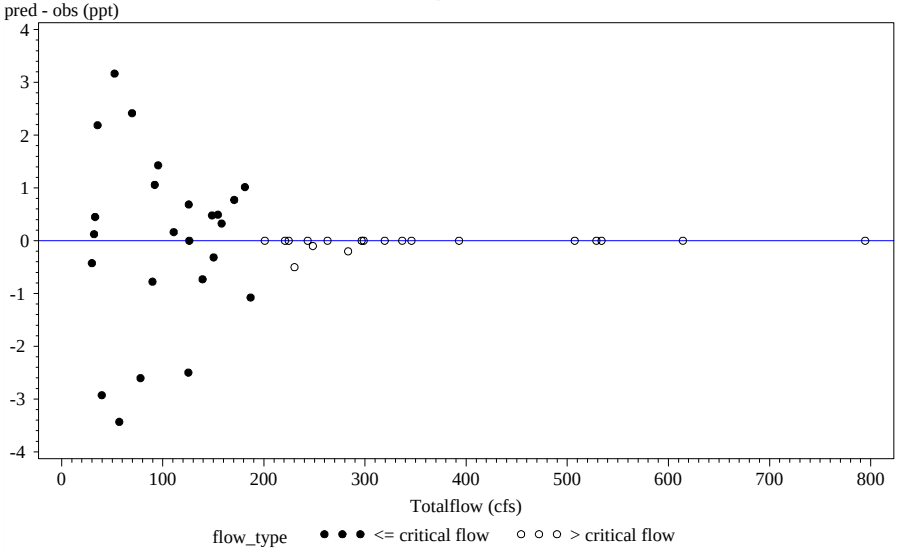
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=2 Meter



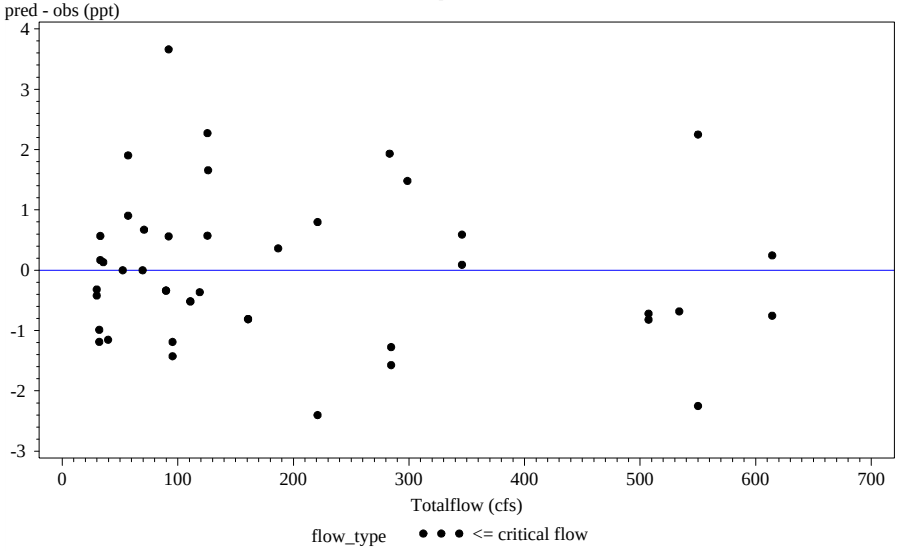
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=Bottom



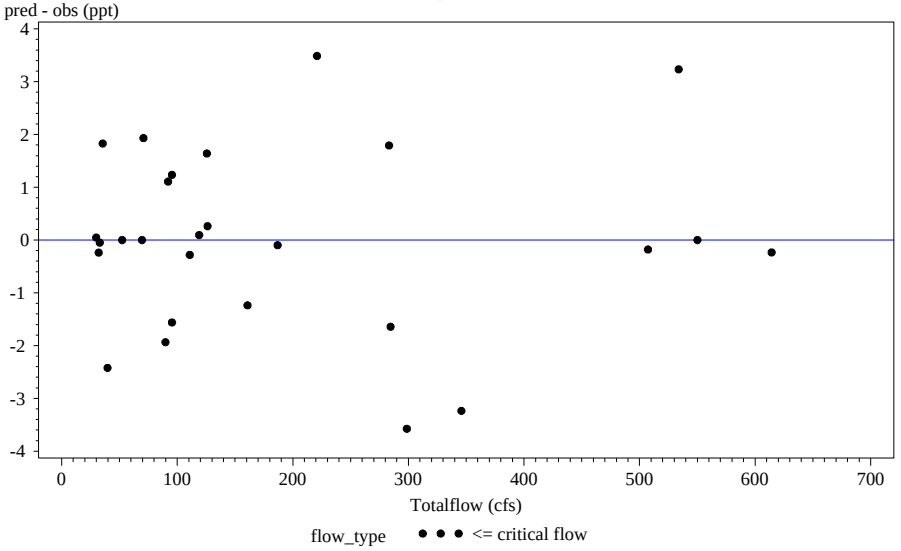
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=Surface



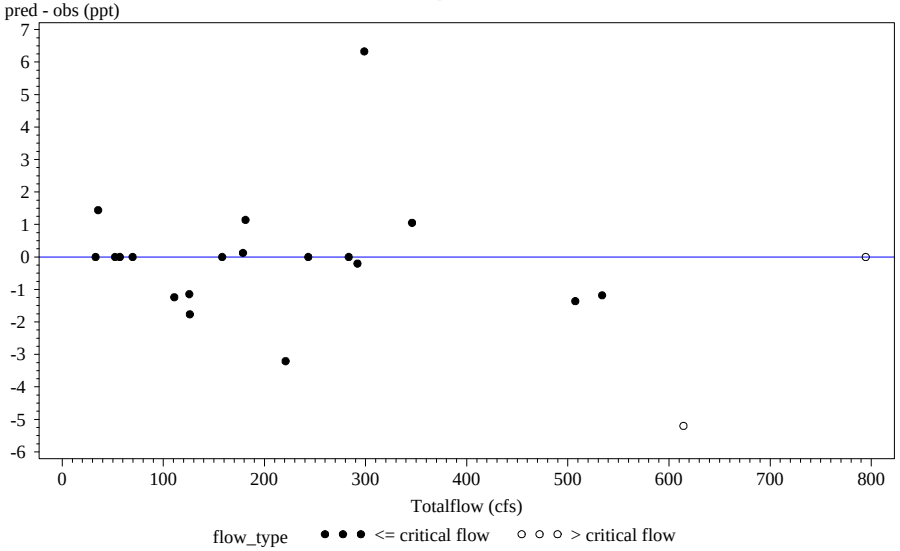
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=B Sample Level=Bottom



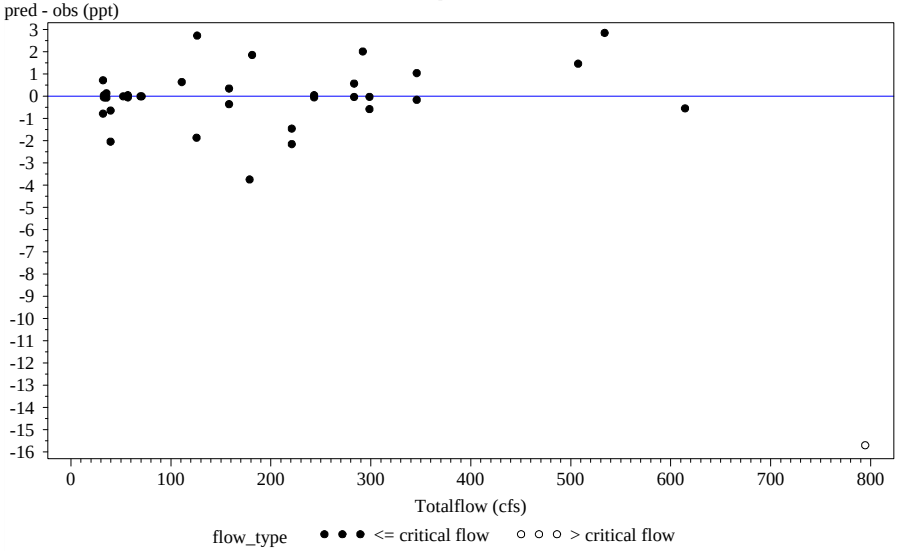
Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=B Sample Level=Surface



Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=C Sample Level=1 Meter



Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: SWFWMD
Station=C Sample Level=Bottom

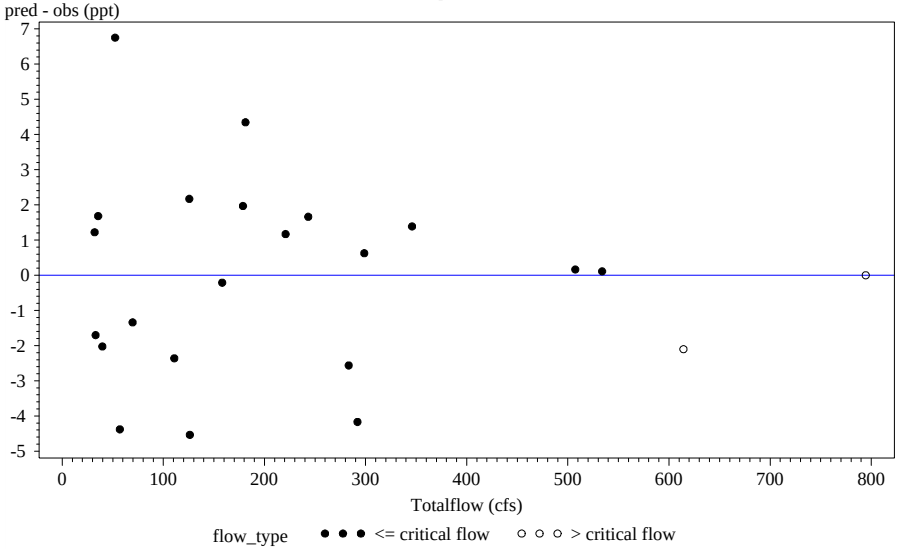


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: SWFWMD

Station=C Sample Level=Surface

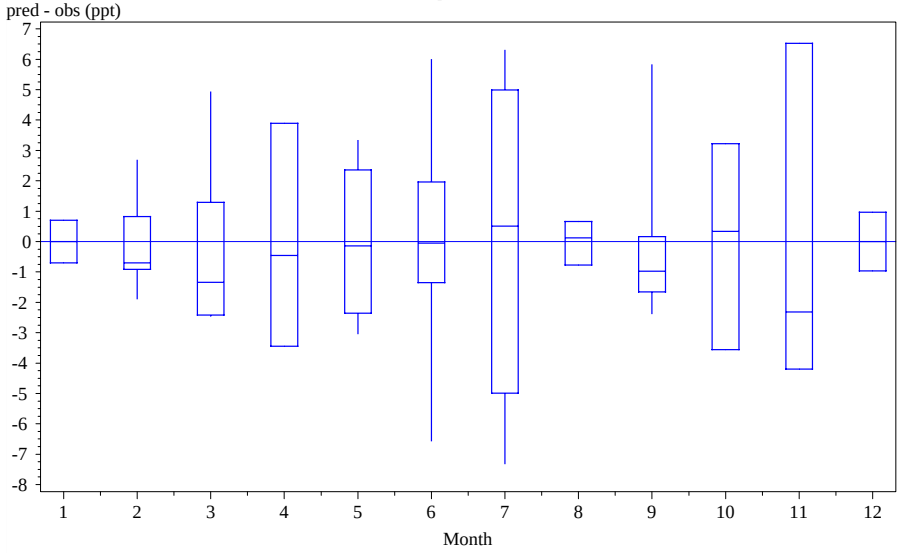


Alafia River Analysis

Residual of Salinity vs. Month in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=1 Meter

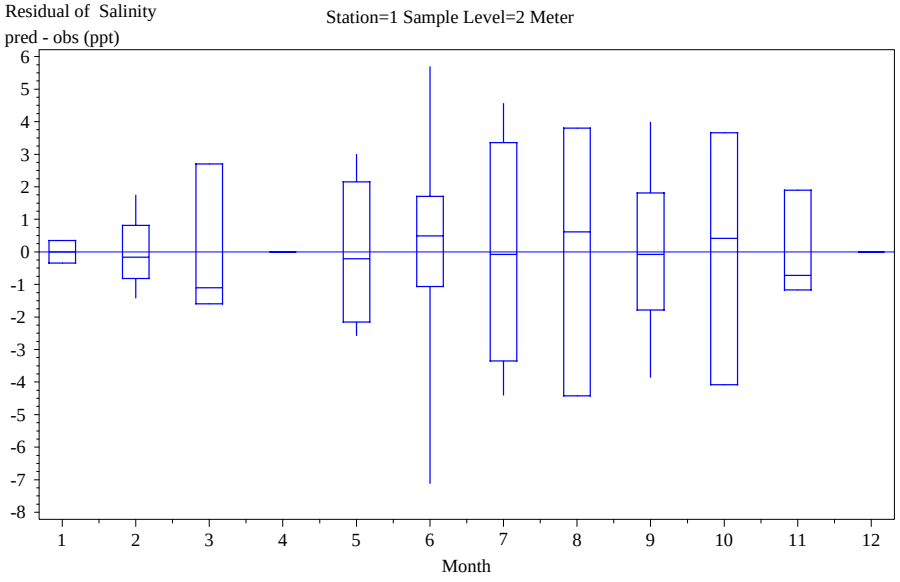


Alafia River Analysis

Residual of Salinity vs. Month in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=2 Meter

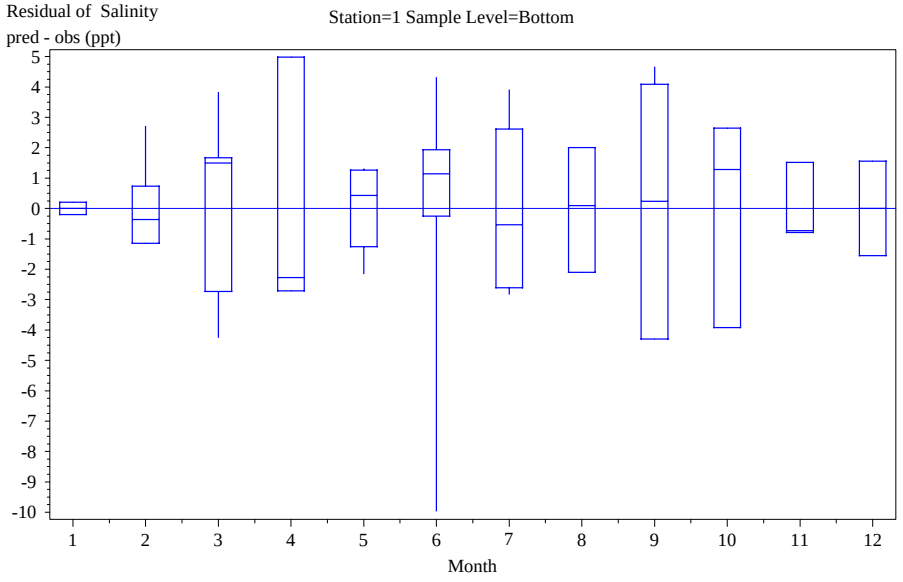


Alafia River Analysis

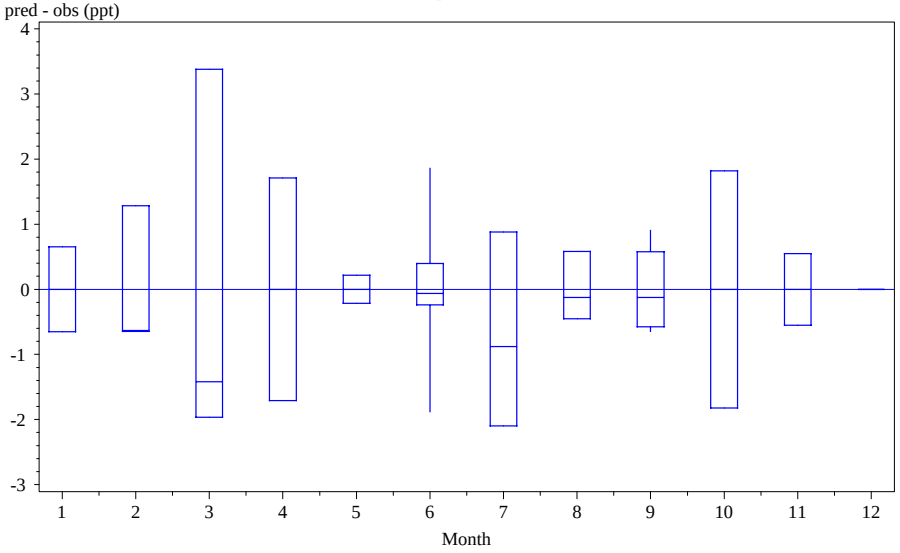
Residual of Salinity vs. Month in each Sample Level and Station

Source: SWFWMD

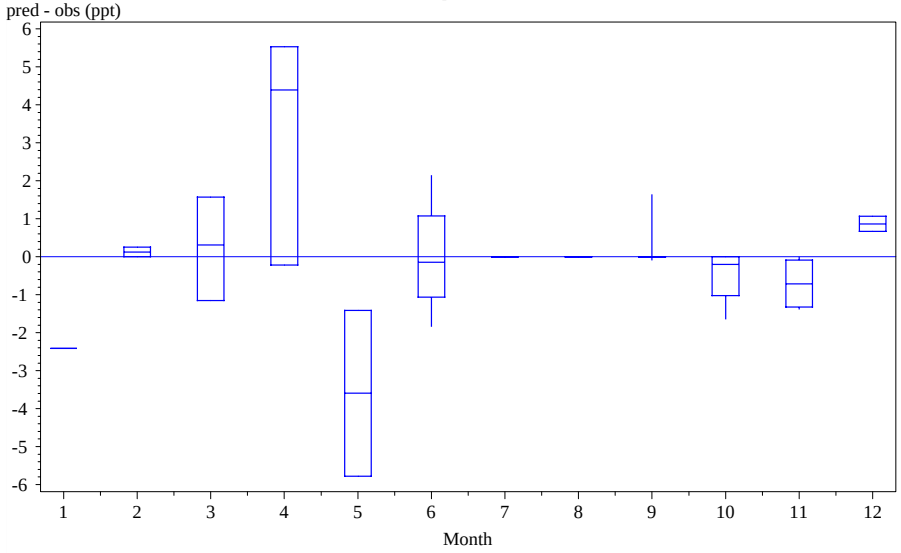
Station=1 Sample Level=Bottom



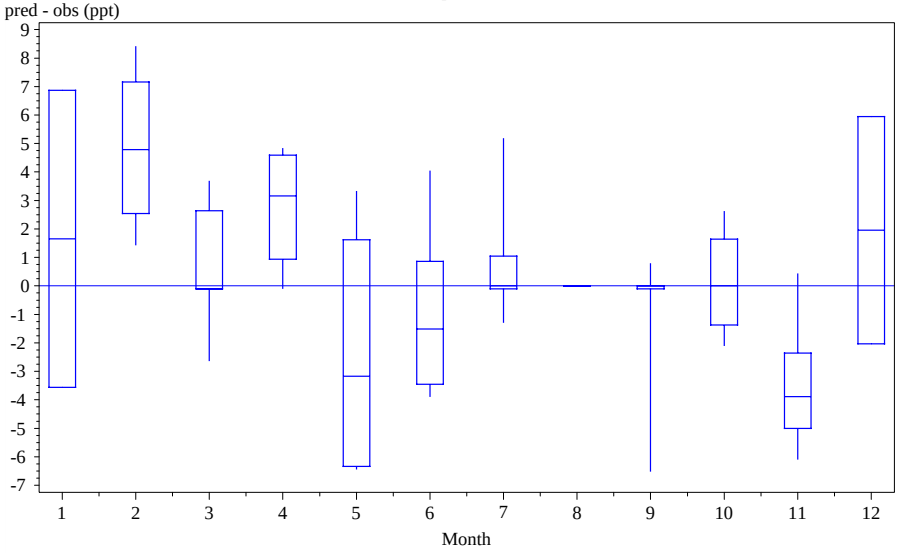
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=1 Sample Level=Surface



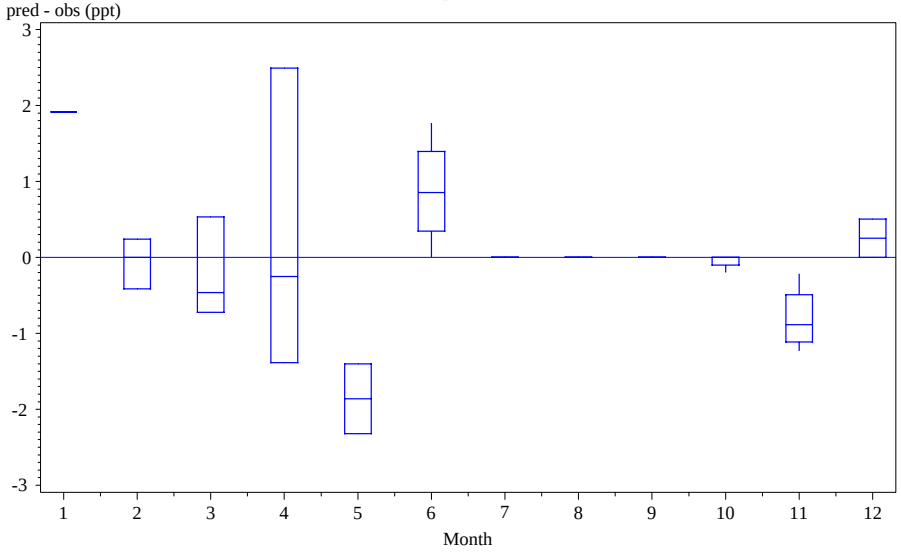
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=1 Meter



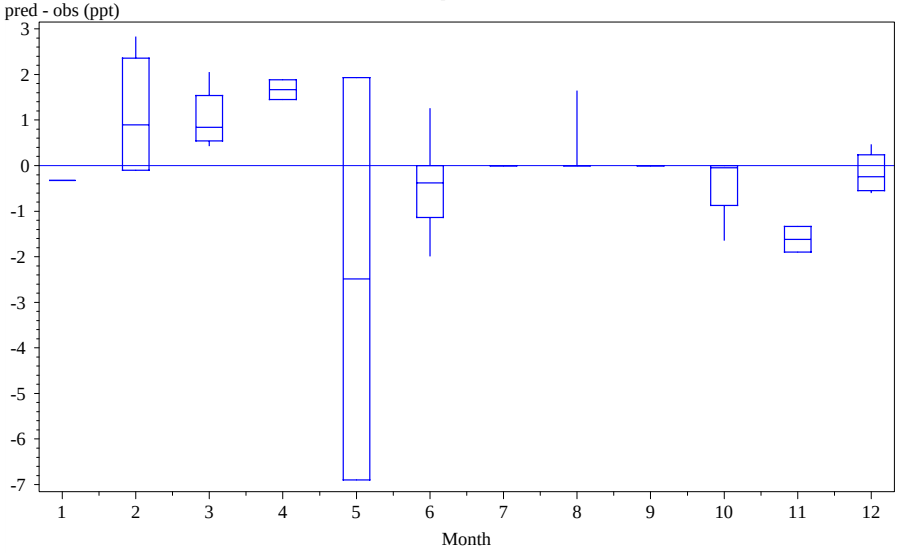
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=Bottom



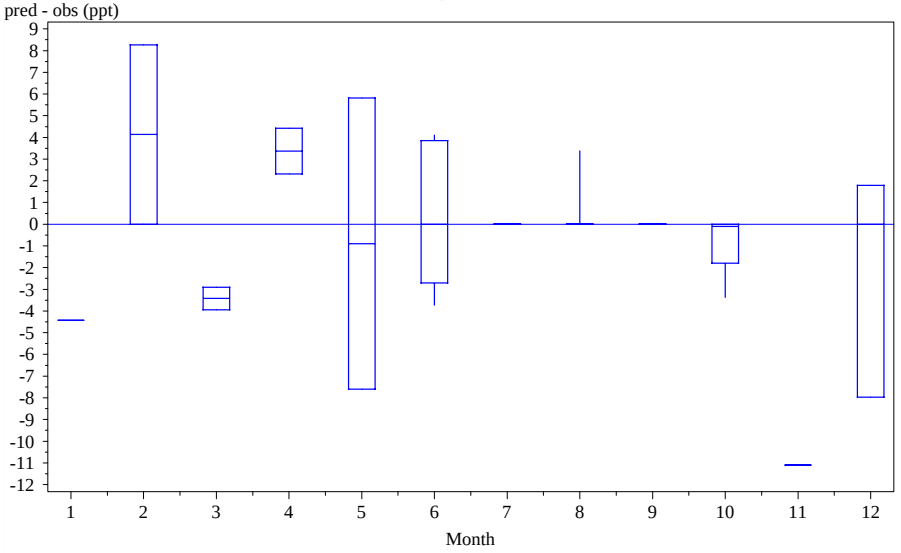
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=10 Sample Level=Surface



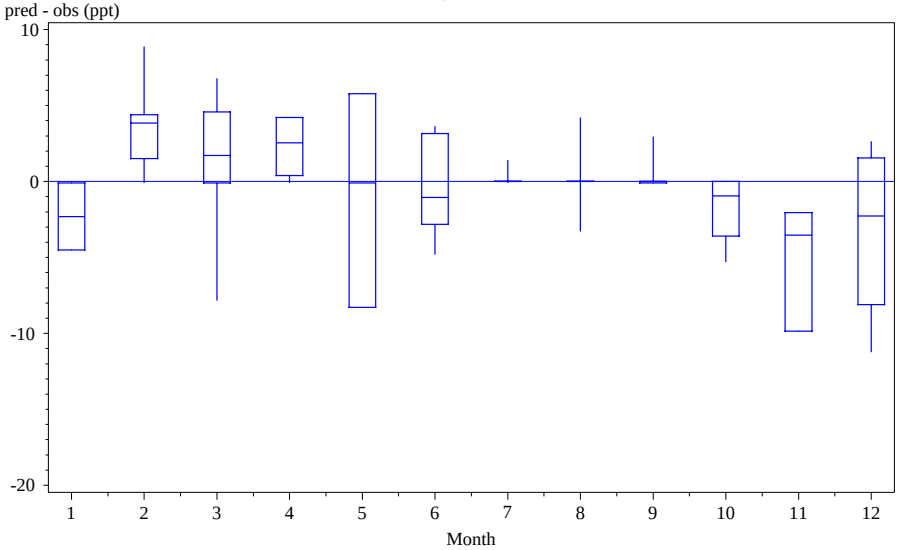
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=1 Meter



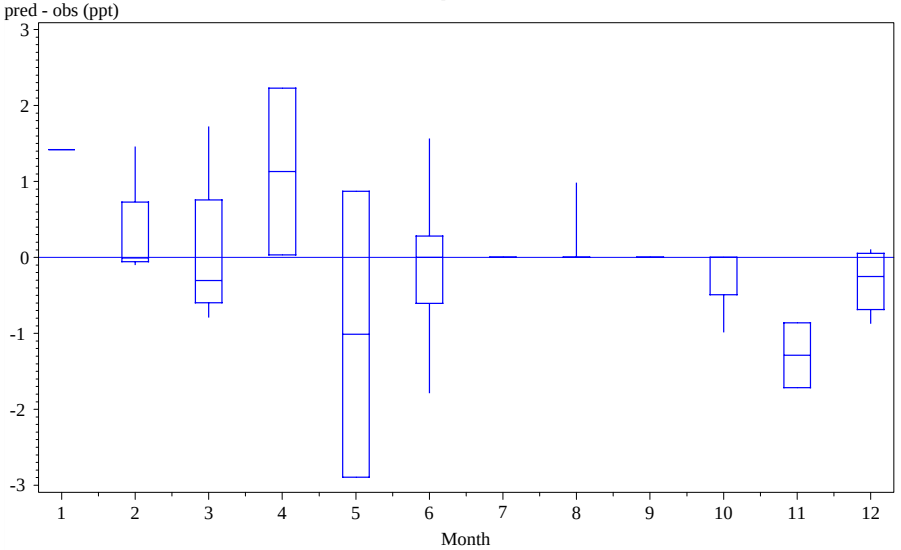
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=2 Meter



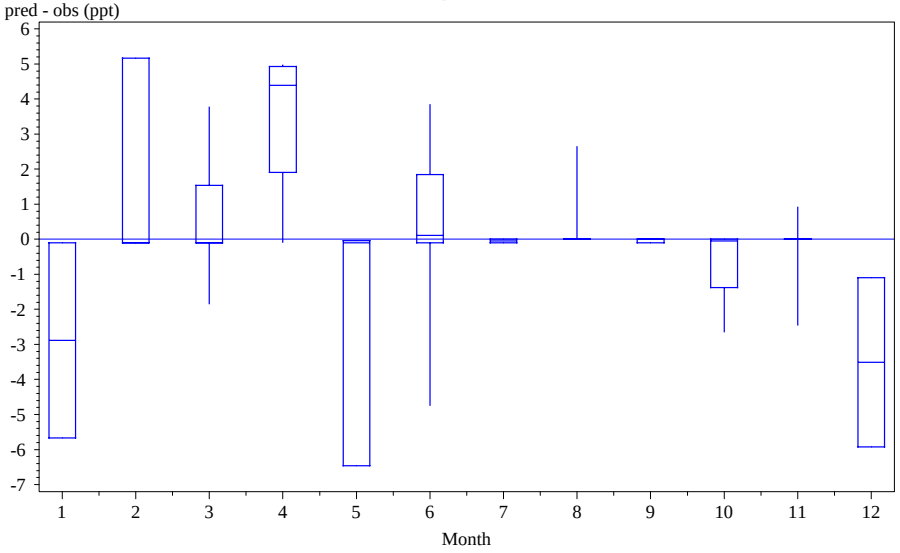
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=Bottom



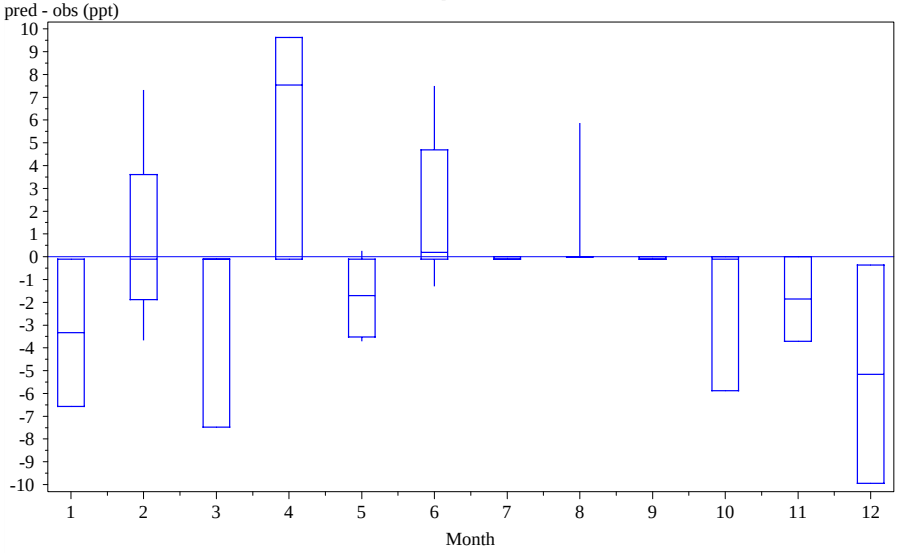
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=11 Sample Level=Surface



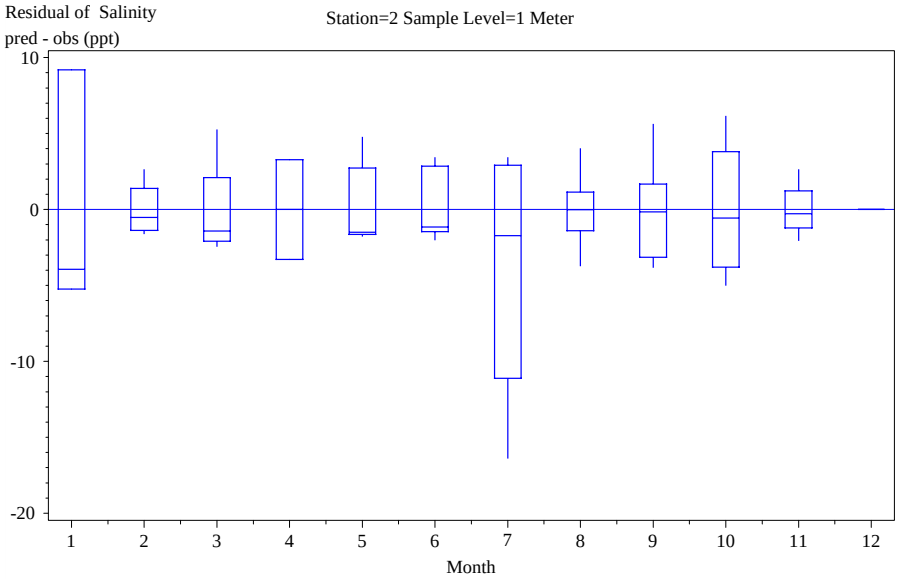
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=13 Sample Level=Bottom



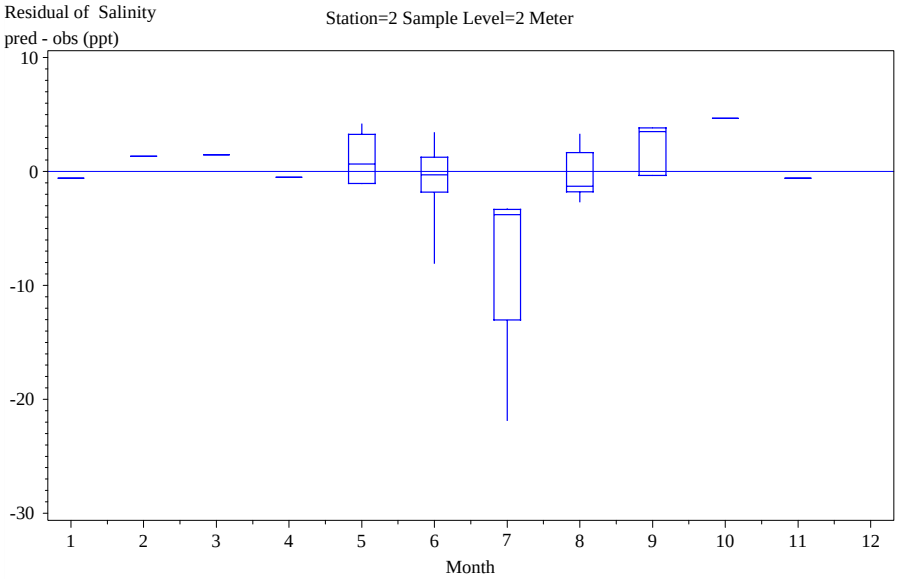
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=14 Sample Level=Bottom



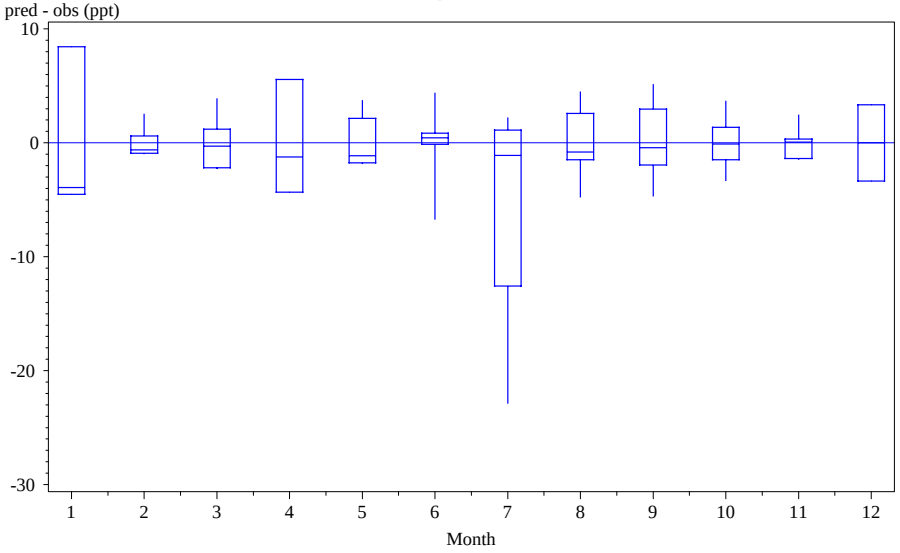
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=1 Meter



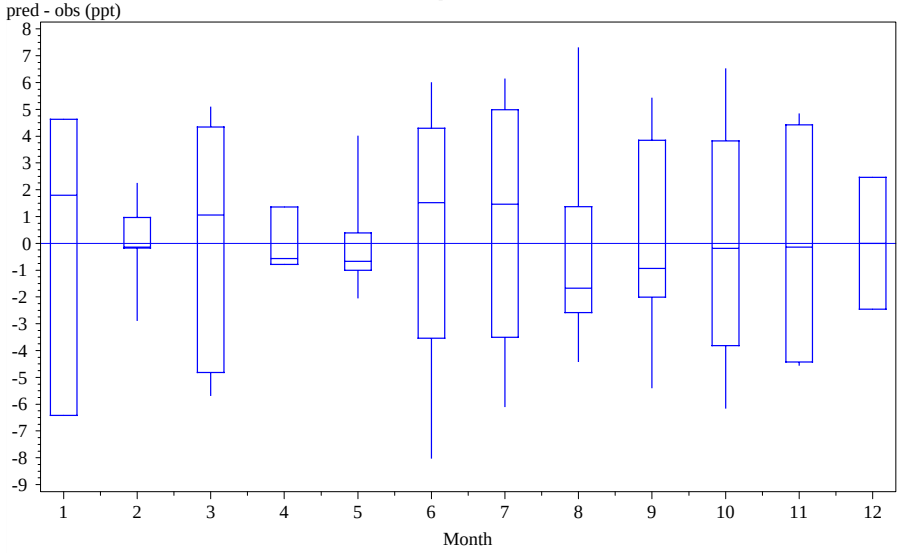
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=2 Meter



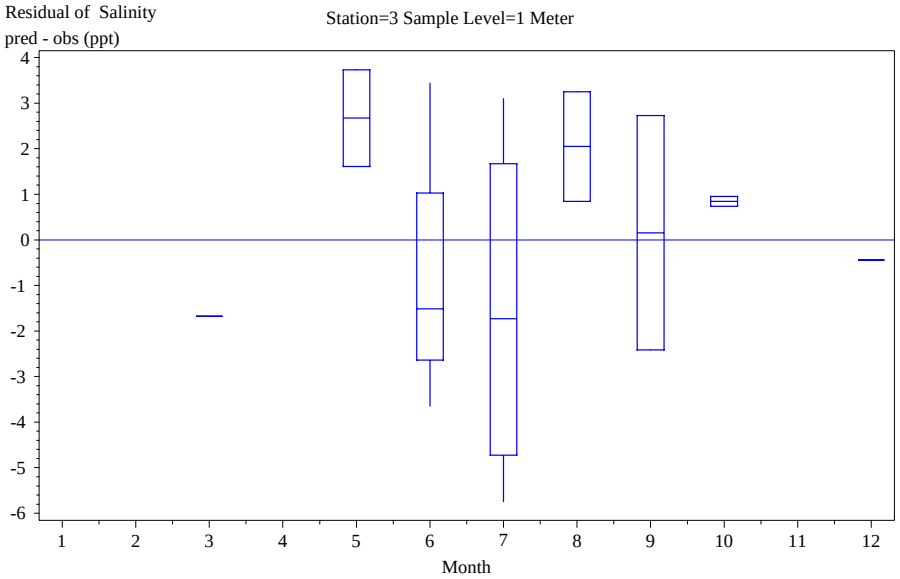
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=Bottom



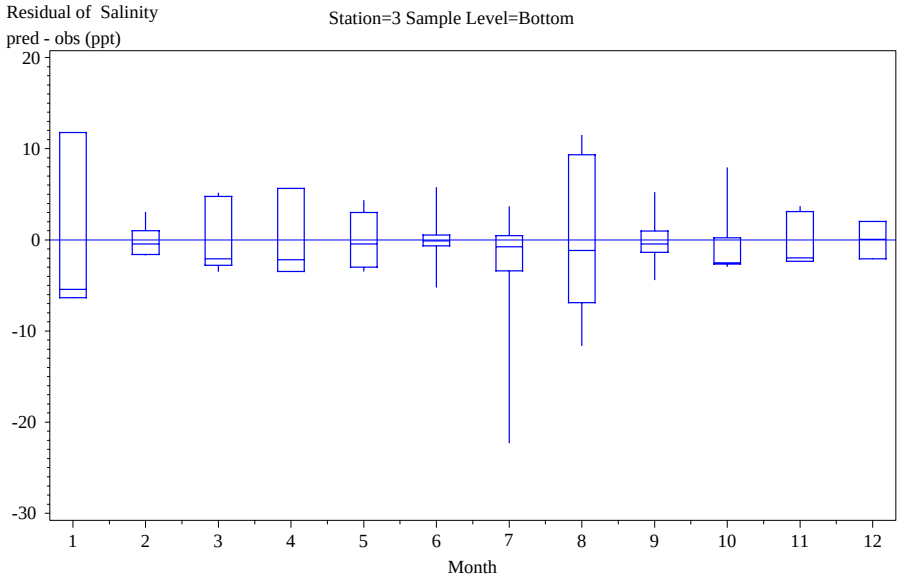
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=2 Sample Level=Surface



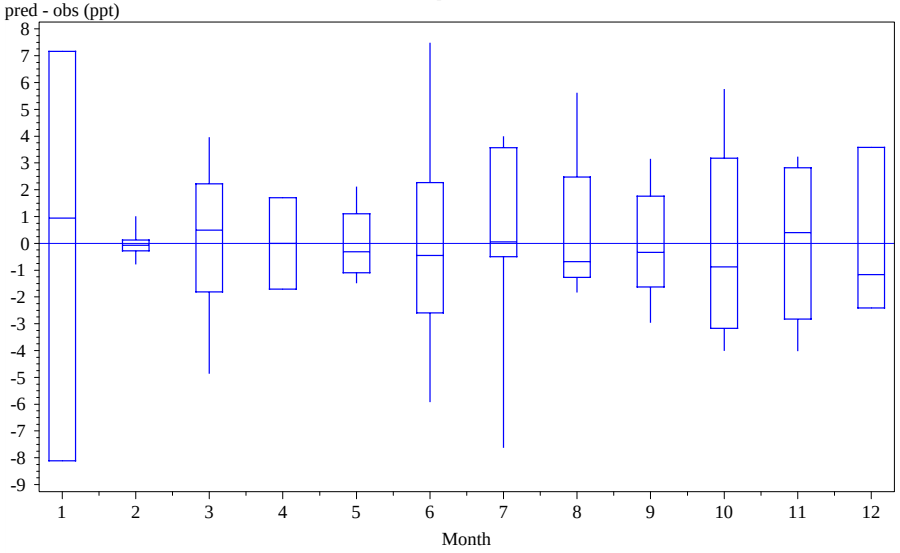
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=1 Meter



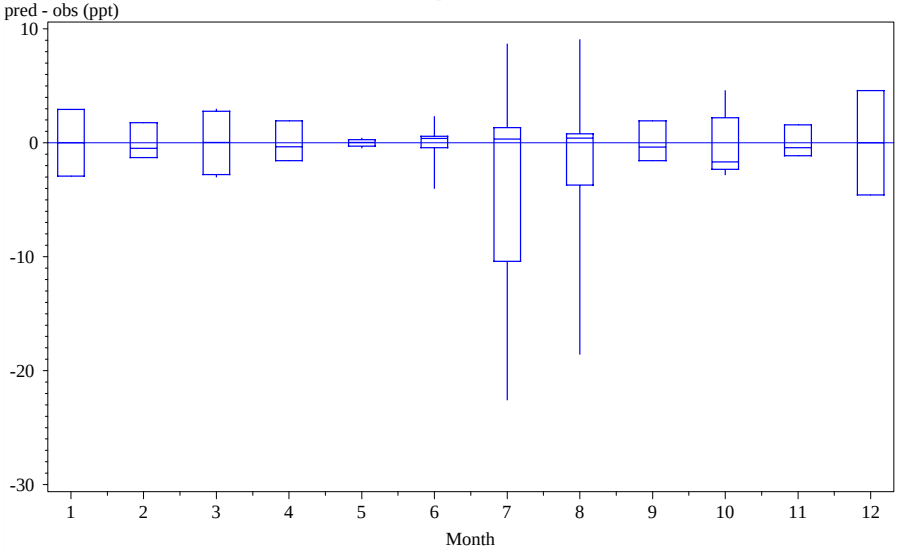
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=Bottom



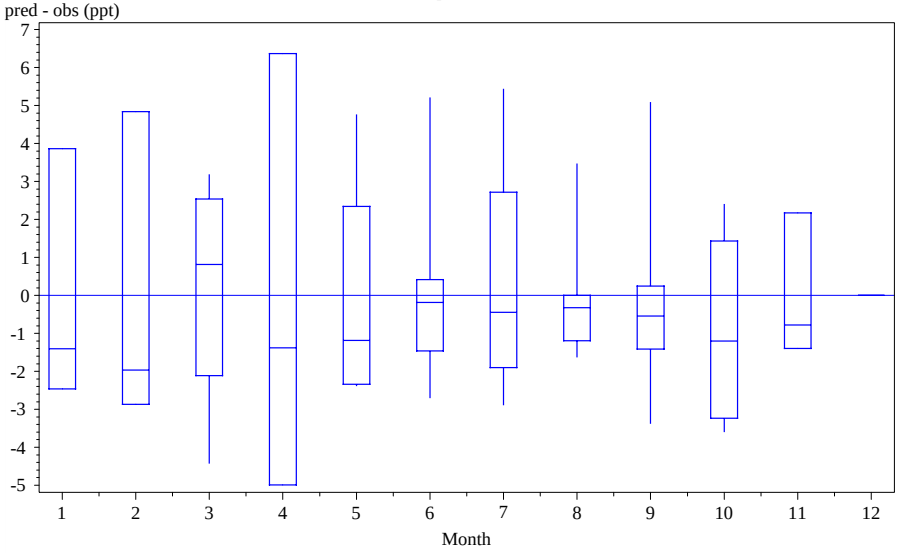
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=3 Sample Level=Surface



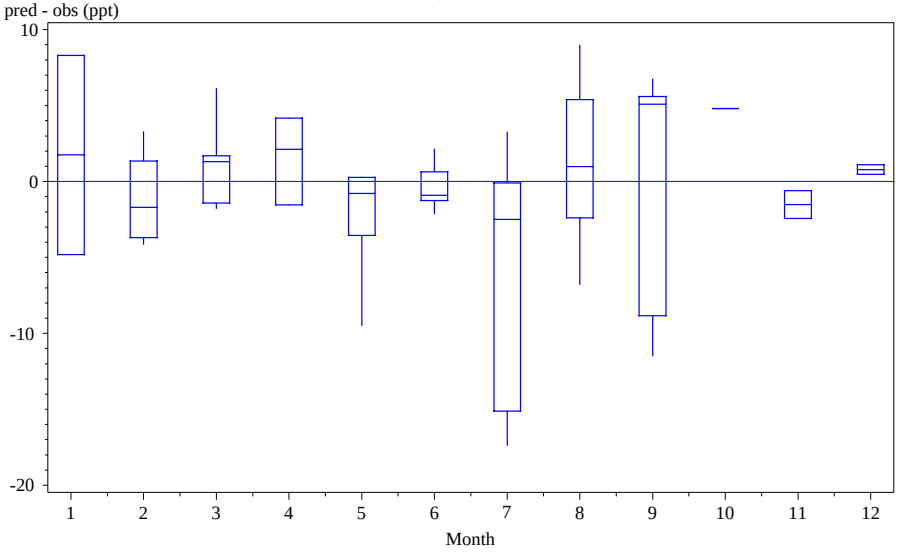
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=4 Sample Level=Bottom



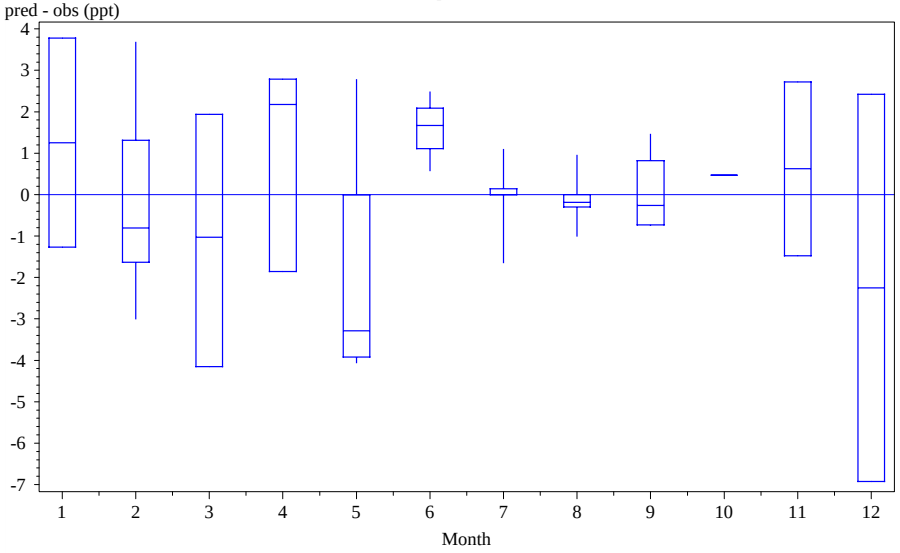
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=4 Sample Level=Surface



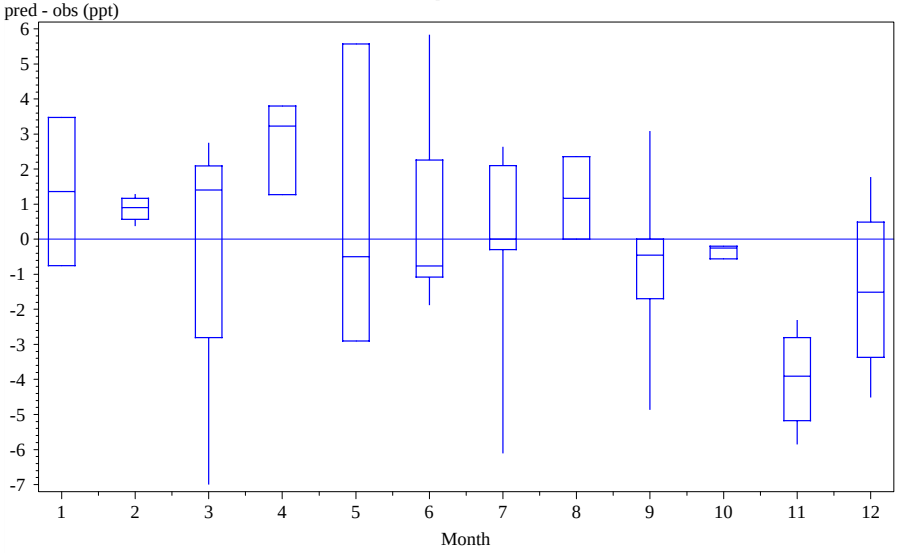
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=5 Sample Level=Bottom



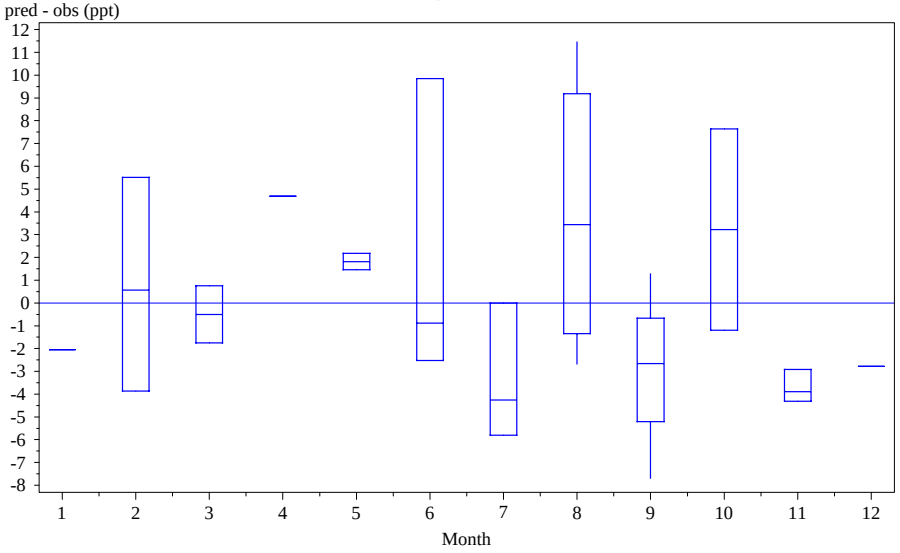
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=5 Sample Level=Surface



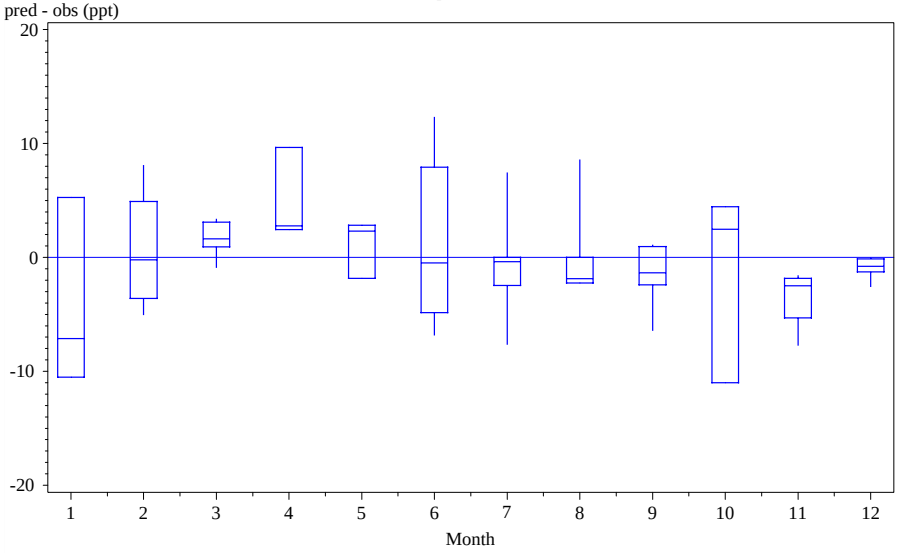
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=6 Sample Level=1 Meter



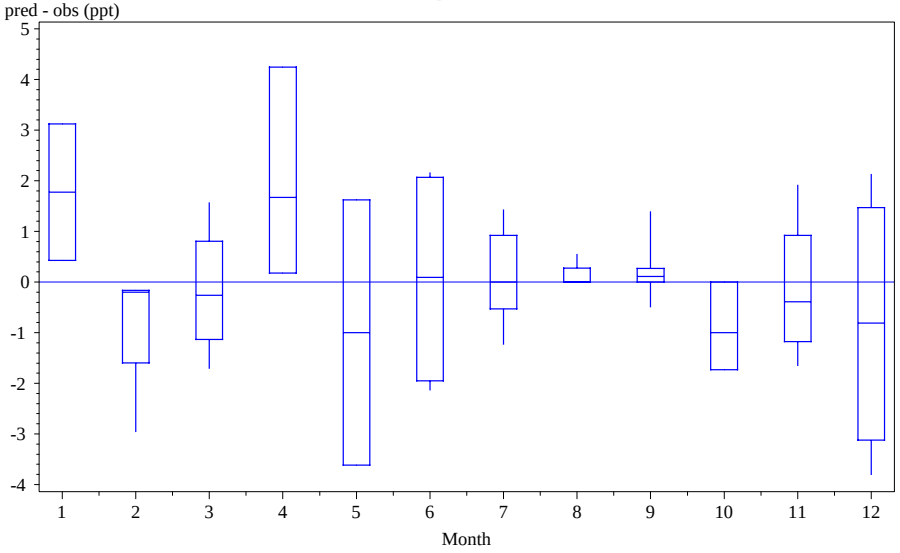
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=6 Sample Level=2 Meter



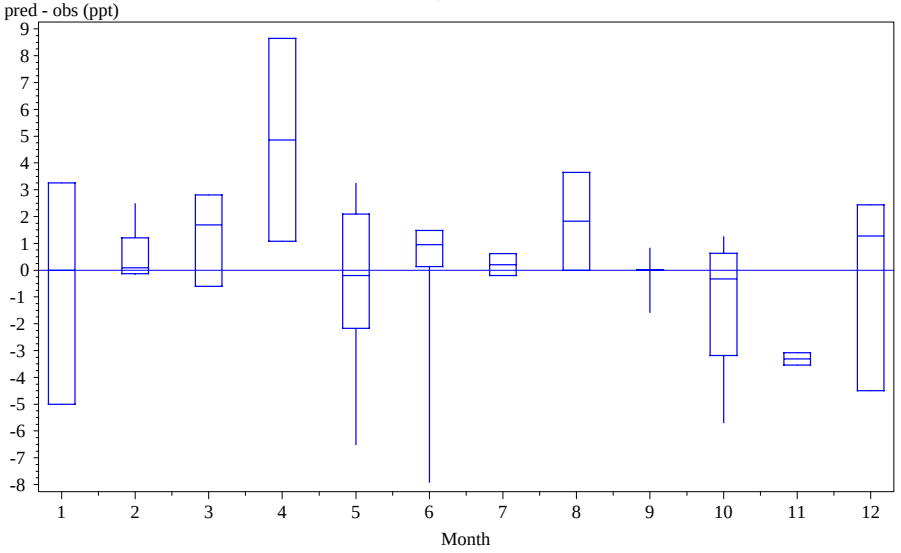
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=6 Sample Level=Bottom



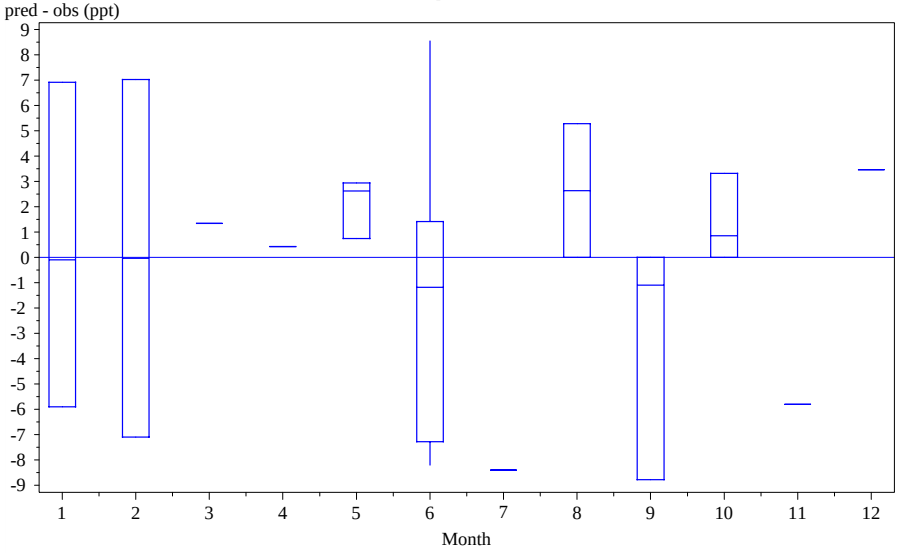
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=6 Sample Level=Surface



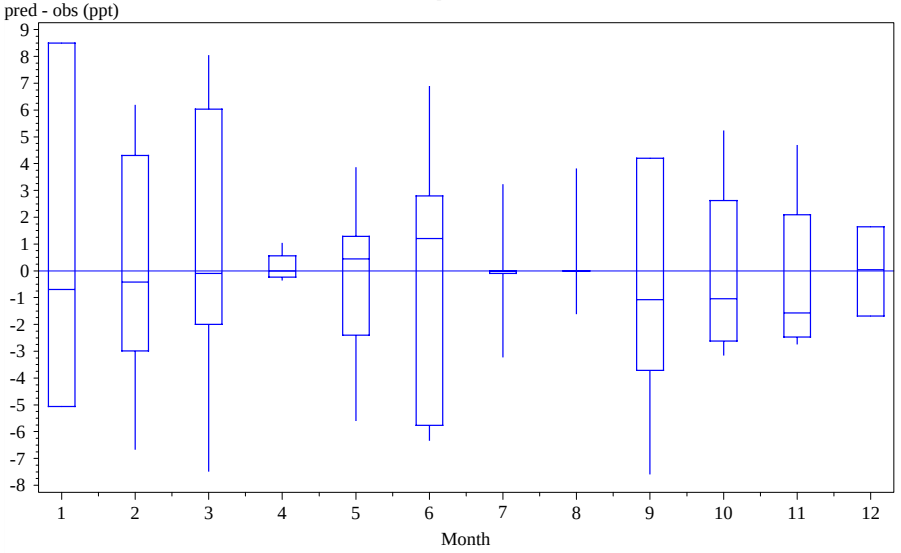
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=1 Meter



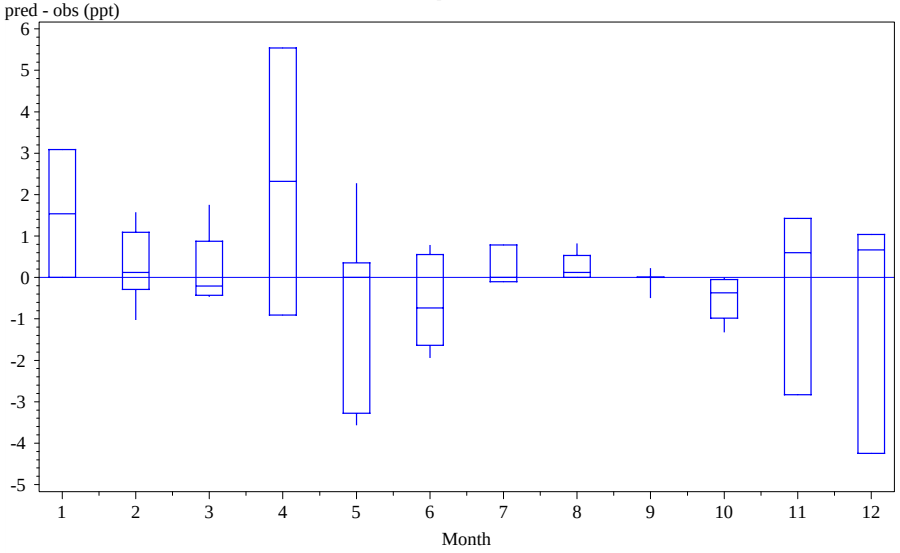
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=2 Meter



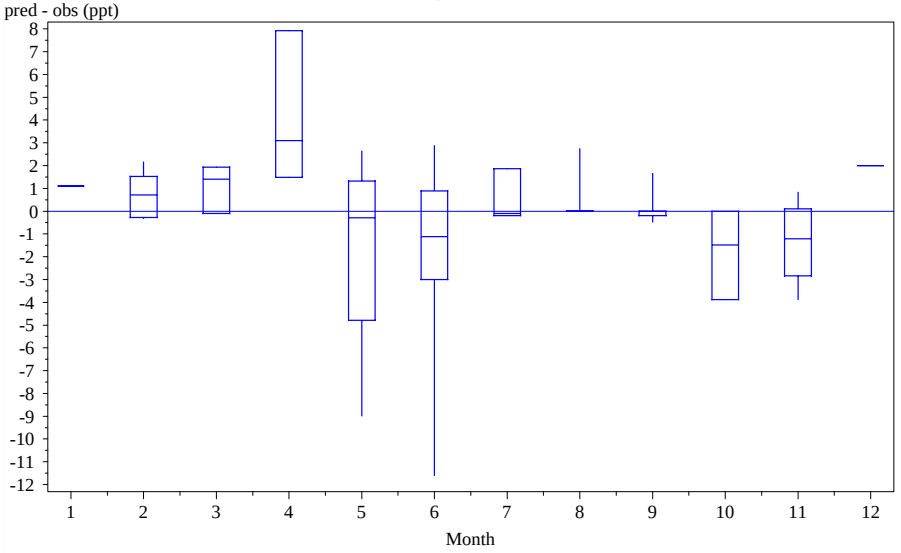
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=Bottom



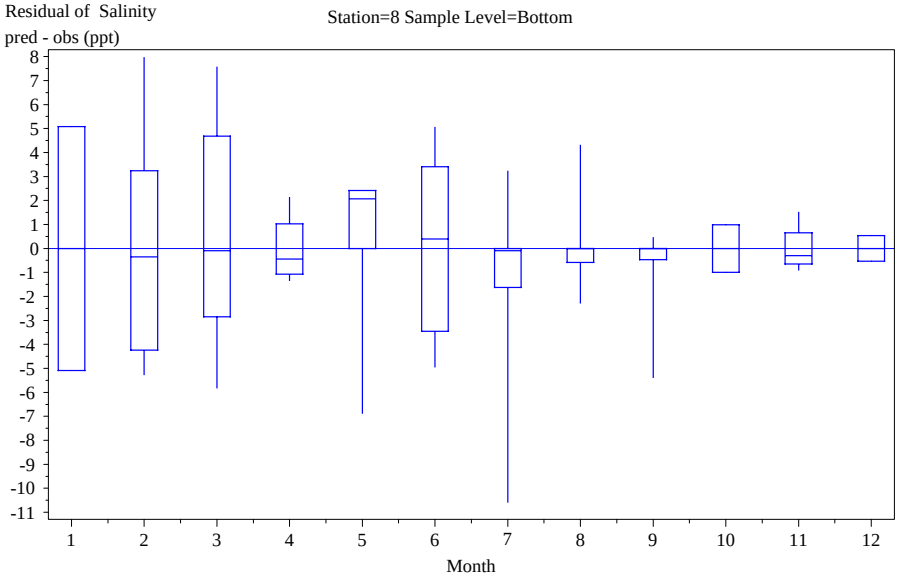
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=7 Sample Level=Surface



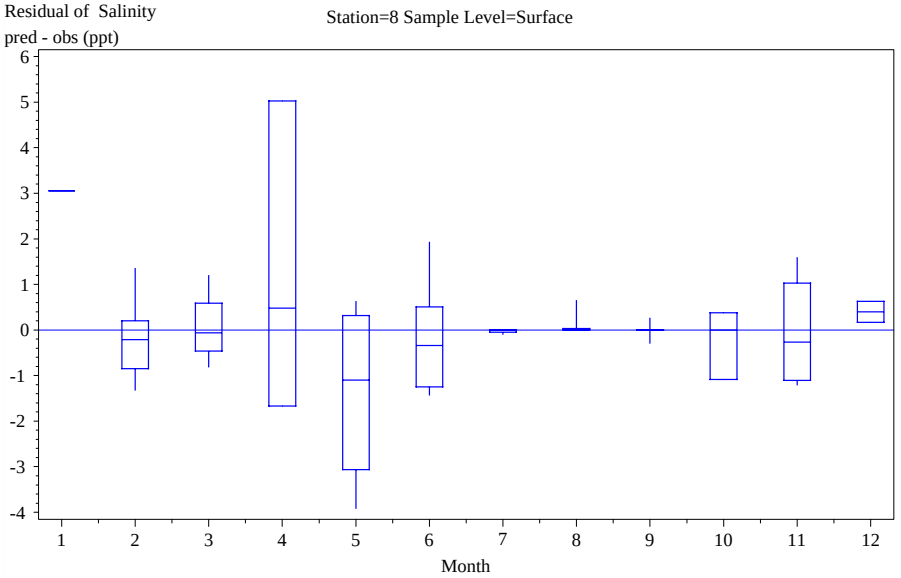
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=1 Meter



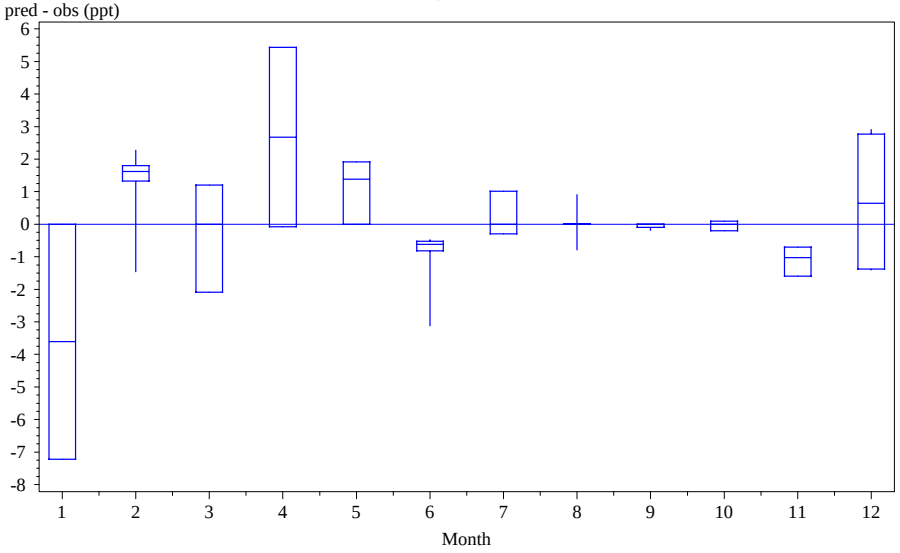
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=Bottom



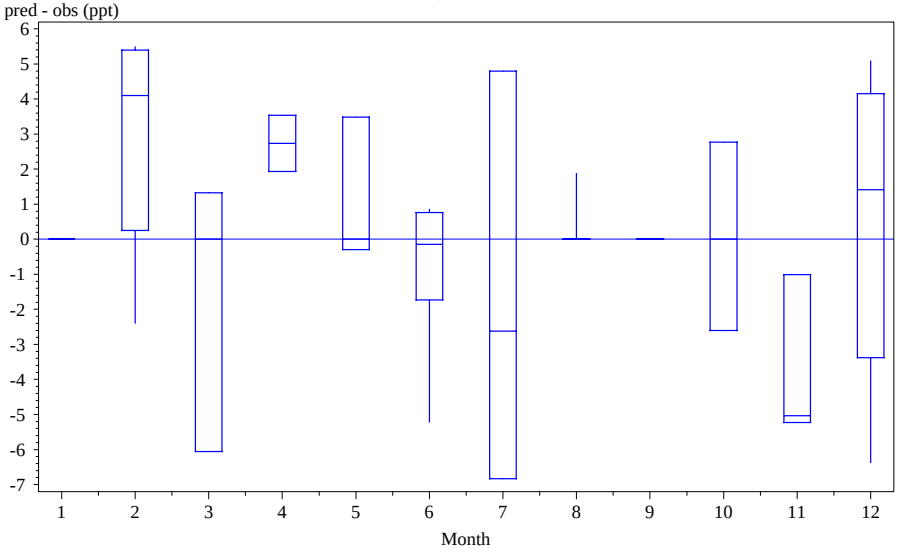
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=8 Sample Level=Surface



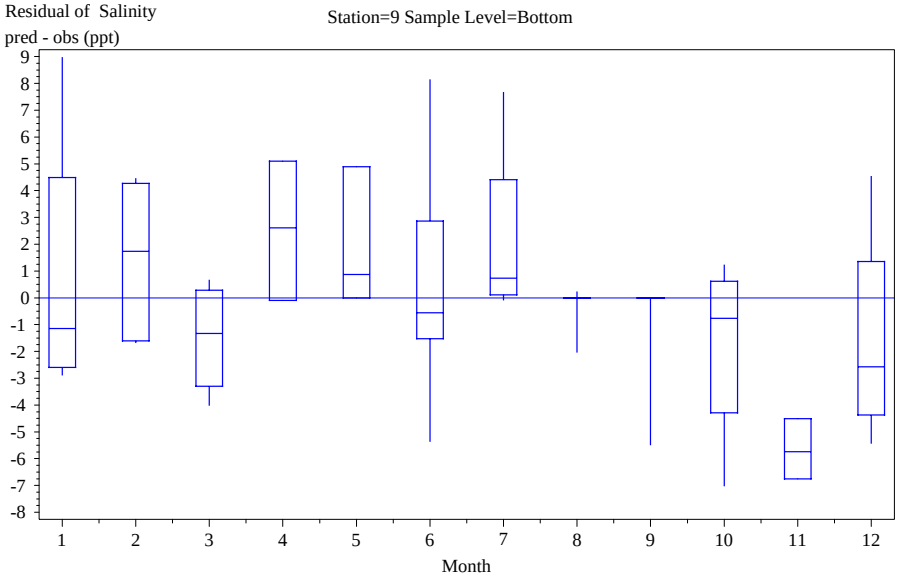
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=1 Meter



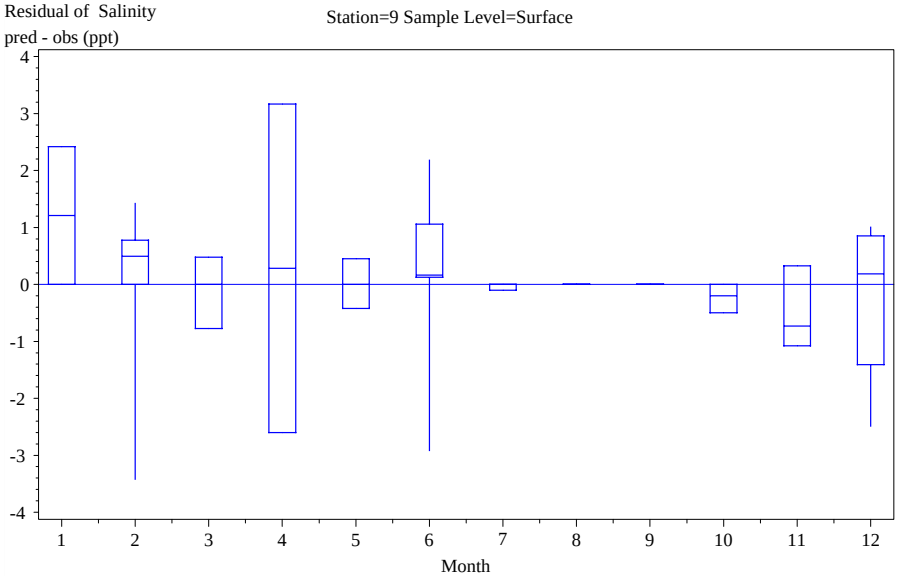
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=2 Meter



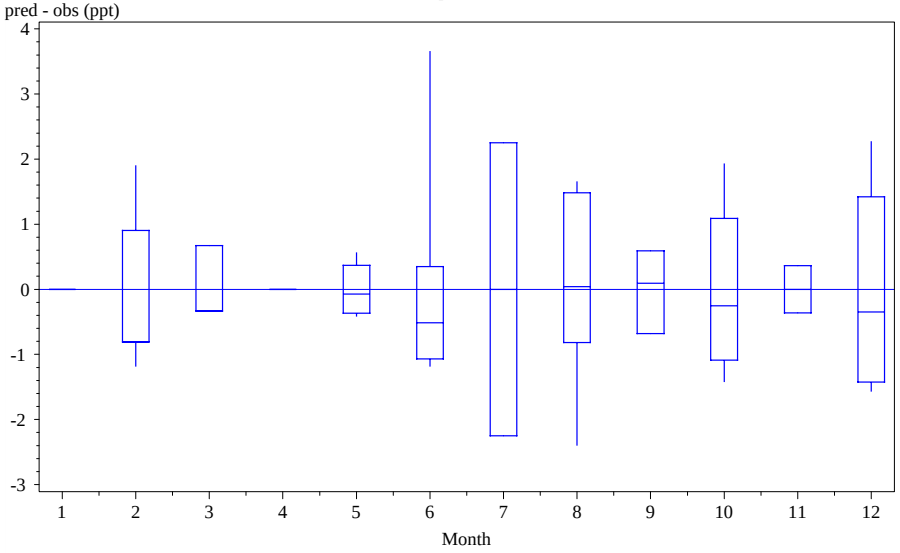
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=Bottom



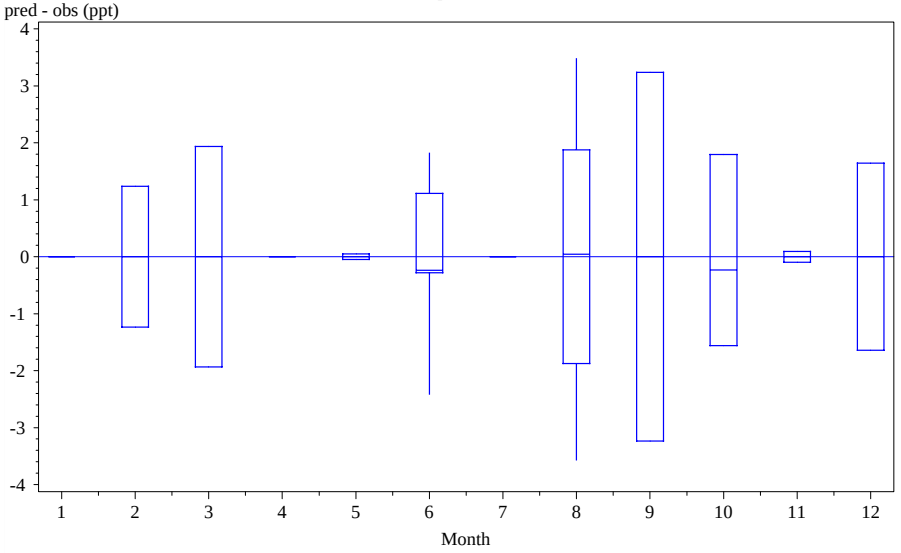
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=9 Sample Level=Surface



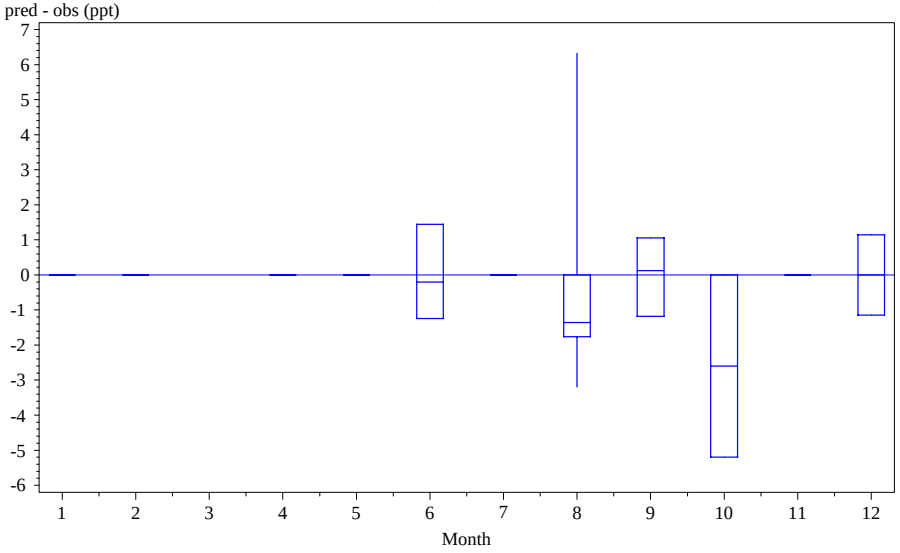
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=B Sample Level=Bottom



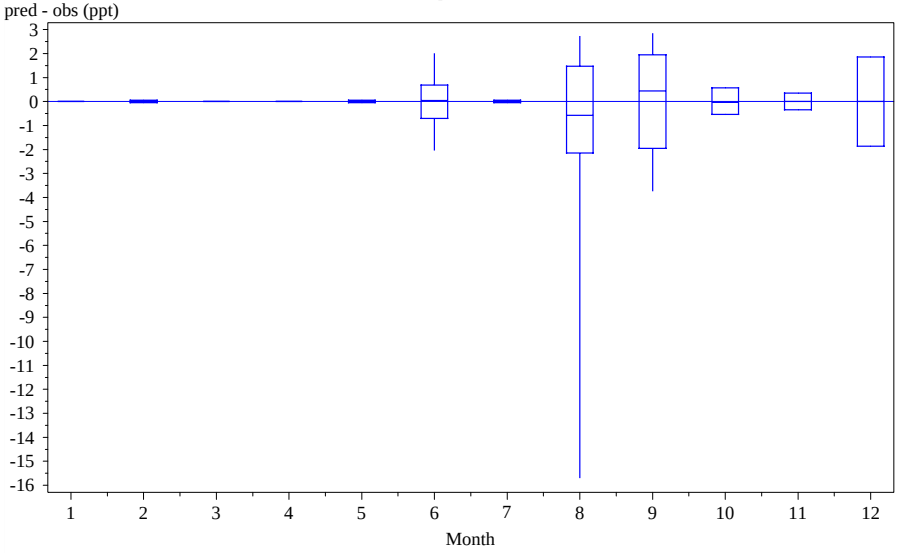
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=B Sample Level=Surface



Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=C Sample Level=1 Meter



Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: SWFWMD
Station=C Sample Level=Bottom

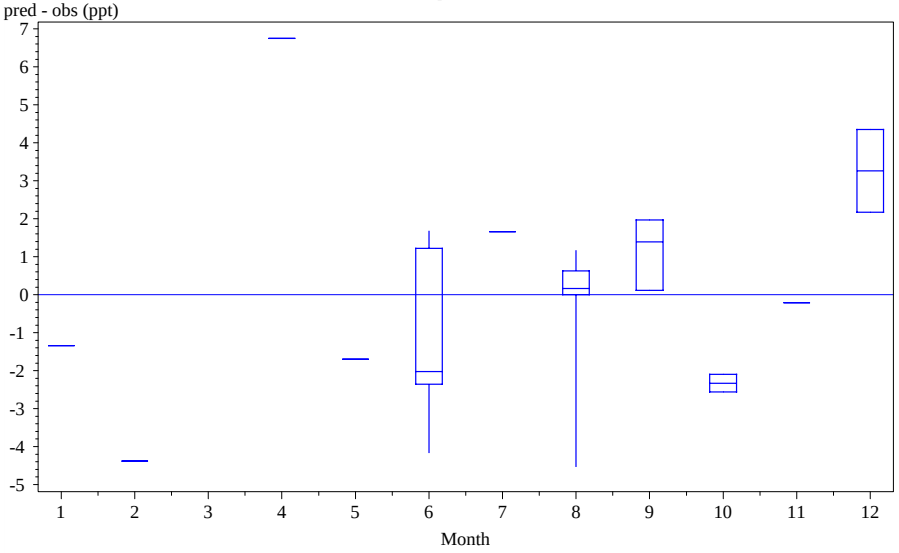


Alafia River Analysis

Residual of Salinity vs. Month in each Sample Level and Station

Source: SWFWMD

Station=C Sample Level=Surface

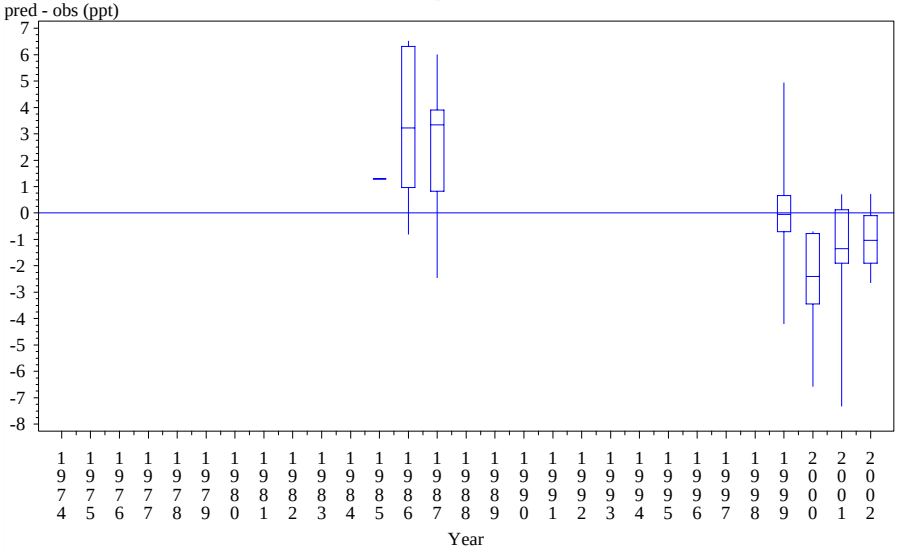


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=1 Meter

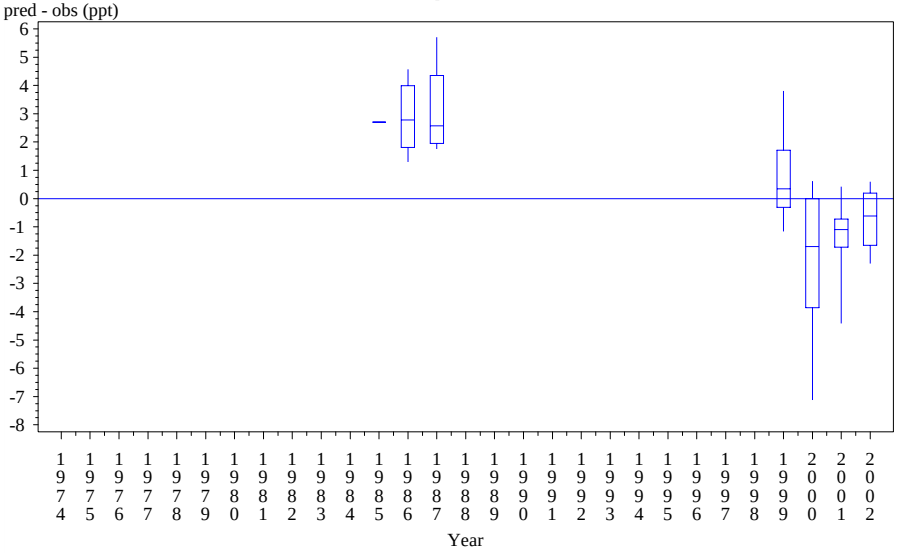


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=2 Meter

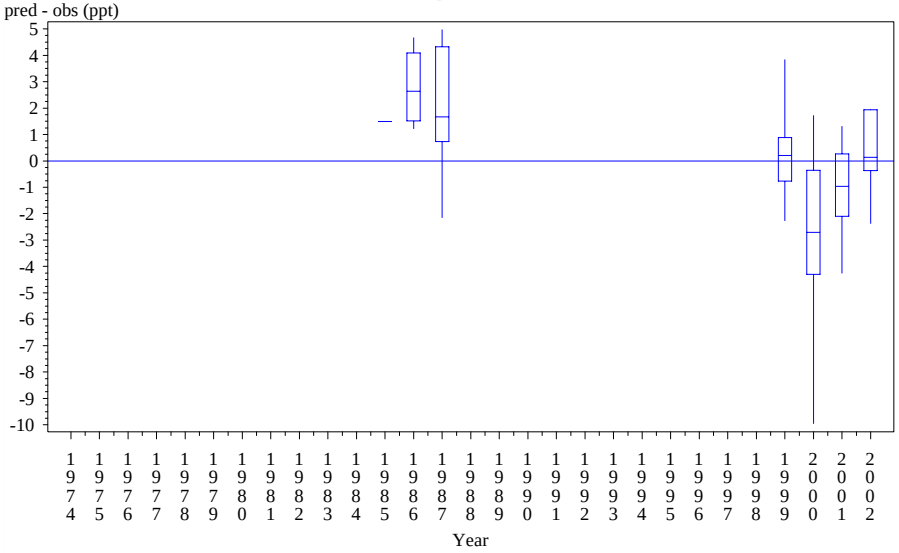


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=Bottom

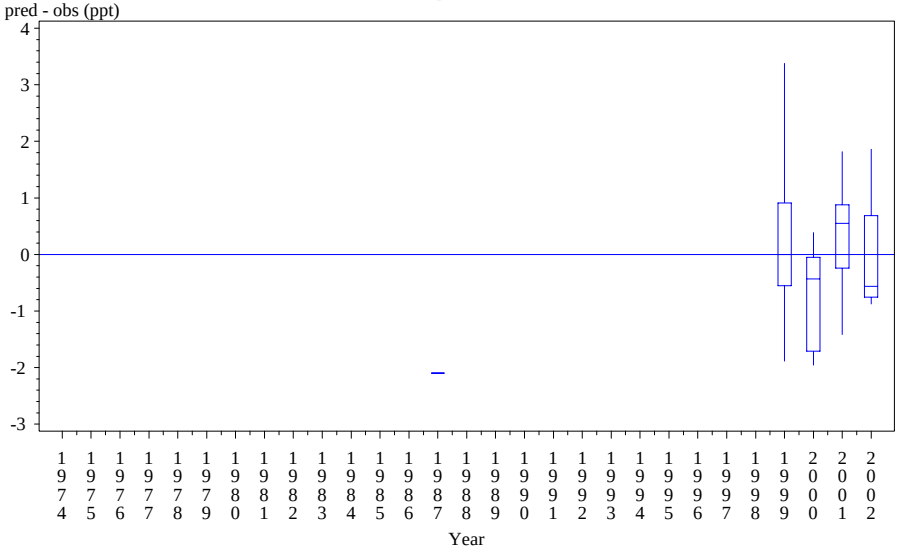


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=1 Sample Level=Surface

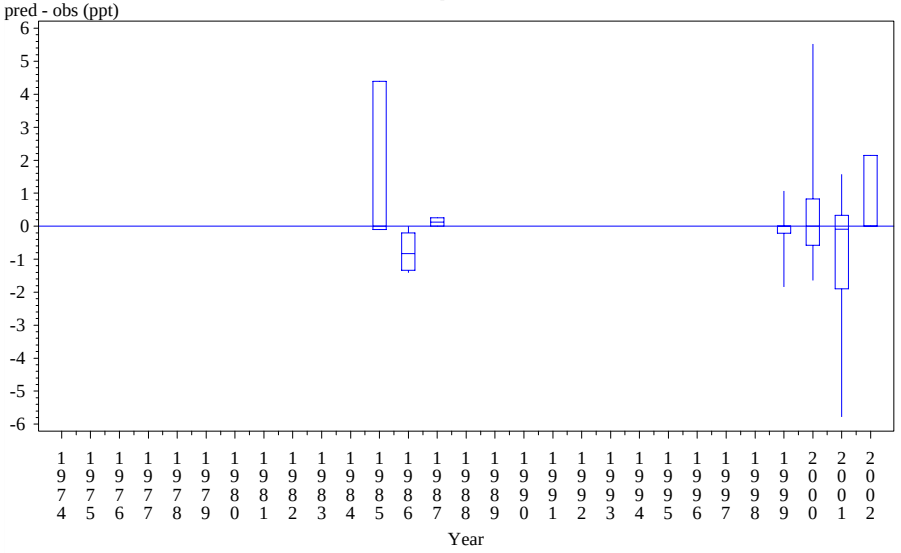


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=10 Sample Level=1 Meter

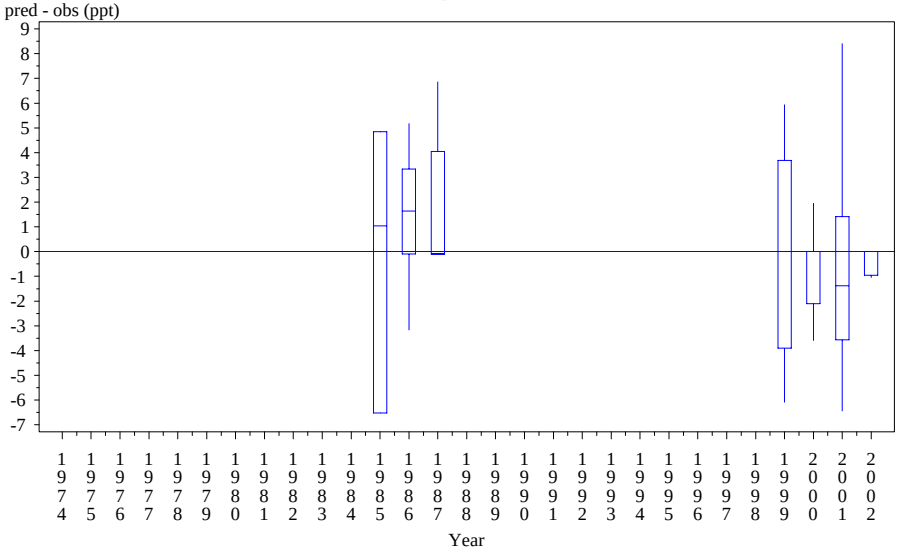


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=10 Sample Level=Bottom

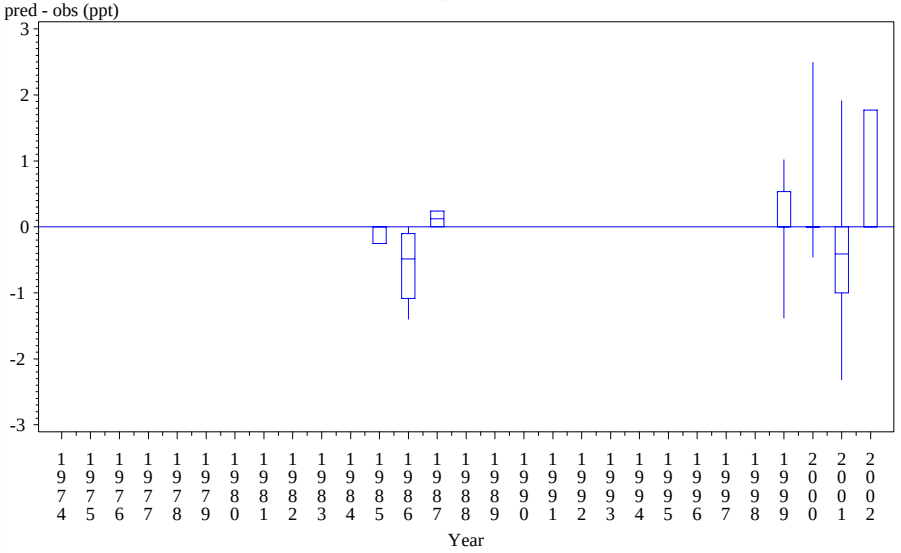


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=10 Sample Level=Surface

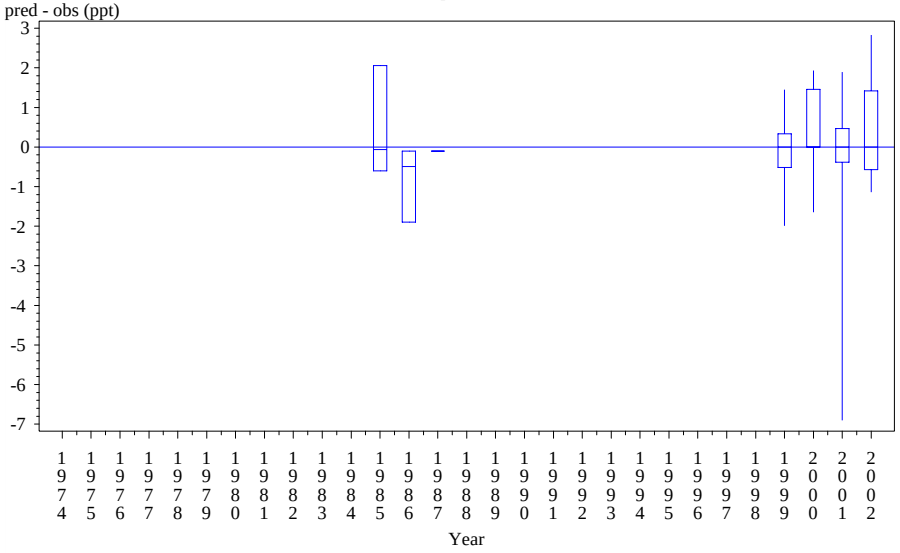


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=11 Sample Level=1 Meter

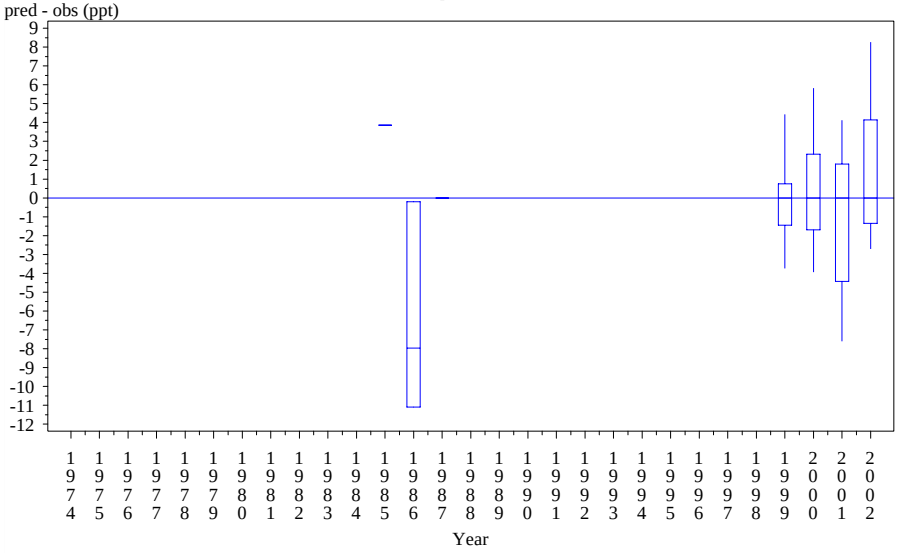


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=11 Sample Level=2 Meter

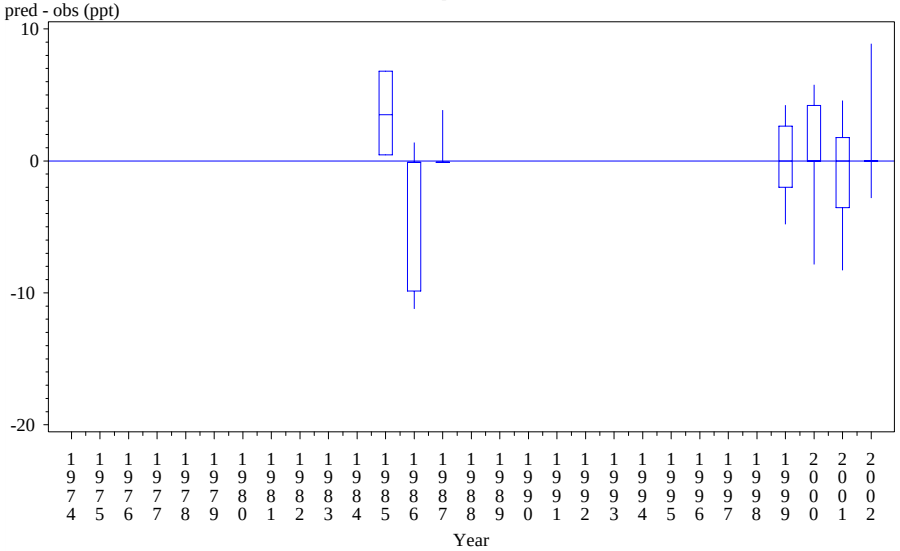


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=11 Sample Level=Bottom

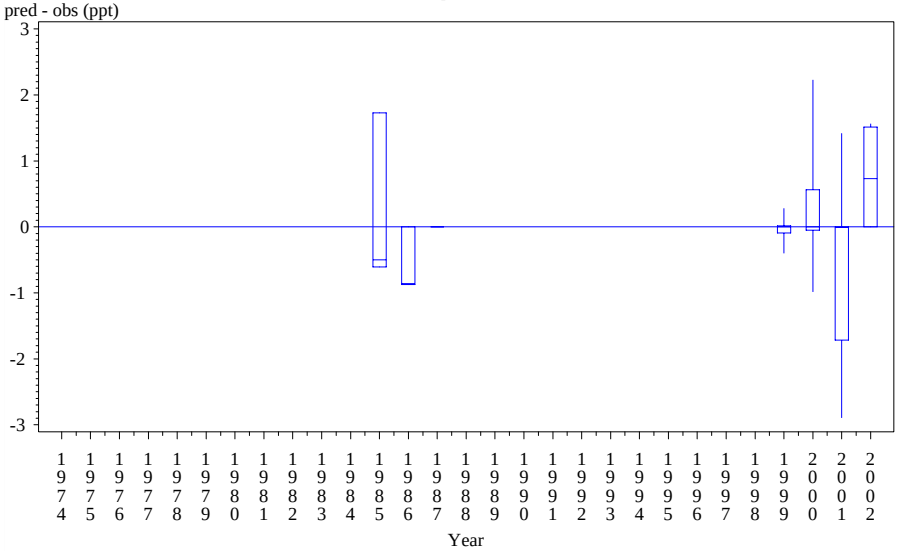


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=11 Sample Level=Surface

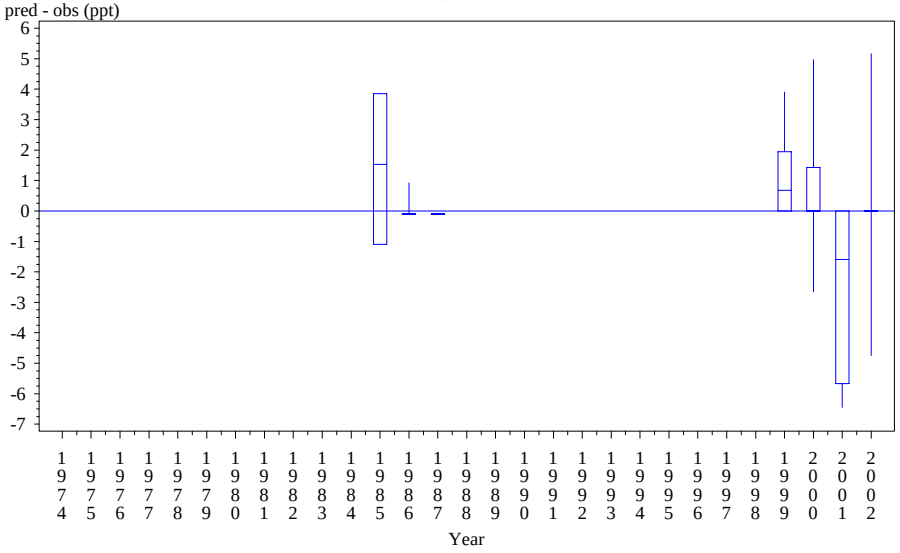


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=13 Sample Level=Bottom

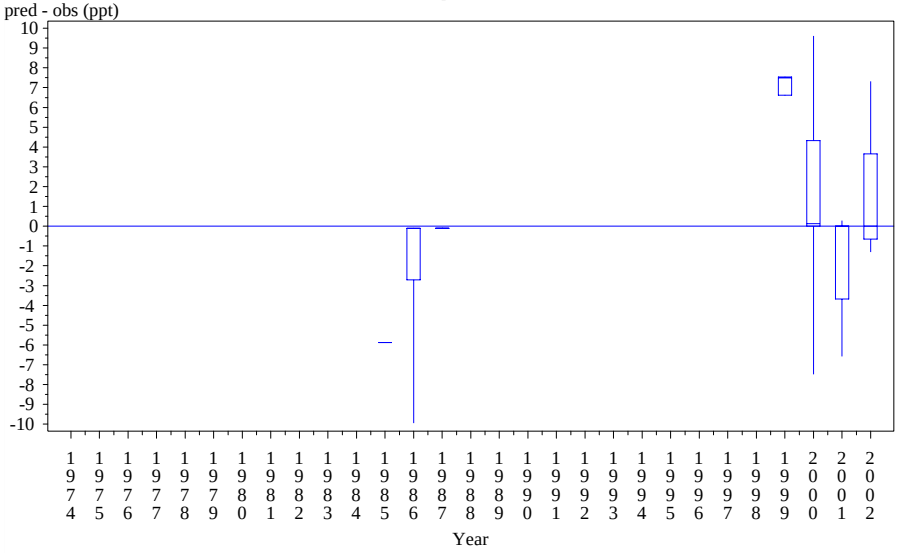


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=14 Sample Level=Bottom

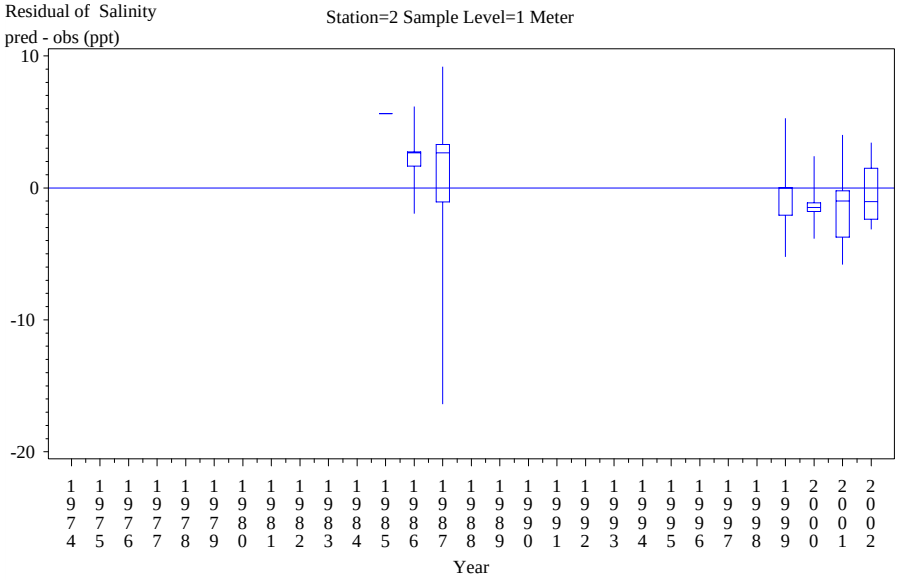


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=2 Sample Level=1 Meter

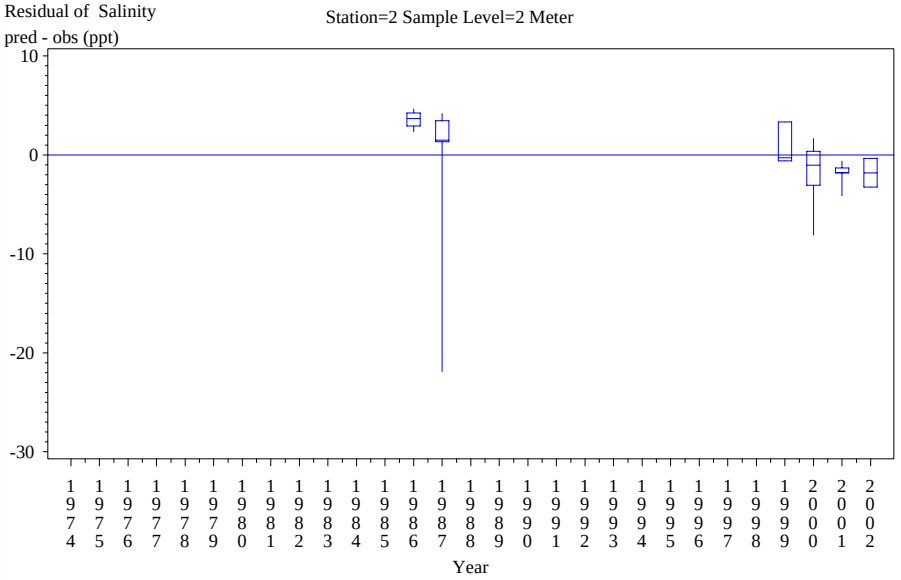


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=2 Sample Level=2 Meter

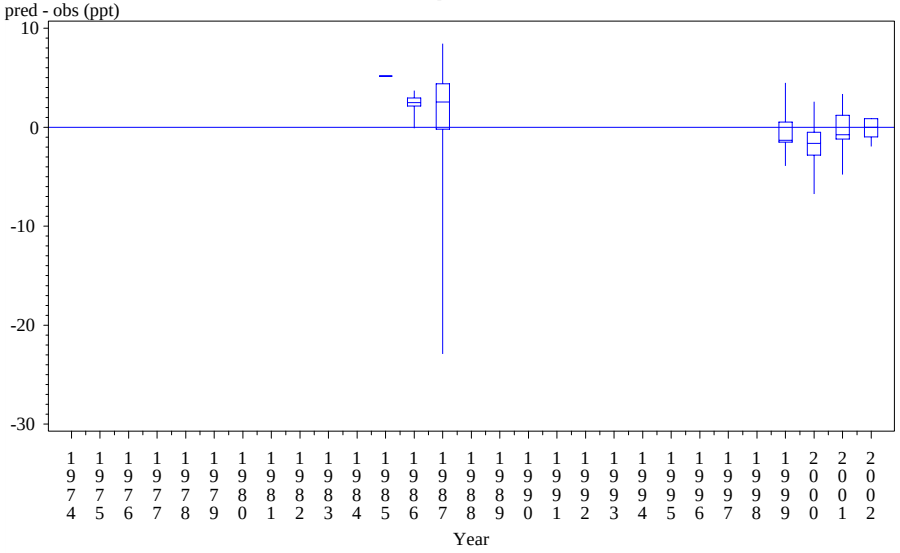


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=2 Sample Level=Bottom

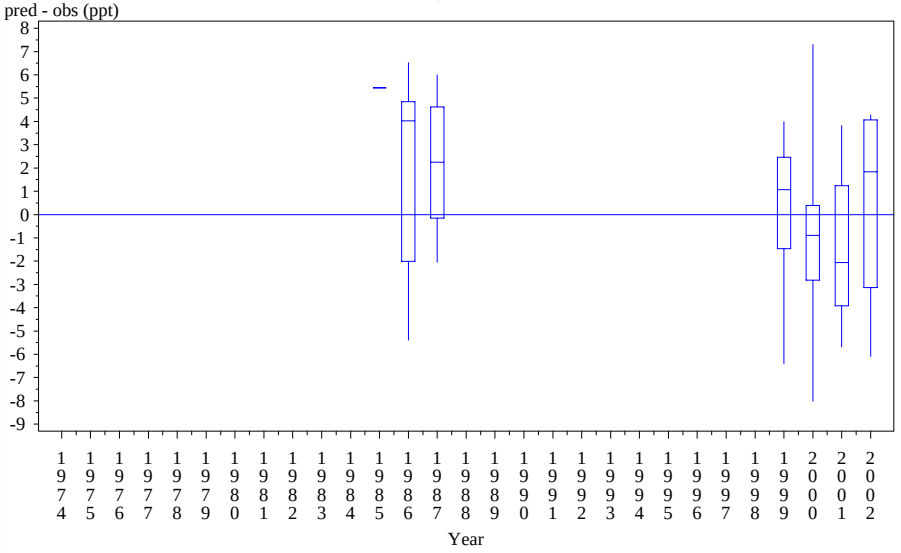


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=2 Sample Level=Surface

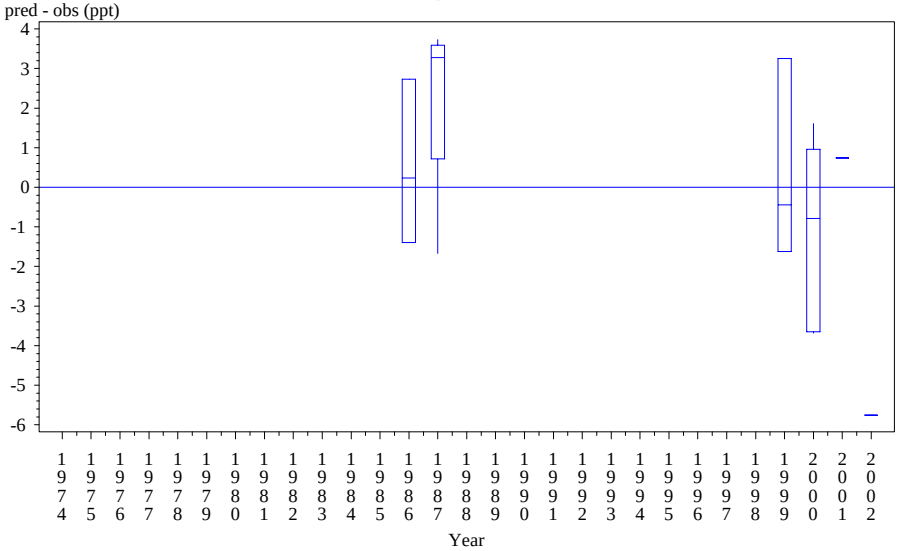


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=3 Sample Level=1 Meter

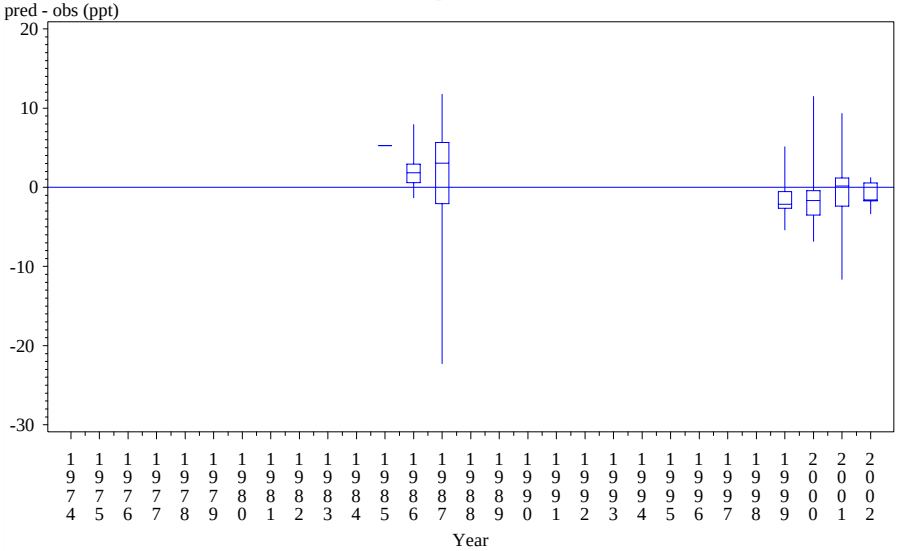


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=3 Sample Level=Bottom

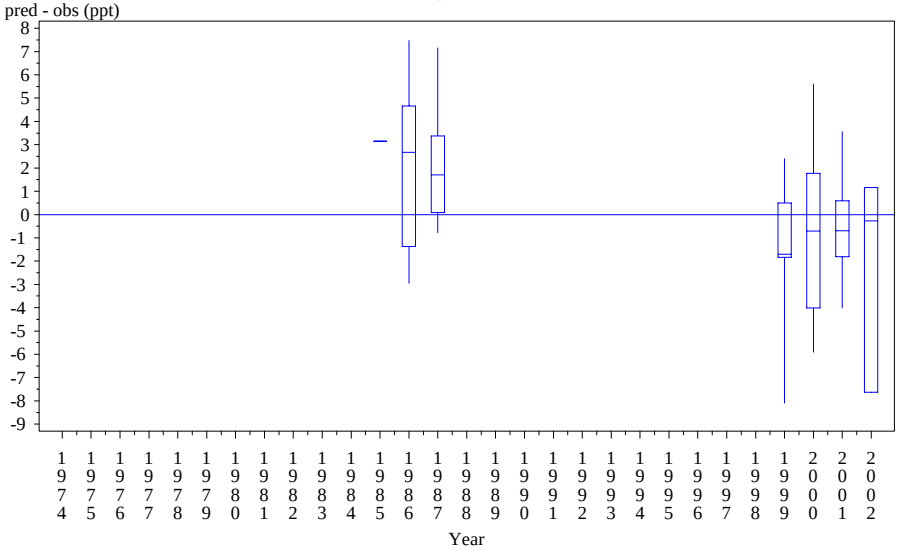


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=3 Sample Level=Surface

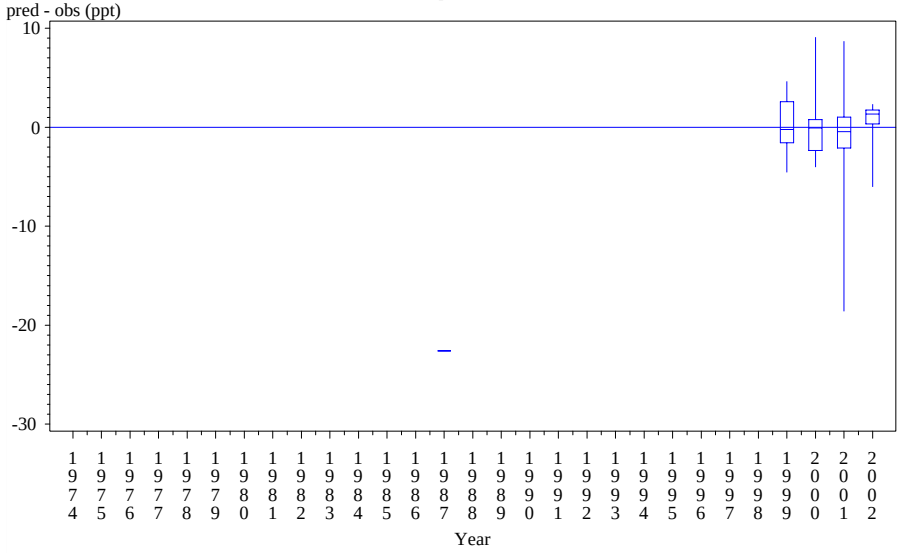


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=4 Sample Level=Bottom

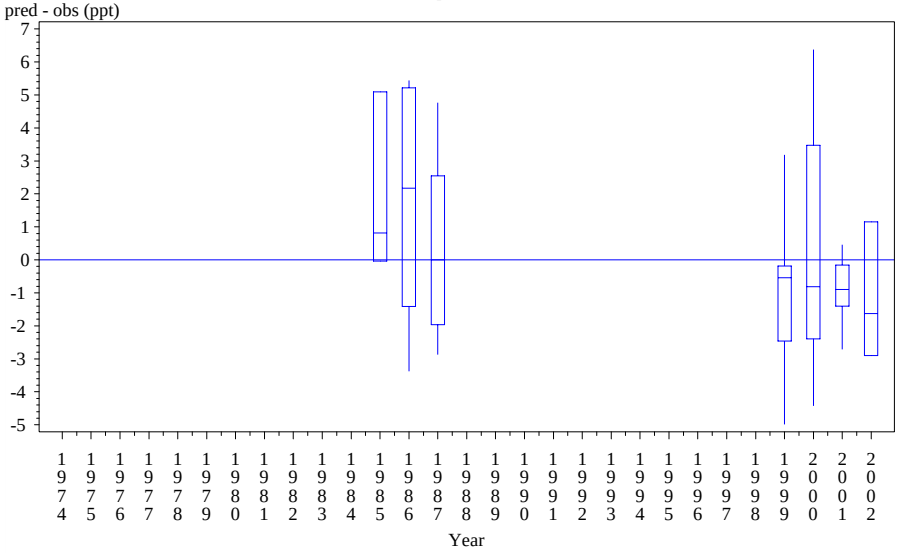


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=4 Sample Level=Surface

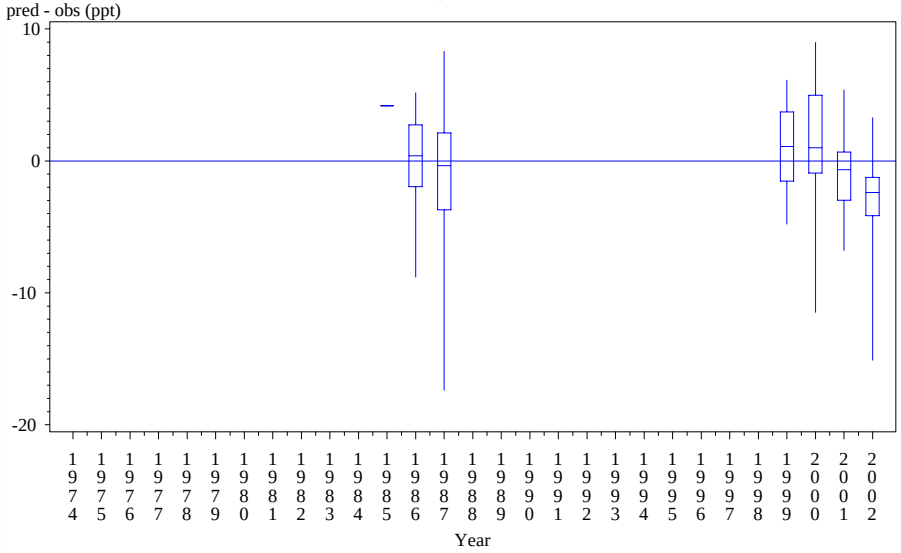


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=5 Sample Level=Bottom

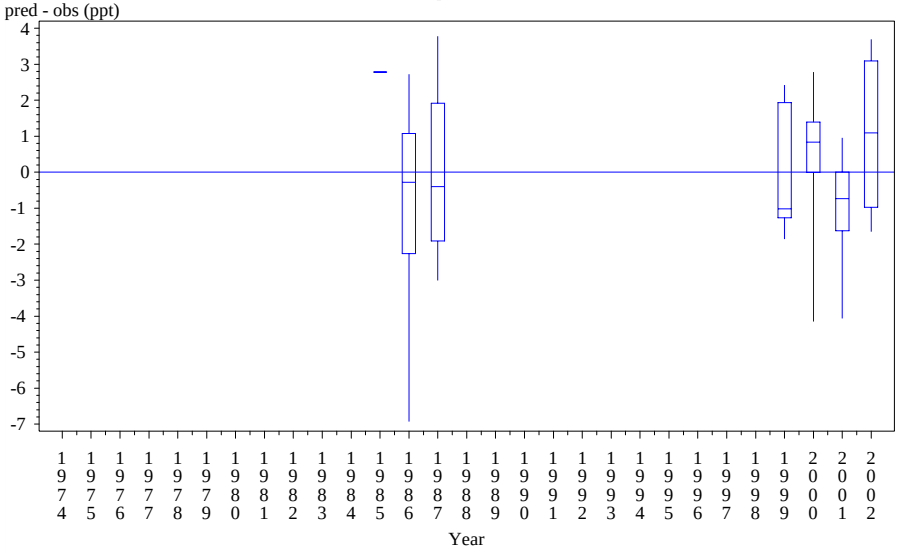


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=5 Sample Level=Surface

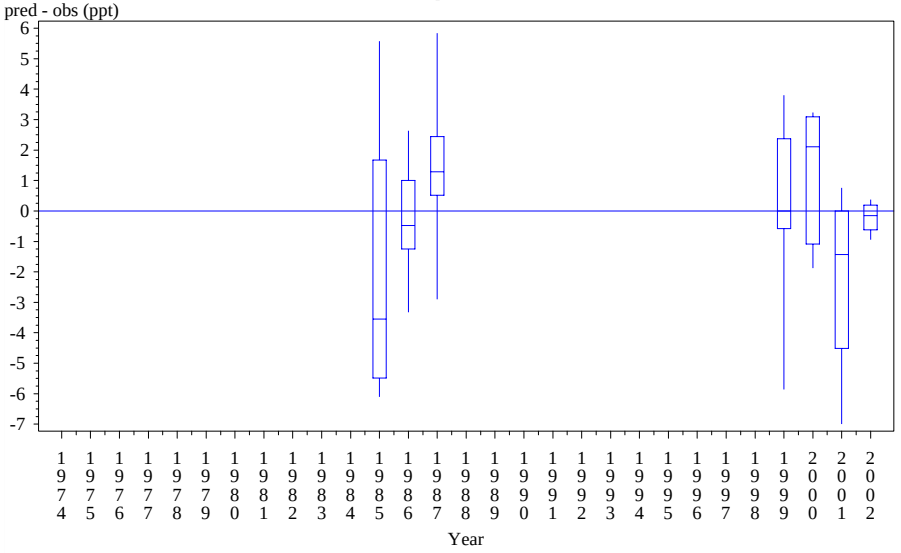


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=1 Meter

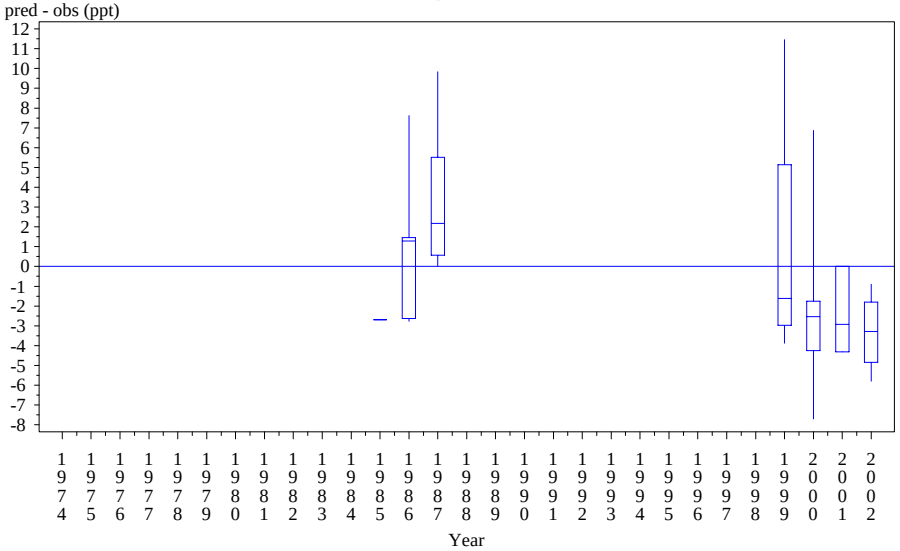


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=2 Meter

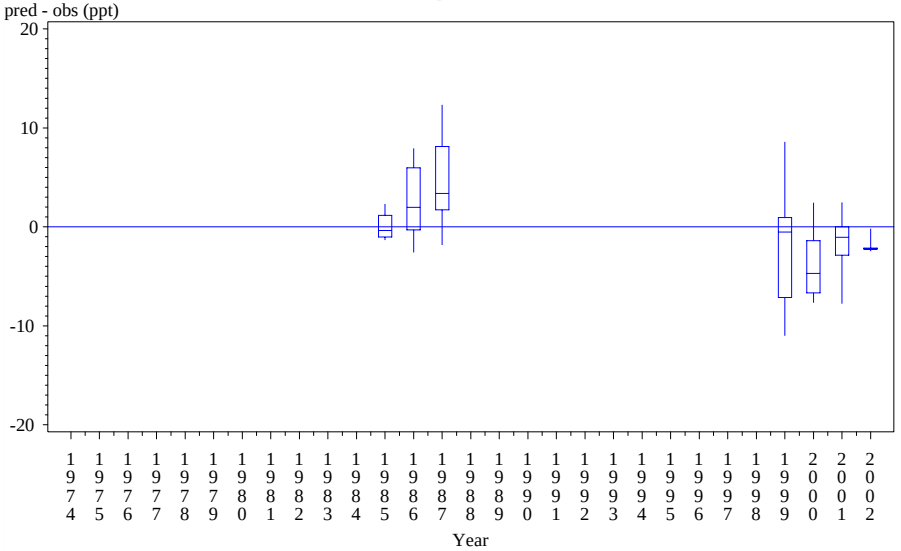


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=Bottom

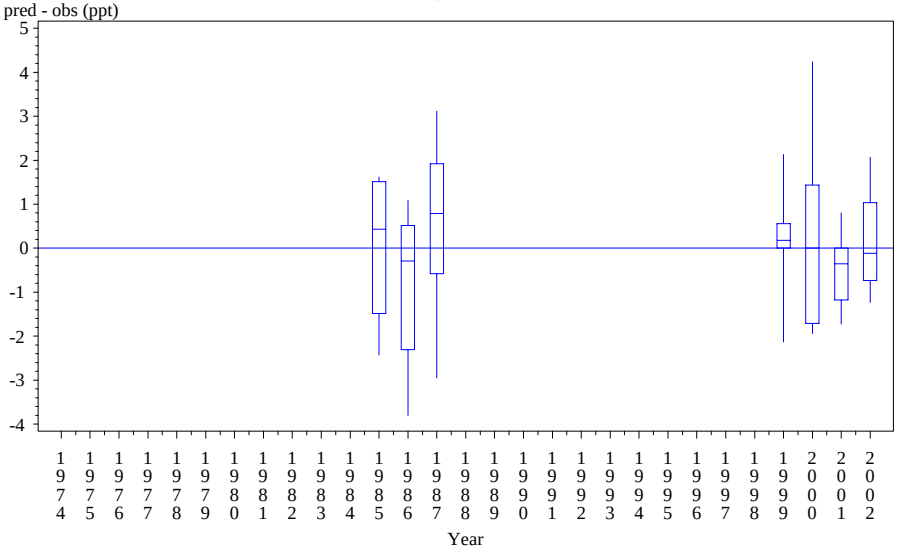


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=6 Sample Level=Surface

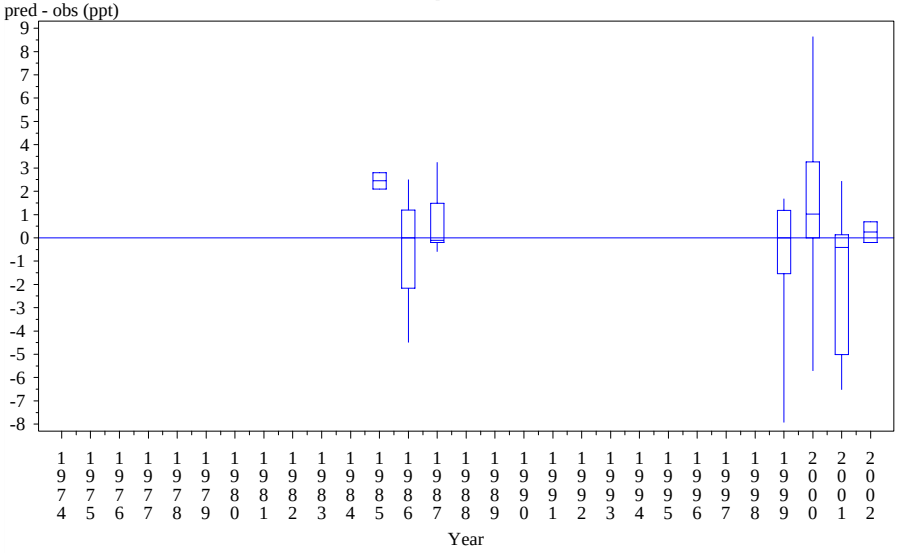


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=7 Sample Level=1 Meter

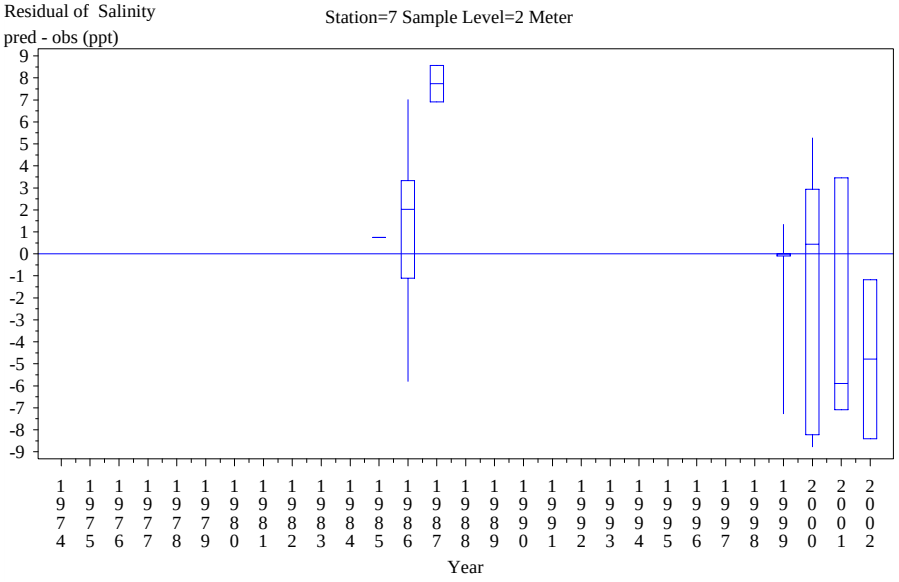


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=7 Sample Level=2 Meter

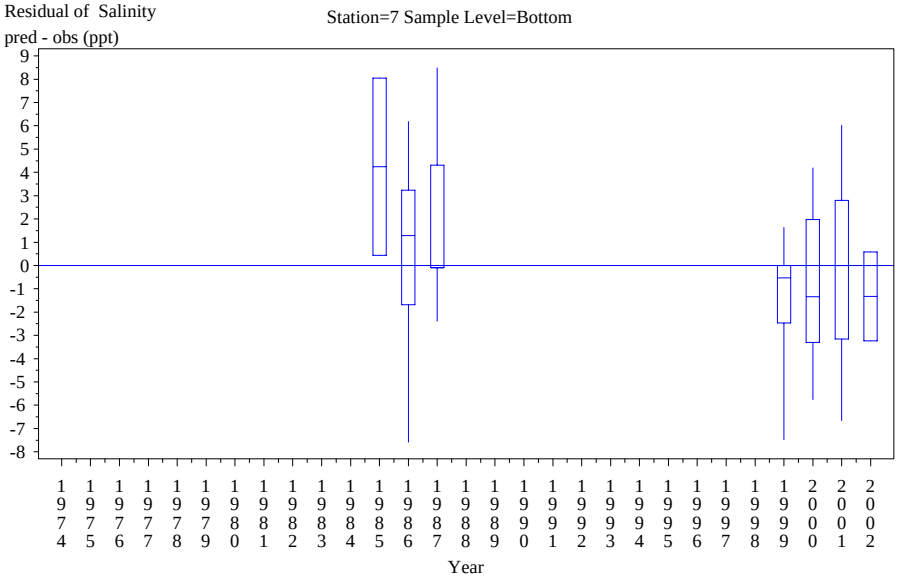


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=7 Sample Level=Bottom

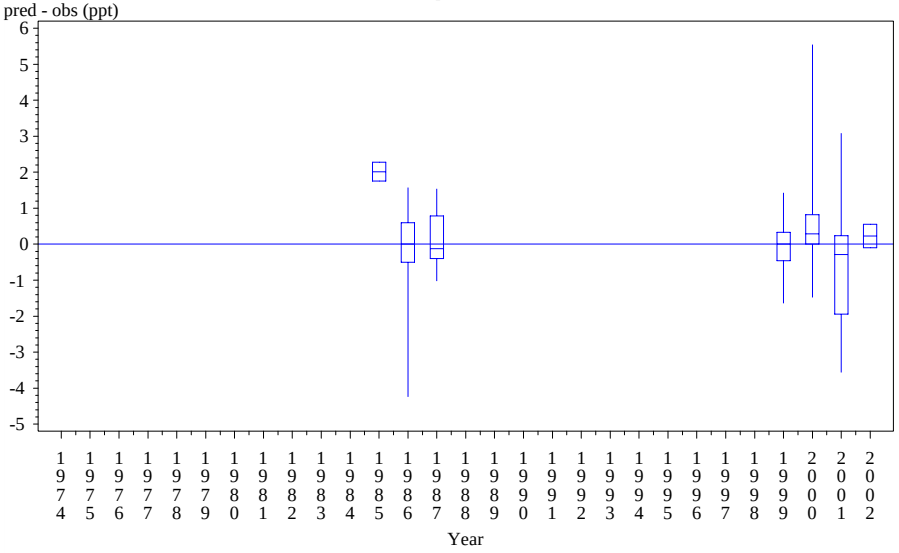


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=7 Sample Level=Surface

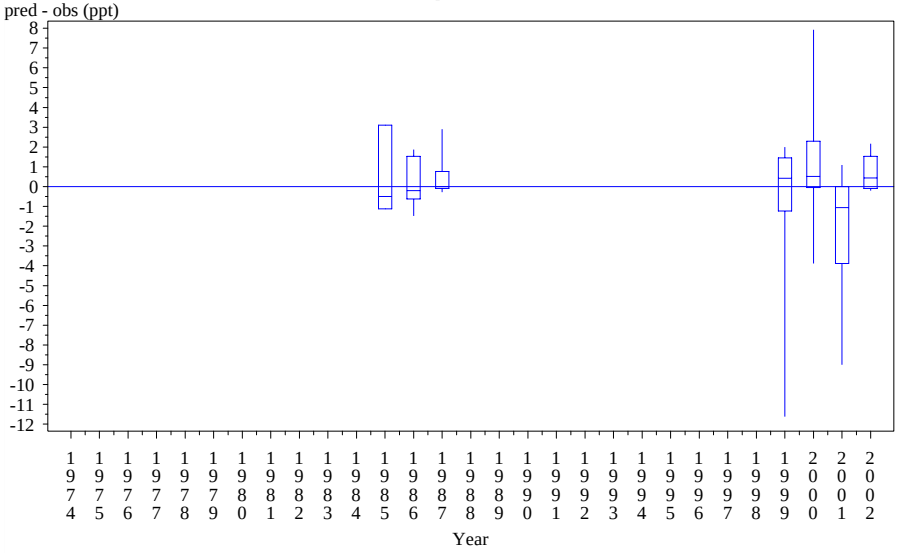


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=8 Sample Level=1 Meter

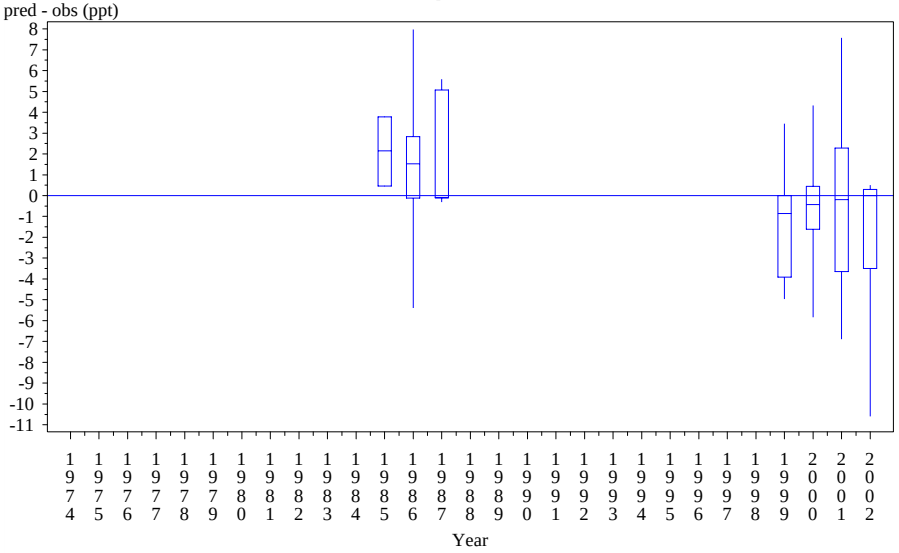


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=8 Sample Level=Bottom

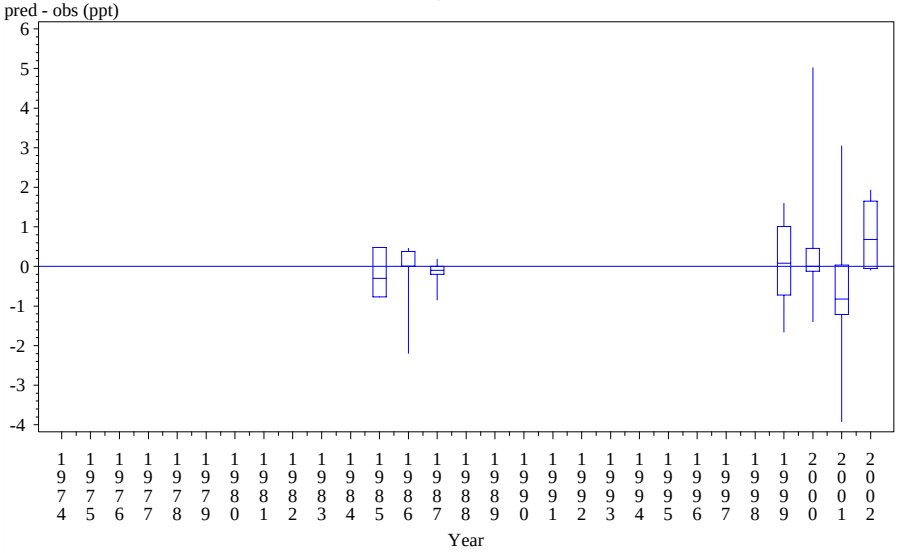


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=8 Sample Level=Surface

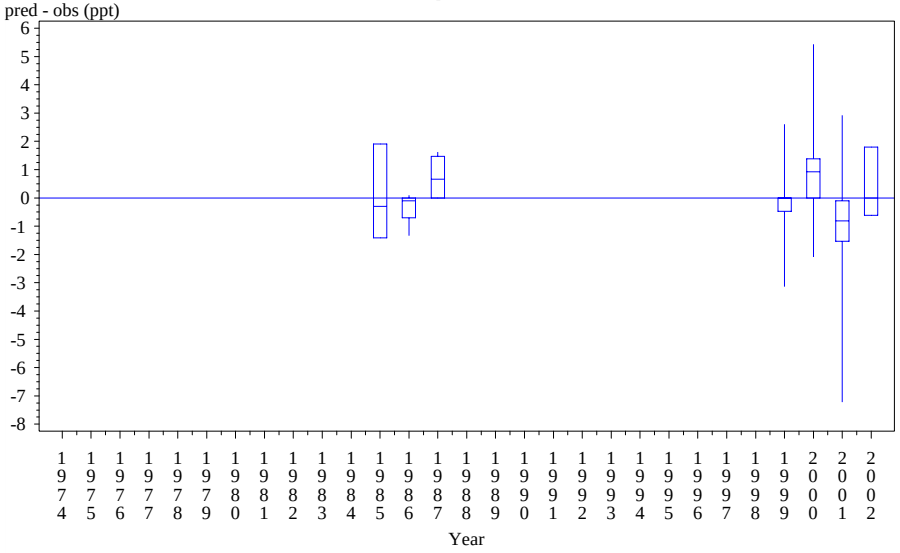


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=9 Sample Level=1 Meter

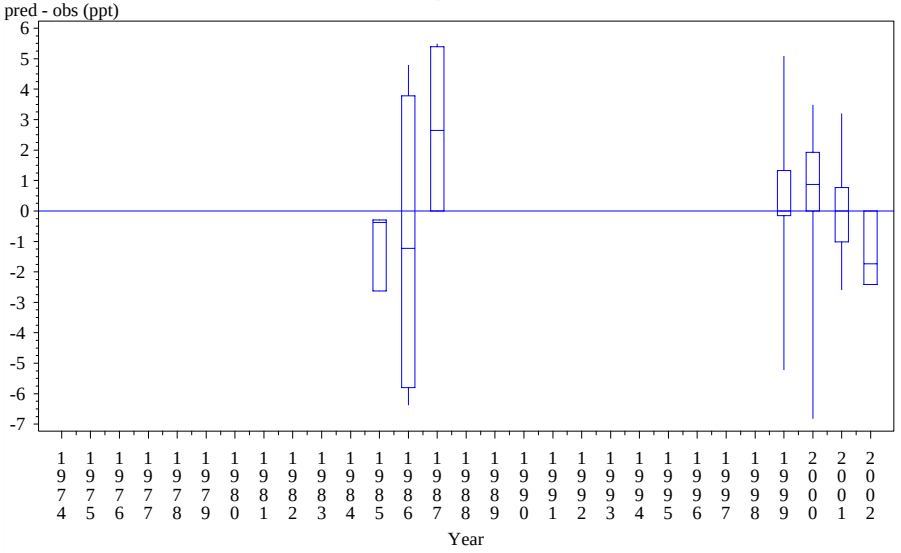


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=9 Sample Level=2 Meter

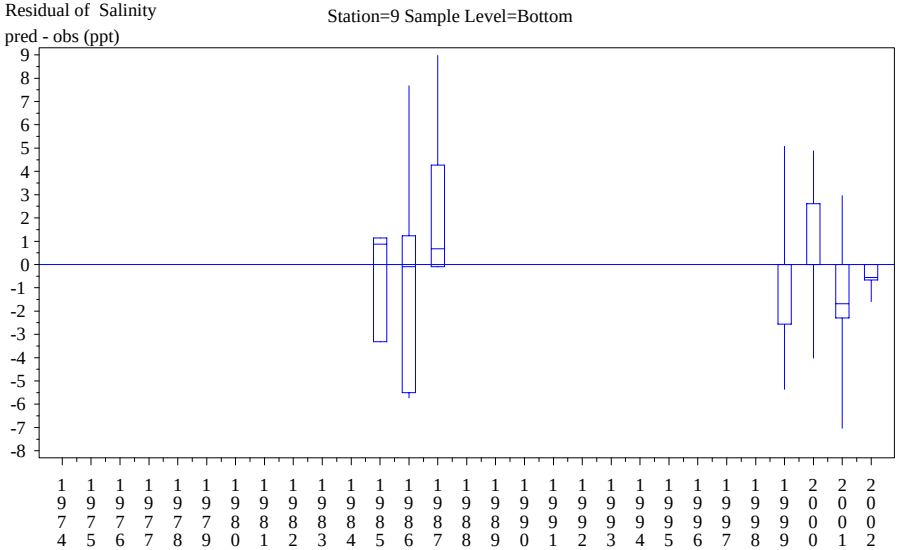


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=9 Sample Level=Bottom

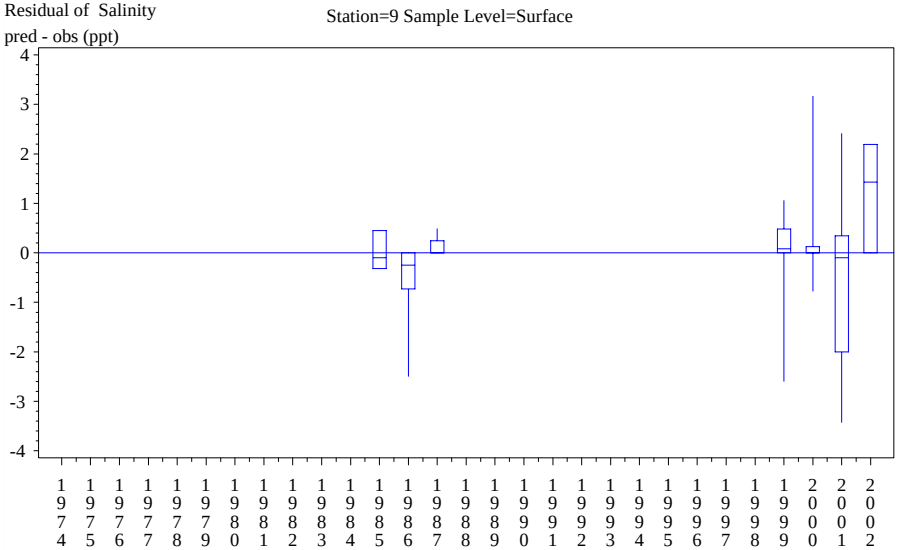


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=9 Sample Level=Surface

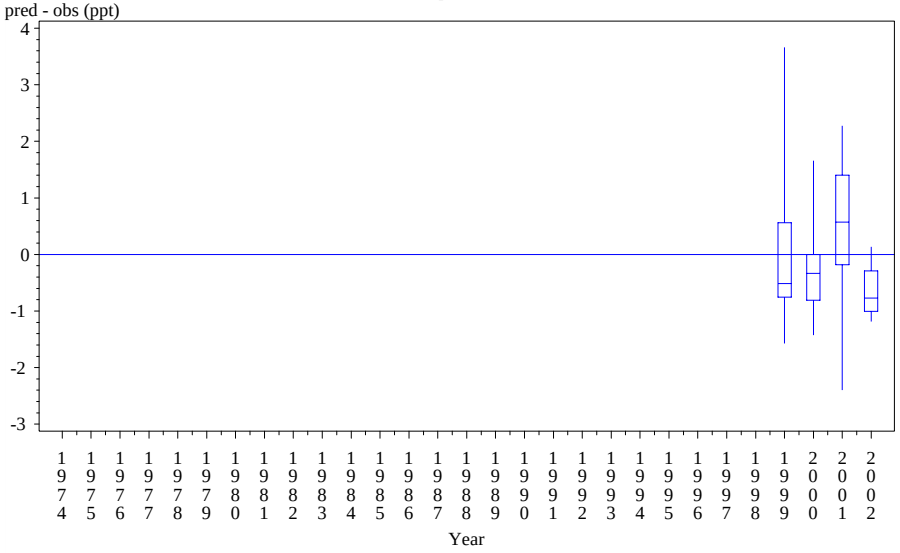


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=B Sample Level=Bottom

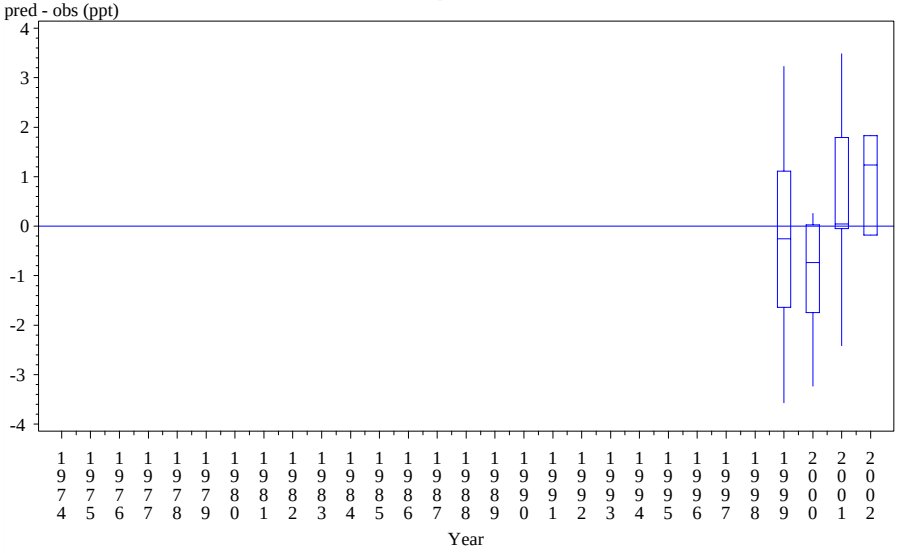


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=B Sample Level=Surface

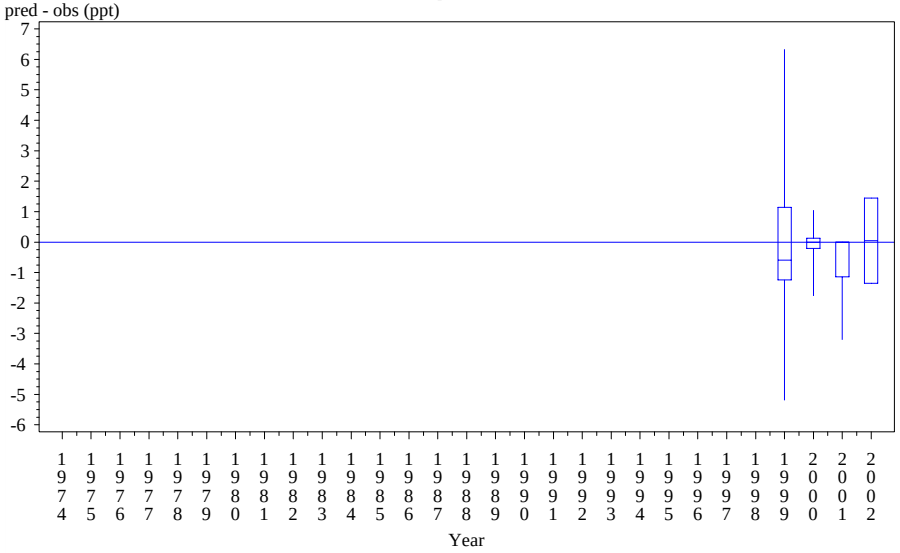


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=C Sample Level=1 Meter

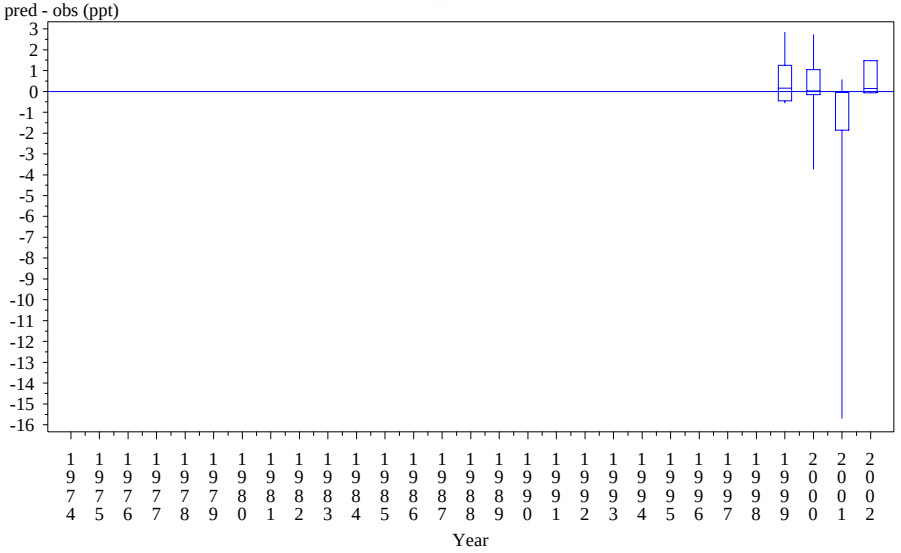


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=C Sample Level=Bottom

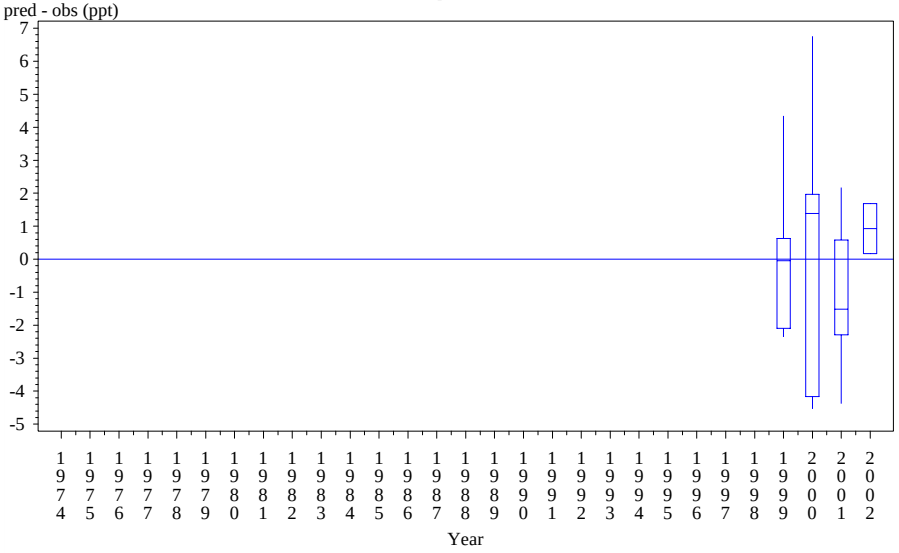


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: SWFWMD

Station=C Sample Level=Surface



Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 153 and 1 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	-3.87236	3.86900	-1.00	0.3302
a7		1	-5.00583	4.66612	-1.07	0.2975
a8		1	-3.26116	6.40055	-0.51	0.6166
a9		1	-0.61986	6.62706	-0.09	0.9265
a10		1	-0.07261	4.00796	-0.02	0.9857
a11		1	-2.10372	3.71336	-0.57	0.5780
flopower02_sum4		1	-10.35638	3.16503	-3.27	0.0042

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 153 and Bottom Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	4	681.45752	170.36438	5.68	0.0018
Error	28	840.21763	30.00777		
Corrected Total	32	1521.67515			

Root MSE	5.47794	**R-Square**	0.4478
Dependent Mean	16.32121	**Adj R-Sq**	0.3690
Coeff Var	33.56329		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	20.33378	5.36705	3.79	0.0007
wetseason		1	1.60121	3.77140	0.42	0.6744
l2_flow		1	-0.04830	0.01581	-3.06	0.0049
l4_flow		1	0.00682	0.02556	0.27	0.7915
int		1	0.00003706	0.00004041	0.92	0.3669

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 153 and Surface Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	2	314.59628	157.29814	47.98	<.0001
Error	24	78.67557	3.27815		
Corrected Total	26	393.27185			

Root MSE	1.81057	**R-Square**	0.7999
Dependent Mean	6.42593	**Adj R-Sq**	0.7833
Coeff Var	28.17595		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	-7.69287	1.51202	-5.09	<.0001
wetseason		1	1.47583	1.20699	1.22	0.2333
flopowerm04_sum8		1	171.60441	20.31953	8.45	<.0001

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and 1 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	12	2541.55053	211.79588	6.07	<.0001
Error	133	4643.97933	34.91714		
Corrected Total	145	7185.52986			

Root MSE	5.90907	**R-Square**	0.3537
Dependent Mean	20.07808	**Adj R-Sq**	0.2954
Coeff Var	29.43046		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	40.43000	4.50895	8.97	<.0001
a1		1	1.14973	2.13018	0.54	0.5903
a2		1	2.06303	2.17571	0.95	0.3447
a3		1	1.39808	2.15535	0.65	0.5177
a4		1	1.75610	2.17069	0.81	0.4200
a5		1	3.97115	2.39910	1.66	0.1002

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and 1 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	8.85676	2.92557	3.03	0.0030
a7		1	6.55979	2.62658	2.50	0.0137
a8		1	1.95302	3.09749	0.63	0.5294
a9		1	-4.21856	2.78936	-1.51	0.1328
a10		1	-3.96084	2.49970	-1.58	0.1154
a11		1	0.97898	2.24584	0.44	0.6636
flopower02_sum8		1	-4.89028	1.02164	-4.79	<.0001

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and 2 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	15	2477.93237	165.19549	5.39	<.0001
Error	135	4138.45849	30.65525		
Corrected Total	150	6616.39086			

Root MSE	5.53672	**R-Square**	0.3745
Dependent Mean	22.28874	**Adj R-Sq**	0.3050
Coeff Var	24.84087		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	22.65000	2.52323	8.98	<.0001
a1		1	4.91019	3.09140	1.59	0.1145
a2		1	1.55026	3.03421	0.51	0.6102
a3		1	6.15845	2.77968	2.22	0.0284
a4		1	5.55022	2.80478	1.98	0.0499
a5		1	6.10136	2.54313	2.40	0.0178

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and 2 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	7.58370	2.48945	3.05	0.0028
a7		1	6.93152	2.51873	2.75	0.0067
a8		1	5.42938	2.51051	2.16	0.0323
a9		1	4.16512	2.61765	1.59	0.1139
a10		1	0.64251	2.50882	0.26	0.7983
a11		1	4.02750	2.77165	1.45	0.1485
Totalflow	Total Flow (cfs)	1	-0.01258	0.00725	-1.74	0.0849
l1_flow		1	0.00808	0.00912	0.89	0.3771
flopower07_sum6		1	-0.02181	0.01288	-1.69	0.0928
int		1	0.00000145	0.00000731	0.20	0.8426

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and Bottom Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	14	1865.86433	133.27602	11.11	<.0001
Error	232	2782.26320	11.99251		
Corrected Total	246	4648.12753			

Root MSE	3.46302	**R-Square**	0.4014
Dependent Mean	24.38543	**Adj R-Sq**	0.3653
Coeff Var	14.20119		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	50.59056	5.57456	9.08	<.0001
a1		1	0.47903	1.19571	0.40	0.6891
a2		1	-1.14003	1.17863	-0.97	0.3344
a3		1	-0.84149	1.13075	-0.74	0.4575
a4		1	-1.03783	1.12685	-0.92	0.3580
a5		1	-0.18568	1.13856	-0.16	0.8706

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and Bottom Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	1.85455	1.16420	1.59	0.1125
a7		1	2.60515	1.16191	2.24	0.0259
a8		1	1.76067	1.20342	1.46	0.1448
a9		1	-1.97218	1.24878	-1.58	0.1156
a10		1	-2.23290	1.16370	-1.92	0.0562
a11		1	-0.19843	1.16551	-0.17	0.8650
flopower02_sum8		1	-7.63635	1.59227	-4.80	<.0001
flopower04_sum4		1	0.41952	0.42034	1.00	0.3193
int		1	0.02458	0.06935	0.35	0.7233

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and Surface Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	12	7343.51798	611.95983	18.86	<.0001
Error	232	7528.52757	32.45055		
Corrected Total	244	14872			

Root MSE	5.69654	**R-Square**	0.4938
Dependent Mean	16.38653	**Adj R-Sq**	0.4676
Coeff Var	34.76354		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	48.89932	3.19050	15.33	<.0001
a1		1	-0.55552	1.94288	-0.29	0.7752
a2		1	-0.68262	1.93346	-0.35	0.7244
a3		1	1.47631	1.85481	0.80	0.4269
a4		1	-0.41801	1.84492	-0.23	0.8210
a5		1	2.89624	1.84183	1.57	0.1172

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 74 and Surface Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	4.71936	1.93316	2.44	0.0154
a7		1	1.30033	1.90787	0.68	0.4962
a8		1	0.97169	1.96070	0.50	0.6207
a9		1	-1.77752	2.05337	-0.87	0.3876
a10		1	-3.10141	1.88236	-1.65	0.1008
a11		1	1.73874	1.91262	0.91	0.3642
flopower02_sum4		1	-8.46123	0.75463	-11.21	<.0001

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and 1 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	15	2829.11831	188.60789	28.54	<.0001
Error	230	1519.88499	6.60820		
Corrected Total	245	4349.00329			

Root MSE	2.57064	**R-Square**	0.6505
Dependent Mean	24.26707	**Adj R-Sq**	0.6277
Coeff Var	10.59312		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	22.70129	3.63435	6.25	<.0001
a1		1	1.01827	0.96034	1.06	0.2901
a2		1	0.81386	0.93373	0.87	0.3843
a3		1	0.08063	0.87485	0.09	0.9267
a4		1	-1.41506	0.85394	-1.66	0.0989
a5		1	-1.24285	0.85634	-1.45	0.1480

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and 1 Meter Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a6		1	0.74801	0.88184	0.85	0.3972
a7		1	1.75628	0.87377	2.01	0.0456
a8		1	0.18924	0.93979	0.20	0.8406
a9		1	-0.99990	0.95493	-1.05	0.2962
a10		1	-1.75058	0.91740	-1.91	0.0576
a11		1	-1.02373	0.94757	-1.08	0.2811
flopower03_sum8		1	-0.33087	0.25900	-1.28	0.2027
l7_flow		1	0.00040037	0.00393	0.10	0.9189
flopowerm04		1	45.36706	11.85847	3.83	0.0002
int		1	-0.00023669	0.00021907	-1.08	0.2811

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and Bottom Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	14	2515.14804	179.65343	20.35	<.0001
Error	273	2410.46942	8.82956		
Corrected Total	287	4925.61747			

Root MSE	2.97146	**R-Square**	0.5106
Dependent Mean	24.06215	**Adj R-Sq**	0.4855
Coeff Var	12.34909		

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	Intercept	1	46.37848	5.03000	9.22	<.0001
a1		1	0.85936	0.78888	1.09	0.2770
a2		1	0.26629	0.74979	0.36	0.7227
a3		1	0.57282	0.84280	0.68	0.4973
a4		1	0.39172	0.87362	0.45	0.6542
a5		1	-0.64730	0.86776	-0.75	0.4563
a6		1	1.96698	0.83531	2.35	0.0192

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and Bottom Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Parameter Estimates						
Variable	**Label**	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a7		1	3.04903	0.83516	3.65	0.0003
a8		1	0.59844	0.84350	0.71	0.4786
a9		1	-1.49229	0.83888	-1.78	0.0764
a10		1	-0.60570	0.80564	-0.75	0.4528
a11		1	-0.33167	0.82409	-0.40	0.6877
flopower02_sum8		1	-6.37360	2.00676	-3.18	0.0017
flopower03_sum6		1	0.67497	1.02102	0.66	0.5091
int		1	0.00626	0.11233	0.06	0.9556

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and Surface Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	2663.56825	190.25488	21.10	<.0001
Error	117	1054.87235	9.01600		
Corrected Total	131	3718.44061			

Root MSE	3.00267	R-Square	0.7163
Dependent Mean	23.68788	Adj R-Sq	0.6824
Coeff Var	12.67596		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	35.52807	1.32016	26.91	<.0001
a1		1	3.06321	1.36651	2.24	0.0269
a2		1	1.35093	1.30945	1.03	0.3044
a3		1	2.00716	1.23030	1.63	0.1055
a4		1	1.31054	1.20483	1.09	0.2789
a5		1	-0.14914	1.31815	-0.11	0.9101

Alafia River Analysis

Regression Procedure Results For EPCHCAMB Records at Station 8 and Surface Level

Source:Salinity Sampled by EPCHCAMB, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Salinity Salinity (ppt)

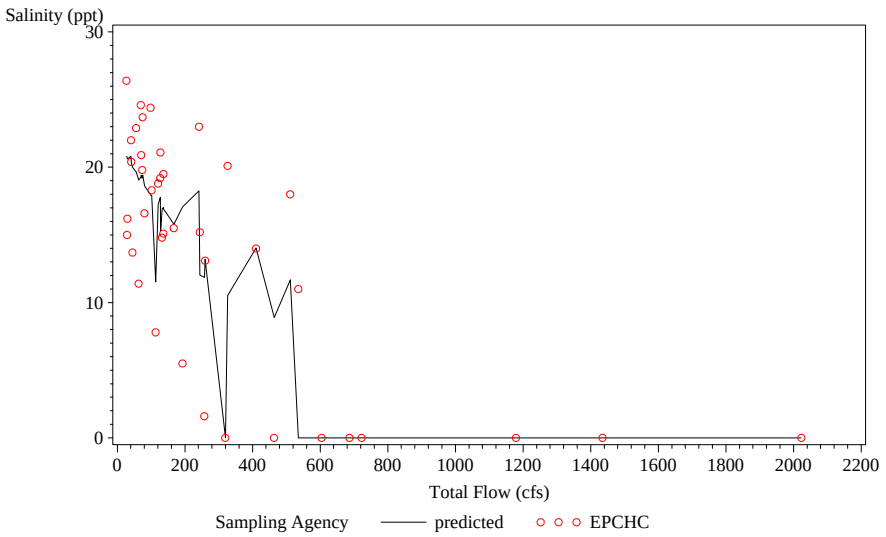
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a6		1	2.46922	1.19172	2.07	0.0405
a7		1	2.86015	1.33231	2.15	0.0339
a8		1	0.50785	1.38413	0.37	0.7144
a9		1	0.56996	1.29726	0.44	0.6612
a10		1	1.13495	1.24876	0.91	0.3653
a11		1	0.49238	1.24300	0.40	0.6927
flopower04_sum8		1	-0.62576	0.05699	-10.98	<.0001
flow3		1	-0.00151	0.00804	-0.19	0.8518
int		1	-0.00021111	0.00032153	-0.66	0.5127

Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=153 Sample Level=Bottom

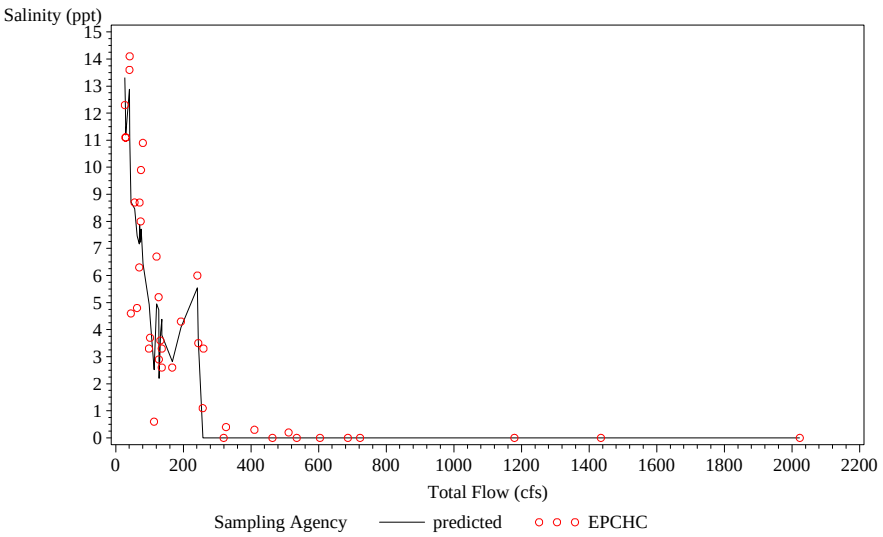


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=153 Sample Level=Surface

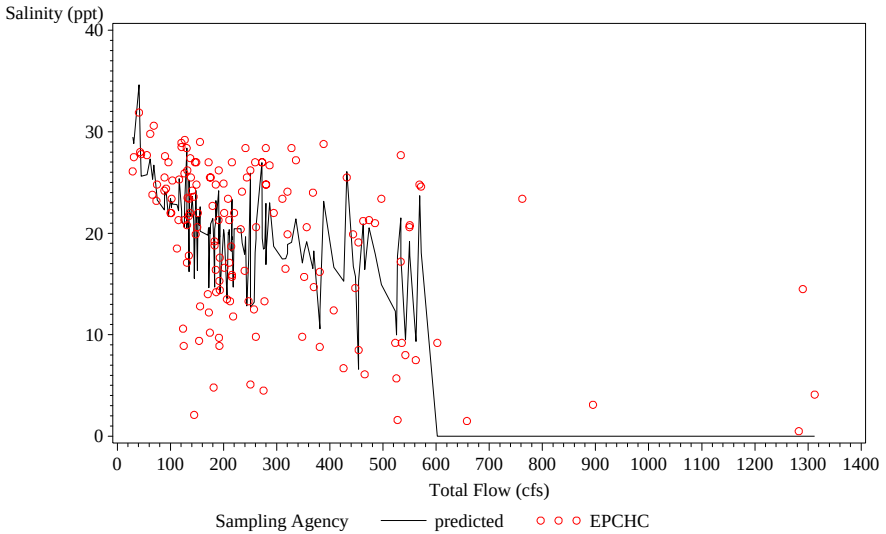


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=1 Meter

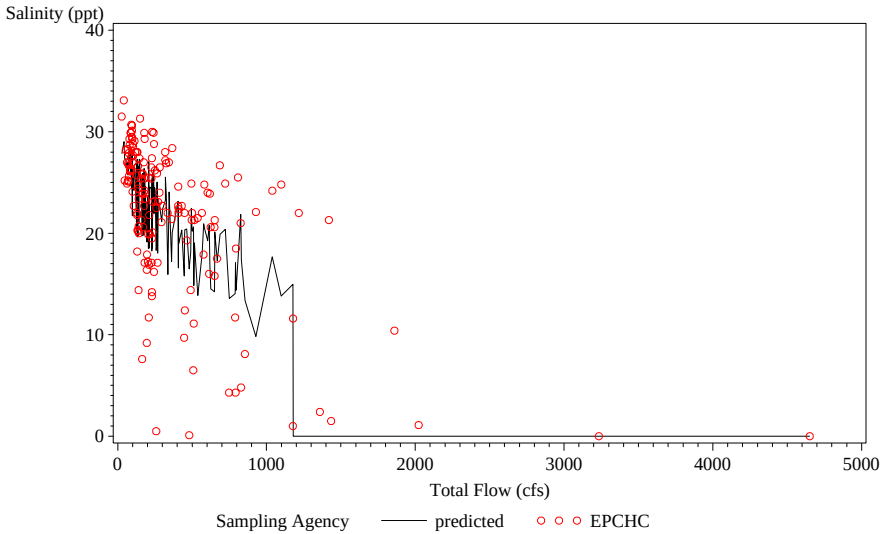


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=2 Meter

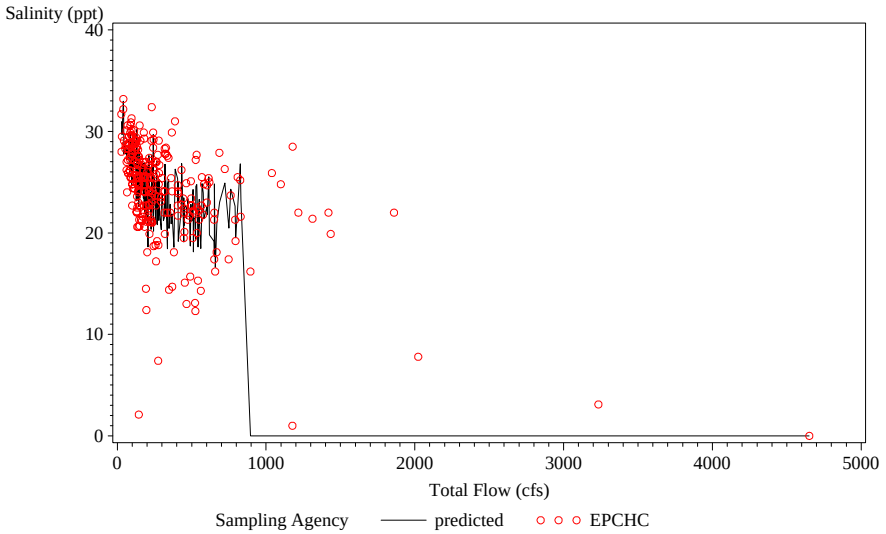


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=Bottom

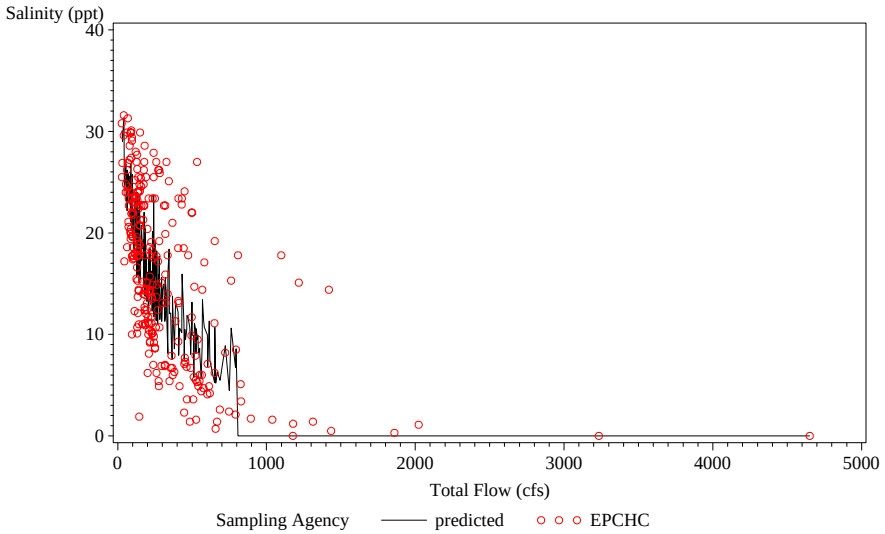


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=Surface

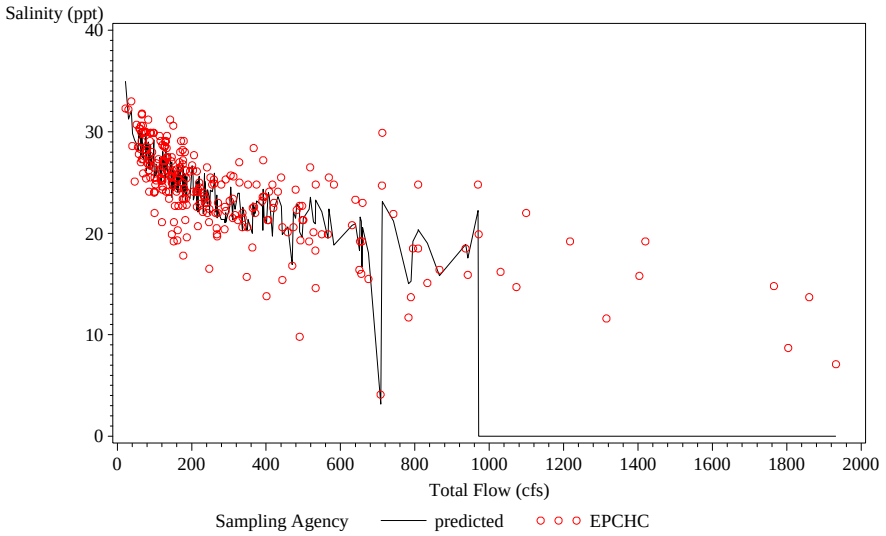


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=1 Meter

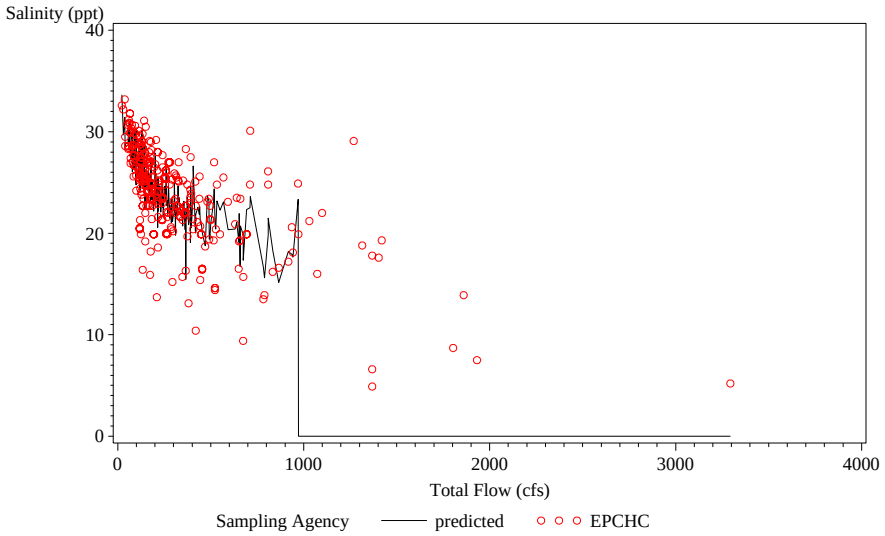


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=Bottom

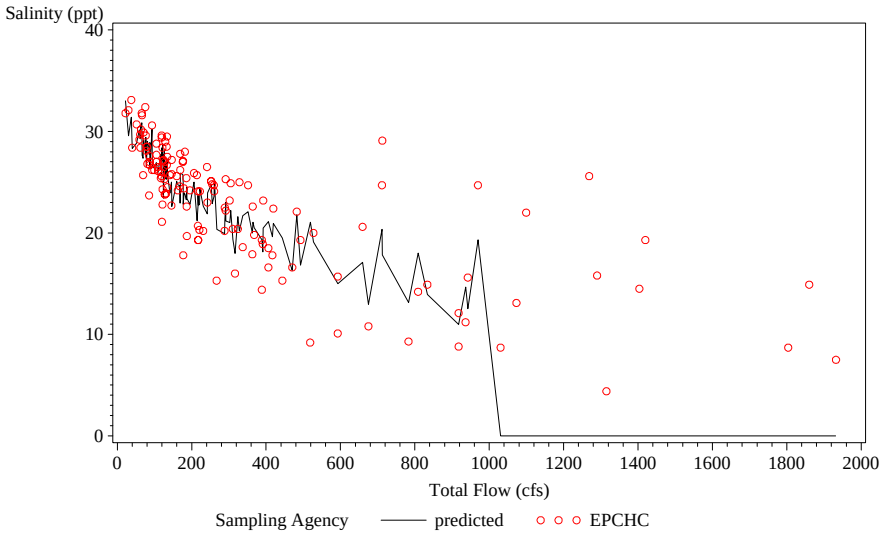


Alafia River Analyses

Observed Salinity and Predicated Salinity VS Totalflow in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=Surface



Alafia River Analyses

R Square Result for EPCHCAMB Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

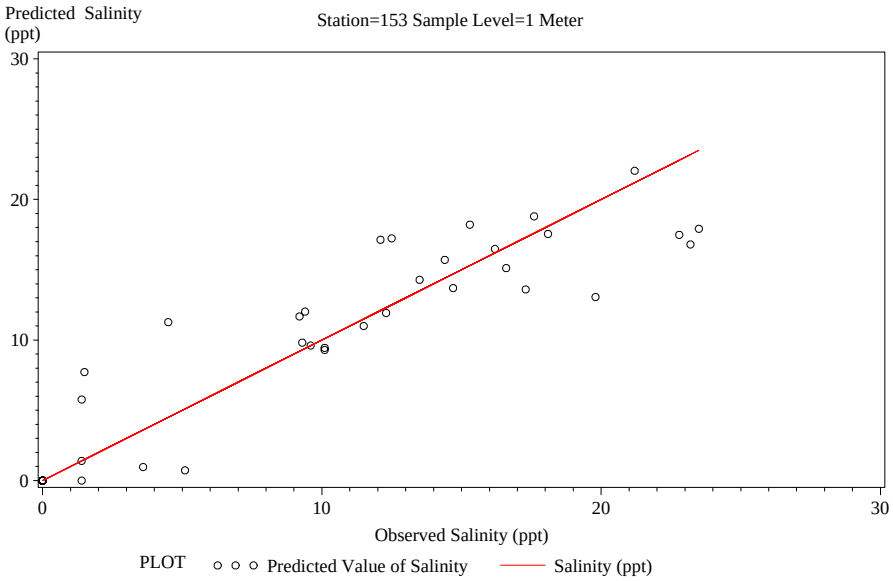
Station	Sample Level	CSS Observed Salinity	USS Residual Salinity	Rsquare
153	1 Meter	2380.66	370.24	0.84448
153	Bottom	2881.78	959.46	0.66706
153	Surface	729.92	89.57	0.87728
74	1 Meter	8571.62	5515.35	0.35656
74	2 Meter	9037.20	5328.09	0.41043
74	Bottom	6609.96	7520.22	-0.13771
74	Surface	17492.41	8645.55	0.50575
8	1 Meter	5506.18	4532.73	0.17679
8	Bottom	6760.69	6615.02	0.02155
8	Surface	5084.84	3647.22	0.28273

Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=153 Sample Level=1 Meter

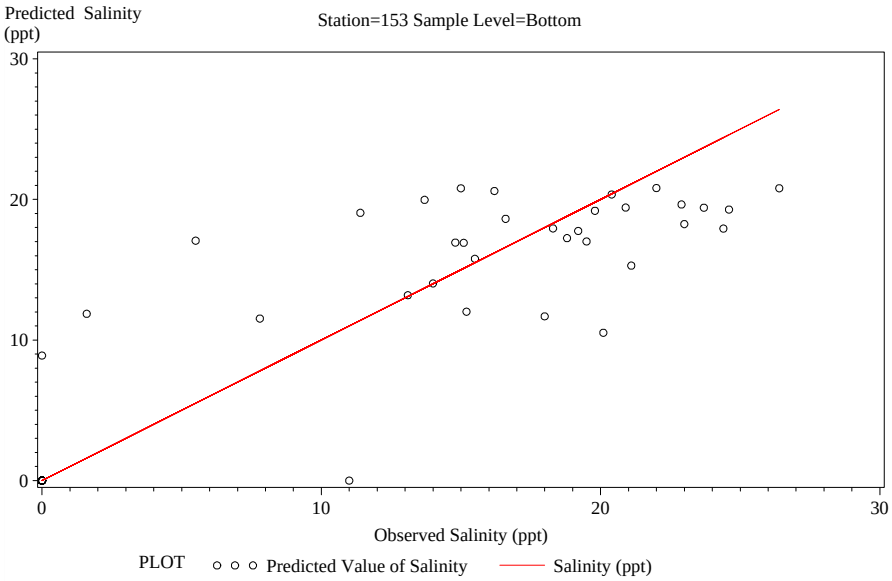


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=153 Sample Level=Bottom

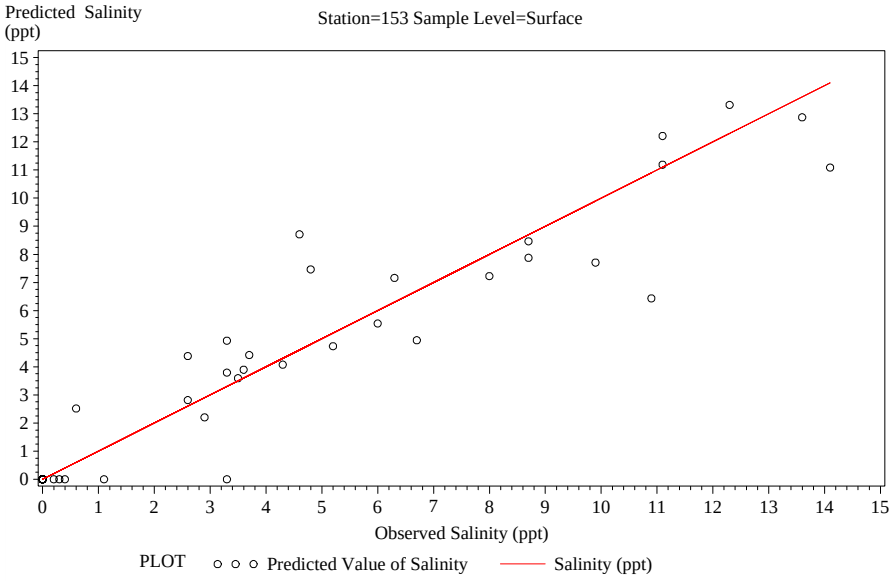


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=153 Sample Level=Surface

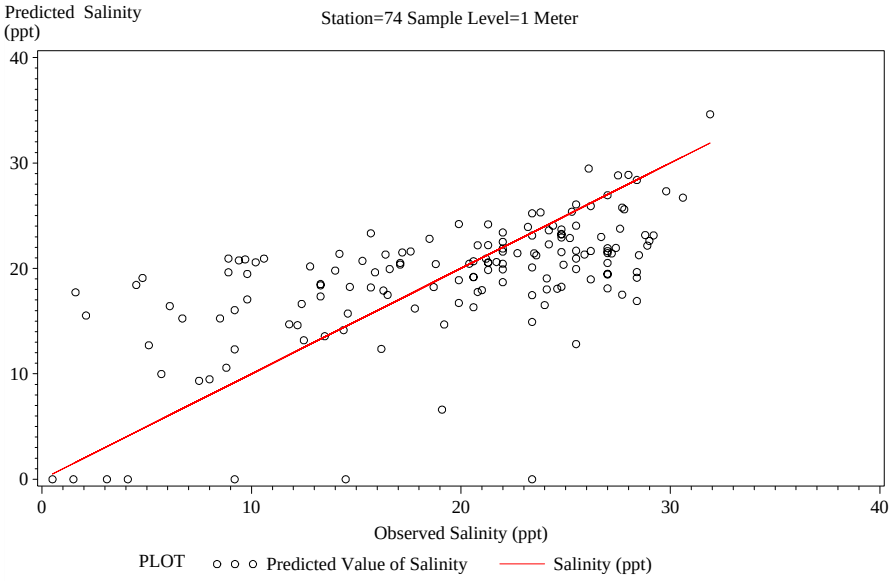


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=1 Meter

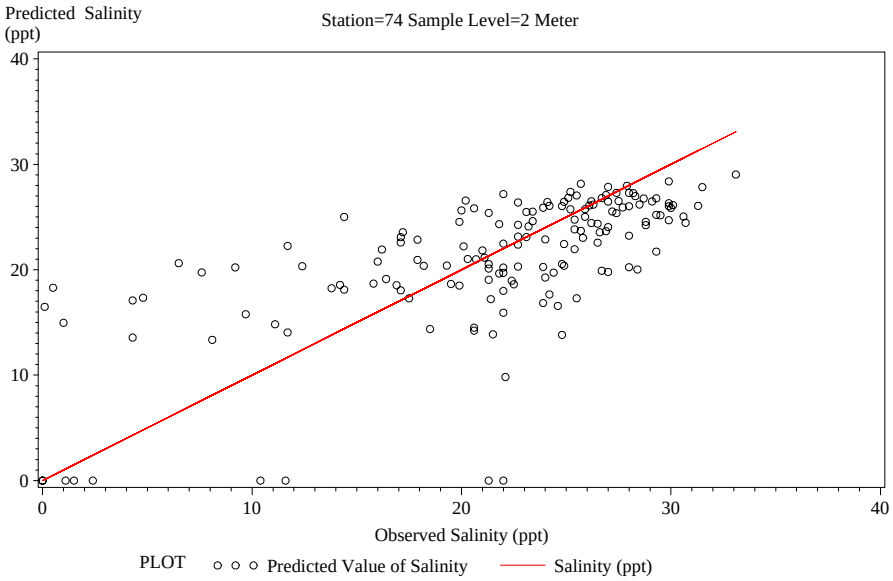


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=2 Meter

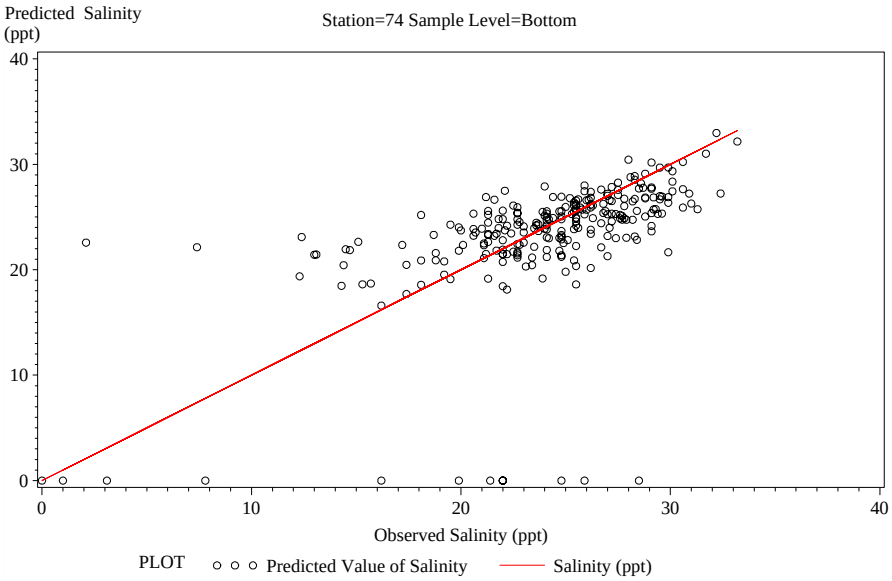


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=Bottom

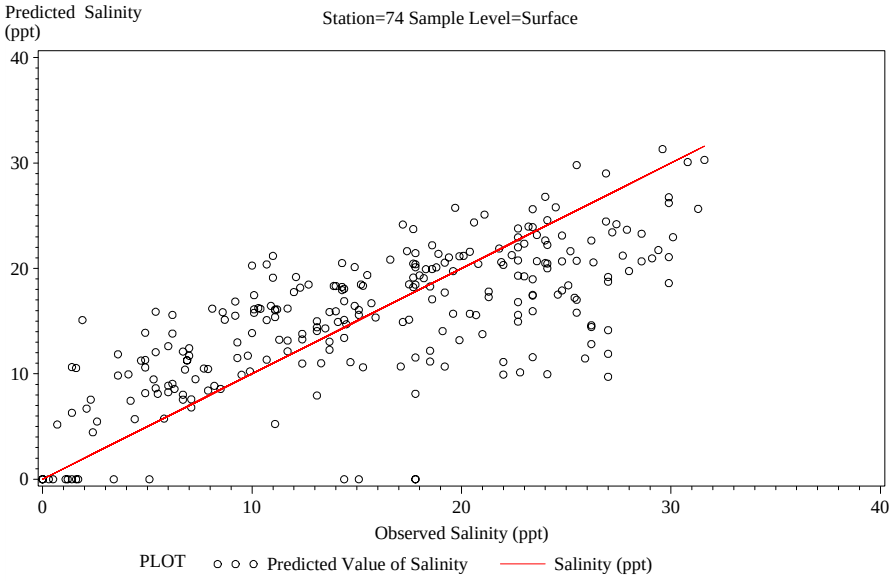


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=74 Sample Level=Surface

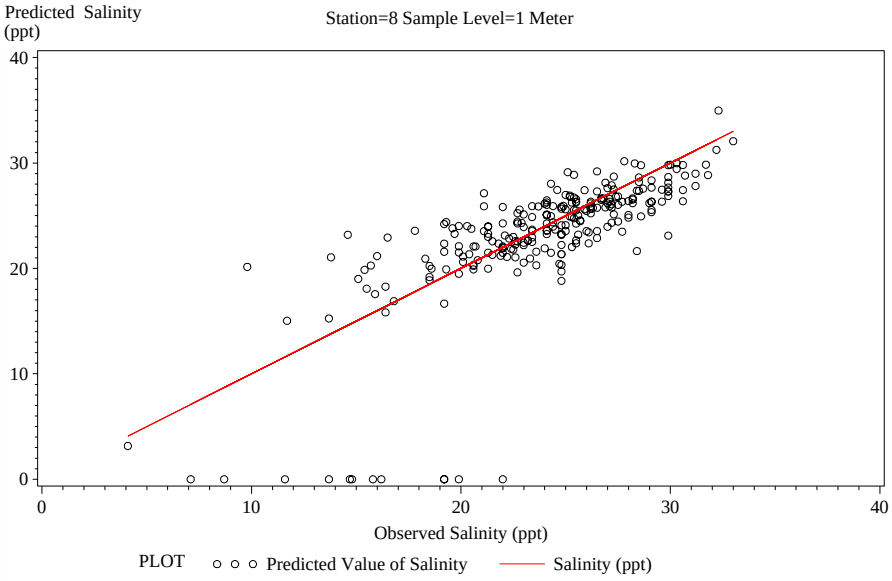


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=1 Meter

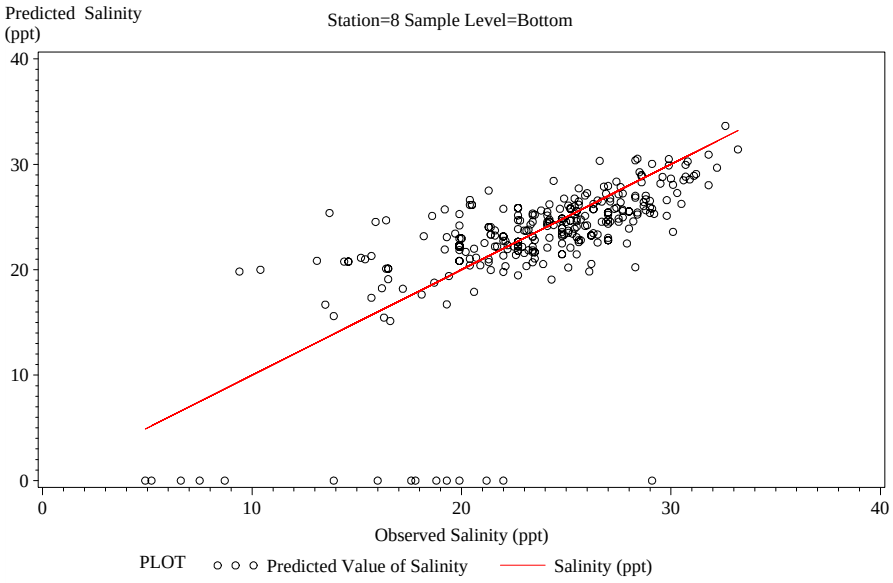


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=Bottom

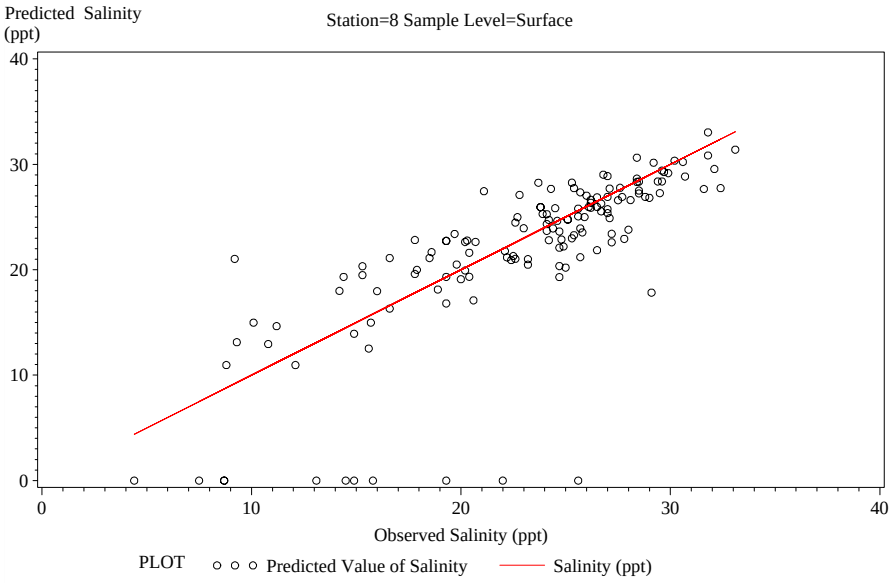


Alafia River Analyses

Predicted Salinity vs. Observed Salinity in each Station and Sample Level

Source: EPCHCAMB

Station=8 Sample Level=Surface

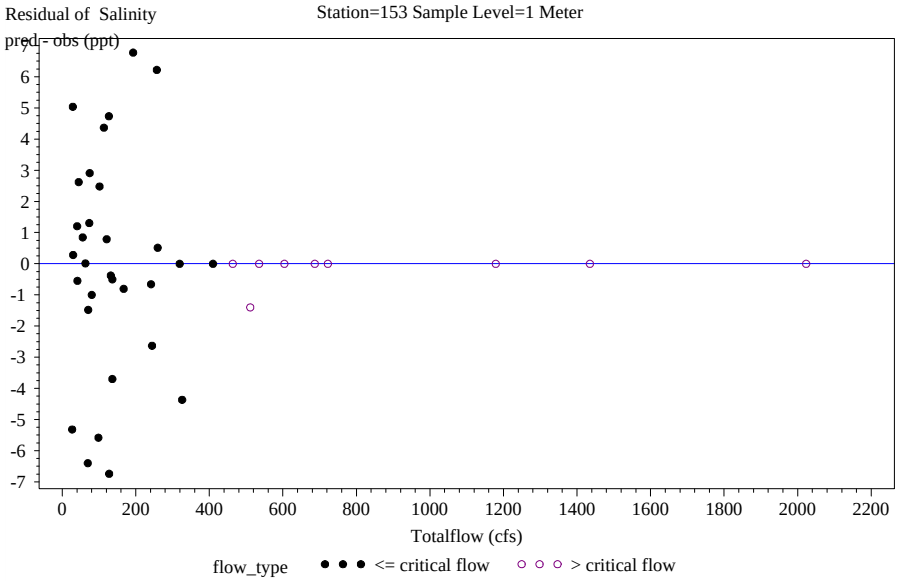


Alafia River Analysis

Residual of Salinity vs. Totalflow in each Sample Level and Station

Source: Program EPCHCAMB

Station=153 Sample Level=1 Meter

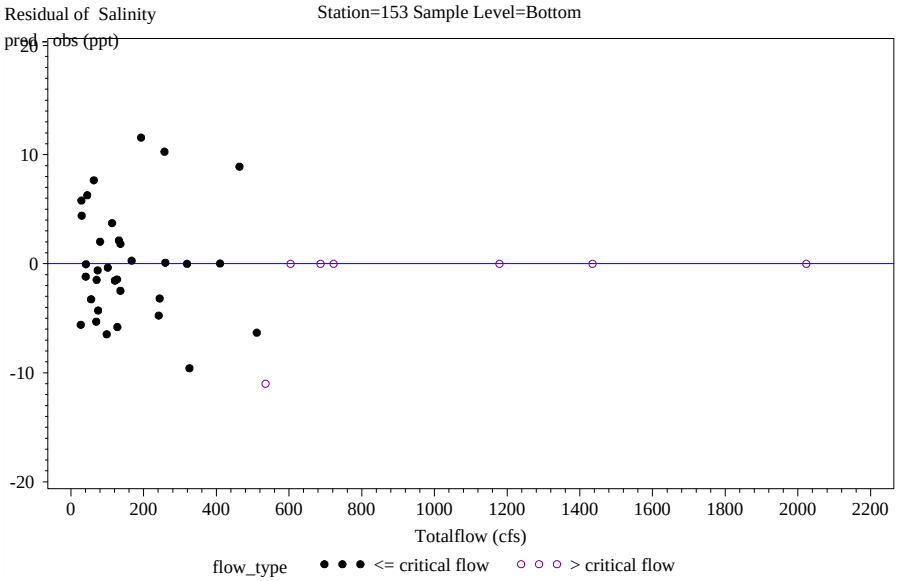


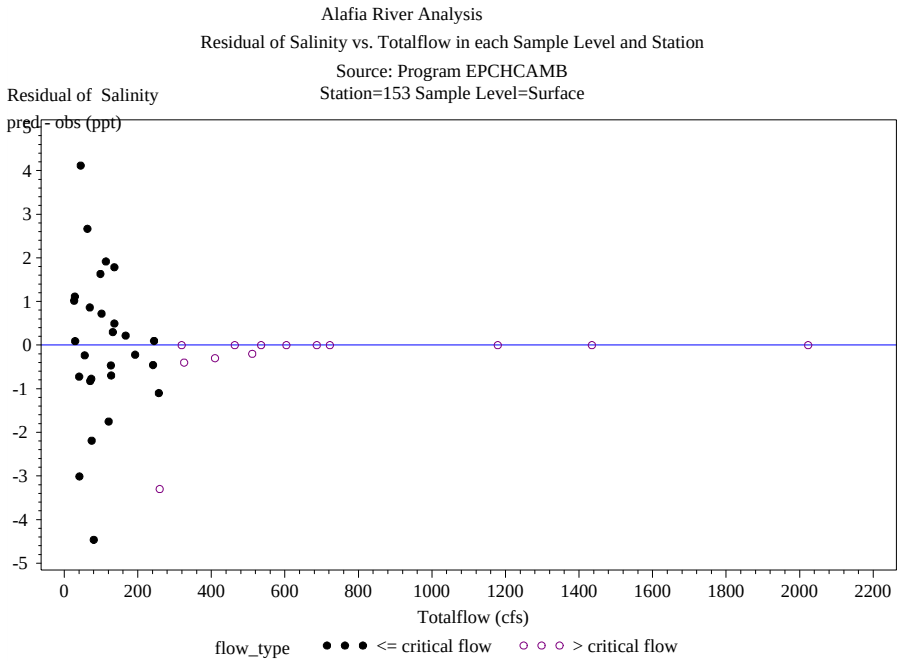
Alafia River Analysis

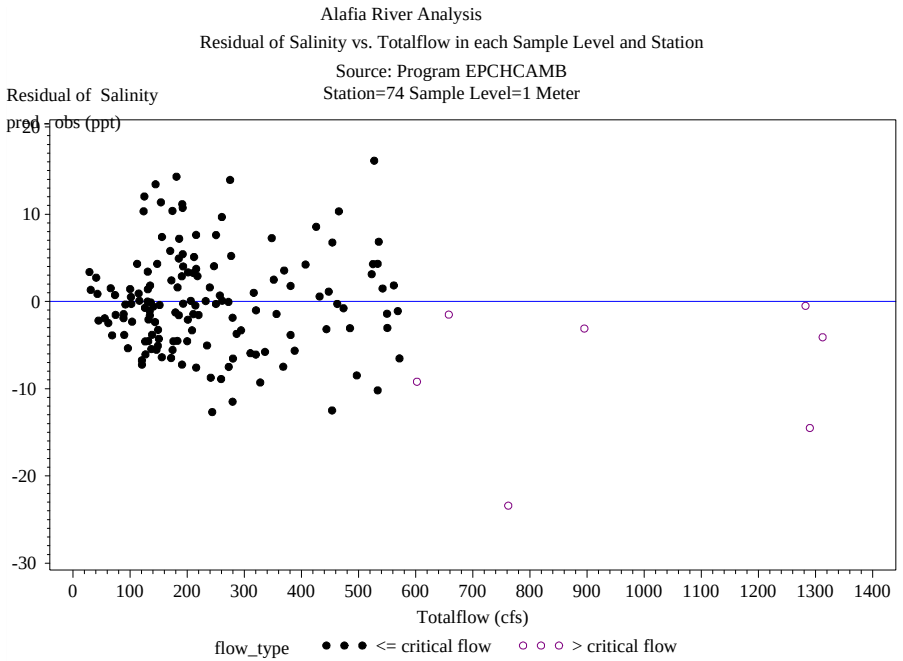
Residual of Salinity vs. Totalflow in each Sample Level and Station

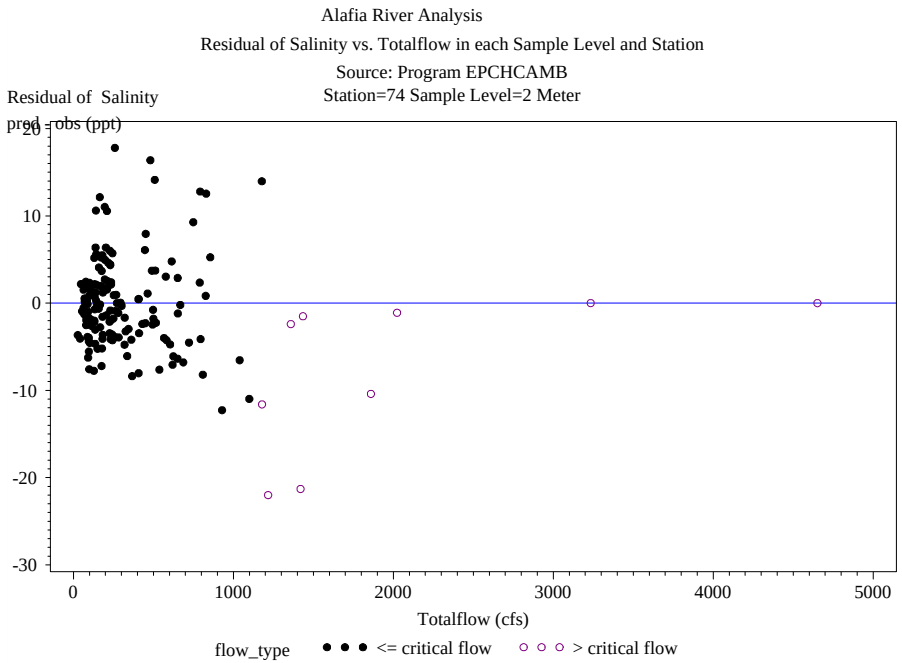
Source: Program EPCHCAMB

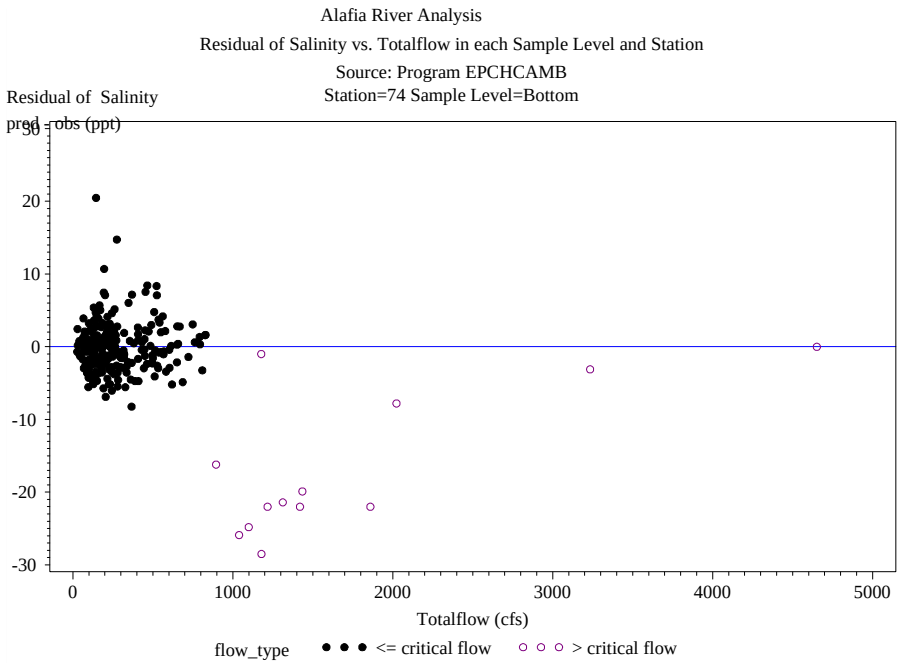
Station=153 Sample Level=Bottom

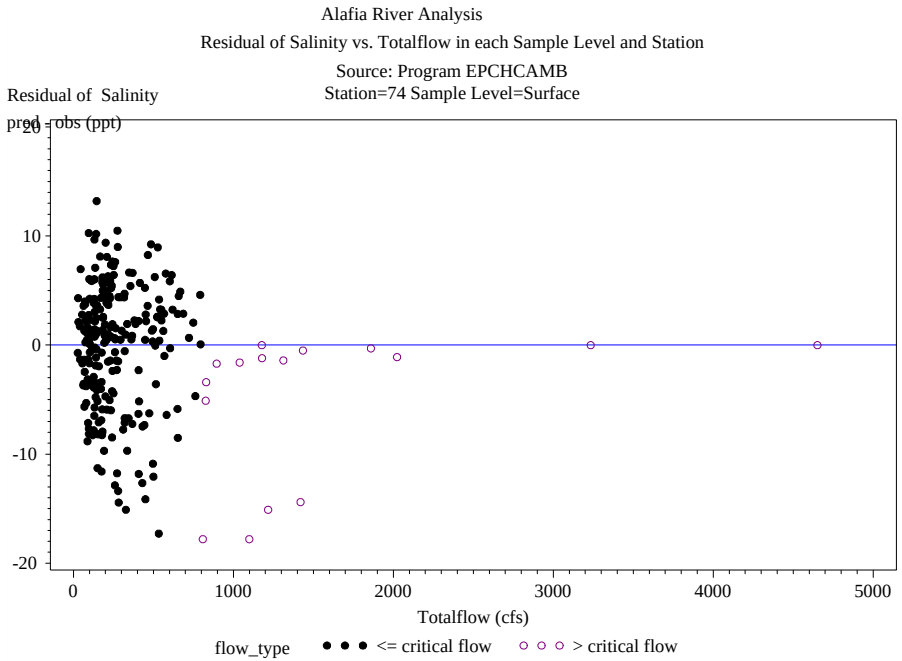


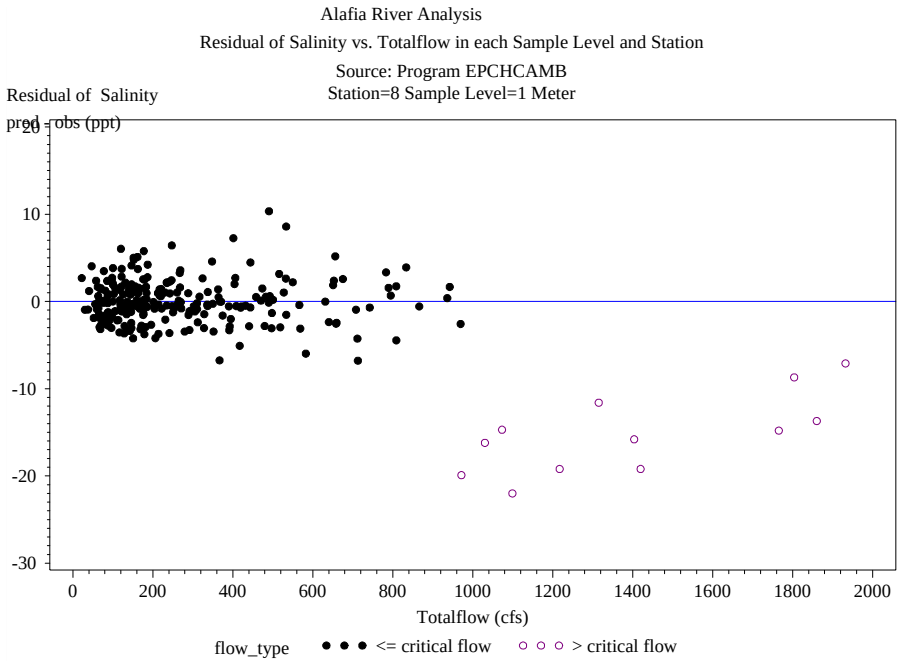

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=153 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

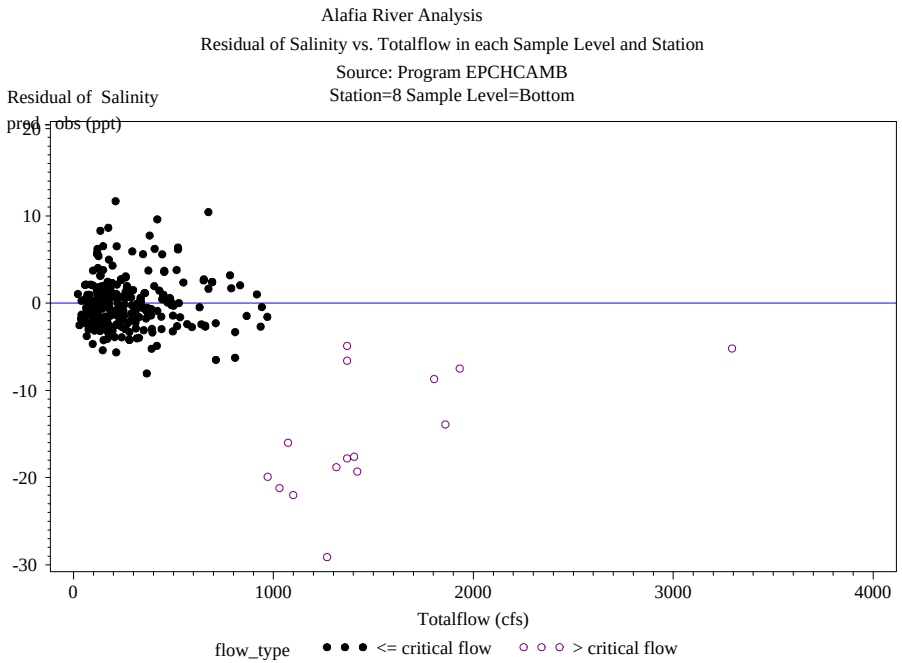

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=74 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

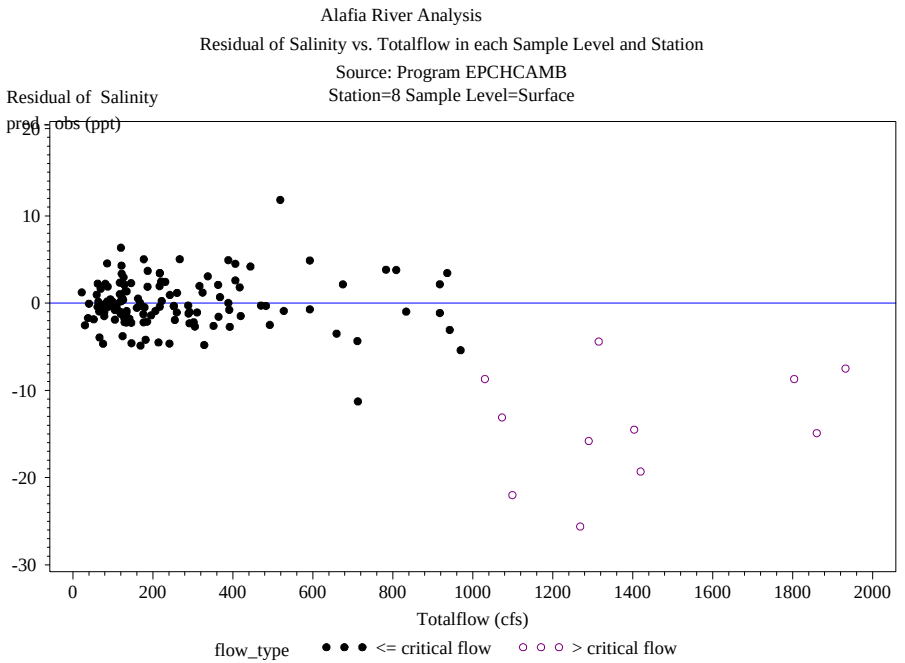

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=74 Sample Level=2 Meter
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=74 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

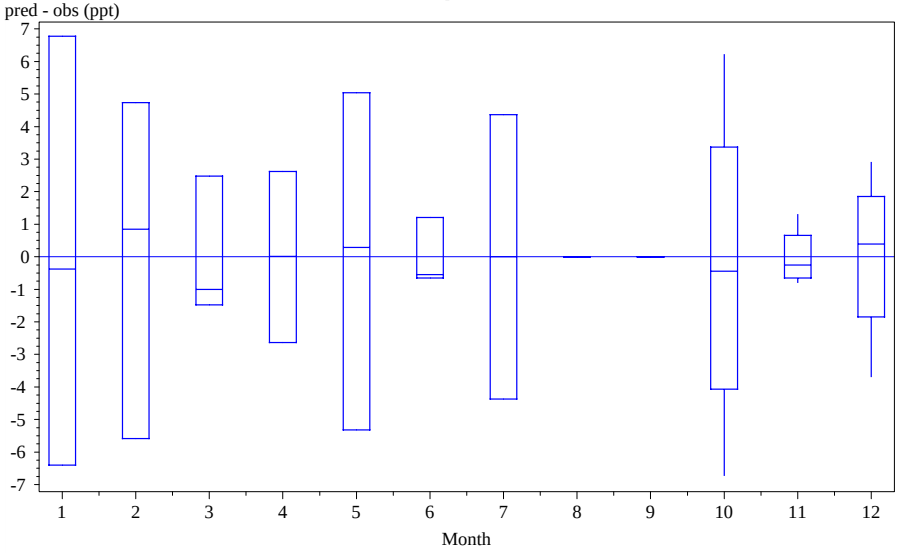

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=74 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=8 Sample Level=1 Meter
Residual of Salinity
pred - obs (ppt)
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

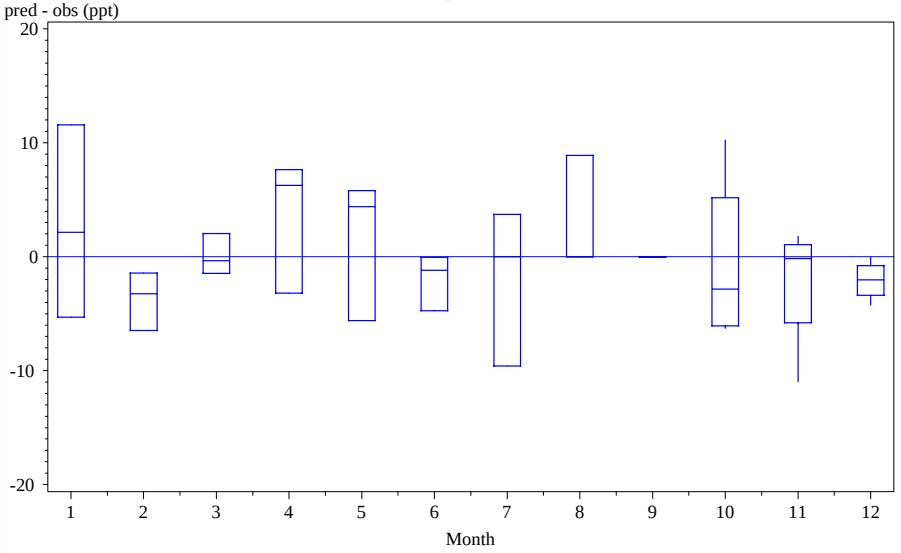

Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=8 Sample Level=Bottom
Residual of Salinity
pred - obs (ppt)
20
10
0
-10
-20
-30
0
1000
2000
3000
4000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Salinity vs. Totalflow in each Sample Level and Station
Source: Program EPCHCAMB
Station=8 Sample Level=Surface
Residual of Salinity
pred - obs (ppt)
20
10
0
-10
-20
-30
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

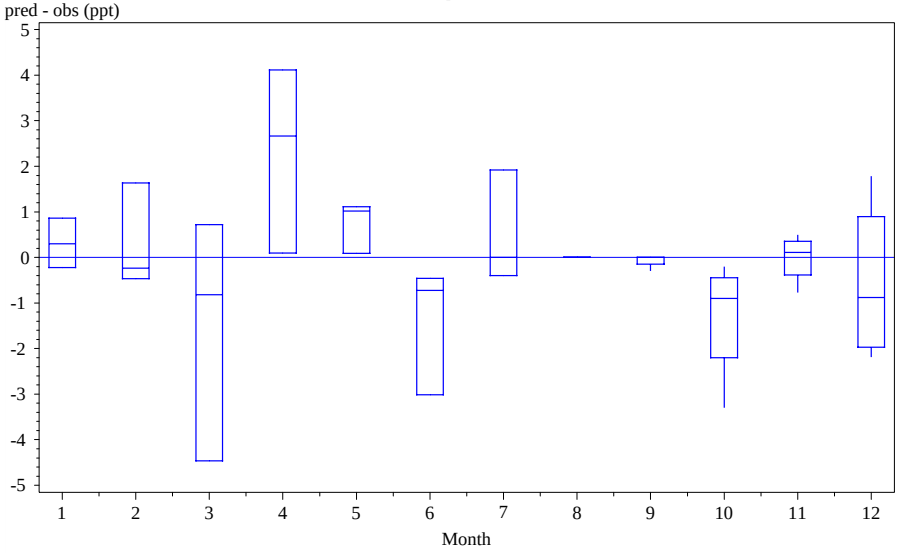
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=153 Sample Level=1 Meter



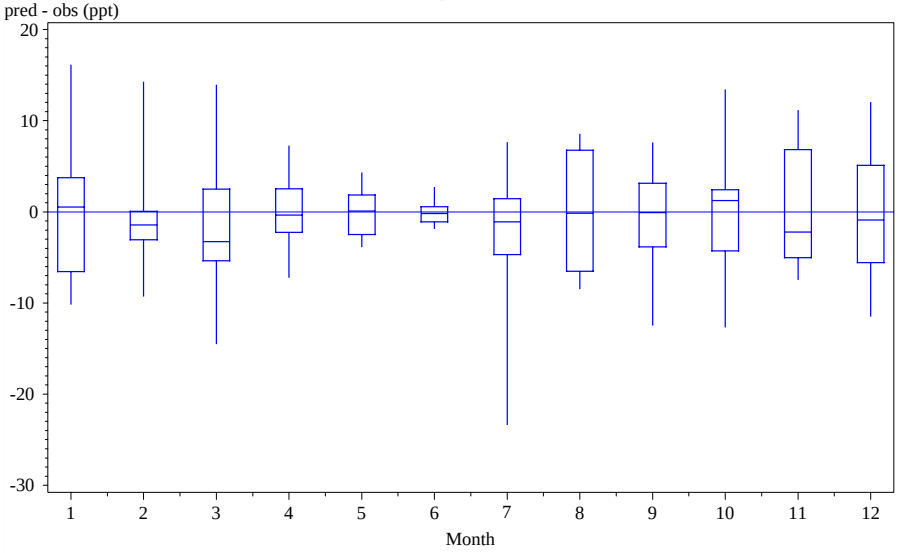
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=153 Sample Level=Bottom



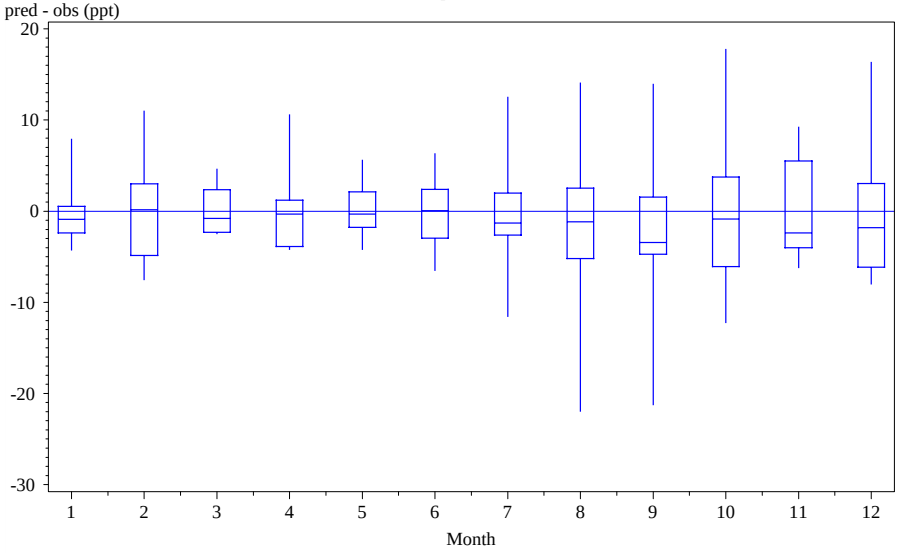
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=153 Sample Level=Surface



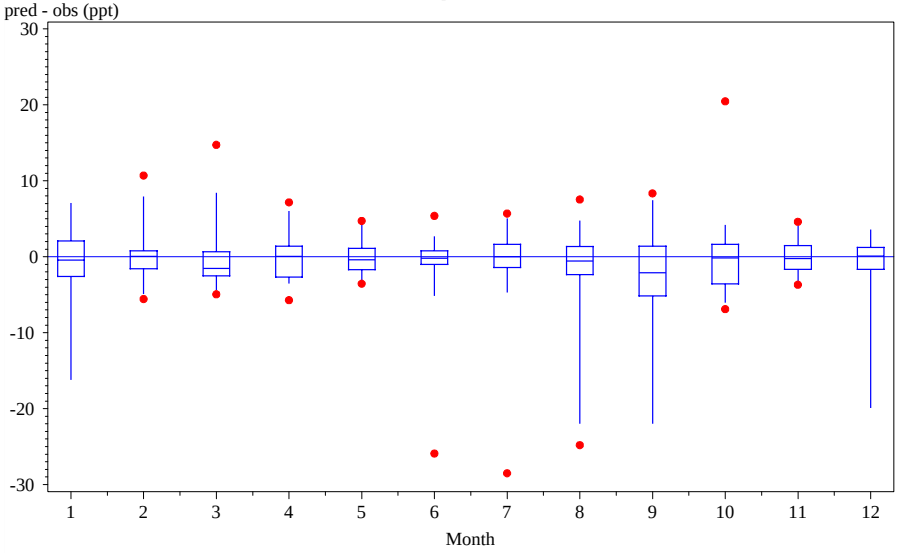
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=74 Sample Level=1 Meter



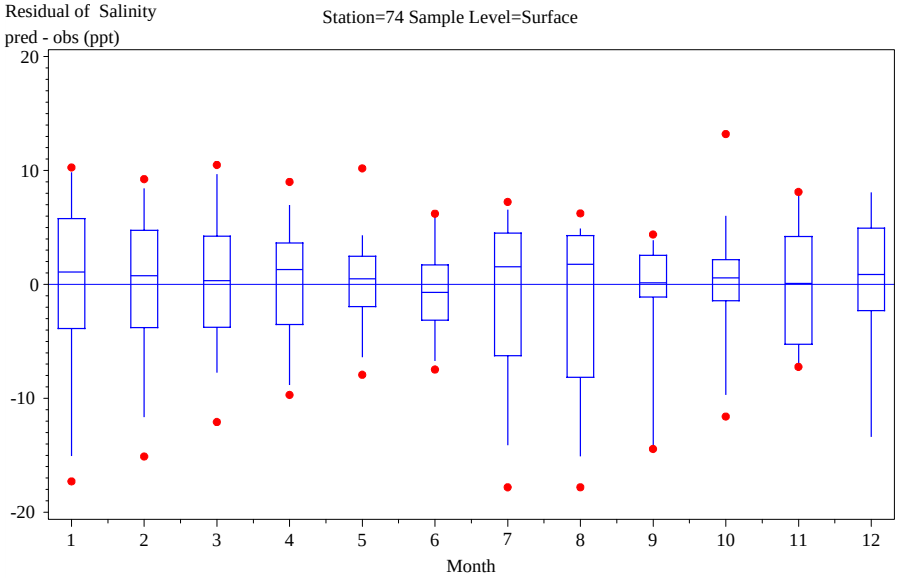
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=74 Sample Level=2 Meter



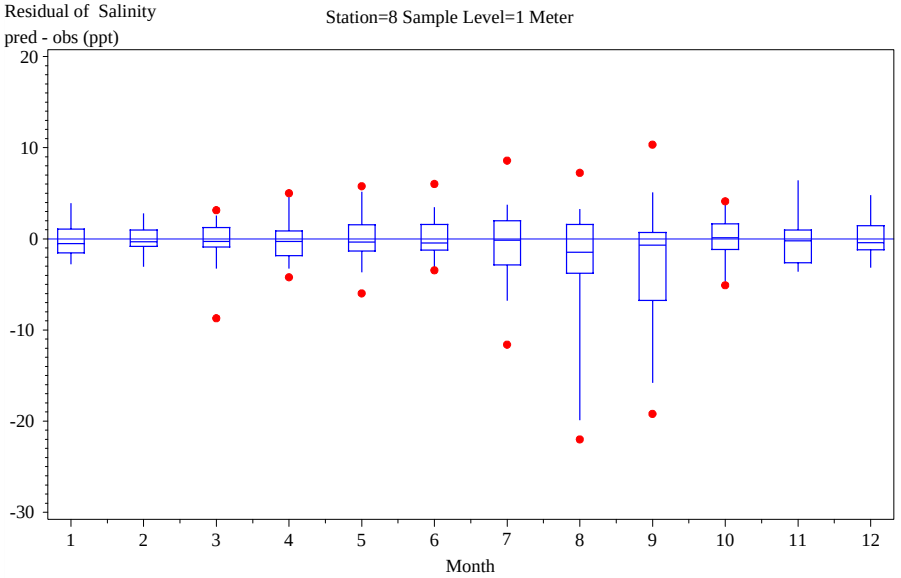
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=74 Sample Level=Bottom



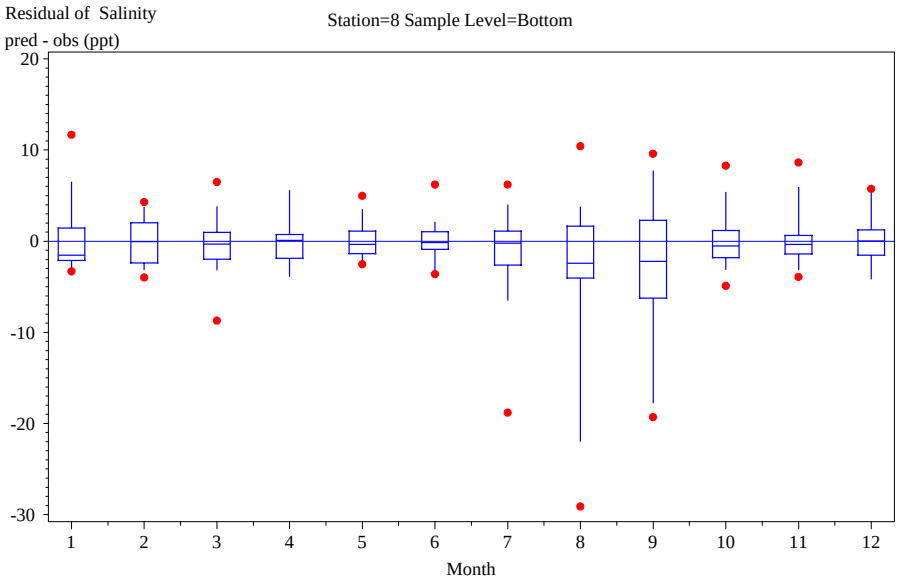
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=74 Sample Level=Surface



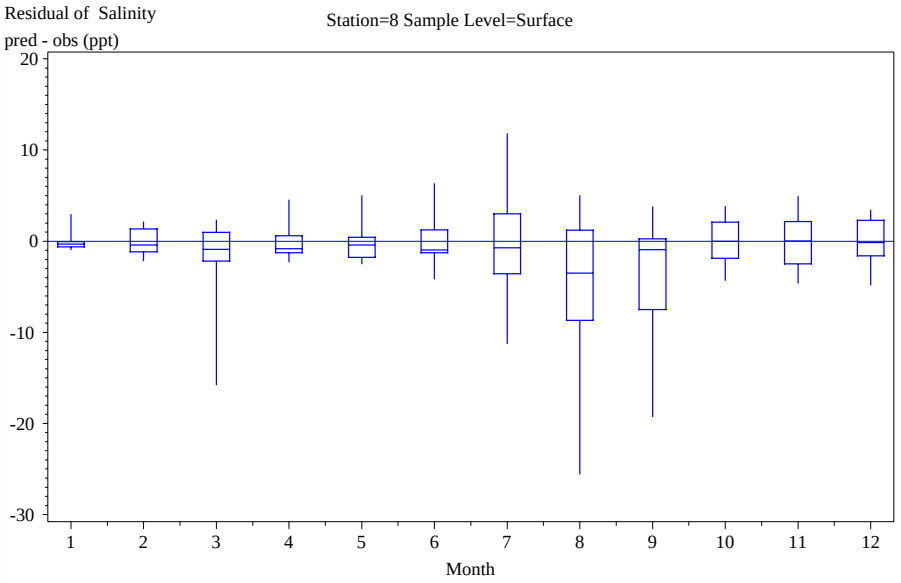
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=1 Meter



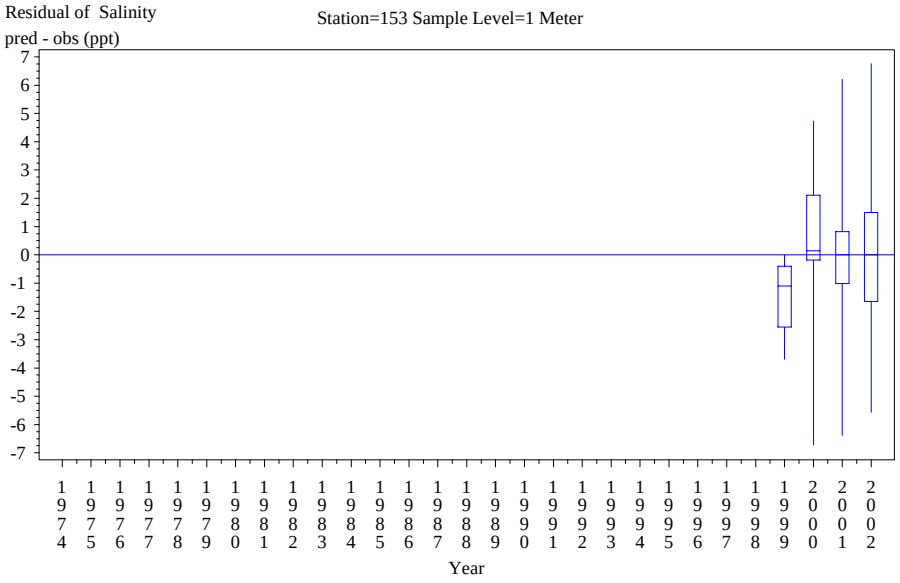
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=Bottom



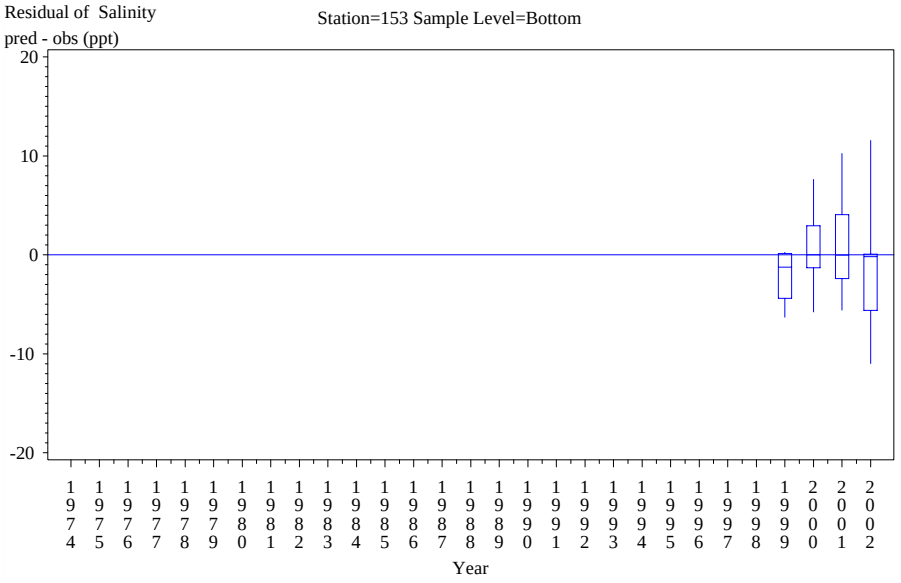
Alafia River Analysis
Residual of Salinity vs. Month in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=Surface



Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=153 Sample Level=1 Meter



Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=153 Sample Level=Bottom

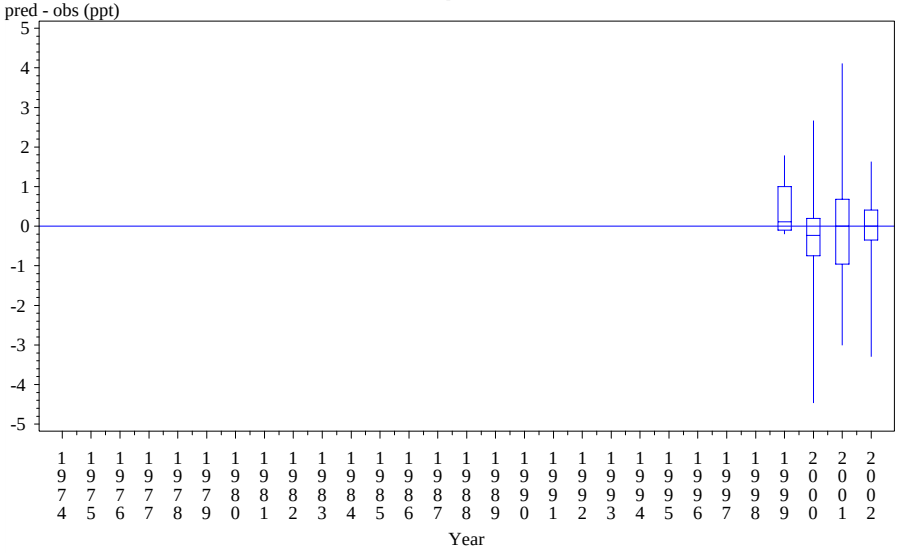


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: EPCHCAMB

Station=153 Sample Level=Surface

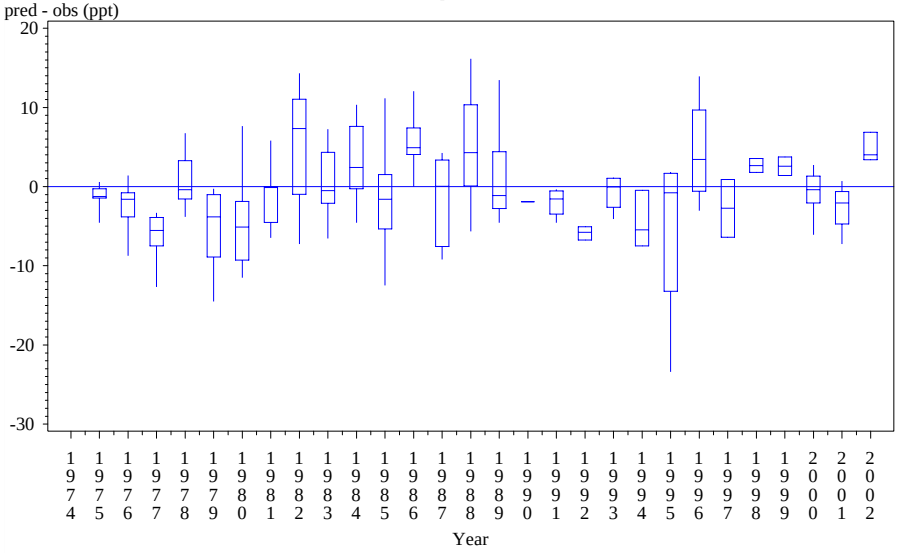


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: EPCHCAMB

Station=74 Sample Level=1 Meter

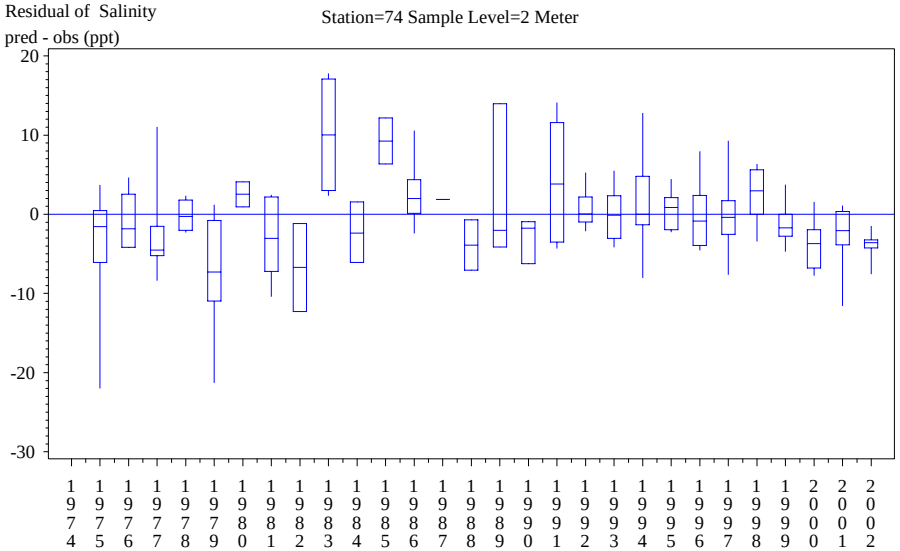


Alafia River Analysis

Residual of Salinity vs. Year in each Sample Level and Station

Source: EPCHCAMB

Station=74 Sample Level=2 Meter

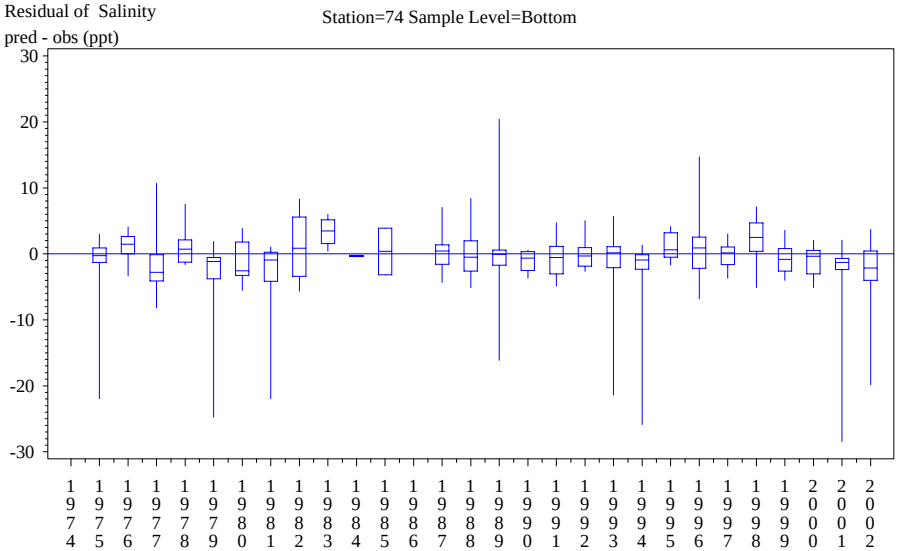


Alafia River Analysis

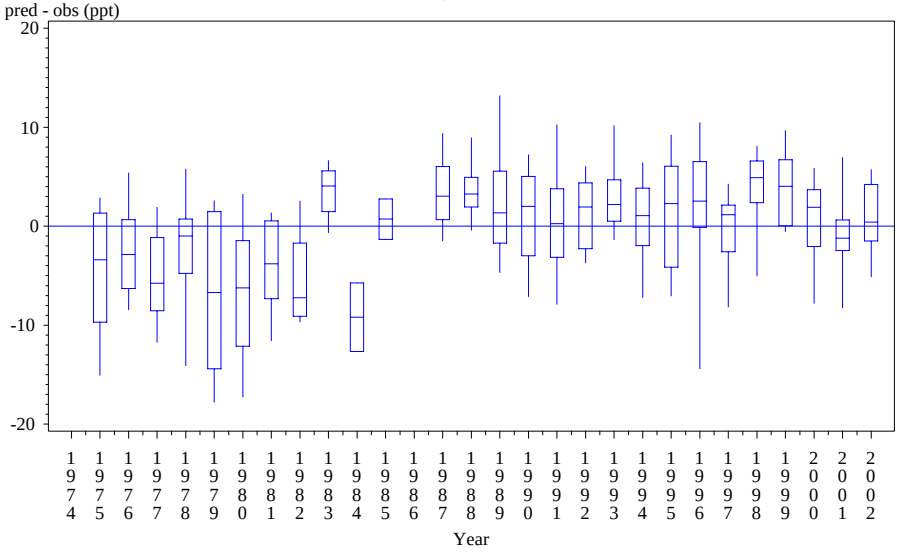
Residual of Salinity vs. Year in each Sample Level and Station

Source: EPCHCAMB

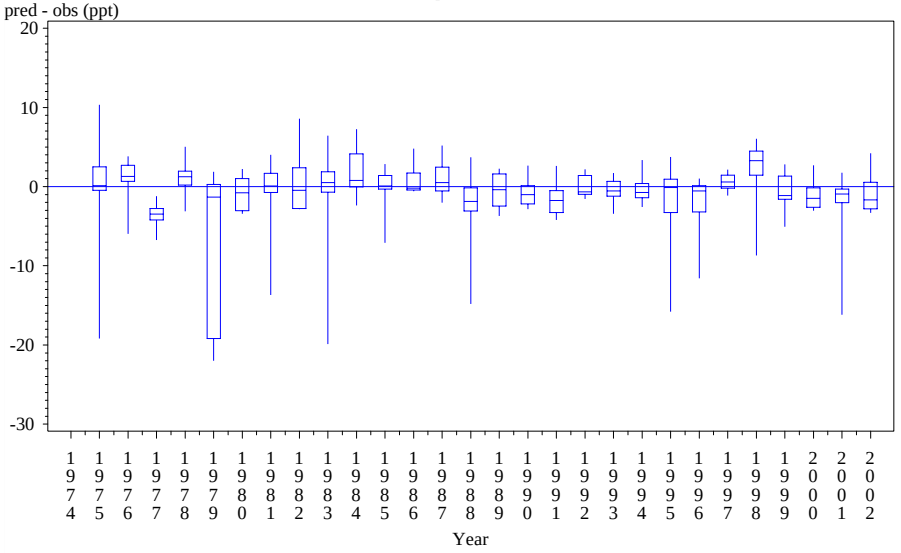
Station=74 Sample Level=Bottom



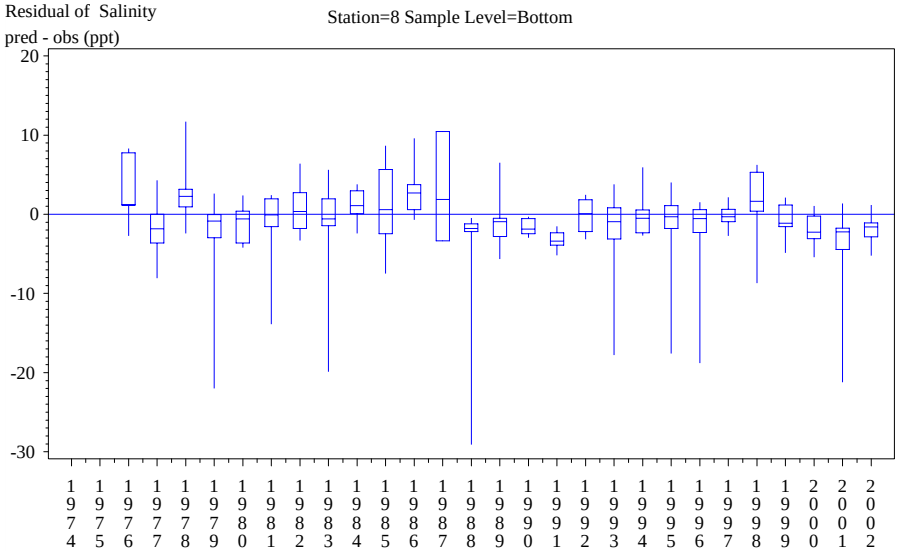
Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=74 Sample Level=Surface



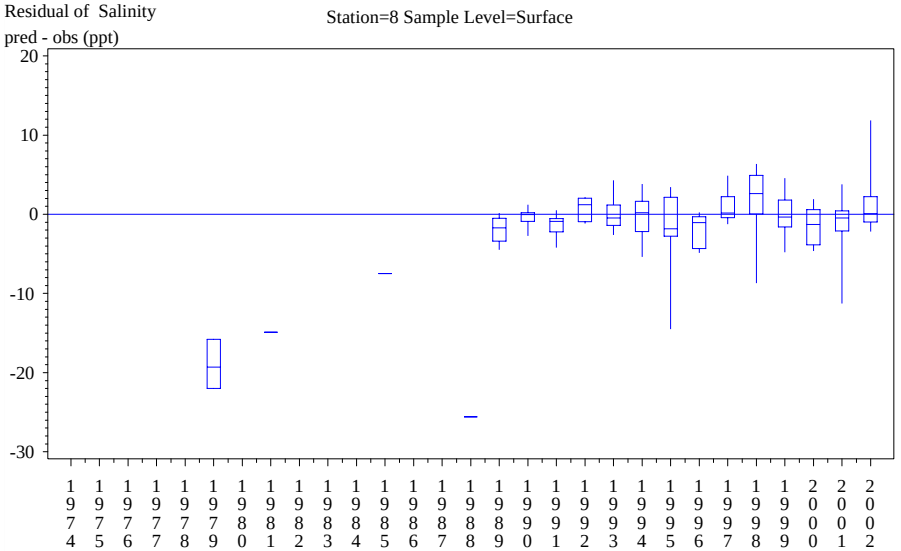
Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=1 Meter



Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=Bottom



Alafia River Analysis
Residual of Salinity vs. Year in each Sample Level and Station
Source: EPCHCAMB
Station=8 Sample Level=Surface



Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301718 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301718 sample_level=B

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5		1	-3.63960	0.54961	-6.62	<.0001
a6		1	-0.84439	0.53838	-1.57	0.1171
a7		1	-3.87709	0.56913	-6.81	<.0001
a8		1	-3.74603	0.57268	-6.54	<.0001
a9		1	-3.17071	0.60487	-5.24	<.0001
a10		1	0.79292	0.58184	1.36	0.1732
a11		1	1.64508	0.54234	3.03	0.0025
flopower03_sum3		1	-3.37444	0.18575	-18.17	<.0001
flow1		1	-0.01680	0.01283	-1.31	0.1908
l3_flow		1	0.00244	0.00139	1.76	0.0792
int		1	0.00367	0.00175	2.09	0.0366

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301718 sample_level=S

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	19661	1310.73458	210.54	<.0001
Error	1072	6673.80054	6.22556		
Corrected Total	1087	26335			

Root MSE	2.49511	R-Square	0.7466
Dependent Mean	6.82693	Adj R-Sq	0.7430
Coeff Var	36.54799		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	70.88765	11.21192	6.32	<.0001
a1		1	-2.68335	0.36613	-7.33	<.0001
a2		1	-3.09886	0.37486	-8.27	<.0001
a3		1	-4.13330	0.36859	-11.21	<.0001
a4		1	-4.30352	0.38033	-11.32	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301718 sample_level=S

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5		1	-2.21738	0.41164	-5.39	<.0001
a6		1	-1.16233	0.38432	-3.02	0.0026
a7		1	-2.69645	0.39875	-6.76	<.0001
a8		1	-3.19826	0.40985	-7.80	<.0001
a9		1	-2.81913	0.43141	-6.53	<.0001
a10		1	0.40530	0.40647	1.00	0.3189
a11		1	1.19439	0.37071	3.22	0.0013
flopower02_sum3		1	-21.54778	4.66242	-4.62	<.0001
flopower09_sum3		1	0.07805	0.04748	1.64	0.1005
flopowerm1		1	-155.36316	36.78677	-4.22	<.0001
int		1	-0.01002	0.00812	-1.23	0.2179

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301719 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	12	21334	1777.87237	241.34	<.0001
Error	1020	7514.03553	7.36670		
Corrected Total	1032	28849			

Root MSE	2.71417	R-Square	0.7395
Dependent Mean	18.60112	Adj R-Sq	0.7365
Coeff Var	14.59142		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	30.76094	0.41387	74.32	<.0001
a1		1	-1.49346	0.39805	-3.75	0.0002
a2		1	-1.69785	0.40729	-4.17	<.0001
a3		1	-2.33841	0.39844	-5.87	<.0001
a4		1	-2.86119	0.40271	-7.10	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301719 sample_level=B

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5		1	-0.04037	0.41553	-0.10	0.9226
a6		1	1.63740	0.40352	4.06	<.0001
a7		1	-0.95623	0.45446	-2.10	0.0356
a8		1	-0.11096	0.44597	-0.25	0.8036
a9		1	-0.09158	0.46608	-0.20	0.8443
a10		1	0.25615	0.45468	0.56	0.5733
a11		1	0.48410	0.40532	1.19	0.2326
flopower04_sum2		1	-1.18905	0.03494	-34.03	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301721 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	2182.02801	145.46853	75.27	<.0001
Error	533	1030.11362	1.93267		
Corrected Total	548	3212.14164			

Root MSE	1.39021	R-Square	0.6793
Dependent Mean	26.99708	Adj R-Sq	0.6703
Coeff Var	5.14947		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	38.98867	1.09776	35.52	<.0001
a1		1	-0.57645	0.35319	-1.63	0.1032
a2		1	-1.08364	0.36020	-3.01	0.0027
a3		1	-1.33533	0.36277	-3.68	0.0003
a4		1	-1.04621	0.37410	-2.80	0.0054

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301721 sample_level=B

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5		1	-0.11738	0.33966	-0.35	0.7298
a6		1	1.95913	0.32731	5.99	<.0001
a7		1	1.18208	0.31203	3.79	0.0002
a8		1	-0.03602	0.31659	-0.11	0.9094
a9		1	-0.30735	0.32448	-0.95	0.3440
a10		1	0.51292	0.32236	1.59	0.1122
a11		1	-0.38899	0.32841	-1.18	0.2368
flopower02		1	-4.47941	0.48827	-9.17	<.0001
l7_flow		1	0.00070100	0.00467	0.15	0.8806
Totalflow	Total Flow (cfs)	1	0.00369	0.00164	2.25	0.0247
int		1	-0.00098967	0.00143	-0.69	0.4883

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301721 sample_level=S

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	14	9602.77518	685.91251	161.54	<.0001
Error	536	2275.83811	4.24597		
Corrected Total	550	11879			

Root MSE	2.06057	R-Square	0.8084
Dependent Mean	21.96436	Adj R-Sq	0.8034
Coeff Var	9.38145		

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	44.59724	1.08061	41.27	<.0001
a1		1	-1.48513	0.52346	-2.84	0.0047
a2		1	-0.19349	0.53367	-0.36	0.7171
a3		1	-0.17442	0.53747	-0.32	0.7457
a4		1	-0.31851	0.55338	-0.58	0.5652

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301721 sample_level=S

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5		1	0.52821	0.49744	1.06	0.2888
a6		1	1.87936	0.48044	3.91	0.0001
a7		1	2.00614	0.46012	4.36	<.0001
a8		1	-0.70123	0.46173	-1.52	0.1294
a9		1	-0.31280	0.47247	-0.66	0.5082
a10		1	0.66935	0.47407	1.41	0.1585
a11		1	0.36365	0.48609	0.75	0.4547
flopower02_sum3		1	-6.49080	0.28894	-22.46	<.0001
l7_flow		1	-0.00760	0.00479	-1.59	0.1127
int		1	0.00126	0.00113	1.12	0.2649

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily Average Records at Station 02301721 and M Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: daily_avg_sal Salinity (ppt)

Station=02301721 sample_level=M

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	346.04522	86.51131	50.17	<.0001
Error	139	239.70232	1.72448		
Corrected Total	143	585.74754			

Root MSE	1.31319	R-Square	0.5908
Dependent Mean	26.71910	Adj R-Sq	0.5790
Coeff Var	4.91481		

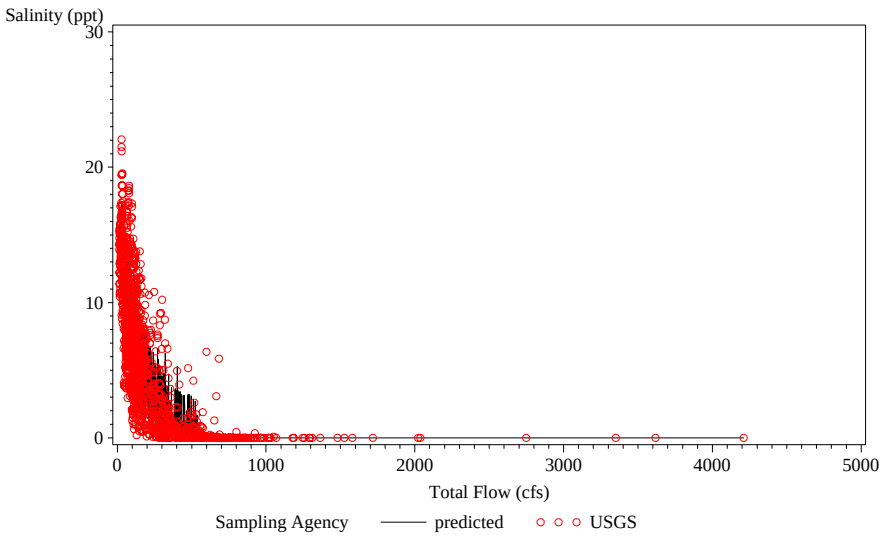
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	48.03352	13.23526	3.63	0.0004
wetseason		1	1.58483	0.34816	4.55	<.0001
flopower02_sum2		1	-9.37753	4.50566	-2.08	0.0392
sal_55b_p09		1	-0.63988	0.72508	-0.88	0.3790
int		1	0.34251	0.24722	1.39	0.1681

Alafia River Analyses

Observed Daily Average Salinity and Predicated Daily Average Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301718 sample_level=S

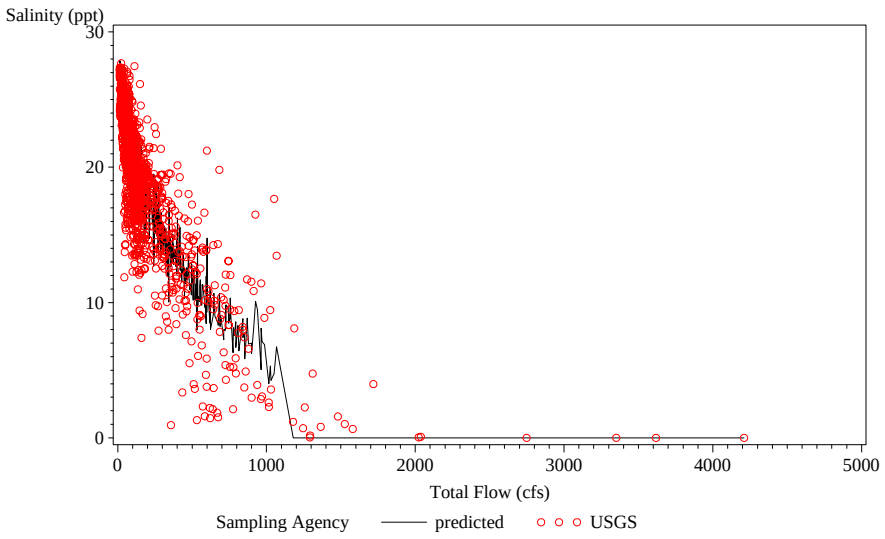


Alafia River Analyses

Observed Daily Average Salinity and Predicated Daily Average Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301719 sample_level=B

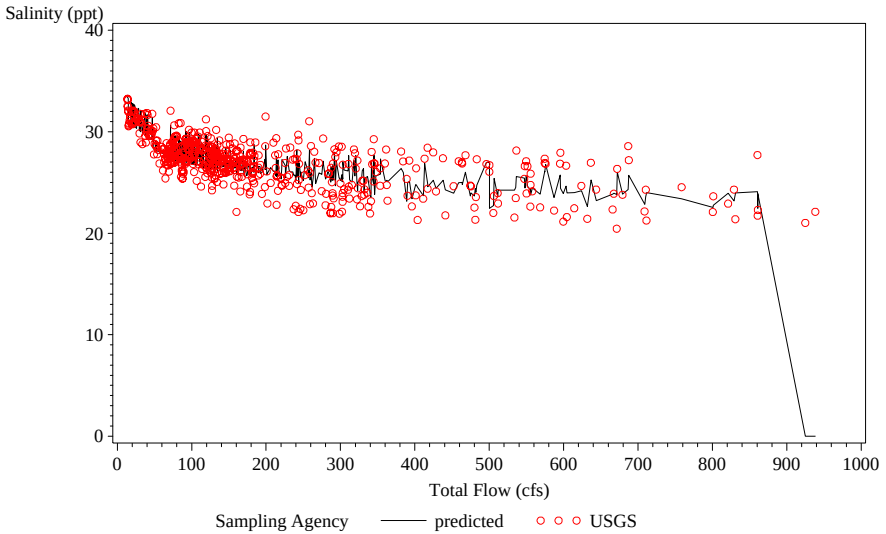


Alafia River Analyses

Observed Daily Average Salinity and Predicated Daily Average Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=B

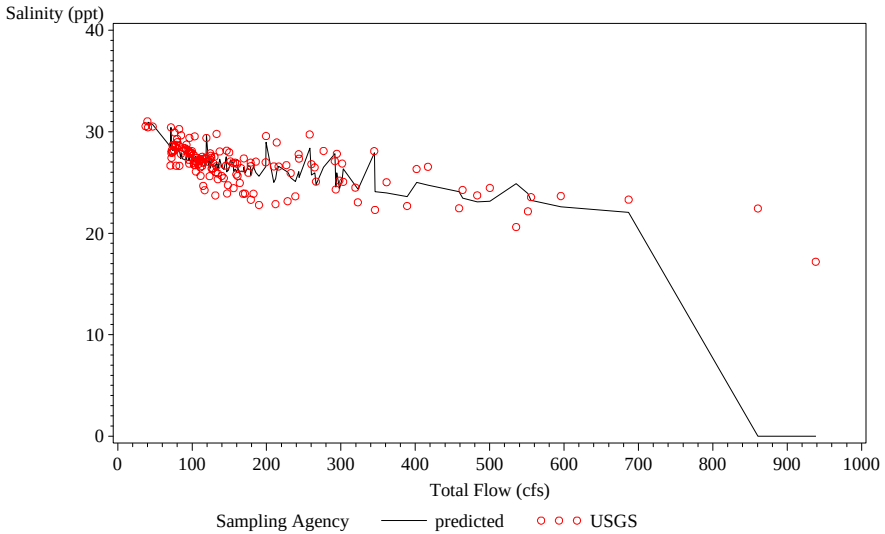


Alafia River Analyses

Observed Daily Average Salinity and Predicated Daily Average Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=M

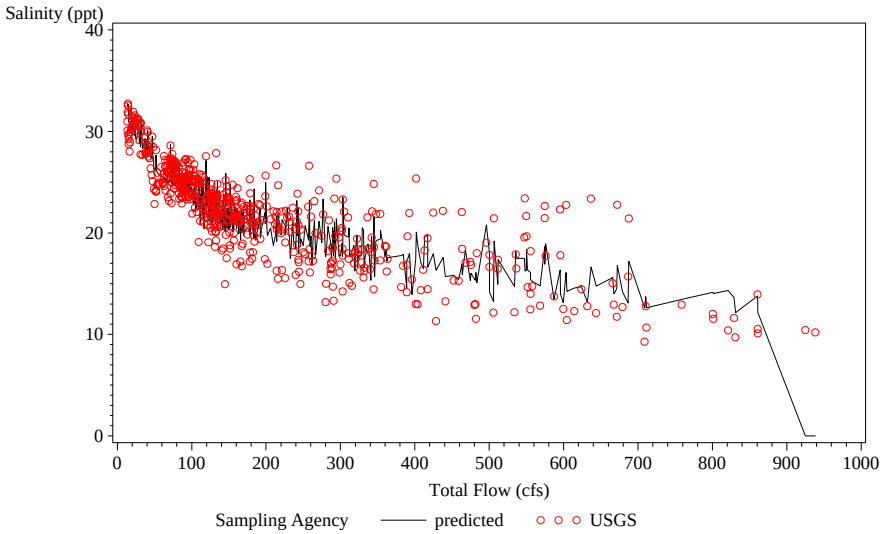


Alafia River Analyses

Observed Daily Average Salinity and Predicated Daily Average Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=S



Alafia River Analyses

R Square Result for USGS Continuous Daily Average Salinity Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

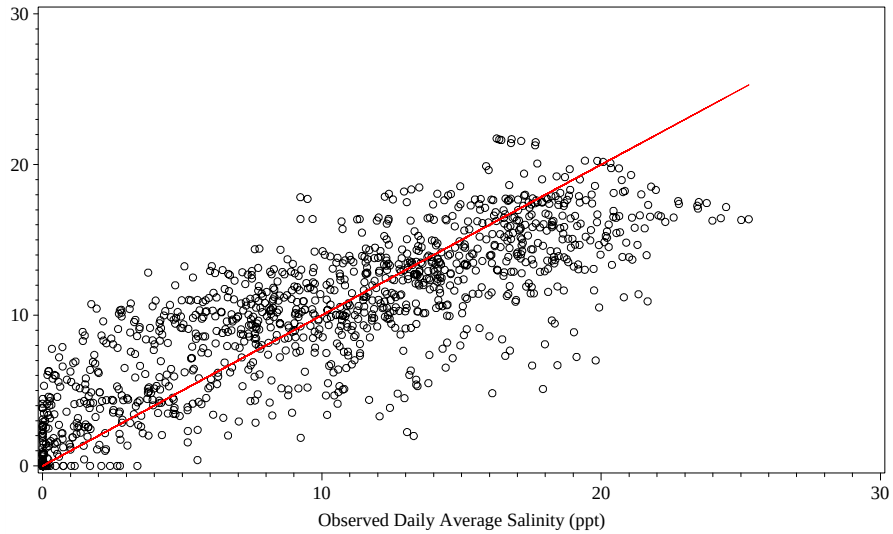
Station	sample_level	CSS Observed Daily Average Salinity	USS Residual Daily Average Salinity	Rsquare
02301718	B	52227.55	15180.91	0.70933
02301718	S	31910.34	6737.95	0.78885
02301719	B	34156.26	7629.71	0.77662
02301721	B	3271.45	1961.18	0.40052
02301721	M	693.41	1039.17	-0.49864
02301721	S	12148.92	2488.80	0.79514

Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=B

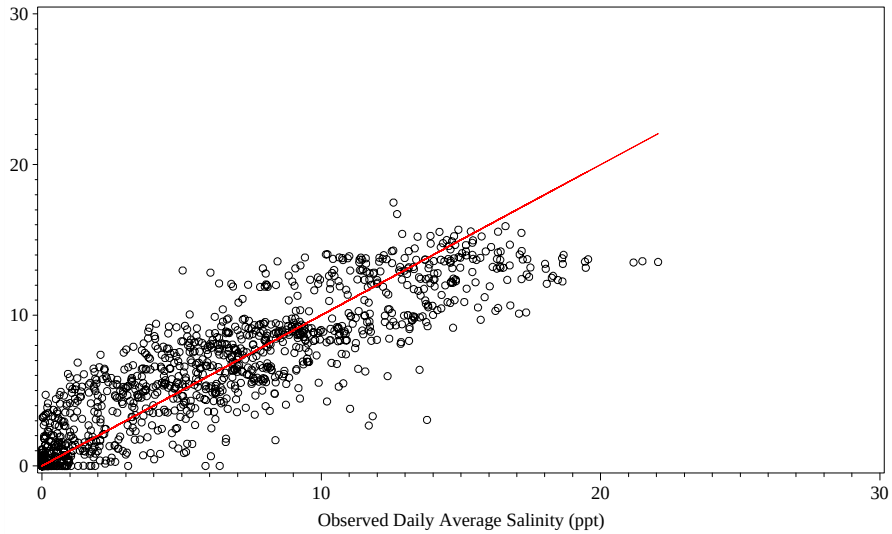


Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=S

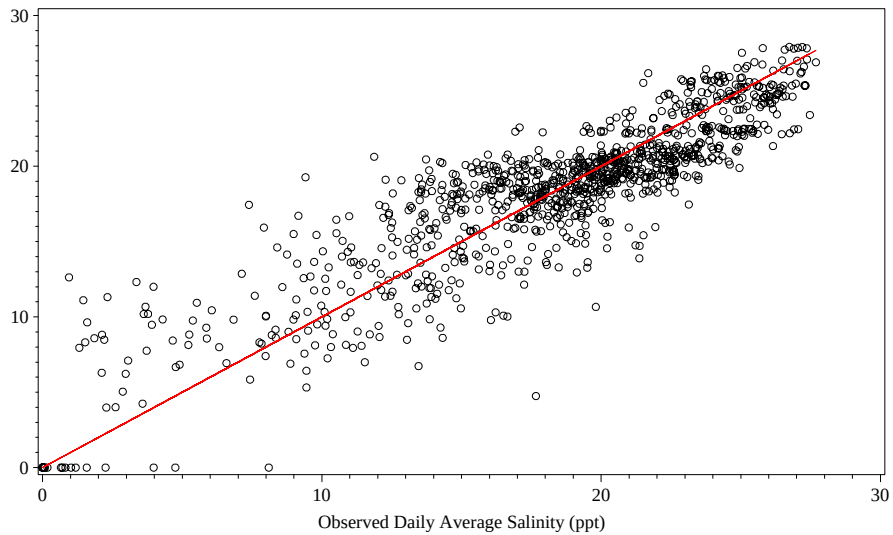


Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301719 sample_level=B

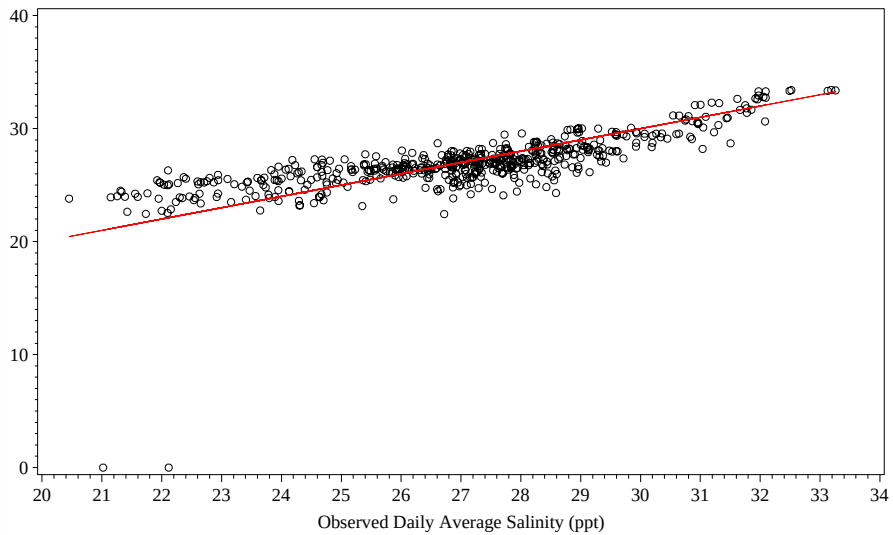


Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301721 sample_level=B

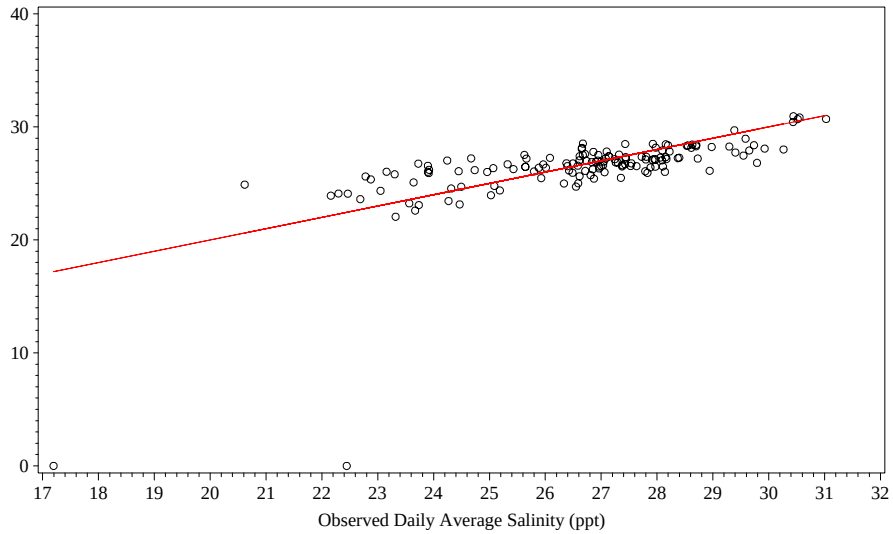


Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301721 sample_level=M

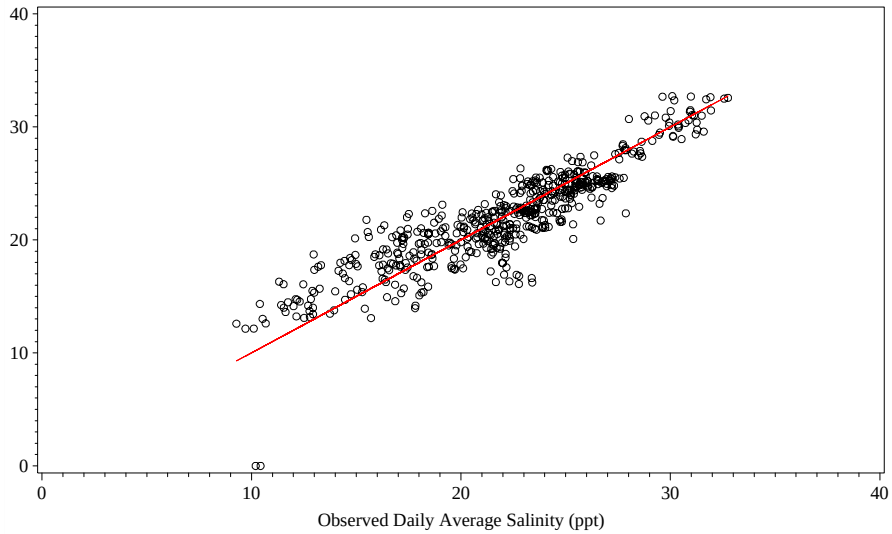


Alafia River Analyses

Predicted Daily Average Salinity vs. Observed Daily Average Salinity in each Station and Sample Level

Source: USGS

Station=02301721 sample_level=S

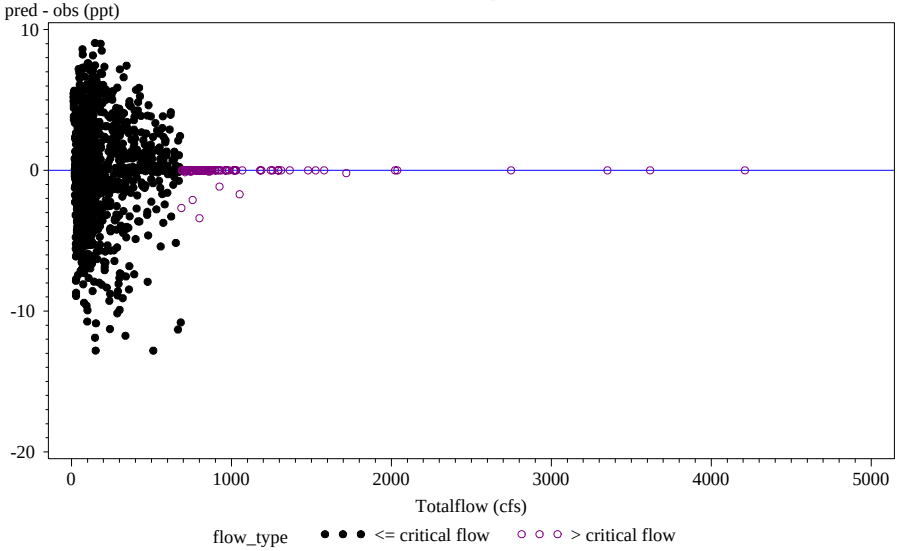


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301718 sample_level=B

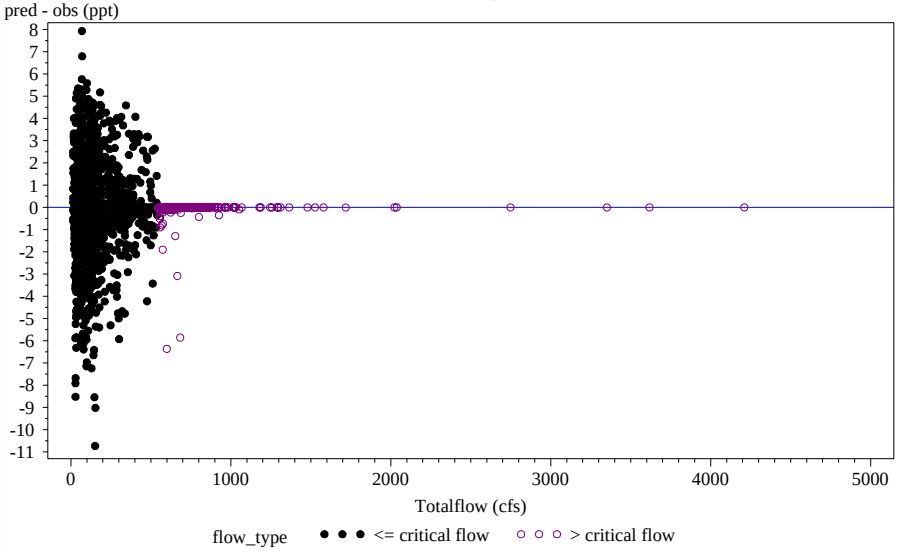


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301718 sample_level=S

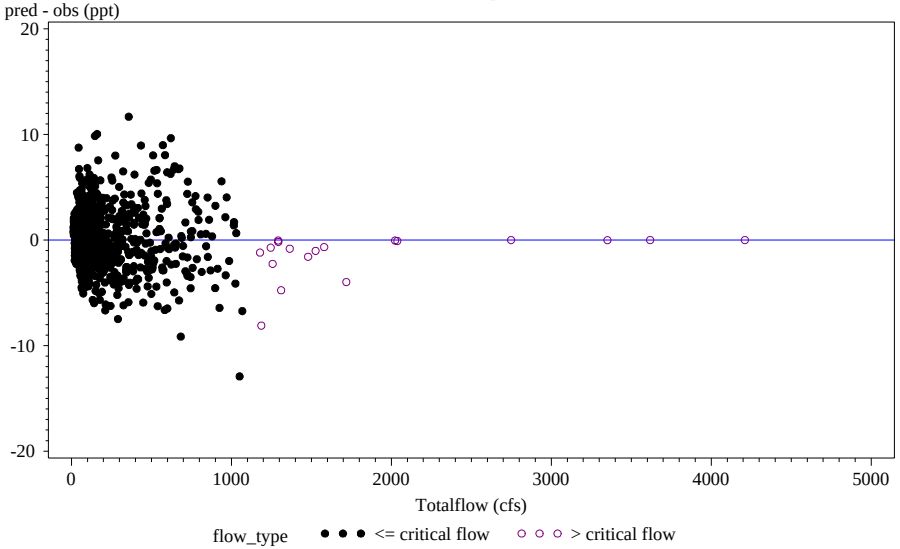


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301719 sample_level=B

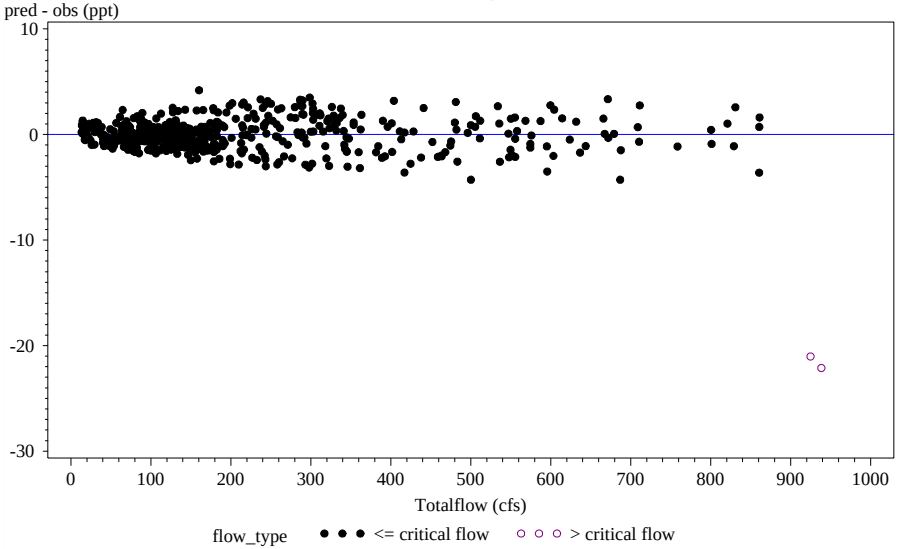


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301721 sample_level=B

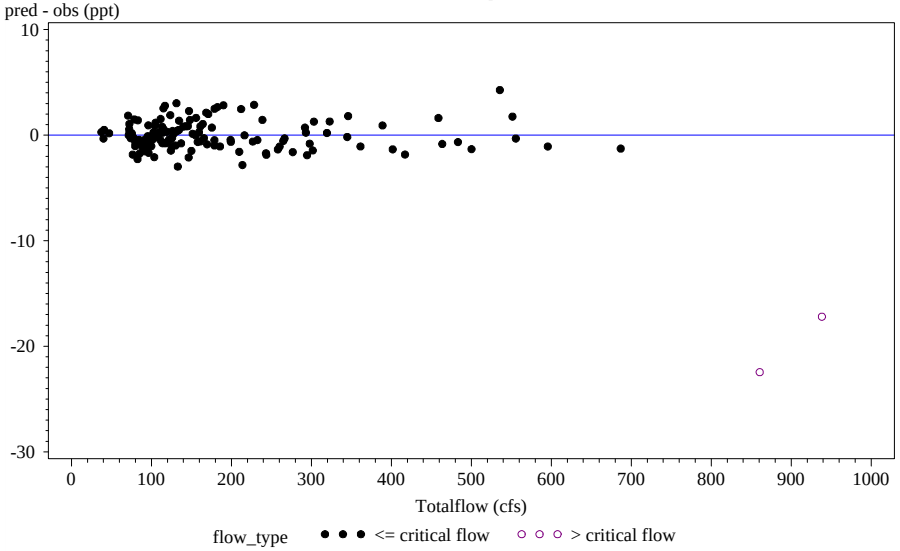


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301721 sample_level=M

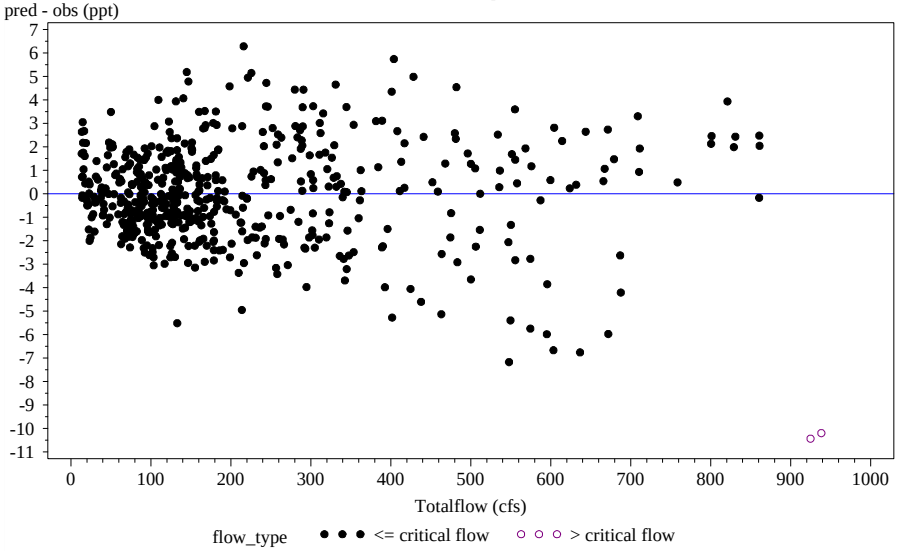


Alafia River Analysis

Residual of Daily Average Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301721 sample_level=S



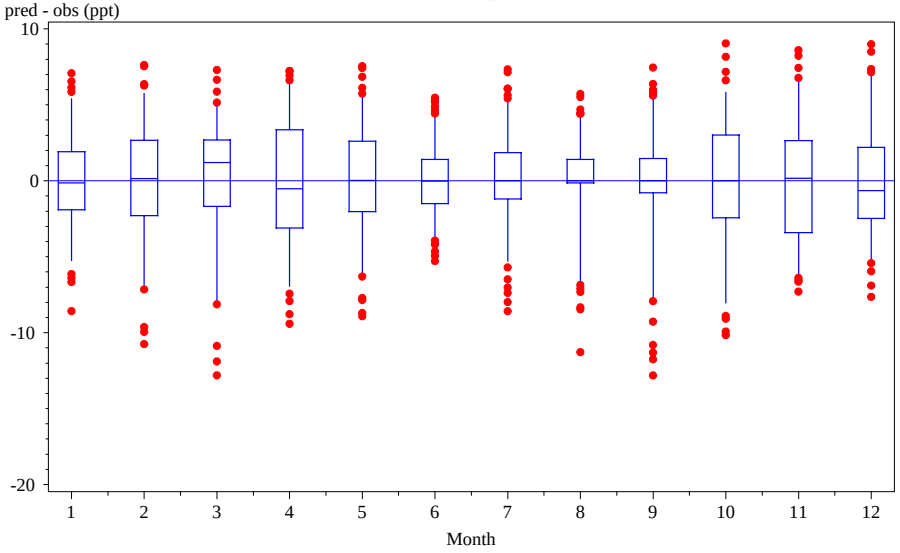
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301718 sample_level=B



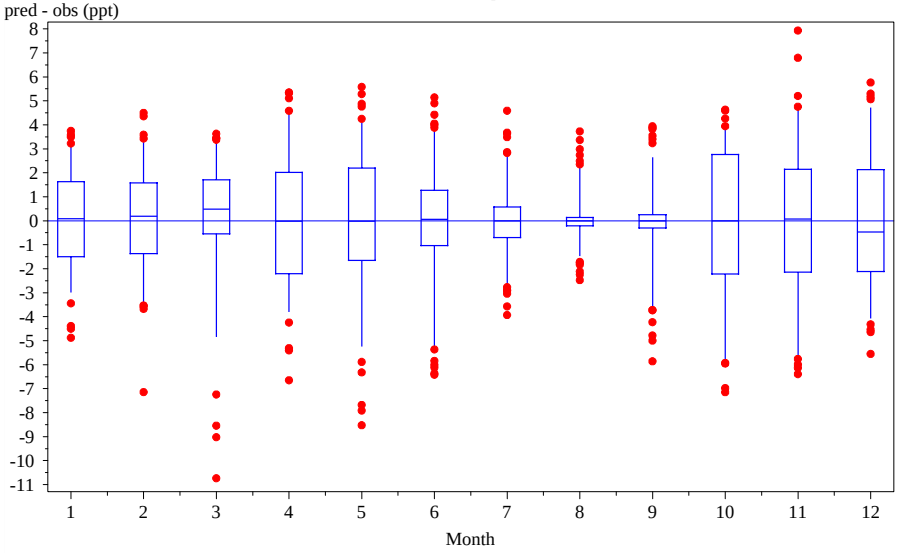
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301718 sample_level=S



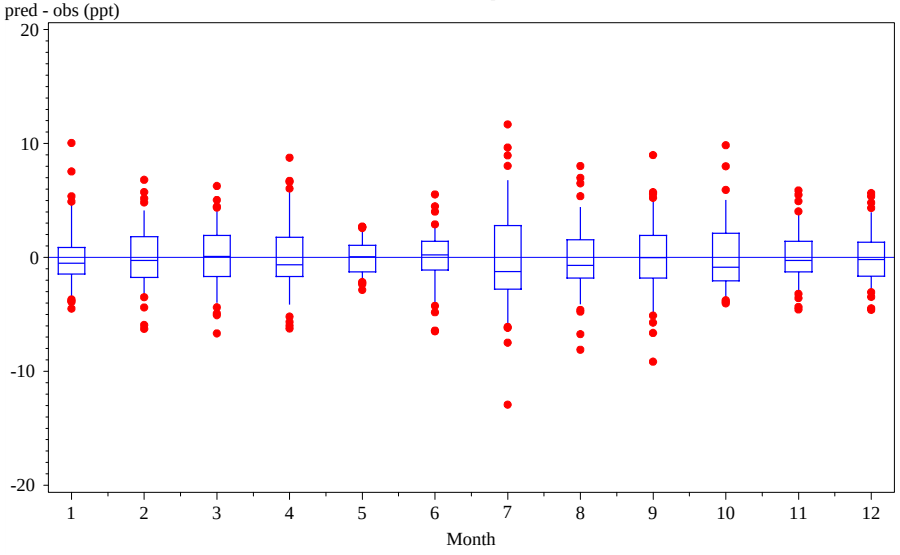
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301719 sample_level=B



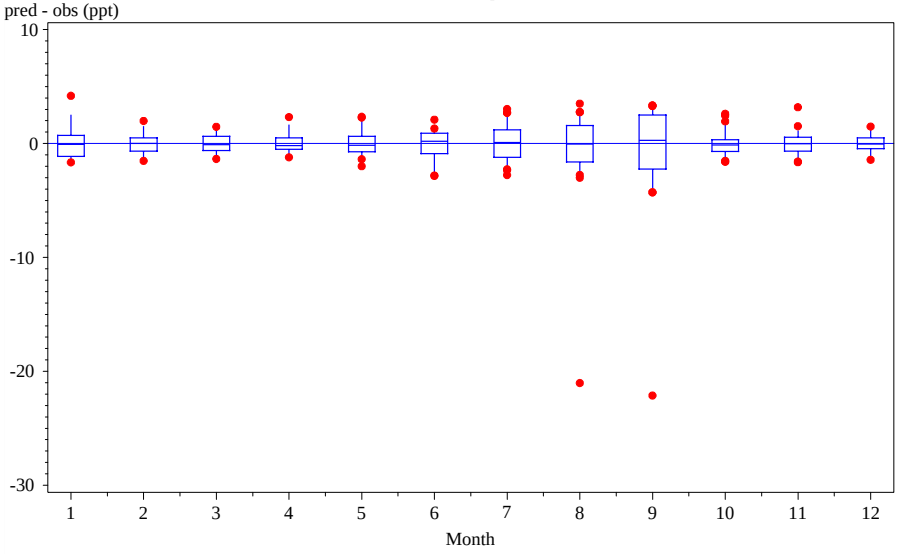
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301721 sample_level=B



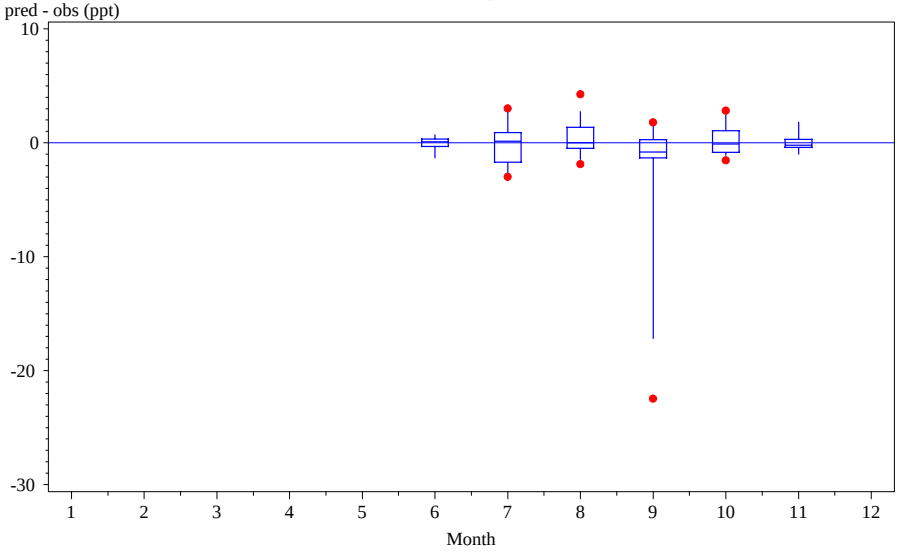
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301721 sample_level=M



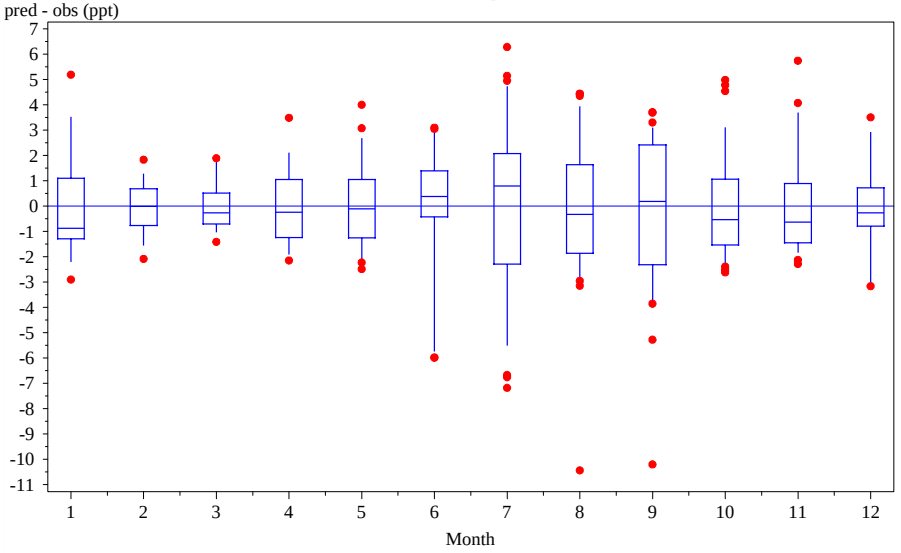
Alafia River Analysis

Residual of Daily Average Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301721 sample_level=S



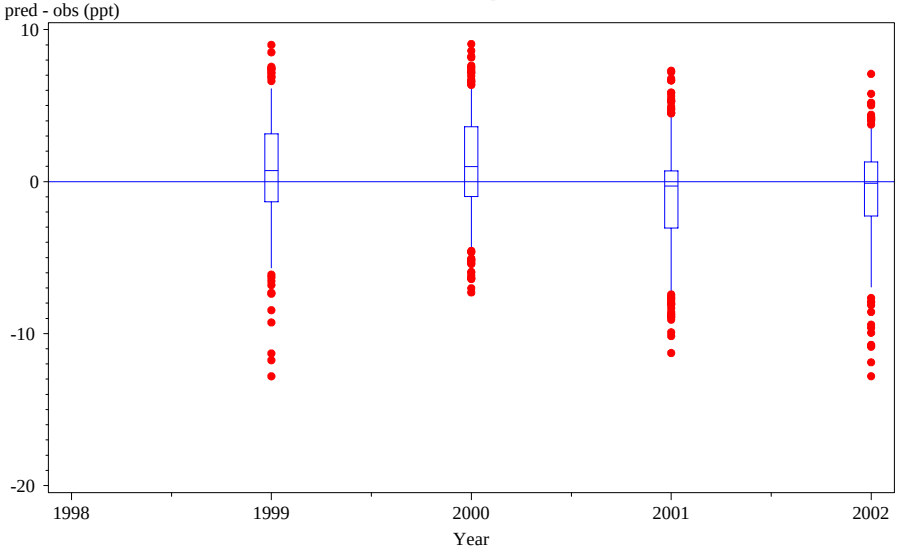
Alafia River Analysis

Residual of Daily Average Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

Station=02301718 sample_level=B



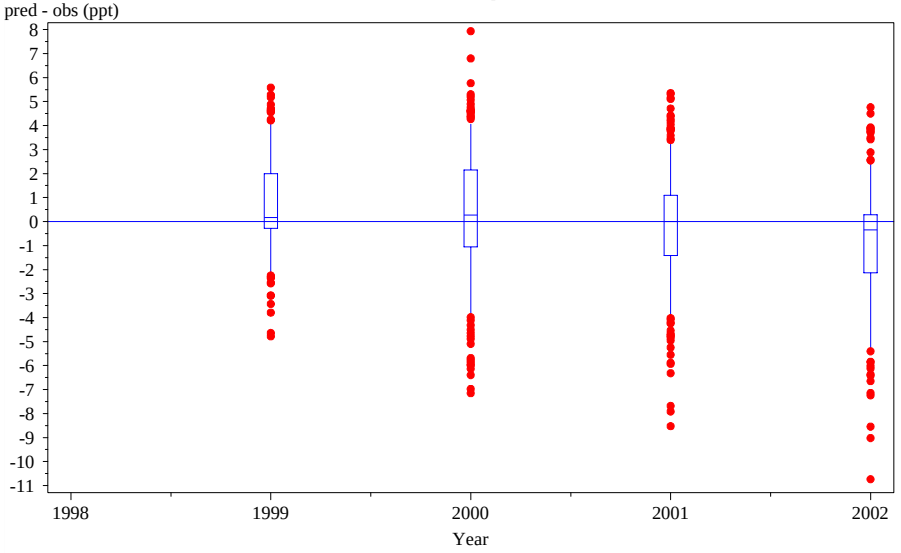
Alafia River Analysis

Residual of Daily Average Salinity vs. Year in each Sample Level and Station

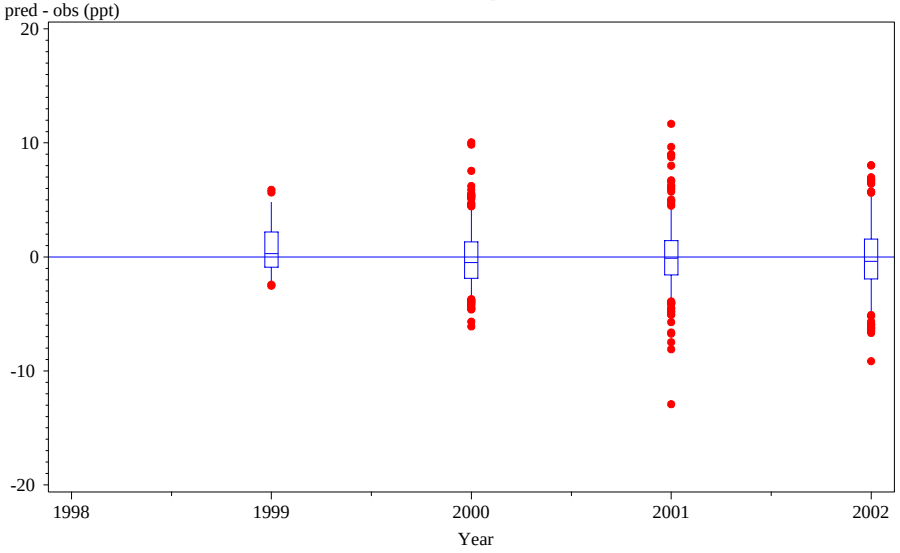
Source: USGS

Residual of Daily Average Salinity pred - obs (ppt)

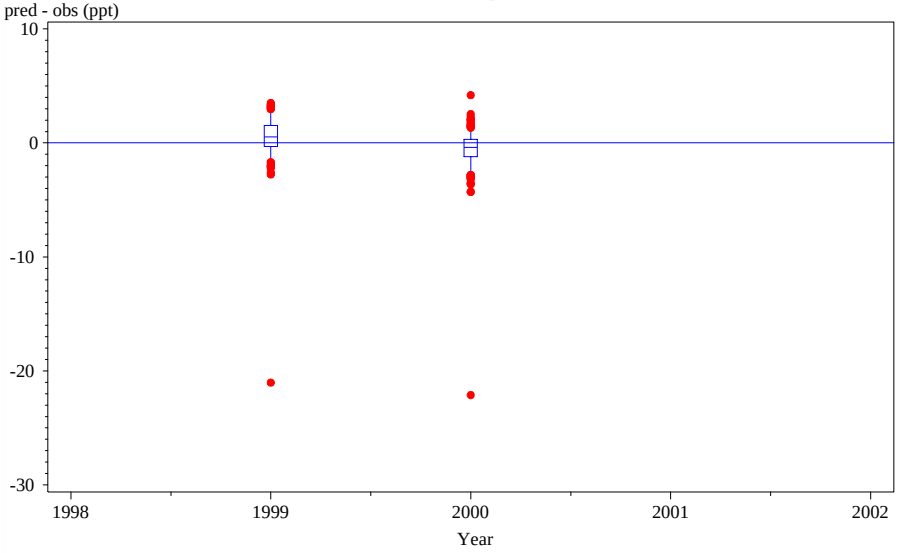
Station=02301718 sample_level=S



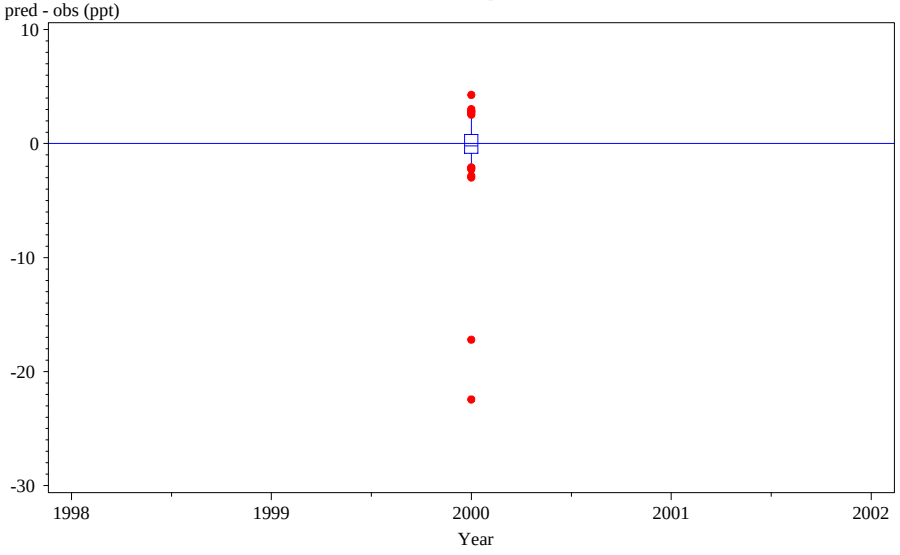
Alafia River Analysis
Residual of Daily Average Salinity vs. Year in each Sample Level and Station
Source: USGS
Station=02301719 sample_level=B



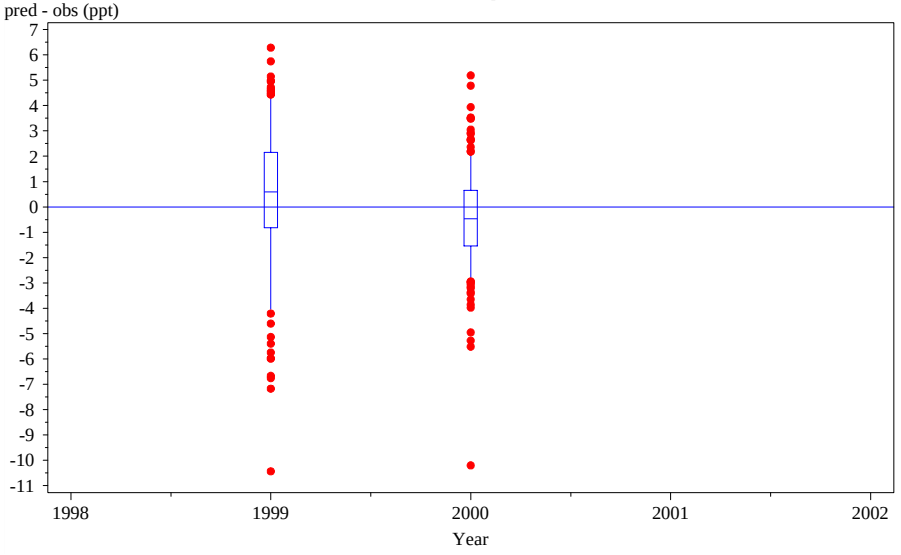
Alafia River Analysis
Residual of Daily Average Salinity vs. Year in each Sample Level and Station
Source: USGS
Station=02301721 sample_level=B



Alafia River Analysis
Residual of Daily Average Salinity vs. Year in each Sample Level and Station
Source: USGS
Station=02301721 sample_level=M



Alafia River Analysis
Residual of Daily Average Salinity vs. Year in each Sample Level and Station
Source: USGS
Station=02301721 sample_level=S



Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301718 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301718 sample_level=B

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
sal_55t_p09	1	2.23463	0.29368	7.61	<.0001
int	1	-585.73183	714.50804	-0.82	0.4125

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301718 sample_level=S

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	5	10291	2058.24437	807.01	<.0001
Error	1222	3116.65018	2.55045		
Corrected Total	1227	13408			

Root MSE	1.59701	**R-Square**	0.7676
Dependent Mean	3.19617	**Adj R-Sq**	0.7666
Coeff Var	49.96642		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-49.33088	5.04927	-9.77	<.0001
dryseason	1	1.51721	0.18398	8.25	<.0001
flopowerm04_sum6	1	54.31952	26.56407	2.04	0.0411
sal_55b_m1	1	509.53439	74.90613	6.80	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301718 sample_level=S

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
sal_55t_p09	1	1.38012	0.14089	9.80	<.0001
int	1	1365.65392	712.73133	1.92	0.0556

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301719 sample_level=B

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	5	25640	5127.90492	627.97	<.0001
Error	1045	8533.29882	8.16584		
Corrected Total	1050	34173			

Root MSE	2.85759	**R-Square**	0.7503
Dependent Mean	11.50590	**Adj R-Sq**	0.7491
Coeff Var	24.83589		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	35.74545	1.72964	20.67	<.0001
dryseason	1	1.05899	0.27466	3.86	0.0001
flopower02_sum3	1	-9.80201	0.70175	-13.97	<.0001
flopower09_sum3	1	0.00196	0.00495	0.40	0.6928

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301719 sample_level=B

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
sal_55b_m1	1	183.62438	24.97749	7.35	<.0001
int	1	0.00039759	0.00071238	0.56	0.5769

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301721 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	3035.60482	607.12096	94.91	<.0001
Error	545	3486.08174	6.39648		
Corrected Total	550	6521.68656			

Root MSE	2.52913	R-Square	0.4655
Dependent Mean	23.20808	Adj R-Sq	0.4606
Coeff Var	10.89761		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	11.43981	0.83014	13.78	<.0001
dryseason	1	0.42472	0.26124	1.63	0.1046
flopowerm02	1	31.33676	2.01002	15.59	<.0001
flow1	1	-0.08695	0.02035	-4.27	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301721 sample_level=B

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
flow2	1	0.01689	0.00903	1.87	0.0618
int	1	0.15274	0.04036	3.78	0.0002

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301721 sample_level=S

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	17940	3588.09650	601.14	<.0001
Error	547	3264.94091	5.96881		
Corrected Total	552	21205			

Root MSE	2.44312	R-Square	0.8460
Dependent Mean	13.89159	Adj R-Sq	0.8446
Coeff Var	17.58701		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	28.67347	6.91555	4.15	<.0001
dryseason	1	0.25481	0.25899	0.98	0.3256
flopower02_sum3	1	6.23576	4.84691	1.29	0.1988
flopower09_sum4	1	0.22758	0.06461	3.52	0.0005

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301721 sample_level=S

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
flopower06_sum4	1	-1.82028	0.48589	-3.75	0.0002
int	1	-0.02190	0.00695	-3.15	0.0017

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301721 and M Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301721 sample_level=M

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	3121.87961	1560.93981	293.81	<.0001
Error	143	759.73354	5.31282		
Corrected Total	145	3881.61315			

Root MSE	2.30496	R-Square	0.8043
Dependent Mean	18.79315	Adj R-Sq	0.8015
Coeff Var	12.26487		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	33.25388	0.65183	51.02	<.0001
dryseason	1	-2.01231	0.55591	-3.62	0.0004
flopower05_sum2	1	-0.69776	0.03266	-21.36	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301638 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301638 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	0.00659	0.00132	7.03	<.0001
Error	1481	0.27775	0.00018754		
Corrected Total	1486	0.28434			

Root MSE	0.01369	R-Square	0.0232
Dependent Mean	0.00195	Adj R-Sq	0.0199
Coeff Var	702.20550		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	0.04468	0.01035	4.32	<.0001
dryseason	1	0.00301	0.00105	2.88	0.0040
flopower04	1	0.00872	0.00269	3.24	0.0012
flopowerm1_sum7	1	-2.67596	1.09118	-2.45	0.0143

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301638 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301638 sample_level=B

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
flopower03	1	-0.02352	0.00661	-3.56	0.0004
int	1	0.06282	0.33261	0.19	0.8502

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301638 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301638 sample_level=S

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	5	0.00547	0.00109	6.75	<.0001
Error	1605	0.26001	0.00016200		
Corrected Total	1610	0.26547			

Root MSE	0.01273	**R-Square**	0.0206
Dependent Mean	0.00168	**Adj R-Sq**	0.0175
Coeff Var	759.42694		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	-0.06413	0.02339	-2.74	0.0062
dryseason	1	0.00235	0.00089679	2.62	0.0088
flopower02_sum2	1	0.00572	0.00296	1.93	0.0536
flopowerm1_sum7	1	-2.07051	2.49942	-0.83	0.4076

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 5 Percent Records at Station 02301638 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p05_sal

Station=02301638 sample_level=S

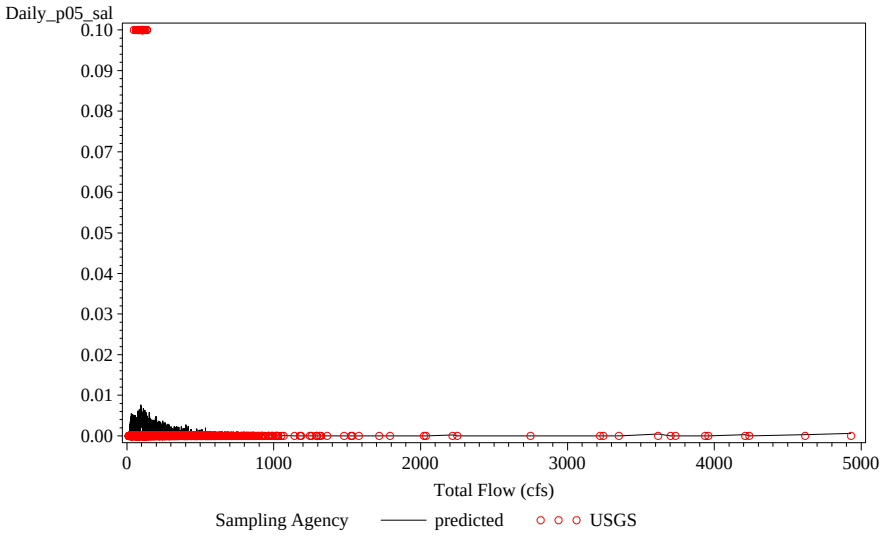
Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
flopowerm02_sum3	1	0.17712	0.05271	3.36	0.0008
int	1	-0.85468	1.38245	-0.62	0.5365

Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301638 sample_level=S

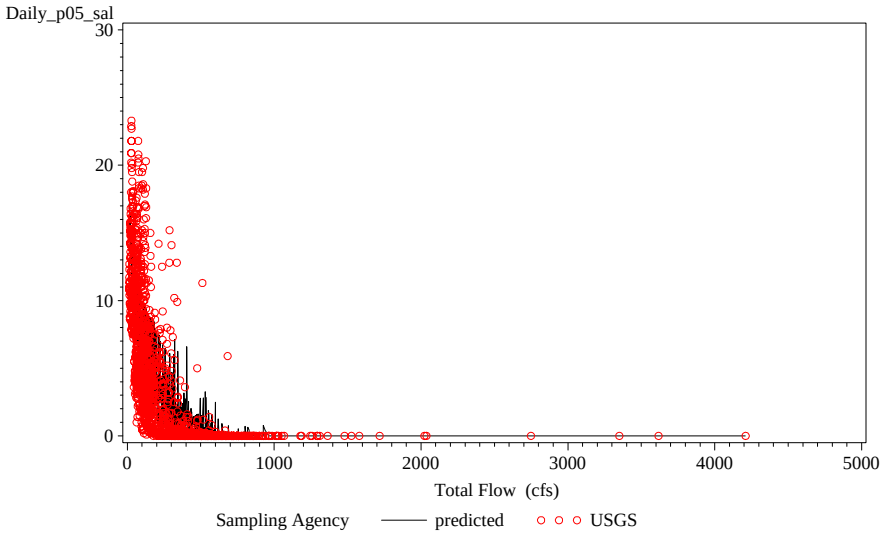


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301718 sample_level=B

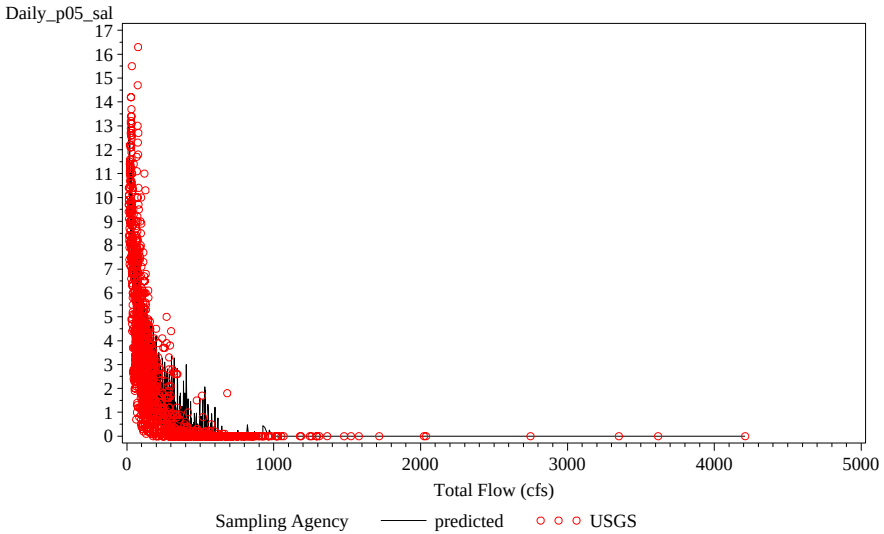


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301718 sample_level=S

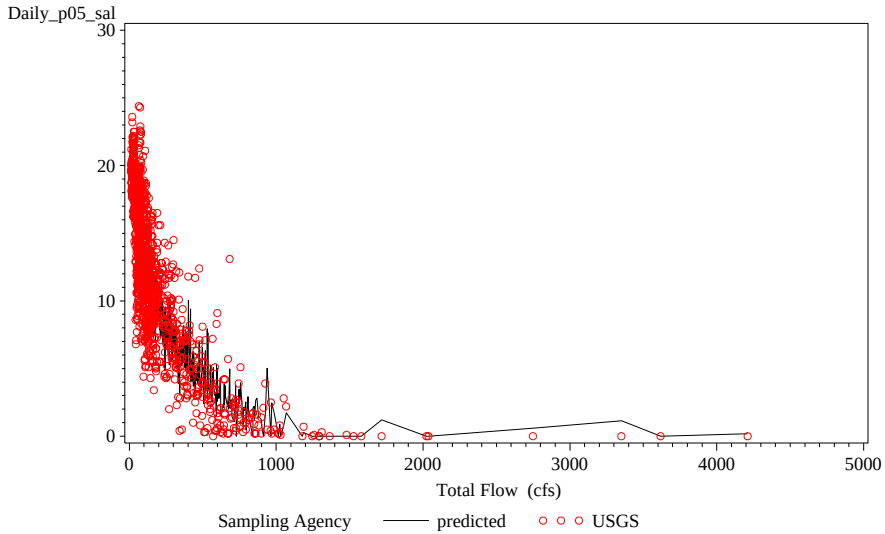


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301719 sample_level=B

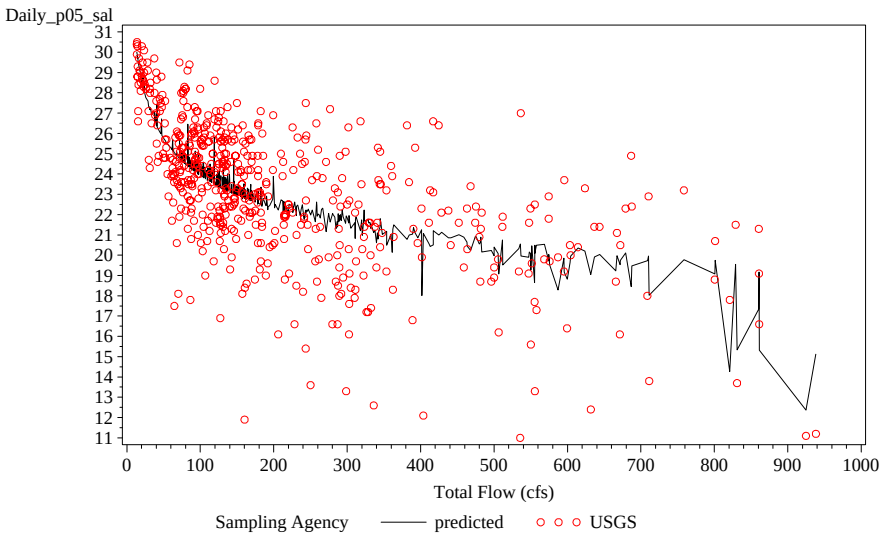


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=B

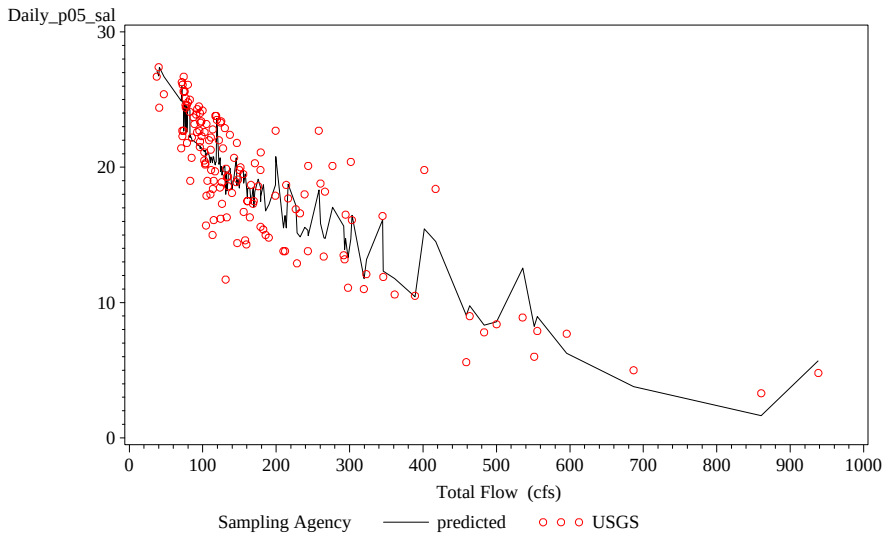


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=M

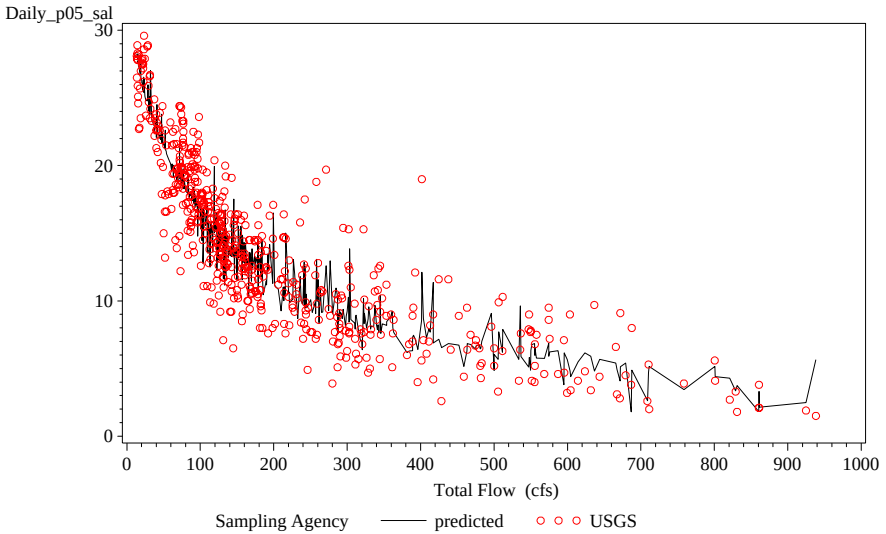


Alafia River Analyses

Observed Daily 5% Salinity and Predicated Daily 5% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=S



Alafia River Analyses

R Square Result for USGS Continuous Daily 5 Percent Salinity Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

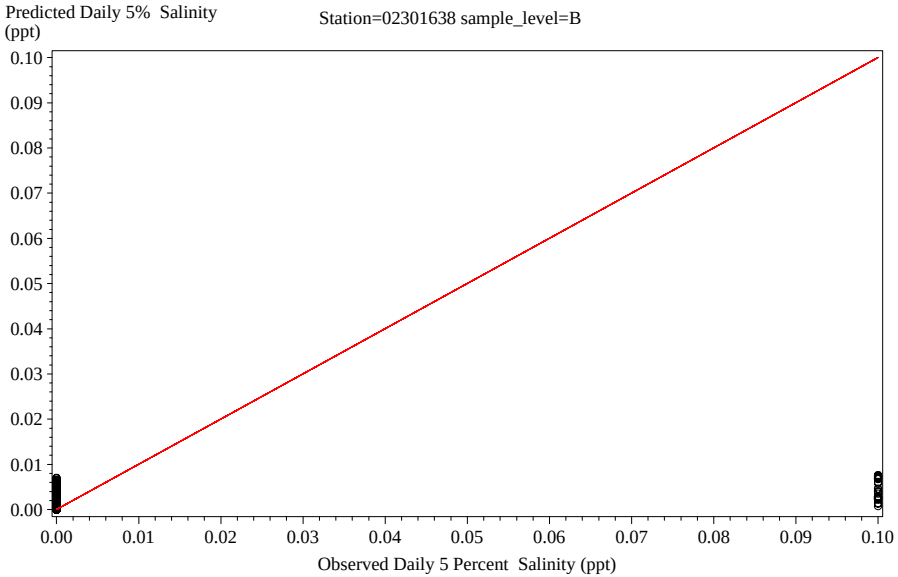
Station	sample_level	CSS Observed Daily 5 Percent Salinity	USS Residual Daily 5 Percent Salinity	Rsquare
02301638	B	0.28	0.28	0.02670
02301638	S	0.27	0.26	0.02060
02301718	B	34633.33	13263.85	0.61702
02301718	S	13407.87	2975.75	0.77806
02301719	B	34172.82	8518.62	0.75072
02301721	B	6521.69	3486.08	0.46546
02301721	M	3881.61	759.73	0.80427
02301721	S	21205.42	3264.94	0.84603

Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301638 sample_level=B

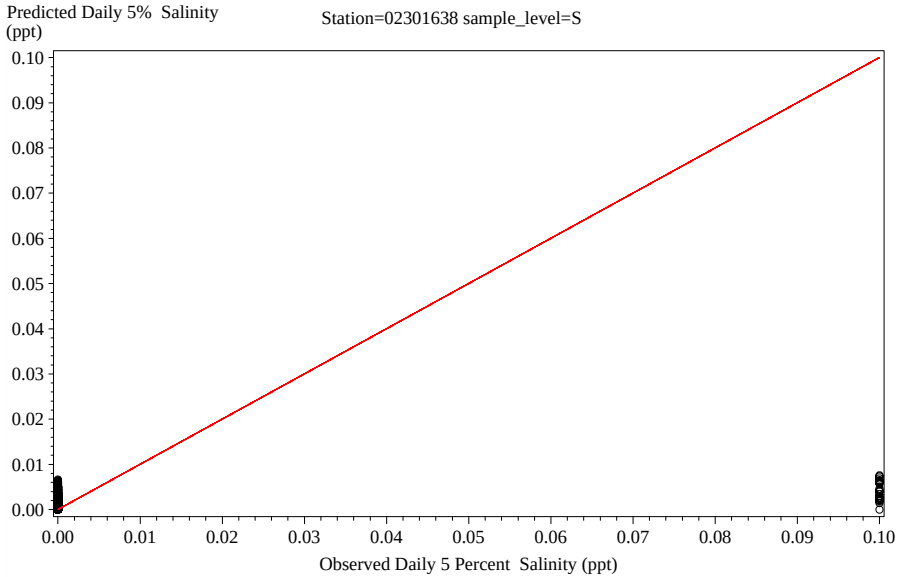


Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301638 sample_level=S

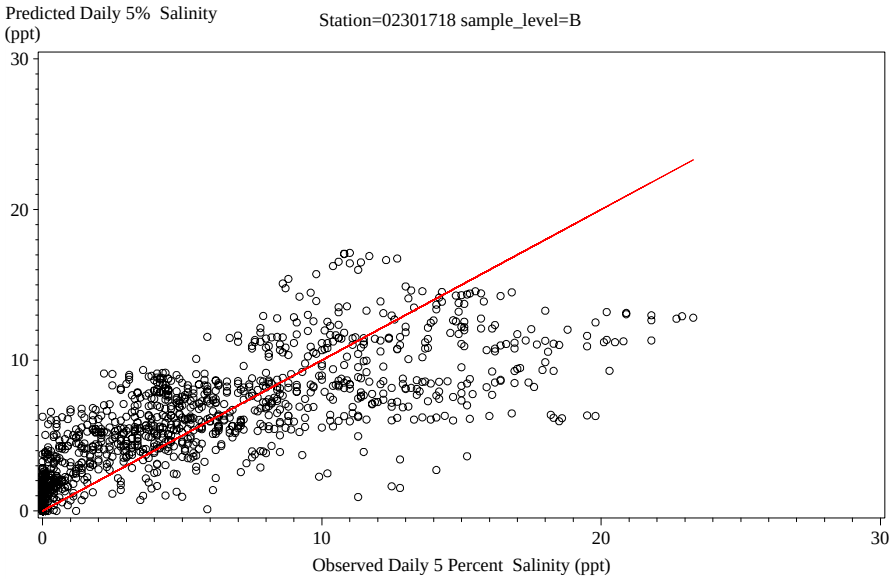


Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=B

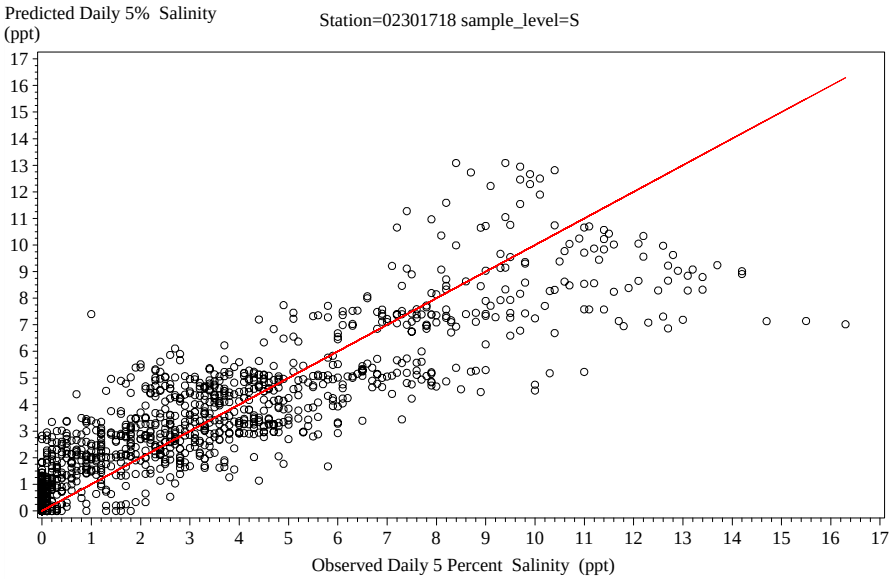


Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=S

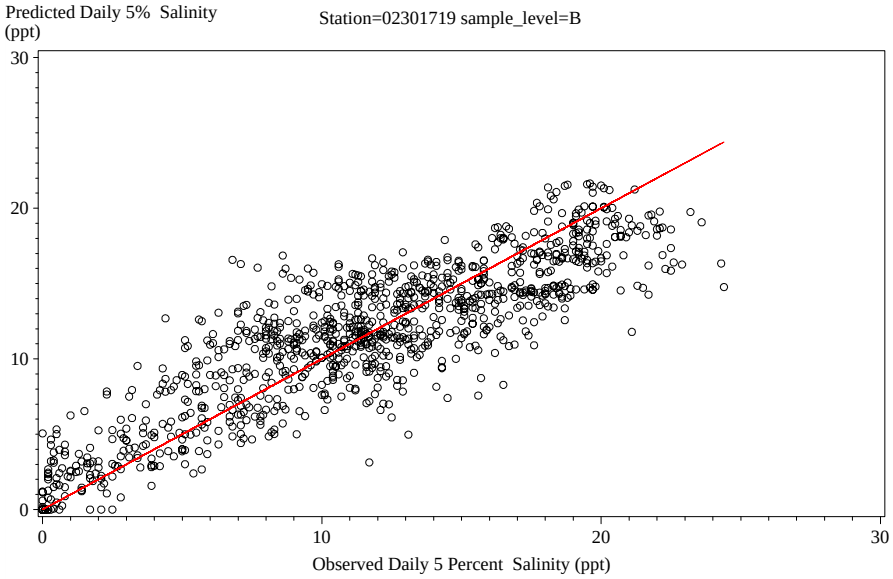


Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301719 sample_level=B

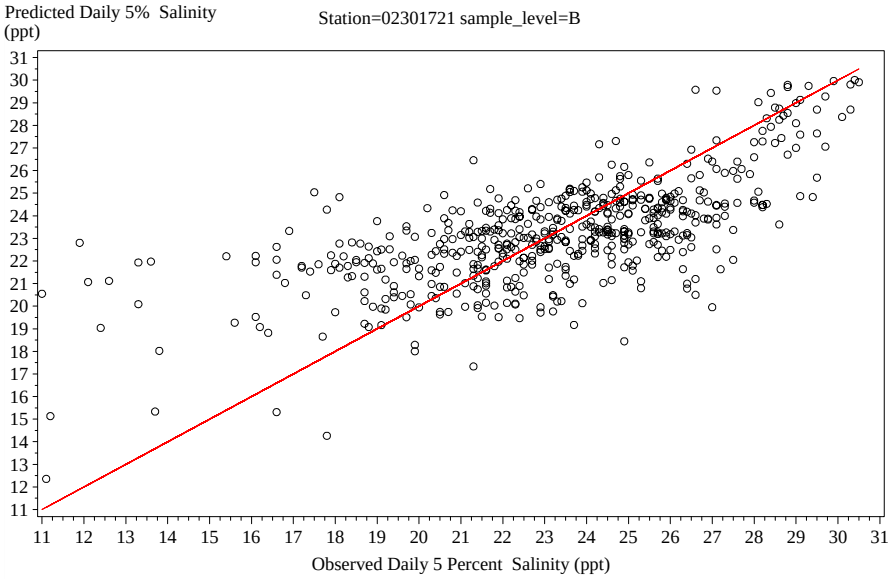


Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

Source: USGS

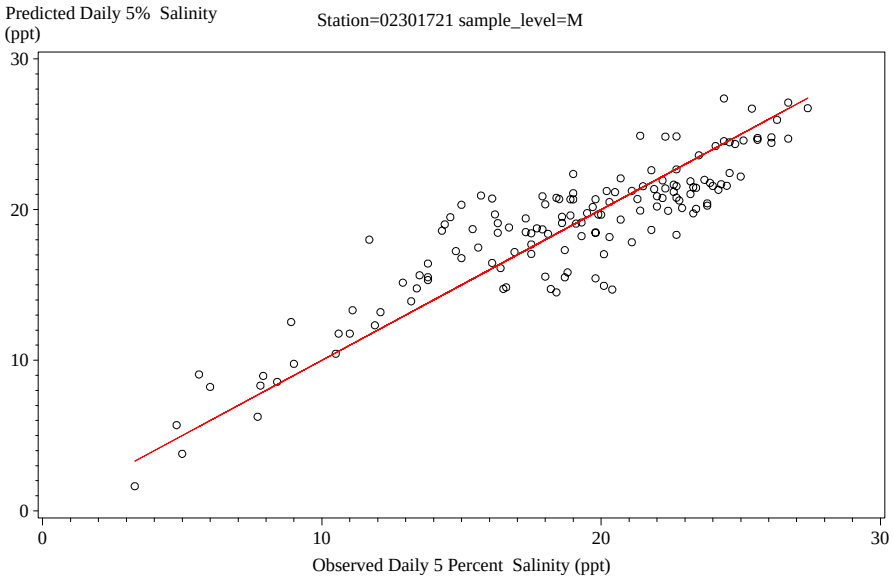
Station=02301721 sample_level=B



Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

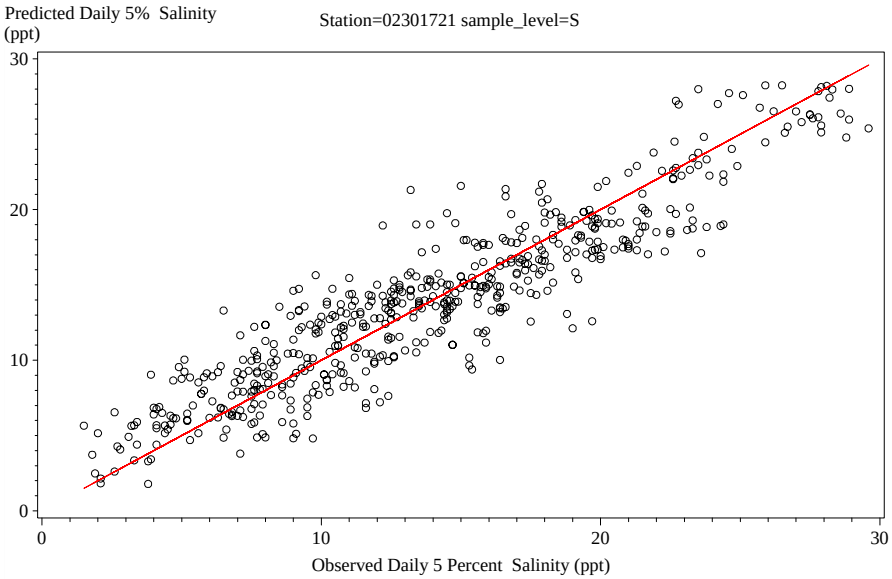
Source: USGS



Alafia River Analyses

Predicted Daily 5 Percent Salinity vs. Observed Daily 5 Percent Salinity in each Station and Sample Level

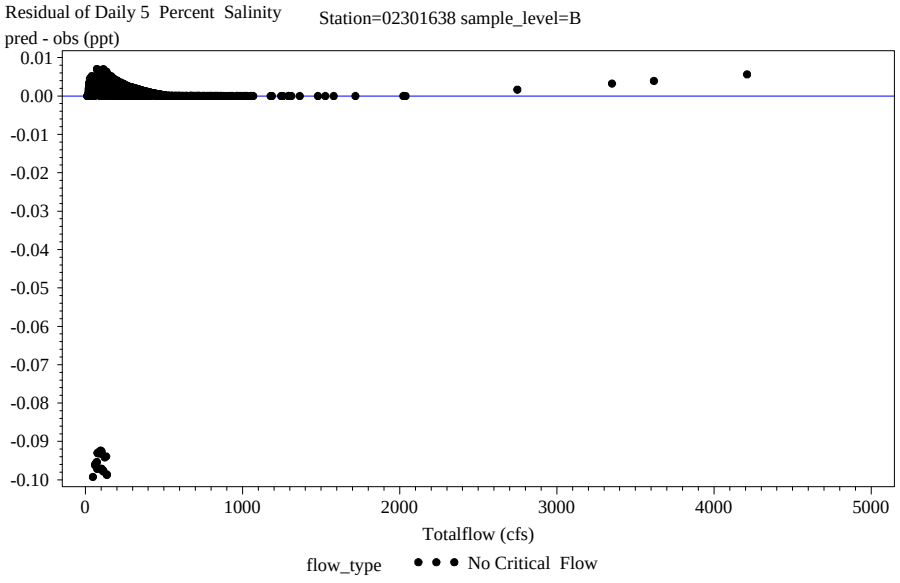
Source: USGS



Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

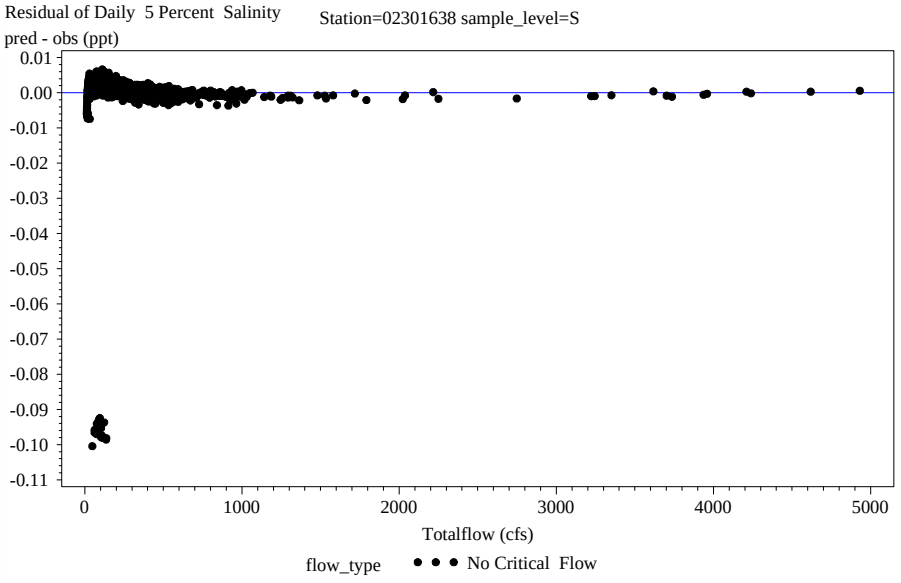
Source: USGS



Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

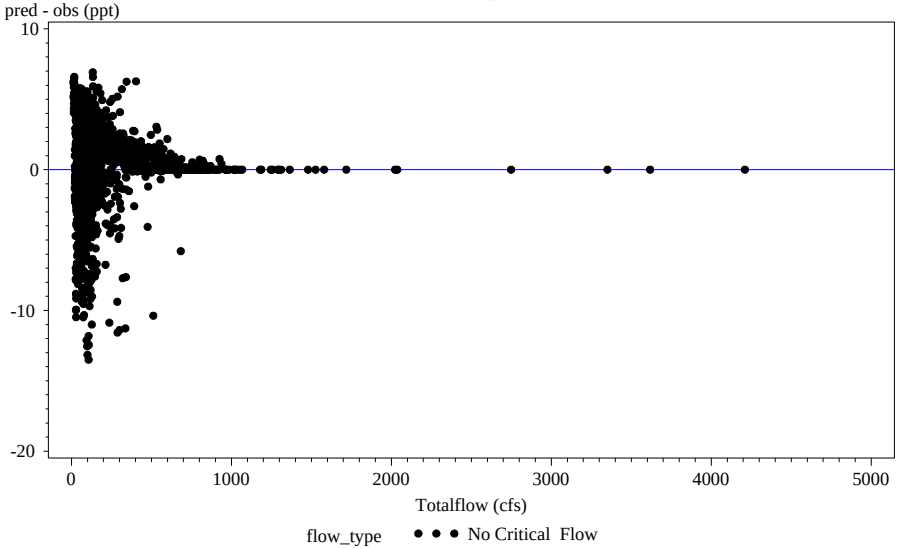


Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301718 sample_level=B

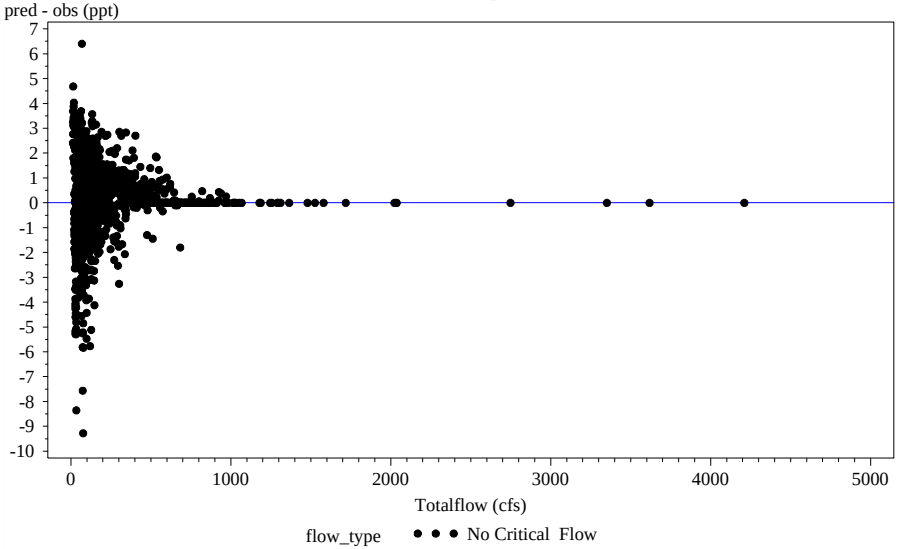


Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301718 sample_level=S

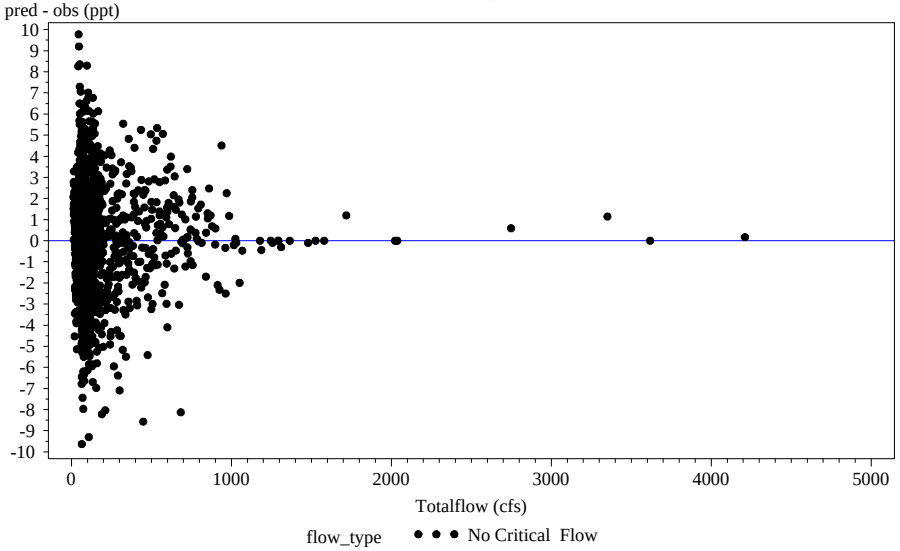


Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301719 sample_level=B

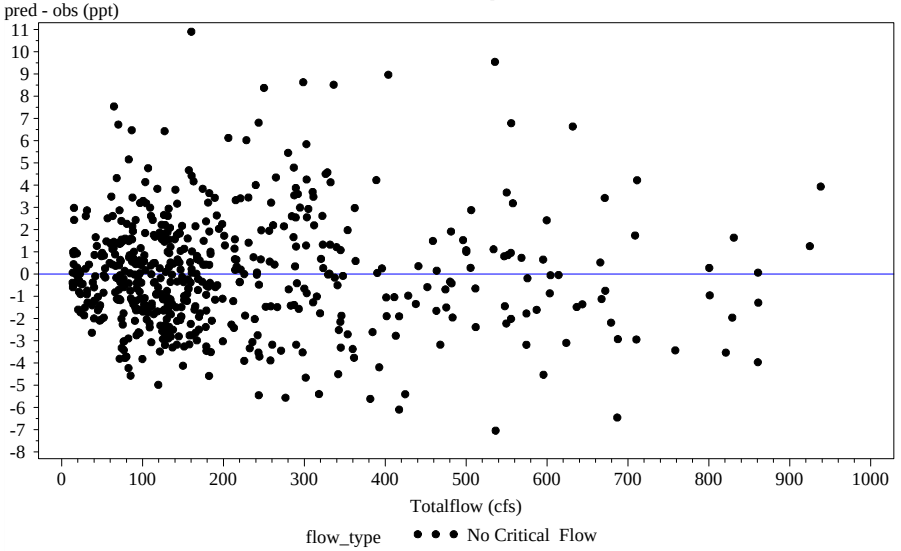


Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Station=02301721 sample_level=B



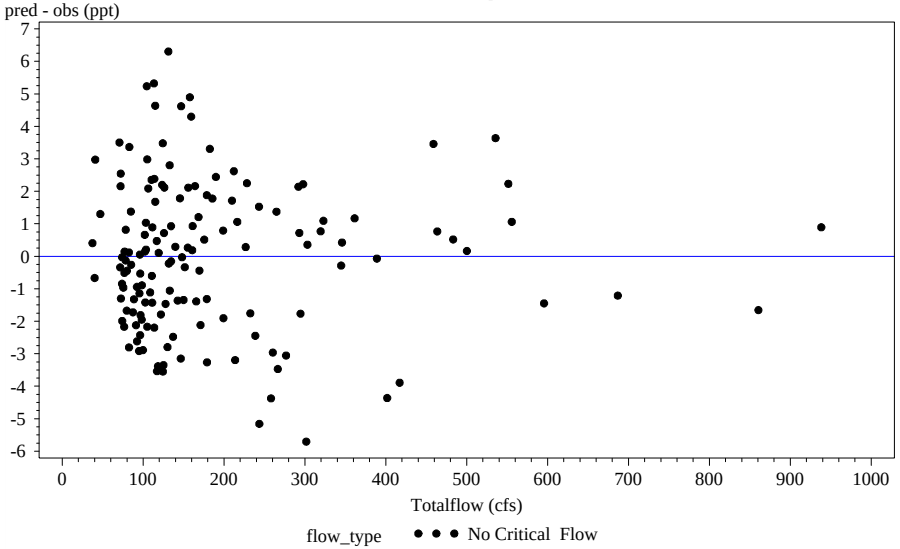
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=M



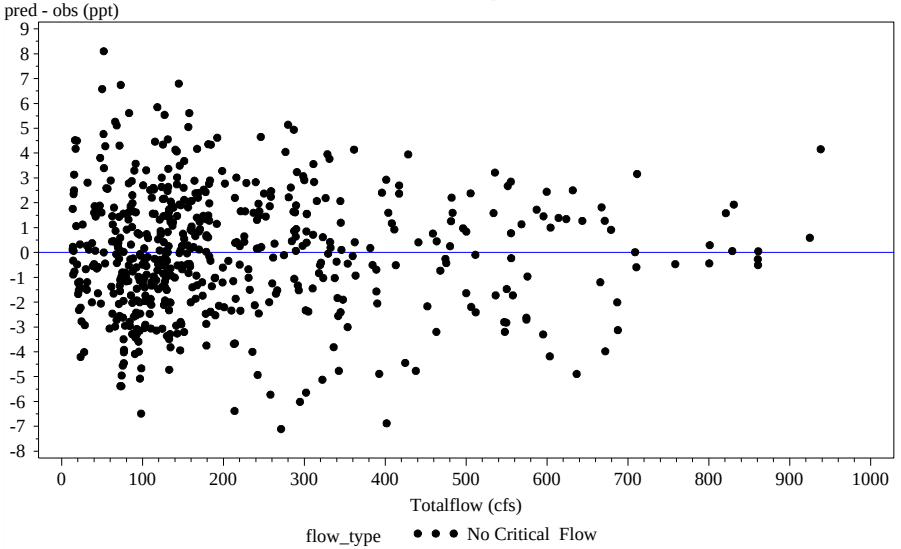
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Totalflow in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=S



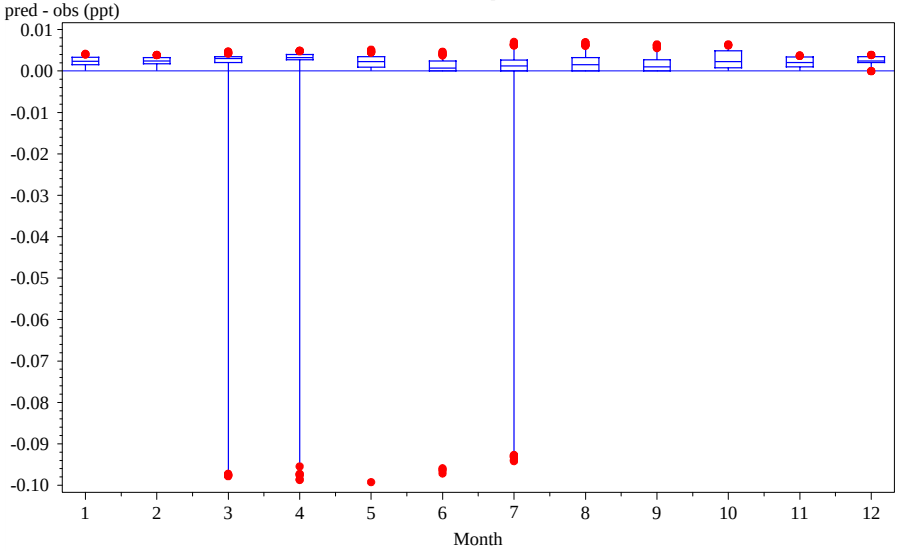
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301638 sample_level=B



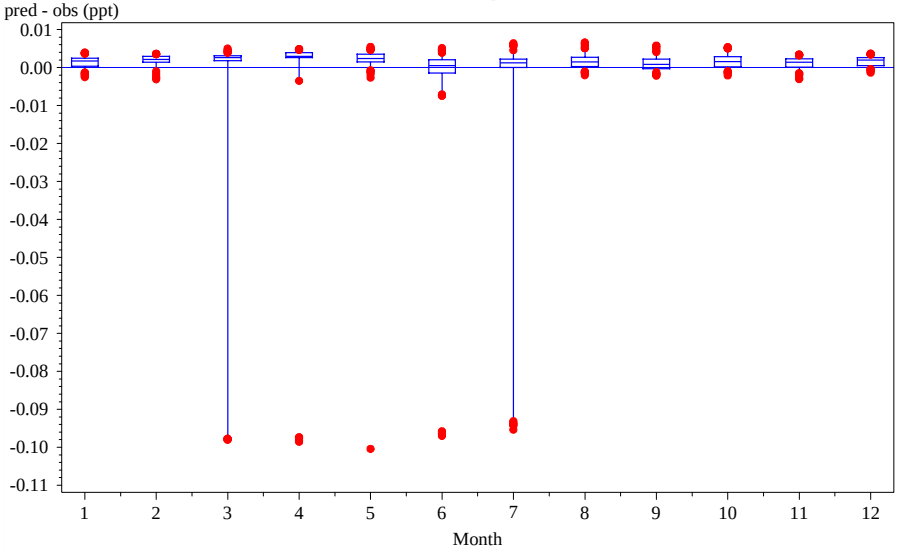
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301638 sample_level=S



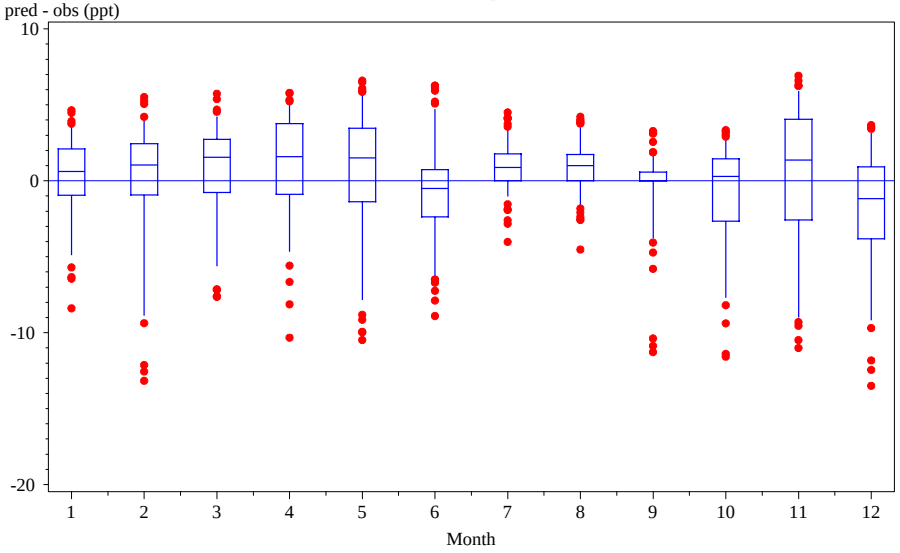
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=B



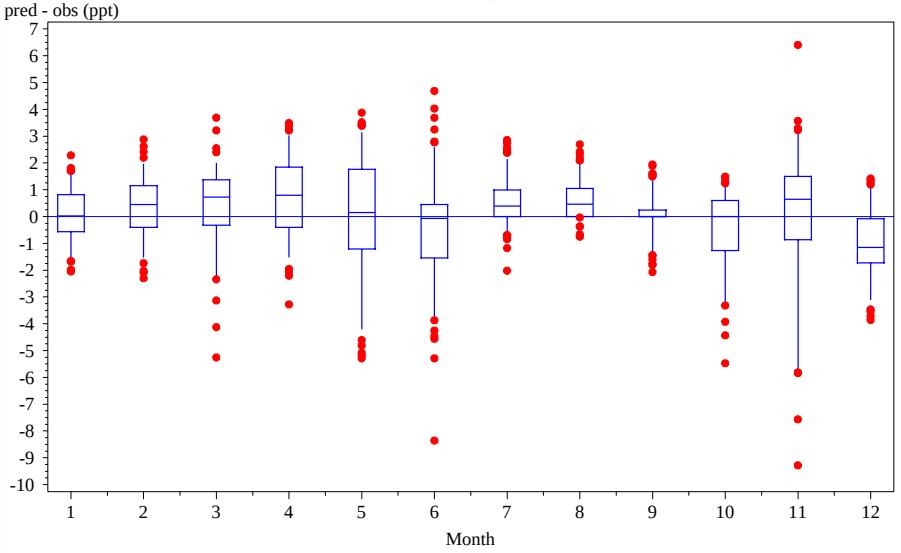
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=S



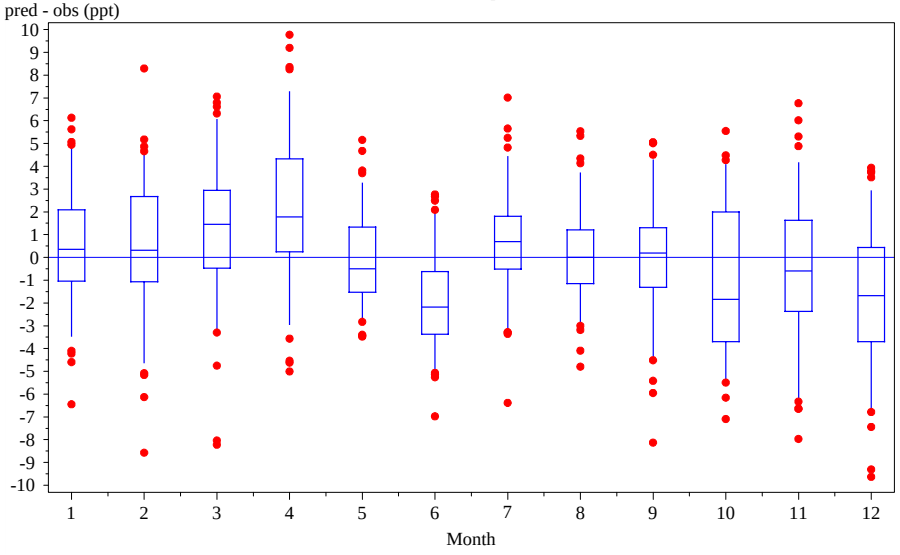
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301719 sample_level=B



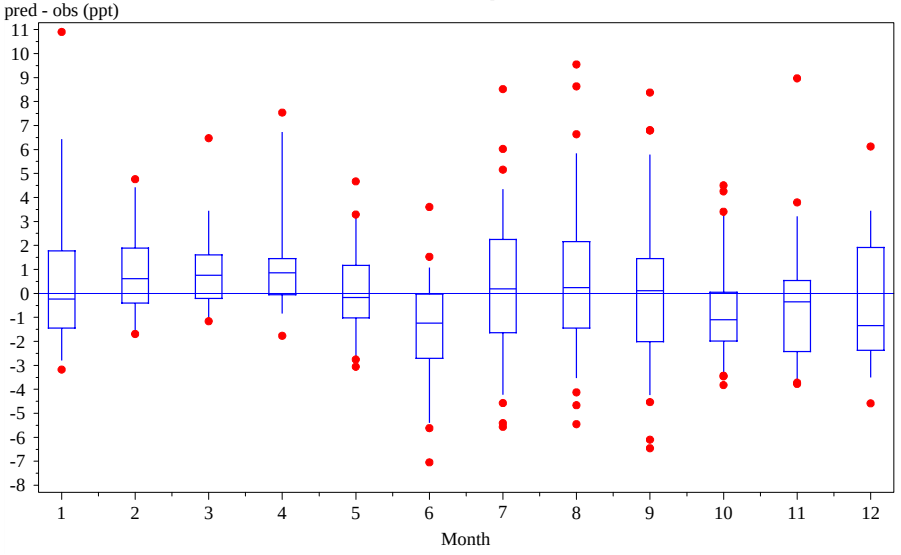
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=B



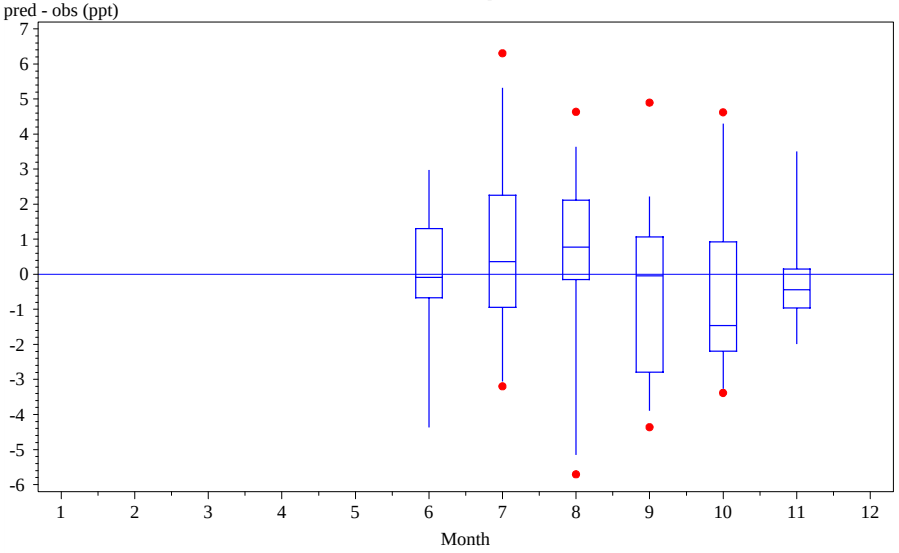
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=M



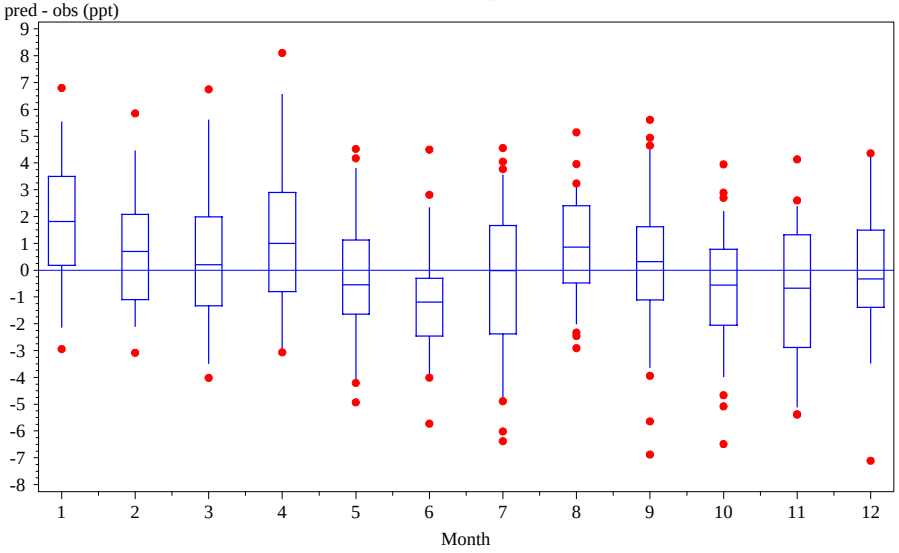
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=S



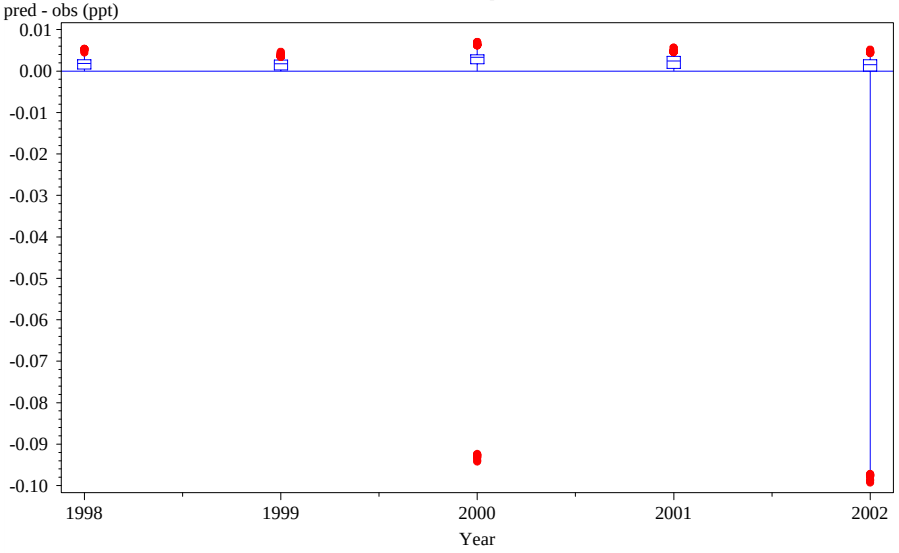
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301638 sample_level=B



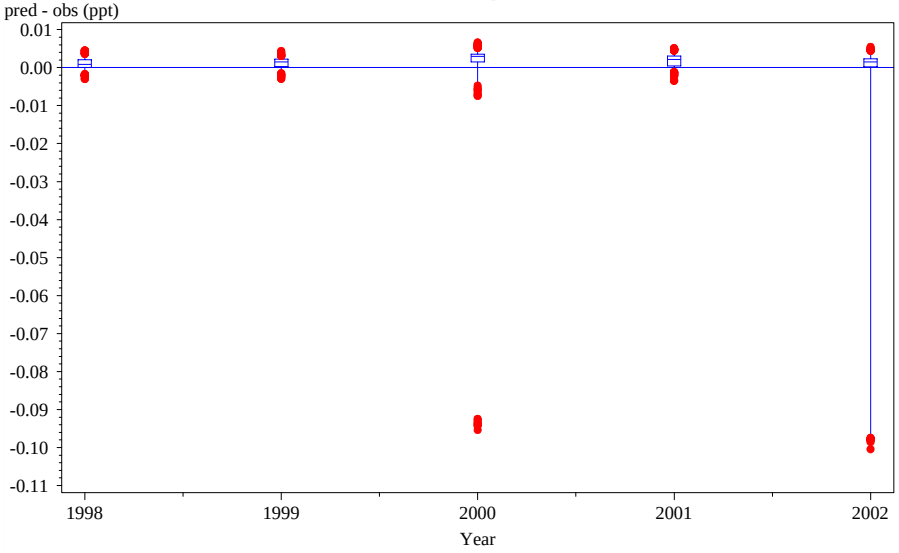
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301638 sample_level=S



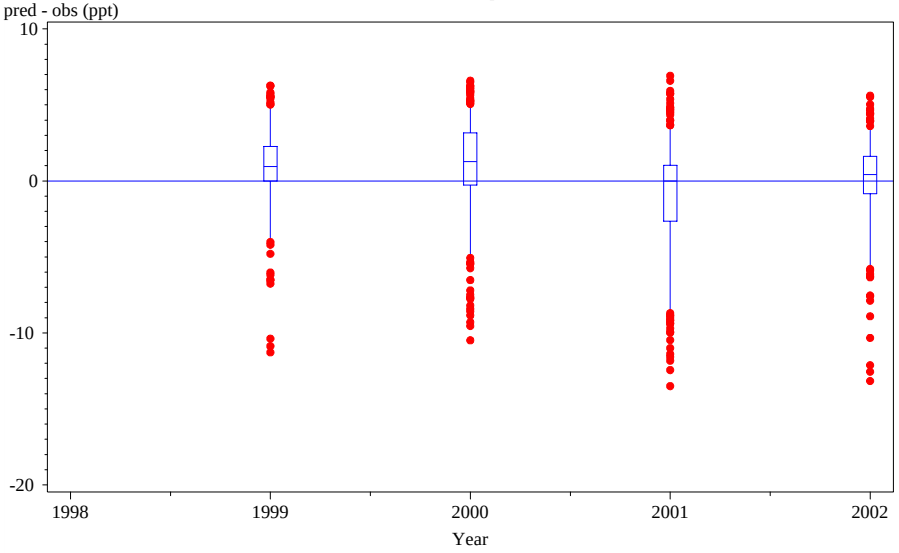
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=B



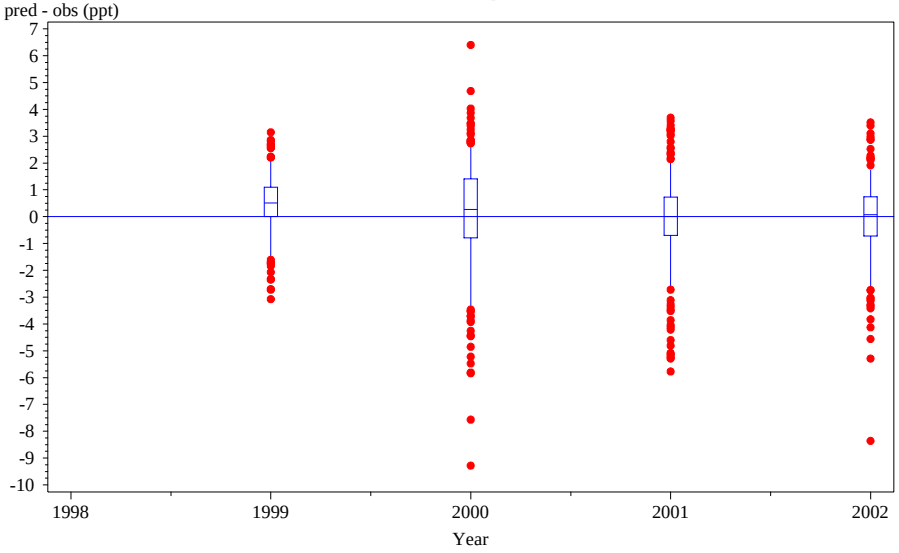
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=S



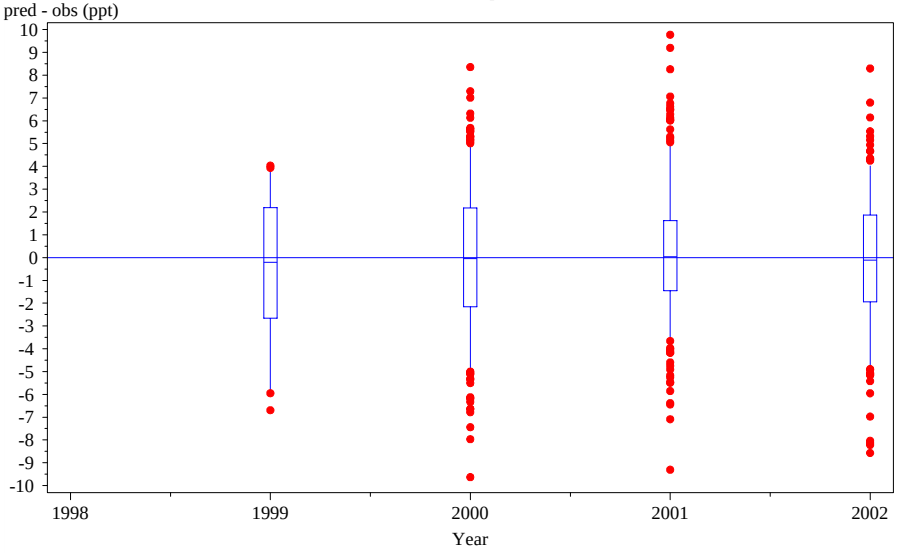
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301719 sample_level=B



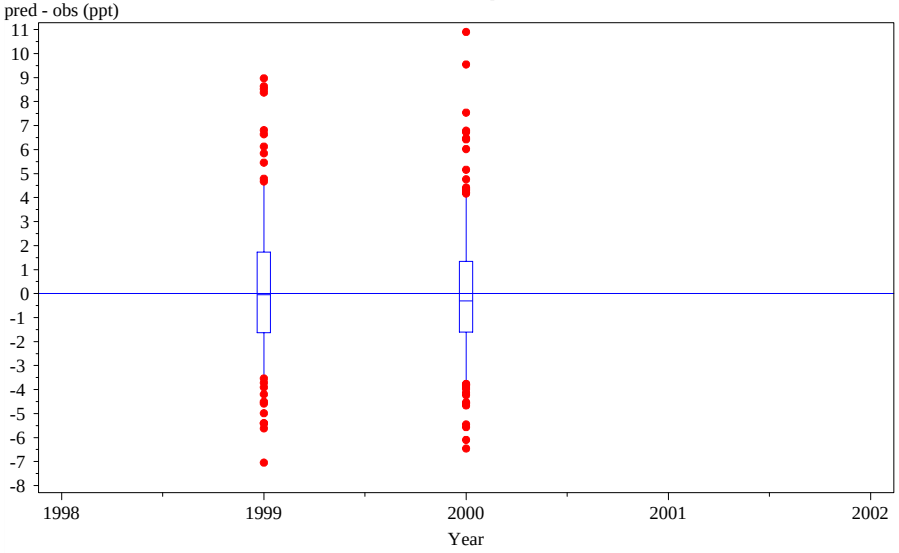
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=B



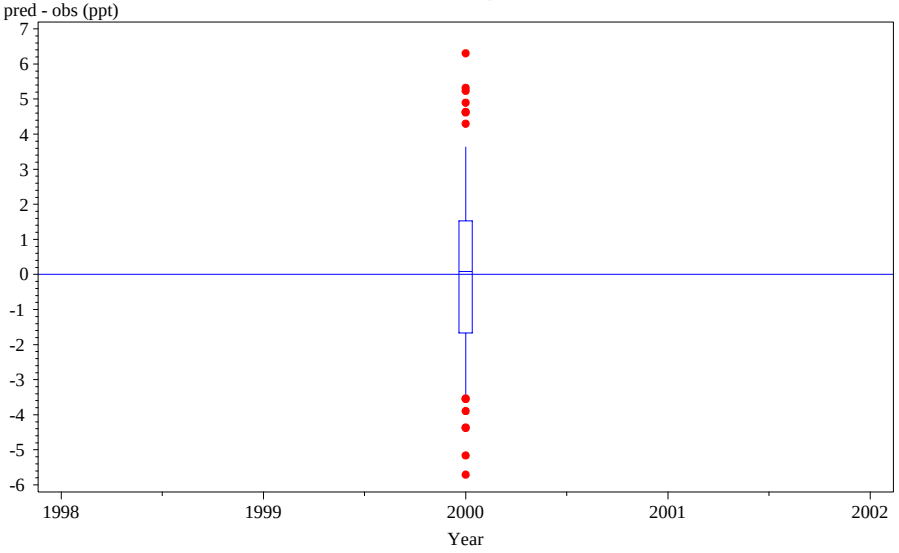
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=M



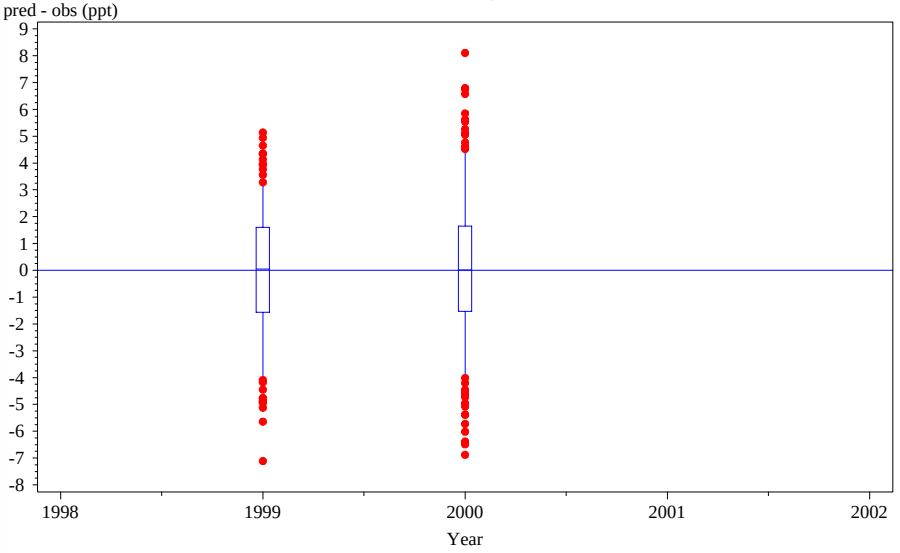
Alafia River Analysis

Residual of Daily 5 Percent Salinity vs. Year in each Sample Level and Station

Source: USGS

Residual of Daily 5 Percent Salinity pred - obs (ppt)

Station=02301721 sample_level=S



Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301718 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301718 sample_level=B

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
a5	1	-3.38413	0.61004	-5.55	<.0001
a6	1	-0.21205	0.60939	-0.35	0.7279
a7	1	-3.16481	0.65784	-4.81	<.0001
a8	1	-3.38548	0.66154	-5.12	<.0001
a9	1	-2.38794	0.68805	-3.47	0.0005
a10	1	1.16567	0.67383	1.73	0.0839
a11	1	0.86828	0.62964	1.38	0.1682
flopower06_sum3	1	-0.36581	0.07226	-5.06	<.0001
flow3	1	0.00214	0.00308	0.69	0.4879
flopower06_sum4	1	0.11201	0.05914	1.89	0.0585
int	1	0.00002968	0.00005253	0.57	0.5722

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301718 sample_level=S

Analysis of Variance					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Model	12	33926	2827.15521	186.71	<.0001
Error	1125	17035	15.14236		
Corrected Total	1137	50961			

Root MSE	3.89132	**R-Square**	0.6657
Dependent Mean	10.43805	**Adj R-Sq**	0.6622
Coeff Var	37.28014		

Parameter Estimates					
Variable	**DF**	**Parameter Estimate**	**Standard Error**	**t Value**	**Pr > |t|**
Intercept	1	32.56754	0.73349	44.40	<.0001
a1	1	-3.07872	0.57069	-5.39	<.0001
a2	1	-3.62707	0.58394	-6.21	<.0001
a3	1	-5.47685	0.57137	-9.59	<.0001
a4	1	-5.73568	0.58733	-9.77	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301718 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301718 sample_level=S

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5	1	-3.60980	0.56946	-6.34	<.0001
a6	1	-1.61341	0.54643	-2.95	0.0032
a7	1	-4.03288	0.58842	-6.85	<.0001
a8	1	-5.35732	0.60526	-8.85	<.0001
a9	1	-4.48752	0.63362	-7.08	<.0001
a10	1	-0.39462	0.61102	-0.65	0.5185
a11	1	0.52413	0.57654	0.91	0.3635
flopower03_sum3	1	-3.08826	0.10748	-28.73	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301719 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	8173.04170	544.86945	60.91	<.0001
Error	1017	9097.47131	8.94540		
Corrected Total	1032	17271			

Root MSE	2.99089	R-Square	0.4732
Dependent Mean	24.64308	Adj R-Sq	0.4655
Coeff Var	12.13682		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	34.59760	0.77216	44.81	<.0001
a1	1	-0.71131	0.43868	-1.62	0.1052
a2	1	-0.69064	0.44896	-1.54	0.1243
a3	1	-2.13655	0.43934	-4.86	<.0001
a4	1	-2.22685	0.44649	-4.99	<.0001

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301719 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301719 sample_level=B

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5	1	-0.12075	0.48209	-0.25	0.8023
a6	1	1.42795	0.45715	3.12	0.0018
a7	1	0.86476	0.51003	1.70	0.0903
a8	1	1.41409	0.50746	2.79	0.0054
a9	1	-0.30140	0.52196	-0.58	0.5638
a10	1	-0.42737	0.51534	-0.83	0.4071
a11	1	-0.24011	0.44814	-0.54	0.5922
flopower03_sum2	1	-1.66931	0.15869	-10.52	<.0001
l7_flow	1	-0.00887	0.00278	-3.19	0.0015
l2_flow	1	0.00017434	0.00115	0.15	0.8800
int	1	0.00082827	0.00030838	2.69	0.0074

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301721 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	1975.24154	131.68277	70.02	<.0001
Error	534	1004.32055	1.88075		
Corrected Total	549	2979.56210			

Root MSE	1.37140	R-Square	0.6629
Dependent Mean	28.70609	Adj R-Sq	0.6535
Coeff Var	4.77740		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	35.67755	1.45329	24.55	<.0001
a1	1	-0.23155	0.34845	-0.66	0.5067
a2	1	-0.80184	0.35515	-2.26	0.0244
a3	1	-1.09389	0.35604	-3.07	0.0022
a4	1	-0.61968	0.36652	-1.69	0.0915

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301721 and B Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301721 sample_level=B

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5	1	0.20662	0.33449	0.62	0.5370
a6	1	2.07152	0.32953	6.29	<.0001
a7	1	1.65551	0.30770	5.38	<.0001
a8	1	0.24024	0.30843	0.78	0.4364
a9	1	-0.14141	0.31711	-0.45	0.6558
a10	1	0.49225	0.31789	1.55	0.1221
a11	1	-0.47921	0.32390	-1.48	0.1396
flopower03_sum8	1	-1.79194	0.54876	-3.27	0.0012
flopower02	1	-1.21914	0.58863	-2.07	0.0388
flopower03_sum7	1	1.61968	0.59007	2.74	0.0063
int	1	-0.07325	0.05506	-1.33	0.1840

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301721 sample_level=S

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	15	2868.76805	191.25120	59.20	<.0001
Error	536	1731.54297	3.23049		
Corrected Total	551	4600.31101			

Root MSE	1.79736	R-Square	0.6236
Dependent Mean	27.65942	Adj R-Sq	0.6131
Coeff Var	6.49817		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	37.55922	1.59420	23.56	<.0001
a1	1	-1.65785	0.45691	-3.63	0.0003
a2	1	-0.52236	0.46554	-1.12	0.2623
a3	1	-1.32642	0.46722	-2.84	0.0047
a4	1	-0.82065	0.48141	-1.70	0.0888

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301721 and S Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301721 sample_level=S

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
a5	1	-0.02847	0.43860	-0.06	0.9483
a6	1	1.11656	0.43341	2.58	0.0103
a7	1	1.45737	0.41441	3.52	0.0005
a8	1	0.22895	0.41374	0.55	0.5802
a9	1	-0.15666	0.43100	-0.36	0.7164
a10	1	0.22132	0.41294	0.54	0.5922
a11	1	-0.19866	0.42446	-0.47	0.6400
flopower02_sum8	1	-1.61676	0.43460	-3.72	0.0002
flopower04	1	-0.24193	0.22887	-1.06	0.2910
flow3	1	0.00160	0.00090894	1.76	0.0790
int	1	-0.03910	0.04151	-0.94	0.3467

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301721 and M Level

Source:Salinity Sampled by USGS, USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301721 sample_level=M

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	119.59921	29.89980	25.34	<.0001
Error	139	164.03302	1.18009		
Corrected Total	143	283.63222			

Root MSE	1.08632	R-Square	0.4217
Dependent Mean	30.06389	Adj R-Sq	0.4050
Coeff Var	3.61338		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	23.24325	1.86871	12.44	<.0001
wetseason	1	1.57100	0.28785	5.46	<.0001
sal_55b_p09	1	0.38406	0.10380	3.70	0.0003
l7_flow	1	-0.01905	0.01428	-1.33	0.1844
int	1	0.00094704	0.00080658	1.17	0.2423

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301638 and B Level

Source:Salinity Sampled by USGS,USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301638 sample_level=B

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5.35756	1.33939	39.48	<.0001
Error	132	4.47777	0.03392		
Corrected Total	136	9.83533			

Root MSE	0.18418	R-Square	0.5447
Dependent Mean	0.09416	Adj R-Sq	0.5309
Coeff Var	195.60263		

Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	68.37823	31.81365	2.15	0.0334
flopowerm1_sum2	1	-287817	120822	-2.38	0.0186
flopowerm09_sum2	1	385987	163745	2.36	0.0199
flopowerm08_sum2	1	-132301	56715	-2.33	0.0212
int	1	98959	37603	2.63	0.0095

Alafia River Analysis

Regression Procedure Results For USGS Continuous Daily 95 Percent Records at Station 02301638 and S Level

Source:Salinity Sampled by USGS,USGS Flow < Critical Flow

The REG Procedure
Model: MODEL1
Dependent Variable: Daily_p95_sal

Station=02301638 sample_level=S

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5.04944	1.26236	36.93	<.0001
Error	132	4.51187	0.03418		
Corrected Total	136	9.56131			

Root MSE	0.18488	R-Square	0.5281
Dependent Mean	0.08832	Adj R-Sq	0.5138
Coeff Var	209.32759		

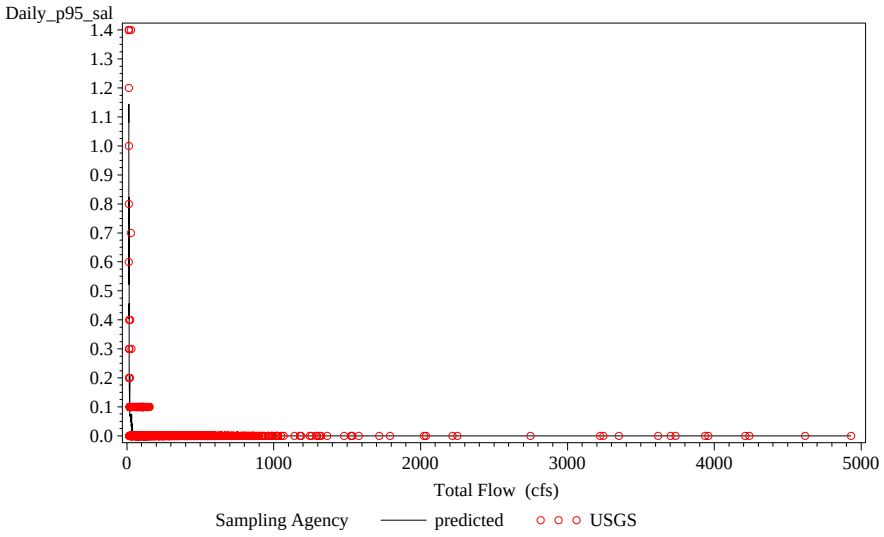
Parameter Estimates					
Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	57.27043	31.93456	1.79	0.0752
flopowerm1_sum2	1	-246258	121281	-2.03	0.0443
flopowerm09_sum2	1	329548	164368	2.00	0.0470
flopowerm08_sum2	1	-112715	56930	-1.98	0.0498
int	1	86300	37746	2.29	0.0238

Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301638 sample_level=S

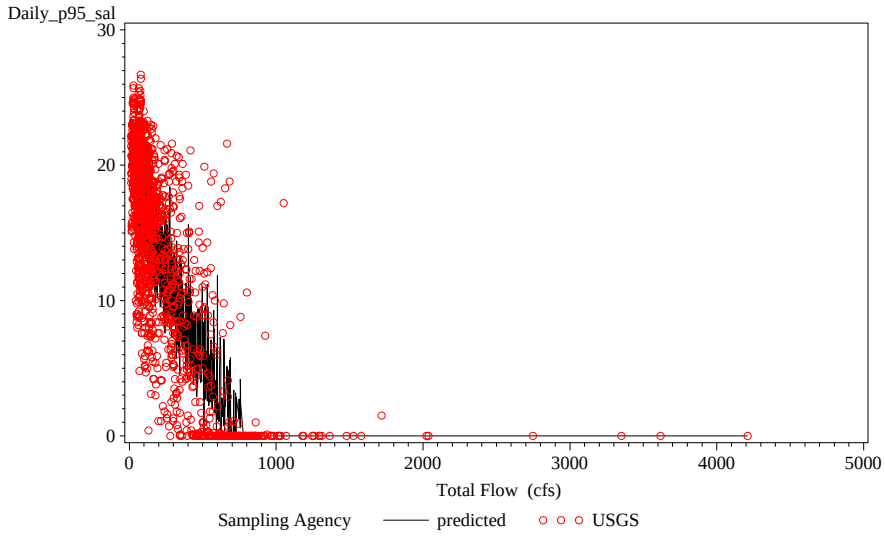


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301718 sample_level=B

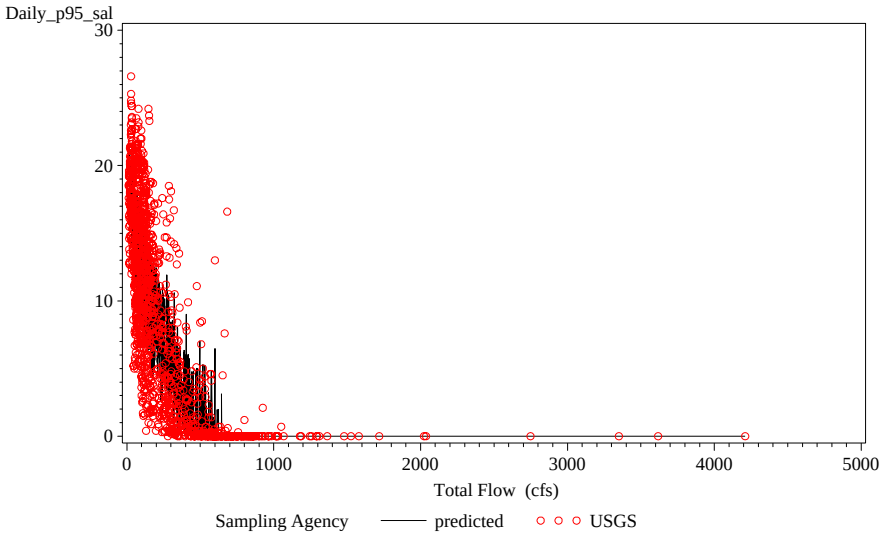


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301718 sample_level=S

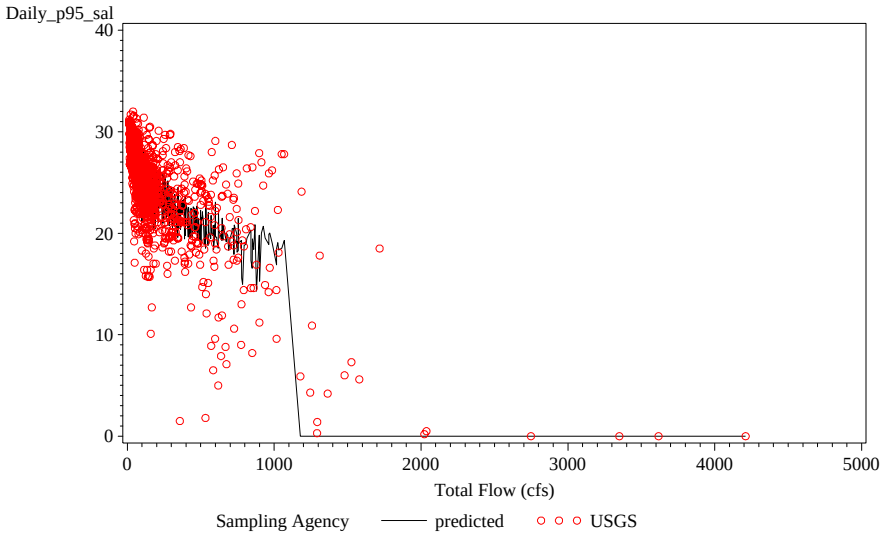


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301719 sample_level=B

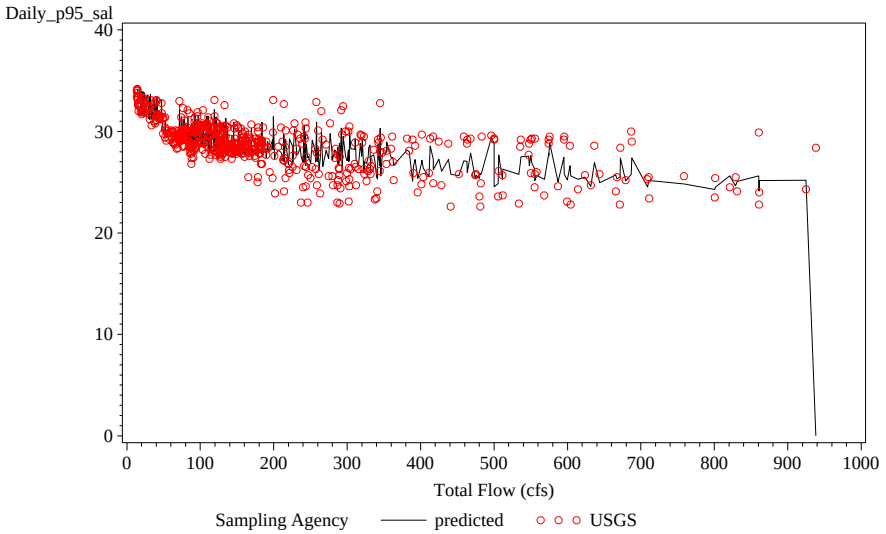


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=B

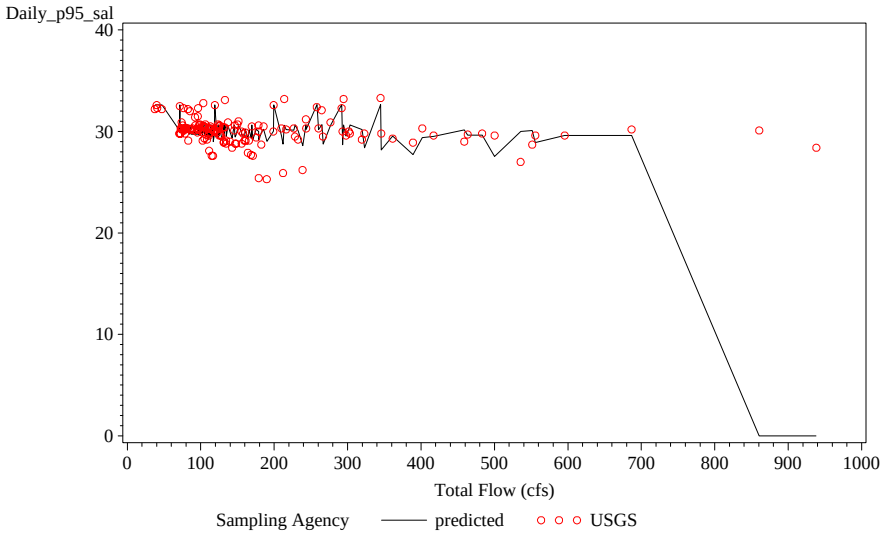


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=M

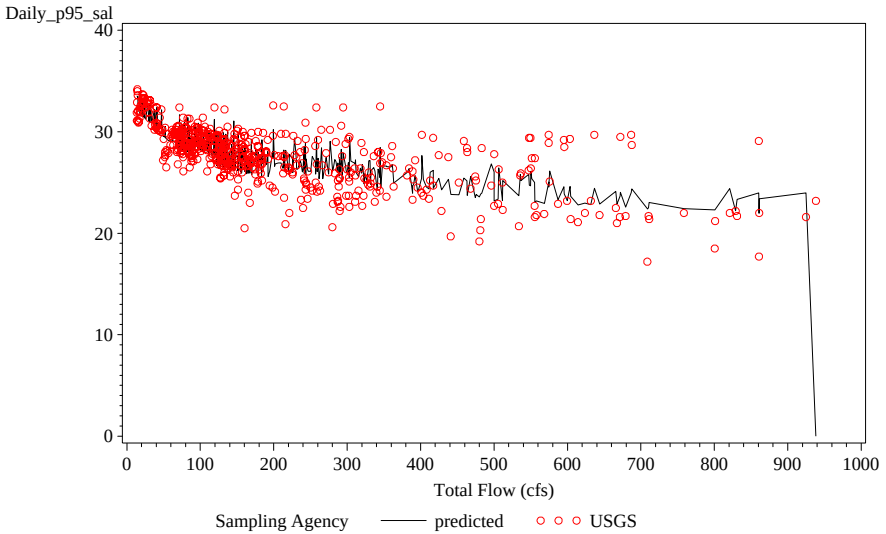


Alafia River Analyses

Observed Daily 95% Salinity and Predicated Daily 95% Salinity VS Totalflow in each Station and Sample Level

Source: USGS Continuous Data

Station=02301721 sample_level=S



Alafia River Analyses

R Square Result for USGS Continuous Daily 95 Percent Salinity Regression Procedure at Each Station and Sample Level

All USGS Flow Values (Regardless of critical flow value)

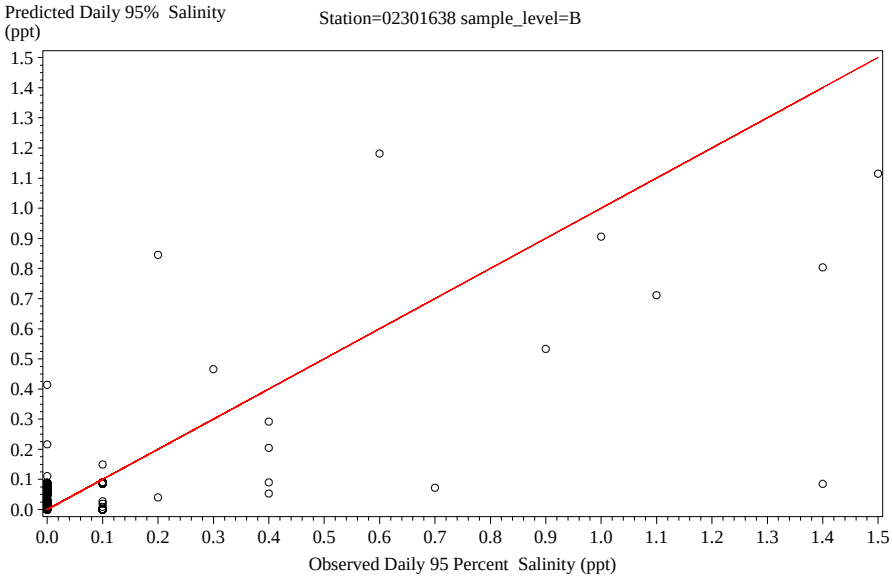
Station	sample_level	CSS Observed Daily 95 Percent Salinity	USS Residual Daily 95 Percent Salinity	Rsquare
02301638	B	11.36	5.02	0.55865
02301638	S	11.01	5.09	0.53757
02301718	B	63368.22	21359.29	0.66293
02301718	S	59749.93	17214.00	0.71190
02301719	B	24372.81	10650.11	0.56303
02301721	B	2979.66	1810.88	0.39225
02301721	M	286.38	1876.60	-5.55275
02301721	S	4620.16	2269.78	0.50872

Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301638 sample_level=B

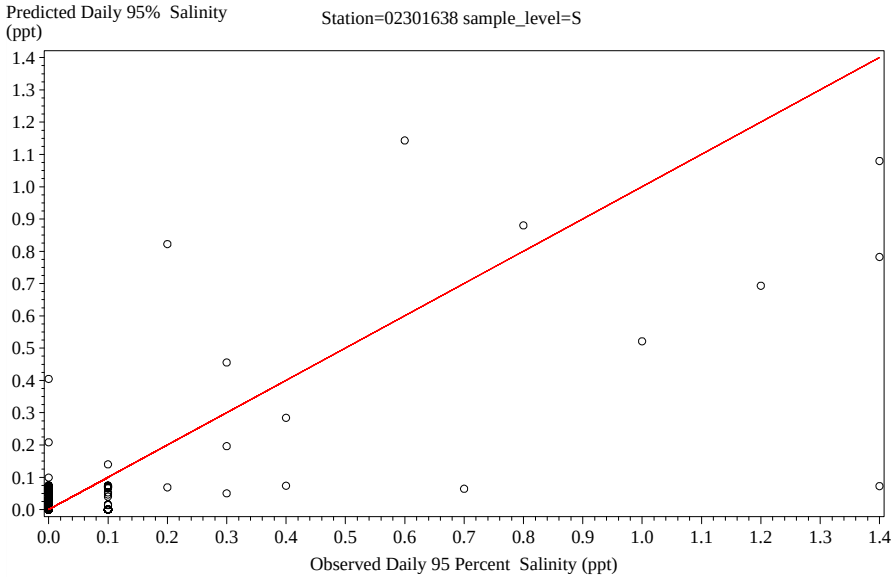


Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301638 sample_level=S

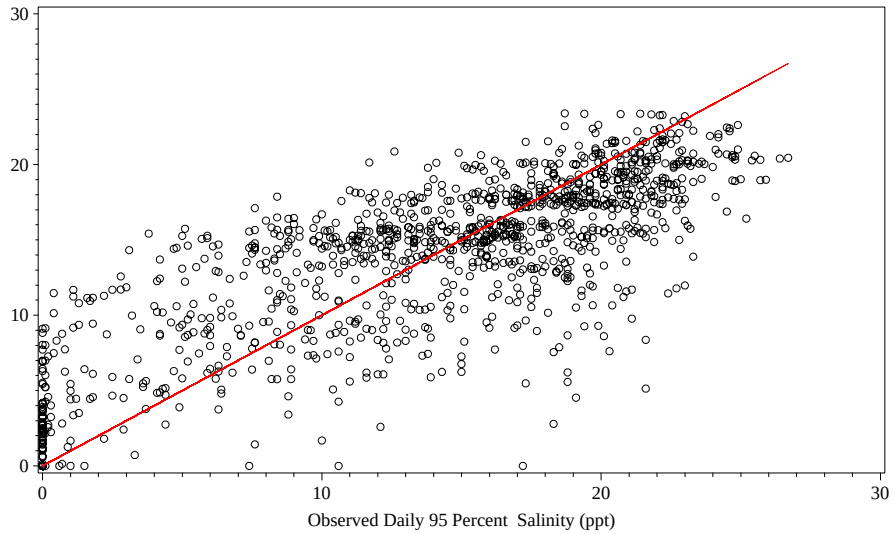


Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=B

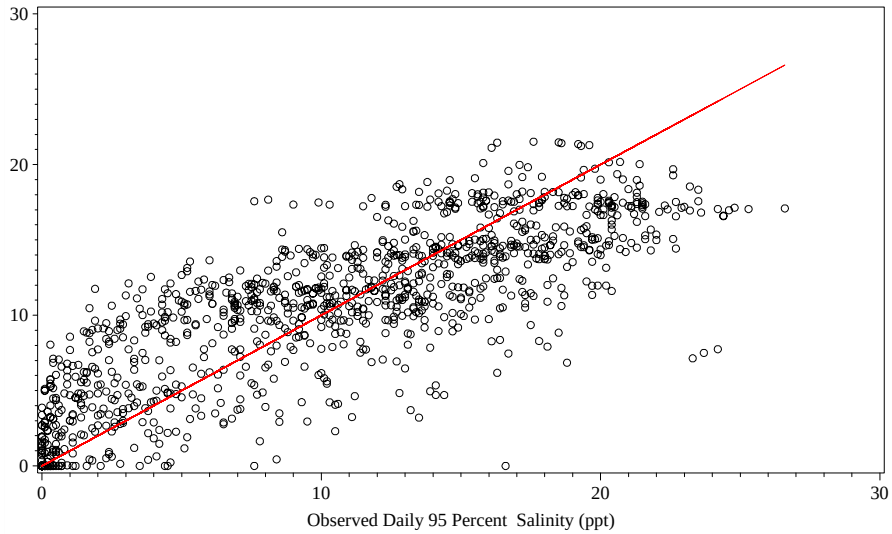


Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301718 sample_level=S

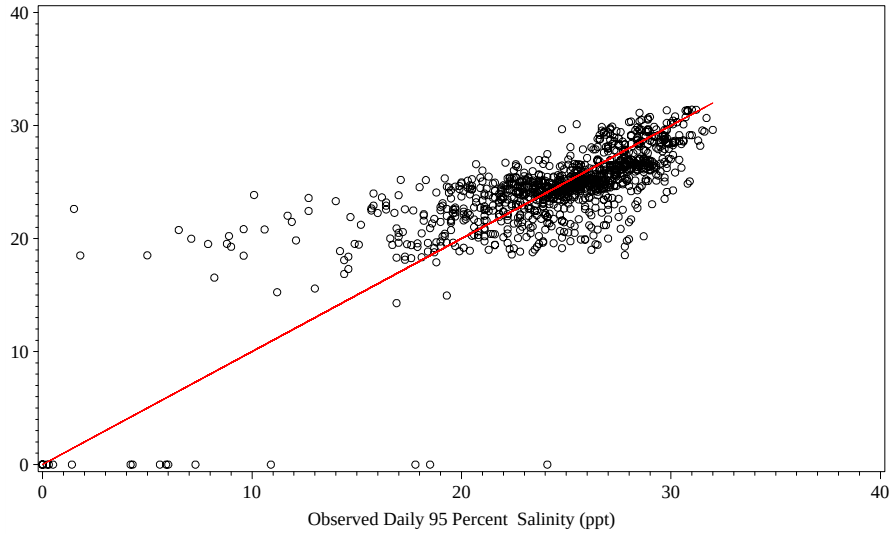


Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

Station=02301719 sample_level=B

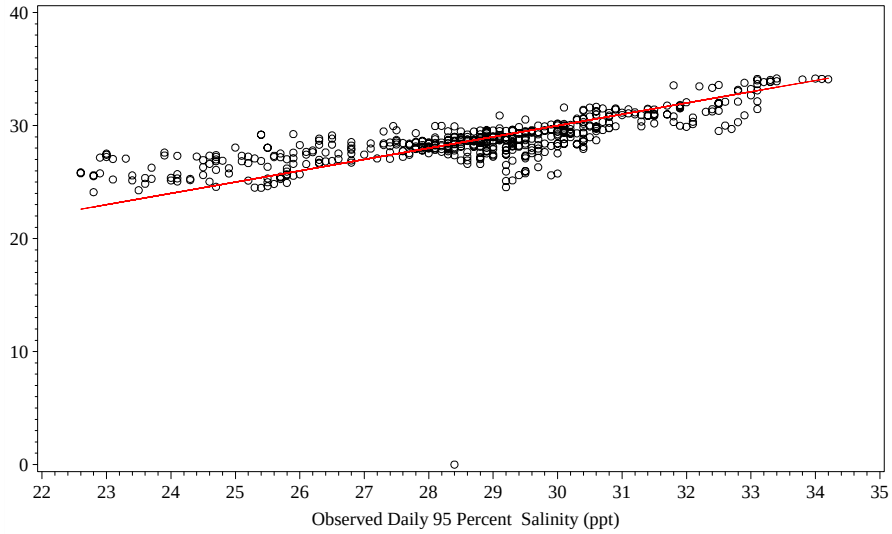


Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS

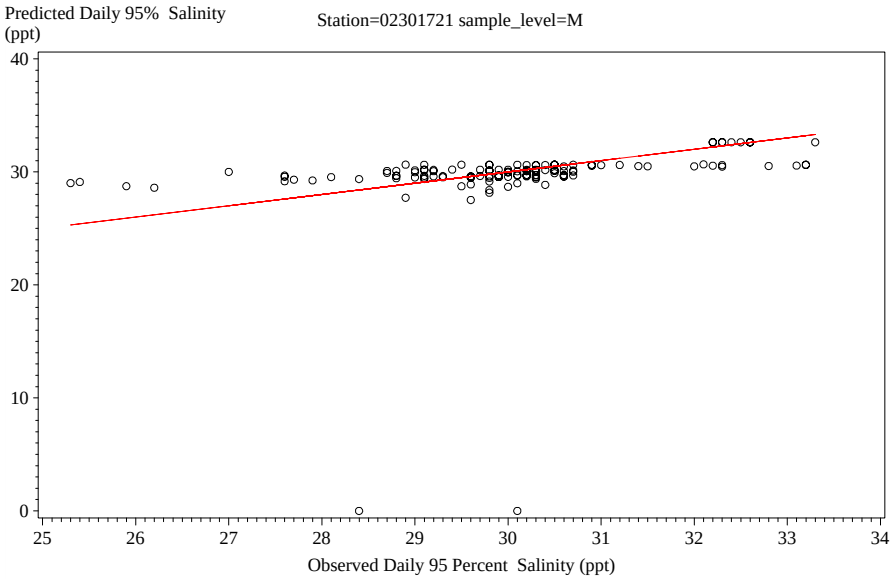
Station=02301721 sample_level=B



Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

Source: USGS



Alafia River Analyses

Predicted Daily 95 Percent Salinity vs. Observed Daily 95 Percent Salinity in each Station and Sample Level

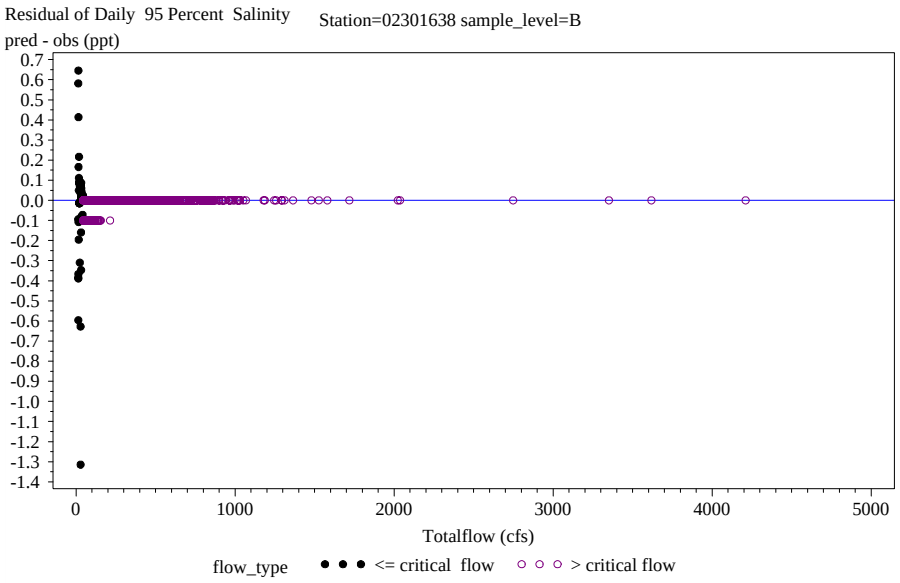
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station

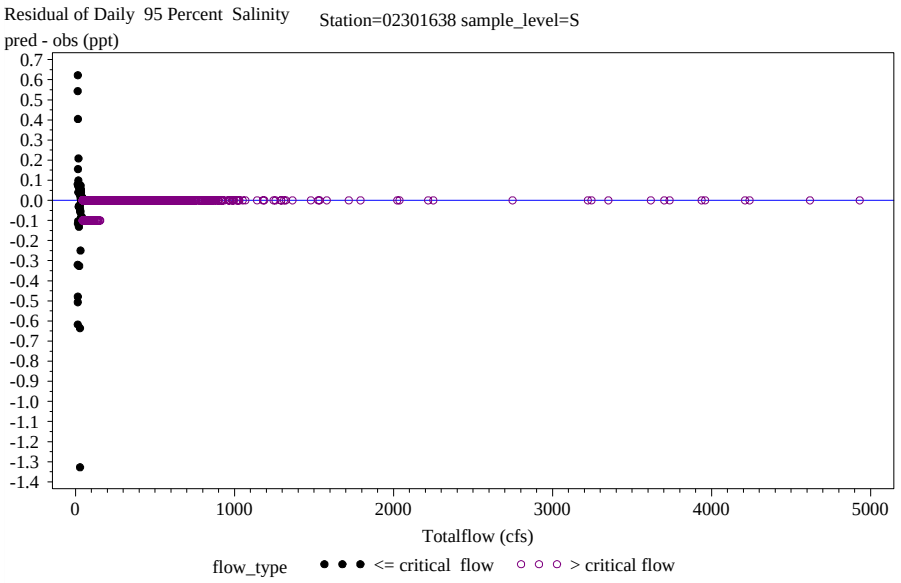
Source: USGS

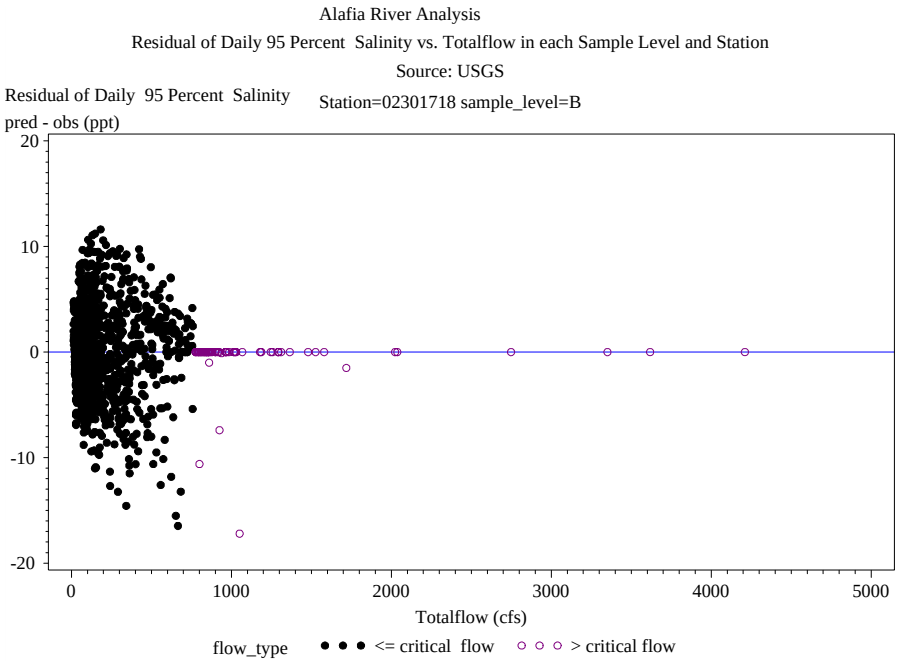


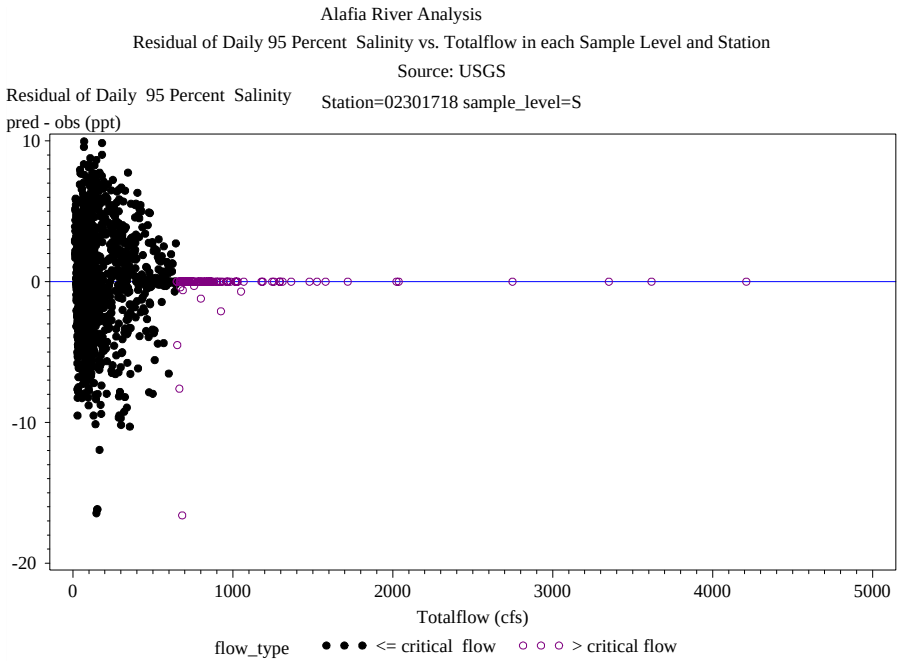
Alafia River Analysis

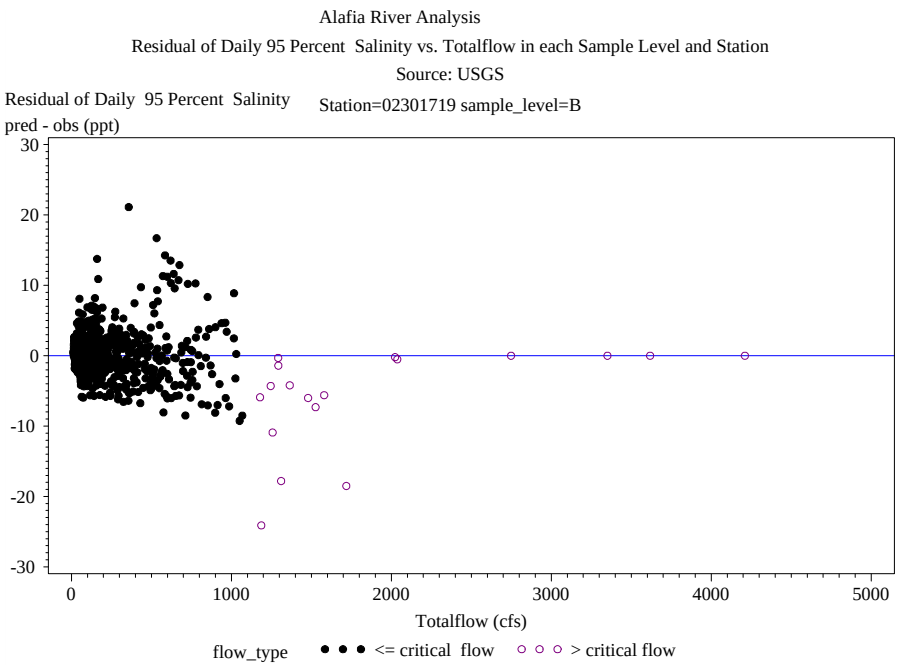
Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station

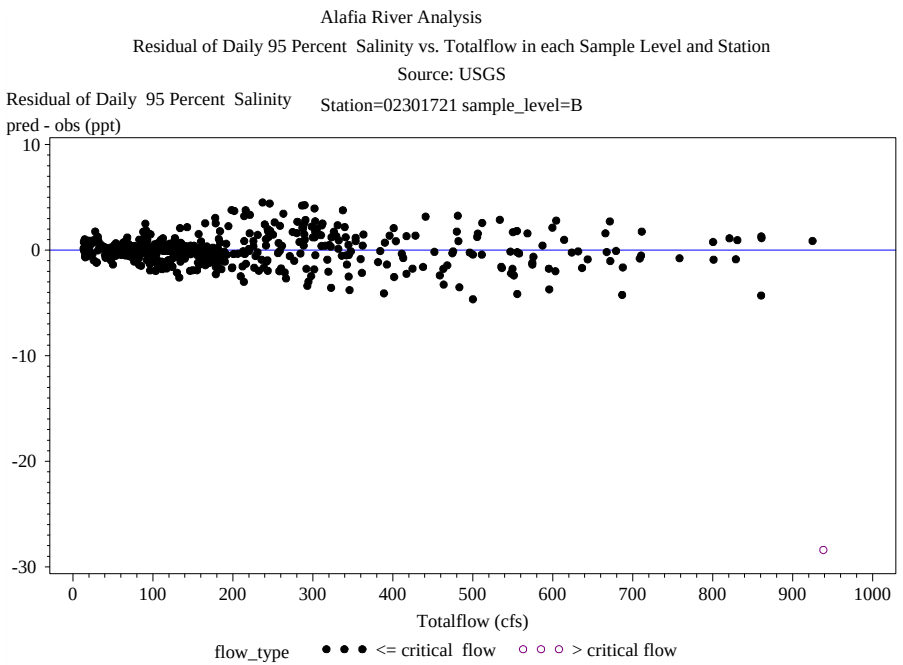
Source: USGS




Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301718 sample_level=B
20
10
0
-10
-20
0
1000
2000
3000
4000
5000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301718 sample_level=S
10
0
-10
-20
0
1000
2000
3000
4000
5000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

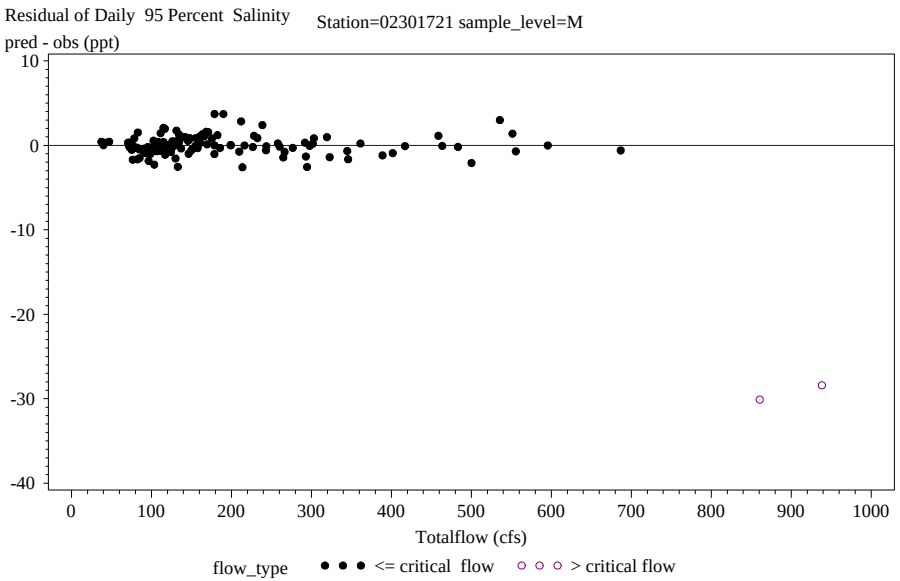

Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301719 sample_level=B
30
20
10
0
-10
-20
-30
0
1000
2000
3000
4000
5000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow


Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301721 sample_level=B
10
0
-10
-20
-30
0
100
200
300
400
500
600
700
800
900
1000
Totalflow (cfs)
flow_type
<= critical flow
> critical flow

Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station

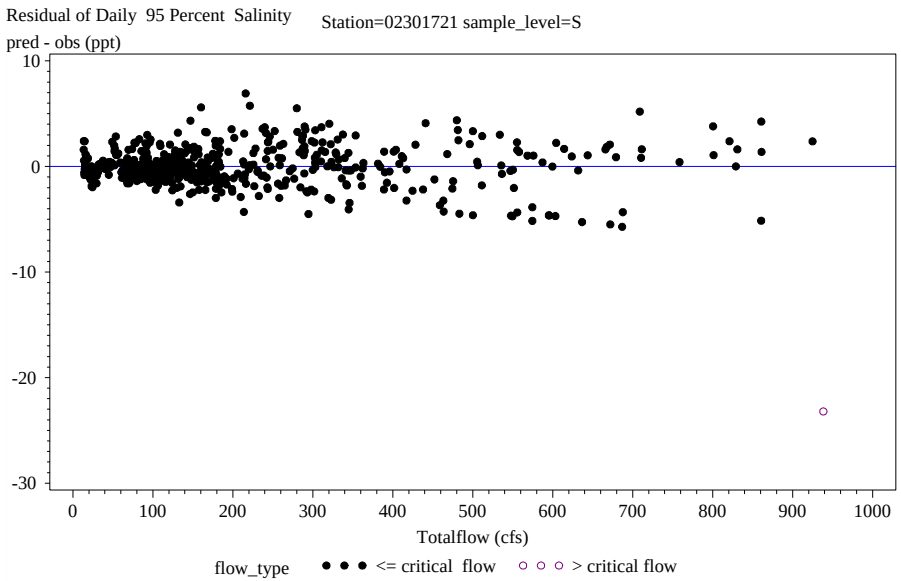
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Totalflow in each Sample Level and Station

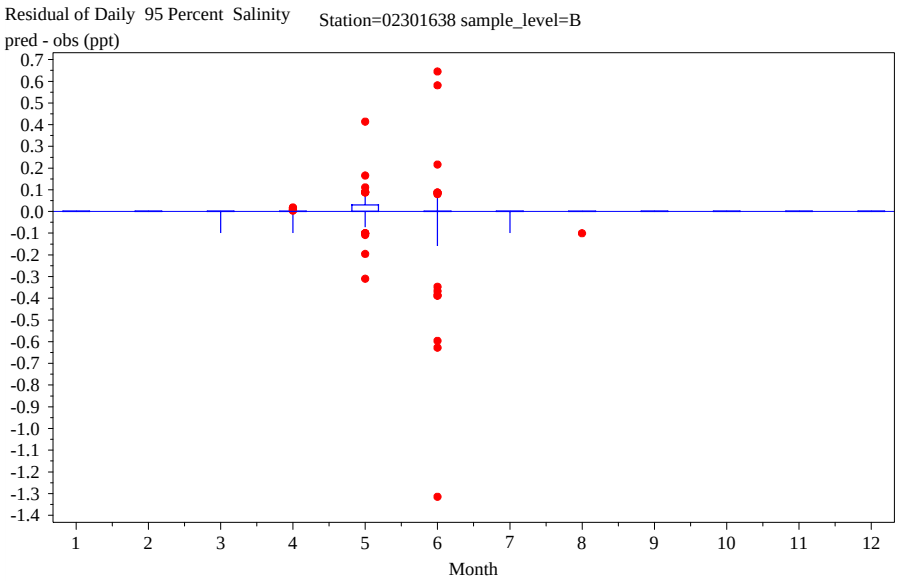
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

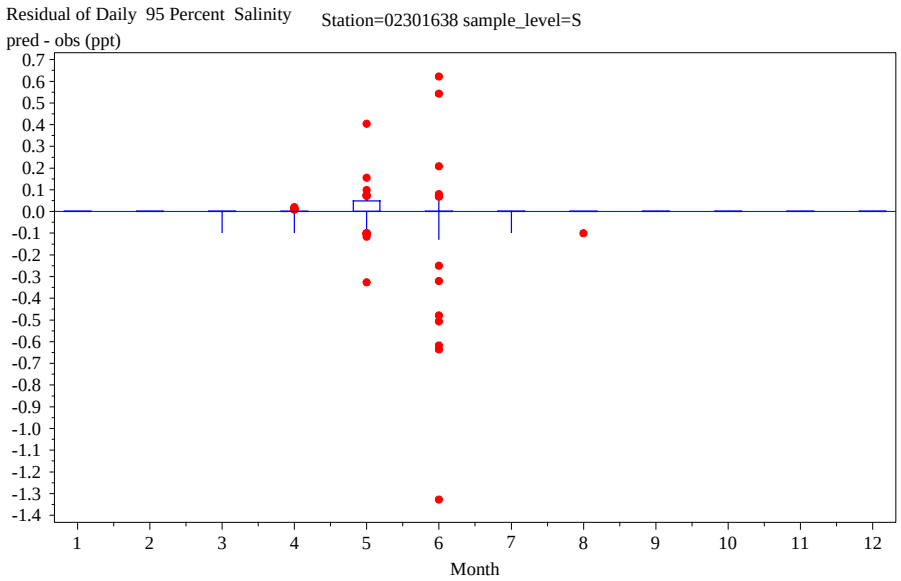
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS



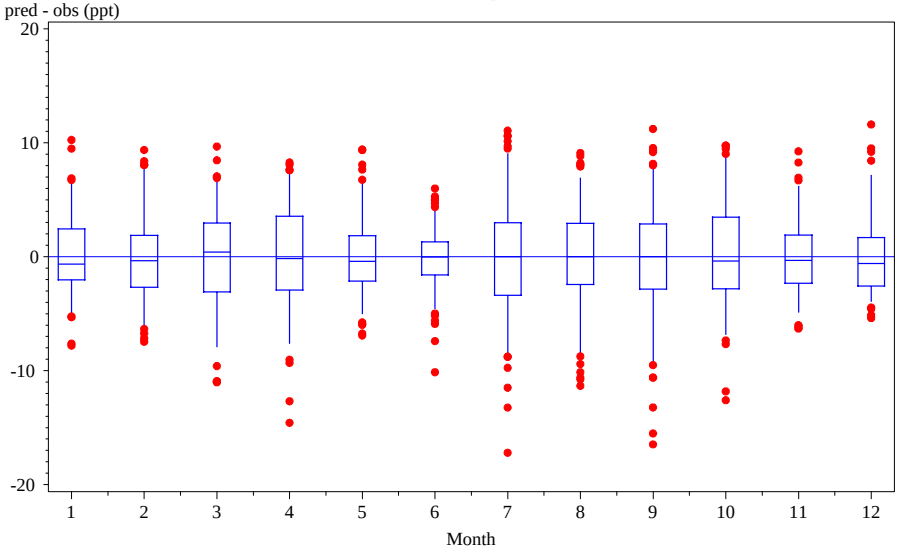
Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 95 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=B



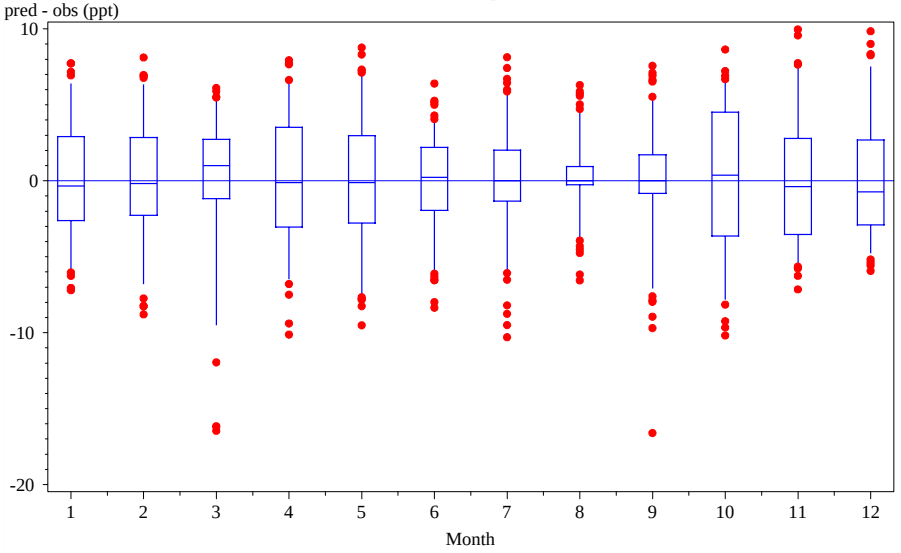
Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 95 Percent Salinity pred - obs (ppt)

Station=02301718 sample_level=S



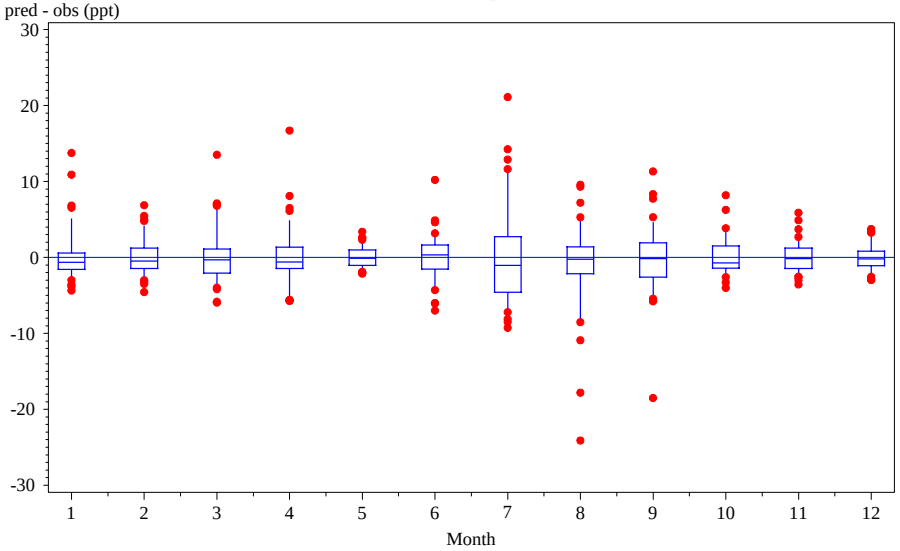
Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 95 Percent Salinity pred - obs (ppt)

Station=02301719 sample_level=B



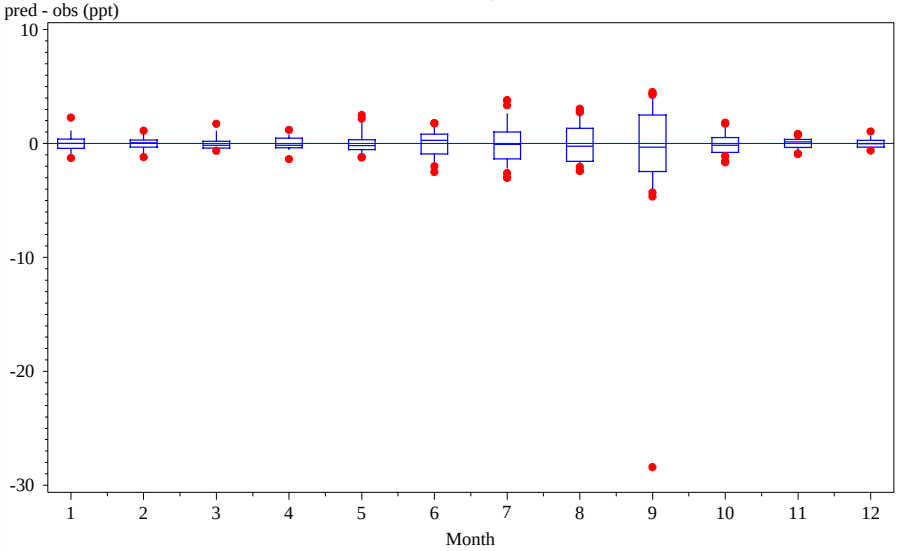
Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

Source: USGS

Residual of Daily 95 Percent Salinity pred - obs (ppt)

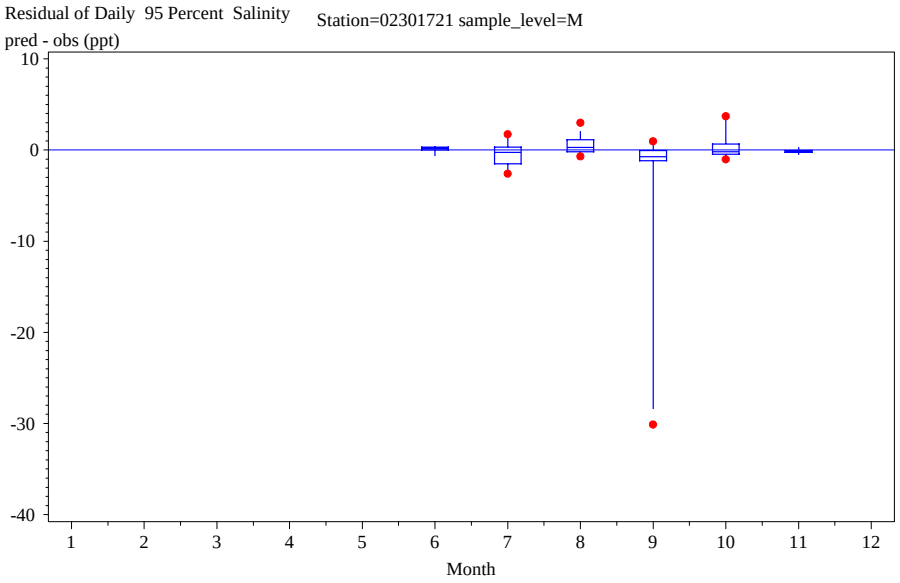
Station=02301721 sample_level=B



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

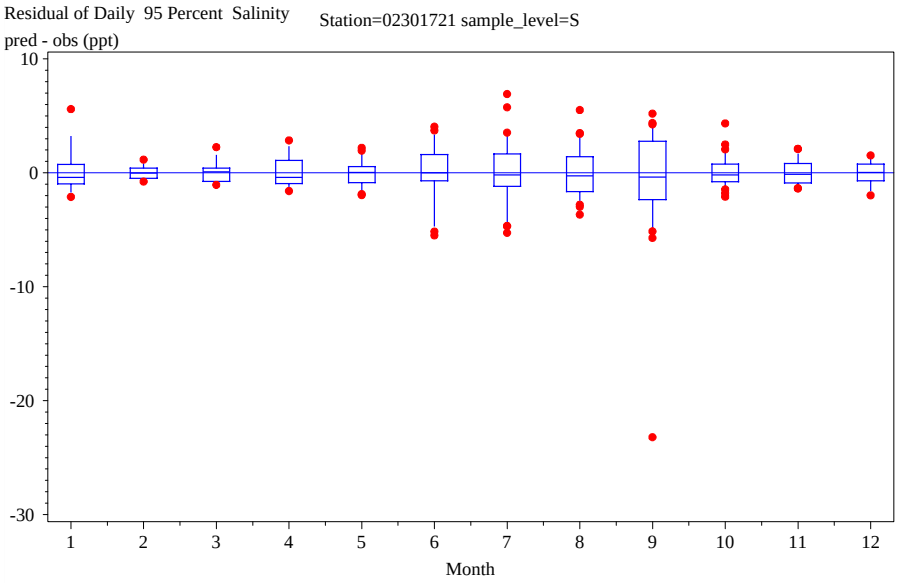
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Month in each Sample Level and Station

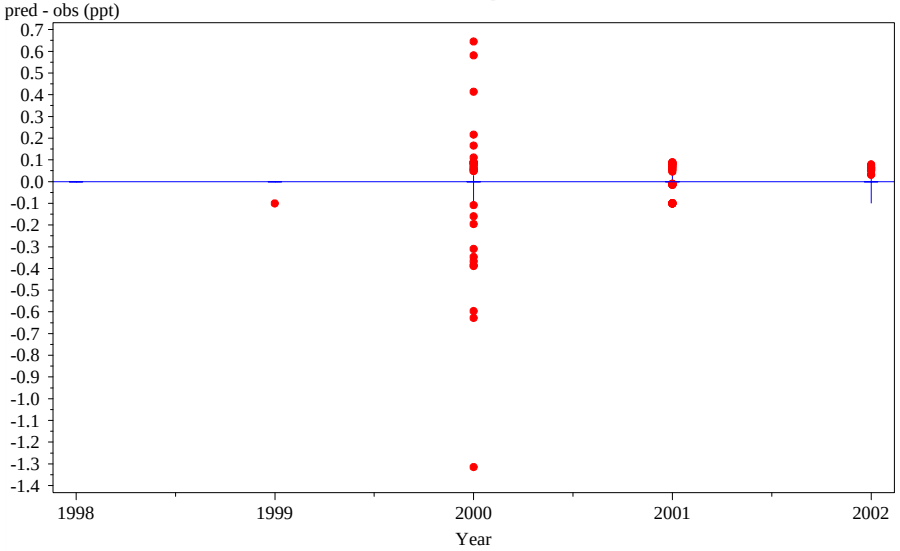
Source: USGS



Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station

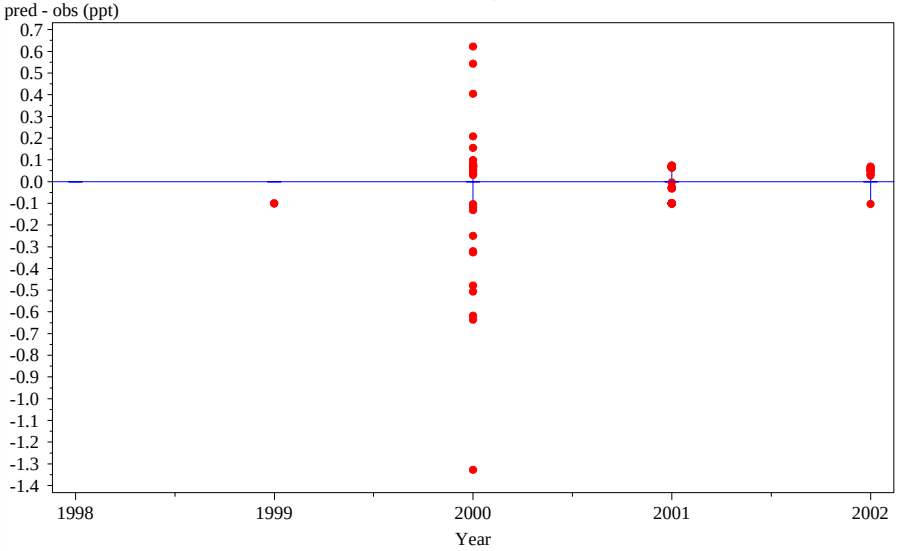
Source: USGS



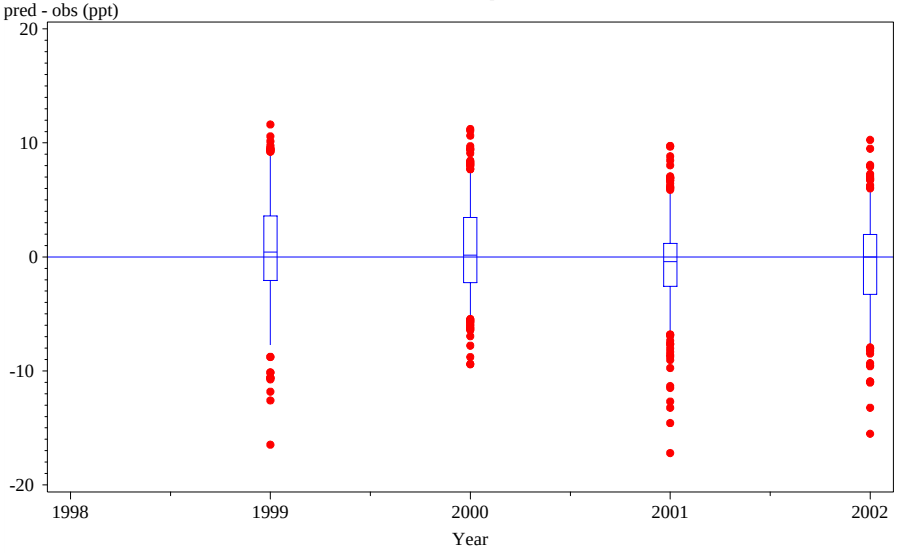
Alafia River Analysis

Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station

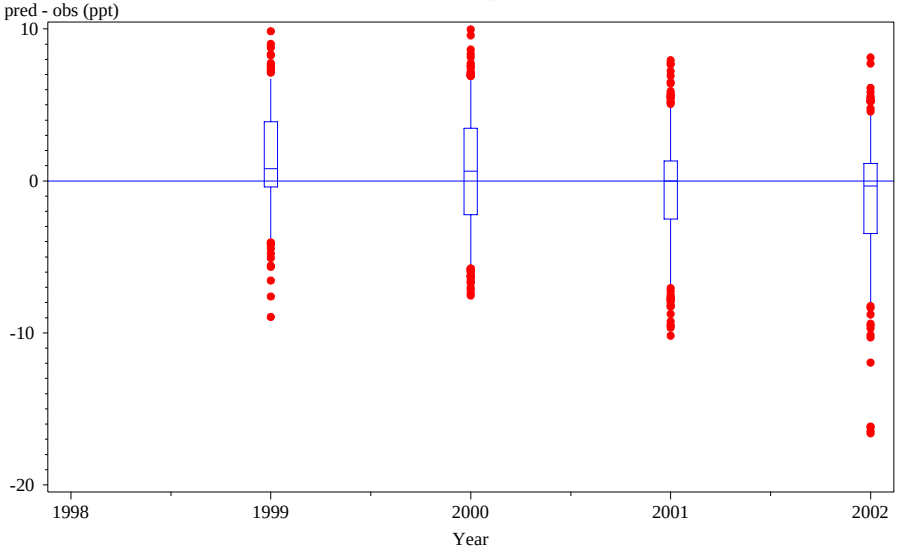
Source: USGS



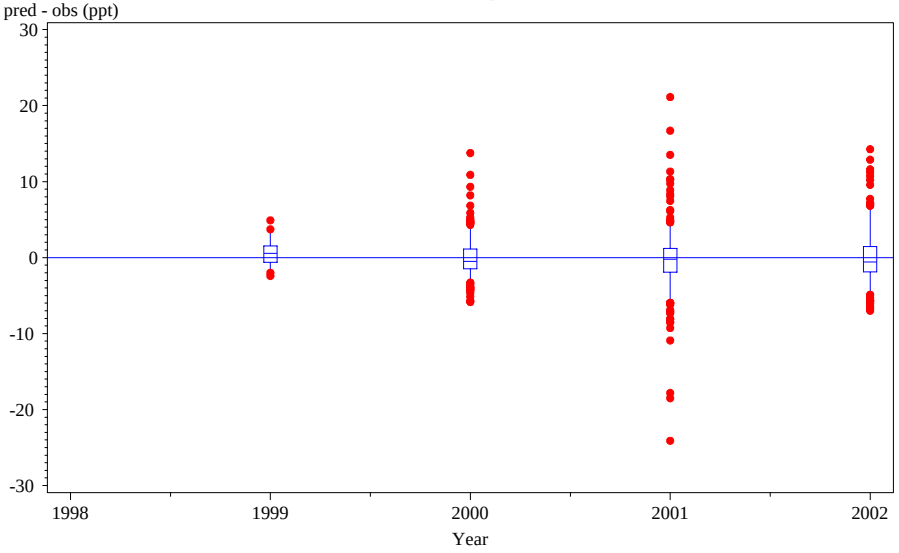
Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301718 sample_level=B



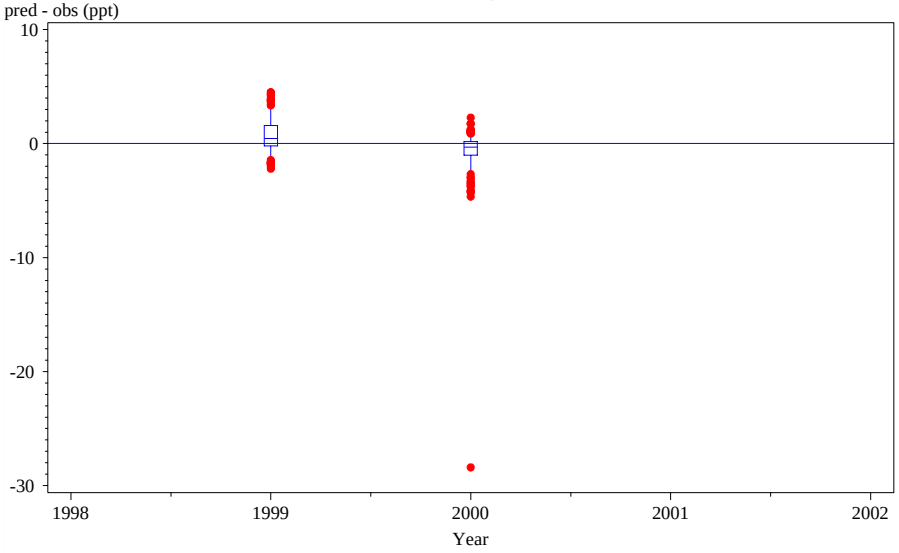
Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301718 sample_level=S

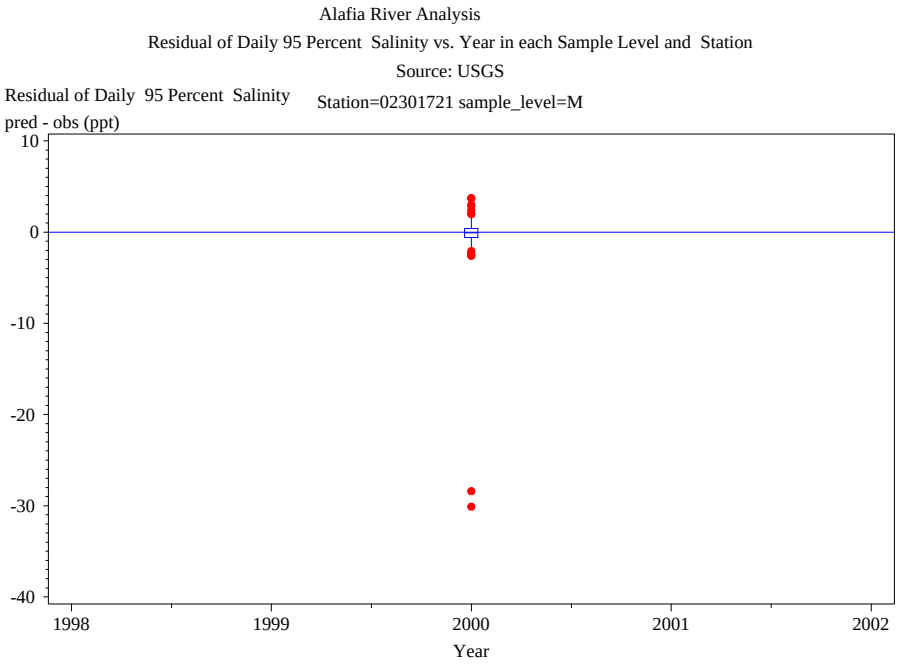


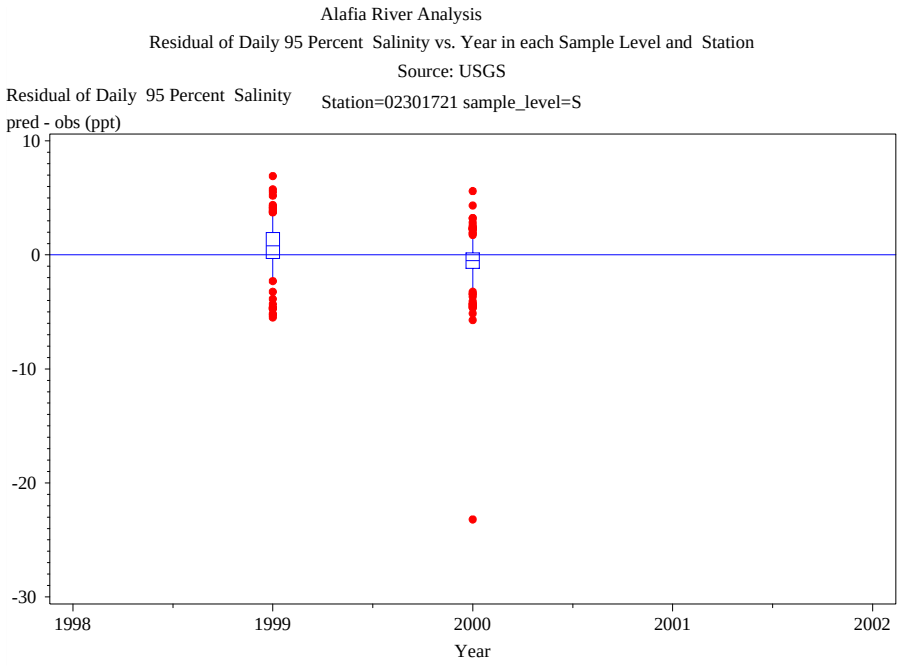
Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301719 sample_level=B



Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity pred - obs (ppt)
Station=02301721 sample_level=B



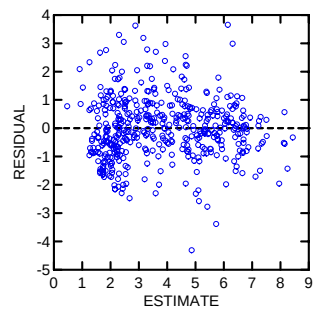

Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity
pred - obs (ppt)
Station=02301721 sample_level=M
10
0
-10
-20
-30
-40
1998
1999
2000
2001
2002
Year

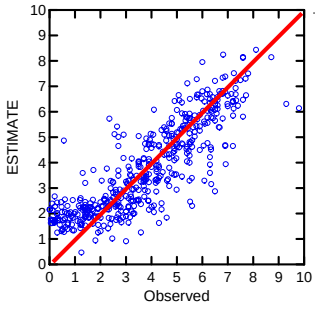

Alafia River Analysis
Residual of Daily 95 Percent Salinity vs. Year in each Sample Level and Station
Source: USGS
Residual of Daily 95 Percent Salinity
pred - obs (ppt)
Station=02301721 sample_level=S
10
0
-10
-20
-30
1998
1999
2000
2001
2002
Year

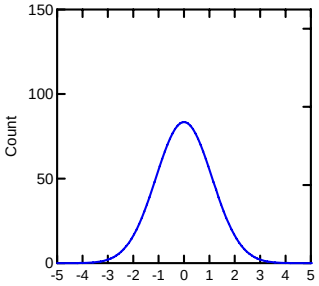
APPENDIX 5D

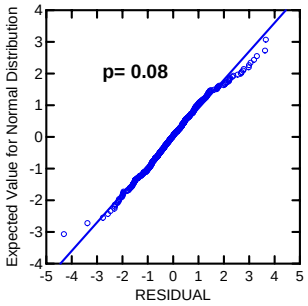
Residuals for regressions to predict dissolved concentrations listed in Table 5-1

Segment 0 - 3 KM. Waters ≥ 2m Depth
DO (mg/l) = 13.68 – 0.32*temperature – 0.28*Inflow$^{0.333}$



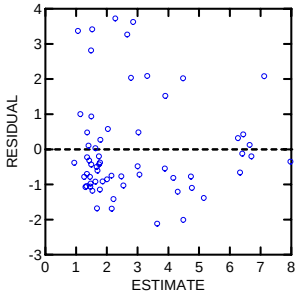


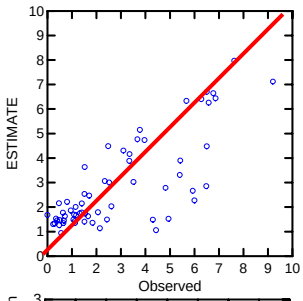


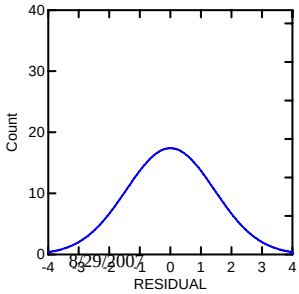


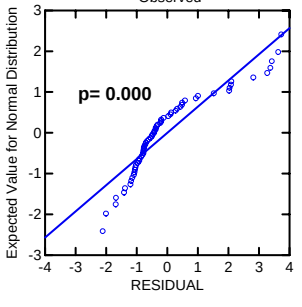
8/29/2007 DO_B_Multi.ppt 1

Segment 3 - 6 KM. Waters ≥ 2m Depth
DO (mg/l) = 14.72 – 0.38*temperature – 0.35*Ln(Inflow)



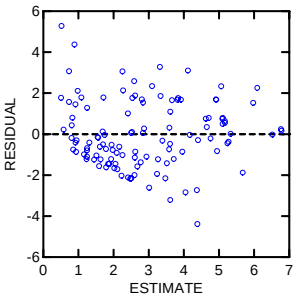


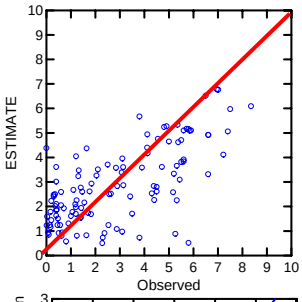


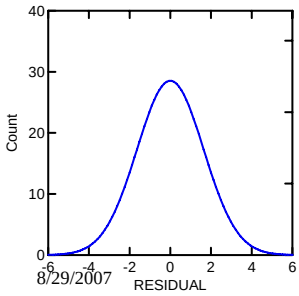


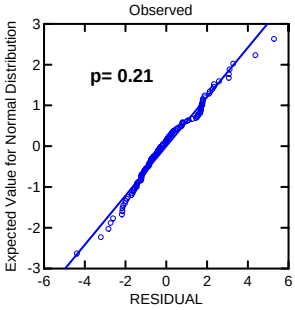
8/29/2007 DO_B_Multi.ppt 2

Segment 6 - 9 KM. Waters ≥ 2m Depth
DO (mg/l) = 10.85 - 0.33*temperature + (0.283 *10^{-6})*(Inflow)^2









Appendix 5E

Statistics and residuals for piecewise regressions to predict DO concentrations at depth ≥ 2 meters in segments 9-12 and 12-15 kilometers in Table 5-2.

The models were run on data from two sections of the river between Kilometers 9-12 and kilometers 12-15 for samples collected near the bottom. Data for depths shallower than 2 meters were excluded plus a few other data points determined to be outliers, consistent Results are as follows:

Segment	BA0	BA1	BB1	BB2	Knot1	R-Square
D (9-12 km)	7.99	-0.269	0.007	-0.007	555	0.53
E (12-15 km)	6.26	-0.245	0.024	0.024	226	0.63

Prediction equations are of the form

Predicted DO =

BA0 + BA1*Temp + BB1*Flow for Flow < Knot1 and

BA0 + BA1*Temp + BB1*Flow + BB2*(Flow-Knot1) for Flow > Knot1

Where Temp and Flow are the water temperature (C) at the sampling location and daily flow (cfs).

The output files include various plots of residuals, observed, and predicted values. There is some bias noted, particularly in the Segment E model.

SPSS output files

Constrained Nonlinear Regression
Segment D
Y1=DO_b, Xa=Temp_b, and Xb=jq0(Flow)

```
All the derivatives will be calculated numerically.

The following new variables are being created:

Name          Label

PREDEX1       Predicted Values
RESIDEX1      Residuals
_
```

Iteration	Residual SS	BA0	BA1	BB1	BB2
		KNOT1			
0.1	1291.213970	8.00000000	-.20000000	.004000000	-.00300000
		500.000000			
1.1	1281.677600	7.99999433	-.20014709	.003578481	-.00291383
		500.000000			
2.1	1227.809177	7.99990407	-.20250392	.002390851	.000802171
		500.000000			
3.1	905.5810933	7.99731550	-.27041782	.007931314	-.00711034
		500.000000			
4.1	905.5766604	8.02490139	-.27147071	.007928096	-.00710911
		500.038929			
5.1	903.0991295	8.05153189	-.27290443	.007985521	-.00752081
		532.974588			
6.1	901.5783353	8.06310237	-.27194358	.007688408	-.00733168
		552.049009			
7.1	901.5605761	8.02317520	-.27043845	.007701724	-.00738112
		552.232394			
8.1	901.4868014	8.09041726	-.27314238	.007680876	-.00741515
		552.828696			
9.1	901.3696671	8.04995500	-.27091230	.007574378	-.00722342
		553.518338			
10.1	901.3695916	8.04867739	-.27089048	.007575683	-.00722436
		553.514736			
11.1	901.3682971	8.03884585	-.27050813	.007578852	-.00723658
		553.440336			
12.1	901.3671092	8.03865701	-.27048843	.007576374	-.00724000
		554.019361			
13.1	901.3660846	8.03806425	-.27043371	.007570114	-.00724584
		555.262473			
14.1	901.3660845	8.03806400	-.27043347	.007570086	-.00724573
		555.258069			

```
Run stopped after 14 major iterations.
Optimal solution found.
```

Nonlinear Regression Summary Statistics Dependent Variable Y1

Source	DF	Sum of Squares	Mean Square
Regression	5	4302.85162	860.57032
Residual	311	901.36608	2.89828
Uncorrected Total	316	5204.21770	
(Corrected Total)	315	1927.73890	

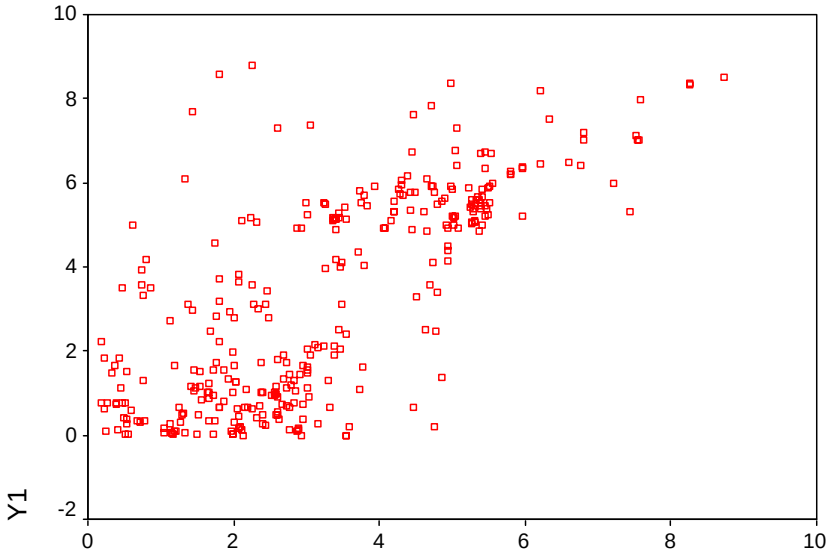
R squared = 1 - Residual SS / Corrected SS = .53242

Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95 % Confidence Interval Lower	Upper
BA0	8.038064000	.704207974	6.652449508	9.423678492
BA1	-.270433467	.027660244	-.324858348	-.216008586
BB1	.007570086	.000689134	.006214132	.008926040
BB2	-.007245732	.001173008	-.009553767	-.004937697
KNOT1	555.25806902	66.034246660	425.32768977	685.18844827

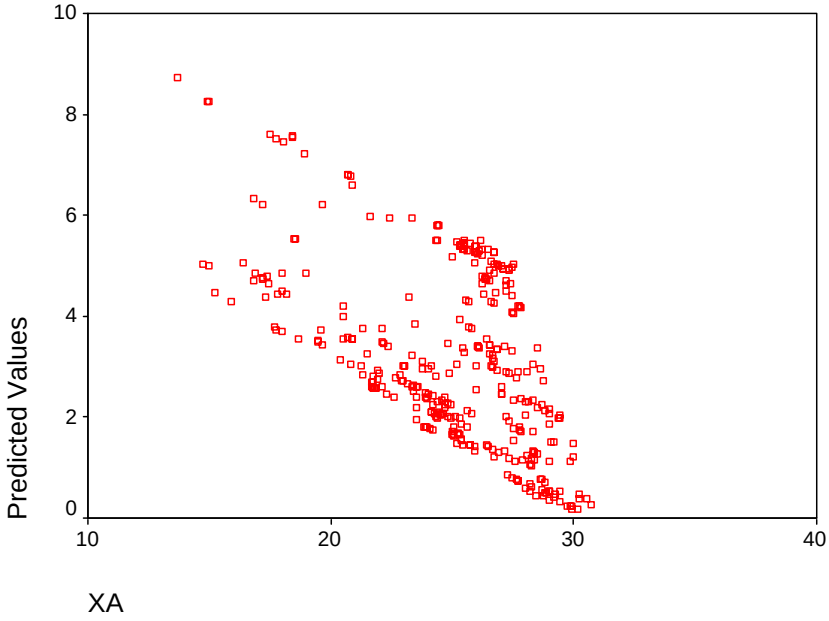
Asymptotic Correlation Matrix of the Parameter Estimates

	BA0	BA1	BB1	BB2	KNOT1
BA0	1.0000	-.9716	-.1213	.0279	.0140
BA1	-.9716	1.0000	-.0641	.0823	.0518
BB1	-.1213	-.0641	1.0000	-.5904	-.5296
BB2	.0279	.0823	-.5904	1.0000	-.2164
KNOT1	.0140	.0518	-.5296	-.2164	1.0000

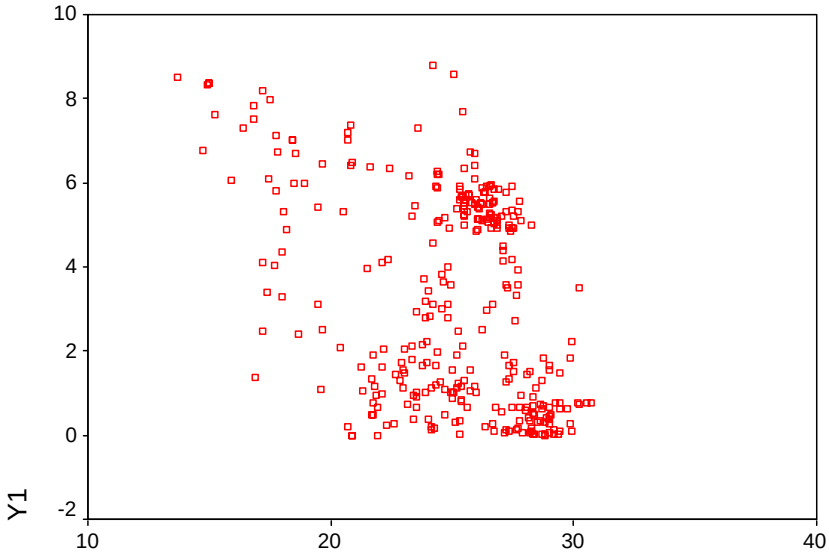
Plot of Y1 with PREDEX1



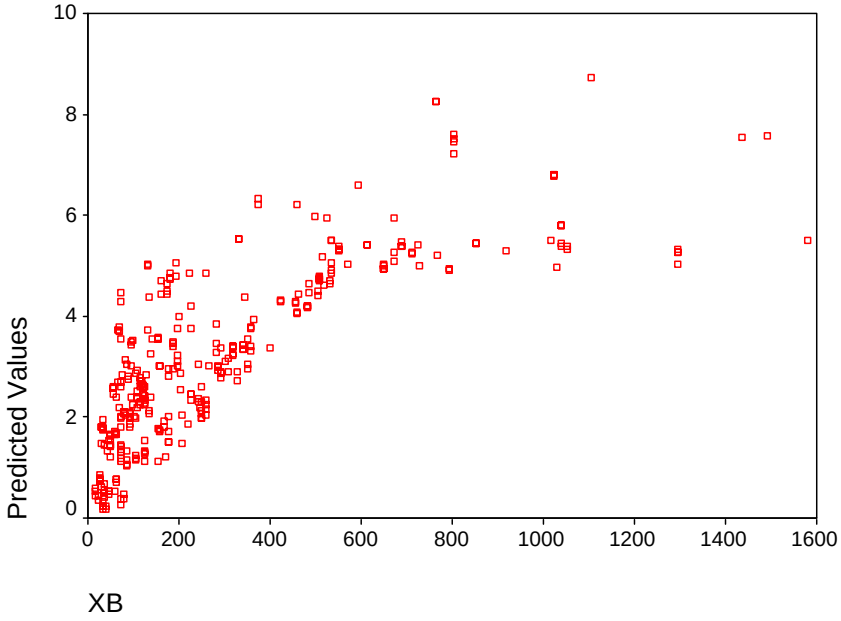
Plot of PREDEX1 with XA

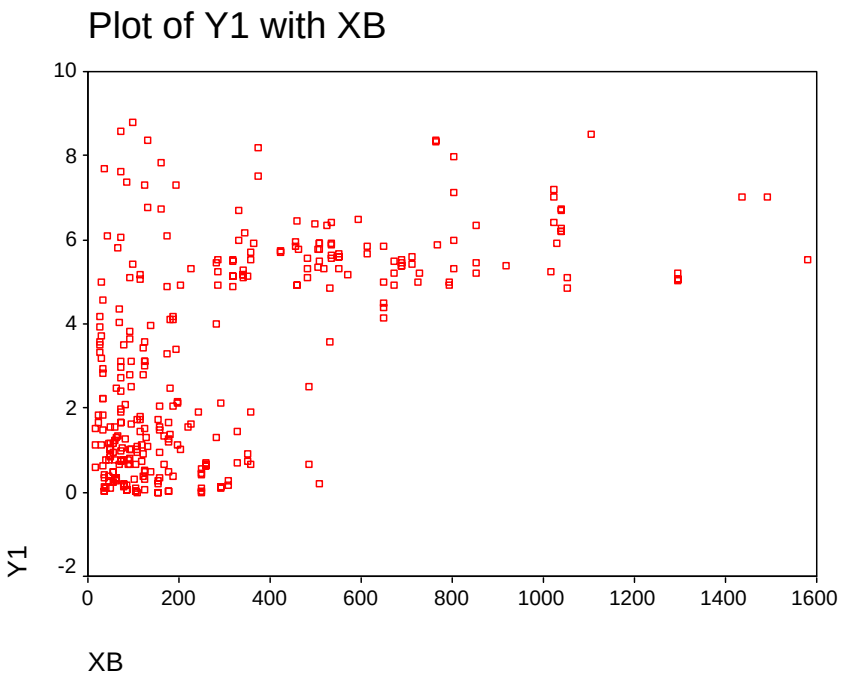


Plot of Y1 with XA

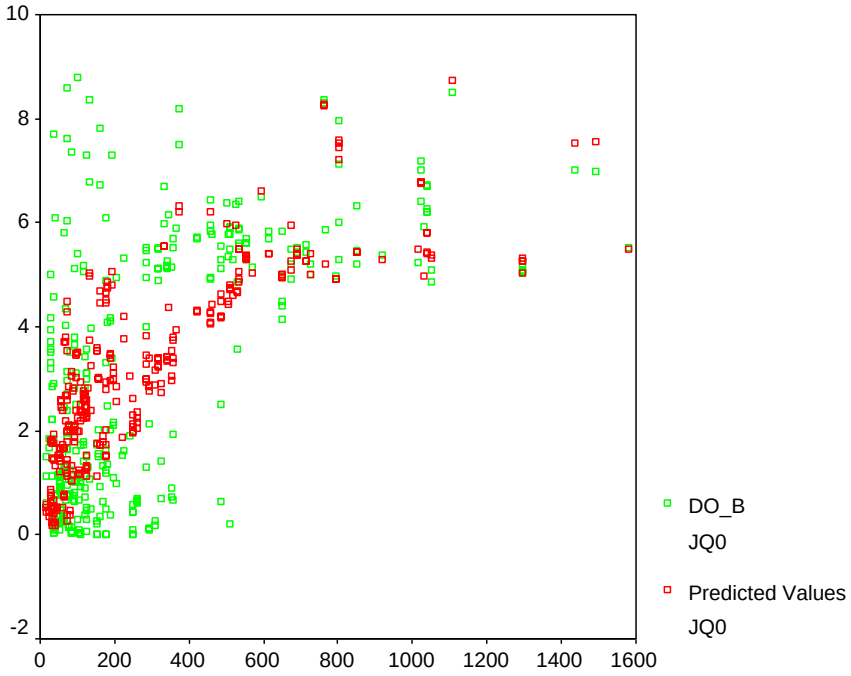


Plot of PREDEX1 with XB

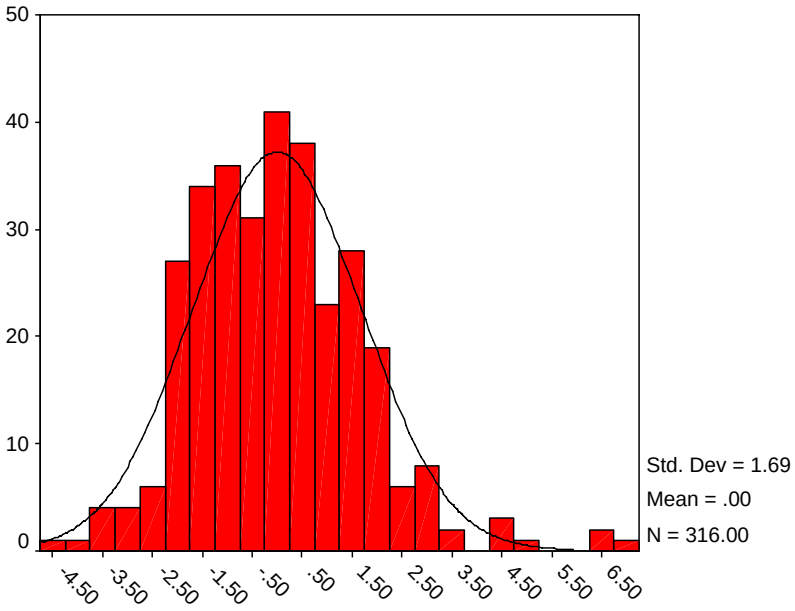



Plot of Y1 with XB
Y1
XB
10
8
6
4
2
0
-2
0
200
400
600
800
1000
1200
1400
1600

Graph


10
8
6
4
2
0
-2
0
200
400
600
800
1000
1200
1400
1600
DO_B
JQ0
Predicted Values
JQ0

Graph



Residuals

PPlot

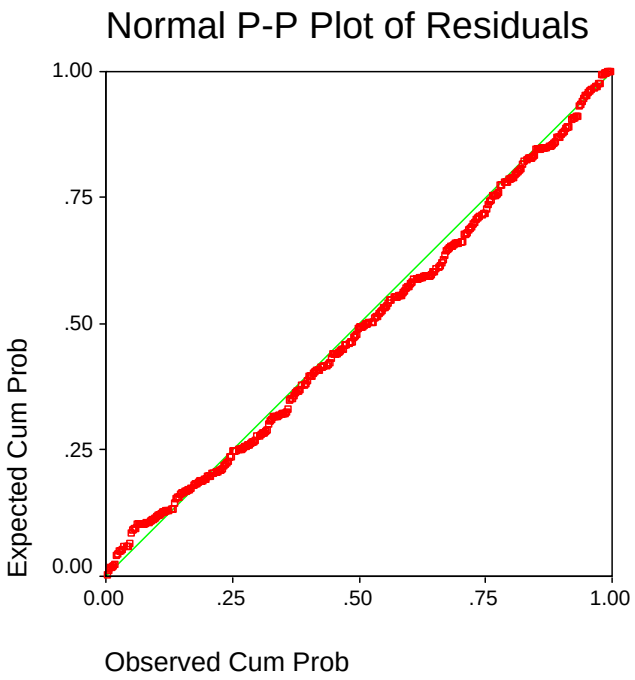
```
MODEL:  MOD_1.

Expected Normal quantiles calculated using Blom's proportional
estimation formula and assigning the mean to ties.

_


For variable RESIDEX1...

Normal distribution parameters estimated: location=.00000003
scale=1.6915909
```


Normal P-P Plot of Residuals
Expected Cum Prob
Observed Cum Prob
1.00
.75
.50
.25
0.00
0.00
.25
.50
.75
1.00

Constrained Nonlinear Regression
Segment E
Y1=DO_b, Xa=Temp_b, and Xb=jq0(Flow)

```
All the derivatives will be calculated numerically.

The following new variables are being created:

Name          Label

PREDEX1       Predicted Values
RESIDEX1      Residuals
_
```

Iteration	Residual SS	BA0	BA1	BB1	BB2
		KNOT1			
0.1	1145.162417	8.00000000	-.20000000	.004000000	-.00300000
		500.000000			
1.1	1124.448792	7.99999900	-.20002640	.004604497	-.00296567
		500.000000			
2.1	1070.579732	7.99995933	-.20103940	.006375113	-.00709917
		500.000000			
3.1	803.8981537	7.99729784	-.26791482	.011656838	-.01387081
		500.000000			
4.1	803.4113481	8.30581461	-.28032139	.011638187	-.01384598
		499.937699			
5.2	783.9645550	8.13452726	-.27757774	.012151124	-.01427794
		449.322334			
6.2	733.1387060	7.48207094	-.26184155	.014807666	-.01528353
		324.251324			
7.1	732.2971163	7.99965464	-.27811046	.014493252	-.01474449
		319.656445			
8.1	728.5820616	8.12876311	-.28552209	.015269727	-.01598659
		316.896199			
9.1	707.2601514	6.90535142	-.25309468	.018734258	-.01901900
		299.265010			
10.1	706.1855190	7.21785958	-.26974522	.019057471	-.01928239
		297.132083			
11.1	694.6389053	6.77056703	-.25396547	.020084820	-.01989095
		259.005883			
12.1	693.4336173	6.68432650	-.25162648	.020558298	-.02027935
		248.581634			
13.1	690.4470862	6.83645048	-.25633725	.020871734	-.02079091
		248.236050			
14.1	688.1190023	6.77702655	-.25579167	.021615837	-.02154165
		243.512521			
15.1	685.1314330	6.44910861	-.24947434	.023529639	-.02340925
		230.427512			
16.1	684.7174189	6.27990588	-.24516009	.024153044	-.02395664
		227.095773			
17.1	684.7076824	6.24810856	-.24469709	.024343542	-.02415697
		225.975363			

```
    18.1    684.7048440  6.25564418  -.24482754  .024298800  -.02411067
                         226.378647
    19.1    684.7048095  6.25580770  -.24482462  .024299871  -.02411064
                         226.328526
    20.1    684.7048074  6.25567535  -.24482379  .024300750  -.02411182
                         226.330983
    21.1    684.7048074  6.25568857  -.24482429  .024300822  -.02411191
                         226.330922
    22.1    684.7048073  6.25569280  -.24482441  .024300833  -.02411192
                         226.330818

Run stopped after 22 major iterations.
Optimal solution found.
_
```

Nonlinear Regression Summary Statistics Dependent Variable Y1

Source	DF	Sum of Squares	Mean Square
Regression	5	5543.44039	1108.68808
Residual	282	684.70481	2.42803
Uncorrected Total	287	6228.14520	
(Corrected Total)	286	1833.18489	

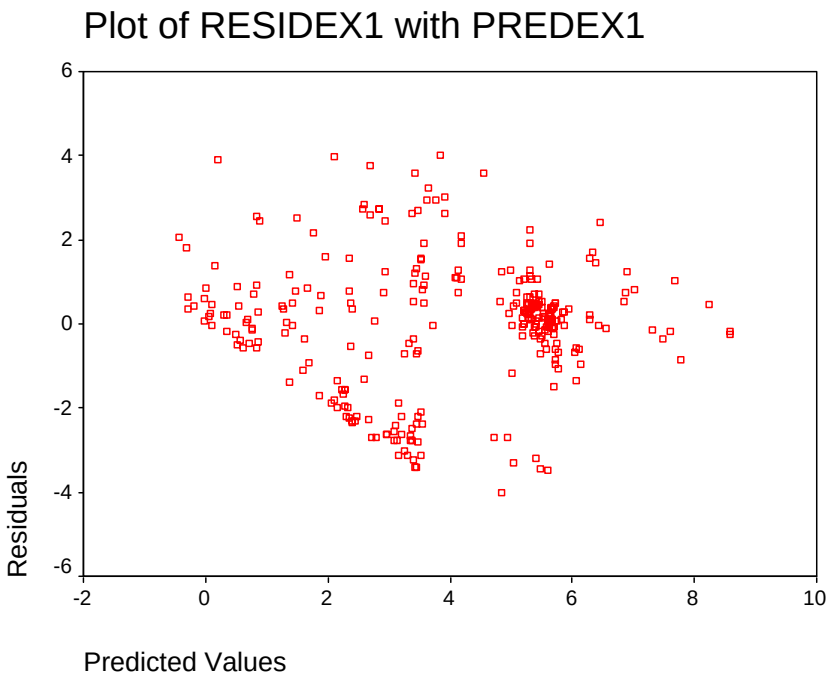
R squared = 1 - Residual SS / Corrected SS = .62649

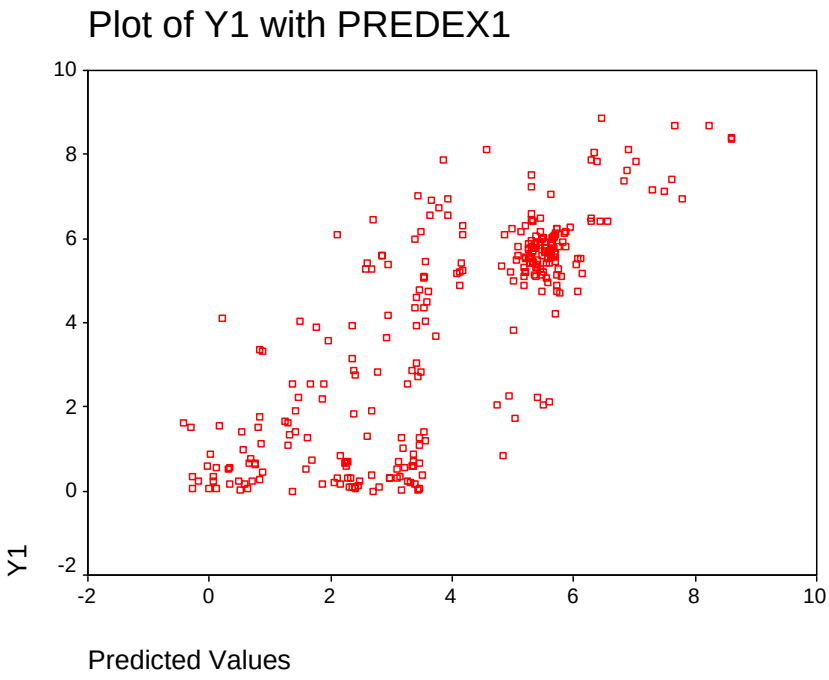
Parameter	Estimate	Asymptotic Std. Error	Asymptotic 95 % Confidence Interval Lower	Upper
BA0	6.255692802	.793947425	4.692877242	7.818508362
BA1	-.244824408	.029718461	-.303322581	-.186326236
BB1	.024300833	.002370753	.019634216	.028967451
BB2	-.024111922	.002401157	-.028838388	-.019385456
KNOT1	226.33081846	16.897682105	193.06921991	259.59241700

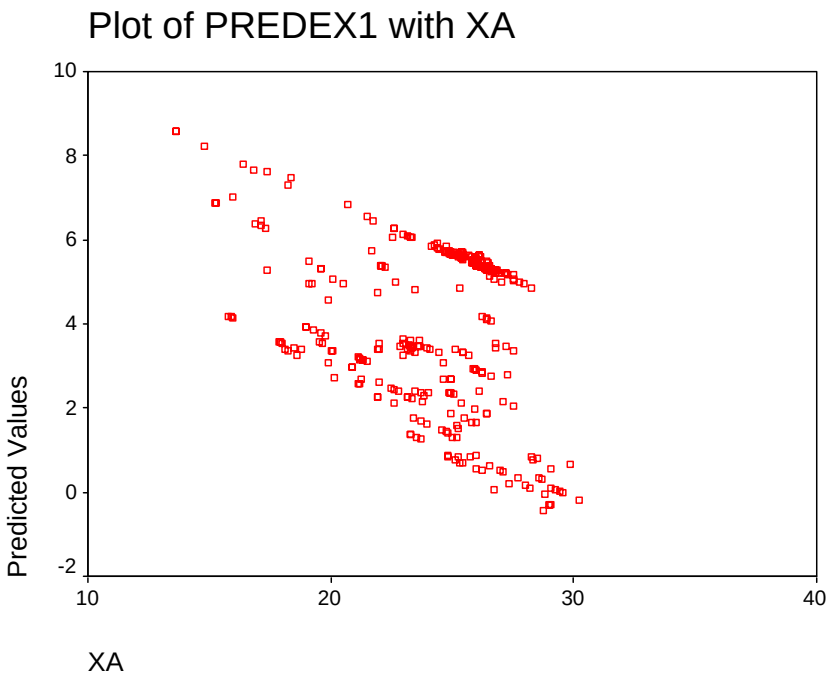
Asymptotic Correlation Matrix of the Parameter Estimates

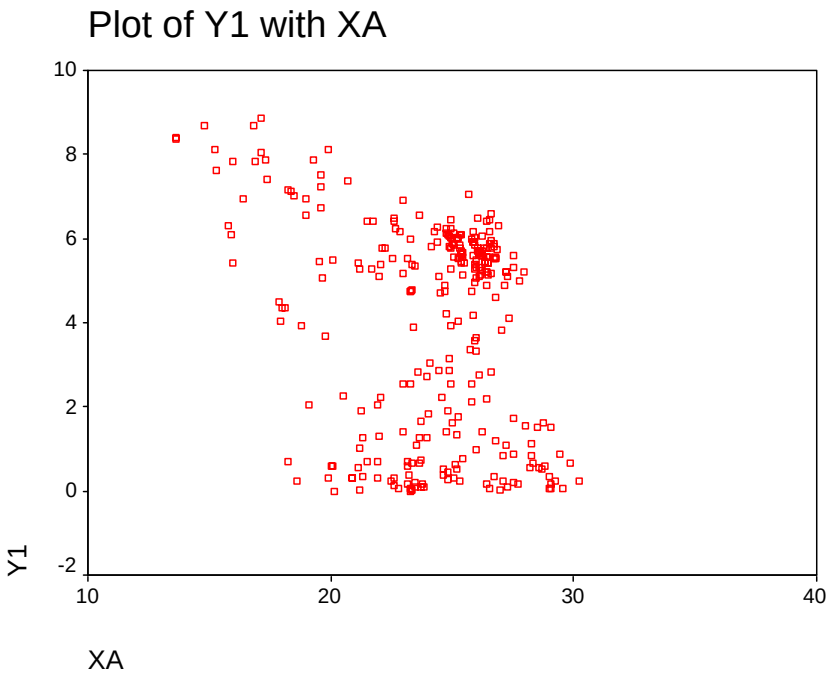
	BA0	BA1	BB1	BB2	KNOT1
BA0	1.0000	-.9506	-.4901	.4734	.4482
BA1	-.9506	1.0000	.2368	-.2227	-.3020
BB1	-.4901	.2368	1.0000	-.9847	-.7982
BB2	.4734	-.2227	-.9847	1.0000	.7208
KNOT1	.4482	-.3020	-.7982	.7208	1.0000

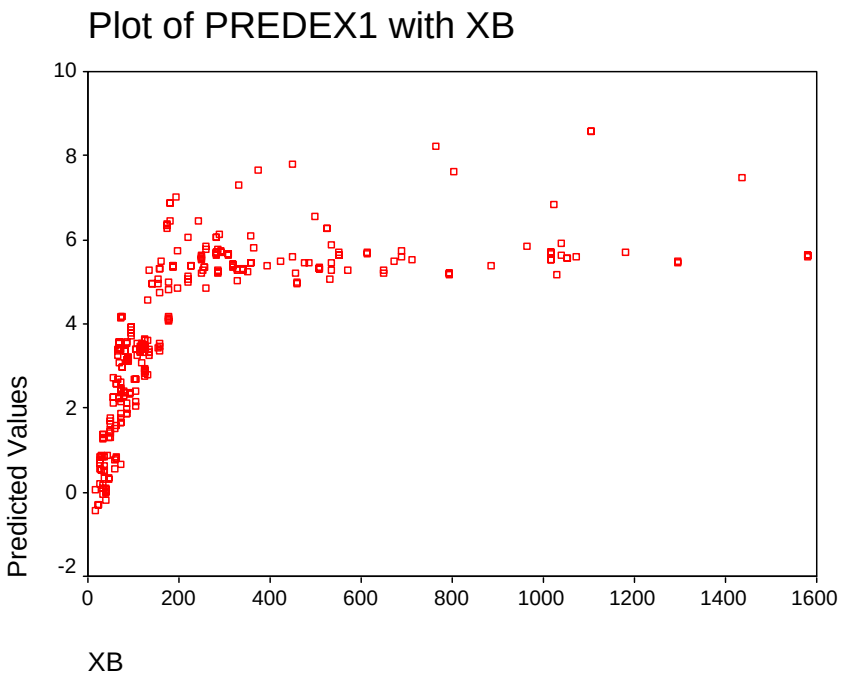
Plot

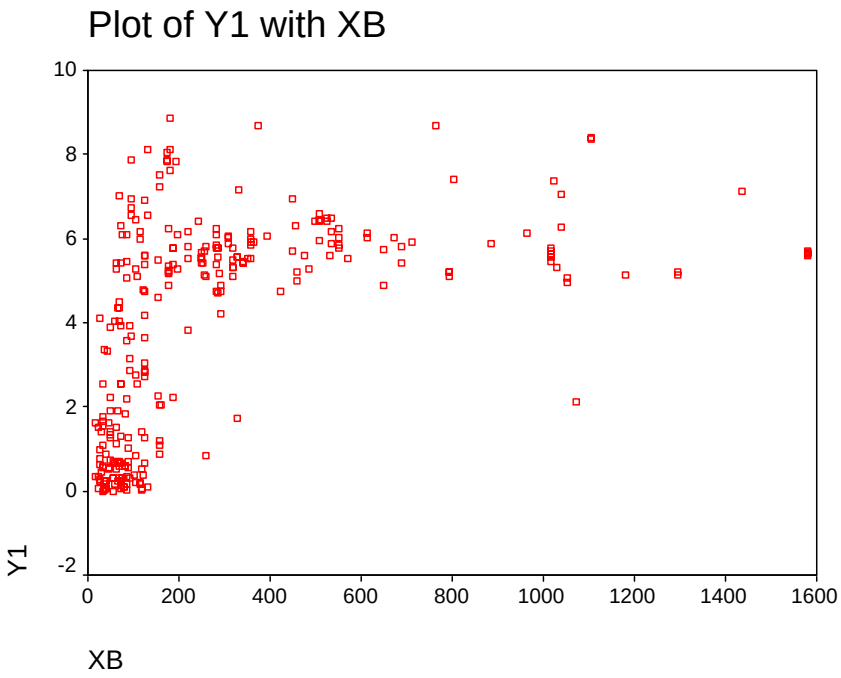

Plot of RESIDEX1 with PREDEX1
Residuals
6
4
2
0
-2
-4
-6
-2
0
2
4
6
8
10
Predicted Values


Plot of Y1 with PREDEX1
Y1
10
8
6
4
2
0
-2
-2
0
2
4
6
8
10
Predicted Values

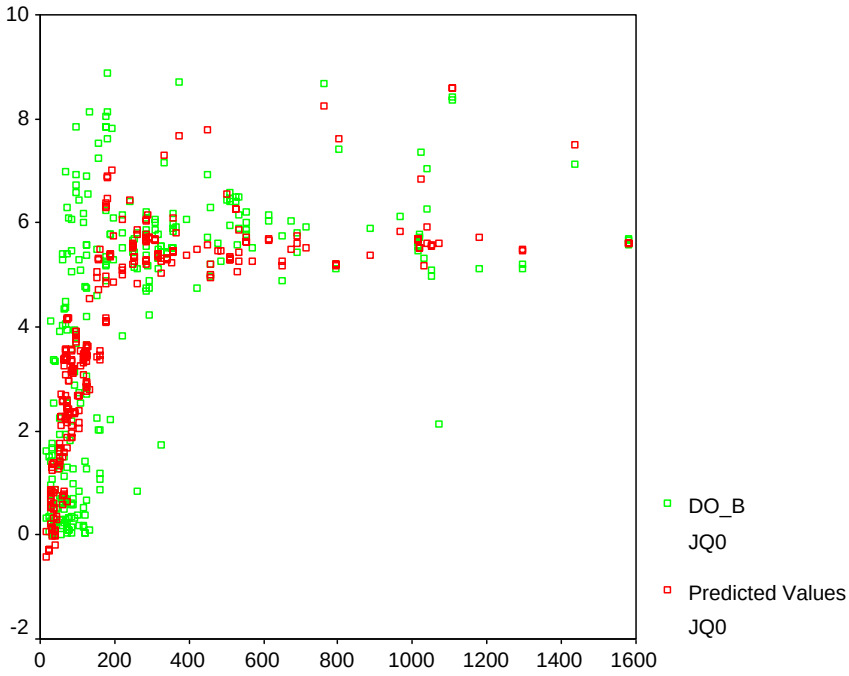

Plot of PREDEX1 with XA
Predicted Values
10
8
6
4
2
0
-2
10
20
30
40
XA


Plot of Y1 with XA
Y1
10
8
6
4
2
0
-2
10
20
30
40
XA

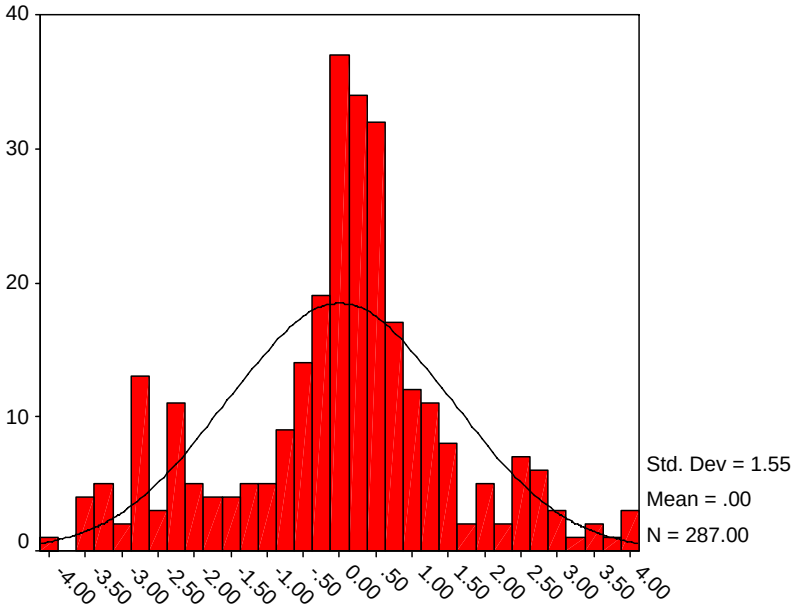

Plot of PREDEX1 with XB
Predicted Values
10
8
6
4
2
0
-2
0
200
400
600
800
1000
1200
1400
1600
XB


Plot of Y1 with XB
Y1
10
8
6
4
2
0
-2
0
200
400
600
800
1000
1200
1400
1600
XB

Graph



Graph



Residuals

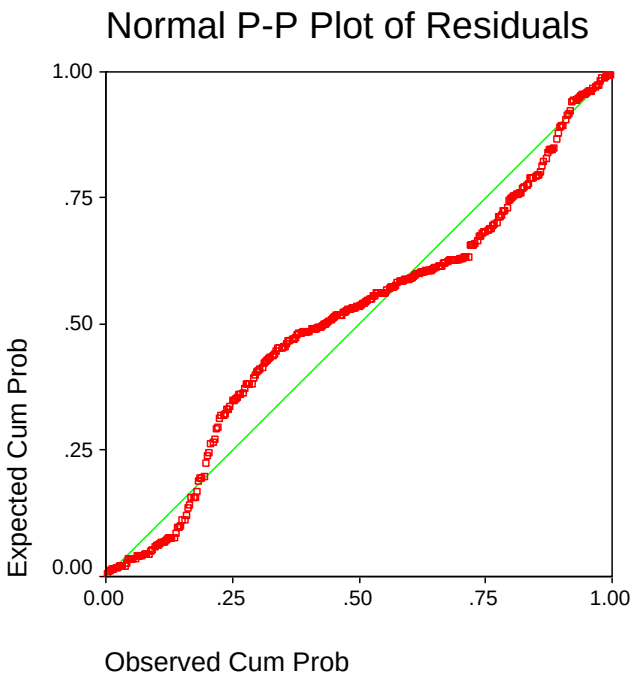
PPlot

```
MODEL:  MOD_3.

Expected Normal quantiles calculated using Blom's proportional
estimation formula and assigning the mean to ties.
```

For variable RESIDEX1...

Normal distribution parameters estimated: location=.00000002
scale=1.5472791



Appendix 5F
Condordance Tables for Logistic Regressions
Listed in Tables 5-3, 5-4 and 5-6 in Chapter 5

Table 5-3 Logistic regression of probability of D0 < 2 mg/l in waters ≥ 2m deep

	# Correctly Identified		
Segment	Response DO < 2 mg/l	Reference DO > 2mg/l	Overall
0-3	62.5/108 (58%)	311.5/357 (87%)	80%
3-6	22.7/31 (73%)	23.7/32 (74%)	74%
6-9	32.8/54 (61%)	48.8/70 (70%)	66%
9-12	94.5/141 (67%)	136.5/183 (75%)	71%
12-15	61.4/92 (67%)	173.6/204 (85%)	80%
15-18	14.3/29 (49%)	116.3/131 (89%)	82%

Table 5-4 Logistic regression of probability of D0 percent saturation > 120%

	# Correctly Identified		
Segment	Response DO saturation > 120%	Response DO saturation < 120%	Overall
3-6	9.7/55 (18%)	373/418 (89%)	81%
6-9	28.6/84 (34%)	462/517 (89%)	82%
9-12	10.4/47 (22%)	503/540 (93%)	87%
12-15	0.60/11 (15%)	421/431 (98%)	95%

Table 5-6 Logistic regression of probability of Chlorophyll *a* > 30 µg/l

Segment	Response (> 30 ug/l)	Reference (≤ 30 ug/l)	Overall
3-6	10.1/38 (26%)	101/129 (78%)	66%
6-9	44/83 (53%)	105/144 (73%)	66%
9-12	19/42 (45%)	113/136 (83%)	74%
12-15	2.6/11 (24%)	109/118 (92%)	87%

Appendix 6A

Alafia River Phytoplankton Data Collection and Enumeration Methods
Enumeration Conducted by the City of Tampa Bay Studies Group

Field collection - Surface Water samples (.3 m depth) were collected from the Alafia River by staff of the Southwest Florida Water Management District on approximately a monthly basis. Sub-samples for phytoplankton counts were fixed with Lugol's solution and kept on ice until delivery to the laboratory, where they were refrigerated until counts were performed. On all trips, samples were collected from a fixed-location station in Tampa Bay and four moving stations in the river that are based on the locations of surface water salinity values (0.5, 6, 12, and 18 ppt). During dry periods, when salinity in the river was high, samples were also be collected at a second fixed-location station located upstream of the US 41 Bridge. Phytoplankton samples were collected for a 15-month period from March 1, 2000 through May 31, 2001.

Enumeration - The phytoplankton enumeration procedure followed Method 10200F in the 19th Edition of Standard Methods for the Examination of Water and Wastewater, 1995

- The phytoplankton samples collected by the Southwest Florida Water Management District were preserved with Lugol's solution and refrigerated until analysis. The Lugol's solution was prepared according to 10200F of Standard Methods.

- Replicate analyses were performed on each of the quantitative samples. Qualitative scans were performed on phytoplankton samples that were collected in areas where unusual blooms appeared.

- All samples were shaken vigorously to remove plankton cells from the sides to the container and analyzed using a Zeiss inverted phase contrast microscope. Using a 5mL settling chamber, each sample was scanned for large and less abundant phytoplankton cells that may not be detected in smaller counting chambers. This scan was performed at 200X magnification and was recorded as the "5mL chamber scan." The qualitative samples were analyzed and the various phytoplankton species were assigned a percentage to denote their abundance in the chamber.

- If phytoplankton cells were abundant, a Palmer-Maloney (PM) chamber was filled with a 0.1 ml aliquot the phytoplankton sample. The cells were allowed to settle onto the cover slip of the counting chamber and were analyzed at 320X magnification. Phytoplankton cells were identified and counted using 6 diameter paths of the PM chamber. A minimum of 150 cells were counted for each sample.

- During periods of low cell abundance, when less than 150 cells/mL were encountered in 6 paths of the PM chamber, replicate 5mL settling chambers were used for cell identification and enumeration. Two rows in each of the chambers were analyzed at 320X.

- Individual phytoplankton cells were identified to the lowest practical taxon and enumerated on a cells/L basis.

- Each phytoplankton taxon was assigned a code number and added to an electronic database.

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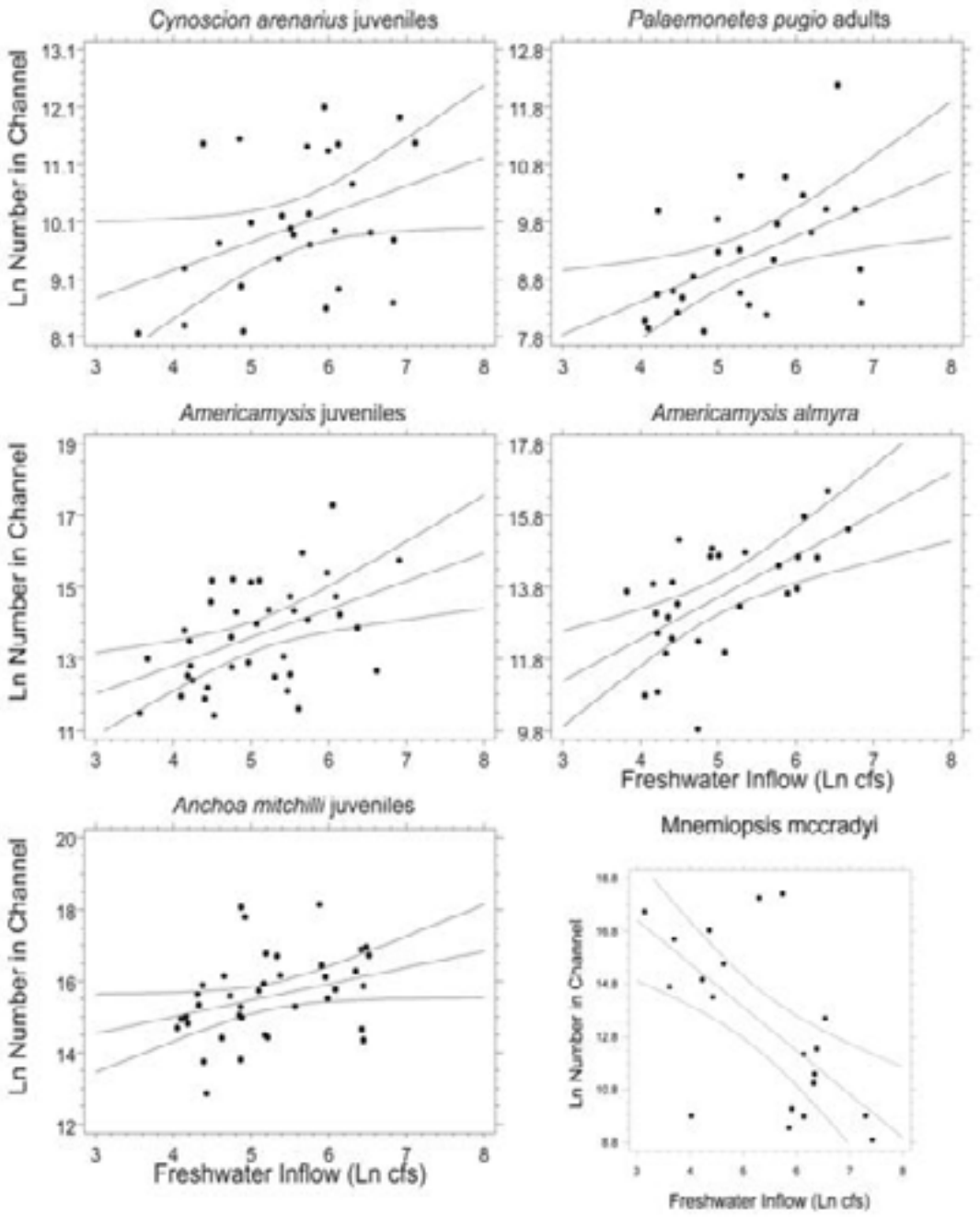
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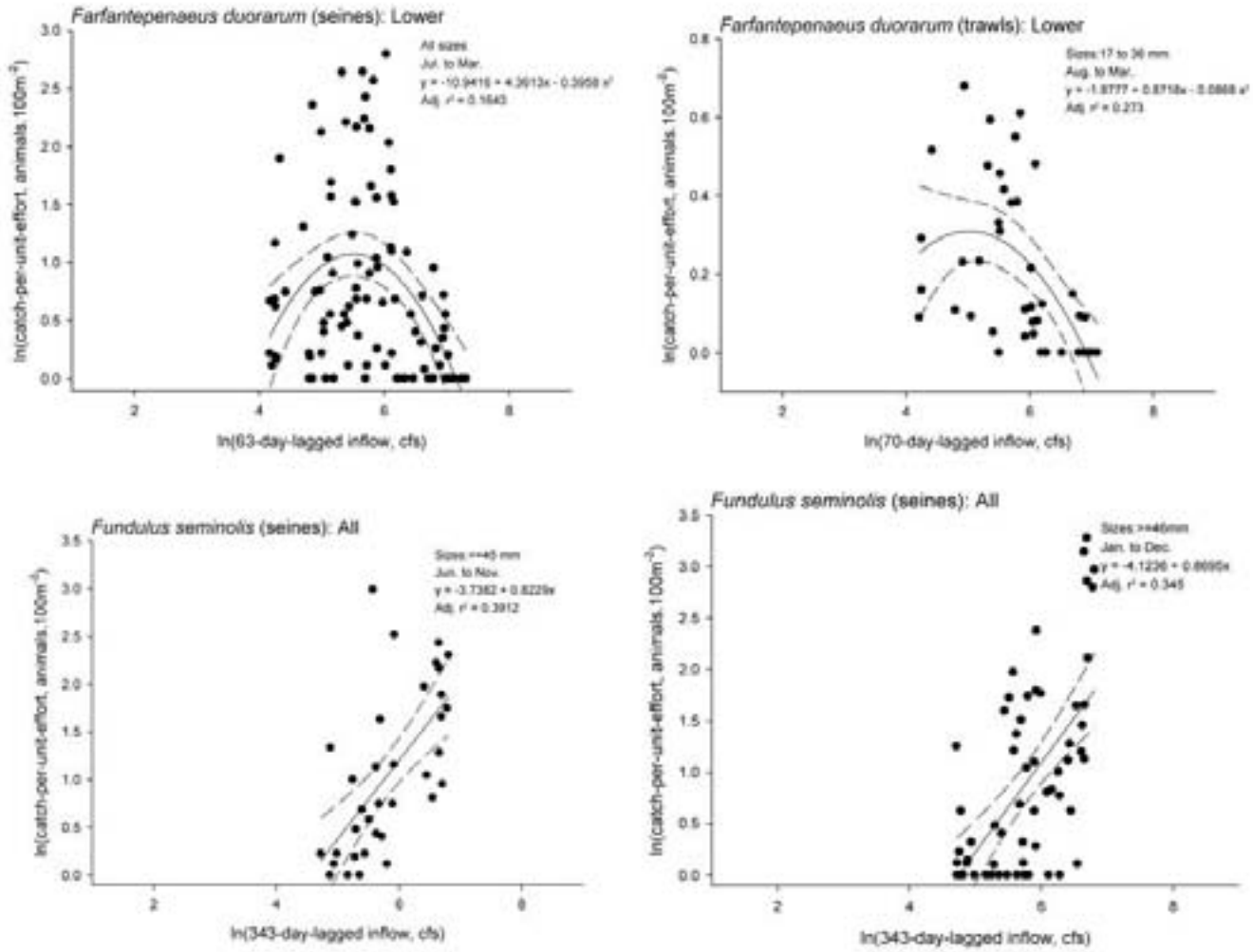
Appendix 8A

Scatter plots for regressions for indicator species/age-size classes in Table 8-1

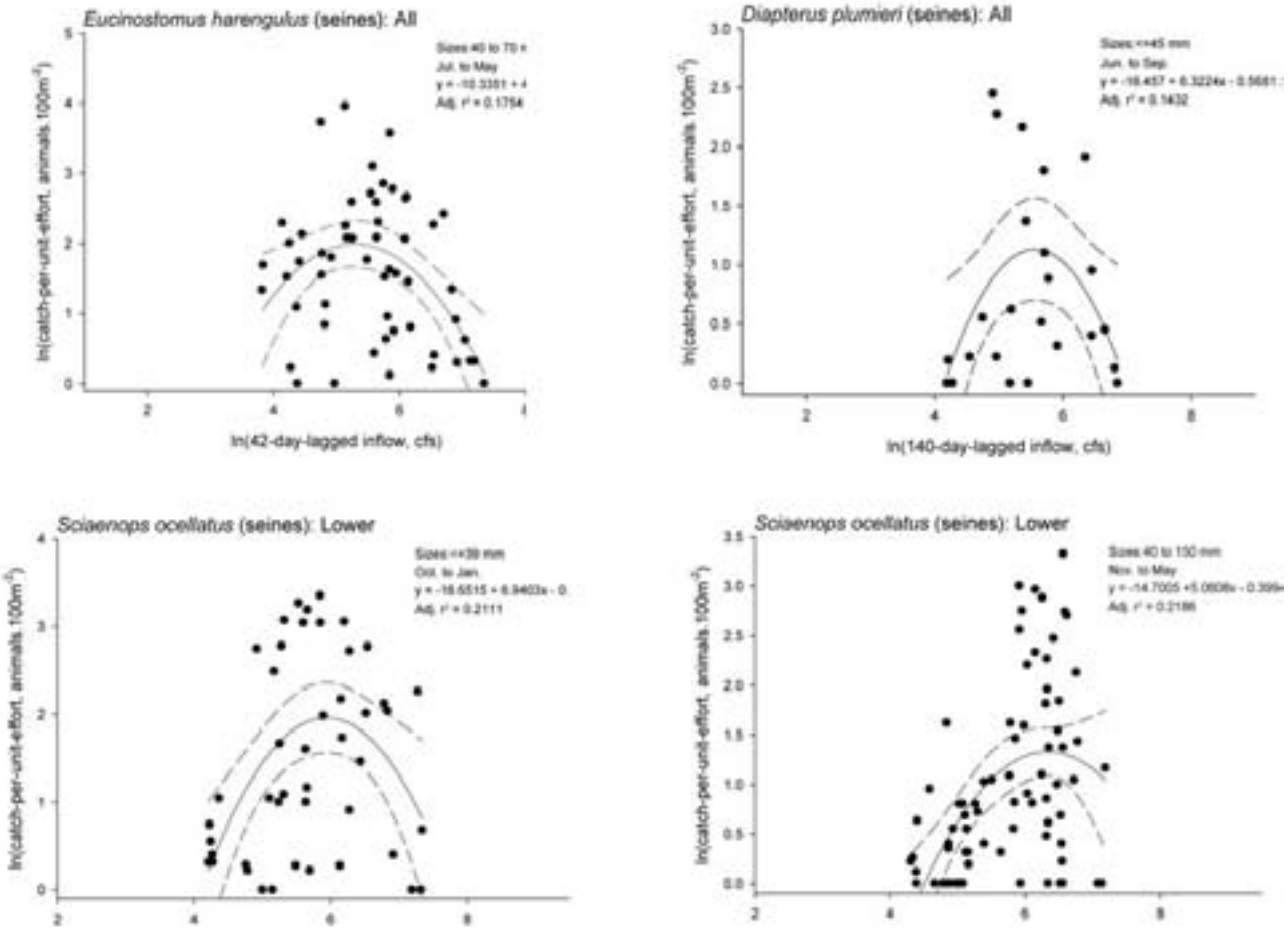
Taken from Peebles (2005), Matheson et al. (2005), and MacDonald (2007)



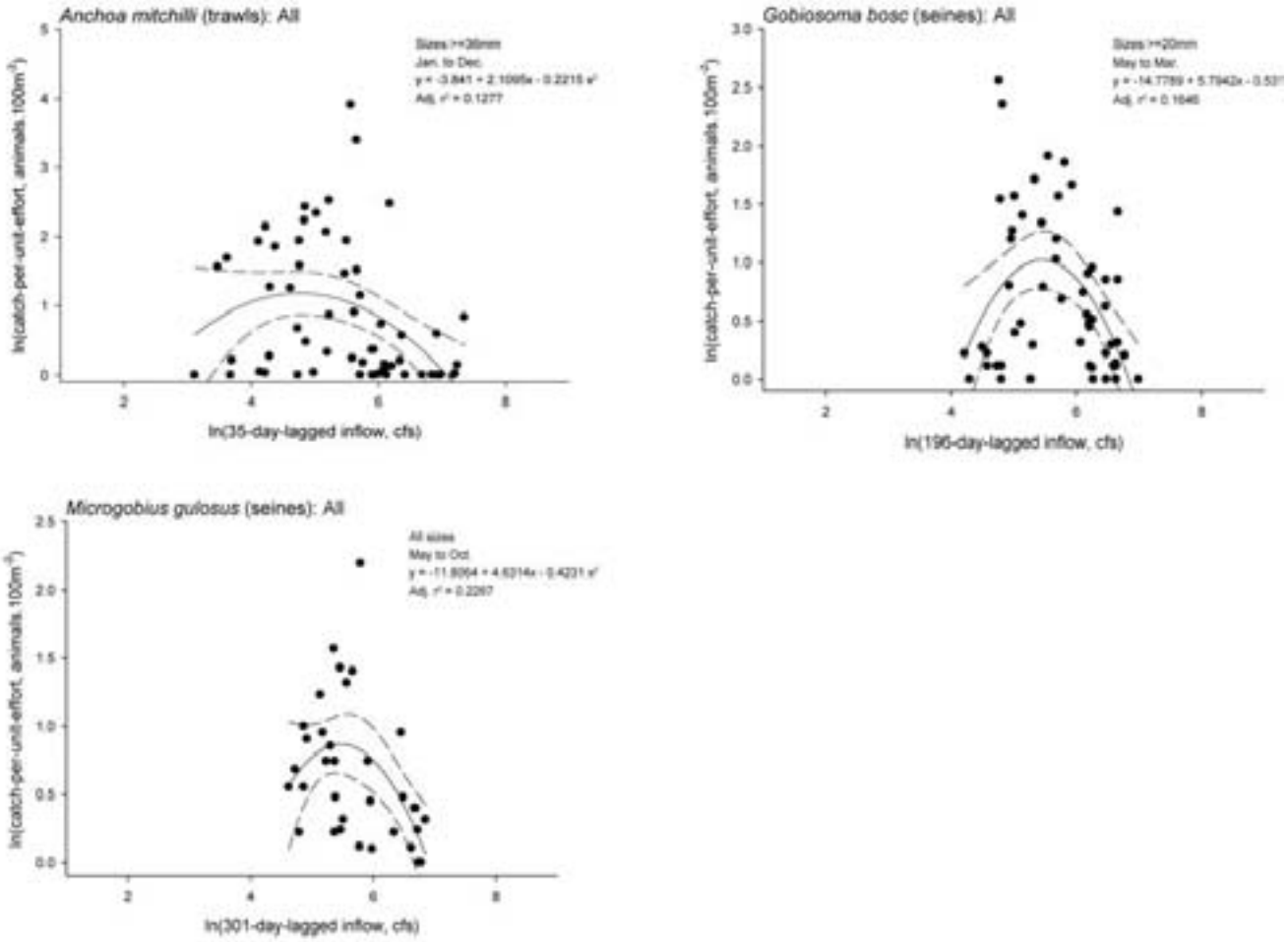
Scatter plots and regressions of taxa /age-size classes taken in Table 8-1 taken from Peebles (2005).



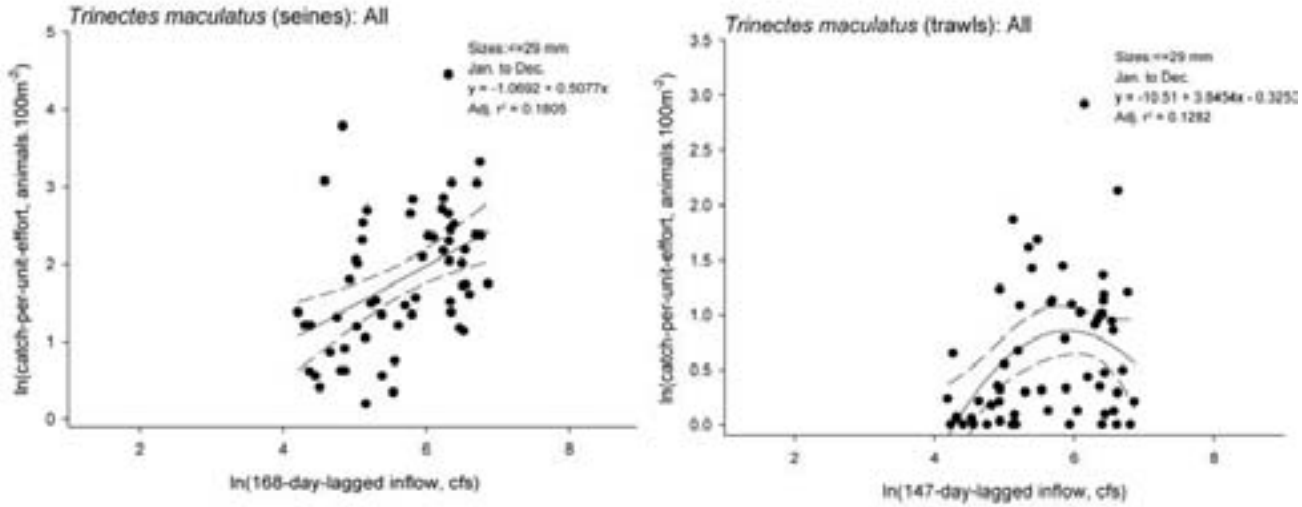
Scatter plots and regressions of taxa /age-size classes taken in Table 8-1 taken from Matheson et al. (2005)



Scatter plots and regressions of taxa /age-size classes taken in Table 8-1 taken from Matheson et al. (2005) and MacDonald (2007) for *Sciaenops occellatus*



Scatter plots and regressions of taxa /age-size classes taken in Table 8-1 taken from Matheson et al. (2005)



Scatter plots and regressions of taxa /age-size classes taken in Table 8-1 taken from Matheson et al. (2005)