

Appendix L

Estimating the Un-Gaged Inflows In the Little Manatee River Basin, Florida

Prepared for

Southwest Florida
Water Management District



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PO 04PC0003420

March 2006

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Project Objectives

The objective of this project was to determine the un-gaged inflows to the Little Manatee River (see Figure 1) in response to rainfall events. These flows are needed to evaluate the salinity interface in conjunction with determining minimum flows and levels (MFL) in the river. The un-gaged inflows to the river can significantly affect the location and distribution of the salinity wedge. Currently the U.S. Geological Survey (USGS) gages the upper two thirds of the basin (see blue shaded basin in Figure 1). The lower third of the basin remains un-gaged (shown in yellow). The ability to continuously gage the lower portion of any river basin is reduced due to the impacts of the tidal fluxes. The surface water model HSPF (Hydrological Simulation Program - FORTRAN) was used to estimate the storm water response of the Little Manatee basin. The HSPF model was calibrated utilizing the rainfall response from the gaged portion of the basin. The calibrated parameters were then extrapolated to the un-gaged basins utilizing the available landuse distribution.

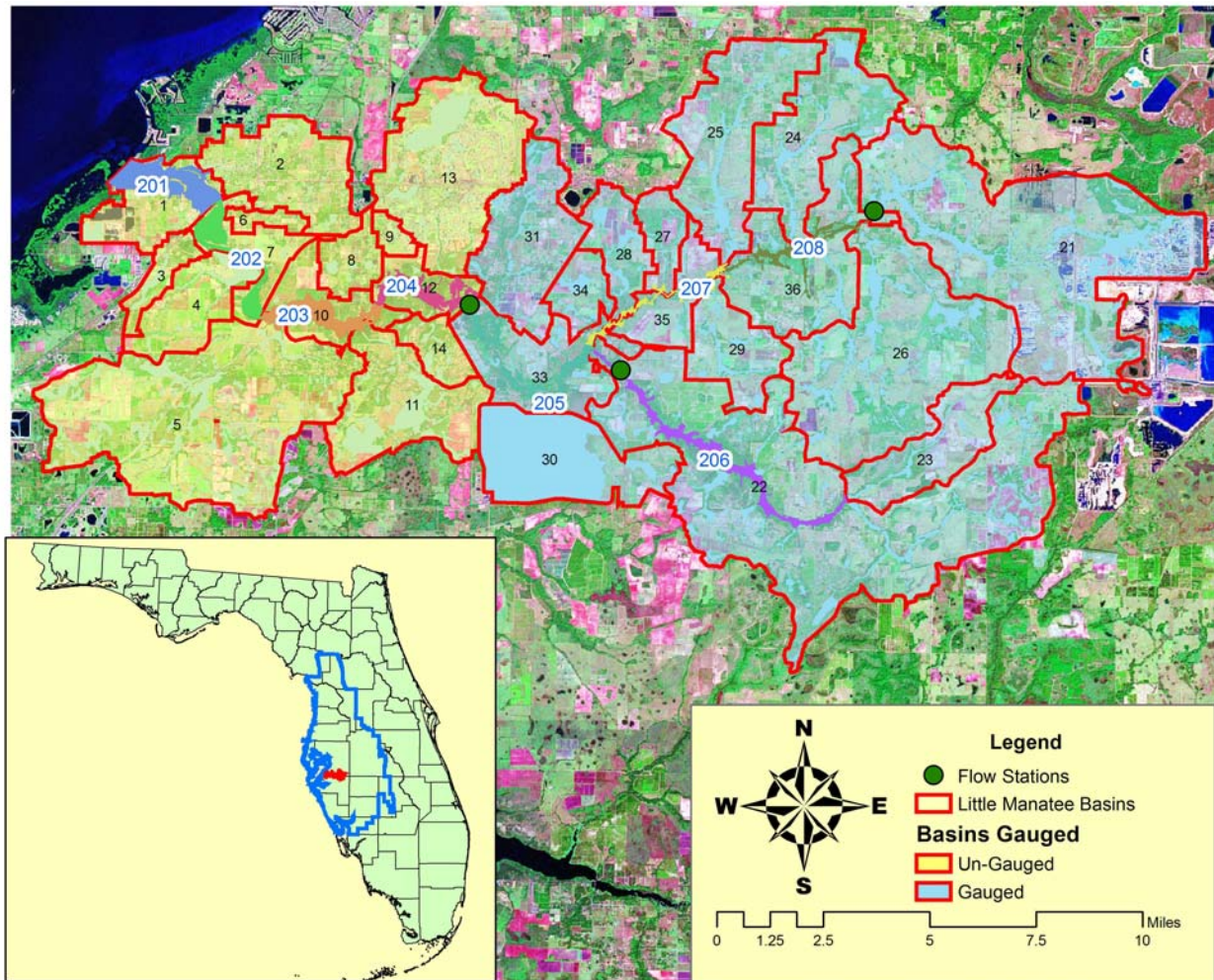


Figure 1 Little Manatee River Basin with Gaged and Un-Gaged Areas Highlighted

Data Collection and Analysis

Before applying the HSPF model, specific data were required for boundary condition fluxes and to provide calibration targets (observed internal/external fluxes). In addition spatial data (from GIS (Geographical Information System) analysis) is required to help develop model parameters. In this case many groups of external fluxes and thematic spatial data were used to drive the model. The data developed for this effort is described below.

Surface Water Basins

Several basin boundaries were collected from a number of sources including Southwest Florida Water Management District (SWFWMD or District), USGS, Tampa Bay Water (TBW), and Hillsborough County. The basins used in this project were derived from the extremely detailed basin delineation performed by Hillsborough County. The resolution of the county basins was far too detailed (2000 basins) for the requirements of this work so the basins were aggregated into 29 sub-basins (see Figure 2). The USGS quadrangles, 100,000 scale hydrography, USGS drainage basins, and even the Digital Orthophoto Quarter Quadrangle (DOQQ)'s were all used to aid in the aggregation process. The final basin delineation is shown in Figure 2.

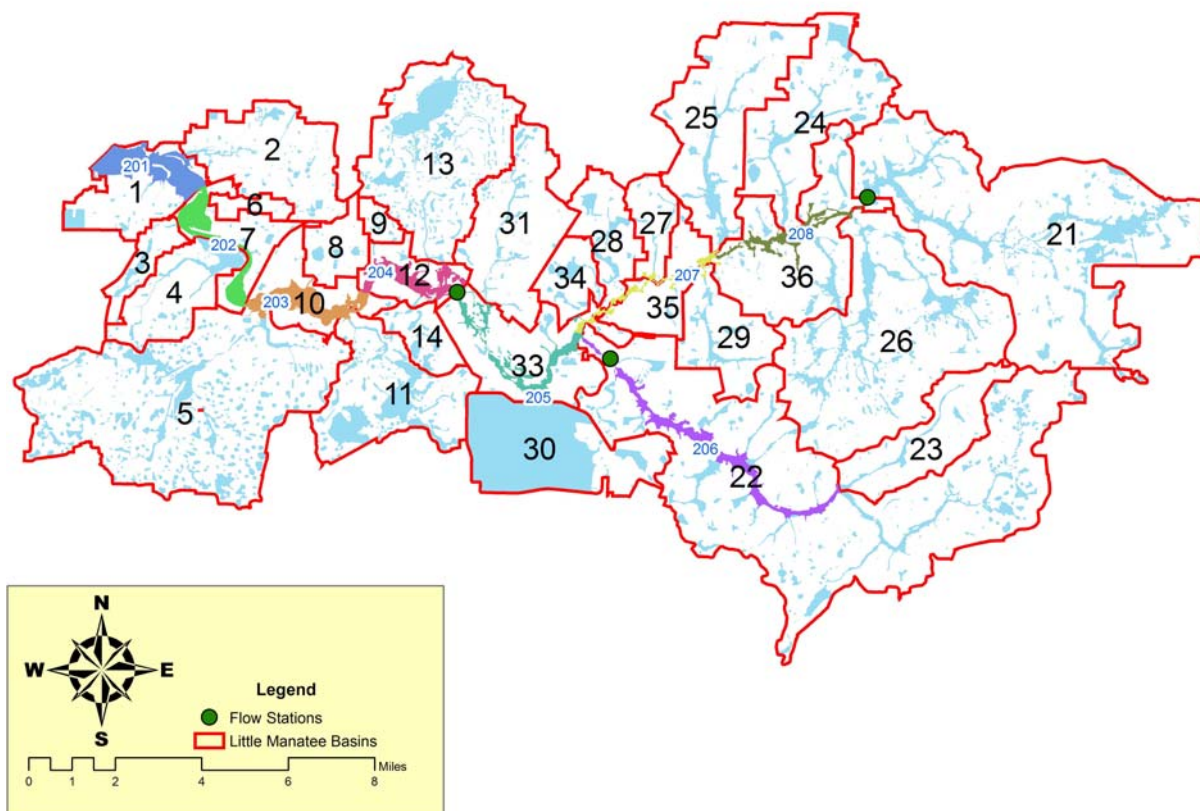


Figure 2 Little Manatee River Basins with Model Subbasins

Basin Land Use

The land use and land cover map (dated 2000) was obtained from the District's online GIS data. The landuse data was used as the best estimate for the spatial coverage of wetlands and lakes which produced the hydrography area used in the model. This area was assumed to act as a storage reservoir and was simulated as such in HSPF (see Model Preparation section below). Prior efforts made an attempt at estimating the wetlands that acted like closed basins. Using a thorough review of the available data it was determined that the amount of closed or conditionally connected reaches was fairly insignificant due to the considerable ditching in the area. The land use map was also utilized to determine the irrigated agricultural areas. The irrigated portion for each basin was simulated as a separate land segment. Separating each basin into multiple land segments allows for better definition of model parameters and boundary conditions (i.e., irrigation inflows are not averaged over the entire basin only over the irrigated agricultural lands). The generalized landuse map is shown in Figure 3. See Appendix A.1 for a table showing the Florida Land Use, Cover and Forms Classification System (FLUCCS) codes

and the generalized land use conditions for each code. Each generalized land use condition was represented in the model as a separate computational element to eliminate gross parameter lumping. Appendix E shows a table of the basin areas (in acres) as simulated in the model.

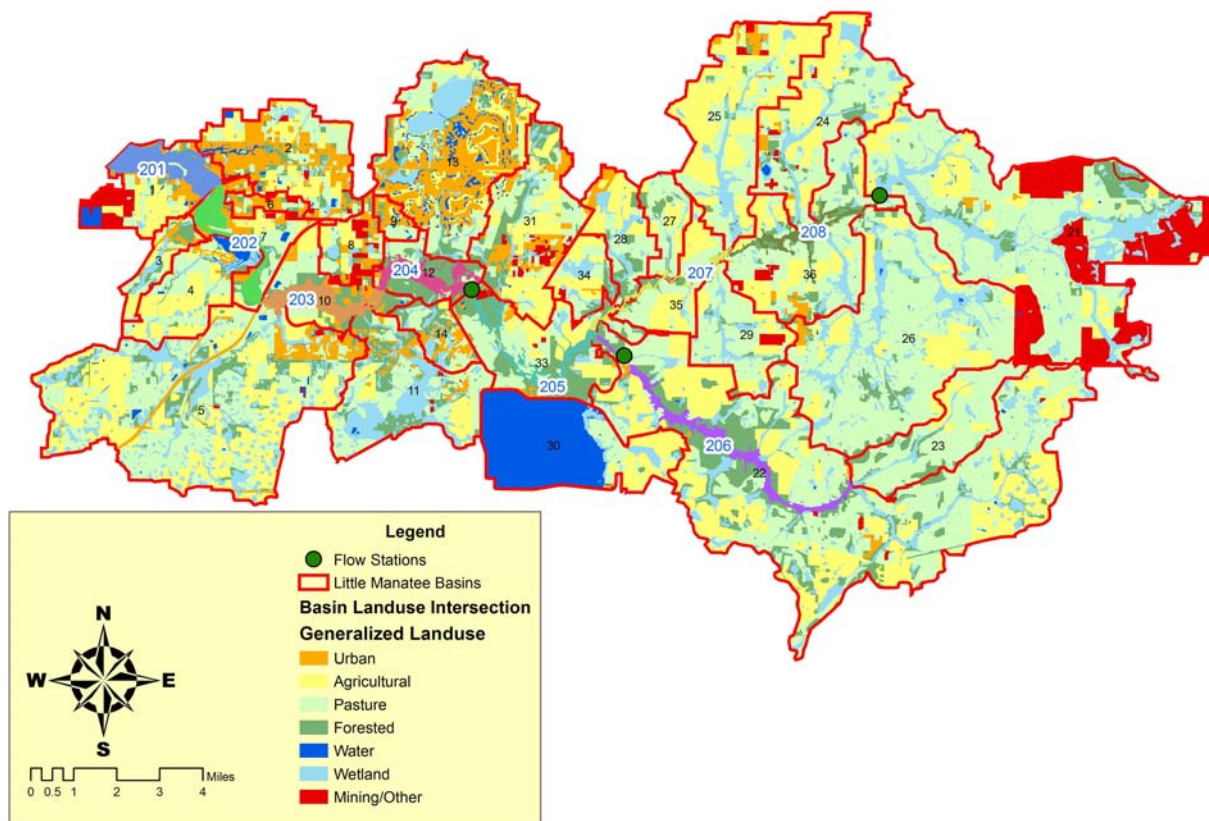


Figure 3 Little Manatee River Basin and Generalized Landuse Map

Basin Slope

The seamless Digital Elevation Model (DEM) data was obtained for the Little Manatee River Basin from USGS. The DEM data was converted to a slope grid in ArcMap. The zonal statistics for each basin was computed using the slope surface. The computed average slope determined from the zonal statistics was used to develop the HSPF data set.

Rainfall

Rainfall data was obtained at various time scales from various agencies including: TBW, SWFWMD, National Oceanic and Atmospheric Association (NOAA), as well as local municipalities (see Figure 4 for a map of station locations and resulting Thiessen polygons; see

Appendix A.2 for a table of rain stations utilized). The daily data was utilized to capture the best definition of the spatial distribution of rainfall. The NOAA 15-minute data were obtained to provide the best temporal distribution. The daily rainfall data, obtained from the SWFWMD, are predominately volunteer data collectors that read standard volumetric rain gages. This data is prone to errors for many reasons (not read, not read on time, zero data mistaken for missing records, etc.). However, the 16 SWFWMD daily rainfall stations represent the best spatial resolution available. Only 3 stations were available from the NOAA 15 Minute data, 1 from the NOAA Summary of the Day data. By averaging all available rain data on a daily basis the best daily volume or basin average is obtained for modeling. This averaging was performed using the area of the Thiessen polygons as a weighting factor (if no data was available the area was excluded from the averaging). The daily volume was then disaggregated into a fifteen-minute time-series for use by the hydrologic model. The disaggregation was performed using the temporal distribution found at the nearest fifteen-minute station (86880 Parrish station, 84797 Lakeland, 84802 Lakeland 2, and 87886 St. Petersburg) that had a similar (+/- 50%) daily total rainfall. If no NOAA 15 minute station fit these criteria, standardized distributions were used (Table 1, Hernandez, 2001). The standard distribution was developed from high frequency rain data collected at USF (Hernandez, 2001). The daily rainfall value for a basin was disaggregated into a 15-minute time series by scaling the precipitation record of the nearest 15-minute station by the proportionate difference in rainfall at the basin. For example, if 1 inch of precipitation was estimated for a basin and the closest 15-minute station recorded 2 inches, each 15-minute record would be scaled by $\frac{1}{2}$ for that basin. The developed rainfall time-series for the Little Manatee River Basin was stored in a model binary data format (WDM) for use by HSPF.

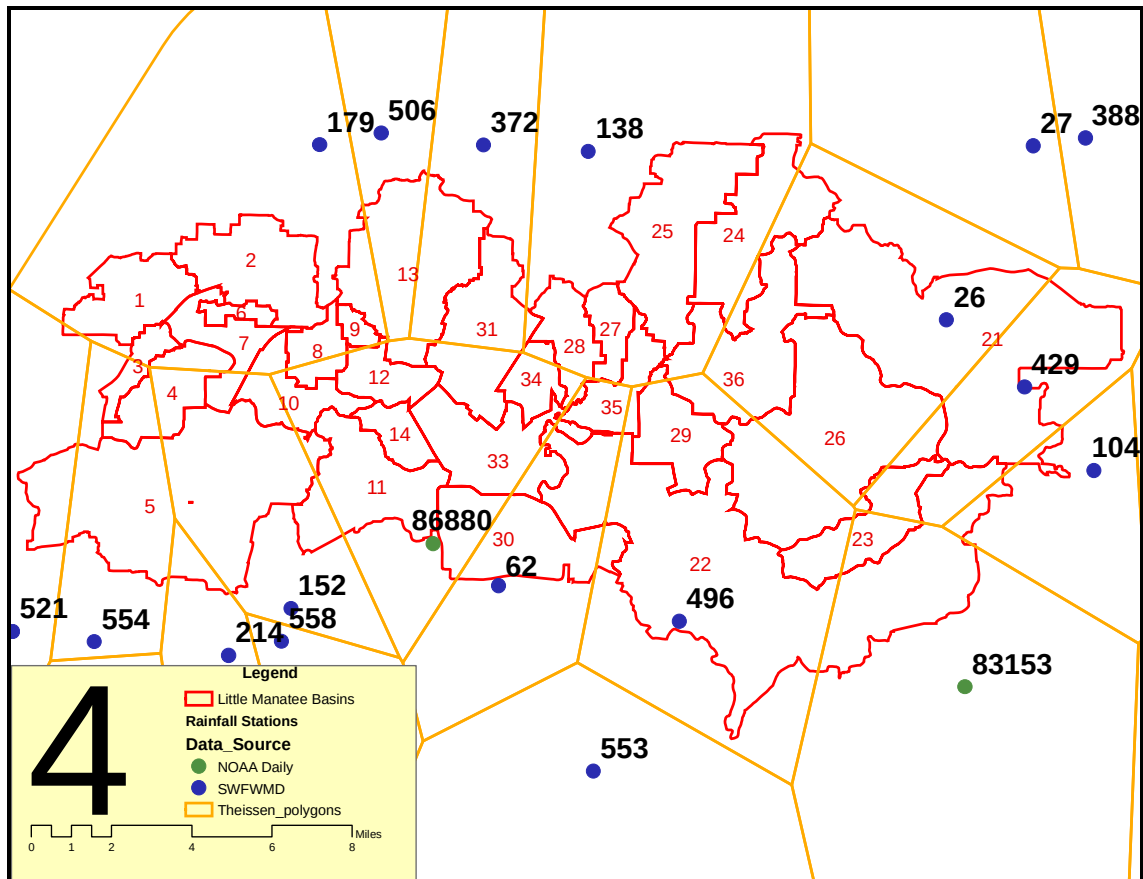


Figure 4 Rain Gage Locations

Table 1 Statistically Defined Rainfall Distributions

		Daily Rainfall Total (inches)			
Rainfall Distribution Fractions	Time of Day	< 0.2	0.2 to 0.4	0.4 to 0.7	> 0.7
	5:15 PM	1	0.15	0.11	0.07
	5:30 PM		0.7	0.11	0.07
	5:45 PM		0.15	0.56	0.07
	6:00 PM			0.11	0.07
	6:15 PM			0.11	0.43
	6:30 PM				0.07
	6:45 PM				0.07
	7:00 PM				0.07
	7:15 PM				0.07

Evaporation

The potential evaporation time-series (daily) was developed from the available pan evaporation data from the Lake Alfred, Moore Haven, and Lisbon NOAA ET stations (see Figure 5 for station locations). Other sources of pan evaporation data were investigated (SWFWMD, TBW, and Manatee Water Supply) but only NOAA data was used in this project. The other sources were too problematic to successfully apply to this study. A hierarchy was set up for the data source for the model. Lake Alfred pan data was the first choice. When Lake Alfred was not available, the missing data was replaced using one of two methods. For short periods of missing data, simple linear interpolation was employed. For longer periods, for example the month of October 1997, the average of two simulated Lake Alfred data (simulated using linear regressions from Lisbon and Moore Haven gage data) was employed. Lake Alfred pan data collection ceased in May 2000, this period was also filled using the average of the two simulated time series. The pan evaporation data was then scaled during the model simulation (HSPF multiplication factor) by a factor of 0.7 to estimate the potential ET of the region. The corrected pan data was stored in WDM binary file format for use by HSPF.

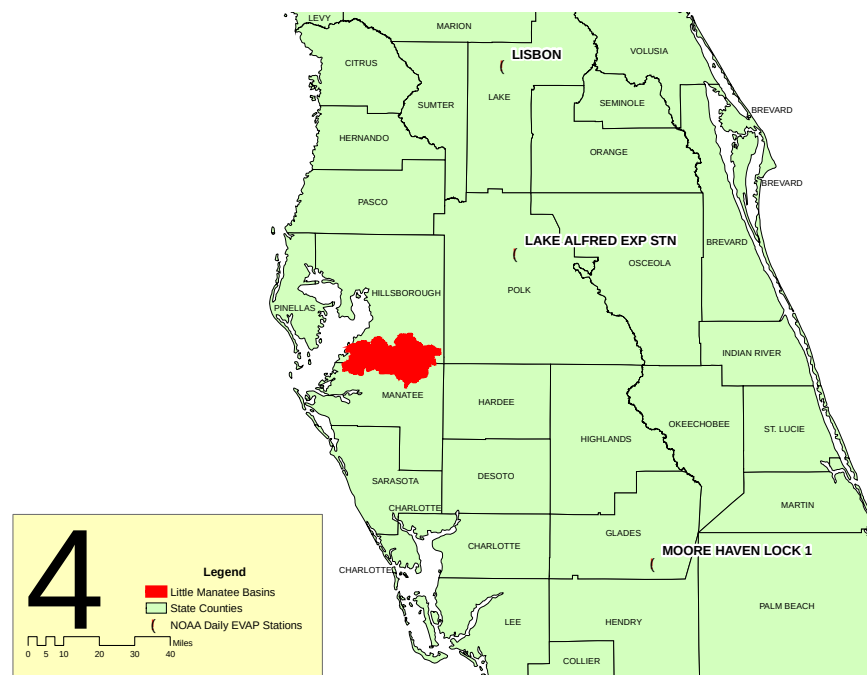


Figure 5 Pan Evaporation Station Locations

Agricultural Irrigation

For detailed water budget analysis of basins heavily impacted by groundwater pumping it is necessary to return groundwater pumping used for irrigation to the surface water system. The groundwater to surface water exchange can have a significant effect on the overall water budget

in agricultural areas especially the low flow conditions. The metered and estimated monthly groundwater-pumping rates were obtained from the District. Agricultural and recreational wells identified by USETYPE codes 'A' and 'R' (respectively) in the SWFWMD well permit database were used to develop the irrigation time series. Irrigated land was identified by selecting areas with a FLUCCS code between 2100 and 2600 as well as 1800. This selection criterion included all irrigated land uses including agriculture and recreation. Recreation was included to account for irrigation on golf courses. Figure 6 shows the irrigation land use polygons with the associated water use points. The water pumped from agricultural wells was then applied to the irrigated land areas within the basins identified as agricultural land use conditions. All agricultural pumping for the month was distributed to all days without significant rainfall (<.5 inches). The developed daily time-series assumed the irrigation volume for the day is applied to the land surface and to interception storage (HSPF Lateral surface inflow [SURLI] and Initial Interception Storage [CEPS] variables) within a four hour application interval from 5:00AM to 9:00AM. The fraction of irrigation delivered to CEPS and SURLI was obtained from the INTB model application. The fraction of drip irrigation and spray irrigation was determined from available data on crop types. The estimated irrigation data was not available for the years 2003 for the calibration period and both 2004 and 2005 for the verification/predictive simulations. These missing years were estimated using representative years. The selection of the representative years were based on a simple analysis using the precipitation time series both annual rainfall totals as well as seasonal totals (using the assumption that irrigation practices would be similar for similar rainfall). The developed time series for each basin is stored in the WDM binary format for use by HSPF.

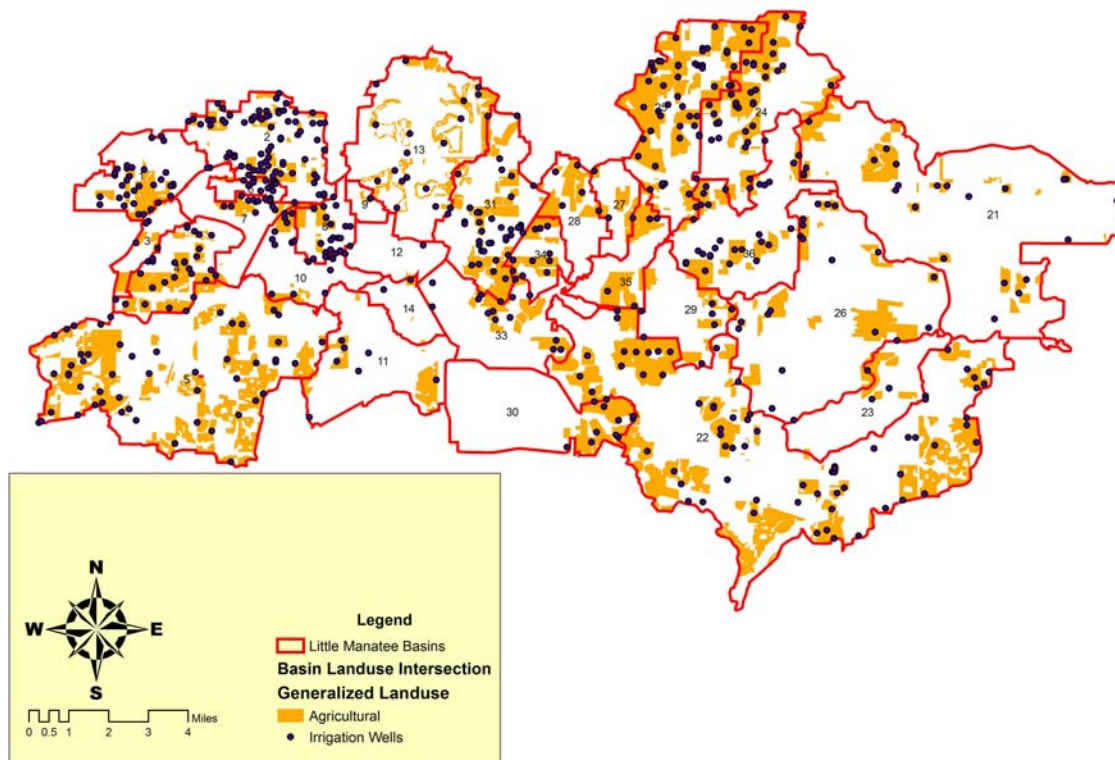


Figure 6 Agricultural Irrigation Land Segments and Water Use Points

Stream Flow

Observed stream flows were obtained from the USGS for three stations: Little Manatee River at Wimauma (USGS station ID 02300100), Little Manatee River at Fort Lonesome (USGS station ID 02300100), and South Fork Little Manatee River near Wimauma (USGS station ID 02300300). The data represents the observed average daily flow. This data was converted to an estimate for runoff and baseflow for calibration and verification comparisons (see following sections). The South Fork Little Manatee River gage was not used for calibration comparison. The time series for this gage started on 10/1/2000. Originally this gage was not included in the calibration due to the short record available. This gage, however, was included in the verification comparisons (see results). Figure 7 shows the Little Manatee River Basin and subbasins with the locations of the USGS gaging stations.

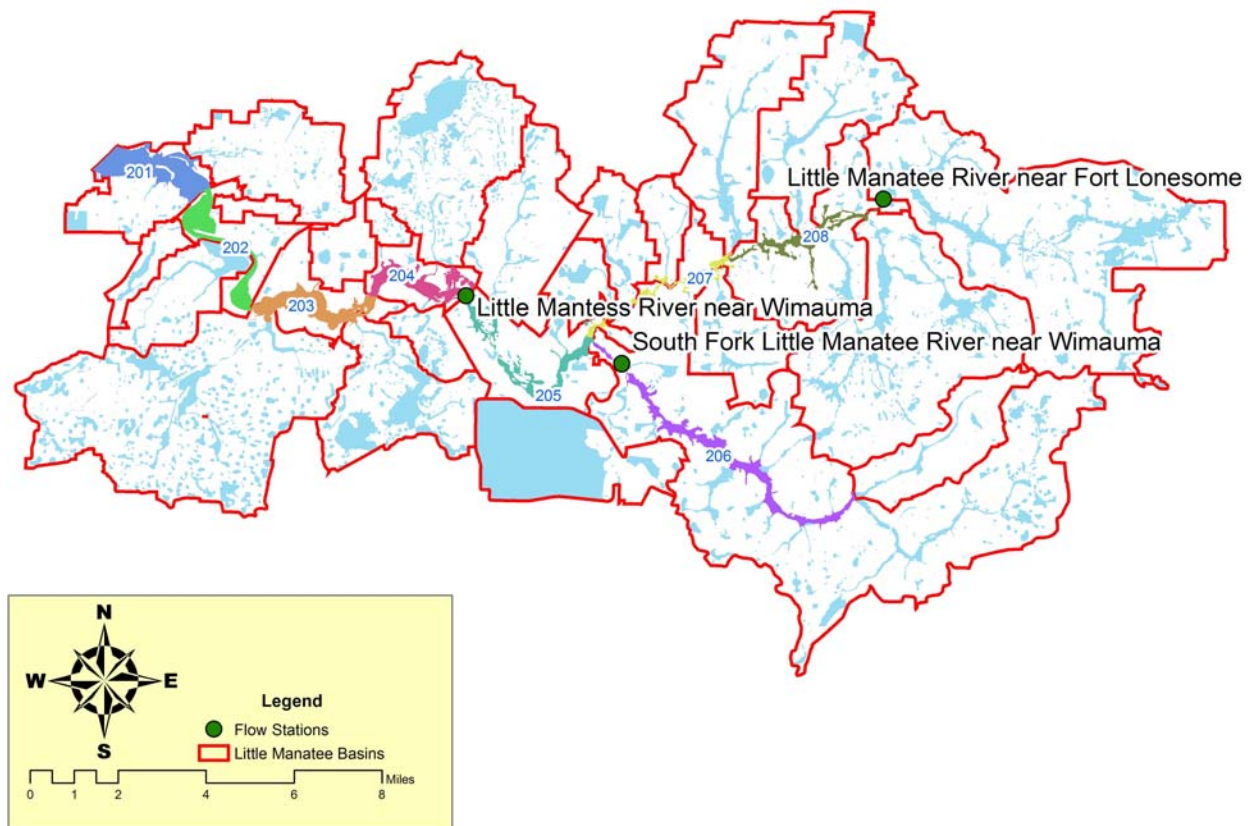


Figure 7 Calibration and Verification Streamflow Gage Locations

Baseflow

Baseflow at each observed streamflow station was estimated using a numerical baseflow separation technique. The technique is described in detail in the Southern District Modeling study (Geurink *et al.* 2001). The method is basically a low pass filter time series filter. This technique was used for both the observed and simulated hydrographs. A separation method was necessary for the observed hydrographs because only total streamflow can be measured. As it is impossible to fully differentiate groundwater flow from surface water flow in a stream flow record, it was desirable to utilize the same procedures on the simulated results so as to make an assessment of the low flow model performance (see results section below).

Florida Progress Water Use

Florida Progress uses a large surface water use permit to supply make up water for their reservoir. The metered water use was obtained from the District. These water use rates were

available only in monthly accumulated totals (million gallons). These monthly rates were converted into a WDM data set and applied as a withdrawal time series to the routing reach 205.

Model Preparation

The HSPF model for the Little Manatee River basin was developed using the spatial data and temporal data collected and processed as described above. The basins were divided into the land segments to preserve the correct parameters and avoid parameter lumping (for example averaging impervious with pervious). The reaches were developed from the land use mapping and the USGS rating tables. This allowed correct representation of the reach storage potential and therefore reach water budget. Details on the model development, calibration, and predictions are included in the sections below.

Integrated Northern Tampa Bay Model

The model developed in this study was built from the existing model parameters that were developed for the Integrated Northern Tampa Bay (INTB) model application (Ruskauff *et al.* 2001). In the INTB model, the Little Manatee basin was represented with 5 basins (see Figure 8). Since the INTB application used the same landuse based calibration the INTB model parameters were used as a starting point for this calibration exercise. Other non landuse based parameters (for example soils based data) were extrapolated from the INTB calibration based on an overlay of the basins.

The Integrated Northern Tampa Bay (INTB) Model was calibrated from 1/1/1989 to 12/31/2000 (Ruskauff *et al.* 2003). This period represented a significant dry period as well as two significant wet periods (1992-1993 and 1997-1998). This large variation in the calibration period is useful to help build confidence in the model's predictive capability for a wide variety of conditions. The INTB model was shown to predict cumulative hydrographs as well as hydrograph peaks and basin annual targets of estimated ET to within acceptable differences for the scale of the problem. The INTB model parameters for the basins that comprised the Little Manatee River (specifically 157, 158, 159, 160, and 161) were used as a starting point for this model. The parameters were further calibrated (see calibration section below).

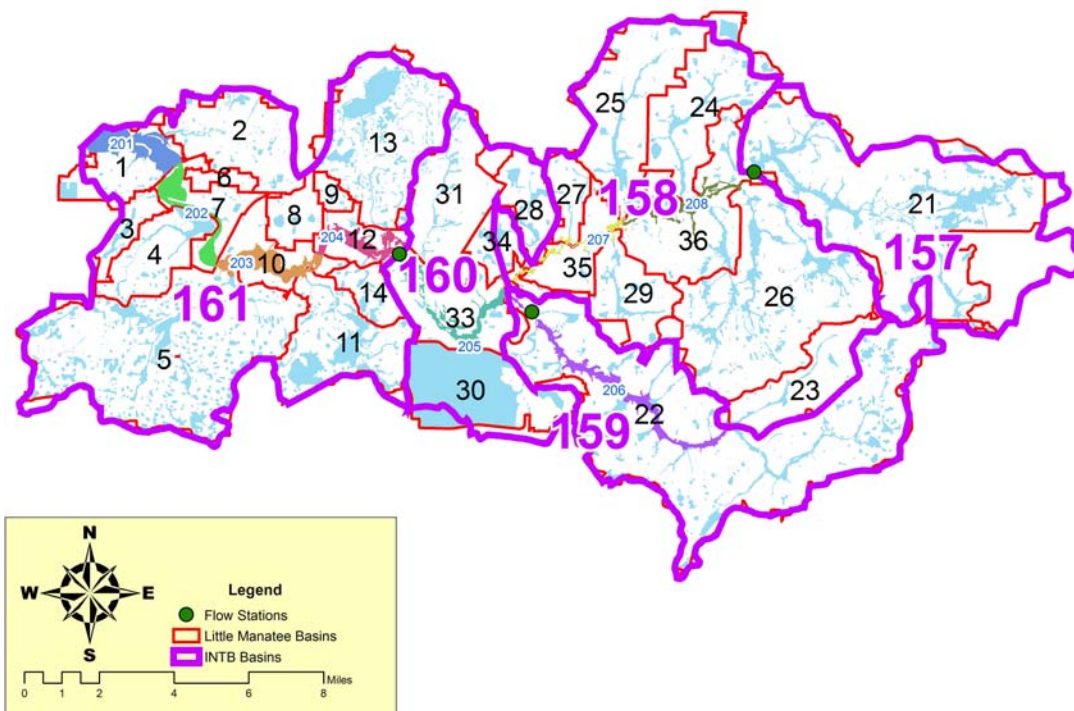


Figure 8 Little Manatee River Subbasins and INTB Basin Overlay

Gaged/Un-Gaged Little Manatee River Basin

As stated previously, the Little Manatee basin for this project was sub-divided into 29 sub-basins (see Figure 2). The 29 subbasins defined the entire Little Manatee basin. The un-gaged portion of the Little Manatee River is represented by 14 of those subbasins while the gaged portion was represented with 15 subbasins. The 29 subbasins were divided into 137 pervious land segments and 28 impervious land segments. Dividing the basins into land segments practically eliminates the parameter lumping typically found in hydrologic models. The resulting operation number in the HSPF data set was set to $\text{BasinID} \times 10 + \text{generalized land use code}$. The generalized land use codes used in the model are listed in Table 2. The landuse and soils parameters for the un-gaged basins were extrapolated from the calibrated parameters from the gaged basins. This extrapolation assumes that the landforms within the basins upstream of the gages are hydraulically similar to the basins downstream of the gages. Unfortunately this is an assumption that is problematic. Moving westward towards Tampa Bay, the amount of development or impervious area, mining effects, and drainage all change dramatically. Nevertheless, it is still the best available information given the lack of measurements and difficulty in making those measurements. Also the downstream basins have generally shallower depth to water table and the water budget may be affected by groundwater discharge zones. Model parameters were adjusted to help account for this but no information or calibration data is available.

The 14 basins that represent the un-gaged portion of the Little Manatee River include: 1) “Lower Little Manatee”, 2) Marsh Branch, 3) “Sun City”, 4) Wildcat Creek, 5) Curiosity Creek, 6) “Fish Hatcheries 1”, 7) Mill Bayou, 8) “Fish Hatcheries 2”, 9) “No Name 1”, 10) Upper “Middle Little Manatee River”, 11) “No Name 2”, 12) “Upper Little Manatee River”, 13) Cypress Creek, and 14) “No Name 3”.

Table 2 Generalized Landuse Codes

Land Use Code	Land Use Description
1	Urban
2	Agricultural
3	Pasture
4	Forested
7	Other/Mining

Model Basin Parameters

Appendix B tabulates model parameters and the entire HSPF model data set used in both the calibration as well as the predictive hydrologic simulations.

Model Reach Parameters

The hydrography or reaches (wetlands, lakes, and streams) play a very significant role in the hydrologic response of the basins in West-Central Florida. The reaches have considerable impact on modifying the basin runoff response to given rainfall events. The storage in these water features attenuates or even completely captures the runoff hydrograph from upland portions of the basin. The available storage capacity before a storm is a function of the antecedent moisture condition. The best way to represent this storage in HSPF is through the Free Flowing Reach or Reservoir (RCHRES) module. In the Little Manatee River Model two types of reaches were utilized to represent the hydrography in the basin: storage attenuation reaches and routing reaches. The storage attenuation reaches were defined as an aggregate of all wetlands and lakes within each of the sub-basin boundaries (one for each sub-basin). The storage attenuation reaches were classified with the basin ID in which they resided therefore the RCHRES operation ID used the same number. The routing reaches were defined as the rivers and associated riparian wetlands that convey the runoff hydrographs from each basin (technically each storage attenuation reach) to the final outfall, Tampa Bay. The routing reaches RCHRES operations were number from 201 to 208 (see figure 2). An additional RCHRES operation was utilized to simplify post-processing. This additional RCHRES (operation ID 300, not shown on any map) is used to accumulate flows from reaches 205 and 31.

In HSPF's RCHRES operations, the non-linear relationship between reach stage, storage volume, and discharge is defined with a table called an F-TABLE. The 2000 land-use map was used as the best available data for defining the spatial extent or the area of the reaches. The area for each reach was defined as a constant for all stages based on the land use mapping. This assumes the mapping represents normal pool extents. The constant area was used to eliminate the possibility of mass balance errors caused by double accounting for areas that may or may not be inundated. If the reach area were allowed to change at different stages, then the basin areas would have to change as well to conserve mass (precipitation times area and ET times area). Standard HSPF does not allow the basin areas to change with time (the reach area would not be available until after the reaches are simulated thus making it an iterative problem). Maintaining constant reach areas does introduce errors. The constant area forces the model to remove potential evaporation and add rainfall over the defined area at all times. When the reach is dry the area that should be represented with full open water potential evaporation should be something less than the defined constant area. This will over-estimate the reach evaporation rates. In turn the inflow volume will be over-estimated for rain event during times of low wetland stage. The high water table (even during dry periods) and the dense vegetation in wetlands will cause the actual ET to approach that of open water evaporation rates. The over-estimation of precipitation inflows will be reduced because the storage volume can include (below the invert of discharge) vadose zone soil storage. The most representative USGS rating or stage-discharge relationship of each observed gage was scaled for each reach based on the ratio between the contributing area to the reach and the contributing area of the gage. The nearest downstream rating was used to define this relationship for each reach. The volumes were then defined as the reach area times the stage (defined again by the scaling the USGS rating condition) times a volume adjustment factor. The volume adjustment factor allowed for a diminishing volume stored at lower stages while exponentially increasing at the higher stages to allow for the extreme volumes stored at high stages. The volume adjustment factors were adjusted to improve the match between observed and simulated stream discharges. This methodology dramatically simplifies the reach calibration while remaining true to the available data.

Model Simulation and Results

The simulation results include a complete water budget for all basins and reaches included in the simulation. For the gaged portion of the basin the simulation results were compared to the observed measurements. After the calibration and extrapolation of the basin and reach parameters, the un-gaged results were generated into time series inflows to the Little Manatee River.

Calibration and Verification Results

Model calibration and verification are necessary and critical steps in any model application. For HSPF, as with any numerical model, calibration is an iterative procedure of parameter evaluation and refinement, as a result of comparing simulated and observed values of interest. It is required for parameters that cannot be deterministically, and uniquely, evaluated from topographic, climatic, edaphic, or physical/chemical characteristics of the watershed and compounds of

interest. Ideally, calibration is based on several years of simulation in order to evaluate parameters under a variety of climatic, soil moisture, and water quality conditions. Calibration should result in parameter values that produce the best overall agreement between simulated and observed values throughout the calibration period while remaining within the bounds of published literature ranges.

Calibration includes the comparison of both monthly and annual values, and individual storm events, whenever sufficient data are available for these comparisons. In addition, when a continuous observed record is available, such as for streamflow, simulated and observed values should be analyzed on a frequency basis and their resulting cumulative distributions compared to assess the model behavior and agreement over the full range of observations. In addition, other calibration targets can include estimates for baseflow, ET, and reach stage or storage.

Model verification is an extension of the calibration process. Its purpose is to assure that the calibrated model properly assesses all the variables and conditions which can affect model results. While there are several approaches to validating a model, perhaps the most effective procedure is to use only a portion of the available record of observed values for calibration; once the final parameter values are developed through calibration, simulation is performed for the remaining period of observed values and goodness-of-fit between recorded and simulated values is reassessed (Donigian, 2002).

The Little Manatee model was calibrated for the period from January 1, 1992 to December 31, 2003. Two long term flow gages (Little Manatee near Wimauma and Little Manatee near Fort Lonesome) were available for this period. The calibration comparisons were made using a variety of graphical and statistical analyses. Graphical plots included cumulative volume as well as arithmetic and logarithmic hydrographs. The cumulative graphs show the running volume comparisons over the calibration period. The arithmetic hydrographs provide an effective comparison of peak flows while the logarithmic hydrographs provide an effective comparison of low flows. Scatter plots of simulated versus observed average daily flows, for the period from January 1, 1992 to September 30, 2005, were also generated giving both a visual and statistical (R^2) measure of model performance. The calibration process also included the use of the HSPF Expert System (HSPEXP). This valuable tool provides statistical analysis of a wide range of model components (peak flows, low flows, recession rates, seasonal variations, etc.).

For model verification (as well as the predictive simulations, see below), the simulation period was extended until September 30, 2005. These additional years were required to predict the inflows to the Little Manatee River during which river salinities were collected. Using this period for verification also provided an additional observed flow record (South Fork Little Manatee near Ft Lonesome) for model comparison (there was not enough useful data at this station for use in calibration).

The calibration and verification results were considered reasonable estimates of total streamflow for all the gaging stations considering the scale of the application and the uncertainty of hydrologic input and hydrologic processes. The calibration comparisons for each flow gage are shown in Appendix C.

Predictive Simulation Results

Predictive simulations were performed on the basins that were not gaged. The un-gaged portion of the Little Manatee River is represented by 14 individual time series. These time series of flow enter the Little Manatee River as either a point source or non-point source. The un-gaged basins are shown in Figure 9. The hydro-dynamic model domain is required in order to determine the locations for the application of the time series.

The time series of streamflow discharges for the 14 basins were generated for the period 1989-2005 and were transmitted in electronic file format to the District for use in the salinity model. Running hydrographs for each ungaged basin are shown in Appendix D.

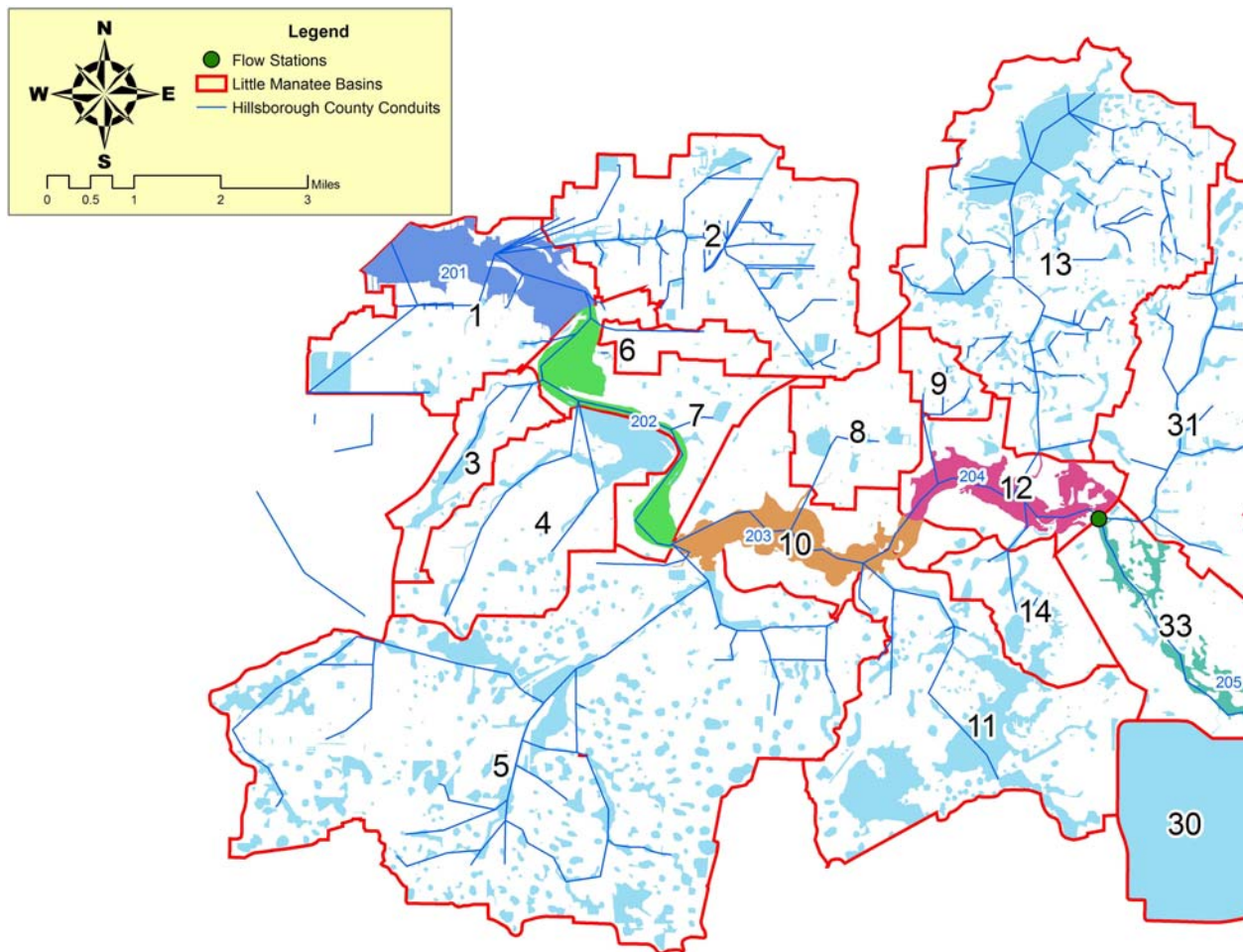


Figure 9 Ungaged Subbasins of the Little Manatee River Watershed

Recommendations

This project estimated the un-gaged flows into the Little Manatee River. Confidence in the estimate is modest given limitations in rainfall measurement, lack of regional groundwater

discharges, and inadequacies in calibration extrapolation. However, to date it is the best available estimate given these data inadequacies and the limited scope of this effort. Shortcomings in the results include (in no particular order of significance):

1. Observed stream flow estimates. Confidence in the model performance would greatly increase if more observations were available for tributaries of the un-gaged portion of the basin. Ideally gages would record hydrologic response from basins with a single predominant landform. This would isolate the processes and improve model calibration.
2. Rainfall estimates. Rainfall is the most important component of the water budget. It is also the easiest to measure at a point. To best observe the spatial distribution of the storm many rain gages are necessary. Also, for surface water modeling, finer temporal distribution is required. Model performance can be significantly increased by a more thorough review of the single most significant component of the water budget: rain fall. Suspected data gaps and accumulation errors plague the daily rainfall dataset (e.g., cooperators either does not read the rain gage or accumulated the past several days together). These errors can usually be identified, but it is a time consuming task. Also, a new source of rain data has been recently made available. The radar rain or raster rain utilizes Doppler radar to detect rainfall quantities on a 2km x 2km grid. The district has recently purchased the data. The radar rain can be readily processed into input for the HSPF surface water model of the Little Manatee River.
3. Integrated surface/ groundwater modeling. Considerable thought should be given towards using an integrated surface / groundwater model to better estimate the ungaged flows. Given the coastal proximity of this part of the basin it is, understandably, heavily influenced by regional groundwater discharges which impact the surface water budget through maintaining higher water table heads thereby generating more runoff, baseflow and ET. These regional groundwater discharges can be at times (especially during dry periods) a significant inflow to the Manatee River.

REFERENCES

- Geurink, J., Nachabe, M., Ross, M., Tara, P. (2001). "Development of Interfacial Boundary Conditions for the Southern District Ground Water Model of the Southwest Florida Water Management District." University of South Florida.
- Tara, P.D., Trout, K., Vomacka, J., Ross, M.A., Stewart, M. (2000). "Hydrologic Investigation of the Phosphate Mined Upper Saddle Creek Watershed, West-Central Florida." University of South Florida.
- Hernandez T., (2001). "Rainfall-Runoff Modeling in Humid Shallow Water Table Environments." Masters Thesis, University of South Florida.
- Tara, P.D., Rokicki, R., Trout, K., Ross, M.A. (2002). "Estimating the Un-Gaged Flows in the Alafia River." University of South Florida.
- Ruskauff, G., Aly, A., Tara, P., (2004), "Integrated Northern Tampa Bay an Application of the IHM." INTERA.
- Donigian, A.S. Jr. (2002) "Watershed Model Calibration and Validation: The HSPF Experience." WEF National TMDL Science and Policy 2002, November 13-16, 2002. Phoenix, AZ. WEF Specialty Conference Proceedings on CD-ROM.

APPENDICES

APPENDIX A.1 Land Use Codes within the Little Manatee River Basin

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	1
1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	1
1300	RESIDENTIAL HIGH DENSITY	1
1400	COMMERCIAL AND SERVICES	1
1500	INDUSTRIAL	1
1600	EXTRACTIVE	7
1700	INSTITUTIONAL	1
1800	RECREATIONAL	2
1900	OPEN LAND	3
2100	CROPLAND AND PASTURELAND	3
2140	ROW CROPS	2
2200	TREE CROPS	2
2300	FEEDING OPERATIONS	2
2400	NURSERIES AND VINEYARDS	2
2440	VINEYARDS	2
2500	SPECIALTY FARMS	7
2550	TROPICAL FISH FARMS	7

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
2600	OTHER OPEN LANDS	3
3100	HERBACEOUS	3
3200	SHRUB AND BRUSHLAND	3
3300	MIXED RANGELAND	3
4100	UPLAND CONIFEROUS FOREST	4
4110	PINE FLATWOODS	4
4200	UPLAND HARDWOOD FORESTS - PART 1	4
4340	HARDWOOD CONIFER MIXED	4
4400	TREE PLANTATIONS	4
5100	STREAMS AND WATERWAYS	5
5200	LAKES	5
5300	RESERVOIRS	5
5400	BAYS AND ESTUARIES	5
6110	BAY SWAMPS	6
6120	MANGROVE SWAMPS	6
6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	6
6200	WETLAND CONIFEROUS FORESTS	6
6210	CYPRESS	6
6300	WETLAND FORESTED MIXED	6
6400	VEGETATED NON-FORESTED WETLANDS	6

FLUCCSCODE	FLUCSDESC	Generalized Land Use Code
6410	FRESHWATER MARSHES	6
6420	SALTWATER MARSHES	6
6430	WET PRAIRIES	6
6440	EMERGENT AQUATIC VEGETATION	6
6500	NON-VEGETATED	6
6510	TIDAL FLATS/SUBMERGED SHALLOW PLATFORM	6
6520	SHORELINES	6
6530	INTERMITTENT PONDS	6
7400	DISTURBED LAND	7
8100	TRANSPORTATION	1
8200	COMMUNICATIONS	1
8300	UTILITIES	1

APPENDIX A.2 Rain Stations Used to Develop Model Data Time Series

Site	UIDSITENAM	Type	LAT	LONG	Data Source	Min Date	Max Date
5	KINGSFORD	RAIN	27.7975	-82.0019	SWFWMD	1/1/1990	5/31/2003
26	HERRING	RAIN	27.6998	-82.1421	SWFWMD	1/1/1982	2/28/1999
27	ROMP 49 BALM PARK	RAIN	27.7631	-82.1074	SWFWMD	8/1/1989	9/3/2005
62	FP & L	RAIN	27.6017	-82.3232	SWFWMD	1/1/1988	4/30/2000
104	FOUR CORNERS MINE	RAIN	27.6456	-82.0816	SWFWMD	9/1/1978	5/31/2003
138	WIMAUMA	RAIN	27.7595	-82.2885	SWFWMD	1/1/1981	7/31/1993
152	BLISS TOWER	RAIN	27.5925	-82.4074	SWFWMD	10/1/1975	7/31/1996
172	FORT GREEN	RAIN	27.6731	-81.9883	SWFWMD	10/1/1975	5/31/2003
179	RUSKIN	RAIN	27.7609	-82.3980	SWFWMD	5/1/1976	9/30/2000
214	PARRISH NWS	RAIN	27.5753	-82.4327	SWFWMD	1/1/1958	12/31/2004
254	RG-3 C & F INDUSTRIES	RAIN	27.5628	-81.9938	SWFWMD	1/1/1976	4/30/2005
372	BROWN TOWER	RAIN	27.7614	-82.3313	SWFWMD	7/1/1970	4/30/1998
388	WIMAUMA AIRPORT	RAIN	27.7661	-82.0863	SWFWMD	8/1/1993	10/2/2005
427	ROMP 40 FOUR CORNERS	RAIN	27.6478	-82.0460	SWFWMD	6/27/1992	7/17/2005
429	ROMP 123 STARLING	RAIN	27.6756	-82.1102	SWFWMD	1/2/1992	7/17/2005
496	ROMP 39 OAK KNOLL	RAIN	27.5895	-82.2496	SWFWMD	8/15/1999	7/17/2005
506	ROMP TR 9-2 APOLLO BEACH	RAIN	27.7653	-82.3730	SWFWMD	8/6/1999	7/17/2005
521	ROMP TR 8-1 RUBONIA	RAIN	27.5831	-82.5205	SWFWMD	4/11/2000	7/17/2005
553	GAMBLE CREEK	RAIN	27.5348	-82.2839	SWFWMD	3/6/2001	7/17/2005
554	FROG CREEK	RAIN	27.5797	-82.4872	SWFWMD	8/16/2000	7/16/2005
555	GOVERNMENT HAMMOCK	RAIN	27.5347	-82.4968	SWFWMD	4/4/2001	7/17/2005
558	PARRISH CEMETERY	RAIN	27.5806	-82.4111	SWFWMD	1/1/2001	5/31/2005

83153	FORT GREEN 12 WSW	RAIN	27.5667	-82.1333	NOAA daily	1/1/1989	7/31/2005
86880	PARRISH	RAIN	27.6167	-82.3500	NOAA daily	1/1/1989	7/31/2005
86880	PARRISH	RAIN	27.6167	-82.3500	NOAA 15-minute	1/1/1989	6/1/2005
84797	LAKELAND	RAIN	28.0167	-81.9167	NOAA 15-minute	1/1/1980	5/1/2003
84802	LAKELAND 2	RAIN	27.9833	-82.0167	NOAA 15-minute	11/1/2001	6/1/2005
87886	ST PETERSBURG WHITTD	RAIN	27.7667	-82.6333	NOAA 15-minute	1/1/1989	6/1/2005

APPENDIX B Model Dataset

RUN

GLOBAL

LittleManatee, Base5 scen, dec. LZETP, inc. INFILT
 START 1992/ 1/01 00:00 END 2005/ 9/30 24:00
 RUN INTERP OUTPT LEVELS 5 0
 RESUME 0 RUN 1 UNITS 1

END GLOBAL

FILES

<FILE> <UN#>***<---FILE NAME----->
 MESSU 24 Base6.ech
 91 Base6.out
 WDM1 25 Base6.wdm
 WDM2 26 LManPred.wdm
 BINO 92 Final.hbn
 END FILES

OPN SEQUENCE

INGRP INDELT 00:15

PERLND 11
 PERLND 12
 PERLND 13
 PERLND 14
 PERLND 17
 IMPLND 11
 PERLND 21
 PERLND 22
 PERLND 23
 PERLND 24
 PERLND 27
 IMPLND 21
 PERLND 31
 PERLND 32
 PERLND 33
 PERLND 34
 PERLND 37
 IMPLND 31
 PERLND 41
 PERLND 42
 PERLND 43
 PERLND 44
 IMPLND 41
 PERLND 51
 PERLND 52
 PERLND 53
 PERLND 54
 PERLND 57
 IMPLND 51
 PERLND 61
 PERLND 62
 PERLND 63
 PERLND 64
 PERLND 67
 IMPLND 61
 PERLND 71
 PERLND 72
 PERLND 73
 PERLND 74
 PERLND 77
 IMPLND 71
 PERLND 81

PERLND 82
 PERLND 83
 PERLND 84
 PERLND 87
 IMPLND 81
 PERLND 91
 PERLND 92
 PERLND 93
 PERLND 94
 IMPLND 91
 PERLND 101
 PERLND 102
 PERLND 103
 PERLND 104
 PERLND 107
 IMPLND 101
 PERLND 111
 PERLND 112
 PERLND 113
 PERLND 114
 PERLND 117
 IMPLND 111
 PERLND 121
 PERLND 122
 PERLND 123
 PERLND 124
 PERLND 127
 IMPLND 121
 PERLND 131
 PERLND 132
 PERLND 133
 PERLND 134
 PERLND 137
 IMPLND 131
 PERLND 141
 PERLND 142
 PERLND 143
 PERLND 144
 IMPLND 141
 PERLND 211
 PERLND 212
 PERLND 213
 PERLND 214
 PERLND 217
 IMPLND 211
 PERLND 221
 PERLND 222
 PERLND 223
 PERLND 224
 PERLND 227
 IMPLND 221
 PERLND 231
 PERLND 232
 PERLND 233
 PERLND 234
 PERLND 237
 IMPLND 231
 PERLND 241
 PERLND 242
 PERLND 243
 PERLND 244
 PERLND 247

*Estimating the Un-Gaged Inflows in the
 Little Manatee River Basin, Florida
 March 2006*



```

IMPLND 241
PERLND 251
PERLND 252
PERLND 253
PERLND 254
PERLND 257
IMPLND 251
PERLND 261
PERLND 262
PERLND 263
PERLND 264
PERLND 267
IMPLND 261
PERLND 271
PERLND 272
PERLND 273
PERLND 274
IMPLND 271
PERLND 281
PERLND 282
PERLND 283
PERLND 284
IMPLND 281
PERLND 292
PERLND 293
PERLND 294
PERLND 297
PERLND 301
PERLND 302
PERLND 303
PERLND 304
IMPLND 301
PERLND 311
PERLND 312
PERLND 313
PERLND 314
PERLND 317
IMPLND 311
PERLND 331
PERLND 332
PERLND 333
PERLND 334
PERLND 337
IMPLND 331
PERLND 341
PERLND 342
PERLND 343
PERLND 344
PERLND 347
IMPLND 341
PERLND 351
PERLND 352
PERLND 353
PERLND 354
IMPLND 351
PERLND 361
PERLND 362
PERLND 363
PERLND 364
PERLND 367
IMPLND 361
RCHRES 1
RCHRES 2
RCHRES 3
RCHRES 4
RCHRES 5
RCHRES 6
RCHRES 7

```

```

RCHRES 8
RCHRES 9
RCHRES 10
RCHRES 11
RCHRES 12
RCHRES 13
RCHRES 14
RCHRES 21
RCHRES 22
RCHRES 23
RCHRES 24
RCHRES 25
RCHRES 26
RCHRES 27
RCHRES 28
RCHRES 29
RCHRES 30
RCHRES 31
RCHRES 33
RCHRES 34
RCHRES 35
RCHRES 36
RCHRES 206
RCHRES 208
RCHRES 207
RCHRES 205
RCHRES 300
RCHRES 204
RCHRES 203
RCHRES 202
RCHRES 201
COPY 1
COPY 2
END INGRP
END OPN SEQUENCE

PERLND
ACTIVITY
*** <PLS >
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
11 367 0 0 1 0 0 0 0 0 0 0 0 0
END ACTIVITY

PRINT-INFO
*** < PLS>
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC PIVL PYR
11 367 4 4 5 4 4 4 4 4 4 4 4 1 12
END PRINT-INFO

BINARY-INFO
*** < PLS>
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC PIVL PYR
11 367 4 4 4 4 4 4 4 4 4 4 4 1 12
END BINARY-INFO

GEN-INFO
***
*** <PLS >
*** x - x
11 Urban
12 Irrigated Land
13 Grass/Pasture
14 Forested
17 Mining/Other
21 Urban
22 Irrigated Land
23 Grass/Pasture
24 Forested

```

Unit-systems		Printer	BinaryOut
t-series	Engl Metr	Engl Metr	Engl Metr
in out			
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92
1 1	91	0	92



27	Mining/Other	1	1	91	0	92	0
31	Urban	1	1	91	0	92	0
32	Irrigated Land	1	1	91	0	92	0
33	Grass/Pasture	1	1	91	0	92	0
34	Forested	1	1	91	0	92	0
37	Mining/Other	1	1	91	0	92	0
41	Urban	1	1	91	0	92	0
42	Irrigated Land	1	1	91	0	92	0
43	Grass/Pasture	1	1	91	0	92	0
44	Forested	1	1	91	0	92	0
51	Urban	1	1	91	0	92	0
52	Irrigated Land	1	1	91	0	92	0
53	Grass/Pasture	1	1	91	0	92	0
54	Forested	1	1	91	0	92	0
57	Mining/Other	1	1	91	0	92	0
61	Urban	1	1	91	0	92	0
62	Irrigated Land	1	1	91	0	92	0
63	Grass/Pasture	1	1	91	0	92	0
64	Forested	1	1	91	0	92	0
67	Mining/Other	1	1	91	0	92	0
71	Urban	1	1	91	0	92	0
72	Irrigated Land	1	1	91	0	92	0
73	Grass/Pasture	1	1	91	0	92	0
74	Forested	1	1	91	0	92	0
77	Mining/Other	1	1	91	0	92	0
81	Urban	1	1	91	0	92	0
82	Irrigated Land	1	1	91	0	92	0
83	Grass/Pasture	1	1	91	0	92	0
84	Forested	1	1	91	0	92	0
87	Mining/Other	1	1	91	0	92	0
91	Urban	1	1	91	0	92	0
92	Irrigated Land	1	1	91	0	92	0
93	Grass/Pasture	1	1	91	0	92	0
94	Forested	1	1	91	0	92	0
101	Urban	1	1	91	0	92	0
102	Irrigated Land	1	1	91	0	92	0
103	Grass/Pasture	1	1	91	0	92	0
104	Forested	1	1	91	0	92	0
107	Mining/Other	1	1	91	0	92	0
111	Urban	1	1	91	0	92	0
112	Irrigated Land	1	1	91	0	92	0
113	Grass/Pasture	1	1	91	0	92	0
114	Forested	1	1	91	0	92	0
117	Mining/Other	1	1	91	0	92	0
121	Urban	1	1	91	0	92	0
122	Irrigated Land	1	1	91	0	92	0
123	Grass/Pasture	1	1	91	0	92	0
124	Forested	1	1	91	0	92	0
127	Mining/Other	1	1	91	0	92	0
131	Urban	1	1	91	0	92	0
132	Irrigated Land	1	1	91	0	92	0
133	Grass/Pasture	1	1	91	0	92	0
134	Forested	1	1	91	0	92	0
137	Mining/Other	1	1	91	0	92	0
141	Urban	1	1	91	0	92	0
142	Irrigated Land	1	1	91	0	92	0
143	Grass/Pasture	1	1	91	0	92	0
144	Forested	1	1	91	0	92	0
211	Urban	1	1	91	0	92	0
212	Irrigated Land	1	1	91	0	92	0
213	Grass/Pasture	1	1	91	0	92	0
214	Forested	1	1	91	0	92	0
217	Mining/Other	1	1	91	0	92	0
221	Urban	1	1	91	0	92	0
222	Irrigated Land	1	1	91	0	92	0
223	Grass/Pasture	1	1	91	0	92	0
224	Forested	1	1	91	0	92	0
227	Mining/Other	1	1	91	0	92	0

231	Urban	1	1	91	0	92	0
232	Irrigated Land	1	1	91	0	92	0
233	Grass/Pasture	1	1	91	0	92	0
234	Forested	1	1	91	0	92	0
237	Mining/Other	1	1	91	0	92	0
241	Urban	1	1	91	0	92	0
242	Irrigated Land	1	1	91	0	92	0
243	Grass/Pasture	1	1	91	0	92	0
244	Forested	1	1	91	0	92	0
247	Mining/Other	1	1	91	0	92	0
251	Urban	1	1	91	0	92	0
252	Irrigated Land	1	1	91	0	92	0
253	Grass/Pasture	1	1	91	0	92	0
254	Forested	1	1	91	0	92	0
257	Mining/Other	1	1	91	0	92	0
261	Urban	1	1	91	0	92	0
262	Irrigated Land	1	1	91	0	92	0
263	Grass/Pasture	1	1	91	0	92	0
264	Forested	1	1	91	0	92	0
267	Mining/Other	1	1	91	0	92	0
271	Urban	1	1	91	0	92	0
272	Irrigated Land	1	1	91	0	92	0
273	Grass/Pasture	1	1	91	0	92	0
274	Forested	1	1	91	0	92	0
281	Urban	1	1	91	0	92	0
282	Irrigated Land	1	1	91	0	92	0
283	Grass/Pasture	1	1	91	0	92	0
284	Forested	1	1	91	0	92	0
292	Irrigated Land	1	1	91	0	92	0
293	Grass/Pasture	1	1	91	0	92	0
294	Forested	1	1	91	0	92	0
297	Mining/Other	1	1	91	0	92	0
301	Urban	1	1	91	0	92	0
302	Irrigated Land	1	1	91	0	92	0
303	Grass/Pasture	1	1	91	0	92	0
304	Forested	1	1	91	0	92	0
311	Urban	1	1	91	0	92	0
312	Irrigated Land	1	1	91	0	92	0
313	Grass/Pasture	1	1	91	0	92	0
314	Forested	1	1	91	0	92	0
317	Mining/Other	1	1	91	0	92	0
331	Urban	1	1	91	0	92	0
332	Irrigated Land	1	1	91	0	92	0
333	Grass/Pasture	1	1	91	0	92	0
334	Forested	1	1	91	0	92	0
337	Mining/Other	1	1	91	0	92	0
341	Urban	1	1	91	0	92	0
342	Irrigated Land	1	1	91	0	92	0
343	Grass/Pasture	1	1	91	0	92	0
344	Forested	1	1	91	0	92	0
347	Mining/Other	1	1	91	0	92	0
351	Urban	1	1	91	0	92	0
352	Irrigated Land	1	1	91	0	92	0
353	Grass/Pasture	1	1	91	0	92	0
354	Forested	1	1	91	0	92	0
361	Urban	1	1	91	0	92	0
362	Irrigated Land	1	1	91	0	92	0
363	Grass/Pasture	1	1	91	0	92	0
364	Forested	1	1	91	0	92	0
367	Mining/Other	1	1	91	0	92	0

END GEN-INFO

PWAT-PARM1

*** <PLS >

*** x -	x	CSNO	RTOP	UZFG	VCS	VUZ	VNN	VIFW	VIRC	VLE	IFFC	HWT	IRRG	IFRD
11		0	1	1	1	0	0	0	0	1	1	0	0	0
12		0	1	1	1	0	0	0	0	1	1	0	1	0
13	17	0	1	1	1	0	0	0	0	1	1	0	0	0

```

21      0 1 1 1 0 0 0 0 1 1 0 0 0
22      0 1 1 1 0 0 0 0 1 1 0 1 0
23 27    0 1 1 1 0 0 0 0 1 1 0 0 0
31      0 1 1 1 0 0 0 0 1 1 0 0 0
32      0 1 1 1 0 0 0 0 1 1 0 1 0
33 37    0 1 1 1 0 0 0 0 1 1 0 0 0
41      0 1 1 1 0 0 0 0 1 1 0 0 0
42      0 1 1 1 0 0 0 0 1 1 0 1 0
43 47    0 1 1 1 0 0 0 0 1 1 0 0 0
51      0 1 1 1 0 0 0 0 1 1 0 0 0
52      0 1 1 1 0 0 0 0 1 1 0 1 0
53 57    0 1 1 1 0 0 0 0 1 1 0 0 0
61      0 1 1 1 0 0 0 0 1 1 0 0 0
62      0 1 1 1 0 0 0 0 1 1 0 1 0
63 67    0 1 1 1 0 0 0 0 1 1 0 0 0
71      0 1 1 1 0 0 0 0 1 1 0 0 0
72      0 1 1 1 0 0 0 0 1 1 0 1 0
73 77    0 1 1 1 0 0 0 0 1 1 0 0 0
81      0 1 1 1 0 0 0 0 1 1 0 0 0
82      0 1 1 1 0 0 0 0 1 1 0 1 0
83 87    0 1 1 1 0 0 0 0 1 1 0 0 0
91      0 1 1 1 0 0 0 0 1 1 0 0 0
92      0 1 1 1 0 0 0 0 1 1 0 1 0
93 97    0 1 1 1 0 0 0 0 1 1 0 0 0
101     0 1 1 1 0 0 0 0 1 1 0 0 0
102     0 1 1 1 0 0 0 0 1 1 0 1 0
103 107   0 1 1 1 0 0 0 0 1 1 0 0 0
111     0 1 1 1 0 0 0 0 1 1 0 0 0
112     0 1 1 1 0 0 0 0 1 1 0 1 0
113 117   0 1 1 1 0 0 0 0 1 1 0 0 0
121     0 1 1 1 0 0 0 0 1 1 0 0 0
122     0 1 1 1 0 0 0 0 1 1 0 1 0
123 127   0 1 1 1 0 0 0 0 1 1 0 0 0
131     0 1 1 1 0 0 0 0 1 1 0 0 0
132     0 1 1 1 0 0 0 0 1 1 0 1 0
133 137   0 1 1 1 0 0 0 0 1 1 0 0 0
141     0 1 1 1 0 0 0 0 1 1 0 0 0
142     0 1 1 1 0 0 0 0 1 1 0 1 0
143 147   0 1 1 1 0 0 0 0 1 1 0 0 0
211     0 1 1 1 0 0 0 0 1 1 0 0 0
212     0 1 1 1 0 0 0 0 1 1 0 1 0
213 217   0 1 1 1 0 0 0 0 1 1 0 0 0
221     0 1 1 1 0 0 0 0 1 1 0 0 0
222     0 1 1 1 0 0 0 0 1 1 0 1 0
223 227   0 1 1 1 0 0 0 0 1 1 0 0 0
231     0 1 1 1 0 0 0 0 1 1 0 0 0
232     0 1 1 1 0 0 0 0 1 1 0 1 0
233 237   0 1 1 1 0 0 0 0 1 1 0 0 0
241     0 1 1 1 0 0 0 0 1 1 0 0 0
242     0 1 1 1 0 0 0 0 1 1 0 1 0
243 247   0 1 1 1 0 0 0 0 1 1 0 0 0
251     0 1 1 1 0 0 0 0 1 1 0 0 0
252     0 1 1 1 0 0 0 0 1 1 0 1 0
253 257   0 1 1 1 0 0 0 0 1 1 0 0 0
261     0 1 1 1 0 0 0 0 1 1 0 0 0
262     0 1 1 1 0 0 0 0 1 1 0 1 0
263 267   0 1 1 1 0 0 0 0 1 1 0 0 0
271     0 1 1 1 0 0 0 0 1 1 0 0 0
272     0 1 1 1 0 0 0 0 1 1 0 1 0
273 277   0 1 1 1 0 0 0 0 1 1 0 0 0
281     0 1 1 1 0 0 0 0 1 1 0 0 0
282     0 1 1 1 0 0 0 0 1 1 0 1 0
283 287   0 1 1 1 0 0 0 0 1 1 0 0 0
291     0 1 1 1 0 0 0 0 1 1 0 0 0
292     0 1 1 1 0 0 0 0 1 1 0 1 0
293 297   0 1 1 1 0 0 0 0 1 1 0 0 0
301     0 1 1 1 0 0 0 0 1 1 0 0 0
302     0 1 1 1 0 0 0 0 1 1 0 1 0

```

```

303 307   0 1 1 1 0 0 0 0 1 1 0 0 0
311     0 1 1 1 0 0 0 0 1 1 0 0 0
312     0 1 1 1 0 0 0 0 1 1 0 1 0
313 317   0 1 1 1 0 0 0 0 1 1 0 0 0
331     0 1 1 1 0 0 0 0 1 1 0 0 0
332     0 1 1 1 0 0 0 0 1 1 0 1 0
333 337   0 1 1 1 0 0 0 0 1 1 0 0 0
341     0 1 1 1 0 0 0 0 1 1 0 0 0
342     0 1 1 1 0 0 0 0 1 1 0 1 0
343 347   0 1 1 1 0 0 0 0 1 1 0 0 0
351     0 1 1 1 0 0 0 0 1 1 0 0 0
352     0 1 1 1 0 0 0 0 1 1 0 1 0
353 357   0 1 1 1 0 0 0 0 1 1 0 0 0
361     0 1 1 1 0 0 0 0 1 1 0 0 0
362     0 1 1 1 0 0 0 0 1 1 0 1 0
363 367   0 1 1 1 0 0 0 0 1 1 0 0 0
END PWAT-PARM1

```

*** Use same assumptions as INTB model for irrigation (comments below from INTB)

*** All spray irrigation is considered as coming from an external source
 *** and all is applied as additional precip, i.e. subject to interception.
 *** It is applied using the irrigation function instead of additional
 *** precip so that the amounts can be tracked separately by the program.

*** Drip irrigation is handled separately as lateral inflow. It is not
 *** handled as part of the single irrigation demand timeseries so that it
 *** can be given a different daily schedule (6 hrs in the morning) than
 *** the spray (3 hrs in the morning).

```

IRRIG-SOURCE
*** < PLS><-----External-----><---Groundwater---><-----RCHRES----->
*** x - x  XPRIOR  XFRAC  GPRIOR  GFRAC  RPRIOR  RFRAC  IRCHNO
12 362      1      1.0
END IRRIG-SOURCE

```

```

IRRIG-TARGET
*** < PLS> Irrigation Application Target Fractions
*** x - x Intercep Surface Upper Lower Active GW
12 362      1.0
END IRRIG-TARGET

```

*** initial LSUR values from Intera geodatabase, all others from corresponding
 INTB land use

*** Adjusted INFILT values down by 75% from INTB

```

PWAT-PARM2
*** < PLS>
*** x - x  FOREST  LZSN  INFILT  LSUR  SLSUR  KVARY  AGWRC
              (in)  (in/hr)  (ft)
11      0.  3.60  0.250  143.  0.0068  0.  0.999
12      1.  4.20  0.250  273.  0.0043  0.  0.999
13      1.  4.20  0.250  311.  0.0042  0.  0.999
14      1.  4.40  0.220  500.  0.0061  0.  0.999
17      1.  3.80  0.150  300.  0.0039  0.  0.999
21      0.  3.60  0.250  151.  0.0046  0.  0.999
22      1.  4.20  0.250  245.  0.0041  0.  0.999
23      1.  4.20  0.250  302.  0.0051  0.  0.999
24      1.  4.40  0.220  500.  0.0049  0.  0.999
27      1.  3.80  0.150  50.  0.0033  0.  0.999
31      0.  3.60  0.250  159.  0.0068  0.  0.999
32      1.  4.20  0.250  228.  0.003  0.  0.999
33      1.  4.20  0.250  322.  0.0043  0.  0.999
34      1.  4.40  0.220  500.  0.0089  0.  0.999
37      1.  3.80  0.150  300.  0.001  0.  0.999
41      0.  3.60  0.250  152.  0.0136  0.  0.999
42      1.  4.20  0.250  271.  0.0053  0.  0.999
43      1.  4.20  0.250  322.  0.007  0.  0.999
44      1.  4.40  0.220  500.  0.0184  0.  0.999
51      0.  3.60  0.250  182.  0.0056  0.  0.999

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52	1.	4.20	0.250	190.	0.0041	0.	0.999	252	1.	5.10	0.250	267.	0.0082	0.	0.999
53	1.	4.20	0.250	315.	0.0048	0.	0.999	253	1.	4.60	0.250	300.	0.0107	0.	0.999
54	1.	4.40	0.220	500.	0.0071	0.	0.999	254	1.	5.40	0.220	500.	0.0128	0.	0.999
57	1.	3.80	0.150	300.	0.0016	0.	0.999	257	1.	3.70	0.150	235.	0.0178	0.	0.999
61	0.	3.60	0.250	159.	0.0054	0.	0.999	261	0.	3.70	0.250	200.	0.0111	0.	0.999
62	1.	4.20	0.250	218.	0.0073	0.	0.999	262	1.	5.10	0.250	182.	0.0078	0.	0.999
63	1.	4.20	0.250	301.	0.0048	0.	0.999	263	1.	4.60	0.250	330.	0.0072	0.	0.999
64	1.	4.40	0.220	500.	0.0077	0.	0.999	264	1.	5.40	0.220	500.	0.0068	0.	0.999
67	1.	3.80	0.150	50.	0.0025	0.	0.999	267	1.	3.70	0.150	300.	0.0051	0.	0.999
71	0.	3.60	0.250	147.	0.0097	0.	0.999	271	0.	3.70	0.250	150.	0.0033	0.	0.999
72	1.	4.20	0.250	198.	0.0048	0.	0.999	272	1.	5.10	0.250	165.	0.0099	0.	0.999
73	1.	4.20	0.250	302.	0.0076	0.	0.999	273	1.	4.60	0.250	328.	0.0127	0.	0.999
74	1.	4.40	0.220	500.	0.0186	0.	0.999	274	1.	5.40	0.220	500.	0.0139	0.	0.999
77	1.	3.80	0.150	50.	0.0028	0.	0.999	281	0.	3.70	0.250	144.	0.0079	0.	0.999
81	0.	3.60	0.250	187.	0.0055	0.	0.999	282	1.	5.10	0.250	225.	0.0082	0.	0.999
82	1.	4.20	0.250	228.	0.0076	0.	0.999	283	1.	4.60	0.250	344.	0.0092	0.	0.999
83	1.	4.20	0.250	304.	0.0066	0.	0.999	284	1.	5.40	0.220	500.	0.0111	0.	0.999
84	1.	4.40	0.220	500.	0.0055	0.	0.999	292	1.	5.10	0.250	185.	0.0072	0.	0.999
87	1.	3.80	0.150	50.	0.0067	0.	0.999	293	1.	4.60	0.250	309.	0.0092	0.	0.999
91	0.	3.60	0.250	126.	0.004	0.	0.999	294	1.	5.40	0.220	500.	0.0095	0.	0.999
92	1.	4.20	0.250	200.	0.003	0.	0.999	297	1.	3.70	0.150	50.	0.0053	0.	0.999
93	1.	4.20	0.250	304.	0.0069	0.	0.999	301	0.	3.70	0.250	150.	0.0046	0.	0.999
94	1.	4.40	0.220	500.	0.0046	0.	0.999	302	1.	5.10	0.250	268.	0.0092	0.	0.999
101	0.	3.60	0.250	181.	0.0076	0.	0.999	303	1.	4.60	0.250	314.	0.0106	0.	0.999
102	1.	4.20	0.250	250.	0.0058	0.	0.999	304	1.	5.40	0.220	500.	0.0058	0.	0.999
103	1.	4.20	0.250	309.	0.0064	0.	0.999	311	0.	3.70	0.250	175.	0.0104	0.	0.999
104	1.	4.40	0.220	500.	0.0109	0.	0.999	312	1.	5.10	0.250	195.	0.0082	0.	0.999
107	1.	3.80	0.150	50.	0.0047	0.	0.999	313	1.	4.60	0.250	338.	0.008	0.	0.999
111	0.	3.60	0.250	188.	0.0063	0.	0.999	314	1.	5.40	0.220	500.	0.0122	0.	0.999
112	1.	4.20	0.250	196.	0.0082	0.	0.999	317	1.	3.70	0.150	50.	0.0081	0.	0.999
113	1.	4.20	0.250	337.	0.0049	0.	0.999	331	0.	3.70	0.250	165.	0.0176	0.	0.999
114	1.	4.40	0.220	500.	0.0072	0.	0.999	332	1.	5.10	0.250	198.	0.01	0.	0.999
117	1.	3.80	0.150	96.	0.0041	0.	0.999	333	1.	4.60	0.250	331.	0.0127	0.	0.999
121	0.	3.60	0.250	179.	0.0078	0.	0.999	334	1.	5.40	0.220	500.	0.0171	0.	0.999
122	1.	4.20	0.250	300.	0.0268	0.	0.999	337	1.	3.70	0.150	256.	0.0178	0.	0.999
123	1.	4.20	0.250	325.	0.0124	0.	0.999	341	0.	3.70	0.250	109.	0.0039	0.	0.999
124	1.	4.40	0.220	500.	0.0135	0.	0.999	342	1.	5.10	0.250	165.	0.0039	0.	0.999
127	1.	3.80	0.150	50.	0.005	0.	0.999	343	1.	4.60	0.250	312.	0.0035	0.	0.999
131	0.	3.60	0.250	109.	0.0059	0.	0.999	344	1.	5.40	0.220	500.	0.0095	0.	0.999
132	1.	4.20	0.250	188.	0.0058	0.	0.999	347	1.	3.70	0.150	50.	0.0034	0.	0.999
133	1.	4.20	0.250	318.	0.0065	0.	0.999	351	0.	3.70	0.250	200.	0.0214	0.	0.999
134	1.	4.40	0.220	500.	0.0105	0.	0.999	352	1.	5.10	0.250	156.	0.0073	0.	0.999
137	1.	3.80	0.150	300.	0.0096	0.	0.999	353	1.	4.60	0.250	317.	0.013	0.	0.999
141	0.	3.60	0.250	194.	0.0063	0.	0.999	354	1.	5.40	0.220	500.	0.0222	0.	0.999
142	1.	4.20	0.250	269.	0.0118	0.	0.999	361	0.	3.70	0.250	191.	0.0081	0.	0.999
143	1.	4.20	0.250	368.	0.0061	0.	0.999	362	1.	5.10	0.250	272.	0.0115	0.	0.999
144	1.	4.40	0.220	500.	0.0046	0.	0.999	363	1.	4.60	0.250	313.	0.0103	0.	0.999
211	0.	3.70	0.250	160.	0.0104	0.	0.999	364	1.	5.40	0.220	500.	0.0131	0.	0.999
212	1.	5.10	0.250	222.	0.0091	0.	0.999	367	1.	3.70	0.150	50.	0.0096	0.	0.999
213	1.	4.50	0.250	309.	0.0084	0.	0.999	END PWAT-PARM2							
214	1.	5.0	0.220	500.	0.0075	0.	0.999	*** All initial values from INTB							
217	1.	3.8	0.150	300.	0.0068	0.	0.999	*** Adjusted INFILD from 1.0 to 2.0							
221	0.	3.40	0.250	186.	0.012	0.	0.999	*** Adjusted DEEPFR values from 1.0 to 0.1							
222	1.	5.70	0.250	221.	0.0069	0.	0.999	*** Adjusted AGWETP values down by 50% or more							
223	1.	4.70	0.250	322.	0.0078	0.	0.999	PWAT-PARM3							
224	1.	6.2	0.220	500.	0.0153	0.	0.999	*** < PLS>	PETMAX	PETMIN	INFEXP	INFILD	DEEPFR	BASETP	AGWETP
227	1.	3.4	0.150	223.	0.0059	0.	0.999	*** x - x	(deg F)	(deg F)					
231	0.	3.70	0.250	200.	0.0076	0.	0.999	11	40	35	2	2.0	0.1	0	0.1
232	1.	5.10	0.250	155.	0.0062	0.	0.999	12	40	35	2	2.0	0.1	0	0.15
233	1.	4.60	0.250	320.	0.0062	0.	0.999	13	40	35	2	2.0	0.1	0	0.11
234	1.	5.40	0.220	500.	0.0058	0.	0.999	14	40	35	2	2.0	0.1	0	0.12
237	1.	3.70	0.150	300.	0.0025	0.	0.999	17	40	35	2	2.0	0.1	0	0.14
241	0.	3.70	0.250	200.	0.0078	0.	0.999	21	40	35	2	2.0	0.1	0	0.1
242	1.	5.10	0.250	273.	0.0062	0.	0.999	22	40	35	2	2.0	0.1	0	0.15
243	1.	4.60	0.250	321.	0.0074	0.	0.999	23	40	35	2	2.0	0.1	0	0.11
244	1.	5.40	0.220	500.	0.0093	0.	0.999	24	40	35	2	2.0	0.1	0	0.12
247	1.	3.70	0.150	50.	0.0116	0.	0.999	27	40	35	2	2.0	0.1	0	0.14
251	0.	3.70	0.250	189.	0.0109	0.	0.999								

31	40	35	2	2.0	0.1	0	0.1	232	40	35	2	2.0	0.1	0	0.15
32	40	35	2	2.0	0.1	0	0.15	233	40	35	2	2.0	0.1	0	0.11
33	40	35	2	2.0	0.1	0	0.11	234	40	35	2	2.0	0.1	0	0.12
34	40	35	2	2.0	0.1	0	0.12	237	40	35	2	2.0	0.1	0	0.14
37	40	35	2	2.0	0.1	0	0.14	241	40	35	2	2.0	0.1	0	0.1
41	40	35	2	2.0	0.1	0	0.1	242	40	35	2	2.0	0.1	0	0.15
42	40	35	2	2.0	0.1	0	0.15	243	40	35	2	2.0	0.1	0	0.11
43	40	35	2	2.0	0.1	0	0.11	244	40	35	2	2.0	0.1	0	0.12
44	40	35	2	2.0	0.1	0	0.12	247	40	35	2	2.0	0.1	0	0.14
51	40	35	2	2.0	0.1	0	0.1	251	40	35	2	2.0	0.1	0	0.1
52	40	35	2	2.0	0.1	0	0.15	252	40	35	2	2.0	0.1	0	0.15
53	40	35	2	2.0	0.1	0	0.11	253	40	35	2	2.0	0.1	0	0.11
54	40	35	2	2.0	0.1	0	0.12	254	40	35	2	2.0	0.1	0	0.12
57	40	35	2	2.0	0.1	0	0.14	257	40	35	2	2.0	0.1	0	0.14
61	40	35	2	2.0	0.1	0	0.1	261	40	35	2	2.0	0.1	0	0.1
62	40	35	2	2.0	0.1	0	0.15	262	40	35	2	2.0	0.1	0	0.15
63	40	35	2	2.0	0.1	0	0.11	263	40	35	2	2.0	0.1	0	0.11
64	40	35	2	2.0	0.1	0	0.12	264	40	35	2	2.0	0.1	0	0.12
67	40	35	2	2.0	0.1	0	0.14	267	40	35	2	2.0	0.1	0	0.14
71	40	35	2	2.0	0.1	0	0.1	271	40	35	2	2.0	0.1	0	0.1
72	40	35	2	2.0	0.1	0	0.15	272	40	35	2	2.0	0.1	0	0.15
73	40	35	2	2.0	0.1	0	0.11	273	40	35	2	2.0	0.1	0	0.11
74	40	35	2	2.0	0.1	0	0.12	274	40	35	2	2.0	0.1	0	0.12
77	40	35	2	2.0	0.1	0	0.14	281	40	35	2	2.0	0.1	0	0.1
81	40	35	2	2.0	0.1	0	0.1	282	40	35	2	2.0	0.1	0	0.15
82	40	35	2	2.0	0.1	0	0.15	283	40	35	2	2.0	0.1	0	0.11
83	40	35	2	2.0	0.1	0	0.11	284	40	35	2	2.0	0.1	0	0.12
84	40	35	2	2.0	0.1	0	0.12	292	40	35	2	2.0	0.1	0	0.15
87	40	35	2	2.0	0.1	0	0.14	293	40	35	2	2.0	0.1	0	0.11
91	40	35	2	2.0	0.1	0	0.1	294	40	35	2	2.0	0.1	0	0.12
92	40	35	2	2.0	0.1	0	0.15	297	40	35	2	2.0	0.1	0	0.14
93	40	35	2	2.0	0.1	0	0.11	301	40	35	2	2.0	0.1	0	0.1
94	40	35	2	2.0	0.1	0	0.12	302	40	35	2	2.0	0.1	0	0.15
101	40	35	2	2.0	0.1	0	0.1	303	40	35	2	2.0	0.1	0	0.11
102	40	35	2	2.0	0.1	0	0.15	304	40	35	2	2.0	0.1	0	0.12
103	40	35	2	2.0	0.1	0	0.11	311	40	35	2	2.0	0.1	0	0.1
104	40	35	2	2.0	0.1	0	0.12	312	40	35	2	2.0	0.1	0	0.15
107	40	35	2	2.0	0.1	0	0.14	313	40	35	2	2.0	0.1	0	0.11
111	40	35	2	2.0	0.1	0	0.1	314	40	35	2	2.0	0.1	0	0.12
112	40	35	2	2.0	0.1	0	0.15	317	40	35	2	2.0	0.1	0	0.14
113	40	35	2	2.0	0.1	0	0.11	331	40	35	2	2.0	0.1	0	0.1
114	40	35	2	2.0	0.1	0	0.12	332	40	35	2	2.0	0.1	0	0.15
117	40	35	2	2.0	0.1	0	0.14	333	40	35	2	2.0	0.1	0	0.11
121	40	35	2	2.0	0.1	0	0.1	334	40	35	2	2.0	0.1	0	0.12
122	40	35	2	2.0	0.1	0	0.15	337	40	35	2	2.0	0.1	0	0.14
123	40	35	2	2.0	0.1	0	0.11	341	40	35	2	2.0	0.1	0	0.1
124	40	35	2	2.0	0.1	0	0.12	342	40	35	2	2.0	0.1	0	0.15
127	40	35	2	2.0	0.1	0	0.14	343	40	35	2	2.0	0.1	0	0.11
131	40	35	2	2.0	0.1	0	0.1	344	40	35	2	2.0	0.1	0	0.12
132	40	35	2	2.0	0.1	0	0.15	347	40	35	2	2.0	0.1	0	0.14
133	40	35	2	2.0	0.1	0	0.11	351	40	35	2	2.0	0.1	0	0.1
134	40	35	2	2.0	0.1	0	0.12	352	40	35	2	2.0	0.1	0	0.15
137	40	35	2	2.0	0.1	0	0.14	353	40	35	2	2.0	0.1	0	0.11
141	40	35	2	2.0	0.1	0	0.1	354	40	35	2	2.0	0.1	0	0.12
142	40	35	2	2.0	0.1	0	0.15	361	40	35	2	2.0	0.1	0	0.1
143	40	35	2	2.0	0.1	0	0.11	362	40	35	2	2.0	0.1	0	0.15
144	40	35	2	2.0	0.1	0	0.12	363	40	35	2	2.0	0.1	0	0.11
211	40	35	2	2.0	0.1	0	0.1	364	40	35	2	2.0	0.1	0	0.12
212	40	35	2	2.0	0.1	0	0.15	367	40	35	2	2.0	0.1	0	0.14
213	40	35	2	2.0	0.1	0	0.11	END PWAT-PARM3							
214	40	35	2	2.0	0.1	0	0.12	*** initial UZSN and NSUR values from Intera geodatabase, all others from INTB							
217	40	35	2	2.0	0.1	0	0.14	*** Adjusted INTFW values up by 2X							
221	40	35	2	2.0	0.1	0	0.1	PWAT-PARM4							
222	40	35	2	2.0	0.1	0	0.15	*** <PLS >	CEPSC	UZSN	NSUR	INTFW	IRC	LZETP	
223	40	35	2	2.0	0.1	0	0.11	*** x - x	(in)	(in)			(1/day)		
224	40	35	2	2.0	0.1	0	0.12	11	0.05	0.118	0.239	1.20	0.2	0.22	
227	40	35	2	2.0	0.1	0	0.14	12	0.090	0.113	0.298	1.20	0.2	0.35	
231	40	35	2	2.0	0.1	0	0.1								

13	0.061	0.078	0.300	1.15	0.2	0.2	214	0.16	0.15	0.430	1.10	0.2	0.4
14	0.16	0.15	0.450	1.10	0.2	0.4	217	0.050	0.1	0.2	1.10	0.2	0.44
17	0.050	0.1	0.2	1.10	0.2	0.44	221	0.05	0.137	0.273	1.20	0.2	0.22
21	0.05	0.117	0.229	1.20	0.2	0.22	222	0.074	0.100	0.300	1.20	0.2	0.35
22	0.079	0.105	0.288	1.20	0.2	0.35	223	0.067	0.089	0.289	1.15	0.2	0.2
23	0.060	0.076	0.303	1.15	0.2	0.2	224	0.16	0.15	0.450	1.10	0.2	0.4
24	0.16	0.15	0.450	1.10	0.2	0.4	227	0.037	0.119	0.2	1.10	0.2	0.44
27	0.030	0.107	0.2	1.10	0.2	0.44	231	0.05	0.150	0.300	1.20	0.2	0.22
31	0.05	0.112	0.240	1.20	0.2	0.22	232	0.052	0.081	0.300	1.20	0.2	0.35
32	0.075	0.101	0.295	1.20	0.2	0.35	233	0.066	0.088	0.290	1.15	0.2	0.2
33	0.064	0.074	0.301	1.15	0.2	0.2	234	0.16	0.15	0.450	1.10	0.2	0.4
34	0.16	0.15	0.450	1.10	0.2	0.4	237	0.047	0.107	0.2	1.10	0.2	0.44
37	0.030	0.05	0.2	1.10	0.2	0.44	241	0.05	0.150	0.300	1.20	0.2	0.22
41	0.05	0.122	0.247	1.20	0.2	0.22	242	0.091	0.113	0.297	1.20	0.2	0.35
42	0.090	0.113	0.300	1.20	0.2	0.35	243	0.066	0.088	0.290	1.15	0.2	0.2
43	0.066	0.085	0.292	1.15	0.2	0.2	244	0.16	0.15	0.450	1.10	0.2	0.4
44	0.16	0.15	0.450	1.10	0.2	0.4	247	0.030	0.1	0.2	1.10	0.2	0.44
51	0.05	0.127	0.264	1.20	0.2	0.22	251	0.05	0.143	0.279	1.20	0.2	0.22
52	0.064	0.091	0.299	1.20	0.2	0.35	252	0.089	0.111	0.298	1.20	0.2	0.35
53	0.064	0.084	0.294	1.15	0.2	0.2	253	0.060	0.080	0.300	1.15	0.2	0.2
54	0.16	0.15	0.449	1.10	0.2	0.4	254	0.16	0.15	0.450	1.10	0.2	0.4
57	0.050	0.1	0.2	1.10	0.2	0.44	257	0.030	0.099	0.2	1.10	0.2	0.44
61	0.05	0.127	0.253	1.20	0.2	0.22	261	0.05	0.150	0.300	1.20	0.2	0.22
62	0.067	0.098	0.270	1.20	0.2	0.35	262	0.059	0.089	0.292	1.20	0.2	0.35
63	0.058	0.069	0.309	1.15	0.2	0.2	263	0.069	0.092	0.285	1.15	0.2	0.2
64	0.16	0.15	0.450	1.10	0.2	0.4	264	0.16	0.15	0.450	1.10	0.2	0.4
67	0.030	0.1	0.2	1.10	0.2	0.44	267	0.050	0.1	0.2	1.10	0.2	0.44
71	0.05	0.113	0.225	1.20	0.2	0.22	271	0.05	0.080	0.200	1.20	0.2	0.22
72	0.065	0.093	0.294	1.20	0.2	0.35	272	0.055	0.084	0.300	1.20	0.2	0.35
73	0.059	0.070	0.308	1.15	0.2	0.2	273	0.068	0.091	0.286	1.15	0.2	0.2
74	0.16	0.15	0.450	1.10	0.2	0.4	274	0.16	0.15	0.450	1.10	0.2	0.4
77	0.030	0.1	0.2	1.10	0.2	0.44	281	0.05	0.116	0.216	1.20	0.2	0.22
81	0.05	0.142	0.283	1.20	0.2	0.22	282	0.075	0.100	0.300	1.20	0.2	0.35
82	0.076	0.101	0.300	1.20	0.2	0.35	283	0.071	0.098	0.278	1.15	0.2	0.2
83	0.061	0.078	0.301	1.15	0.2	0.2	284	0.16	0.15	0.450	1.10	0.2	0.4
84	0.16	0.15	0.450	1.10	0.2	0.4	292	0.061	0.089	0.300	1.20	0.2	0.35
87	0.030	0.1	0.2	1.10	0.2	0.44	293	0.063	0.084	0.296	1.15	0.2	0.2
91	0.05	0.108	0.222	1.20	0.2	0.22	294	0.16	0.15	0.450	1.10	0.2	0.4
92	0.070	0.100	0.300	1.20	0.2	0.35	297	0.030	0.1	0.2	1.10	0.2	0.44
93	0.061	0.078	0.301	1.15	0.2	0.2	301	0.05	0.096	0.200	1.20	0.2	0.22
94	0.16	0.15	0.450	1.10	0.2	0.4	302	0.089	0.112	0.300	1.20	0.2	0.35
101	0.05	0.124	0.263	1.20	0.2	0.22	303	0.064	0.086	0.293	1.15	0.2	0.2
102	0.083	0.107	0.300	1.20	0.2	0.35	304	0.16	0.15	0.450	1.10	0.2	0.4
103	0.062	0.083	0.296	1.15	0.2	0.2	311	0.05	0.136	0.264	1.20	0.2	0.22
104	0.16	0.15	0.438	1.10	0.2	0.4	312	0.065	0.092	0.297	1.20	0.2	0.35
107	0.030	0.1	0.2	1.10	0.2	0.44	313	0.071	0.095	0.282	1.15	0.2	0.2
111	0.05	0.139	0.275	1.20	0.2	0.22	314	0.16	0.15	0.449	1.10	0.2	0.4
112	0.064	0.093	0.295	1.20	0.2	0.35	317	0.030	0.1	0.2	1.10	0.2	0.44
113	0.071	0.093	0.283	1.15	0.2	0.2	331	0.05	0.115	0.237	1.20	0.2	0.22
114	0.16	0.15	0.450	1.10	0.2	0.4	332	0.066	0.093	0.300	1.20	0.2	0.35
117	0.030	0.084	0.2	1.10	0.2	0.44	333	0.069	0.092	0.285	1.15	0.2	0.2
121	0.05	0.125	0.263	1.20	0.2	0.22	334	0.16	0.15	0.450	1.10	0.2	0.4
122	0.100	0.120	0.300	1.20	0.2	0.35	337	0.030	0.068	0.2	1.10	0.2	0.44
123	0.067	0.087	0.290	1.15	0.2	0.2	341	0.05	0.104	0.117	1.20	0.2	0.22
124	0.16	0.15	0.443	1.10	0.2	0.4	342	0.055	0.084	0.300	1.20	0.2	0.35
127	0.030	0.1	0.2	1.10	0.2	0.44	343	0.063	0.085	0.294	1.15	0.2	0.2
131	0.05	0.100	0.193	1.20	0.2	0.22	344	0.16	0.15	0.450	1.10	0.2	0.4
132	0.065	0.095	0.300	1.20	0.2	0.35	347	0.030	0.1	0.2	1.10	0.2	0.44
133	0.063	0.071	0.305	1.15	0.2	0.2	351	0.05	0.150	0.300	1.20	0.2	0.22
134	0.16	0.15	0.450	1.10	0.2	0.4	352	0.052	0.082	0.300	1.20	0.2	0.35
137	0.030	0.1	0.2	1.10	0.2	0.44	353	0.064	0.087	0.292	1.15	0.2	0.2
141	0.05	0.147	0.289	1.20	0.2	0.22	354	0.16	0.15	0.450	1.10	0.2	0.4
142	0.089	0.112	0.295	1.20	0.2	0.35	361	0.05	0.146	0.282	1.20	0.2	0.22
143	0.079	0.098	0.274	1.15	0.2	0.2	362	0.091	0.112	0.300	1.20	0.2	0.35
144	0.16	0.15	0.434	1.10	0.2	0.4	363	0.064	0.085	0.294	1.15	0.2	0.2
211	0.05	0.126	0.246	1.20	0.2	0.22	364	0.16	0.15	0.450	1.10	0.2	0.4
212	0.074	0.099	0.299	1.20	0.2	0.35	367	0.030	0.1	0.2	1.10	0.2	0.44
213	0.062	0.084	0.296	1.15	0.2	0.2	END PWAT - PARM4						

Estimating the Un-Gaged Inflows in the
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93	93	.93	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210
94	94	.240	.260	.280	.300	.320	.340	.460	.480	.460	.380	.280	.260	
97	97	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
101	101	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
102	102	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
103	103	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
104	104	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
107	107	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
111	111	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
112	112	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
113	113	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
114	114	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
117	117	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
121	121	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
122	122	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
123	123	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
124	124	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
127	127	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
131	131	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
132	132	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
133	133	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
134	134	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
137	137	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
141	141	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
142	142	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
143	143	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
144	144	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
147	147	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
211	211	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
212	212	.260	.280	.300	.320	.340	.480	.500	.500	.480	.400	.300	.280	
213	213	.200	.230	.26	.280	.300	.400	.420	.420	.40	.310	.23	.210	
214	214	.240	.260	.280	.300	.320	.460	.480	.480	.460	.380	.280	.260	
217	217	.250	.270	.290	.310	.330	.470	.490	.490	.470	.390	.290	.270	
221	221	.180	.200	.22	.230	.260	.320	.340	.340	.320	.280	.240	.200	
222	222	.260	.280	.300	.3									

MON - LZETPARM

**x	-	x	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
11	11	180	200	22	230	260	320	340	340	340	320	280	240	200
12	12	260	280	300	320	340	480	500	500	480	400	300	280	
13	13	200	230	26	280	300	400	420	420	40	310	23	210	
14	14	240	260	280	300	320	460	480	480	460	380	280	260	
17	17	250	270	290	310	330	470	490	490	470	390	290	270	
21	21	180	200	22	230	260	320	340	340	320	280	240	200	
22	22	260	280	300	320	340	480	500	500	480	400	300	280	
23	23	200	230	26	280	300	400	420	420	40	310	23	210	
24	24	240	260	280	300	320	460	480	480	460	380	280	260	
27	27	250	270	290	310	330	470	490	490	470	390	290	270	
31	31	180	200	22	230	260	320	340	340	320	280	240	200	
32	32	260	280	300	320	340	480	500	500	480	400	300	280	
33	33	200	230	26	280	300	400	420	420	40	310	23	210	
34	34	240	260	280	300	320	460	480	480	460	380	280	260	
37	37	250	270	290	310	330	470	490	490	470	390	290	270	
41	41	180	200	22	230	260	320	340	340	320	280	240	200	
42	42	260	280	300	320	340	480	500	500	480	400	300	280	
43	43	200	230	26	280	300	400	420	420	40	310	23	210	
44	44	240	260	280	300	320	460	480	480	460	380	280	260	
47	47	250	270	290	310	330	470	490	490	470	390	290	270	
51	51	180	200	22	230	260	320	340	340	320	280	240	200	
52	52	260	280	300	320	340	480	500	500	480	400	300	280	
53	53	200	230	26	280	300	400	420	420	40	310	23	210	
54	54	240	260	280	300	320	460	480	480	460	380	280	260	
57	57	250	270	290	310	330	470	490	490	470	390	290	270	
61	61	180	200	22	230	260	320	340	340	320	280	240	200	
62	62	260	280	300	320	340	480	500	500	480	400	300	280	
63	63	200	230	26	280	300	400	420	420	40	310	23	210	
64	64	240	260	280	300	320	460	480	480	460	380	280	260	
67	67	250	270	290	310	330	470	490	490	470	390	290	270	
71	71	180	200	22	230	260	320	340	340	320	280	240	200	
72	72	260	280	300	320	340	480	500	500	480	400	300	280	
73	73	200	230	26	280	300	400	420	420	40	310	23	210	
74	74	240	260	280	300	320	460	480	480	460	380	280	260	
77	7													



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291 291 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
292 292 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
293 293 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
294 294 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
297 297 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
301 301 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
302 302 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
303 303 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
304 304 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
307 307 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
311 311 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
312 312 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
313 313 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
314 314 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
317 317 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
331 331 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
332 332 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
333 333 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
334 334 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
337 337 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
341 341 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
342 342 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
343 343 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
344 344 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
347 347 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
351 351 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
352 352 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
353 353 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
354 354 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
357 357 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
361 361 .180 .200 .22 .230 .260 .320 .340 .340 .320 .280 .240 .200
362 362 .260 .280 .300 .320 .340 .480 .500 .480 .400 .300 .280
363 363 .200 .230 .26 .280 .300 .400 .420 .420 .40 .310 .23 .210
364 364 .240 .260 .280 .300 .320 .460 .480 .480 .460 .380 .280 .260
367 367 .250 .270 .290 .310 .330 .470 .490 .490 .470 .390 .290 .270
END MON-LZETPARM

```

END PERLND

IMPLND

```

ACTIVITY
*** <ILS > Active Sections
*** x - x ATMP SNOW IWAT SLD IWG IQAL
11 361 0 0 1 0 0 0 0
END ACTIVITY

```

PRINT-INFO

```

*** <ILS > ***** Print-flags ***** PIVL PYR
*** x - x ATMP SNOW IWAT SLD IWG IQAL *****
11 361 4 4 4 4 4 1 12
END PRINT-INFO

```

BINARY-INFO

```

*** <ILS > ***** Binary-Output-flags ***** PIVL PYR
*** x - x ATMP SNOW IWAT SLD IWG IQAL *****
11 361 4 4 5 4 4 1 12
END BINARY-INFO

```

GEN-INFO

```

*** Name Unit-systems Printer BinaryOut
*** <ILS > t-series Engl Metr Engl Metr
*** x - x in out
11 361Urban 1 1 0 0 92 0
END GEN-INFO

```

IWAT-PARM1

```

*** <ILS > Flags
*** x - x CSNO RTOP VRS VNN RTLI

```

Estimating the Un-Gaged Inflows in the
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```

11 361 0 0 0 0 0
END IWAT-PARM1

```

IWAT-PARM2

```

*** <ILS > LSUR SLSUR NSUR RETSC
*** x - x (ft) (in)
11 100. 0.0068 0.05 0.1
21 100. 0.0046 0.05 0.1
31 100. 0.0068 0.05 0.1
41 100. 0.0136 0.05 0.1
51 100. 0.0056 0.05 0.1
61 100. 0.0054 0.05 0.1
71 100. 0.0097 0.05 0.1
81 100. 0.0055 0.05 0.1
91 100. 2.38E-06 0.05 0.1
101 100. 0.0076 0.05 0.1
111 100. 0.0063 0.05 0.1
121 100. 0.0078 0.05 0.1
131 100. 0.0059 0.05 0.1
141 100. 0.0063 0.05 0.1
211 100. 0.0104 0.05 0.1
221 100. 0.012 0.05 0.1
231 100. 0.0006 0.05 0.1
241 100. 0.0078 0.05 0.1
251 100. 0.0109 0.05 0.1
261 100. 0.0111 0.05 0.1
271 100. 0.0003 0.05 0.1
281 100. 0.0079 0.05 0.1
301 100. 0.046 0.05 0.1
311 100. 0.0104 0.05 0.1
331 100. 0.0176 0.05 0.1
341 100. 0.0039 0.05 0.1
351 100. 0.0214 0.05 0.1
361 100. 0.0081 0.05 0.1
END IWAT-PARM2

```

IWAT-PARM3

```

*** <ILS > PETMAX PETMIN
*** x - x (deg F) (deg F)
11 361 40. 35.
END IWAT-PARM3

```

IWAT-STATE1

```

*** <ILS > IWATER state variables (inches)
*** x - x RETS SURS
11 361 0.01 0.01
END IWAT-STATE1

```

END IMPLND

RCHRES

```

ACTIVITY
*** RCHRES Active sections
*** x - x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUGF PKFG PHFG
1 300 1 0 0 0 0 0 0 0 0 0 0
END ACTIVITY

```

PRINT-INFO

```

*** RCHRES Printout level flags
*** x - x HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR
1 300 4 4 4 4 4 4 4 4 4 1 12
END PRINT-INFO

```

BINARY-INFO

```

*** RCHRES Binary Output level flags
*** x - x HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR
1 300 3 4 4 4 4 4 4 4 4 1 12
END BINARY-INFO

```



```

GEN-INFO
*** RCHRES      Name      Nexits      Unit Systems      Printer
*** x - x      t-series  Engl Metr LKFG
*** x - x      in      out
1      Reach 1      1      1      1      91      0      1      92      0
2      Reach 2      1      1      1      91      0      1      92      0
3      Reach 3      1      1      1      91      0      1      92      0
4      Reach 4      1      1      1      91      0      1      92      0
5      Reach 5      1      1      1      91      0      1      92      0
6      Reach 6      1      1      1      91      0      1      92      0
7      Reach 7      1      1      1      91      0      1      92      0
8      Reach 8      1      1      1      91      0      1      92      0
9      Reach 9      1      1      1      91      0      1      92      0
10     Reach 10     1      1      1      91      0      1      92      0
11     Reach 11     1      1      1      91      0      1      92      0
12     Reach 12     1      1      1      91      0      1      92      0
13     Reach 13     1      1      1      91      0      1      92      0
14     Reach 14     1      1      1      91      0      1      92      0
21     Reach 21     1      1      1      91      0      1      92      0
22     Reach 22     1      1      1      91      0      1      92      0
23     Reach 23     1      1      1      91      0      1      92      0
24     Reach 24     1      1      1      91      0      1      92      0
25     Reach 25     1      1      1      91      0      1      92      0
26     Reach 26     1      1      1      91      0      1      92      0
27     Reach 27     1      1      1      91      0      1      92      0
28     Reach 28     1      1      1      91      0      1      92      0
29     Reach 29     1      1      1      91      0      1      92      0
30     Reach 30     1      1      1      91      0      1      92      0
31     Reach 31     1      1      1      91      0      1      92      0
33     Reach 33     1      1      1      91      0      1      92      0
34     Reach 34     1      1      1      91      0      1      92      0
35     Reach 35     1      1      1      91      0      1      92      0
36     Reach 36     1      1      1      91      0      1      92      0
201    Reach 201    1      1      1      91      0      0      92      0
202    Reach 202    1      1      1      91      0      0      92      0
203    Reach 203    1      1      1      91      0      0      92      0
204    Reach 204    1      1      1      91      0      0      92      0
205    Reach 205    2      1      1      91      0      0      92      0
206    Reach 206    1      1      1      91      0      0      92      0
207    Reach 207    1      1      1      91      0      0      92      0
208    Reach 208    1      1      1      91      0      0      92      0
300    Reach 300    1      1      1      91      0      0      92      0
END GEN-INFO

HYDR-PARM1
*** RCHRES      VC A1 A2 A3 ODFVFG for each *** ODGTFG for each      FUNCT for each
*** x - x      FG FG FG FG possible exit *** possible exit      possible exit
1      204      0      1      1      1      4      0      0      0      0      0      0      0      0      1      1      1      1      1
205    205      0      1      1      1      4      0      0      0      0      0      0      2      0      0      0      1      1      1      1
206    300      0      1      1      1      4      0      0      0      0      0      0      0      0      0      0      1      1      1      1
END HYDR-PARM1

HYDR-PARM2
*** RCHRES      FTBW      FTBU      LEN      DELTH      STCOR      KS      DB50
*** x - x      (miles)      (ft)      (ft)      (in)
1      0.      1.      1.      3.      3.2      0.5      0.01
2      0.      2.      1.      3.      3.2      0.5      0.01
3      0.      3.      1.      3.      3.2      0.5      0.01
4      0.      4.      1.      3.      3.2      0.5      0.01
5      0.      5.      1.      3.      3.2      0.5      0.01
6      0.      6.      1.      3.      3.2      0.5      0.01
7      0.      7.      1.      3.      3.2      0.5      0.01
8      0.      8.      1.      3.      3.2      0.5      0.01
9      0.      9.      1.      3.      3.2      0.5      0.01
10     0.      10.     1.      3.      3.2      0.5      0.01
11     0.      11.     1.      3.      3.2      0.5      0.01

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12     0.      12.     1.      3.      3.2      0.5      0.01
13     0.      13.     1.      3.      3.2      0.5      0.01
14     0.      14.     1.      3.      3.2      0.5      0.01
21     0.      21.     1.      3.      3.2      0.5      0.01
22     0.      22.     1.      3.      3.2      0.5      0.01
23     0.      23.     1.      3.      3.2      0.5      0.01
24     0.      24.     1.      3.      3.2      0.5      0.01
25     0.      25.     1.      3.      3.2      0.5      0.01
26     0.      26.     1.      3.      3.2      0.5      0.01
27     0.      27.     1.      3.      3.2      0.5      0.01
28     0.      28.     1.      3.      3.2      0.5      0.01
29     0.      29.     1.      3.      3.2      0.5      0.01
30     0.      30.     1.      3.      3.2      0.5      0.01
31     0.      31.     1.      3.      3.2      0.5      0.01
33     0.      33.     1.      3.      3.2      0.5      0.01
34     0.      34.     1.      3.      3.2      0.5      0.01
35     0.      35.     1.      3.      3.2      0.5      0.01
36     0.      36.     1.      3.      3.2      0.5      0.01
201    0.      201.     1.      3.      3.2      0.5      0.01
202    0.      202.     1.      3.      3.2      0.5      0.01
203    0.      203.     1.      3.      3.2      0.5      0.01
204    0.      204.     1.      3.      3.2      0.5      0.01
205    0.      205.     1.      3.      3.2      0.5      0.01
206    0.      206.     1.      3.      3.2      0.5      0.01
207    0.      207.     1.      3.      3.2      0.5      0.01
208    0.      208.     1.      3.      3.2      0.5      0.01
300    0.      300.     1.      3.      3.2      0.5      0.01
END HYDR-PARM2

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HYDR-INIT
***RC HRES      VOL      CAT      Initial value of COLIND      initial value of OUTDGT
*** x - x      ac-ft      for each possible exit      for each possible exit,ft3
1      20      20.00      4.2      4.5      4.5      4.5      4.2      2.1      1.2      0.5      1.2      1.8
21     21      200.00      4.2      4.5      4.5      4.5      4.2      2.1      1.2      0.5      1.2      1.8
22     300      20.00      4.2      4.5      4.5      4.5      4.2      2.1      1.2      0.5      1.2      1.8
END HYDR-INIT

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END RCHRES

FTABLES

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*****
FTABLE      1
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0      1.932E+02      0      0
6.437E-01      1.932E+02      3.731E+01      5.429E-01
1.287E+00      1.932E+02      7.463E+01      7.030E+00
1.931E+00      1.932E+02      1.119E+02      2.600E+01
2.575E+00      1.932E+02      1.493E+02      4.246E+01
3.218E+00      1.932E+02      1.866E+02      6.243E+01
3.862E+00      1.932E+02      2.239E+02      8.584E+01
4.506E+00      1.932E+02      2.799E+02      1.188E+02
5.150E+00      1.932E+02      3.545E+02      1.614E+02
5.793E+00      1.932E+02      4.478E+02      2.114E+02
6.437E+00      1.932E+02      5.659E+02      2.691E+02
7.081E+00      1.932E+02      6.903E+02      2.961E+02
9.081E+00      1.932E+02      4.555E+03      5.921E+02
END FTABLE      1
*****
FTABLE      2
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0      3.494E+02      0      0

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```

1.019E+00 3.494E+02 1.068E+02 1.167E+00
2.037E+00 3.494E+02 2.136E+02 1.511E+01
3.056E+00 3.494E+02 3.203E+02 5.587E+01
4.074E+00 3.494E+02 4.271E+02 9.124E+01
5.093E+00 3.494E+02 5.339E+02 1.342E+02
6.112E+00 3.494E+02 6.407E+02 1.845E+02
7.130E+00 3.494E+02 8.008E+02 2.553E+02
8.149E+00 3.494E+02 1.014E+03 3.468E+02
9.167E+00 3.494E+02 1.281E+03 4.542E+02
1.019E+01 3.494E+02 1.619E+03 5.783E+02
1.120E+01 3.494E+02 1.975E+03 6.362E+02
1.320E+01 3.494E+02 8.964E+03 1.272E+03
END FTABLE 2
*****
FTABLE 3
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 1.522E+02 0 0
4.127E-01 1.522E+02 1.884E+01 2.589E-01
8.255E-01 1.522E+02 3.769E+01 3.352E+00
1.238E+00 1.522E+02 5.653E+01 1.240E+01
1.651E+00 1.522E+02 7.537E+01 2.025E+01
2.064E+00 1.522E+02 9.422E+01 2.977E+01
2.476E+00 1.522E+02 1.131E+02 4.093E+01
2.889E+00 1.522E+02 1.413E+02 5.665E+01
3.302E+00 1.522E+02 1.790E+02 7.695E+01
3.715E+00 1.522E+02 2.261E+02 1.008E+02
4.127E+00 1.522E+02 2.858E+02 1.283E+02
4.540E+00 1.522E+02 3.486E+02 1.412E+02
6.540E+00 1.522E+02 3.392E+03 2.823E+02
END FTABLE 3
*****
FTABLE 4
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 5.174E+02 0 0
7.272E-01 5.174E+02 1.129E+02 6.652E-01
1.454E+00 5.174E+02 2.258E+02 8.614E+00
2.182E+00 5.174E+02 3.386E+02 3.186E+01
2.909E+00 5.174E+02 4.515E+02 5.203E+01
3.636E+00 5.174E+02 5.644E+02 7.650E+01
4.363E+00 5.174E+02 6.773E+02 1.052E+02
5.090E+00 5.174E+02 8.466E+02 1.456E+02
5.817E+00 5.174E+02 1.072E+03 1.977E+02
6.545E+00 5.174E+02 1.355E+03 2.590E+02
7.272E+00 5.174E+02 1.712E+03 3.298E+02
7.999E+00 5.174E+02 2.088E+03 3.628E+02
9.999E+00 5.174E+02 1.244E+04 7.256E+02
END FTABLE 4
*****
FTABLE 5
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.600E+03 0 0
1.025E+00 2.600E+03 7.991E+02 6.746E-01
2.049E+00 2.600E+03 1.598E+03 1.081E+01
3.074E+00 2.600E+03 2.397E+03 4.347E+01
4.098E+00 2.600E+03 3.196E+03 7.142E+01
5.123E+00 2.600E+03 3.995E+03 1.102E+02
6.148E+00 2.600E+03 4.794E+03 2.192E+02
7.172E+00 2.600E+03 5.993E+03 4.918E+02
8.197E+00 2.600E+03 7.591E+03 9.919E+02

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9.221E+00 2.600E+03 9.589E+03 1.841E+03
1.025E+01 2.600E+03 1.212E+04 3.198E+03
1.127E+01 2.600E+03 1.478E+04 3.518E+03
1.327E+01 2.600E+03 6.677E+04 7.036E+03
END FTABLE 5
*****
FTABLE 6
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 5.575E+00 0 0
3.046E-01 5.575E+00 5.094E-01 1.560E-01
6.092E-01 5.575E+00 1.019E+00 2.020E+00
9.137E-01 5.575E+00 1.528E+00 7.470E+00
1.218E+00 5.575E+00 2.038E+00 1.220E+01
1.523E+00 5.575E+00 2.547E+00 1.794E+01
1.827E+00 5.575E+00 3.057E+00 2.466E+01
2.132E+00 5.575E+00 3.821E+00 3.414E+01
2.437E+00 5.575E+00 4.840E+00 4.637E+01
2.741E+00 5.575E+00 6.113E+00 6.073E+01
3.046E+00 5.575E+00 7.726E+00 7.733E+01
3.350E+00 5.575E+00 9.425E+00 8.506E+01
5.350E+00 5.575E+00 1.125E+03 1.701E+02
END FTABLE 6
*****
FTABLE 7
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 8.950E+01 0 0
5.444E-01 8.950E+01 1.462E+01 4.107E-01
1.089E+00 8.950E+01 2.924E+01 5.318E+00
1.633E+00 8.950E+01 4.386E+01 1.967E+01
2.178E+00 8.950E+01 5.848E+01 3.212E+01
2.722E+00 8.950E+01 7.310E+01 4.723E+01
3.267E+00 8.950E+01 8.771E+01 6.494E+01
3.811E+00 8.950E+01 1.096E+02 8.988E+01
4.356E+00 8.950E+01 1.389E+02 1.221E+02
4.900E+00 8.950E+01 1.754E+02 1.599E+02
5.444E+00 8.950E+01 2.217E+02 2.036E+02
5.989E+00 8.950E+01 2.705E+02 2.240E+02
7.989E+00 8.950E+01 2.061E+03 4.479E+02
END FTABLE 7
*****
FTABLE 8
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 1.079E+02 0 0
5.056E-01 1.079E+02 1.636E+01 3.630E-01
1.011E+00 1.079E+02 3.273E+01 4.700E+00
1.517E+00 1.079E+02 4.909E+01 1.739E+01
2.022E+00 1.079E+02 6.546E+01 2.839E+01
2.528E+00 1.079E+02 8.182E+01 4.175E+01
3.034E+00 1.079E+02 9.819E+01 5.740E+01
3.539E+00 1.079E+02 1.227E+02 7.944E+01
4.045E+00 1.079E+02 1.555E+02 1.079E+02
4.550E+00 1.079E+02 1.964E+02 1.413E+02
5.056E+00 1.079E+02 2.482E+02 1.800E+02
5.561E+00 1.079E+02 3.027E+02 1.980E+02
7.561E+00 1.079E+02 2.461E+03 3.959E+02
END FTABLE 8
*****
FTABLE 9
ROWS COLS***

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13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 3.447E+01 0 0
2.721E-01 3.447E+01 2.814E+00 1.293E-01
5.443E-01 3.447E+01 5.628E+00 1.674E+00
8.164E-01 3.447E+01 8.442E+00 6.192E+00
1.089E+00 3.447E+01 1.126E+01 1.011E+01
1.361E+00 3.447E+01 1.407E+01 1.487E+01
1.633E+00 3.447E+01 1.688E+01 2.044E+01
1.905E+00 3.447E+01 2.110E+01 2.829E+01
2.177E+00 3.447E+01 2.673E+01 3.843E+01
2.449E+00 3.447E+01 3.377E+01 5.034E+01
2.721E+00 3.447E+01 4.268E+01 6.409E+01
2.993E+00 3.447E+01 5.206E+01 7.050E+01
4.993E+00 3.447E+01 7.414E+02 1.410E+02
END FTABLE 9
*****
FTABLE 10
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 2.769E+01 0 0
6.021E-01 2.769E+01 5.001E+00 4.857E-01
1.204E+00 2.769E+01 1.000E+01 6.289E+00
1.806E+00 2.769E+01 1.500E+01 2.326E+01
2.408E+00 2.769E+01 2.000E+01 3.799E+01
3.010E+00 2.769E+01 2.500E+01 5.586E+01
3.613E+00 2.769E+01 3.001E+01 7.680E+01
4.215E+00 2.769E+01 3.751E+01 1.063E+02
4.817E+00 2.769E+01 4.751E+01 1.444E+02
5.419E+00 2.769E+01 6.001E+01 1.891E+02
6.021E+00 2.769E+01 7.585E+01 2.408E+02
6.623E+00 2.769E+01 9.252E+01 2.649E+02
8.623E+00 2.769E+01 5.630E+03 5.297E+02
END FTABLE 10
*****
FTABLE 11
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 1.409E+03 0 0
9.301E-01 1.409E+03 3.931E+02 1.003E+00
1.860E+00 1.409E+03 7.863E+02 1.298E+01
2.790E+00 1.409E+03 1.179E+03 4.801E+01
3.720E+00 1.409E+03 1.573E+03 7.841E+01
4.650E+00 1.409E+03 1.966E+03 1.153E+02
5.580E+00 1.409E+03 2.359E+03 1.585E+02
6.510E+00 1.409E+03 2.949E+03 2.194E+02
7.440E+00 1.409E+03 3.735E+03 2.980E+02
8.371E+00 1.409E+03 4.718E+03 3.903E+02
9.301E+00 1.409E+03 5.963E+03 4.970E+02
1.023E+01 1.409E+03 7.273E+03 5.467E+02
1.223E+01 1.409E+03 3.545E+04 1.093E+03
END FTABLE 11
*****
FTABLE 12
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 4.154E+01 0 0
4.547E-01 4.154E+01 5.666E+00 3.041E-01
9.093E-01 4.154E+01 1.133E+01 3.938E+00
1.364E+00 4.154E+01 1.700E+01 1.457E+01
1.819E+00 4.154E+01 2.267E+01 2.379E+01

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2.273E+00 4.154E+01 2.833E+01 3.498E+01
2.728E+00 4.154E+01 3.400E+01 4.809E+01
3.183E+00 4.154E+01 4.250E+01 6.656E+01
3.637E+00 4.154E+01 5.383E+01 9.041E+01
4.092E+00 4.154E+01 6.800E+01 1.184E+02
4.547E+00 4.154E+01 8.594E+01 1.508E+02
5.001E+00 4.154E+01 1.048E+02 1.659E+02
7.001E+00 4.154E+01 9.357E+02 3.317E+02
END FTABLE 12
*****
FTABLE 13
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 1.512E+03 0 0
1.277E+00 1.512E+03 5.794E+02 1.701E+00
2.554E+00 1.512E+03 1.159E+03 2.202E+01
3.832E+00 1.512E+03 1.738E+03 8.146E+01
5.109E+00 1.512E+03 2.317E+03 1.330E+02
6.386E+00 1.512E+03 2.897E+03 1.956E+02
7.663E+00 1.512E+03 3.476E+03 2.689E+02
8.940E+00 1.512E+03 4.345E+03 3.722E+02
1.022E+01 1.512E+03 5.504E+03 5.056E+02
1.149E+01 1.512E+03 6.952E+03 6.623E+02
1.277E+01 1.512E+03 8.787E+03 8.432E+02
1.405E+01 1.512E+03 1.072E+04 9.276E+02
1.605E+01 1.512E+03 4.096E+04 1.855E+03
END FTABLE 13
*****
FTABLE 14
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 2.274E+02 0 0
4.481E-01 2.274E+02 3.057E+01 2.969E-01
8.962E-01 2.274E+02 6.113E+01 3.844E+00
1.344E+00 2.274E+02 9.170E+01 1.422E+01
1.792E+00 2.274E+02 1.223E+02 2.322E+01
2.241E+00 2.274E+02 1.528E+02 3.414E+01
2.689E+00 2.274E+02 1.834E+02 4.694E+01
3.137E+00 2.274E+02 2.292E+02 6.497E+01
3.585E+00 2.274E+02 2.904E+02 8.824E+01
4.033E+00 2.274E+02 3.668E+02 1.156E+02
4.481E+00 2.274E+02 4.636E+02 1.472E+02
4.929E+00 2.274E+02 5.655E+02 1.619E+02
6.929E+00 2.274E+02 5.113E+03 3.238E+02
END FTABLE 14
*****
FTABLE 21
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 2.532E+03 0 0
1.140E+00 2.532E+03 8.659E+02 8.059E-01
2.280E+00 2.532E+03 1.732E+03 1.291E+01
3.420E+00 2.532E+03 2.598E+03 5.193E+01
4.560E+00 2.532E+03 3.464E+03 8.532E+01
5.700E+00 2.532E+03 4.329E+03 1.316E+02
6.840E+00 2.532E+03 5.195E+03 2.618E+02
7.980E+00 2.532E+03 6.494E+03 5.876E+02
9.120E+00 2.532E+03 8.226E+03 1.185E+03
1.026E+01 2.532E+03 1.039E+04 2.199E+03
1.140E+01 2.532E+03 1.313E+04 3.821E+03
1.254E+01 2.532E+03 1.602E+04 4.203E+03
1.454E+01 2.532E+03 6.666E+04 8.406E+03

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END FTABLE 21
*****
TABLE 22
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.096E+03 0 0
1.392E+00 2.096E+03 8.750E+02 1.124E+00
2.783E+00 2.096E+03 1.750E+03 1.800E+01
4.175E+00 2.096E+03 2.625E+03 7.242E+01
5.567E+00 2.096E+03 3.500E+03 1.190E+02
6.959E+00 2.096E+03 4.375E+03 1.835E+02
8.350E+00 2.096E+03 5.250E+03 3.651E+02
9.742E+00 2.096E+03 6.563E+03 8.194E+02
1.113E+01 2.096E+03 8.313E+03 1.652E+03
1.253E+01 2.096E+03 1.050E+04 3.067E+03
1.392E+01 2.096E+03 1.327E+04 5.328E+03
1.531E+01 2.096E+03 1.619E+04 5.861E+03
1.731E+01 2.096E+03 5.810E+04 1.172E+04
END FTABLE 22
*****
TABLE 23
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.009E+02 0 0
4.757E-01 2.009E+02 2.868E+01 1.878E-01
9.515E-01 2.009E+02 5.735E+01 3.009E+00
1.427E+00 2.009E+02 8.603E+01 1.210E+01
1.903E+00 2.009E+02 1.147E+02 1.988E+01
2.379E+00 2.009E+02 1.434E+02 3.067E+01
2.854E+00 2.009E+02 1.721E+02 6.101E+01
3.330E+00 2.009E+02 2.151E+02 1.369E+02
3.806E+00 2.009E+02 2.724E+02 2.762E+02
4.282E+00 2.009E+02 3.441E+02 5.125E+02
4.757E+00 2.009E+02 4.349E+02 8.904E+02
5.233E+00 2.009E+02 5.305E+02 9.795E+02
7.233E+00 2.009E+02 4.549E+03 1.959E+03
END FTABLE 23
*****
TABLE 24
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 7.921E+02 0 0
5.933E-01 7.921E+02 1.410E+02 2.713E-01
1.187E+00 7.921E+02 2.820E+02 4.347E+00
1.780E+00 7.921E+02 4.230E+02 1.749E+01
2.373E+00 7.921E+02 5.639E+02 2.873E+01
2.966E+00 7.921E+02 7.049E+02 4.431E+01
3.560E+00 7.921E+02 8.459E+02 8.816E+01
4.153E+00 7.921E+02 1.057E+03 1.978E+02
4.746E+00 7.921E+02 1.339E+03 3.990E+02
5.339E+00 7.921E+02 1.692E+03 7.405E+02
5.933E+00 7.921E+02 2.138E+03 1.287E+03
6.526E+00 7.921E+02 2.608E+03 1.415E+03
8.526E+00 7.921E+02 1.845E+04 2.830E+03
END FTABLE 24
*****
TABLE 25
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 6.219E+02 0 0

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6.590E-01 6.219E+02 1.229E+02 3.232E-01
1.318E+00 6.219E+02 2.459E+02 5.179E+00
1.977E+00 6.219E+02 3.688E+02 2.083E+01
2.636E+00 6.219E+02 4.918E+02 3.422E+01
3.295E+00 6.219E+02 6.147E+02 5.279E+01
3.954E+00 6.219E+02 7.377E+02 1.050E+02
4.613E+00 6.219E+02 9.221E+02 2.357E+02
5.272E+00 6.219E+02 1.168E+03 4.753E+02
5.931E+00 6.219E+02 1.475E+03 8.822E+02
6.590E+00 6.219E+02 1.865E+03 1.533E+03
7.249E+00 6.219E+02 2.274E+03 1.686E+03
9.249E+00 6.219E+02 1.471E+04 3.372E+03
END FTABLE 25
*****
TABLE 26
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 1.676E+03 0 0
9.455E-01 1.676E+03 4.754E+02 5.901E-01
1.891E+00 1.676E+03 9.508E+02 9.453E+00
2.837E+00 1.676E+03 1.426E+03 3.803E+01
3.782E+00 1.676E+03 1.902E+03 6.247E+01
4.728E+00 1.676E+03 2.377E+03 9.636E+01
5.673E+00 1.676E+03 2.852E+03 1.917E+02
6.619E+00 1.676E+03 3.566E+03 4.302E+02
7.564E+00 1.676E+03 4.516E+03 8.676E+02
8.510E+00 1.676E+03 5.705E+03 1.610E+03
9.455E+00 1.676E+03 7.210E+03 2.798E+03
1.040E+01 1.676E+03 8.795E+03 3.077E+03
1.240E+01 1.676E+03 4.231E+04 6.155E+03
END FTABLE 26
*****
TABLE 27
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 7.884E+01 0 0
2.688E-01 7.884E+01 6.357E+00 7.250E-02
5.375E-01 7.884E+01 1.271E+01 1.162E+00
8.063E-01 7.884E+01 1.907E+01 4.672E+00
1.075E+00 7.884E+01 2.543E+01 7.676E+00
1.344E+00 7.884E+01 3.178E+01 1.184E+01
1.613E+00 7.884E+01 3.814E+01 2.355E+01
1.881E+00 7.884E+01 4.767E+01 5.286E+01
2.150E+00 7.884E+01 6.039E+01 1.066E+02
2.419E+00 7.884E+01 7.628E+01 1.979E+02
2.688E+00 7.884E+01 9.641E+01 3.438E+02
2.956E+00 7.884E+01 1.176E+02 3.781E+02
4.956E+00 7.884E+01 1.694E+03 7.563E+02
END FTABLE 27
*****
TABLE 28
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.914E+02 0 0
3.290E-01 2.914E+02 2.876E+01 1.016E-01
6.580E-01 2.914E+02 5.752E+01 1.627E+00
9.870E-01 2.914E+02 8.628E+01 6.545E+00
1.316E+00 2.914E+02 1.150E+02 1.075E+01
1.645E+00 2.914E+02 1.438E+02 1.659E+01
1.974E+00 2.914E+02 1.726E+02 3.300E+01
2.303E+00 2.914E+02 2.157E+02 7.406E+01
2.632E+00 2.914E+02 2.732E+02 1.494E+02

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2.961E+00 2.914E+02 3.451E+02 2.772E+02
3.290E+00 2.914E+02 4.362E+02 4.816E+02
3.619E+00 2.914E+02 5.321E+02 5.297E+02
5.619E+00 2.914E+02 6.360E+03 1.059E+03
END FTABLE 28
*****
FTABLE 29
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 3.498E+02 0 0
4.022E-01 3.498E+02 4.221E+01 1.420E-01
8.045E-01 3.498E+02 8.441E+01 2.275E+00
1.207E+00 3.498E+02 1.266E+02 9.150E+00
1.609E+00 3.498E+02 1.688E+02 1.503E+01
2.011E+00 3.498E+02 2.110E+02 2.319E+01
2.413E+00 3.498E+02 2.532E+02 4.613E+01
2.816E+00 3.498E+02 3.166E+02 1.035E+02
3.218E+00 3.498E+02 4.010E+02 2.088E+02
3.620E+00 3.498E+02 5.065E+02 3.875E+02
4.022E+00 3.498E+02 6.401E+02 6.732E+02
4.425E+00 3.498E+02 7.808E+02 7.405E+02
6.425E+00 3.498E+02 7.776E+03 1.481E+03
END FTABLE 29
*****
FTABLE 30
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 3.858E+03 0 0
2.790E-01 3.858E+03 3.228E+02 7.715E-02
5.579E-01 3.858E+03 6.457E+02 1.236E+00
8.369E-01 3.858E+03 9.685E+02 4.972E+00
1.116E+00 3.858E+03 1.291E+03 8.168E+00
1.395E+00 3.858E+03 1.614E+03 1.260E+01
1.674E+00 3.858E+03 1.937E+03 2.506E+01
1.953E+00 3.858E+03 2.421E+03 5.625E+01
2.232E+00 3.858E+03 3.067E+03 1.134E+02
2.511E+00 3.858E+03 3.874E+03 2.106E+02
2.790E+00 3.858E+03 4.896E+03 3.658E+02
3.069E+00 3.858E+03 5.972E+03 4.024E+02
5.069E+00 3.858E+03 8.313E+04 8.047E+02
END FTABLE 30
*****
FTABLE 31
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 3.663E+02 0 0
5.726E-01 3.663E+02 6.292E+01 2.558E-01
1.145E+00 3.663E+02 1.258E+02 4.098E+00
1.718E+00 3.663E+02 1.887E+02 1.648E+01
2.290E+00 3.663E+02 2.517E+02 2.708E+01
2.863E+00 3.663E+02 3.146E+02 4.177E+01
3.436E+00 3.663E+02 3.775E+02 8.310E+01
4.008E+00 3.663E+02 4.719E+02 1.865E+02
4.581E+00 3.663E+02 5.977E+02 3.761E+02
5.153E+00 3.663E+02 7.550E+02 6.980E+02
5.726E+00 3.663E+02 9.542E+02 1.213E+03
6.299E+00 3.663E+02 1.164E+03 1.334E+03
8.299E+00 3.663E+02 8.489E+03 2.668E+03
END FTABLE 31
*****
FTABLE 33
ROWS COLS***

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13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 1.727E+02 0 0
5.135E-01 1.727E+02 2.661E+01 2.133E-01
1.027E+00 1.727E+02 5.322E+01 3.417E+00
1.540E+00 1.727E+02 7.983E+01 1.374E+01
2.054E+00 1.727E+02 1.064E+02 2.258E+01
2.567E+00 1.727E+02 1.331E+02 3.483E+01
3.081E+00 1.727E+02 1.597E+02 6.929E+01
3.594E+00 1.727E+02 1.996E+02 1.555E+02
4.108E+00 1.727E+02 2.528E+02 3.136E+02
4.621E+00 1.727E+02 3.193E+02 5.821E+02
5.135E+00 1.727E+02 4.036E+02 1.011E+03
5.648E+00 1.727E+02 4.923E+02 1.112E+03
7.648E+00 1.727E+02 3.947E+03 2.225E+03
END FTABLE 33
*****
FTABLE 34
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.317E+02 0 0
2.554E-01 2.317E+02 1.775E+01 6.658E-02
5.107E-01 2.317E+02 3.551E+01 1.067E+00
7.661E-01 2.317E+02 5.326E+01 4.290E+00
1.021E+00 2.317E+02 7.101E+01 7.049E+00
1.277E+00 2.317E+02 8.877E+01 1.087E+01
1.532E+00 2.317E+02 1.065E+02 2.163E+01
1.787E+00 2.317E+02 1.332E+02 4.854E+01
2.043E+00 2.317E+02 1.687E+02 9.790E+01
2.298E+00 2.317E+02 2.130E+02 1.817E+02
2.554E+00 2.317E+02 2.693E+02 3.157E+02
2.809E+00 2.317E+02 3.284E+02 3.472E+02
4.809E+00 2.317E+02 4.963E+03 6.945E+02
END FTABLE 34
*****
FTABLE 35
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 5.386E+01 0 0
3.448E-01 5.386E+01 5.571E+00 1.098E-01
6.895E-01 5.386E+01 1.114E+01 1.759E+00
1.034E+00 5.386E+01 1.671E+01 7.076E+00
1.379E+00 5.386E+01 2.228E+01 1.163E+01
1.724E+00 5.386E+01 2.785E+01 1.793E+01
2.069E+00 5.386E+01 3.342E+01 3.567E+01
2.413E+00 5.386E+01 4.178E+01 8.006E+01
2.758E+00 5.386E+01 5.292E+01 1.615E+02
3.103E+00 5.386E+01 6.685E+01 2.997E+02
3.448E+00 5.386E+01 8.449E+01 5.206E+02
3.792E+00 5.386E+01 1.031E+02 5.727E+02
5.792E+00 5.386E+01 1.088E+04 1.145E+03
END FTABLE 35
*****
FTABLE 36
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 4.779E+02 0 0
6.149E-01 4.779E+02 8.815E+01 2.880E-01
1.230E+00 4.779E+02 1.763E+02 4.614E+00
1.845E+00 4.779E+02 2.644E+02 1.856E+01
2.459E+00 4.779E+02 3.526E+02 3.049E+01

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3.074E+00 4.779E+02 4.407E+02 4.703E+01
3.689E+00 4.779E+02 5.289E+02 9.357E+01
4.304E+00 4.779E+02 6.611E+02 2.100E+02
4.919E+00 4.779E+02 8.374E+02 4.235E+02
5.534E+00 4.779E+02 1.058E+03 7.860E+02
6.149E+00 4.779E+02 1.337E+03 1.366E+03
6.764E+00 4.779E+02 1.631E+03 1.502E+03
8.764E+00 4.779E+02 1.119E+04 3.004E+03
END FTABLE 36
*****
FTABLE 201
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 9.878E+02 0 0
2.148E+00 9.878E+02 2.122E+01 7.893E+01
4.296E+00 9.878E+02 2.334E+02 2.566E+02
6.444E+00 9.878E+02 4.880E+02 4.772E+02
8.592E+00 9.878E+02 8.062E+02 7.588E+02
1.074E+01 9.878E+02 1.231E+03 1.099E+03
1.289E+01 9.878E+02 1.867E+03 1.561E+03
1.504E+01 9.878E+02 2.822E+03 2.830E+03
1.718E+01 9.878E+02 4.095E+03 5.432E+03
1.933E+01 9.878E+02 5.686E+03 9.695E+03
2.148E+01 9.878E+02 7.702E+03 1.633E+04
2.363E+01 9.878E+02 9.823E+03 1.796E+04
2.563E+01 9.878E+02 2.958E+04 3.593E+04
END FTABLE201
*****
FTABLE 202
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 6.014E+02 0 0
1.938E+00 6.014E+02 1.166E+01 6.651E+01
3.876E+00 6.014E+02 1.282E+02 2.162E+02
5.815E+00 6.014E+02 2.681E+02 4.021E+02
7.753E+00 6.014E+02 4.429E+02 6.394E+02
9.691E+00 6.014E+02 6.760E+02 9.262E+02
1.163E+01 6.014E+02 1.026E+03 1.316E+03
1.357E+01 6.014E+02 1.550E+03 2.385E+03
1.551E+01 6.014E+02 2.250E+03 4.577E+03
1.744E+01 6.014E+02 3.124E+03 8.169E+03
1.938E+01 6.014E+02 4.231E+03 1.376E+04
2.132E+01 6.014E+02 5.397E+03 1.514E+04
2.332E+01 6.014E+02 1.742E+04 3.027E+04
END FTABLE202
*****
FTABLE 203
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 7.754E+02 0 0
1.887E+00 7.754E+02 1.463E+01 6.363E+01
3.775E+00 7.754E+02 1.610E+02 2.068E+02
5.662E+00 7.754E+02 3.366E+02 3.847E+02
7.549E+00 7.754E+02 5.561E+02 6.117E+02
9.437E+00 7.754E+02 8.487E+02 8.860E+02
1.132E+01 7.754E+02 1.288E+03 1.259E+03
1.321E+01 7.754E+02 1.946E+03 2.281E+03
1.510E+01 7.754E+02 2.824E+03 4.378E+03
1.699E+01 7.754E+02 3.922E+03 7.815E+03
1.887E+01 7.754E+02 5.312E+03 1.316E+04
2.076E+01 7.754E+02 6.775E+03 1.448E+04
2.276E+01 7.754E+02 2.228E+04 2.896E+04

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END FTABLE203
*****
FTABLE 204
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 5.999E+02 0 0
1.804E+00 5.999E+02 1.082E+01 5.899E+01
3.607E+00 5.999E+02 1.190E+02 1.917E+02
5.411E+00 5.999E+02 2.488E+02 3.567E+02
7.214E+00 5.999E+02 4.111E+02 5.671E+02
9.018E+00 5.999E+02 6.275E+02 8.214E+02
1.082E+01 5.999E+02 9.521E+02 1.167E+03
1.262E+01 5.999E+02 1.439E+03 2.115E+03
1.443E+01 5.999E+02 2.088E+03 4.059E+03
1.623E+01 5.999E+02 2.900E+03 7.245E+03
1.804E+01 5.999E+02 3.927E+03 1.220E+04
1.984E+01 5.999E+02 5.009E+03 1.342E+04
2.184E+01 5.999E+02 1.701E+04 2.685E+04
END FTABLE204
*****
FTABLE 205
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 5.685E+02 0 0
1.646E+00 5.685E+02 9.356E+00 5.064E+01
3.291E+00 5.685E+02 1.029E+02 1.646E+02
4.937E+00 5.685E+02 2.152E+02 3.062E+02
6.583E+00 5.685E+02 3.555E+02 4.868E+02
8.228E+00 5.685E+02 5.426E+02 7.051E+02
9.874E+00 5.685E+02 8.233E+02 1.002E+03
1.152E+01 5.685E+02 1.244E+03 1.815E+03
1.317E+01 5.685E+02 1.806E+03 3.485E+03
1.481E+01 5.685E+02 2.507E+03 6.220E+03
1.646E+01 5.685E+02 3.396E+03 1.048E+04
1.810E+01 5.685E+02 4.332E+03 1.152E+04
2.010E+01 5.685E+02 1.570E+04 2.305E+04
END FTABLE205
*****
FTABLE 206
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 9.011E+02 0 0
1.527E+00 9.011E+02 1.376E+01 1.312E+01
3.054E+00 9.011E+02 1.514E+02 4.203E+01
4.581E+00 9.011E+02 3.165E+02 8.452E+01
6.108E+00 9.011E+02 5.229E+02 1.389E+02
7.635E+00 9.011E+02 7.981E+02 2.142E+02
9.162E+00 9.011E+02 1.211E+03 4.261E+02
1.069E+01 9.011E+02 1.830E+03 9.563E+02
1.222E+01 9.011E+02 2.656E+03 1.929E+03
1.374E+01 9.011E+02 3.688E+03 3.580E+03
1.527E+01 9.011E+02 4.995E+03 6.219E+03
1.680E+01 9.011E+02 6.371E+03 6.841E+03
1.880E+01 9.011E+02 2.439E+04 1.368E+04
END FTABLE206
*****
FTABLE 207
ROWS COLS***
13 4
*** DEPTH AREA VOLUME DISCH FLO-THRU ***
*** (FT) (ACRES) (AC-FT) (CFS) (MIN) ***
0 2.917E+02 0 0

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2.304E+00 2.917E+02 6.720E+00 2.603E+01
4.607E+00 2.917E+02 7.392E+01 8.340E+01
6.911E+00 2.917E+02 1.546E+02 1.677E+02
9.214E+00 2.917E+02 2.554E+02 2.756E+02
1.152E+01 2.917E+02 3.898E+02 4.250E+02
1.382E+01 2.917E+02 5.914E+02 8.456E+02
1.613E+01 2.917E+02 8.938E+02 1.898E+03
1.843E+01 2.917E+02 1.297E+03 3.827E+03
2.073E+01 2.917E+02 1.801E+03 7.104E+03
2.304E+01 2.917E+02 2.439E+03 1.234E+04
2.534E+01 2.917E+02 3.111E+03 1.358E+04
2.734E+01 2.917E+02 8.946E+03 2.715E+04
END FTABLE207
*****
FTABLE      208
ROWS COLS***
13      4
*** DEPTH      AREA      VOLUME      DISCH      FLO-THRU ***
*** (FT)      (ACRES)      (AC-FT)      (CFS)      (MIN) ***
0 4.908E+02 0 0
1.940E+00 4.908E+02 9.524E+00 1.955E+01
3.881E+00 4.908E+02 1.048E+02 6.265E+01
5.821E+00 4.908E+02 2.190E+02 1.260E+02
7.761E+00 4.908E+02 3.619E+02 2.070E+02
9.702E+00 4.908E+02 5.524E+02 3.193E+02
1.164E+01 4.908E+02 8.381E+02 6.352E+02
1.358E+01 4.908E+02 1.267E+03 1.426E+03
1.552E+01 4.908E+02 1.838E+03 2.875E+03
1.746E+01 4.908E+02 2.552E+03 5.336E+03
1.940E+01 4.908E+02 3.457E+03 9.271E+03
2.134E+01 4.908E+02 4.410E+03 1.020E+04
2.334E+01 4.908E+02 1.423E+04 2.040E+04
END FTABLE208
*****
FTABLE      300
rows cols      ***
13      4
depth      area      volume      outflow1 ***
0.      10.      0.      0.
1.65      10.      1.60      58.
3.29      10.      1.81      189.
4.94      10.      3.79      352.
6.58      10.      6.25      561.
8.23      10.      9.54      813.
9.87      10.      14.48      1155.
11.52      10.      21.89      2093.
13.17      10.      31.76      4020.
14.81      10.      44.1      7175.
16.46      10.      59.74      12080.
18.1      10.      76.19      13290.
20.1      10.      276.19      26580.
END FTABLE300
END FTABLES
COPY
TIMESERIES
Copy-opn***
*** x - x NPT NMN
1 2 0 7
END TIMESERIES
END COPY
EXT SOURCES
<-Volume-> <Member> SsysSgap<-Mult-->Tran <-Target vols> <-Grp> <-Member-> ***

```

```

<Name> x <Name> x tem strg<-factor->strg <Name> x x <Name> x x ***
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2 106 PREC ENGL SAME PERLND 11 367 EXTNL PREC
WDM2 113 PEVT ENGL 0.7DIV PERLND 11 367 EXTNL PETINP
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2 106 PREC ENGL SAME IMPLND 11 361 EXTNL PREC
WDM2 113 PEVT ENGL 0.7DIV IMPLND 11 361 EXTNL PETINP
*** Met Seg LITTLE,PI:PETINP=0.7
WDM2 106 PREC ENGL SAME RCHRES 1 300 EXTNL PREC
WDM2 113 PEVT ENGL 0.7DIV RCHRES 1 300 EXTNL POTEV

*** Irrigation (using fractions from INTB PERLNDs 573 - 613)
*** INTB PERLND 613 --> PERLNDs 12-142
WDM2 1 IRRIG ENGL 0.90506DIV PERLND 12 EXTNL SURLI
WDM2 1 IRRIG ENGL 0.09494DIV PERLND 12 EXTNL IRRINP
WDM2 2 IRRIG ENGL 0.90506DIV PERLND 22 EXTNL SURLI
WDM2 2 IRRIG ENGL 0.09494DIV PERLND 22 EXTNL IRRINP
WDM2 3 IRRIG ENGL 0.90506DIV PERLND 32 EXTNL SURLI
WDM2 3 IRRIG ENGL 0.09494DIV PERLND 32 EXTNL IRRINP
WDM2 4 IRRIG ENGL 0.90506DIV PERLND 42 EXTNL SURLI
WDM2 4 IRRIG ENGL 0.09494DIV PERLND 42 EXTNL IRRINP
WDM2 5 IRRIG ENGL 0.90506DIV PERLND 52 EXTNL SURLI
WDM2 5 IRRIG ENGL 0.09494DIV PERLND 52 EXTNL IRRINP
WDM2 6 IRRIG ENGL 0.90506DIV PERLND 62 EXTNL SURLI
WDM2 6 IRRIG ENGL 0.09494DIV PERLND 62 EXTNL IRRINP
WDM2 7 IRRIG ENGL 0.90506DIV PERLND 72 EXTNL SURLI
WDM2 7 IRRIG ENGL 0.09494DIV PERLND 72 EXTNL IRRINP
WDM2 8 IRRIG ENGL 0.90506DIV PERLND 82 EXTNL SURLI
WDM2 8 IRRIG ENGL 0.09494DIV PERLND 82 EXTNL IRRINP
***WDM2 9 IRRIG ENGL 0.90506DIV PERLND 92 EXTNL SURLI
***WDM2 9 IRRIG ENGL 0.09494DIV PERLND 92 EXTNL IRRINP
WDM2 10 IRRIG ENGL 0.90506DIV PERLND 102 EXTNL SURLI
WDM2 10 IRRIG ENGL 0.09494DIV PERLND 102 EXTNL IRRINP
WDM2 11 IRRIG ENGL 0.90506DIV PERLND 112 EXTNL SURLI
WDM2 11 IRRIG ENGL 0.09494DIV PERLND 112 EXTNL IRRINP
***WDM2 12 IRRIG ENGL 0.90506DIV PERLND 122 EXTNL SURLI
***WDM2 12 IRRIG ENGL 0.09494DIV PERLND 122 EXTNL IRRINP
WDM2 13 IRRIG ENGL 0.90506DIV PERLND 132 EXTNL SURLI
WDM2 13 IRRIG ENGL 0.09494DIV PERLND 132 EXTNL IRRINP
WDM2 14 IRRIG ENGL 0.90506DIV PERLND 142 EXTNL SURLI
WDM2 14 IRRIG ENGL 0.09494DIV PERLND 142 EXTNL IRRINP
*** INTB PERLND 573 --> PERLND 212
WDM2 21 IRRIG ENGL 0.95455DIV PERLND 212 EXTNL SURLI
WDM2 21 IRRIG ENGL 0.04545DIV PERLND 212 EXTNL IRRINP
*** INTB PERLND 593 --> PERLND 222
WDM2 22 IRRIG ENGL 0.81609DIV PERLND 222 EXTNL SURLI
WDM2 22 IRRIG ENGL 0.18391DIV PERLND 222 EXTNL IRRINP
*** INTB PERLND 583 --> PERLNDs 232-272,292,352,362
WDM2 23 IRRIG ENGL 0.82353DIV PERLND 232 EXTNL SURLI
WDM2 23 IRRIG ENGL 0.17647DIV PERLND 232 EXTNL IRRINP
WDM2 24 IRRIG ENGL 0.82353DIV PERLND 242 EXTNL SURLI
WDM2 24 IRRIG ENGL 0.17647DIV PERLND 242 EXTNL IRRINP
WDM2 25 IRRIG ENGL 0.82353DIV PERLND 252 EXTNL SURLI
WDM2 25 IRRIG ENGL 0.17647DIV PERLND 252 EXTNL IRRINP
WDM2 26 IRRIG ENGL 0.82353DIV PERLND 262 EXTNL SURLI
WDM2 26 IRRIG ENGL 0.17647DIV PERLND 262 EXTNL IRRINP
WDM2 27 IRRIG ENGL 0.82353DIV PERLND 272 EXTNL SURLI
WDM2 27 IRRIG ENGL 0.17647DIV PERLND 272 EXTNL IRRINP
WDM2 29 IRRIG ENGL 0.82353DIV PERLND 292 EXTNL SURLI
WDM2 29 IRRIG ENGL 0.17647DIV PERLND 292 EXTNL IRRINP
WDM2 35 IRRIG ENGL 0.82353DIV PERLND 352 EXTNL SURLI
WDM2 35 IRRIG ENGL 0.17647DIV PERLND 352 EXTNL IRRINP
WDM2 36 IRRIG ENGL 0.82353DIV PERLND 362 EXTNL SURLI
WDM2 36 IRRIG ENGL 0.17647DIV PERLND 362 EXTNL IRRINP
*** INTB PERLND 603 --> PERLNDs 282,302-332
WDM2 28 IRRIG ENGL 1.00000DIV PERLND 282 EXTNL SURLI
WDM2 28 IRRIG ENGL 0.00000DIV PERLND 282 EXTNL IRRINP
WDM2 30 IRRIG ENGL 1.00000DIV PERLND 302 EXTNL SURLI

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WDM2	30	IRRIG	ENGL	0.00000DIV	PERLND 302	EXTNL	IRRINP
WDM2	31	IRRIG	ENGL	1.00000DIV	PERLND 312	EXTNL	SURLI
WDM2	31	IRRIG	ENGL	0.00000DIV	PERLND 312	EXTNL	IRRINP
WDM2	32	IRRIG	ENGL	1.00000DIV	PERLND 322	EXTNL	SURLI
WDM2	32	IRRIG	ENGL	0.00000DIV	PERLND 322	EXTNL	IRRINP
WDM2	33	IRRIG	ENGL	1.00000DIV	PERLND 332	EXTNL	SURLI
WDM2	33	IRRIG	ENGL	0.00000DIV	PERLND 332	EXTNL	IRRINP

*** Withdrawal from RCH205 for nearby reservoir - mfact converts MGD to cfs
WDM2 206 OFLOW ENGL 1.5477 SAME RCHRES 205 EXTNL OUTDGT 2

END EXT SOURCES

SCHEMATIC

<-Volume->		<-Area-->	<-Volume->	<ML#>	***	<sb>
<Name>	x	<-factor->	<Name>	x	***	x x
PERLND 11		307.21	RCHRES 1	2		
PERLND 12		594.55	RCHRES 1	2		
PERLND 13		329.72	RCHRES 1	2		
PERLND 14		115.1	RCHRES 1	2		
PERLND 17		437.16	RCHRES 1	2		
IMPLND 11		52.1	RCHRES 1	1		
PERLND 21		1249.92	RCHRES 2	2		
PERLND 22		847.81	RCHRES 2	2		
PERLND 23		1147.33	RCHRES 2	2		
PERLND 24		293.8	RCHRES 2	2		
PERLND 27		107.03	RCHRES 2	2		
IMPLND 21		298.93	RCHRES 2	1		
PERLND 31		135.2	RCHRES 3	2		
PERLND 32		248.48	RCHRES 3	2		
PERLND 33		284.22	RCHRES 3	2		
PERLND 34		172.81	RCHRES 3	2		
PERLND 37		3.32	RCHRES 3	2		
IMPLND 31		31.3	RCHRES 3	1		
PERLND 41		105.46	RCHRES 4	2		
PERLND 42		1091.75	RCHRES 4	2		
PERLND 43		925.41	RCHRES 4	2		
PERLND 44		112.31	RCHRES 4	2		
IMPLND 41		14.65	RCHRES 4	1		
PERLND 51		742.91	RCHRES 5	2		
PERLND 52		4638.65	RCHRES 5	2		
PERLND 53		4587.15	RCHRES 5	2		
PERLND 54		1149.41	RCHRES 5	2		
PERLND 57		26.04	RCHRES 5	2		
IMPLND 51		135.24	RCHRES 5	1		
PERLND 61		220.74	RCHRES 6	2		
PERLND 62		37.75	RCHRES 6	2		
PERLND 63		109.08	RCHRES 6	2		
PERLND 64		65.46	RCHRES 6	2		
PERLND 67		63.75	RCHRES 6	2		
IMPLND 61		30.67	RCHRES 6	1		
PERLND 71		364.54	RCHRES 7	2		
PERLND 72		273.96	RCHRES 7	2		
PERLND 73		477.61	RCHRES 7	2		
PERLND 74		162.46	RCHRES 7	2		
PERLND 77		20.19	RCHRES 7	2		
IMPLND 71		90	RCHRES 7	1		
PERLND 81		257.9	RCHRES 8	2		
PERLND 82		274.73	RCHRES 8	2		
PERLND 83		311.94	RCHRES 8	2		
PERLND 84		135.22	RCHRES 8	2		
PERLND 87		224.69	RCHRES 8	2		
IMPLND 81		23.04	RCHRES 8	1		
PERLND 91		193.09	RCHRES 9	2		
PERLND 92		26.79	RCHRES 9	2		
PERLND 93		142.81	RCHRES 9	2		
PERLND 94		33.25	RCHRES 9	2		
IMPLND 91		41.24	RCHRES 9	1		

PERLND 101	236.96	RCHRES 10	2
PERLND 102	316.84	RCHRES 10	2
PERLND 103	505.05	RCHRES 10	2
PERLND 104	486.54	RCHRES 10	2
PERLND 107	51.54	RCHRES 10	2
IMPLND 101	45.47	RCHRES 10	1
PERLND 111	324.36	RCHRES 11	2
PERLND 112	554.98	RCHRES 11	2
PERLND 113	1604.02	RCHRES 11	2
PERLND 114	847.66	RCHRES 11	2
PERLND 117	19.83	RCHRES 11	2
IMPLND 111	39.27	RCHRES 11	1
PERLND 121	52.38	RCHRES 12	2
PERLND 122	14.67	RCHRES 12	2
PERLND 123	276.49	RCHRES 12	2
PERLND 124	662.84	RCHRES 12	2
PERLND 127	12.67	RCHRES 12	2
IMPLND 121	9.39	RCHRES 12	1
PERLND 131	2056.83	RCHRES 13	2
PERLND 132	1261.84	RCHRES 13	2
PERLND 133	1256.77	RCHRES 13	2
PERLND 134	484.5	RCHRES 13	2
PERLND 137	2.5	RCHRES 13	2
IMPLND 131	689.27	RCHRES 13	1
PERLND 141	264.14	RCHRES 14	2
PERLND 142	51.21	RCHRES 14	2
PERLND 143	358.73	RCHRES 14	2
PERLND 144	307.11	RCHRES 14	2
IMPLND 141	22.66	RCHRES 14	1
PERLND 211	60.49	RCHRES 21	2
PERLND 212	1533.54	RCHRES 21	2
PERLND 213	7314.26	RCHRES 21	2
PERLND 214	827.74	RCHRES 21	2
PERLND 217	3728.16	RCHRES 21	2
IMPLND 211	10.93	RCHRES 21	1
PERLND 221	137.01	RCHRES 22	2
PERLND 222	6574.59	RCHRES 22	2
PERLND 223	8549.38	RCHRES 22	2
PERLND 224	3410.99	RCHRES 22	2
PERLND 227	99.39	RCHRES 22	2
IMPLND 221	19.57	RCHRES 22	1
PERLND 231	13.77	RCHRES 23	2
PERLND 232	332.61	RCHRES 23	2
PERLND 233	2411.68	RCHRES 23	2
PERLND 234	361.14	RCHRES 23	2
PERLND 237	20.31	RCHRES 23	2
IMPLND 231	0.72	RCHRES 23	1
PERLND 241	110.07	RCHRES 24	2
PERLND 242	1895.11	RCHRES 24	2
PERLND 243	2126.64	RCHRES 24	2
PERLND 244	313.55	RCHRES 24	2
PERLND 247	85.97	RCHRES 24	2
IMPLND 241	5.79	RCHRES 24	1
PERLND 251	182.83	RCHRES 25	2
PERLND 252	3213.86	RCHRES 25	2
PERLND 253	1795.68	RCHRES 25	2
PERLND 254	112.37	RCHRES 25	2
PERLND 257	77.87	RCHRES 25	2
IMPLND 251	22.37	RCHRES 25	1
PERLND 261	86.54	RCHRES 26	2
PERLND 262	1651.06	RCHRES 26	2
PERLND 263	7410.22	RCHRES 26	2
PERLND 264	527.96	RCHRES 26	2
PERLND 267	186.06	RCHRES 26	2
IMPLND 261	4.55	RCHRES 26	1
PERLND 271	0.28	RCHRES 27	2
PERLND 272	301.99	RCHRES 27	2
PERLND 273	735.53	RCHRES 27	2

PERLND 274	174.34	RCHRES 27	2	RCHRES 8	RCHRES 203	3
IMPLND 271	0.15	RCHRES 27	1	RCHRES 9	RCHRES 203	3
PERLND 281	130.17	RCHRES 28	2	RCHRES 10	RCHRES 203	3
PERLND 282	611.28	RCHRES 28	2	RCHRES 11	RCHRES 203	3
PERLND 283	621.45	RCHRES 28	2	RCHRES 204	RCHRES 203	3
PERLND 284	309.7	RCHRES 28	2	RCHRES 4	RCHRES 202	3
IMPLND 281	25.72	RCHRES 28	1	RCHRES 6	RCHRES 202	3
PERLND 292	490.68	RCHRES 29	2	RCHRES 7	RCHRES 202	3
PERLND 293	1633.75	RCHRES 29	2	RCHRES 203	RCHRES 202	3
PERLND 294	154.42	RCHRES 29	2	RCHRES 1	RCHRES 201	3
PERLND 297	95.33	RCHRES 29	2	RCHRES 2	RCHRES 201	3
PERLND 301	28.88	RCHRES 30	2	RCHRES 3	RCHRES 201	3
PERLND 302	780.39	RCHRES 30	2	RCHRES 5	RCHRES 201	3
PERLND 303	439.38	RCHRES 30	2	RCHRES 202	RCHRES 201	3
PERLND 304	28.32	RCHRES 30	2	PERLND 211	COPY 1	90
IMPLND 301	13.04	RCHRES 30	1	PERLND 212	1533.54 COPY 1	90
PERLND 311	636.28	RCHRES 31	2	PERLND 213	7314.26 COPY 1	90
PERLND 312	1442.12	RCHRES 31	2	PERLND 214	827.74 COPY 1	90
PERLND 313	1200.95	RCHRES 31	2	PERLND 217	3728.16 COPY 1	90
PERLND 314	713.6	RCHRES 31	2	IMPLND 211	10.93 COPY 1	91
PERLND 317	194.5	RCHRES 31	2	PERLND 311	636.28 COPY 2	90
IMPLND 311	89.24	RCHRES 31	1	PERLND 312	1442.12 COPY 2	90
PERLND 331	171.67	RCHRES 33	2	PERLND 313	1200.95 COPY 2	90
PERLND 332	712.74	RCHRES 33	2	PERLND 314	713.6 COPY 2	90
PERLND 333	1453.77	RCHRES 33	2	PERLND 317	194.5 COPY 2	90
PERLND 334	1121.97	RCHRES 33	2	IMPLND 311	89.24 COPY 2	91
PERLND 337	59.99	RCHRES 33	2	PERLND 281	130.17 COPY 2	90
IMPLND 331	46.18	RCHRES 33	1	PERLND 282	611.28 COPY 2	90
PERLND 341	9.21	RCHRES 34	2	PERLND 283	621.45 COPY 2	90
PERLND 342	528.48	RCHRES 34	2	PERLND 284	309.7 COPY 2	90
PERLND 343	376.21	RCHRES 34	2	IMPLND 281	25.72 COPY 2	91
PERLND 344	151.12	RCHRES 34	2	PERLND 301	28.88 COPY 2	90
PERLND 347	36.85	RCHRES 34	2	PERLND 302	780.39 COPY 2	90
IMPLND 341	11.4	RCHRES 34	1	PERLND 303	439.38 COPY 2	90
PERLND 351	2.99	RCHRES 35	2	PERLND 304	28.32 COPY 2	90
PERLND 352	796.26	RCHRES 35	2	IMPLND 301	13.04 COPY 2	91
PERLND 353	904.95	RCHRES 35	2	PERLND 331	171.67 COPY 2	90
PERLND 354	131.73	RCHRES 35	2	PERLND 332	712.74 COPY 2	90
IMPLND 351	0.16	RCHRES 35	1	PERLND 333	1453.77 COPY 2	90
PERLND 361	124.83	RCHRES 36	2	PERLND 334	1121.97 COPY 2	90
PERLND 362	1115.47	RCHRES 36	2	PERLND 337	59.99 COPY 2	90
PERLND 363	2960.7	RCHRES 36	2	IMPLND 331	46.18 COPY 2	91
PERLND 364	476.33	RCHRES 36	2	PERLND 341	9.21 COPY 2	90
PERLND 367	124.72	RCHRES 36	2	PERLND 342	528.48 COPY 2	90
IMPLND 361	13.72	RCHRES 36	1	PERLND 343	376.21 COPY 2	90
RCHRES 22		RCHRES 206	3	PERLND 344	151.12 COPY 2	90
RCHRES 23		RCHRES 206	3	PERLND 347	36.85 COPY 2	90
RCHRES 21		RCHRES 208	3	IMPLND 341	11.4 COPY 2	91
RCHRES 24		RCHRES 208	3	PERLND 221	137.01 COPY 2	90
RCHRES 26		RCHRES 208	3	PERLND 222	6574.59 COPY 2	90
RCHRES 36		RCHRES 208	3	PERLND 223	8549.38 COPY 2	90
RCHRES 25		RCHRES 207	3	PERLND 224	3410.99 COPY 2	90
RCHRES 27		RCHRES 207	3	PERLND 227	99.39 COPY 2	90
RCHRES 29		RCHRES 207	3	IMPLND 221	19.57 COPY 2	91
RCHRES 35		RCHRES 207	3	PERLND 231	13.77 COPY 2	90
RCHRES 208		RCHRES 207	3	PERLND 232	332.61 COPY 2	90
RCHRES 28		RCHRES 205	3	PERLND 233	2411.68 COPY 2	90
RCHRES 30		RCHRES 205	3	PERLND 234	361.14 COPY 2	90
RCHRES 33		RCHRES 205	3	PERLND 237	20.31 COPY 2	90
RCHRES 34		RCHRES 205	3	IMPLND 231	0.72 COPY 2	91
RCHRES 206		RCHRES 205	3	PERLND 251	182.83 COPY 2	90
RCHRES 207		RCHRES 205	3	PERLND 252	3213.86 COPY 2	90
RCHRES 31		RCHRES 300	3	PERLND 253	1795.68 COPY 2	90
RCHRES 205		RCHRES 300	4	PERLND 254	112.37 COPY 2	90
RCHRES 12		RCHRES 204	3	PERLND 257	77.87 COPY 2	90
RCHRES 13		RCHRES 204	3	IMPLND 251	22.37 COPY 2	91
RCHRES 14		RCHRES 204	3	PERLND 271	0.28 COPY 2	90
RCHRES 300		RCHRES 204	3	PERLND 272	301.99 COPY 2	90

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PERLND 273          735.53    COPY 2    90
PERLND 274          174.34    COPY 2    90
IMPLND 271           0.15     COPY 2    91
PERLND 292          490.68    COPY 2    90
PERLND 293         1633.75    COPY 2    90
PERLND 294          154.42    COPY 2    90
PERLND 297           95.33    COPY 2    90
PERLND 351           2.99     COPY 2    90
PERLND 352          796.26    COPY 2    90
PERLND 353          904.95    COPY 2    90
PERLND 354          131.73    COPY 2    90
IMPLND 351           0.16     COPY 2    91
PERLND 211           60.49    COPY 2    90
PERLND 212          1533.54    COPY 2    90
PERLND 213          7314.26    COPY 2    90
PERLND 214           827.74    COPY 2    90
PERLND 217          3728.16    COPY 2    90
IMPLND 211           10.93    COPY 2    91
PERLND 241           110.07    COPY 2    90
PERLND 242          1895.11    COPY 2    90
PERLND 243          2126.64    COPY 2    90
PERLND 244          313.55    COPY 2    90
PERLND 247           85.97     COPY 2    90
IMPLND 241           5.79     COPY 2    91
PERLND 261           86.54     COPY 2    90
PERLND 262          1651.06    COPY 2    90
PERLND 263          7410.22    COPY 2    90
PERLND 264           527.96    COPY 2    90
PERLND 267           186.06    COPY 2    90
IMPLND 261           4.55     COPY 2    91
PERLND 361          124.83    COPY 2    90
PERLND 362          1115.47    COPY 2    90
PERLND 363          2960.7     COPY 2    90
PERLND 364           476.33    COPY 2    90
PERLND 367           124.72    COPY 2    90
IMPLND 361           13.72     COPY 2    91
END SCHEMATIC

EXT TARGETS
<-Volume-> <-Grp> <-Member-> <--Mult--> Tran <-Volume-> <-Member> Tsys Aggr Amd ***
<Name> x <Name> x x <-factor-> strg <Name> x <Name> qf tem strg strg ***
RCHRES 1 HYDR RO 1 1 AVER WDM1 2001 FLOW 1 ENGL AGGR REPL
RCHRES 2 HYDR RO 1 1 AVER WDM1 2002 FLOW 1 ENGL AGGR REPL
RCHRES 3 HYDR RO 1 1 AVER WDM1 2003 FLOW 1 ENGL AGGR REPL
RCHRES 4 HYDR RO 1 1 AVER WDM1 2004 FLOW 1 ENGL AGGR REPL
RCHRES 5 HYDR RO 1 1 AVER WDM1 2005 FLOW 1 ENGL AGGR REPL
RCHRES 6 HYDR RO 1 1 AVER WDM1 2006 FLOW 1 ENGL AGGR REPL
RCHRES 7 HYDR RO 1 1 AVER WDM1 2007 FLOW 1 ENGL AGGR REPL
RCHRES 8 HYDR RO 1 1 AVER WDM1 2008 FLOW 1 ENGL AGGR REPL
RCHRES 9 HYDR RO 1 1 AVER WDM1 2009 FLOW 1 ENGL AGGR REPL
RCHRES 10 HYDR RO 1 1 AVER WDM1 2010 FLOW 1 ENGL AGGR REPL
RCHRES 11 HYDR RO 1 1 AVER WDM1 2011 FLOW 1 ENGL AGGR REPL
RCHRES 12 HYDR RO 1 1 AVER WDM1 2012 FLOW 1 ENGL AGGR REPL
RCHRES 13 HYDR RO 1 1 AVER WDM1 2013 FLOW 1 ENGL AGGR REPL
RCHRES 14 HYDR RO 1 1 AVER WDM1 2014 FLOW 1 ENGL AGGR REPL
RCHRES 21 HYDR RO 1 1 AVER WDM1 2021 FLOW 1 ENGL AGGR REPL
*** commented out area term is sum of PERLND,IMPLND,RCHRES areas (16006 ac)
*** RCHRES 21 ROFLOW ROVOL 1 1 7.4967e-4 WDM 501 SIMQ 1 ENGL AGGR REPL
*** this area term is reported by the USGS gage as 20096 ac
RCHRES 21 ROFLOW ROVOL 1 1 5.9713e-4 WDM 2501 SIMQ 1 ENGL AGGR REPL
RCHRES 22 HYDR RO 1 1 AVER WDM1 2022 FLOW 1 ENGL AGGR REPL
RCHRES 23 HYDR RO 1 1 AVER WDM1 2023 FLOW 1 ENGL AGGR REPL
RCHRES 24 HYDR RO 1 1 AVER WDM1 2024 FLOW 1 ENGL AGGR REPL
RCHRES 25 HYDR RO 1 1 AVER WDM1 2025 FLOW 1 ENGL AGGR REPL
RCHRES 26 HYDR RO 1 1 AVER WDM1 2026 FLOW 1 ENGL AGGR REPL
RCHRES 27 HYDR RO 1 1 AVER WDM1 2027 FLOW 1 ENGL AGGR REPL
RCHRES 28 HYDR RO 1 1 AVER WDM1 2028 FLOW 1 ENGL AGGR REPL
RCHRES 29 HYDR RO 1 1 AVER WDM1 2029 FLOW 1 ENGL AGGR REPL

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RCHRES 30 HYDR RO 1 1 AVER WDM1 2030 FLOW 1 ENGL AGGR REPL
RCHRES 31 HYDR RO 1 1 AVER WDM1 2031 FLOW 1 ENGL AGGR REPL
RCHRES 33 HYDR RO 1 1 AVER WDM1 2033 FLOW 1 ENGL AGGR REPL
RCHRES 34 HYDR RO 1 1 AVER WDM1 2034 FLOW 1 ENGL AGGR REPL
RCHRES 35 HYDR RO 1 1 AVER WDM1 2035 FLOW 1 ENGL AGGR REPL
RCHRES 36 HYDR RO 1 1 AVER WDM1 2036 FLOW 1 ENGL AGGR REPL
RCHRES 206 HYDR RO 1 1 AVER WDM1 2206 FLOW 1 ENGL AGGR REPL
RCHRES 208 HYDR RO 1 1 AVER WDM1 2208 FLOW 1 ENGL AGGR REPL
RCHRES 207 HYDR RO 1 1 AVER WDM1 2207 FLOW 1 ENGL AGGR REPL
RCHRES 205 HYDR RO 1 1 AVER WDM1 2205 FLOW 1 ENGL AGGR REPL
*** commented out area term is sum of PERLND,IMPLND,RCHRES areas (93448.6 ac)
*** RCHRES 300 ROFLOW ROVOL 1 1 1.2841e-4 WDM 2511 SIMQ 1 ENGL AGGR REPL
*** this area term is reported by the USGS gage as 95360 ac
RCHRES 300 ROFLOW ROVOL 1 1 1.2584e-4 WDM 2511 SIMQ 1 ENGL AGGR REPL
RCHRES 300 HYDR RO 1 1 AVER WDM1 2300 FLOW 1 ENGL AGGR REPL
RCHRES 204 HYDR RO 1 1 AVER WDM1 2204 FLOW 1 ENGL AGGR REPL
RCHRES 203 HYDR RO 1 1 AVER WDM1 2203 FLOW 1 ENGL AGGR REPL
RCHRES 202 HYDR RO 1 1 AVER WDM1 2202 FLOW 1 ENGL AGGR REPL
RCHRES 201 HYDR RO 1 1 AVER WDM1 2201 FLOW 1 ENGL AGGR REPL
*** these area terms are based on the sum of the PERLND and IMPLND areas (13475
ac)
COPY 1 OUTPUT MEAN 1 1 7.4211e-5 WDM 2502 SURO 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 2 1 7.4211e-5 WDM 2503 IFWO 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 3 1 7.4211e-5 WDM 2504 AGWO 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 4 1 7.4211e-5 WDM 2505 PETX 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 5 1 7.4211e-5 WDM 2506 SAET 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 6 1 7.4211e-5 AVER WDM 2507 UZSX 1 ENGL AGGR REPL
COPY 1 OUTPUT MEAN 7 1 7.4211e-5 AVER WDM 2508 LZSX 1 ENGL AGGR REPL
*** these area terms are based on the sum of the PERLND and IMPLND areas (77397.7
ac)
COPY 2 OUTPUT MEAN 1 1 1.292E-05 WDM 2512 SURO 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 2 1 1.292E-05 WDM 2513 IFWO 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 3 1 1.292E-05 WDM 2514 AGWO 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 4 1 1.292E-05 WDM 2515 PETX 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 5 1 1.292E-05 WDM 2516 SAET 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 6 1 1.292E-05 AVER WDM 2517 UZSX 1 ENGL AGGR REPL
COPY 2 OUTPUT MEAN 7 1 1.292E-05 AVER WDM 2518 LZSX 1 ENGL AGGR REPL
RCHRES 206 HYDR AVVEL 1 1 AVER WDM1 2306 AVEL 1 ENGL AGGR REPL
RCHRES 208 HYDR AVVEL 1 1 AVER WDM1 2308 AVEL 1 ENGL AGGR REPL
RCHRES 207 HYDR AVVEL 1 1 AVER WDM1 2307 AVEL 1 ENGL AGGR REPL
RCHRES 205 HYDR AVVEL 1 1 AVER WDM1 2305 AVEL 1 ENGL AGGR REPL
RCHRES 300 HYDR AVVEL 1 1 AVER WDM1 2400 AVEL 1 ENGL AGGR REPL
RCHRES 21 HYDR AVVEL 1 1 AVER WDM1 2121 AVEL 1 ENGL AGGR REPL
RCHRES 22 HYDR AVVEL 1 1 AVER WDM1 2122 AVEL 1 ENGL AGGR REPL
END EXT TARGETS

```

MASS-LINK

```

MASS-LINK 2
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<Name> <Name> x x <-factor-> <Name> <Name> x x ***
PERLND PWATER PERO 0.0833333 RCHRES INFLOW IVOL
PERLND PWTGAS PODOXM RCHRES INFLOW OXIF 1
PERLND PWTGAS POHT RCHRES INFLOW IHEAT 1
PERLND PQUAL PQUAL 1 RCHRES INFLOW IDQAL 1
PERLND PEST POPST 1 RCHRES INFLOW IDQAL 1
PERLND PEST SOSDPS 1 RCHRES INFLOW ISQAL 1 1
PERLND PEST SOSDPS 1 RCHRES INFLOW ISQAL 2 1
PERLND PEST SOSDPS 1 RCHRES INFLOW ISQAL 3 1
PERLND SEDMNT SOSED 1 0.05 RCHRES INFLOW ISED 1
PERLND SEDMNT SOSED 1 0.55 RCHRES INFLOW ISED 2
PERLND SEDMNT SOSED 1 0.4 RCHRES INFLOW ISED 3
END MASS-LINK 2

```

```

MASS-LINK 1
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IMPLND IWATER SURO 0.0833333 RCHRES INFLOW IVOL

```

Estimating the Un-Gaged Inflows in the
Little Manatee River Basin, Florida
March 2006



```

IMPLND IWTGAS SODOXM          RCHRES INFLOW OXIF 1
IMPLND IWTGAS SOHT           RCHRES INFLOW IHEAT 1
IMPLND IQUAL SOQUAL 1        RCHRES INFLOW IDQAL 1
IMPLND SOLIDS SOSLD 1        RCHRES INFLOW ISED 1
IMPLND SOLIDS SOSLD 1        RCHRES INFLOW ISED 2
IMPLND SOLIDS SOSLD 1        RCHRES INFLOW ISED 3
END MASS-LINK 1

MASS-LINK 3
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<Name> <Name> x x<-factor-> <Name> <Name> x x ***
RCHRES ROFLOW
END MASS-LINK 3

MASS-LINK 4
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<Name> <Name> x x<-factor-> <Name> <Name> x x ***
RCHRES OFLOW OVOL 1
END MASS-LINK 4

MASS-LINK 90
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<Name> <Name> x x<-factor-> <Name> <Name> x x ***
PERLND PWATER SURO COPY INPUT MEAN 1
PERLND PWATER IFWO COPY INPUT MEAN 2
PERLND PWATER AGWO COPY INPUT MEAN 3
PERLND PWATER PET COPY INPUT MEAN 4
PERLND PWATER TAET COPY INPUT MEAN 5
PERLND PWATER UZS COPY INPUT MEAN 6
PERLND PWATER LZS COPY INPUT MEAN 7
END MASS-LINK 90

MASS-LINK 91
<-Volume-> <-Grp> <-Member-><--Mult--> <-Target vols> <-Grp> <-Member-> ***
<Name> <Name> x x<-factor-> <Name> <Name> x x ***
IMPLND IWATER SURO COPY INPUT MEAN 1
IMPLND IWATER PET COPY INPUT MEAN 4
IMPLND IWATER IMPEV COPY INPUT MEAN 5
END MASS-LINK 91
END MASS-LINK
END RUN

```

APPENDIX C Calibration/Verification Simulation Results

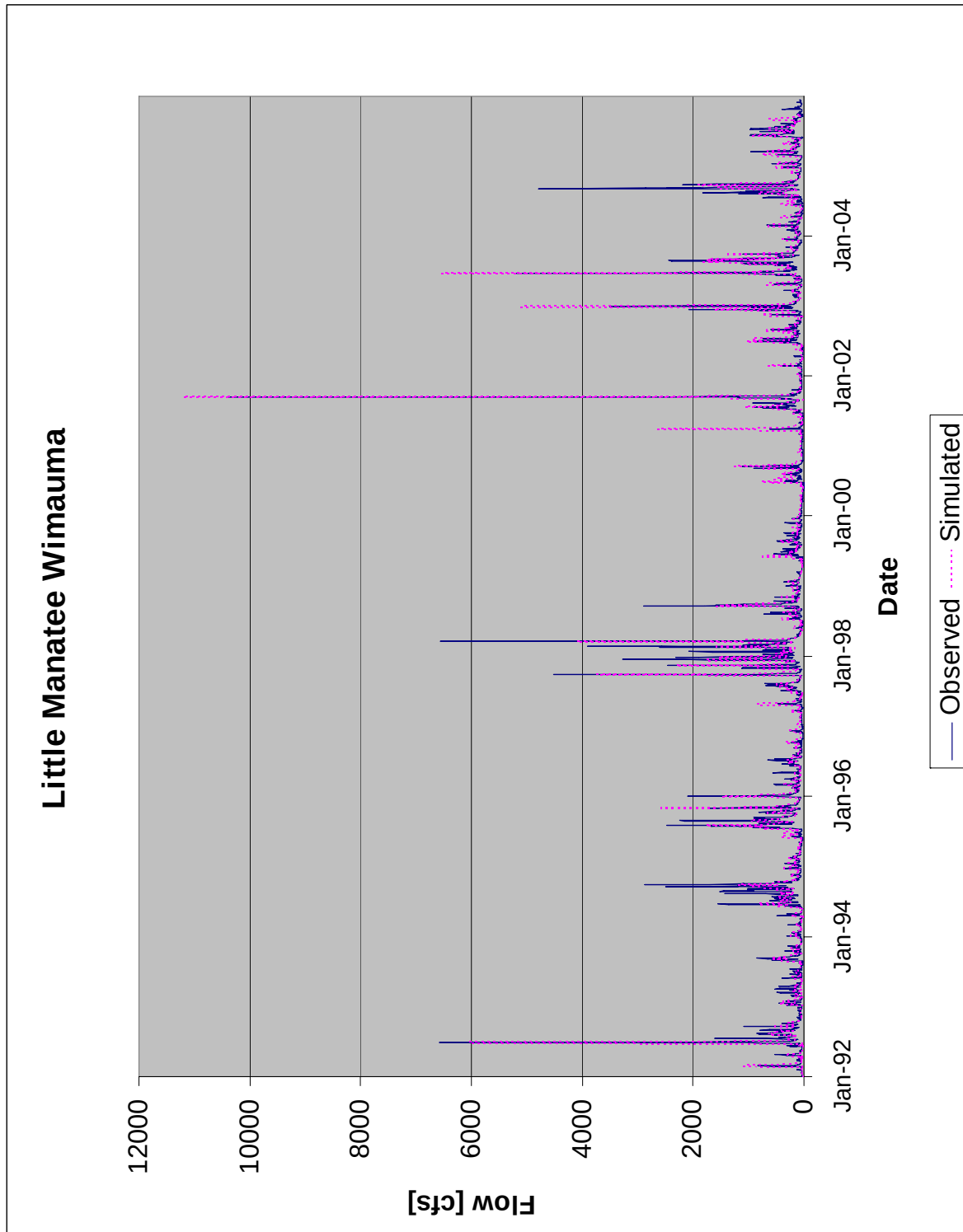


Figure 10 Little Manatee Wimauma Hydrograph

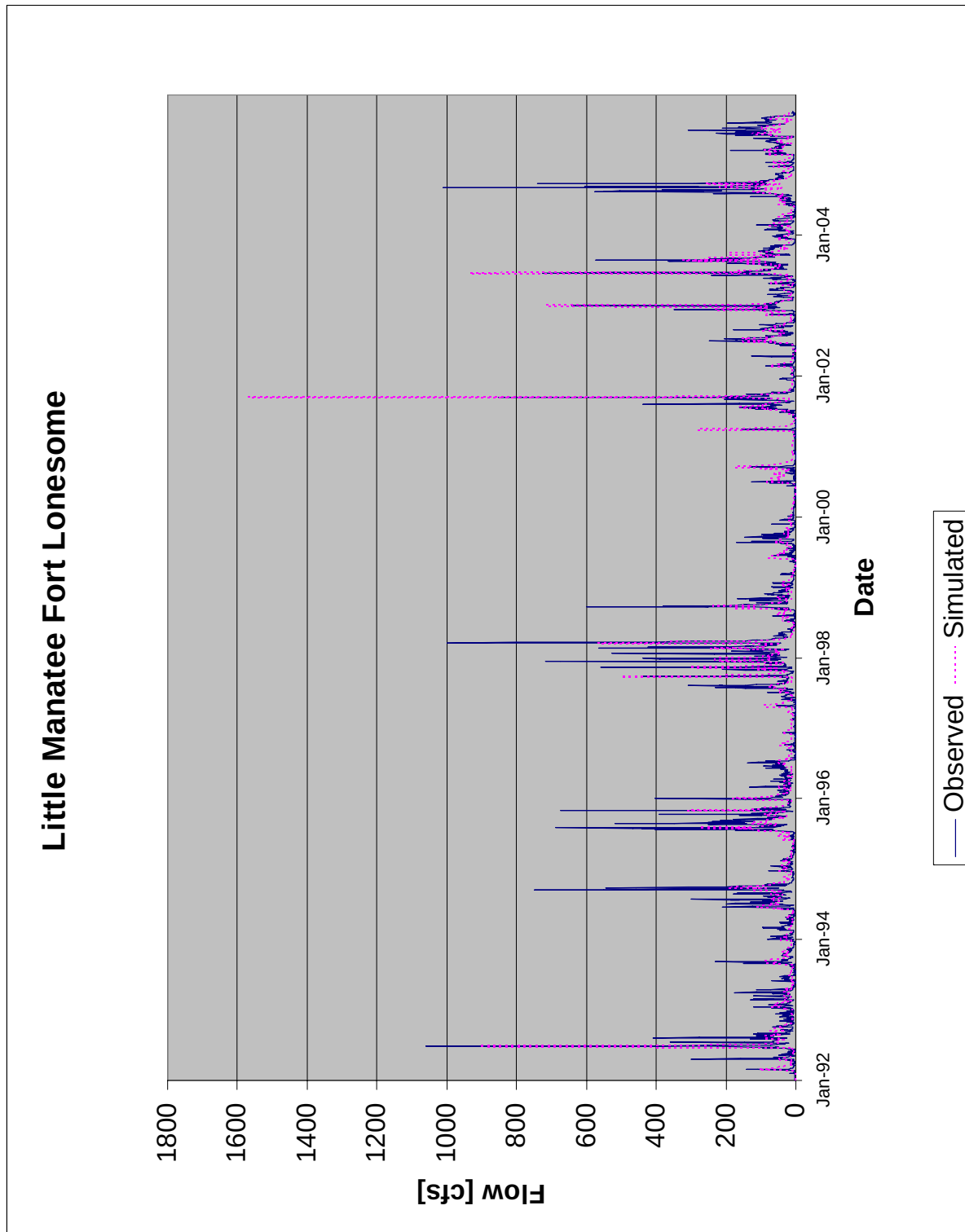


Figure 11 Little Manatee Fort Lonesome Hydrograph

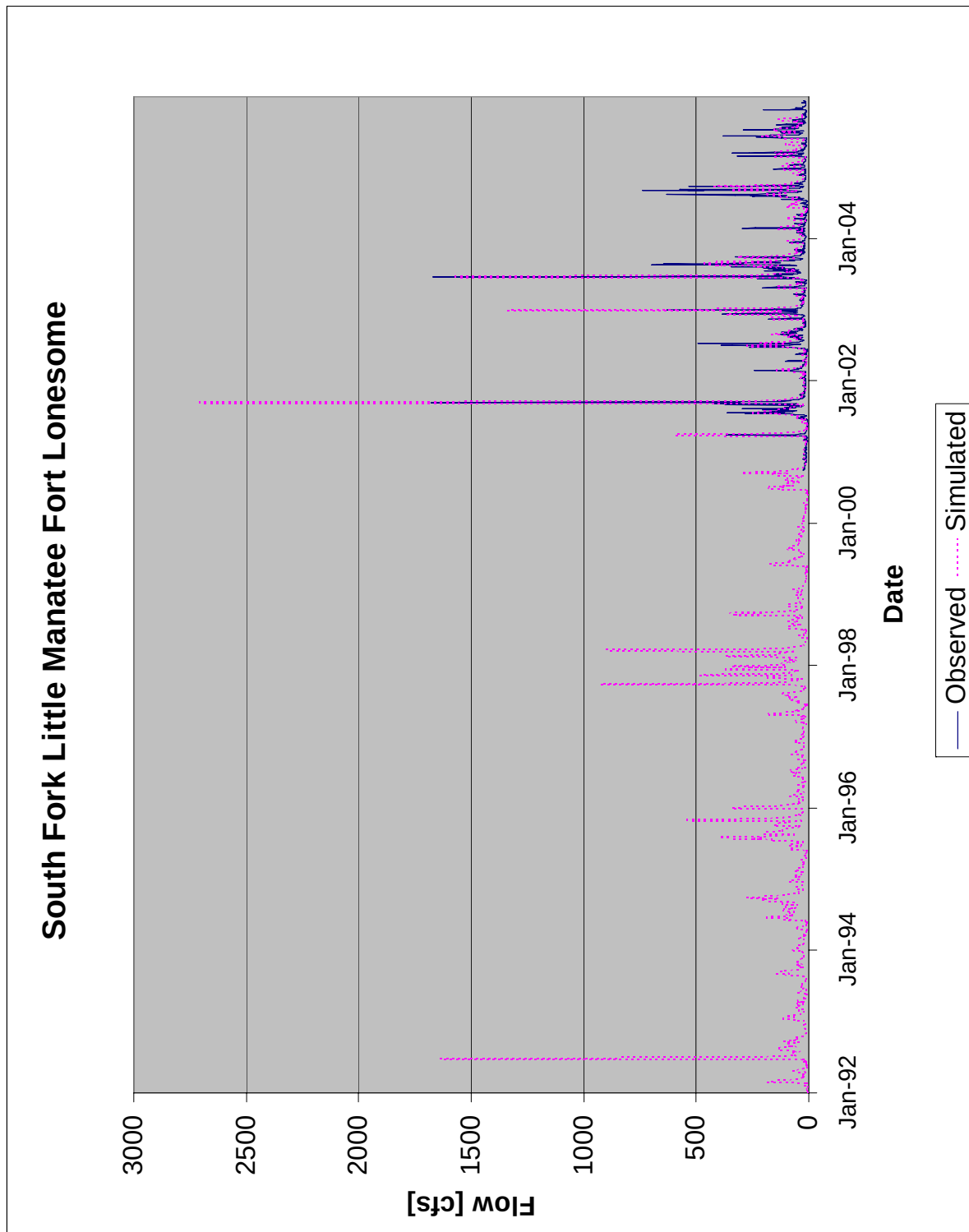


Figure 12 South Fork Little Manatee Fort Lonesome Hydrograph

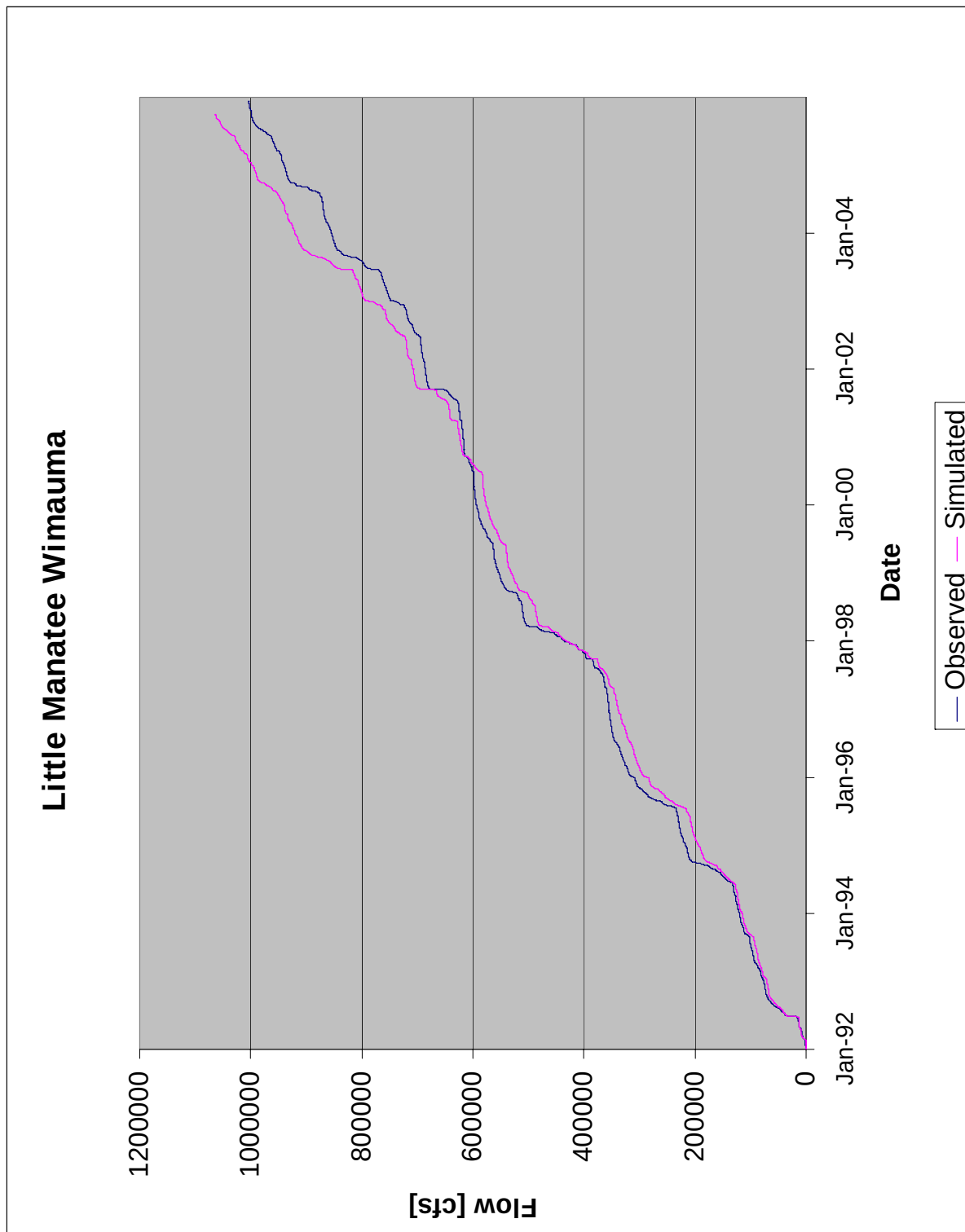


Figure 13 Little Manatee Wimauma Cumulative Hydrograph

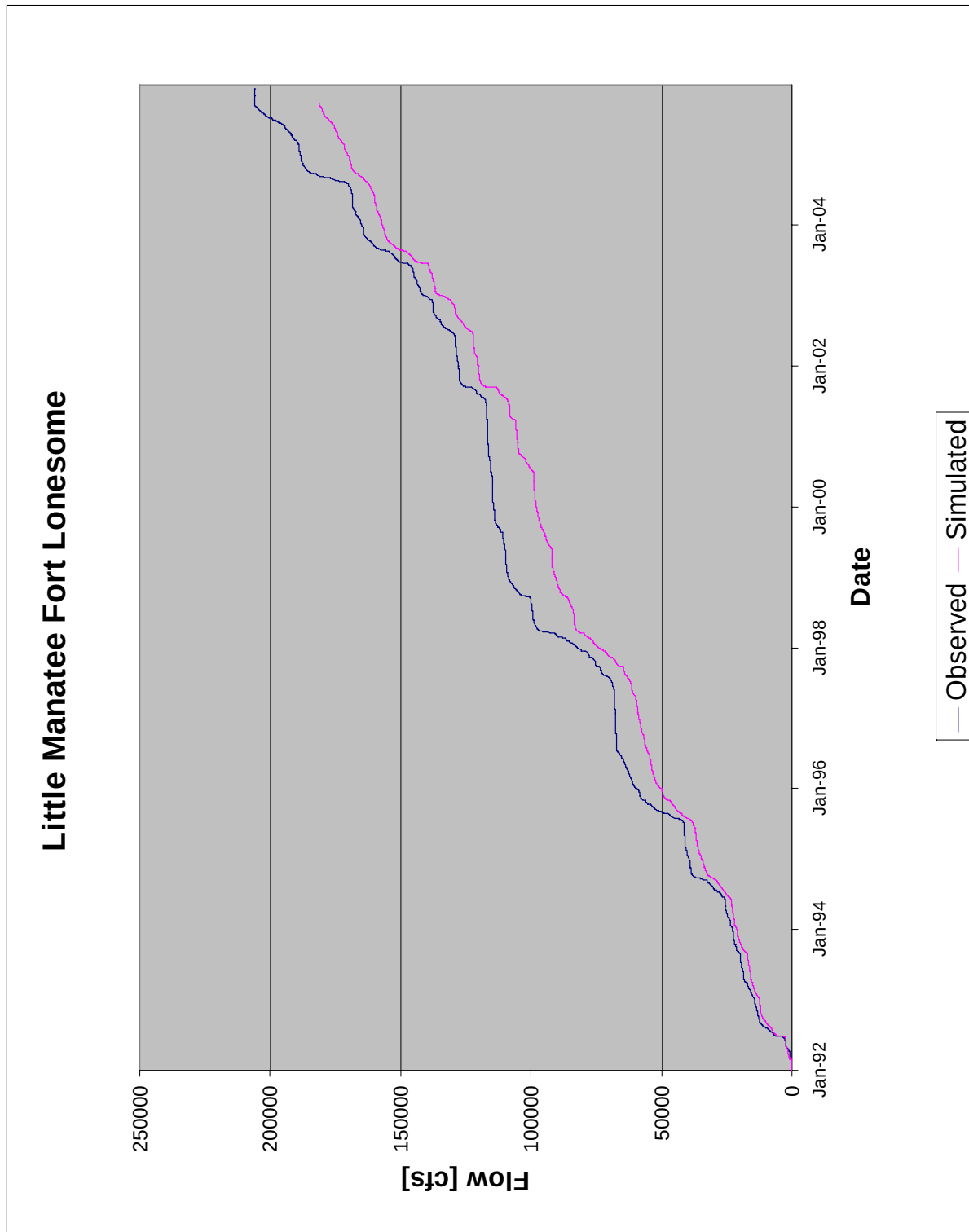


Figure 14 Little Manatee Fort Lonesome Cumulative Hydrograph

South Fork Little Manatee Fort Lonesome

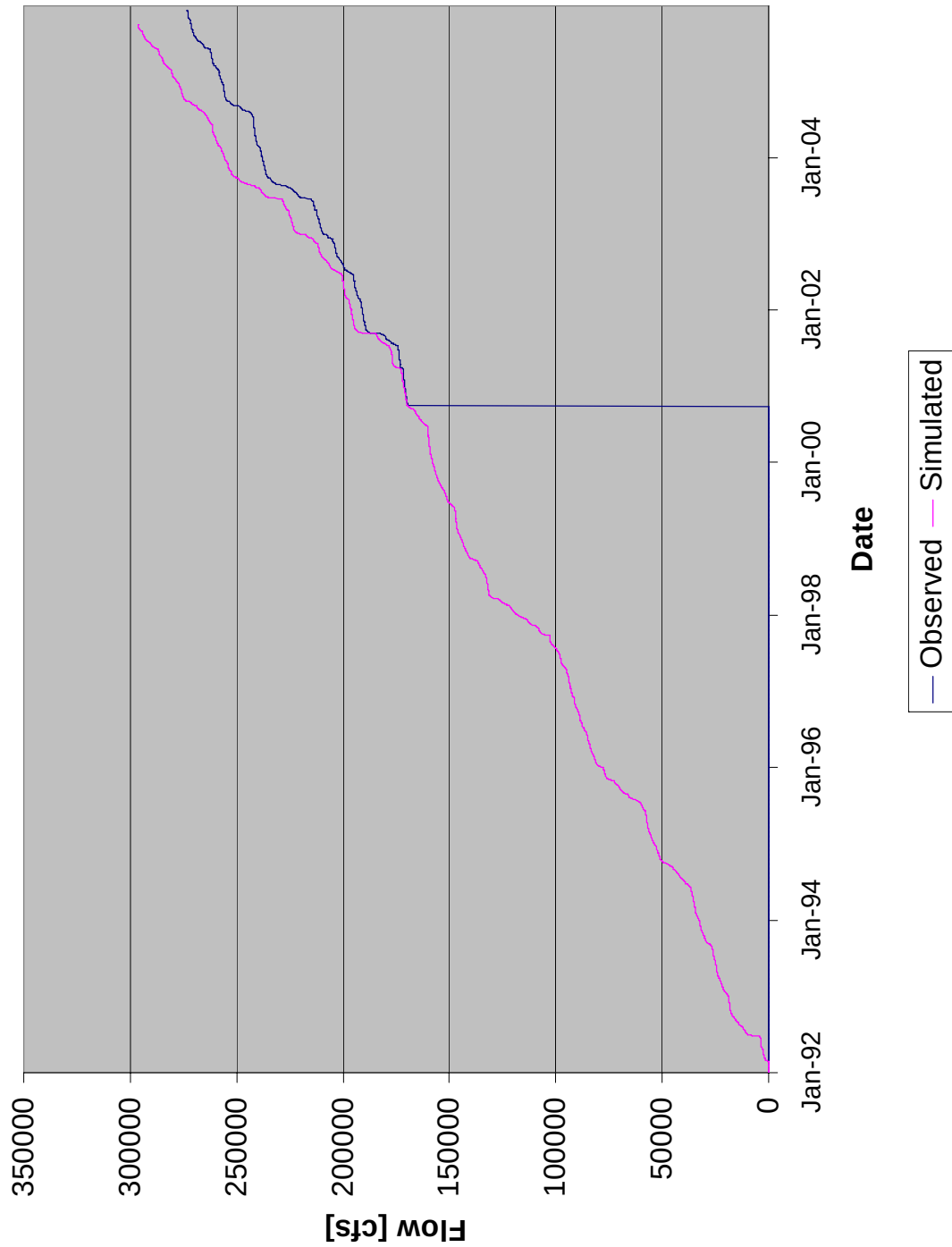


Figure 15 South Fork Little Manatee Fort Lonesome Cumulative Hydrograph

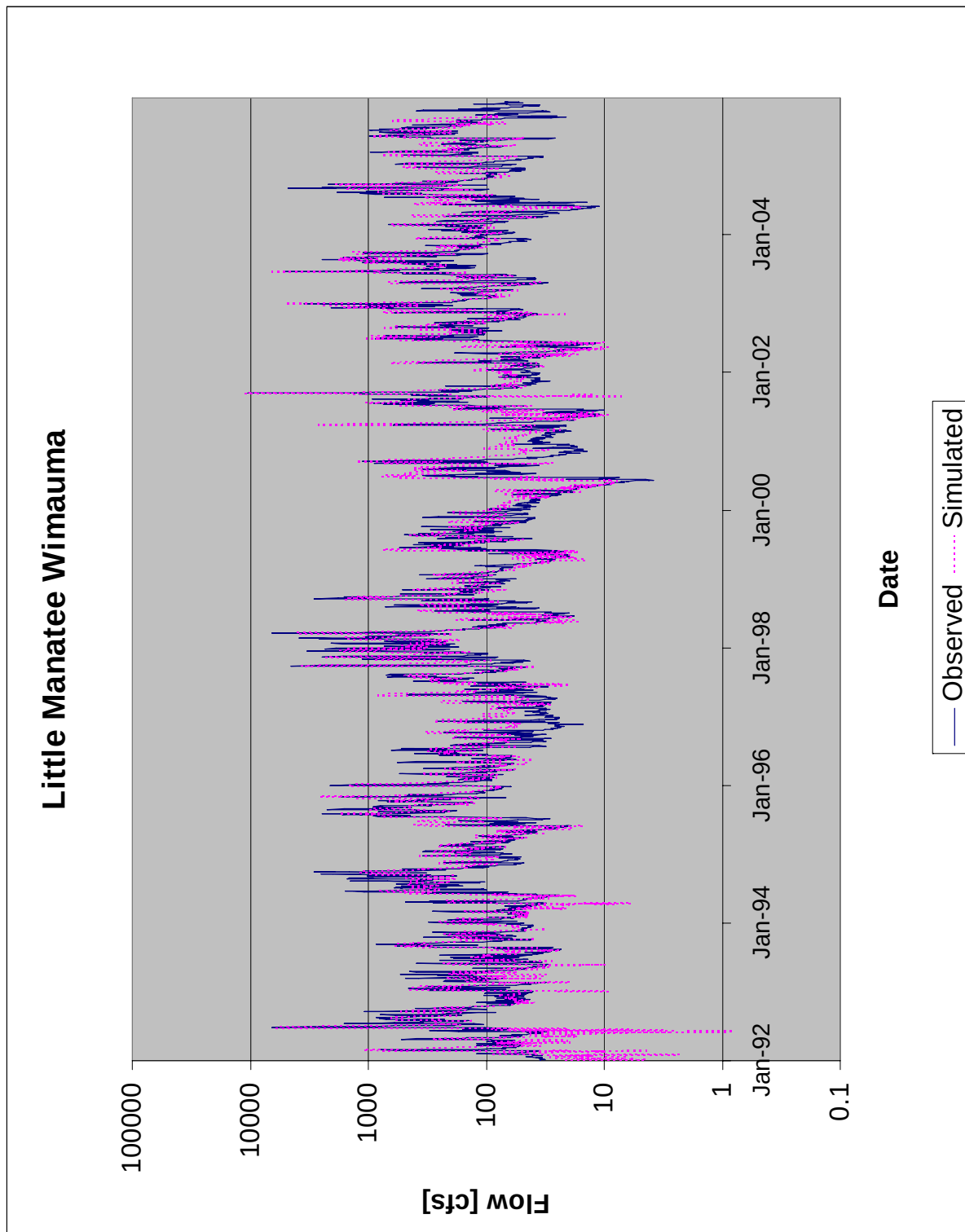


Figure 16 Little Manatee Wimauma Log Hydrograph

Little Manatee Fort Lonesome

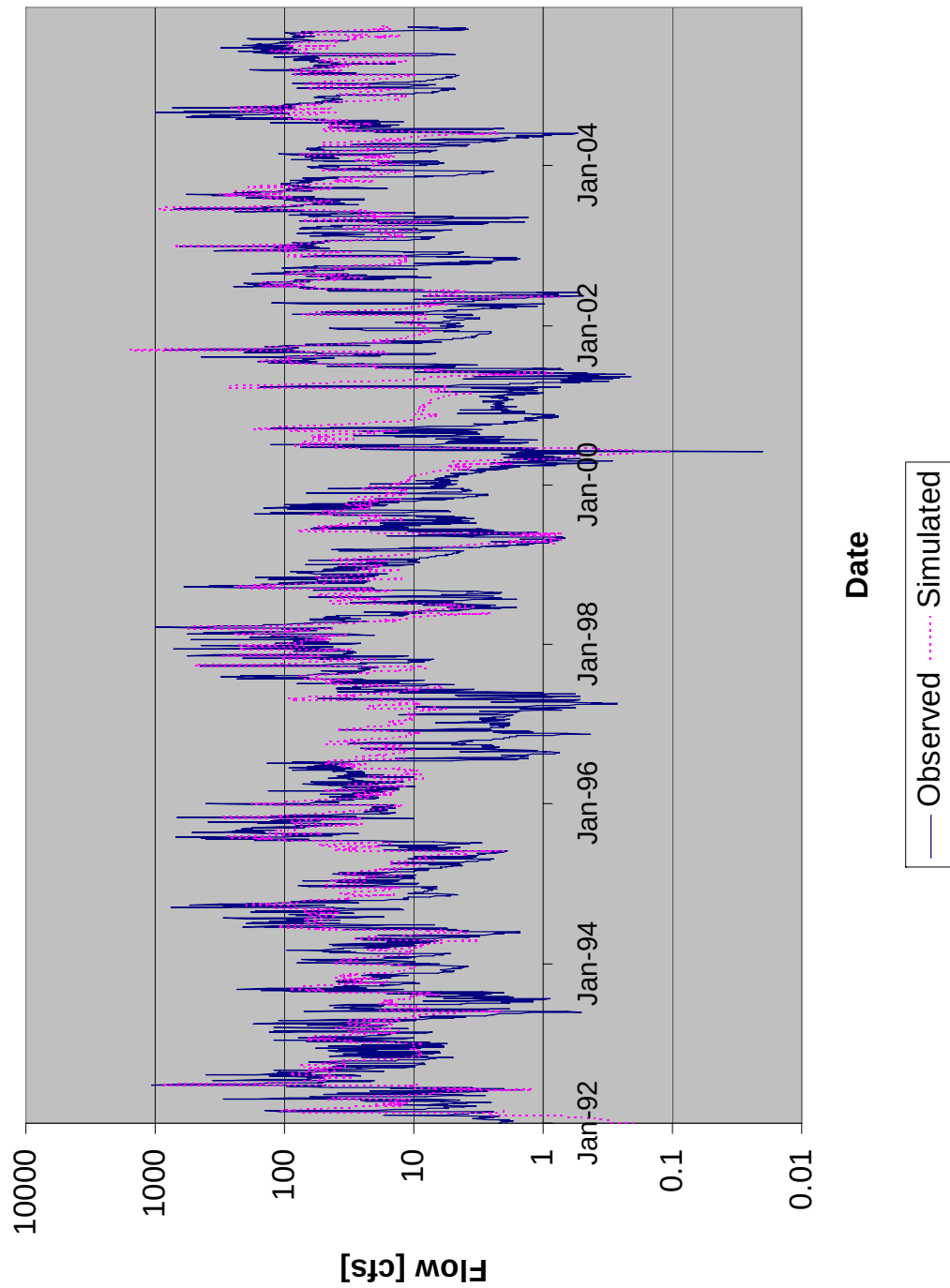


Figure 17 Little Manatee Fort Lonesome Log Hydrograph

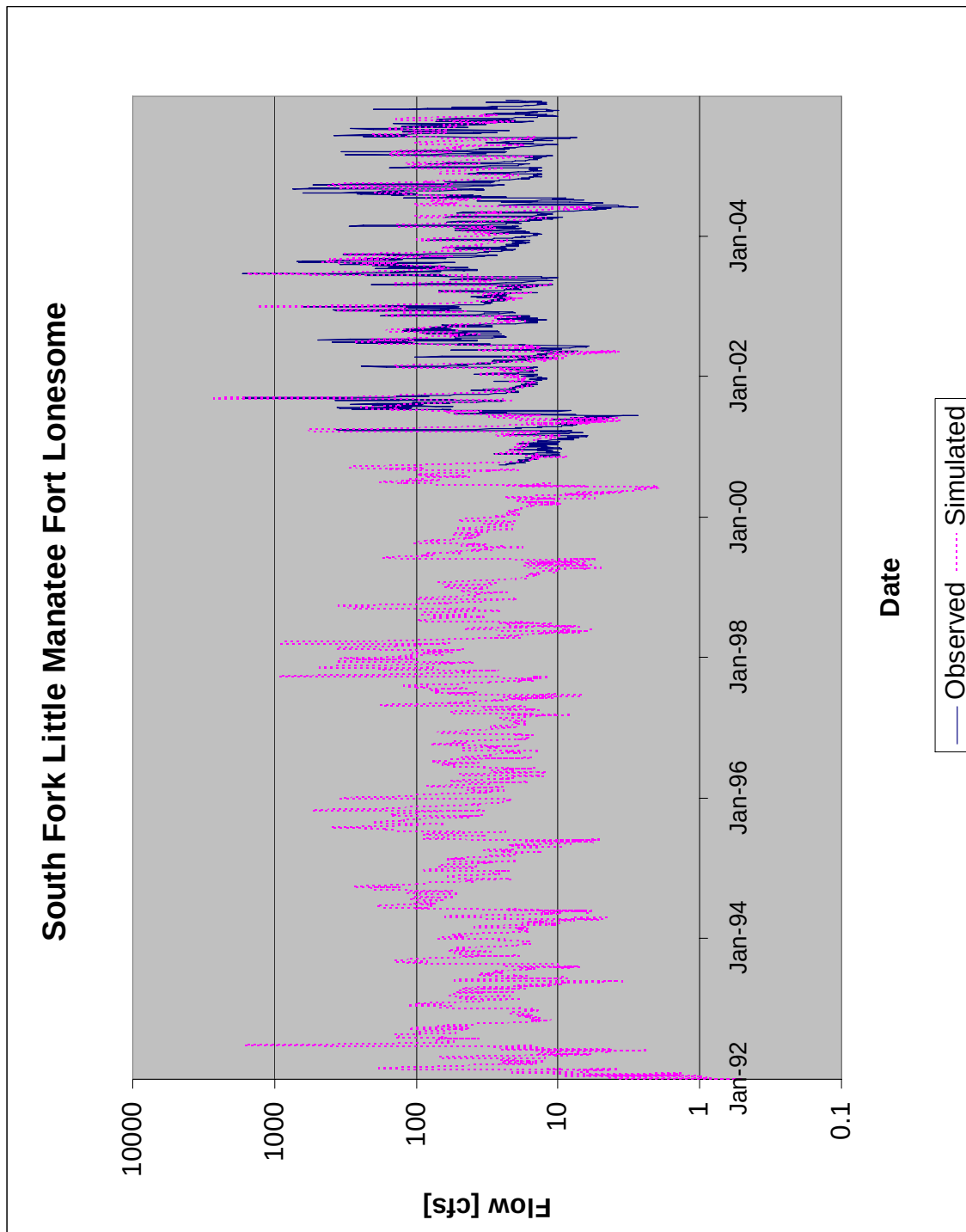


Figure 18 South Fork Little Manatee Fort Lonesome Log Hydrograph

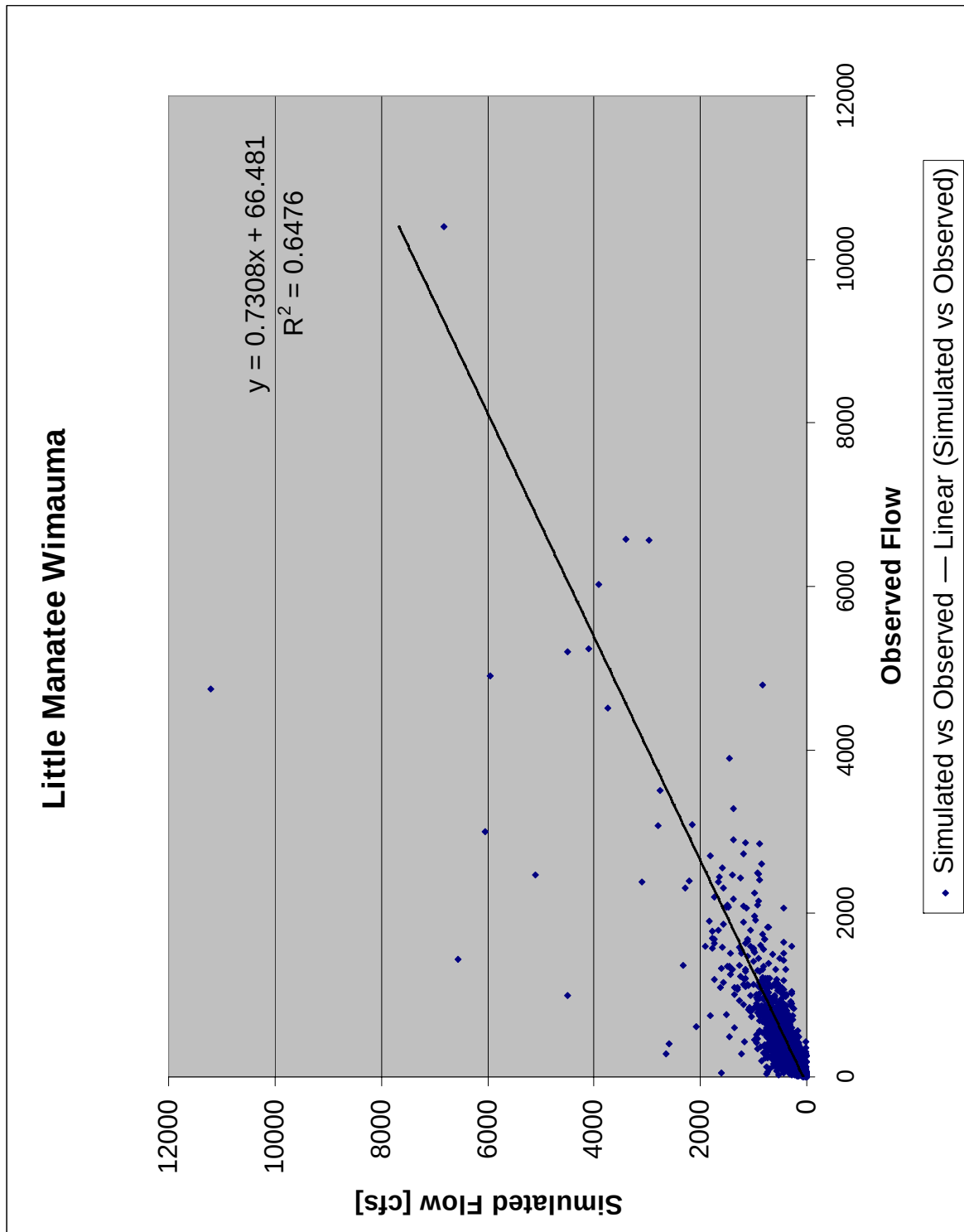


Figure 19 Little Manatee Wimauma Simulated vs Observed Flows

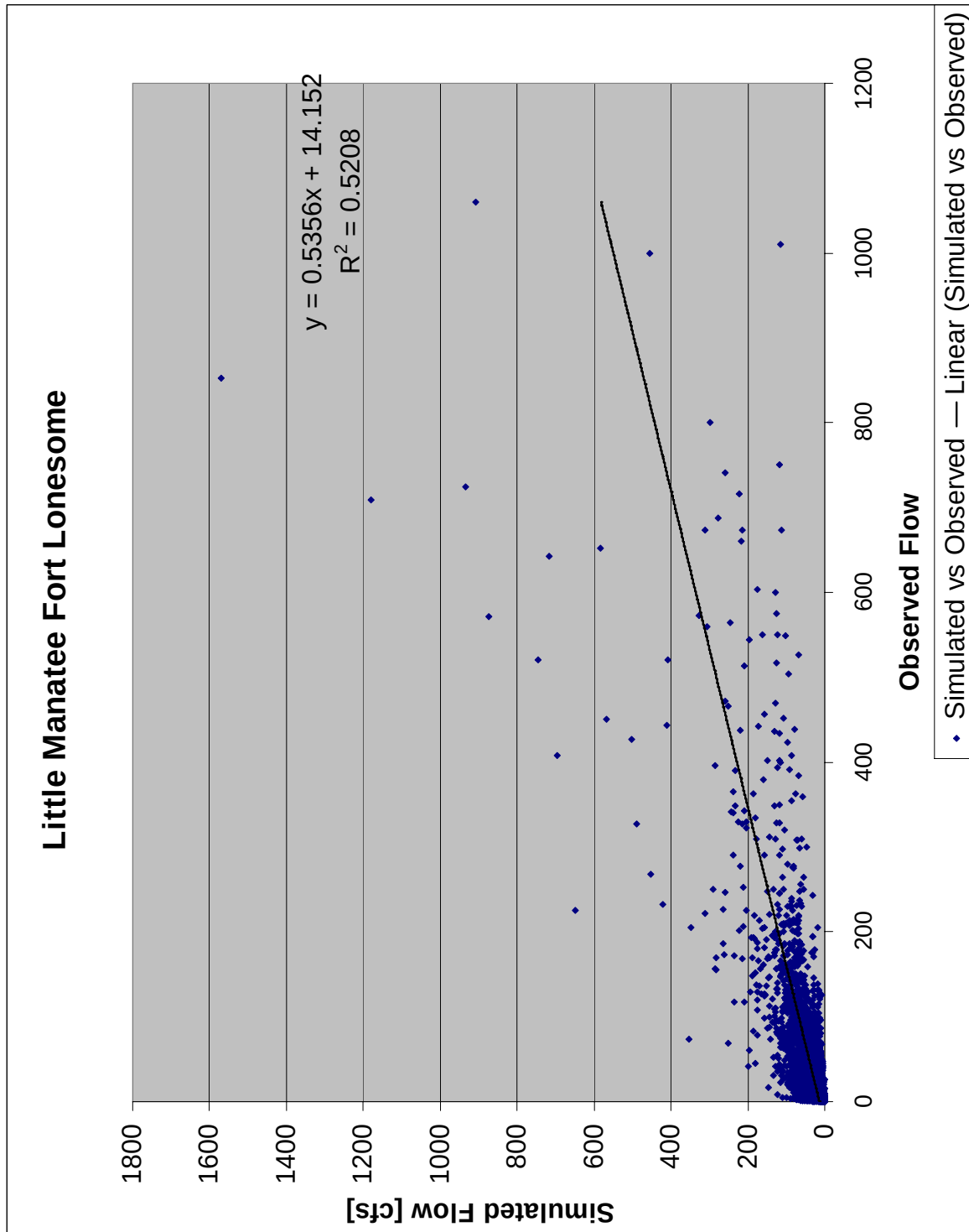


Figure 20 Little ManateeFort Lonesome Simulated vs Observed Flows

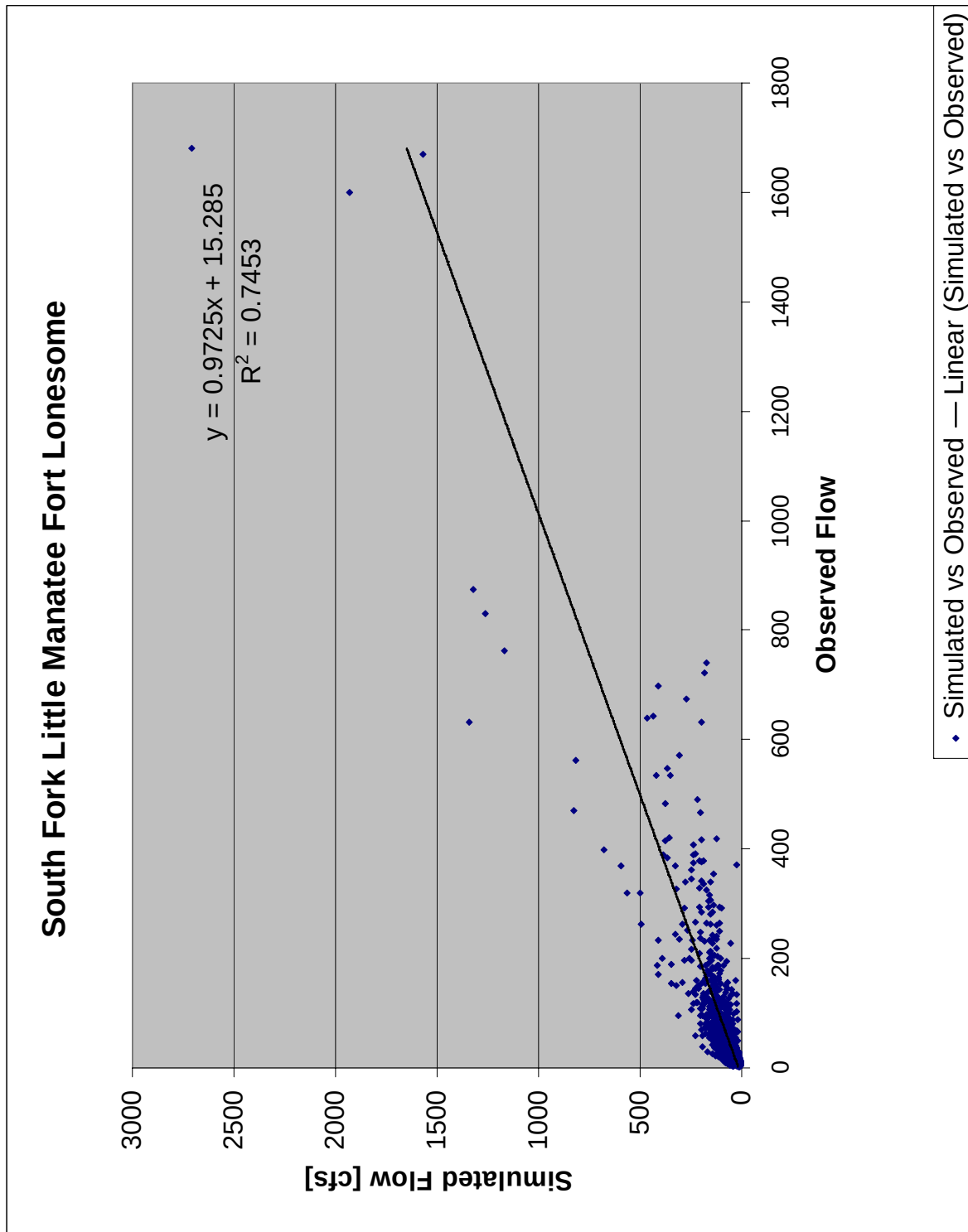
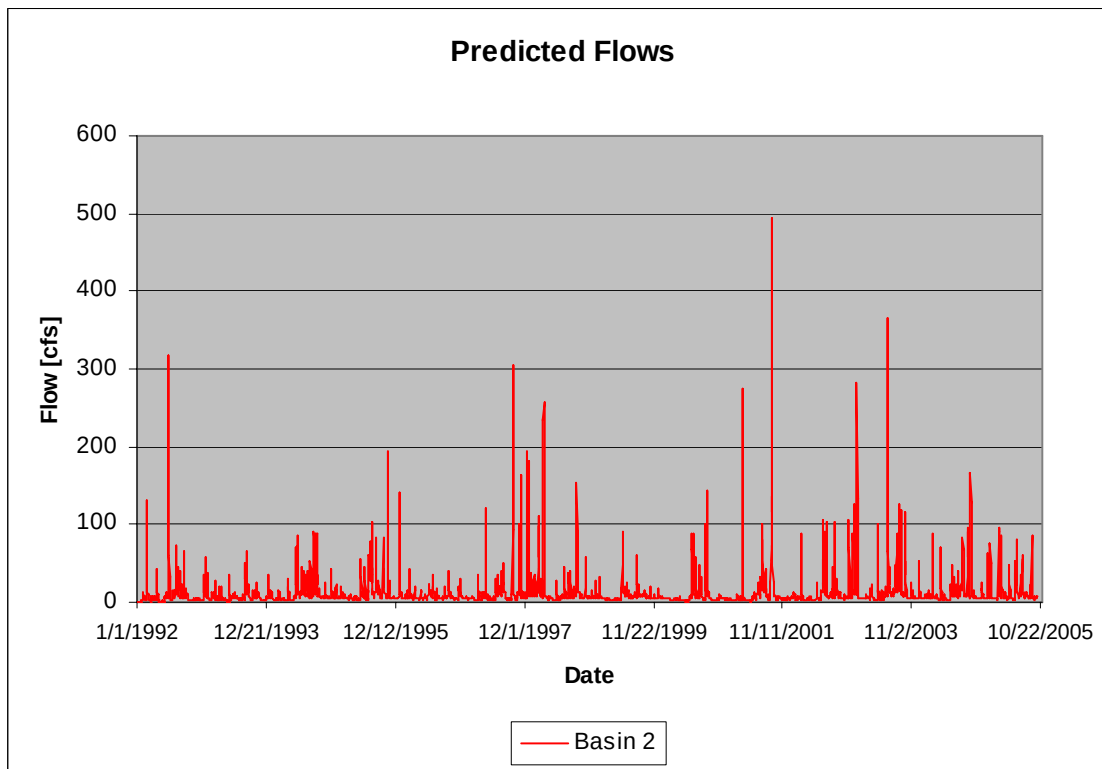
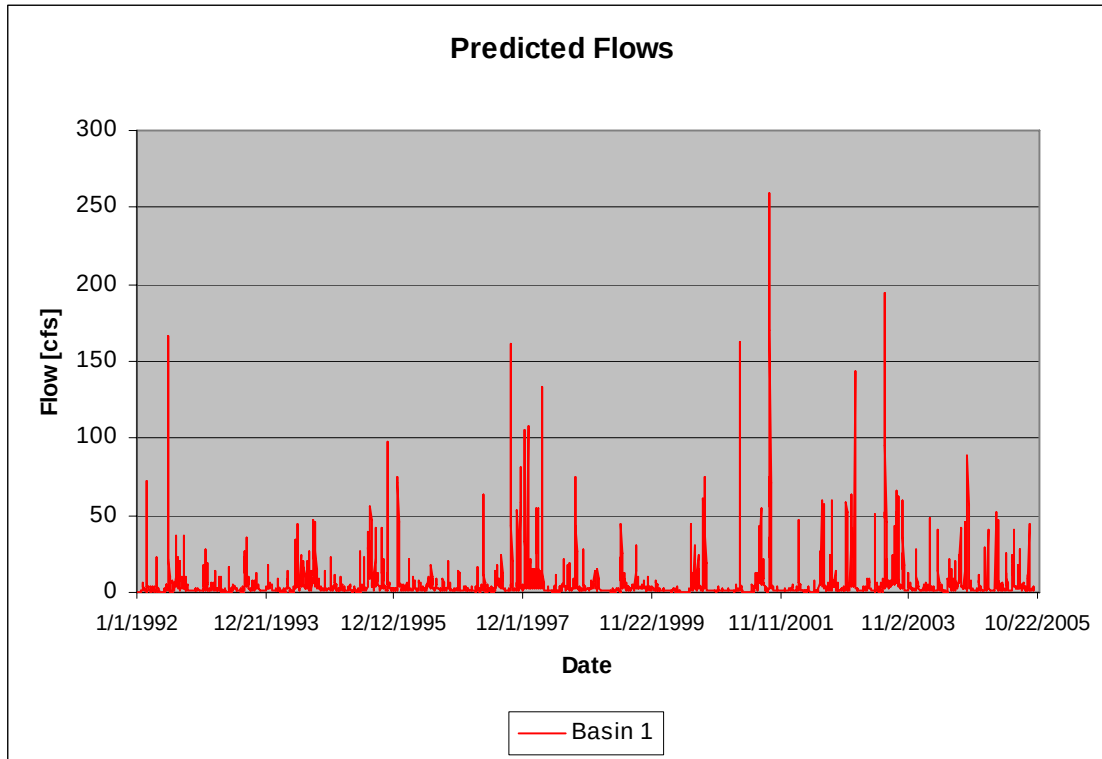
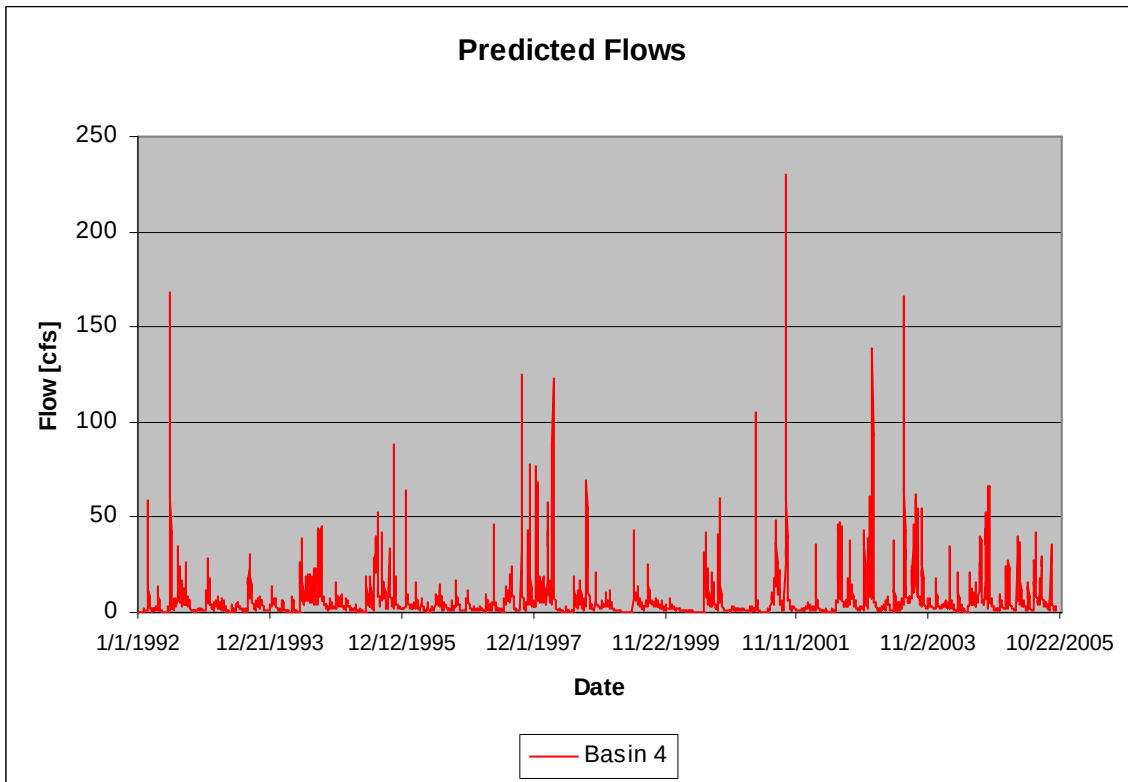
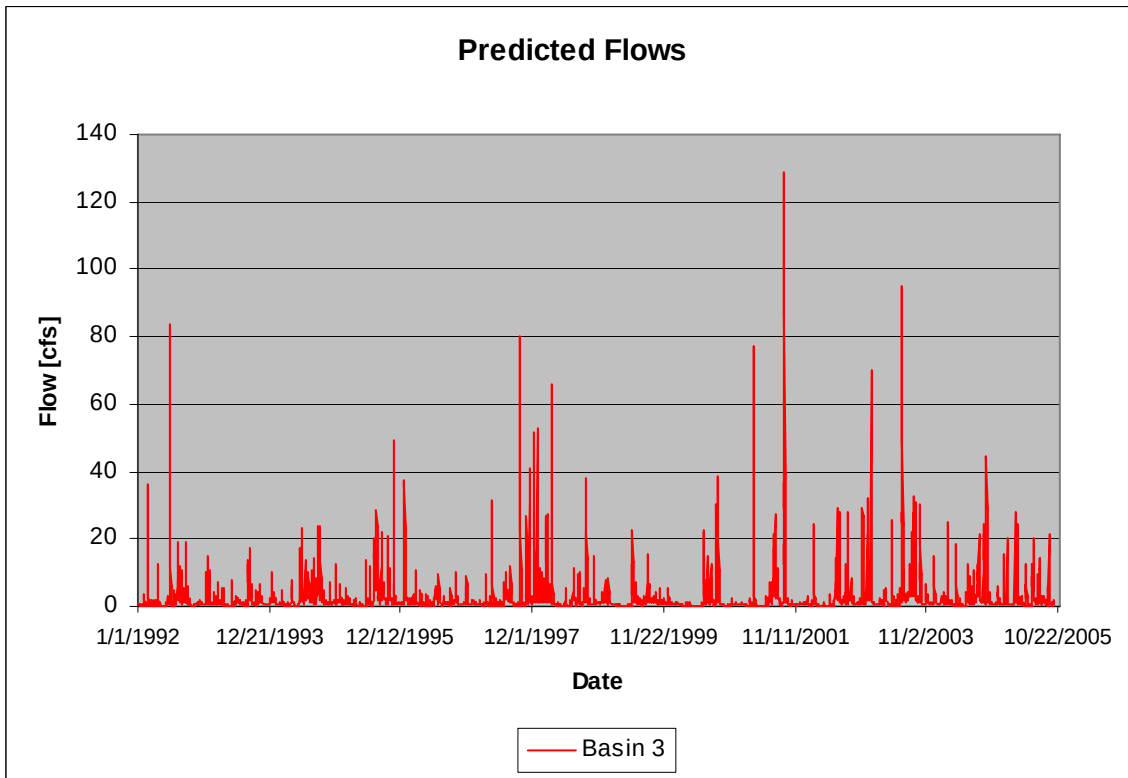
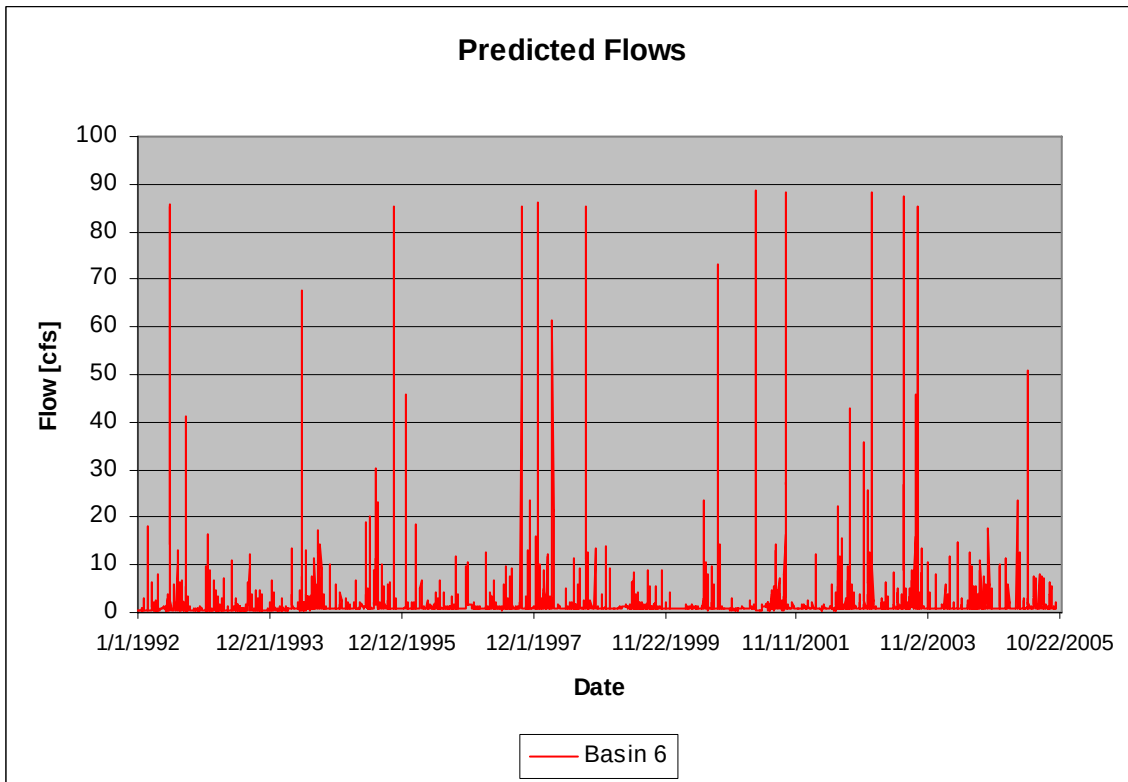
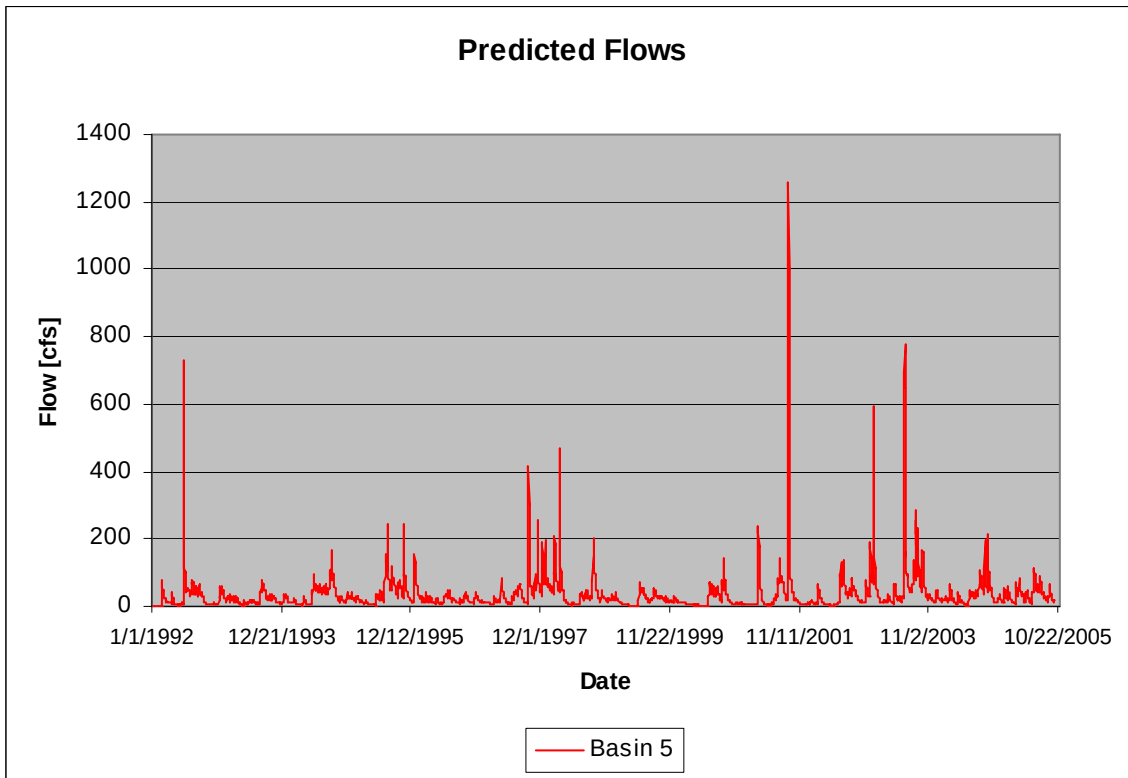


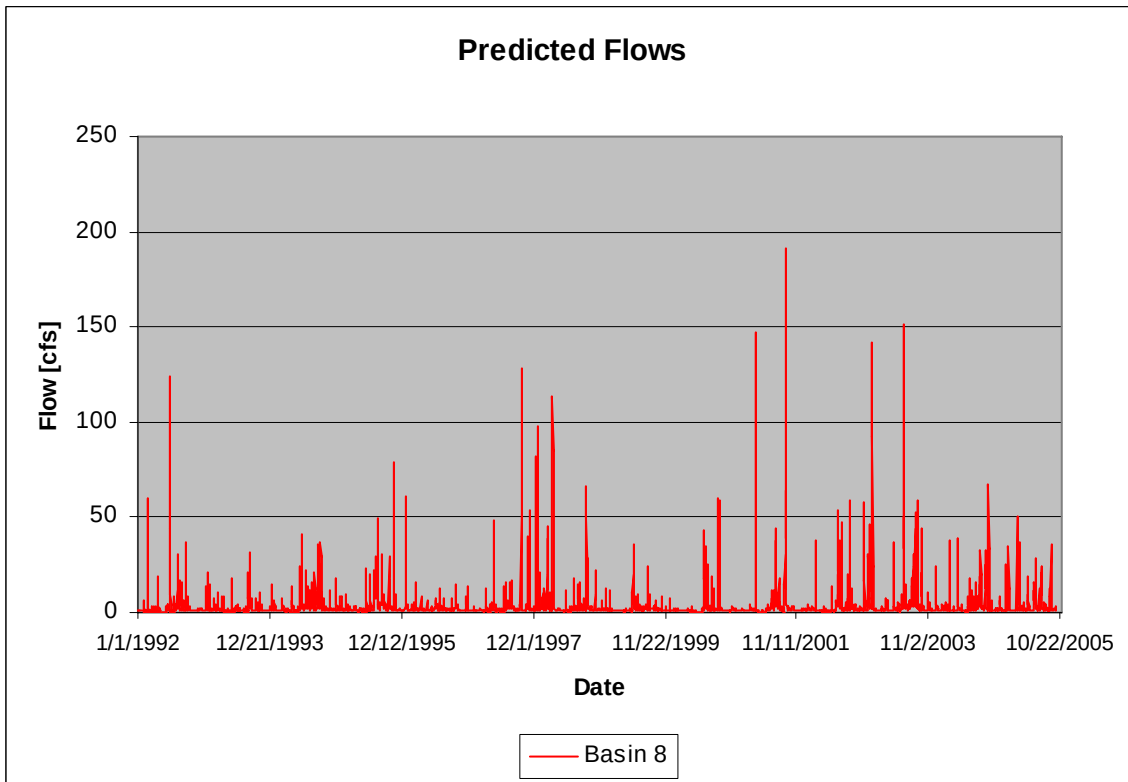
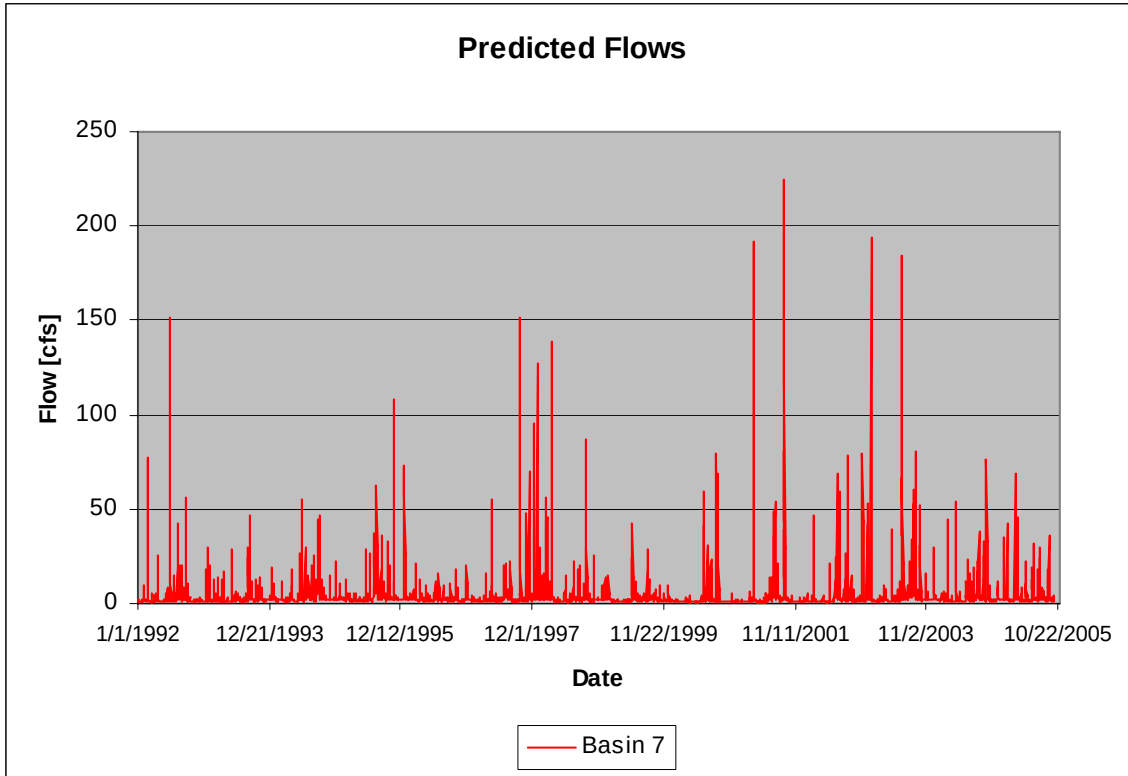
Figure 21 South Fork Little Manatee Fort Lonesome Simulated vs Observed Flows

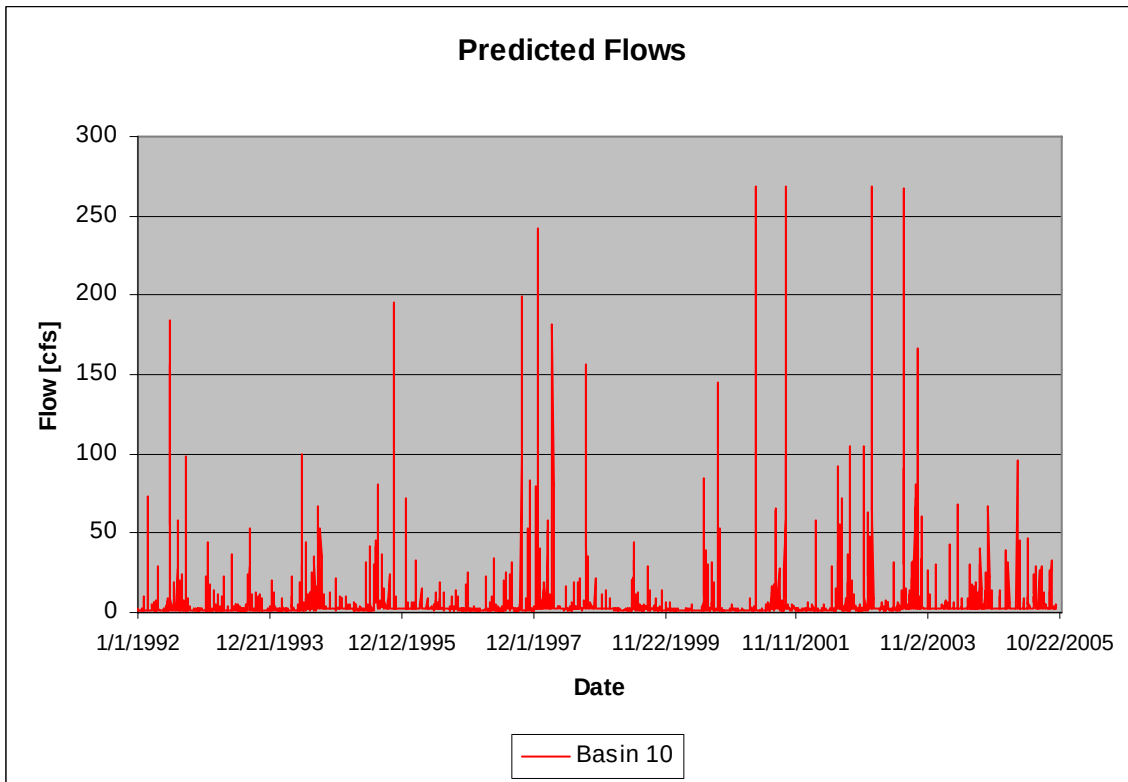
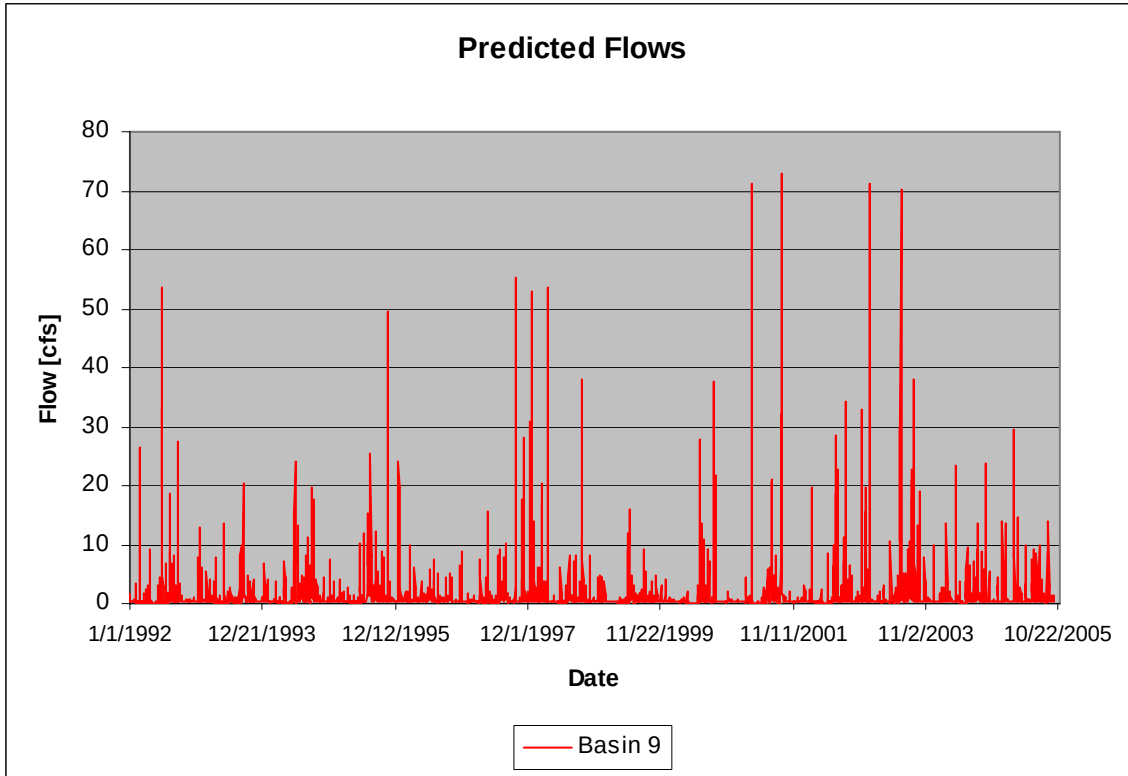
APPENDIX D Predictive Simulation Results

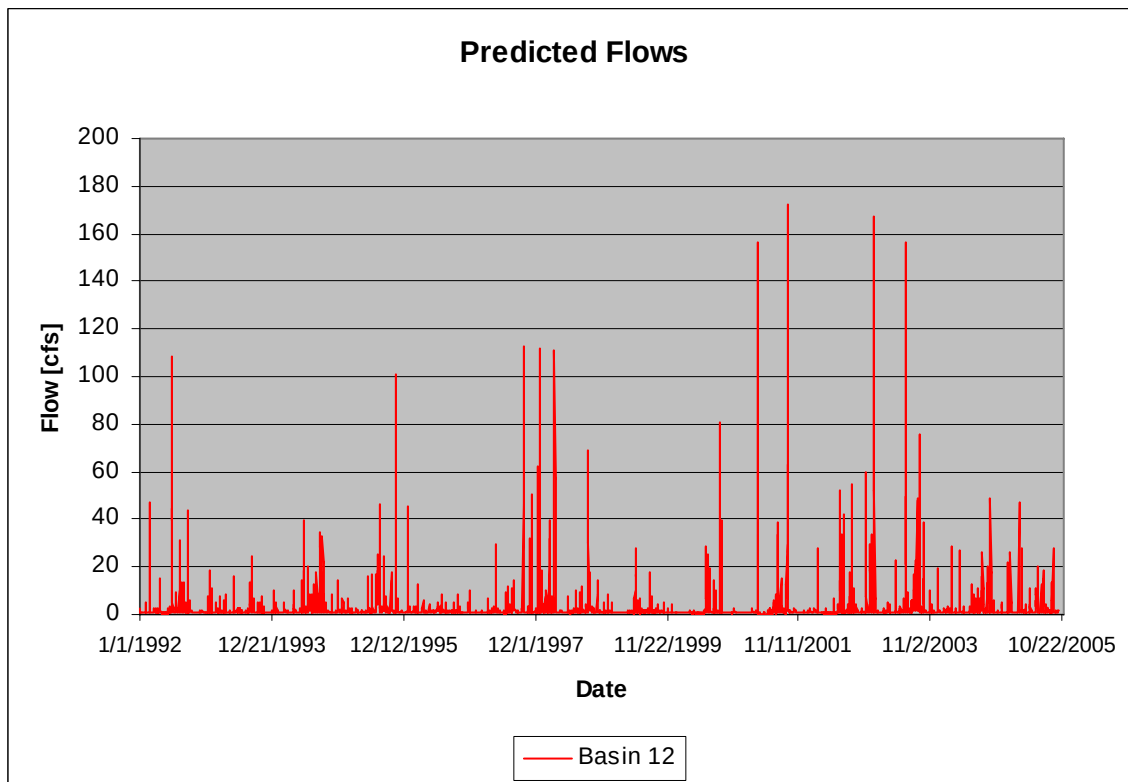
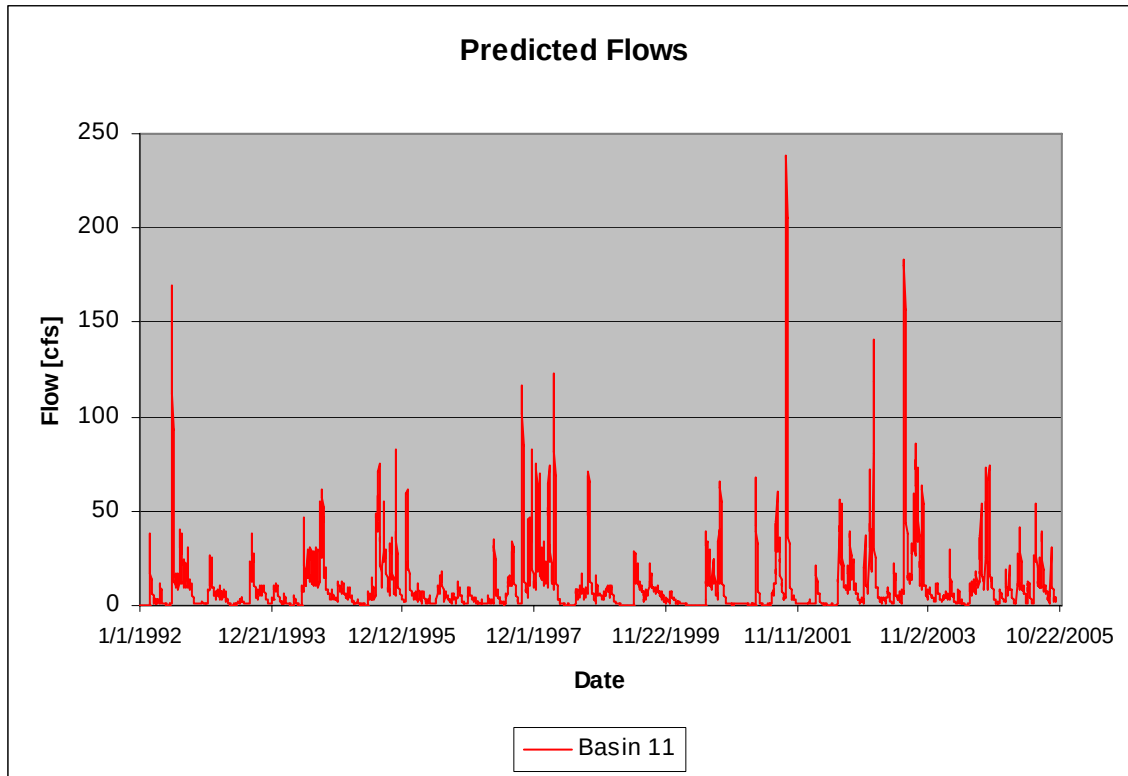


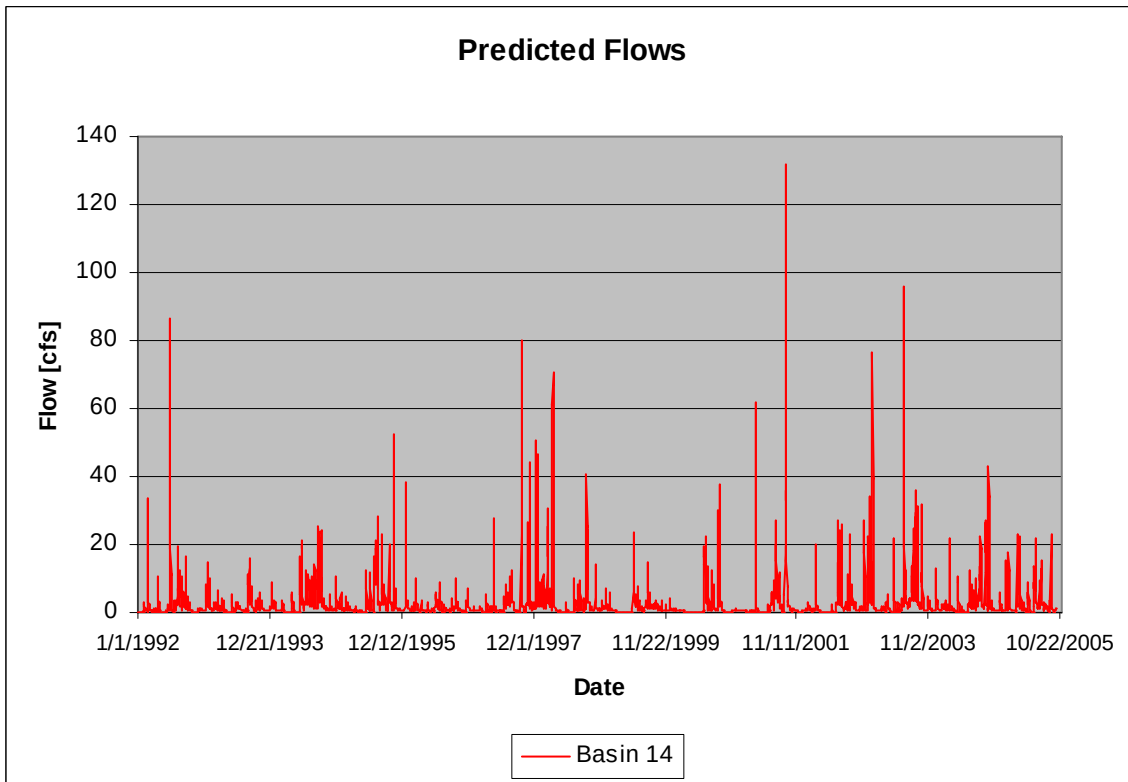
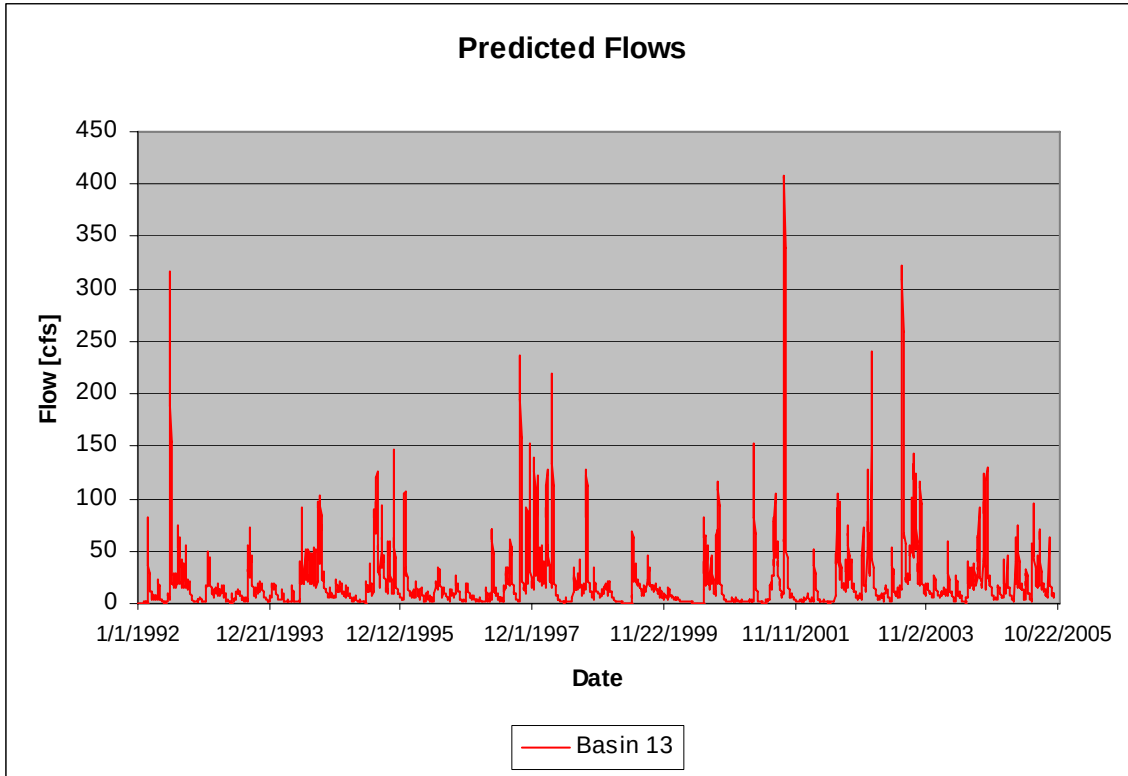












APPENDIX E Land Segment Area in Acres by Landuse

BasinID	Land Segment Area in Acres by Land Use				
	1 - Urban	2 - Irrigated	3 - Pasture	4 - Forested	7 - Other
1	359.3	594.6	329.7	115.1	437.2
2	1548.9	847.8	1147.3	293.8	107.0
3	166.5	248.5	284.2	172.8	3.3
4	120.1	1091.7	925.4	112.3	
5	878.1	4638.6	4587.1	1149.4	26.0
6	251.4	37.7	109.1	65.5	63.8
7	454.5	274.0	477.6	162.5	20.2
8	280.9	274.7	311.9	135.2	224.7
9	234.3	26.8	142.8	33.2	
10	282.4	316.8	505.0	486.5	51.5
11	363.6	555.0	1604.0	847.7	19.8
12	61.8	14.7	276.5	662.8	12.7
13	2746.1	1261.8	1256.8	484.5	2.5
14	286.8	51.2	358.7	307.1	
21	71.4	1533.5	7314.3	827.7	3728.2
22	156.6	6574.6	8549.4	3411.0	99.4
23	14.5	332.6	2411.7	361.1	20.3
24	115.9	1895.1	2126.6	313.6	86.0
25	205.2	3213.9	1795.7	112.4	77.9
26	91.1	1651.1	7410.2	528.0	186.1
27	0.4	302.0	735.5	174.3	
28	155.9	611.3	621.5	309.7	
29		490.7	1633.7	154.4	95.3
30	41.9	780.4	439.4	28.3	
31	725.5	1442.1	1200.9	713.6	194.5
33	217.9	712.7	1453.8	1122.0	60.0
34	20.6	528.5	376.2	151.1	36.8
35	3.1	796.3	905.0	131.7	
36	138.5	1115.5	2960.7	476.3	124.7

Appendix F Response to Comments from the District



INTERA Incorporated

1541 North Dale Mabry Highway, Suite 202
Lutz, Florida 33548
ph: 813 600 5737 fax: 813 600 3761
Fax: 813 354 4698

Mike Heyl
Southwest Florida Water Management District
7601 Highway 301 North
Tampa, Florida 33637

Mike,

Below is a compiled list of the report comments that I received from District. In some cases the reviewer asked a simple question and therefore it was easier to compile this reply. In other cases the reviewer asked for specific report modifications. A revised final copy of the report will be submitted to the District. The page numbers listed below referred to the original text. This letter will be included as an addition appendix to the final report.

Sincerely,

A handwritten signature in blue ink, appearing to read "Patrick Tara". The signature is fluid and cursive, with the first name "Patrick" and last name "Tara" clearly distinguishable.

Patrick Tara
Senior Engineer
INTERA Incorporated



Sid Flannery's comments:

page 4. What does DEM stand for? In this and other instances, please spell out the complete term when an acronym is first introduced.

The report was modified explaining the many acronyms.

page 5 and 6. The term potential evaporation is used on page 5, while page 6 states that pan evaporation were multiplied by 0.7 to yield potential ET (evapotranspiration) of the region. It is my understanding that pan evaporation * 0.7 is the evaporation from an open water surface, so I suppose this could be potential ET since water is not limiting. However, how was this term applied to different land covers? Was pan evap * 0.7 applied to the entire watershed area - that is what the sentence implies, or was it modified for different land covers in the watershed.

The model requires potential ET as an external time series. One potential ET time series was generated and applied to all land uses and water bodies within the model. The pan ET rate is elevated above natural systems ET for a number of reasons (local effect of wind caused by the pan itself, heat transfer through the pan material, etc). For these reasons potential ET is assumed to be pan factored by a pan ET coefficient. For the Little Manatee River application .7 was used to scale pan ET to open water ET. Open water ET was assumed as potential ET from the natural system. It is up to the model and the model conceptualization to limit the available water that satisfies that potential. Open water obviously would easily satisfy the potential (therefore actual ET is equal to the potential) On the other hand pasture would limit the available water and other model parameters (as determined from the land use calibration) and would therefore have a simulated actual ET which is much less than the potential.

P 13 and pages 55-56. From what time periods are the data shown in the scatter plots on pages 55 - 56. Is this for the entire period of simulation for each gage, including 2004 and 2005, or for some sub-set of the simulation period? Also, over what time steps are the flow data shown in these figures aggregated - are these average daily flows? Please specify in the text.

The total simulation period is from 1/1/1992 to 9/30/2005. This period was mainly dictated by the Districts estimated water use database. At the time the model was completed 2003, 2004, and 2005 were not available. These years were populated using representative years based on similar precipitation records.

P 13. In the calibration procedure and the plots of simulated vs observed flows for the Little Manatee River at Wimauma, did you add withdrawals from the river by Florida Power and Light back into the flow record?

Yes. Monthly data was obtained for the FPL water use. These records were utilized in the calibration as a withdrawal evenly distributed across the month.

P 13. In general, there should be some more write-up of the calibration and verification results. Are there any likely reasons that certain outliers occurred (such as variability in rain coverage). Of all the gages, the agreement of observed and simulated flows was the best for the South Fork. Is there any likely reason for that?

Outliers will always be present in any model whether statistical or numerical. There are many reasons that can be blamed for their presence. As you suggested the variability in rainfall is probably the number one reason (since it is the most significant water balance term). The good agreement for the South Fork is purely happenstance. The South Fork data was not even used for calibration. The period of record was too short for utility in the calibration process. It was used in the model verification task. The reasons for this are varied as well but rainfall, landuse, ditching, soils, depth to water, regional discharge all play a role in introducing variability from subbasin to subbasin.

P 13. What was the exact ending date of the simulation period in 2005. The graphs make it look like it was near Oct 22, 2005 - can the exact date be stated in the text.

The total simulation period is from 1/1/1992 to 9/30/2005. The ending dates for all graphs is 9/30/2005.

Importantly, we would like to know the areas for the 14 ungaged sub-basins. Also, could you provide a table of the area-normalized runoff in inches for these 14 ungaged basins and the three gaged sub-basins for the period of simulation, which should be 1989 -2005 for LMR at Wimauma and Ft. Lonesome, and October 2000 - 2005 for the South Fork.

This data was included with the transmittal of the ungaged basin flows. They are again included here for completeness.

Basin	Area Sq Miles
1	2.87
2	6.16
3	1.37
4	3.51
5	17.62
6	0.82
7	2.17
8	1.92
9	0.68
10	2.57
11	5.30
12	1.61
13	8.99
14	1.57
21	21.05

Mike Heyl's comments:

Page 1 - Patrick - The "Un-Gaged" legend washes out on the printed copy. Can you put an outline on it please?

The GIS graphic was updated.

Page 3 - A table in the appendix with acres of land use by sub-basin would be useful.

A table will be added with this information.

Page 4 – Where did you get the DEM data? Can you elaborate?

The DEM data is readily available from the USGS (<http://seamless.usgs.gov>).

Page 5 – Two formatting issues here. The Table spans the page and the outer boundaries of the theissen polygons are missing.

The table will be corrected. As for the Theissen polygons the outer boundaries were truncated, they actually extend much further. A frame was placed around the graphic.

Page 5 - Can you elaborate? What were the problems with the other data sets? Can you specify by source ?

The hydrologic model requires a clean and continuous time series. Data gaps need to be filled. If the gap is small a simple interpolation will suffice. Large gaps must be filled using more complicated techniques. If the data gaps are large and numerous, the data can be deemed too problematic for useful application to a numerical model.

Page 6 - What is the basis for this number ? Mark Ross used it too, but he ignored my review comment asking for justification. I think it is the correction from pan to lake evaporation. I gotta believe that when you add transpiration to the evaporation this value will change. Do you have any peer-review citations for this.

The adjustment factor of .7 modifies the pan ET rate to a potential ET rate for natural systems. The Class A pans are small in size, shallow, wind effects induced pan, thermal heat transfer through pan material, etc. These effects cause the pan ET rate to exceed the natural systems and therefore a coefficient is used to adjust the measurements. The Class A pan, the most commonly used pan in the US, has ranges in the coefficient from .64-.82. An average coefficient of .7 is well adopted in literature to represent average conditions (Bras 1990).

Page 6 - Figure 6 shows A LOT of wells that are not surrounded by Ag or Rec land uses. How/where these assigned?

Many of the wells Ag and Rec wells are associated with an Ag or Rec polygon. A small number are not directly associated with the appropriate land use. These can be caused by changing landuse conditions, or poor location of wells in the original database. These wells that are not directly associated with the appropriate irrigated landuse were lumped with into the other irrigation and applied to the irrigated land segment within the model.

Page 8 - Need to mention adjustments for FPL.

Agreed. A section will be added for the FPL data.

Page 10 - I don't follow these comments. Are you saying that the impervious area of a residential neighborhood is greater downstream than the impervious area of a residential area upstream? I thought the whole concept of this project was to characterize the landuses in the gaged watershed and then apply those parameters to the SAME landuses in the ungaged area. Granted the

characteristics of the undeveloped areas may change, but I don't follow the comment to developed areas.

The report was stating the fact that the relative areas of development change as you move closer to the bay (for example 10% of the basin is developed in eastern half of the basin yet 30% of the basin is developed close to Tampa Bay). This changing landuse condition forces to use of landuse based calibration (which is what was performed for the Little Manatee Application). Expanding on this is the changes in the density of the development. The density of the development to the east of the basin is much less than the density of the development to the west. The change in the densities of the development is the uncertainty that the report was alluding to. The model was calibrated to the less dense eastern half yet the predictions were made using the same model parameters on the western denser half of the basin. Since there is no data to calibrate the denser land use conditions the uncertainty in the predictions is the best available data.

Page 12 - How significant are these areas to contributing area? I understand the significance in terms of storage and the timing of runoff, but what percentage of the contributing area are the wetlands? Perhaps a table of F-table area compared to the sub-basin area?

The wetlands in West Central Florida are a significant component of the landscape. In this particular Little Manatee River domain the wetlands and lakes represent about 20 percent of the basin. The uplands sum to 156 thousand acres and water bodies sum to 30 thousand acres.

Page 12 - I think this should exceed lake evaporation rates since you have both unlimited evaporation coupled with unlimited transpiration.

Potential ET is the limit due to the atmosphere inability of removing more water.

Page 12 - I'm not following any of this. A dry reach will: a) over estimate evaporation b) over estimate inflow but the over-estimation will be reduced the excess rainfall will go into vadose zone soil storage. Doesn't that always happen - up to the capacity and infiltration rate? What is different?

In the physical landscape the wetland areas change dramatically. In the model the area of the reaches are held constant. Holding the reach areas constant for all stages cause the model to produce errors. At high stage the model should be representing the large area with potential ET. Since the model is using the fixed area it will under estimate the ET when the wetland is under high stage conditions. Conversely, when the physical system is extremely dry the area should be small. Again the model area is held constant at the wetland area as represented with normal pool

stages. During dry conditions the model will over estimate the wetland ET. The report was stating the deficiency in the model's ability to represent the physical hydrologic cycle during extreme shifts in the wetland areas. These statements describe reasons for the scatter as mentioned in Sid Flannery's comments above.

Page 13 - Do the scatter plots really contain 4,328 points or are they a subset of the calibration /verification period.

They actually have 5022 points. Daily data from 1/1/1992 to 9/30/2005 inclusive.

XinJian Chen's comments

Page 4 - Not very clear on what was exactly done here. An equation or a figure may be helpful.

This averaging was performed using the area weighted approach. The areas were determined from the Thiessen polygons (if no data was available for the particular rain gage the area was excluded from the weighting). This averaging was performed for each day for the simulations period.

Page 4 - Not found in References. Did you mean (Hernandez, 2001)?

Yes

Page 5 - NOAA daily or 15-minute rain?

NOAA daily

Page 7 – Any references on this number? I would think 0.5" rain is not very tiny. If you get 0.49" everyday for many days, you don't need to turn on your irrigation system at all during these days.

This number has been used before in other studies (i.e., Southern District Model, Alafia model, INTB model). There is no scientific reason or determination for the threshold. The distribution of the monthly irrigation is prone to errors. Some farmers even irrigate during rain due to the nature of automatic irrigation systems. Some have automatic shut off there is a wide spectrum of irrigation practices.

Page 9 – small changes

Fixed

Page 11 - I don't see Reach 209 in Figure 2.

Typo supposed to be 208

Page 11 - Did you mean Sub-Basin (Storage) 31?

Each basin has an associated storage attenuation reach. The storage attenuation reaches are numbered the same as the basin. The text is correct in referring to reach 31.

Page 12 - Please reword. The term "low wetland stage rain event" makes no sense.

Reworded: In turn the inflow volume will be over-estimated for rain event during times of low wetland stage.

Page 12 - Is vadose zone soil storage included in the model?

In the reach conceptual model the vadose zone storage is included. The vadose zone storage allows the reaches to ET during extended dry periods. Obviously there is no accurate way to measure this storage as well as the above ground storage of wetlands. The storage becomes a calibration factor. The storage is adjusted to capture the small events that do not discharge as well as the attenuation of the large events that do discharge.

Page 12 - I don't understand this. You are not scaling the stage, do you? How do you determine this volume adjustment factor which is time-dependent as the stage is time-dependent?

The Ftable defines the stage storage discharge and area nonlinear relationship for each reach. The Ftable was developed from each reach from the GIS data as well as the USGS ratings. These ratings were scaled and extrapolated to better define the conditions for the water bodies. As the text states the areas for each reach were held constant for all stages. The stages and flows for the USGS rating were scaled based on the relative contributing area. The volumes were

calculated from the area and the scaled stages. An adjustment factor was also implemented in the conceptual model to allow calibration. The scale factor accounted for vadose zone storage as well as storage below the invert. The adjustment factor is stage dependant (allowing the modeler to adjust storage below the invert as well as above the invert). There is not temporal variability to the volume adjustment.

Page 13 - Please add figure numbers and captions to the figures in Appendix C.

Figure captions will be added.

Page 13 - Please add some discussions on comparing model results with measured data. Also, please provide a table showing the starting and ending River Kilometers of each un-gaged sub-basins.

We would need the coverage of the river miles. The location of river mile 0.0 is fairly ambiguous (where does the bay stop and the river start). We can provide the District with the basins and hydrography coverages. From the GIS coverages the river miles can be determined.

Page 15 – minor changes

Corrected