

# Upper Peace River Woody Habitat Analysis

April 17, 2025

## 1. Overview

Woody habitats are important instream features that serve as a relatively stable, structurally multifaceted medium that provides cover for organisms, particularly invertebrates and fish (Benke and Wallace 1990). As physical impediments to flow, woody structures enhance the formation of leaf packs and debris dams that further improve instream habitat complexity and diversity. With sustained inundation, microbial conditioning and periphyton growth can occur on woody materials, leading to macroinvertebrate colonization and subsequent support for aquatic food webs (Benke and Wallace 2003). Maintaining flows required to ensure different periods of woody habitat inundation can be protective of instream habitats.

## 2. Methods

### 2.1 Data Collection

During a period of low flow in April and May 2022, Environmental Science Associates (ESA) collected woody habitat data at twenty sites dispersed between the United States Geological Survey (USGS) Peace River at SR 60 at Bartow gage (No. 02294560) and the USGS Peace River at Zolfo Springs gage (No. 02295637; Figure 1, Table 1). Sites were selected based on the existence of previously established benchmarks, suitable access, the presence of representative woody habitat, and a roughly even geographic distribution throughout the study reach.

At each site, along both banks, the elevation, percent cover, and volume of woody habitats were determined, as briefly described below. Additional details regarding site selection and data collection may be found in ESA (2023).

To collect elevation data, a representative 15.24 meter (m) section of bank was selected. Within this sampling boundary, the top and bottom elevations of fifteen dead and live woods were measured. Dead wood included snag habitats. Live wood was measured in two different ways, depending upon the date of sampling. At some sites, live wood included both exposed roots and the trunk of trees to the top of the bank, referred to as the “ESA” method. At others, the traditional District method of measuring only the elevation of exposed roots was conducted, referred to as the “Hood” method.

To estimate percent coverage of woody habitat, five 10 m long transects were established parallel to the water surface between the water’s edge and the top of the bank, within the 15.24 m section of bank previously delineated for elevation data collection. The transects were at least 0.5 m apart from one another. Along each transect, five 0.5 m x 0.5 m quadrats were used to quantify percent coverage of representative woody habitat in increments of 10%.

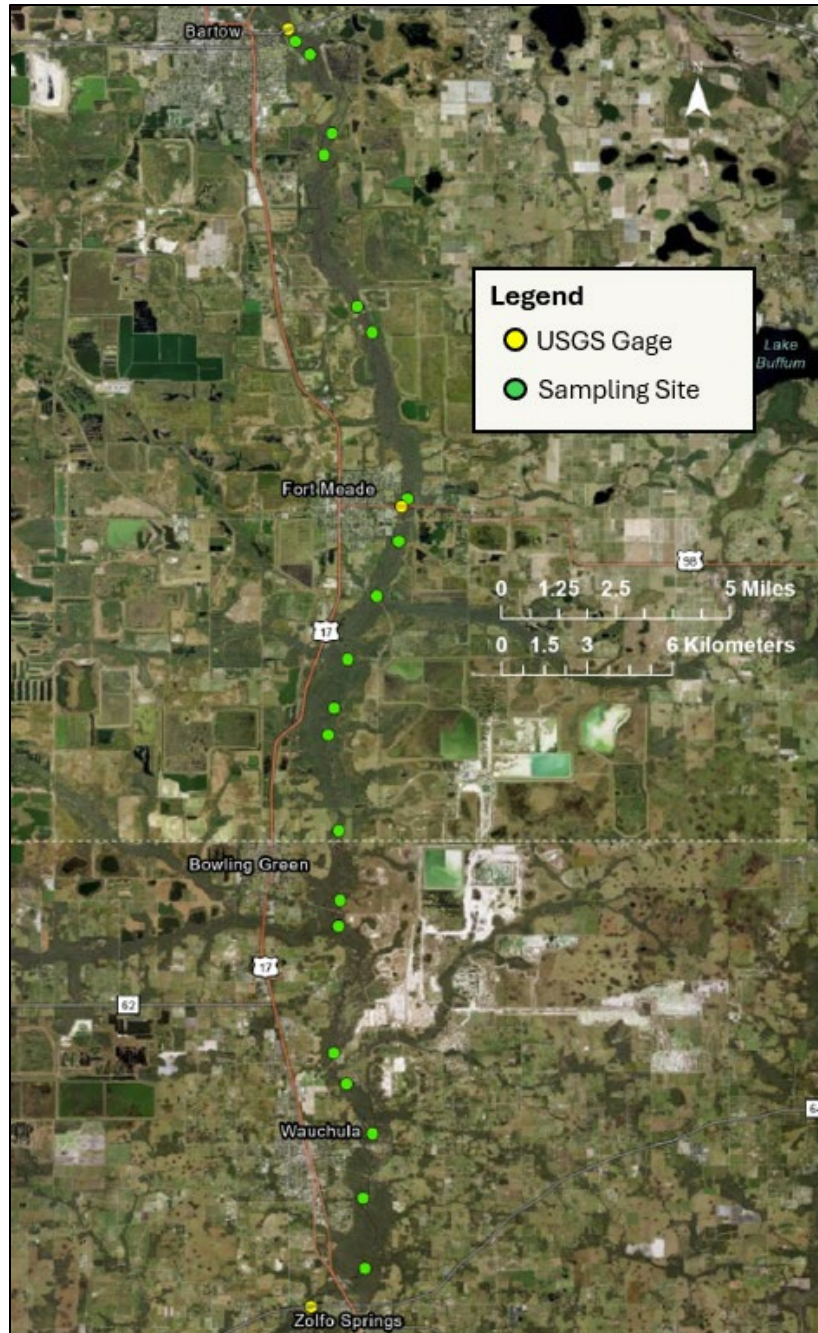
To calculate volume of woody habitat, a minimum of 20 pieces of woody habitat with diameters greater than 3 centimeters (cm) were measured along each of the transects established for estimation of percent coverage. Volume was then calculated according to Van Wagner’s formula (Van Wagner 1968):

$$V = (\pi^2 \sum d^2) / 8L$$

where V = surface area of wood, per unit area,

d = diameter of wood

L = the length of the transect.



**Figure 1: Overview of woody habitat sites (green dots) sampled by Environmental Science Associates in April and May 2022 and the United States Geological Survey (USGS) flow gages (yellow dots) used for data analysis. Additional station and gage details are provided in Figures 3-5.**

**Table 1: Woody habitat sampling sites with their benchmark coordinates and their associated index United States Geological Survey (USGS) gage.**

Site	Latitude	Longitude	Index USGS Gage
E01	27.869487	-81.803802	Peace River at SR 60 at Bartow (No. 02294650)
E02	27.862645	-81.806301	Peace River at SR 60 at Bartow (No. 02294650)
E03	27.814797	-81.795721	Peace River at SR60 at Bartow (No. 02294650)
E04	27.754171	-81.779956	Peace River at Fort Meade (No. 02294898)
E05	27.688111	-81.803038	Peace River at Fort Meade (No. 02294898)
E06	27.680065	-81.804975	Peace River at Fort Meade (No. 02294898)
E07	27.649799	-81.801697	Peace River at Fort Meade (No. 02294898)
E08	27.627872	-81.801226	Peace River at Zolfo Springs (No. 02295637)
E09	27.579638	-81.803137	Peace River at Zolfo Springs (No. 02295637)
E10	27.569930	-81.799209	Peace River at Zolfo Springs (No. 02295637)
E11	27.511729	-81.793295	Peace River at Zolfo Springs (No. 02295637)
SEFA01	27.898511	-81.815343	Peace River at SR 60 at Bartow (No. 02294650)
SEFA04	27.894384	-81.810726	Peace River at SR 60 at Bartow (No. 02294650)
SEFA12	27.806623	-81.791066	Peace River at SR 60 at Bartow (No. 02294650)
SEFA16	27.740656	-81.782669	Peace River at Fort Meade (No. 02294898)
SEFA19	27.723426	-81.789662	Peace River at Fort Meade (No. 02294898)
SEFA20	27.703469	-81.798841	Peace River at Fort Meade (No. 02294898)
SEFA24	27.619766	-81.801751	Peace River at Zolfo Springs (No. 02295637)
SEFA28	27.554237	-81.790974	Peace River at Zolfo Springs (No. 02295637)
SEFA29	27.533947	-81.794001	Peace River at Zolfo Springs (No. 02295637)

## 2.2 Data Analysis

For analysis purposes, the sites were divided into three river reaches: an upper river reach from Bartow to Fort Meade (Figure 2), a middle reach from Fort Meade to Bowling Green (Figure 3), and a lower river reach from Bowling Green to Zolfo Springs (Figure 4). Sites within each reach were associated with flows at an index USGS gage over the same period of record, from January 1, 1975, to December 31, 2022 (Table 1).

By comparing mean percent coverage and volume data, the bank with more abundant woody habitat at each site was selected for further analysis (Table 2). In instances where percent coverage and volume data did not result in the same bank, the bank with the higher mean percent coverage was selected, as volume results could be skewed by the inclusion of a large log or tree across a transect.

The mean elevation of live and dead wood was calculated for the selected bank at each sampling site (Table 3). In almost every case, the mean elevation of dead wood was less than that of live woody habitats. Regardless of whether the Hood or ESA method was used to measure the elevation of live wood, there did not appear to be significant differences in the trends of live elevation data throughout the system. Therefore, all data were considered.

To examine the woody habitat most likely impacted by flow reductions during Blocks 1 and 2 (low to medium flow condition), individual elevations of live and dead wood were identified that were associated with water elevations corresponding below the Block 2/Block 3 threshold, as identified during floodplain inundation analysis. The Block 2/Block 3 threshold corresponded to flows of less than or equal to 71 cfs at the USGS Peace River at SR60 at Bartow gage (No.

02294650), to flows of less than or equal to 120 cfs at the USGS Peace River at Fort Meade gage (No. 02294898), and to flows of less than or equal to 274 cfs at the USGS Peace River at Zolfo Springs gage (No. 02295637).

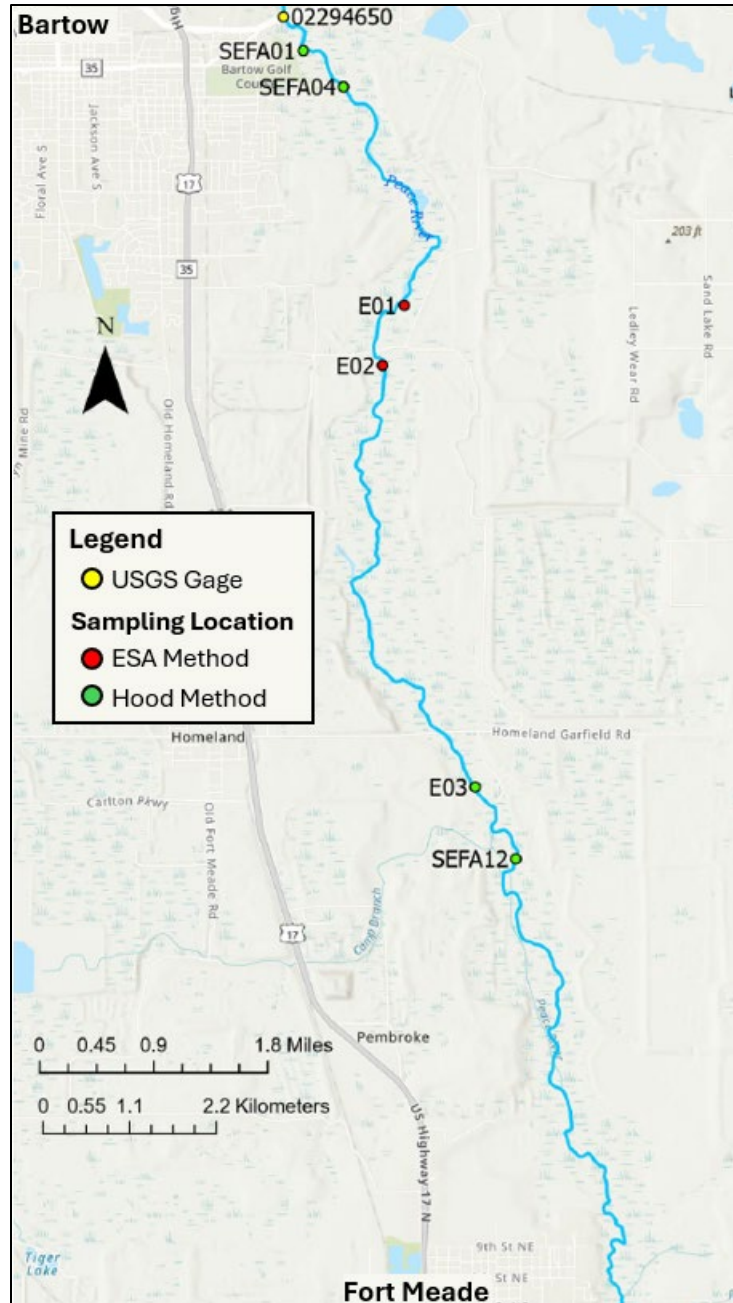
The flows required at the site-associated USGS index gage to inundate select elevations of woody habitat were determined. Then, the maximum percent-of-flow reduction at the USGS index gage that would lead to a 15% change in the number of 1-day, 7-day, and 30-day periods of inundation for specific woody habitat elevations were calculated using the period of baseline record from January 1, 1975, to December 31, 2022. The results were then averaged for each river segment as shown in Tables 4, 5 and 6.

**Table 2: Mean woody habitat surface area and volume at each sampling site.**

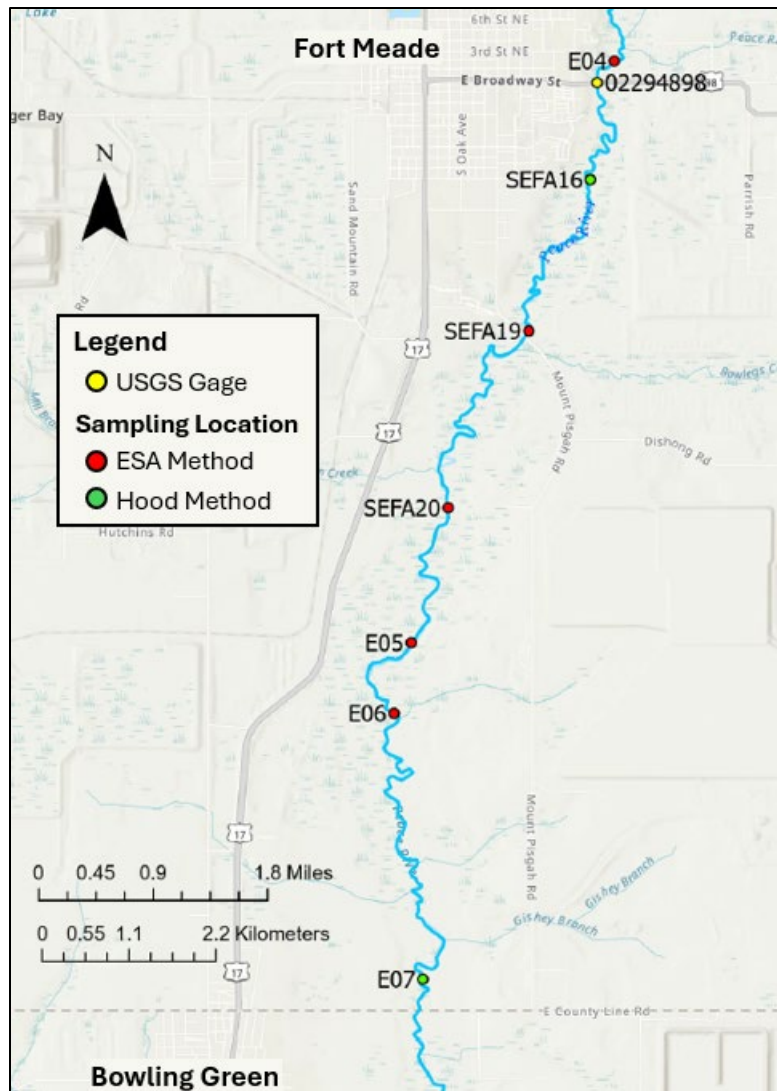
Site	Bank	Mean Woody Habitat Surface Area (%)	Mean Woody Habitat Volume (m <sup>3</sup> )	Bank Selected for Further Analysis (*)
E01	Left	33.6	3.14	*
	Right	24.8	1.55	
E02	Left	48.8	6.63	*
	Right	5.2	0.28	
E03	Left	17.6	7.23	
	Right	25.6	0.81	*
E04	Left	28.8	22.86	*
	Right	1.03	22.4	
E05	Left	13.6	0.28	
	Right	18.4	540.35	*
E06	Left	19.6	1.41	*
	Right	6.8	1.23	
E07	Left	12.4	0.53	*
	Right	8.4	9.6	
E08	Left	8.8	6.24	*
	Right	4.8	0.23	
E09	Left	24.4	12.51	*
	Right	12	0.47	
E10	Left	24.4	6.44	*
	Right	18	5.16	
E11	Left	8.4	0.08	
	Right	30	0.48	*
SEFA01	Left	9.6	0.08	
	Right	32.4	0.25	*
SEFA04	Left	70	13.33	*
	Right	19.2	0.65	
SEFA12	Left	16.8	2.77	*
	Right	13.6	6.12	
SEFA16	Left	20.4	1.58	
	Right	24.8	0.41	*
SEFA19	Left	26.8	6.78	*
	Right	20.8	3.94	
SEFA20	Left	24.8	4.26	*
	Right	16.4	0.35	
SEFA24	Left	13.2	0.61	
	Right	24.8	2.37	*
SEFA28	Left	22.4	4.58	*
	Right	8.8	0.71	
SEFA29	Left	11.2	8.87	
	Right	26	9.66	*

**Table 3: Bank-specific mean elevation data by type of woody habitat.**

Site	Bank	Elevation Method	Type of Habitat	Mean Elevation (NAVD88)
E01	Left	Hood	Dead	86.45
			Live	86.42
E02	Left	Hood	Dead	86.24
			Live	86.72
E03	Right	ESA	Dead	82.37
			Live	82.67
E04	Left	Hood	Dead	71.83
			Live	72.95
E05	Right	Hood	Dead	62.43
			Live	62.82
E06	Left	Hood	Dead	61.18
			Live	62.78
E07	Left	ESA	Dead	55.90
			Live	57.18
E08	Left	Hood	Dead	54.56
			Live	54.95
E09	Left	ESA	Dead	44.74
			Live	47.69
E10	Left	ESA	Dead	44.93
			Live	50.34
E11	Right	ESA	Dead	38.54
			Live	40.10
SEFA01	Right	ESA	Dead	91.58
			Live	92.31
SEFA04	Left	ESA	Dead	90.18
			Live	90.52
SEFA12	Left	ESA	Dead	81.61
			Live	81.70
SEFA16	Right	ESA	Dead	70.88
			Live	72.01
SEFA19	Left	Hood	Dead	67.91
			Live	68.94
SEFA20	Left	Hood	Dead	63.56
			Live	64.84
SEFA24	Right	Hood	Dead	49.04
			Live	51.83
SEFA28	Left	ESA	Dead	42.39
			Live	46.00
SEFA29	Right	ESA	Dead	40.30
			Live	42.07

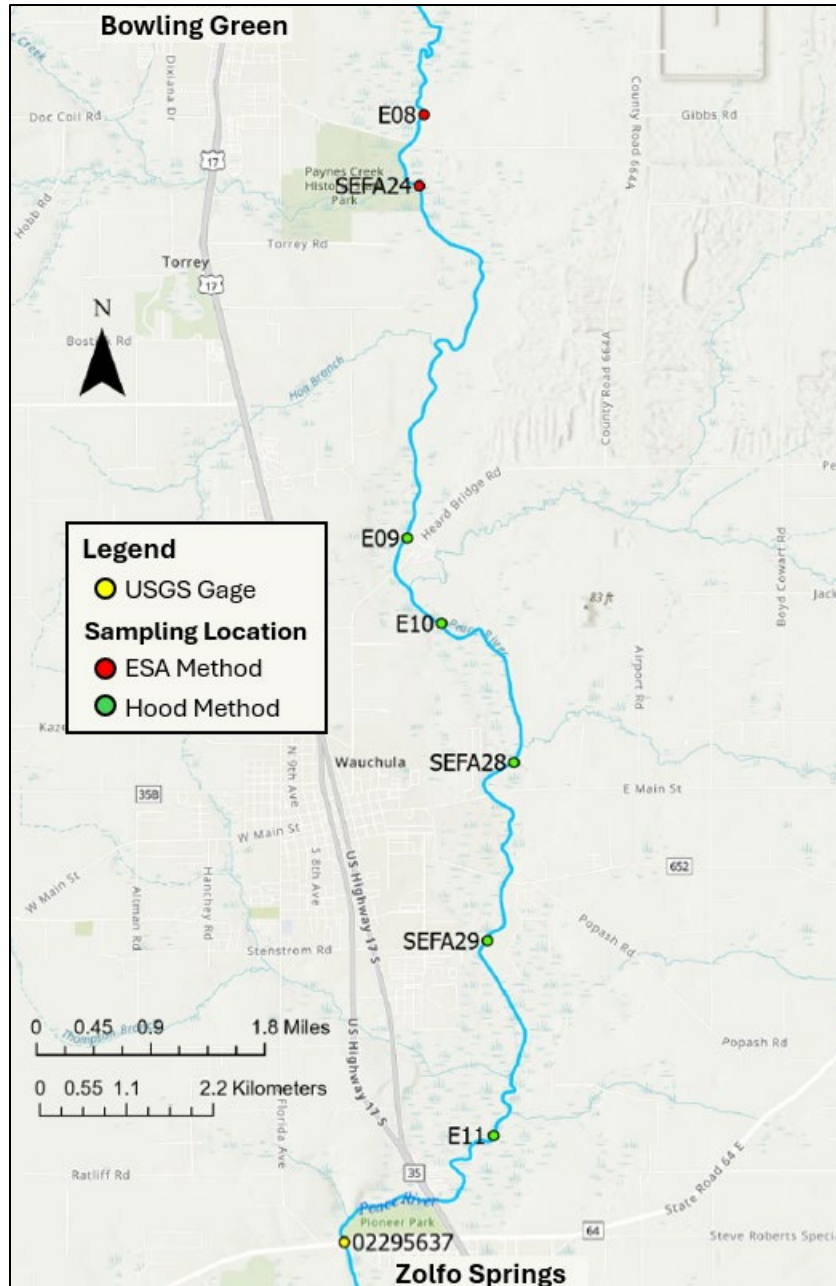


**Figure 2: Woody habitat sites sampled by Environmental Science Associates in the upper reach of the Upper Peace River, between Bartow and Fort Meade, with their reference flow gage (United States Geological Survey (USGS) Peace River at Bartow gage (No. 02294560)). Sites are color coded by the method used to obtain elevation data.**



**Figure 3: Woody habitat sites sampled by Environmental Science Associates in the middle reach of the Upper Peace River, between Fort Meade and Bowling Green, with their reference flow gage (United States Geological Survey (USGS) Peace River at Fort Meade gage (No. 02294898)). Sites are color coded by the method used to obtain elevation data.**





**Figure 4: Woody habitat sites sampled by Environmental Science Associates in the middle reach of the Upper Peace River, between Bowling Green and Zolfo Springs, with their reference flow gage (United States Geological Survey (USGS) Peace River at Zolfo Springs gage (No. 02295637)). Sites are color coded by the method used to obtain elevation data.**

### 3. Results

The inundation patterns of woody habitats with elevations anticipated to be submerged at flows below the Block 2/Block 3 threshold were examined at twenty locations in the Upper Peace River. The number of days the flow targets associated with qualifying woody habitat elevations were equaled or exceeded for 1-day, 7-day, and 30-day durations was assessed using the baseline flow record for each reference USGS gage over the period of records from January 1, 1975, to December 31, 2022. The percent-of-flow reductions that would result in greater than a 15% reduction in the number of days of the specified duration-events relative to those associated with baseline flows were calculated (Tables 4-7).

For the upstream river reach between Bartow and Fort Meade, all six of the sampled sites contained measured woody habitat at elevations anticipated to be inundated during targeted flows (Table 4). This included 31 samples of dead wood and 14 samples of live wood throughout the reach. The mean allowable flow reduction associated with 1-day duration events was 24%, with a range from 22% to 34%. The mean allowable flow reduction for inundations of 7-day duration was 21%, with a range of 20% to 29%. Inundations of 30-day durations were most sensitive to flow reductions, with a mean allowable flow reduction of 16% and a range of 14% to 24%. Based on these results, a 16% flow reduction in Block 2 is considered protective of woody habitat in this river segment (Table 7).

For the middle river reach between Fort Meade and Bowling Green, all seven of the sampled stations contained at least one sample of woody habitat that was expected to be inundated during target flows (Table 5). In total, the elevations of 21 samples of dead wood and two samples of live wood were considered. The mean allowable flow reduction associated with 1-day duration events was 25% with a range of 21% to 29%. The mean allowable flow reduction for inundations of 7-day duration was 22%, with a range of 18% to 27%. Inundations of 30 days were most sensitive to flow reductions, with a mean allowable flow reduction of 16% and a range of 10% to 25%. Based on these results, a 16% flow reduction in Block 2 is considered protective of woody habitat in this river segment (Table 7).

For the downstream river reach between Bowling Green and Zolfo Springs, six of the seven sampled stations contained at least one sample of woody habitat that was expected to be inundated during target flows, including 38 samples of dead wood and five samples of live wood within this river reach (Table 6). The mean allowable flow reduction associated with 1-day duration events was 31% with a range of 19% to 63%. The mean allowable flow reduction for inundations of 7-day duration was 26%, with a range of 15% to 57%. Inundations of 30 days were most sensitive to flow reductions, with a mean allowable flow reduction of 20% and a range of 10% to 46%. Based on these results, a 20% flow reduction in Block 2 is considered protective of woody habitat in this river segment (Table 7).

**Table 4: Selected instream woody habitat flow targets and allowable flow reductions associated with a 15% reduction from conditions at the index gage over the period of baseline record (1975-2022) in the number of days of flow sufficient to inundate woody habitat for 1-day, 7-day, and 30-day durations. This considers elevations of woody habitat that require flows less than or equal to 71 cfs at the United States Geological Survey Peace River at SR 60 at Bartow (02294650) gage. The river reach includes stations between Bartow and Fort Meade.**

Site	Bank	Habitat Type	Sample Elevation (ft, NAVD 88)	Target Flow (cfs) at Index Gage	Maximum Allowable Flow Reduction (%)		
					1-Day	7-Days	30-Days
E01	Left	Dead	86.37	71.20	23	20	14
			86.32	68.70	23	20	14
			86.31	68.23	23	21	14
			86.17	60.30	22	21	16
			86.10	56.53	23	21	15
			85.90	50.25	23	21	16
			85.90	50.25	23	21	16
		Live	86.29	67.30	23	21	14
			86.14	58.00	23	21	16
			86.12	57.27	23	21	15
			86.02	53.25	23	21	14
			85.98	52.27	23	21	15
			85.95	51.53	23	21	16
			85.83	47.95	24	21	17
			85.83	47.95	24	21	17
E02	Left	Dead	86.06	60.80	22	20	15
			86.01	57.45	23	21	15
			85.98	55.80	23	21	16
			85.96	54.87	23	21	16
			85.95	54.40	23	21	15
			85.77	48.93	23	21	16
			85.72	47.15	24	21	17
			85.58	43.56	25	22	18
		Live	85.91	53.17	23	20	14
			85.79	49.80	23	21	16
E03	Right	Dead	80.69	61.47	22	20	15
SEFA01	Right	Dead	90.56	64.30	23	21	15
			90.55	63.70	23	20	15
			90.44	58.00	23	21	16
			90.14	40.40	25	22	18
			90.11	37.90	25	23	17
		Live	90.60	66.37	23	21	14

**(Table 4: Continued)**

Site	Bank	Habitat Type	Sample Elevation (ft, NGVD 88)	Target Flow (cfs) at Index Gage	Maximum Allowable Flow Reduction (%)		
					1-Day	7-Days	30-Days
SEFA04	Left	Dead	90.08	71.20	23	20	14
			89.83	57.45	23	21	15
			89.83	57.45	23	21	15
			89.81	56.53	23	21	15
			89.65	48.50	24	21	16
			89.64	47.95	24	21	17
			89.60	45.40	24	22	17
			89.59	44.90	25	22	17
			89.49	39.27	25	22	17
		Live	90.08	71.20	23	20	14
			89.84	58.00	23	21	16
			89.61	46.40	24	21	16
SEFA12	Left	Dead	78.85	28.90	34	29	24

**Table 5: Selected instream woody habitat flow targets and allowable flow reductions associated with a 15% reduction from conditions over the period of baseline record (1975-2022) at the index gage in the number of days of flow sufficient to inundate woody habitat for 1-day, 7-day, and 30-day durations. This considers elevations of woody habitat that require flows less than or equal to 120 cfs at the United States Geological Survey Peace River at Fort Meade (02294898) gage. The river reach includes stations between Fort Meade and Bowling Green.**

Site	Bank	Habitat Type	Sample Elevation (ft, NAVD 88)	Target Flow (cfs) at Index Gage	Maximum Allowable Flow Reduction (%)		
					1-Day	7-Days	30-Days
E04	Left	Dead	71.60	92.37	22	20	15
			71.24	70.30	25	23	16
			71.01	58.40	28	26	24
E05	Right	Dead	60.23	107.67	21	18	13
			59.50	57.43	28	27	25
			59.12	44.75	29	24	17
E06	Left	Dead	59.19	109.00	21	19	14
E07	Left	Dead	53.19	100.30	21	19	14
			53.09	88.45	22	20	16
SEFA16	Right	Dead	69.83	98.80	22	19	13
			69.83	98.80	22	19	13
			69.81	97.60	21	19	13
SEFA19	Left	Dead	66.30	69.30	27	23	17
			66.29	68.76	27	24	18
			66.29	68.76	27	24	18
			65.95	52.90	28	26	21
			65.89	50.70	28	25	21
			65.74	44.50	29	24	17
		Live	66.82	103.50	21	19	14
			66.52	81.87	24	19	13
SEFA20	Left	Dead	61.74	79.20	24	20	10

**Table 6: Selected instream woody habitat flow targets and allowable flow reductions associated with a 15% reduction from conditions over the period of baseline record (1975-2022) at the index gage in the number of days of flow sufficient to inundate woody habitat for 1-day, 7-day, and 30-day durations. This considers elevations of woody habitat that require flows less than or equal to 274 cfs at the United States Geological Survey Peace River at Zolfo Springs (02295637) gage. The river reach includes stations between Bowling Green and Zolfo Springs.**

Site	Bank	Habitat Type	Sample Elevation (ft, NAVD 88)	Target Flow (cfs) at Index Gage	Maximum Allowable Flow Reduction (%)		
					1-Day	7-Days	30-Days
E09	Left	Dead	44.17	252.80	20	16	12
			43.89	213.40	21	17	10
			43.12	136.00	29	25	20
			41.76	42.50	54	48	39
			41.69	39.13	56	50	42
			41.48	30.00	63	57	46
		Live	41.65	37.39	57	52	43
E10	Left	Dead	42.88	254.20	19	16	11
			42.32	191.00	23	19	13
			41.79	140.57	28	25	21
			41.69	132.00	30	25	21
			41.07	84.50	36	31	24
E11	Right	Dead	37.65	248.60	20	16	12
			37.36	202.50	23	18	11
			37.26	190.00	24	19	13
			36.91	144.67	28	25	20
			36.89	142.00	28	25	20
		Live	37.44	214.00	21	17	10
SEFA24	Right	Dead	48.76	263.00	20	16	10
			48.63	239.50	20	16	11
			47.63	87.33	35	31	23
			47.62	86.00	36	31	24
			47.32	57.50	45	39	30
			47.30	56.00	46	40	31
			47.24	50.60	49	43	34
SEFA28	Left	Dead	42.20	263.67	20	16	11
			42.06	244.17	20	16	11
			42.01	236.00	20	17	11
			41.11	133.25	30	26	20
			40.61	86.00	36	31	24
			40.10	48.71	50	44	36

**(Table 6: Continued)**

Site	Bank	Habitat Type	Sample Elevation (ft, NAVD 88)	Target Flow (cfs) at Index Gage	Maximum Allowable Flow Reduction (%)		
					1-Day	7-Days	30-Days
SEFA29	Right	Dead	39.70	268.50	20	15	10
			39.38	220.00	21	17	10
			39.24	202.20	23	18	11
			39.24	202.20	23	18	11
		Live	39.32	212.20	22	17	10
			39.22	199.80	23	18	11
			38.85	157.00	27	24	19

**Table 7: Summary of allowable flow reductions in each segment of the Upper Peace River associated with a 15% reduction from baseline flow conditions over the period of record (1975-2022) at the respective index gage in the number of days of flow sufficient to inundate woody habitat for 1-day, 7-day, and 30-day durations.**

River Segment	Index Gage	Allowable Flow Reduction (%)		
		1-Day	7-Days	30-Days
Upper	Peace River at SR 60 at Bartow (No. 02294650)	24	21	16
Middle	Peace River at Fort Meade (No. 02294898)	25	22	16
Lower	Peace River at Zolfo Springs (No. 02295637)	31	26	20



**References**

- Benke A.C. and J.B. Wallace. 2003. Influence of Wood on Invertebrate Communities in Streams and Rivers. American Fisheries Society Symposium. 37:149-177.
- Benke A.C. and J.B. Wallace. 1990. Wood Dynamics in Coastal Plain Blackwater Streams. Canadian Journal of Fisheries and Aquatic Sciences. 47:92-99.
- Environmental Science Associates (ESA). 2023. Upper Peace River Woody Habitat Sampling Field Work Summary. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.
- Hood, J. 2006. Standardized Methods Utilized by the Ecologic Evaluation Section for Collecting and Management of Physical Habitat Simulation Model and Instream Habitat Data. Southwest Florida Water Management District. Brooksville, Florida.
- Van Wagner, C. E. 1968. The Line Intersect Method in Forest Fuel Sampling. Forest Science. 14(1): 20-26.