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# WATER RESOURCE VALUE ASSESSMENT FOR JACKSON BLUE SPRING

## TECHNICAL REPORT

*Prepared for*

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## 1. Introduction

This report describes the modeling and analyses that were performed for the Jackson Blue Spring (JBS) system water resource value (WRV) assessments in support of the development of a recommended minimum flow for Jackson Blue Spring. There are three main sections to this report. The first section describes the development of the steady-state Hydrologic Engineering Center River Analysis System (HEC-RAS) model, which was used to generate steady flow profiles to represent steady flow conditions in Merritts Mill Pond, and Spring Creek. The second section describes an analysis which was performed to assess the influence of the downstream boundary condition (Chipola River stage) on sensitivity of stages throughout the system to JBS flow to appropriately select downstream boundary conditions for the WRV assessments. The third section describes the WRV assessments and their results in relation to the Jackson Blue Spring Minimum Flow.

The study area includes Jackson Blue Spring, Merritts Mill Pond, and Spring Creek down to its confluence with the Chipola River. The study area is presented in Figure 1.

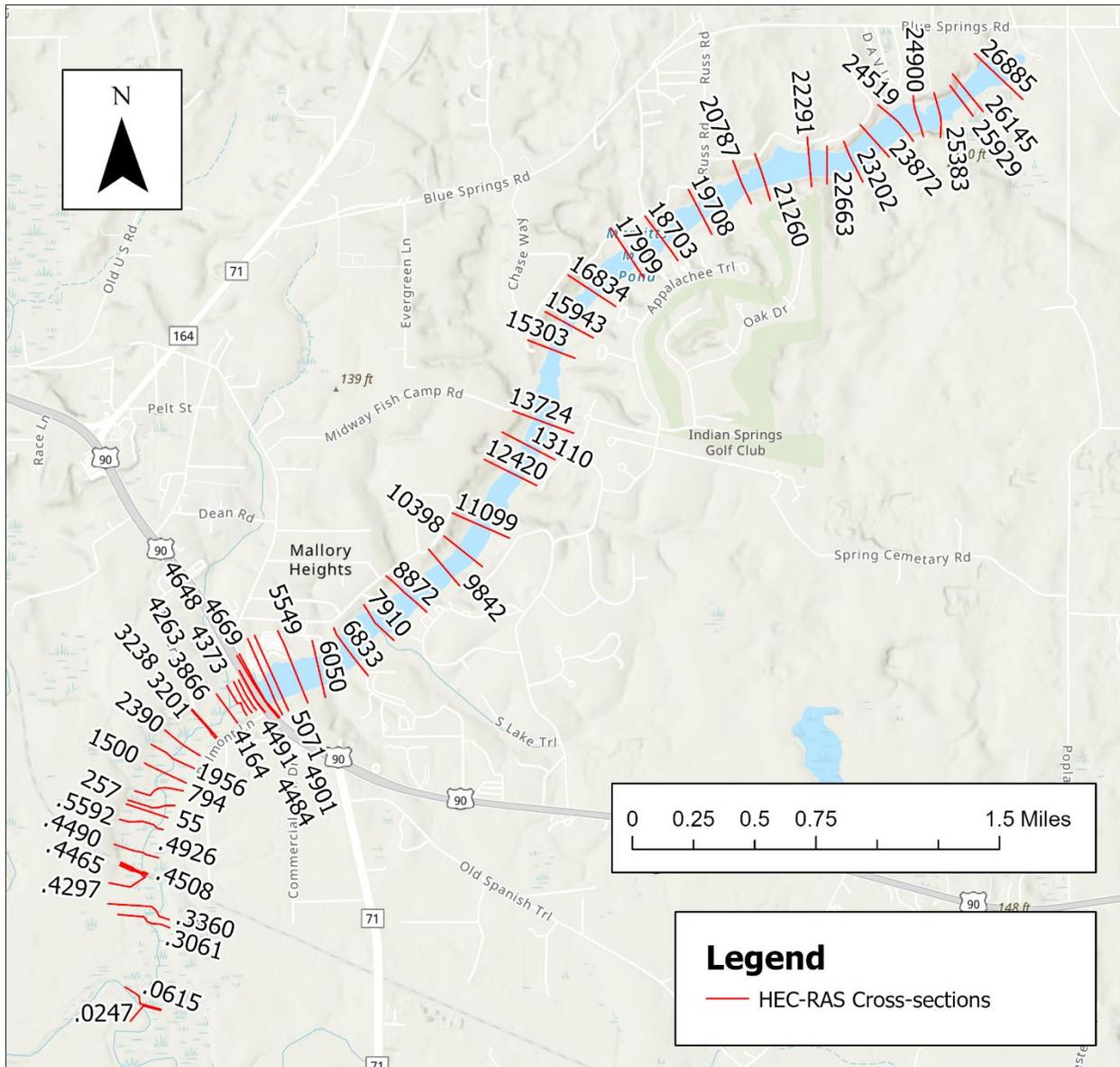


**Figure 1: Jackson Blue Spring MFL Study Area and Surface Water Monitoring Stations**

## 2. Steady-State HEC-RAS Model Development

### 2.1 Background

A steady-state HEC-RAS model was needed to develop a minimum flow and level (MFL) for Jackson Blue Spring (JBS) for the Northwest Florida Water Management District (NFWMD or 'District'). This model would be used to generate water surface profiles along Merritts Mill Pond (MMP) and Spring Creek (SC) as a function of Jackson Blue Spring discharge rate and Spring Creek stage at its confluence with the Chipola River (CR). The model could then be used to perform MFL water resource value (WRV) assessments for Merritts Mill Pond and Spring Creek. An unsteady-state model (with the HEC-RAS project name, Jackson Spring MFL\_2024) had been previously developed for the purpose of estimating Manning's  $n$  values for the Spring Creek channel and floodplain (Geosyntec Consultants, Inc., 2026). The unsteady-state model served as the starting point for the steady-state model. The locations of the cross-sections used in the HEC-RAS models are shown in Figure 2 and additional details on the cross-sections are provided in Table 1.



**Figure 2: Locations of the Cross-Sections Used in the HEC-RAS Model Labeled with Identifiers Used in the Model**

**Table 1: Geographical Information on the HEC-RAS Cross-Sections Used in the Model**

<b>ID</b>	<b>Waterbody</b>	<b>Landmark</b>	<b>Distance to Next Cross-section (ft)</b>	<b>Distance from Chipola River (ft)</b>
26885	Merritts Mill Pond	Jackson Blue Spring	740	32,451
26145	Merritts Mill Pond		216	31,711
25929	Merritts Mill Pond		546	31,495
25383	Merritts Mill Pond		483	30,949
24900	Merritts Mill Pond		382	30,467
24519	Merritts Mill Pond		647	30,085
23872	Merritts Mill Pond		670	29,438
23202	Merritts Mill Pond		539	28,768
22663	Merritts Mill Pond		372	28,230
22291	Merritts Mill Pond		1,031	27,857
21260	Merritts Mill Pond		473	26,826
20787	Merritts Mill Pond		1,079	26,353
19708	Merritts Mill Pond		1,005	25,274
18703	Merritts Mill Pond		795	24,270
17909	Merritts Mill Pond		1,074	23,475
16834	Merritts Mill Pond		891	22,401
15943	Merritts Mill Pond		641	21,509
15303	Merritts Mill Pond		1,579	20,869
13724	Merritts Mill Pond		613	19,290
13110	Merritts Mill Pond		691	18,677
12420	Merritts Mill Pond		1,320	17,986
11099	Merritts Mill Pond		701	16,665
10398	Merritts Mill Pond		557	15,964
9842	Merritts Mill Pond		970	15,408
8872	Merritts Mill Pond		961	14,438
7910	Merritts Mill Pond		1,077	13,476
6833	Merritts Mill Pond		784	12,400
6050	Merritts Mill Pond		500	11,616
5549	Merritts Mill Pond		479	11,115
5071	Merritts Mill Pond		169	10,637
4901	Merritts Mill Pond		232	10,467

**Table 1: Geographical Information on the HEC-RAS Cross-Sections Used in the Model**

ID	Waterbody	Landmark	Distance to Next Cross-section (ft)	Distance from Chipola River (ft)
4669	Merritts Mill Pond		21	10,235
4648	Merritts Mill Pond		88	10,214
4575	Merritts Mill Pond	Hwy. 90 Bridge	70	10,126
4491	Merritts Mill Pond		7	10,056
4484	Merritts Mill Pond		8	10,050
4482.4	Merritts Mill Pond	Control Structure	104	10,042
4373	Spring Creek		110	9,939
4263	Spring Creek		99	9,828
4164	Spring Creek		298	9,729
3866	Spring Creek		628	9,431
3238	Spring Creek		37	8,803
3201	Spring Creek		811	8,767
2390	Spring Creek		434	7,955
1956	Spring Creek		456	7,522
1500	Spring Creek		706	7,065
794	Spring Creek		537	6,360
257	Spring Creek		202	5,823
55	Spring Creek		275	5,620
0.5592	Spring Creek		667	5,345
0.4926	Spring Creek		418	4,678
0.4508	Spring Creek		18	4,261
0.4490	Spring Creek	Railroad Bridge	24	4,242
0.4465	Spring Creek		169	4,218
0.4297	Spring Creek		937	4,050
0.3360	Spring Creek		300	3,113
0.3061	Spring Creek		2,445	2,814
0.0615	Spring Creek		368	368
0.0247	Chipola River	Chipola River		

## 2.2 Modeling Methods

All HEC-RAS modeling done for this task was executed using HEC-RAS 6.4.1, [U. S. Army Corps of Engineers, (USACE), 2023], the same software version used to develop the unsteady model. The previously developed unsteady model was imported to HEC-RAS and saved as a new project (with the HEC-RAS project name Jackson Spring MFL\_2025\_Steady) to be modified for steady flow analysis.

### 2.2.1 Input Data Analysis and Preparation

The main modification to the HEC-RAS files was the creation of multiple sets of steady flow files which defined the flow and stage boundary values used to generate each of the desired water surface elevation (WSE) profiles. Data representing flow within the system (originating from JBS and flow pickup from smaller sources along the channel) and stage at the downstream end of the system (at the confluence of SC and CR) were needed to define the boundary conditions of the steady-state profiles. Data provided by the District representing flow from JBS and MMP and stage at the confluence of SC and CR were used for this purpose, but analysis and processing of the data was needed to assure that the HEC-RAS profiles would be adequate for the use in subsequent MFL WRV assessments. This included analysis of periods of record, probability distributions, and relationships between variables along with gap-filling and aggregation to produce consistent representations of daily mean values for each variable.

A time series representative of JBS discharge, corrected for historical groundwater withdrawals, was provided by the District to be used to define the upstream flow boundary in the model. This is described in more detail in the main body of the JBS technical assessment report. Statistical analysis was performed to investigate the relationship between MMP stage and MMP discharge along with JBS discharge and MMP discharge in order to extend the MMP discharge record. Ultimately, a data time series representative of MMP flow pickup, corrected for historical groundwater withdrawals, was provided by the District to define the flow at cross-sections along MMP where all of the flow pickup in the system was assumed to occur. No flow pickup was assumed for SC. This was based on concurrent manual flow measurements made at the most downstream end of MMP and three locations along SC showing very little increase in flow between MMP and the most downstream location in SC (2 to 9 cfs or 1 to 6 percent of the corresponding average daily measured flow; Table 2). A linear regression between daily CR stage at the United States Geological Survey (USGS) Marianna gage (USGS site ID: 02358789) and CR stage immediately upstream of the confluence with SC (the District’s “above Spring Creek” gage) was performed and the resulting model was used to create an extended, estimated data time series representing water surface elevation at the confluence of SC and CR, which was used to define the downstream model boundary. See the accompanying report on the development of the JBS HEC-RAS model (Geosyntec Consultants, Inc., 2026) for more details on the development of the model used for this work.

**Table 2: Manually Measured Flow and Stage Data Collected in Merritts Mill Pond and Spring Creek**

Date	Station Name	Distance from Chipola River (ft)	Measured Flow (cfs)	Station Stage (ft-NAVD88)
1/14/2025	Merritts Mill Pond	10,126	168	76.7
1/14/2025	Spring Creek Station 22	8,194	166	65.3
1/14/2025	Spring Creek Station 23	5,584	167	63.9

**Table 2: Manually Measured Flow and Stage Data Collected in Merritts Mill Pond and Spring Creek**

Date	Station Name	Distance from Chipola River (ft)	Measured Flow (cfs)	Station Stage (ft-NAVD88)
1/14/2025	Spring Creek TM13	4,493	170	63.3
1/28/2025	Merritts Mill Pond	10,126	157	76.6
1/28/2025	Spring Creek Station 22	8,194	160	65.2
1/28/2025	Spring Creek Station 23	5,584	157	63.9
1/28/2025	Spring Creek TM13	4,493	159	63.3
2/12/2025	Merritts Mill Pond	10,126	151	76.5
2/12/2025	Spring Creek Station 22	8,194	154	65.2
2/12/2025	Spring Creek Station 23	5,584	151	63.9
2/12/2025	Spring Creek TM13	4,493	157	63.2
2/25/2025	Merritts Mill Pond	10,126	147	76.5
2/25/2025	Spring Creek Station 22	8,194	156	65.2
2/25/2025	Spring Creek Station 23	5,584	153	63.8
2/25/2025	Spring Creek TM13	4,493	156	63.1

### 2.2.2 Model Setup and Calibration

The 1<sup>st</sup> – 99<sup>th</sup> percentiles of each of the time series referenced were used to define the boundaries for 99 steady-state HEC-RAS profiles. Prior to calculating percentile values, the three datasets were merged by date so that the percentiles for each variable were based on a consistent period of record, and the merged dataset was truncated so that only full years were included to account for data seasonality. The 99 percentile-based profiles verified the ability of the model to produce reasonable simulated water levels over the full range of observed flow and downstream water level conditions.

In addition to the 99 profiles generated based on corresponding percentiles of the three boundary datasets, profiles were also generated for comparison with concurrent manual stage measurements along SC (Table 2). This was done by first estimating the most downstream SC stage using the stage recorded at the Marianna gage by the USGS on each data collection date and the previously mentioned linear regression model. For instance, the average gage height at the Marianna gage reported by the USGS on the first manual flow measurement date (1/14/2025) was 7.38 ft. Using Equation 2, the water level at the confluence of SC and CR (i.e., the most downstream water level on SC) was estimated to be 60.97 ft-NAVD88. One steady-state model run was performed for each data collection date using the estimated downstream boundary condition for each date to generate a simulated water surface profile for each data collection date that could be compared to manually measured water surface elevations. Each model run used the 1 – 99-percentile JBS and MMP flows, resulting in 99 steady-state water surface profiles representing the water surface that would result under the downstream condition observed on each data collection date and each of the 99 flow conditions. A profile for each data collection date was generated by interpolating the HEC-RAS-generated profiles based on the average flow measured on each day. For instance, the average flow measured on 1/14/2025 was 168 cfs. Therefore, the water surface profiles under the 28<sup>th</sup>-percentile flow (167 cfs) and the 29<sup>th</sup>-

percentile flow (169 cfs) were interpolated between to generate a water surface profile representative of 1/14/2025. The flow-interpolated profile was then interpolated between cross-sections to estimate the modeled WSE at the location of each manual measurement station. The modeled WSE data was compared to the measured data, and adjustments were made to Manning’s n values in the Spring Creek channel to calibrate the model to the measured data by minimizing the error between the measured and modeled datasets.

## 2.3 Modeling Results

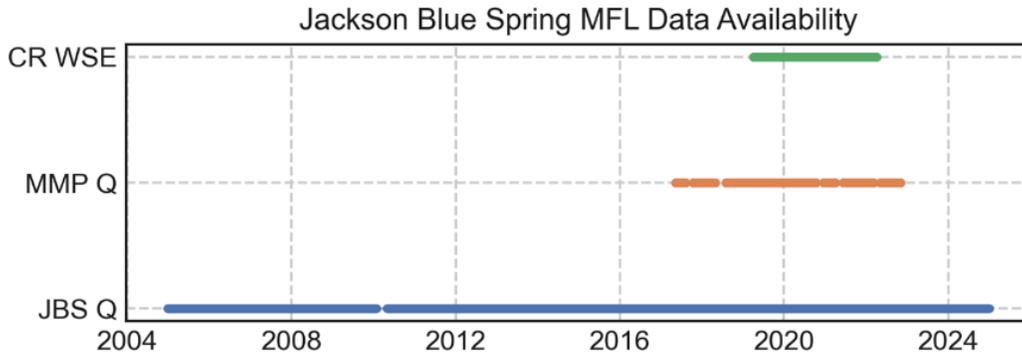
### 2.3.1 Input Data Analysis and Preparation

The available data for JBS flow, MMP flow, and CR/SC stage were analyzed to determine the effects of differing periods of record and data frequencies on the probability distributions that the modeled WSE profiles would be based on. Daily data were available for JBS flow from 12/21/2004 to 1/1/2025, 15-minute data were available for MMP flow from 5/10/2017 to 11/2/2022, and 15-minute data were available for CR/SC stage from 4/1/2019 to 4/5/2022 (Figure 3). Large differences were found between the probability distributions of the variables derived from the period of record of each variable compared to probability distributions derived from the ~3-year period common to all three variables (Figure 4a – Figure 4c) especially for JBS flow which had the longest period of record (Figure 4a). However, only slight differences were found between 15-minute, mean hourly, and mean daily MMP flow (Figure 4d). These results suggested that mean daily data would be sufficient for describing the three variables, but that the periods of record should be extended if possible so that the derived distributions would be more representative of the true distributions, representative of historical conditions.

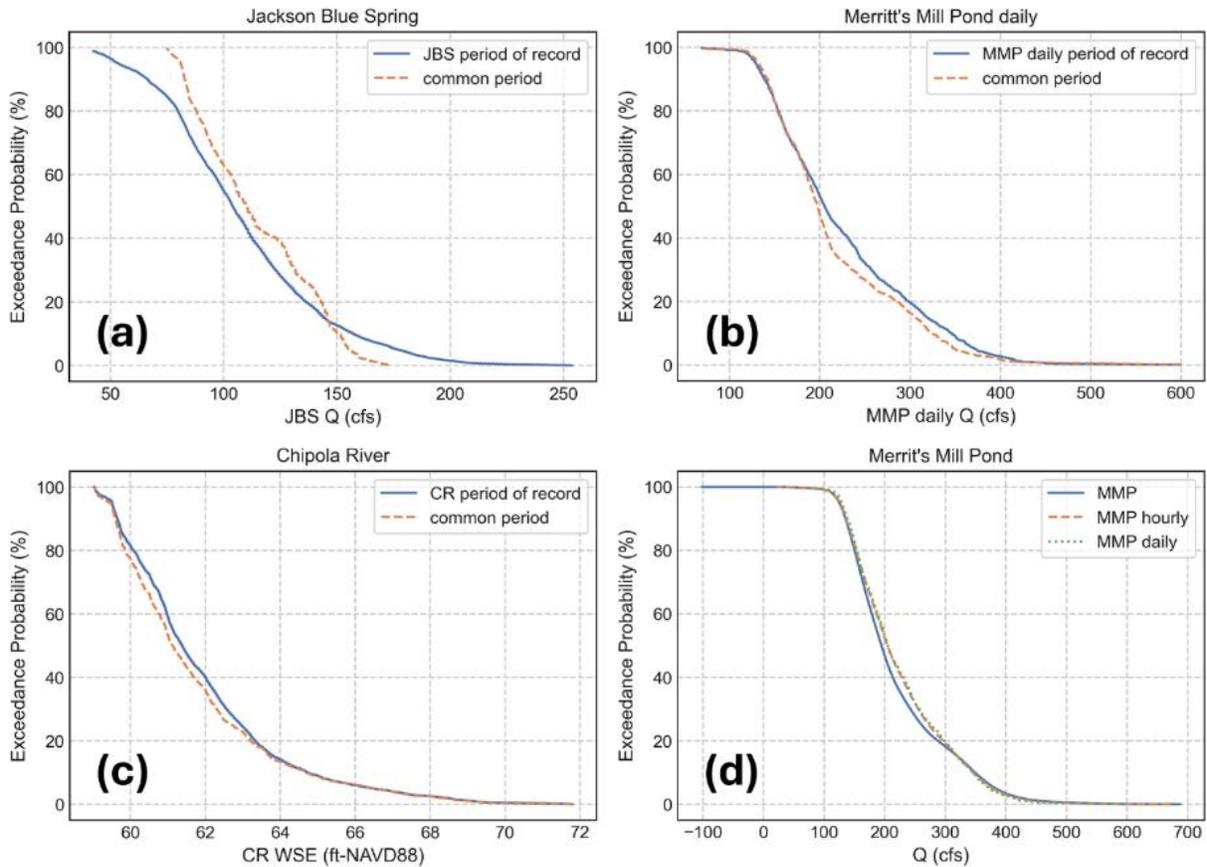
A regression was previously developed by Verdantas to extend the 15-minute data record for Chipola River above Spring Creek stage (Equation 1) (Verdantas, 2022). That regression estimated WSE, in feet above North American Vertical Datum of 1988 (ft-NAVD88), at Chipola River above Spring Creek based on WSE at the Marianna gage 9 hours prior. Since daily data were to be used for the HEC-RAS model, a similar regression equation was developed between gage height at the Marianna gage (with a datum 55.7 ft above NAVD88) and WSE above Spring Creek in NAVD88 (Equation 2 and Figure 5). The resulting equation had a slope identical to the previously developed equation, an intercept similar to the datum of the Marianna gage, and an  $r^2$  value of 0.99. It was decided to use this equation to extend the CR above SC record to match the record of the Marianna gage available at the time (9/30/1999 – 2/10/2025).

$$WSE_{SC} = 0.8002 * WSE_{M,t-9} + 10.4641 \quad \text{Equation 1}$$

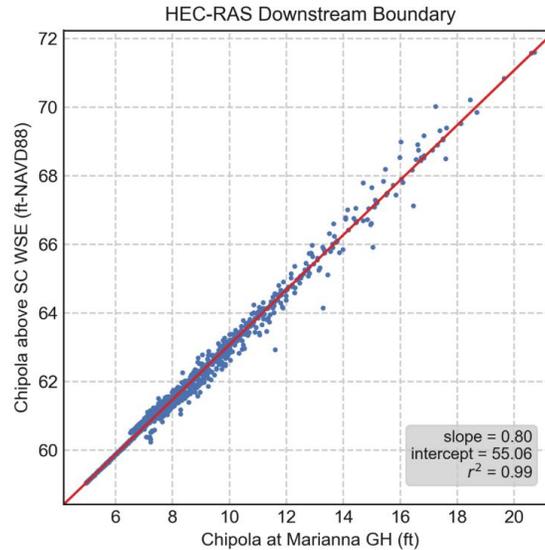
$$WSE_{SC} = 0.80 * WSE_M + 55.06 \quad \text{Equation 2}$$



**Figure 3: Periods of Record for Jackson Blue Spring Discharge (JBS Q, daily, corrected for historical withdrawals), Merritts Mill Pond Discharge (MMP Q, 15-minute), and Chipola River above Spring Creek Stage (CR WSE, 15-minute)**



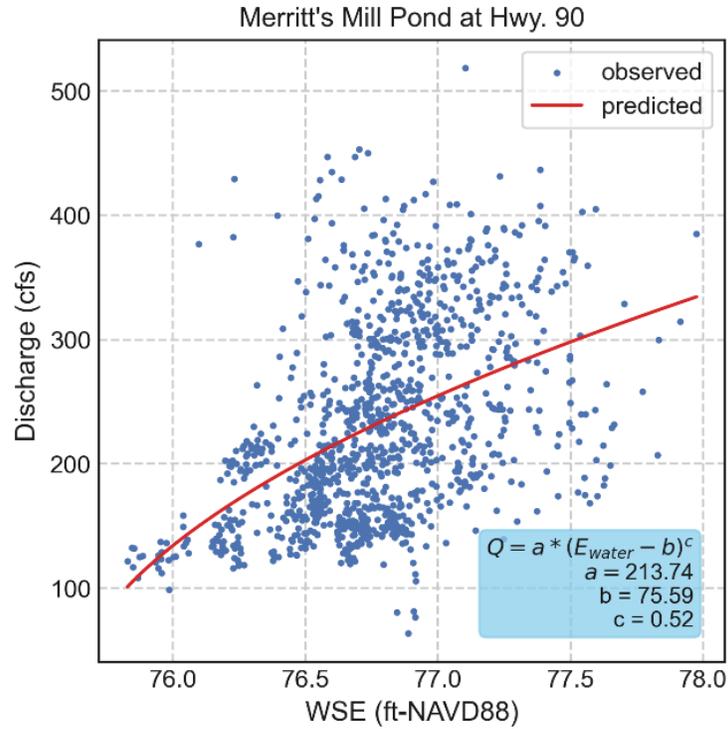
**Figure 4: Exceedance Probability Distributions for Daily Mean Jackson Blue Spring flow (a), Merritts Mill Pond flow (b and d), and Chipola River above Spring Creek stage (c) Based on Respective Periods of Record and the ~3-year Common Period and for Three Different Aggregation Levels (15-minute, hourly, and daily; MMP only; d)**



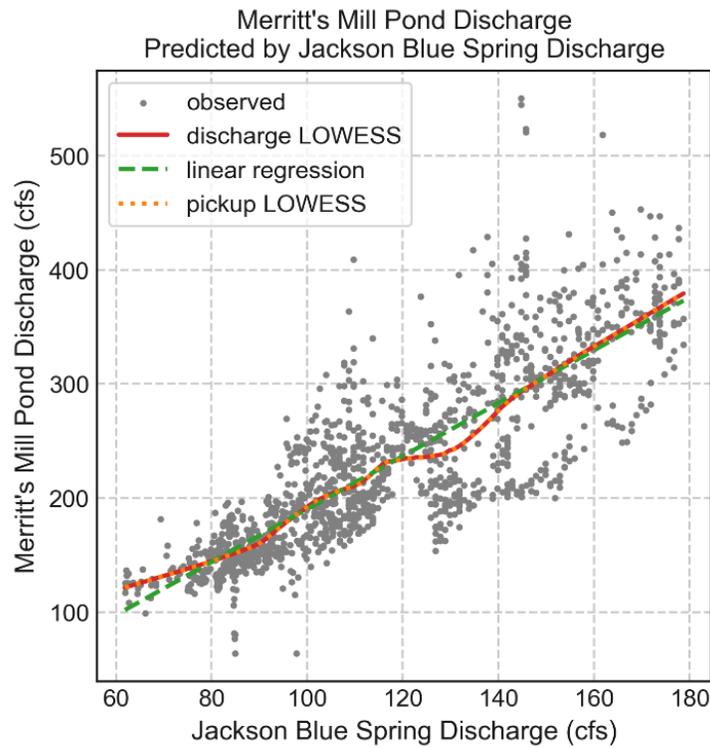
**Figure 5: Relationship between Water Surface Elevation (in ft-NAVD88) at the Chipola River above Spring Creek and Chipola River Gage Height at the Marianna Gage**

MMP discharge was modeled statistically using a power relationship with MMP stage (Figure 6). MMP was also modeled statistically using a linear regression and Locally Weighted Scatter Plot Smoothing (LOWESS) with JBS discharge (Figure 7). The statistical analysis of MMP discharge with MMP stage and JBS discharge showed that there was a much higher correlation with JBS discharge compared to MMP stage. This indicated that the best available option for extending the MMP discharge dataset was to use a relationship with JBS discharge. Also, it was found that MMP discharge could be modeled by estimating flow pickup in MMP based on JBS discharge with equal predictive accuracy as estimating MMP discharge directly. Since the District’s groundwater flow model covering the underlying aquifer system in this area was capable of estimating MMP pickup, the District decided to estimate MMP pickup using a locally estimated scatterplot smoothing (LOESS) model with JBS discharge. The LOESS model used was slightly smoother than the LOWESS model depicted in Figure 7 and appeared to be a good compromise between the LOWESS and linear models. The estimated MMP pickup dataset was then adjusted to account for historical pumping using the District’s groundwater flow model in the same way the JBS discharge dataset was adjusted for pumping impacts. The final, historical pumping-corrected, MMP pickup dataset was provided by the District and reflects a baseline flow time series with historical pumping impacts removed. The pickup was then added incrementally to the total flow at each cross-section along MMP in the HEC-RAS model.

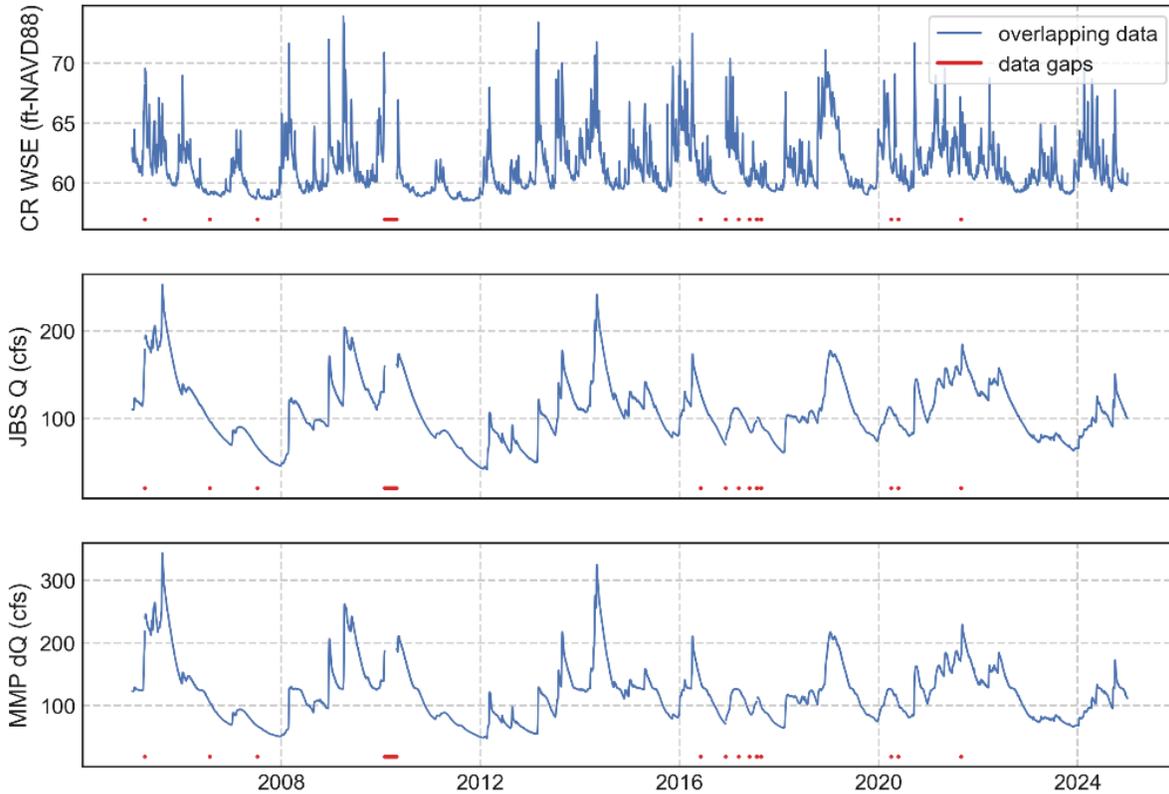
After the extended datasets had been generated for CR/SC stage and MMP pickup, the three boundary condition datasets were filtered based on the period of record common to all three and trimmed to only include full years. This resulted in three near-continuous, 20-year timeseries datasets spanning from 1/1/2005 – 12/31/2024 (Figure 8).



**Figure 6: Relationship between Merritts Mill Pond Discharge and Water Surface Elevation Modeled Using a Power Law Equation**



**Figure 7: Relationship between Merritts Mill Pond Discharge and Jackson Blue Spring Discharge Modeled Using Linear Regression and LOWESS**



**Figure 8: The Three Daily Time Series; Chipola River above Spring Creek Stage (CR WSE), Jackson Blue Spring Discharge (JBS Q) and Merritts Mill Pond Pickup (MMP dQ), Used to Define Downstream Stage and Upstream/Intermediate Flow Boundaries in the Steady-State HEC-RAS Model**

### 2.3.2 Model Setup and Calibration

Initial model setup and testing involved creating 99 WSE profiles based on the 1<sup>st</sup> – 99<sup>th</sup> percentiles of flow and stage boundaries. This initial test resulted in a successful model execution and showed that the model could produce reasonable results over the full range of water levels and flows needed for MFL WRV assessments (Figure 9).

Other initial tests included model runs in which the flow boundaries were based on the 1<sup>st</sup> – 99<sup>th</sup> percentiles of JBS discharge and MMP pickup (MMP dQ), but the downstream flow boundary was set at the mean elevation for the Chipola River above Spring Creek for each of the four dates that manual flow and stage measurements took place, estimated using the mean daily gage height measured at the Marianna gage by the USGS on those dates and Equation 2. As described in Section 2.2.2, the WSE profiles simulated by these model runs were linearly interpolated based on flow and total distance upstream to generate WSE estimates for each of the manual measurement times and locations.

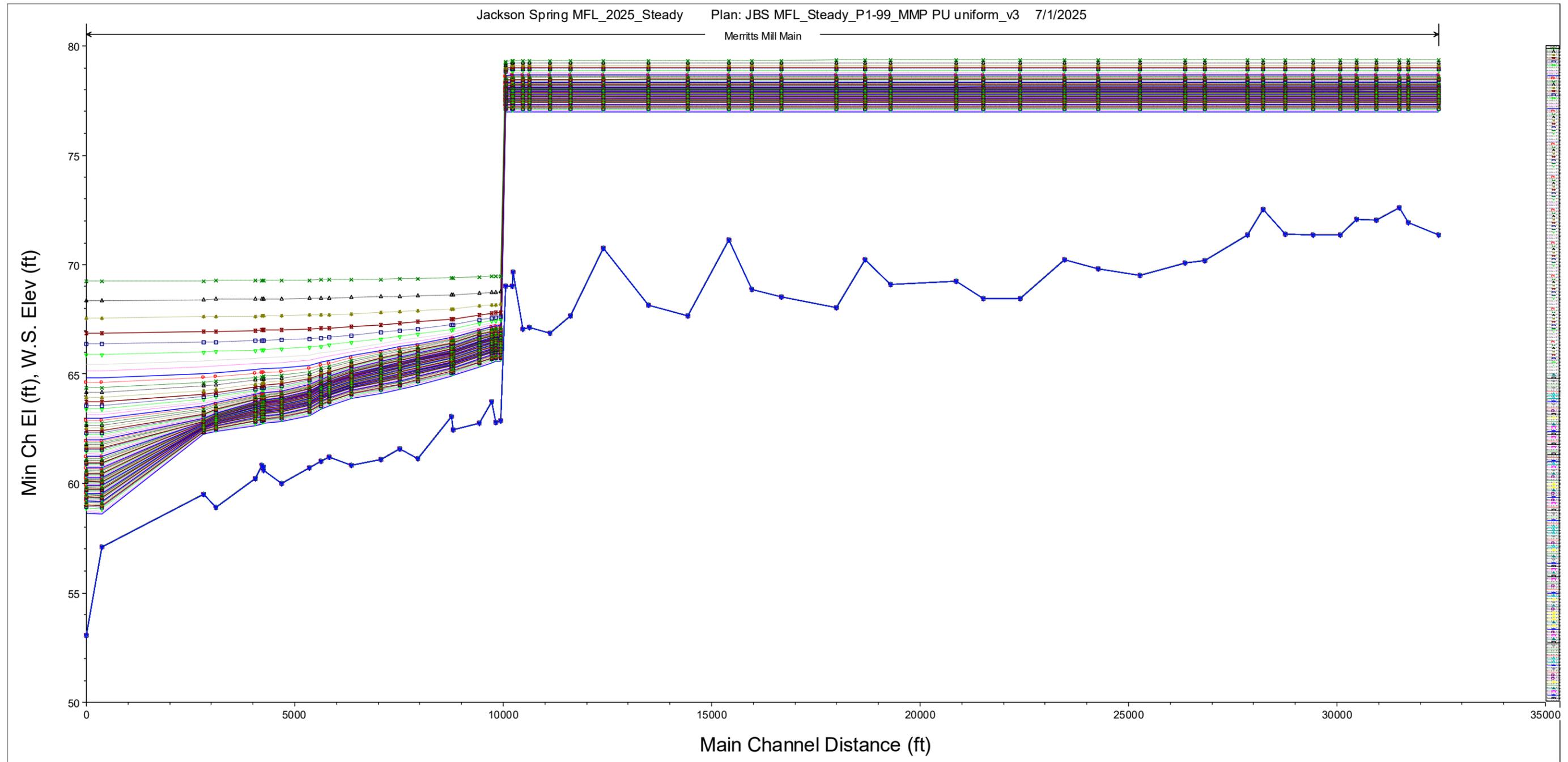
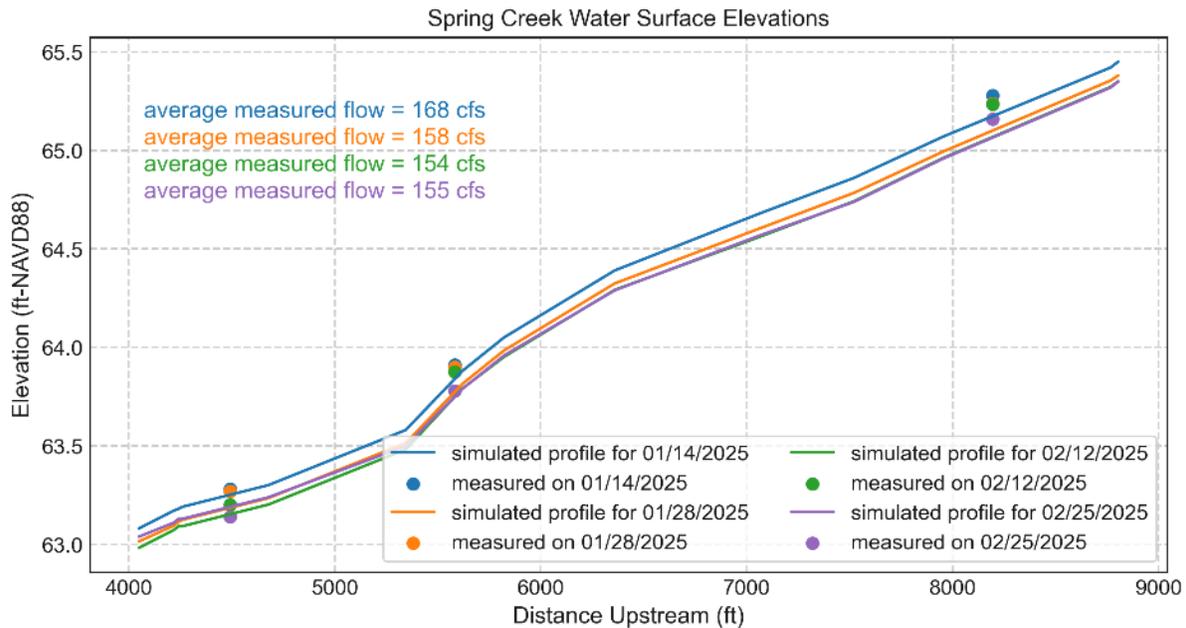
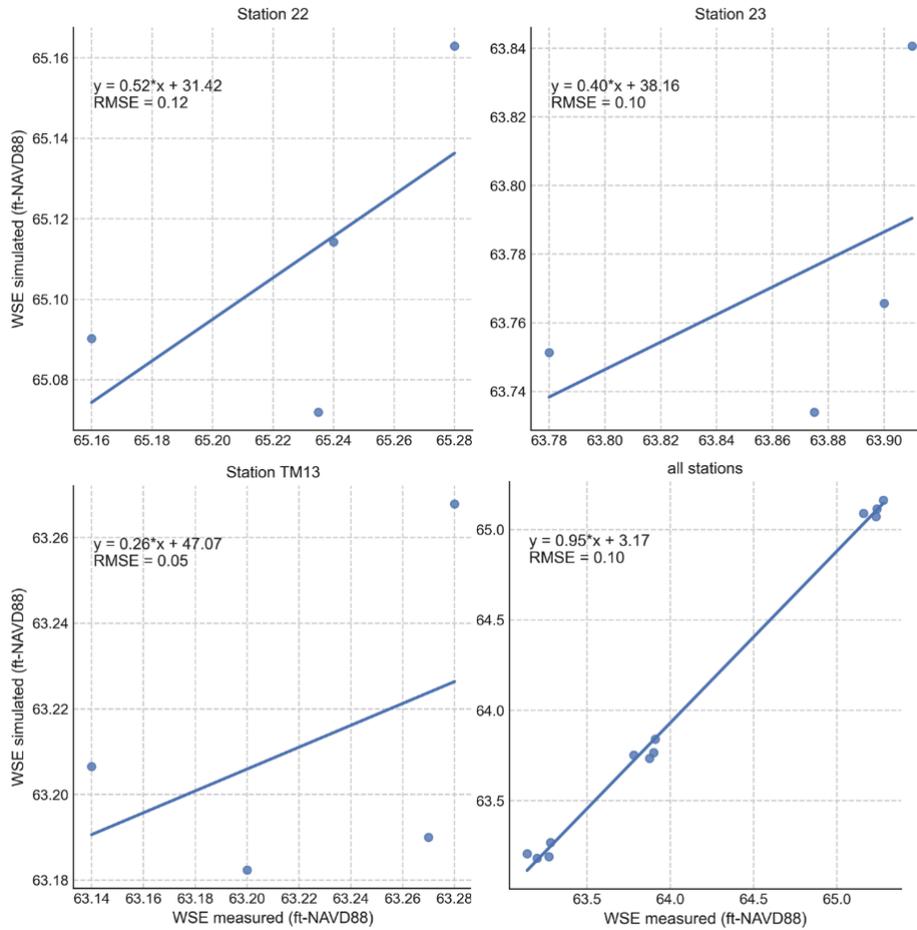


Figure 9: Simulated Steady-State Water Surface Elevation Profiles Based on 1st – 99th Percentile Jackson Blue Spring Discharge, Merritts Mill Pond Discharge, and Chipola River above Spring Creek Stage. The lowest elevation (blue) line is the channel thalweg elevation used in the model, for reference.

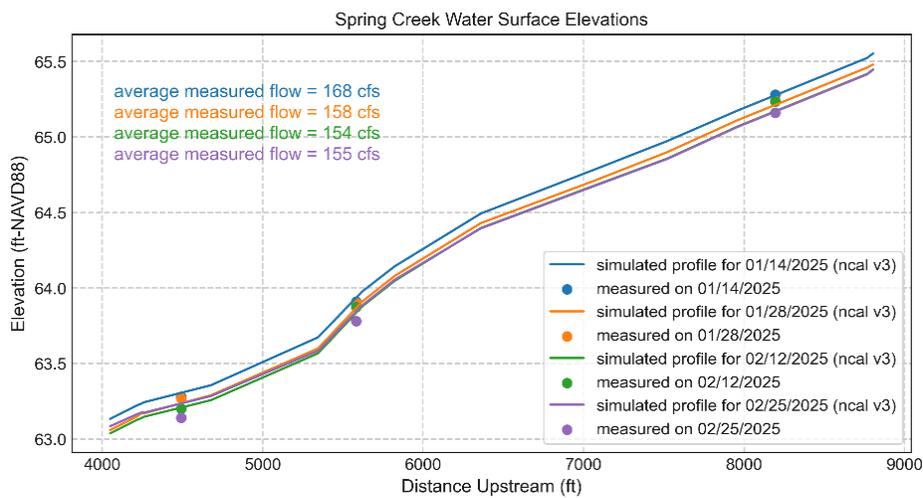
The initial model comparisons to the measured WSE data showed that the model tended to underestimate upstream WSEs (Figure 10) and there was an overall WSE root mean square error of 0.10 ft (Figure 11). The Manning’s n values were adjusted iteratively to minimize the error in the WSE estimates resulting in a final WSE Root Mean Squared Error (RMSE) of 0.05 ft (Figure 12 and Figure 13). This was achieved by adjusting all Manning’s n values in Spring Creek upstream of the railroad bridge (above cross section 0.4508) up by 0.005 and adjusting all Manning’s n values in Spring Creek at and downstream of the railroad bridge up by 0.002. This change in Manning’s n values resulted in an average increase of 0.09 ft in WSE simulated in Spring Creek (2.5% increase in depth) and a maximum increase of 0.16 ft (5% increase in depth) over the full range of flows used in the simulation, indicating the overall effect of the adjustment was minimal. It was decided that the steady-state model with adjusted Manning’s n values would be used to produce the WSE profiles needed for the Jackson Blue Spring MFL WRV assessments. These profiles would be based on the 1<sup>st</sup> – 99<sup>th</sup> percentiles of JBS discharge and MMP pickup, and the downstream boundaries would be determined based on the results of a sensitivity analysis such that WRVs would be assessed based on flows and levels dominated by JBS discharge rather than CR stage (Section 3).



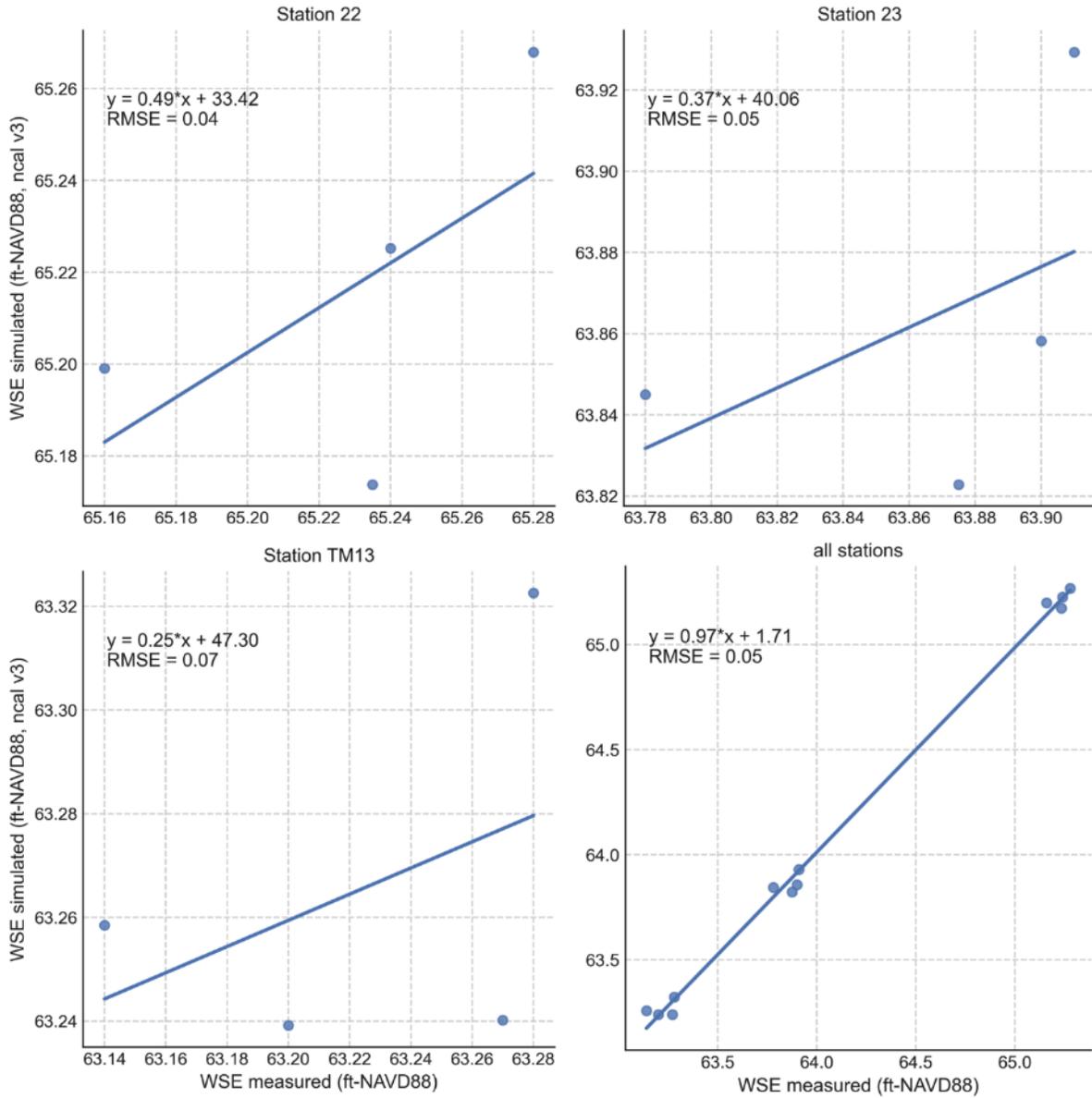
**Figure 10: Simulated Water Surface Elevation Profiles And Corresponding Manually Measured Water Surface Elevations For Each Data Collection Date before Adjustment of Manning’s n Values**



**Figure 11: Simulated Water Surface Elevations versus Corresponding Manually Measured Water Surface Elevations before Adjustment of Manning’s n Values**



**Figure 12: Simulated Water Surface Elevation Profiles and Corresponding Manually Measured Water Surface Elevations for Each Data Collection Date after Adjustment of Manning’s n Values**



**Figure 13: Simulated Water Surface Elevations versus Corresponding Manually Measured Water Surface Elevations after Adjustment of Manning’s n Values**

### 3. Assessment of the Influence of Chipola River Stage on the Sensitivity of Spring Creek Stage to Jackson Blue Spring Flow

#### 3.1 Background

The establishment of the MFLs for Jackson Blue Spring (JBS) required determining the maximum change in JBS discharge at which no downstream water resource values would be significantly harmed. Therefore, it was required to determine which water levels at downstream locations were dominated by JBS discharge as opposed to other potential drivers, such as backwater effects by the Chipola River.

JBS flows directly into MMP and forms the headwaters of the pond. MMP flows into Spring Creek (SC), which flows into the Chipola River (CR) (Figure 1). Water levels in MMP are controlled artificially by a manmade control structure, which was assumed to be fixed such that MMP would be controlled at its highest controllable elevation for the MFL WRV assessments. Thus, variations in levels in MMP were expected to be dominated by JBS discharge in the JBS MFL analyses. The water levels in Spring Creek, however, are also affected by the Chipola River stage, which varies naturally due to time-varying hydrological processes such as rainfall, runoff and baseflow pickup. Given that the Spring Creek thalweg elevation decreases by approximately 6.5 ft between its start at MMP and its end at CR, it is likely that upstream Spring Creek water levels are dominated by JBS discharge while downstream levels are dominated by CR stage. It is also likely that the transition point between the two water level control regimes depends on JBS discharge and CR stage.

As discussed in the previous section, a HEC-RAS model was developed to generate steady-state WSE profiles in MMP and SC based on JBS discharge, MMP pickup, and CR stage. The WSE profiles simulated by the hydraulic model were used for the WRV assessments, which are discussed in the following section. Therefore, a sensitivity analysis was performed on the WSE profiles simulated by the steady-state HEC-RAS model to determine the locations and conditions at which WSE is dominated by JBS discharge as opposed to CR stage.

#### 3.2 Modeling Methods

Multiple model runs were performed to generate WSE profiles which could be used to quantify the sensitivity of the simulated WSEs to JBS discharge. Nine total model runs were performed corresponding to downstream boundaries ranging from the 10<sup>th</sup> percentile CR stage to the 90<sup>th</sup> percentile CR stage in increments of 10 percent. Each model run generated 99 WSE profiles corresponding to the 1<sup>st</sup> – 99<sup>th</sup> percentile JBS discharge and MMP pickup which defined the upstream and intermediate flow boundaries, respectively.

The sensitivity of simulated WSE to JBS discharge and MMP discharge was calculated for every flow percentile, at each HEC-RAS cross-section, and for each CR percentile using Equation 3. Sensitivity statistics (mean and standard deviation) were also calculated for each location and downstream boundary condition, and the results were analyzed graphically to determine the points at which WSE was dominated by JBS/MMP discharge.

$$\frac{dE_P}{dQ_P} = \frac{\frac{E_{P+1} - E_P}{Q_{P+1} - Q_P} + \frac{E_P - E_{P-1}}{Q_P - Q_{P-1}}}{2}$$

Equation 3

where:

$E_P$  = Simulated water surface elevation (ft-NAVD88) corresponding to upstream/intermediate flow boundary percentile  $P$ .

$Q_P$  = JBS or MMP  $P$ -percentile discharge in cubic feet per second (cfs).

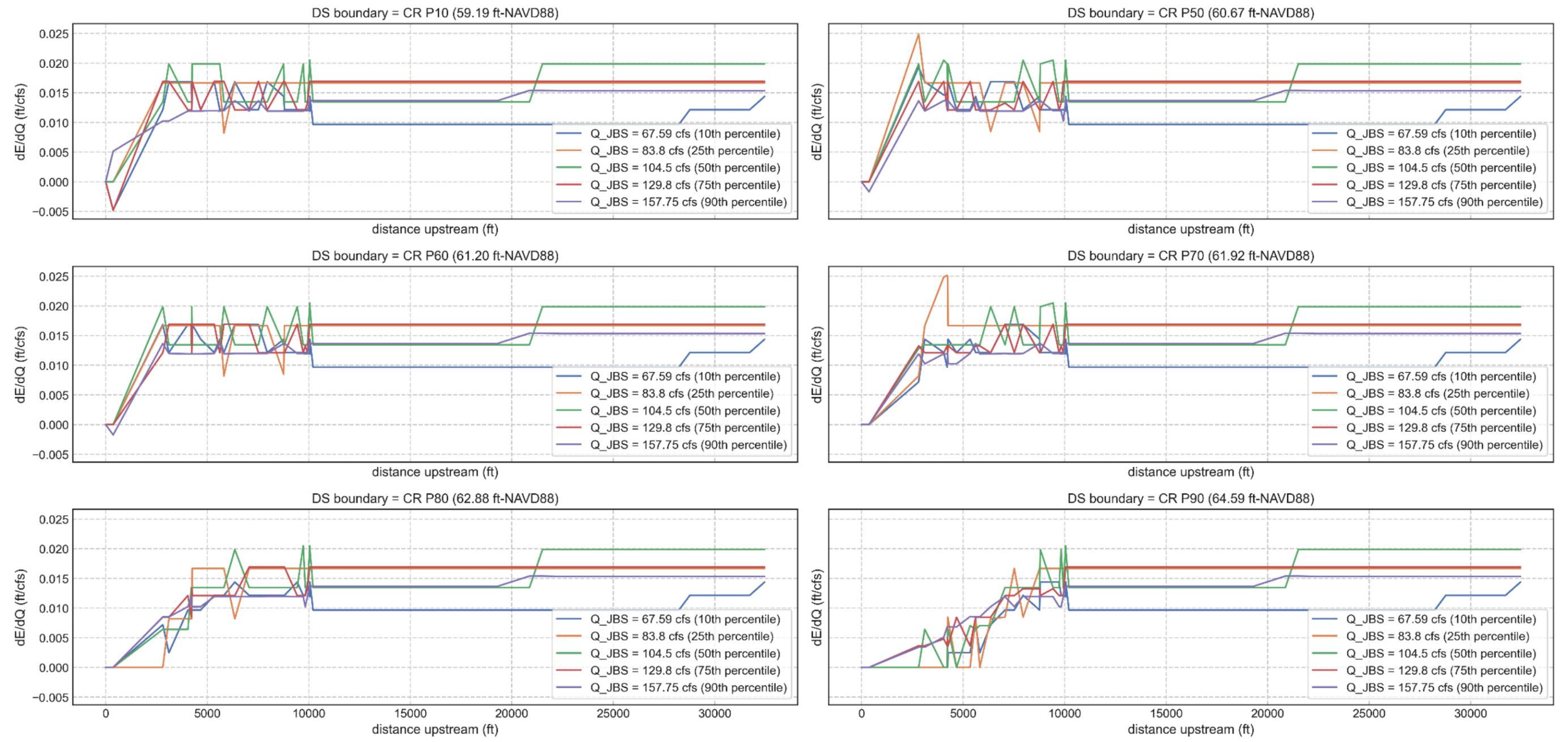
### 3.3 Results

The sensitivity of simulated WSE to JBS discharge and MMP discharge was calculated at every cross-section in the HEC-RAS model for every discharge percentile and downstream boundary condition (examples shown in Figure 14 through Figure 17). It was found that the WSE sensitivity varied with both location and flow, but the effect of location was more pronounced in Spring Creek compared to Merritts Mill Pond. Given the high variability in sensitivity between locations along Spring Creek, mean and standard deviation of sensitivity at each location and downstream boundary condition were calculated and visualized to more clearly discern the relationships between sensitivity and flow, downstream stage, and location (Figure 18 through Figure 23).

The mean WSE sensitivity to JBS discharge ranged from 0 – 0.017 ft/cfs and that for MMP discharge ranged from 0 – 0.008 ft/cfs. It was found that the WSE sensitivity to JBS flow was typically ~2 times that to MMP flow, which is likely due to MMP flow being estimated from JBS flow with an approximately linear relationship, and the estimated MMP flow was typically ~2 times that of JBS flow. While the magnitude of sensitivities to JBS flow were different than that to MMP flow, the overall patterns in relation to location and CR stage were nearly identical.

The mean WSE sensitivity to JBS discharge calculated in Merritts Mill Pond was found to be an almost constant value of 0.015 ft/cfs at each cross-section (Figure 18). The average sensitivity along Spring Creek, excluding the last two cross-sections and for CR stages below the 70<sup>th</sup> percentile (61.92 ft-NAVD88), was also 0.015 ft/cfs, but there was more variability in mean sensitivity between cross-sections in Spring Creek compared to those in Merritts Mill Pond.

While sensitivity in MMP was found to be independent of CR stage, the sensitivity in SC was found to decrease with increasing CR stage. The decrease in sensitivity was also location-dependent, with more downstream cross-sections (i.e., those with lower thalweg elevations and closer to the confluence with CR) being less sensitive to JBS flow for a given CR stage. The upstream extent to which CR stage affects the sensitivity of SC stage to upstream discharges was also found to depend on CR stage based on at which cross-sections the sensitivity profiles diverge in Figure 22 and Figure 23. For instance, the extent of the influence of CR stage was ~5,500 ft upstream of the mouth of SC for the 70<sup>th</sup> percentile CR stage but was ~10,000 ft (all the way to the MMP control structure) for the 90<sup>th</sup> percentile CR stage.



**Figure 14: Sensitivity of Simulated Water Surface Elevation to Jackson Blue Spring Discharge at Each Cross-Section in the HEC-RAS Model for 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> discharge percentiles and 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**

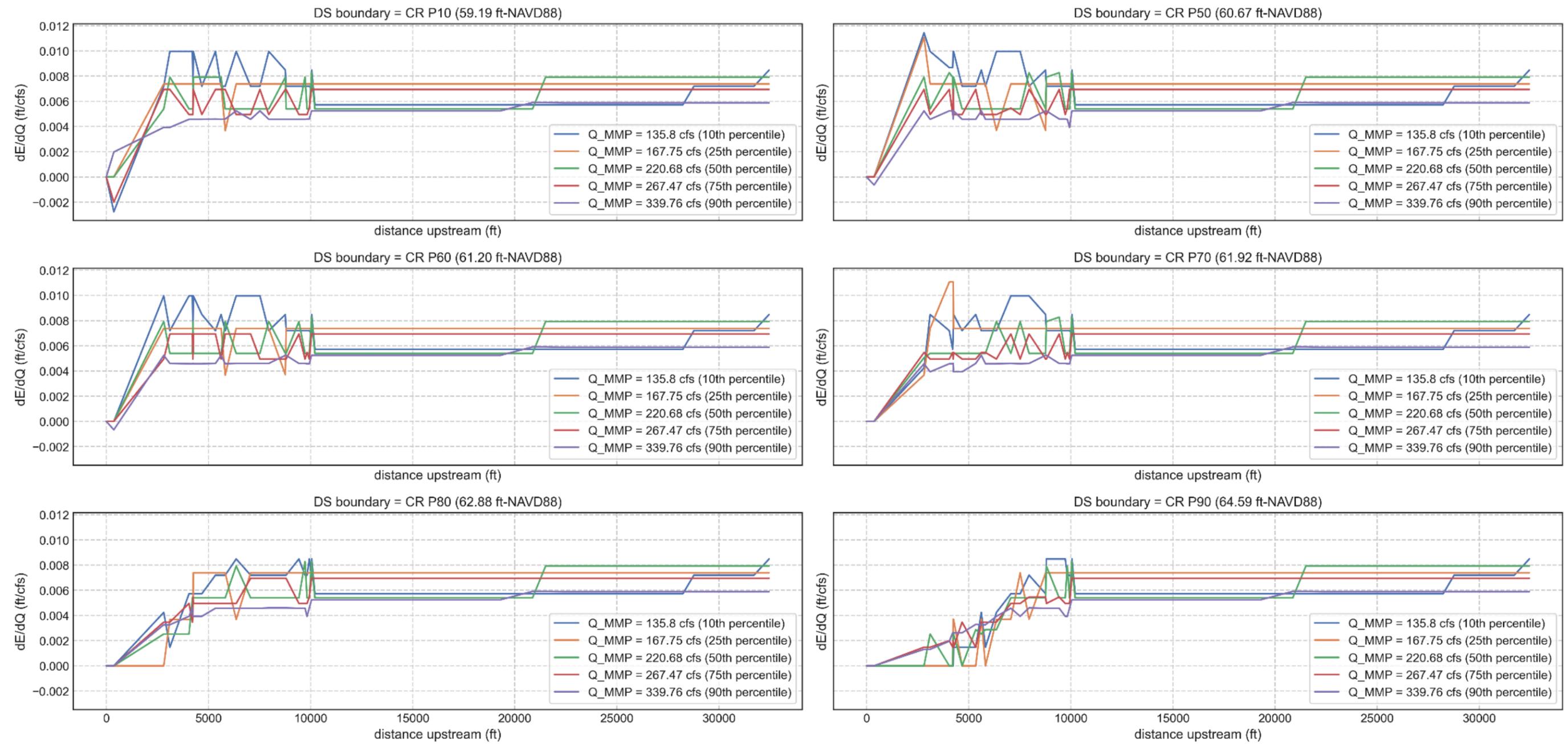
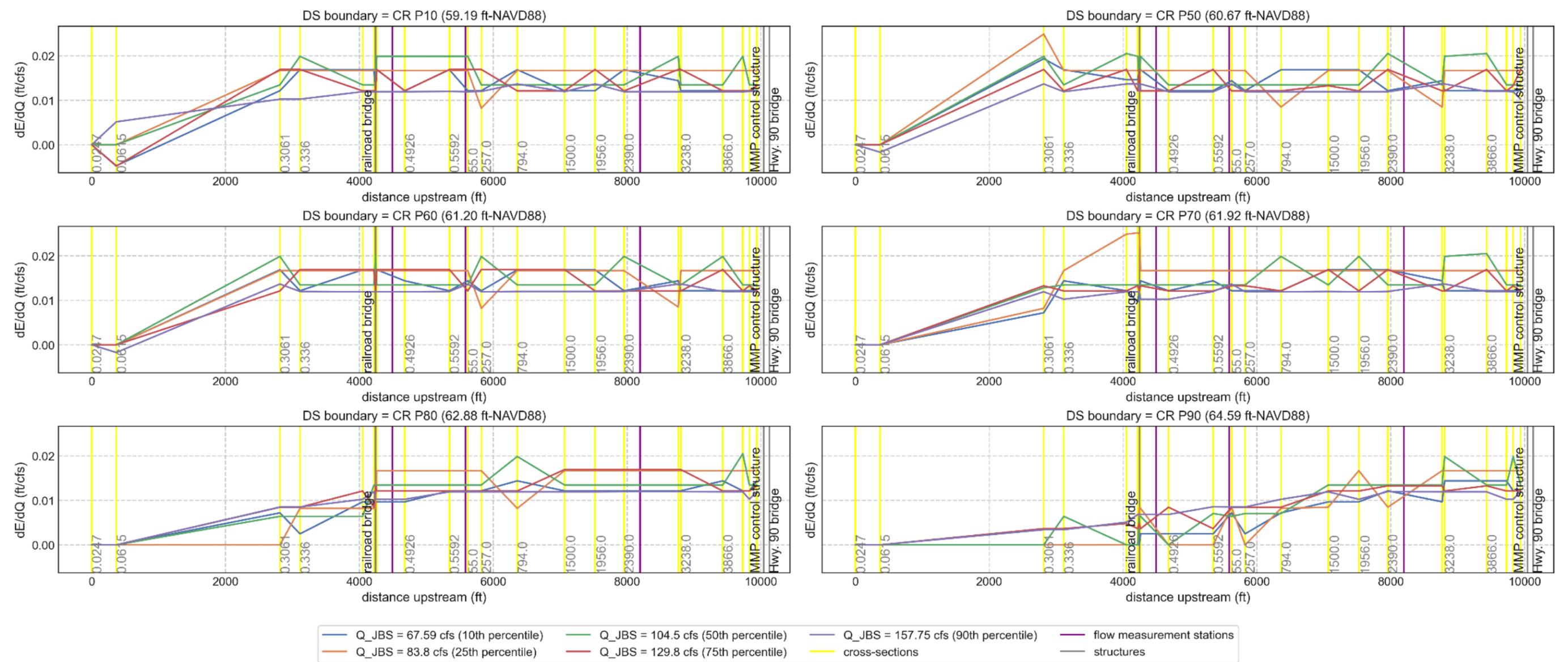


Figure 15: Sensitivity of Simulated Water Surface Elevation to Merritts Mill Pond Discharge at Each Cross-Section in the HEC-RAS Model for 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> Discharge Percentiles and 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles



**Figure 16: Sensitivity of Simulated Water Surface Elevation to Jackson Blue Spring Discharge at the Spring Creek Cross-Sections in the HEC-RAS Model for 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> Discharge Percentiles and 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**

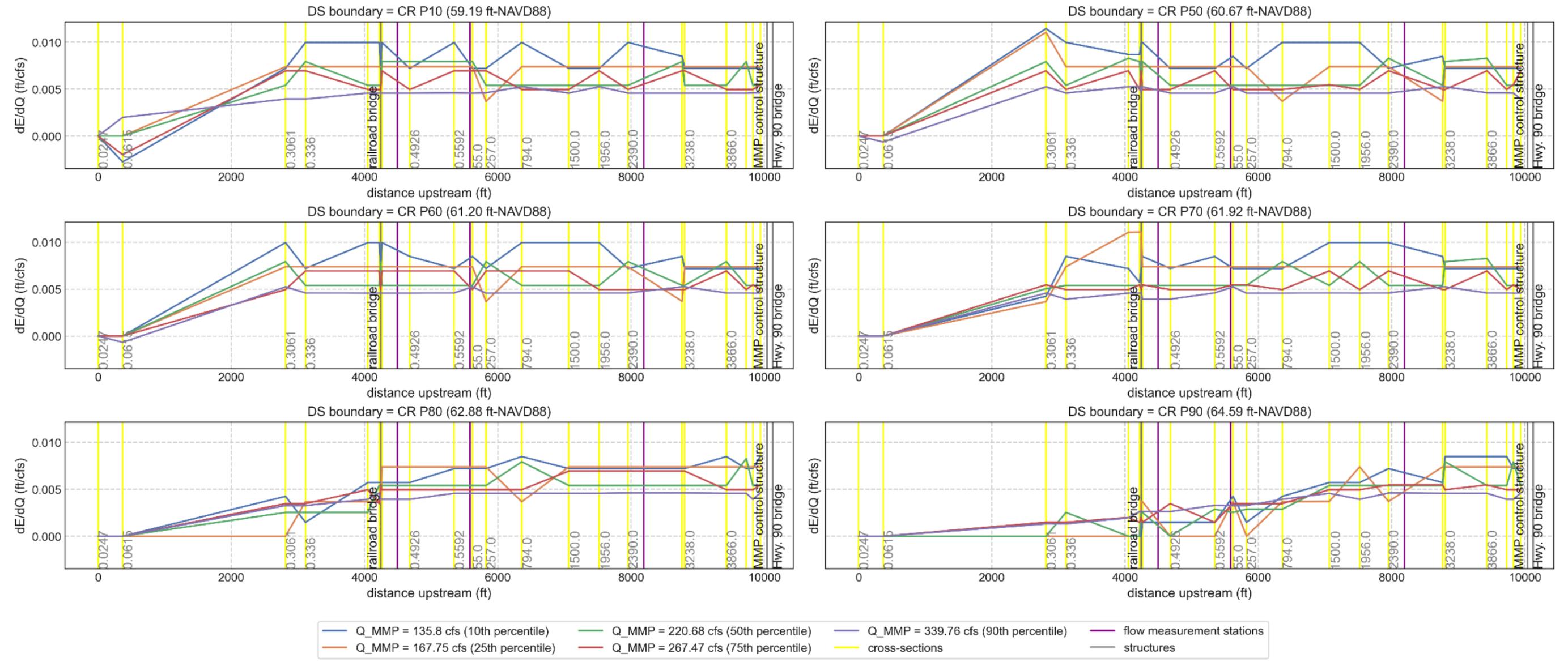
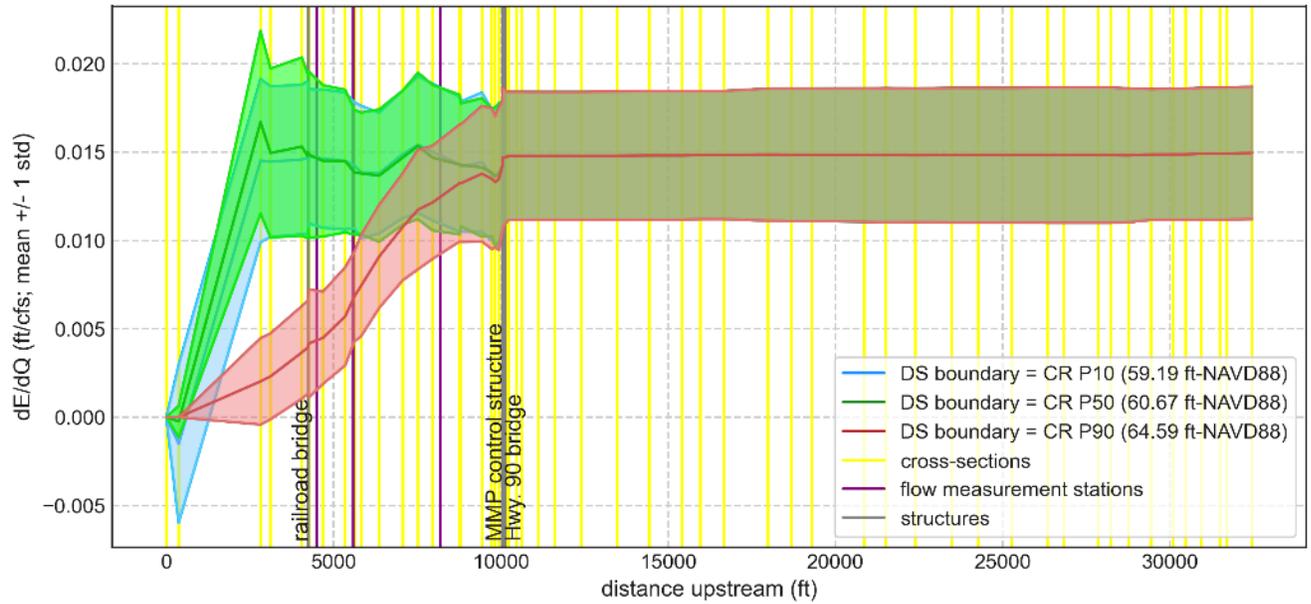
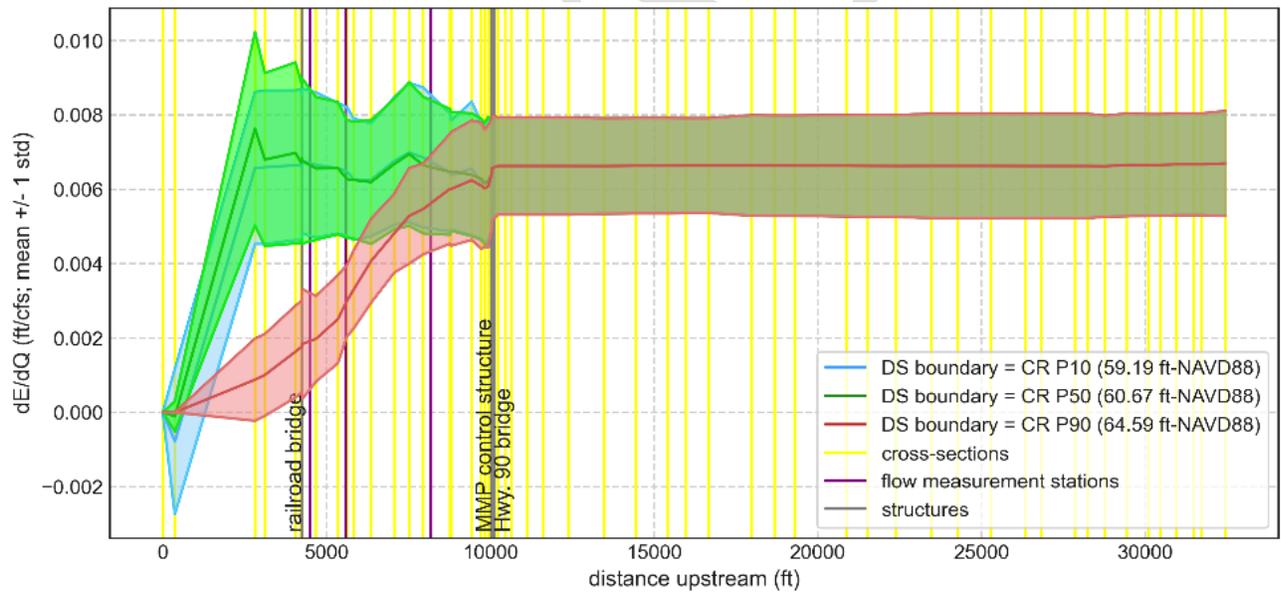


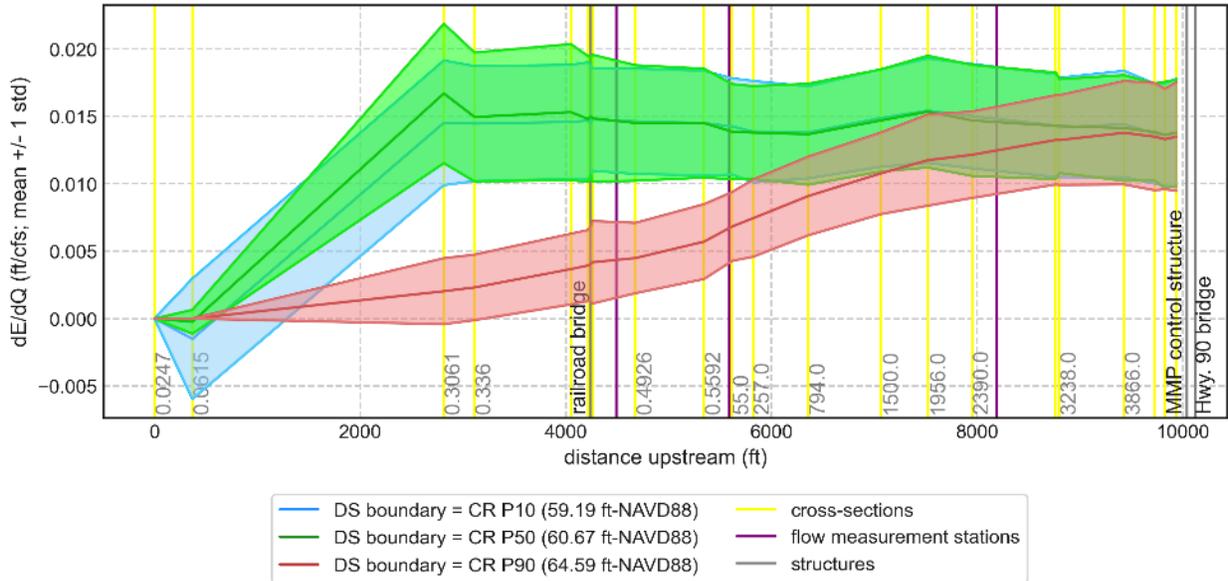
Figure 17: Sensitivity of Simulated Water Surface Elevation to Merritts Mill Pond Discharge at the Spring Creek Cross-Sections in the HEC-RAS Model for 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, and 90<sup>th</sup> Discharge Percentiles and 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles



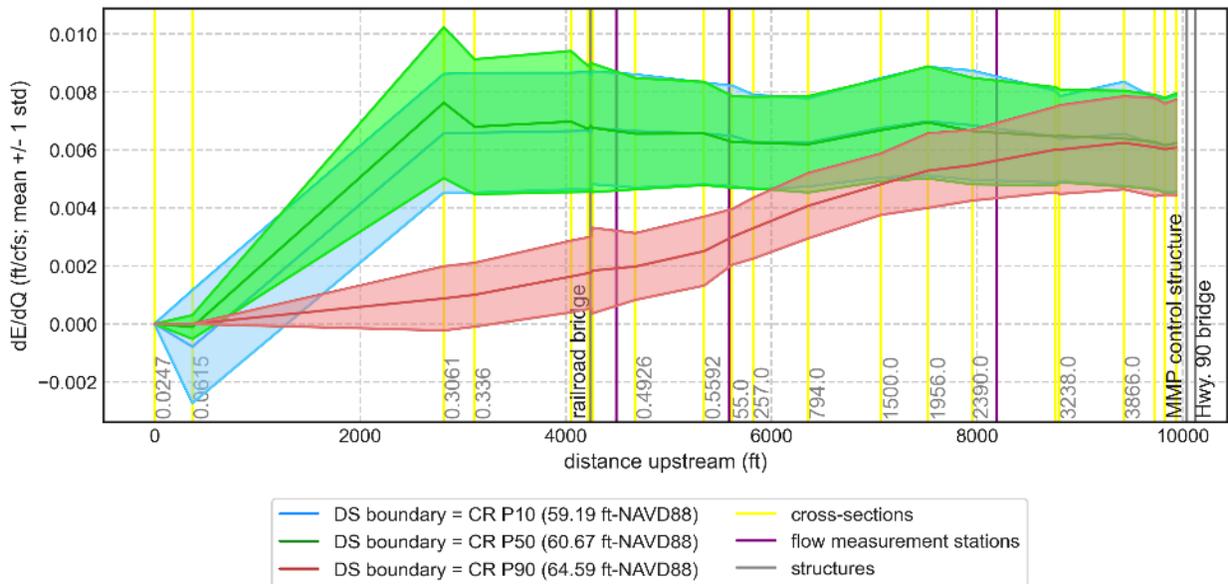
**Figure 18: Water Surface Elevation Sensitivity to Jackson Blue Spring Discharge Statistics (mean  $\pm$  1 standard deviation) at Each Cross-Section in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**



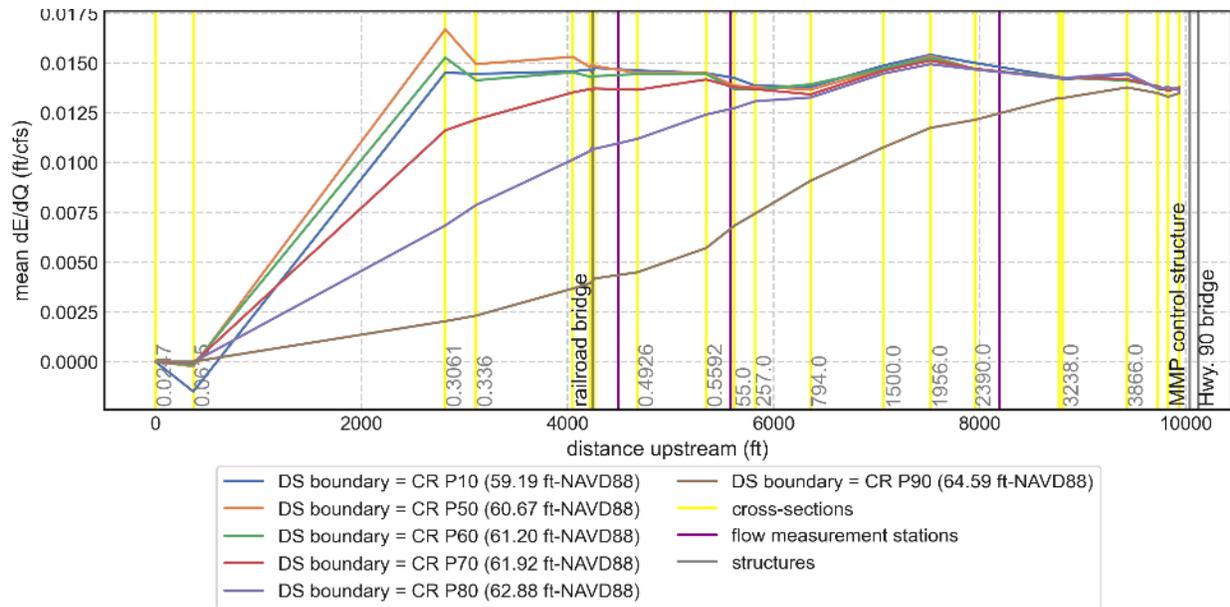
**Figure 19: Water Surface Elevation Sensitivity to Merritts Mill Pond Discharge Statistics (mean  $\pm$  1 standard deviation) at Each Cross-Section in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**



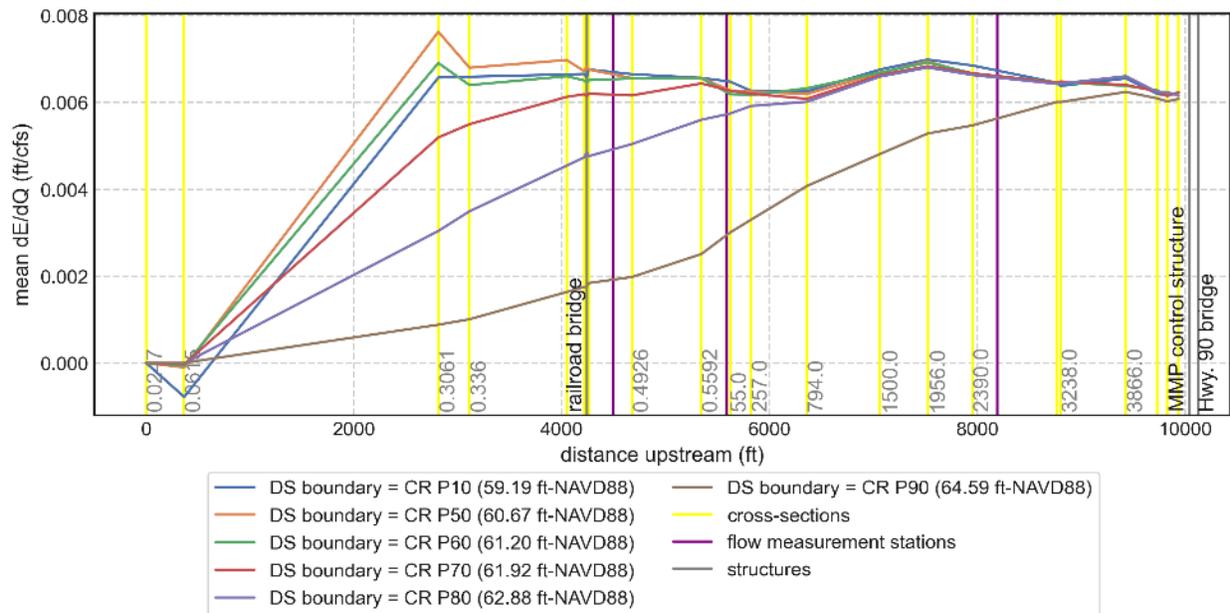
**Figure 20: Water Surface Elevation Sensitivity to Jackson Blue Spring Discharge Statistics (mean  $\pm$  1 standard deviation) at Spring Creek Cross-Sections in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**



**Figure 21: Water Surface Elevation Sensitivity to Merritts Mill Pond Discharge Statistics (mean  $\pm$  1 standard deviation) at Spring Creek Cross-Sections in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**



**Figure 22: Mean Water Surface Elevation Sensitivity to Jackson Blue Spring Discharge at Spring Creek Cross-Sections in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup> and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**



**Figure 23: Mean Water Surface Elevation Sensitivity to Merritts Mill Pond Discharge at Spring Creek Cross-Sections in the HEC-RAS Model and for 10<sup>th</sup>, 50<sup>th</sup>, 60<sup>th</sup>, 70<sup>th</sup>, 80<sup>th</sup> and 90<sup>th</sup> Chipola River above Spring Creek Stage Percentiles**

## 4. Water Resource Value Assessments

### 4.1 Background

In the establishment of MFLs, water management districts are required to use the “best available information.” In accordance with [Rule 62-40.473, Florida Administrative Code](#), and [Section 373.0421, Florida Statutes](#), the District must consider natural seasonal fluctuations in water flows or levels, non-consumptive uses, structural alterations, and ten environmental values (referred to as Water Resource Values or WRVs), when developing the minimum flows. These WRVs include:

1. Recreation in and on the water;
2. Fish and wildlife habitats and the passage of fish;
3. Estuarine resources;
4. Transfer of detrital material;
5. Maintenance of freshwater storage and supply;
6. Aesthetic and scenic attributes;
7. Filtration and absorption of nutrients and other pollutants;
8. Sediment loads;
9. Water quality; and,
10. Navigation.

WRVs are assessed for the purpose of establishing a minimum flow or level using specific WRV metrics. These metrics are quantifiable measures that relate the ten WRVs above to flow or water level. Further, some WRV metrics are believed to be indicative of multiple WRVs.

Although significant harm is not specifically defined in statute, an allowable 15 percent reduction in WRV metrics has been implemented as the protection standard for multiple MFLs throughout Florida, recognizing that additional data collection and long-term research to confirm or refine this threshold for MFL assessments in Florida would be beneficial.

Not all WRVs are relevant to every water system. For example, commercial navigation is not present in the JBS MFL study area and as a result is not relevant. Therefore, best available information regarding the properties and uses of a system must be used to determine appropriate WRVs and WRV metrics prior to performing a WRV assessment.

#### 4.1.1 Definitions

The following terms will be used when presenting the results of the water resource value assessments:

**Baseline Days Exceeded:** The total number of days that a critical flow is equaled or exceeded in the baseline (pumping-adjusted) flow record.

**Critical Elevation:** The minimum water surface elevation required for the waterbody to provide a given water resource value; typically used to calculate a critical flow.

**Critical Flow:** The flow rate at the compliance point (Jackson Blue Spring) required for the waterbody to provide a given water resource value; usually associated with a critical elevation.

**Critical Percentile:** The percentile of a critical elevation or flow based on the baseline (pumping-adjusted) flow record.

**Allowable Flow Reduction:** The maximum amount that the long-term median flow rate at the compliance point (Jackson Blue Spring) can be reduced before a given WRV is significantly impacted.

**Minimum Allowable Flow:** The minimum value that the long-term median flow rate at the compliance point (Jackson Blue Spring) is allowed to reach before a given WRV is significantly impacted.

**Percent Flow Reduction:** The Allowable Flow Reduction as a percentage of the long-term median flow rate at the compliance point (Jackson Blue Spring).

**Reduced Days Exceeded:** The total number of days that a critical flow is equaled or exceeded in the baseline (pumping-adjusted) flow record reduced by the maximum allowable flow reduction based on a given allowable WRV impact; typically 85 percent of the corresponding Baseline Days Exceeded.

## 4.2 Methods

The applicable WRVs and associated metrics pertaining to the Jackson Blue Spring/Merritts Mill Pond/Spring Creek system are listed in Table 3. Details regarding the selection of appropriate WRVs and quantitative metrics are found in the main body of the Jackson Blue Spring MFL Technical Assessment. Since the Merritts Mill Pond control structure creates a distinct divide within the system regarding important properties such as water depth and velocity, some of the WRV metrics were investigated for only one section of the system or the two sections separately.

**Table 3: Summary of Methods Used to Assess the Water Resource Values of the Jackson Blue Spring/Merritts Mill Pond/Spring Creek System**

Metric	Criteria	Extent	Water Resource Value
Canoe/kayak passage	Maintain a minimum depth of 1.5 ft above thalweg	Entire study area	Recreation in and on the water
Power boat passage	Maintain a minimum depth of 2 ft across a 30-ft width	Merritts Mill Pond only	Recreation in and on the water
Power boat passage	Maintain a minimum depth of 2 ft across a 15-ft width	Spring Creek only	Recreation in and on the water
Tubing passage	Maintain minimum depth of 1.05 ft above thalweg	Spring Creek only	Recreation in and on the water
Fish passage	Maintain minimum depth of 0.6 ft above thalweg	Entire study area	Fish and wildlife habitat and the passage of fish
Instream habitat of aquatic species <sup>1</sup>	Area weighted suitability (AWS) versus streamflow for select aquatic species using SEFA <sup>1</sup> (APPENDIX A)	Entire study area	Fish and wildlife habitat and the passage of fish

**Table 3: Summary of Methods Used to Assess the Water Resource Values of the Jackson Blue Spring/Merritts Mill Pond/Spring Creek System**

Metric	Criteria	Extent	Water Resource Value
Riparian wetland inundation	Total inundated area containing hydric soils or wetland vegetation	Spring Creek only	Fish and wildlife habitat and the passage of fish; transfer of detrital material; maintenance of freshwater storage and supply; aesthetic and scenic attributes; filtration and absorption of nutrients and other pollutants; sediment loads; and water quality
Lentic hydroperiod	Total area of ecologically or socially relevant zones defined by critical depths	Merritts Mill Pond only	Recreation in and on the water; fish and wildlife habitat and the passage of fish; transfer of detrital material; maintenance of freshwater storage and supply; aesthetic and scenic attributes; filtration and absorption of nutrients and other pollutants; sediment loads; and water quality
Weighted wetted perimeter	Water elevations at changepoints in the relationship between wetted perimeter and flow, aggregated for all cross-sections, weighted by longitudinal distance	Entire study area	Fish and wildlife habitat and the passage of fish; transfer of detrital material; maintenance of freshwater storage and supply; aesthetic and scenic attributes; filtration and absorption of nutrients and other pollutants; sediment loads; and water quality
Detailed wetted perimeter	Water elevations at changepoints in the relationship between wetted perimeter and flow, separately for each cross-section	Entire study area	Fish and wildlife habitat and the passage of fish; transfer of detrital material; maintenance of freshwater storage and supply; aesthetic and scenic attributes; filtration and absorption of nutrients and other pollutants; sediment loads; and water quality

<sup>1</sup> Discussed in APPENDIX A.

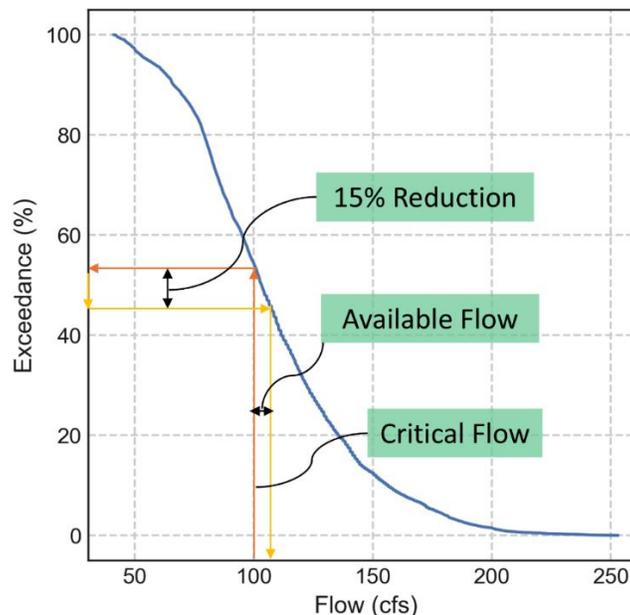
All WRV metrics were calculated based on information exported from the steady-state HEC-RAS model and the baseline flow timeseries for Jackson Blue Spring. The assessment of the effects of the Chipola River on the sensitivity of Merritts Mill Pond/Spring Creek water levels to Jackson Blue Spring discharge (Section 3) indicated that water levels at all HEC-RAS cross-sections, except for the two most downstream cross-sections, were driven primarily by JBS discharge when the Chipola River stage was less than or equal to the P50 (Figure 22 and Figure 23). Therefore, profiles generated with downstream conditions equal to the P10 and P50 Chipola River stages were used for WRV assessments to assess the full range of tailwater conditions under which water levels in Merritts Mill Pond and Spring Creek are predominantly driven by JBS discharge. Also, WRV's were not assessed at the two most downstream cross-sections in the model since those two cross-sections were found to have very low sensitivity to JBS discharge under all tailwater conditions and thus would decrease the overall sensitivity of the WRV metrics to JBS discharge if included in the assessment.

Critical flows were determined in association with each WRV metric. MFL metrics such as maximum allowable flow reductions and minimum allowable long-term median flows were calculated based on critical flows. Flow reductions were determined corresponding to a 15 percent reduction in each WRV metric. The flow reductions were applied to the median, pumping-corrected JBS flow of 103.3 cfs to determine a minimum allowable median flow for the spring. Flow reductions were also calculated as percentages of the median JBS flow. These analyses were accomplished using standard data analysis software including Microsoft Excel, ArcGIS Pro, and Python.

#### 4.2.1 Passage Metrics

All passage metrics (canoe/kayak passage, fish passage, and motorboat passage) involved a calculation procedure incorporating cross-section data and water surface elevation profiles produced by HEC-RAS. First, the minimum water level at which the minimum depth and width were met (i.e., the critical elevation) was determined for each cross-section. The passage criteria for each metric are listed in Table 3. Then, the minimum JBS flow rates required to achieve each of the critical depths (i.e., the critical flows) were determined by interpolating between the steady-state HEC-RAS profiles. Flow reductions were based on a 15 percent change in the amount of time that the critical flows were equaled or exceeded. An example calculation of the allowable flow reduction based on a 15 percent decrease in time is illustrated in Figure 24.

MFL metrics (e.g., allowable flow reduction) were not calculated for cases where the critical flow or the reduced flow was less than the 1<sup>st</sup> percentile. The final recommended MFL metrics derived from the passage assessments were based on the most limiting cross-sections considering the magnitude of the allowable flow reductions (with a lower flow reduction being more limiting) and the specific portions of Merritts Mill Pond or Spring Creek that restricted passage at a given cross-section could limit access to (with larger limited portions being more limiting).



**Figure 24: Example Calculation of the Allowable Flow Reduction (i.e., the available flow) Based on a 15 percent Decrease in the Percentage of Time that a Critical Flow is Exceeded, which was Applied to Multiple WRV Metrics in this Analysis**

## 4.2.2 Wetted Perimeter

Wetted perimeter is defined as the length of the interface between the conveying material (e.g., the stream bed) and the water being conveyed in a cross-section perpendicular to the direction of flow. Since wetted perimeter is a measure of inundated substrate, it is also a measure of habitat for aquatic organisms. The relationship of wetted perimeter with stage or flow rate is a function of the geometry of the cross-section, and changes in that relationship are indicative of changes in geometry which is also indicative of changes in hydroecological niches. For instance, the rate of change of wetted perimeter with respect to stage when the water surface is in the main stream channel is less than that when the water surface is in the floodplain because of the slope of the floodplain land surface being much less than that in the main channel. Thus, a changepoint is observed in the relationship between wetted perimeter and stage for the stage at which water first starts entering the floodplain. This changepoint can be defined as a significant increase in the slope of the line representing the relationship between wetted perimeter and stage. Wetted perimeter has previously been evaluated in systems throughout the state of Florida as an indicator of riparian bank habitat for the establishment of minimum flows including the Aucilla/Wacissa River (SRWMD, 2016), the Rainbow River (SWFWMD, 2017), and the Econfina Creek (NFWFMD, 2024).

Two WRV assessments were performed involving wetted perimeter. Both assessments utilized flow-dependent, cross-section wetted perimeter data produced by the HEC-RAS model. Both methods also involved the same basic methodology for determining critical flows based on changepoints in the relationship between wetted perimeter and JBS flow rate. Wetted perimeter-based flow reductions were calculated based on a 15 percent reduction in wetted perimeter at the identified critical flow. These analyses were done separately for Merritts Mill Pond and Spring Creek.

### 4.2.2.1 Weighted Wetted Perimeter

The weighted wetted perimeter (WWP) WRV assessment involved calculating an average wetted perimeter between all cross-sections, weighted by longitudinal distance between cross-sections. This resulted in one weighted wetted perimeter versus flow relationship for each sub-system (Merritts Mill Pond and Spring Creek) which could be analyzed for changepoints to determine critical flows and calculate MFL metrics. Since only one distinct changepoint was observed in the relationship between weighted wetted perimeter and flow rate, corresponding to the JBS flow rate at which the water surface reaches the floodplain, the binary segmentation method implemented in the *ruptures* Python library (Truong et al., 2020) was used for determining changepoints in the WWP analysis.

### 4.2.2.2 Detailed Wetted Perimeter

In the detailed wetted perimeter analysis, wetted perimeter versus flow relationships were developed, changepoints were identified, and MFL metrics were calculated individually for each cross-section. This analysis had the benefit of filtering out cross-sections which did not exhibit distinct changepoints due to having abnormal channel geometry and to include multiple changepoints for cross-sections with complex geometry. MFL metrics defined from valid cross-sections were evaluated in aggregate using descriptive statistics.

Since the detailed wetted perimeter required consistent identification of multiple changepoints in many cross-sections, a custom algorithm was written for this purpose. The algorithm required calculating the first and second derivatives (i.e., the slope and concavity) of wetted perimeter

with respect to JBS flow. Since the changepoints always correspond to a flattening in channel geometry, they were identified by extreme peaks in the second derivative, indicating a sudden and significant increase in the rate of change of wetted perimeter with respect to flow. The extreme peaks were defined as local maxima in the second derivative which were greater than the mean local maximum plus 1.5-times the interquartile range in local maxima (example shown in Figure 29). Detected changepoints were screened manually, and some were discarded as false positives.

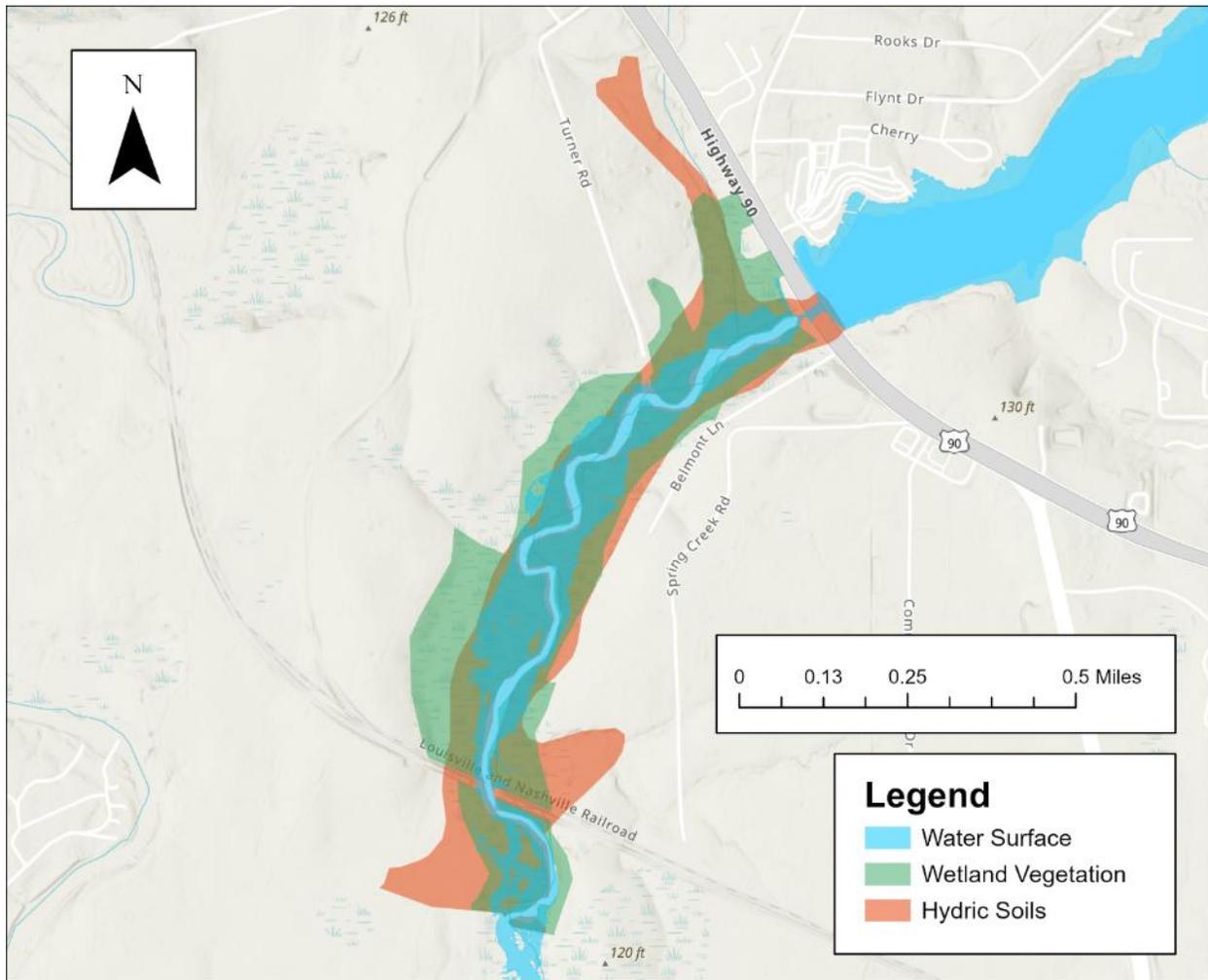
MFL metrics were not calculated for some cross-sections and changepoints due to several disqualifying situations that can occur. One of which was that no distinct changepoints were detected for some cross-sections. Also, some cross-section changepoints would require flow to be reduced below the 1<sup>st</sup> percentile flow to result in a 15 percent reduction in wetted perimeter. Finally, some allowable flow reductions were greater than the median baseline flow, meaning the minimum allowable flow would be negative. MFL metrics were not calculated for all those situations. Summary statistics were calculated for the resulting set of valid MFL metrics derived from the detailed wetted perimeter analysis, and mean values were used as the final MFL recommendations based on that WRV assessment.

### 4.2.3 Riparian Wetland Inundation

The riparian wetland inundation analysis was performed on Spring Creek using geospatial datasets mapping wetland vegetation, hydric soils, and flow-dependent water surfaces (Table 4 and Figure 25). The wetland vegetation and hydric soils layers were gathered from publicly available datasets, and the water surface layers were generated using HEC-RAS Mapper. The water surface layers represented the extent of the water surface at a given flow rate. Inundated area was calculated for each flow rate as the area of the intersection of the corresponding water surface layers with the wetland layers. The calculated inundated wetland areas corresponding to each flow rate were used to develop a relationship between inundated wetland area and flow rate. Critical flows were determined based on changepoints in the flow versus inundated wetland area relationship, which, like with the wetted perimeter analyses, are indicative of changes in hydroecological niches. Also, the 50<sup>th</sup> percentile and 99<sup>th</sup> percentile flows were considered as critical flows due to their hydrostatistical significance. Flow reductions were calculated based on a 15 percent reduction in inundated wetland area at each critical flow. This analysis was applied to Spring Creek only, since the wetland inundation in Merritts Mill Pond was assessed by the hydroperiod tool analysis.

**Table 4: Geospatial Datasets used for the Riparian Wetland Inundation Analysis Performed on Spring Creek**

Dataset	Description	Source
Wetland Vegetation Land Cover	Subset based on LEVEL 1 LANDUSE DESCRIPTION = "Wetlands"	Florida Statewide Land Use Land Cover: <a href="https://geodata.dep.state.fl.us/datasets/statewide-land-use-land-cover/explore">https://geodata.dep.state.fl.us/datasets/statewide-land-use-land-cover/explore</a>
Hydric Soils	Subset based on Hydric soil rating = "Yes"	NRCS Web Soil Survey: <a href="https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx">https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx</a>
Water Surface	One layer for each of 11 flow rates ranging from 1st to 99th percentile	Steady-state HEC-RAS model



**Figure 25: Map of the Geospatial Data Used in the Wetland Inundation Analysis. The water surface layer shown as an example corresponds to the HEC-RAS profile produced using the 99<sup>th</sup> percentile JBS flow and 50<sup>th</sup> percentile CR stage**

## 4.3 Results

### 4.3.1 Passage Metrics

#### 4.3.1.1 Canoe/Kayak Passage

As shown in Table 5, all critical flows limiting canoe/kayak passage were below the 1<sup>st</sup> percentile. These flows were deemed too infrequent to serve as a basis for MFL determination, and thus, no MFL metrics were calculated based on canoe/kayak passage.

**Table 5: Canoe/Kayak Passage WRV Assessment Results**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
26885	Merritts Mill Pond	32,451	72.87	<P1	<P1
26145	Merritts Mill Pond	31,711	73.44	<P1	<P1

**Table 5: Canoe/Kayak Passage WRV Assessment Results**

<b>Cross-Section</b>	<b>Waterbody</b>	<b>Distance from Chipola River (ft)</b>	<b>Critical Elevation (ft-NAVD88)</b>	<b>Critical Flow (cfs); Downstream Condition = CR P10</b>	<b>Critical Flow (cfs); Downstream Condition = CR P50</b>
25929	Merritts Mill Pond	31,495	74.09	<P1	<P1
25383	Merritts Mill Pond	30,949	73.54	<P1	<P1
24900	Merritts Mill Pond	30,467	73.56	<P1	<P1
24519	Merritts Mill Pond	30,085	72.84	<P1	<P1
23872	Merritts Mill Pond	29,438	72.85	<P1	<P1
23202	Merritts Mill Pond	28,768	72.91	<P1	<P1
22663	Merritts Mill Pond	28,230	74.04	<P1	<P1
22291	Merritts Mill Pond	27,857	72.85	<P1	<P1
21260	Merritts Mill Pond	26,826	71.70	<P1	<P1
20787	Merritts Mill Pond	26,353	71.59	<P1	<P1
19708	Merritts Mill Pond	25,274	71.01	<P1	<P1
18703	Merritts Mill Pond	24,270	71.32	<P1	<P1
17909	Merritts Mill Pond	23,475	71.72	<P1	<P1
16834	Merritts Mill Pond	22,401	69.97	<P1	<P1
15943	Merritts Mill Pond	21,509	69.95	<P1	<P1
15303	Merritts Mill Pond	20,869	70.74	<P1	<P1
13724	Merritts Mill Pond	19,290	70.60	<P1	<P1
13110	Merritts Mill Pond	18,677	71.74	<P1	<P1
12420	Merritts Mill Pond	17,986	69.54	<P1	<P1
11099	Merritts Mill Pond	16,665	70.02	<P1	<P1
10398	Merritts Mill Pond	15,964	70.38	<P1	<P1
9842	Merritts Mill Pond	15,408	72.64	<P1	<P1
8872	Merritts Mill Pond	14,438	69.15	<P1	<P1
7910	Merritts Mill Pond	13,476	69.64	<P1	<P1
6833	Merritts Mill Pond	12,400	72.24	<P1	<P1
6050	Merritts Mill Pond	11,616	69.17	<P1	<P1
5549	Merritts Mill Pond	11,115	68.36	<P1	<P1
5071	Merritts Mill Pond	10,637	68.63	<P1	<P1
4901	Merritts Mill Pond	10,467	68.57	<P1	<P1
4669	Merritts Mill Pond	10,235	71.15	<P1	<P1
4648	Merritts Mill Pond	10,214	70.50	<P1	<P1
4491	Merritts Mill Pond	10,056	70.50	<P1	<P1
4484	Merritts Mill Pond	10,050	70.50	<P1	<P1
4373	Spring Creek	9,939	64.36	<P1	<P1
4263	Spring Creek	9,828	64.28	<P1	<P1
4164	Spring Creek	9,729	65.25	<P1	<P1
3866	Spring Creek	9,431	64.27	<P1	<P1

**Table 5: Canoe/Kayak Passage WRV Assessment Results**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
3238	Spring Creek	8,803	63.94	<P1	<P1
3201	Spring Creek	8,767	64.54	<P1	<P1
2390	Spring Creek	7,955	62.65	<P1	<P1
1956	Spring Creek	7,522	63.07	<P1	<P1
1500	Spring Creek	7,065	62.58	<P1	<P1
794	Spring Creek	6,360	62.32	<P1	<P1
257	Spring Creek	5,823	62.72	<P1	<P1
55	Spring Creek	5,620	62.52	<P1	<P1
0.5592	Spring Creek	5,345	62.23	<P1	<P1
0.4926	Spring Creek	4,678	61.52	<P1	<P1
0.4508	Spring Creek	4,261	62.12	<P1	<P1
0.449	Spring Creek	4,242	62.25	<P1	<P1
0.4465	Spring Creek	4,218	62.32	<P1	<P1
0.4297	Spring Creek	4,050	61.73	<P1	<P1
0.336	Spring Creek	3,113	60.41	<P1	<P1
0.3061	Spring Creek	2,814	61.02	<P1	<P1

**4.3.1.2 Fish Passage**

As shown in **Error! Reference source not found.**, all critical flows limiting fish passage were below the 1<sup>st</sup> percentile. These flows were deemed too infrequent to serve as a basis for MFL determination, and thus, no MFL metrics were calculated based on fish passage.

**Table 6: Fish Passage WRV Assessment Results**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
26885	Merritts Mill Pond	32,451	71.97	<P1	<P1
26145	Merritts Mill Pond	31,711	72.54	<P1	<P1
25929	Merritts Mill Pond	31,495	73.19	<P1	<P1
25383	Merritts Mill Pond	30,949	72.64	<P1	<P1
24900	Merritts Mill Pond	30,467	72.66	<P1	<P1
24519	Merritts Mill Pond	30,085	71.94	<P1	<P1
23872	Merritts Mill Pond	29,438	71.95	<P1	<P1
23202	Merritts Mill Pond	28,768	72.01	<P1	<P1
22663	Merritts Mill Pond	28,230	73.14	<P1	<P1
22291	Merritts Mill Pond	27,857	71.95	<P1	<P1
21260	Merritts Mill Pond	26,826	70.80	<P1	<P1
20787	Merritts Mill Pond	26,353	70.69	<P1	<P1

**Table 6: Fish Passage WRV Assessment Results**

<b>Cross-Section</b>	<b>Waterbody</b>	<b>Distance from Chipola River (ft)</b>	<b>Critical Elevation (ft-NAVD88)</b>	<b>Critical Flow (cfs); Downstream Condition = CR P10</b>	<b>Critical Flow (cfs); Downstream Condition = CR P50</b>
19708	Merritts Mill Pond	25,274	70.11	<P1	<P1
18703	Merritts Mill Pond	24,270	70.42	<P1	<P1
17909	Merritts Mill Pond	23,475	70.82	<P1	<P1
16834	Merritts Mill Pond	22,401	69.07	<P1	<P1
15943	Merritts Mill Pond	21,509	69.05	<P1	<P1
15303	Merritts Mill Pond	20,869	69.84	<P1	<P1
13724	Merritts Mill Pond	19,290	69.70	<P1	<P1
13110	Merritts Mill Pond	18,677	70.84	<P1	<P1
12420	Merritts Mill Pond	17,986	68.64	<P1	<P1
11099	Merritts Mill Pond	16,665	69.12	<P1	<P1
10398	Merritts Mill Pond	15,964	69.48	<P1	<P1
9842	Merritts Mill Pond	15,408	71.74	<P1	<P1
8872	Merritts Mill Pond	14,438	68.25	<P1	<P1
7910	Merritts Mill Pond	13,476	68.74	<P1	<P1
6833	Merritts Mill Pond	12,400	71.34	<P1	<P1
6050	Merritts Mill Pond	11,616	68.27	<P1	<P1
5549	Merritts Mill Pond	11,115	67.46	<P1	<P1
5071	Merritts Mill Pond	10,637	67.73	<P1	<P1
4901	Merritts Mill Pond	10,467	67.67	<P1	<P1
4669	Merritts Mill Pond	10,235	70.25	<P1	<P1
4648	Merritts Mill Pond	10,214	69.60	<P1	<P1
4491	Merritts Mill Pond	10,056	69.60	<P1	<P1
4484	Merritts Mill Pond	10,050	69.60	<P1	<P1
4373	Spring Creek	9,939	63.46	<P1	<P1
4263	Spring Creek	9,828	63.38	<P1	<P1
4164	Spring Creek	9,729	64.35	<P1	<P1
3866	Spring Creek	9,431	63.37	<P1	<P1
3238	Spring Creek	8,803	63.04	<P1	<P1
3201	Spring Creek	8,767	63.64	<P1	<P1
2390	Spring Creek	7,955	61.75	<P1	<P1
1956	Spring Creek	7,522	62.17	<P1	<P1
1500	Spring Creek	7,065	61.68	<P1	<P1
794	Spring Creek	6,360	61.42	<P1	<P1
257	Spring Creek	5,823	61.82	<P1	<P1
55	Spring Creek	5,620	61.62	<P1	<P1
0.5592	Spring Creek	5,345	61.33	<P1	<P1
0.4926	Spring Creek	4,678	60.62	<P1	<P1

**Table 6: Fish Passage WRV Assessment Results**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
0.4508	Spring Creek	4,261	61.22	<P1	<P1
0.449	Spring Creek	4,242	61.35	<P1	<P1
0.4465	Spring Creek	4,218	61.42	<P1	<P1
0.4297	Spring Creek	4,050	60.83	<P1	<P1
0.336	Spring Creek	3,113	59.51	<P1	<P1
0.3061	Spring Creek	2,814	60.12	<P1	<P1

#### 4.3.1.3 Tubing Passage

As shown in **Error! Reference source not found.**, all critical flows limiting tubing passage were below the 1<sup>st</sup> percentile. These flows were deemed too infrequent to serve as a basis for MFL determination, and thus, no MFL metrics were calculated based on tubing passage.

**Table 7: Tubing Passage WRV Assessment Results**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
4373	Spring Creek	9,939	63.91	<P1	<P1
4263	Spring Creek	9,828	63.83	<P1	<P1
4164	Spring Creek	9,729	64.80	<P1	<P1
3866	Spring Creek	9,431	63.82	<P1	<P1
3238	Spring Creek	8,803	63.49	<P1	<P1
3201	Spring Creek	8,767	64.09	<P1	<P1
2390	Spring Creek	7,955	62.20	<P1	<P1
1956	Spring Creek	7,522	62.62	<P1	<P1
1500	Spring Creek	7,065	62.13	<P1	<P1
794	Spring Creek	6,360	61.87	<P1	<P1
257	Spring Creek	5,823	62.27	<P1	<P1
55	Spring Creek	5,620	62.07	<P1	<P1
0.5592	Spring Creek	5,345	61.78	<P1	<P1
0.4926	Spring Creek	4,678	61.07	<P1	<P1
0.4508	Spring Creek	4,261	61.67	<P1	<P1
0.449	Spring Creek	4,242	61.80	<P1	<P1
0.4465	Spring Creek	4,218	61.87	<P1	<P1
0.4297	Spring Creek	4,050	61.28	<P1	<P1
0.336	Spring Creek	3,113	59.96	<P1	<P1
0.3061	Spring Creek	2,814	60.57	<P1	<P1

#### 4.3.1.4 Motorboat Passage in Merritts Mill Pond

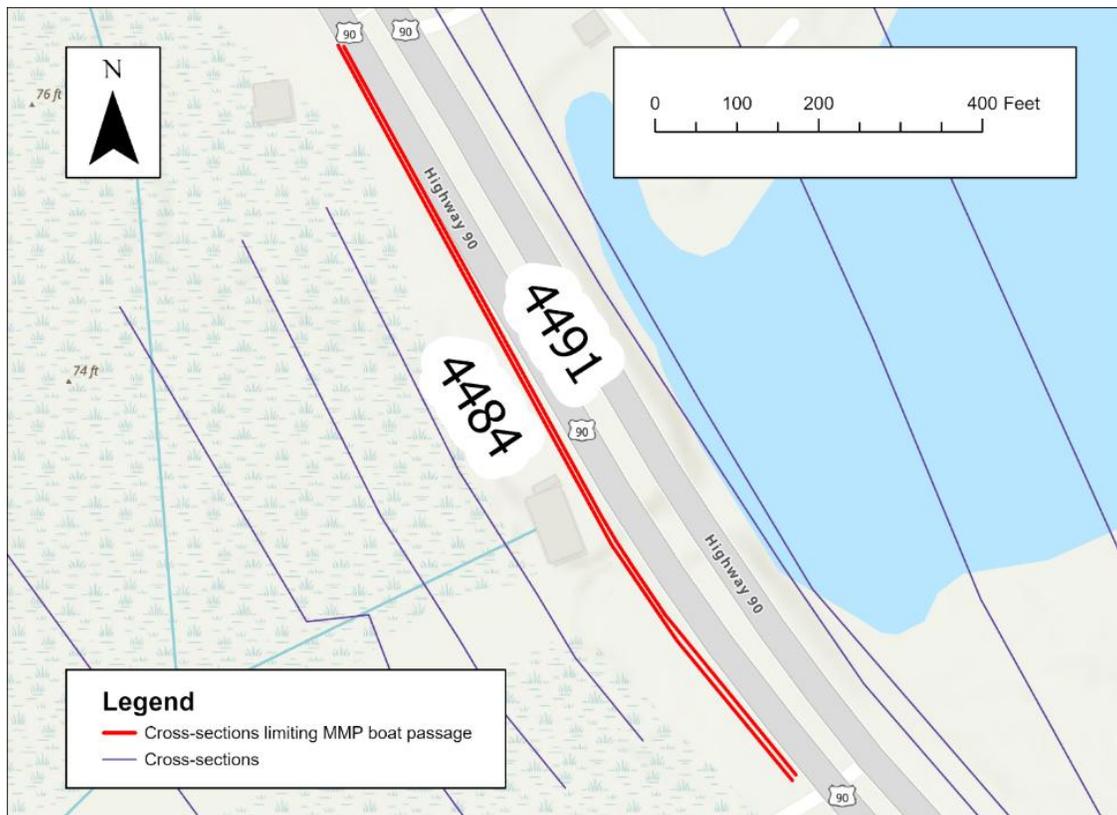
As shown in **Error! Reference source not found.**, the critical flows limiting motorboat passage in Merritts Mill Pond were below the 1<sup>st</sup> percentile for all cross-sections except for the two most downstream cross-sections (Figure 26). The flows below the 1<sup>st</sup> percentile were deemed too infrequent to serve as a basis for MFL determination. Also, the close proximity of the two limiting cross-sections to the Merritts Mill Pond control structure caused them to be deemed inappropriate to serve as a basis for MFL determination, because limited passage at those cross-sections would only limit access to a small portion of the lake that is unsafe for motorboating. Thus, no MFL metrics were calculated based on motorboat passage in Merritts Mill Pond. It should be noted that the numerous cypress knees and submerged logs and stumps present in MMP are passage hazards at all MMP elevations when boats are traveling outside the historic spring run.

**Table 8: Motorboat Passage in Merritts Mill Pond WRV Assessment Results**

Cross-Section	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
26885	32,451	73.40	<P1	<P1
26145	31,711	74.30	<P1	<P1
25929	31,495	74.70	<P1	<P1
25383	30,949	74.06	<P1	<P1
24900	30,467	74.11	<P1	<P1
24519	30,085	73.36	<P1	<P1
23872	29,438	73.38	<P1	<P1
23202	28,768	73.47	<P1	<P1
22663	28,230	74.55	<P1	<P1
22291	27,857	73.38	<P1	<P1
21260	26,826	72.25	<P1	<P1
20787	26,353	72.12	<P1	<P1
19708	25,274	71.71	<P1	<P1
18703	24,270	71.88	<P1	<P1
17909	23,475	72.85	<P1	<P1
16834	22,401	70.71	<P1	<P1
15943	21,509	70.58	<P1	<P1
15303	20,869	71.38	<P1	<P1
13724	19,290	71.19	<P1	<P1
13110	18,677	72.27	<P1	<P1
12420	17,986	70.12	<P1	<P1
11099	16,665	70.61	<P1	<P1
10398	15,964	70.92	<P1	<P1
9842	15,408	73.21	<P1	<P1
8872	14,438	70.08	<P1	<P1

**Table 8: Motorboat Passage in Merritts Mill Pond WRV Assessment Results**

Cross-Section	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
7910	13,476	70.42	<P1	<P1
6833	12,400	72.84	<P1	<P1
6050	11,616	69.74	<P1	<P1
5549	11,115	68.92	<P1	<P1
5071	10,637	69.28	<P1	<P1
4901	10,467	69.18	<P1	<P1
4669	10,235	71.75	<P1	<P1
4648	10,214	71.01	<P1	<P1
4491	10,056	77.13	55.4	55.4
4484	10,050	79.02	188.3	188.3



**Figure 26: Map Showing the Two Cross-Sections with Limiting Critical Flows for Motorboat Passage on Merritts Mill Pond (MMP). These two cross-sections were disregarded due to their close proximity to the control structure causing them to limit access to a negligible portion of the lake**

#### 4.3.1.5 Motorboat Passage in Spring Creek

As shown in **Error! Reference source not found.**, critical flows from 12 of the 20 cross-sections from Spring Creek were below the 1<sup>st</sup> percentile under both downstream boundary conditions. The remaining 8 cross-sections were found to have critical flows ranging from 47 cfs to 87 cfs. The extremely low flows (below 1<sup>st</sup> percentile flow) were deemed too infrequent to serve as a basis for MFL determination, and thus, no MFL metrics were calculated based on motorboat passage for those cross-sections. MFL metrics were calculated for the cross-sections exhibiting valid critical flows (**Error! Reference source not found.**, Table 11, and Table 12 and Figure 27).

**Table 9: Motorboat in Passage in Spring Creek WRV Assessment Results**

Cross-Section	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs); Downstream Condition = CR P10	Critical Flow (cfs); Downstream Condition = CR P50
4373	9,939	64.92	<P1	<P1
4263	9,828	64.84	<P1	<P1
4164	9,729	66.16	87.0	87.0
3866	9,431	64.95	<P1	<P1
3238	8,803	64.79	<P1	<P1
3201	8,767	65.26	67.6	67.6
2390	7,955	63.49	<P1	<P1
1956	7,522	63.97	<P1	<P1
1500	7,065	63.35	<P1	<P1
794	6,360	63.32	<P1	<P1
257	5,823	63.37	<P1	<P1
55	5,620	63.31	<P1	<P1
0.5592	5,345	63.09	47.0	49.2
0.4926	4,678	62.46	<P1	<P1
0.4508	4,261	62.79	51.2	57.3
0.449	4,242	62.76	49.8	56.0
0.4465	4,218	63.04	66.2	73.2
0.4297	4,050	62.53	<P1	50.4
0.336	3,113	61.38	<P1	<P1
0.3061	2,814	61.75	<P1	56.2

**Table 10: MFL Metrics for HEC-RAS Cross-Sections Limiting Motorboat Passage in Spring Creek under the CR P10 Downstream Condition**

Cross-Section	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs)	Baseline Days Exceeded	Reduced Days Exceeded	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
4164	9,729	66.2	87.0	4931	4190	93.8	9.5	9.2
3201	8,767	65.3	67.6	6419	5457	88.9	14.4	13.9
0.5592	5,345	63.1	47.0	7068	6005	74.2	29.1	28.2
0.4508	4,261	62.8	51.2	6926	5892	76.8	26.5	25.7
0.449	4,242	62.8	49.8	6990	5940	76.0	27.3	26.5
0.4465	4,218	63.0	66.2	6469	5504	87.9	15.4	14.9

<sup>1</sup> Percent flow reductions are percentages of the median baseline Jackson Blue Spring Flow (103.3 cfs).

**Table 11: MFL Metrics for Cross-Sections Limiting Motorboat Passage in Spring Creek under the CR P50 Downstream Condition**

Cross-Section	Distance from Chipola River (ft)	Critical Elevation (ft-NAVD88)	Critical Flow (cfs)	Baseline Days Exceeded	Reduced Days Exceeded	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
4164	9,729	66.2	87.0	4931	4190	93.8	9.5	9.2
3201	8,767	65.3	67.6	6419	5457	88.9	14.4	13.9
0.5592	5,345	63.1	49.2	7003	5957	75.6	27.7	26.9
0.4508	4,261	62.8	57.3	6783	5768	81.7	21.6	21.0
0.449	4,242	62.8	56.0	6808	5796	80.6	22.7	22.0
0.4465	4,218	63.0	73.2	6175	5249	92.8	10.5	10.2
0.4297	4,050	62.5	50.4	6950	5908	76.2	27.1	26.2
0.3061	2,814	61.7	56.2	6803	5784	80.8	22.5	21.8

<sup>1</sup> Percent flow reductions are percentages of the median baseline Jackson Blue Spring Flow (103.3 cfs).

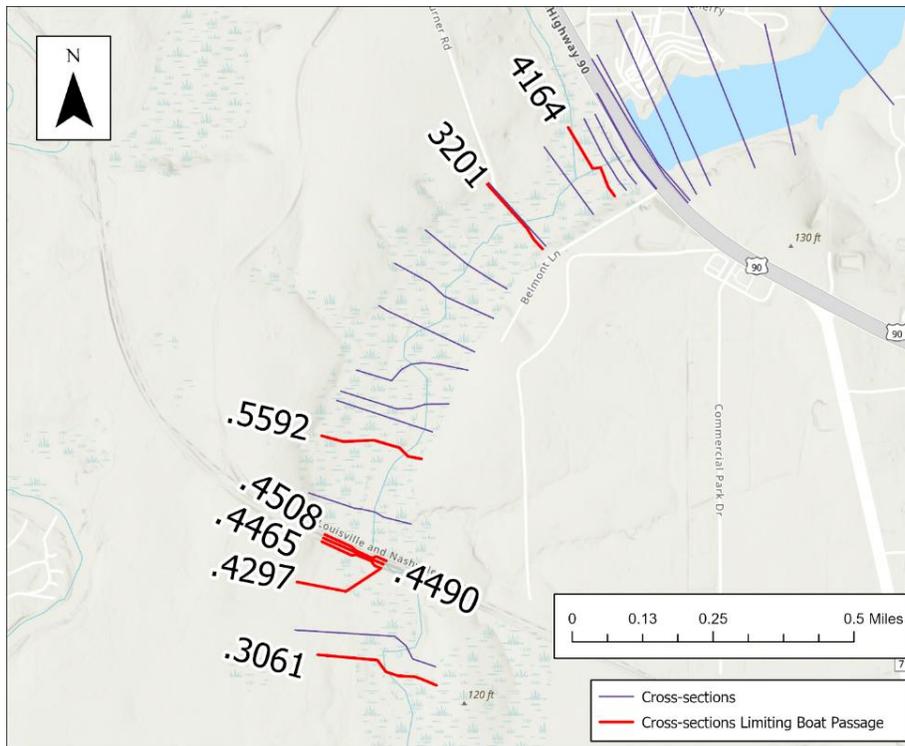
**Table 12: MFL Metric Statistics for Cross-Sections Limiting Motorboat Passage in Spring Creek under Both Downstream Conditions**

Cross-Section	Distance from Chipola River (ft)	Mean			Range			Downstream Conditions
		Percent Flow Reduction (%) <sup>1</sup>	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	
4164	9,729	9.2	93.8	9.5	0	0	0	CR P50, CR P10
3201	8,767	13.9	88.9	14.4	0	0	0	CR P50, CR P10
0.5592	5,345	27.5	74.9	28.4	1.3	1.4	1.4	CR P50, CR P10

**Table 12: MFL Metric Statistics for Cross-Sections Limiting Motorboat Passage in Spring Creek under Both Downstream Conditions**

Cross-Section	Distance from Chipola River (ft)	Mean			Range			Downstream Conditions
		Percent Flow Reduction (%) <sup>1</sup>	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	
0.4508	4,261	23.3	79.2	24.1	4.7	4.9	4.9	CR P50, CR P10
0.449	4,242	24.2	78.3	25.0	4.5	4.6	4.6	CR P50, CR P10
0.4465	4,218	12.5	90.4	12.9	4.7	4.9	4.9	CR P50, CR P10
0.4297	4,050	26.2	76.2	27.1	NA	NA	NA	CR P50
0.3061	2,814	21.8	80.8	22.5	NA	NA	NA	CR P50

<sup>1</sup> Percent flow reductions are percentages of the median baseline Jackson Blue Spring Flow (103.3 cfs).



**Figure 27: Map Showing the Eight Cross-Sections with Limiting Critical Flows for Motorboat Passage on Spring Creek**

### 4.3.2 Wetted Perimeter

#### 4.3.2.1 Weighted Wetted Perimeter

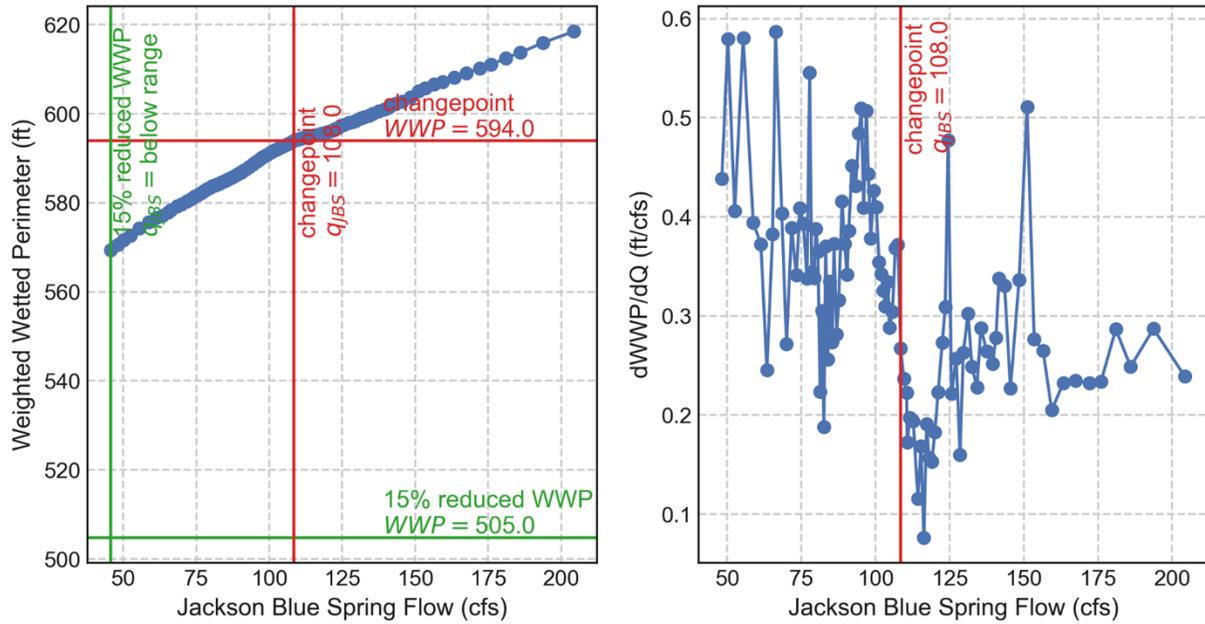
The weighted wetted perimeter (WWP) analysis was performed using cross-sections on Merritts Mill Pond and Spring Creek, separately and combined, to calculate MFL metrics based on a 15 percent reduction in weighted wetted perimeter. As shown in Figure 28, a changepoint was

detected at a flow rate of 108 cfs in Merritts Mill Pond, and one was detected at a flow rate of 124 cfs in Spring Creek. The changepoint for Merritts Mill Pond marked a significant decrease in the rate of change of WWP with respect to JBS flow (top panels of Figure 28), signifying an increase in bank slope, whereas the changepoint for Spring Creek marked a significant increase in WWP with respect to JBS flow (bottom panels of Figure 28), signifying a significant decrease in bank slope. This distinction in WWP relationships with flow in Merritts Mill Pond and Spring Creek can be explained by the elevated water level in Merritts Mill Pond caused by the control structure, which in turn causes the natural floodplain in Merritts Mill Pond to be inundated at low flows and for the water to be surrounded by steep banks at high flows. The results for Spring Creek suggest that the water is contained in the main channel up until a flow rate of 124 cfs, at which point the water begins to enter the floodplain. The elevated water levels in MMP also cause it to have a consistently high WWP that is insensitive to JBS flow. Due to these properties, a flow reduction below the 1<sup>st</sup> percentile flow would be required to cause a 15 percent decrease in WWP in Merritts Mill Pond, and MFL metrics could not be calculated based on WWP when cross-sections from Merritts Mill Pond were included (Table 13). However, it was found that an average flow reduction of 35 cfs (34 percent of the median baseline flow rate) would cause a 15 percent decrease in WWP at the critical flow in Spring Creek.

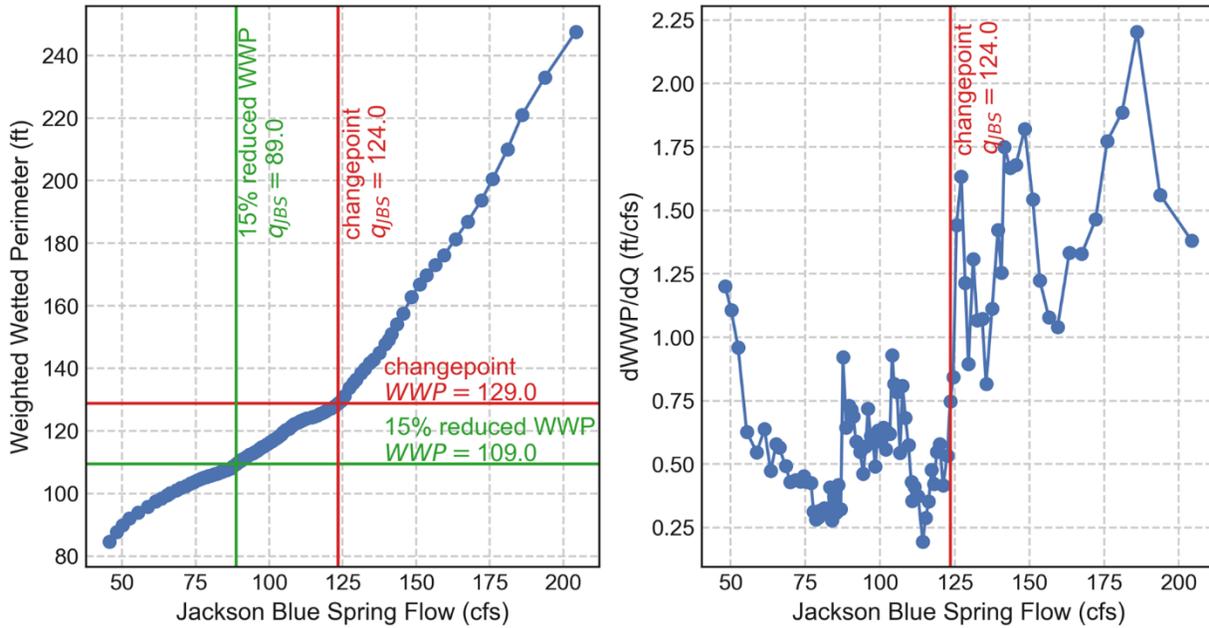
#### ***4.3.2.2 Detailed Wetted Perimeter***

Results of the detailed wetted perimeter analysis are shown in Table 14. It should be noted that some cross-sections did not exhibit distinct changepoints in their relationship between wetted perimeter and JBS flow, and some cross-sections exhibited multiple distinct changepoints. An example of a cross-section with multiple changepoints is shown in Figure 29, and the flow reduction calculation for one of those changepoints is shown in Figure 30. Also, similar to the weighted wetted perimeter results for Merritts Mill Pond, MFL metrics could not be calculated for many cross-sections (primarily in Merritts Mill Pond) due to the flow needing to be reduced below the 1<sup>st</sup> percentile to result in a 15 percent reduction in wetted perimeter. Statistics describing the MFL metrics resulting from all valid changepoints are shown in Table 15. The statistics show that there is a lot of variability in the MFL metrics derived from the detailed wetted perimeter analysis, which was a function of the variable in the channel geometry between cross-sections and, thus, the detected changepoints/critical flows. Also, both the mean and median allowable flow reductions calculated based on the detailed wetted perimeter analysis (31 cfs and 24 cfs, respectively) were both less than the average for the weighted wetted perimeter analysis. This is likely due to the ability of the detailed wetted perimeter analysis to account for less pronounced changepoints in individual cross-sections at flow rates less than 124 cfs, which was the primary changepoint for Spring Creek determined in the weighted wetted perimeter analysis.

**Merritts Mill Pond**



**Spring Creek**



**Figure 28: Plots Showing the Relationship between Weighted Wetted Perimeter (WWP) and Jackson Blue Spring Flow (left side) and the Discrete First Derivative of that Relationship (right side) for Merritts Mill Pond (top) and Spring Creek (bottom), which were Used to Determine Critical Flows Based on Changepoints and Flow Reductions Based on a 15 percent Reduction in WWP.**

**Table 13: Results of the Weighted Wetted Perimeter (WWP) WRV Assessment**

Reach	Downstream Condition	Critical Flow (cfs)	WWP (ft)	15% Reduced WWP (ft)	Flow at Reduced WWP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
MMP and SC	CR P10	123.5	468.8	398.5	<P1	NA	NA	NA
MMP	CR P10	108.5	593.9	504.8	<P1	NA	NA	NA
SC	CR P10	123.5	132.1	112.3	87.4	67.2	36.1	34.9
MMP and SC	CR P50	123.5	467.9	397.7	<P1	NA	NA	NA
MMP	CR P50	108.5	593.9	504.8	<P1	NA	NA	NA
SC	CR P50	123.5	128.8	109.4	88.8	68.6	34.7	33.6

<sup>1</sup>Percent flow reduction is a percentage of the median of the baseline Jackson Blue Spring discharge (103.3 cfs).

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
26885	Merritts Mill Pond	32,451	CR P10	NA	NA	NA	NA	NA	NA	NA
26145	Merritts Mill Pond	31,711	CR P10	82.6	673.5	572.5	<P1	NA	NA	NA
26145	Merritts Mill Pond	31,711	CR P10	96.0	679.0	577.2	<P1	NA	NA	NA
25929	Merritts Mill Pond	31,495	CR P10	87.6	559.4	475.5	<P1	NA	NA	NA
25929	Merritts Mill Pond	31,495	CR P10	98.4	567.7	482.6	<P1	NA	NA	NA
25383	Merritts Mill Pond	30,949	CR P10	50.2	656.3	557.9	<P1	NA	NA	NA
25383	Merritts Mill Pond	30,949	CR P10	92.0	678.9	577.1	<P1	NA	NA	NA
24900	Merritts Mill Pond	30,467	CR P10	82.6	638.4	542.7	<P1	NA	NA	NA
24519	Merritts Mill Pond	30,085	CR P10	70.0	691.3	587.6	<P1	NA	NA	NA
24519	Merritts Mill Pond	30,085	CR P10	76.9	700.0	595.0	<P1	NA	NA	NA
23872	Merritts Mill Pond	29,438	CR P10	NA	NA	NA	NA	NA	NA	NA
23202	Merritts Mill Pond	28,768	CR P10	82.6	543.0	461.6	<P1	NA	NA	NA
22663	Merritts Mill Pond	28,230	CR P10	90.4	597.6	508.0	<P1	NA	NA	NA
22291	Merritts Mill Pond	27,857	CR P10	63.4	549.8	467.3	<P1	NA	NA	NA
22291	Merritts Mill Pond	27,857	CR P10	122.5	581.6	494.4	<P1	NA	NA	NA
21260	Merritts Mill Pond	26,826	CR P10	NA	NA	NA	NA	NA	NA	NA
20787	Merritts Mill Pond	26,353	CR P10	NA	NA	NA	NA	NA	NA	NA
19708	Merritts Mill Pond	25,274	CR P10	63.4	492.7	418.8	<P1	NA	NA	NA
19708	Merritts Mill Pond	25,274	CR P10	151.1	520.9	442.8	<P1	NA	NA	NA
18703	Merritts Mill Pond	24,270	CR P10	NA	NA	NA	NA	NA	NA	NA
17909	Merritts Mill Pond	23,475	CR P10	122.5	602.4	512.0	<P1	NA	NA	NA
17909	Merritts Mill Pond	23,475	CR P10	145.5	618.9	526.1	<P1	NA	NA	NA
16834	Merritts Mill Pond	22,401	CR P10	106.7	527.9	448.7	<P1	NA	NA	NA

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
15943	Merritts Mill Pond	21,509	CR P10	82.6	535.0	454.8	<P1	NA	NA	NA
15943	Merritts Mill Pond	21,509	CR P10	87.6	538.4	457.7	<P1	NA	NA	NA
15303	Merritts Mill Pond	20,869	CR P10	63.4	462.3	393.0	<P1	NA	NA	NA
15303	Merritts Mill Pond	20,869	CR P10	82.6	470.0	399.5	<P1	NA	NA	NA
13724	Merritts Mill Pond	19,290	CR P10	93.3	572.0	486.2	<P1	NA	NA	NA
13110	Merritts Mill Pond	18,677	CR P10	75.7	519.8	441.8	<P1	NA	NA	NA
13110	Merritts Mill Pond	18,677	CR P10	92.0	532.3	452.5	<P1	NA	NA	NA
12420	Merritts Mill Pond	17,986	CR P10	65.3	523.2	444.7	<P1	NA	NA	NA
11099	Merritts Mill Pond	16,665	CR P10	87.6	521.4	443.2	<P1	NA	NA	NA
11099	Merritts Mill Pond	16,665	CR P10	91.0	525.5	446.7	<P1	NA	NA	NA
10398	Merritts Mill Pond	15,964	CR P10	82.6	524.5	445.9	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P10	70.0	524.6	445.9	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P10	74.5	528.3	449.1	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P10	105.7	543.7	462.2	<P1	NA	NA	NA
8872	Merritts Mill Pond	14,438	CR P10	123.5	618.1	525.4	<P1	NA	NA	NA
7910	Merritts Mill Pond	13,476	CR P10	90.4	741.9	630.6	<P1	NA	NA	NA
6833	Merritts Mill Pond	12,400	CR P10	104.1	700.6	595.5	<P1	NA	NA	NA
6833	Merritts Mill Pond	12,400	CR P10	140.6	711.5	604.7	<P1	NA	NA	NA
6050	Merritts Mill Pond	11,616	CR P10	100.3	715.4	608.1	<P1	NA	NA	NA
6050	Merritts Mill Pond	11,616	CR P10	145.5	735.1	624.8	<P1	NA	NA	NA
5549	Merritts Mill Pond	11,115	CR P10	176.0	791.1	672.4	<P1	NA	NA	NA
5071	Merritts Mill Pond	10,637	CR P10	52.5	730.2	620.7	<P1	NA	NA	NA
5071	Merritts Mill Pond	10,637	CR P10	71.7	755.9	642.5	<P1	NA	NA	NA

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
5071	Merritts Mill Pond	10,637	CR P10	176.0	781.5	664.3	<P1	NA	NA	NA
4901	Merritts Mill Pond	10,467	CR P10	52.5	594.7	505.5	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P10	82.0	113.7	96.6	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P10	94.4	125.3	106.5	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P10	98.4	137.7	117.0	84.5	89.4	13.9	13.5
4263	Spring Creek	9,828	CR P10	83.2	135.0	114.8	<P1	NA	NA	NA
4263	Spring Creek	9,828	CR P10	131.2	149.3	126.9	<P1	NA	NA	NA
4263	Spring Creek	9,828	CR P10	135.5	151.4	128.7	<P1	NA	NA	NA
4263	Spring Creek	9,828	CR P10	163.3	173.2	147.2	118.9	58.9	44.4	43.0
4263	Spring Creek	9,828	CR P10	176.0	194.7	165.5	151.2	78.5	24.8	24.0
4164	Spring Creek	9,729	CR P10	88.7	166.7	141.7	<P1	NA	NA	NA
4164	Spring Creek	9,729	CR P10	95.2	176.5	150.0	<P1	NA	NA	NA
4164	Spring Creek	9,729	CR P10	103.3	204.8	174.1	91.0	91.0	12.3	11.9
4164	Spring Creek	9,729	CR P10	121.1	263.9	224.3	107.1	89.3	14.0	13.6
3866	Spring Creek	9,431	CR P10	94.4	123.2	104.7	55.8	64.7	38.6	37.4
3866	Spring Creek	9,431	CR P10	97.6	130.7	111.1	71.5	77.2	26.1	25.2
3866	Spring Creek	9,431	CR P10	103.3	156.7	133.2	98.5	98.5	4.8	4.7
3866	Spring Creek	9,431	CR P10	118.0	192.7	163.8	104.1	89.4	13.9	13.5
3866	Spring Creek	9,431	CR P10	124.5	204.1	173.5	106.0	84.8	18.5	17.9
3238	Spring Creek	8,803	CR P10	105.7	99.0	84.2	<P1	NA	NA	NA
3238	Spring Creek	8,803	CR P10	115.3	111.0	94.3	76.4	64.4	38.9	37.6
3238	Spring Creek	8,803	CR P10	122.5	120.2	102.2	107.2	88.0	15.3	14.8
3238	Spring Creek	8,803	CR P10	129.6	150.8	128.2	124.0	97.7	5.6	5.4

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
3238	Spring Creek	8,803	CR P10	137.5	198.6	168.8	132.4	98.2	5.1	4.9
3201	Spring Creek	8,767	CR P10	106.7	114.0	96.9	<P1	NA	NA	NA
3201	Spring Creek	8,767	CR P10	115.3	120.6	102.5	<P1	NA	NA	NA
3201	Spring Creek	8,767	CR P10	124.5	142.1	120.8	115.4	94.2	9.1	8.8
3201	Spring Creek	8,767	CR P10	129.6	182.4	155.0	125.8	99.5	3.8	3.7
3201	Spring Creek	8,767	CR P10	141.6	245.4	208.6	133.2	94.9	8.4	8.1
2390	Spring Creek	7,955	CR P10	135.5	140.2	119.2	48.3	16.1	87.2	84.4
2390	Spring Creek	7,955	CR P10	143.5	191.2	162.5	139.5	99.3	4.0	3.8
1956	Spring Creek	7,522	CR P10	86.0	137.2	116.6	59.2	76.5	26.8	26.0
1500	Spring Creek	7,065	CR P10	129.6	81.0	68.9	<P1	NA	NA	NA
1500	Spring Creek	7,065	CR P10	140.6	89.8	76.4	63.2	25.9	77.4	74.9
1500	Spring Creek	7,065	CR P10	159.4	123.3	104.8	144.3	88.2	15.1	14.6
1500	Spring Creek	7,065	CR P10	172.2	192.3	163.4	167.8	98.9	4.4	4.2
794	Spring Creek	6,360	CR P10	68.4	90.5	76.9	<P1	NA	NA	NA
794	Spring Creek	6,360	CR P10	101.9	102.9	87.5	55.6	57.0	46.3	44.8
794	Spring Creek	6,360	CR P10	121.1	111.9	95.1	73.6	55.8	47.5	46.0
794	Spring Creek	6,360	CR P10	167.5	134.5	114.3	123.1	58.9	44.4	43.0
257	Spring Creek	5,823	CR P10	186.0	119.0	101.2	76.2	NA	NA	NA
55	Spring Creek	5,620	CR P10	96.9	92.6	78.7	52.9	59.3	44.0	42.6
0.5592	Spring Creek	5,345	CR P10	50.2	74.9	63.7	<P1	NA	NA	NA
0.5592	Spring Creek	5,345	CR P10	82.6	87.3	74.2	48.4	69.1	34.2	33.1
0.5592	Spring Creek	5,345	CR P10	120.0	94.6	80.4	61.6	44.9	58.4	56.6
0.4926	Spring Creek	4,678	CR P10	108.5	115.6	98.3	<P1	NA	NA	NA

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
0.4926	Spring Creek	4,678	CR P10	120.0	117.3	99.7	<P1	NA	NA	NA
0.4508	Spring Creek	4,261	CR P10	NA	NA	NA	NA	NA	NA	NA
0.449	Spring Creek	4,242	CR P10	NA	NA	NA	NA	NA	NA	NA
0.4465	Spring Creek	4,218	CR P10	86.9	119.4	101.5	<P1	NA	NA	NA
0.4297	Spring Creek	4,050	CR P10	55.4	75.9	64.5	<P1	NA	NA	NA
0.4297	Spring Creek	4,050	CR P10	172.2	93.7	79.6	59.8	NA	NA	NA
0.336	Spring Creek	3,113	CR P10	71.7	87.5	74.3	<P1	NA	NA	NA
0.336	Spring Creek	3,113	CR P10	101.2	113.1	96.2	75.2	77.3	26.0	25.1
0.3061	Spring Creek	2,814	CR P10	139.5	153.2	130.2	89.3	53.1	50.2	48.6
26885	Merritts Mill Pond	32,451	CR P50	NA	NA	NA	NA	NA	NA	NA
26145	Merritts Mill Pond	31,711	CR P50	82.6	673.5	572.5	<P1	NA	NA	NA
26145	Merritts Mill Pond	31,711	CR P50	96.0	679.0	577.2	<P1	NA	NA	NA
25929	Merritts Mill Pond	31,495	CR P50	87.6	559.4	475.5	<P1	NA	NA	NA
25929	Merritts Mill Pond	31,495	CR P50	98.4	567.7	482.6	<P1	NA	NA	NA
25383	Merritts Mill Pond	30,949	CR P50	50.2	656.3	557.9	<P1	NA	NA	NA
25383	Merritts Mill Pond	30,949	CR P50	92.0	678.9	577.1	<P1	NA	NA	NA
24900	Merritts Mill Pond	30,467	CR P50	82.6	638.4	542.7	<P1	NA	NA	NA
24519	Merritts Mill Pond	30,085	CR P50	70.0	691.3	587.6	<P1	NA	NA	NA
24519	Merritts Mill Pond	30,085	CR P50	76.9	700.0	595.0	<P1	NA	NA	NA
23872	Merritts Mill Pond	29,438	CR P50	NA	NA	NA	NA	NA	NA	NA
23202	Merritts Mill Pond	28,768	CR P50	82.6	543.0	461.6	<P1	NA	NA	NA
22663	Merritts Mill Pond	28,230	CR P50	90.4	597.6	508.0	<P1	NA	NA	NA
22291	Merritts Mill Pond	27,857	CR P50	63.4	549.8	467.3	<P1	NA	NA	NA

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
22291	Merritts Mill Pond	27,857	CR P50	122.5	581.6	494.4	<P1	NA	NA	NA
21260	Merritts Mill Pond	26,826	CR P50	NA	NA	NA	NA	NA	NA	NA
20787	Merritts Mill Pond	26,353	CR P50	NA	NA	NA	NA	NA	NA	NA
19708	Merritts Mill Pond	25,274	CR P50	63.4	492.7	418.8	<P1	NA	NA	NA
19708	Merritts Mill Pond	25,274	CR P50	151.1	520.9	442.8	<P1	NA	NA	NA
18703	Merritts Mill Pond	24,270	CR P50	NA	NA	NA	NA	NA	NA	NA
17909	Merritts Mill Pond	23,475	CR P50	122.5	602.4	512.0	<P1	NA	NA	NA
17909	Merritts Mill Pond	23,475	CR P50	145.5	618.9	526.1	<P1	NA	NA	NA
16834	Merritts Mill Pond	22,401	CR P50	106.7	527.9	448.7	<P1	NA	NA	NA
15943	Merritts Mill Pond	21,509	CR P50	82.6	535.0	454.8	<P1	NA	NA	NA
15943	Merritts Mill Pond	21,509	CR P50	87.6	538.4	457.7	<P1	NA	NA	NA
15303	Merritts Mill Pond	20,869	CR P50	63.4	462.3	393.0	<P1	NA	NA	NA
15303	Merritts Mill Pond	20,869	CR P50	82.6	470.0	399.5	<P1	NA	NA	NA
13724	Merritts Mill Pond	19,290	CR P50	93.3	572.0	486.2	<P1	NA	NA	NA
13110	Merritts Mill Pond	18,677	CR P50	75.7	519.8	441.8	<P1	NA	NA	NA
13110	Merritts Mill Pond	18,677	CR P50	92.0	532.3	452.5	<P1	NA	NA	NA
12420	Merritts Mill Pond	17,986	CR P50	65.3	523.2	444.7	<P1	NA	NA	NA
11099	Merritts Mill Pond	16,665	CR P50	87.6	521.4	443.2	<P1	NA	NA	NA
11099	Merritts Mill Pond	16,665	CR P50	91.0	525.5	446.7	<P1	NA	NA	NA
10398	Merritts Mill Pond	15,964	CR P50	82.6	524.5	445.9	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P50	70.0	524.6	445.9	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P50	74.5	528.3	449.1	<P1	NA	NA	NA
9842	Merritts Mill Pond	15,408	CR P50	105.7	543.7	462.2	<P1	NA	NA	NA

**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
8872	Merritts Mill Pond	14,438	CR P50	123.5	618.1	525.4	<P1	NA	NA	NA
7910	Merritts Mill Pond	13,476	CR P50	90.4	741.9	630.6	<P1	NA	NA	NA
6833	Merritts Mill Pond	12,400	CR P50	104.1	700.6	595.5	<P1	NA	NA	NA
6833	Merritts Mill Pond	12,400	CR P50	140.6	711.5	604.7	<P1	NA	NA	NA
6050	Merritts Mill Pond	11,616	CR P50	100.3	715.4	608.1	<P1	NA	NA	NA
6050	Merritts Mill Pond	11,616	CR P50	145.5	735.1	624.8	<P1	NA	NA	NA
5549	Merritts Mill Pond	11,115	CR P50	176.0	791.1	672.4	<P1	NA	NA	NA
5071	Merritts Mill Pond	10,637	CR P50	52.5	730.2	620.7	<P1	NA	NA	NA
5071	Merritts Mill Pond	10,637	CR P50	71.7	755.9	642.5	<P1	NA	NA	NA
5071	Merritts Mill Pond	10,637	CR P50	176.0	781.5	664.3	<P1	NA	NA	NA
4901	Merritts Mill Pond	10,467	CR P50	52.5	594.7	505.5	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P50	82.0	113.6	96.5	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P50	94.4	125.3	106.5	<P1	NA	NA	NA
4373	Spring Creek	9,939	CR P50	98.4	137.6	116.9	84.4	89.3	14.0	13.5
4263	Spring Creek	9,828	CR P50	83.2	135.0	114.7	<P1	NA	NA	NA
4263	Spring Creek	9,828	CR P50	135.5	151.3	128.6	<P1	NA	NA	NA
4263	Spring Creek	9,828	CR P50	163.3	173.0	147.0	117.6	57.5	45.8	44.3
4263	Spring Creek	9,828	CR P50	176.0	194.2	165.1	150.9	78.1	25.2	24.3
4164	Spring Creek	9,729	CR P50	88.7	166.6	141.6	<P1	NA	NA	NA
4164	Spring Creek	9,729	CR P50	95.2	176.2	149.8	<P1	NA	NA	NA
4164	Spring Creek	9,729	CR P50	103.3	204.5	173.8	90.9	90.9	12.4	12.0
4164	Spring Creek	9,729	CR P50	121.1	263.3	223.8	107.1	89.3	14.0	13.6
3866	Spring Creek	9,431	CR P50	95.2	123.8	105.2	57.0	65.1	38.2	37.0

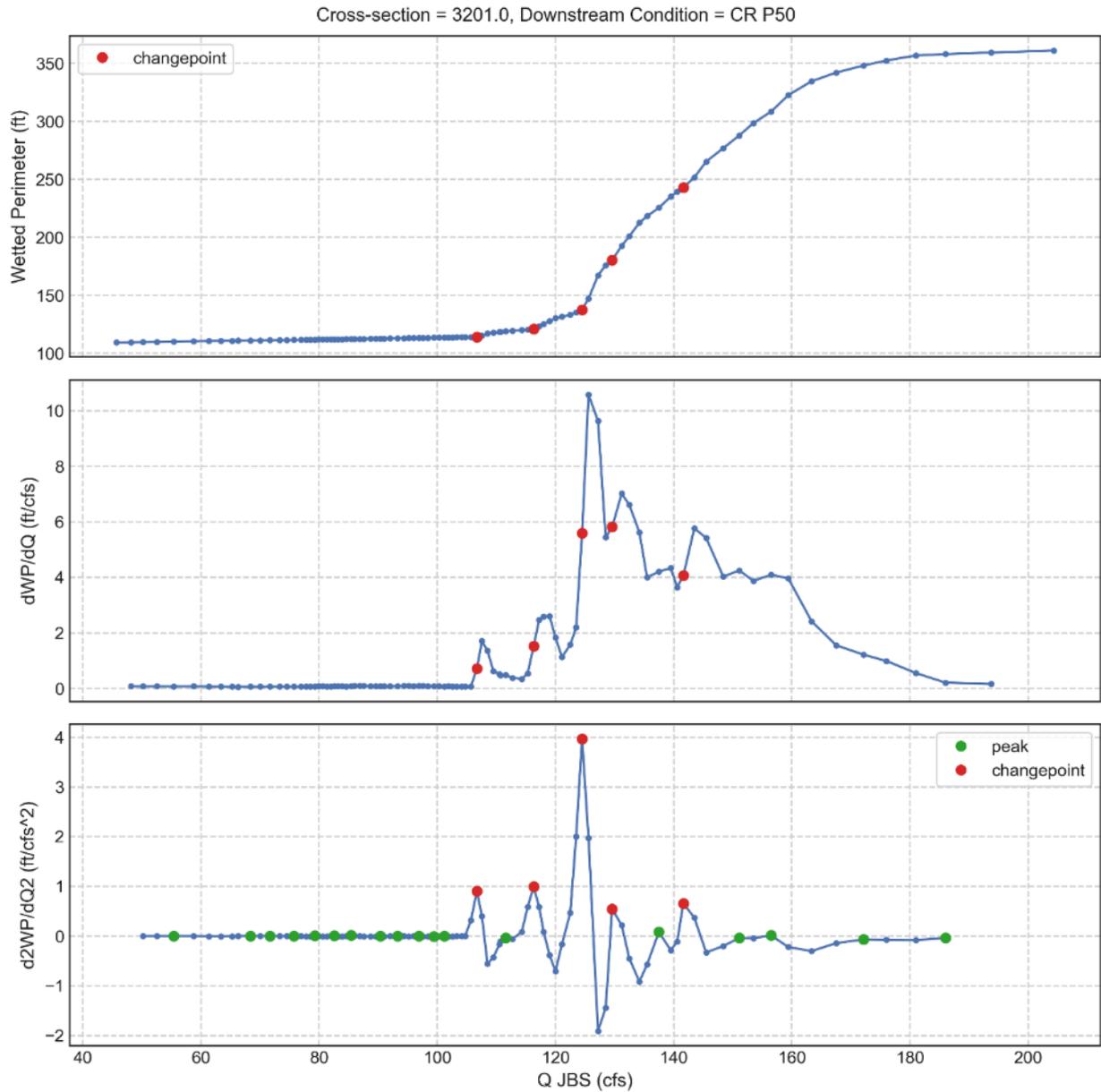
**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
3866	Spring Creek	9,431	CR P50	103.3	156.1	132.7	98.4	98.4	4.9	4.7
3866	Spring Creek	9,431	CR P50	118.0	192.4	163.5	104.2	89.5	13.8	13.4
3866	Spring Creek	9,431	CR P50	124.5	202.8	172.4	105.7	84.5	18.8	18.2
3238	Spring Creek	8,803	CR P50	106.7	99.6	84.6	45.7	42.3	61.0	59.0
3238	Spring Creek	8,803	CR P50	115.3	110.3	93.8	71.6	59.6	43.7	42.3
3238	Spring Creek	8,803	CR P50	122.5	119.4	101.5	107.3	88.1	15.2	14.8
3238	Spring Creek	8,803	CR P50	129.6	149.1	126.7	124.2	97.9	5.4	5.2
3238	Spring Creek	8,803	CR P50	139.5	210.7	179.1	134.8	98.6	4.7	4.6
3201	Spring Creek	8,767	CR P50	106.7	114.0	96.9	<P1	NA	NA	NA
3201	Spring Creek	8,767	CR P50	116.3	121.0	102.8	<P1	NA	NA	NA
3201	Spring Creek	8,767	CR P50	124.5	137.6	117.0	108.4	87.2	16.1	15.6
3201	Spring Creek	8,767	CR P50	129.6	180.4	153.4	126.1	99.8	3.5	3.4
3201	Spring Creek	8,767	CR P50	141.6	242.9	206.5	133.3	95.0	8.3	8.1
2390	Spring Creek	7,955	CR P50	135.5	139.1	118.2	45.9	13.7	89.6	86.7
2390	Spring Creek	7,955	CR P50	140.6	163.9	139.3	135.6	98.3	5.0	4.9
2390	Spring Creek	7,955	CR P50	145.5	196.3	166.8	140.9	98.7	4.6	4.5
1956	Spring Creek	7,522	CR P50	86.9	137.4	116.8	59.7	76.1	27.2	26.4
1500	Spring Creek	7,065	CR P50	141.6	87.2	74.1	<P1	NA	NA	NA
1500	Spring Creek	7,065	CR P50	159.4	120.6	102.5	145.2	89.1	14.2	13.8
1500	Spring Creek	7,065	CR P50	172.2	182.2	154.9	167.7	98.9	4.4	4.3
794	Spring Creek	6,360	CR P50	70.0	91.3	77.6	<P1	NA	NA	NA
794	Spring Creek	6,360	CR P50	103.3	103.1	87.6	56.7	56.7	46.6	45.1
794	Spring Creek	6,360	CR P50	123.5	112.6	95.7	75.0	54.8	48.5	47.0

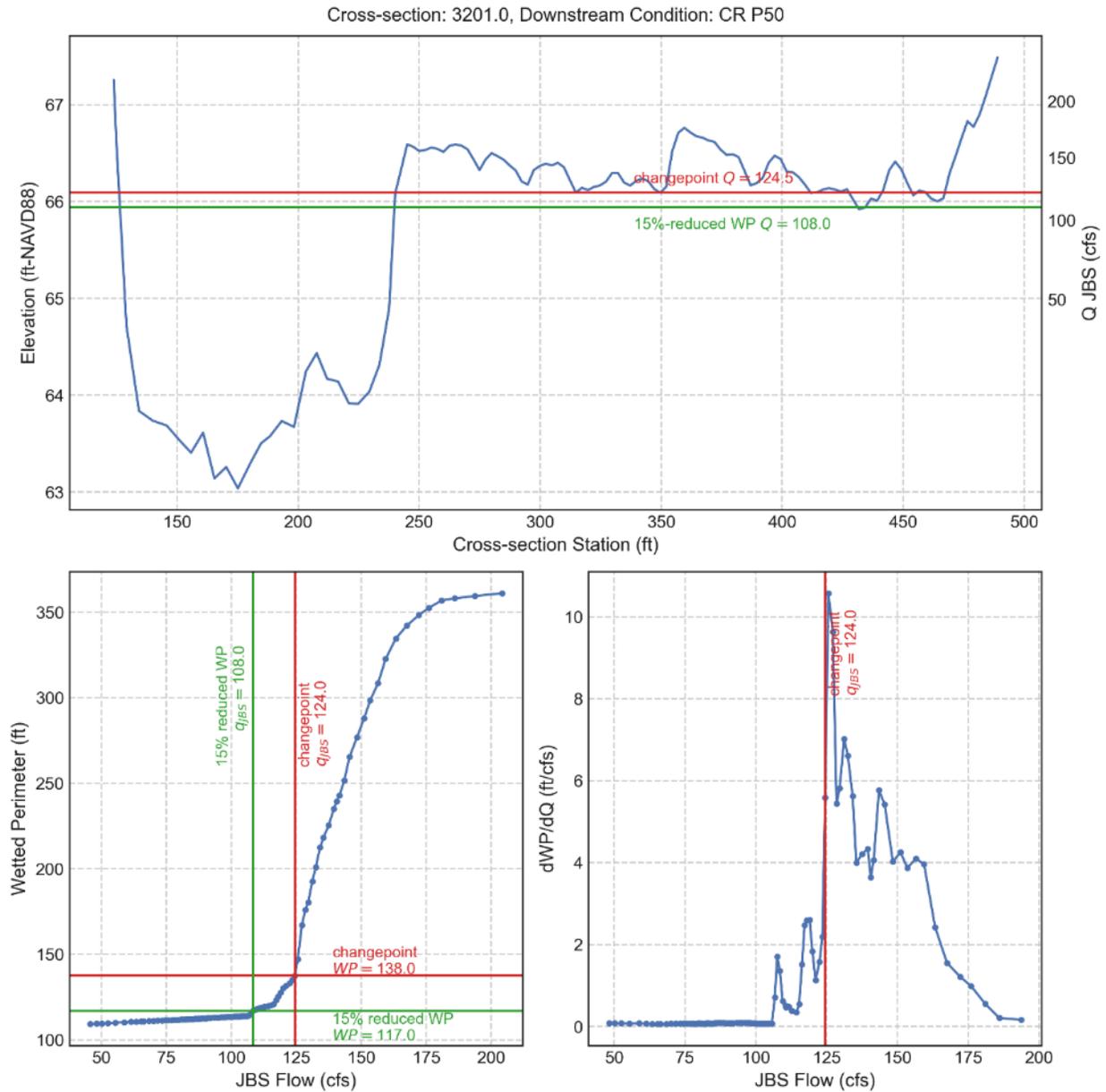
**Table 14:. Results of the Detailed Wetted Perimeter Analysis Based on a 15% Reduction in Wetted Perimeter (WP) at Critical Changepoints for each Cross-Section. Rows containing “NA” correspond to cross-sections with either no changepoints or invalid flow reductions. Note that there are multiple rows for cross-sections which exhibited multiple changepoints**

Cross-Section	Waterbody	Distance from Chipola River (ft)	Downstream Condition	Critical Flow (cfs)	Critical WP (ft)	15%-Reduced WP (ft)	Flow at Reduced WP (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
794	Spring Creek	6,360	CR P50	172.2	144.7	123.0	147.8	78.9	24.4	23.6
257	Spring Creek	5,823	CR P50	79.3	101.5	86.3	<P1	NA	NA	NA
257	Spring Creek	5,823	CR P50	186.0	115.4	98.0	64.2	NA	NA	NA
55	Spring Creek	5,620	CR P50	98.4	92.2	78.4	53.0	57.9	45.4	43.9
55	Spring Creek	5,620	CR P50	120.0	104.8	89.1	88.2	71.5	31.8	30.8
0.5592	Spring Creek	5,345	CR P50	82.6	86.0	73.1	48.0	68.7	34.6	33.5
0.5592	Spring Creek	5,345	CR P50	84.6	86.7	73.7	49.5	68.2	35.1	34.0
0.4926	Spring Creek	4,678	CR P50	87.6	111.3	94.6	<P1	NA	NA	NA
0.4926	Spring Creek	4,678	CR P50	121.1	115.7	98.3	46.4	28.6	74.7	72.3
0.4508	Spring Creek	4,261	CR P50	87.6	141.9	120.6	<P1	NA	NA	NA
0.449	Spring Creek	4,242	CR P50	86.9	109.9	93.4	<P1	NA	NA	NA
0.4465	Spring Creek	4,218	CR P50	93.3	119.8	101.8	<P1	NA	NA	NA
0.4297	Spring Creek	4,050	CR P50	63.4	76.0	64.6	<P1	NA	NA	NA
0.4297	Spring Creek	4,050	CR P50	86.9	83.9	71.3	<P1	NA	NA	NA
0.4297	Spring Creek	4,050	CR P50	181.0	93.6	79.6	68.0	NA	NA	NA
0.336	Spring Creek	3,113	CR P50	86.9	86.0	73.1	52.3	68.7	34.6	33.5
0.336	Spring Creek	3,113	CR P50	122.5	112.7	95.8	90.2	71.0	32.3	31.3
0.3061	Spring Creek	2,814	CR P50	NA	NA	NA	NA	NA	NA	NA

<sup>1</sup> Percent flow reductions are percentages of the median baseline Jackson Blue Spring Flow (103.3 cfs).



**Figure 29: Plots Showing Changepoints Identified based on Extreme Peaks in the Second Derivative of Wetted Perimeter versus Flow Rate at an Example Cross-Section (3201)**



**Figure 30: Plots Showing the Flow Reduction Based on a 15% Decrease in Wetted Perimeter for an Example Cross-Section and Changepoint**

**Table 15: Statistics Describing the MFL Metrics Calculated from All Valid Changepoints in the Detailed Wetted Perimeter Analysis**

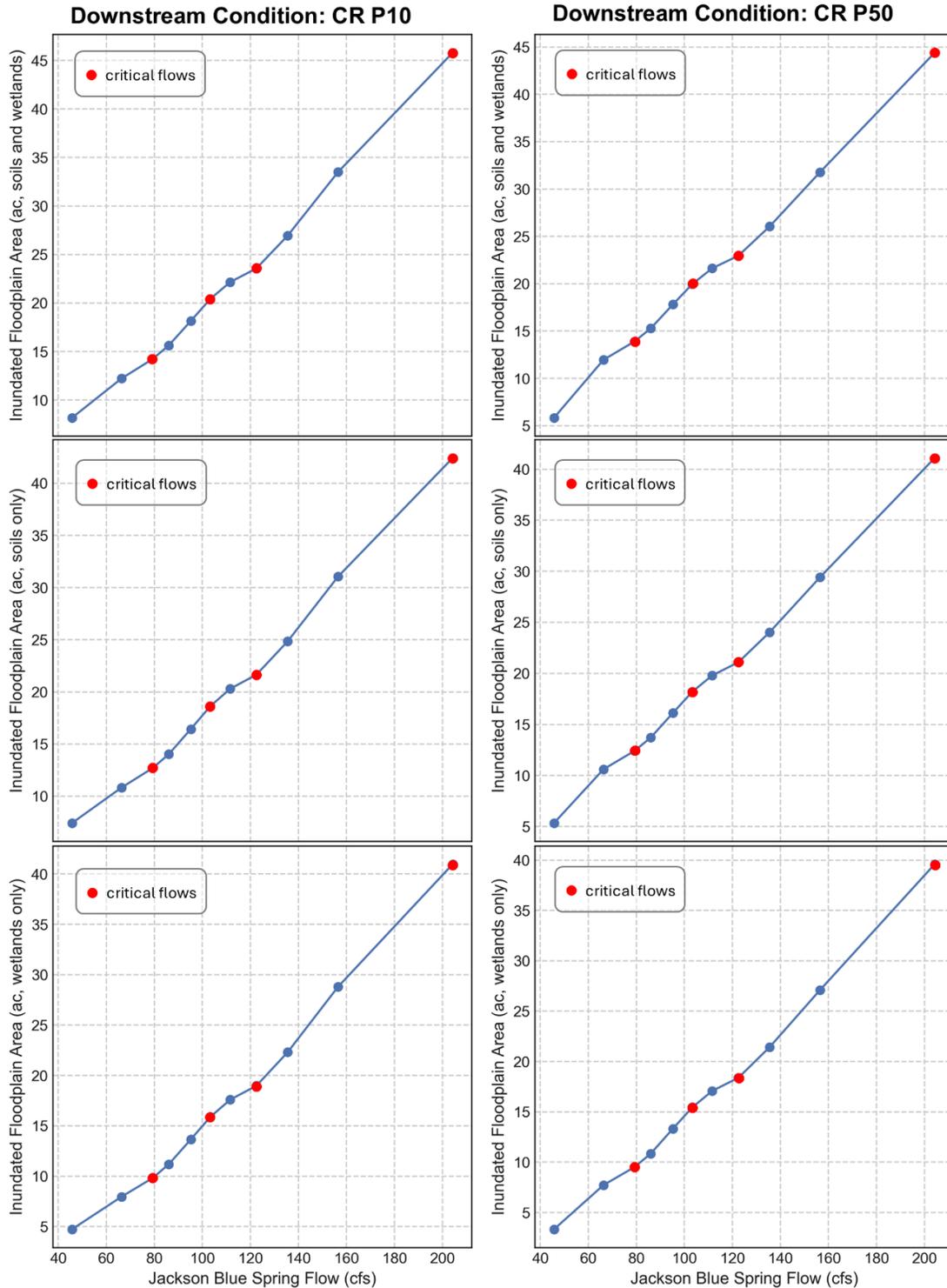
	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%) <sup>1</sup>
Count	39	39	39
Mean	72.8	30.5	29.5
Standard Deviation	22.7	22.7	22.0
Minimum	13.7	4.7	4.6
15 <sup>th</sup> Percentile	56.2	13.4	13.0
25 <sup>th</sup> Percentile	59.5	14.0	13.5
50 <sup>th</sup> Percentile	78.9	24.4	23.6
75 <sup>th</sup> Percentile	89.3	43.8	42.4
85 <sup>th</sup> Percentile	89.9	47.1	45.6
Maximum	98.6	89.6	86.7

<sup>1</sup> Percent flow reductions are percentages of the median baseline Jackson Blue Spring Flow (103.3 cfs).

### 4.3.3 Riparian Wetland Inundation

The inundation of riparian wetlands due to various flow rates/water levels in adjacent streams provides multiple water resource values such as flood mitigation, water quality improvements, transfer of detrital material, and the maintenance of habitat for wetland species. The riparian wetland inundation analysis was performed to derive MFL metrics that would be protective of those WRVs based on an allowable 15 percent reduction in inundated wetland area. This analysis was performed for Spring Creek only, since inundation of wetlands around Merritts Mill Pond was assessed in the hydroperiod tool analysis.

Relationships between Jackson Blue Spring flow and inundated wetland area were developed using multiple wetland dataset (land cover and hydric soils, land cover only, and hydric soils only) and two downstream boundary conditions (CR P10 and CR P50, Figure 31). These relationships were used to determine flow reductions at multiple critical flows/percentiles, including the 20<sup>th</sup> and 70<sup>th</sup> percentiles which corresponded to visually identified changepoints along with the 50<sup>th</sup> and 99<sup>th</sup> percentiles (Table 16). The changepoint at the 70<sup>th</sup> percentile flow (123 cfs) was comparable to the changepoint for weighted wetted perimeter (124 cfs), but the allowable flow reduction was significantly less (~20 cfs versus 35 cfs) likely due to the metric being focused on a subset of inundated area rather than total inundated area. This indicates that wetland inundation is a more sensitive metric than wetted perimeter. The results varied slightly depending on how the wetland was defined, but in all cases the most restrictive MFL metrics based on wetland inundation were calculated using the 50<sup>th</sup> percentile flow as the critical flow, suggesting that allowing a 15 percent reduction in inundated area at the median flow would be equally or more protective of wetlands dependent on higher or lower flows.



**Figure 31: Relationships between Jackson Blue Spring Flow and Inundated Wetland Area Based on Both Land Cover And Hydric Soils (top row), Hydric Soils Only (middle row), and Land Cover Only (bottom row) with a Downstream Boundary Condition Equal to CR P10 (left column) and CR P50 (right column)**

**Table 16: Results of the Riparian Wetland Inundation Analysis**

Downstream Condition	Wetland Representation	Critical Percentile (%)	Critical Area (ac)	Critical Flow (cfs)	15%-Reduced Area (ac)	Flow at Reduced Area (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%)
CR P10	Hydric soils and land cover	20	14.2	79.3	12.1	65.7	89.7	13.6	13.2
CR P10	Hydric soils and land cover	50	20.4	103.3	17.4	92.3	92.3	11.0	10.7
CR P10	Hydric soils and land cover	70	23.6	122.5	20.0	101.9	82.7	20.6	19.9
CR P10	Hydric soils and land cover	99	45.8	204.3	38.9	177.6	76.6	26.7	25.8
CR P10	Hydric soils only	20	12.7	79.3	10.8	66.1	90.1	13.2	12.7
CR P10	Hydric soils only	50	18.6	103.3	15.8	92.9	92.9	10.4	10.1
CR P10	Hydric soils only	70	21.6	122.5	18.4	102.5	83.3	20.0	19.4
CR P10	Hydric soils only	99	42.4	204.3	36.1	177.6	76.6	26.7	25.9
CR P10	Land cover only	20	9.8	79.3	8.3	69.0	93.0	10.3	9.9
CR P10	Land cover only	50	15.9	103.3	13.5	94.6	94.6	8.7	8.4
CR P10	Land cover only	70	19.0	122.5	16.1	104.5	85.3	18.0	17.4
CR P10	Land cover only	99	41.0	204.3	34.8	180.2	79.2	24.1	23.3
CR P50	Hydric soils and land cover	20	13.9	79.3	11.8	65.8	89.8	13.5	13.0
CR P50	Hydric soils and land cover	50	20.0	103.3	17.0	92.2	92.2	11.1	10.8
CR P50	Hydric soils and land cover	70	23.0	122.5	19.5	101.6	82.4	20.9	20.2
CR P50	Hydric soils and land cover	99	44.4	204.3	37.8	179.1	78.1	25.2	24.4
CR P50	Hydric soils only	20	12.4	79.3	10.6	66.1	90.1	13.2	12.8

**Table 16: Results of the Riparian Wetland Inundation Analysis**

Downstream Condition	Wetland Representation	Critical Percentile (%)	Critical Area (ac)	Critical Flow (cfs)	15%-Reduced Area (ac)	Flow at Reduced Area (cfs)	Minimum Allowable Flow (cfs)	Allowable Flow Reduction (cfs)	Percent Flow Reduction (%)
CR P50	Hydric soils only	50	18.2	103.3	15.5	92.7	92.7	10.6	10.2
CR P50	Hydric soils only	70	21.1	122.5	17.9	102.2	83.0	20.3	19.6
CR P50	Hydric soils only	99	41.1	204.3	34.9	179.1	78.1	25.2	24.4
CR P50	Land cover only	20	9.5	79.3	8.1	69.0	93.0	10.3	10.0
CR P50	Land cover only	50	15.4	103.3	13.1	94.5	94.5	8.8	8.5
CR P50	Land cover only	70	18.4	122.5	15.6	104.2	85.0	18.3	17.7
CR P50	Land cover only	99	39.6	204.3	33.7	181.6	80.6	22.7	22.0

## 5. Application of the Hydroperiod Tool to the Jackson Blue Spring System

### 5.1 Background

Two reaches within the Jackson Blue Spring System are affected by flows from Jackson Blue Spring: Merritts Mill Pond and Spring Creek (Figure 32). To ensure that MFLs developed for Jackson Blue Spring will protect both reaches, two analytical approaches have been employed to demonstrate how the MFL would be developed. Given that Spring Creek is a lotic system (i.e., a flowing water), the System for Environmental Flow Analysis (SEFA) analysis approach was taken for that reach. A discussion of this approach and results is contained in the report, “SEFA Model Development and Evaluation of Instream Habitat Metrics for Jackson Blue Spring System Minimum Flows”, included as APPENDIX A. In contrast, Merritts Mill Pond resembles a lentic system (i.e., a lake or ponded water) where velocities are relatively lower than in lotic systems. As a result, an alternative approach to MFL development was employed. The Hydroperiod (“water time”) Tool (Fox et al., 2022; Jennewein et al., 2020; Shadik et al., 2025; Sutherland et al., 2021) recently developed by the St. Johns River Water Management District was applied to the Merritts Mill Pond. The Hydroperiod Tool focuses on the relationship between flow and pond depth as the relative velocities are typically low and spatially similar. As such, this effort was made to evaluate the effects of water level decline on the average area of various fish and wildlife habitats that provide the specific depths in the pond as a function of Jackson Blue Spring discharge

### 5.2 Objective

The objective is to evaluate the effect of changes in Jackson Blue Spring discharge to metrics within a lentic system (Merritts Mill Pond) that are primarily driven by changes in depth.

### 5.3 Hydroperiod Analysis

#### 5.3.1 Pond Elevations

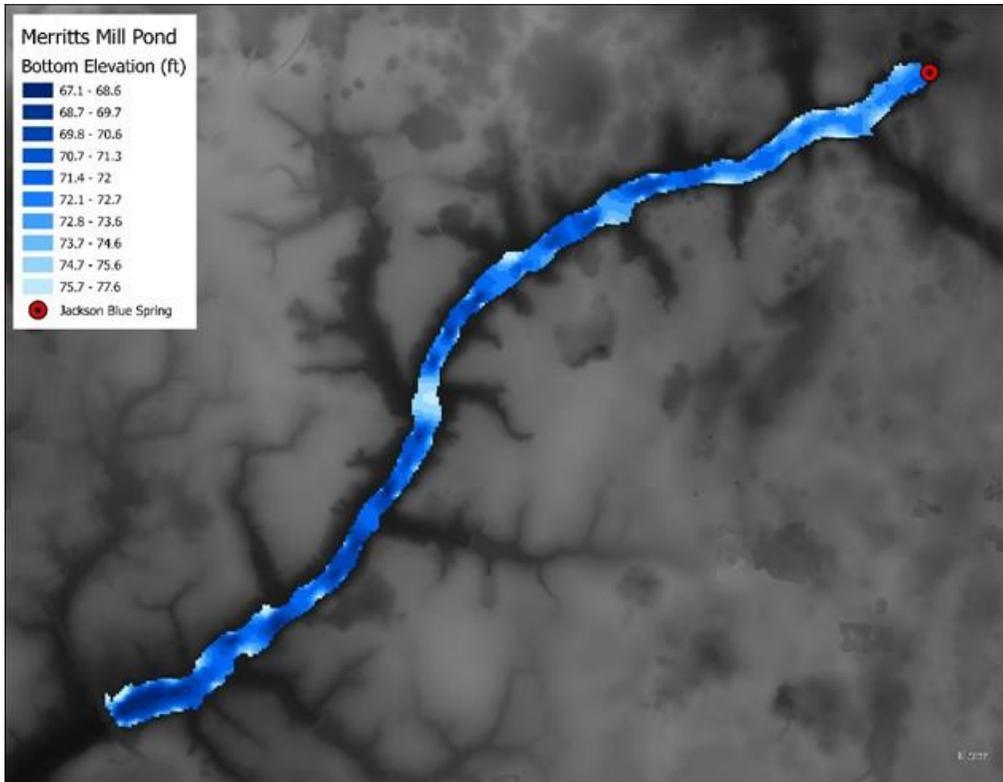
The first step in the analysis was to create a digital elevation model (DEM) of the elevation of the bottom of Merritts Mill Pond between the Jackson Blue Spring and discharge structure to Spring Creek at US 90. This was achieved using the same cross-sections and associated elevations that were used to develop the HEC-RAS model (Figure 33). Within a geographic information system (ESRI ArcGIS Pro 3.5), the transects and the elevations along the lines were plotted. Various techniques were tested to interpolate the elevations between the transects. The spline with boundary tool, using the outline of the pond as the boundary was selected to create the DEM of Merritts Mill Pond (Figure 34). The use of the spline with boundary tool constrained the interpolation to the area of the pond while the other techniques worked beyond the pond and caused non-neighboring areas to affect one another in the interpolation. The tool creates a continuous raster of bottom elevations within Merritts Mill Pond based on the elevations from the HEC-RAS cross-sections.

#### 5.3.2 Water Depth

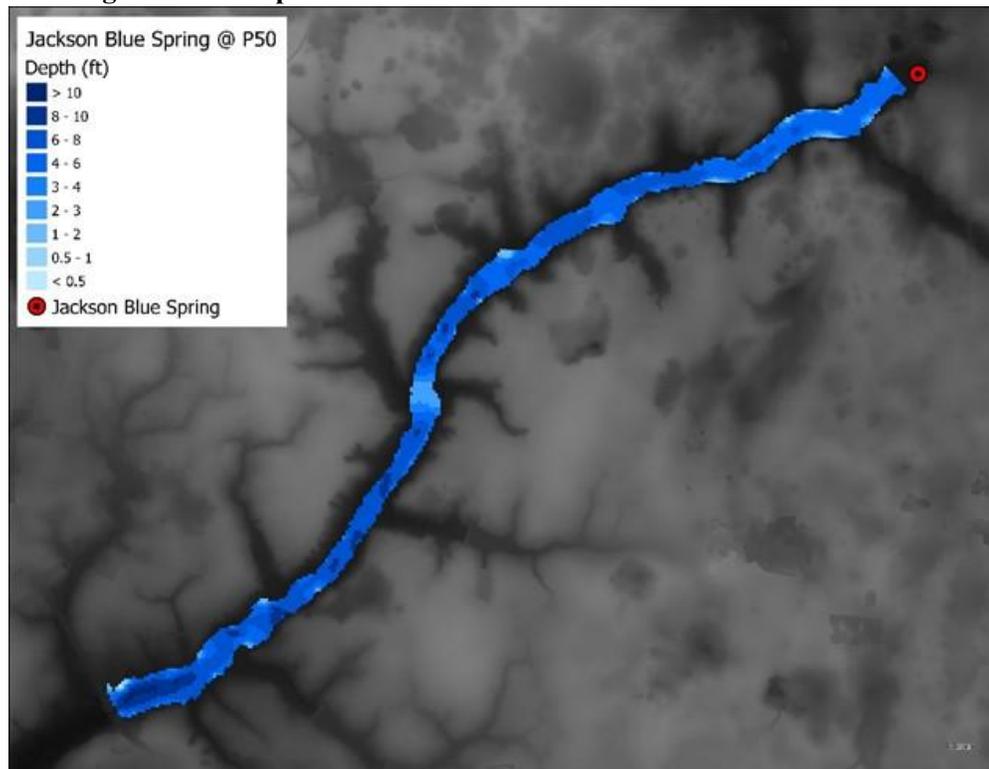
HEC-RAS water surface elevations (WSE) were provided for the P1, P5, P10, P15, P20, P30, P40, P50, P60, P70, P80, P90, and P99 percentile flows for Jackson Blue Spring. The depth was calculated as the difference between the WSE and the bottom elevation described above using the Raster Calculator within the ArcGIS Pro software. An example is shown in Figure 34.



Figure 32: Transect Locations in Merritts Mill Pond and Spring Creek



**Figure 33: Interpolated Bottom Elevations within Merritts Mill Pond**



**Figure 34: Calculated Depths in Merritts Mill Pond when Discharge from Jackson Blue Spring at P50**

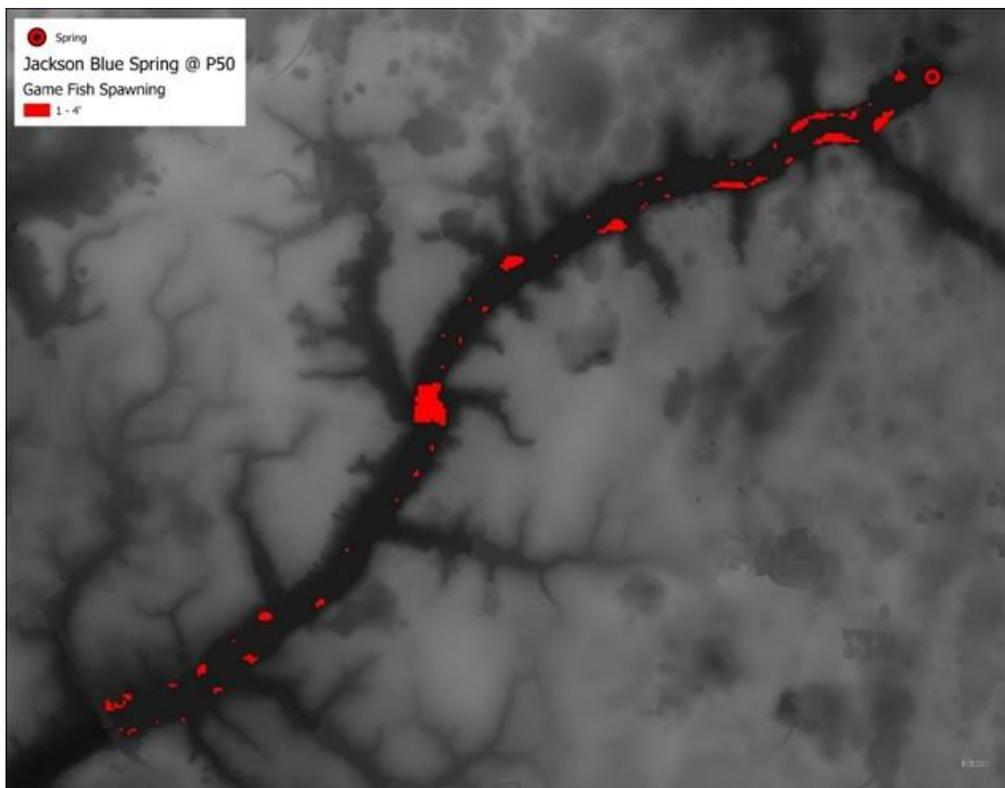
### 5.3.3 Identify Metrics and Depth Reclassification

The next step was to identify the metrics that would be analyzed. Small and large wading birds along with spawning game fish were chosen as the metrics that would be analyzed. Since depth requirements for wading birds and game fish spawning within Merritts Mill Pond, specifically, were unavailable, the critical depth ranges used in previous MFLs (Jennewein et al., 2020; Shadik et al., 2025; Sutherland et al., 2021), which were determined based on literature review, were used in this analysis, representing best available data (Table 17).

These values were then entered into the GIS system to reclassify the depth raster and identify the areas within the range of critical depths for each of the metrics. The reclassified areas were then tabulated for each Jackson Blue Spring percentile flow listed above for further analysis. An example of the reclassified areas for game fish spawning for the 50th percentile flow is shown in Figure 35.

**Table 17: Critical Depths For Selected Metrics**

Metric	Critical Depth Range (ft)
Small Wading Birds	
Snail Kite                      Tricolored Heron	0.1 – 0.5
Snowy Egret                    Green Heron	
Large Wading Birds	
Great Blue Heron            Great Egret	0.1 – 1.0
Wood Stork                    Sandhill Crane	
White Ibis	
Game Fish Spawning (e.g., largemouth bass)	1 – 4



**Figure 35: Areas Meeting the Game Fish Spawning Critical Depth Range**

## 5.4 Results

Table 18 and Figure 36 present the results from the hydroperiod analysis. The maximum area for each of the categories tested was found at the elevation associated with the P1 percentile flow (45.7 cfs) from Jackson Blue Spring. To achieve a 15 percent reduction in area would require an extrapolation to flows never seen within the system. Since this is the case, this metric would not make a good candidate for setting the MFL.

**Table 18: Hydroperiod Results for Merritts Mill Pond**

Category	Maximum Area (feet <sup>2</sup> )	Flow @ Maximum Area (cfs)	15% Reduction in Maximum Area (feet <sup>2</sup> )	Flow @ Reduced Maximum Area (cfs)	Difference from Max Area Flow	% Reduction in Flow
Game Fish Spawning	2,470,291	45.7	2,099,747	<P1	N/A	N/A
Large Waders	106,823	45.7	90,800	<P1	N/A	N/A
Small Waders	33,382	45.7	28,375	<P1	N/A	N/A



Figure 36: Plot of the Area Versus Percentile Flows at Jackson Blue Spring

## 6. Summary and Conclusions

Table 19 contains a summary of all the MFL metrics that can be derived from the WRV assessments that were performed for the Jackson Blue Spring/Merritts Mill Pond/Spring Creek system. No MFL metrics are reported related to fish passage, tubing passage, and canoe/kayak passage due to their all having extremely low critical flows which are exceeded more than 99 percent of the time. This is also true for motorboat passage in Merritts Mill Pond. Also, no MFL metrics are reported related to the Merritts Mill Pond hydroperiod analysis due to all WRV response functions having a negative relationship with flow, meaning no harm is indicated by decreasing flow.

The most limiting result for the assessment of motorboat passage in Spring Creek suggested a maximum allowable flow reduction of 12.9 cfs to prevent significant harm to recreation provided by motorboating. This corresponds to the average allowable flow reduction calculated at HEC-RAS cross-section 0.4465. While the assessment indicated that motorboat passage could be significantly harmed at cross-section 4164 due to a slightly lower flow reduction (9.5 cfs, on average), limited boat passage at that cross-section would not restrict access to a significant portion of Spring Creek due to its location.

The MFL metrics corresponding to the assessments of weighted wetted perimeter and detailed wetted perimeter both represent aggregated thresholds for all cross-sections representing Spring Creek and suggest JBS discharge could be reduced by 35.4 cfs and 30.5 cfs, respectively, without significantly harming WRV's dependent on wetted perimeter. This is similar to the allowable flow reduction of 34.7 cfs indicated by the weighted habitat suitability assessment.

Riparian wetland inundation was found to be the most sensitive WRV metric with an average allowable flow reduction of 11.1 cfs (10.7 percent of the median baseline JBS discharge). This is based on the analysis which defined the wetland areas using the union of best available delineations of wetland vegetation and hydric soils in the portion of Spring Creek most sensitive to JBS discharge. While the wetland inundation assessment including only wetland vegetation (i.e., land cover) suggested a lower allowable flow reduction, that is based on a less comprehensive definition of wetlands and may neglect areas which provide wetland functions (i.e., nutrient cycling and flood mitigation) but do not currently harbor wetland vegetation. Thus, it was determined that the MFL metrics derived from the more comprehensive definition of wetlands surrounding Spring Creek were more reliable indicators of thresholds for significant harm to WRVs provided by wetland inundation.

**Table 19: Summary of All WRV Assessment Results**

<b>Metric</b>	<b>Minimum Allowable Flow (cfs)</b>	<b>Allowable Flow Reduction (cfs)</b>	<b>Percent Flow Reduction (%)</b>	<b>Comments</b>
Fish Passage	NA	NA	NA	No valid limiting cross-sections
Tubing Passage	NA	NA	NA	No valid limiting cross-sections
Canoe/Kayak Passage	NA	NA	NA	No valid limiting cross-sections
Motorboat Passage in Merritts Mill Pond	NA	NA	NA	No valid limiting cross-sections
Motorboat Passage in Spring Creek	90.4	12.9	12.5	Based on average results for both downstream boundary conditions at most limiting cross-section (0.4465)
Weighted Wetted Perimeter	67.9	35.4	34.2	Based on average results for both downstream boundary conditions in Spring Creek only
Detailed Wetted Perimeter	72.8	30.5	29.5	Based on average of all valid results under both downstream boundary conditions
Riparian Wetland Inundation	92.2	11.1	10.7	Based on average results for both downstream boundary conditions at the median JBS flow
Weighted Habitat Suitability	68.6	34.7	33.6	Based on average results for Spotted Sunfish Spawning in Spring Creek under both downstream boundary conditions
Hydroperiod	NA	NA	NA	All response functions were found to have a negative relationship with flow

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# APPENDIX A

## SEFA Model Development and Evaluation of Instream Habitat Metrics for Jackson Blue Spring System Minimum Flows

**SEFA Model Development and Evaluation of Instream Habitat  
Metrics  
for Jackson Blue Spring System  
Minimum Flows**

**Prepared for:  
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**September 25, 2025**

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## 1. Introduction

System for Environmental Flow Analysis (SEFA) (Aquatic Habitat Analysts, Inc. 2012) is a Windows-based program that was developed as a tool for use in studies that utilize the Instream Flow Incremental Methodology (IFIM; Bovee, 1982; Bovee, 1986; Bovee and Milhous, 1978; Milhous and others, 1989). The Instream Flow Incremental Methodology is a framework developed by the U.S. Fish and Wildlife Services in the 1970s for determining the relationship between stream flows and fish habitat. SEFA is current software that implements the IFIM framework that utilizes hydraulic models coupled with habitat suitability relationships for specific classes of species to determine relationships between streamflow and available habitat. Habitat suitability is defined based on relationships among depth, substrate, and stream velocity at specific transect locations. Through a series of subroutine programs in SEFA, a prediction of the suitability index of available habitat Area Weighted Suitability (AWS) for target organism(s) over a range of streamflow conditions is created.

The IFIM methodology utilizing SEFA software has been applied to help support the development of environmental flow regimes as required by Florida’s MFL statute. Specifically, SEFA has been applied to support MFL development for lotic ecosystems (i.e. rivers and creeks) by four of the Florida water management districts (WMDs) – Southwest Florida WMD, St. Johns River WMD, Suwannee River WMD, and the NFWMD (Table 1). SEFA applications can be found across many U.S. systems in Georgia (Evans, and England, 1995); Arkansas (Filipek et al. 1987). Texas (Mathews and Bao, 1991), and Oklahoma (Normandeau Associates, Inc. 2017). SEFA has also been applied in various international projects including France (Mattia Damiani et al., 2018); Australia (Hughes & James, 1989) and New Zealand (Jowett et al., 2008).

**Table 1: MFLs Where SEFA was Applied**

River System	Reference
Steinhatchee River	Minimum Flows and Levels for Steinhatchee River, Florida. Prepared for Suwannee River Water Management District. Prepared by ATM and Janicki Environmental, May 2018.
Lower Santa Fe and Ichetucknee Rivers and Priority Springs	Minimum Flows and Minimum Water Levels Re-Evaluation For the Lower Santa Fe and Ichetucknee Rivers and Priority Springs. Prepared for Suwannee River Water Management District. Prepared by HSW Engineering, January 2021.
Aucilla River, Wacissa River and Priority Springs	Minimum Flows and Levels for the Aucilla River, Wacissa River and Priority Springs. Prepared for Suwannee River Water Management District. Prepared by HSW Engineering, January 2021.
Little Manatee River	Recommended Minimum Flows for the Little Manatee River Final Draft Report. Prepared for the Southwest Florida Water Management District. Prepared by SWFWMD and Janicki Environmental, November 2023.
Horse Creek	Recommended Minimum Flows for Horse Creek Final Report. Prepared for the Southwest Florida Water Management District. Prepared by SWFWMD December 2023.

**Table 1: MFLs Where SEFA was Applied**

River System	Reference
Econfina Creek	Recommended Minimum Flow for Middle Econfina Creek, including Gainer Spring, Williford Spring, and Sylvan Spring Groups Washington and Bay Counties, Florida. Technical Report Series 25-01. Prepared by NFWFMD. March 2025.

SEFA habitat modeling utilizes habitat suitability curves (HSCs), which relate physical habitat variables including depth, velocity, and substrate (if applicable) to an index of habitat suitability for a selected guild, species, or life stage. HSCs can represent individual species, life stages such as juveniles or adults, and/or habitat guilds which include species with similar habitat requirements. The HSC index values vary between 0 (least suitable) and 1 (optimal suitability) and provide a relative measure of how suitable a habitat is for a specific species (including different life history stages) or a group of species inhabiting a similar habitat (habitat guild).

The SEFA model uses riverine hydraulic variables (cross-sectional elevation profiles, water surface elevation, and velocity) in conjunction with HSCs to calculate AWS, a suitability index that reflects habitat quality and quantity expressed in units of square feet of habitat per linear foot of creek length (ft<sup>2</sup>/ft). Although AWS is expressed in units of ft<sup>2</sup>/ft, it is considered a weighted measure of habitat suitability, and not an area or volume with direct physical interpretation (Herrick 2021). Riverine hydraulic information for purposes of SEFA modeling can be determined through field measurements of channel bathymetry, water depth, velocity, flow, and substrate (if applicable) at specified cross sections. Alternately SEFA modeling can be completed using a previously constructed and calibrated HEC-RAS (Hydrologic Engineering Center River Analysis System) model of the system, or some combination of the two methods. For a given flow, SEFA calculates habitat suitability for each variable (depth, velocity, and substrate if applicable) based on input habitat suitability curves and the depth and velocity at each point along a cross section. The combined suitability index for a given flow at a specific subsection along a cross section or transect is then determined as the product of the suitability of depth, velocity, and, if applicable, substrate (Herrick 2021).

AWS can be modeled within SEFA for an individual cross section, or in aggregate for any number of cross sections or the entirety of the model domain. The SEFA model can be run to compute aggregate AWS for each flow in a streamflow time series. The model output is a curve relating flow to AWS, with each value of flow having a single corresponding aggregate AWS value for the model domain. Therefore, a series of flow values can be converted into a series of AWS values for each taxon/life history stage or habitat guild that comprise a given habitat suitability group. Alternative scenarios, for example time series of flows under baseline (unimpacted) conditions, can be compared to flow-reduction scenarios to determine change in AWS associated with changes in flows (Herrick, 2021).

## 2. SEFA Model Development for the Jackson Blue Spring Study Area

The District contracted with Geosyntec Consultants, Inc., d/b/a Applied Technology and Management, Inc. (ATM) to develop a System for Environmental Flow Analysis (SEFA) model for the entirety of the Jackson Blue Spring MFL study area which includes Jackson Blue Spring, Merritts Mill Pond and Spring Creek. (Figure 1). Environmental Science Associates (ESA), a subcontractor, worked with ATM to satisfy the objectives of this project. The goal of this task was to examine the extent to which reductions in streamflow affect habitat availability, as indicated by AWS, for relevant species within the Jackson Blue Spring MFL study area. Version 1.8 of the SEFA software was used in this project.

### 2.1 Jackson Blue Spring System Biota and Habitat Suitability Curves

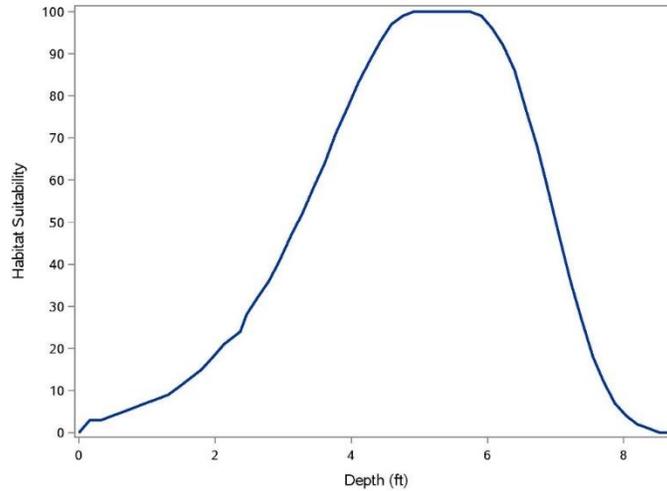
A habitat suitability curve (HSC) relates how well a species is likely to thrive at different levels of specific environmental factors, such as stream depth or water velocity. A habitat suitability value of 1 represents optimal conditions, where the habitat is considered most suitable for the species. Decreasing values of habitat suitability indicate decreasing suitability and a habitat suitability value of 0 indicates the habitat is unsuitable for that taxon. Figure 2 presents a simplified representation of a habitat suitability curve based on water depth. Similarly, curves for velocity present habitat suitability on the y-axis and velocity on the x-axis.

Habitat suitability curves (HSCs) considered for utilization within the SEFA application for the Jackson Blue Spring study area included all relevant curves for documented fish species as well as mussel species and host fish, and macroinvertebrates within the study area. All relevant HSCs relating depth and velocity with habitat suitability were considered. HSCs relating substrate to flow were not utilized in the Jackson Blue Spring MFL evaluation because the spatial variability of substrate within the study area (consisting of sands and limestone) was not considered sufficient to warrant inclusion of substrate-based HSCs.

Table 2 presents the fish species documented to occur in the Jackson Blue Spring System and whether suitable habitat suitability curves exist for that species. Lists of documented species were obtained from the Florida Wildlife Commission (Erik Nagid, personal communication) and University of Florida fish collection library (<https://www.floridamuseum.ufl.edu/fish/>). Habitat suitability curves were identified by cross-referencing the species in Table 2 from a series of existing curves found in either the Gore library or Nagid Library. The Gore Library includes curves used in the Little Manatee River and Wekiva River MFL evaluations (SWFWMD 2023, SJRWMD 2024). The Nagid library includes curves found in the Florida Handbook of Habitat Suitability Indices (Nagid 2022a, Nagid 2022b). Based upon the relevant fish species identified and the availability of corresponding HSCs, HSCs for nine fish species were incorporated into the SEFA modeling. In addition, HSCs for four distinct habitat guilds (deep fast water, deep slow water, shallow fast water, and shallow slow water) were included. These guilds were previously defined within the Gore and Nagid libraries and represent fish species commonly present within the study area.



**Figure 1: Map of Jackson Blue Spring System including Jackson Blue Spring, Merritts Mill Pond and Spring Creek**



**Figure 2: Example of a Habitat Suitability Curve**

**Table 2: Fish Taxa Found in the Jackson Blue Spring System. Those that have habitat suitability curves are identified.**

Species Name	Common Name	Location		HSC
		Merritts Mill Pond	Spring Creek	
<i>Ameiurus nebulosis</i>	Brown bullhead	X		
<i>Aphredoderus sayanus</i>	Pirate perch	X	X	X
<i>Ctenopharyngodon idella</i>	Grass carp	X		
<i>Cyprinella venusta cercostigma</i>	Eastern blacktail shiner		X	
<i>Cyprinus carpio</i>	Common Carp	X		
<i>Elassoma evergladei</i>	Everglades pygmy sunfish	X		
<i>Elassoma gilberti</i>	Gulf coast pygmy sunfish		X	
<i>Esox americanus</i>	Redfin pickerel		X	
<i>Etheostoma edwini</i>	Brown darter		X	
<i>Etheostoma swaini</i>	Gulf darter		X	
<i>Gambusia holbrooki</i>	Mosquitofish	X	X	
<i>Labidesthes sicculus</i>	Brook silverside	X	X	
<i>Lepomis auritus</i>	Redbreast sunfish		X	X
<i>Lepomis gulosus</i>	Warmouth	X		
<i>Lepomis macrochirus</i>	Bluegill	X	X	X
<i>Lepomis marginatus</i>	Dollar sunfish		X	
<i>Lepomis microlophus</i>	Redear sunfish	X	X	
<i>Lepomis punctatus</i>	Spotted sunfish	X		X
<i>Lucania goodei</i>	Rainwater killifish	X	X	
<i>Micropterus cataractae</i>	Shoal bass			
<i>Micropterus salmoides</i>	Largemouth bass	X		X

**Table 2: Fish Taxa Found in the Jackson Blue Spring System. Those that have habitat suitability curves are identified.**

Species Name	Common Name	Location		HSC
		Merritts Mill Pond	Spring Creek	
<i>Micropterus sp.</i>	Unidentified black bass		X	
<i>Minytrema melanops</i>	Spotted sucker		X	X
<i>Notropis cummingsae</i>	Dusky shiner		X	
<i>Notropis harperi</i>	Redeye chub	X	X	X
<i>Notropis petersoni</i>	Coastal shiner		X	
<i>Notropis texanus</i>	Weed shiner	X	X	
<i>Noturus gyrinus</i>	Tadpole madtom		X	
<i>Noturus leptacanthus</i>	Speckled madtom		X	X
<i>Percina nigrofasciata</i>	Blackbanded darter		X	X
<i>Pteronotropis grandipinnis</i>	Apalachee shiner		X	
Grand Total Documented		15	23	9

In addition, habitat suitability curves for several macroinvertebrate species were considered. Table 3 presents macroinvertebrate species documented in the Jackson Blue Spring System, and whether suitable habitat suitability curves exist for that species. Based on available curves found in the Nagid and Gore libraries, curves utilized in SEFA for this study included Ephemeroptera (Mayflies), Plecoptera (Stoneflies), Trichoptera (Caddisflies), and curves representing EPT, a hybrid group of three orders of macroinvertebrates (Ephemeroptera, Plecoptera, Trichoptera). Low Gradient Macroinvertebrates (species that prefer slow water-velocity conditions) were also considered.

HSCs for mussel species and their hosts within the study area were also considered. Table 4 lists the mussel species and associated host fish documented in the system. While HSC curves for the mussel and many host species have not been developed, the District utilized available curves for all documented species in the system and four distinct habitat guilds (deep fast water, deep slow water, shallow fast water, and shallow slow water). Although additional research is needed to better define the water velocity and depth requirements needed by mussel species, and their host species, by utilizing available HSC curves including host fish species, other fish species, macroinvertebrate species, and habitat guilds, the District is utilizing the best available information and the number of curves analyzed is assumed to be protective of these species. Attachment A displays all HSCs utilized within this study.

**Table 3: Macroinvertebrates Found in the Jackson Blue Spring System. Those that have habitat suitability curves are identified.**

Species	Common Name	Federal Listing	State Listing	HSC
<i>Acroneturia arenosa</i>	Eastern stone stonefly	N	N	X
<i>Atteneuria ruralis</i>	Giant stone stonefly	N	N	X
<i>Cambarellus schmitti</i>	Frontal dwarf crayfish	N	N	

**Table 3: Macroinvertebrates Found in the Jackson Blue Spring System. Those that have habitat suitability curves are identified.**

Species	Common Name	Federal Listing	State Listing	HSC
<i>Cambarus cryptodytes</i>	Dougherty plains cave crayfish	N	N	
<i>Cambarus striatus</i>	Ambiguous crayfish	N	N	
<i>Cheumatopsyche campyla</i>	Caddisfly	N	N	X
<i>Coptotomus interrogatus</i>	Diving beetle	N	N	
<i>Coptotomus venustus</i>	Diving beetle	N	N	
<i>Crangonyx manubrium</i>	Jackson County cave amphipod	N	N	
<i>Creaserinus byersi</i>	Lavender burrowing crayfish	N	N	
<i>Elimia athearni</i>	Knobby elimia snail	N	N	
<i>Elimia clenchi</i>	Slackwater elimia snail	N	N	
<i>Elimia doolyensis</i>	Graphite elimia snail	N	N	
<i>Elimia floridensis</i>	Rasp elimia snail	N	N	
<i>Hetaerina americana</i>	American rubyspot damselfly	N	N	
<i>Hydropsyche simulans</i>	caddisfly	N	N	X
<i>Macrostemum carolina</i>	Zebra caddisfly	N	N	X
<i>Mexistenasellus floridensis</i>	Florida cave isopod	N	N	
<i>Notogillia wetherbyi</i>	Alligator slitsnail	N	N	
<i>Oecetis parva</i>	Little oecetis longhorn caddisfly	N	N	X
<i>Ophiogomphus australis</i>	Southern snaketail dragonfly	N	N	
<i>Palaemonetes paludosus</i>	Freshwater shrimp	N	N	
<i>Perlesta shubuta</i>	Cloudy stone stonefly	N	N	
<i>Pomacea paludosa</i>	Florida applesnail	N	N	
<i>Procambarus paeninsulanus</i>	Peninsular crayfish	N	N	
<i>Procambarus spiculifer</i>	White tubercled crayfish	N	N	
<i>Pseudocloeon bimaculatus</i>	Mayfly	N	N	X
<i>Pseudosinella pecki</i>	Marianna cave springtail	N	N	
<i>Stygobromus floridanus</i>	Dougherty plain cave amphipod	N	N	
<i>Viviparus georgianus</i>	Banded mystery snail	N	N	
Grand Total Documented	30	0	0	7

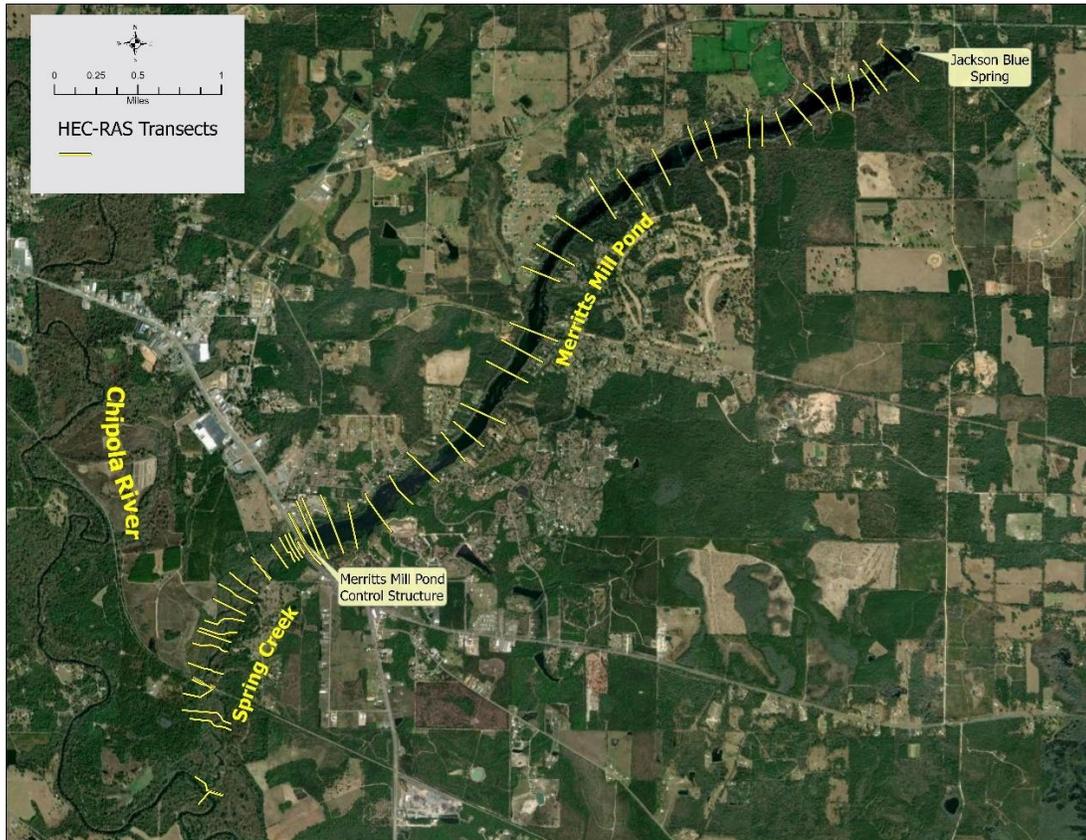
**Table 4: Mussels Found in the Jackson Blue Spring System. Host fish with habitat suitability curves are identified.**

Mussel Species	Mussel Common Name	Host Fish Family	Host Fish Common Name	HSC
<i>Elliptio arctata</i>	Delicate Spike			
<i>Elliptio crassidens</i>	Elephant-ear	<i>Alosa chrysochloris</i>	Skipjack herring	
<i>Elliptio fumata</i>	Gulf slabshell			
<i>Elliptio jayensis</i>	Flat spike			
<i>Elliptio pullata</i>	Gulf spike	<i>Perca flavescens,</i> <i>Lepomis cyanellus,</i> <i>Lepomis humilis,</i> <i>Micropterus salmoides,</i> <i>Pomoxis annularis,</i> <i>Fundulus diaphanus</i>	Yellow perch, Orangespotted sunfish, Largemouth bass, White crappie, Banded killifish	X
<i>Elliptio purpurella</i>	Inflated spike	Centrarchidae	Largemouth bass and bluegill	X
<i>Hamiota subangulata</i>	Shinyrayed pocketbook	Centrarchidae	Black bass	
<i>Lampsilis straminea</i>	Rough fatmucket	Centrarchidae	Bass and bluegill	X
<i>Leaunio lienosus</i>	Little Spectaclecase			
<i>Medionidus penicillatus</i>	Gulf moccasinshell	Percidae	Darter	X
<i>Pleurobema pyriforme</i>	Oval pigtoe	Cyprinidae	Minnow	X
<i>Pyganodon grandis</i>	Giant floater			
<i>Toxolasma paulum</i>	Iridescent lilliput			
<i>Unio merus columbensis</i>	Apalachicola pondhorn			
<i>Utterbackia imbecillis</i>	Paper pondshell			
<i>Villosa vibex</i>	Southern rainbow			
<i>Villosa villosa</i>	Downy rainbow	<i>Micropterus salmoides</i>	Largemouth bass	X
<i>Corbicula fluminea</i>	Asian clam			
<i>Elliptio chipolaensis</i>	Chipola slabshell			
<i>Quadrula infucata</i>	Sculptured pigtoe			
<i>Megaloniaias nervosa</i>	Washboard			

## 2.2 Hydrology and HEC-RAS Data

In addition to the habitat suitability curves, the SEFA application uses riverine hydraulic information in the form of functional relations between water depths, velocities and streamflow. Since a detailed HEC-RAS model of the study area has previously been developed for evaluating several Water Resource Value metrics within the study area, output from the HEC-RAS model

was deemed suitable for providing required riverine hydraulic information within SEFA. The HEC-RAS model that provided the depth and velocity data for this study is documented in NFWMD (2025a). The HEC-RAS model was developed using bathymetric surveys and LiDAR-derived topographic elevation datasets to establish substrate elevations at each transect. These transects provided the basis for the SEFA model transect dimensions. Figure 3 presents the transects used in the HEC-RAS model of the Jackson Blue Spring System.



**Figure 3: Map of Transect Locations with the Jackson Blue Spring System**

The cross-sectional estimates of depth and velocity at specific channel locations across the main channel were obtained from the calibrated steady state HEC-RAS model. For purposes of assessing Water Resource Values, including instream habitat metrics, the HEC-RAS model was converted to a steady state model. Jackson Blue Spring flow and Merritts Mill Pond flow-pickup percentiles were computed for a nearly-continuous 20-year time period from 1/1/2005-12/31/2024 and adjusted to reflect impacts from historical pumping. Modeling scenarios for purposes of this evaluation consisted of one model scenario for each flow percentile (Table 5). Model simulations were performed for two downstream stage boundary conditions, representing the 10<sup>th</sup> and 50<sup>th</sup> percentile Chipola River stage (based on stage from 1/1/2005-12/31/2024) to account for backwater effects of Chipola River stage on Spring Creek stage. Therefore, a total of 99 steady state model scenarios were run (P1 - P99) for each downstream stage boundary condition. This allows for determination of relationships between changes in flow and AWS, and assessing the for the effects of the Chipola River on the Spring Creek stage.

**Table 5: Percentile Flows from Jackson Blue Spring and Merritts Mill Pond (cfs)**

Percentile	Jackson Blue Spring	Merritts Mill Pond	Percentile	Jackson Blue Spring	Merritts Mill Pond	Percentile	Jackson Blue Spring	Merritts Mill Pond
1	45.7	92.8	34	89.6	179.5	67	119	242.29
2	48.2	97.4	35	90.37	181.27	68	120	243.7
3	50.2	101.1	36	91	182.9	69	121.1	245.6
4	52.52	105.4	37	92	185.4	70	122.5	248.4
5	55.4	110.7	38	93.3	188.7	71	123.5	250.5
6	58.77	116.67	39	94.38	191.6	72	124.5	252.7
7	61.35	122	40	95.2	194.06	73	125.6	255.2
8	63.4	125.4	41	96	196.2	74	127.2	259.3
9	65.3	128.7	42	96.9	198.72	75	128.5	262.13
10	66.3	130.4	43	97.6	200.9	76	129.6	264.8
11	68.4	134.1	44	98.4	203	77	131.2	269.2
12	70	136.9	45	99.4	205.7	78	132.5	272.2
13	71.7	140.03	46	100.3	208.2	79	134.2	276.8
14	73.3	143.1	47	101.2	210.5	80	135.5	279.9
15	74.5	145.6	48	101.9	212.2	81	137.5	285
16	75.7	148	49	102.6	213.87	82	139.5	289.9
17	76.9	150.44	50	103.3	215.5	83	140.6	292.7
18	77.8	152.3	51	104.1	217.6	84	141.64	295.2
19	78.5	153.7	52	104.71	219.12	85	143.5	300.3
20	79.28	155.3	53	105.7	221.7	86	145.5	305.5
21	79.9	156.7	54	106.7	224.1	87	148.4	313.1
22	80.6	158.2	55	107.55	226.35	88	151.1	321
23	81.3	159.8	56	108.5	228.4	89	153.5	326.8
24	82	161.3	57	109.5	230.3	90	156.5	334.5
25	82.6	162.5	58	110.5	231.96	91	159.4	342
26	83.2	164.15	59	110.7	232.2	92	163.34	352.6
27	83.9	165.5	60	111.6	233.5	93	167.5	363.7
28	84.6	167.3	61	112.74	235.1	94	172.15	376.53
29	85.39	169	62	114.3	236.4	95	176.01	387.21
30	86	170.8	63	115.3	237.6	96	181	400.5
31	86.9	172.8	64	116.3	238.9	97	186	413.9
32	87.6	174.6	65	117.24	240.2	98	193.71	434.08
33	88.7	177.2	66	118	241.1	99	204.3	462.02

The baseline flow scenarios were executed in the previously developed HEC-RAS model and the resultant depths and velocity distributions, for 20 verticals (subsections) within the main channel, from all model transects in the model domain were utilized within the SEFA model for each baseline flow scenario. Figure 4 presents an example transect (4164) from which depth and

velocities are calculated by the HEC-RAS model of the Jackson Blue System. The SEFA model simulations were run based on output from each baseline model scenario from the HEC-RAS model, resulting in estimated aggregate AWS for taxon or guild as a function of flow for the baseline time series. For purposes of this analysis, Merritts Mill Pond (cross-sections 4901 – 26885) and Spring Creek (cross-sections 0.3061 – 4373) were considered separate reaches, with AWS versus flow relationships assessed independently within each reach for a given taxon or guild of interest.



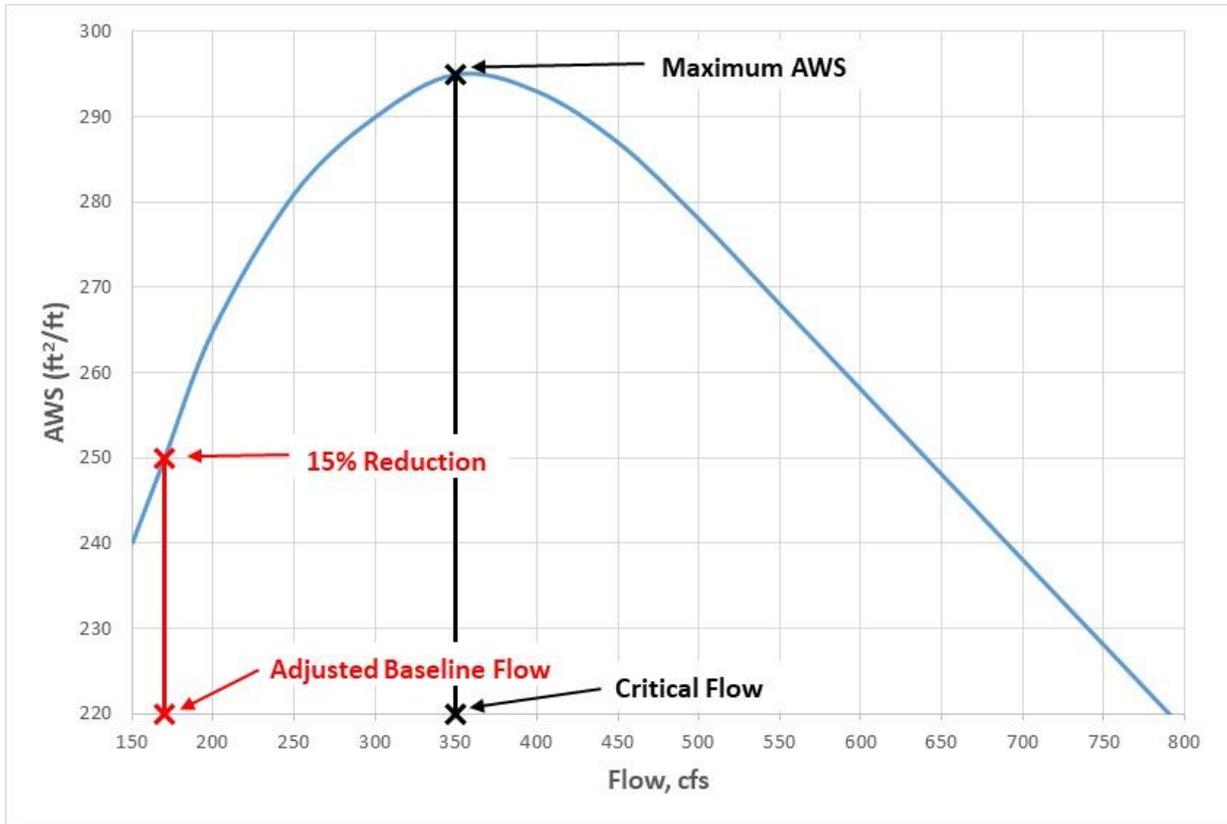
**Figure 4: Example Cross Section (4164) and Verticals from which Depth and Velocities are Estimated by the SEFA Model**

### 3. APPLICATION OF SEFA RESULTS TO DEVELOPMENT OF THE MINIMUM FLOW FOR The Jackson BLUE Spring SYSTEM

The primary response metric employed in the SEFA analysis is the Area Weighted Suitability (AWS) which is often used in environmental studies. Output from the SEFA model was used to develop the relationship between Jackson Blue Spring flow and AWS for aquatic species and guilds, including fish and macroinvertebrate species as well as mussels and host fish. The AWS can be modeled for an individual cross section, in aggregate for any number of cross sections, or for the entirety of the model domain. For the purposes of this study, an aggregate AWS was calculated separately for the Merritts Mill Pond and Spring Creek model sub-reaches utilizing all available transects. The aggregate AWS describes the relative suitability for a given guild/species/life stage throughout the model domain for a given flow.

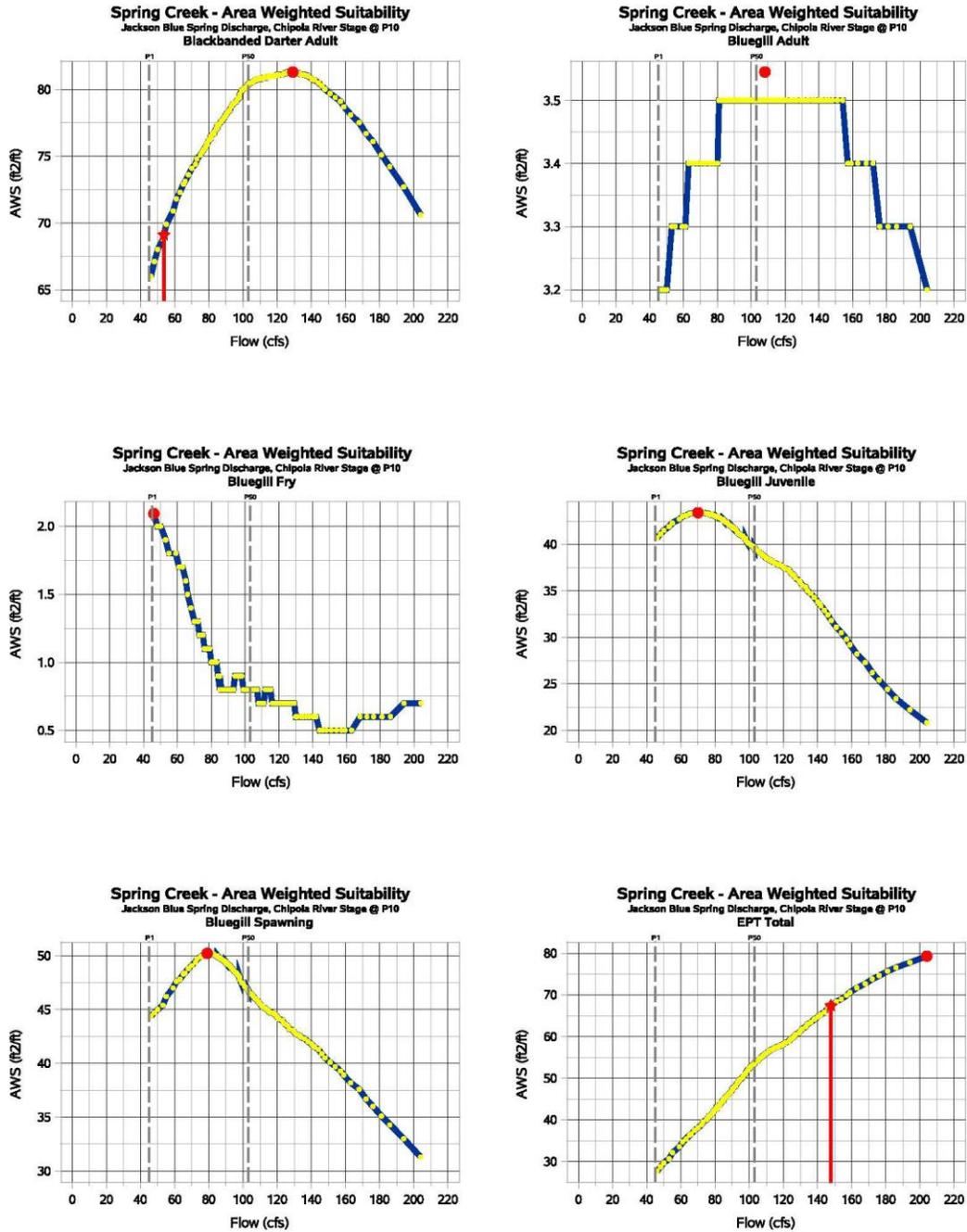
Although significant harm is not specifically defined in statute, an allowable 15 percent reduction in WRV metrics has been implemented as the protection standard for multiple MFLs throughout Florida. This definition of significant harm was first proposed by Gore et al. (2002) during their review of the upper Peace River MFL report (SWFWMD 2002). The peer review panel stated, “In general, instream flow analysts consider a loss of more than 15 percent habitat, as compared to undisturbed or current conditions, to be a significant impact on that population or assemblage.” This definition of significant harm has been subsequently utilized and accepted by more than a dozen MFL peer review panels in the establishment of MFLs for springs and rivers (Munson and Delfino 2007, NFWFMD 2021, NFWFMD 2019, SJRWMD 2017, SRWMD 2005, SRWMD 2007, SRWMD 2013, SRWMD 2015, SRWMD 2016a, SRWMD 2016b, SRWMD 2021, SWFWMD 2008, SWFWMD 2010, SWFWMD 2011, SWFWMD 2012a, SWFWMD 2012b, SWFWMD 2017a, SWFWMD 2017b). The 15 percent threshold is also used in this assessment, recognizing that additional data collection and long-term research to confirm or refine this threshold for MFL assessments in Florida would be beneficial. Implementation will follow an adaptive management approach, with MFLs periodically reviewed and re-evaluated by the District to reflect new data and information. As new data and information are developed regarding the definition of or threshold for significant harm, the District will consider this information in future MFL re-evaluations.

Since the SEFA analysis provides an estimate for aggregate AWS for each flow simulated (Table 5), the relationship between flow and AWS can be used to estimate the reduction in flow that would result in a 15% reduction in maximum AWS for relevant species or guilds. Given the common use of a 15% reduction to define an MFL in Florida and the similar range of habitat reduction suggested by Richter et al. (2011), consideration of the application of a 15% reduction in AWS is warranted and was utilized in this assessment. The maximum AWS was selected as the metric of interest as a conservative assumption to protect Jackson Blue instream habitat. Figure 5 presents a conceptual depiction of the estimation of the flow that results in a 15% reduction in maximum AWS for a specific species or guild of interest.

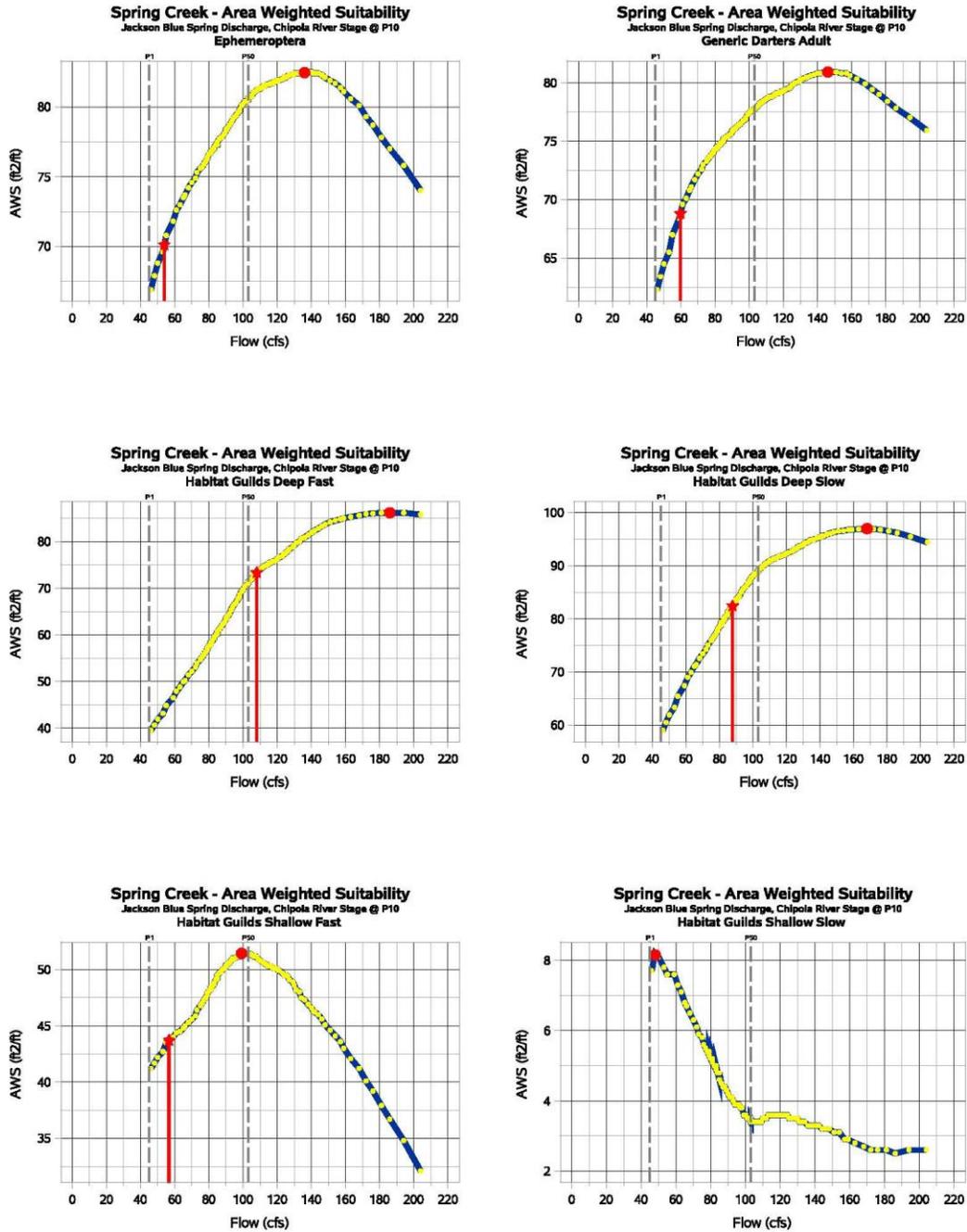


**Figure 5: Conceptual Depiction of the Estimation of the Critical Flow That Results in a 15% Reduction in AWS**

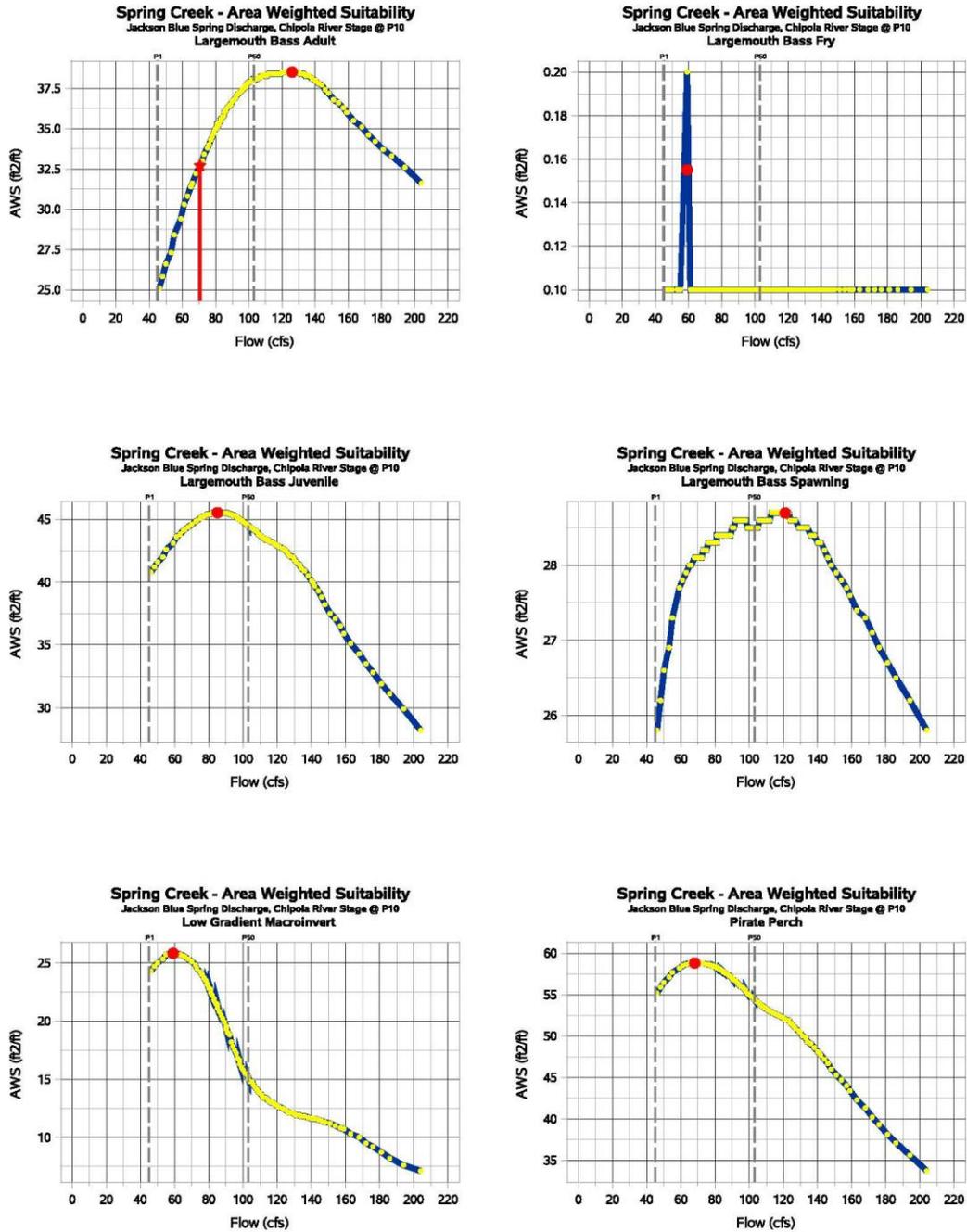
The relationship between the AWS and flow for each species or guild assessed, within the Merritts Mill Pond and Spring Creek sub-reaches, is shown in Figures 6 through 8. The aggregate AWS for each simulated flow is displayed by the yellow markers for each graphic. The blue curve represents a best fit curve through all computed values of AWS versus flow. The uppermost red point represents the maximum AWS and corresponding flow for a given fish species or guild. The lower red point and vertical line indicates a 15% reduction in the maximum AWS and corresponding flow associated with a 15% reduction in the maximum AWS. The flow range that defines the horizontal axis is the range from simulated baseline flows (P1 - P99) presented in Table 6.



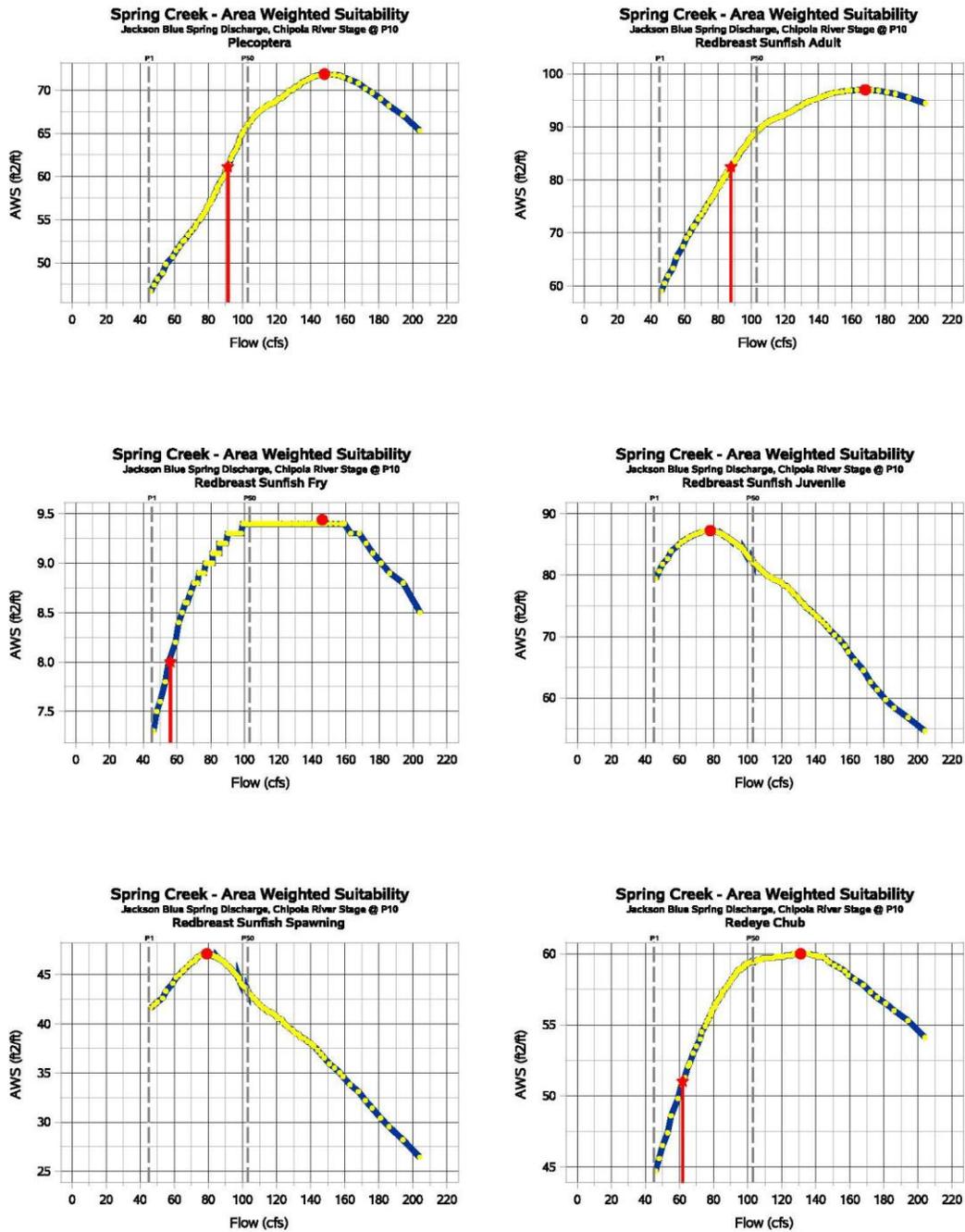
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10th Percentile**



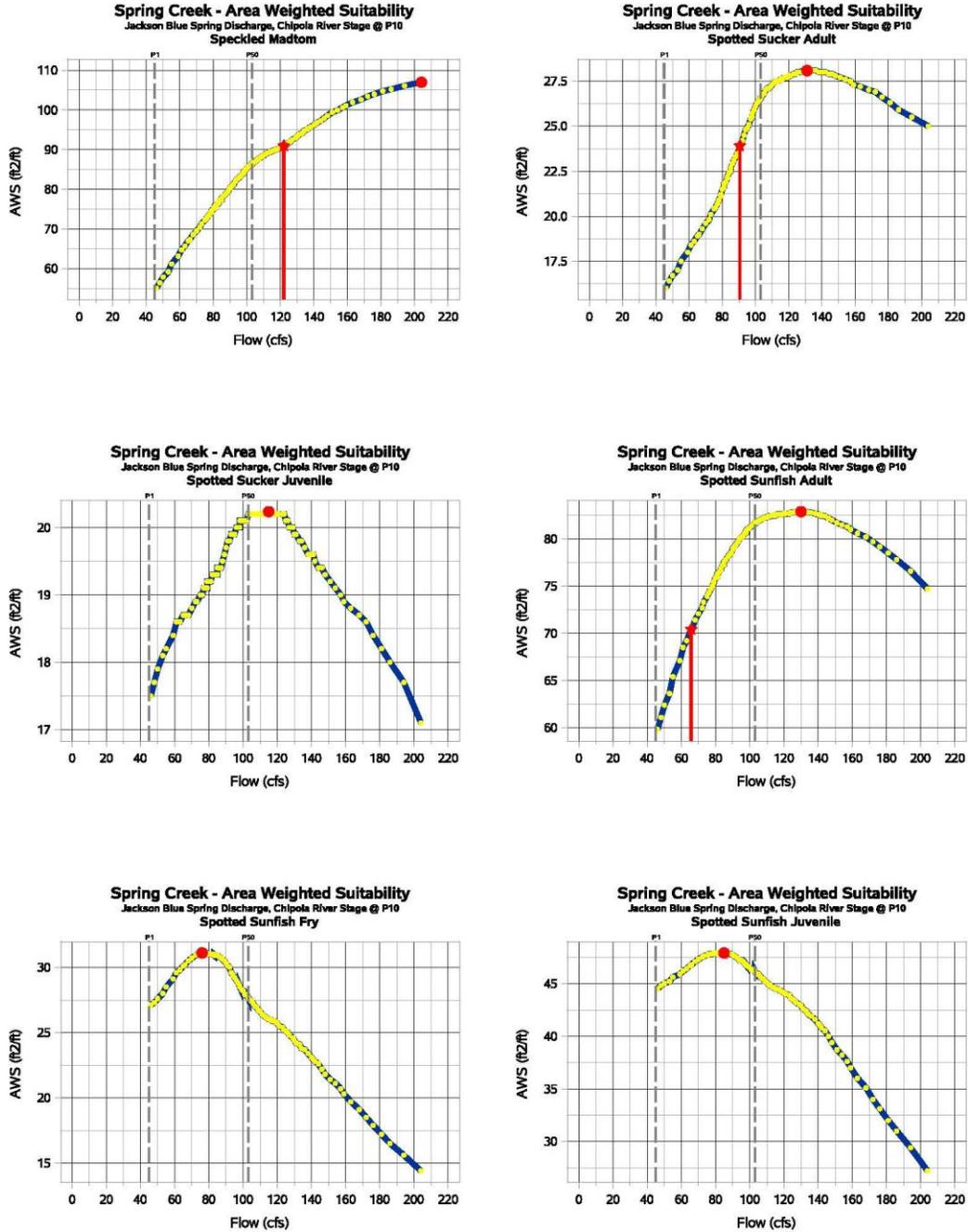
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10<sup>th</sup> Percentile.**



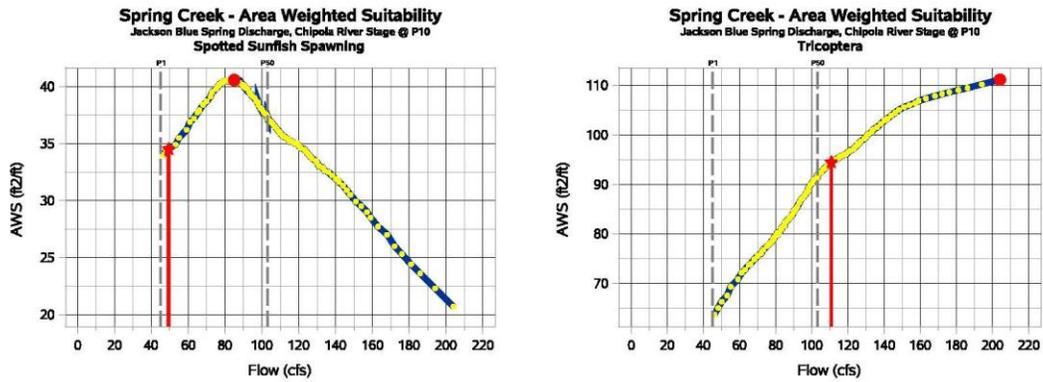
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10<sup>th</sup> Percentile.**



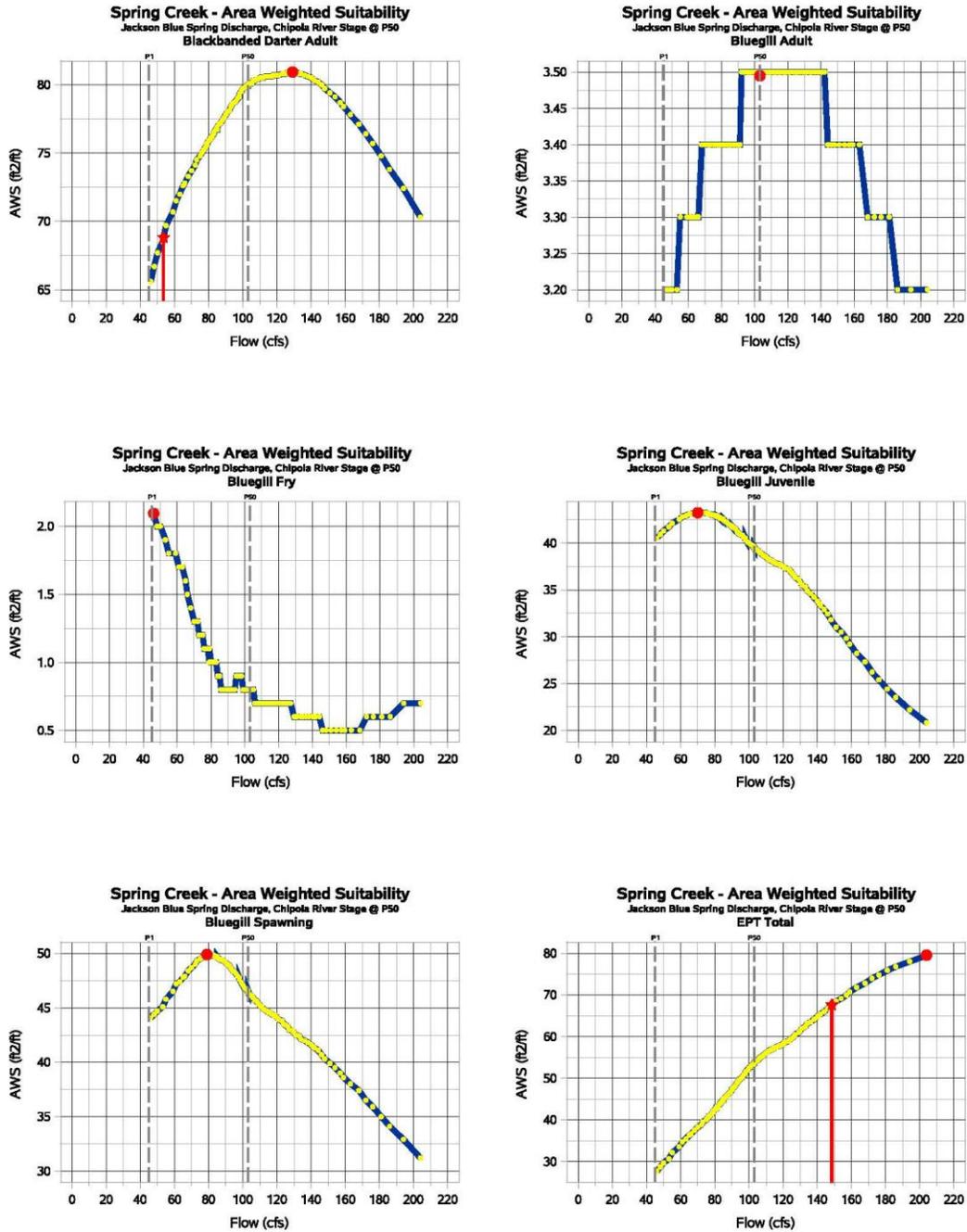
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10<sup>th</sup> Percentile.**



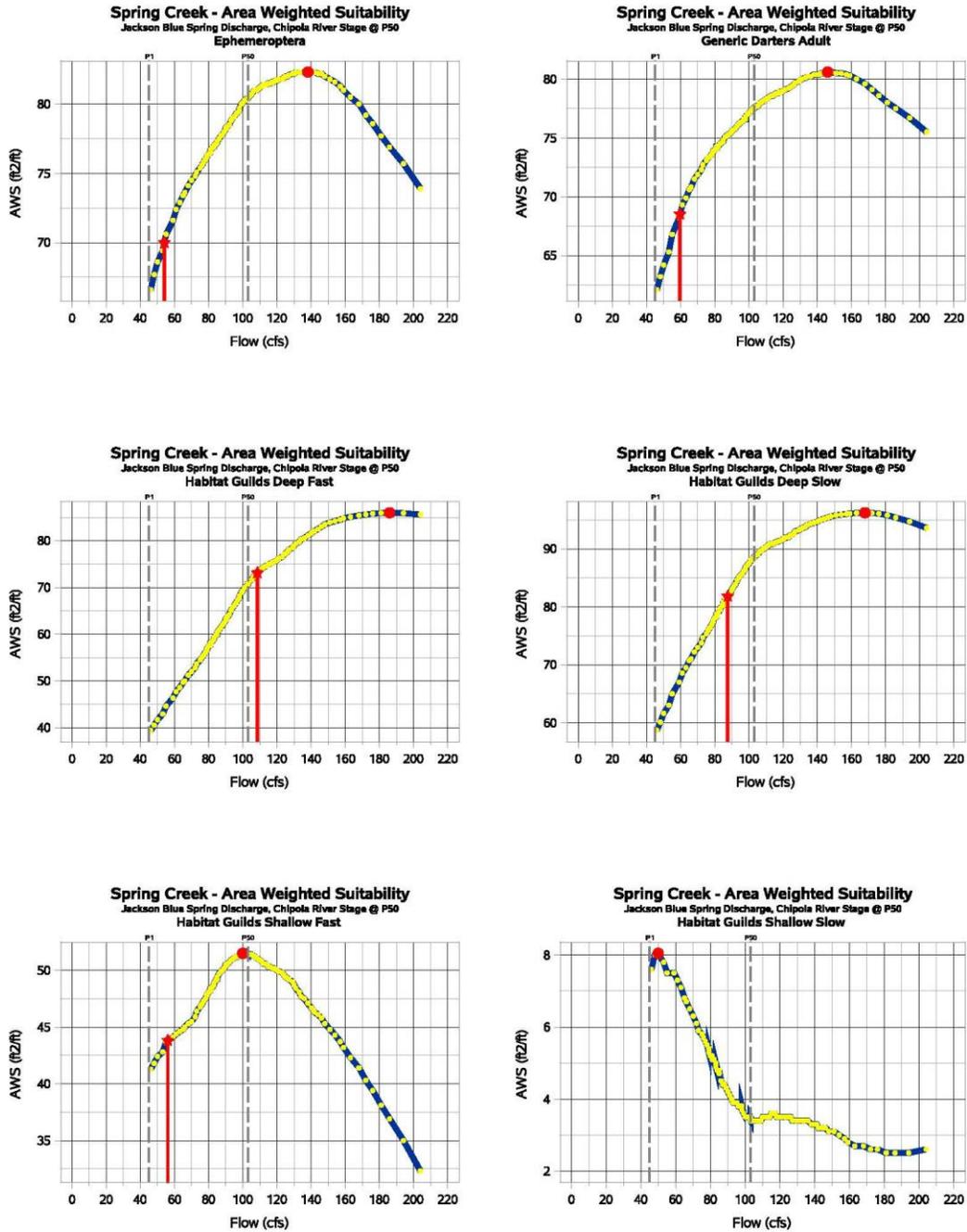
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10<sup>th</sup> Percentile.**



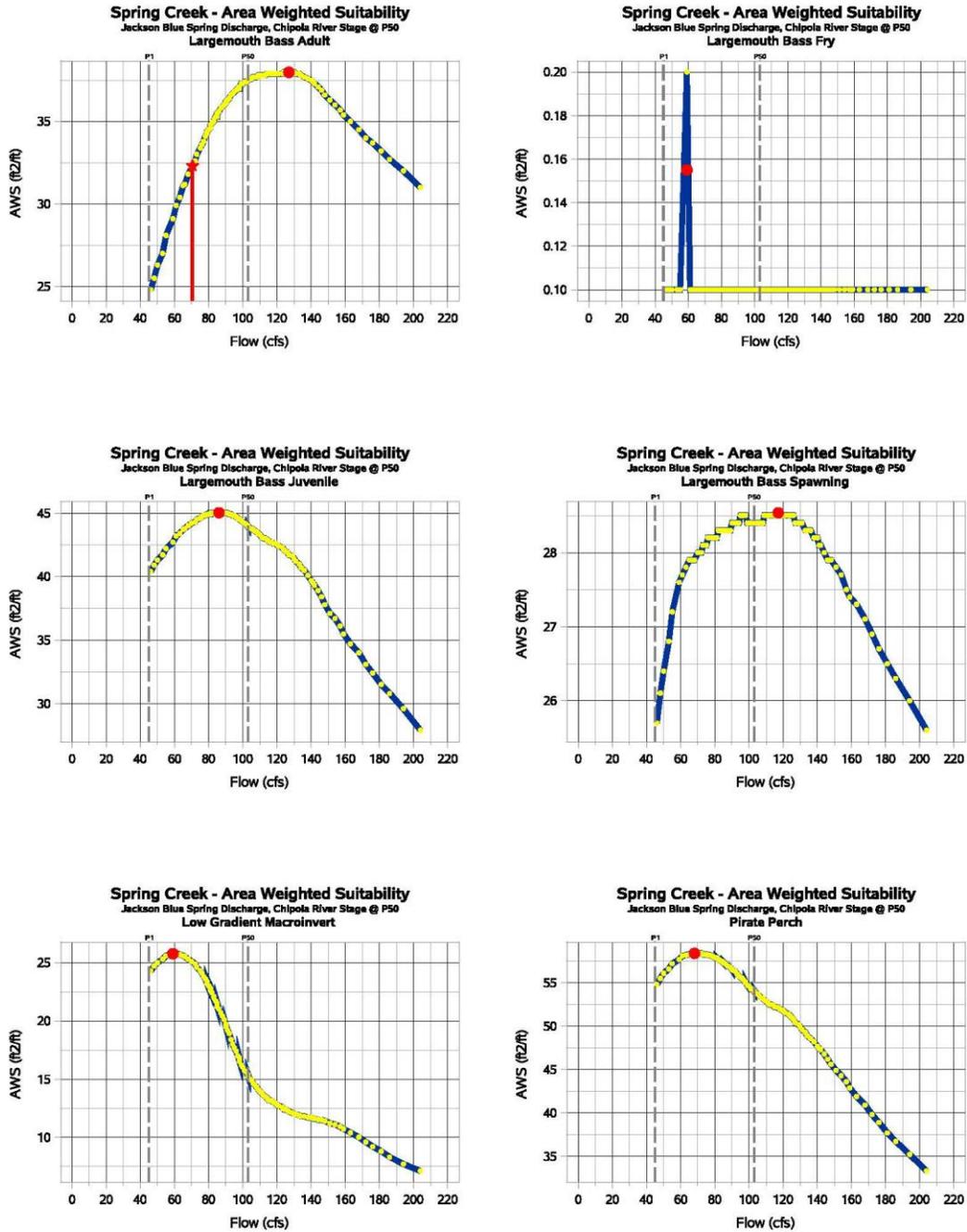
**Figure 6: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 10<sup>th</sup> Percentile.**



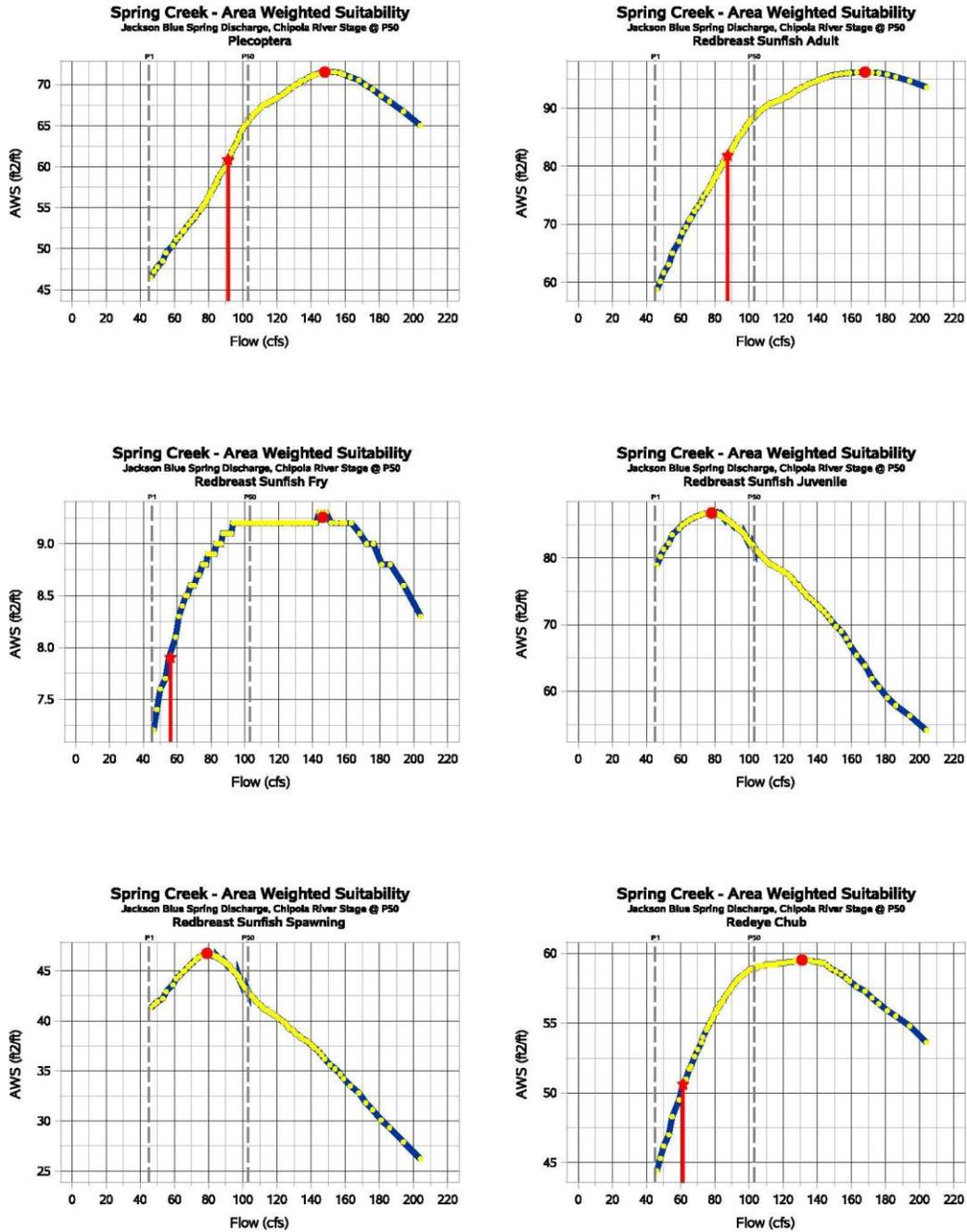
**Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50th Percentile**



**Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50<sup>th</sup> Percentile.**



**Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50<sup>th</sup> Percentile.**



**Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50<sup>th</sup> Percentile.**

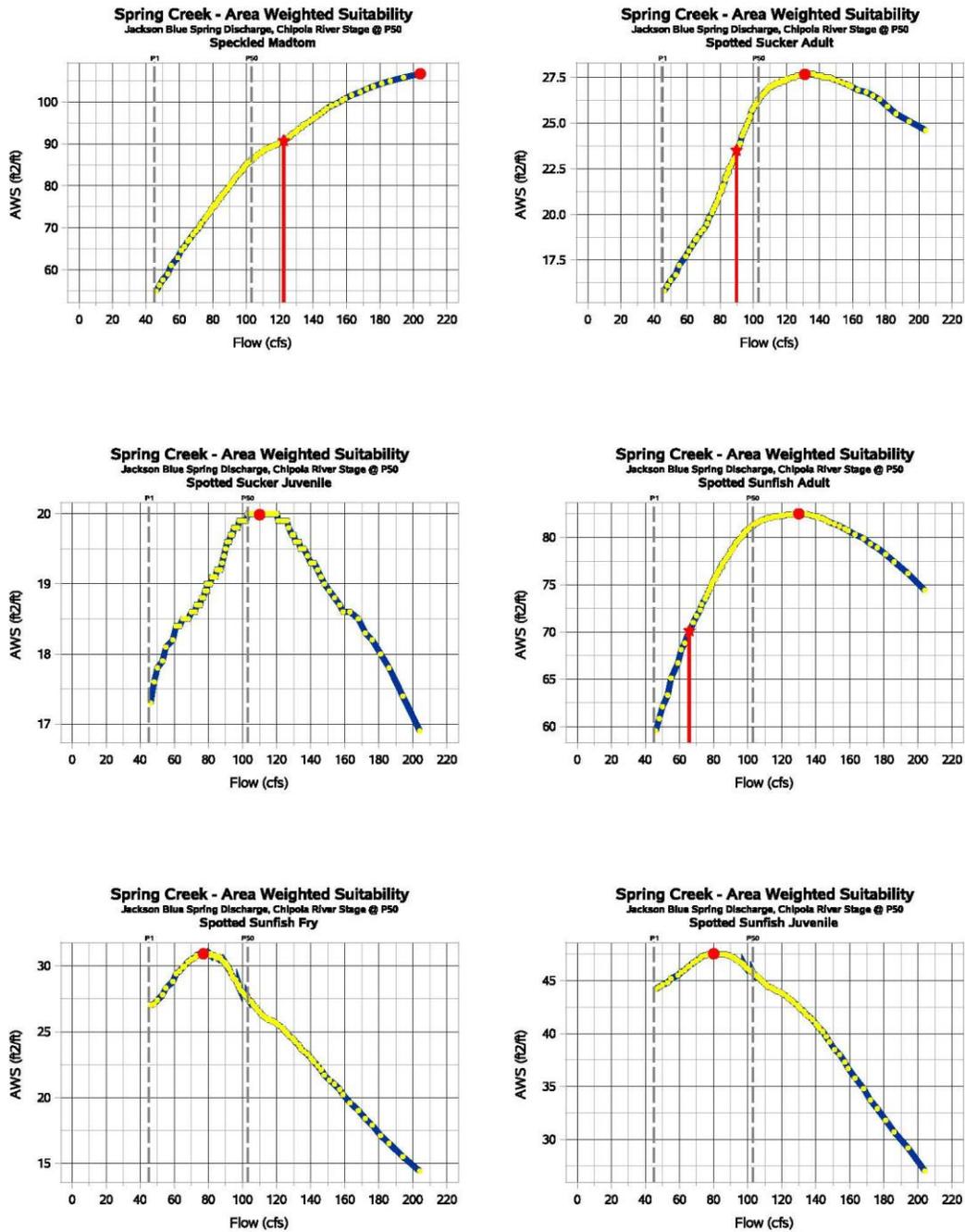
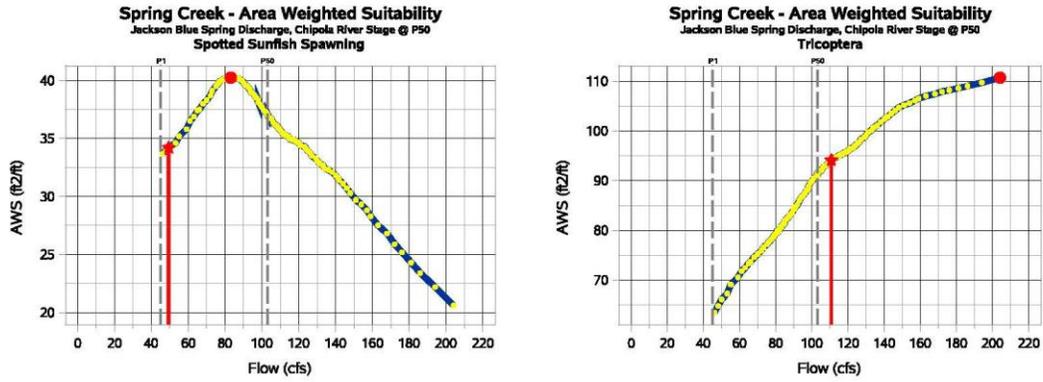
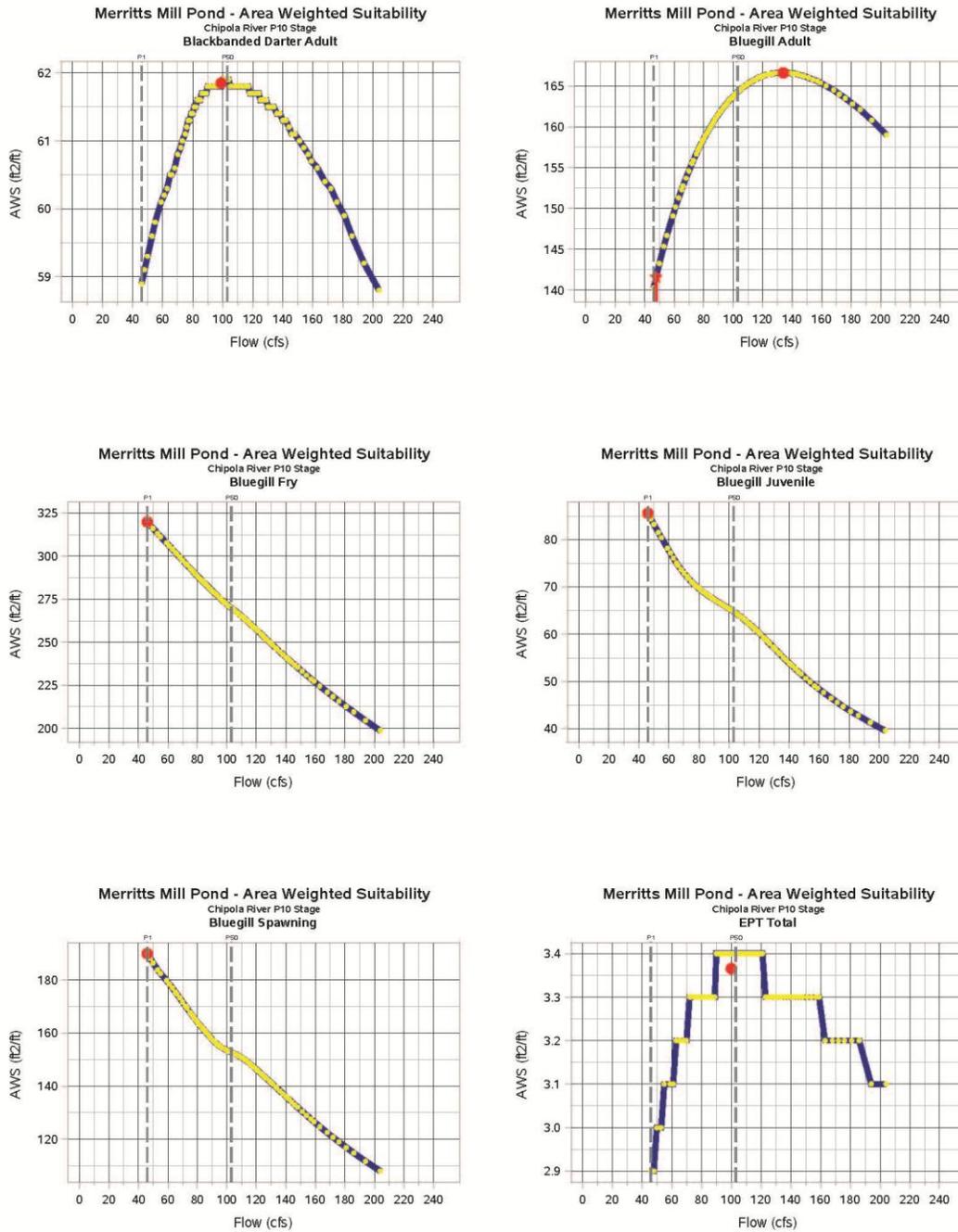


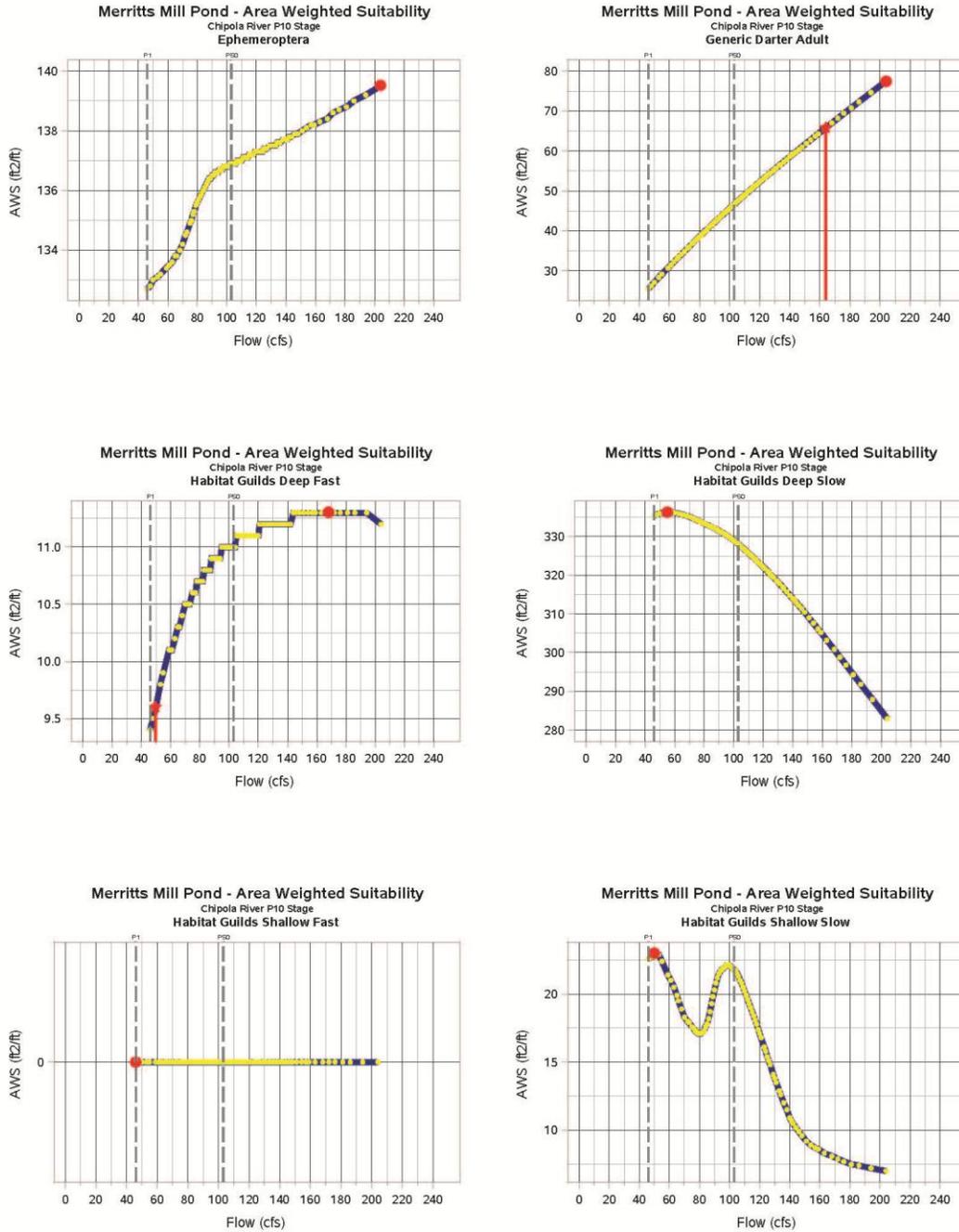
Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50<sup>th</sup> Percentile.



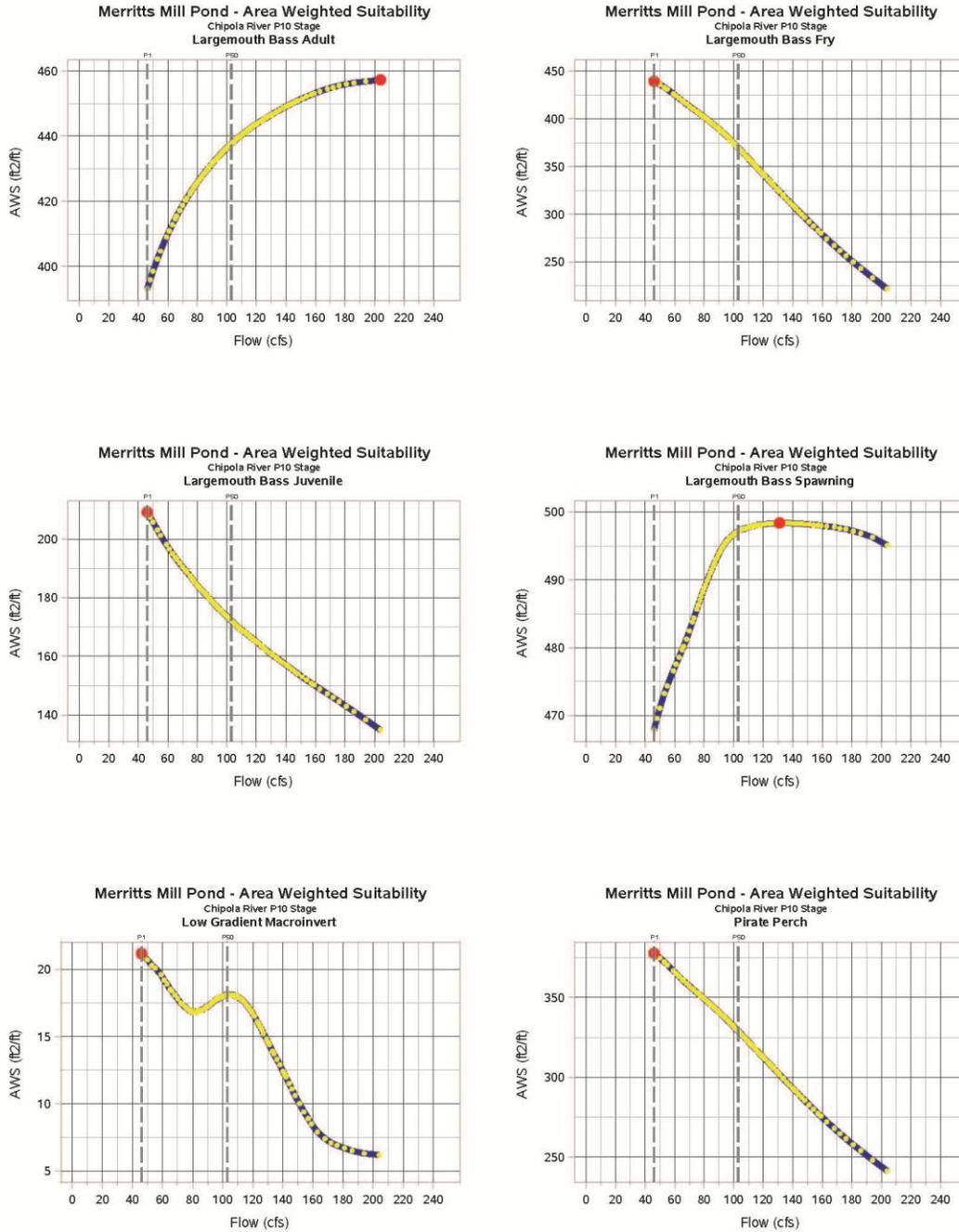
**Figure 7: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Spring Creek with the Chipola River Stage @ 50<sup>th</sup> Percentile.**



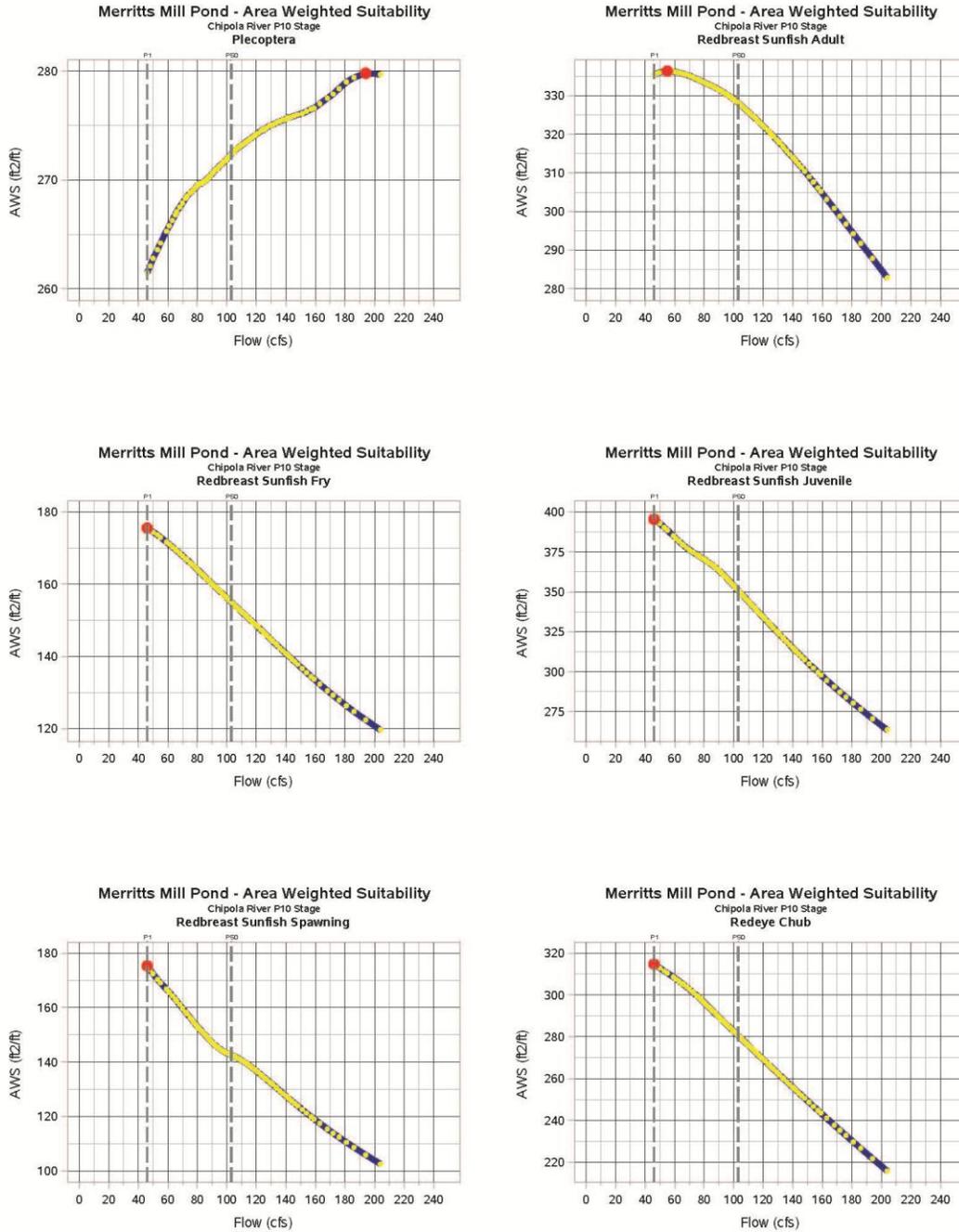
**Figure 8: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Merritts Mill Pond**



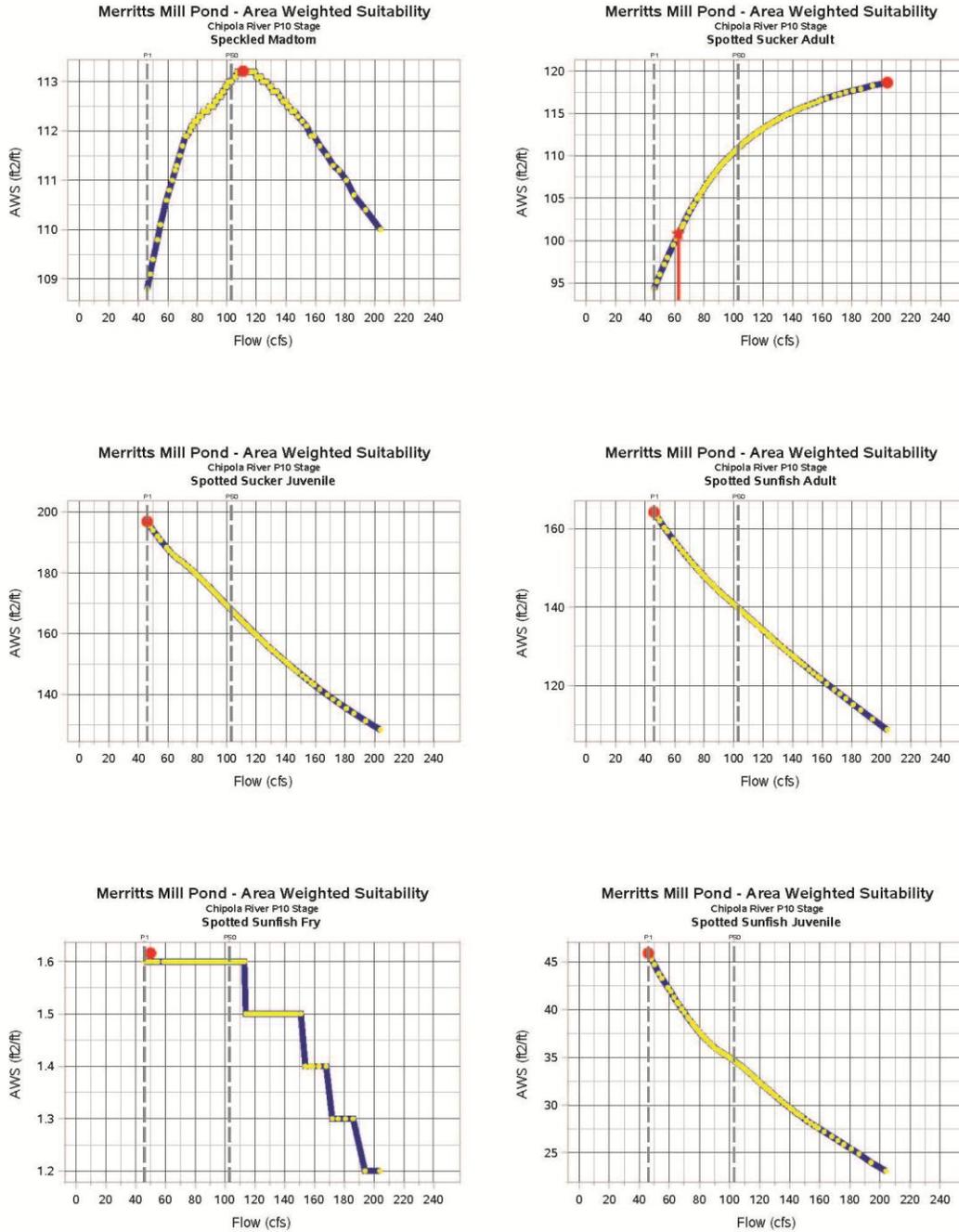
**Figure 8: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Merritts Mill Pond.**



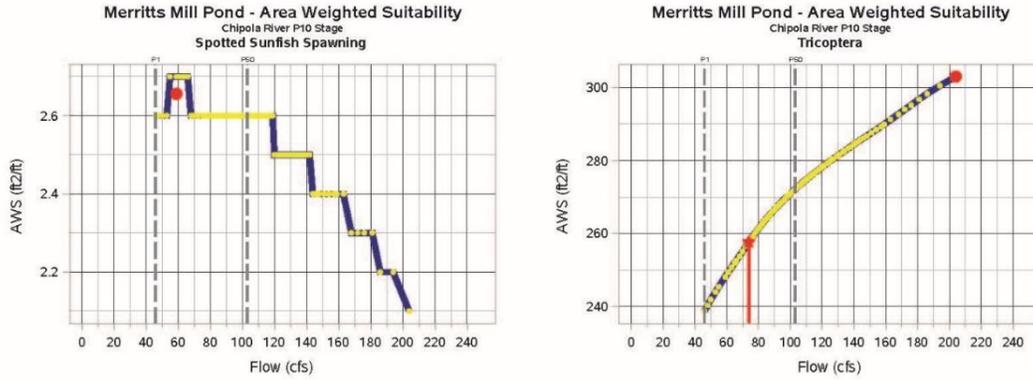
**Figure 8: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Merritts Mill Pond.**



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**Figure 8: Estimation of the Jackson Blue Spring critical flow that results in a 15% reduction in AWS for Merritts Mill Pond.**

**Table 6: SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 10th Percentile**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Spotted Sunfish Spawning	40.6	85.0	34.5	49.3	42.0	35.7	34.5
Spotted Sucker Adult	28.1	131.0	23.9	90.5	30.9	40.5	39.2
Habitat Guilds Shallow Fast	51.4	99.0	43.7	56.6	42.8	42.4	41.0
Largemouth Bass Adult	38.5	126.0	32.7	70.5	44.0	55.5	53.7
Ephemeroptera	79.3	204.0	67.4	147.8	27.6	56.3	54.5
Plecoptera	71.9	148.0	61.1	91.3	38.3	56.7	54.9
Spotted Sunfish Adult	82.9	130.0	70.4	65.7	49.5	64.3	62.3
Redeye Chub	60.0	131.0	51.0	61.8	52.8	69.2	67.0
Blackbanded Darter Adult	81.3	129.0	69.1	53.5	58.5	75.5	73.0
Habitat Guilds Deep Fast	86.2	186.0	73.3	108.0	41.9	78.0	75.5
Habitat Guilds Deep Slow	97.0	168.0	82.4	87.8	47.8	80.3	77.7
Redbreast Sunfish Adult	97.0	168.0	82.4	87.8	47.8	80.3	77.7
Speckled Madtom	107.0	204.0	90.9	122.0	40.2	82.0	79.4
EPT Total	82.5	136.0	70.1	53.8	60.4	82.2	79.5
Generic Darters Adult	80.9	146.0	68.8	59.7	59.1	86.3	83.6
Redbreast Sunfish Fry	9.4	146.0	8.0	56.0	61.6	90.0	87.1
Trichoptera	111.1	204.0	94.4	110.7	45.8	93.3	90.4

Tabular results of maximum AWS and associated critical flows for all species and guilds considered are presented in Attachment B. Species or guilds which displayed an increase in AWS with reduced flow were excluded from further analysis. Allowable flow reductions are indicated as blanks in Attachment B for these species. Additionally, species or guilds for which a 15-percent reduction in maximum AWS resulted in a reduced flow below the lowest simulated baseline flow scenario were excluded from further analysis. For each of the relevant species or guilds, the maximum AWS as well as the Jackson Blue Spring flow associated with a 15-percent reduction in the maximum AWS are shown in Tables 6 and 7 for Spring Creek for both downstream Chipola River stage boundary conditions considered (P10 and P50 Chipola River stage, respectively) and in Table 8 for Merritts Mill Pond. Results within Merritts Mill Pond were identical under either downstream stage boundary condition, due to lack of sensitivity of pond stage with changes in Chipola River stage. These critical points are also indicated on the graphics below. For each relevant species or guild, allowable flow reduction was determined as the difference between the flow associated with the maximum AWS and the reduced flow associated with a 15-percent reduction in maximum AWS. Percent allowable flow reduction in relation to a median (P50) Jackson Blue Spring discharge was determined for consistency with other WRV metric evaluations conducted for this study (NFWFMD 2025b).

**Spring Creek Results** – Because water levels in Spring Creek are significantly affected by backwater effects from the Chipola River, two different downstream boundary conditions were investigated including the P10 and P50 Chipola River stages. Modeling results from both downstream boundary conditions resulted in a total of 17 Habitat Suitability Curves displaying reductions in AWS associated with reductions in flow. The sensitive HSC for each downstream boundary condition were identical although allowable flow reductions varied. During the lower downstream boundary condition modeled (i.e. P10 Chipola River Stage), maximum allowable flow reductions from the median Jackson Blue Spring baseline flow of 103.3 cfs corresponding to a 15 percent reduction in AWS ranged from 35.7 cfs for the most sensitive taxon, spotted sunfish (*Lepomis punctatus*) spawning, to 93.3 cfs for least sensitive taxon, Trichoptera (caddisflies). Utilizing the median downstream boundary condition (i.e. P50 Chipola River stage) resulted in similar results, ranging from a maximum allowable flow reduction of 33.7 cfs for Spotted Sunfish (*Lepomis punctatus*) spawning to a maximum allowable flow reduction of 93.3 cfs for Trichoptera (caddisflies). Overall, these results indicate a lack of sensitivity in AWS with changes in Jackson Blue Spring Flow in Spring Creek.

**Merritts Mill Pond Results** – Overall, minimal sensitivity in AWS with changes in Jackson Blue Spring Flow was evident in Merritts Mill Pond. Five taxon displayed reductions in Area Weighted Suitability (AWS) with reduced Jackson Blue Spring Flow in Merritts Mill Pond. The most sensitive taxa was generic adult darter species which displayed an allowable flow reduction of 40 cfs from a median Jackson Blue Spring flow of 103.3 cfs. Three taxa displayed allowable flow reductions greater than the median Jackson Blue Spring baseline flow.

**Table 7: SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 50th Percentile**

Taxon	Maximum AWS	Flow @ Maximum AWS	15% Reduction in Maximum AWS	Flow @ Reduced Maximum AWS	% Reduction in Flow	Difference from Max AWS	Percent Departure from the Median JBS Flow (103.3 cfs)
Spotted Sunfish Spawning	40.2	83	34.2	49.3	40.6	33.7	32.6
Spotted Sucker Adult	27.7	131	23.5	89.8	31.5	41.3	39.9
Habitat Guilds Shallow Fast	51.5	100	43.8	56.0	44.0	44.0	42.6
Ephemeroptera	79.5	204	67.6	148.5	27.2	55.5	53.7
Largemouth Bass Adult	38.0	127	32.3	70.5	44.5	56.5	54.7
Plecoptera	71.5	148	60.8	91.3	38.3	56.7	54.9
Spotted Sunfish Adult	82.5	130	70.1	65.8	49.4	64.3	62.2
Redeye Chub	59.5	131	50.6	61.4	53.1	69.6	67.4
Blackbanded Darter Adult	80.9	129	68.8	53.5	58.5	75.5	73.1
Habitat Guilds Deep Fast	86.0	186	73.1	108.5	41.7	77.5	75.0
Habitat Guilds Deep Slow	96.2	168	81.8	87.5	47.9	80.5	77.9
Redbreast Sunfish Adult	96.2	168	81.8	87.5	47.9	80.5	77.9
Speckled Madtom	106.7	204	90.7	122.3	40.0	81.7	79.1
EPT Total	82.3	138	70	54.0	60.9	84.0	81.3
Generic Darters Adult	80.6	146	68.5	59.5	59.2	86.5	83.7
Redbreast Sunfish Fry	9.3	146	7.9	56.0	61.6	90.0	87.1
Trichoptera	110.7	204	94.1	110.7	45.8	93.3	90.4

**Table 8: SEFA Model Results for Merritts Mill Pond, Discharge from Jackson Blue Spring**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the median JBS Flow (103.3 cfs)</b>
Generic Darter Adult	77.5	204.0	65.8	164.0	19.6	40.0	38.7
Bluegill Adult	166.6	134.0	141.6	47.7	64.4	86.3	83.5
Habitat Guilds Deep Fast	11.3	168.0	9.6	49.7	70.4	118.3	114.6
Trichoptera	303.0	204.0	257.6	73.9	63.8	130.1	125.9
Spotted Sucker Adult	118.6	204.0	100.8	62.5	69.4	141.5	137.0

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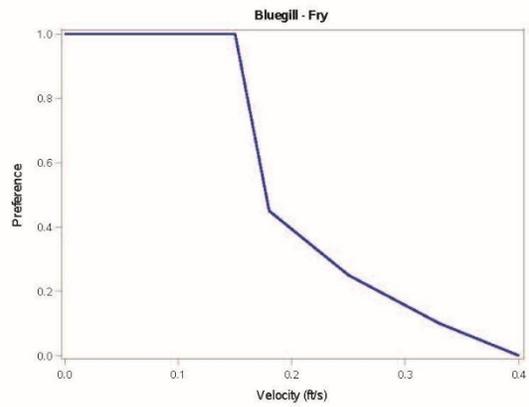
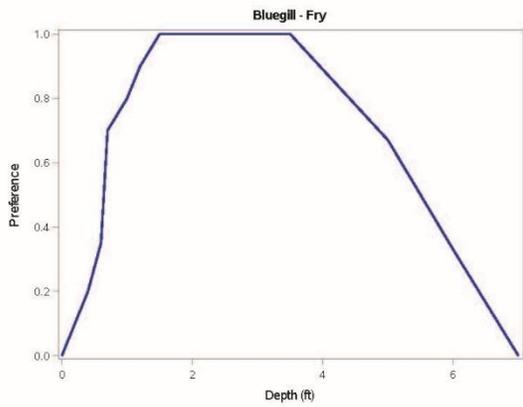
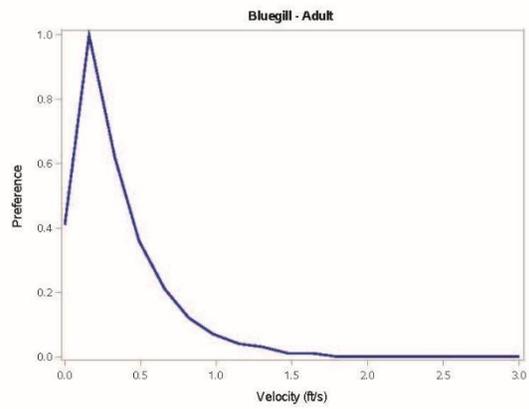
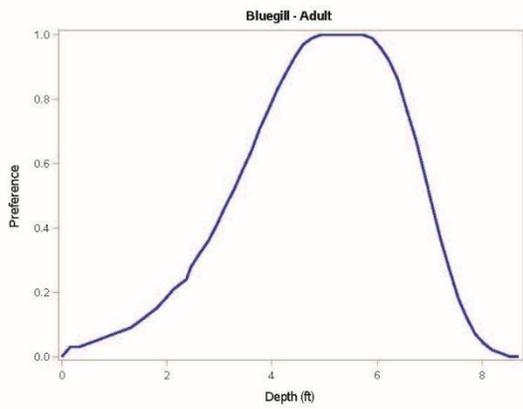
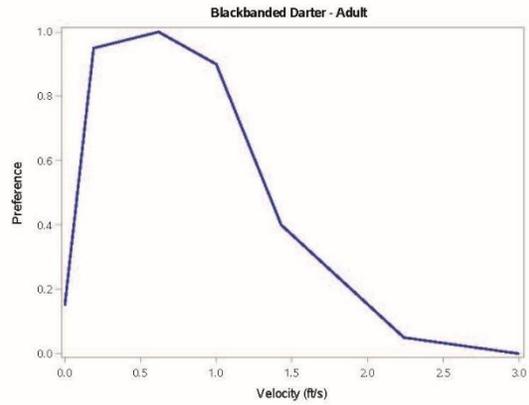
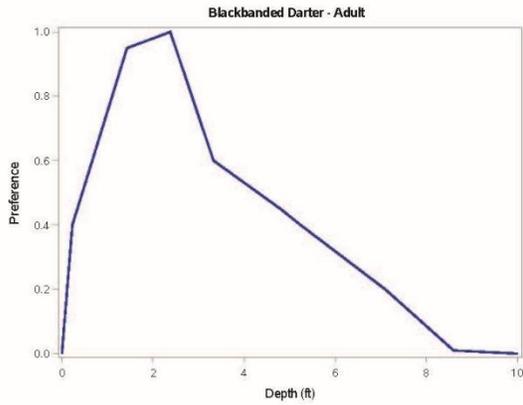
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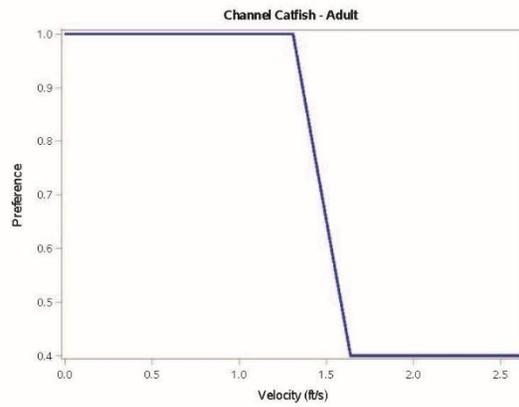
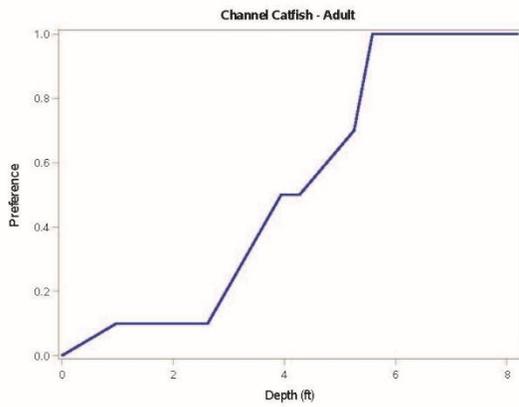
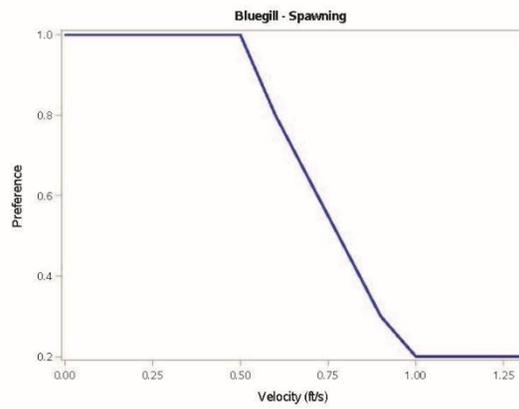
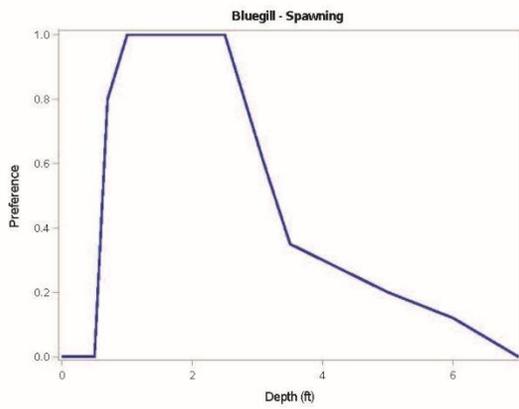
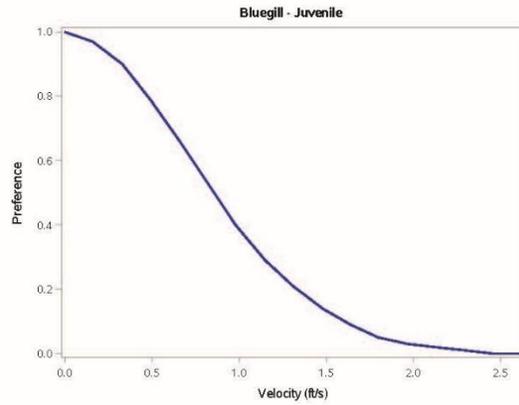
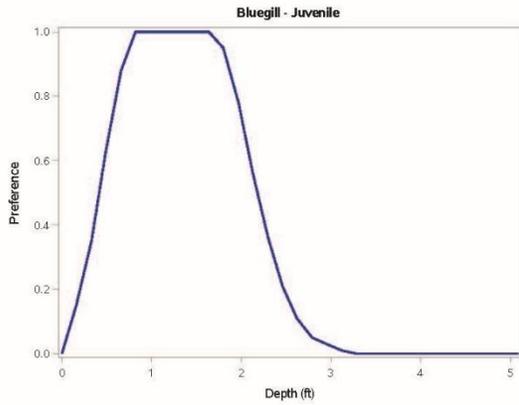
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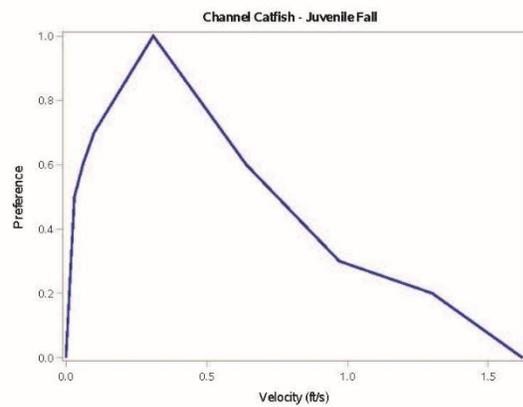
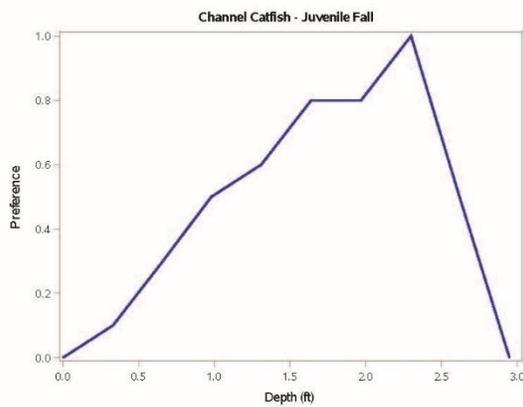
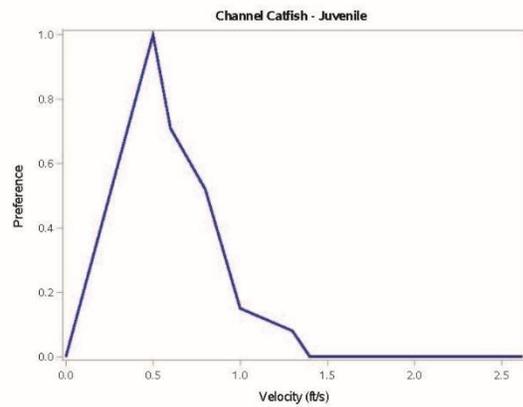
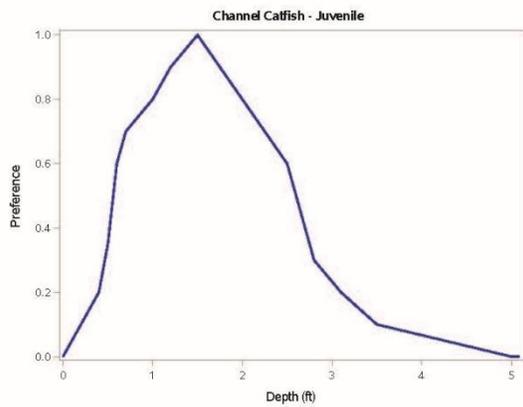
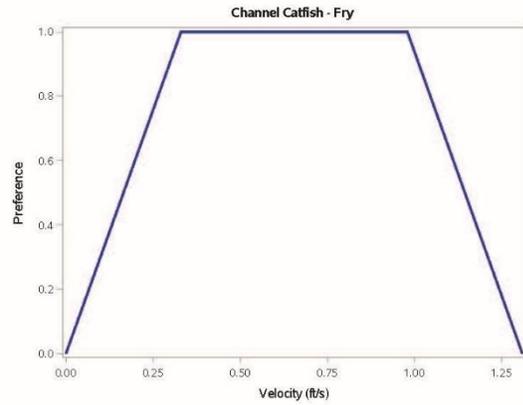
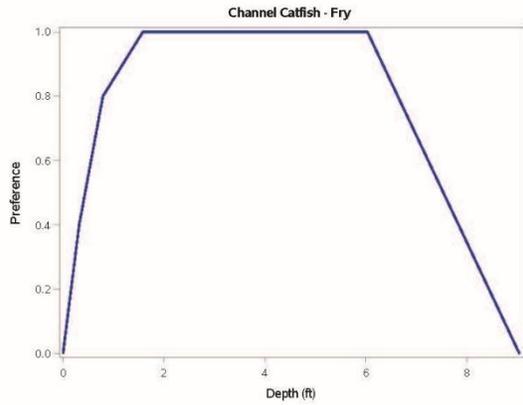
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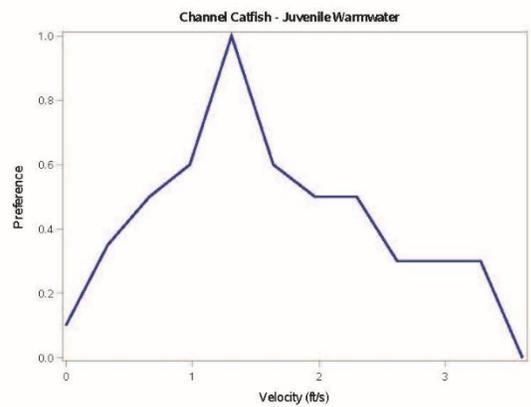
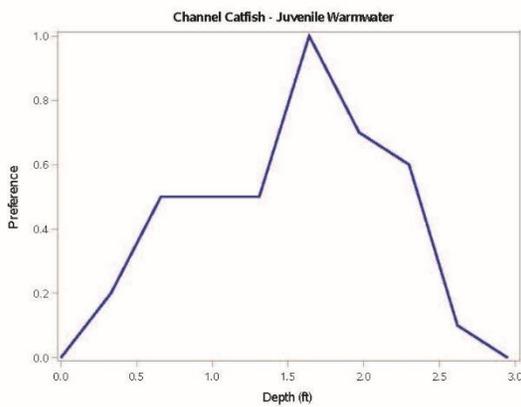
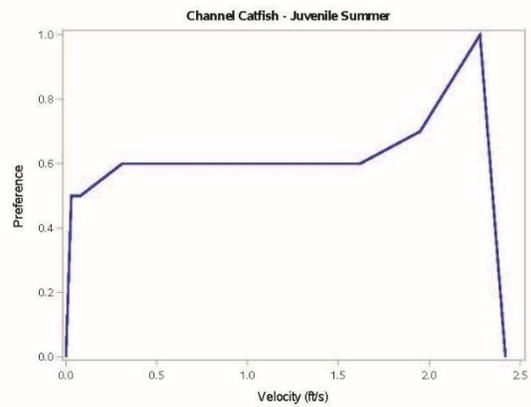
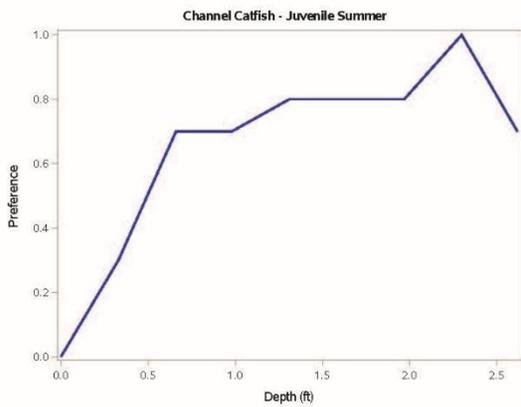
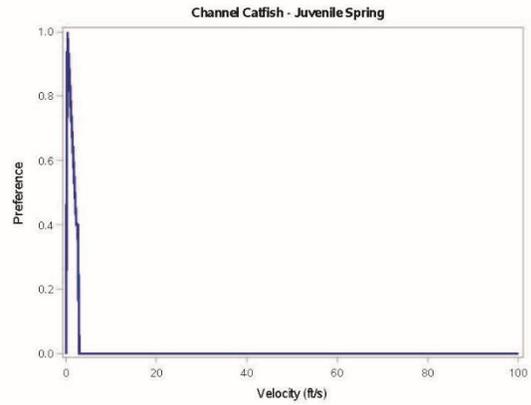
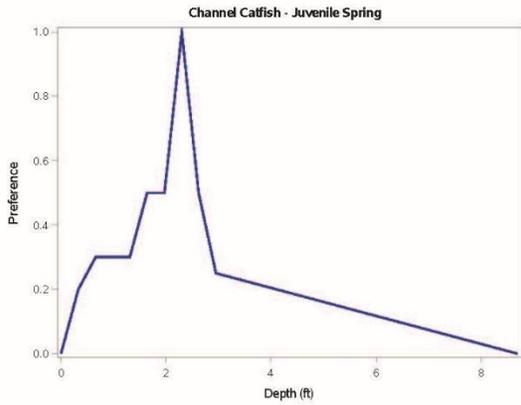
# ATTACHMENT A

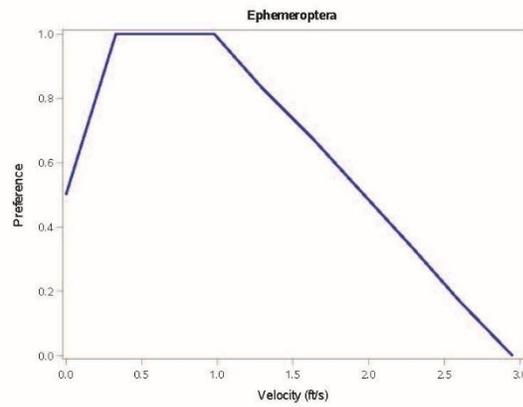
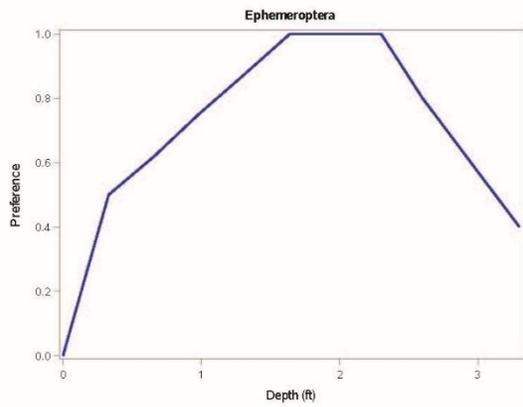
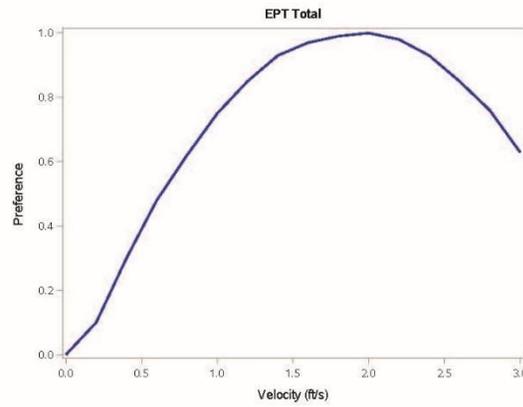
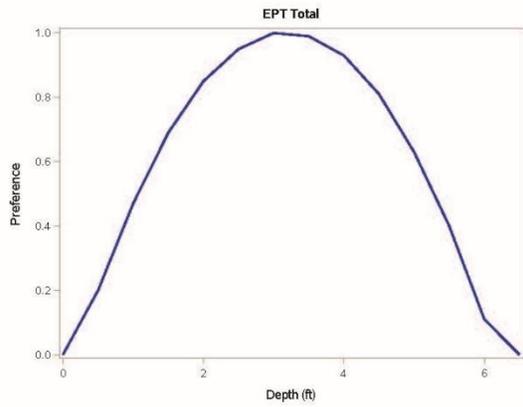
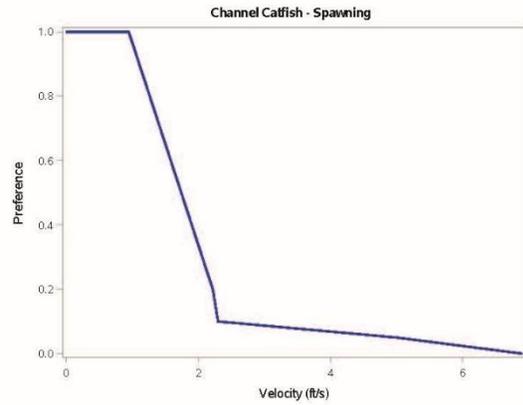
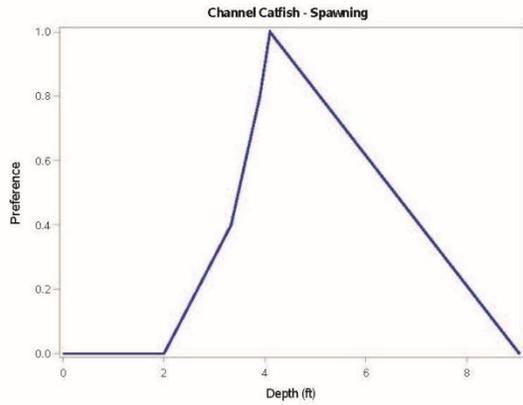
## Habitat Suitability Curves

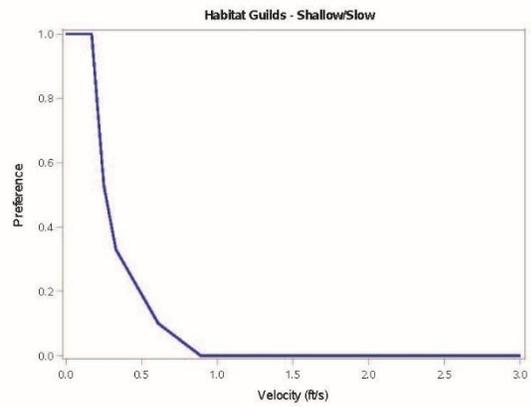
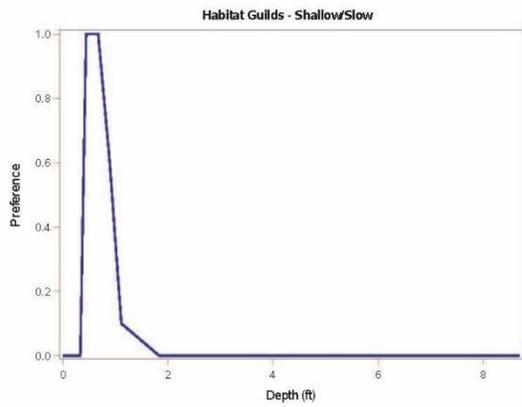
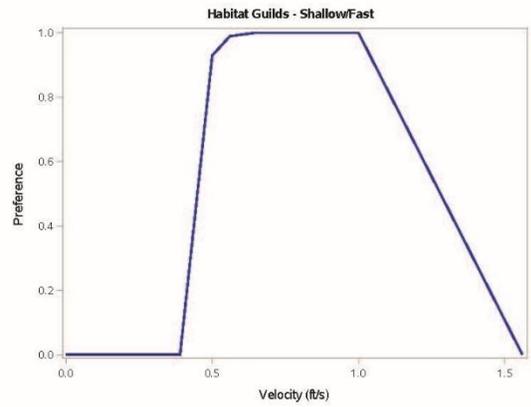
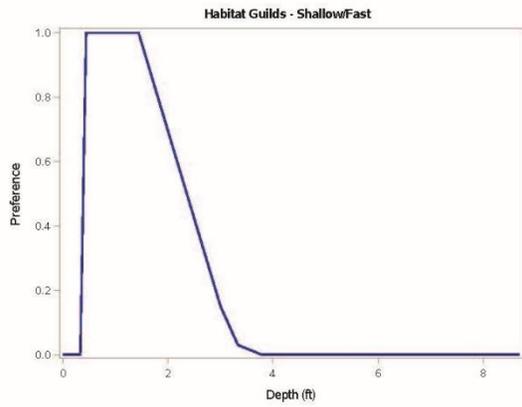
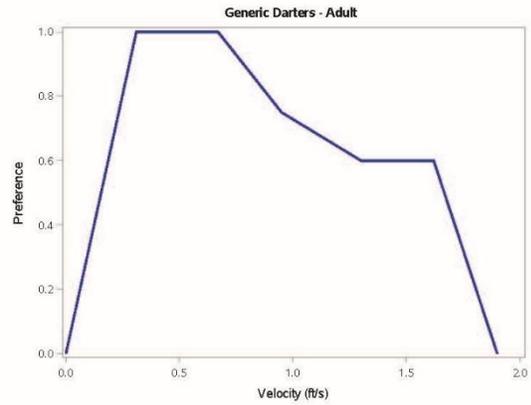
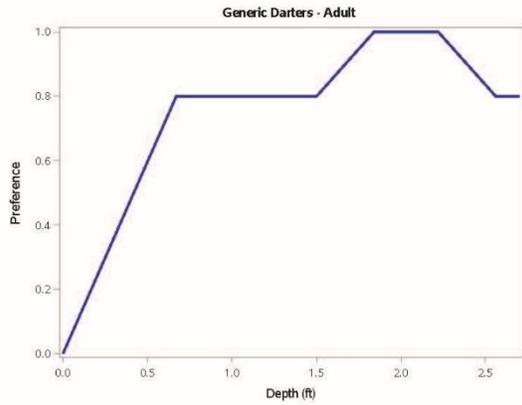


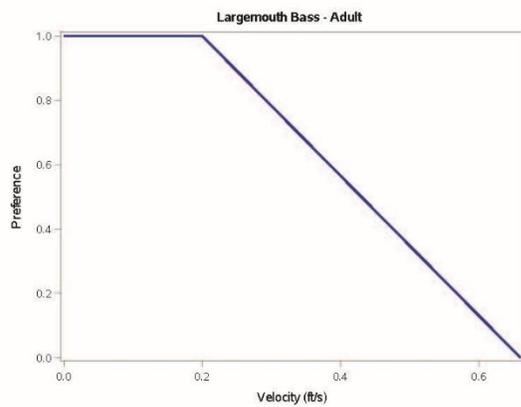
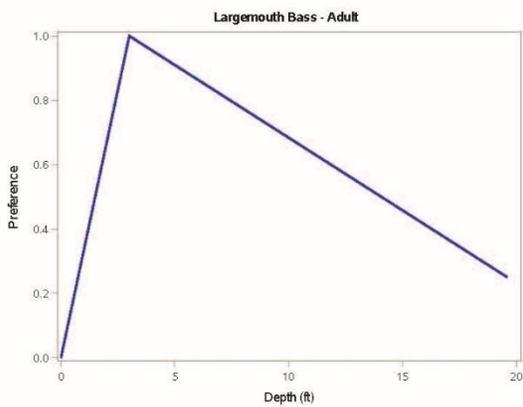
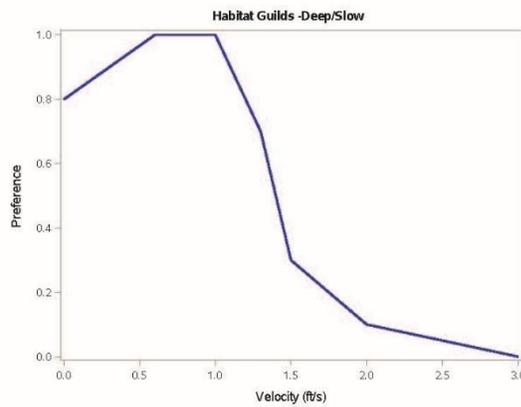
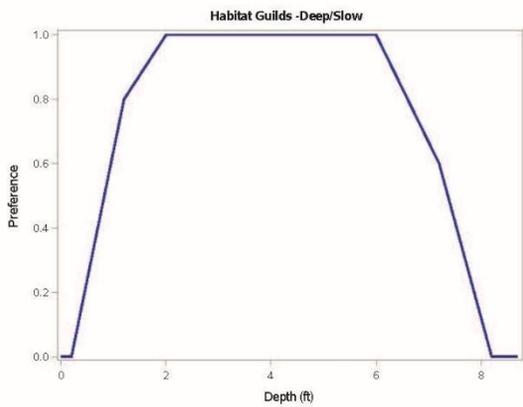
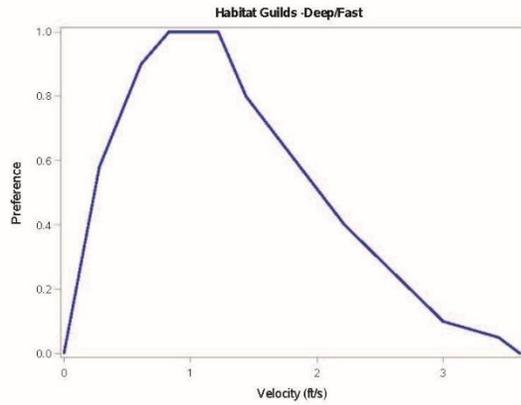
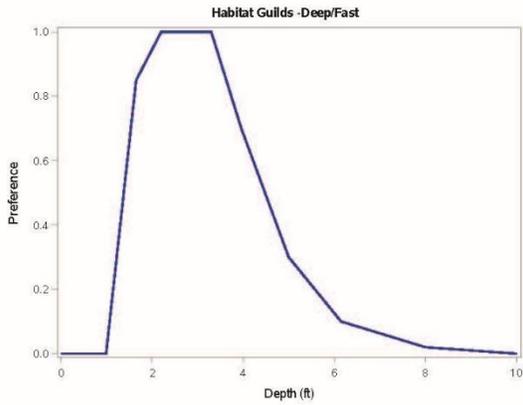


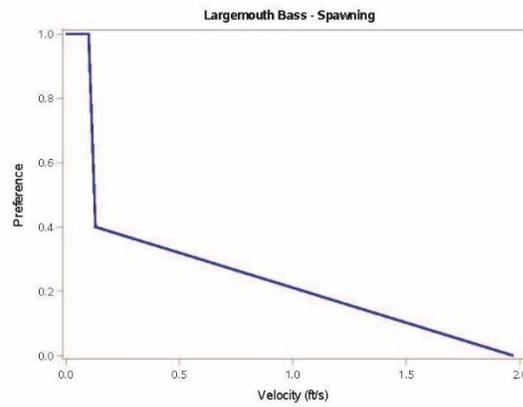
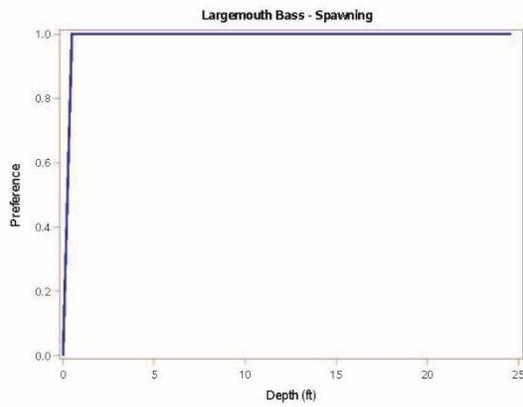
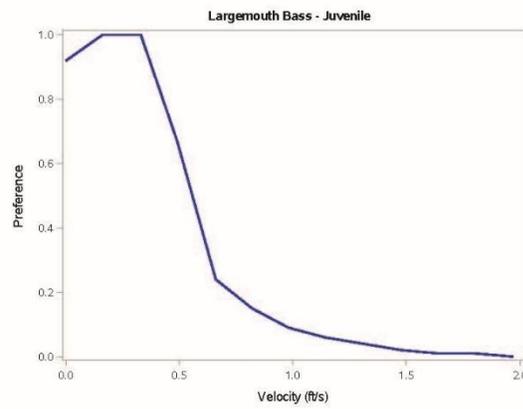
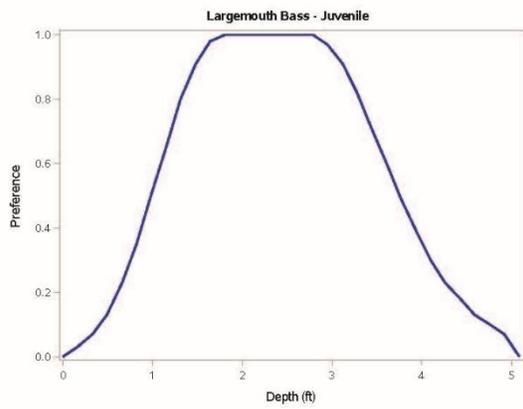
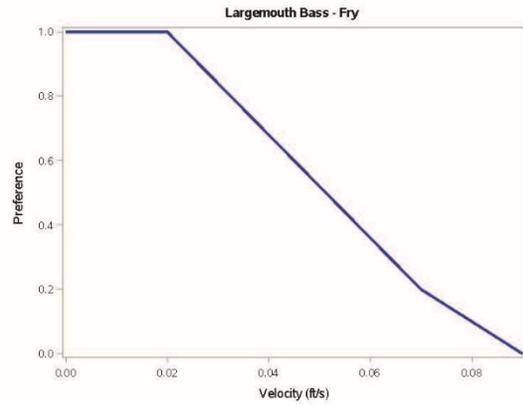
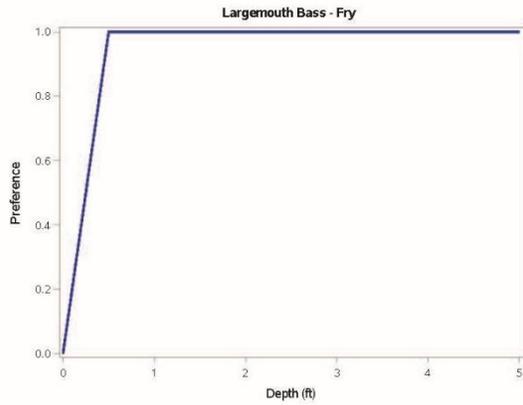


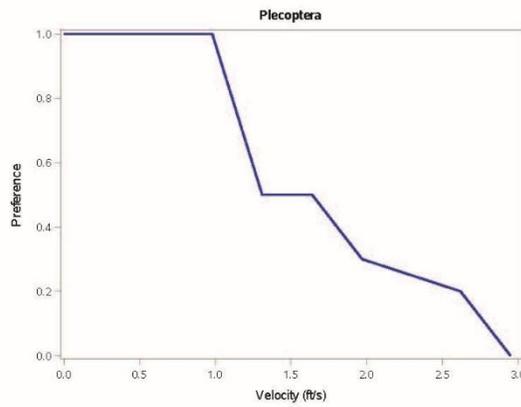
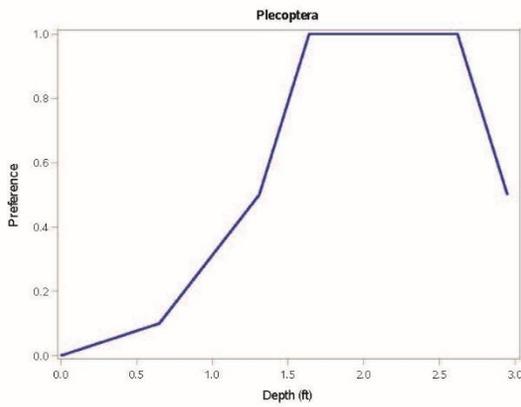
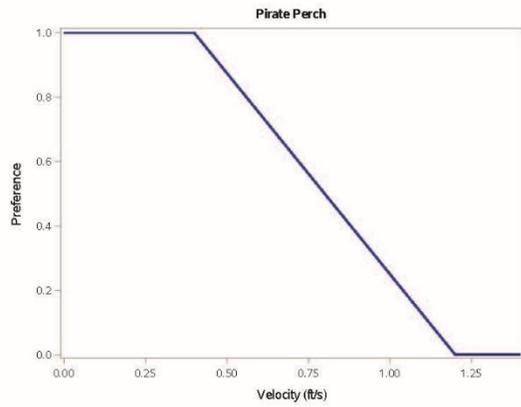
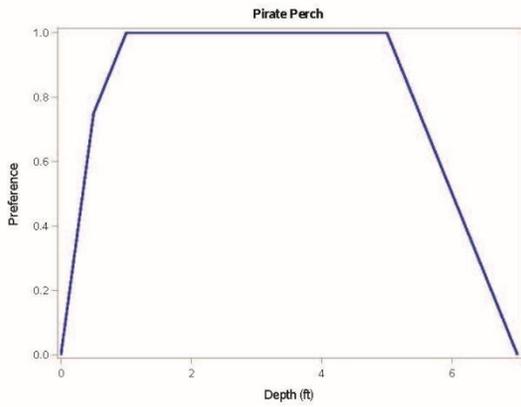
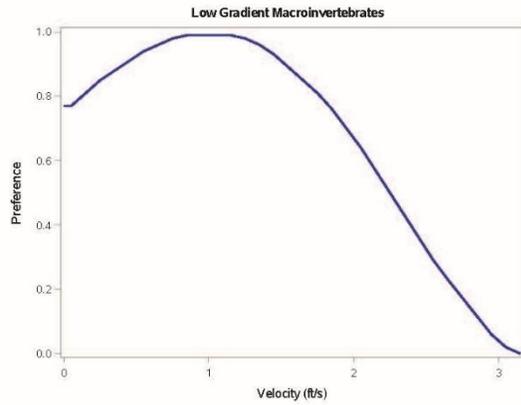
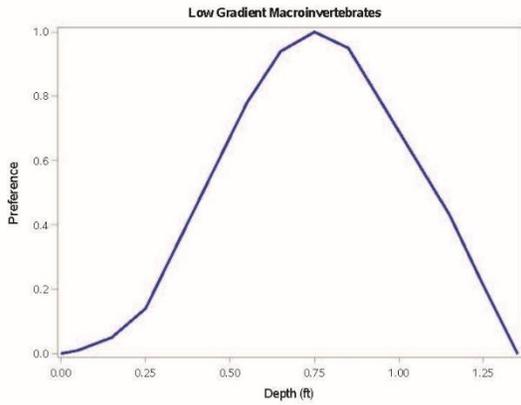


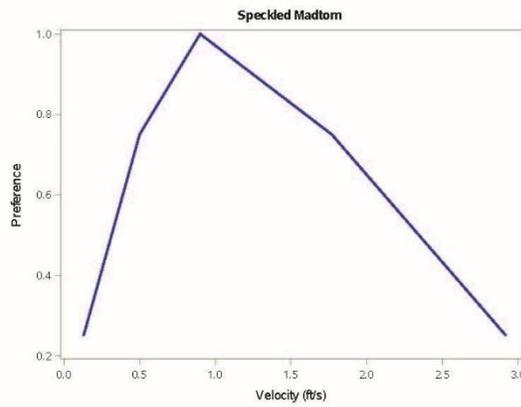
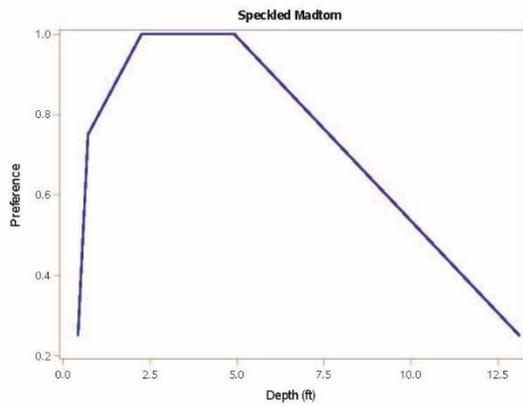
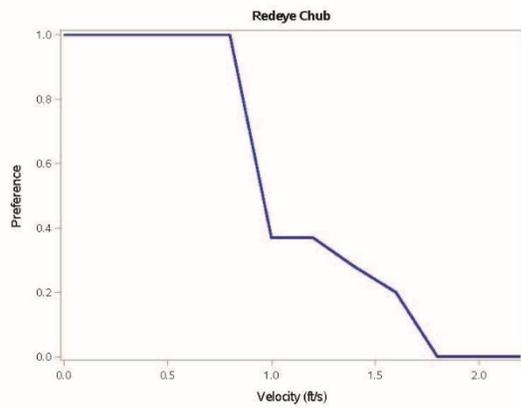
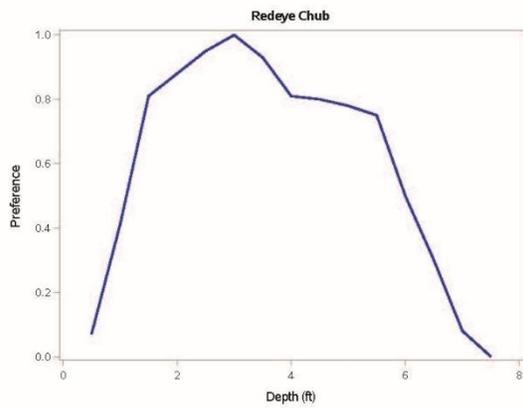
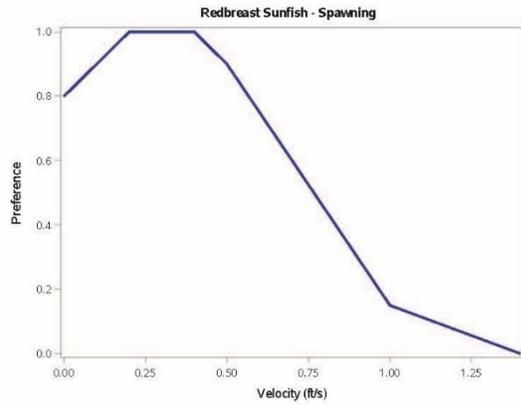
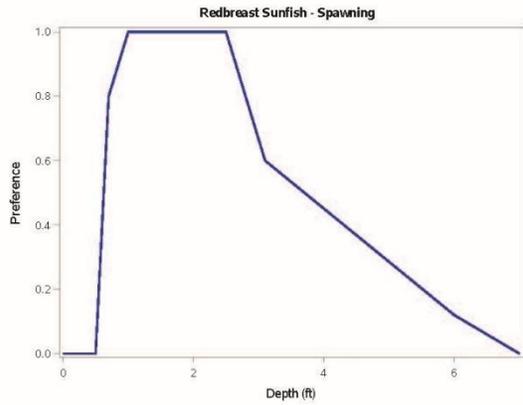


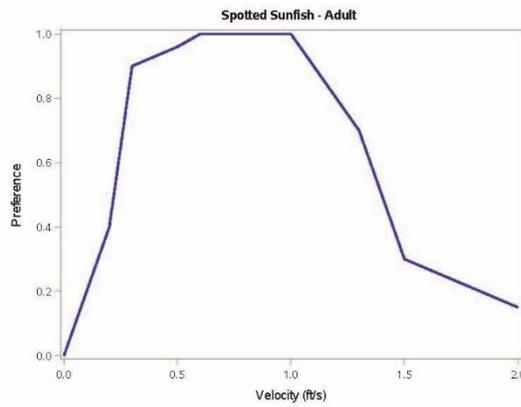
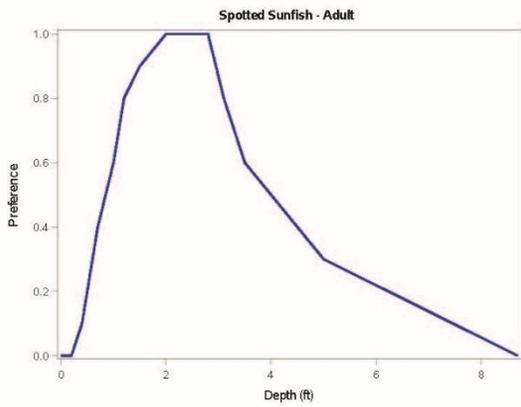
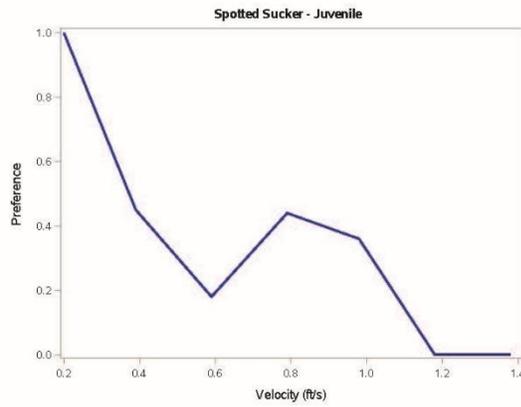
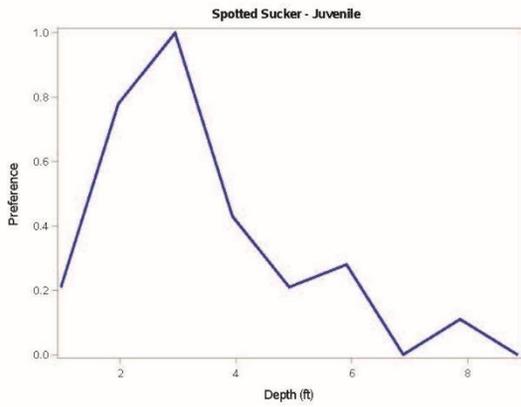
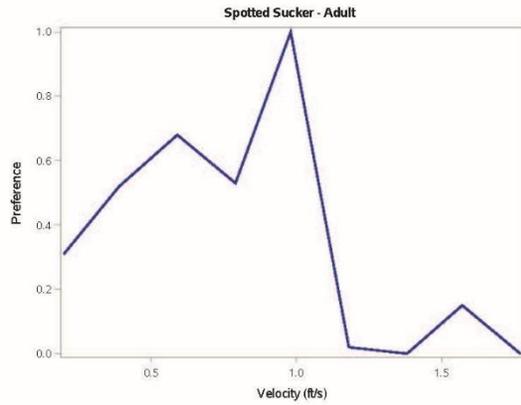
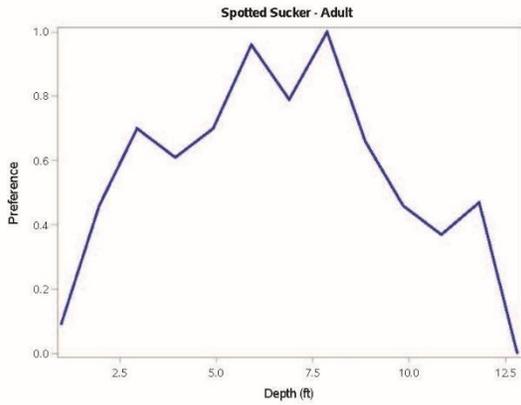


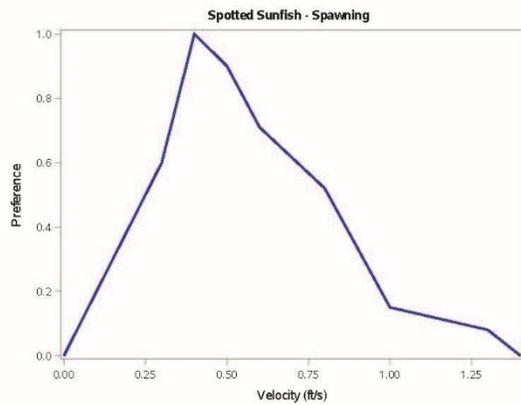
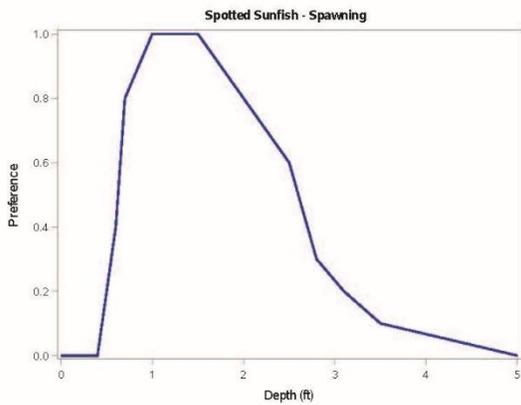
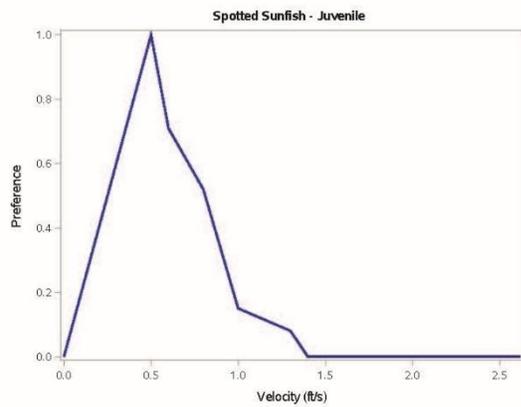
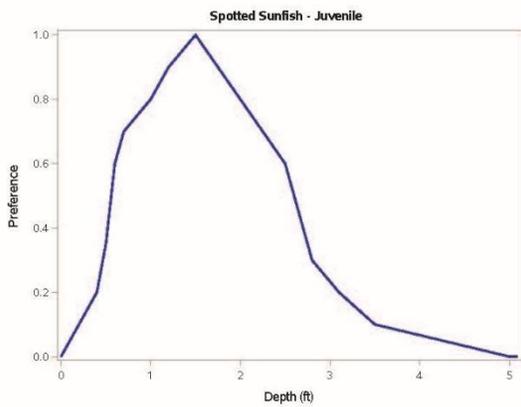
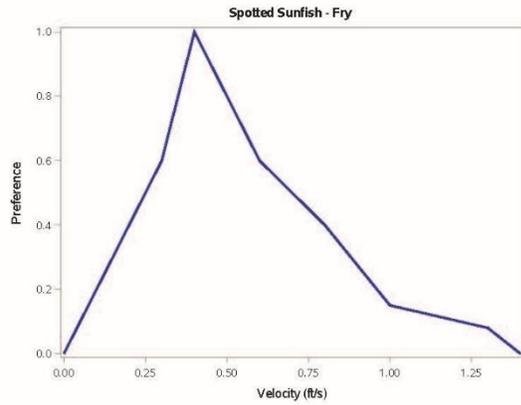
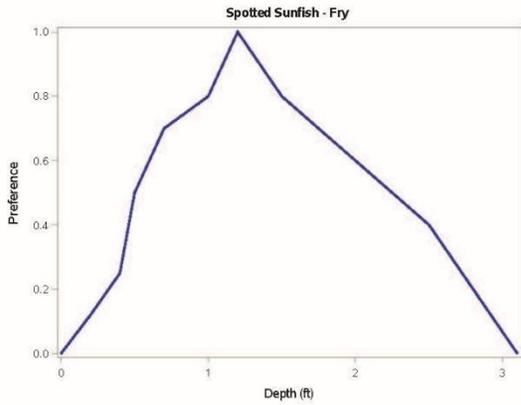


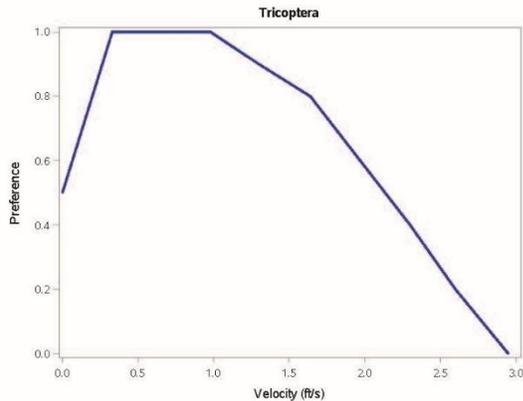
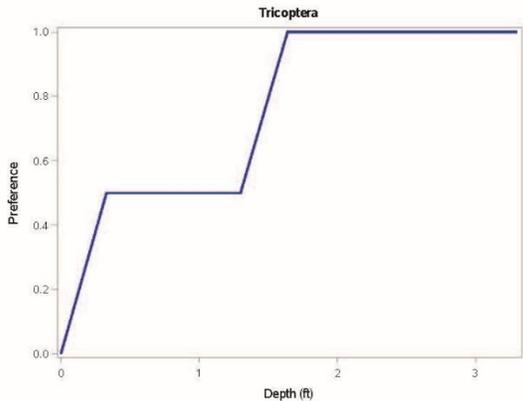












# ATTACHMENT B

## SEFA Model Results

**SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 10<sup>th</sup> Percentile**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Spotted Sunfish Spawning	40.6	85.0	34.5	49.3	42.0	35.7	34.5
Spotted Sucker Adult	28.1	131.0	23.9	90.5	30.9	40.5	39.2
Habitat Guilds Shallow Fast	51.4	99.0	43.7	56.6	42.8	42.4	41.0
Largemouth Bass Adult	38.5	126.0	32.7	70.5	44.0	55.5	53.7
Ephemeroptera	79.3	204.0	67.4	147.8	27.6	56.3	54.5
Plecoptera	71.9	148.0	61.1	91.3	38.3	56.7	54.9
Spotted Sunfish Adult	82.9	130.0	70.4	65.7	49.5	64.3	62.3
Redeye Chub	60.0	131.0	51.0	61.8	52.8	69.2	67.0
Blackbanded Darter Adult	81.3	129.0	69.1	53.5	58.5	75.5	73.0
Habitat Guilds Deep Fast	86.2	186.0	73.3	108.0	41.9	78.0	75.5
Habitat Guilds Deep Slow	97.0	168.0	82.4	87.8	47.8	80.3	77.7
Redbreast Sunfish Adult	97.0	168.0	82.4	87.8	47.8	80.3	77.7
Speckled Madtom	107.0	204.0	90.9	122.0	40.2	82.0	79.4
EPT Total	82.5	136.0	70.1	53.8	60.4	82.2	79.5
Generic Darters Adult	80.9	146.0	68.8	59.7	59.1	86.3	83.6
Redbreast Sunfish Fry	9.4	146.0	8.0	56.0	61.6	90.0	87.1
Trichoptera	111.1	204.0	94.4	110.7	45.8	93.3	90.4
Bluegill Adult	3.5	108.0	3.0				
Bluegill Fry	2.1	46.0	1.8				
Bluegill Juvenile	43.4	70.0	36.9				

**SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 10<sup>th</sup> Percentile**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Bluegill Spawning	50.2	79.0	42.7				
Habitat Guilds Shallow Slow	8.2	48.0	6.9				
Largemouth Bass Fry	0.2	59.0	0.1				
Largemouth Bass Juvenile	45.5	85.0	38.7				
Largemouth Bass Spawning	28.7	121.0	24.4				
Low Gradient Macroinvert	25.8	59.0	21.9				
Pirate Perch	58.8	68.0	50.0				
Redbreast Sunfish Juvenile	87.2	78.0	74.1				
Redbreast Sunfish Spawning	47.1	79.0	40.0				
Spotted Sucker Juvenile	20.2	115.0	17.2				
Spotted Sunfish Fry	31.1	76.0	26.4				
Spotted Sunfish Juvenile	47.9	85.0	40.7				

**SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 50th Percentile**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Spotted Sunfish Spawning	40.2	83	34.2	49.3	40.6	33.7	32.6
Spotted Sucker Adult	27.7	131	23.5	89.8	31.5	41.3	39.9
Habitat Guilds Shallow Fast	51.5	100	43.8	56.0	44.0	44.0	42.6
Ephemeroptera	79.5	204	67.6	148.5	27.2	55.5	53.7
Largemouth Bass Adult	38.0	127	32.3	70.5	44.5	56.5	54.7
Plecoptera	71.5	148	60.8	91.3	38.3	56.7	54.9
Spotted Sunfish Adult	82.5	130	70.1	65.8	49.4	64.3	62.2
Redeye Chub	59.5	131	50.6	61.4	53.1	69.6	67.4
Blackbanded Darter Adult	80.9	129	68.8	53.5	58.5	75.5	73.1
Habitat Guilds Deep Fast	86.0	186	73.1	108.5	41.7	77.5	75.0
Habitat Guilds Deep Slow	96.2	168	81.8	87.5	47.9	80.5	77.9
Redbreast Sunfish Adult	96.2	168	81.8	87.5	47.9	80.5	77.9
Speckled Madtom	106.7	204	90.7	122.3	40.0	81.7	79.1
EPT Total	82.3	138	70	54.0	60.9	84.0	81.3
Generic Darters Adult	80.6	146	68.5	59.5	59.2	86.5	83.7
Redbreast Sunfish Fry	9.3	146	7.9	56.0	61.6	90.0	87.1
Trichoptera	110.7	204	94.1	110.7	45.8	93.3	90.4
Bluegill Adult	3.495	103	3				
Bluegill Fry	2.096	46	1.8				

**SEFA Model Results for Spring Creek, Discharge from Jackson Blue Spring and Chipola River Stage @ 50th Percentile**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Bluegill Juvenile	43.224	70	36.7				
Bluegill Spawning	49.887	79	42.4				
Habitat Guilds Shallow Slow	8.044	50	6.8				
Largemouth Bass Fry	0.155	59	0.1				
Largemouth Bass Juvenile	45.029	86	38.3				
Largemouth Bass Spawning	28.539	117	24.3				
Low Gradient Macroinvert	25.771	59	21.9				
Pirate Perch	58.4	68	49.6				
Redbreast Sunfish Juvenile	86.766	78	73.8				
Redbreast Sunfish Spawning	46.723	79	39.7				
Spotted Sucker Juvenile	19.985	110	17				
Spotted Sunfish Fry	30.914	77	26.3				
Spotted Sunfish Juvenile	47.535	80	40.4				

**SEFA Model Results for Merritts Mill Pond, Discharge from Jackson Blue Spring.**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Generic Darter Adult	77.5	204.0	65.8	164.0	19.6	40.0	38.7
Bluegill Adult	166.6	134.0	141.6	47.7	64.4	86.3	83.5
Habitat Guilds Deep Fast	11.3	168.0	9.6	49.7	70.4	118.3	114.6
Trichoptera	303.0	204.0	257.6	73.9	63.8	130.1	125.9
Spotted Sucker Adult	118.6	204.0	100.8	62.5	69.4	141.5	137.0
Blackbanded Darter Adult	61.8	99.0	52.6				
Bluegill Fry	319.8	46.0	271.8				
Bluegill Juvenile	85.6	46.0	72.8				
Bluegill Spawning	189.9	46.0	161.4				
Ephemeroptera	3.4	100.0	2.9				
EPT Total	139.5	204.0	118.6				
Habitat Guilds Deep Slow	336.3	55.0	285.9				
Habitat Guilds Shallow Fast	0.0	46.0	0.0				
Habitat Guilds Shallow Slow	23.0	50.0	19.5				
Largemouth Bass Adult	457.3	204.0	388.7				
Largemouth Bass Fry	439.2	46.0	373.3				
Largemouth Bass Juvenile	209.2	46.0	177.8				
Largemouth Bass Spawning	498.4	131.0	423.6				
Low Gradient Macroinvert	21.2	46.0	18.0				
Pirate Perch	377.8	46.0	321.1				

**SEFA Model Results for Merritts Mill Pond, Discharge from Jackson Blue Spring.**

<b>Taxon</b>	<b>Maximum AWS</b>	<b>Flow @ Maximum AWS</b>	<b>15% Reduction in Maximum AWS</b>	<b>Flow @ Reduced Maximum AWS</b>	<b>% Reduction in Flow</b>	<b>Difference from Max AWS</b>	<b>Percent Departure from the Median JBS Flow (103.3 cfs)</b>
Plecoptera	279.8	194.0	237.8				
Redbreast Sunfish Adult	336.3	55.0	285.9				
Redbreast Sunfish Fry	175.5	46.0	149.2				
Redbreast Sunfish Juvenile	395.6	46.0	336.3				
Redbreast Sunfish Spawning	175.3	46.0	149.0				
Redeye Chub	314.8	46.0	267.6				
Speckled Madtom	113.2	111.0	96.2				
Spotted Sucker Juvenile	196.9	46.0	167.4				
Spotted Sunfish Adult	164.2	46.0	139.6				
Spotted Sunfish Fry	1.6	50.0	1.4				
Spotted Sunfish Juvenile	45.9	46.0	39.0				
Spotted Sunfish Spawning	2.7	59.0	2.3				