TETRA TECH

Memo

To:	Moira Homann, DEP; Woo-Jun Kang, DE; Tony Tomalewski, DEP; Diana Turner, DEP
From:	Tetra Tech
Date:	December 13, 2024
Subject:	Draft Task 1. Recalibration of Caloosahatchee River and Estuary HSPF Model Hydrology

1.0 INTRODUCTION

Tetra Tech was contracted by the Florida Department of Environmental Protection (DEP) to extend the Caloosahatchee River and Estuary Hydrological Simulation Program – FORTRAN (HSPF) Model simulation period from January 1, 1996 – December 31, 2014, in the 2017 HSPF Model through December 31, 2023, in what is referred to as the 2024 HSPF Model. The 2024 HSPF Model will be used to support updates to the load allocations in the basin management action plan (BMAP). This memo documents the updates and adjustments made to create the 2024 HSPF Model, including watershed boundary modifications, data integration, and calibration results for the extended simulation period.

2.0 HSPF MODEL EXTENSION

The 2024 HSPF Model included several adjustments to the 2017 HSPF Model, as described in detail below.

2.1 SUBBASIN DELINEATIONS

The 2024 HSPF Model retains the same internal subbasin delineations as the 2017 HSPF Model, consisting of 121 discrete subbasins (Figure 1). However, the overall watershed boundary was slightly modified to reflect changes made by the South Florida Water Management District (SFWMD) in collaboration with the Coordinating Agencies (including DEP, SFWMD, and Florida Department of Agriculture and Consumer Services [FDACS]), who are working to update the Northern Everglades and Estuaries Protection Program statutory boundary for the Caloosahatchee River watershed. This adjustment impacted the outer boundaries of several subbasins along the edge of the watershed. The affected subbasin IDs are: 103, 108, 112, 114, 115, 117, 127, 128, 129, 130, 131, 132, 135, 136, 137, 138, 141, 144, 145, 146, 160, 161, 163, 194, 200, 210, 209, 215, 216, and 219 (Figure 2).

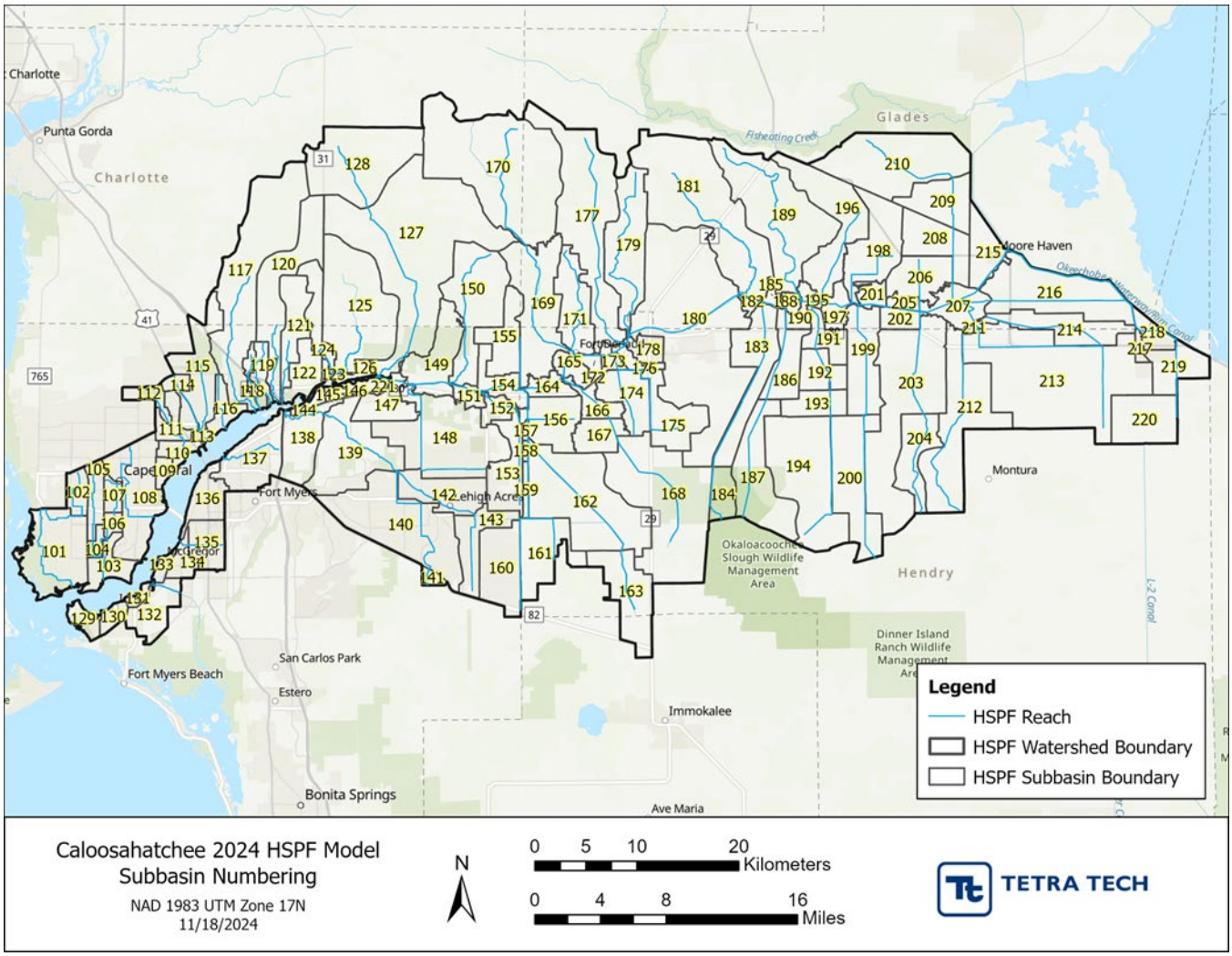

Figure 1. Subbasin delineation for the 2024 HSPF Model

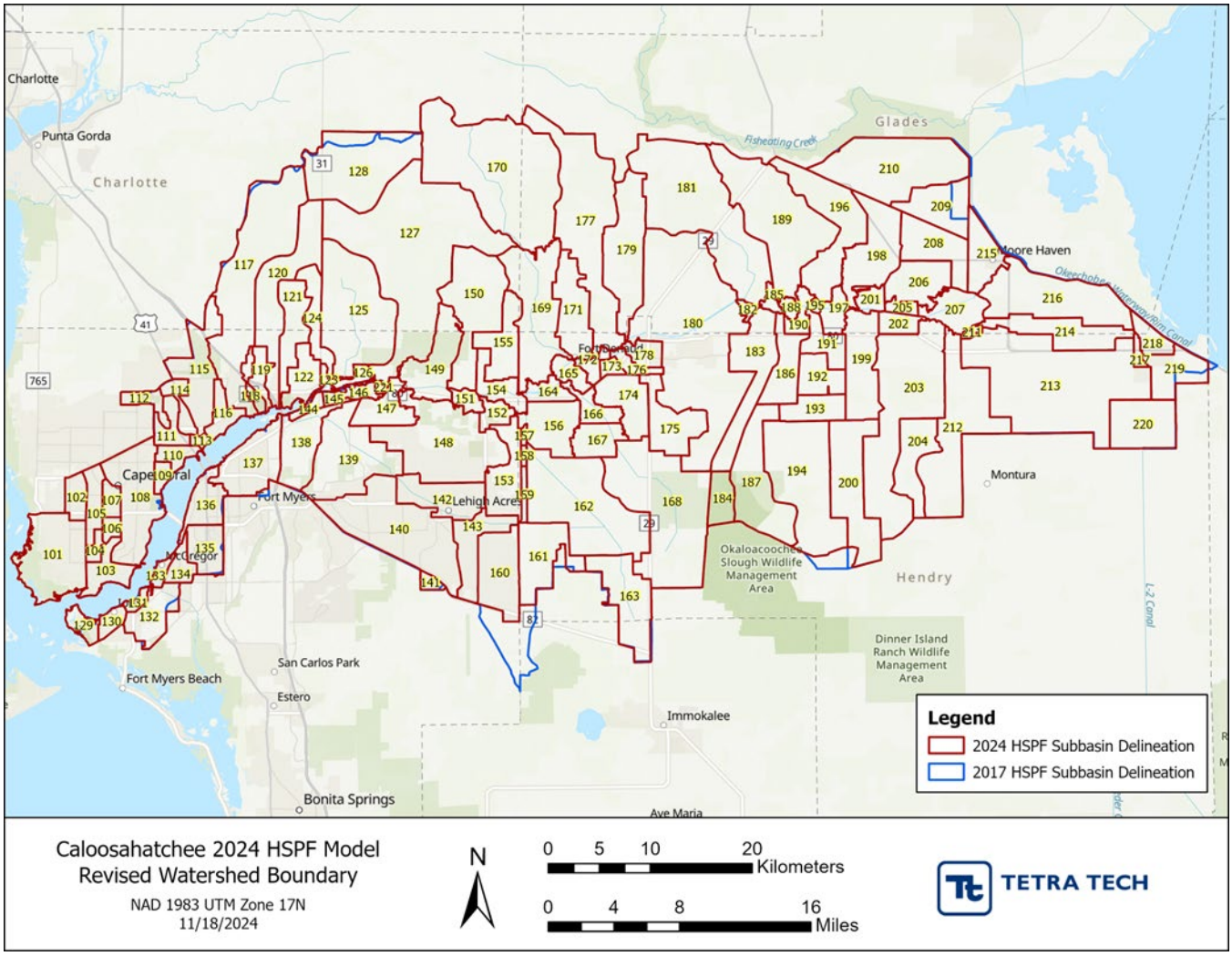

Figure 2. Watershed boundary changes between the 2024 and 2017 HSPF Model

2.2 WEATHER DATA

Precipitation data were extended using Next Generation Weather Radar (NEXRAD) data provided by SFWMD to cover the period from the end of 2014 Model simulation, starting on January 1, 2015, through December 31, 2023. NEXRAD data, which estimate the spatial and temporal distribution of rainfall, were also used in the 2009, 2014, and 2017 HSPF Models. The hourly NEXRAD precipitation data (hourly time steps for 1,076 cells, sized 2 kilometers by 2 kilometers) were averaged into 15 NEXRAD zones (Figure 3), which correspond to the subbasin delineation boundaries and remain unchanged from the previous HSPF Models.

Potential evapotranspiration (PET) data were changed from the reference evapotranspiration (ETo) from the Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) model in the 2017 HSPF model to SFWMD ETo provided at the NEXRAD grid cell level. The same method used to average the NEXRAD precipitation data into 15 NEXRAD zones was used to average ETo into 15 NEXRAD zones.

For the 2017 HSPF Model, air temperature, dew point temperature, wind speed, cloud cover, and solar radiation were obtained from Surface Airways (SA) station WBAN 12835 (Page Field Airport), located in Fort Myers (see Figure 4). WBAN

12835 included a complete record for all variables through 2023; therefore, the 2017 timeseries was extended through 2023.

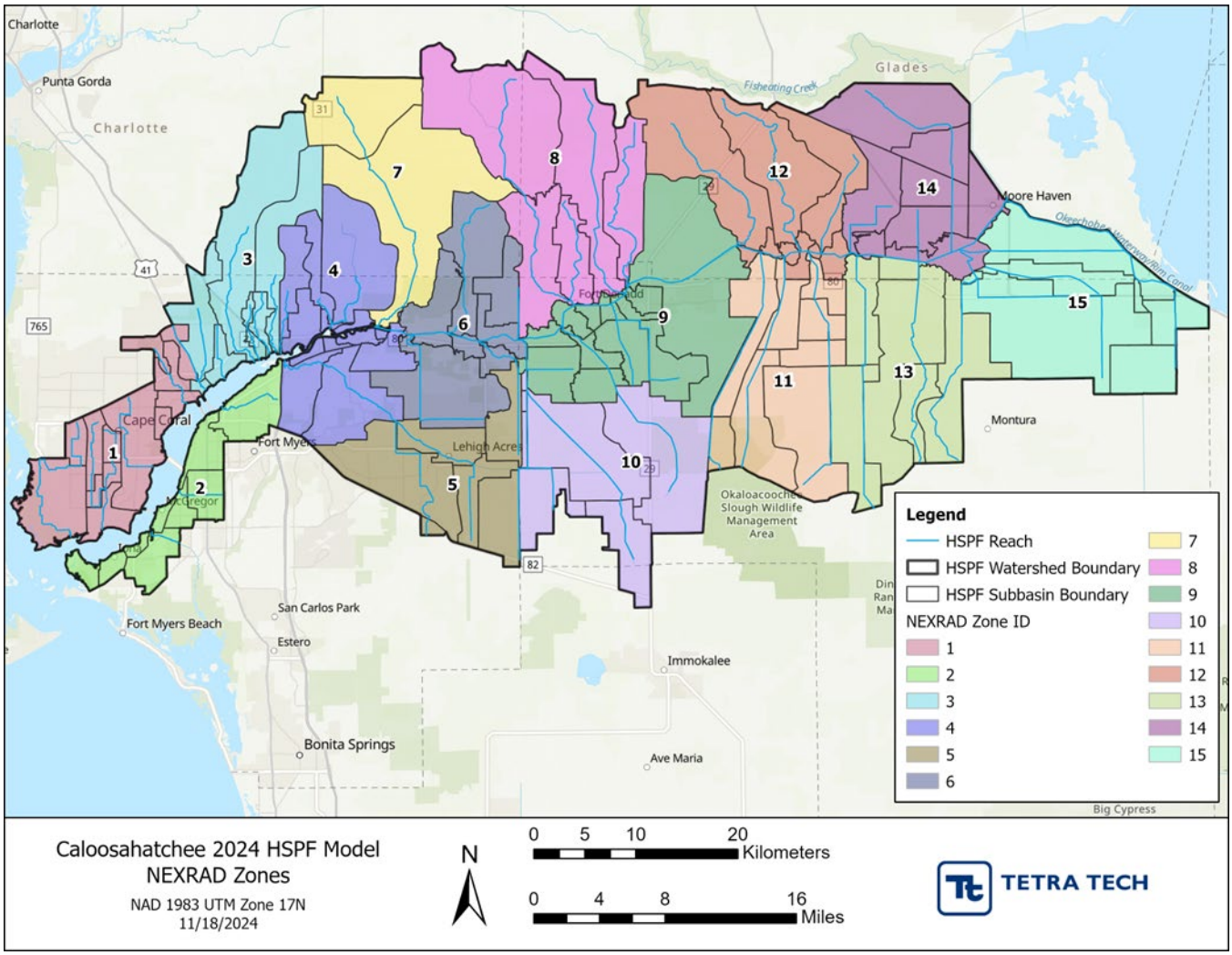

Figure 3. NEXRAD zones in the 2024 HSPF Model watershed

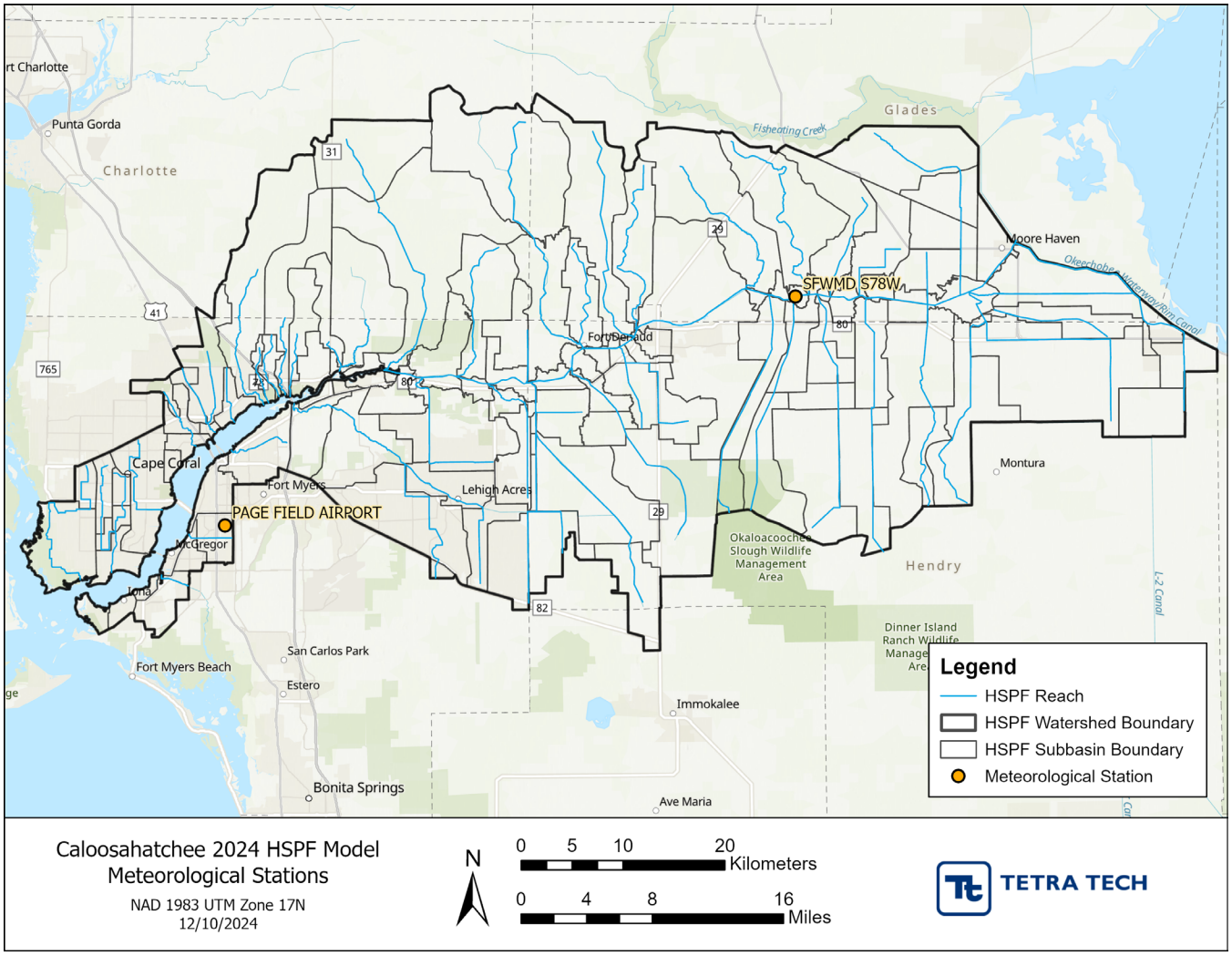

Figure 4. Weather stations used in the 2024 HSPF Model

2.3 LAND USE COVERAGE

The land use/land cover (Figure 5)was updated to the DEP Statewide Land Use Land Cover. This dataset (2017–2022) is a compilation of the land use/land cover datasets created by the five water management districts based on aerial imagery (DEP 2024). The imperviousness was updated to the 2019 National Land Cover Database (NLCD). Land use processing followed the same steps detailed in the 2017 HSPF Model report (Tetra Tech 2017). Table 1 presents a comparison of the land use in the 2017 HSPF Model and 2024 HSPF Model. As noted above, the overall boundary of the watershed was revised as part of the 2024 HSPF Model, resulting in slightly less acreage than the 2017 HSPF Model.

Table 1. Caloosahatchee River Watershed HSPF model pervious land use and impervious land use classification codes and areas for the 2017 HSPF Model

HSPF Land Use Code	Land Use Description	Land Segment	Total Acreage in the 2017 Model	% of Area in the 2017 Model	Total Acreage in the 2024 Model	% of Area in the 2024 Model	% of Area Change
1	Low Density Residential (Pervious)	PERLND	74,606	8.5%	72,737	8.3%	-2.5%

2	Developed Open Space/Disturbed (Pervious)	PERLND	21,587	2.5%	20,283	2.3%	-6.0%
3	Medium Density Residential (Pervious)	PERLND	31,118	3.5%	28,417	3.2%	-8.7%
4	High Density Residential (Pervious)	PERLND	6,162	0.7%	5,453	0.6%	-11.5%
5	Commercial/Institutional/Transportation (Pervious)	PERLND	8,234	0.9%	7,682	0.9%	-6.7%
6	Industrial/Extractive (Pervious)	PERLND	7,408	0.8%	6,483	0.7%	-12.5%
7	Florida Department of Transportation (FDOT) Right-of-Way (Pervious)	PERLND	4,300	0.5%	3,859	0.4%	-10.2%
8	Sugar Cane	PERLND	90,632	10.3%	93,098	10.6%	2.7%
9	Row and Field Crops	PERLND	13,753	1.6%	16,912	1.9%	23.0%
10	Nurseries, Ornamentals, and Vineyards	PERLND	3,670	0.4%	3,514	0.4%	-4.3%
11	Citrus Groves/Other Groves	PERLND	91,032	10.3%	86,197	9.8%	-5.3%
12	Improved Pasture	PERLND	128,792	14.6%	124,279	14.2%	-3.5%
13	Rangeland/Unimproved Pasture/Woodland Pasture/ Shrub	PERLND	102,272	11.6%	102,720	11.7%	0.4%
14	Upland Forests	PERLND	121,115	13.8%	121,070	13.8%	0.0%
15	Wetlands	PERLND	133,590	15.2%	131,059	15.0%	-1.9%
16	Water	PERLND	13,963	1.6%	13,667	1.6%	-2.1%
1	Low Density Residential (Impervious)	IMPLND	4,691	0.5%	7,195	0.8%	53.4%
2	Medium Density Residential (Impervious)	IMPLND	9,924	1.1%	12,998	1.5%	31.0%
3	High Density Residential (Impervious)	IMPLND	3,760	0.4%	4,626	0.5%	23.0%
4	Commercial/Institutional/Transportation/Industrial/ Extractive (Impervious)	IMPLND	7,017	0.8%	8,775	1.0%	25.1%
5	FDOT Right-of-Way (Impervious)	IMPLND	844	0.1%	1,160	0.1%	37.5%
6	Agriculture (Impervious)	IMPLND	699	0.1%	1,770	0.2%	153.2%
7	Other (Impervious)	IMPLND	1,242	0.1%	2,379	0.3%	91.6%
-	**Total**	**-**	**880,408**	**100.0%**	**876,333**	**100.0%**	**-0.5%**

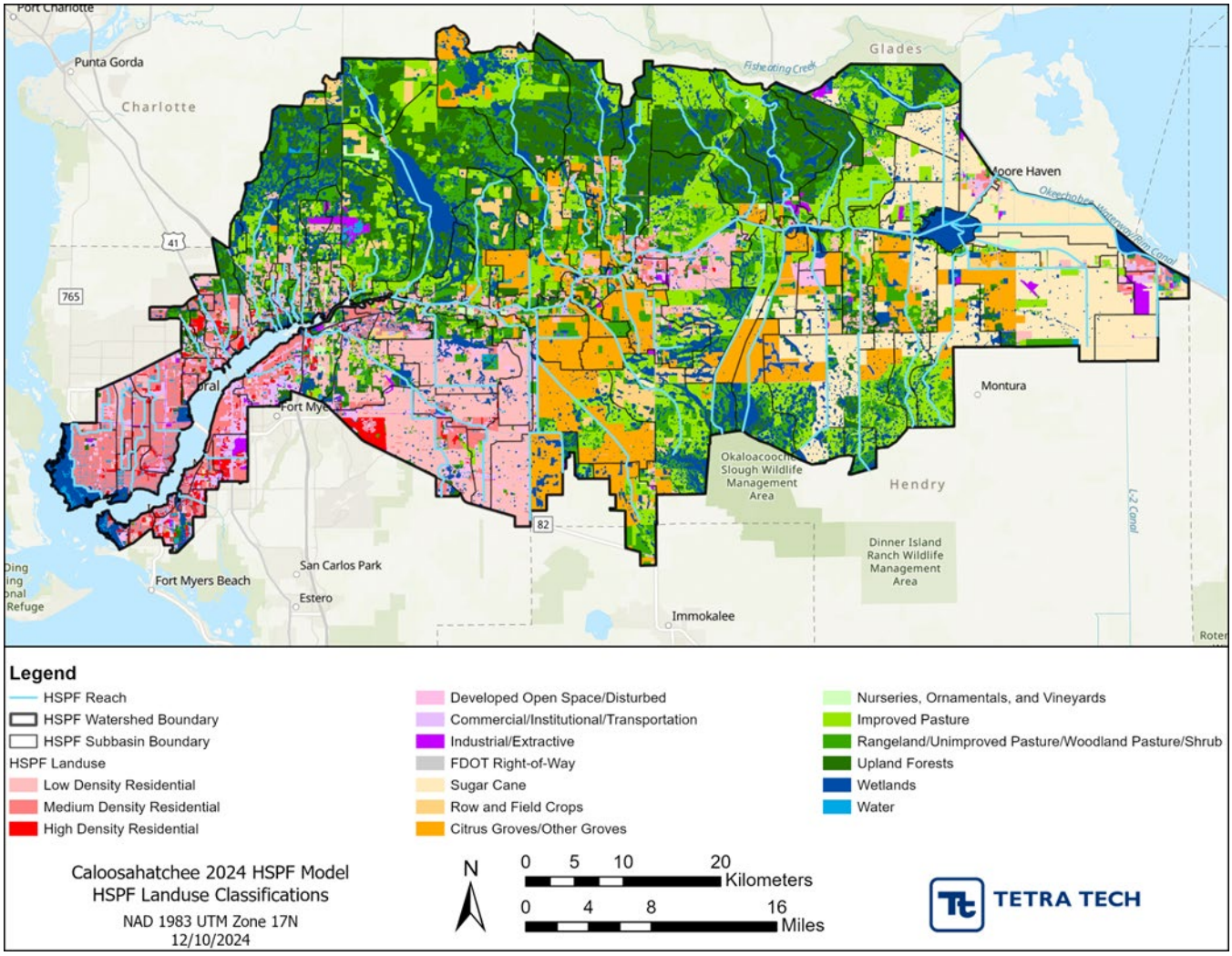

Figure 5. Processed land use classifications in the 2024 HSPF Model

2.4 AGRICULTURAL IRRIGATION

Agricultural irrigation in the 2024 HSPF Model was reprocessed using the methods established for 2017 HSPF Model, using two pieces of updated information. First, irrigated areas were obtained from Florida Statewide Agricultural Irrigation Demand (FSAID) Geodatabase 11 (Figure 6). Table 2 presents a comparison of irrigated area in the 2017 HSPF Model from FSAID 10 and 2024 HSPF Model from FSAID 11. Second, ETo was provided by SFWMD for the full simulation period and the irrigation demand calculations were updated to use SFWMD ETo instead of AFSIRS ETo. All other agricultural irrigation information (i.e., monthly growth coefficients, water use coefficients, root zone depths, crop coefficients, irrigation efficiencies, and irrigation water supply sources) documented in the 2017 HSPF Model report (Tetra Tech 2017)were unchanged for the 2024 HSPF Model update.

Table 2: Acreage and growing season for the major crop categories

Crop Category	Growing Season	2017 Area (acres)	2024 Area (acres)
Sugar Cane	Perennial	84,470	94,633
Nurseries/Ornamentals/Vineyards	Perennial	4,281	3,021
Citrus Groves/Other Groves	Perennial	57,121	42,900

Crop Category	Growing Season	2017 Area (acres)	2024 Area (acres)
All Other Crops	September – March	10,375	18,034
Total	Total	156,247	158,589

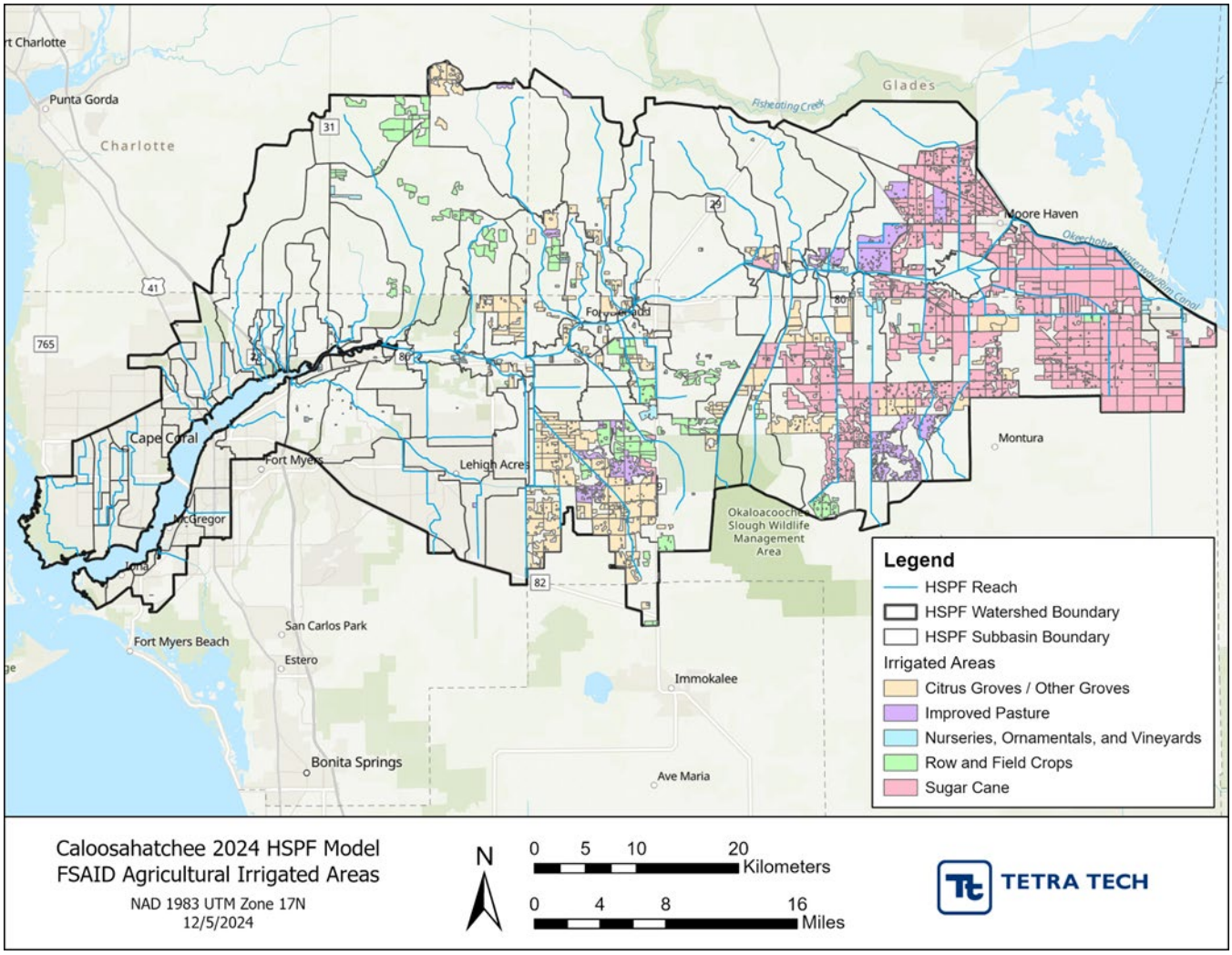

Figure 6. Agricultural irrigated areas in the 2024 HSPF Model watershed

2.5 POINT SOURCES AND REUSE FACILITIES

The 2024 HSPF Model includes point source data from three National Pollutant Discharge Elimination System (NPDES) domestic wastewater (DW) and industrial wastewater (IW) treatment facilities and 11 reuse facilities (Figure 7). DEP provided Tetra Tech with the permit and discharge monitoring report (DMR) data for the NPDES facilities with surface water discharges (Table 3) as well as the reuse facilities with permitted discharges greater than 0.09 million gallons per day (mgd) (Table 4) for the period from January 1, 2015 through December 31, 2023. The extended data were incorporated into the 2024 Model, with missing values filled using the same assumptions applied in the 2017 HSPF Model (Tetra Tech 2017).

Table 3. NPDES facilities included in the 2017 HSPF Model

NPDES ID	Facility Name	Type	Design Capacity (mgd)	Average Flow (mgd)	Number of Observations	Period of Record
FL0037541	E R Jahna Ind - Ortona Mine	IW	20.00	4.62	197	Oct 2002 – Dec 2023
FL0040088	Cape Coral, City of – Reverse Osmosis (RO) Water Treatment Plant (WTP)	IW	3.05	2.04	113	Jan 1999 – Jun 2010
FL0040665	Clewiston, City of – Wastewater Treatment Facility (WWTF)	DW	1.50	1.33	267	Apr 1999 – Dec 2023

Table 4. Reuse facilities included in the 2024 HSPF Model

Facility ID	Facility Name	Type	Usage(s)	Permitted Capacity (mgd)	Average Flow (mgd)	Number of Observations	Period of Record
FL0021261	Fort Myers Central Advanced WWTF	DW	Irrigation and commercial uses	11.000	3.35	249	Sep 2000 – Dec 2023
FL0030007	Cape Coral, City of - Everest Water Reclamation Facility (WRF)	DW	Irrigation	13.400	7.30	144	Nov 2011 – Dec 2023
FL0039829	Fiesta Village Advance Wastewater Treatment Plant	DW	Stormwater lake storage	5.000	1.80	206	Sep 2003 – Dec 2023
FL0040665	Clewiston, City of - WWTF	DW	Land application system (LAS) and irrigation	1.500	1.36	146	Apr 1998 – Dec 2023
FLA014283	LaBelle, City of	DW	LAS	0.750	0.46	138	Jun 2011 – Dec 2023
FLA014290	Port LaBelle	DW	Percolation pond	0.250	0.22	155	Feb 2011 – Dec 2023
FLA014548	Del Prado WWTF (formerly North Fort Myers Utility)	DW	Irrigation	4.250	1.79	124	Jan 2012 – Mar 2023
FLA014565	Lehigh Acres Wastewater Treatment Plant (WWTP)	DW	Percolation ponds and irrigation	2.480	0.94	124	Jan 2012 – Nov 2023
FLA014676	River Trails Mobile Home Park	DW	Percolation pond	0.097	0.06	142	Feb 2010 – Dec 2023
FLA016891	Glades County Correctional	DW	LAS and wetland application site	0.405	0.18	111	Dec 2012 – Dec 2023
FLA144215	Fort Myers Beach Sewage Treatment Plant (STP)	DW	Irrigation, commercial uses, and ponds	6.000	3.20	106	Jan 2015 – Dec 2023

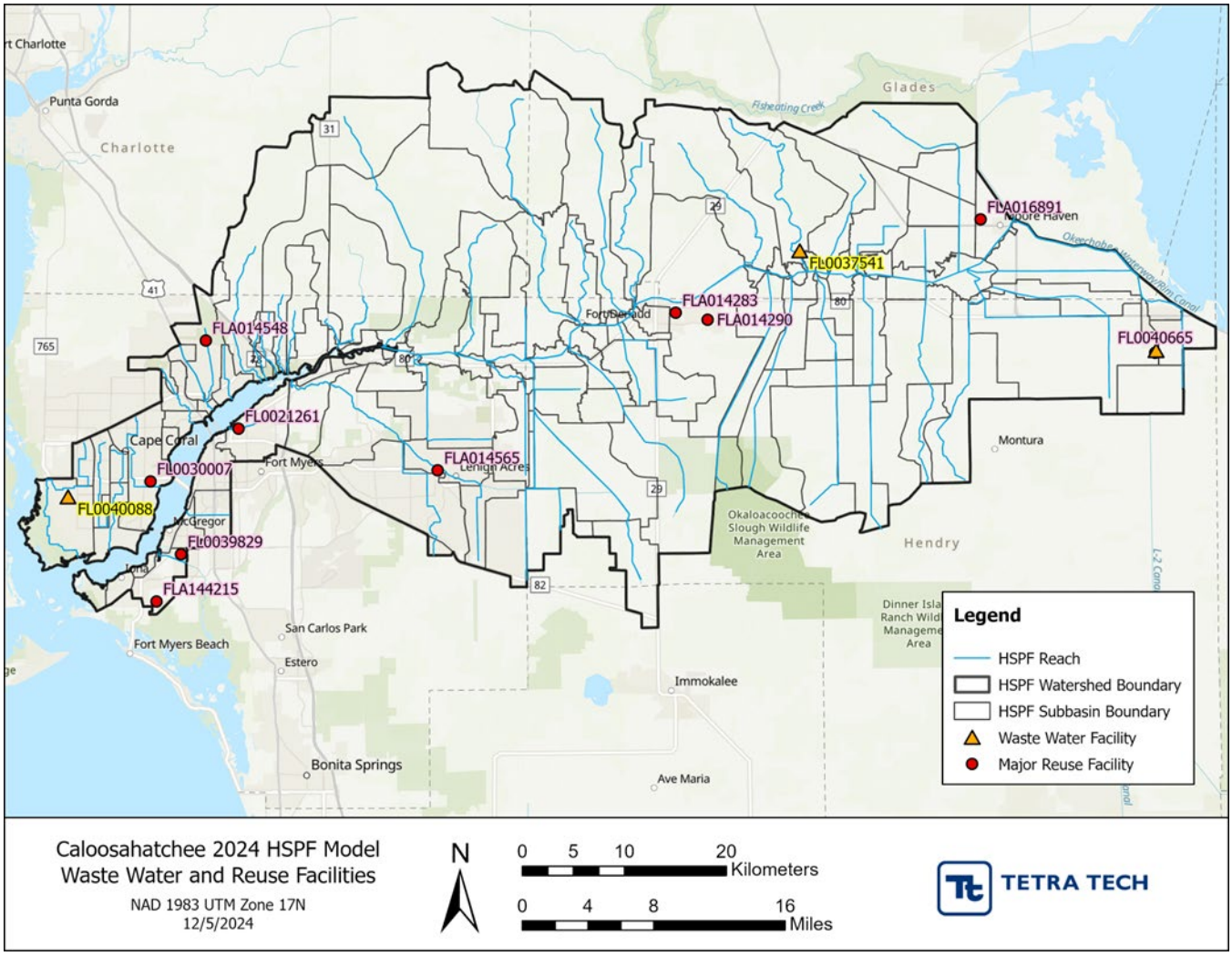

Figure 7. Wastewater and reuse facilities in the 2024 HSPF Model watershed

2.6 MODEL PARAMETERIZATION

The hydrology parameters in the 2024 HSPF Model remain unchanged from the 2017 HSPF Model.

2.7 SPECIALIZED HYDROLOGIC AND HYDRAULIC REPRESENTATIONS

2.7.1 Upstream Boundary Conditions

The Caloosahatchee River receives flows from Lake Okeechobee through the S-77 lock, which is controlled by the United States Army Corps of Engineers (USACE). Water in the Caloosahatchee River is also pumped back into Lake Okeechobee, and this occurred 5% of the time during the model simulation period. During pumping, the flow of water in the Caloosahatchee River reverses and moves towards Lake Okeechobee. USACE maintains a record of the daily average flow at S-77 where positive flow indicates movement from Lake Okeechobee to the Caloosahatchee River and negative flow indicates movement from the Caloosahatchee River to Lake Okeechobee. Positive flows were input into the HSPF model

at the uppermost reach, Reach 215. Measured negative flows were distributed via volume weighting and withdrawn from all reaches between S-78 and S-77 to represent the bidirectional flow caused by the pumping.

For the January 1, 1996, through December 31, 2023, simulation period, USACE S-77 data were 95.5% complete. Data gaps were filled using the United States Geological Survey (USGS) station 02292000 (Caloosahatchee Canal at Moore Haven FL) (151 days, which is 1.5% of the series) and USGS station 02292010 (Caloosahatchee Canal downstream of S-77 at Moore Haven FL) (239 days, which is 2.3% of the series). Best professional judgement using linear interpolation between existing data points was used to fill the remaining 71 days (0.7% of the series).

2.7.2 S-4 Basin and Industrial Canal

The reach referred to as the Industrial Canal in the HSPF Model is comprised of five connected canals and is in the S-4 basin (**Figure 8**). Flows between Lake Okeechobee and the canals, and the Caloosahatchee River and the canals, are regulated by SFWMD through the operation of five structures that include a lock, culverts, and major pumping structure:

- S-310 lock connects Lake Okeechobee to the C-21 canal.
- The LD-1 culverts including C-1, C-1A, and C-2 that connect the canal network to Lake Okeechobee via culverts through the dike/levee.
- S-235 connects the LD-3 canal to the Caloosahatchee River.
- S-169 connects the Industrial Canal via C-21 to and S-4 to Lake Okeechobee.
- S-4 pump connects the entire canal network to Lake Okeechobee.

Table 5 describes the operation of each structure in relation to the other structures.

Table 5. S-4 basin structures operations

Lake Okeechobee Stage	S-310 Gate Status	LD-1 Culverts Gate Status	S-235 Gate Status	S-169 Gate Status	Normal Range S-4 High Water
Over 15.5	Closed	Closed	Full Open	Auto	11-14
14-15.5	Full Open	Closed	Full Open	Closed	11-14
13-14	Full Open	Closed	Full Open	Closed	11-14
Below 13	Full Open	Full Open	Closed	Full Open	Below 13

The complex operation of the locks, culverts, and pumps that are dependent on Lake Okeechobee stage as described in the 2017 HSPF Model report (Tetra Tech 2017) was unchanged for the 2024 HSPF Model. The following points were used to extend the S-4 Basin and Industrial Canal boundaries for the 2024 HSPF Model.

- To estimate the flow entering the Industrial Canal from the Lake Okeechobee rim canal via the S-310 lock, Tetra Tech used the flow information at USGS station 264514080550700 to develop a positive time series of flow entering the Industrial Canal. Measured flow in the canal reversed daily at times, potentially due to wind, waves, or structure operation, and during these periods, measured flow at USGS station 264514080550700 averaged near 0 cubic feet per second (cfs). Therefore, to represent the overall directional movement of water in the Industrial Canal and total volume, Tetra Tech used a seven-day moving average of the USGS flows to develop the S-310 input time series. Positive values from the seven-day moving average were input into the model into Reach 219 as a point source time series.
- To represent the negative flows in the Industrial Canal and the operation of the S-4 pump, water was pumped from reaches 213, 214, 216, 218, 219, 220, and 999 into the Lake Okeechobee rim canal (outside the HSPF Model domain). To be consistent with the development of the positive inflow time series through the S-310 lock, a seven-day moving average was also applied to the USACE observed S-4 pump withdrawal time series. The fraction of the total withdrawal volume from each reach was determined by reach volume weighting.

- To represent seepage flow under the levee into the LD-1 canal, a point source time series was added to Reach 999. The daily under seepage time series was applied as a constant rate of 0.9 cfs per mile per foot of head gradient between the lake and the canal. The levee was approximately 8.75 miles in length. The head difference was calculated using the daily Lake Okeechobee stage recorded at USGS station 02276400 and a constant-head value of 13 feet for the LD-1 canal.

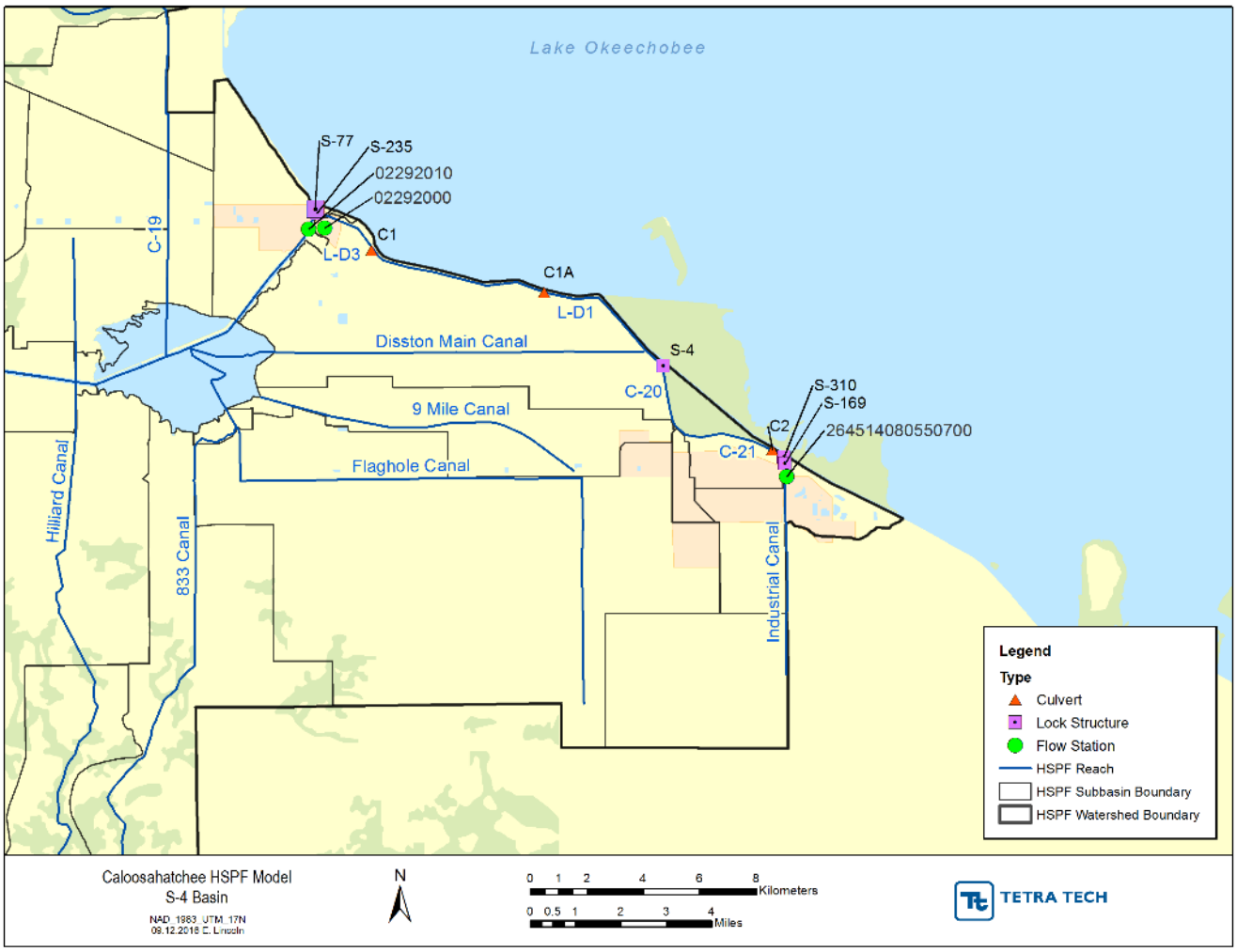

Figure 8. S-4 Basin canals, lock structures, and culverts

2.7.3 Jacks Branch

The 2017 HSPF Model under simulated storm flows at the DEP Jacks Branch gage, which measured discharge from October 1, 2009, through January 3, 2011. The model was able to represent measured storm flows and total flow volumes at USGS station 022929176, located in the neighboring watershed, Telegraph Creek. Predictive errors in storm flow and total volume flow were less than 5% at USGS station 022929176. Telegraph Creek and Jacks Branch have similar areas and land uses, which indicated that the under representation of storm flows in Jacks Branch was either due to an external or unaccounted for source of flow contributing to the Jacks Branch storm flow or potential errors in high flow measurements at Jacks Branch. For the 2017 HSPF Model, it was assumed that the error in high flow was due to an

external source of flow contributing to Jacks Branch during storms following large precipitation events and a corrective timeseries was developed and applied to the model.

For the 2024 HSPF Model, the Jack's Branch corrective timeseries was removed from the simulation. A new USGS gage, USGS 02292740 (Jacks Branch at CR 78 Near Fort Denaud, FL), with a monitoring period of November 16, 2018, to December 31, 2023, indicated a good fit between simulated and observed measurements.

2.7.4 Fast Creek

The 2017 HSPF Model under simulated storm flows at the Fast Creek gage, which measured discharge from April 4, 2010, through December 8, 2010. According to stakeholder information provided during the site visit conducted for the 2017 Model Update, Fast Creek is connected to neighboring subbasins during storm events, and flow from the neighboring watershed is routed to Fast Creek through canals. For the 2017 HSPF Model, Tetra Tech attempted to determine the relationship between rainfall and total storm flow, as well as rainfall and the modeled storm flow deficit; however, the flow volume needed to make up the deficit was greater than the total storm flow volumes of the neighboring subbasins. Therefore, a corrective timeseries for Fast Creek storm volume was not routed from neighboring watersheds to Fast Creek in the 2017 HSPF Model. For the 2024 HSPF Model, additional information was not available and the Fast Creek storm volume routed from neighboring watersheds remained unresolved. Therefore, the 2024 HSPF Model does not include a corrective timeseries for Fast Creek storm volumes.

3.0 HSPF UPDATED MODEL CALIBRATOIN

Tetra Tech calibrated and validated the 2024 HSPF Model by comparing the simulated hydrology outputs and the observed flow data at 23 stations: 17 USGS stations and six DEP stations. Of these, three USGS stations were newly added for the 2024 HSPF Model to ensure adequate coverage of the extended simulation period, in supplement to discontinued stations:

- USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL.
- USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL.
- USGS 02292780 Townsend Canal Near Alva, FL.

The remaining calibration and validation stations were also used in the 2017 HSPF Model. Table 6 provides a complete list of the calibration and validation stations and the observed data periods available during the simulation period. Figure 9 shows the locations of the hydrology calibration and validation stations.

Table 6. Calibration stations and the observed data periods

Type	Station ID	Station Name	Observed Data Start Date	Observed Data End Date
Calibration	USGS 02292000	Caloosahatchee Canal at Moore Haven	1/1/1996	9/29/2003
Calibration	USGS 02292010	Caloosahatchee Canal DWS of S-77 at Moore Haven	5/19/2008	12/31/2023
Calibration	USGS 02292480	Caloosahatchee Canal at Ortona Lock near LaBelle S-78	1/1/1996	9/29/2003
Calibration	USGS 26451408150700	Industrial Canal at Clewiston	1/1/1996	12/31/2023
Calibration	USGS 02292900	Caloosahatchee River at S-79 near Olga, FL	1/1/1996	12/31/2023
Calibration	USGS 022929176	Telegraph Creek at State Highway at Olga	11/2/2007	12/31/2023

Type	Station ID	Station Name	Observed Data Start Date	Observed Data End Date
Calibration	USGS 02293055	Orange River near Buckingham	11/22/2007	12/31/2023
Calibration	USGS 02293090	Popash Creek at Leetana Road near Fort Myers	12/27/2007	12/31/2023
Calibration	UGS 02293190	Billy Creek at Fort Myers	2/29/2008	5/8/2013
Calibration	USGS 02293230	Whiskey Creek at Fort Myers	1/1/1996	12/31/2023
Calibration	USGS 02293240	Aries Canal at Cape Coral	1/1/1996	8/31/2013
Calibration	USGS 02293241	San Carlos Canal at Cape Coral	1/1/1996	4/3/2013
Calibration	USGS 02293243	Courtney Canal at Cape Coral	1/1/1996	7/31/2013
Validation	USGS 264006081534400	Hancock Creek at Pondella Road, North Fort Myers, FL	4/1/2008	4/11/2013
Validation	USGS 02292490	Goodno Canal Below S-78 Near Labelle, FL	12/4/2018	12/31/2023
Validation	USGS 02292740	Jacks Branch at CR 78 Near Fort Denaud, FL	11/16/2018	12/31/2023
Validation	USGS 02292780	Townsend Canal Near Alva, FL	12/18/2018	12/31/2023
Validation	DEP Jacks Branch	DEP Jacks Branch at SR 78	10/1/2009	1/3/2011
Validation	DEP Pollywog Creek	DEP Pollywog Creek at SR 78	9/30/2009	4/14/2010
Validation	DEP Fast Creek	DEP Fast Creek at SR 80	4/22/2010	12/8/2010
Validation	DEP Powell Creek	DEP Powell Creek at SR 78	8/14/2007	12/4/2007
Validation	DEP Stroud Creek	DEP Stroud Creek	8/14/2007	12/4/2007
Validation	DEP Yellow Fever Creek	DEP Yellow Fever Creek	8/14/2007	12/4/2007

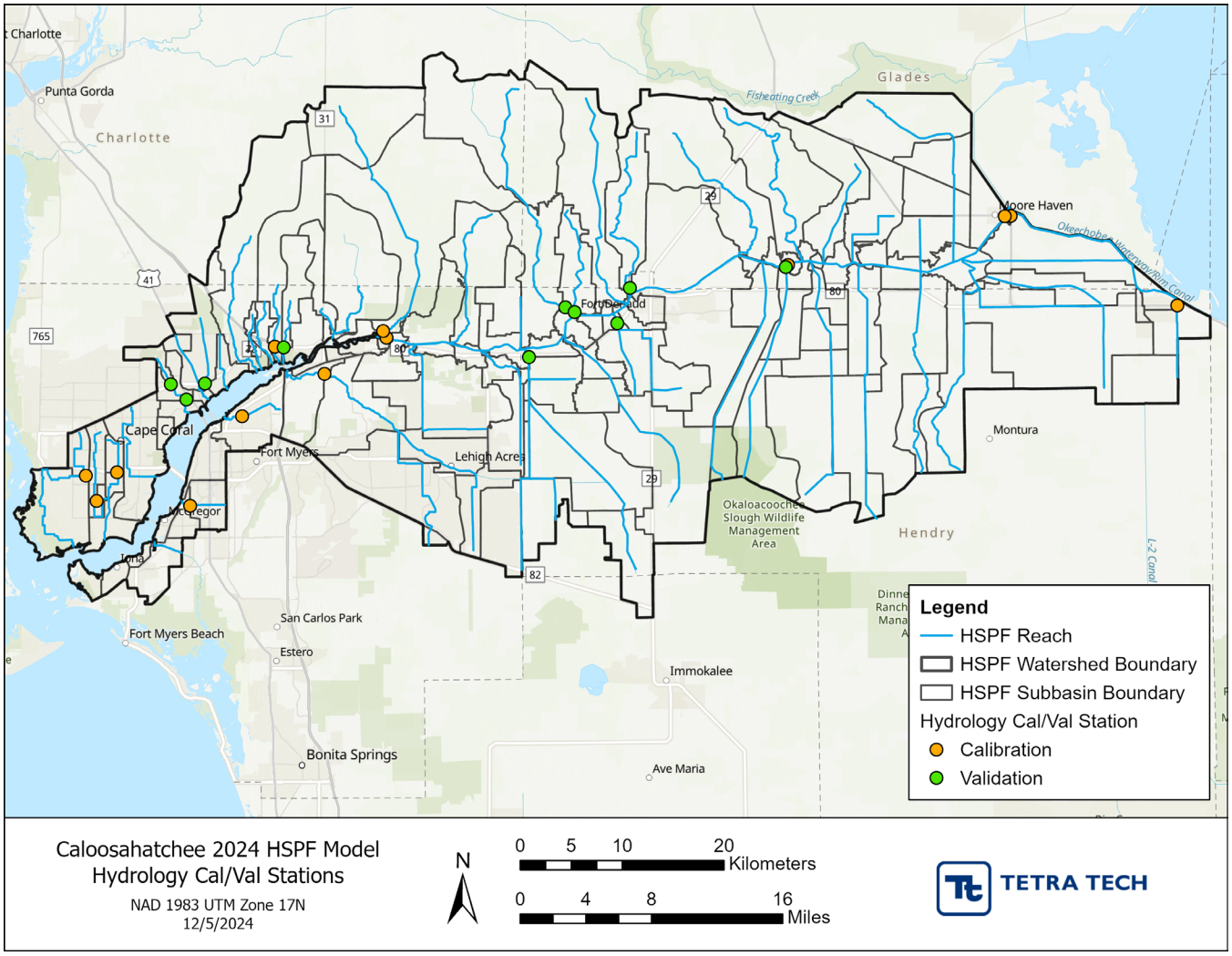

Figure 9. Hydrology calibration and validation stations in the 2024 HSPF Model watershed

Four of the gages are tidally influenced: USGS 022929176 Telegraph Creek, USGS 02293055 Orange River, USGS 02293090 Popash Creek, and USGS 02293190 Billy Creek. USGS used the Godin low-pass filter to remove the tidal frequencies and obtain the tidally filtered flows at the tidal stations. After filtering the data, there were some negative discharges at the stations, indicating a general upstream movement of water on those days. Negative flows were also measured at four other gages with more than one year of data: USGS 02292000 Caloosahatchee Canal at Moore Haven, USGS 02292010 Caloosahatchee Canal at S-77 lock, USGS 26451408150700 Industrial Canal, and DEP Jacks Branch. The negative observed flows were all removed from the visual comparison and statistical analysis in the following sections and Appendix A.

In Appendix A, Tetra Tech has provided daily and monthly average temporal comparison plots, frequency distribution curves, regression plots, and relative error and Nash-Sutcliffe model efficiency statistics for the calibration and validation stations.

Statistical metrics at each stations were compared to Donigian (2002) performance metrics and given a qualitative rating of Very Good, Good, Fair, or Poor (Table 7 and Table 8). The statistical summary of calibration results for the 2024 HSPF

model is provided in Table 9. A summary of the draft hydrology calibration at each station, along with potential calibration issues, are provided in the sections below.

Table 7. Donigian 2002 calibration/validation targets or tolerances for percent difference between modeled observed results for hydrologic parameters

Category	Range
Very Good	<10%
Good	10% - 15%
Fair	15% - 25%
Poor	>25%

Table 8. Donigian 2002 R2 and Nash-Sutcliffe efficiency (NSE) ranges for model performance

Category	Range
Very Good	>0.8
Good	0.7 - 0.8
Fair	0.6 - 0.7
Poor	<0.6

Table 9. Statistical summary of the 2024 HSPF Model hydrological calibration

Station ID	Station Name	R^2 (monthly)	R^2 Rating	NSE	NSE Rating	NSE (monthly)	NSE (monthly) Rating	Total Volume % Error	Total Volume % Error Rating
USGS 02292000	Caloosahatchee Canal at Moore Haven	0.99	Very Good	0.98	Very Good	0.98	Very Good	10.15	Good
USGS 02292010	Caloosahatchee Canal DWS of S-77 at Moore Haven	0.98	Very Good	0.95	Very Good	0.98	Very Good	-4.11	Very Good
USGS 02292480	Caloosahatchee Canal at Ortona Lock near LaBelle S-78	0.94	Very Good	0.86	Very Good	0.94	Very Good	-5.23	Very Good
USGS 26451408150700	Industrial Canal at Clewiston	0.87	Very Good	0.23	Poor	0.47	Poor	-56.05	Poor
USGS 02292900	Caloosahatchee River at S-79 near Olga, FL	0.92	Very Good	0.79	Good	0.87	Very Good	-19.04	Fair
USGS 02293230	Whiskey Creek at Fort Myers	0.73	Good	-0.60	Poor	0.34	Poor	38.03	Poor
USGS 02293240	Aries Canal at Cape Coral	0.68	Fair	0.27	Poor	0.26	Poor	-53.47	Poor
USGS 02293241	San Carlos Canal at Cape Coral	0.65	Fair	0.44	Poor	0.63	Fair	-4.5	Very Good
USGS 022929176	Telegraph Creek at State Highway at Olga	0.84	Very Good	0.75	Good	0.80	Good	7.23	Very Good
USGS 02293055	Orange River near Buckingham	0.81	Very Good	0.38	Poor	0.75	Good	15.76	Fair
USGS 02293090	Popash Creek at Leetana Road near Fort Myers	0.76	Good	0.61	Fair	0.77	Good	13.53	Good
UGS 02293190	Billy Creek at Fort Myers	0.68	Fair	0.13	Poor	0.84	Very Good	9.32	Very Good
USGS 02293243	Courtney Canal at Cape Coral	0.65	Fair	0.36	Poor	0.61	Fair	-1.63	Very Good
USGS 264006081534400	Hancock Creek at Pondella Road, North Fort Myers, FL	0.67	Fair	-0.21	Poor	-0.15	Poor	-75.73	Poor
DEP Jacks Branch	DEP Jacks Branch at SR 78	0.49	Poor	0.22	Poor	0.25	Poor	-39.93	Poor
DEP Fast Creek	DEP Fast Creek at SR 80	0.51	Poor	NC	NC	NC	NC	NC	NC
DEP Pollywog Creek	DEP Pollywog Creek at SR 78	0.19	Poor	NC	NC	NC	NC	NC	NC
DEP Powell Creek	DEP Powell Creek at SR 78	0.49	Poor	NC	NC	NC	NC	NC	NC
DEP Stroud Creek	DEP Stroud Creek	0.65	Fair	NC	NC	NC	NC	NC	NC
DEP Yellow Fever Creek	DEP Yellow Fever Creek	0.54	Poor	NC	NC	NC	NC	NC	NC
USGS 02292490	Goodno Canal Below S-78 Near Labelle, FL	0.69	Fair	0.49	Poor	0.51	Poor	-37.66	Poor
USGS 02292740	Jacks Branch at CR 78 Near Fort Denaud, FL	0.86	Very Good	0.73	Good	0.83	Very Good	21.16	Fair
USGS 02292780	Townsend Canal Near Alva, FL	0.52	Poor	0.38	Poor	0.56	Poor	-42.02	Poor

NC = Not calculated for stations with less than one year of continuous observed data.

3.1 USGS GAGE CALIBRATION

Hydrology calibration and validation summary for the 17 USGS stations are provided in this section. Overall, the 2024 HSPF Model has flow results that are very similar to the flow results from the 2017 HSPF Model

- USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003):
  - Gage used to verify upstream boundary condition contribution from Lake Okeechobee.
  - Nash-Sutcliffe coefficient is the same in 2024 HSPF Model and the 2017 HSPF Model, total volume error 0.18% higher in 2024 HSPF Model due to continued over estimation of low flows.
  - USACE S-77 data were used to develop external boundary condition.
  - Differences in flow due to differences between USACE flow data and USGS flow data.
  - Model was not delineated to gage, and there are differences in low flow due to runoff from subbasin 215 and a portion of the S-4 basin that is routed to reach 215 (controlled by S-235).
- USGS 02292010 Caloosahatchee Canal DWS of S-77 Moore Haven, FL (05/19/2008 – 12/31/2023):
  - Gage used to verify upstream boundary condition contribution from Lake Okeechobee.
  - Error in total volume better in 2024 HSPF Model than 2017 HSPF Model, and error in low flows is higher in 2024 HSPF Model.
  - USACE S-77 data were used to develop external boundary condition.
  - Differences in flow are due to differences between USACE flow data and USGS flow data.
  - Model was not delineated to gage, and there are differences in low flow due to runoff from subbasin 215 and a portion of the S-4 basin that is routed to reach 215 (controlled by S-235).
- USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003):
  - Error in high flows and Nash-Sutcliffe coefficient was better in 2024 HSPF Model than 2017 HSPF Model, and there is similar visual representation in the 2024 HSPF Model and 2017 HSPF Model.
  - R^2, Nash-Sutcliffe coefficient, and total flow error indicate strong performance.
  - Over simulation of low flows (between 35 and 100 cfs) may be due to USACE lock operations not being represented in the model.
- USGS 26451408150700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023):
  - Canal is highly controlled and measured flows do not correspond to rainfall events (i.e. flows are zero during periods of high rainfall and high during periods of low rainfall).
  - When the stage in Lake Okeechobee is between 13.0 and 15.5 feet, the S-310 lock is in the open position and there is no record of the flow rate through the S-310 lock into the Industrial Canal.
  - Positive flows appear under predicted due to hydraulic setup at Industrial Canal which routes some flows directly into S-4 basin interior.
  - Magnitude of volume errors are the same between in the 2024 HSPF Model and 2017 HSPF Model.
- USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023):
  - Error in 50% lowest flows and Nash-Sutcliffe coefficient are better in the 2024 HSPF Model than 2017 HSPF Model.
  - Differences in total volume may be due to USACE lock operations not being represented in the model.
- USGS 022929176 Telegraph Creek at State Highway at Olga, FL – Big Island Canal (01/01/2008 – 04/09/2013, 10/01/2018 – 12/31/2023):
  - Error in 50% lowest flows, winter volume, and spring volume is better in the 2024 HSPF Model than the 2017 HSPF Model with better visual representation in the 2017 HSPF Model.

- Model performed well with the exception of the simulated low flows lower than observed low flows (2007–2013). Station was reactivated in 2018, and the 2019–2023 data have lower low flows, which the 2024 HSPF Model visually captures.
- Gage is tidally influenced at very high tides.

- USGS 02293055 Orange River near Buckingham, FL (01/01/2008 – 04/09/2013, 10/01/2018 – 12/31/2023):
  - Statistical comparison is better in the 2017 HSPF Model than 2024 HSPF Model; however visual representation is similar in the 2017 HSPF Model and 2024 HSPF Model.
  - Model performs very well.
  - Gage is tidally influenced at very high tides.
- USGS 02293090 Popash Creek at Leetana Road near Fort Myers, FL (01/01/2008 – 04/05/2013, 10/01/2018 – 12/31/2023):
  - Error in total volume, high flows, winter volume, and spring volume is better in the 2024 HSPF Model than 2017 HSPF Model with similar visual representation in the 2024 HSPF Model and 2017 HSPF Model.
  - Most overestimation occurred for low flows, producing high statistical differences.
  - Model over simulated flow volumes in months January – June.
  - Gage is tidally influenced at very high tides.
- USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 05/08/2013):
  - Error in 50% lowest flows is better in the 2024 HSPF Model than 2017 HSPF Model, and there is similar visual representation in the 2024 HSPF Model and 2017 HSPF Model.
  - Most overestimation occurred for low flows and for flows in months January – June.
  - Gage is tidally influenced at very high tides.
- USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023):
  - Statistical comparison is better in the 2017 HSPF Model than 2024 HSPF Model; however, the visual representation is similar in the 2017 HSPF Model and 2024 HSPF Model.
  - Error in low flow – high flow distribution and storm volumes are due to the HSPF model not capturing storage in reservoir (pond) and poor timing due to storage and release.
  - Gage is tidally influenced at very high tides.
- USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013):
  - Magnitude of volume errors are the same between the 2024 HSPF Model and the 2017 HSPF Model.
  - Although there are no negative flow measurements, gage may be influenced by tides, which may cause ponding of water in canal system.
- USGS 02293241 San Carlos Canal at Cape Coral, FL (01/01/1997 – 04/03/2013):
  - Error in the total volume and high flows is better in the 2024 HSPF Model than 2017 HSPF Model. The 2017 HSPF Model has better visual representation; however, visual representation is similar in the 2017 HSPF Model and 2024 HSPF Model.
  - Although there are no negative flow measurements, gage may be influenced by tides, which may cause ponding of water in canal system.
- USGS 02293243 Courtney Canal at Cape Coral, FL (01/01/1997 – 07/31/2013):
  - Error in total volume and high flows is better in the 2024 HSPF Model than 2017 HSPF Model. The 2017 HSPF Model has better visual representation; however, visual representation is similar in the 2017 HSPF Model and 2024 HSPF Model.
  - Overestimation occurred for low or 0 cfs observed flows.

- Over simulation occurred for spring flows (April – June) and summer storm volumes.

- USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/02/2008 – 04/09/2013):
  - Statistical comparison is better in the 2017 HSPF Model than 2024 HSPF Model; however, the visual representation is similar in the 2017 HSPF Model and 2024 HSPF Model.
  - Simulated flows were general lower than the observed flows.
  - Gage is tidally influenced.

- USGS 02292490 Goodno Canal below S-78 near Labelle, FL (12/04/2018 – 12/31/2023):
  - Simulated flows were generally lower than the observed flows, with the smallest error in October – December.
  - Most underestimation occurs for flows below 10 cfs which produces high statistical differences

- USGS 02292740 Jacks Branch at County Road 78 near Fort Denaud, FL (11/16/2018 – 12/31/2023):
  - The low flows and baseflow were overestimated, especially in October – March.
  - Most overestimation occurs for flows below 10 cfs, which produces high statistical differences. Visual representation looks good.

- USGS 02292780 Townsend Canal near Alva, FL (12/20/2018 – 12/31/2023):
  - Simulated flows were generally lower than the observed flows, with the smallest error in October – December.
  - Caloosahatchee River (C-43) West Basin Storage Reservoir was under construction in 2023 and was likely undergoing dewatering, which is not represented in the model.

3.2 DEP GAGE CALIBRATION

Among the six DEP stations, Jacks Branch at SR 78 (01/01/2010 – 01/03/2011)was the only station with more than one year of continuous observed data. Therefore, only Jacks Branch's calibration summary is provided in this section.

- The 2017 HSPF Model included external inflow to watershed to account for external connections during storm flows. This representation was removed from the 2024 HSPF Model.
- Over stimulation occurred for low flows and months October – January.
- Under stimulation occurred for high flows, as well as spring and summer months (March – September).
- The flow data collected appears to have some seasonal distribution irregularities when compared with USGS 02292740 Jacks Branch at Cr 78 near Fort Denaud, FL.

3.3 CALIBRATION ISSUES

Issue #1: The low flows at USGS 02292000 (below 100 cfs) and USGS 02292010 (below 50 cfs) are over simulated.

The model is not delineated to the USGS gages, which are located at the upstream model boundary. Therefore, the results include contributing flow from the downstream subbasin 215, as well as a portion of the S-4 basin that is discharging into reach 215. The calibration plots and statistical summary represents the output from reach 215 and includes the internal model area contributing to reach 215 (subbasin 215 and a portion of the S-4 basin). The calibration plots and statistical summary will therefore show this overestimation of low flows.

Issue #2: The flows at USGS 26451408150700 are under simulated.

The hydraulic representation of the S-4 basin is very complex and has been setup to best represent water movement through the Industrial Canal and remaining canals in the S-4 basin. Flow inputs and flow removals in

the Industrial Canal and S-4 basin have been estimated and calculated using the best available data and information. A portion of the flow inputs into the Industrial Canal are routed to the interior of the S-4 basin at times, which causes the visual under simulation at USGS 26451408150700.

Issue #3: The low flows (between 35 and 100 cfs) at USGS 02292480 are over simulated.

USACE operates the S-78 lock located immediately upstream of the gage, and water may be ponded behind the lock during low flows and releases may be increased during high flows. Tetra Tech is representing the Caloosahatchee River below S-78 as a natural river system and did not include USACE operations, which is likely causing the overestimation of low flows.

Issue #4: The low flows (below 100 cfs) at USGS 02292900 do not match measured data.

The USACE operates the S-79 lock located immediately upstream of the gage, and water may be ponded behind the lock during low flows and releases may be increased during high flows. Tetra Tech is representing the Caloosahatchee River below S-79 as a natural river system and did not include USACE operations, which is likely causing the overestimation of low flows.

Issue #5: At USGS 02293230, there is an error in low flow – high flow distribution, as well as the storm volumes.

This error appears to be caused by the HSPF model not capturing storage in the reservoir (pond) and poor timing due to storage and release. Due to the influence of the structures, Tetra Tech believes the low flow – high flow distribution at the gage cannot be captured by the HSPF model because of the gage location.

Issue #6: For station USGS 02293240 on the Cape Coral Aries Canal, there is an underestimation of flows.

Tetra Tech evaluated the delineation of the canal network and determined that the current delineation appears to be correct. Tetra Tech evaluated the impervious area representation in this portion of the watershed and updated the model to the latest land cove, but was not able to improve the overall calibration.

Issue #7: For station USGS 02293241 at the Cape Coral San Carlos Canal, there is an error in the low flow – high flow distribution.

Tetra Tech evaluated the impervious area representation in this portion of the watershed and adjusted parameterization, including decreasing infiltration, but was not able to improve the overall calibration.

Issue #8: For station USGS 02292740 Jacks Branch at County Road 78 near Fort Denaud, FL and DEP Jacks Branch at SR 78, the model compares well against the USGS data but poorly against the DEP data.

Tetra Tech evaluated using a different watershed for comparison against the DEP data but it did not improve the results.

4.0 REFERENCES

Donigian, A.S. 2002. Watershed model calibration and validation: the HSPF experience. AQUA TERRA Consultants. Mountain View, California.

Florida Department of Environmental Protection (DEP). 2024. Statewide Land Use Land Cover. Accessed at: https://geodata.dep.state.fl.us/datasets/FDEP::statewide-land-use-land-cover/about.

Tetra Tech. 2017. Hydrology and Water Quality Modeling Report for the Caloosahatchee River and Estuary, Florida. Prepared for the Florida Department of Environmental Protection.

APPENDIX A: UPDATED HSPF MODEL HYDROLOGY RESULTS

A-1 USGS GAGES CALIBRATION AND VALIDATION COMPARISON

USGS 02292000 Caloosahatchee Canal at Moore Haven

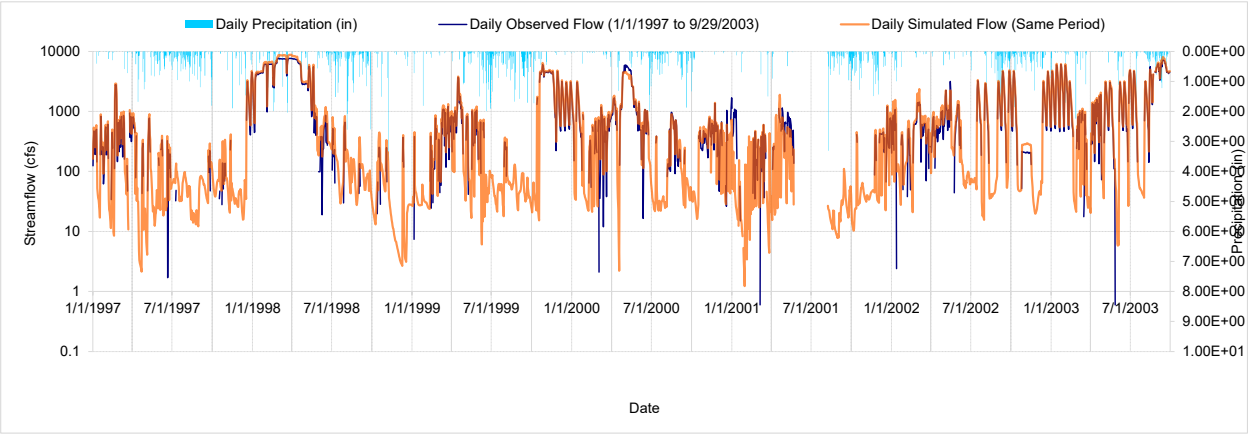

Figure A-10. Mean daily flow: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

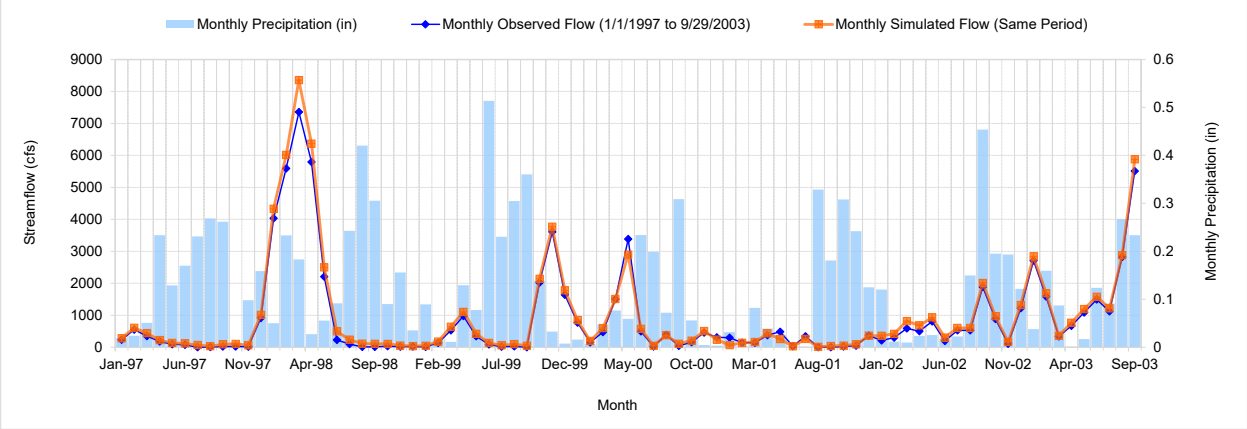

Figure A-11. Mean monthly flow: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

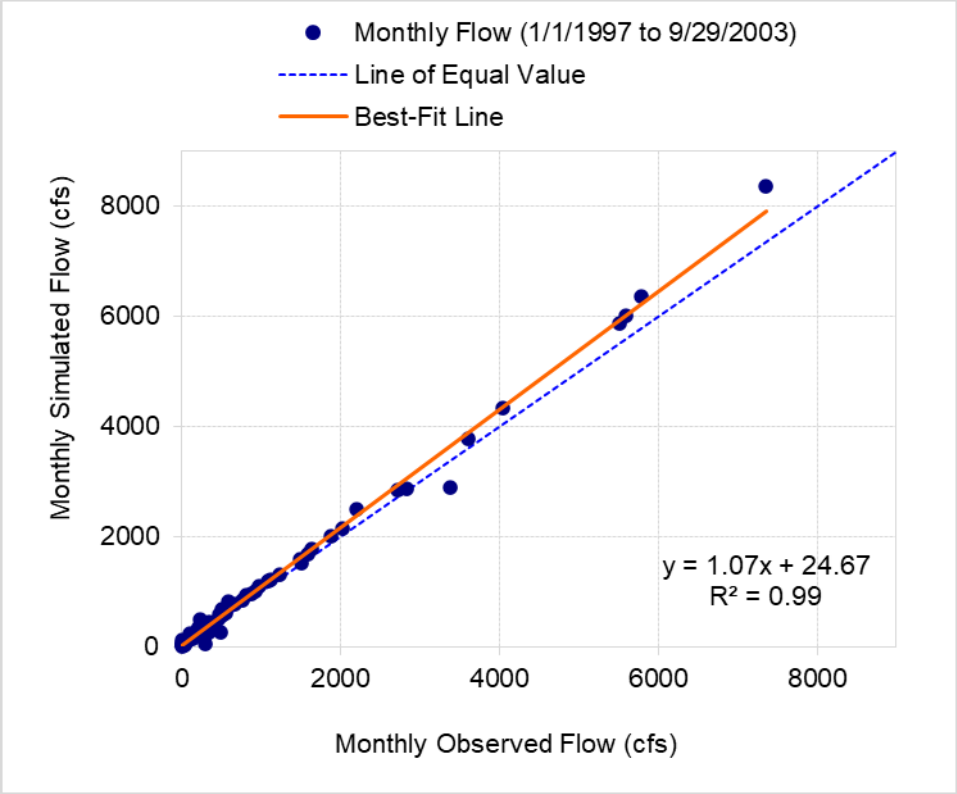

Figure A-12. Monthly flow regression and temporal variation: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

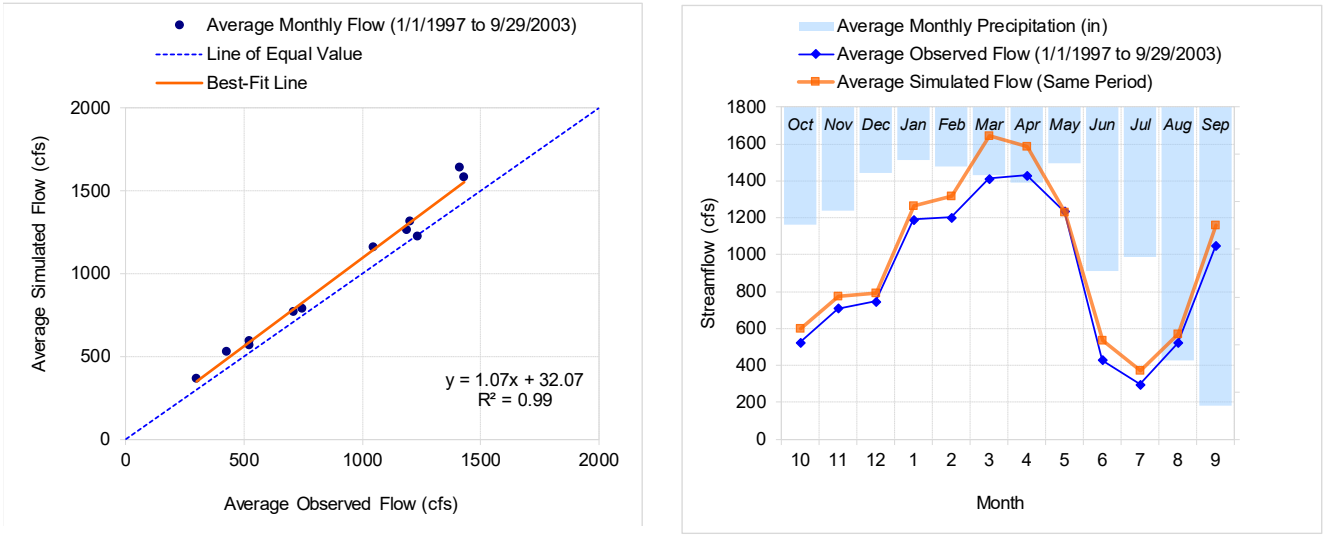

Figure A-13. Seasonal regression and temporal aggregate: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

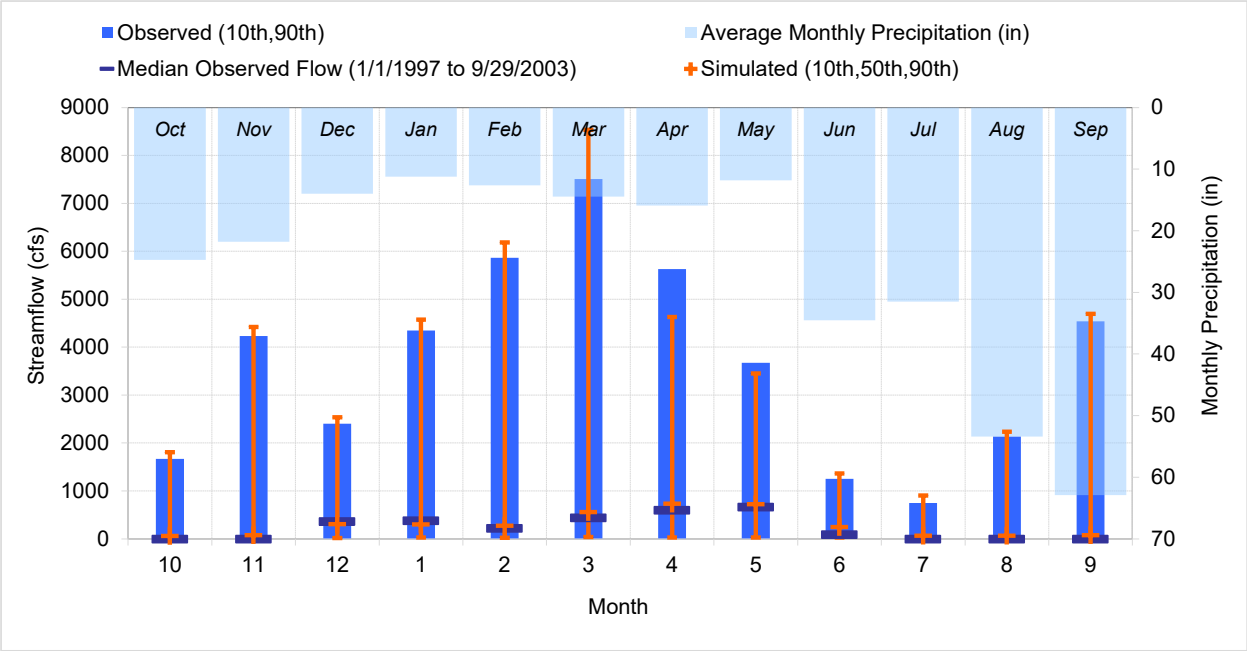

Figure A-14. Seasonal medians and ranges: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

Table A-10. Seasonal summary: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	523.86	0.00	0.00	1670.00	597.57	59.89	20.96	1807.40
Nov	708.33	0.00	0.00	4233.00	775.79	77.12	19.87	4422.10
Dec	745.92	366.00	0.00	2400.00	791.67	307.71	18.81	2536.25
Jan	1189.60	381.00	0.00	4346.00	1264.87	301.08	27.28	4574.84
Feb	1202.88	224.00	0.00	5862.00	1316.09	272.65	22.64	6185.04
Mar	1412.18	443.00	0.00	7507.00	1642.46	556.61	37.03	8536.65
Apr	1428.63	602.00	0.00	5629.00	1584.08	734.35	25.92	4631.22
May	1232.59	667.50	0.00	3673.00	1230.93	726.22	30.28	3453.65
Jun	428.28	92.30	0.00	1250.00	532.56	249.13	26.47	1361.80
Jul	298.14	0.00	0.00	750.40	372.01	64.01	27.40	903.51
Aug	523.16	0.00	0.00	2136.00	571.33	66.59	14.80	2233.82
Sep	1046.72	0.00	0.00	4540.00	1160.43	78.51	30.88	4692.86

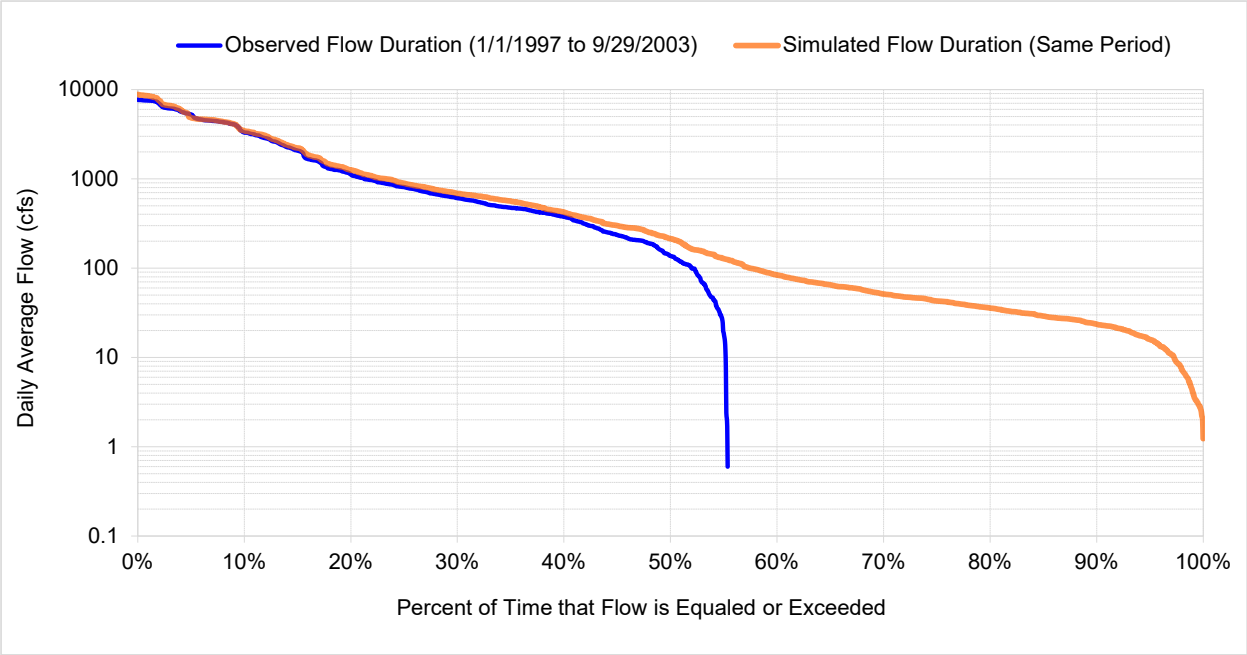

Figure A-15. Flow exceedance: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

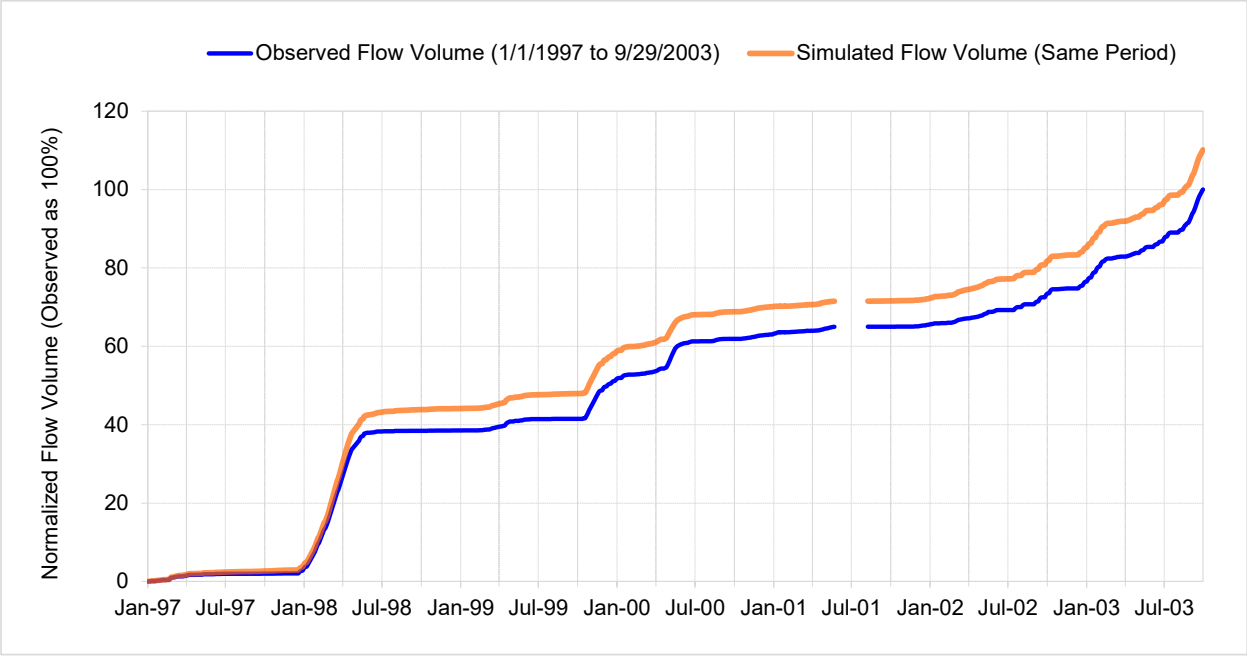

Figure A-16. Flow accumulation: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

Table A-11. Summary statistics: Model output at Reach 215 versus USGS 02292000 Caloosahatchee Canal at Moore Haven, FL (01/01/1997 – 09/30/2003)

Caloosahatchee Canal at Moore Haven, FL (ID - USGS 02292000)
Drainage Area (sq-mi): 5650
Analysis Period: 1/1/1997 to 9/29/2003

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	2.12	2.34	10.15	10
Total lowest 50% flows	0.01	0.07	586.85	10
Total highest 10% flows	1.27	1.34	5.44	15
Summer flow volume (months 7-9)	0.37	0.42	12.42	30
Fall flow volume (months 10-12)	0.36	0.39	9.45	30
Winter flow volume (months 1-3)	0.78	0.86	11.04	30
Spring flow volume (months 4-6)	0.62	0.67	8.07	30
Total storm volume	1.17	1.22	4.14	20
Summer storm volume (7-9)	0.22	0.24	7.59	50
Baseflow	0.95	1.12	17.56	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.982	0.7
Baseline adjusted coefficient (Garrick), E'			0.887	0.5
Monthly NSE			0.984	0.8

USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven

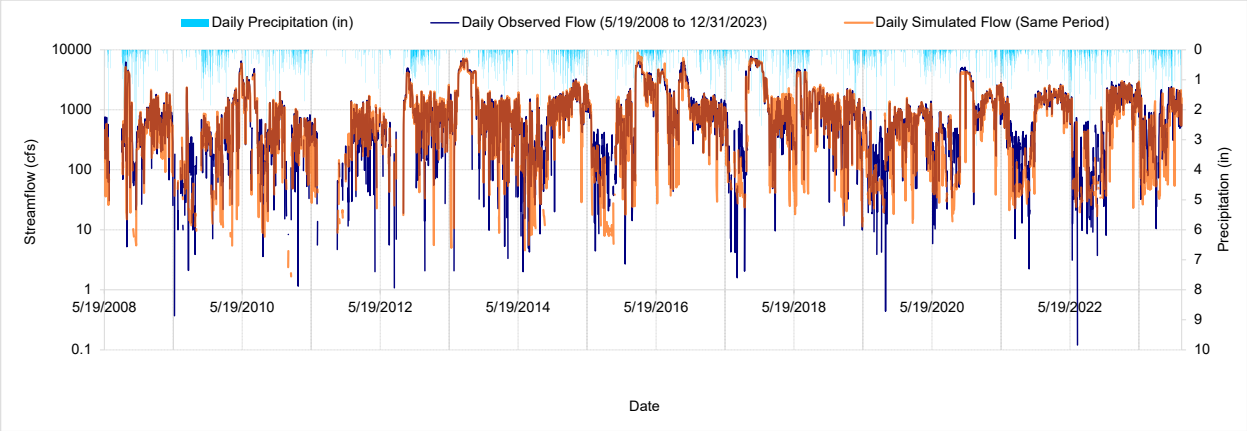

Figure A-17. Mean daily flow: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

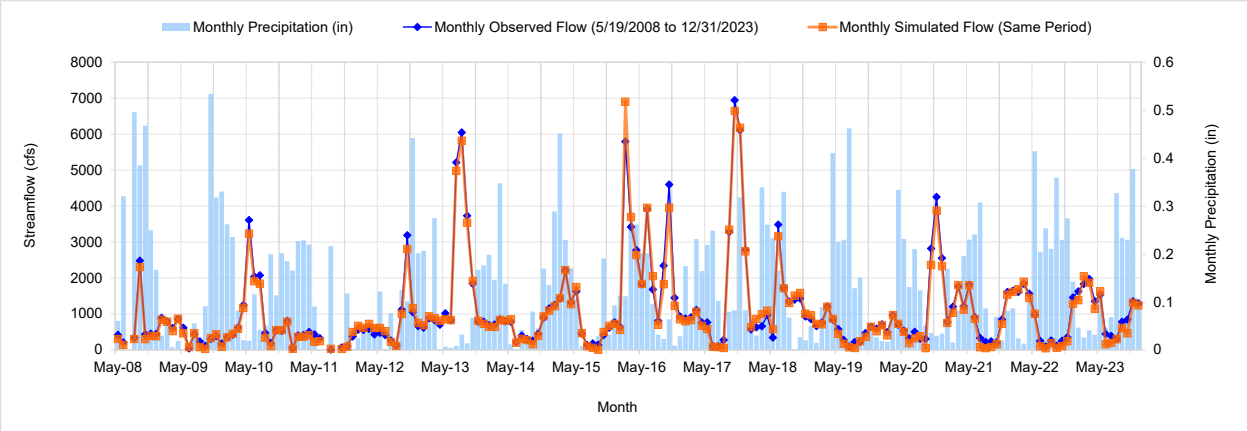

Figure A-18. Mean monthly flow: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

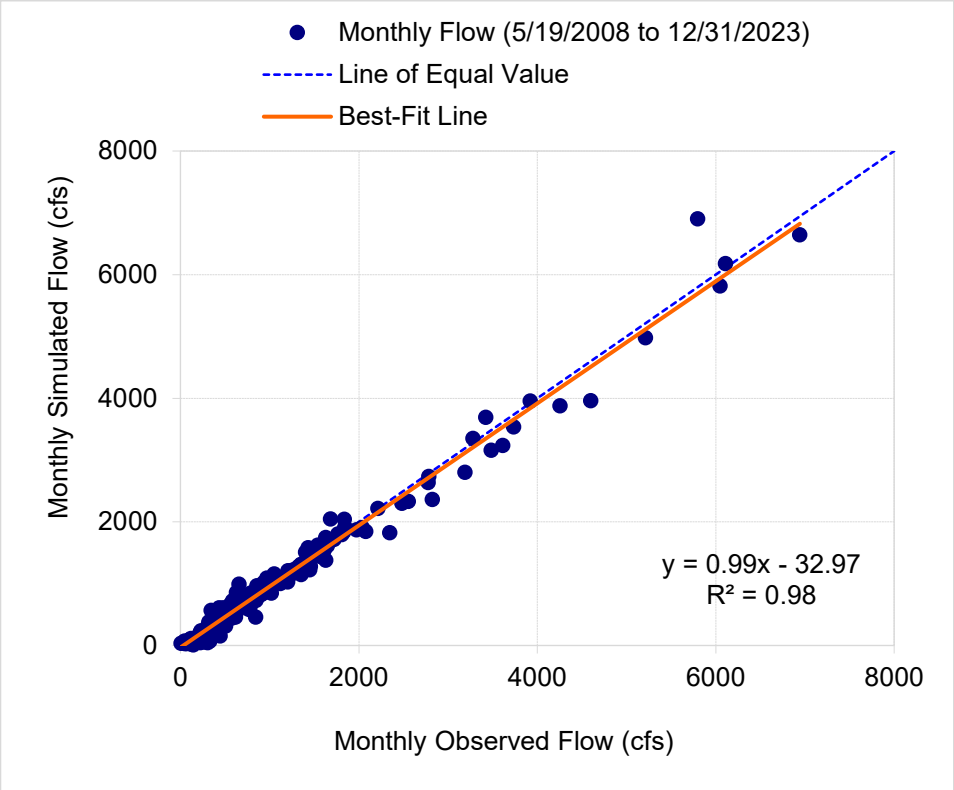

Figure A-19. Monthly flow regression and temporal variation: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

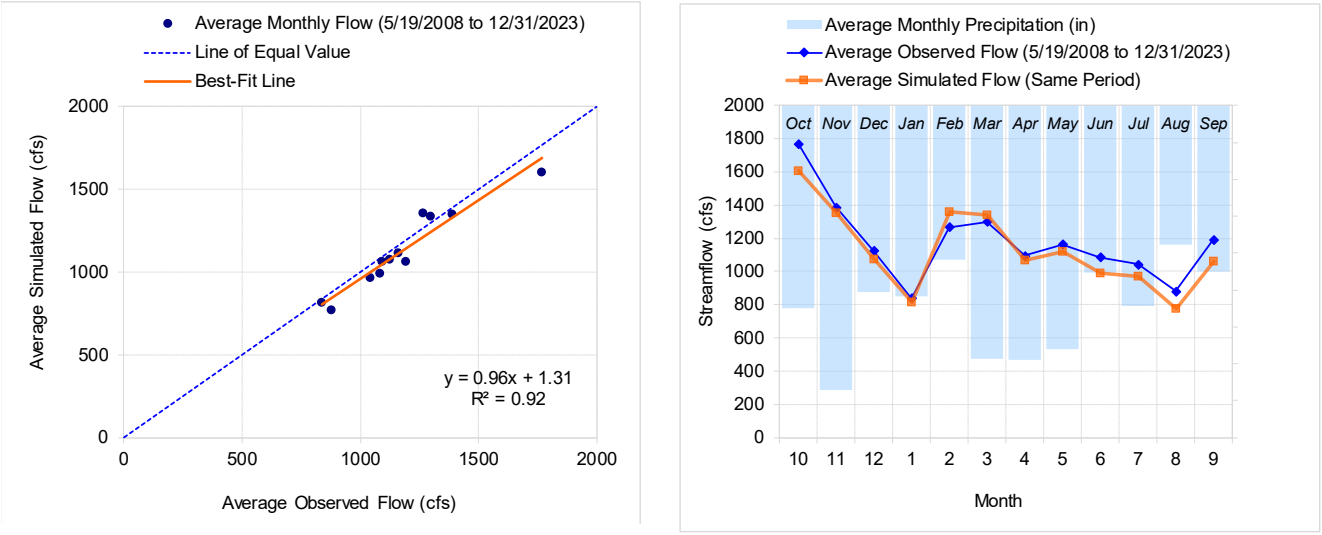

Figure A-20. Seasonal regression and temporal aggregate: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

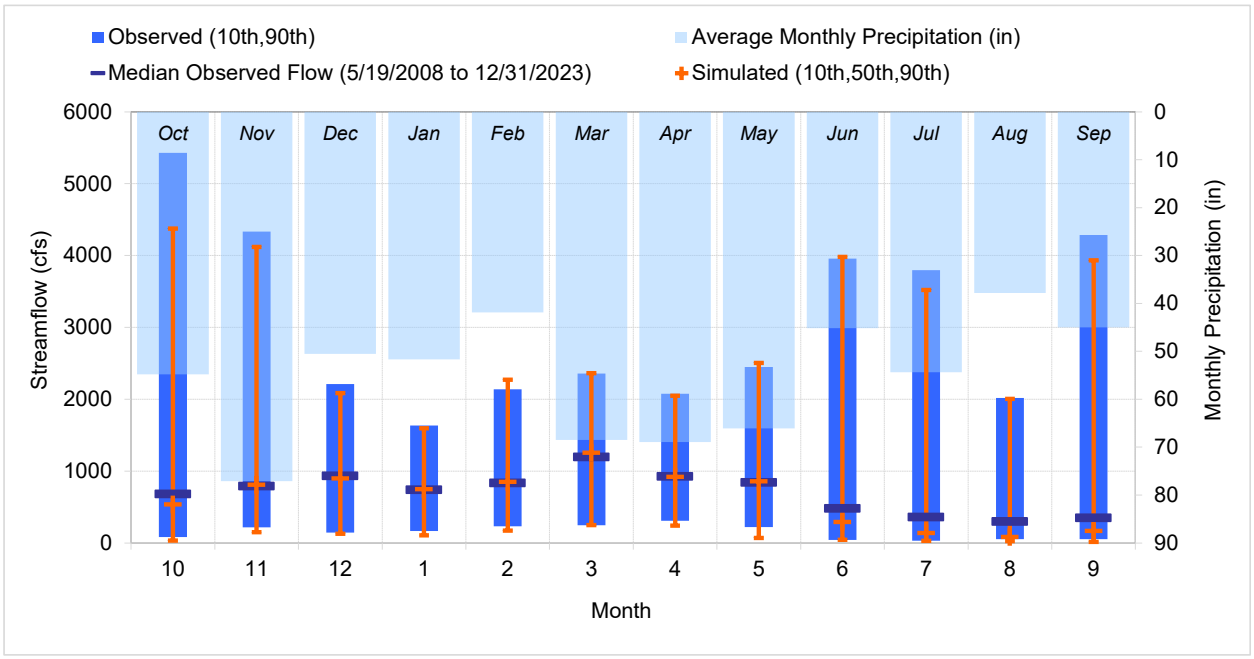

Figure A-21. Seasonal medians and ranges: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

Table A-12. Seasonal summary: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	1769.46	686.00	80.70	5430.00	1605.17	538.71	34.62	4374.80
Nov	1387.50	796.00	216.70	4333.00	1353.59	810.80	150.82	4118.89
Dec	1124.22	935.50	144.10	2210.00	1076.24	899.70	128.36	2086.30
Jan	840.06	743.00	165.10	1633.00	816.50	749.02	104.80	1596.29
Feb	1265.89	839.00	231.30	2138.00	1356.95	852.66	170.84	2271.10
Mar	1299.50	1200.00	248.40	2358.00	1341.78	1256.40	247.14	2364.32
Apr	1095.43	931.00	308.00	2075.00	1066.20	920.53	242.18	2050.60
May	1162.50	845.00	220.20	2448.00	1120.54	859.27	69.15	2503.80
Jun	1084.27	485.00	41.13	3957.00	992.72	290.89	42.97	3979.39
Jul	1042.84	363.00	32.18	3796.00	969.24	139.96	29.62	3522.26
Aug	880.13	302.00	51.92	2018.00	774.12	83.89	24.84	2006.36
Sep	1194.21	353.00	52.34	4284.00	1062.69	169.10	15.31	3931.96

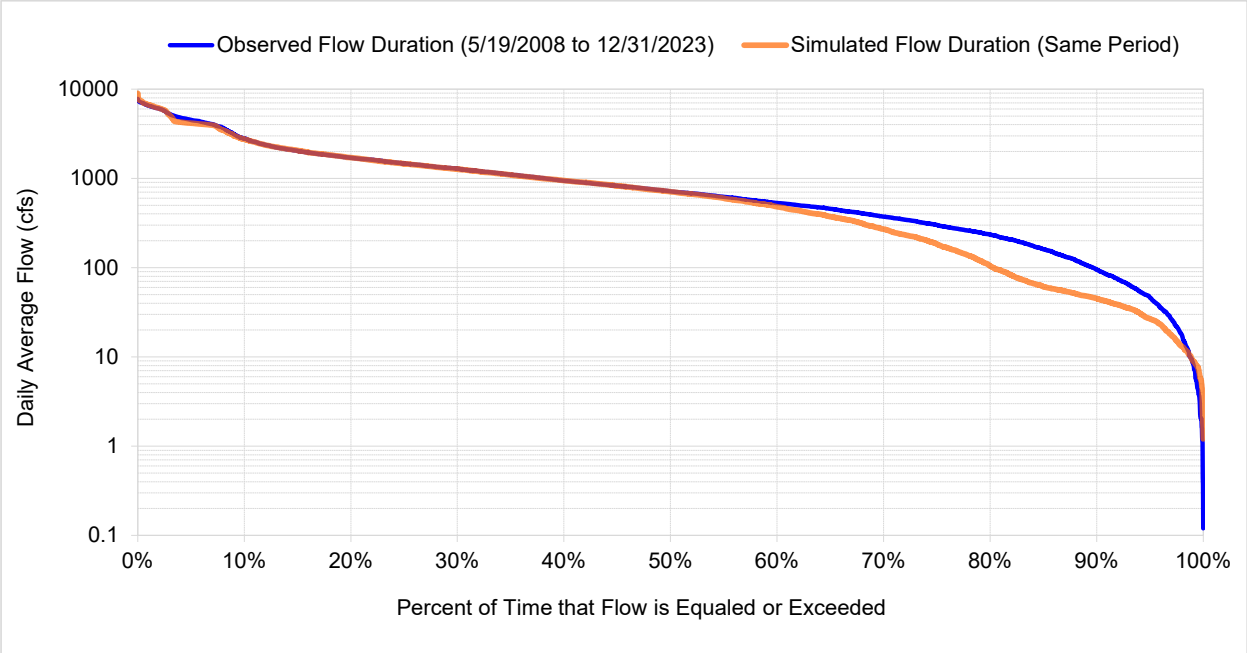

Figure A-22. Flow exceedance: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

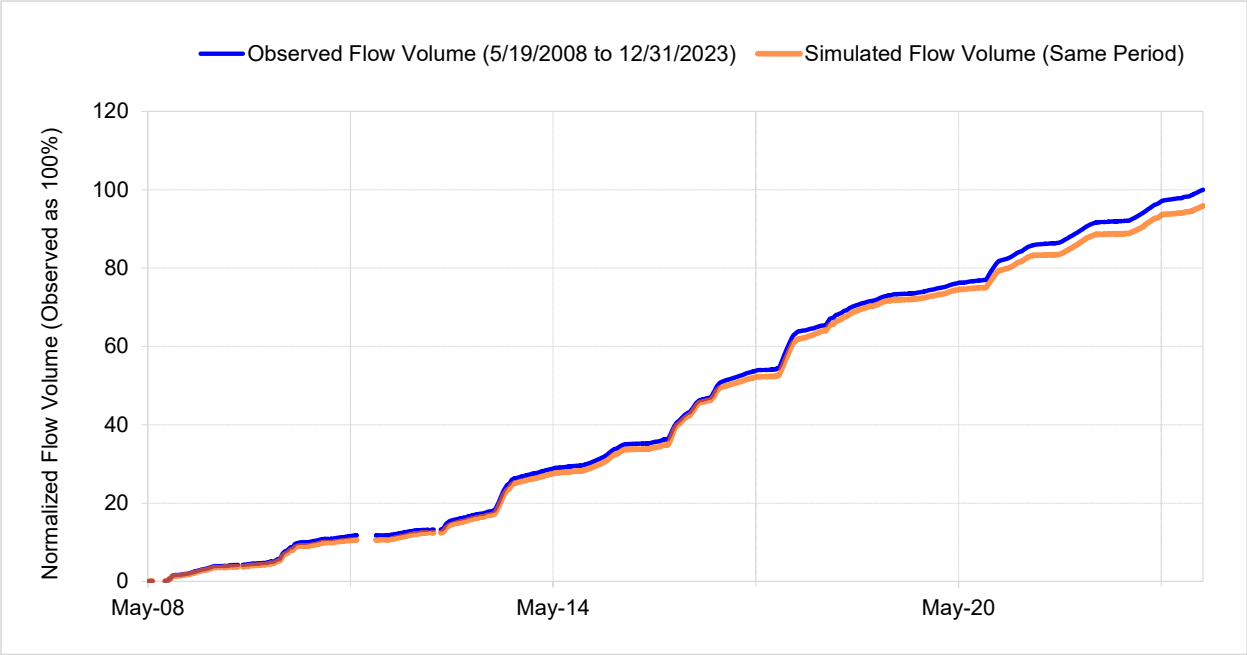

Figure A-23. Flow accumulation: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

Table A-13. Summary statistics: Model output at Reach 215 versus USGS 02292010 Caloosahatchee Canal DWS of S-77 at Moore Haven (06/01/2008 – 12/31/2023)

Caloosahatchee Canal DWS of S-77 at Moore Haven, FL (ID - USGS 02292010)
Drainage Area (sq-mi): 5650
Analysis Period: 5/19/2008 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	2.46	2.36	-4.11	10
Total lowest 50% flows	0.33	0.26	-21.28	10
Total highest 10% flows	0.98	0.96	-2.91	15
Summer flow volume (months 7-9)	0.48	0.44	-10.02	30
Fall flow volume (months 10-12)	0.79	0.74	-5.67	30
Winter flow volume (months 1-3)	0.61	0.63	3.14	30
Spring flow volume (months 4-6)	0.58	0.55	-4.69	30
Total storm volume	1.19	1.14	-4.49	20
Summer storm volume (7-9)	0.24	0.21	-11.63	50
Baseflow	1.27	1.22	-3.75	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.954	0.7
Baseline adjusted coefficient (Garrick), E'			0.815	0.5
Monthly NSE			0.982	0.8

USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78

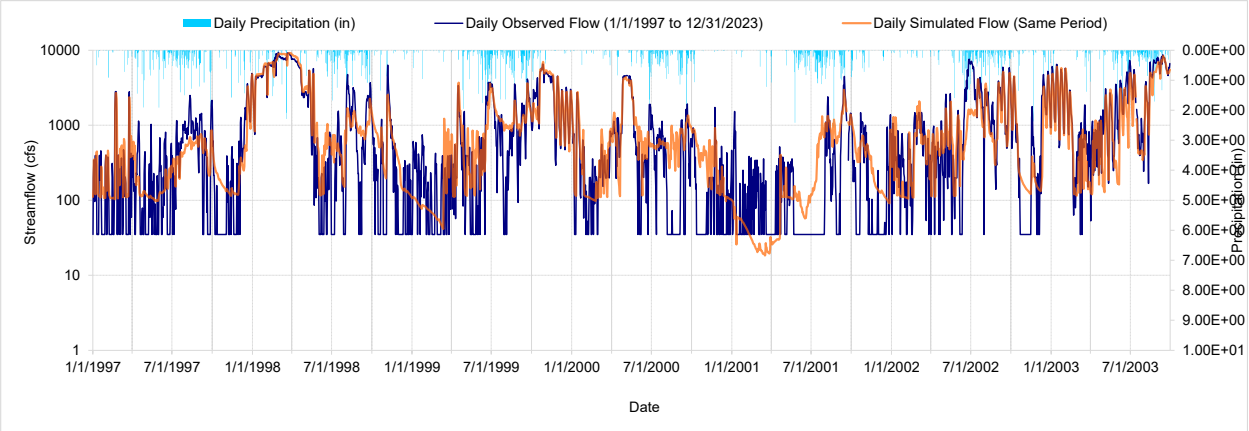

Figure A-24. Mean daily flow: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

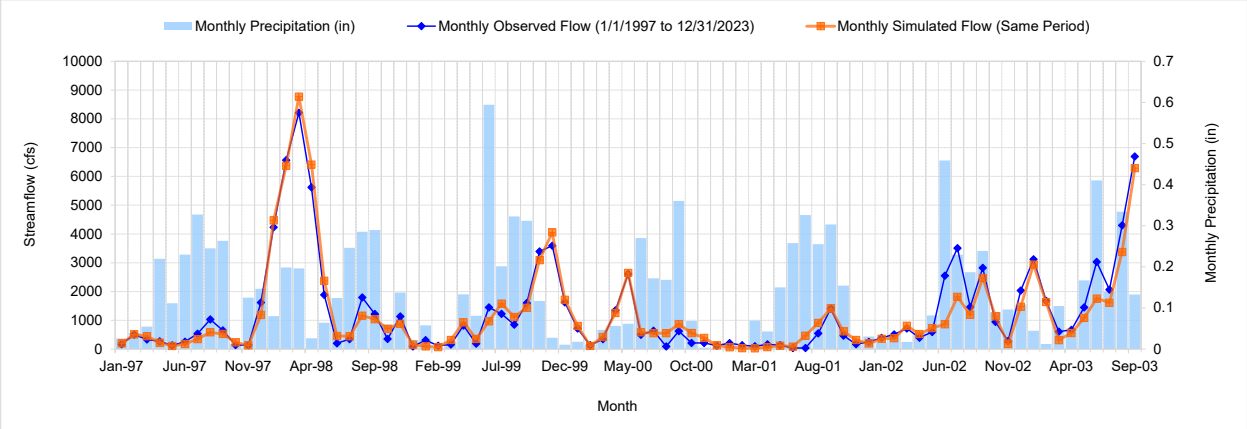

Figure A-25. Mean monthly flow: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

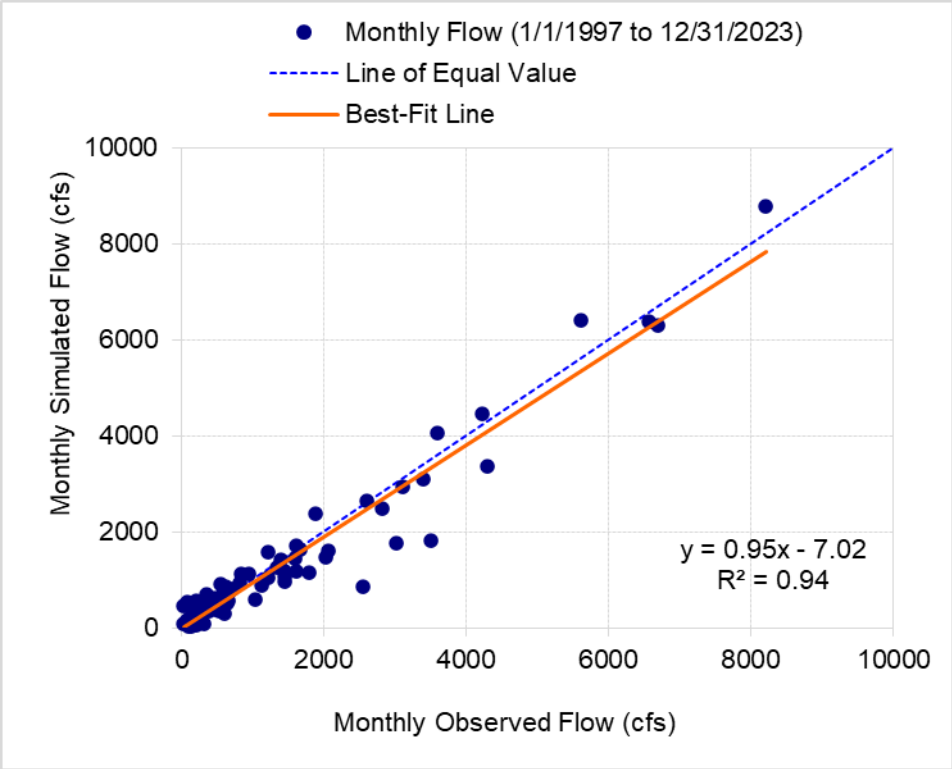

Figure A-26. Monthly flow regression and temporal variation: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

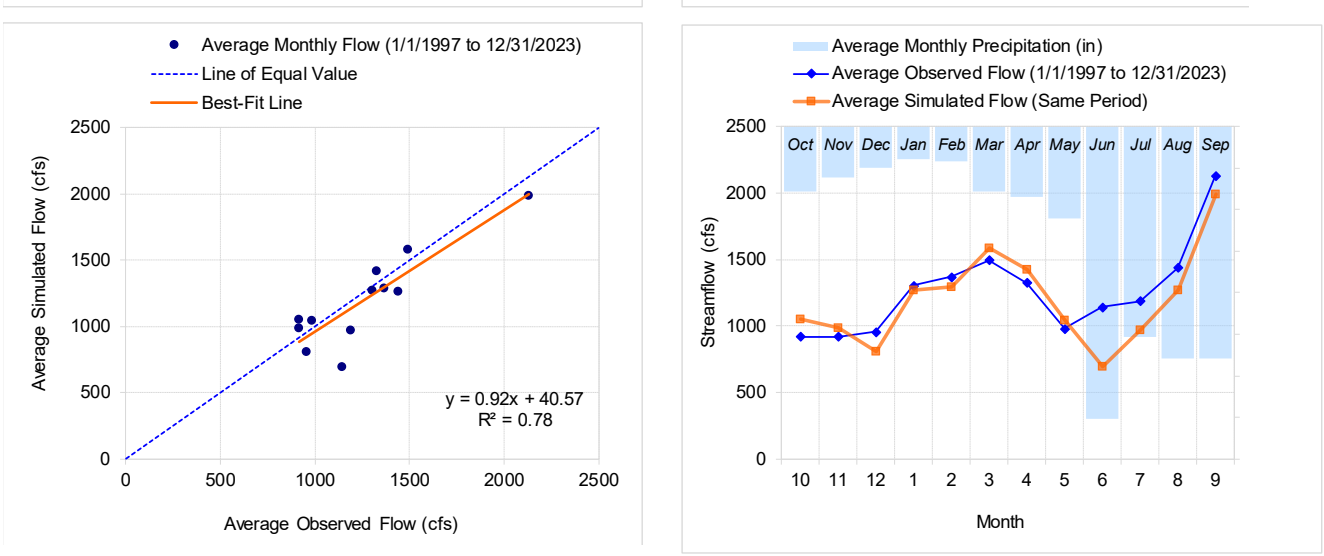

Figure A-27. Seasonal regression and temporal aggregate: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

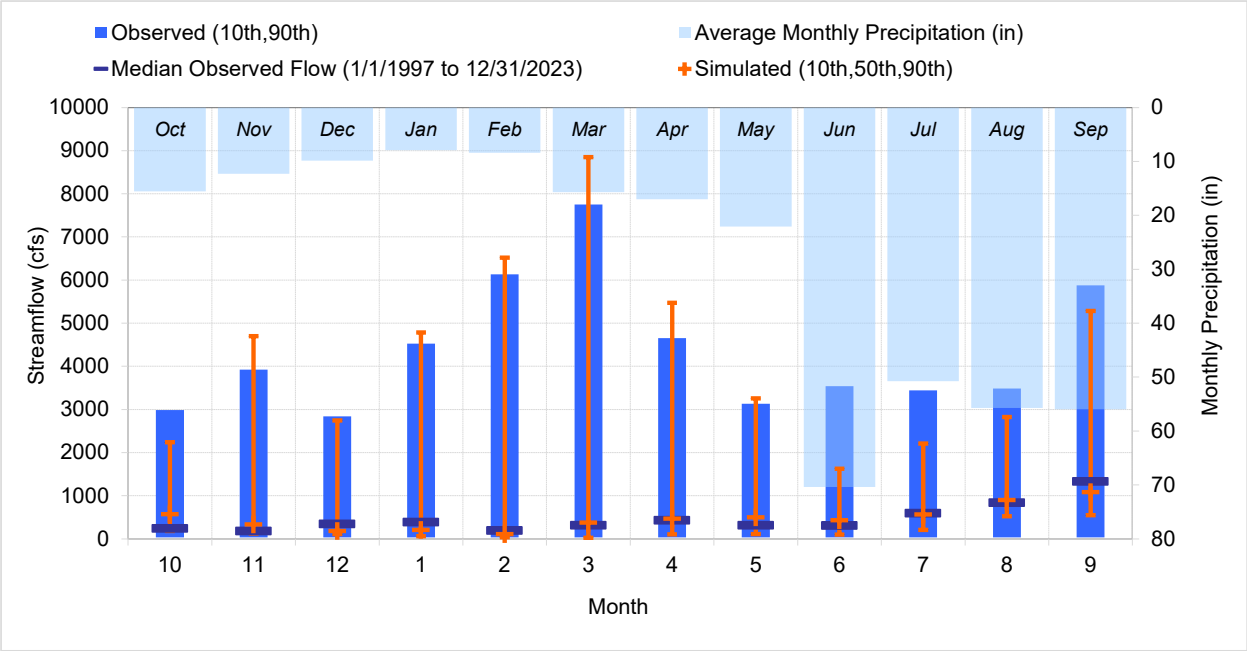

Figure A-28. Seasonal medians and ranges: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

Table A-14. Seasonal summary: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	917.98	248.00	35.00	2985.00	1053.75	570.43	184.58	2237.85
Nov	918.94	183.50	35.00	3922.00	988.97	337.91	124.31	4699.20
Dec	955.65	353.50	35.00	2840.00	807.95	183.42	108.07	2745.30
Jan	1306.09	396.00	35.00	4528.00	1272.97	209.19	59.83	4784.88
Feb	1368.94	197.00	35.00	6130.00	1294.25	110.31	35.90	6516.80
Mar	1494.66	321.00	35.00	7750.00	1585.82	375.55	22.39	8847.92
Apr	1323.83	434.50	35.00	4652.00	1423.92	468.45	102.80	5473.29
May	982.29	323.00	35.00	3132.00	1044.76	498.93	107.51	3258.32
Jun	1143.75	315.50	35.00	3537.00	697.34	433.88	99.62	1625.63
Jul	1187.60	601.00	35.00	3445.00	971.80	567.18	209.24	2207.25
Aug	1438.22	842.00	35.00	3482.00	1267.70	901.60	524.91	2823.38
Sep	2133.02	1335.00	35.00	5880.00	1992.74	1082.80	551.35	5283.40

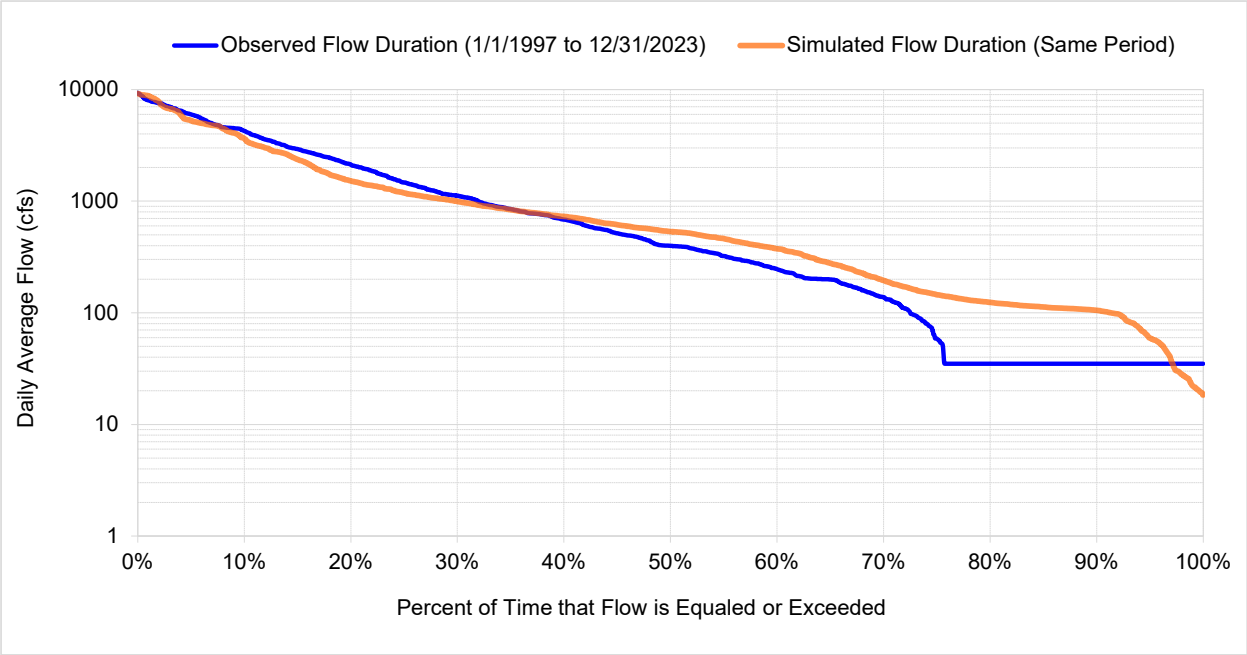

Figure A-29. Flow exceedance: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

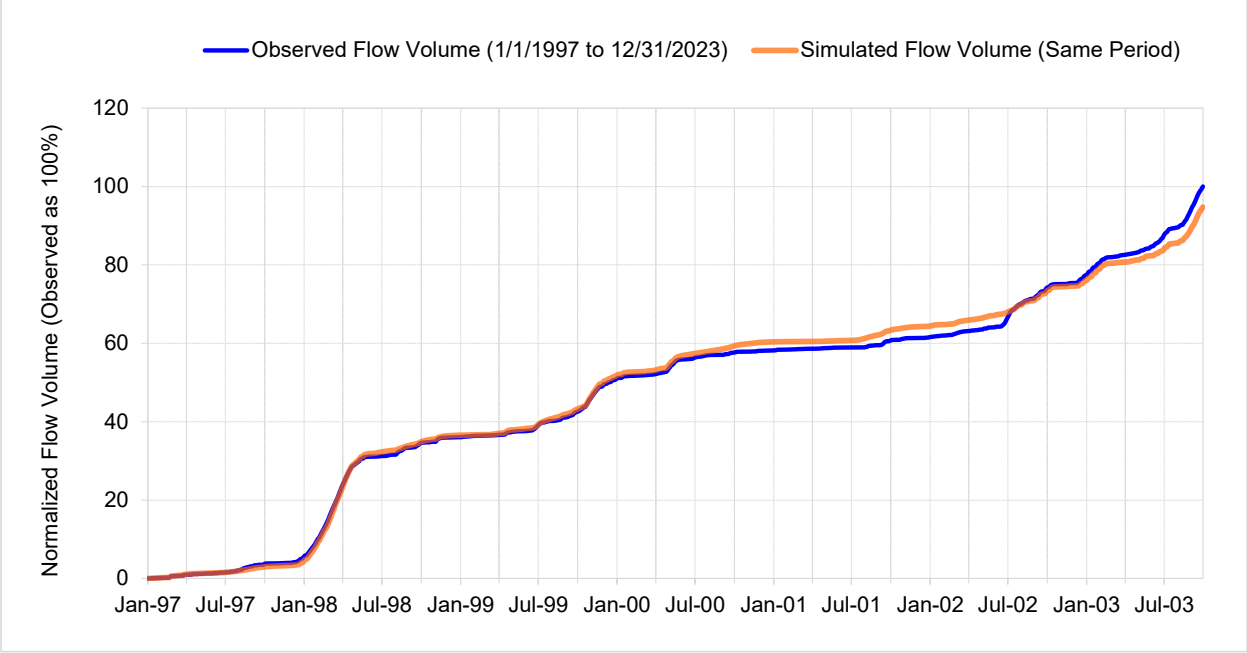

Figure A-30. Flow accumulation: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

Table A-15. Summary statistics: Model output at Reach 188 versus USGS 02292480 Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (01/01/1997 – 09/30/2003)

Caloosahatchee Canal at Ortona Lock near LaBelle S-78 (ID - USGS 02292480)
Drainage Area (sq-mi): 6062
Analysis Period: 1/1/1997 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	2.85	2.70	-5.23	10
Total lowest 50% flows	0.15	0.24	62.46	10
Total highest 10% flows	1.37	1.32	-3.59	15
Summer flow volume (months 7-9)	0.92	0.82	-11.16	30
Fall flow volume (months 10-12)	0.47	0.48	2.02	30
Winter flow volume (months 1-3)	0.80	0.80	-0.24	30
Spring flow volume (months 4-6)	0.66	0.61	-8.13	30
Total storm volume	1.48	1.08	-26.87	20
Summer storm volume (7-9)	0.51	0.30	-40.81	50
Baseflow	1.37	1.62	18.21	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.858	0.7
Baseline adjusted coefficient (Garrick), E'			0.690	0.5
Monthly NSE			0.935	0.8

USGS 264514080550700 Industrial Canal at Clewiston

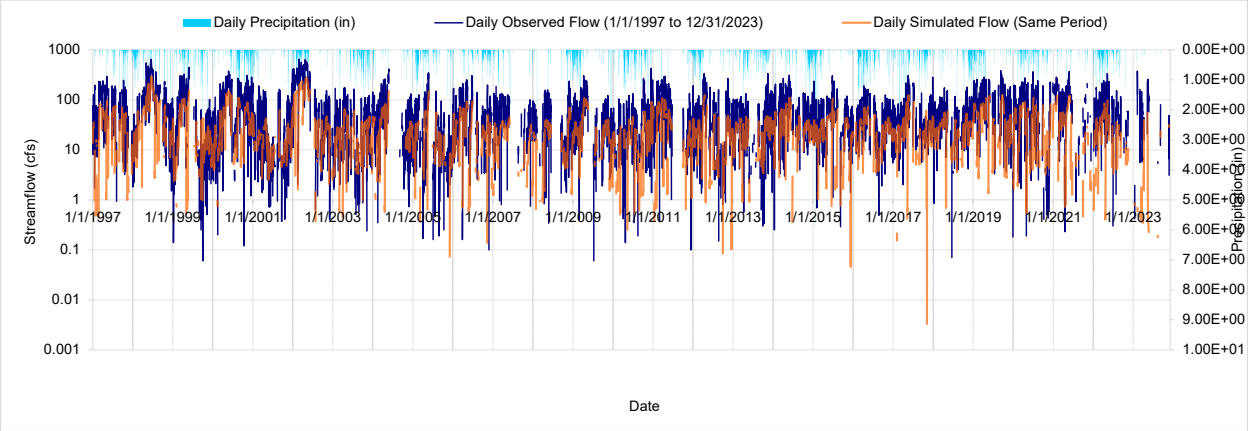

Figure A-31. Mean daily flow: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

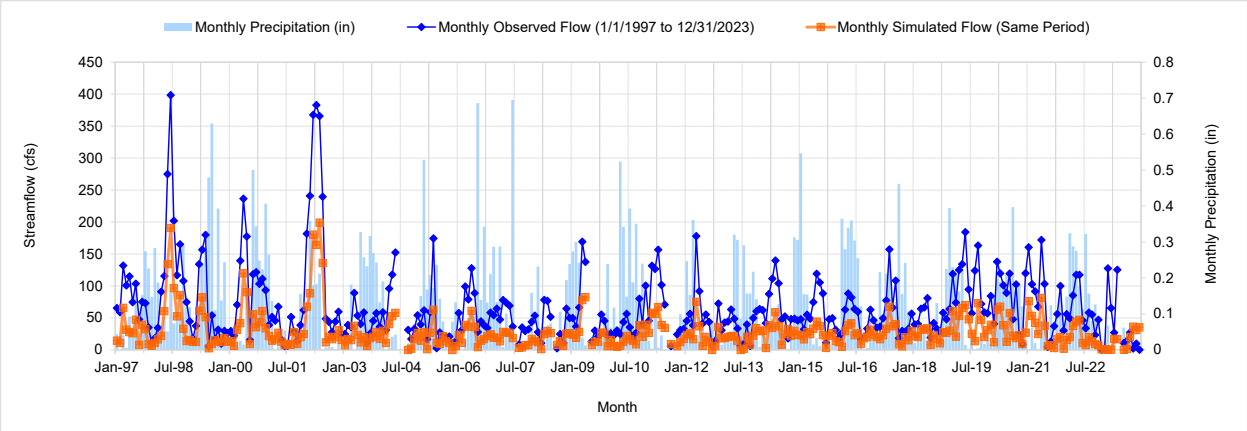

Figure A-32. Mean monthly flow: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

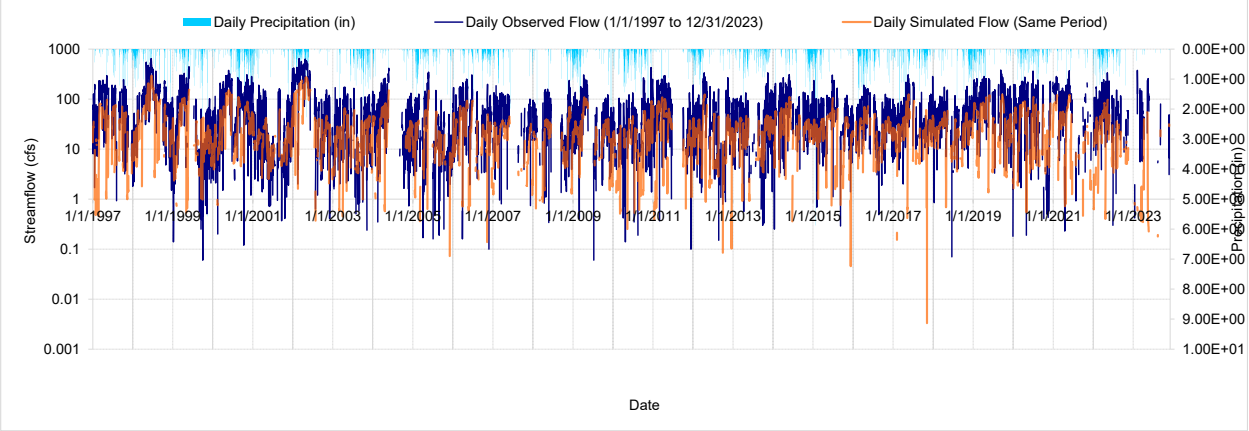

Figure A-33. Mean daily flow: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

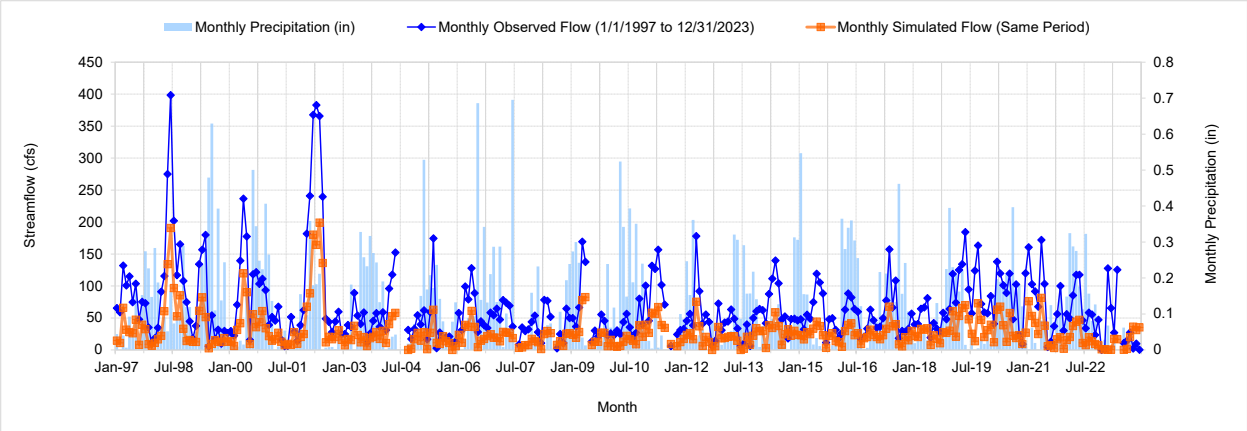

Figure A-34. Mean monthly flow: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

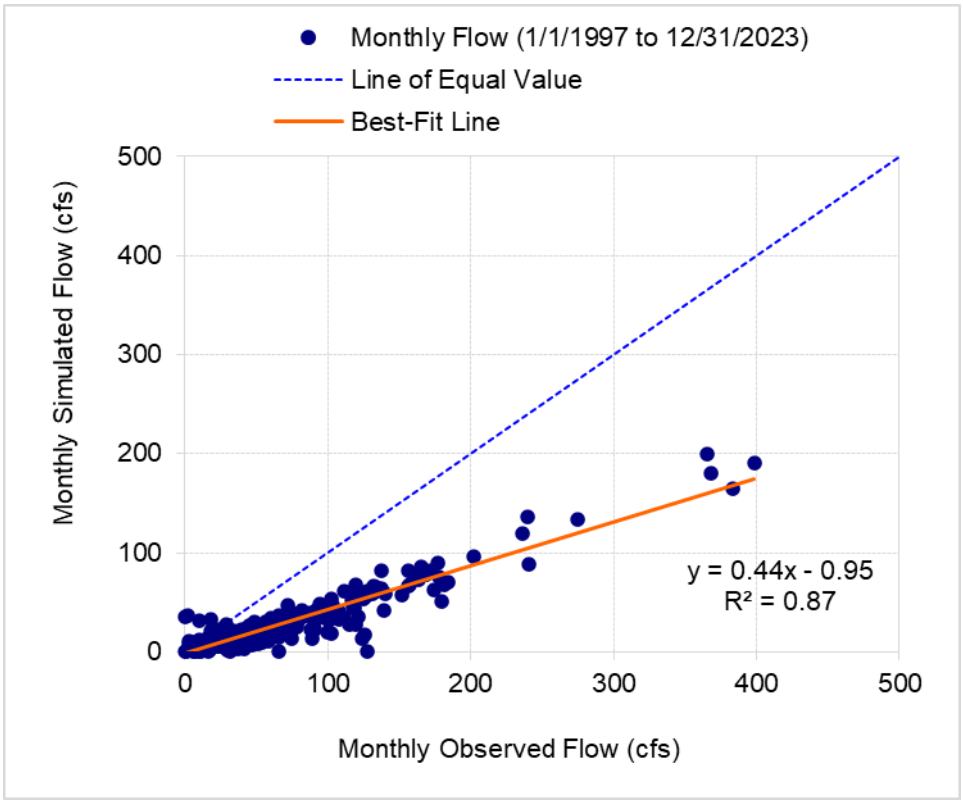

Figure A-35. Monthly flow regression and temporal variation: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

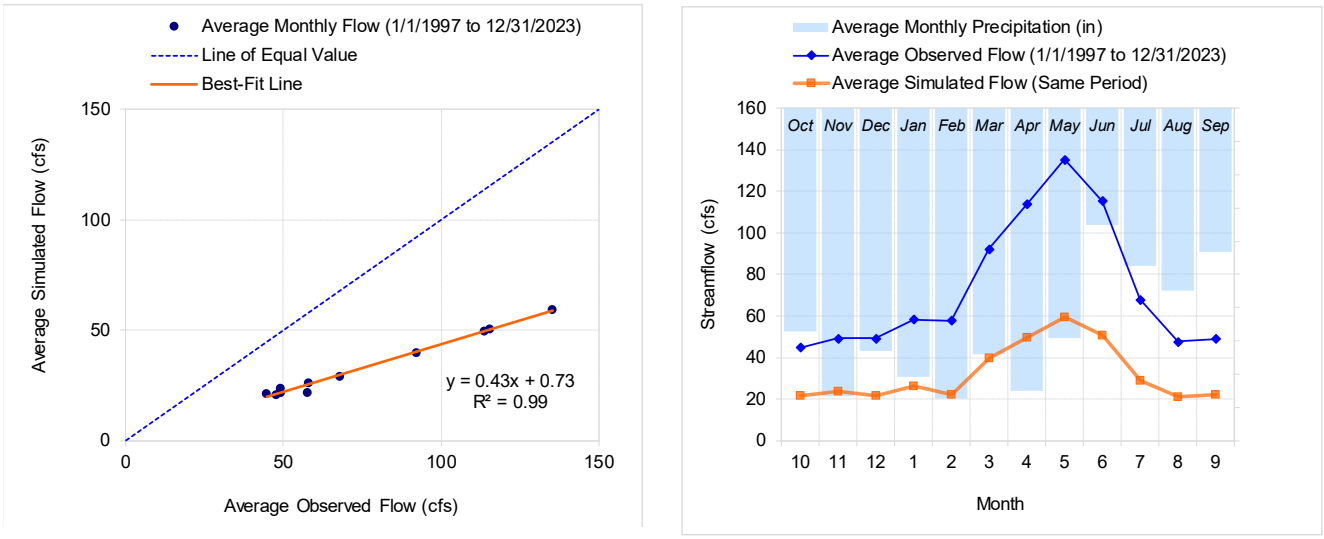

Figure A-36. Seasonal regression and temporal aggregate: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

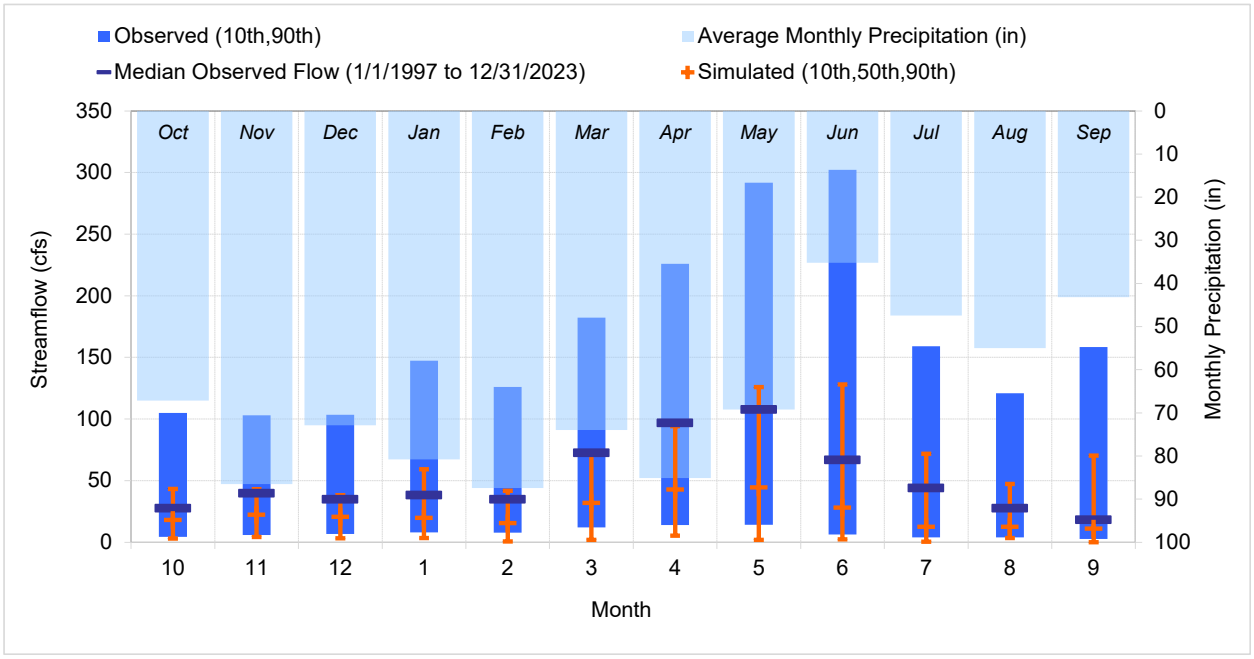

Figure A-37. Seasonal medians and ranges: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

Table A-16. Seasonal summary: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	44.75	27.85	4.36	105.00	21.55	18.16	3.03	43.17
Nov	49.17	39.90	5.92	103.00	23.84	22.29	4.33	43.10
Dec	49.24	35.00	6.73	103.40	21.80	20.65	3.29	38.05
Jan	58.21	38.50	8.11	147.40	26.11	19.93	3.43	59.21
Feb	57.78	35.00	7.70	126.00	22.08	15.48	0.73	41.74
Mar	92.26	72.80	12.00	182.20	39.67	32.08	1.90	73.78
Apr	113.87	97.00	13.98	226.00	49.66	42.74	5.44	94.20
May	135.26	108.00	14.20	291.80	59.26	44.48	1.94	125.94
Jun	115.46	66.95	6.22	302.20	50.71	28.24	2.37	128.13
Jul	67.94	44.30	4.00	159.00	29.01	12.50	0.37	71.77
Aug	47.74	27.75	4.00	121.00	20.91	12.52	3.45	47.28
Sep	49.08	18.45	2.70	158.50	22.03	11.09	0.00	70.22

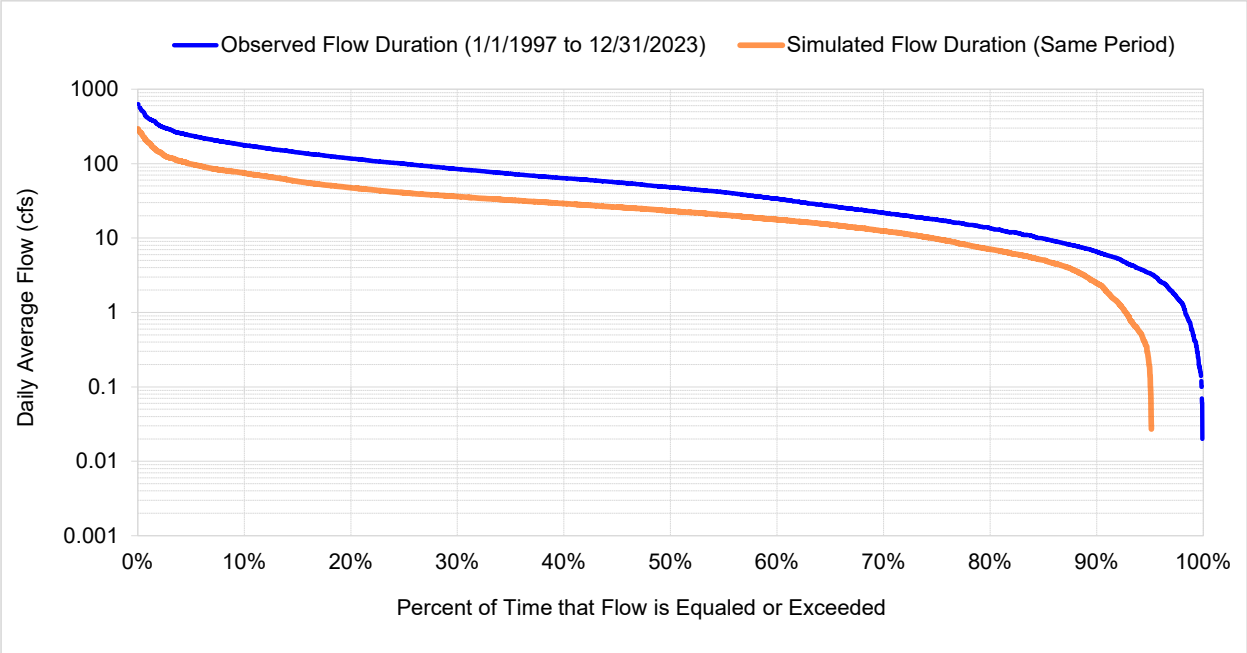

Figure A-38. Flow exceedance: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

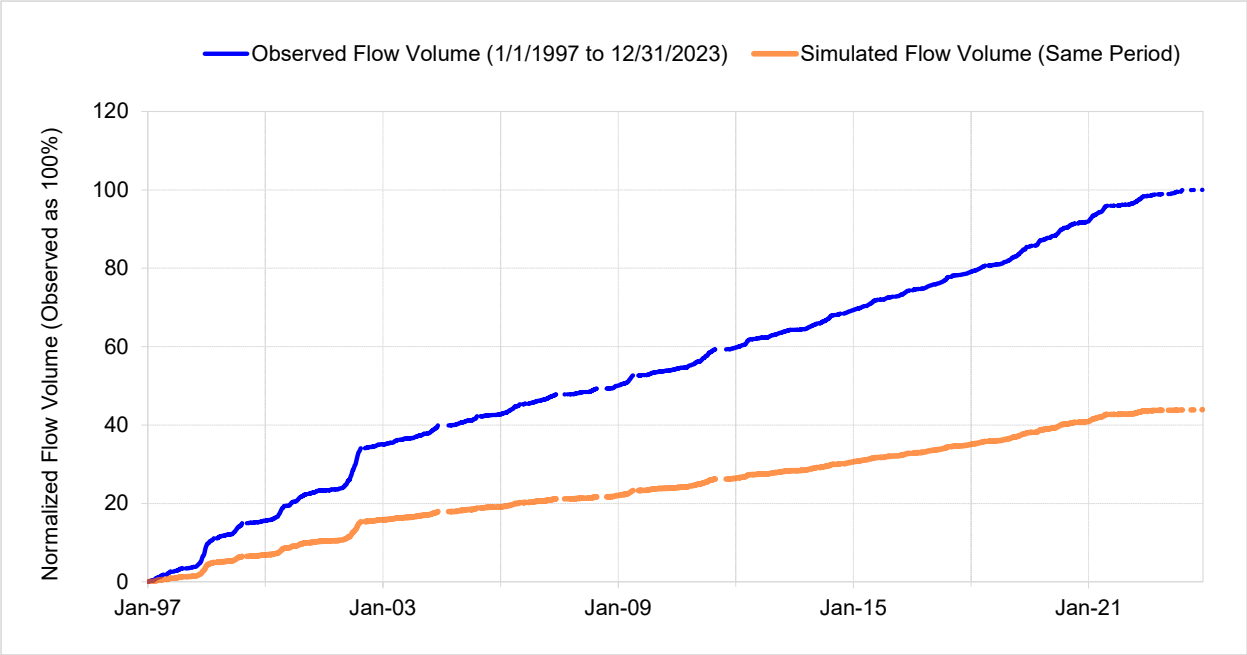

Figure A-39. Flow accumulation: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

Table A-17. Summary statistics: Model output at Reach 219 versus USGS 264514080550700 Industrial Canal at Clewiston (01/01/1997 – 12/31/2023)

Industrial Canal at Clewiston (ID - USGS 264514080550700)
Drainage Area (sq-mi): 5650
Analysis Period: 1/1/1997 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	0.11	0.05	-56.05	10
Total lowest 50% flows	0.02	0.01	-48.70	10
Total highest 10% flows	0.04	0.02	-56.79	15
Summer flow volume (months 7-9)	0.01	0.01	-56.34	30
Fall flow volume (months 10-12)	0.02	0.01	-53.05	30
Winter flow volume (months 1-3)	0.03	0.01	-57.63	30
Spring flow volume (months 4-6)	0.05	0.02	-56.25	30
Total storm volume	0.08	0.02	-70.52	20
Summer storm volume (7-9)	0.01	0.00	-63.43	50
Baseflow	0.03	0.03	-16.40	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.228	0.7
Baseline adjusted coefficient (Garrick), E'			0.188	0.5
Monthly NSE			0.468	0.8

USGS 02292900 Caloosahatchee River at S-79 near Olga, FL

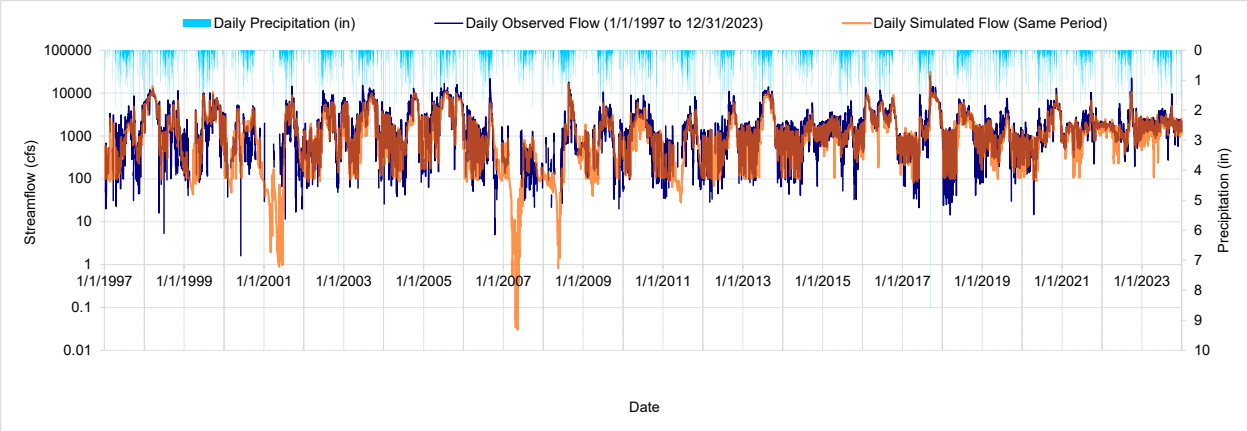

Figure A-40. Mean daily flow: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

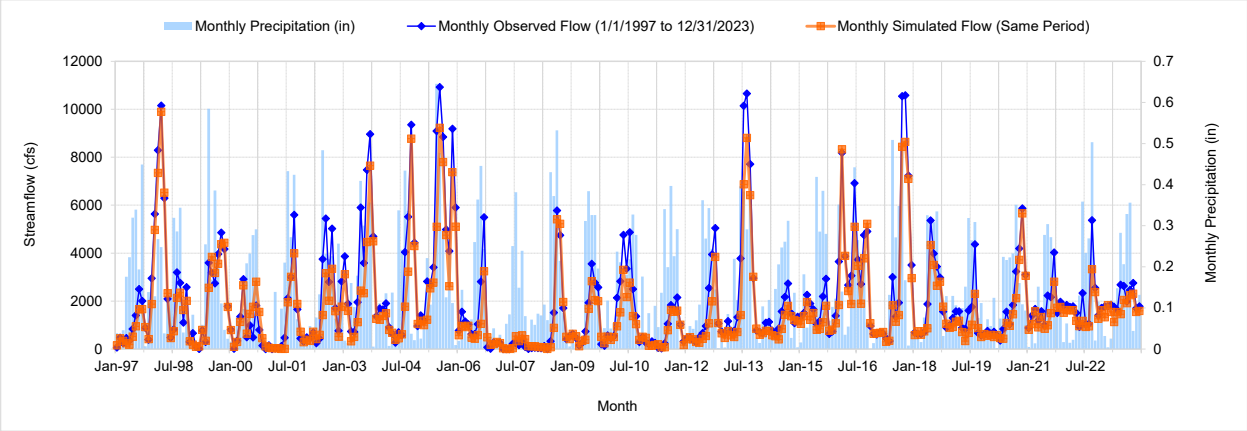

Figure A-41. Mean monthly flow: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

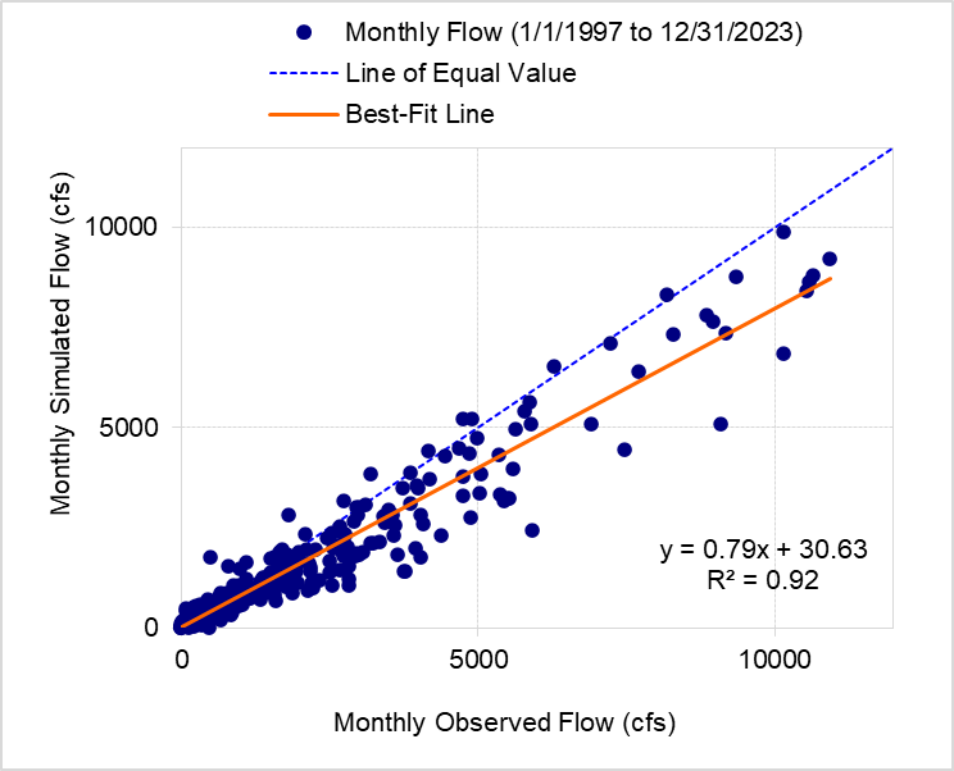

Figure A-42. Monthly flow regression and temporal variation: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

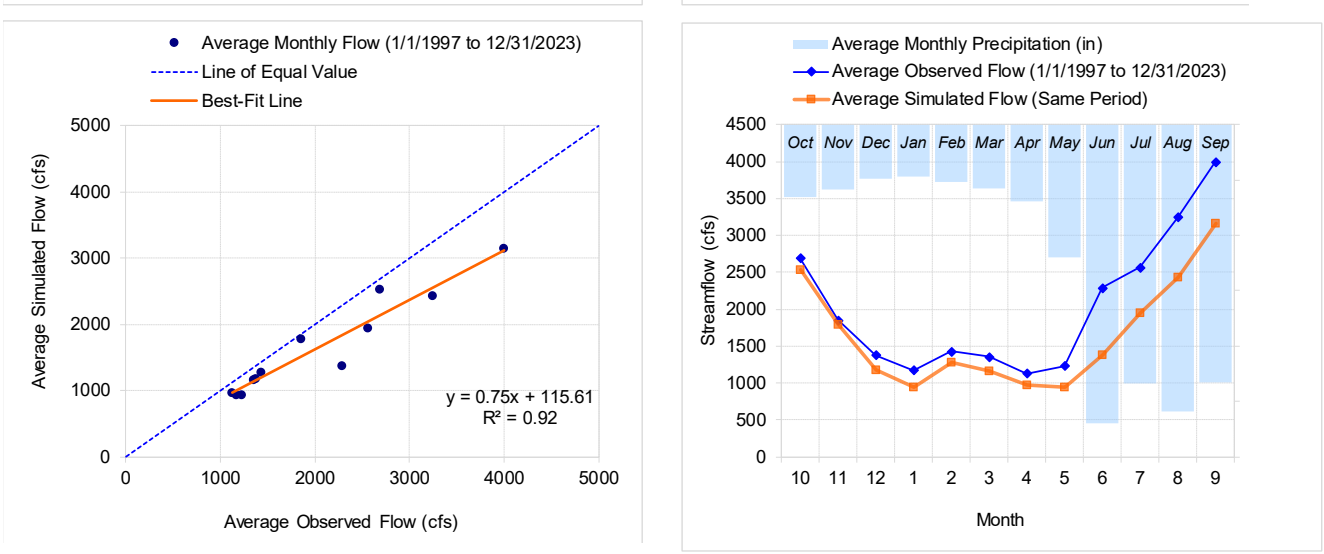

Figure A-43. Seasonal regression and temporal aggregate: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

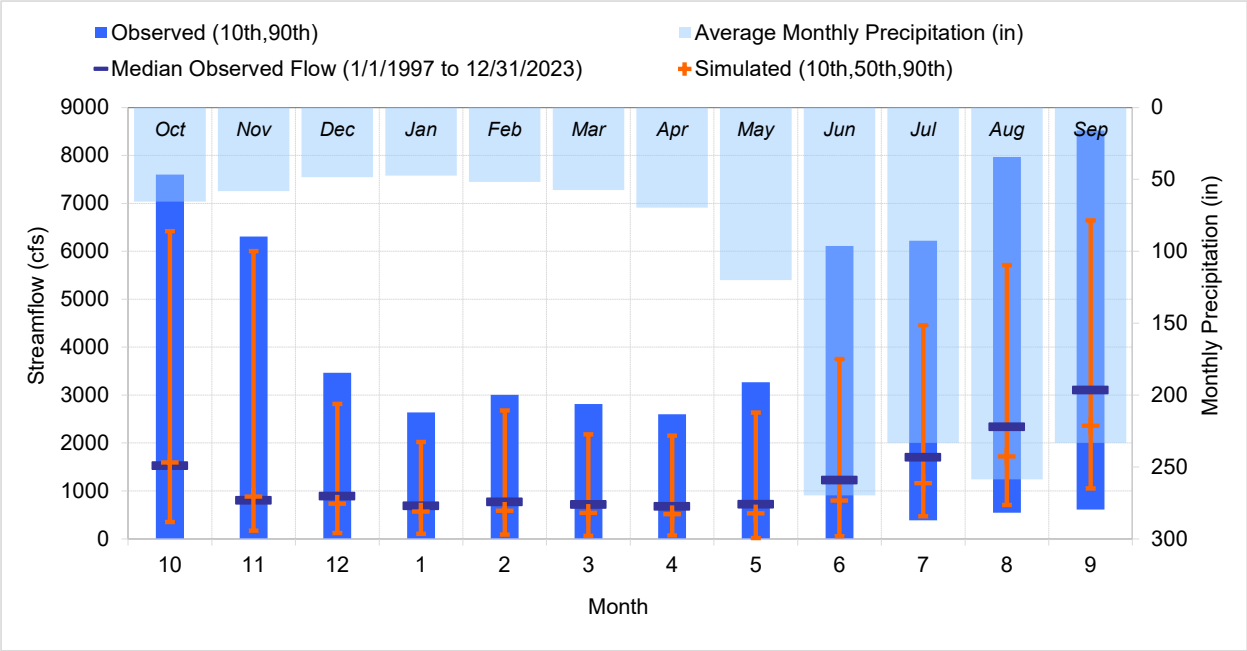

Figure A-44. Seasonal medians and ranges: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

Table A-18. Seasonal summary: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	2692.10	1530.00	0.00	7600.00	2540.60	1595.30	353.35	6420.50
Nov	1852.77	810.00	0.00	6306.00	1784.66	883.09	171.94	6006.72
Dec	1376.15	895.00	0.00	3465.00	1175.95	733.58	119.42	2814.19
Jan	1173.47	695.00	0.00	2640.00	938.54	568.69	102.60	2024.02
Feb	1432.34	773.00	0.00	3006.00	1274.67	584.89	89.60	2679.24
Mar	1354.68	721.00	0.00	2812.00	1166.51	542.29	60.28	2181.46
Apr	1127.54	680.00	0.00	2600.00	966.02	512.83	70.38	2154.70
May	1230.07	728.50	0.00	3269.00	942.49	530.96	19.59	2636.47
Jun	2287.92	1230.00	0.00	6112.00	1375.18	798.24	54.90	3750.24
Jul	2565.35	1705.00	385.00	6222.00	1944.06	1160.90	471.77	4457.71
Aug	3247.32	2340.00	548.20	7967.00	2436.51	1721.70	708.75	5714.95
Sep	3997.76	3110.00	610.00	8522.00	3157.08	2363.90	1053.00	6643.04

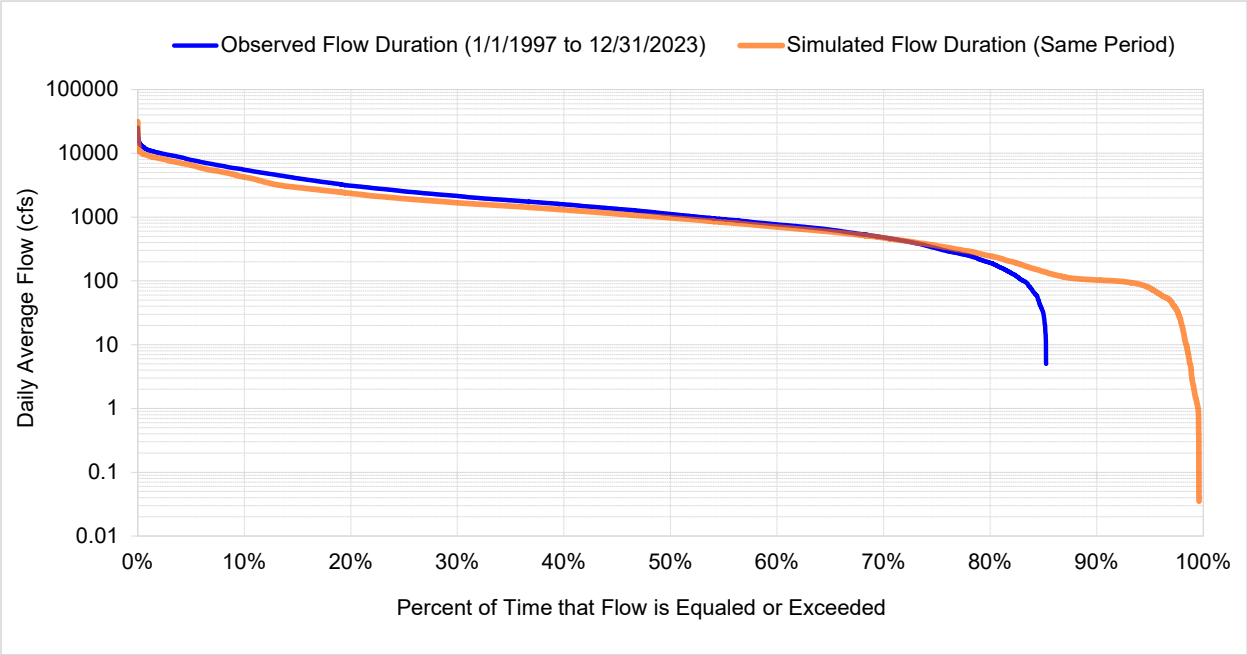

Figure A-45. Flow exceedance: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

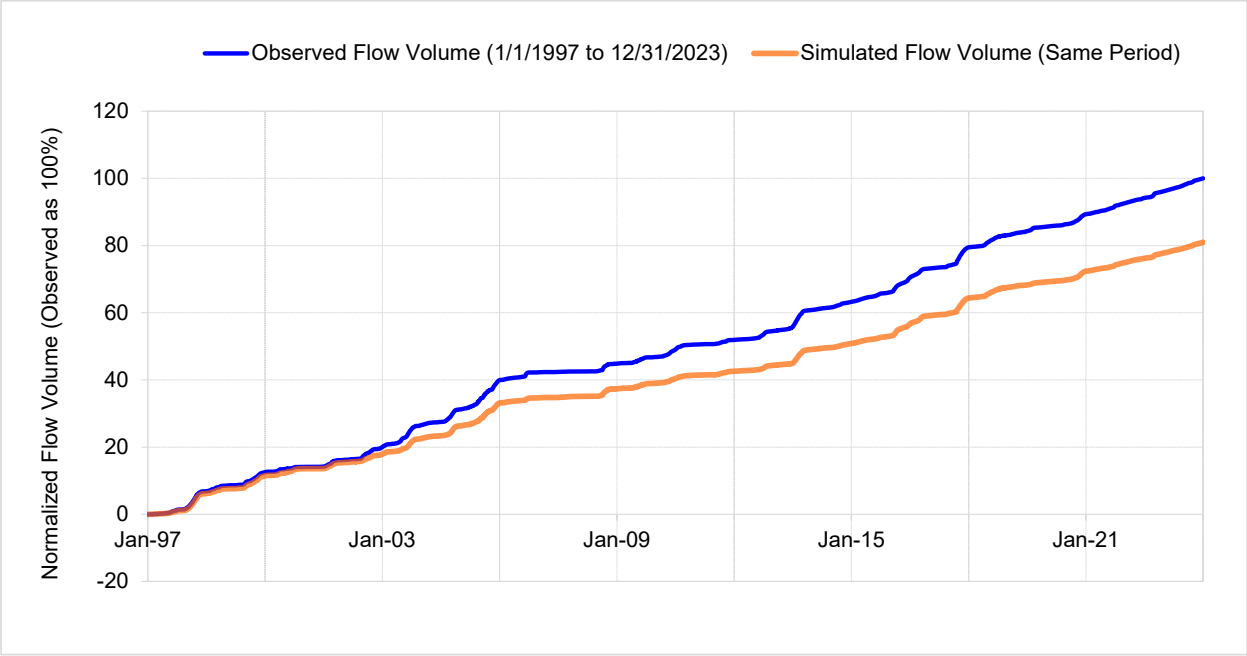

Figure A-46. Flow accumulation: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

Table A-19. Summary statistics: Model output at Reach 147 versus USGS 02292900 Caloosahatchee River at S-79 near Olga, FL (01/01/1997 – 12/31/2023)

Caloosahatchee River at S-79 near Olga, FL (ID - USGS 02292900)
Drainage Area (sq-mi): 6619
Analysis Period: 1/1/1997 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	4.12	3.33	-19.04	10
Total lowest 50% flows	0.40	0.40	2.20	10
Total highest 10% flows	1.71	1.38	-19.23	15
Summer flow volume (months 7-9)	1.66	1.28	-23.19	30
Fall flow volume (months 10-12)	1.01	0.94	-7.14	30
Winter flow volume (months 1-3)	0.66	0.57	-14.80	30
Spring flow volume (months 4-6)	0.78	0.55	-29.22	30
Total storm volume	1.92	1.20	-37.71	20
Summer storm volume (7-9)	0.73	0.39	-46.06	50
Baseflow	2.20	2.14	-2.72	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.789	0.7
Baseline adjusted coefficient (Garrick), E'			0.625	0.5
Monthly NSE			0.871	0.8

USGS 022929176 Telegraph Creek at State Highway at Olga

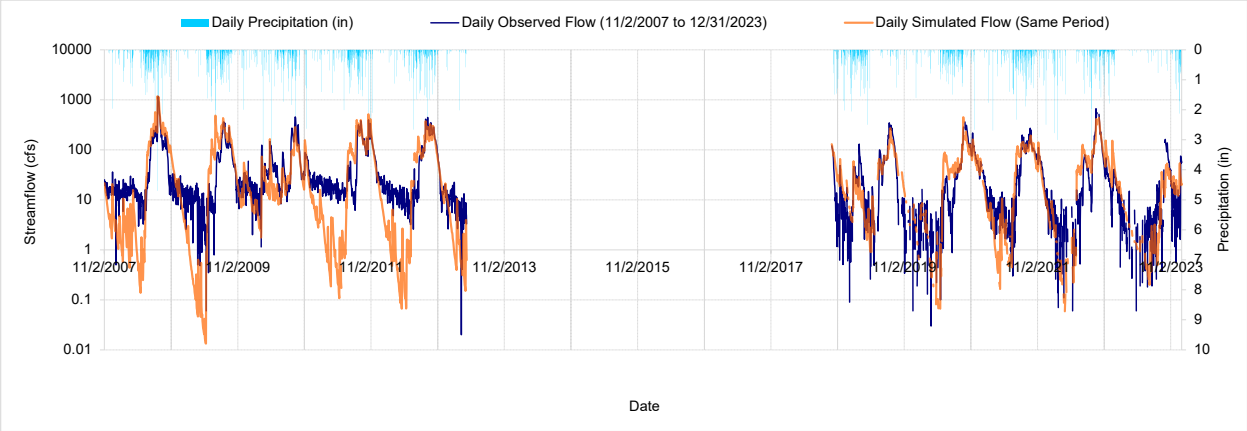

Figure A-47. Mean daily flow: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

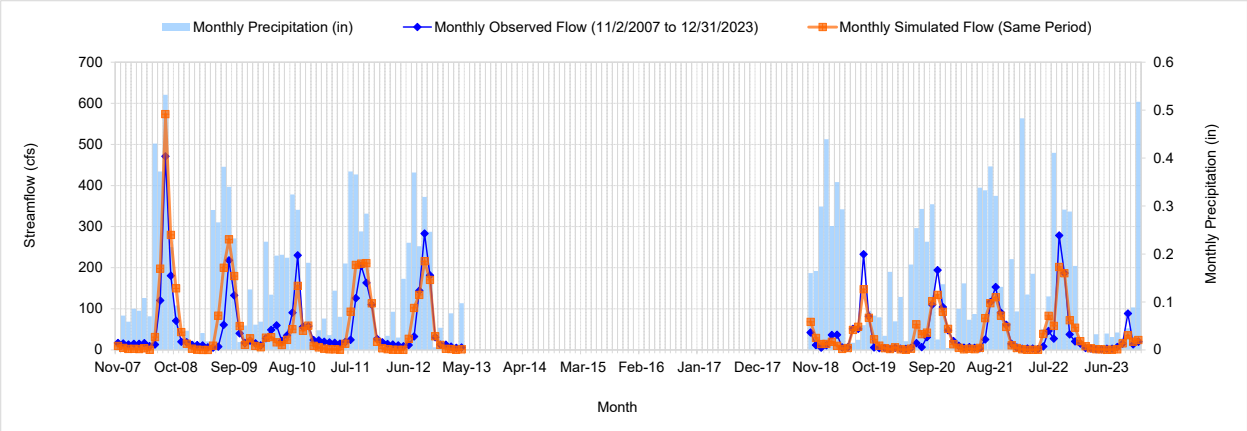

Figure A-48. Mean monthly flow: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

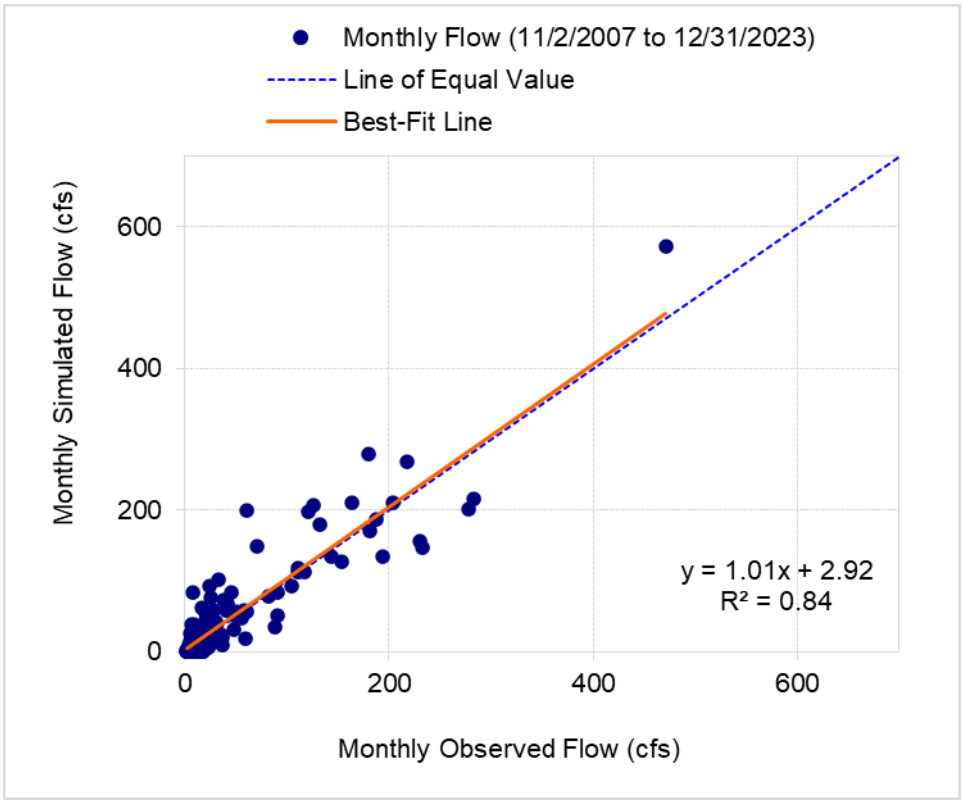

Figure A-49. Monthly flow regression and temporal variation: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

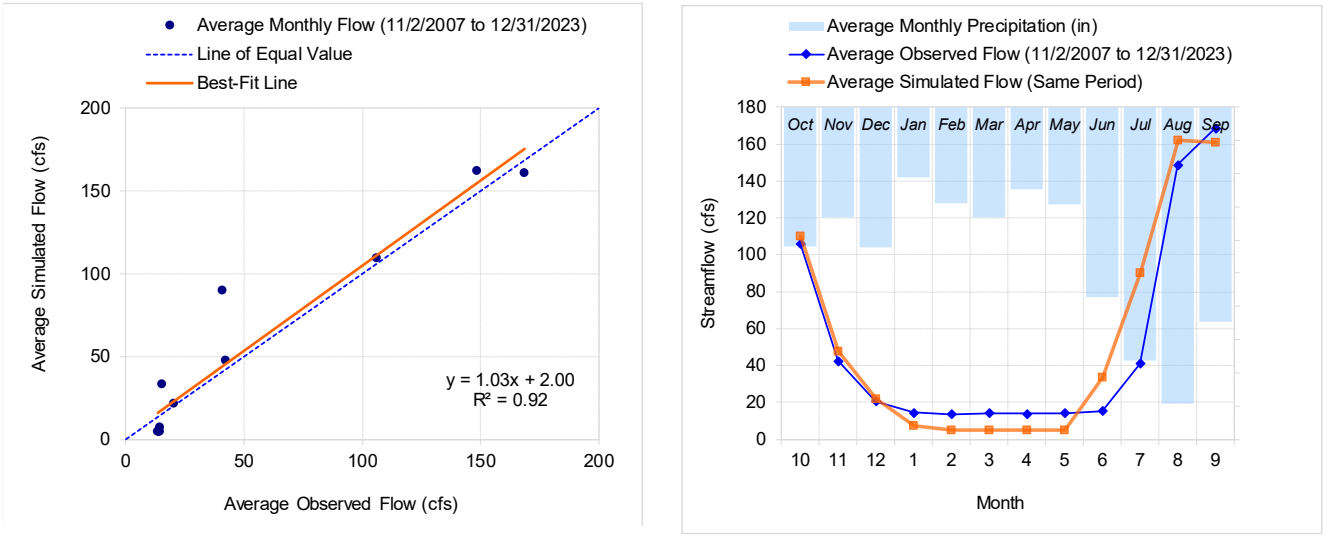

Figure A-50. Seasonal regression and temporal aggregate: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

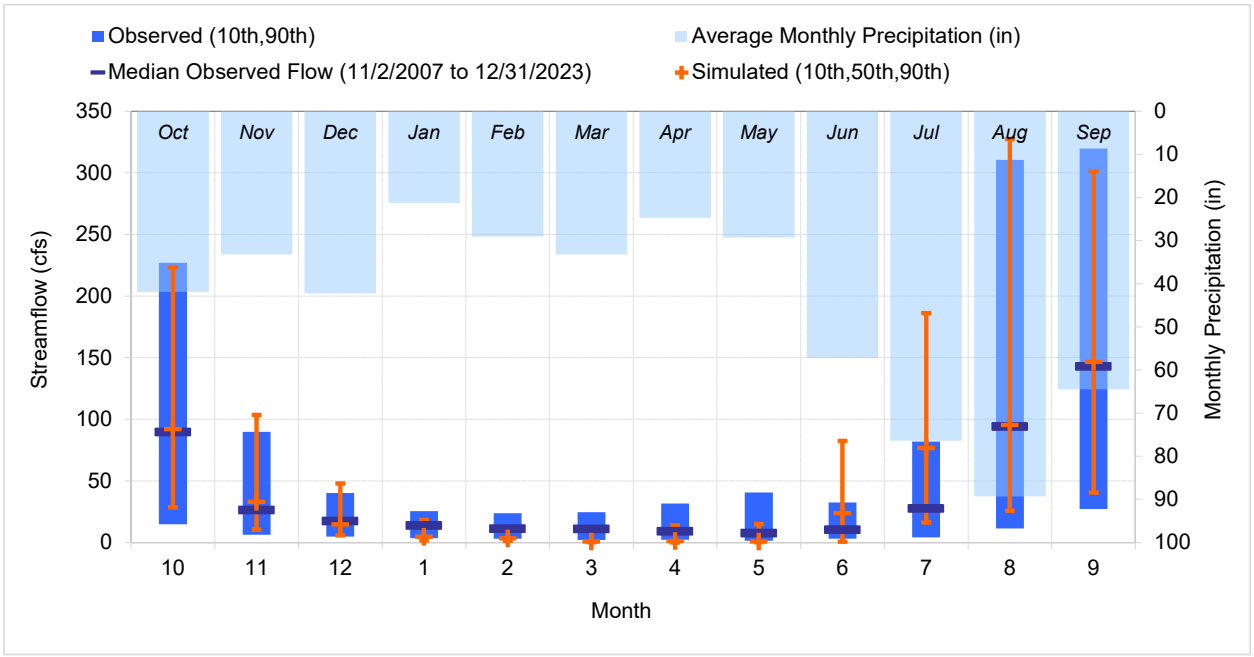

Figure A-51. Seasonal medians and ranges: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

Table A-20. Seasonal summary: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	106.08	89.80	14.80	227.00	109.86	92.14	28.60	223.45
Nov	42.43	26.50	6.24	89.90	47.91	33.05	10.56	103.63
Dec	20.60	17.70	4.89	40.24	21.81	14.74	5.68	47.88
Jan	14.50	14.00	3.45	25.54	7.69	4.65	1.72	18.28
Feb	13.71	11.40	3.04	23.84	5.32	3.53	0.59	11.61
Mar	14.25	11.15	2.00	24.68	4.86	0.77	0.20	12.25
Apr	14.09	9.38	2.33	31.68	5.32	1.21	0.08	13.88
May	14.24	7.71	1.41	40.60	4.88	0.91	0.13	14.89
Jun	15.47	10.60	3.13	32.60	33.84	23.83	0.74	82.49
Jul	41.13	27.90	4.08	82.00	90.00	76.76	16.22	186.21
Aug	148.76	94.20	11.32	310.60	162.30	95.38	25.70	327.44
Sep	168.74	143.00	27.16	319.70	161.02	146.61	40.52	300.97

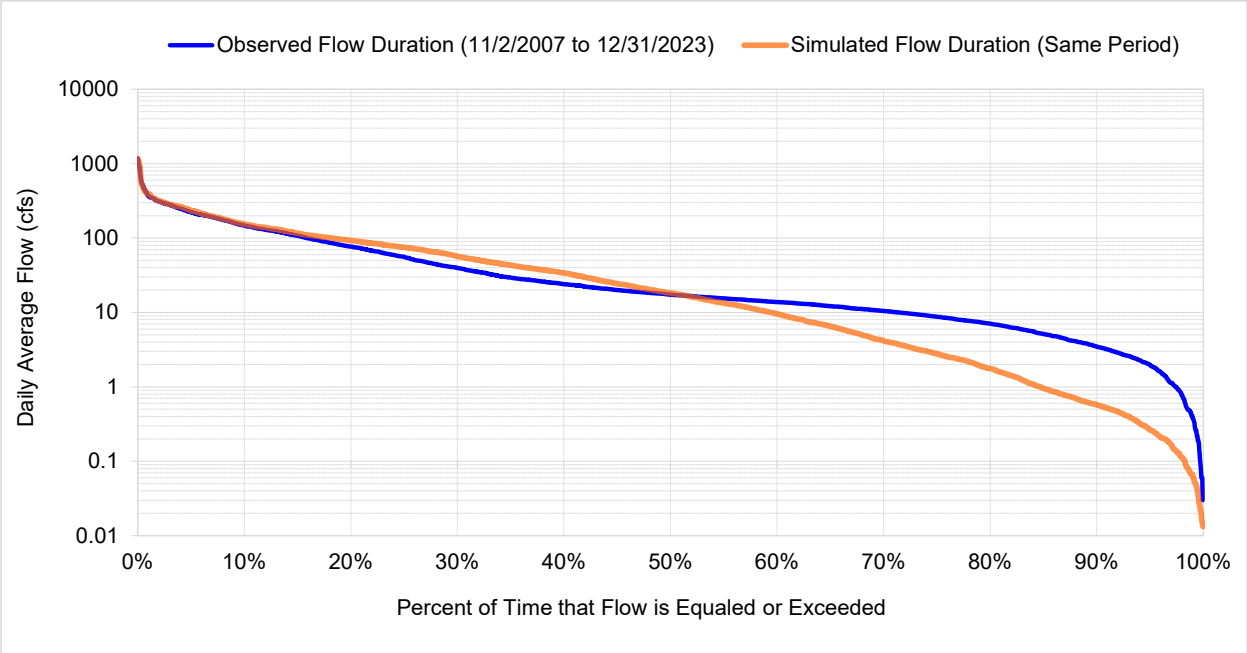

Figure A-52. Flow exceedance: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

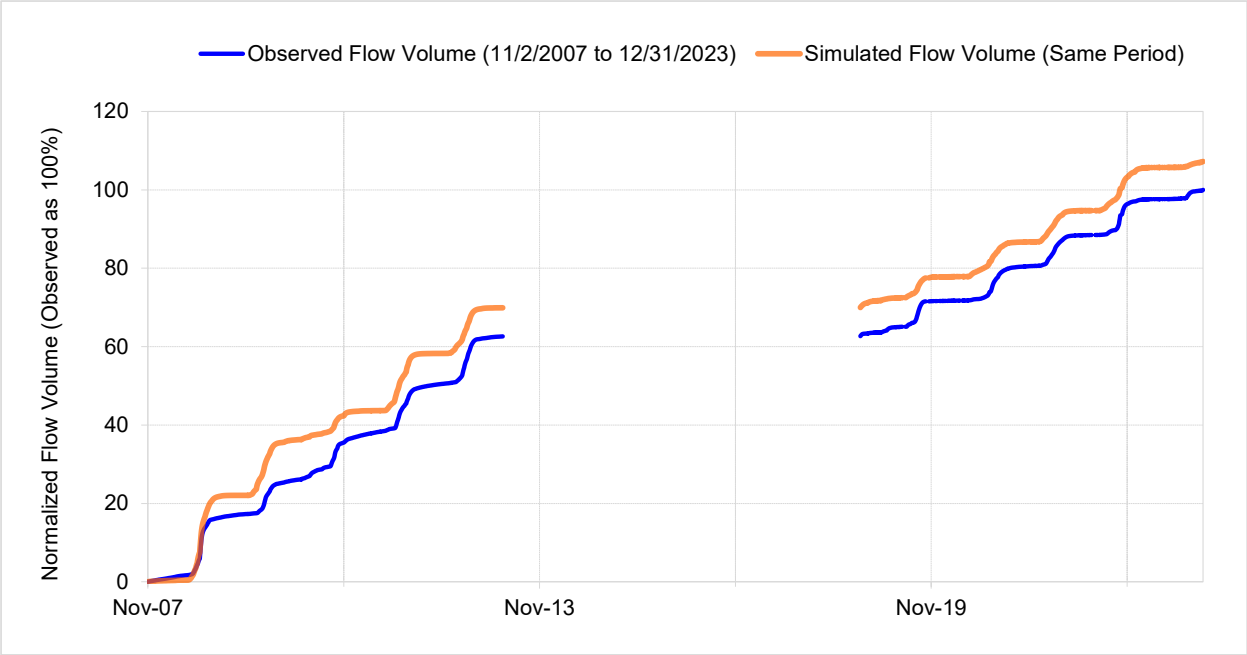

Figure A-53. Flow accumulation: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

Table A-21. Summary statistics: Model output at Reach 127 versus USGS 022929176 Telegraph Creek at State Highway at Olga, FL (Big Island Canal) (12/01/2007 – 12/31/2023)

Telegraph Creek (Big Island Canal) near Olga, FL (ID - USGS 022929176)
Drainage Area (sq-mi): 82.6900024414063
Analysis Period: 11/2/2007 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	5.12	5.49	7.23	10
Total lowest 50% flows	0.43	0.24	-43.99	10
Total highest 10% flows	2.59	2.68	3.56	15
Summer flow volume (months 7-9)	2.93	3.38	15.61	30
Fall flow volume (months 10-12)	1.54	1.64	6.29	30
Winter flow volume (months 1-3)	0.35	0.15	-57.70 >>	30
Spring flow volume (months 4-6)	0.31	0.32	5.26	30
Total storm volume	1.06	0.97	-8.36	20
Summer storm volume (7-9)	0.58	0.58	-0.22	50
Baseflow	4.06	4.52	11.30	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.750	0.7
Baseline adjusted coefficient (Garrick), E'			0.548	0.5
Monthly NSE			0.796	0.8

USGS 02293055 Orange River near Buckingham

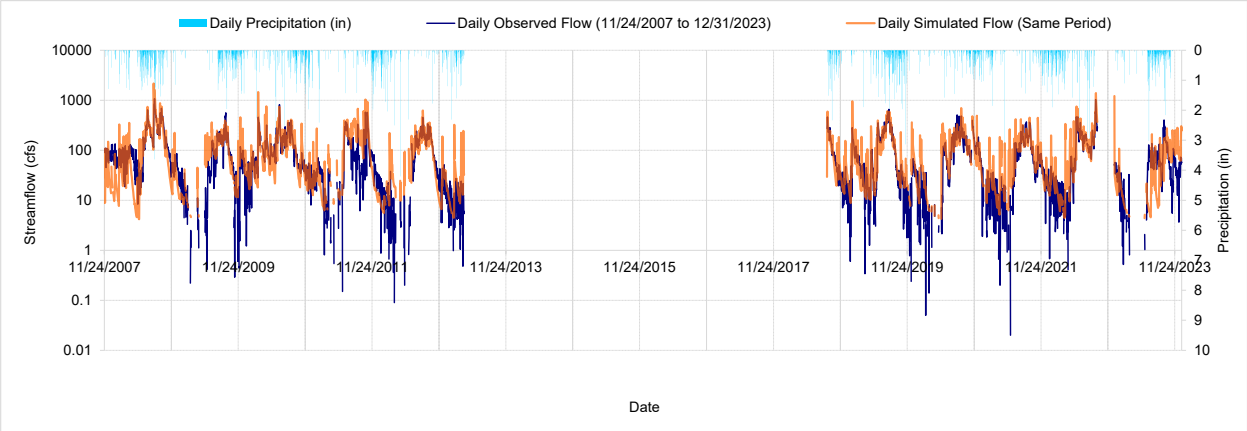

Figure A-54. Mean daily flow: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

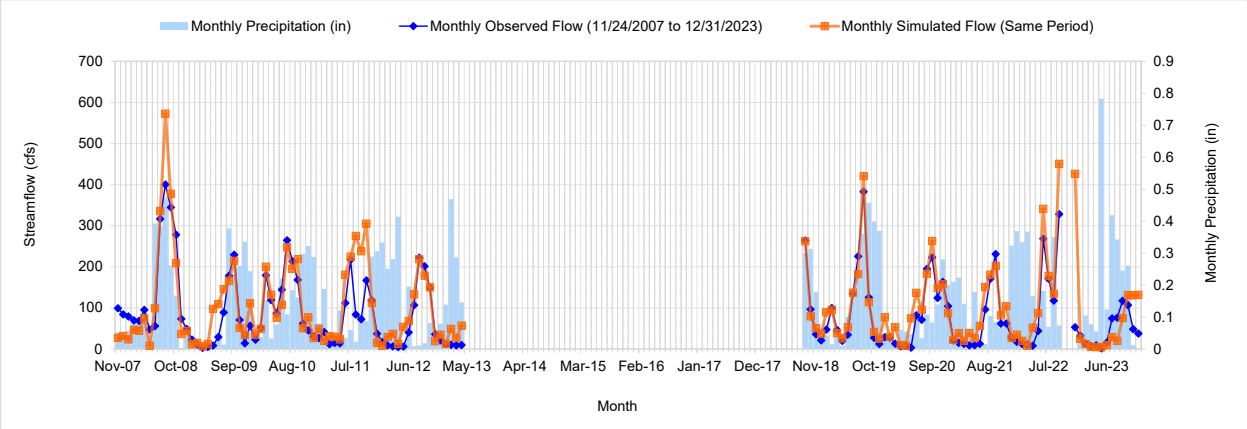

Figure A-55. Mean monthly flow: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

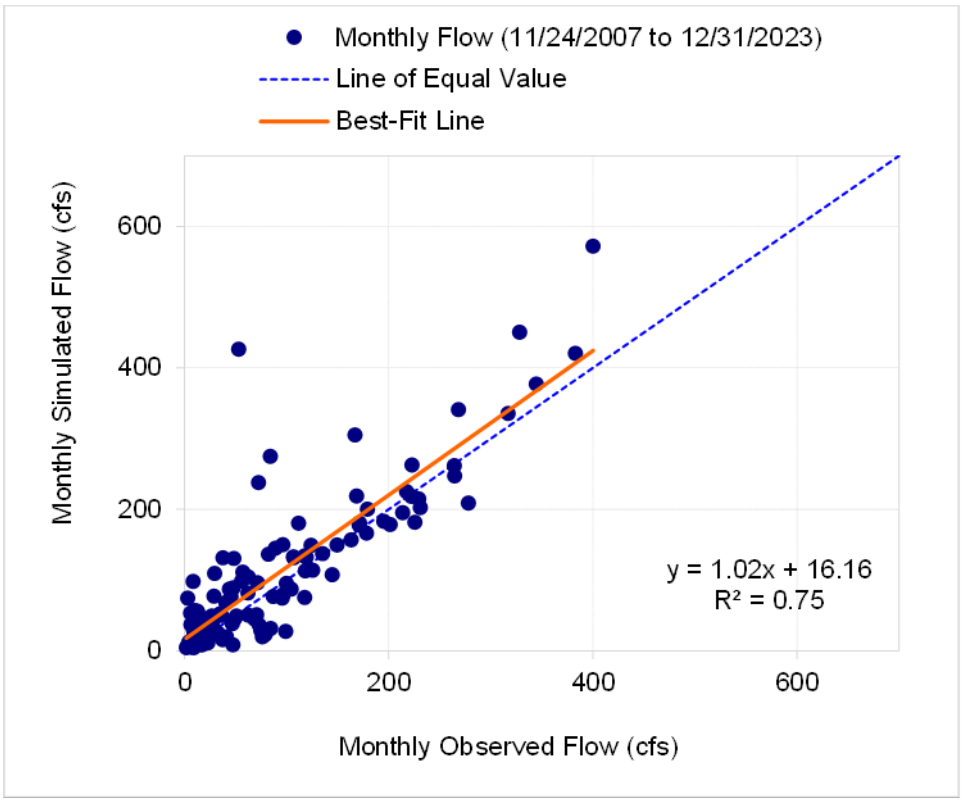

Figure A-56. Monthly flow regression and temporal variation: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

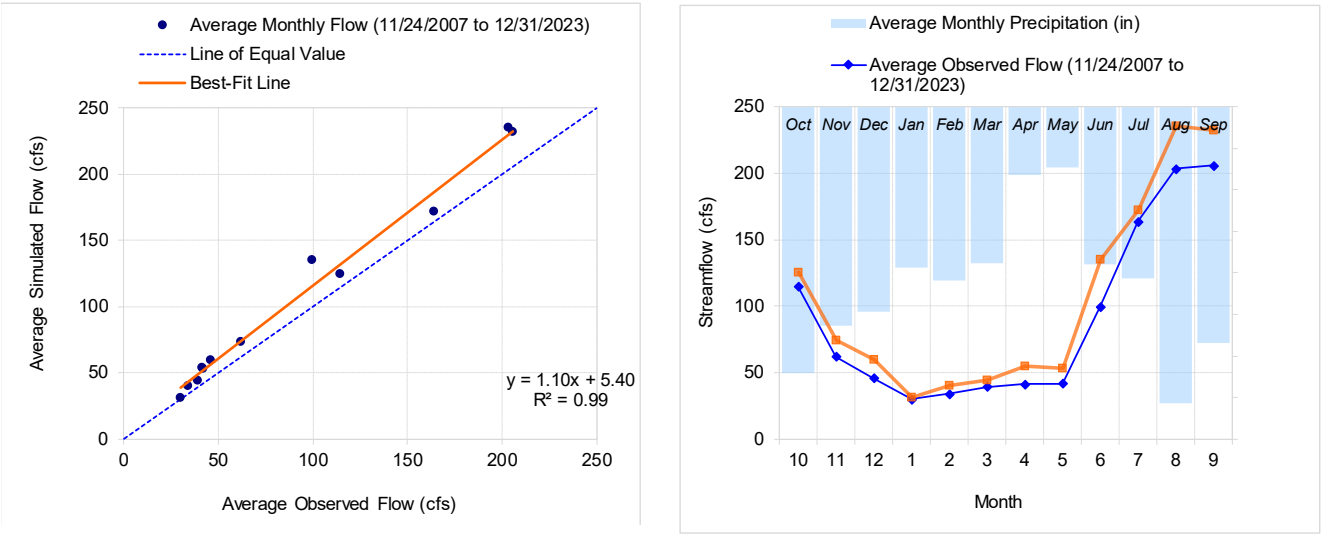

Figure A-57. Seasonal regression and temporal aggregate: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

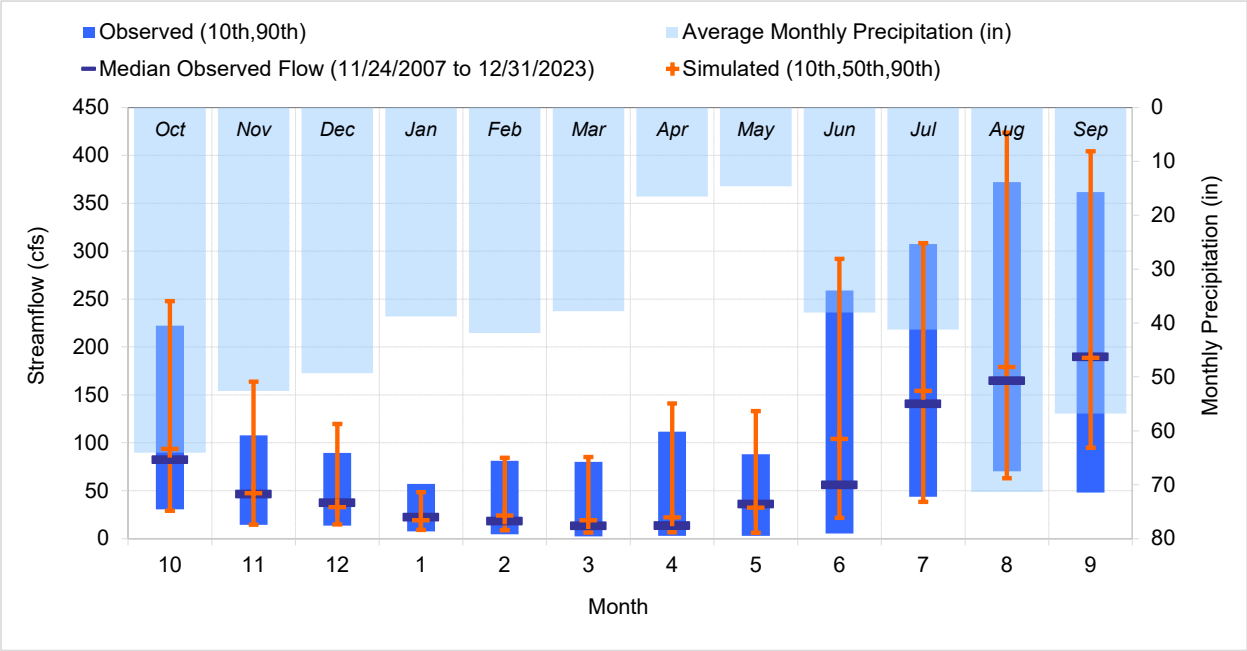

Figure A-58. Seasonal medians and ranges: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

Table A-22. Seasonal summary: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	114.59	82.70	30.56	222.20	125.30	93.72	29.02	247.94
Nov	62.06	46.70	14.50	107.80	74.08	47.50	14.58	163.69
Dec	45.79	37.55	13.58	89.39	59.77	32.99	14.68	119.67
Jan	30.04	22.50	7.61	57.00	31.60	19.18	9.11	48.49
Feb	34.02	18.60	4.45	81.12	40.09	24.25	8.90	84.49
Mar	39.24	13.55	2.27	80.18	44.60	19.12	6.28	85.13
Apr	41.46	13.80	2.83	111.60	54.58	22.28	6.50	141.01
May	41.78	36.20	2.97	88.00	53.40	32.27	5.93	133.06
Jun	99.64	56.20	5.44	259.00	135.39	104.16	21.69	291.88
Jul	163.77	141.00	43.80	307.50	172.44	154.31	38.36	308.31
Aug	203.28	165.00	70.24	372.20	235.90	179.02	62.94	423.65
Sep	205.66	190.00	48.23	361.70	232.17	188.86	94.70	404.32

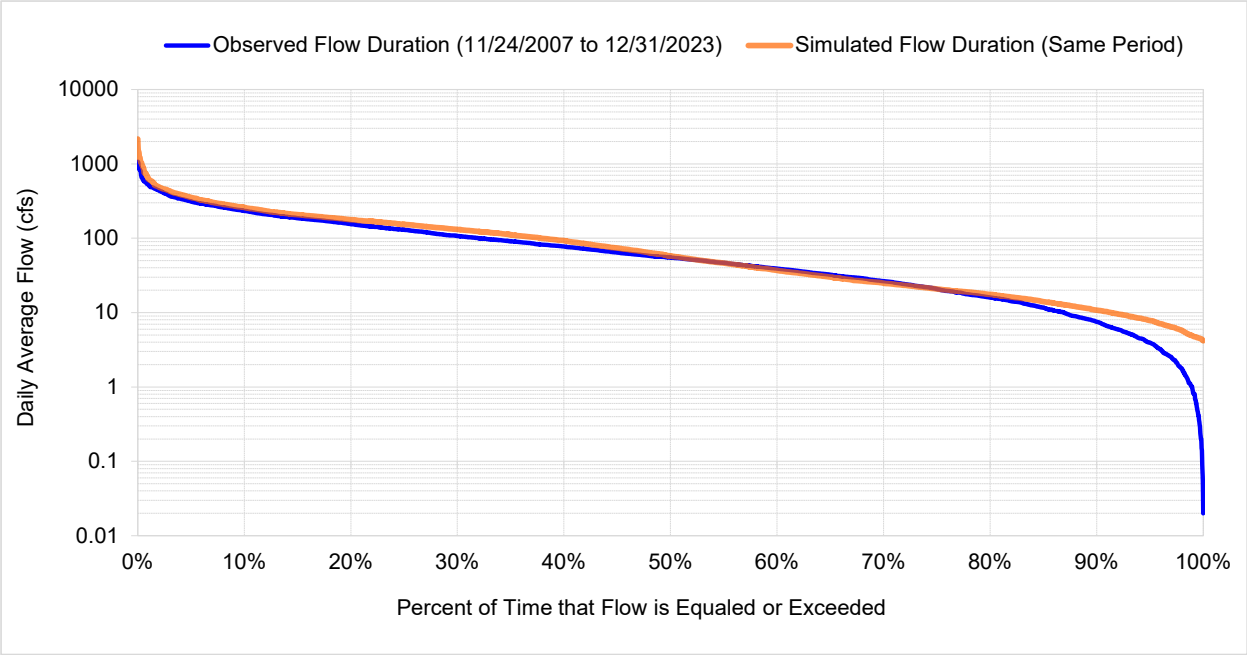

Figure A-59. Flow exceedance: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

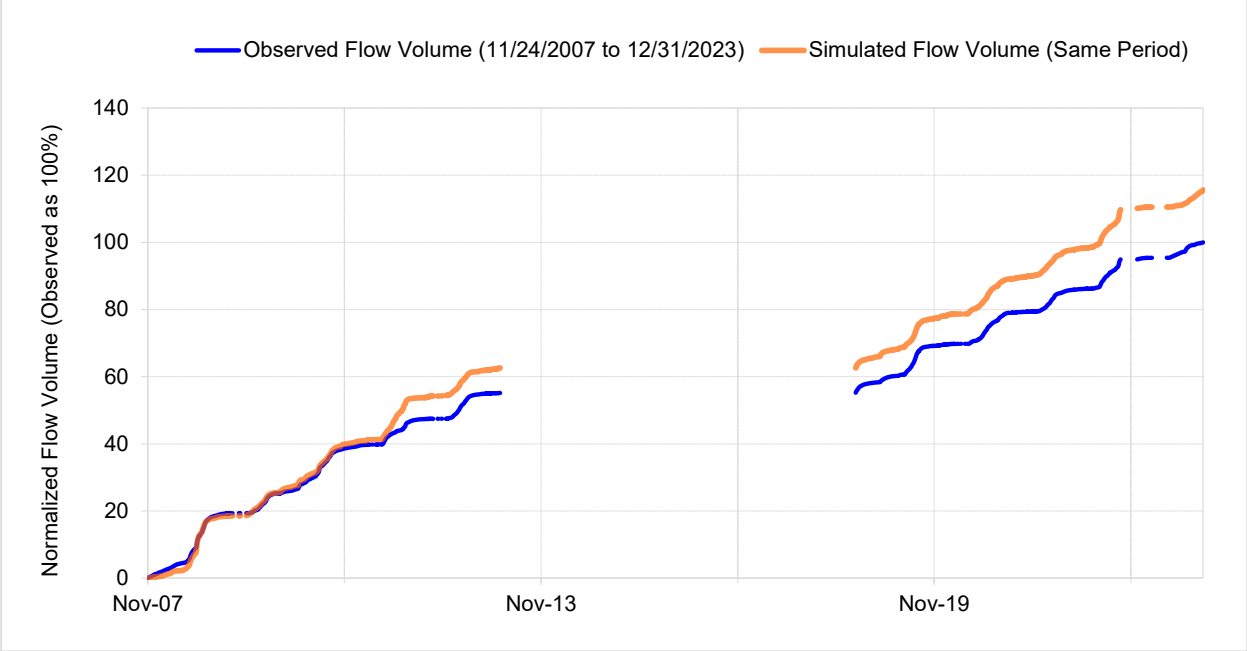

Figure A-60. Flow accumulation: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

Table A-23. Summary statistics: Model output at Reach 139 versus USGS 02293055 Orange River near Buckingham, FL (12/01/2007 – 12/31/2023)

Orange River near Buckingham, FL (ID - USGS 02293055)
Drainage Area (sq-mi): 69.4300003051758
Analysis Period: 11/24/2007 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	10.42	12.05	15.62	10
Total lowest 50% flows	1.27	1.31	3.49	10
Total highest 10% flows	3.94	4.69	19.06	15
Summer flow volume (months 7-9)	5.89	6.59	11.85	30
Fall flow volume (months 10-12)	2.29	2.67	16.70	30
Winter flow volume (months 1-3)	0.96	1.07	12.17	30
Spring flow volume (months 4-6)	1.28	1.71	33.59	30
Total storm volume	2.81	3.89	38.30	20
Summer storm volume (7-9)	1.48	1.85	25.15	50
Baseflow	7.61	8.16	7.24	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.414	0.7
Baseline adjusted coefficient (Garrick), E'			0.418	0.5
Monthly NSE			0.768	0.8

USGS 02293090 Popash Creek at Leetana Road near Fort Myers

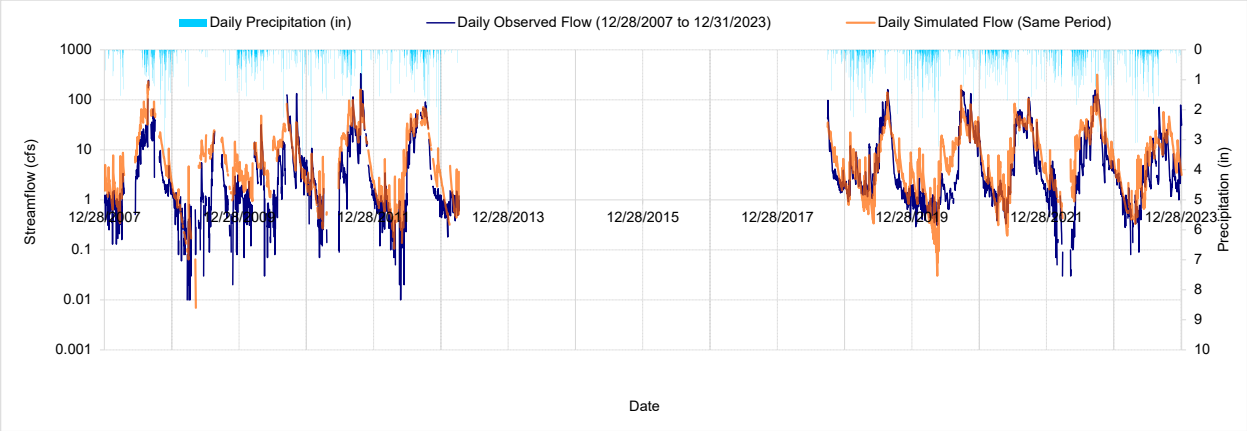

Figure A-61. Mean daily flow: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

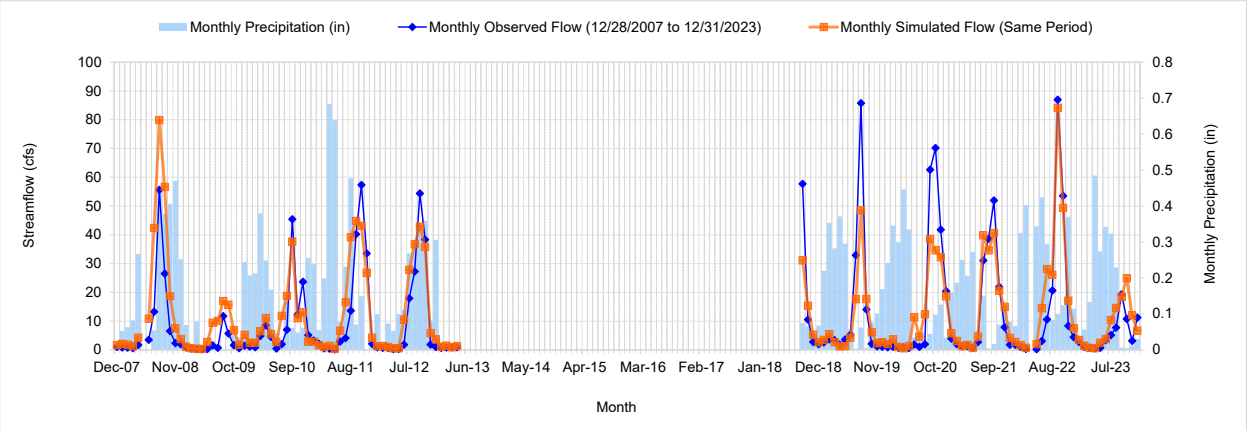

Figure A-62. Mean monthly flow: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

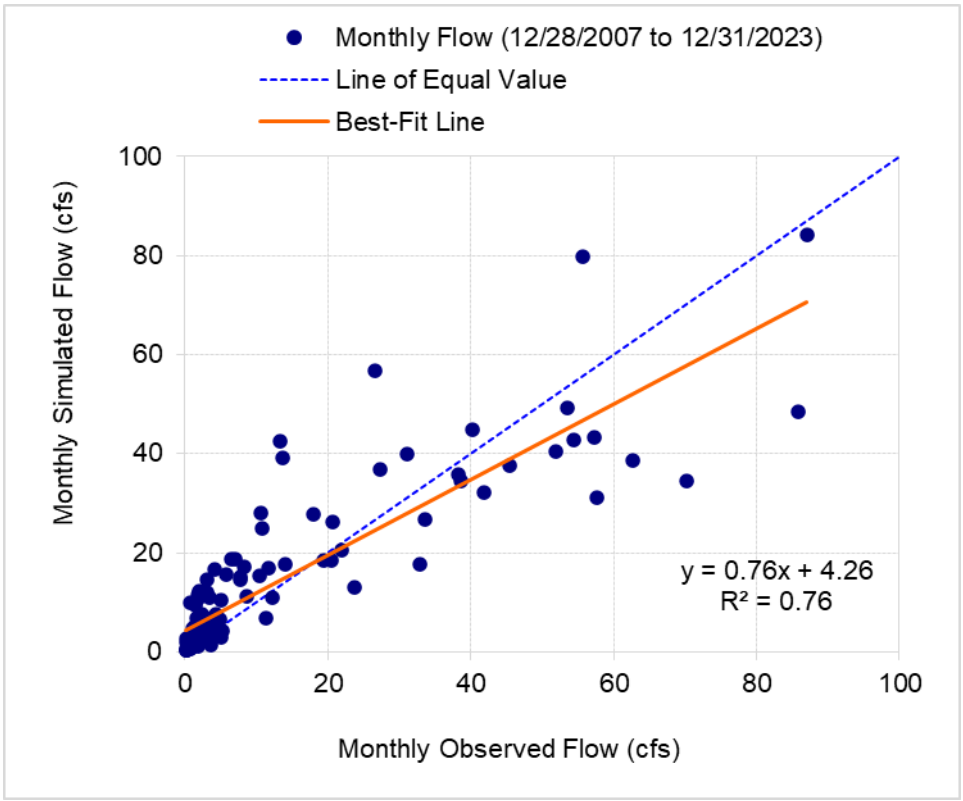

Figure A-63. Monthly flow regression and temporal variation: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

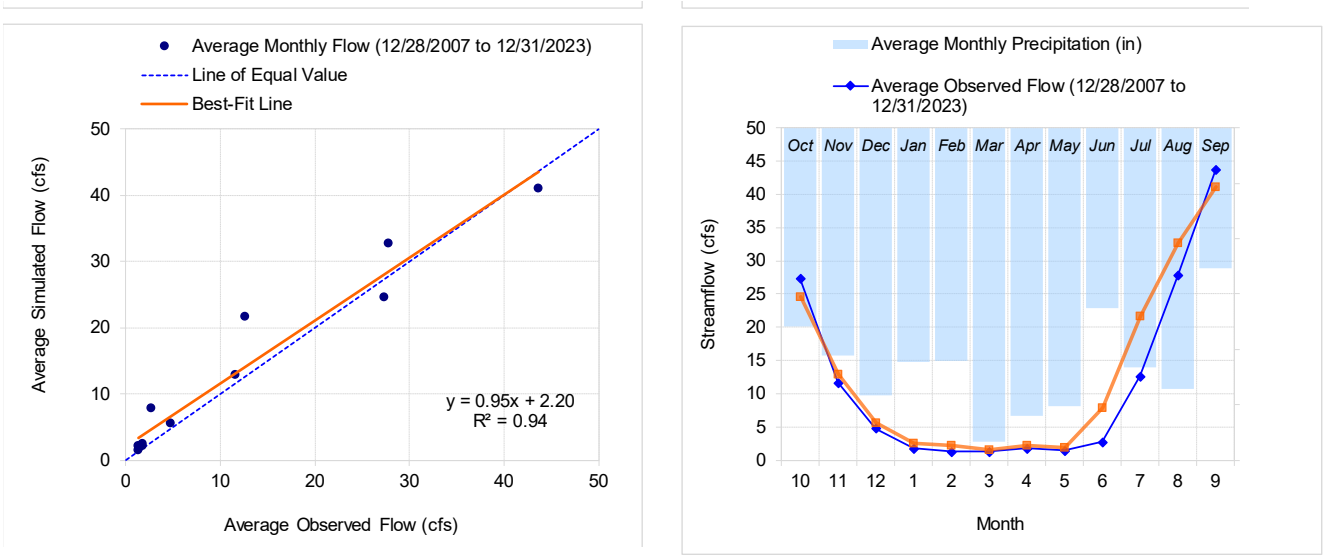

Figure A-64. Seasonal regression and temporal aggregate: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

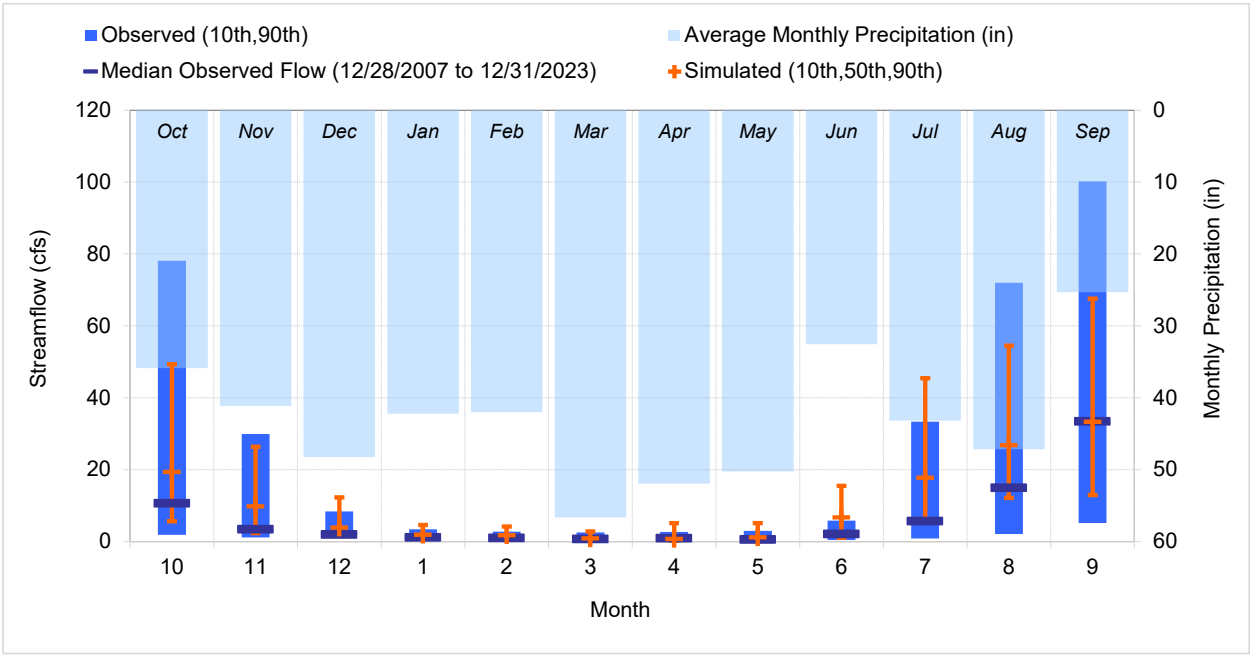

Figure A-65. Seasonal medians and ranges: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

Table A-24. Seasonal summary: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	27.31	10.70	1.88	78.15	24.66	19.33	5.65	49.28
Nov	11.64	3.47	1.15	29.94	12.90	9.81	2.33	26.39
Dec	4.78	1.98	0.98	8.36	5.62	3.88	1.93	12.28
Jan	1.78	1.19	0.56	3.43	2.61	1.89	0.94	4.64
Feb	1.32	1.05	0.34	2.72	2.24	1.77	0.61	4.16
Mar	1.31	0.75	0.23	2.53	1.59	0.89	0.42	2.78
Apr	1.77	0.98	0.17	2.70	2.23	0.70	0.25	5.12
May	1.46	0.66	0.13	2.98	1.96	1.16	0.17	5.13
Jun	2.73	2.15	0.44	5.81	7.97	6.70	1.06	15.50
Jul	12.67	5.73	0.84	33.36	21.74	17.79	6.21	45.47
Aug	27.77	15.00	2.11	71.96	32.75	26.83	12.13	54.51
Sep	43.65	33.50	5.14	100.20	41.16	33.34	12.95	67.59

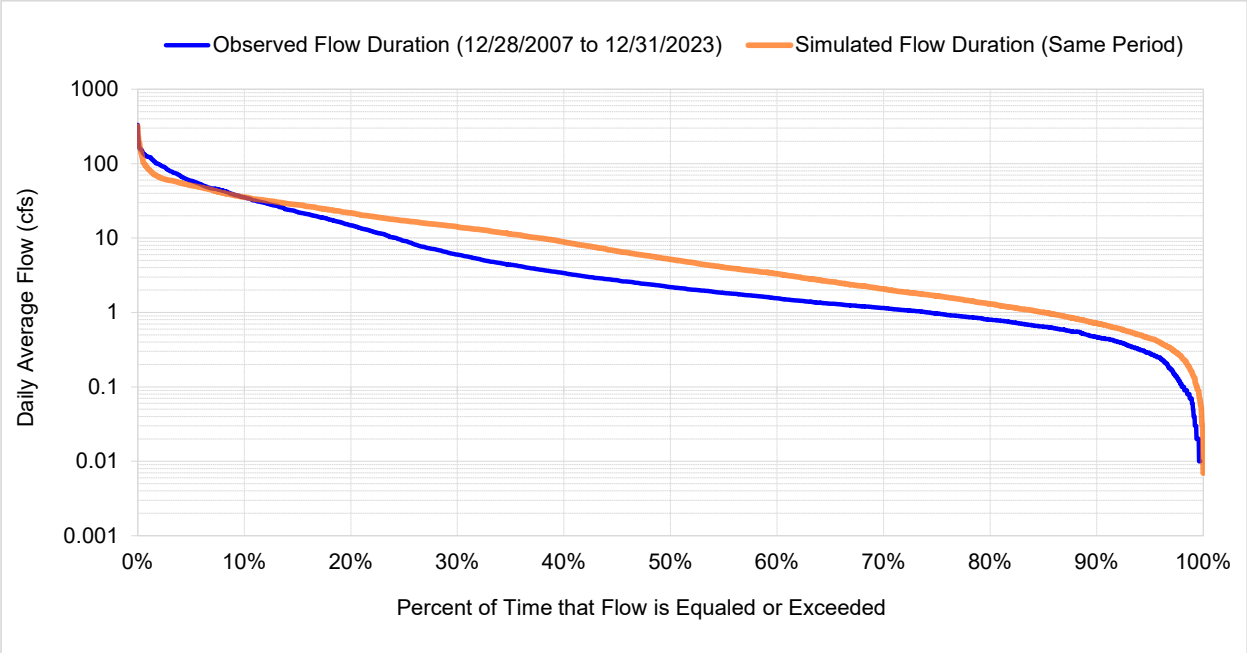

Figure A-66. Flow exceedance: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

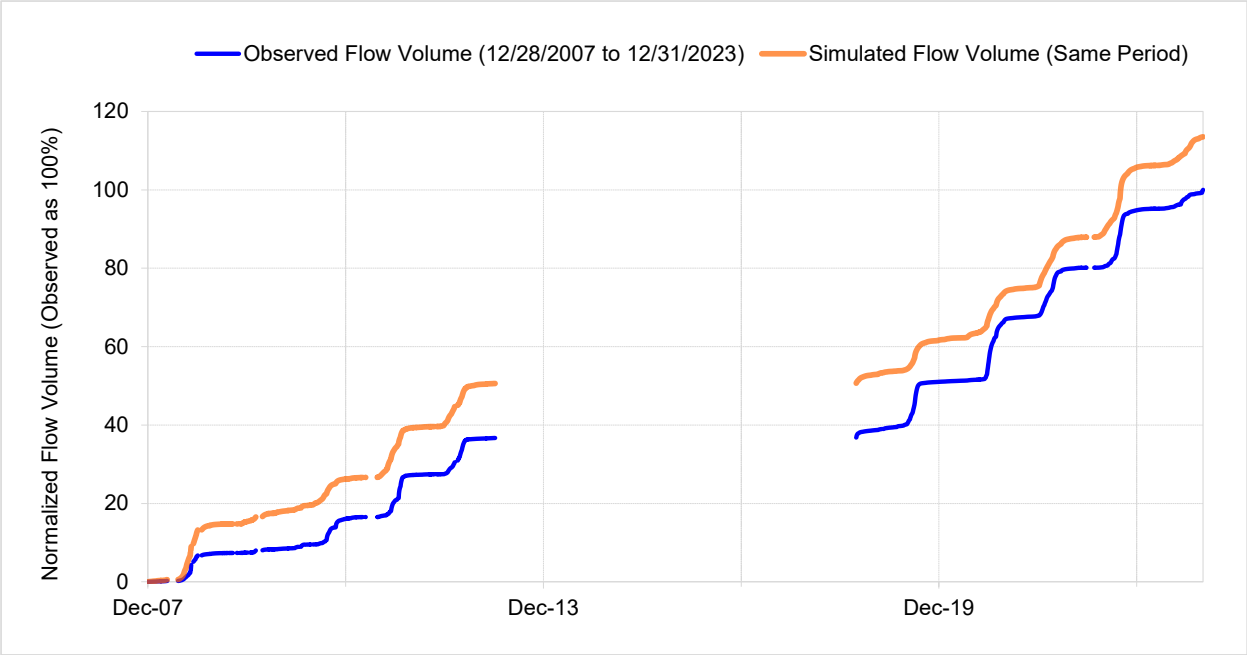

Figure A-67. Flow accumulation: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

Table A-25. Summary statistics: Model output at Reach 120 versus USGS 02293090 Popash Creek at Leetana Road near Fort Myers (12/01/2007 – 12/31/2023)

Popash Creek at Leetana Rd. near North Fort Myers, FL (ID - USGS 02293090)
Drainage Area (sq-mi): 17.5900001525879
Analysis Period: 12/28/2007 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	5.15	5.84	13.53	10
Total lowest 50% flows	0.22	0.43	95.03	10
Total highest 10% flows	3.15	2.61	-17.22	15
Summer flow volume (months 7-9)	2.99	3.43	14.81	30
Fall flow volume (months 10-12)	1.81	1.79	-1.26	30
Winter flow volume (months 1-3)	0.18	0.26	45.94 >>	30
Spring flow volume (months 4-6)	0.17	0.36	114.22	30
Total storm volume	0.93	0.80	-13.63	20
Summer storm volume (7-9)	0.53	0.48	-9.72	50
Baseflow	4.22	5.04	19.49	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.609	0.7
Baseline adjusted coefficient (Garrick), E'			0.499	0.5
Monthly NSE			0.769	0.8

USGS 02293190 Billy Creek at Fort Myers

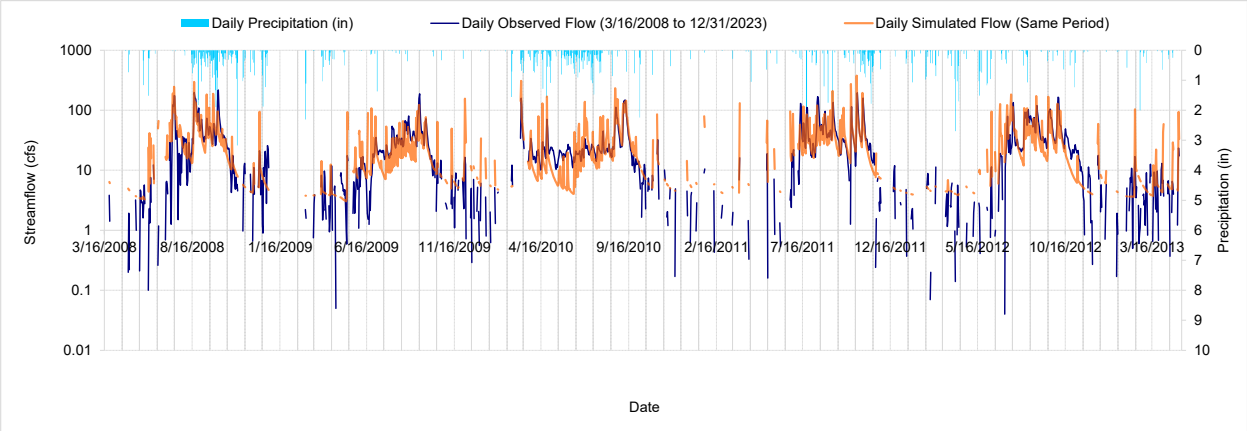

Figure A-68. Mean daily flow: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

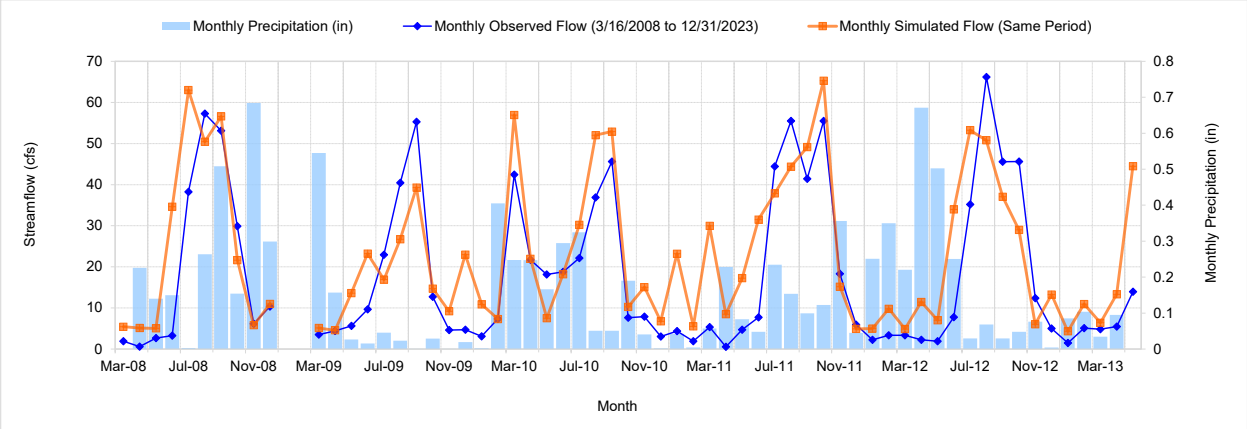

Figure A-69. Mean monthly flow: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

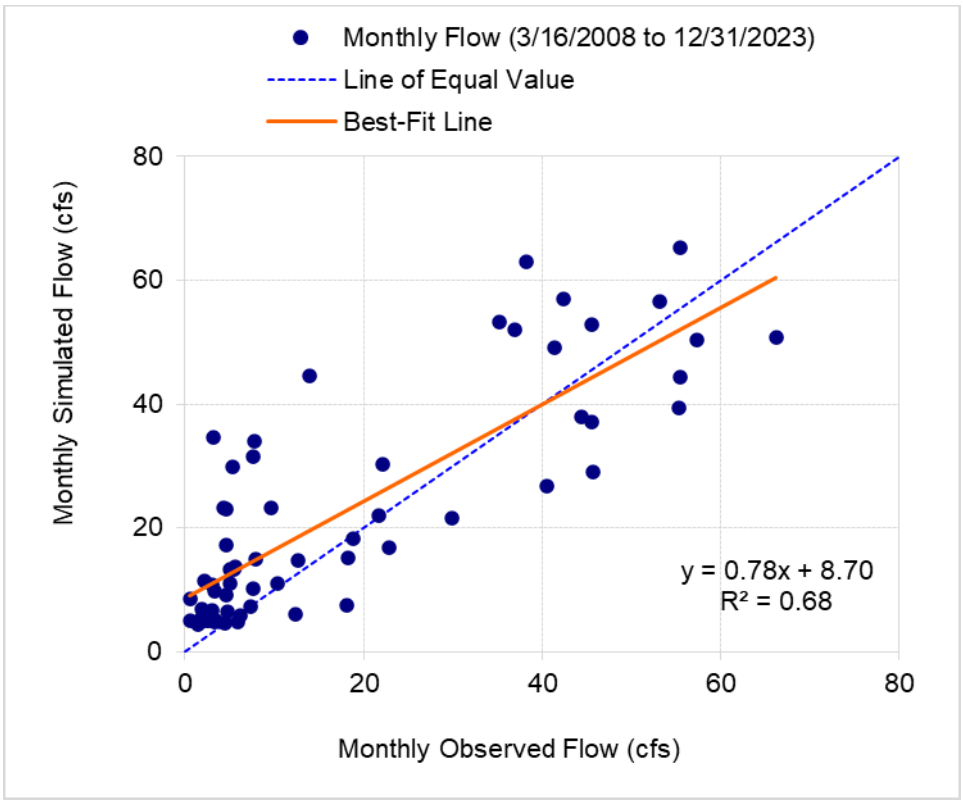

Figure A-70. Monthly flow regression and temporal variation: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

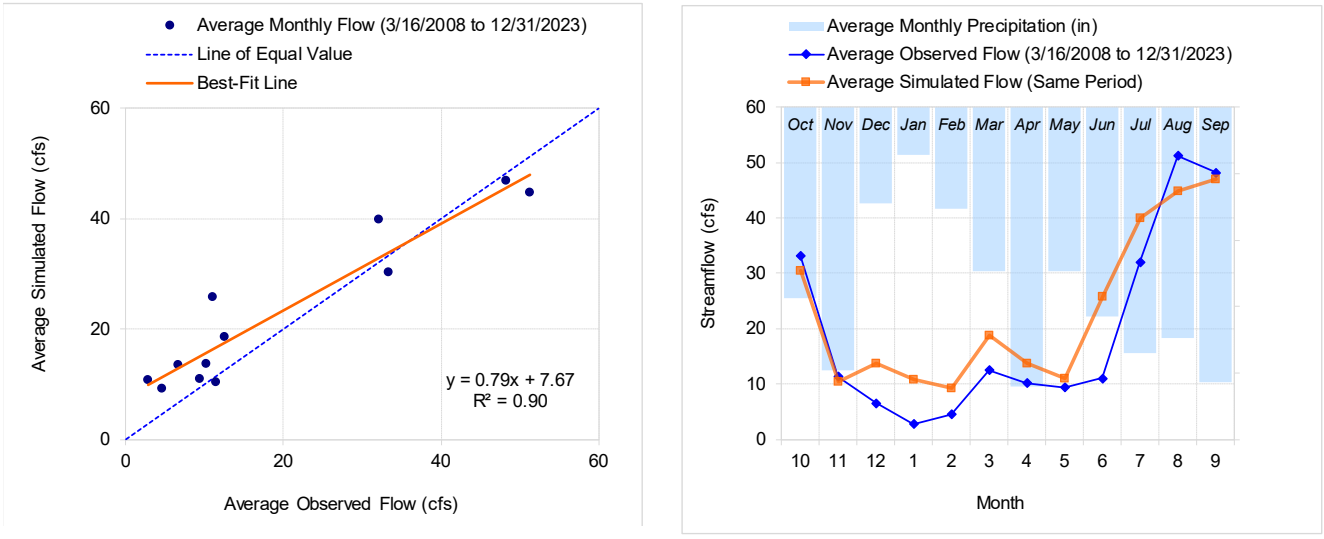

Figure A-71. Seasonal regression and temporal aggregate: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

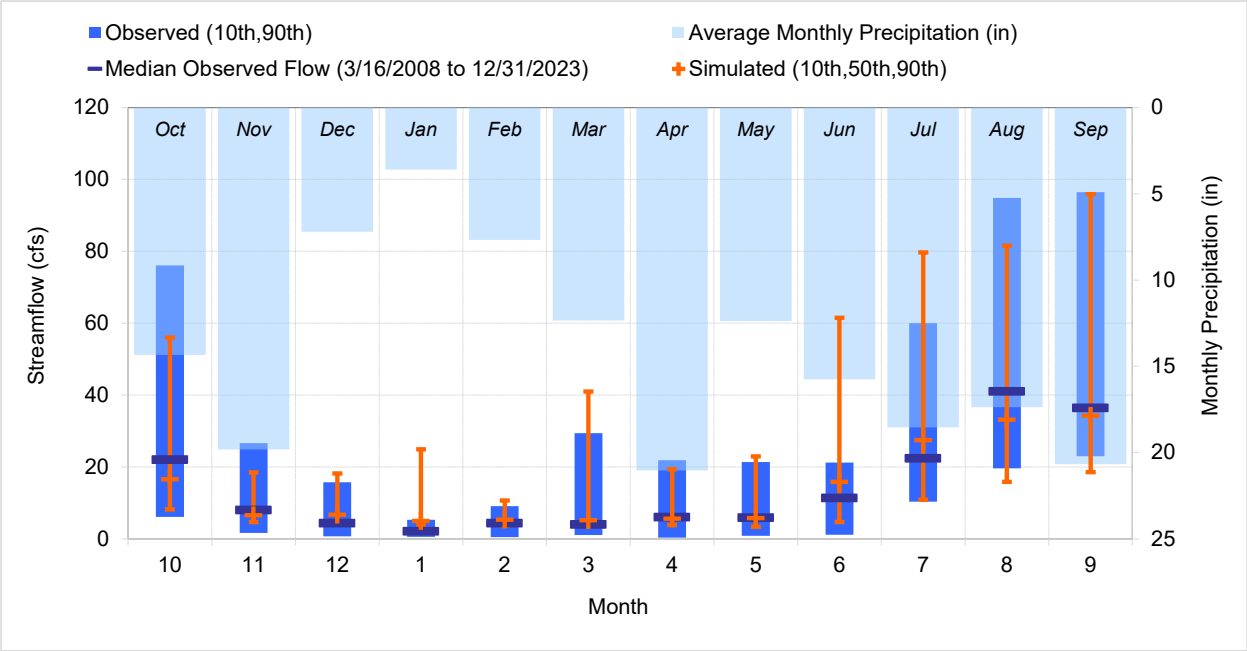

Figure A-72. Seasonal medians and ranges: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

Table A-26. Seasonal summary: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	33.28	22.10	6.10	76.10	30.39	16.59	8.15	56.02
Nov	11.40	8.11	1.64	26.62	10.49	6.59	4.71	18.50
Dec	6.62	4.45	0.71	15.75	13.69	6.71	4.82	18.20
Jan	2.83	2.19	0.56	5.31	10.86	4.99	3.97	24.88
Feb	4.57	4.43	0.50	9.11	9.37	5.37	3.63	10.64
Mar	12.56	4.03	1.06	29.43	18.78	5.22	3.90	40.95
Apr	10.16	6.10	0.34	21.88	13.73	5.67	3.88	19.34
May	9.45	5.99	0.83	21.36	11.03	5.78	3.35	22.94
Jun	11.08	11.45	1.15	21.25	25.88	15.88	4.69	61.47
Jul	32.09	22.50	10.34	60.02	39.93	27.50	10.89	79.72
Aug	51.27	41.10	19.62	94.82	44.88	33.17	15.88	81.61
Sep	48.20	36.50	22.95	96.44	47.00	34.29	18.59	95.87

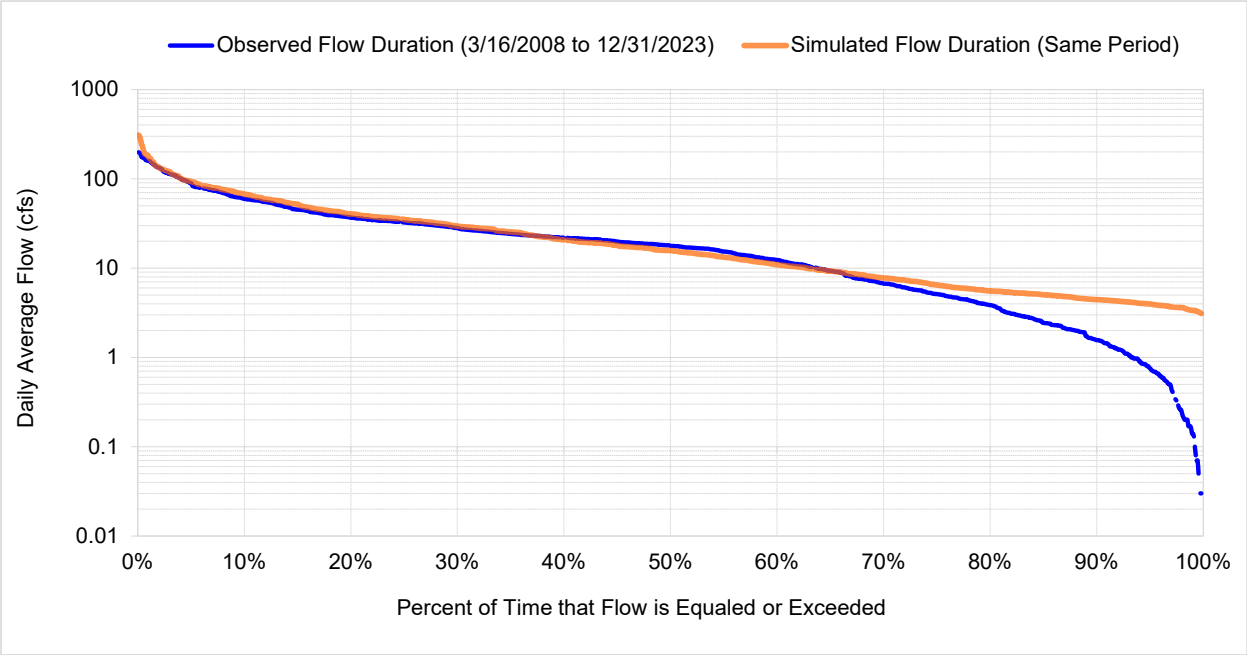

Figure A-73. Flow exceedance: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

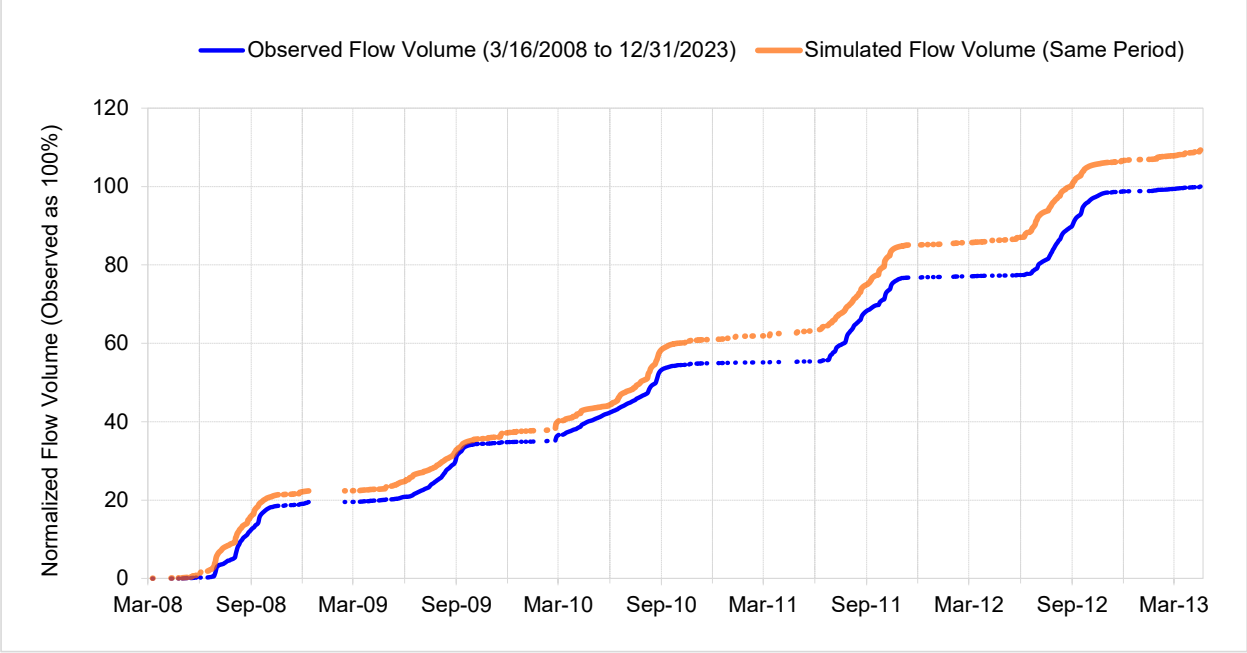

Figure A-74. Flow accumulation: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

Table A-27. Summary statistics: Model output at Reach 137 versus USGS 02293190 Billy Creek at Fort Myers, FL (04/01/2008 – 12/31/2013)

Billys Creek at Ft. Myers, FL (ID - USGS 02293190)
Drainage Area (sq-mi): 8.82999992370605
Analysis Period: 3/16/2008 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	24.31	26.58	9.32	10
Total lowest 50% flows	3.11	3.60	15.70	10
Total highest 10% flows	9.52	10.63	11.63	15
Summer flow volume (months 7-9)	16.30	16.29	-0.10	30
Fall flow volume (months 10-12)	4.81	4.80	-0.21	30
Winter flow volume (months 1-3)	0.94	1.68	79.51	30
Spring flow volume (months 4-6)	2.26	3.81	68.28	30
Total storm volume	6.50	10.42	60.25	20
Summer storm volume (7-9)	3.96	5.79	46.05	50
Baseflow	17.81	16.16	-9.28	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.134	0.7
Baseline adjusted coefficient (Garrick), E'			0.232	0.5
Monthly NSE			0.836	0.8

USGS 02293230 Whiskey Creek at Fort Myers

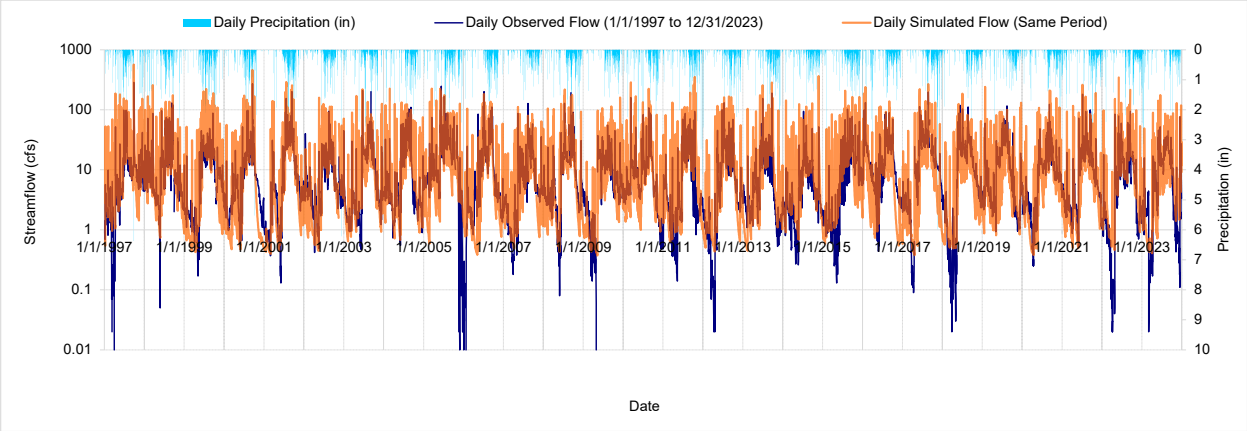

Figure A-75. Mean daily flow: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

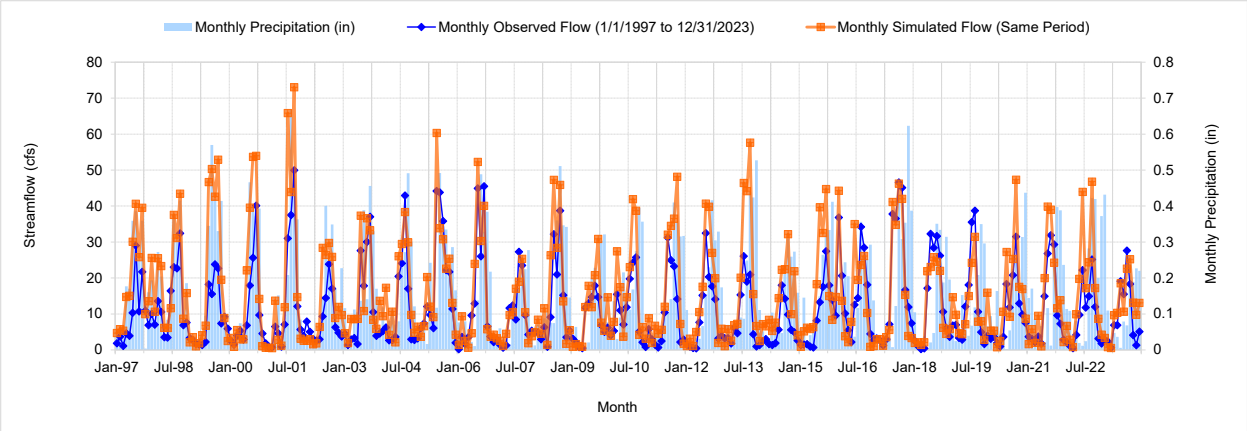

Figure A-76. Mean monthly flow: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

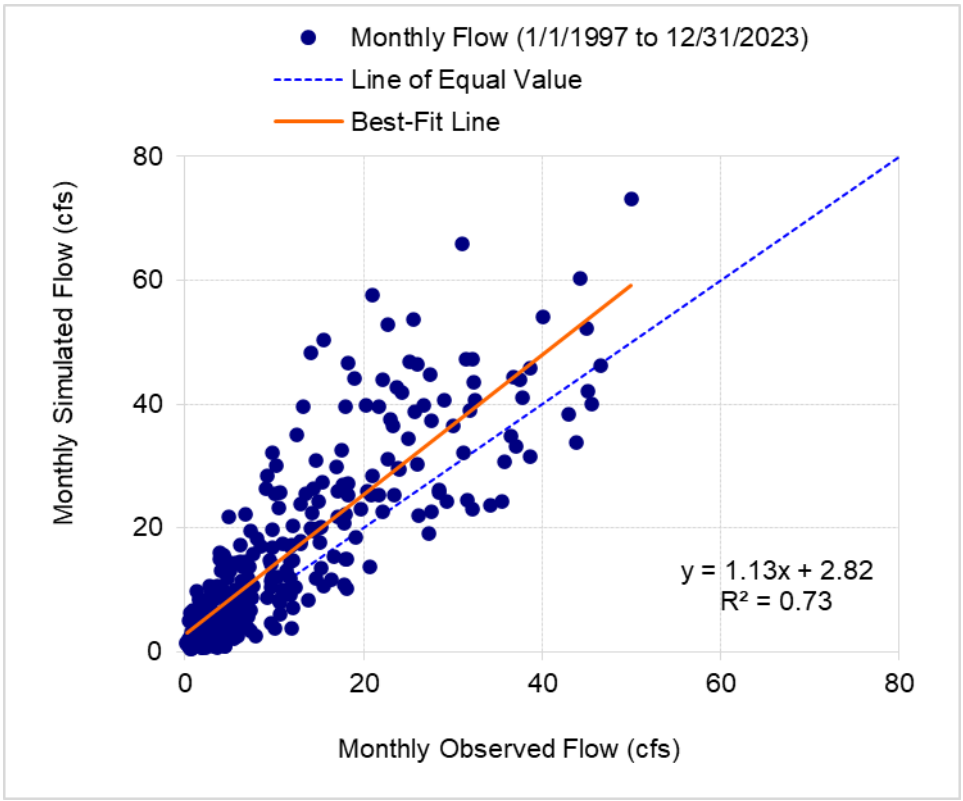

Figure A-77. Monthly flow regression and temporal variation: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

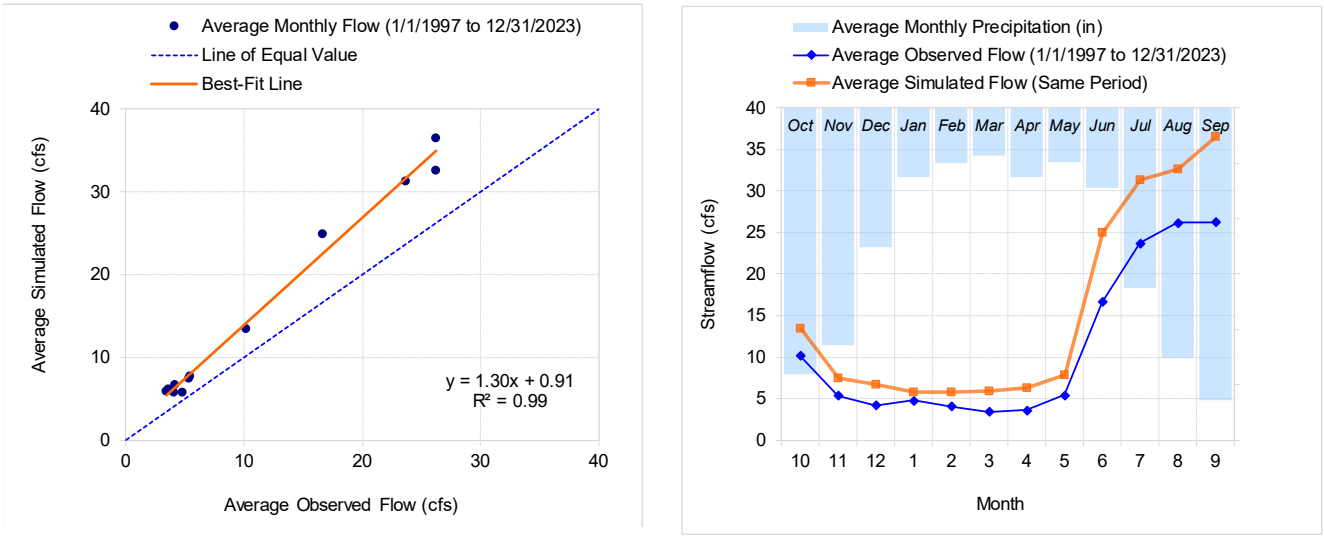

Figure A-78. Seasonal regression and temporal aggregate: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

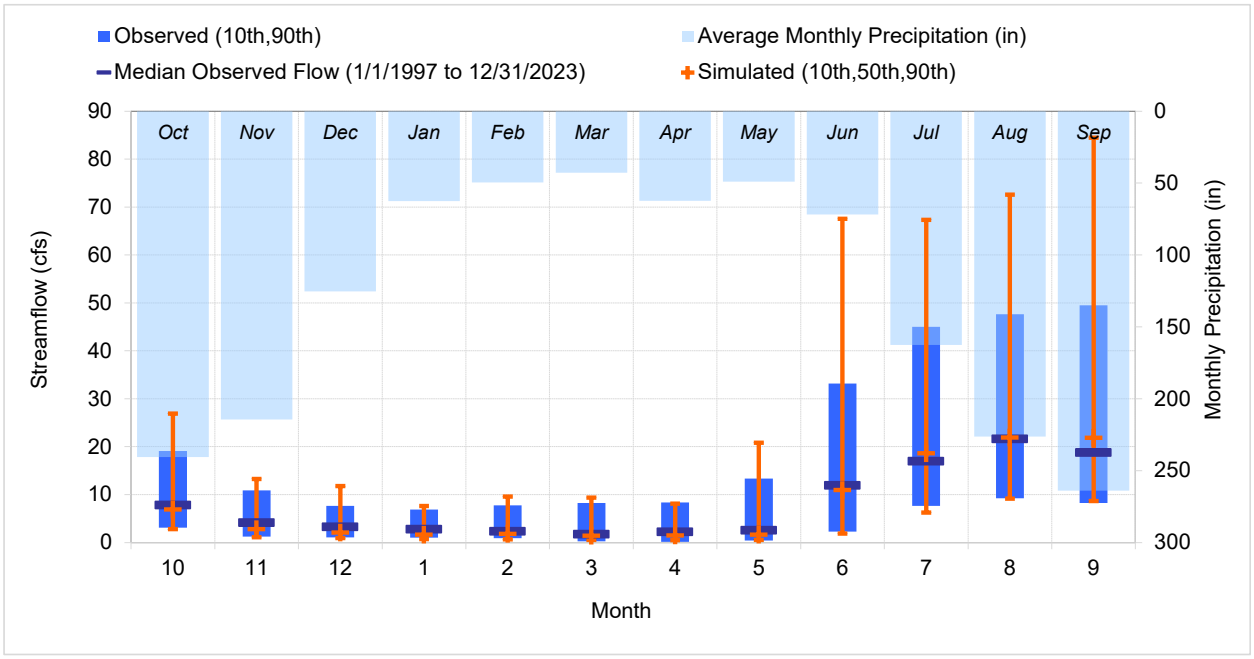

Figure A-79. Seasonal medians and ranges: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

Table A-28. Seasonal summary: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	10.16	7.89	3.12	19.10	13.51	6.89	2.80	26.88
Nov	5.40	4.22	1.23	10.90	7.52	2.80	1.10	13.26
Dec	4.21	3.31	1.06	7.64	6.74	2.11	0.93	11.80
Jan	4.79	2.84	1.00	6.90	5.84	1.67	0.70	7.62
Feb	4.10	2.40	0.89	7.77	5.79	1.80	0.67	9.57
Mar	3.44	1.77	0.25	8.24	5.96	1.41	0.55	9.35
Apr	3.60	2.29	0.15	8.38	6.28	1.51	0.50	8.11
May	5.43	2.60	0.44	13.34	7.82	1.63	0.57	20.84
Jun	16.64	12.00	2.30	33.20	24.94	10.94	1.88	67.53
Jul	23.70	17.00	7.66	45.00	31.30	18.65	6.26	67.35
Aug	26.20	21.65	9.24	47.66	32.63	21.92	9.13	72.60
Sep	26.24	18.80	8.23	49.50	36.57	21.84	8.65	84.49

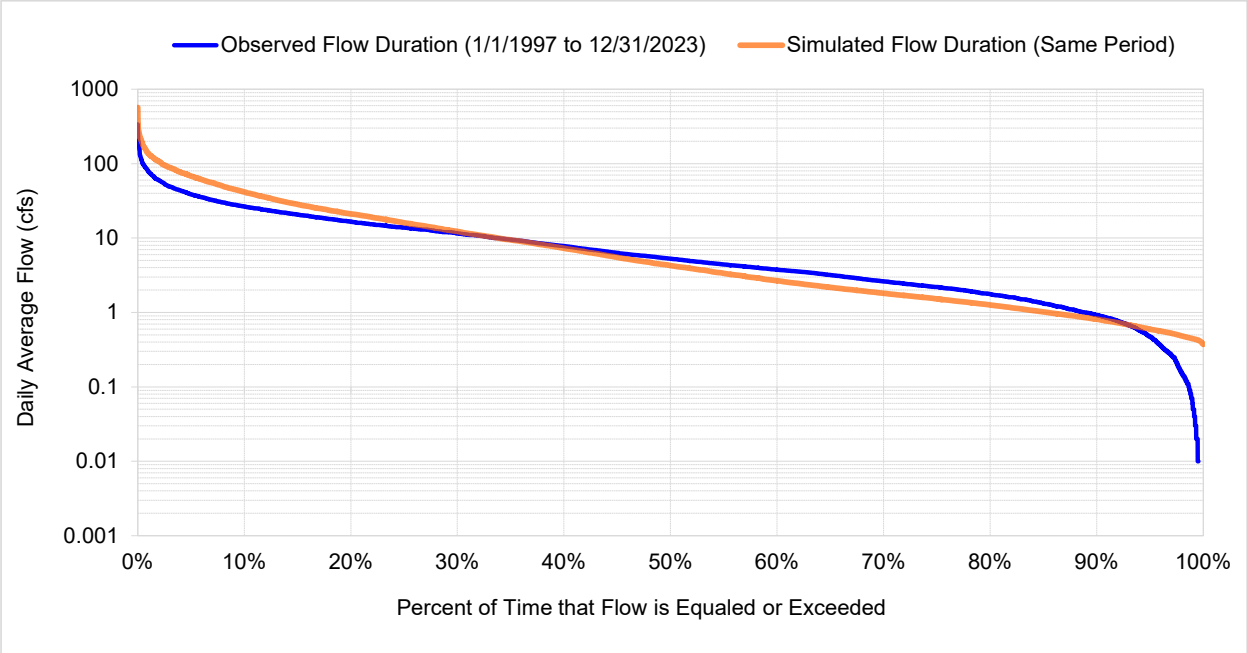

Figure A-80. Flow exceedance: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

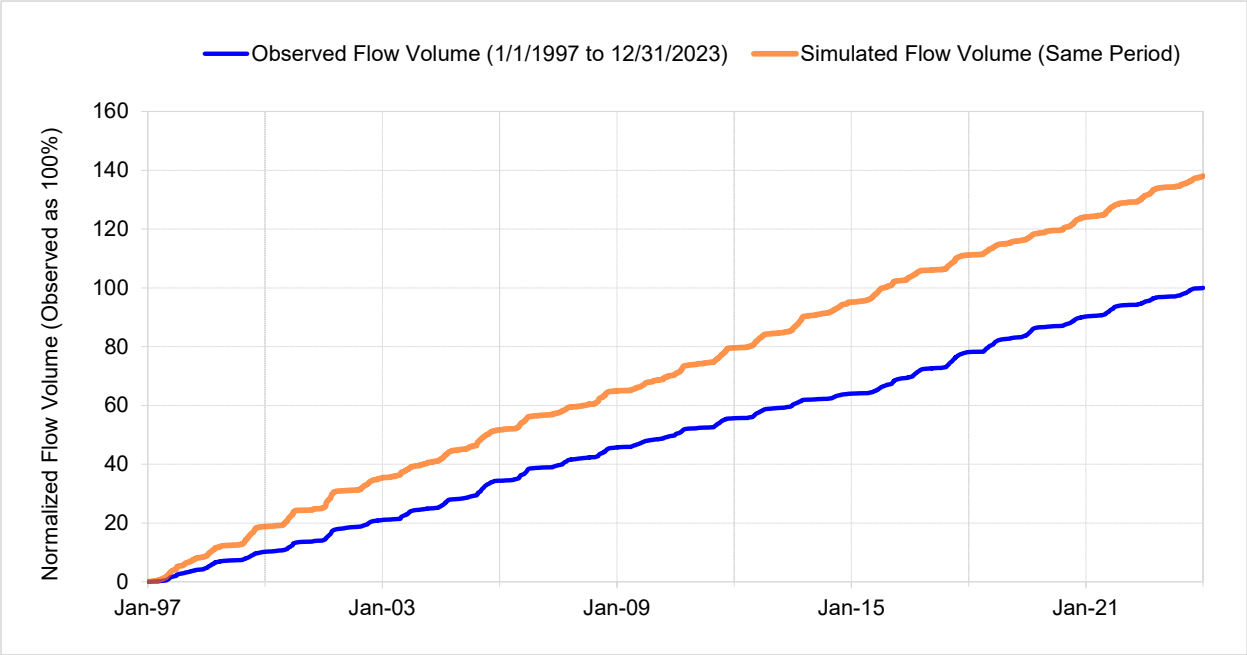

Figure A-81. Flow accumulation: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

Table A-29. Summary statistics: Model output at Reach 135 versus USGS 02293230 Whiskey Creek at Fort Myers, FL (01/01/1997 – 12/31/2023)

Whiskey Creek at Ft. Myers, FL (ID - USGS 02293230)
Drainage Area (sq-mi): 6.09999990463257
Analysis Period: 1/1/1997 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	24.44	33.73	38.03	10
Total lowest 50% flows	2.56	1.93	-24.75	10
Total highest 10% flows	10.69	18.41	72.13	15
Summer flow volume (months 7-9)	13.81	18.21	31.85	30
Fall flow volume (months 10-12)	3.66	5.14	40.47	30
Winter flow volume (months 1-3)	2.25	3.21	42.63 >>	30
Spring flow volume (months 4-6)	4.71	7.16	52.06	30
Total storm volume	6.65	17.16	158.22	20
Summer storm volume (7-9)	3.96	8.39	112.06	50
Baseflow	17.79	16.57	-6.87	20
Nash-Sutcliffe Coefficient of Efficiency, E			-0.604	0.7
Baseline adjusted coefficient (Garrick), E'			0.083	0.5
Monthly NSE			0.338	0.8

USGS 02293240 Aries Canal at Cape Coral

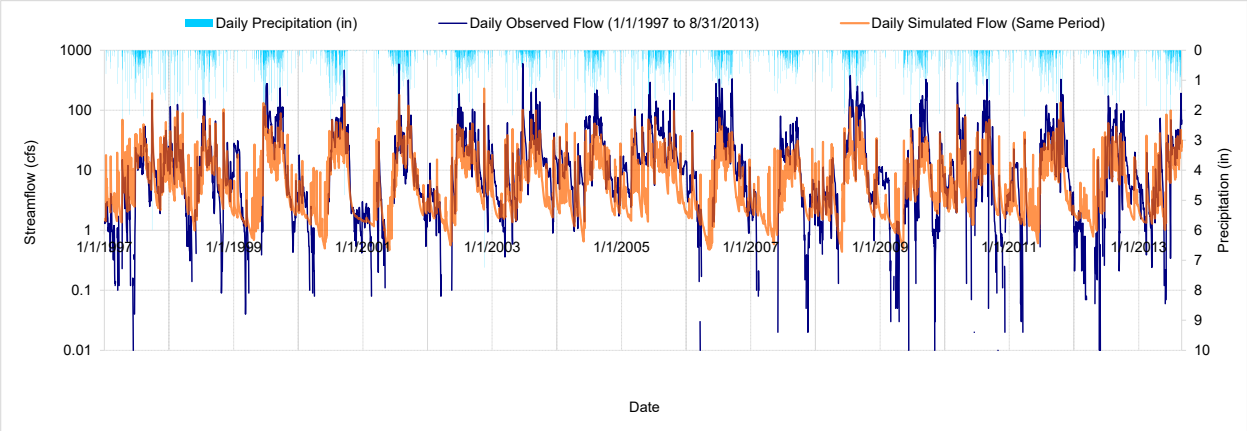

Figure A-82. Mean daily flow: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

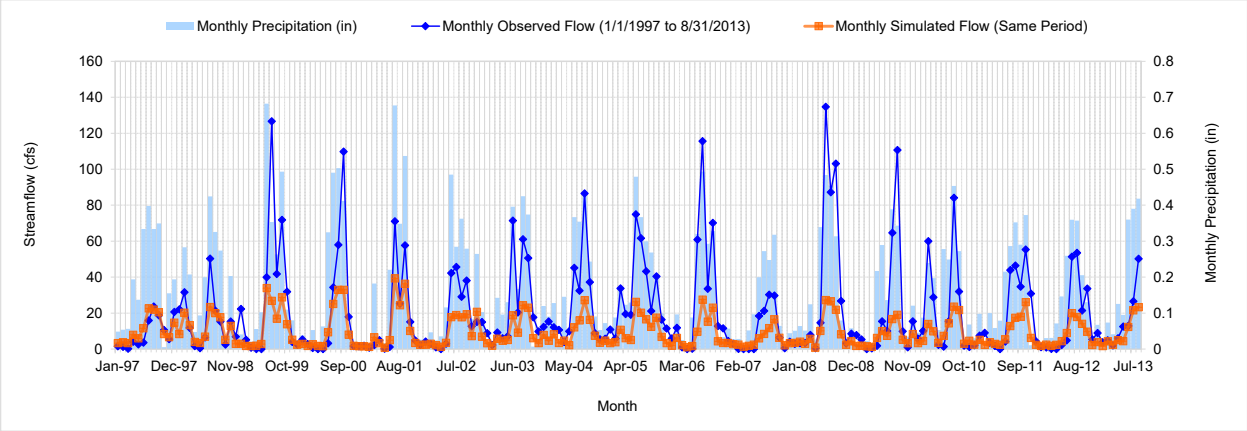

Figure A-83. Mean monthly flow: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

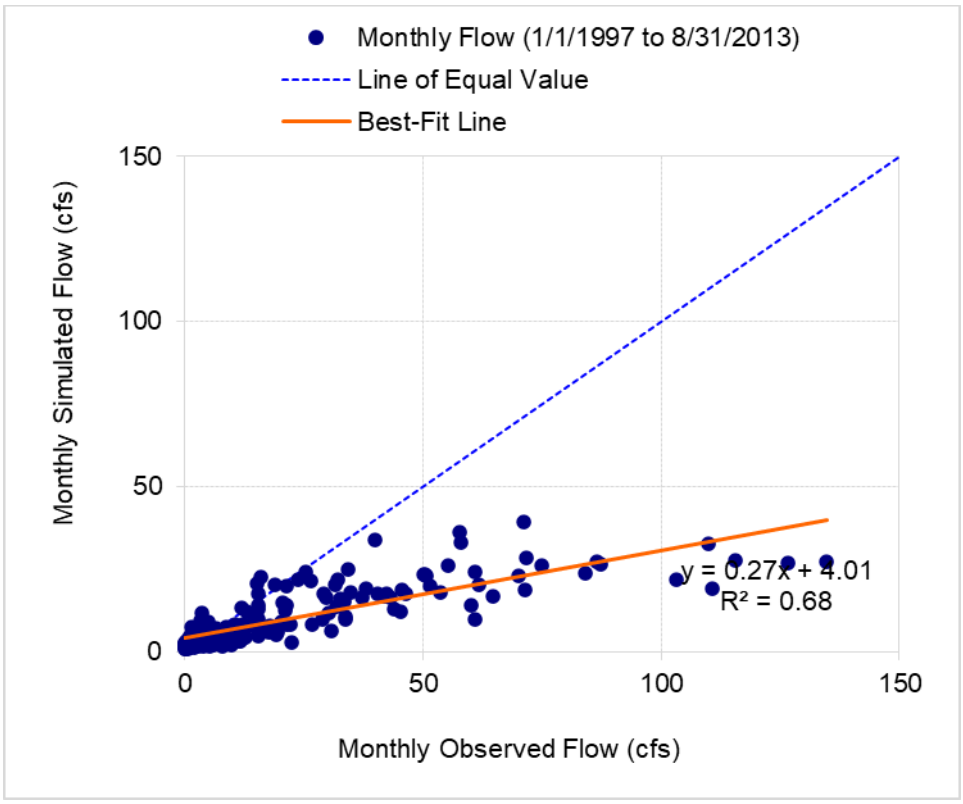

Figure A-84. Monthly flow regression and temporal variation: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

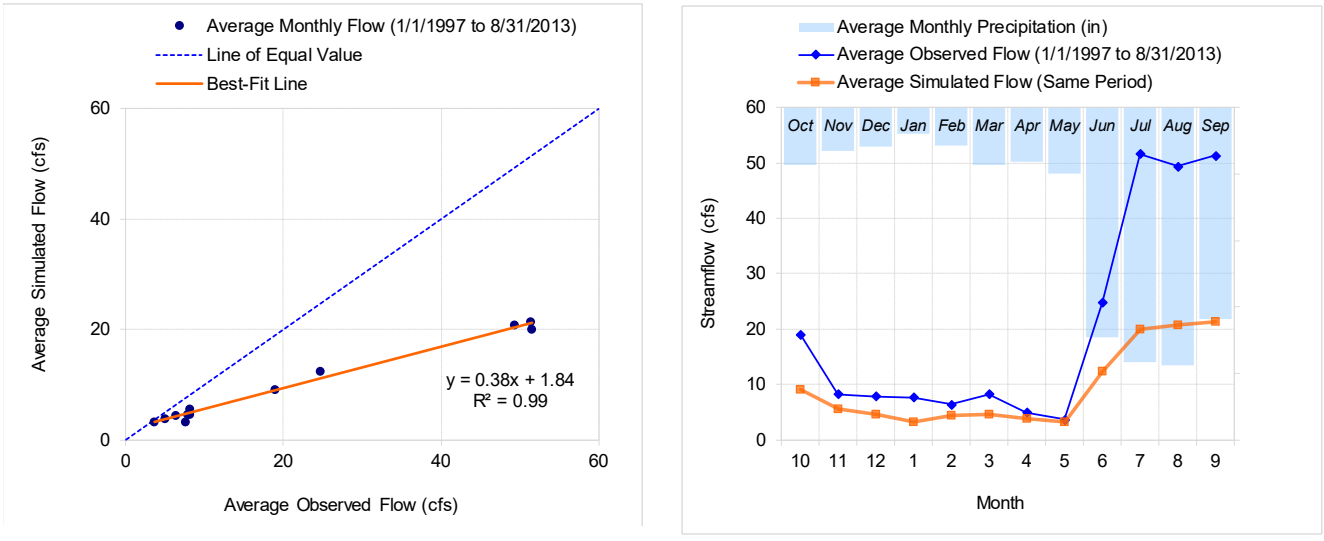

Figure A-85. Seasonal regression and temporal aggregate: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

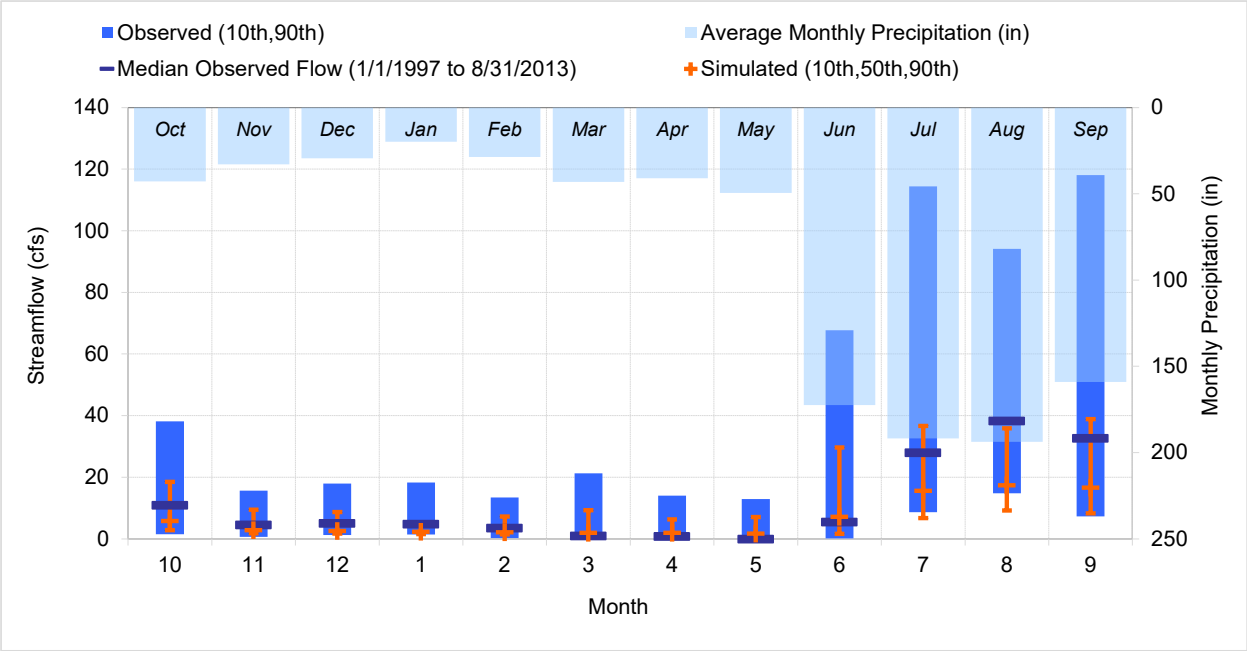

Figure A-86. Seasonal medians and ranges: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

Table A-30. Seasonal summary: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	19.02	11.00	1.47	38.10	9.15	5.81	2.82	18.49
Nov	8.21	4.60	0.68	15.62	5.54	2.86	1.81	9.48
Dec	7.88	5.08	1.28	17.95	4.69	2.59	1.73	8.74
Jan	7.63	4.80	1.40	18.28	3.21	2.28	1.55	5.19
Feb	6.45	3.54	0.23	13.42	4.35	2.17	1.42	7.22
Mar	8.24	0.99	0.00	21.24	4.67	1.99	1.26	9.32
Apr	4.99	0.80	0.00	14.05	3.85	1.94	0.87	6.35
May	3.65	0.00	0.00	12.94	3.30	1.69	0.60	7.09
Jun	24.76	5.47	0.00	67.73	12.41	7.17	1.60	29.63
Jul	51.60	28.00	8.66	114.40	20.03	15.63	6.75	36.63
Aug	49.40	38.30	14.76	94.12	20.83	17.40	9.18	35.89
Sep	51.39	32.70	7.33	118.10	21.33	16.58	8.26	38.90

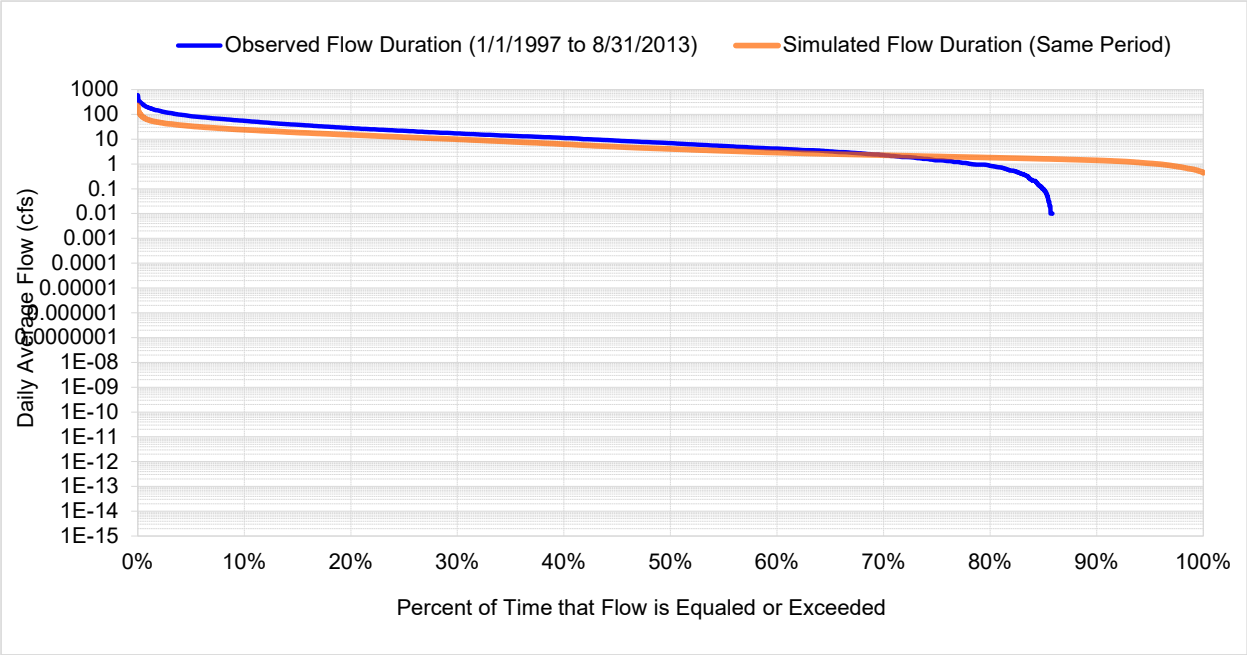

Figure A-87. Flow exceedance: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

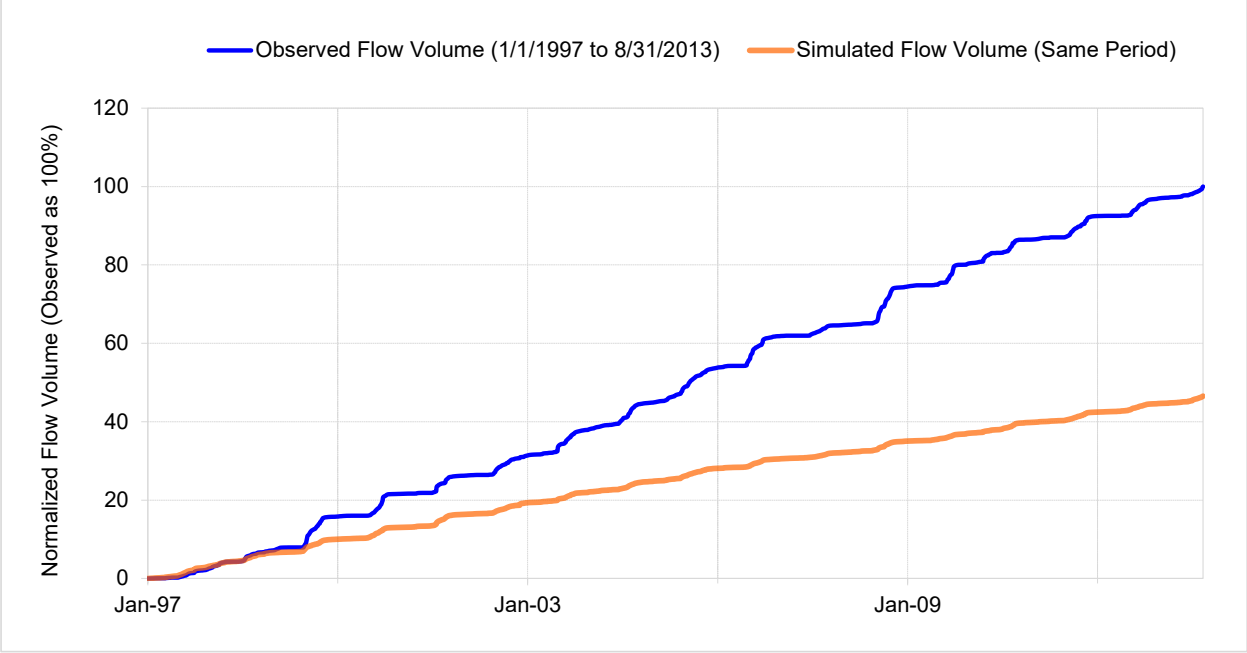

Figure A-88. Flow accumulation: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

Table A-31. Summary statistics: Model output at Reach 102 versus USGS 02293240 Aries Canal at Cape Coral, FL (01/01/1997 – 08/31/2013)

Aries Canal at Cape Coral, FL (ID - USGS 02293240)
Drainage Area (sq-mi): 3.46
Analysis Period: 1/1/1997 to 8/31/2013

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	79.81	37.13	-53.47	10
Total lowest 50% flows	4.04	4.15	2.77	10
Total highest 10% flows	42.96	15.70	-63.46	15
Summer flow volume (months 7-9)	50.25	20.49	-59.22	30
Fall flow volume (months 10-12)	11.15	6.14	-44.88	30
Winter flow volume (months 1-3)	7.39	4.02	-45.56	30
Spring flow volume (months 4-6)	11.03	6.47	-41.31	30
Total storm volume	19.87	10.69	-46.18	20
Summer storm volume (7-9)	12.59	5.31	-57.84	50
Baseflow	59.95	26.44	-55.89	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.268	0.7
Baseline adjusted coefficient (Garrick), E'			0.376	0.5
Monthly NSE			0.263	0.8

USGS 02293241 San Carlos Canal at Cape Coral

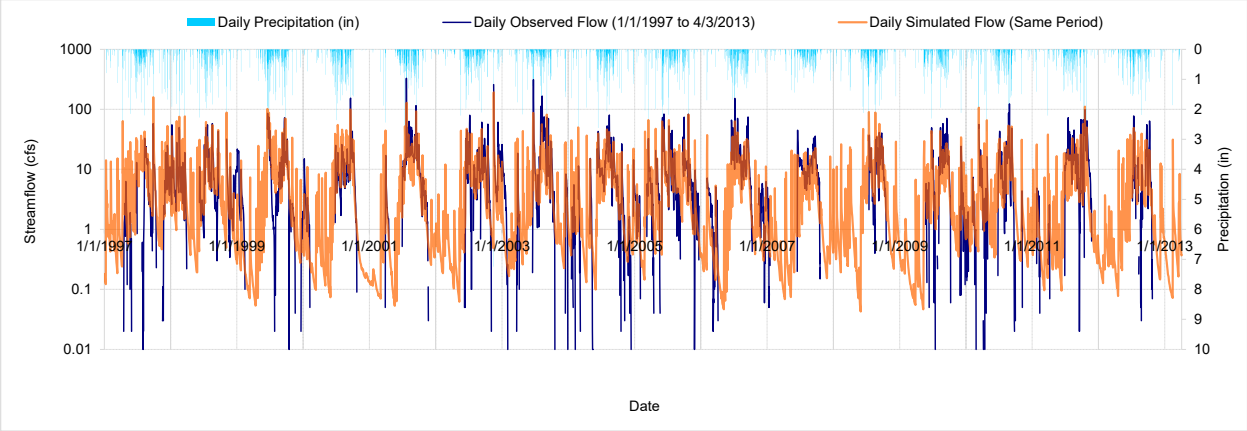

Figure A-89. Mean daily flow: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

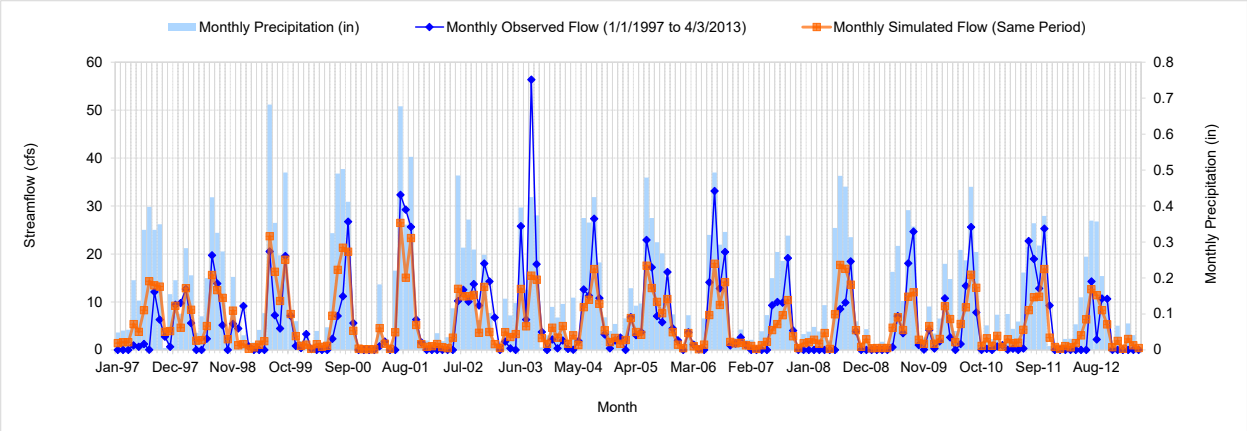

Figure A-90. Mean monthly flow: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

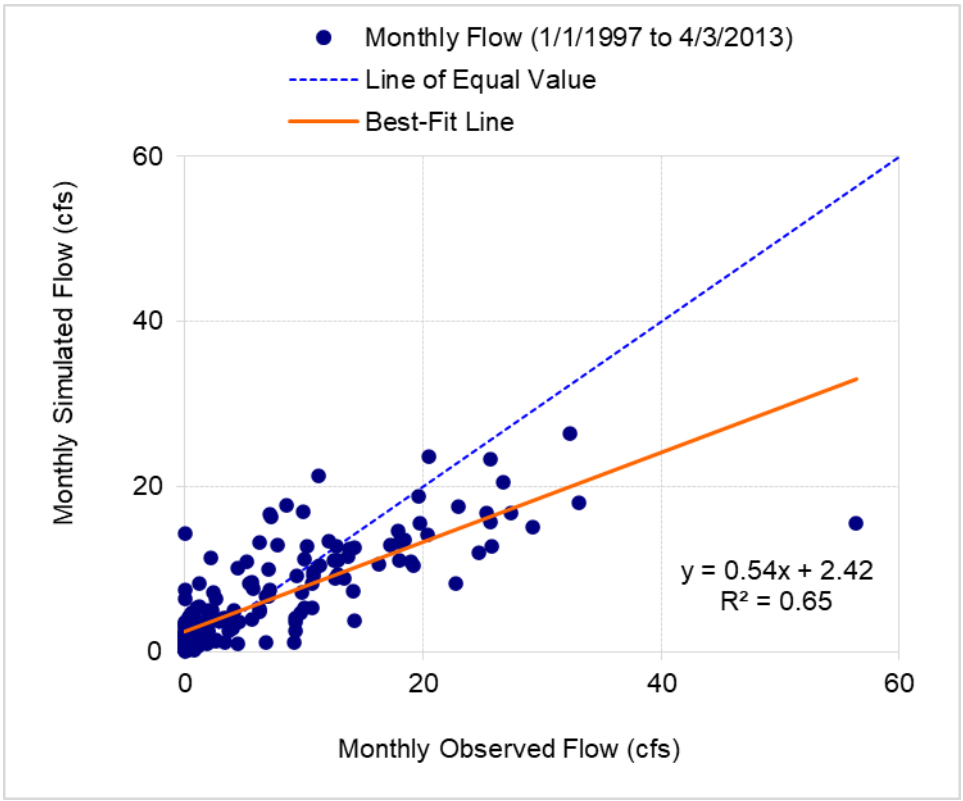

Figure A-91. Monthly flow regression and temporal variation: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

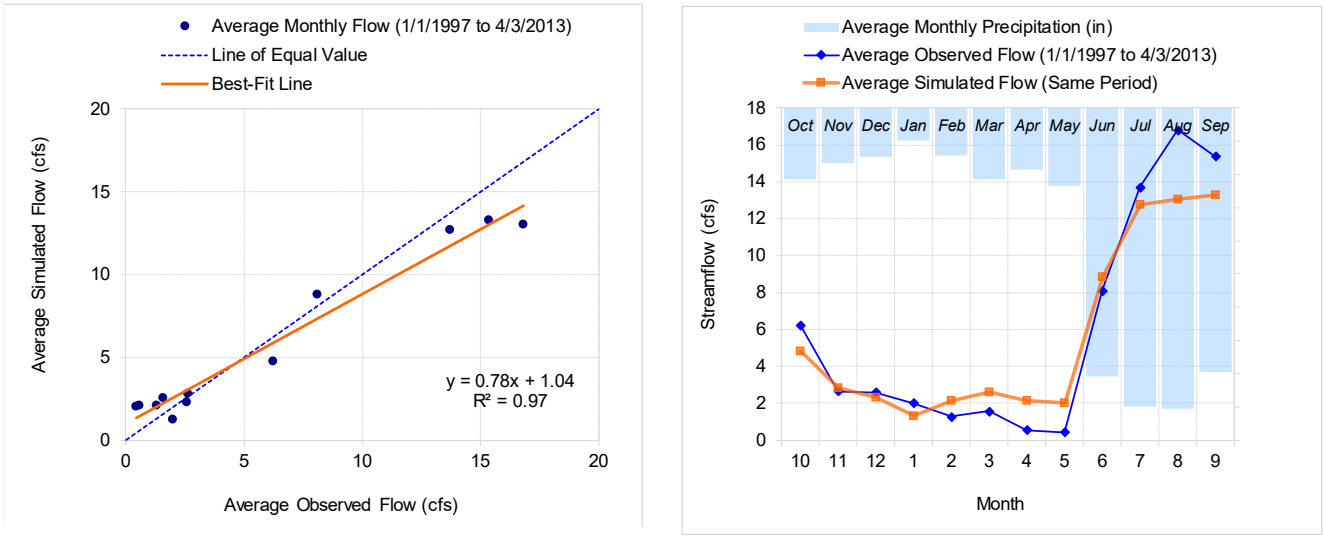

Figure A-92. Seasonal regression and temporal aggregate: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

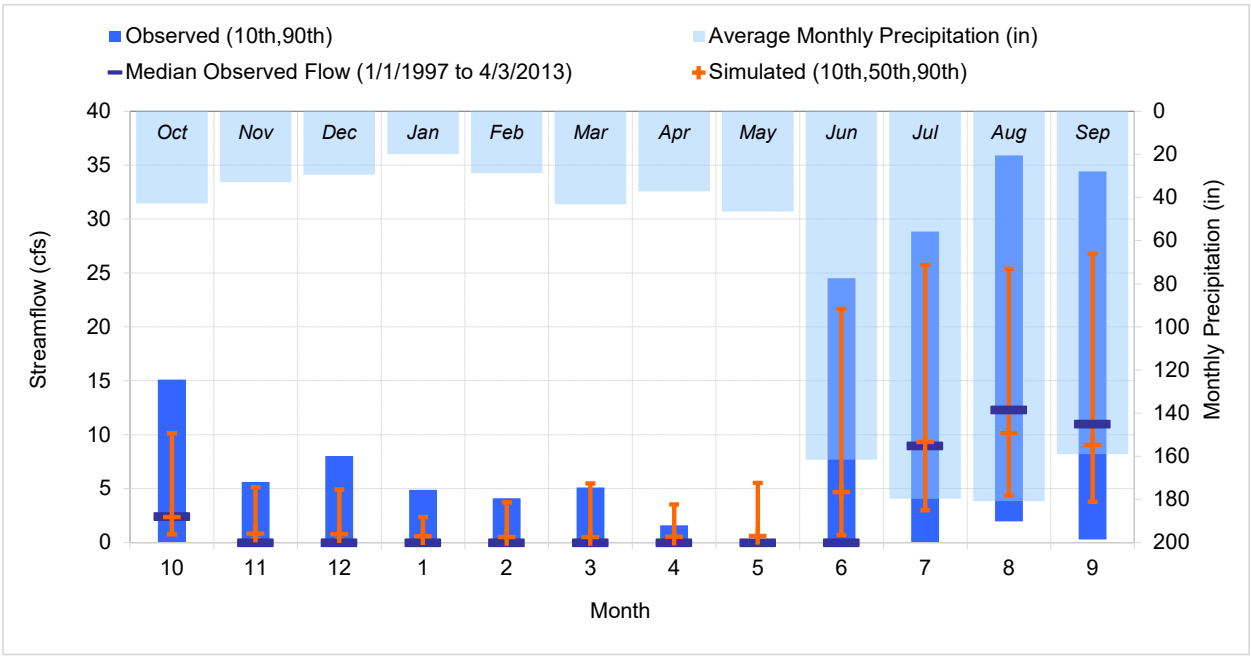

Figure A-93. Seasonal medians and ranges: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

Table A-32. Seasonal summary: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	6.25	2.43	0.00	15.10	4.83	2.36	0.76	10.13
Nov	2.64	0.00	0.00	5.61	2.84	0.84	0.29	5.13
Dec	2.59	0.00	0.00	8.02	2.33	0.78	0.28	4.92
Jan	2.00	0.00	0.00	4.88	1.31	0.58	0.17	2.37
Feb	1.29	0.00	0.00	4.10	2.16	0.52	0.14	3.72
Mar	1.59	0.00	0.00	5.11	2.58	0.52	0.11	5.47
Apr	0.56	0.00	0.00	1.60	2.15	0.53	0.10	3.54
May	0.42	0.00	0.00	0.15	2.04	0.60	0.08	5.54
Jun	8.12	0.00	0.00	24.50	8.84	4.68	0.71	21.68
Jul	13.71	8.98	0.00	28.85	12.75	9.33	2.99	25.73
Aug	16.82	12.30	1.95	35.90	13.06	10.15	4.36	25.37
Sep	15.36	11.00	0.29	34.41	13.30	9.06	3.78	26.79

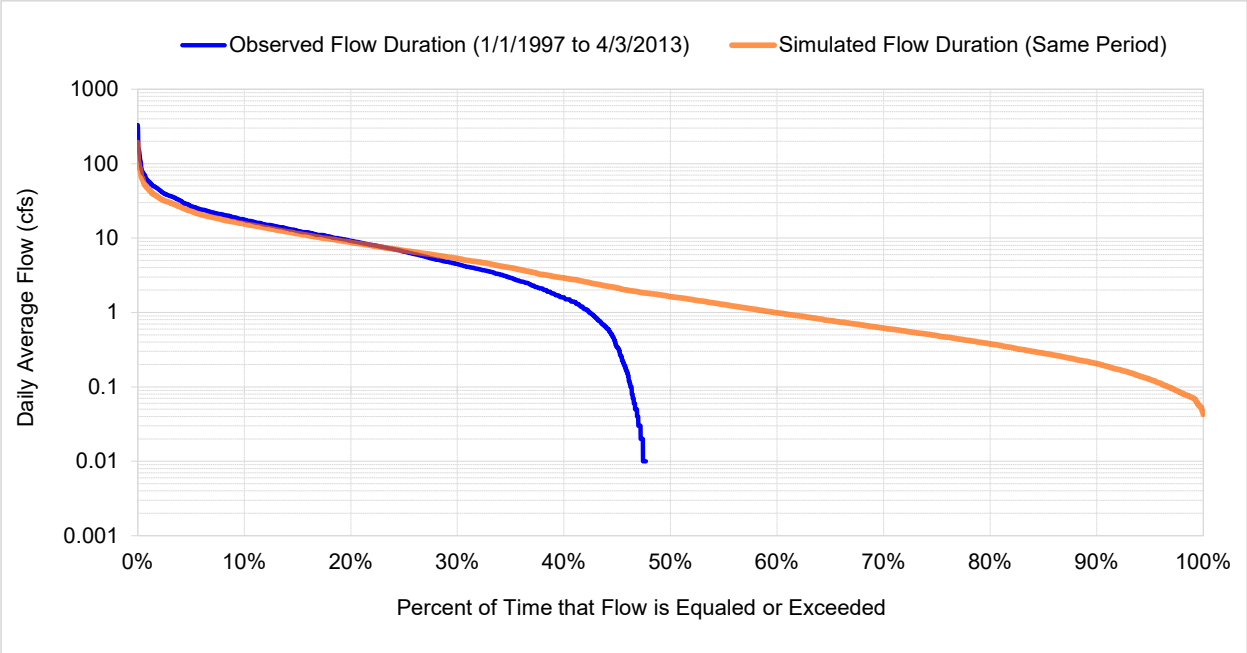

Figure A-94. Flow exceedance: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

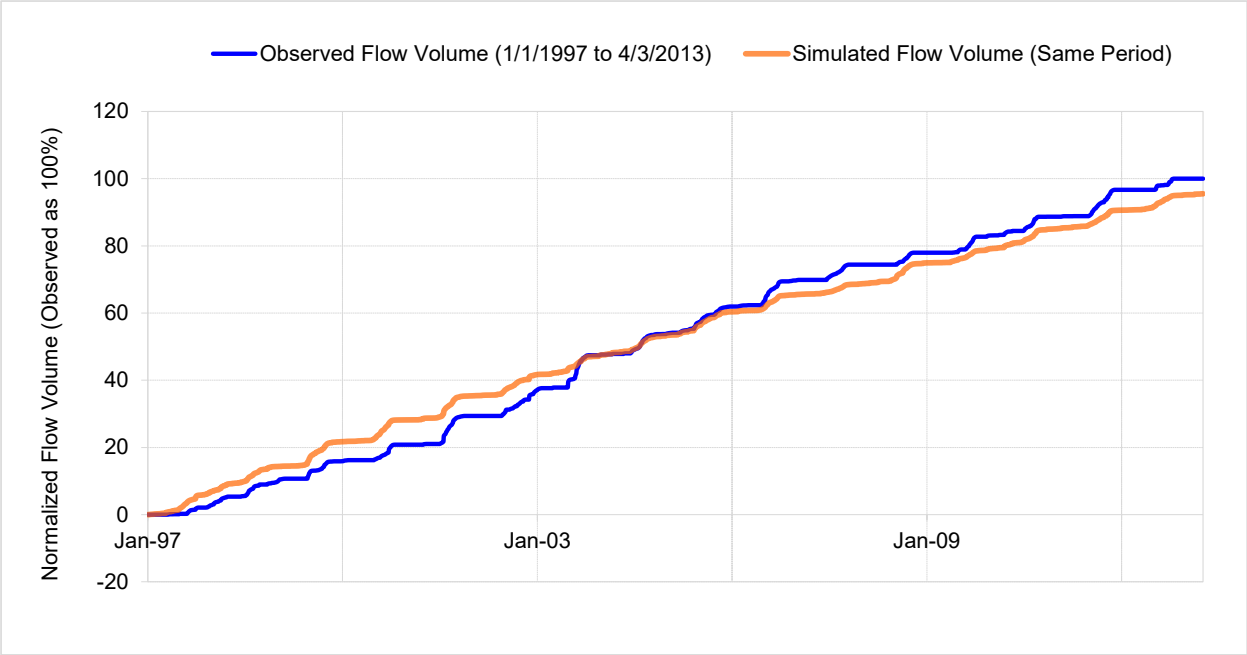

Figure A-95. Flow accumulation: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

Table A-33. Summary statistics: Model output at Reach 107 versus USGS 02293241 San Carlos Canal at Cape Coral (01/01/1997 – 04/03/2013)

San Carlos Canal at Cape Coral, FL (ID - USGS 02293241)
Drainage Area (sq-mi): 2.28
Analysis Period: 1/1/1997 to 4/3/2013

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	35.19	33.60	-4.50	10
Total lowest 50% flows	0.00	1.78	inf	10
Total highest 10% flows	21.50	17.06	-20.67	15
Summer flow volume (months 7-9)	22.60	19.25	-14.80	30
Fall flow volume (months 10-12)	5.67	4.93	-13.04	30
Winter flow volume (months 1-3)	2.52	3.10	23.18	30
Spring flow volume (months 4-6)	4.40	6.32	43.60	30
Total storm volume	11.78	13.77	16.88	20
Summer storm volume (7-9)	7.23	6.83	-5.56	50
Baseflow	23.41	19.83	-15.26	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.436	0.7
Baseline adjusted coefficient (Garrick), E'			0.400	0.5
Monthly NSE			0.627	0.8

USGS 02293243 Courtney Canal at Cape Coral

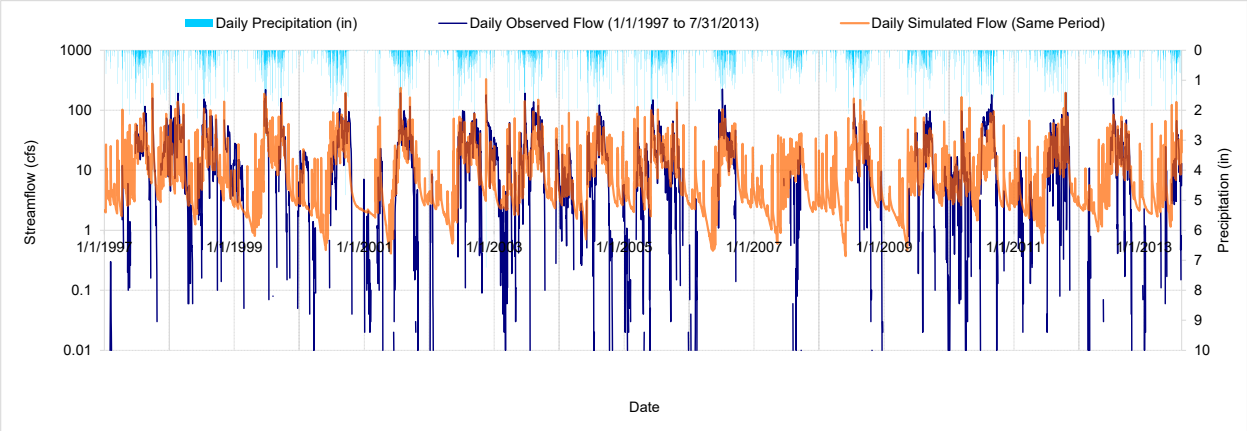

Figure A-96. Mean daily flow: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

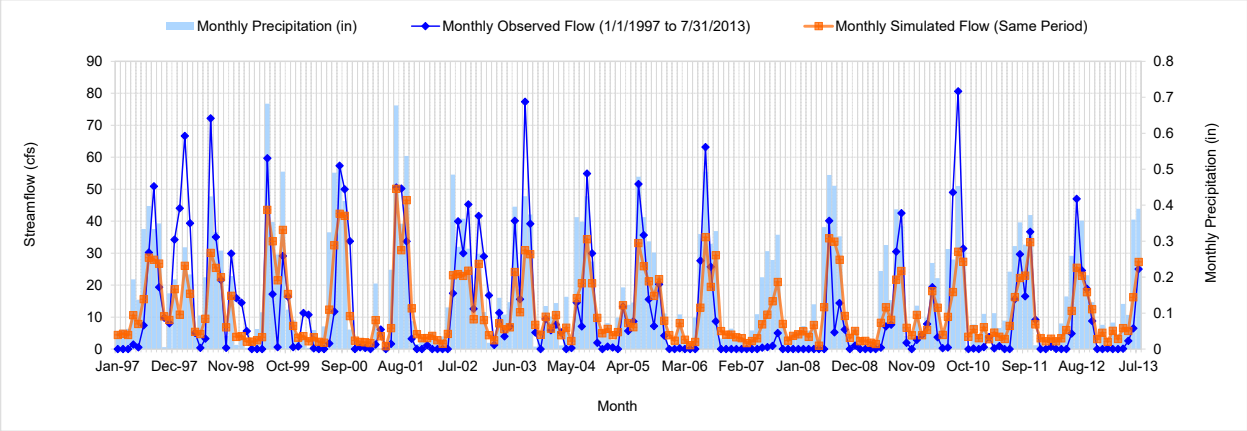

Figure A-97. Mean monthly flow: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

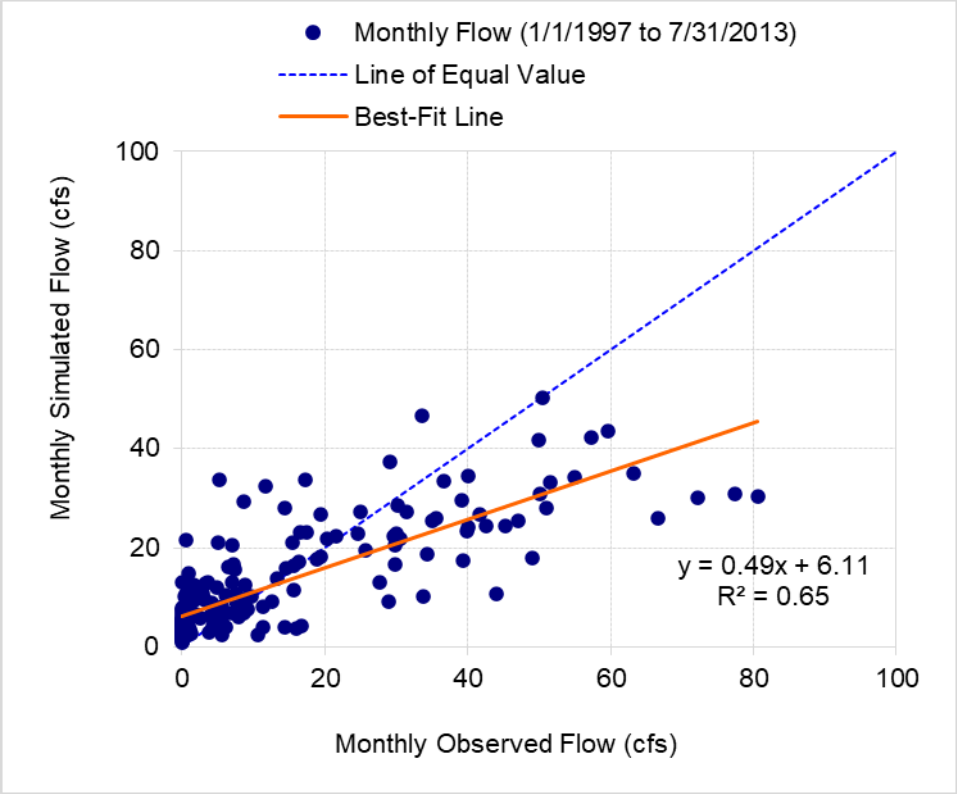

Figure A-98. Monthly flow regression and temporal variation: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

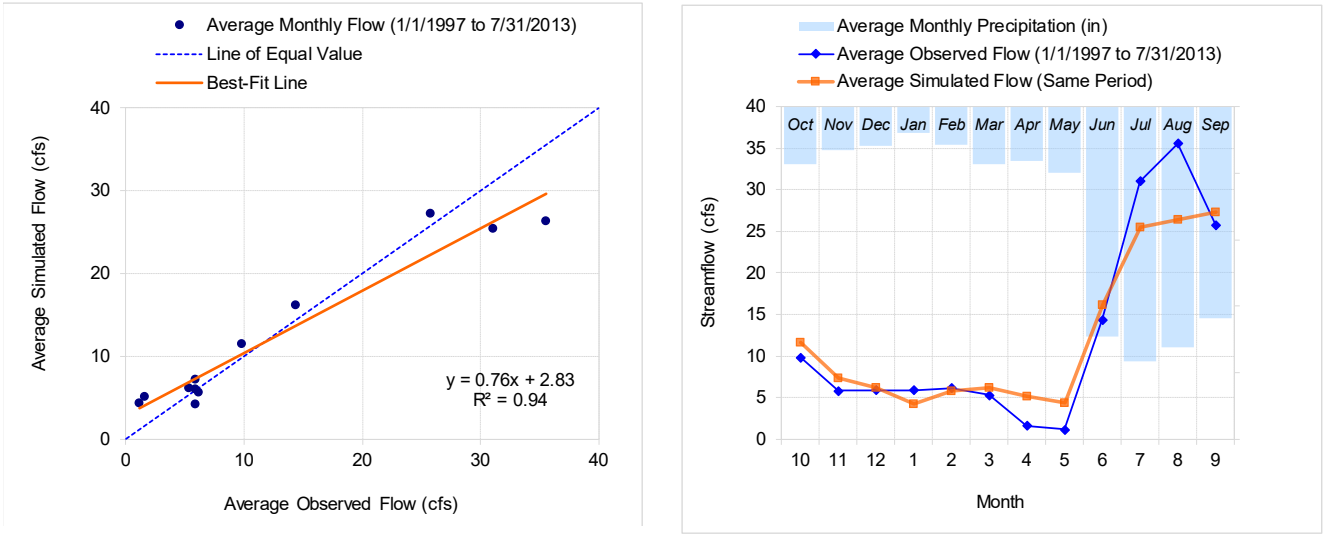

Figure A-99. Seasonal regression and temporal aggregate: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

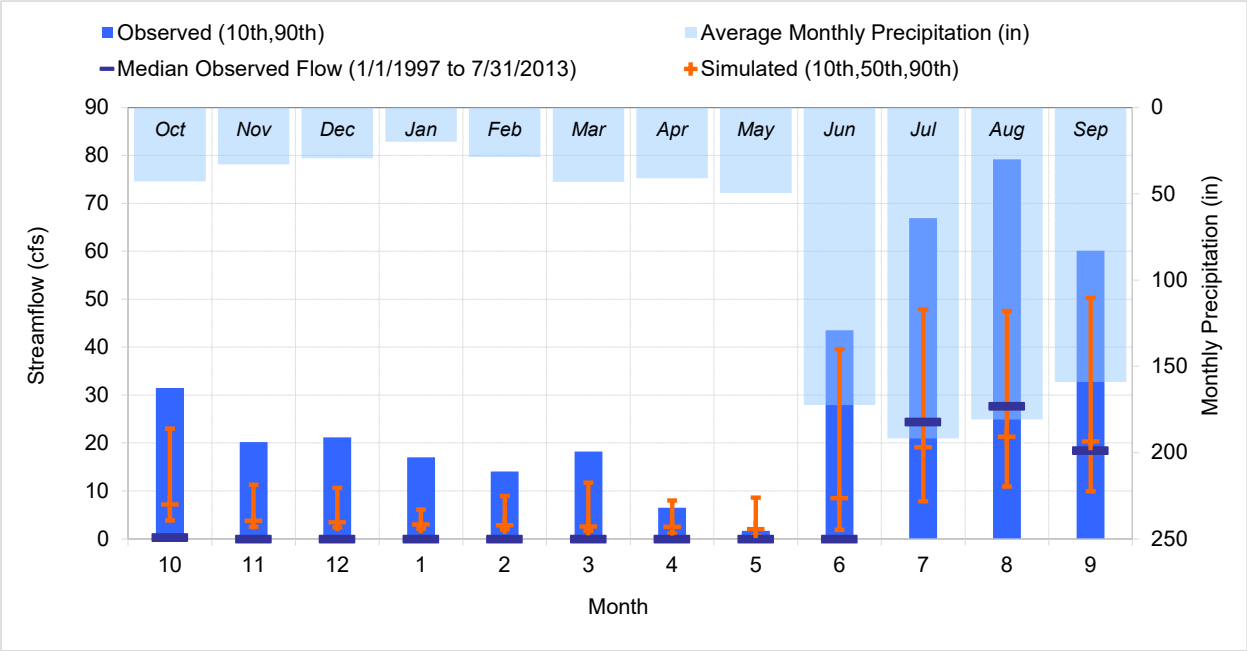

Figure A-100. Seasonal medians and ranges: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

Table A-34. Seasonal summary: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	9.82	0.33	0.00	31.50	11.61	7.18	3.84	22.99
Nov	5.86	0.00	0.00	20.19	7.31	3.81	2.54	11.31
Dec	5.92	0.00	0.00	21.20	6.15	3.46	2.38	10.61
Jan	5.86	0.00	0.00	17.04	4.29	3.04	2.16	6.16
Feb	6.14	0.00	0.00	14.04	5.75	2.87	1.99	8.92
Mar	5.32	0.00	0.00	18.20	6.17	2.61	1.71	11.72
Apr	1.59	0.00	0.00	6.48	5.13	2.54	1.08	8.01
May	1.19	0.00	0.00	1.68	4.35	2.04	0.61	8.61
Jun	14.38	0.00	0.00	43.55	16.23	8.51	1.87	39.63
Jul	31.07	24.40	0.00	66.94	25.46	19.10	7.86	47.89
Aug	35.57	27.70	0.00	79.20	26.43	21.31	10.93	47.53
Sep	25.79	18.45	0.00	60.10	27.30	20.32	9.92	50.31

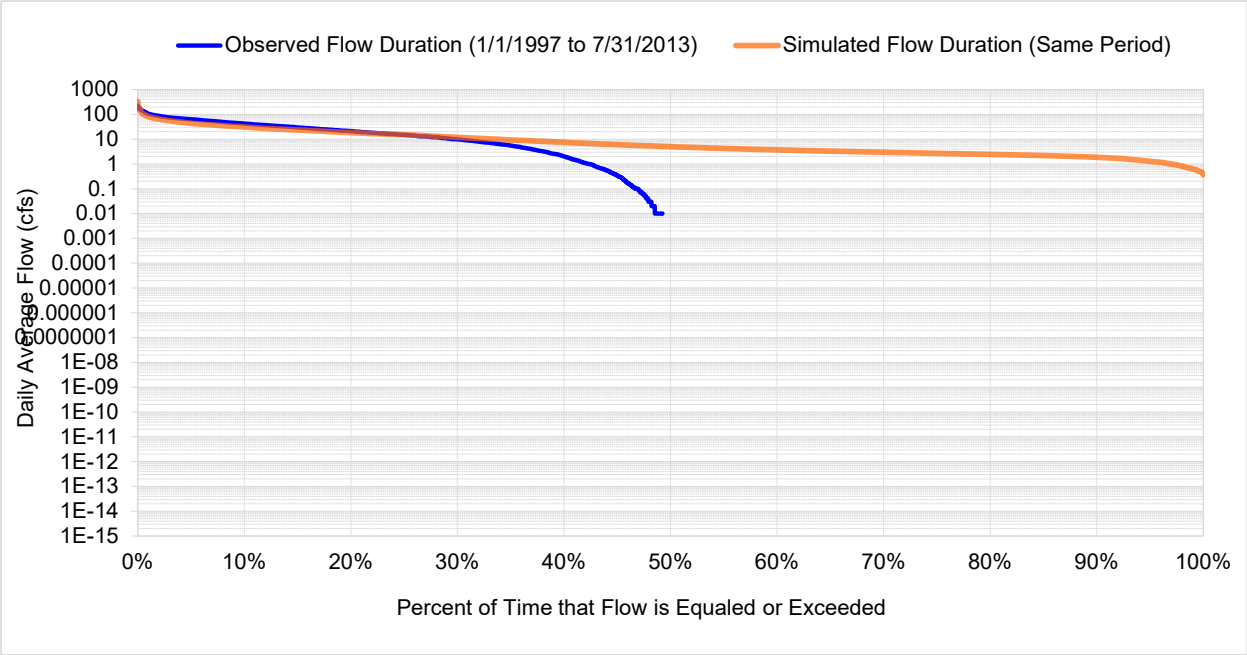

Figure A-101. Flow exceedance: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

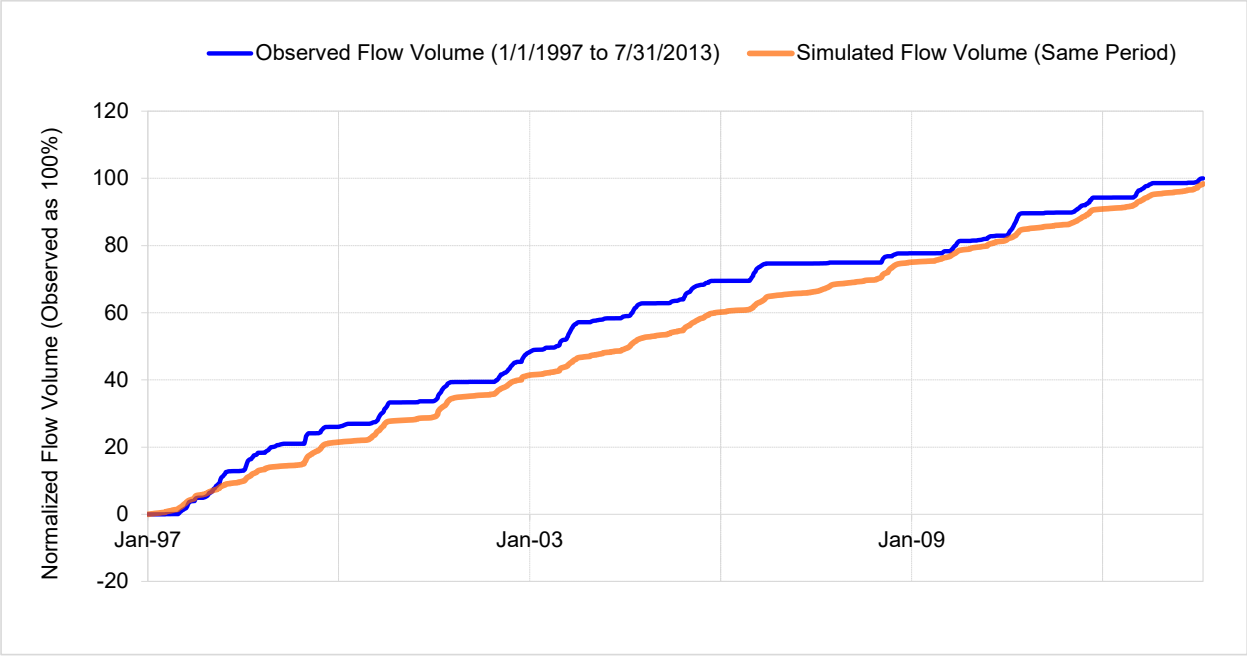

Figure A-102. Flow accumulation: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

Table A-35. Summary statistics: Model output at Reach 105 versus USGS 02293243 Courtney Canal at Cape Coral (01/01/1997 – 07/31/2013)

Courtney Canal at Cape Coral, FL (ID - USGS 02293243)
Drainage Area (sq-mi): 4.42
Analysis Period: 1/1/1997 to 7/31/2013

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	37.88	37.26	-1.63	10
Total lowest 50% flows	0.00	4.20	inf	10
Total highest 10% flows	22.01	16.41	-25.46	15
Summer flow volume (months 7-9)	23.55	20.11	-14.58	30
Fall flow volume (months 10-12)	5.39	6.25	15.97	30
Winter flow volume (months 1-3)	4.49	4.20	-6.40	30
Spring flow volume (months 4-6)	4.45	6.69	50.36	30
Total storm volume	9.43	12.25	29.93	20
Summer storm volume (7-9)	5.46	6.08	11.29	50
Baseflow	28.45	25.01	-12.09	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.364	0.7
Baseline adjusted coefficient (Garrick), E'			0.346	0.5
Monthly NSE			0.611	0.8

USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL

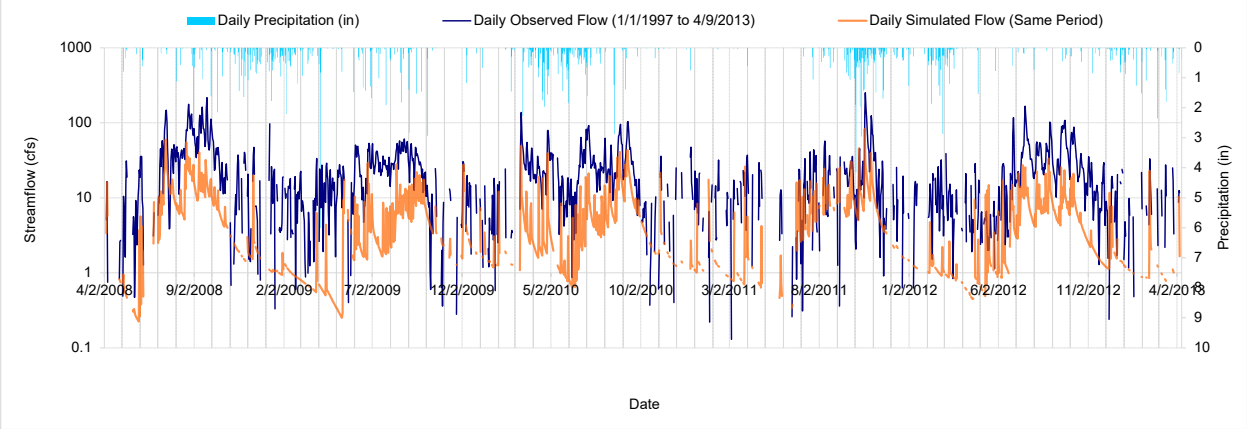

Figure A-103. Mean daily flow: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

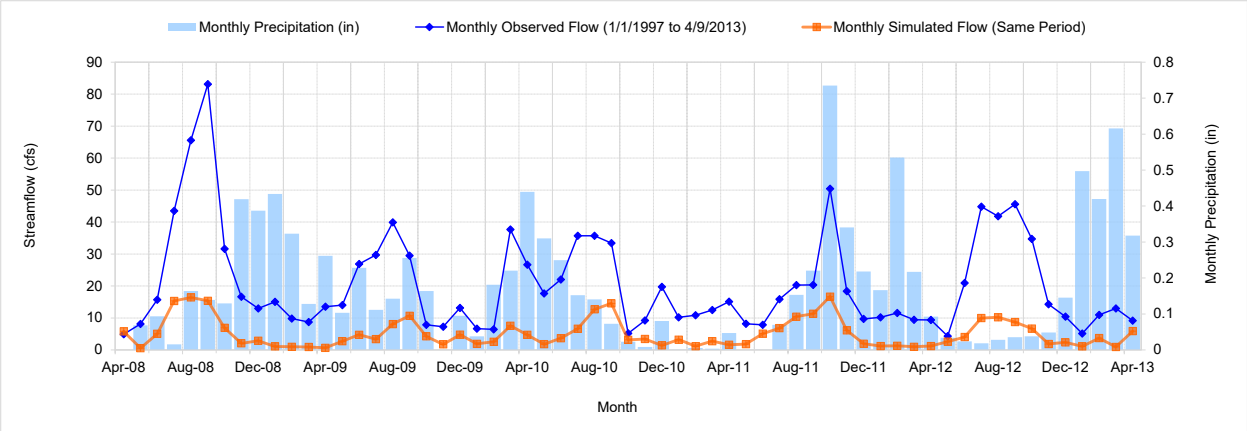

Figure A-104. Mean monthly flow: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

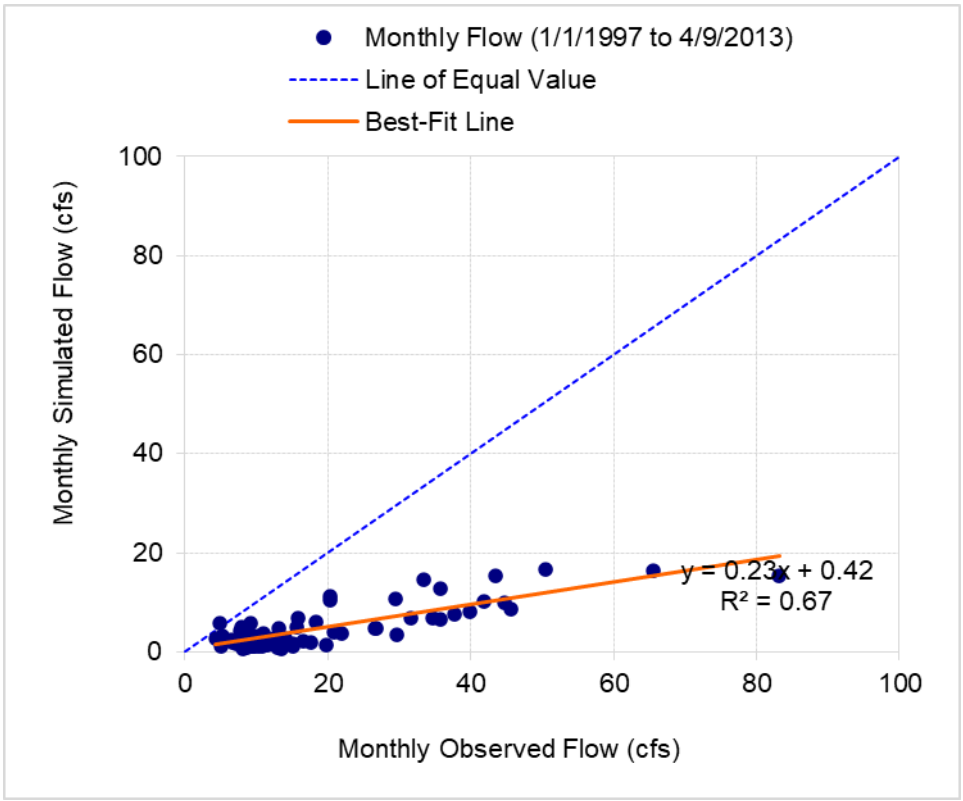

Figure A-105. Monthly flow regression and temporal variation: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

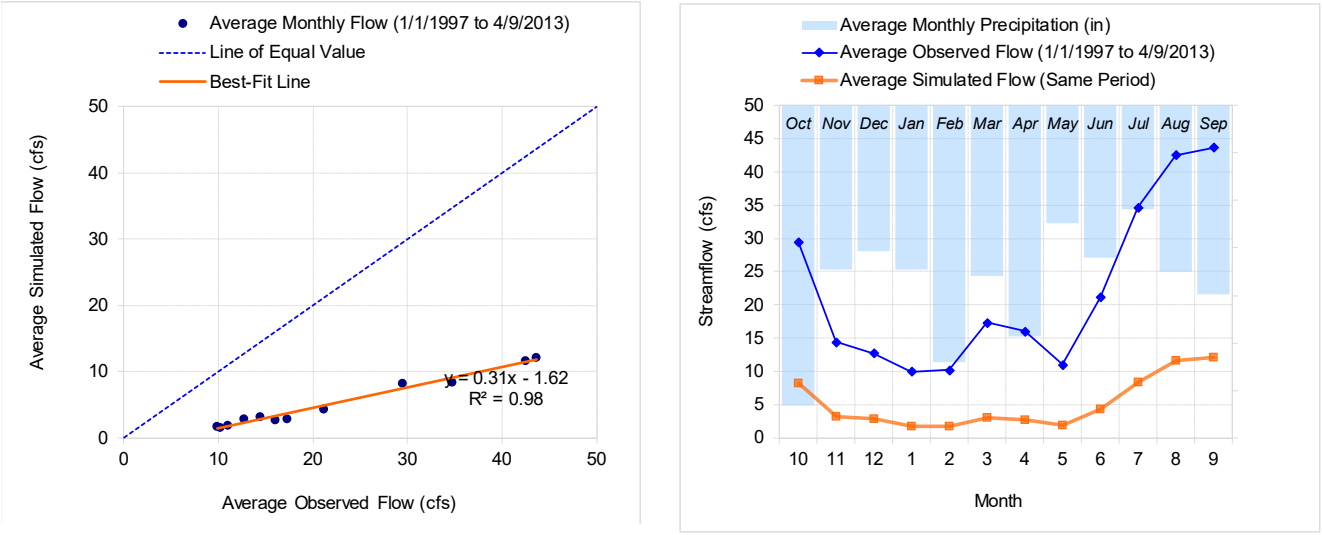

Figure A-97. Seasonal regression and temporal aggregate: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

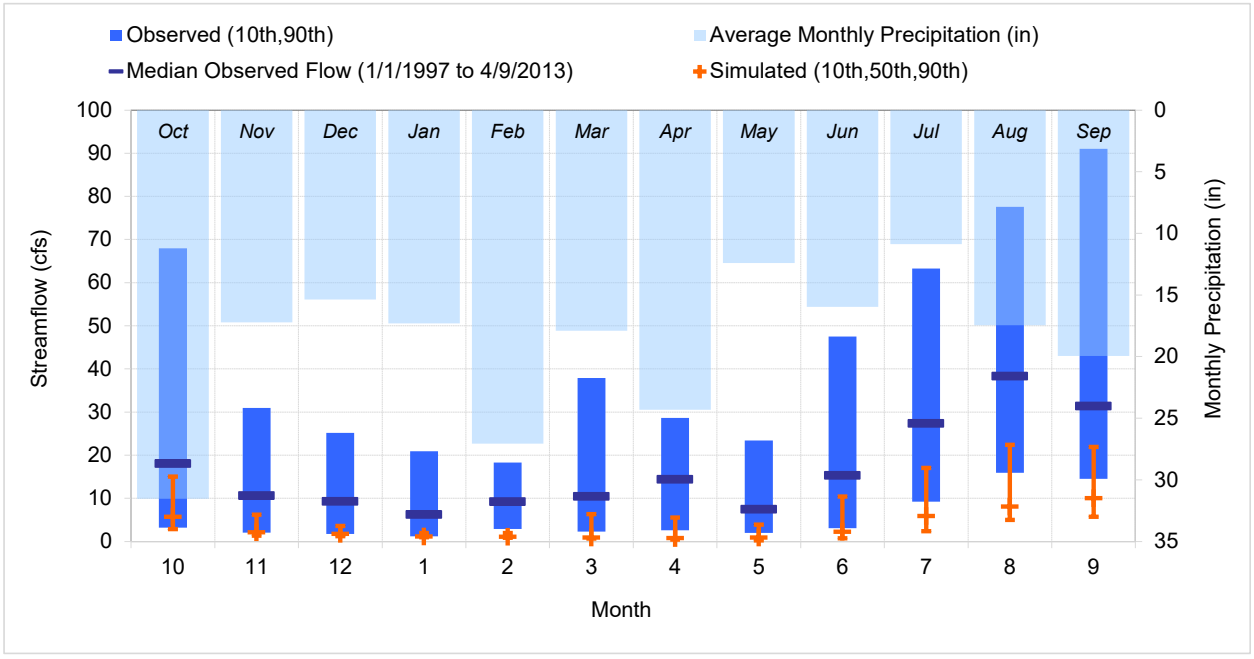

Figure A-98. Seasonal medians and ranges: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

Table A-36. Seasonal summary: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	29.52	18.10	3.22	67.96	8.28	5.73	2.86	15.01
Nov	14.43	10.70	2.03	30.98	3.23	2.12	1.34	6.21
Dec	12.71	9.36	1.76	25.18	2.83	1.77	1.21	3.61
Jan	9.93	6.28	1.18	20.90	1.74	1.18	0.99	1.94
Feb	10.18	9.29	2.90	18.31	1.66	1.12	0.87	1.94
Mar	17.32	10.50	2.29	37.87	2.96	0.91	0.67	6.36
Apr	16.02	14.45	2.60	28.67	2.69	0.83	0.46	5.56
May	10.99	7.50	2.00	23.41	1.92	0.89	0.28	3.88
Jun	21.14	15.40	3.06	47.48	4.35	2.25	0.71	10.43
Jul	34.72	27.40	9.24	63.28	8.45	5.91	2.39	17.07
Aug	42.52	38.35	15.91	77.57	11.66	8.11	4.97	22.42
Sep	43.64	31.45	14.55	91.04	12.18	10.04	5.75	21.93

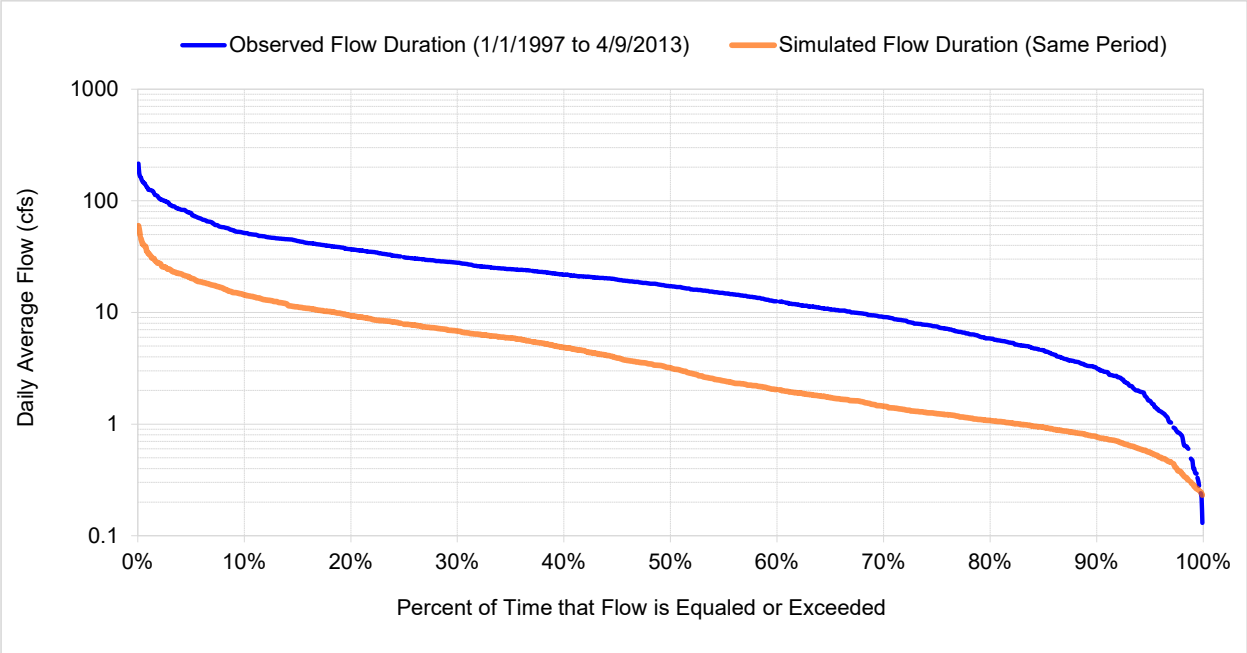

Figure A-99. Flow exceedance: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

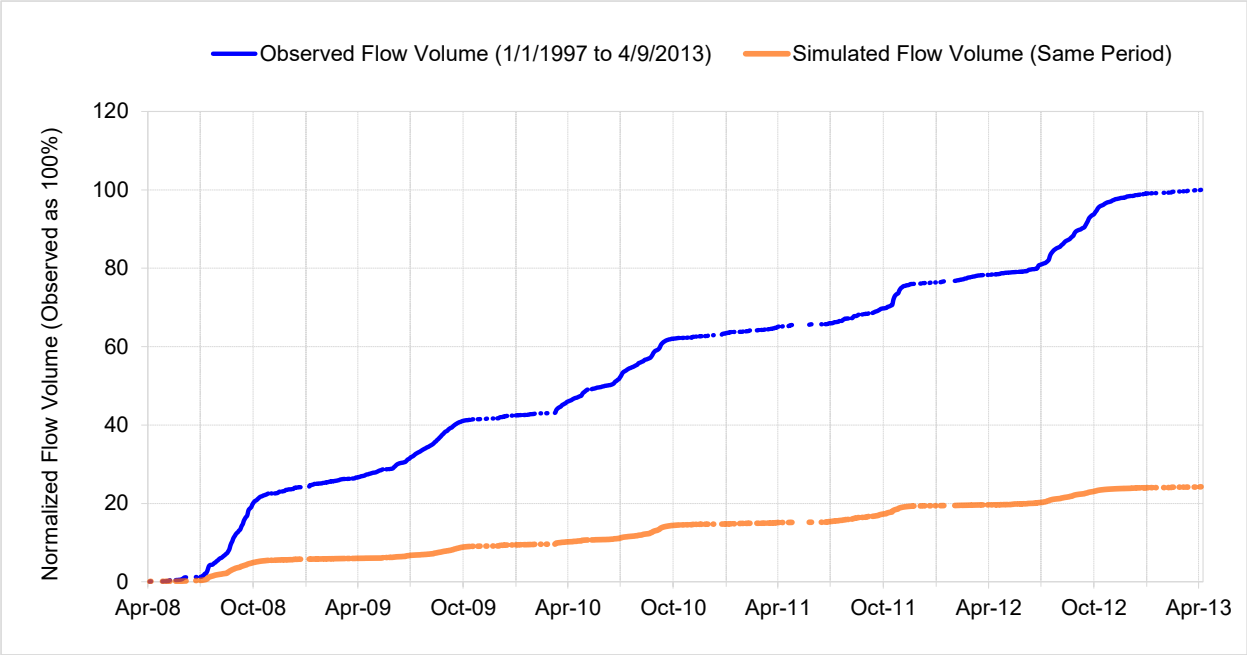

Figure A-100. Flow accumulation: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

Table A-37. Summary statistics: Model output at Reach 111 versus USGS 264006081534400 Hancock Creek at Pondella Road, North Fort Myers, FL (04/01/2008 – 04/11/2013)

Hancock Creek at Pondella Road, North Fort Myers, FL (ID - USGS 264006081534400)
Drainage Area (sq-mi): 6.64
Analysis Period: 1/1/1997 to 4/9/2013

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	35.39	8.59	-75.73	10
Total lowest 50% flows	5.66	1.00	-82.32	10
Total highest 10% flows	12.40	3.35	-72.98	15
Summer flow volume (months 7-9)	19.35	5.16	-73.31	30
Fall flow volume (months 10-12)	6.87	1.78	-74.14	30
Winter flow volume (months 1-3)	3.60	0.61	-82.98	30
Spring flow volume (months 4-6)	5.57	1.04	-81.37	30
Total storm volume	11.23	2.75	-75.52	20
Summer storm volume (7-9)	4.77	1.48	-68.99	50
Baseflow	24.16	5.84	-75.82	20
Nash-Sutcliffe Coefficient of Efficiency, E			-0.210	0.7
Baseline adjusted coefficient (Garrick), E'			-0.074	0.5
Monthly NSE			-0.146	0.8

USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL

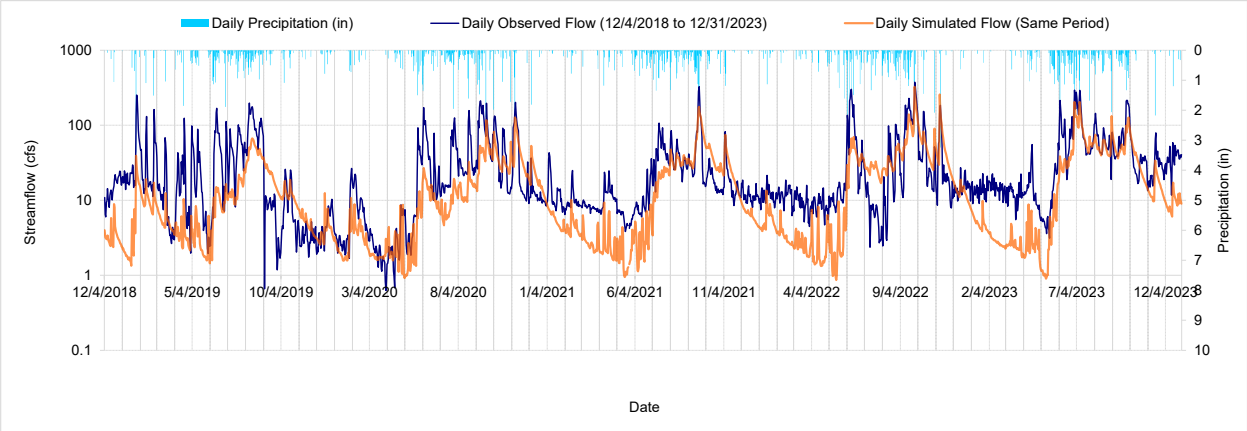

Figure A-101. Mean daily flow: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

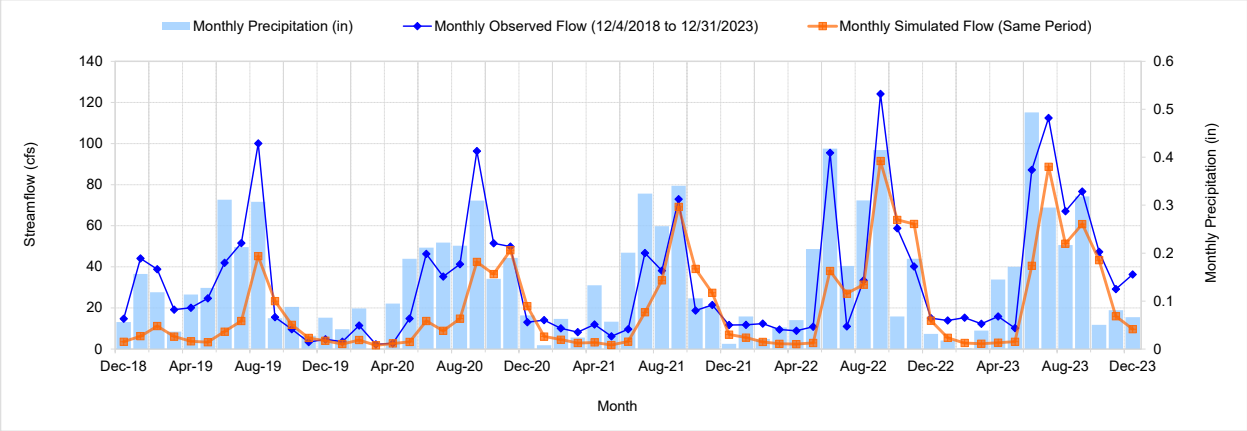

Figure A-102. Mean monthly flow: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

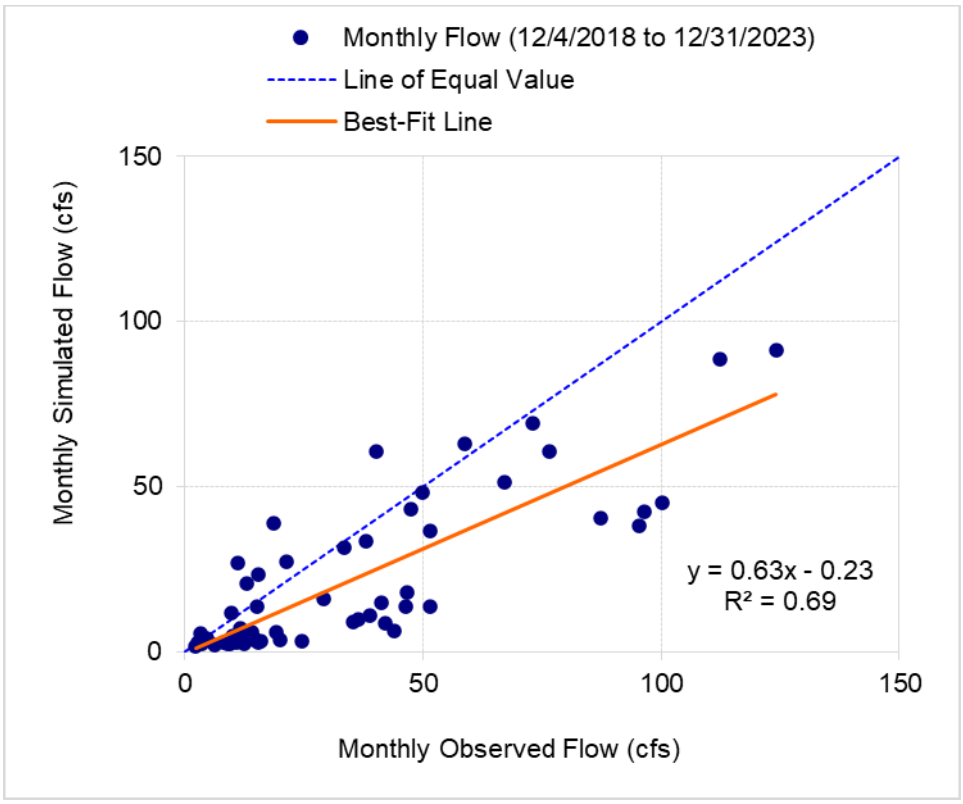

Figure A-103. Monthly flow regression and temporal variation: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

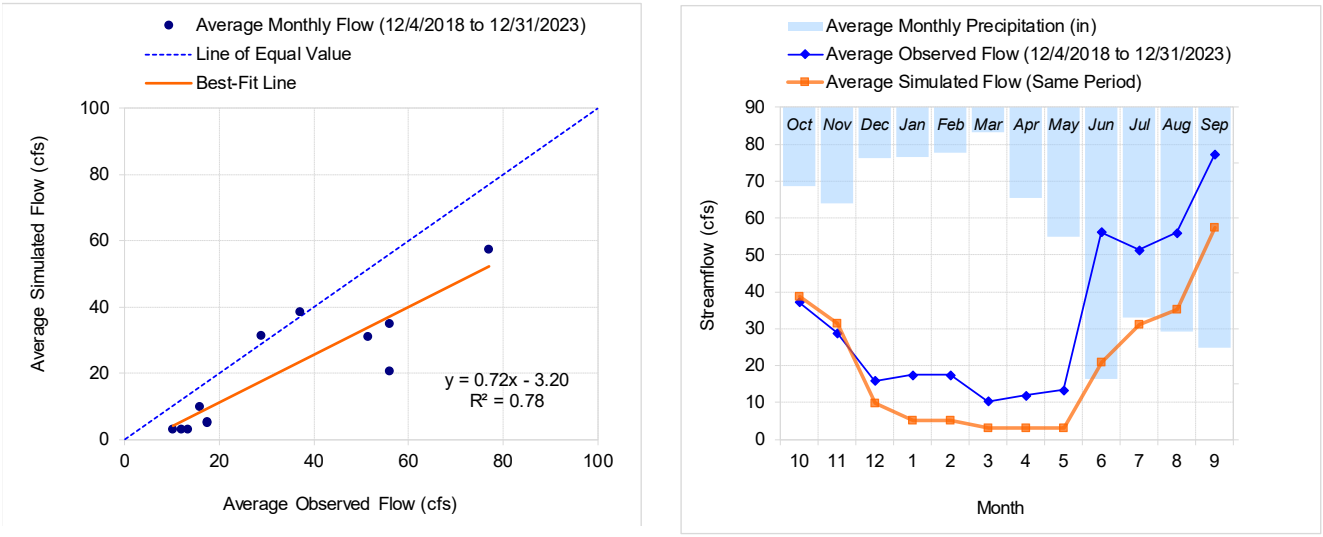

Figure A-104. Seasonal regression and temporal aggregate: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

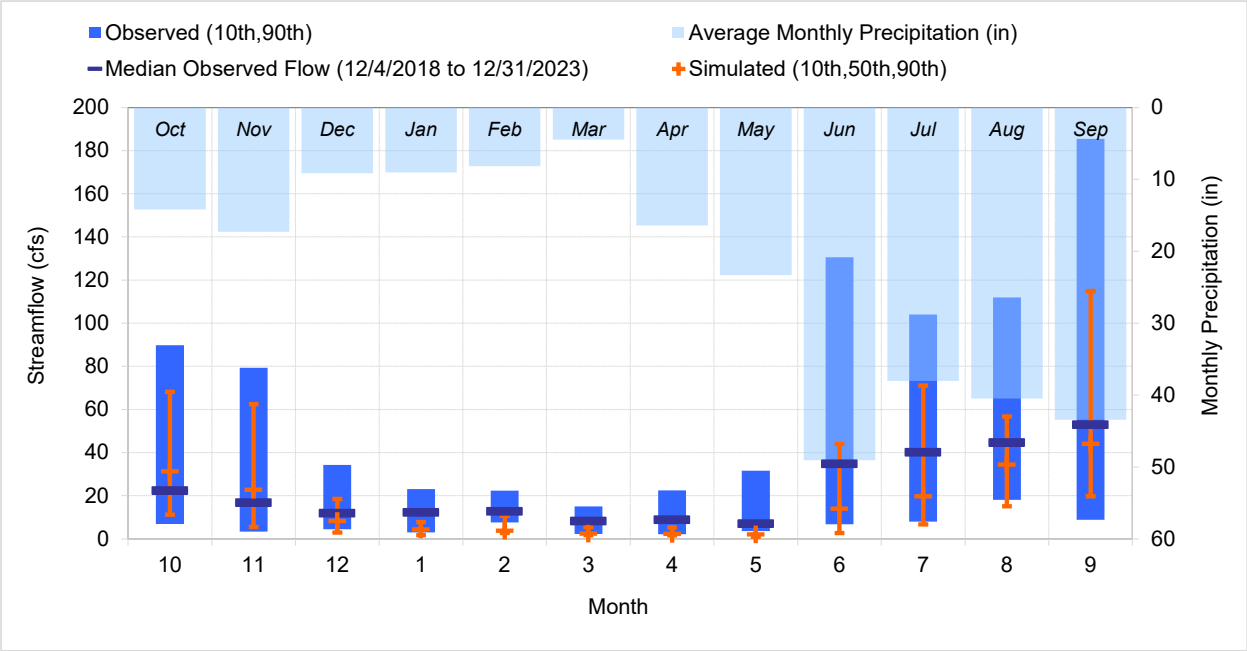

Figure A-105. Seasonal medians and ranges: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

Table A-38. Seasonal summary: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	37.18	22.50	6.89	89.84	38.70	31.34	11.23	68.22
Nov	28.82	16.90	3.36	79.32	31.53	22.83	5.44	62.47
Dec	15.93	12.00	4.44	34.30	9.94	8.29	2.96	18.46
Jan	17.47	12.40	2.99	23.06	5.18	4.36	1.76	7.84
Feb	17.56	12.90	7.58	22.30	5.31	3.84	2.65	10.74
Mar	10.30	8.33	2.24	15.10	3.21	2.47	1.77	5.43
Apr	11.93	8.96	2.15	22.51	3.03	2.29	1.53	5.22
May	13.38	7.12	3.55	31.66	3.08	2.12	1.00	6.43
Jun	56.12	34.90	6.76	130.60	20.88	14.01	2.64	43.96
Jul	51.40	40.20	7.96	104.00	31.23	19.70	6.76	71.13
Aug	56.01	44.70	18.12	112.00	35.21	34.49	15.12	56.72
Sep	77.11	53.00	8.81	185.50	57.43	44.04	19.75	114.95

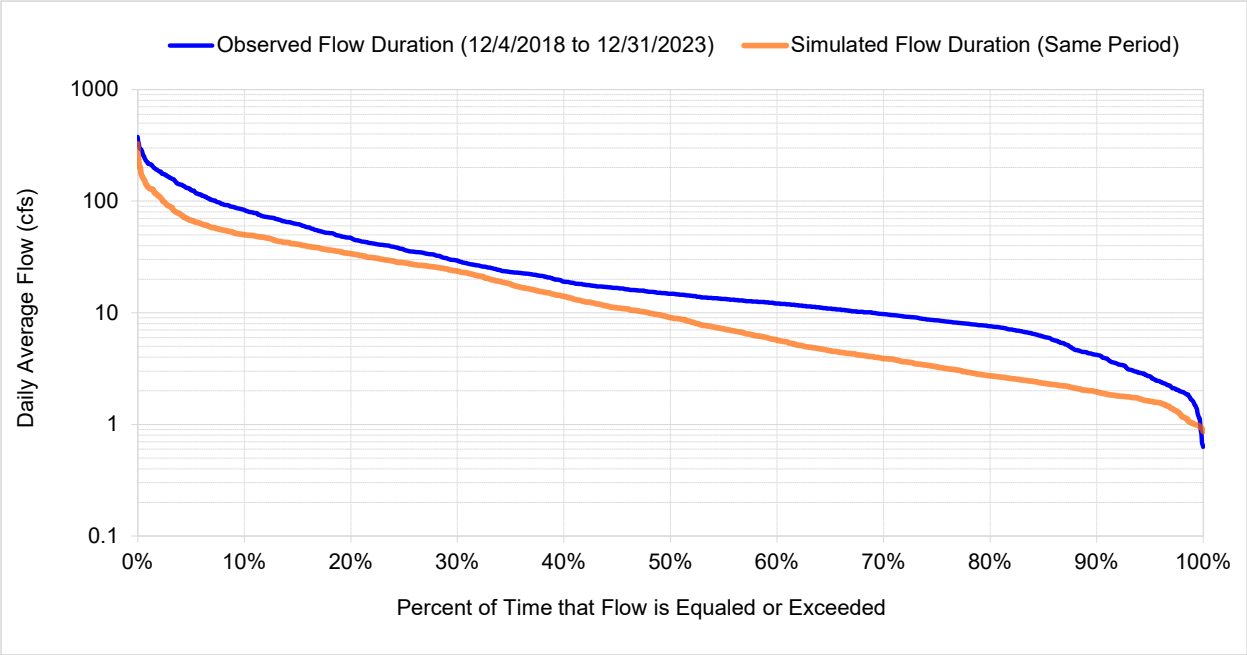

Figure A-106. Flow exceedance: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

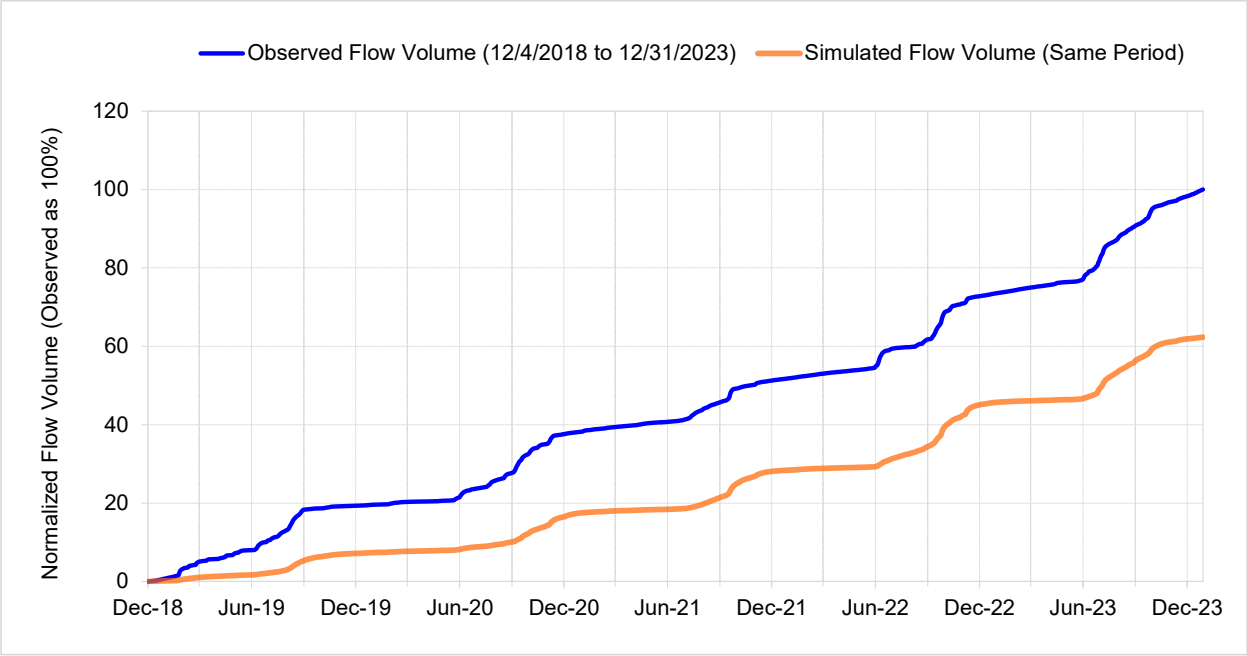

Figure A-107. Flow accumulation: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

Table A-39. Summary statistics: Model output at Reach 186 versus USGS 02292490 Goodno Canal Below S-78 Near Labelle, FL (12/04/2018 – 12/31/2023)

Goodno Canal below S-78 near Labelle Fl (ID - USGS 02292490)
Drainage Area (sq-mi): 25.98175458125
Analysis Period: 12/4/2018 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	17.00	10.60	-37.66	10
Total lowest 50% flows	2.17	0.99	-54.12	10
Total highest 10% flows	7.51	4.40	-41.32	15
Summer flow volume (months 7-9)	7.96	5.34	-32.97	30
Fall flow volume (months 10-12)	3.67	3.54	-3.49	30
Winter flow volume (months 1-3)	1.91	0.58	-69.80	30
Spring flow volume (months 4-6)	3.46	1.15	-66.90	30
Total storm volume	3.99	1.39	-65.03	20
Summer storm volume (7-9)	1.71	0.64	-62.70	50
Baseflow	13.02	9.20	-29.28	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.486	0.7
Baseline adjusted coefficient (Garrick), E'			0.378	0.5
Monthly NSE			0.512	0.8

USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL

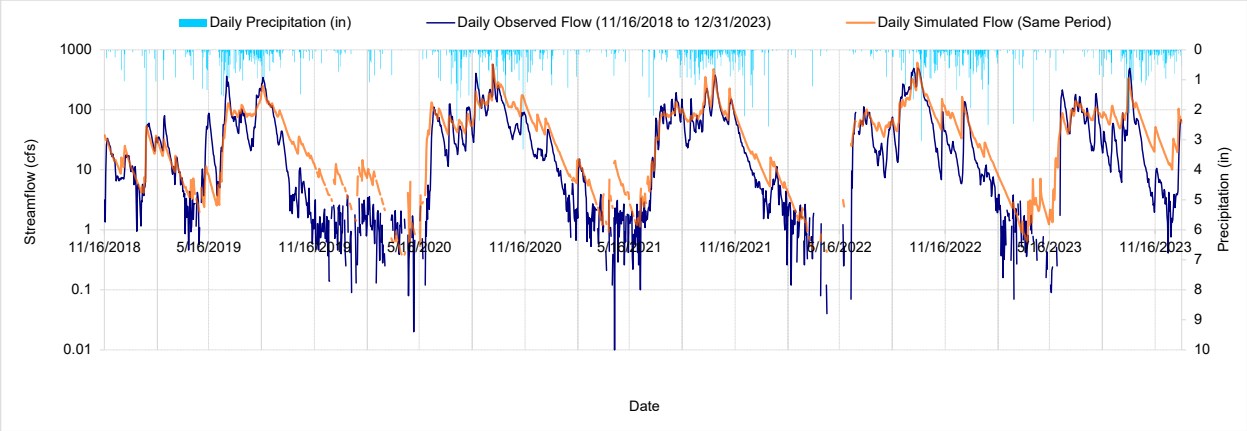

Figure A-108. Mean daily flow: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

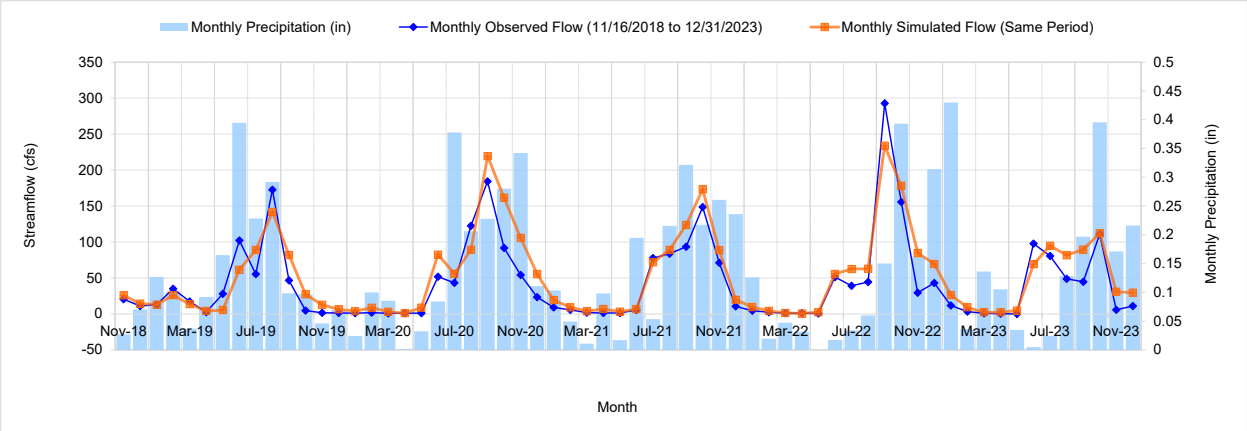

Figure A-109. Mean monthly flow: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

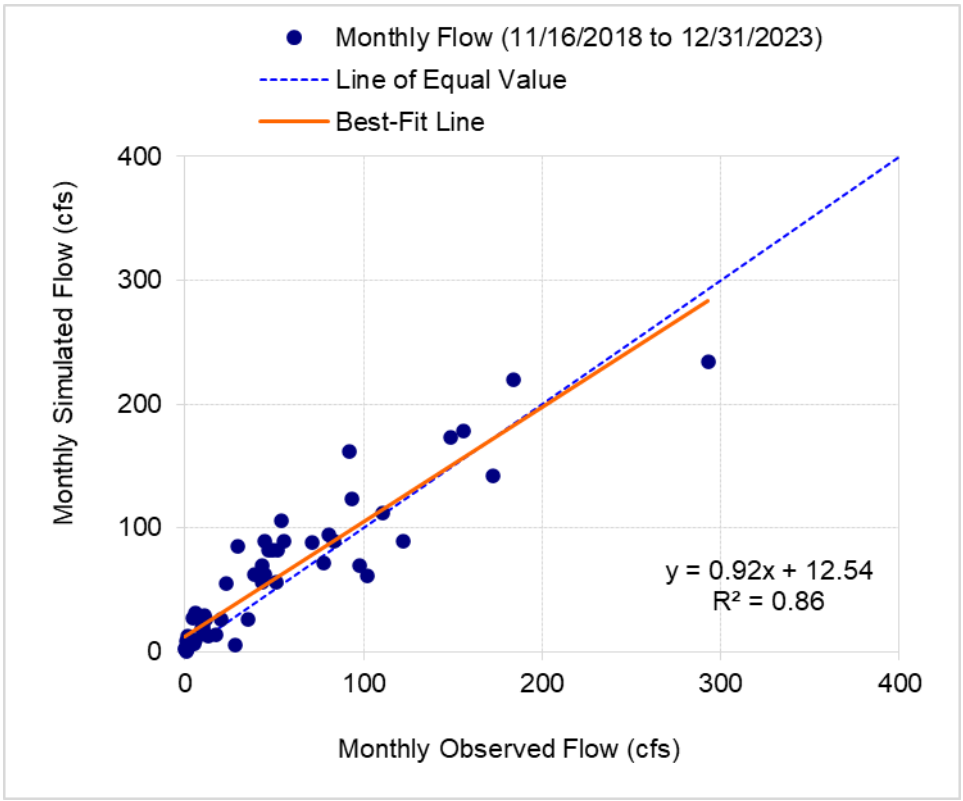

Figure A-106. Monthly flow regression and temporal variation: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

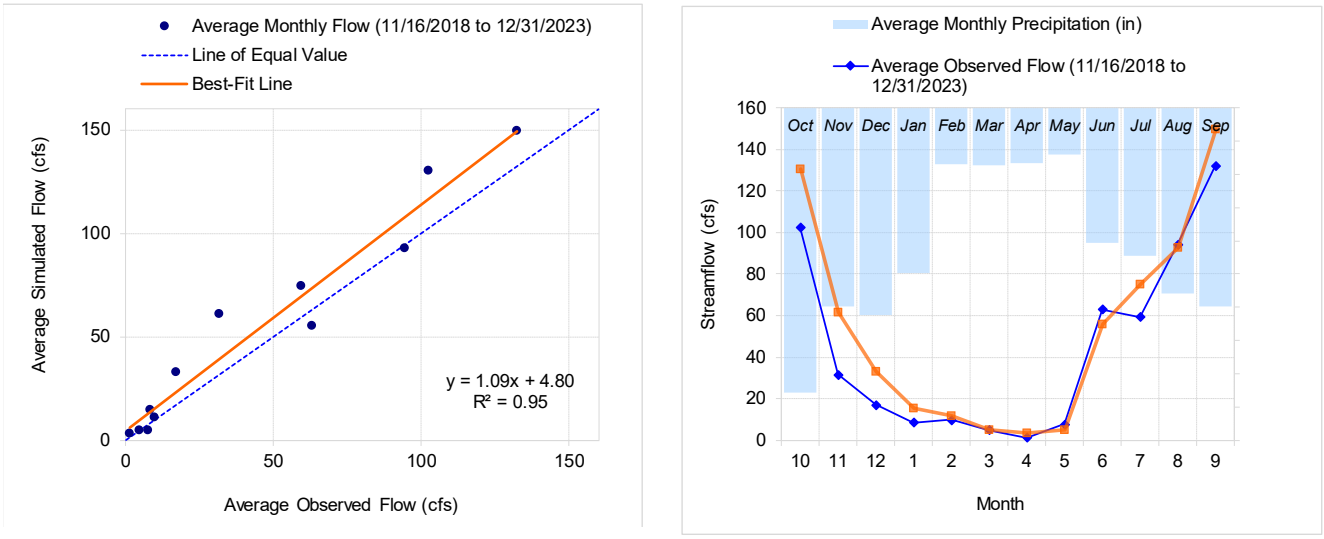

Figure A-111. Seasonal regression and temporal aggregate: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

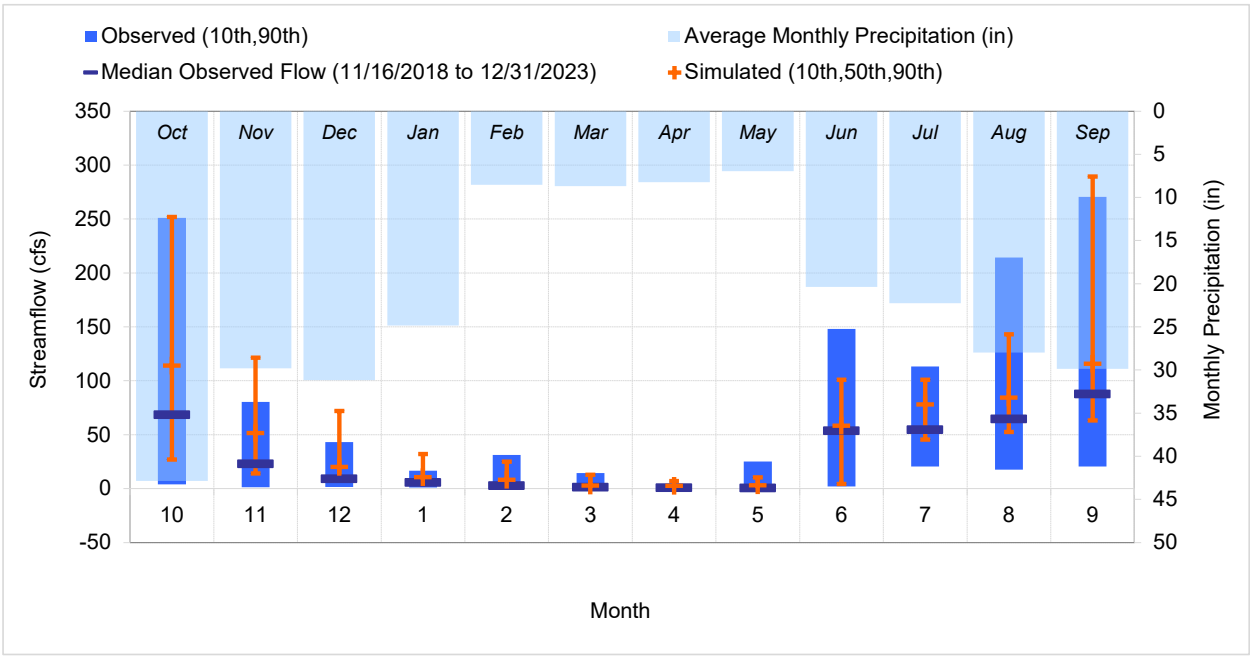

Figure A-112. Seasonal medians and ranges: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

Table A-40. Seasonal summary: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	102.41	68.60	4.01	251.00	130.55	114.21	27.03	251.96
Nov	31.50	23.20	1.39	80.44	61.35	51.49	13.94	121.45
Dec	17.15	9.29	1.43	43.10	33.27	20.17	8.26	71.97
Jan	8.46	5.79	1.00	16.62	15.20	10.65	4.37	32.03
Feb	9.71	3.02	0.97	31.26	11.53	8.29	4.34	25.10
Mar	4.82	1.63	0.29	14.30	5.08	2.84	0.96	12.82
Apr	1.29	1.05	0.01	3.05	3.30	2.57	0.48	7.10
May	7.66	0.89	-0.24	24.89	5.07	3.16	1.24	10.44
Jun	63.02	53.80	2.03	148.00	55.81	58.34	4.31	100.87
Jul	59.26	54.80	20.52	113.20	74.83	78.05	45.42	100.92
Aug	94.41	64.70	17.62	214.40	92.90	84.37	52.41	143.14
Sep	132.34	88.05	20.45	270.50	149.71	115.90	63.20	289.34

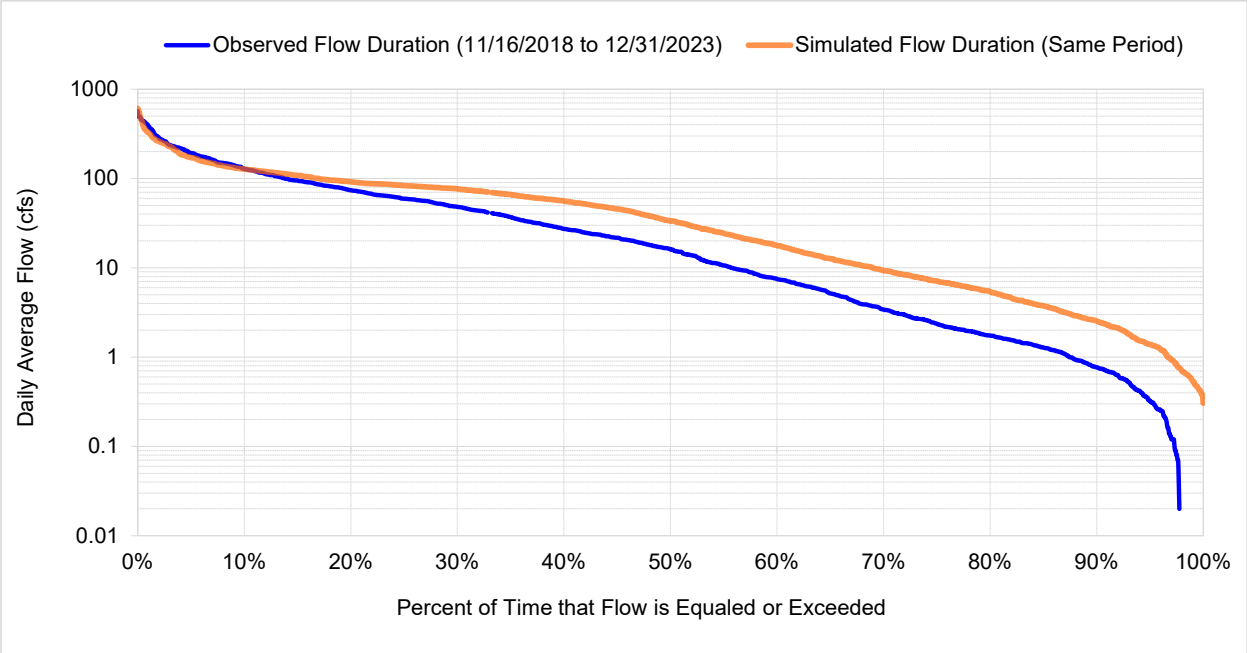

Figure A-113. Flow exceedance: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

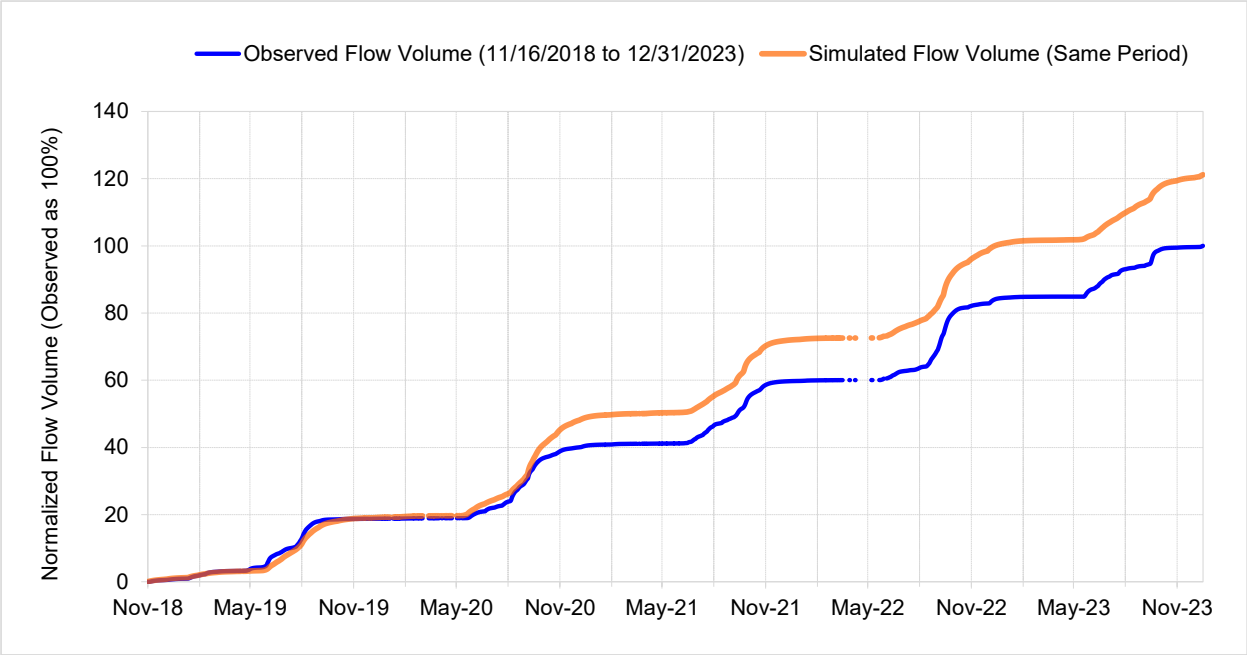

Figure A-107. Flow accumulation: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

Table A-41. Summary statistics: Model output at Reach 171 versus USGS 02292740 Jacks Branch at CR 78 Near Fort Denaud, FL (11/16/2018 – 12/31/2023)

Jacks Branch at Cr 78 nr Ft Denaud Fl (ID - USGS 02292740)
Drainage Area (sq-mi): 81.6237650703125
Analysis Period: 11/16/2018 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	7.20	8.72	21.16	10
Total lowest 50% flows	0.31	0.78	147.40	10
Total highest 10% flows	3.52	3.23	-8.31	15
Summer flow volume (months 7-9)	3.88	4.31	10.96	30
Fall flow volume (months 10-12)	2.15	3.23	50.43	30
Winter flow volume (months 1-3)	0.29	0.40	38.89 >>	30
Spring flow volume (months 4-6)	0.88	0.78	-11.01	30
Total storm volume	2.02	1.46	-27.80	20
Summer storm volume (7-9)	1.11	0.71	-36.14	50
Baseflow	5.18	7.27	40.27	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.729	0.7
Baseline adjusted coefficient (Garrick), E'			0.528	0.5
Monthly NSE			0.828	0.8

USGS 02292780 Townsend Canal Near Alva, FL

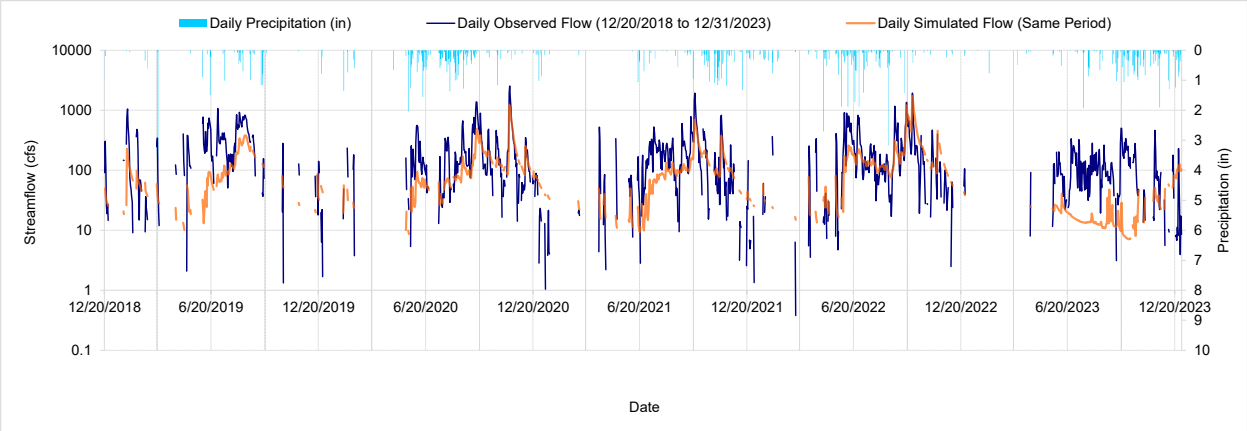

Figure A-115. Mean daily flow: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

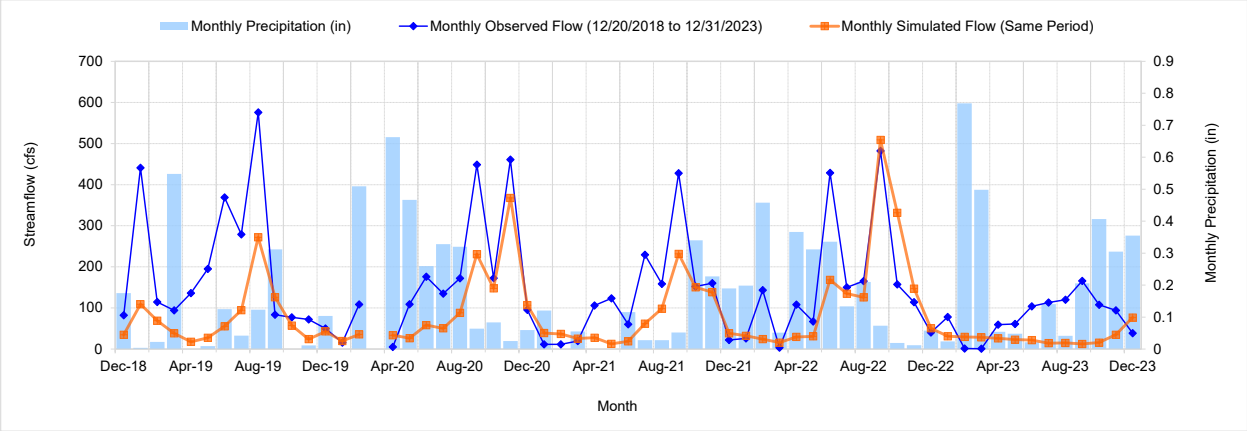

Figure A-116. Mean monthly flow: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

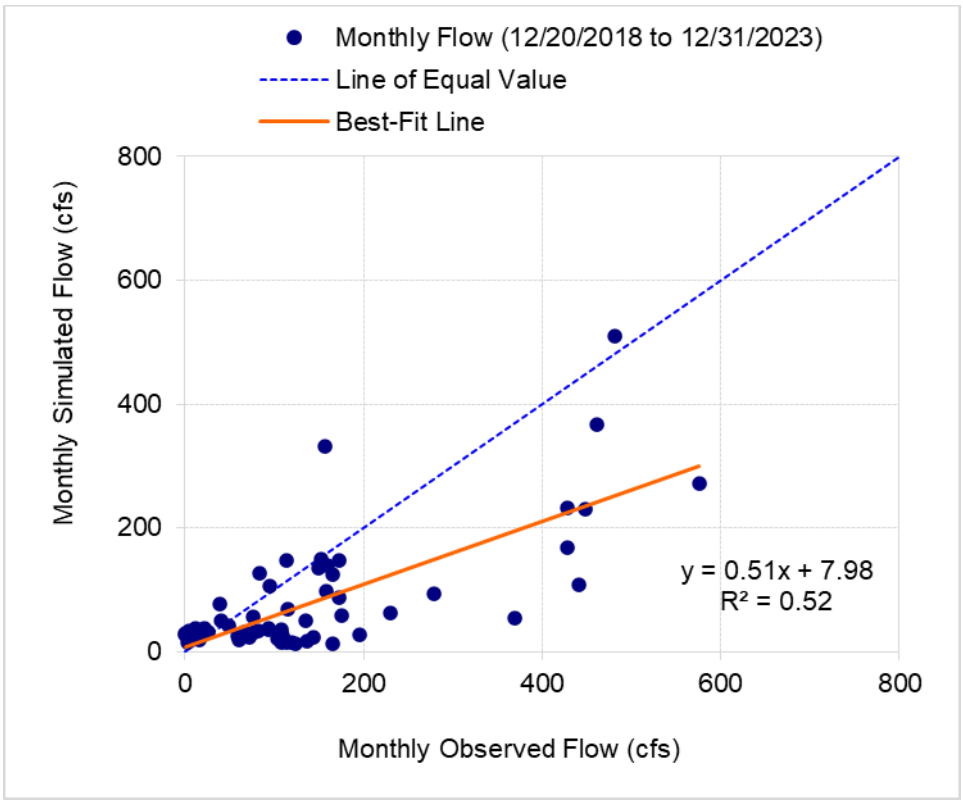

Figure A-117. Monthly flow regression and temporal variation: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

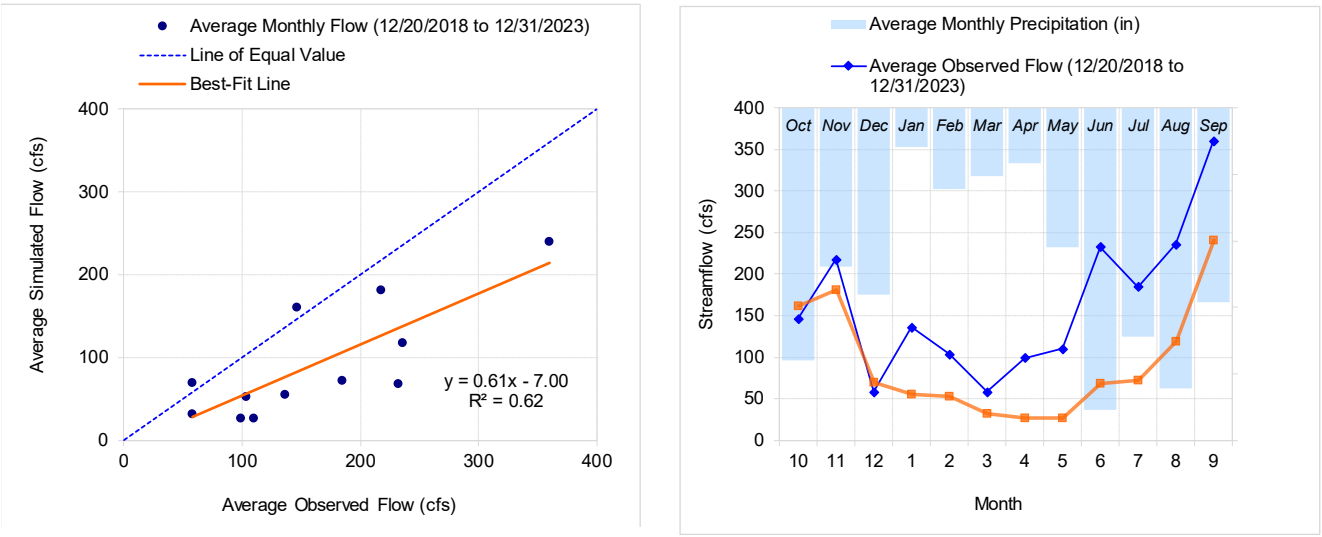

Figure A-118. Seasonal regression and temporal aggregate: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

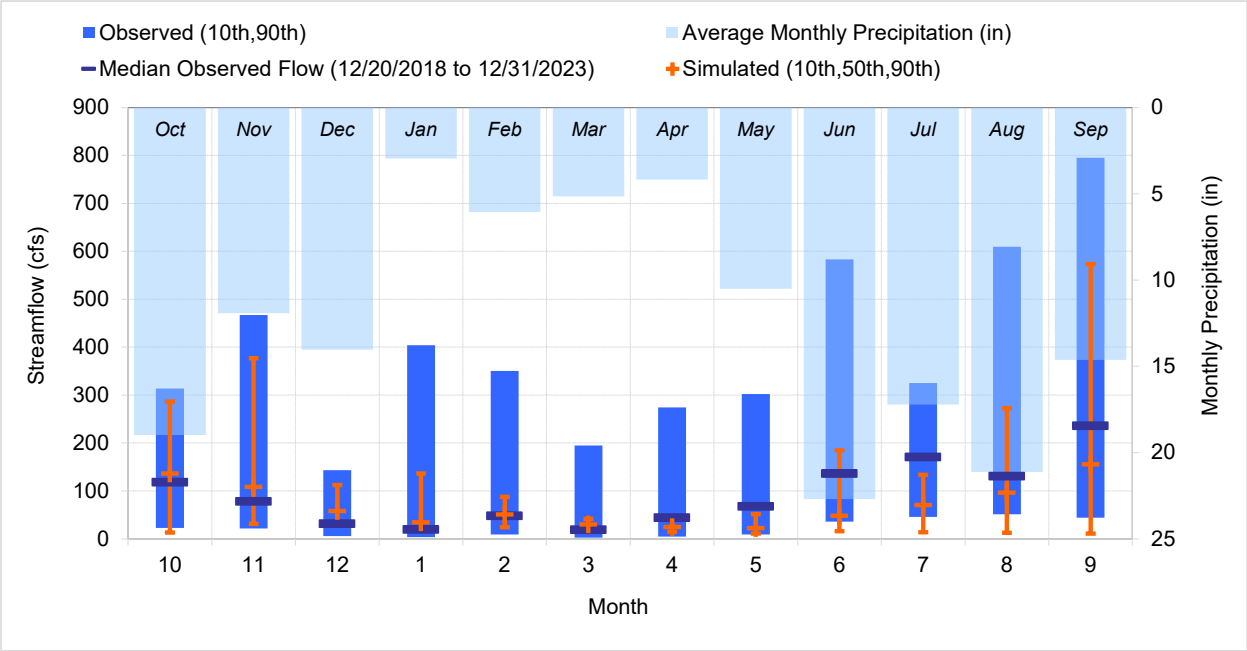

Figure A-119. Seasonal medians and ranges: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

Table A-42. Seasonal summary: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	146.26	118.50	22.74	313.90	161.37	136.59	13.23	286.75
Nov	218.05	78.90	21.60	467.00	181.31	108.76	31.46	376.89
Dec	58.33	31.90	5.86	143.40	69.77	58.19	31.33	112.12
Jan	136.28	19.90	3.70	403.80	55.47	34.34	20.51	136.51
Feb	103.80	48.80	9.11	350.20	52.78	50.75	23.94	87.96
Mar	58.49	19.35	2.60	194.63	31.67	30.01	18.29	41.57
Apr	99.34	44.60	4.77	274.40	27.14	24.44	14.87	41.56
May	109.88	68.40	8.96	302.00	26.53	22.52	10.74	51.35
Jun	232.66	136.50	35.81	583.30	68.72	48.40	16.00	184.92
Jul	184.91	171.00	45.71	325.10	72.86	70.48	13.76	133.51
Aug	235.65	131.00	51.20	609.40	118.54	96.46	12.83	272.78
Sep	360.44	236.50	44.09	795.40	241.07	155.89	11.21	573.64

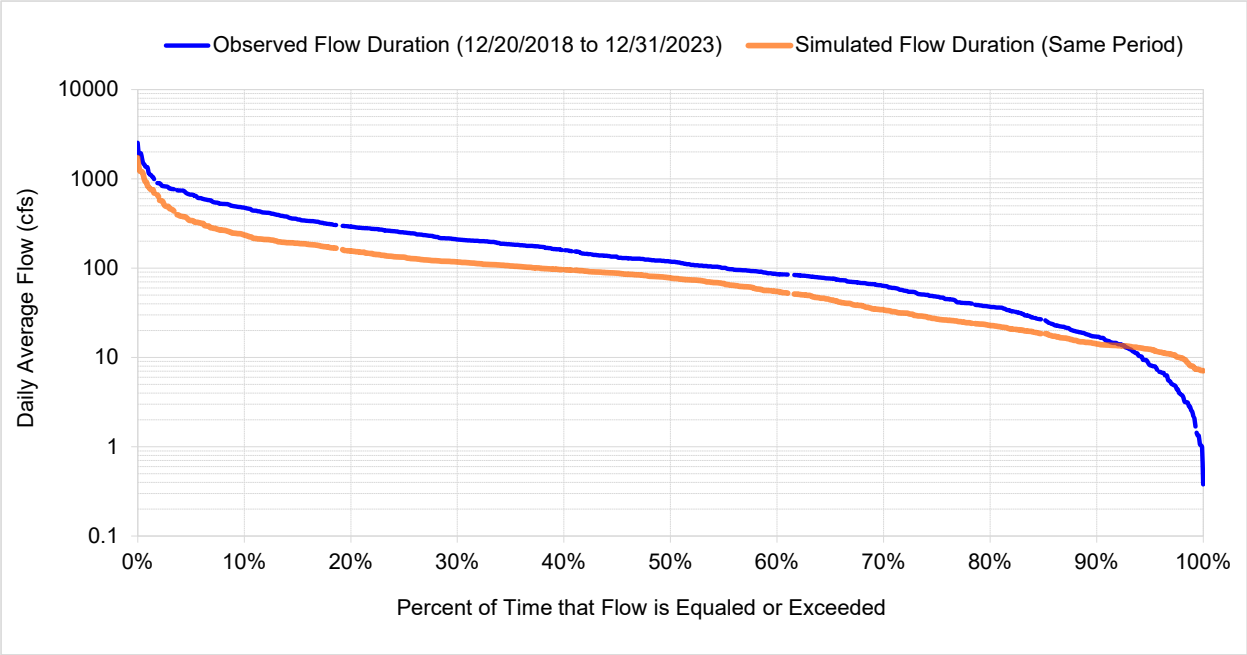

Figure A-120. Flow exceedance: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

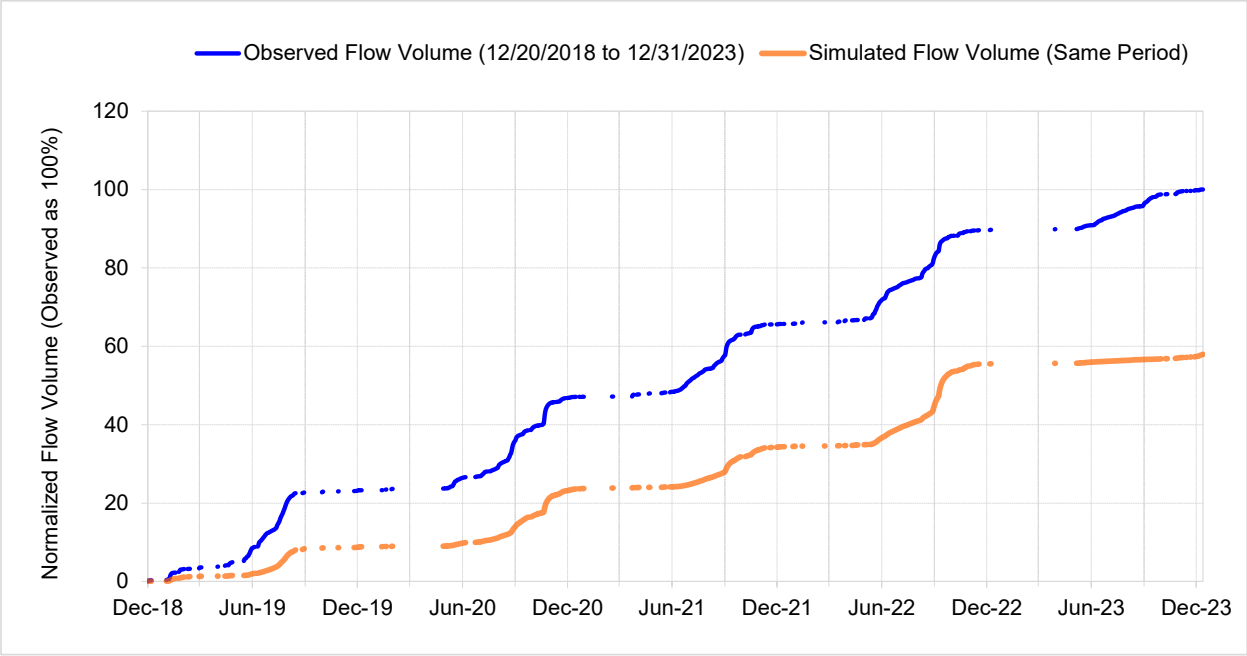

Figure A-121. Flow accumulation: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

Table A-43. Summary statistics: Model output at Reach 156 versus USGS 02292780 Townsend Canal Near Alva, FL (12/18/2018 – 12/31/2023)

Townsend Canal near Alva, Fl (ID - USGS 02292780)
Drainage Area (sq-mi): 71.7919162609375
Analysis Period: 12/20/2018 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	19.86	11.52	-42.02	10
Total lowest 50% flows	2.60	1.68	-35.43	10
Total highest 10% flows	7.83	4.64	-40.77	15
Summer flow volume (months 7-9)	11.11	6.08	-45.30	30
Fall flow volume (months 10-12)	4.03	3.94	-2.27	30
Winter flow volume (months 1-3)	0.83	0.39	-53.77	30
Spring flow volume (months 4-6)	3.89	1.11	-71.37	30
Total storm volume	10.23	2.77	-72.90	20
Summer storm volume (7-9)	4.80	1.37	-71.50	50
Baseflow	9.63	8.74	-9.25	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.375	0.7
Baseline adjusted coefficient (Garrick), E'			0.231	0.5
Monthly NSE			0.564	0.8

A-2 DEP GAGES CALIBRATION AND VALIDATION COMPARISON

DEP Jacks Branch at SR 78

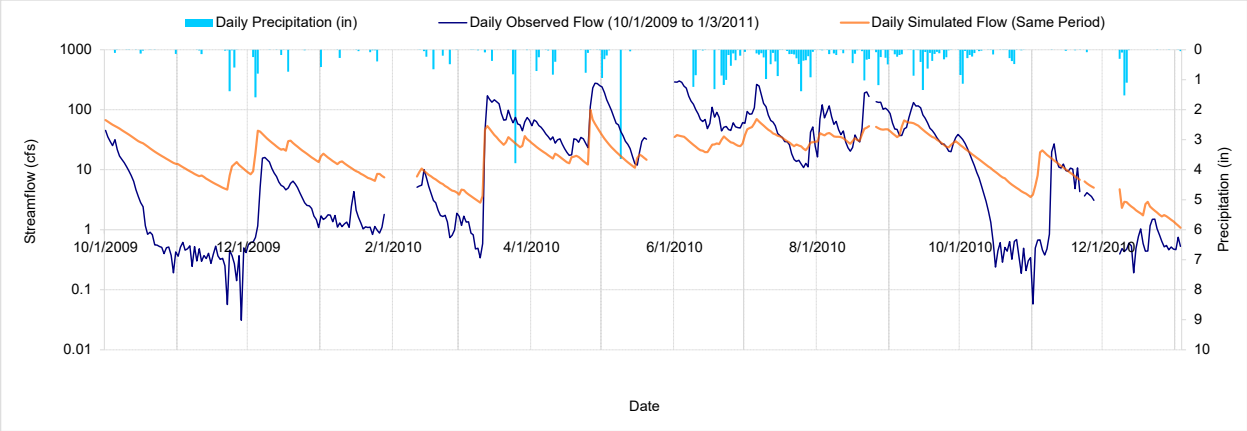

Figure A-122. Mean daily flow: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

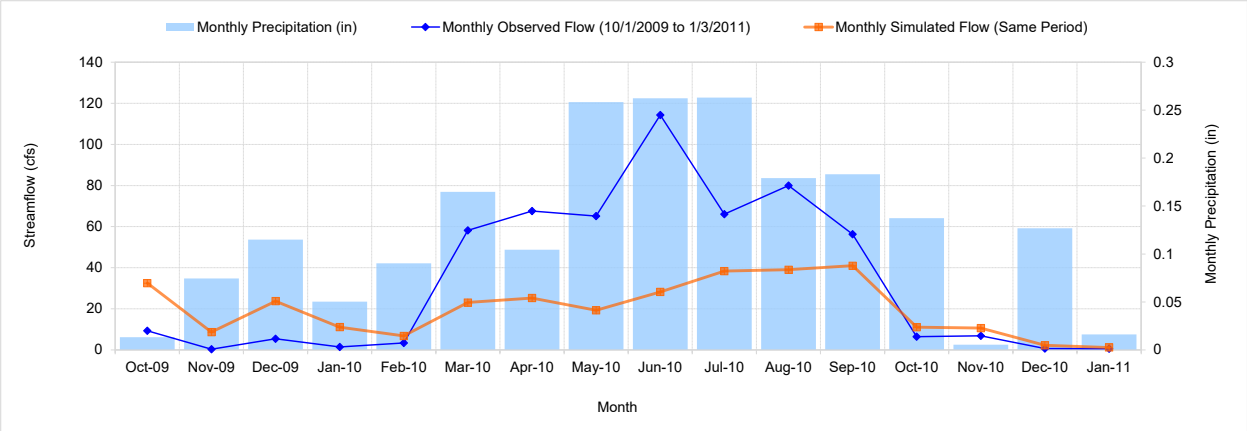

Figure A-123. Mean monthly flow: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

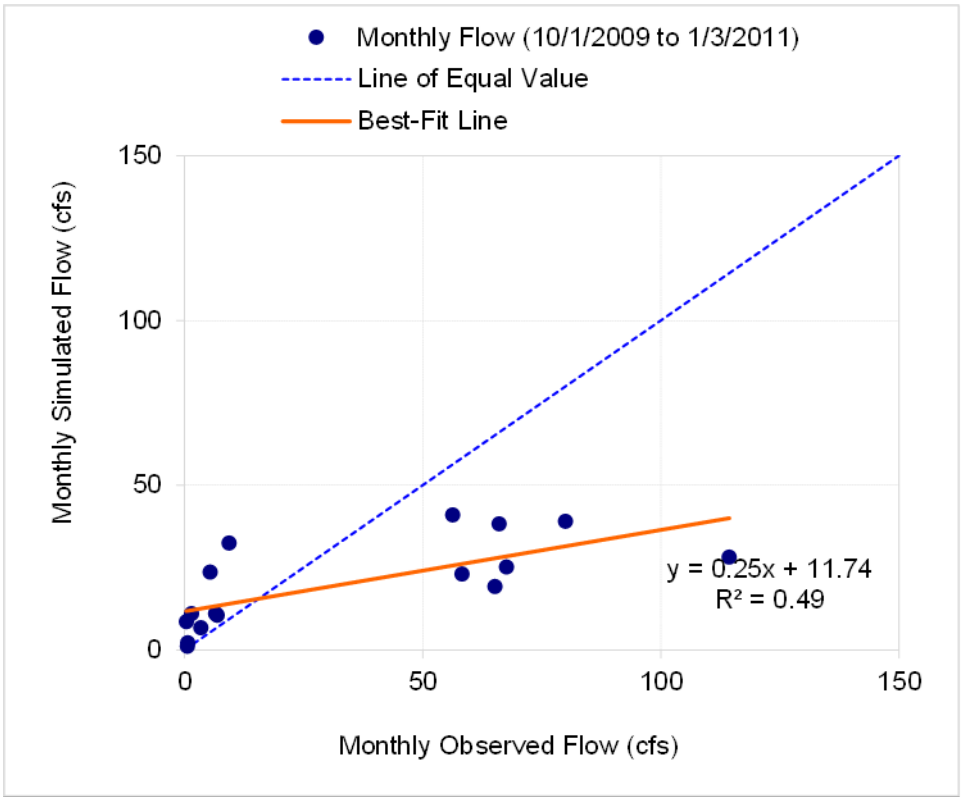

Figure A-124. Monthly flow regression and temporal variation: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

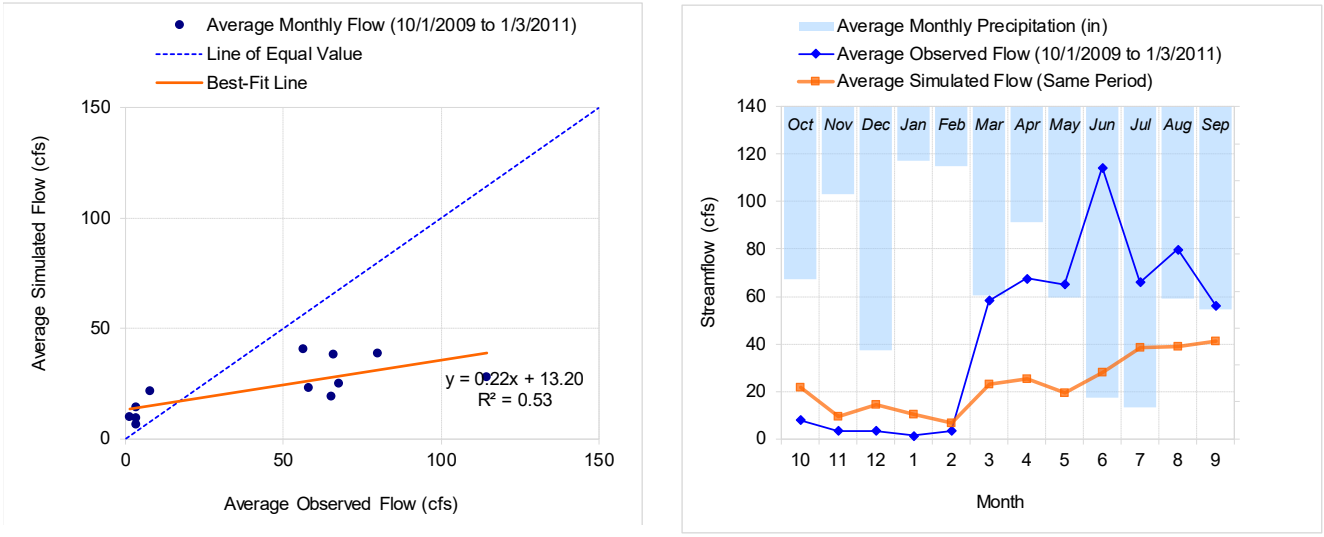

Figure A-125. Seasonal regression and temporal aggregate: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

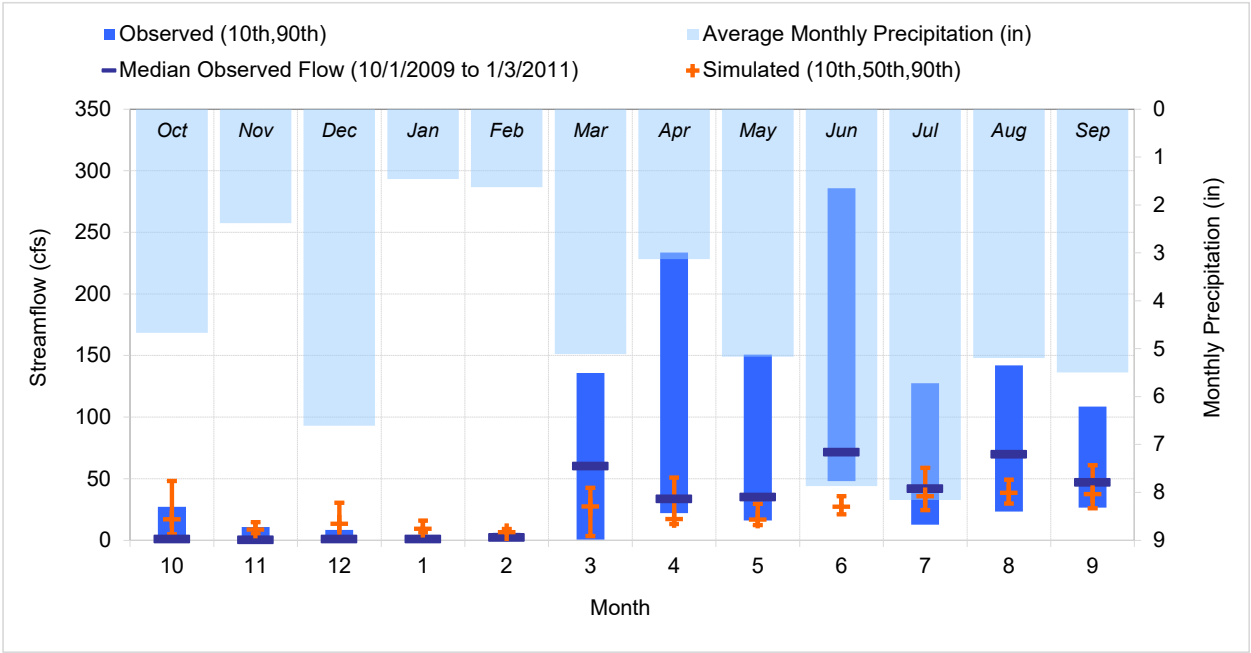

Figure A-126. Seasonal medians and ranges: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

Table A-44. Seasonal summary: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	7.92	1.25	0.32	27.15	21.77	16.96	5.00	48.08
Nov	3.37	0.49	0.26	10.69	9.56	8.69	5.27	14.81
Dec	3.33	1.17	0.47	8.37	14.33	13.45	1.74	30.54
Jan	1.40	1.25	0.83	1.79	10.11	9.45	6.50	15.94
Feb	3.42	2.46	0.93	6.06	6.79	6.64	4.46	9.27
Mar	58.20	60.49	0.59	135.91	23.09	27.40	3.41	42.60
Apr	67.61	33.71	22.04	233.60	25.25	17.25	13.32	50.93
May	65.15	35.30	16.19	150.68	19.28	16.93	12.34	29.72
Jun	114.33	71.80	48.04	285.73	28.20	27.35	21.04	35.86
Jul	66.04	42.14	12.73	127.62	38.33	35.77	24.44	58.75
Aug	79.96	69.99	23.43	142.02	39.05	38.51	29.94	49.13
Sep	56.29	47.24	26.52	108.55	40.99	37.46	26.03	61.01

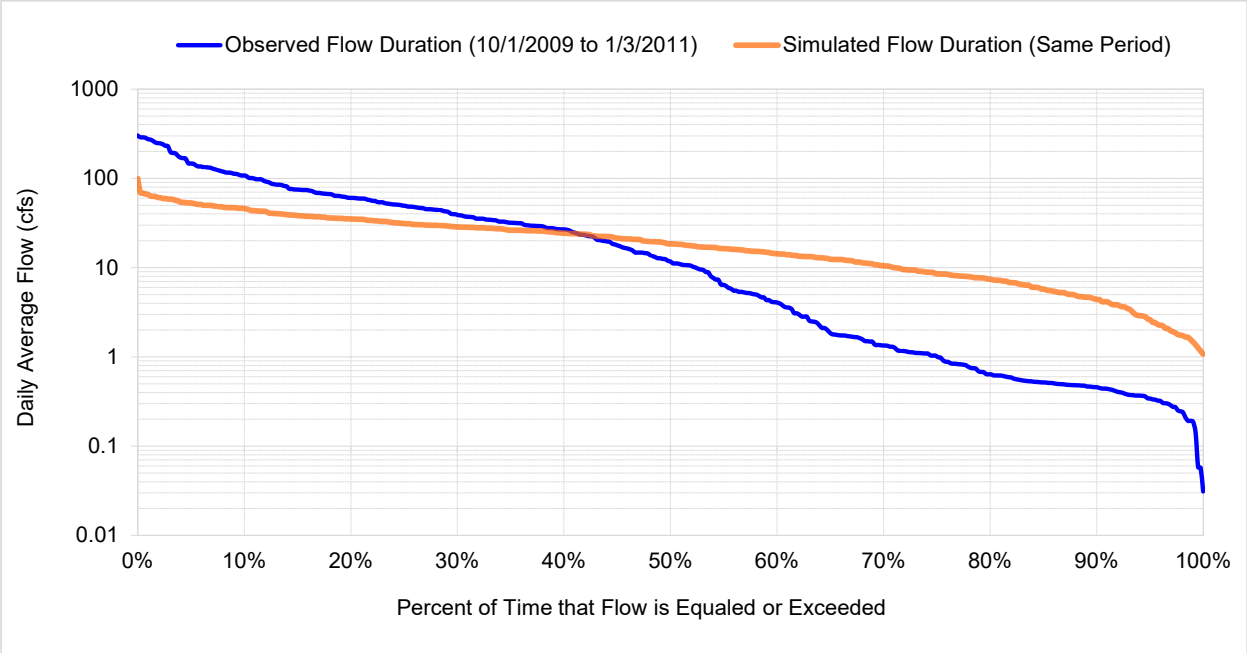

Figure A-127. Flow exceedance: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

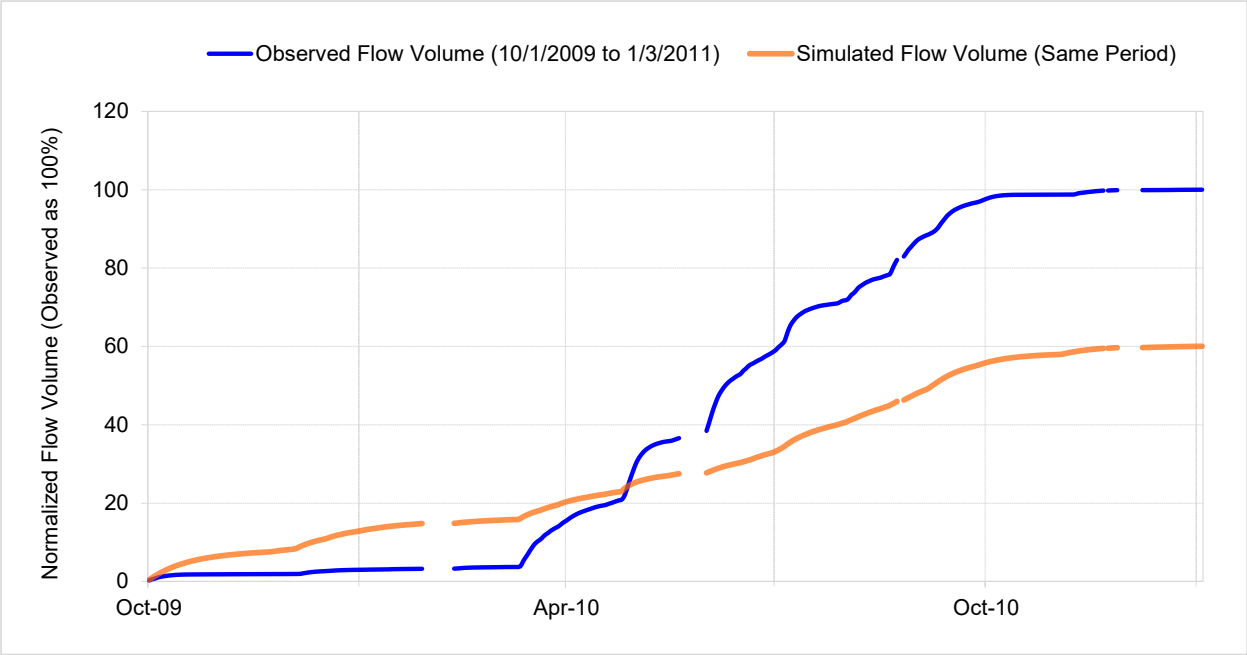

Figure A-128. Flow accumulation: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

Table A-45. Summary statistics: Model output at Reach 169 versus DEP Jacks Branch at SR 78 (11/16/2018 – 01/03/2011)

Jacks Branch at SR 78 (ID - FDEP)
Drainage Area (sq-mi): 65.7799987792969
Analysis Period: 10/1/2009 to 1/3/2011

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	7.01	4.21	-39.93	10
Total lowest 50% flows	0.21	0.88	312.29	10
Total highest 10% flows	3.37	1.05	-68.72	15
Summer flow volume (months 7-9)	2.72	1.60	-41.37	30
Fall flow volume (months 10-12)	0.39	1.20	209.67	30
Winter flow volume (months 1-3)	0.86	0.52	-39.68	30
Spring flow volume (months 4-6)	3.04	0.89	-70.58	30
Total storm volume	2.47	0.69	-72.05	20
Summer storm volume (7-9)	0.95	0.21	-78.16	50
Baseflow	4.55	3.52	-22.50	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.222	0.7
Baseline adjusted coefficient (Garrick), E'			0.334	0.5
Monthly NSE			0.251	0.8

DEP Pollywog Creek at SR 78

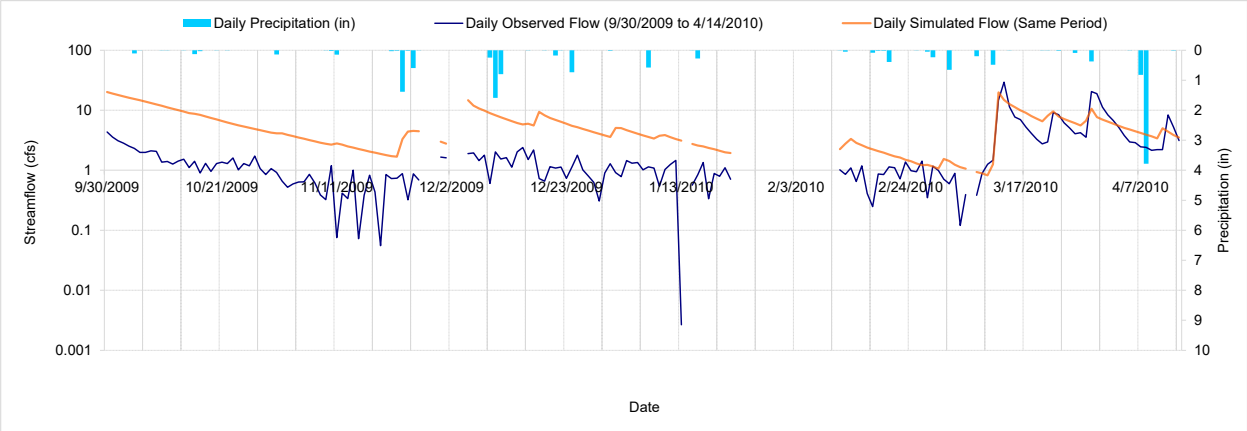

Figure A-129. Mean daily flow: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

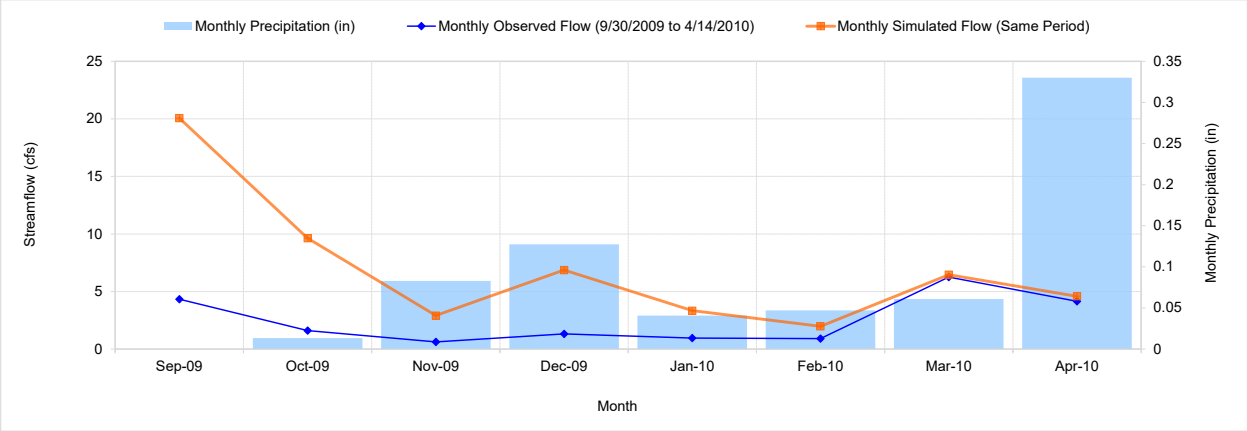

Figure A-130. Mean monthly flow: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

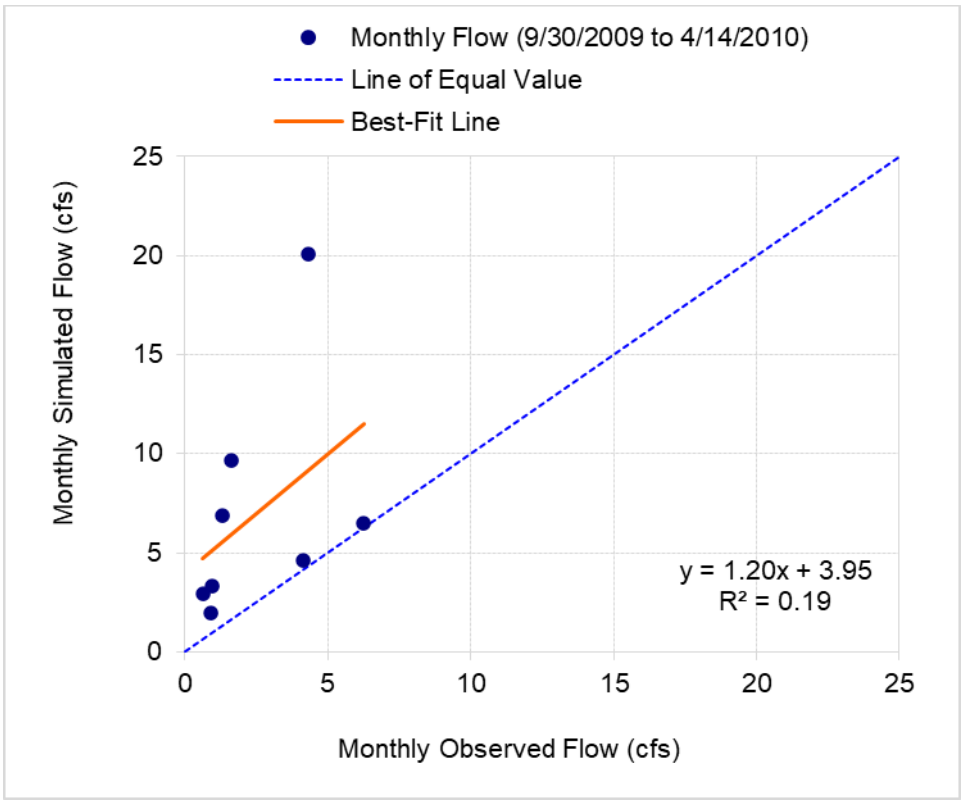

Figure A-131. Monthly flow regression and temporal variation: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

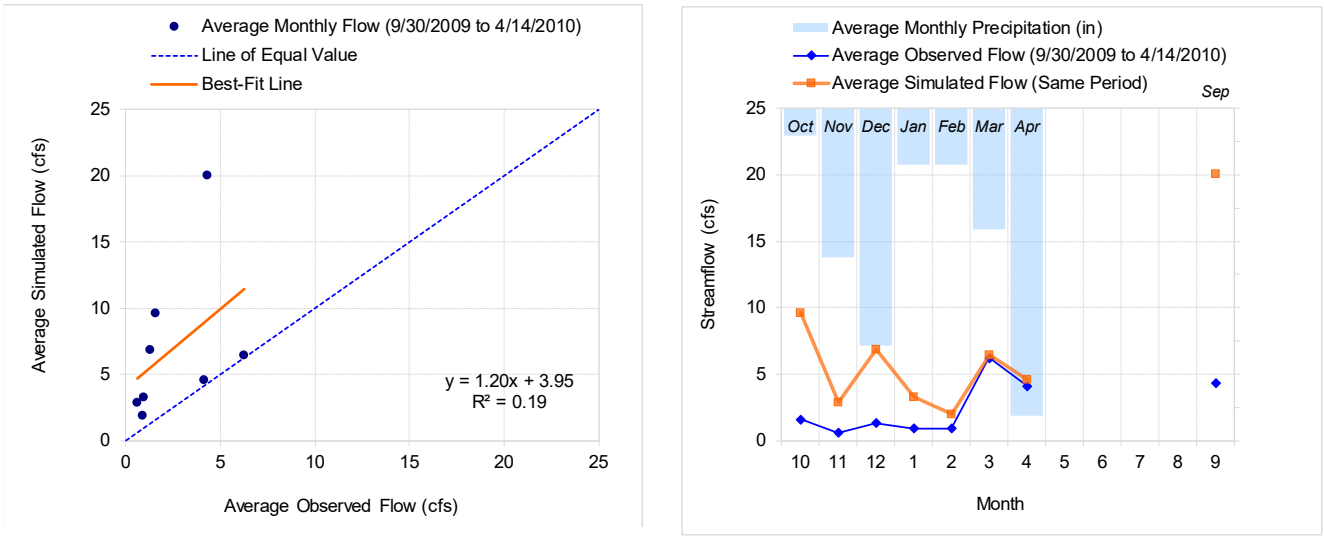

Figure A-132. Seasonal regression and temporal aggregate: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

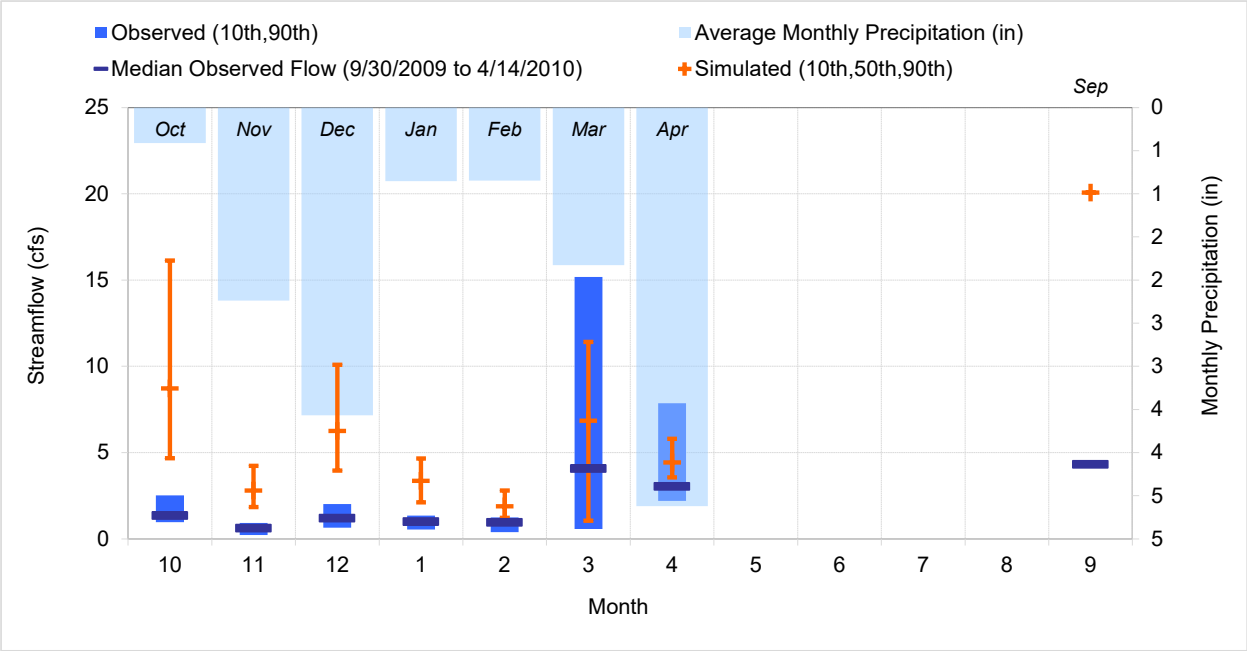

Figure A-133. Seasonal medians and ranges: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

Table A-46. Seasonal summary: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	1.61	1.36	0.96	2.53	9.64	8.72	4.67	16.13
Nov	0.62	0.64	0.22	0.93	2.91	2.81	1.84	4.23
Dec	1.32	1.22	0.65	2.02	6.86	6.26	3.96	10.09
Jan	0.95	1.02	0.54	1.35	3.33	3.36	2.12	4.66
Feb	0.91	0.96	0.39	1.24	1.97	1.89	1.22	2.80
Mar	6.25	4.09	0.57	15.18	6.46	6.84	1.05	11.41
Apr	4.15	3.05	2.20	7.85	4.58	4.44	3.57	5.80
May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sep	4.32	4.32	4.32	4.32	20.07	20.07	20.07	20.07

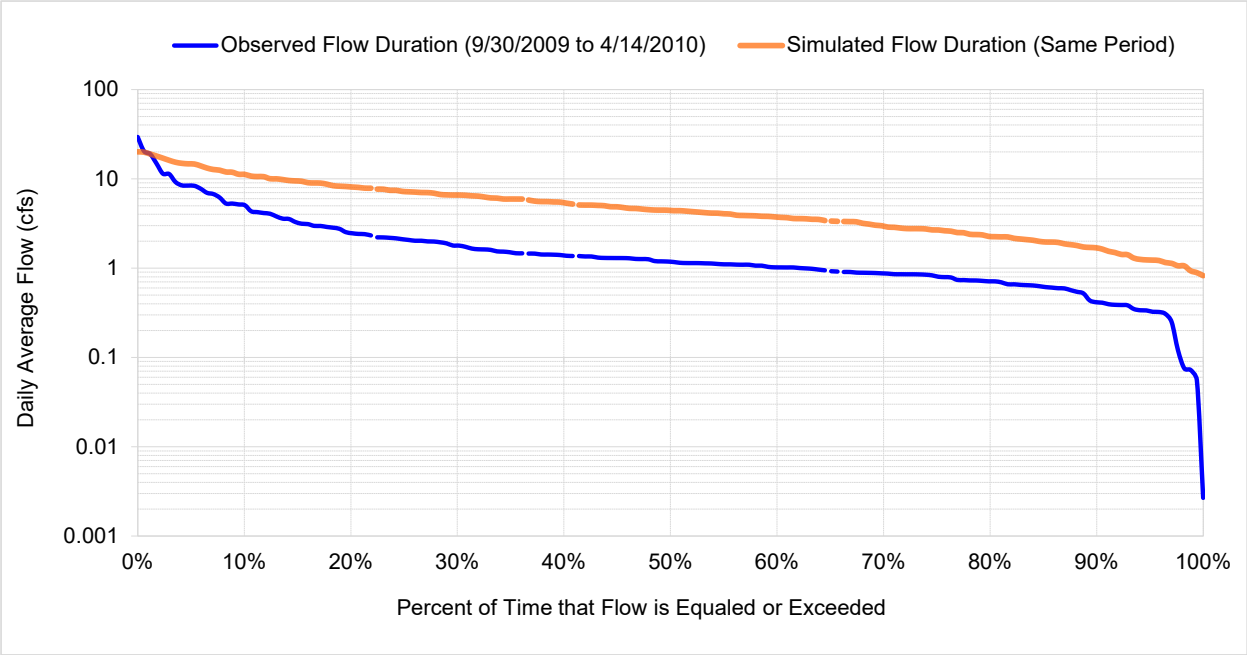

Figure A-134. Flow exceedance: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

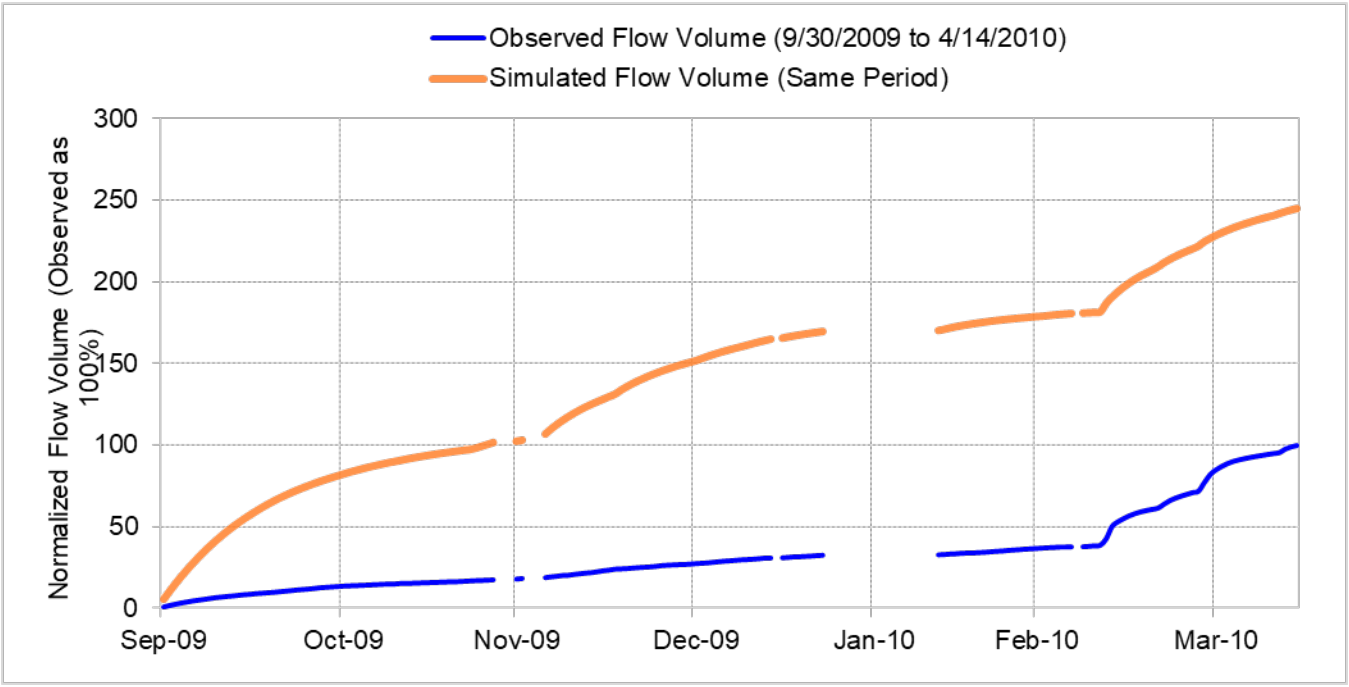

Figure A-135. Flow accumulation: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

Table A-47. Summary statistics: Model output at Reach 179 versus DEP Pollywog Creek at SR 78 (09/30/2009 – 04/14/2010)

Pollywog Creek at SR78 (ID - FDEP)
Drainage Area (sq-mi): 18.1299991607666
Analysis Period: 9/30/2009 to 4/14/2010

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	1.49	3.64	144.51	10
Total lowest 50% flows	0.24	0.86	258.62	10
Total highest 10% flows	0.70	0.98	40.03	15
Summer flow volume (months 7-9)	0.02	0.08	364.17	30
Fall flow volume (months 10-12)	0.40	2.18	449.63	30
Winter flow volume (months 1-3)	0.86	1.14	33.78	30
Spring flow volume (months 4-6)	0.22	0.25	10.47	30
Total storm volume	0.51	0.40	-21.87	20
Summer storm volume (7-9)	0.00	0.00	48.51	50
Baseflow	0.98	3.24	231.36	20
Nash-Sutcliffe Coefficient of Efficiency, E			-1.152	0.7
Baseline adjusted coefficient (Garrick), E'			-1.002	0.5
Monthly NSE			-2.819	0.8

DEP Fast Creek at SR 80

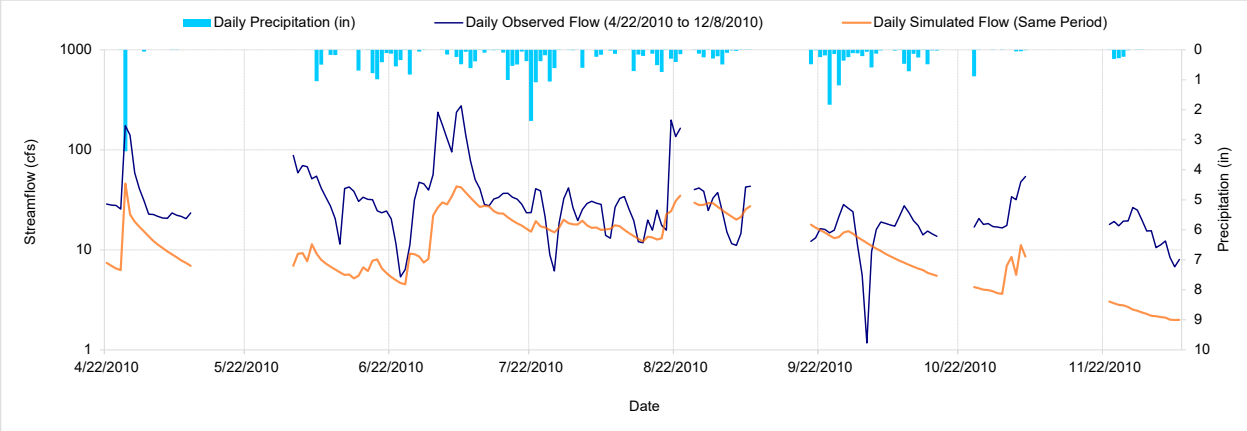

Figure A-136. Mean daily flow: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

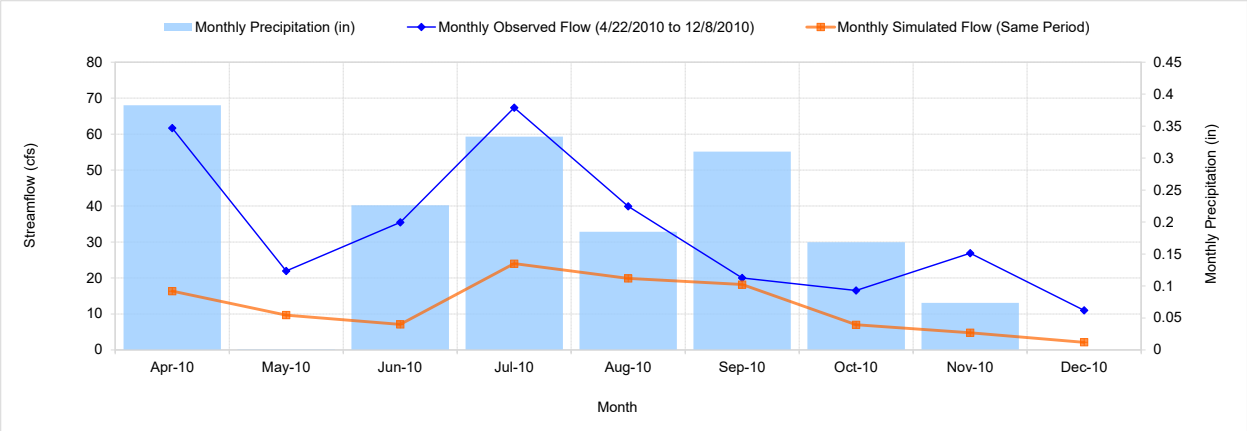

Figure A-137. Mean monthly flow: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

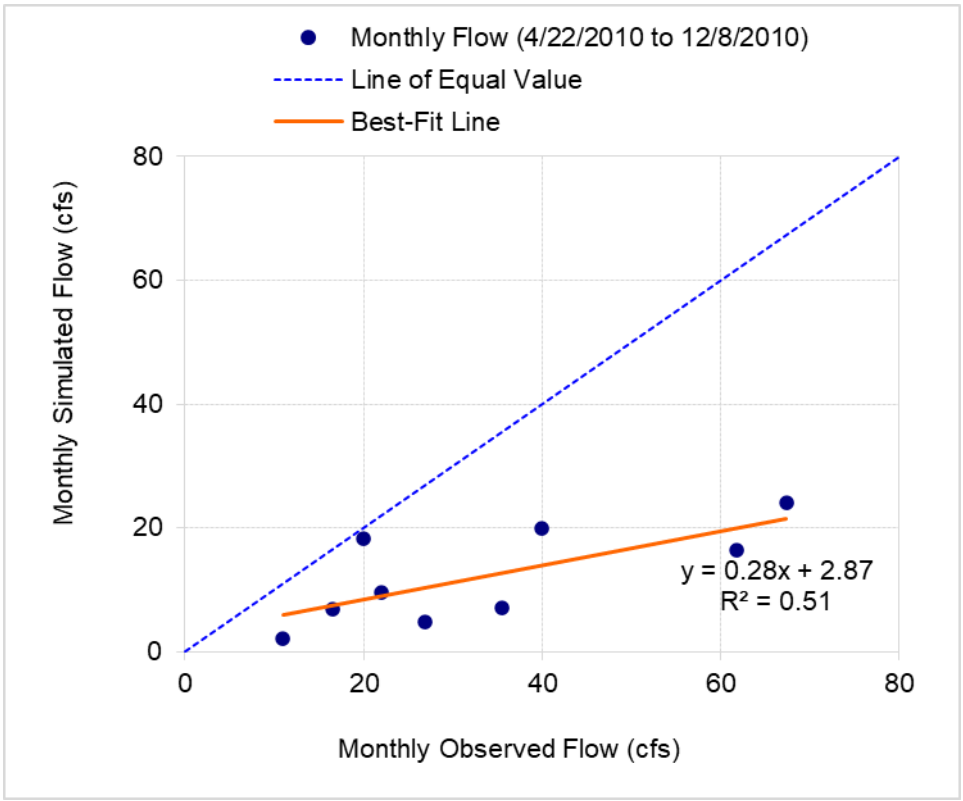

Figure A-138. Monthly flow regression and temporal variation: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

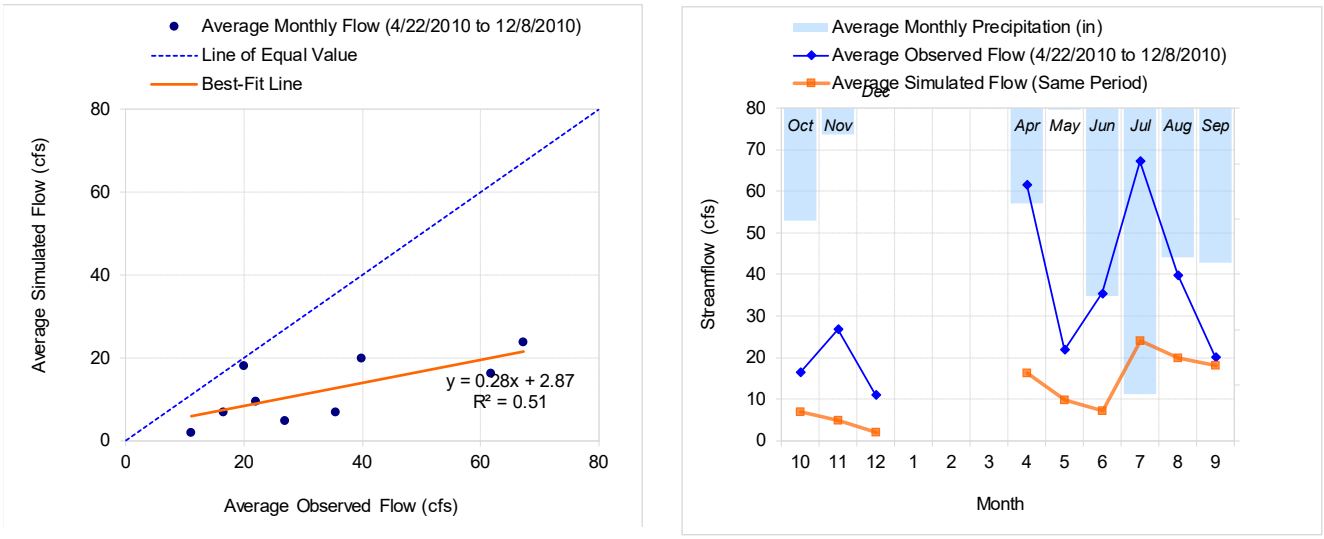

Figure A-139. Seasonal regression and temporal aggregate: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

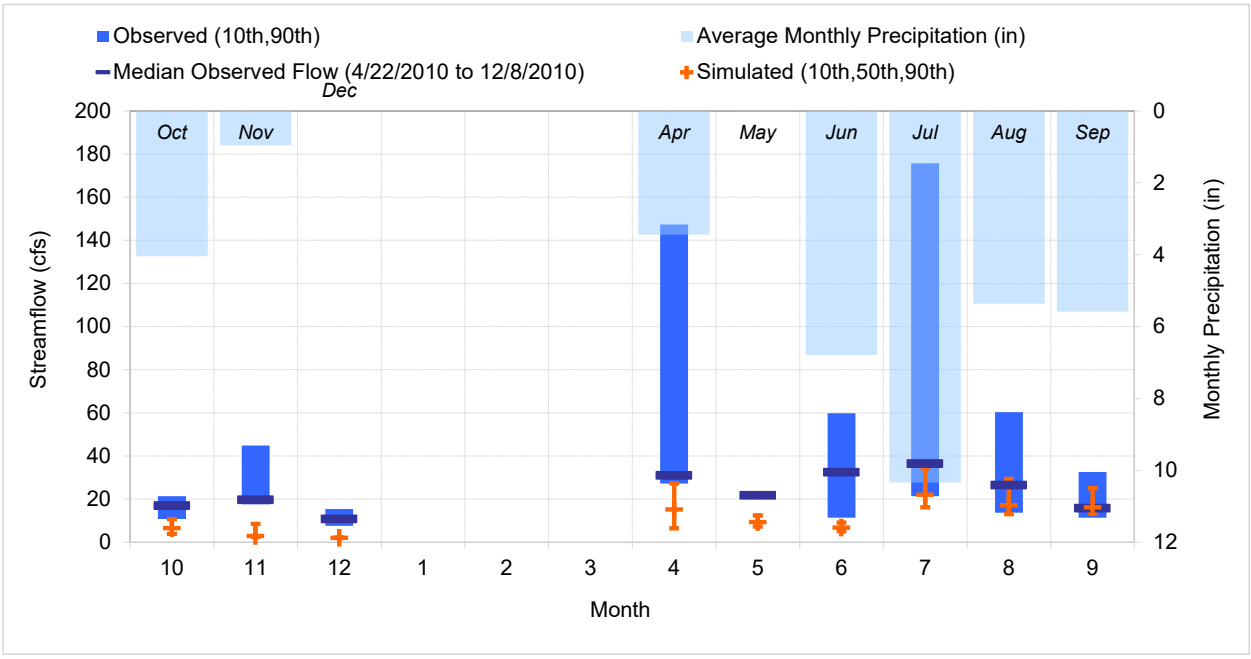

Figure A-140. Seasonal medians and ranges: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

Table A-48. Seasonal summary: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	16.51	17.14	10.82	21.32	6.98	6.64	3.89	10.77
Nov	26.87	19.77	17.60	44.91	4.79	2.92	2.47	8.56
Dec	11.01	10.87	7.64	15.45	2.11	2.11	2.00	2.22
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr	61.70	31.12	27.28	147.31	16.34	15.27	6.47	27.24
May	21.93	21.88	20.63	23.36	9.68	9.33	7.36	12.43
Jun	35.49	32.63	11.38	59.81	7.09	6.85	5.15	9.13
Jul	67.34	36.60	21.35	175.74	24.00	22.01	16.23	34.33
Aug	39.94	26.64	13.74	60.34	19.88	17.17	13.02	29.37
Sep	20.03	15.84	11.39	32.55	18.18	16.19	13.41	25.07

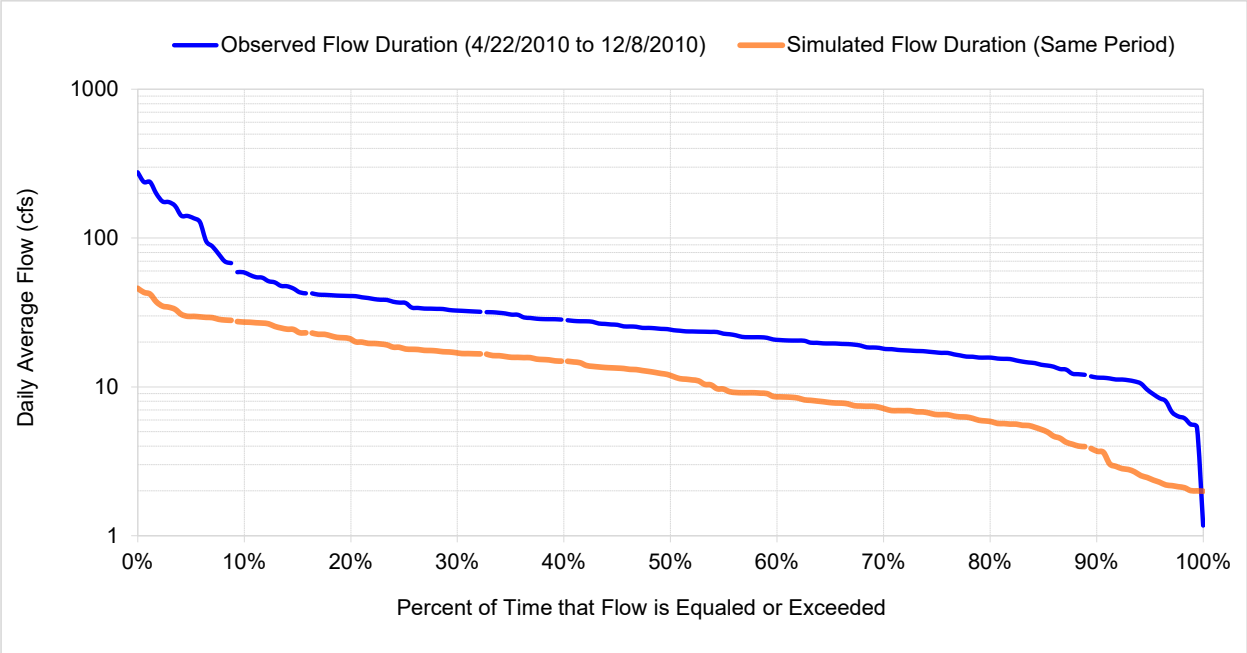

Figure A-141. Flow exceedance: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

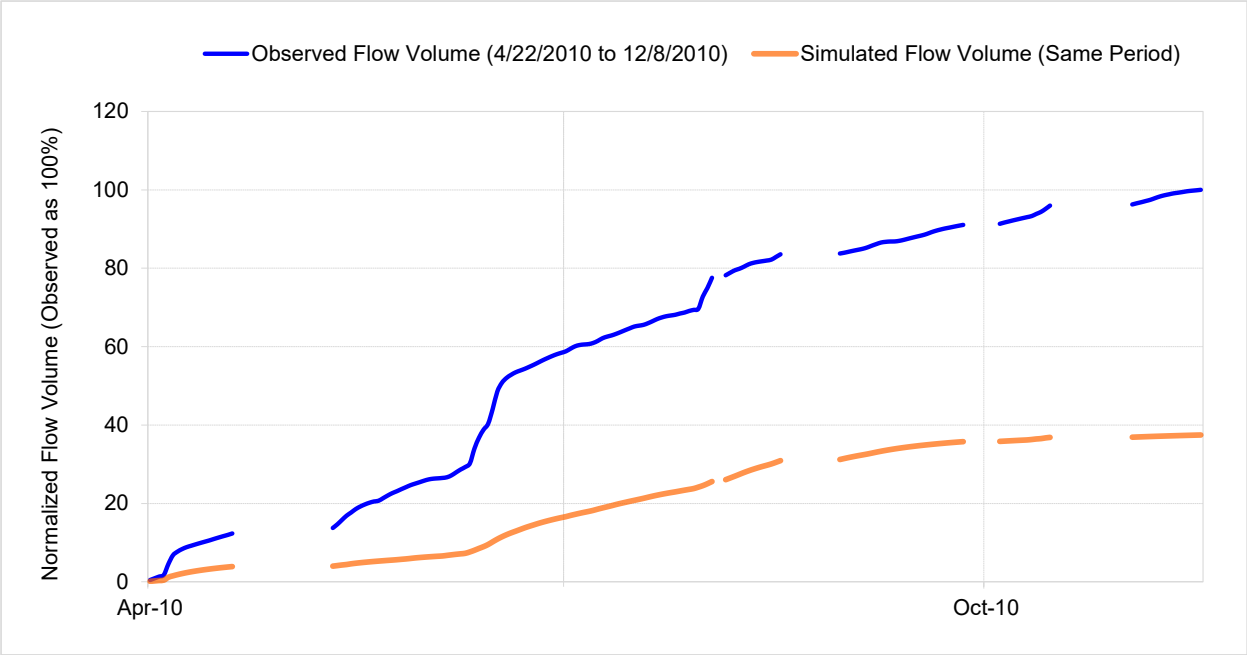

Figure A-142. Flow accumulation: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

Table A-49. Summary statistics: Model output at Reach 173 versus DEP Fast Creek at SR 80 (04/22/2010 – 12/08/2010)

Fast Creek at SR80 (ID - FDEP)
Drainage Area (sq-mi): 19.7199993133545
Analysis Period: 4/22/2010 to 12/8/2010

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	18.81	7.04	-62.56	10
Total lowest 50% flows	4.19	1.63	-61.03	10
Total highest 10% flows	7.39	1.68	-77.24	15
Summer flow volume (months 7-9)	10.80	4.93	-54.31	30
Fall flow volume (months 10-12)	2.50	0.74	-70.40	30
Winter flow volume (months 1-3)	0.00	0.00	nan >>	30
Spring flow volume (months 4-6)	5.51	1.37	-75.18	30
Total storm volume	6.08	0.77	-87.31	20
Summer storm volume (7-9)	4.01	0.45	-88.88	50
Baseflow	12.73	6.27	-50.75	20
Nash-Sutcliffe Coefficient of Efficiency, E			-0.067	0.7
Baseline adjusted coefficient (Garrick), E'			-0.007	0.5
Monthly NSE			0.010	0.8

DEP Powell Creek at SR 78

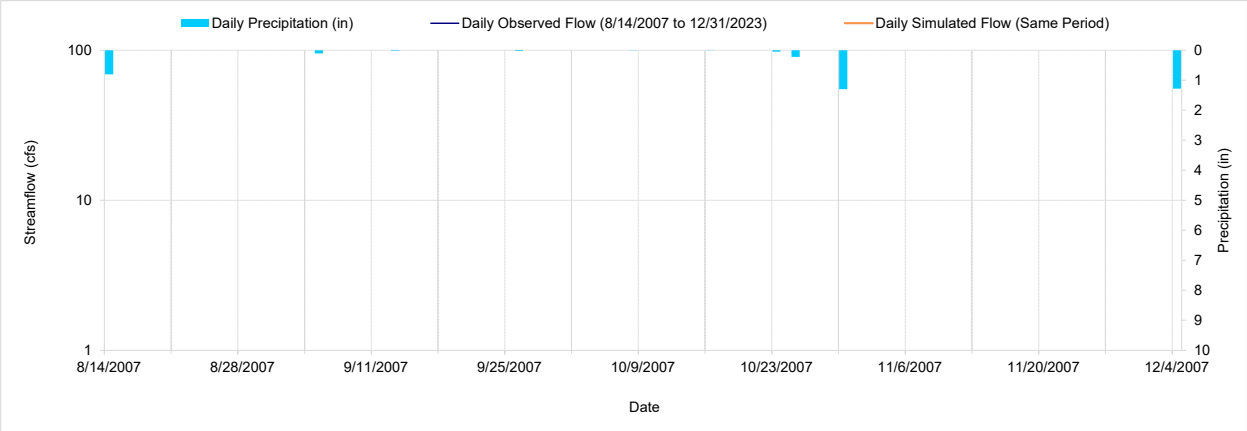

Figure A-143. Mean daily flow: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

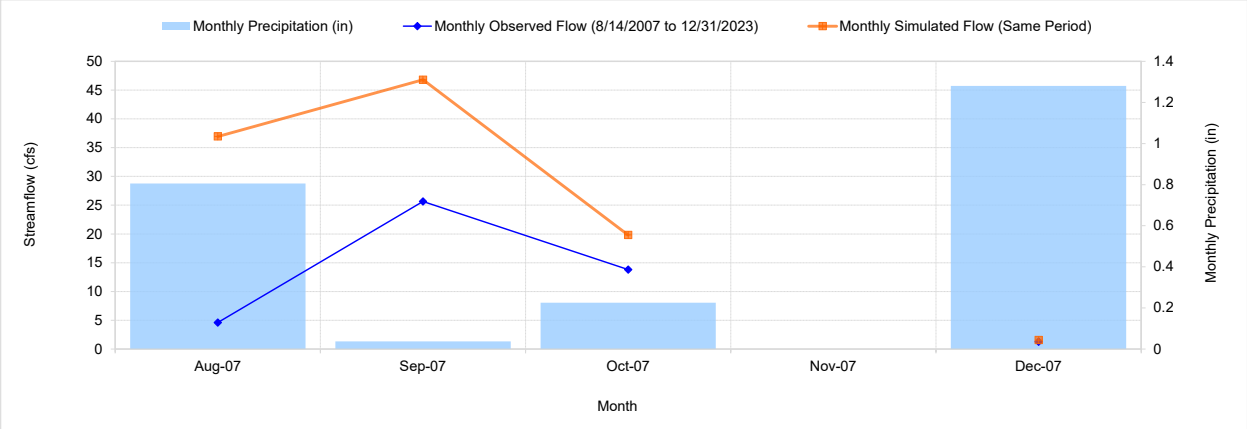

Figure A-144. Mean monthly flow: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

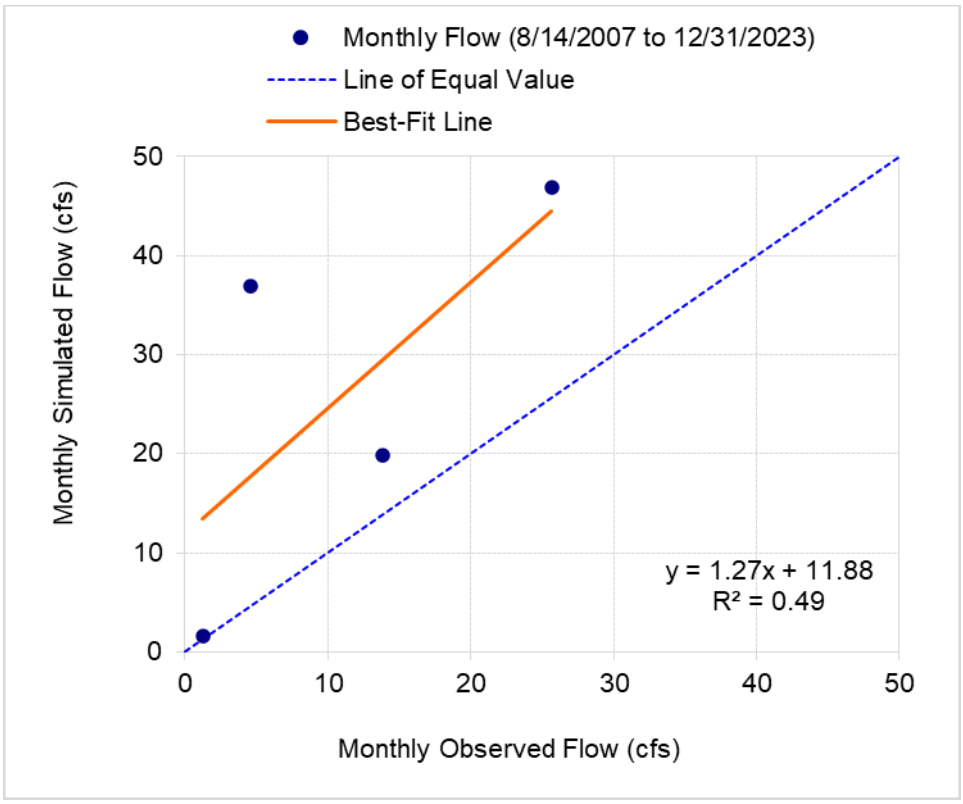

Figure A-145. Monthly flow regression and temporal variation: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

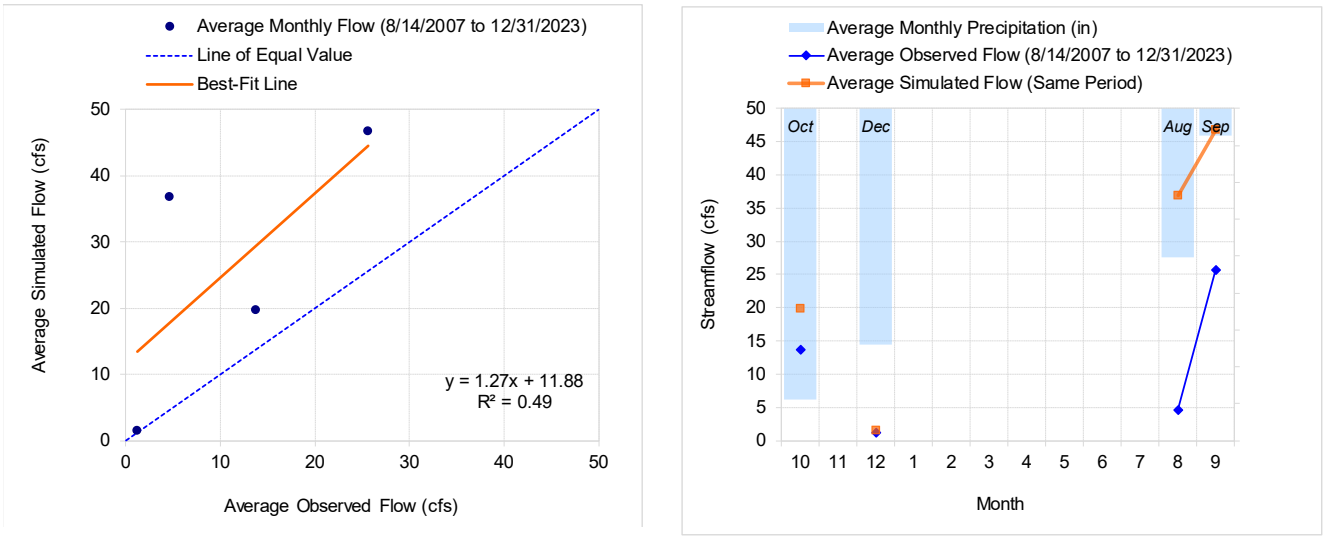

Figure A-146. Seasonal regression and temporal aggregate: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

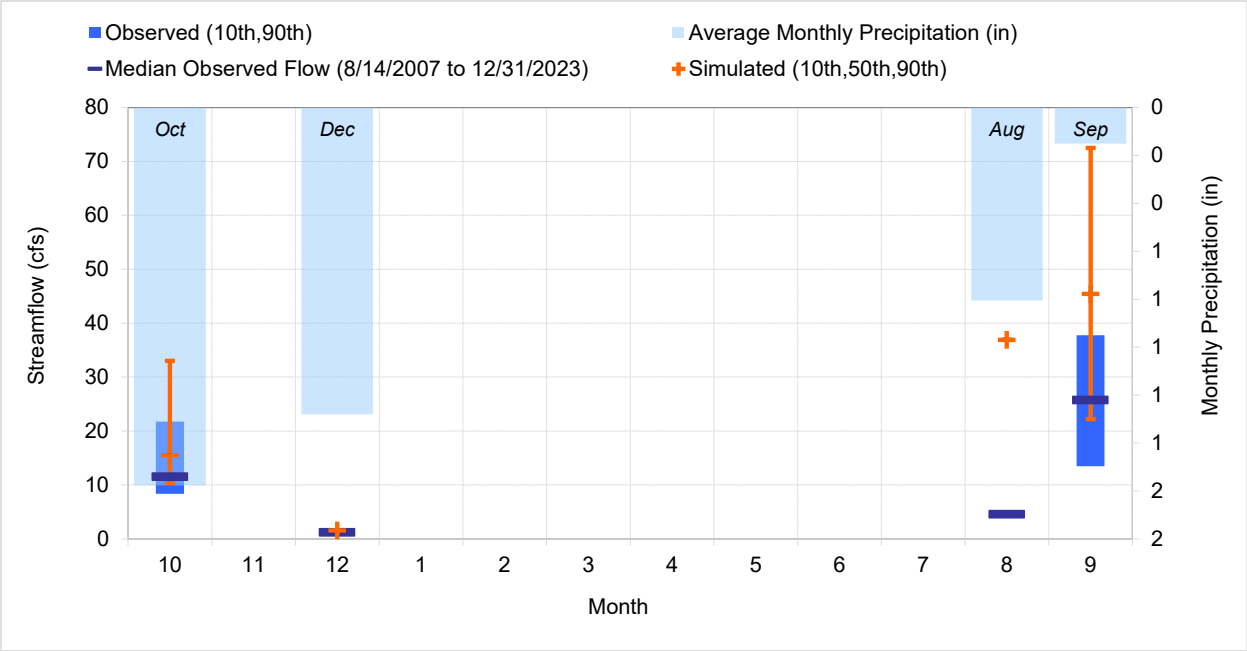

Figure A-147. Seasonal medians and ranges: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

Table A-50. Seasonal summary: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	13.81	11.56	8.37	21.75	19.83	15.54	10.39	33.00
Nov	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	1.26	1.26	1.26	1.26	1.58	1.58	1.58	1.58
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug	4.60	4.60	4.60	4.60	36.94	36.94	36.94	36.94
Sep	25.66	25.77	13.49	37.76	46.81	45.45	22.19	72.53

Table A-51. Summary statistics: Model output at Reach 115 versus DEP Powell Creek at SR 78 (08/14/2007 – 12/04/2007)

Powell Creek at SR80 (ID - FDEP)
Drainage Area (sq-mi): 12.1999998092651
Analysis Period: 8/14/2007 to 12/31/2023

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	2.04	3.62	77.68	10
Total lowest 50% flows	0.43	0.67	57.55	10
Total highest 10% flows	0.39	0.78	101.81	15
Summer flow volume (months 7-9)	1.07	2.23	109.01	30
Fall flow volume (months 10-12)	0.97	1.40	43.36	30
Winter flow volume (months 1-3)	0.00	0.00	nan	30
Spring flow volume (months 4-6)	0.00	0.00	nan	30
Total storm volume	0.68	1.42	108.31	20
Summer storm volume (7-9)	0.47	1.05	124.96	50
Baseflow	1.36	2.21	62.38	20
Nash-Sutcliffe Coefficient of Efficiency, E			-2.796	0.7
Baseline adjusted coefficient (Garrick), E'			-0.489	0.5
Monthly NSE			-0.064	0.8

DEP Stroud Creek

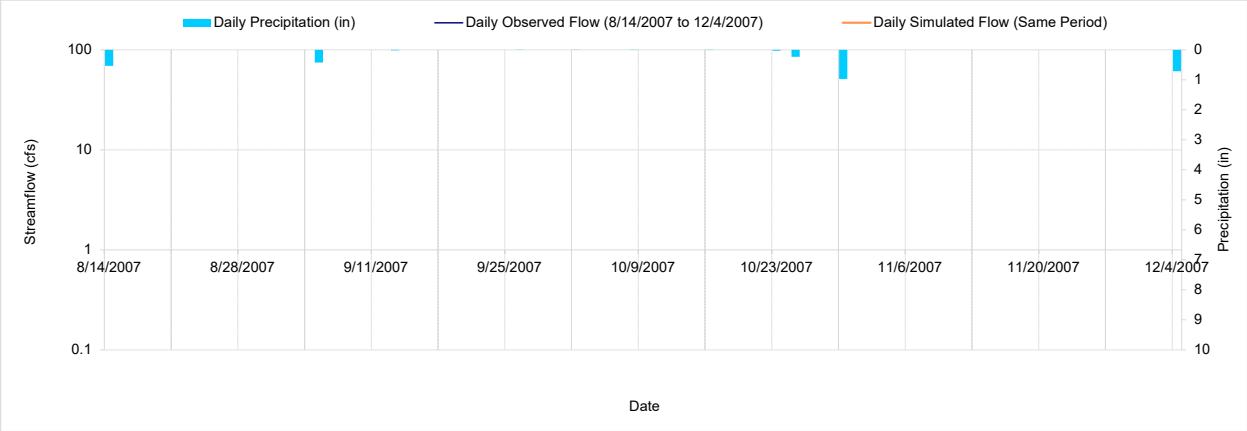

Figure A-148. Mean daily flow: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

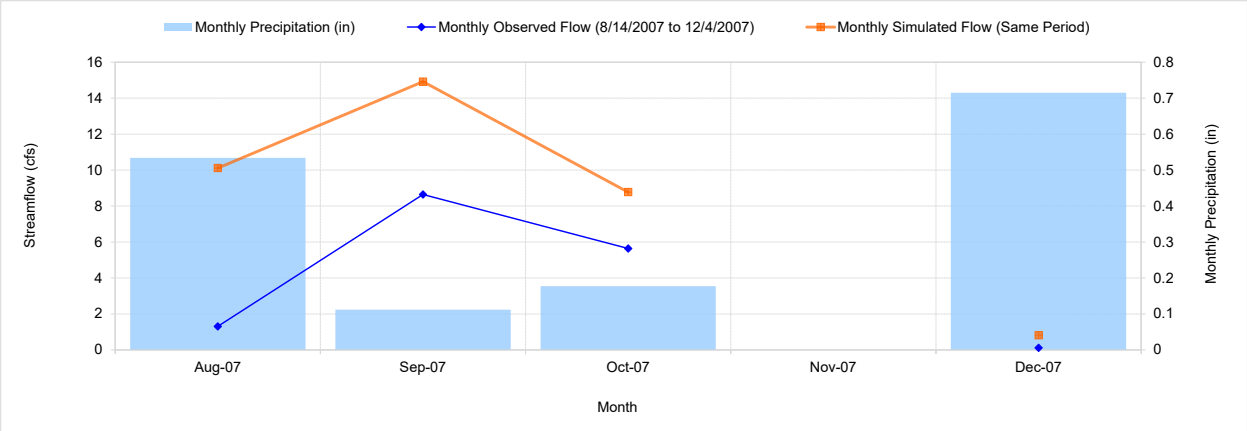

Figure A-149. Mean monthly flow: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

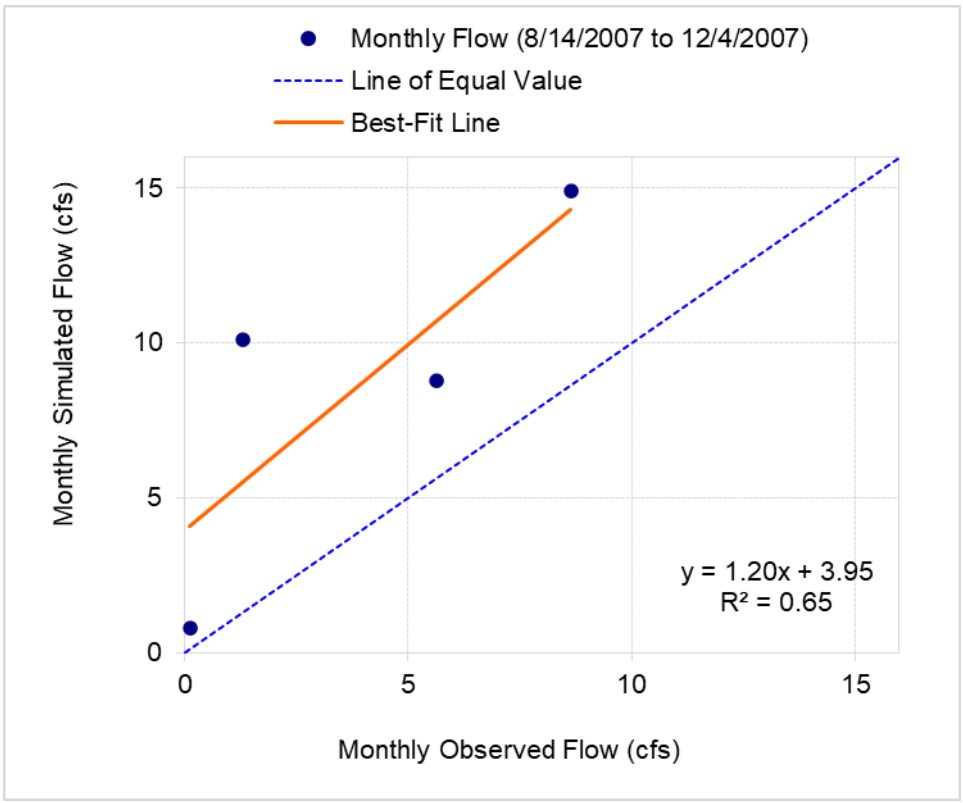

Figure A-150. Monthly flow regression and temporal variation: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

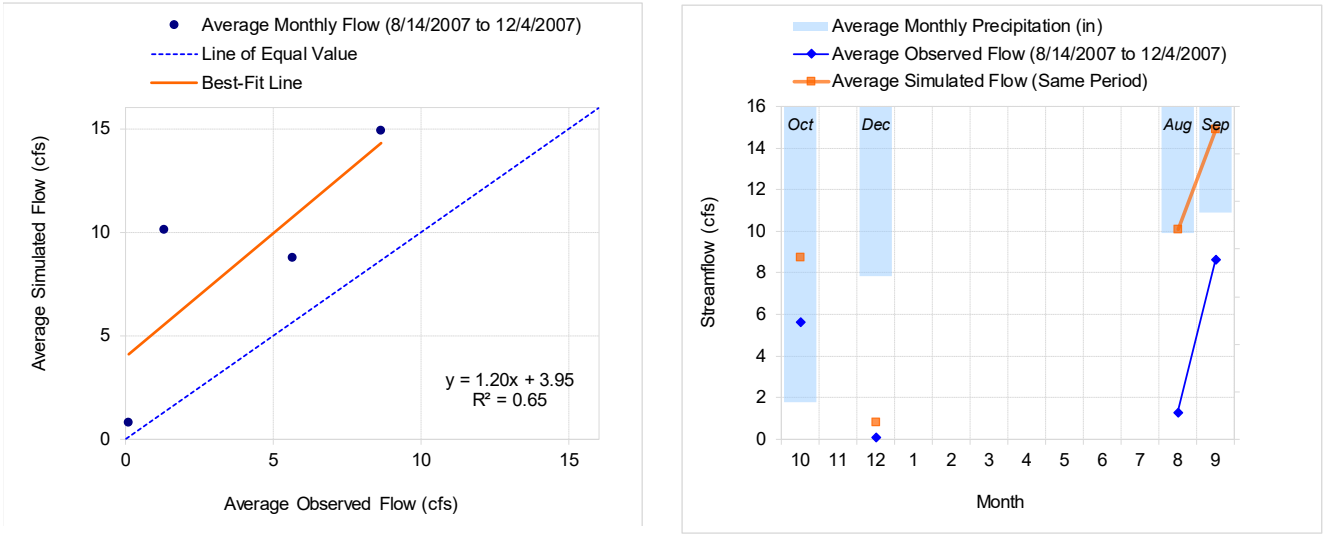

Figure A-151. Seasonal regression and temporal aggregate: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

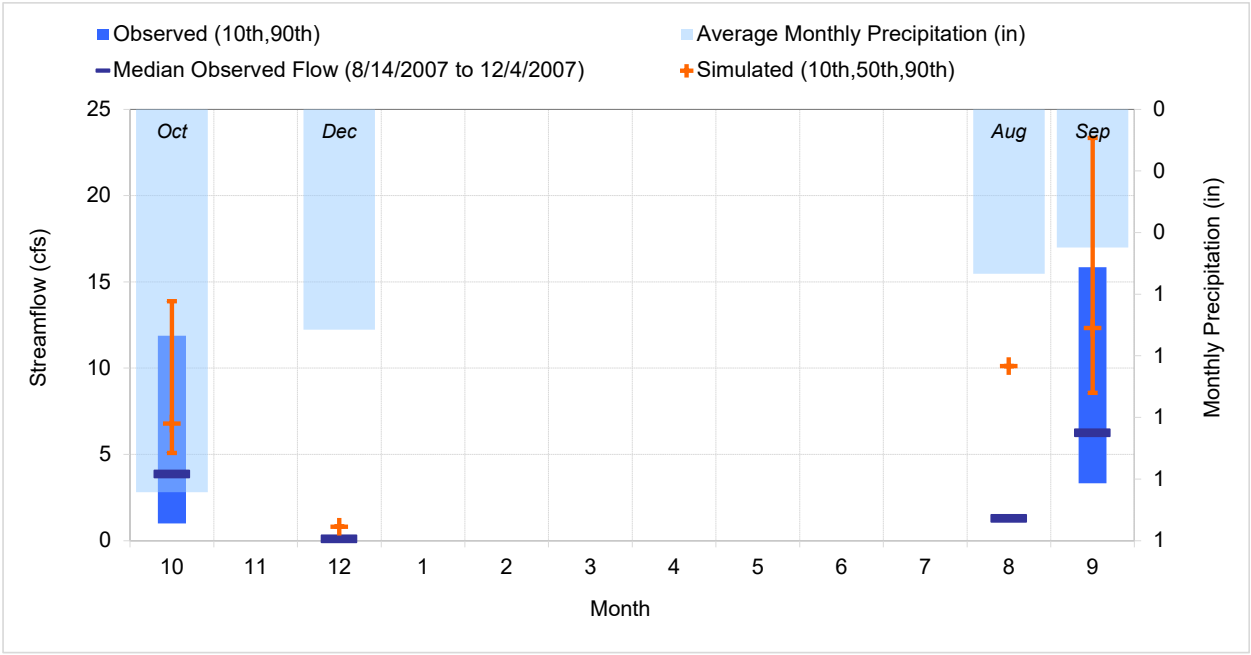

Figure A-152. Seasonal medians and ranges: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

Table A-52. Seasonal summary: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	5.64	3.88	1.00	11.88	8.78	6.78	5.08	13.88
Nov	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0.11	0.11	0.11	0.11	0.81	0.81	0.81	0.81
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug	1.31	1.31	1.31	1.31	10.11	10.11	10.11	10.11
Sep	8.64	6.27	3.33	15.85	14.92	12.33	8.57	23.35

Table A-53. Summary statistics: Model output at Reach 121 versus DEP Stroud Creek (08/14/2007 – 12/04/2007)

Stroud Creek (ID - FDEP)
Drainage Area (sq-mi): 8.48999977111816
Analysis Period: 8/14/2007 to 12/4/2007

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	1.08	1.89	75.00	10
Total lowest 50% flows	0.11	0.46	323.66	10
Total highest 10% flows	0.28	0.39	35.61	15
Summer flow volume (months 7-9)	0.51	1.00	94.62	30
Fall flow volume (months 10-12)	0.57	0.89	57.22	30
Winter flow volume (months 1-3)	0.00	0.00	nan >>	30
Spring flow volume (months 4-6)	0.00	0.00	nan	30
Total storm volume	0.55	0.58	5.84	20
Summer storm volume (7-9)	0.33	0.37	13.91	50
Baseflow	0.53	1.31	145.96	20
Nash-Sutcliffe Coefficient of Efficiency, E			0.057	0.7
Baseline adjusted coefficient (Garrick), E'			0.031	0.5
Monthly NSE			0.105	0.8

DEP Yellow Fever Creek

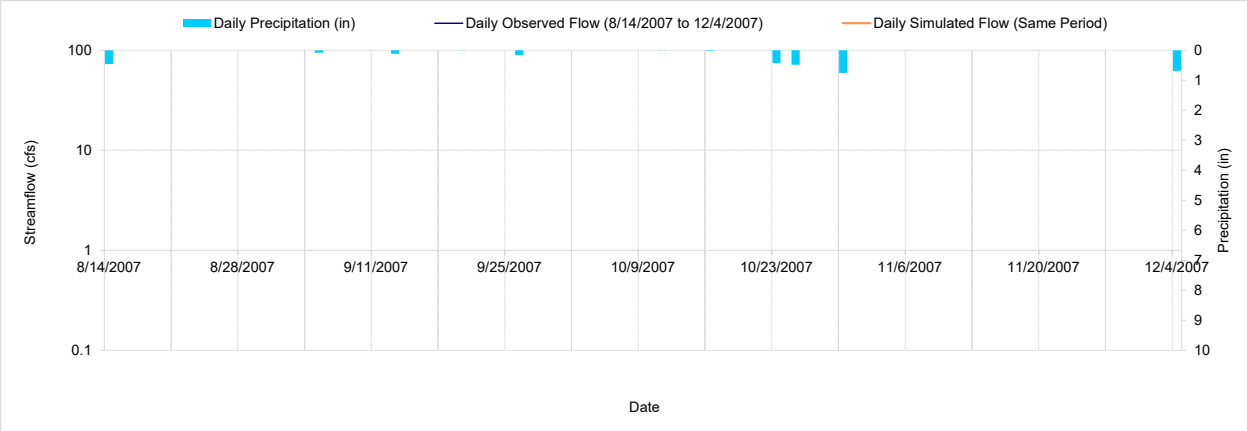

Figure A-153. Mean daily flow: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

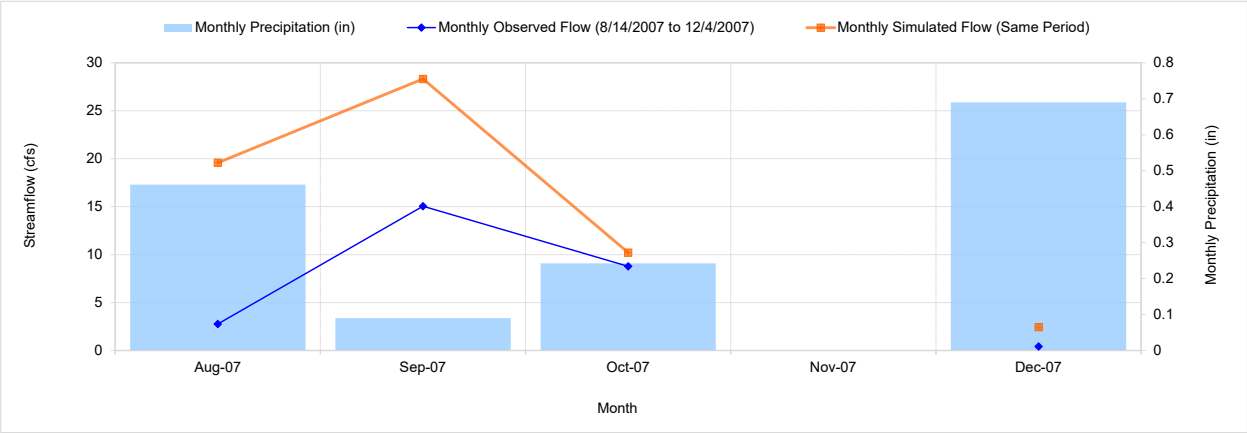

Figure A-154. Mean monthly flow: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

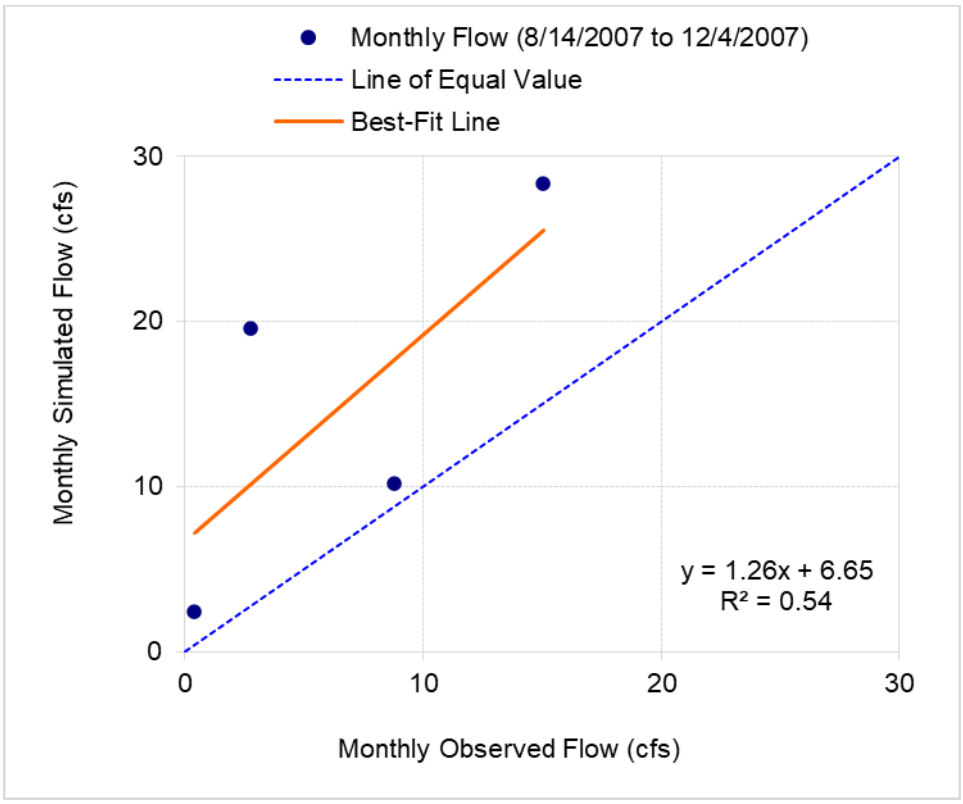

Figure A-155. Monthly flow regression and temporal variation: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

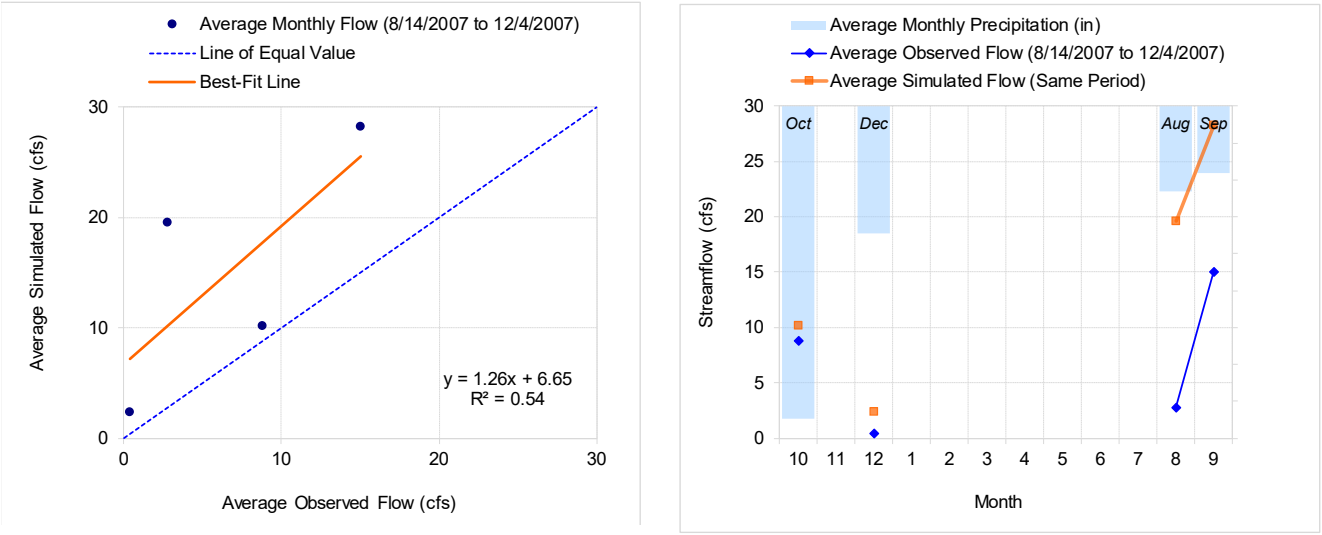

Figure A-156. Seasonal regression and temporal aggregate: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

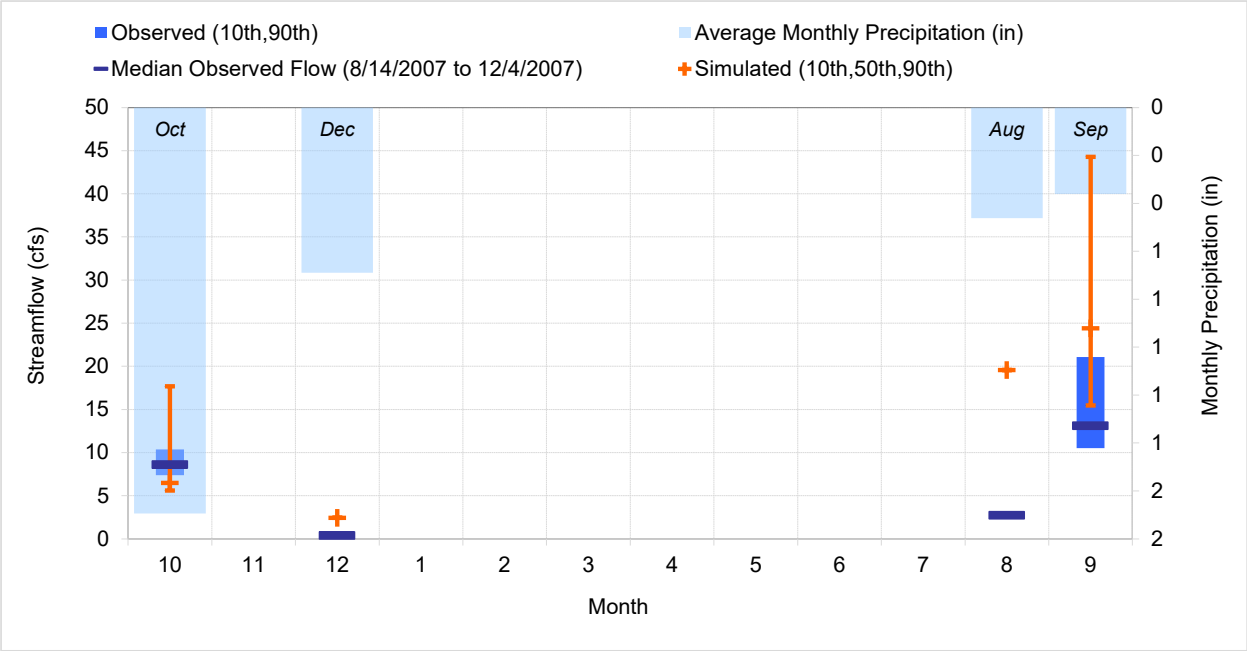

Figure A-157. Seasonal medians and ranges: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

Table A-54. Seasonal summary: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

Month	OBSERVED FLOW (cfs)				MODELED FLOW (cfs)			
	Mean	Median	Lower	Upper	Mean	Median	Lower	Upper
Oct	8.78	8.63	7.39	10.35	10.21	6.49	5.61	17.68
Nov	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dec	0.42	0.42	0.42	0.42	2.43	2.43	2.43	2.43
Jan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aug	2.76	2.76	2.76	2.76	19.58	19.58	19.58	19.58
Sep	15.04	13.13	10.53	21.07	28.31	24.40	15.46	44.29

Table A-55. Summary statistics: Model output at Reach 112 versus DEP Yellow Fever Creek (08/14/2007 – 12/04/2007)

Yellow Fever Creek (ID - FDEP)
Drainage Area (sq-mi): 2.75999999046326
Analysis Period: 8/14/2007 to 12/4/2007

Constituent	*Observed (in/yr)*	*Simulated (in/yr)*	*Error (Sim-Obs)*	*Recommended*
Total flow	5.48	9.09	65.65	10
Total lowest 50% flows	1.52	1.54	1.54	10
Total highest 10% flows	1.07	2.29	113.08	15
Summer flow volume (months 7-9)	2.76	5.84	111.13	30
Fall flow volume (months 10-12)	2.72	3.25	19.43	30
Winter flow volume (months 1-3)	0.00	0.00	nan >>	30
Spring flow volume (months 4-6)	0.00	0.00	nan	30
Total storm volume	1.60	3.36	109.83	20
Summer storm volume (7-9)	1.08	2.22	104.31	50
Baseflow	3.88	5.72	47.40	20
Nash-Sutcliffe Coefficient of Efficiency, E			-4.961	0.7
Baseline adjusted coefficient (Garrick), E'			-1.170	0.5
Monthly NSE			0.087	0.8