Downstream Aquatic Habitat Study Report

R.L. Harris Hydroelectric Project

FERC No. 2628

Prepared for:

Alabama Power Company

Prepared by:

Kleinschmidt Associates

Revised November 2021

This Page Intentionally Left Blank

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Alabama Power Company (Alabama Power) owns and operates the R.L. Harris Hydroelectric Project (Harris Project), licensed by the Federal Energy Regulatory Commission (FERC or Commission) (FERC Project No. 2628). The Harris Project consists of a dam, spillway, powerhouse, and those lands and waters necessary for the operation of the hydroelectric project and enhancement and protection of environmental resources.

Alabama Power began operating the Harris Project in 1983. Initially, the Harris Project operated in peaking mode with no intermittent flows between peaks. Subsequently, agencies and non-governmental organizations requested that Alabama Power modify operations to potentially enhance downstream aquatic habitat. In 2005, based on recommendations developed in cooperation with stakeholders, Alabama Power implemented a pulsing scheme for releases from Harris Dam known as the Green Plan (GP) (Kleinschmidt 2018a). The purpose of the GP was to reduce the effects of peaking operations on the aquatic community downstream. Although GP operations are not required by the existing license, Alabama Power has operated Harris Dam according to its guidelines since 2005.

Commonly used acronyms that may appear in this final report are included in Appendix A.

1.1 STUDY BACKGROUND

Monitoring conducted since initiation of the GP has indicated a positive fish community response due to increased shoal habitat availability (Irwin et al. 2011); however, there is little existing information characterizing the extent that the GP has enhanced the aquatic habitat from Harris Dam downstream through Horseshoe Bend.

During the October 19, 2017 issue identification workshop, several stakeholders noted Tallapoosa River downstream flows and water temperature as potential issues at the Harris Project. On November 13, 2018, Alabama Power filed ten proposed study plans for the Harris Project, including a study plan for downstream aquatic habitat. FERC issued a Study Plan Determination on April 12, 2019, which included FERC staff recommendations. Alabama Power incorporated FERC's recommendations and filed the Final Study Plans with FERC on May 13, 2019.

The goal of this study is to develop a model that describes the relationship between GP operations (baseline) and aquatic habitat. Alabama Power intended to use this model to analyze the effects of downstream release alternatives on aquatic habitat in Phase 2 of the Downstream Release Alternatives Study, in which Alabama Power proposed to model Pre-Green Plan (PGP) operations, a continuous minimum flow (CMF) of 150 cubic feet per second (cfs), and an alternative/modified GP (i.e., changing the time of day in which GP pulses are released). However, in an effort to provide information to stakeholders earlier in the process, Alabama Power used the model to analyze the PGP operations alternative and the 150 CMF alternative, and the results were included in the Draft Downstream Aquatic Habitat Study Report. The complete suite of alternatives, including GP, were analyzed and the effects on habitat are presented in the Downstream Release Alternatives Phase 2 Study Report. Alabama Power prepared and filed the Draft Downstream Aquatic Habitat Study with FERC on June 30, 2020. Concurrently, Alabama Power distributed the draft report to the Harris Action Team (HAT) 3 (Fish and Wildlife) participants. Stakeholders provided comments on the Draft Downstream Aquatic Habitat Study Report, and this Final Downstream Aquatic Habitat Study Report addresses the comments received.

After reviewing the comments on the Draft Downstream Aquatic Habitat Study Report and the FERC-approved study plans for the Downstream Aquatic Habitat Study Report, Aquatic Resources, and Downstream Release Alternatives Study, Alabama Power determined that all temperature data and relevant discussion and conclusions on water temperature in the Tallapoosa River below Harris Dam should be analyzed in the Aquatic Resources Report and Downstream Release Alternatives Study Report. Therefore, temperature data and associated figures that were included in the Draft Downstream Aquatic Habitat Study Report have been moved to the Final Aquatic Resources Report.

This final report was prepared to support the relicensing process and to fulfill the requirements of the FERC-approved Downstream Aquatic Habitat Study Plan.

2.0 METHODS

2.1 MESOHABITAT ANALYSIS

A desktop analysis of the types of available habitat in the Tallapoosa River was conducted using Geographic Information Systems (GIS) and aerial imagery from the U.S. Department of Agriculture National Agriculture Imagery Program (NAIP). A polygon shapefile of the Tallapoosa River from Harris Dam through Horseshoe Bend was obtained from the U.S. Geological Survey's (USGS) national hydrography dataset. The polygon was divided and classified into the following habitat categories:

- Riffle/Shoal: shallow, moderate velocity, turbulent, high gradient, moderate to large substrates (cobble/gravel)
- Run: shallow, moderate to high velocity, turbulent, chutes and eddies present, high gradient, large substrates, or bedrock
- Pool: deep, low velocity, well defined hydraulic control at outlet

Habitat characterizations were verified with field observations obtained during water level monitoring and discharge measurement events. Results were depicted graphically using GIS, and quantitatively summarized in tabular format.

2.2 WATER LEVEL MONITORING

Alabama Power deployed 20 water level/temperature loggers ("loggers" or "level loggers") (Onset U20L-04) within a 48-mile reach of the Tallapoosa River from Harris Dam through Horseshoe Bend to Irwin Shoals beginning in April 2019[1] (Figure 2-1). Although Irwin Shoals is located roughly 4.5 miles downstream of the FERC-approved geographic scope of this study[2] (Harris Dam through Horseshoe Bend), a level logger was deployed at that location, and channel profile data was gathered downstream to Jaybird Landing. The level loggers were set to record measurements at 15-minute intervals, and were deployed on the river bottom in protective, vented PVC tubes, attached to a weight via steel cable, and tethered to a tree on the streambank or other in-river structure, when available. A separate logger was deployed near Harris Dam to record ambient (barometric) pressure, which was used to convert the pressure readings from the water

[1] Loggers were initially targeted for installation in fall 2018, though high river flows from fall 2018 through spring 2019 prevented installation until April 2019.

[2] The geographic scope is also referred to herein as "study area".

level loggers into water depth using the manufacturer's software (HOBOware Pro version 3.7.14).

Data was downloaded from level loggers in the field twice between April 2019 and April 2020 to prevent the loggers from reaching their data storage capacity. On one occasion, malfunctioning equipment caused faulty data transfers and portions of data were lost from four level loggers (logger numbers 12, 14, 18, 20) (Figure 2-1). Therefore, 4 of the 20 loggers, including the logger at Irwin Shoals, did not provide continuous, 15-minute data through April 2020 and were omitted from this analysis; however, water level fluctuation results are provided from Harris Dam through Horseshoe Bend, consistent with the geographic scope of the study plan. Data collected from all level loggers is provided in Appendix B. Line plots of the level logger data are presented in Appendix C.

2.3 CHANNEL PROFILE DATA COLLECTION

The Study Plan indicated that an Acoustic Doppler Current Profiler would be used to collect channel profile data as part of the study. However, due to the shallow nature of the river at many cross-sections, this method was found to be impractical. As such, two alternate methods were used as described below.

In areas with sufficient depth for boating, a Global Positional System (GPS)/Global Navigation Satellite System (GNSS) rover antenna (Trimble R10) mounted above a 200 kilohertz (kHz) echosounder (CEE-LINE, CEE Hydrosystems) was mounted to a kayak and used to collect river bottom elevations at 1-second intervals as the surveyor paddled in a path across the river channel perpendicular to the flow.

In areas where there was insufficient depth for boating, the GPS/GNSS rover antenna was mounted on a 2-meter survey rod and river bottom elevations were collected manually at approximately 10-foot intervals in a path across the river channel perpendicular to the flow. The average horizontal and vertical accuracy of these survey data was 0.08 feet and 0.15 feet, respectively.

2.4 MODELING

A detailed description of the Hydrologic Engineering Center River Analysis System (HEC-RAS) model is provided in the Operating Curve Change Feasibility Analysis Phase 1 Report and the Downstream Release Alternatives Phase 1 Report[3]. To briefly summarize, an existing HEC-RAS model for the Tallapoosa River[4] was updated using data from 2018 Light Detection and Ranging (LiDAR) data/imagery and 2019 bathymetric surveys. A total of 120 bathymetric cross sections between Wadley and the Martin reservoir were surveyed and incorporated into the HEC-RAS model.

Based on analysis of the unimpaired flow dataset, 2001 was selected as a "normal" water year as inflows to the Harris Project were closest to the median, and hourly flow data was available for that year. Since 2001 pre-dated GP implementation, hourly discharge records for Harris Dam were used to model the PGP scenario. The GP scenario was developed by applying existing GP rules to the PGP releases. The 150 CMF scenario was developed by amending the PGP scenario such that no hourly interval had less than a 150 cfs discharge from Harris Dam. Lateral inflow hydrographs were developed based on USGS gauge data for 2001 from the Wadley and Horseshoe Bend sites to represent tributary inputs.

The HEC-RAS model was used to simulate river conditions between Harris Dam and Jaybird Landing. Hourly outputs of wetted perimeter[5] and water surface elevation from model simulations of PGP, GP, and 150 CMF were analyzed to determine and compare hourly, daily, and seasonal trends. As noted in Section 1.1, all downstream release alternatives, including GP (baseline), were modeled using the same methods summarized herein and described in detail in the Downstream Release Alternatives Phase 2 Study Report.

[3] The Operating Curve Change Feasibility Analysis Phase 1 Report and the Downstream Release Alternatives Phase 1 Report are available on the R.L. Harris Hydroelectric Project Relicensing Website: http://www.harrisrelicensing.com.

[4] The geographic scope of this study is the Tallapoosa River below Harris Dam through Horseshoe Bend. The model was developed to run simulations from Harris Dam to Jaybird Landing (approximately river mile 88) which represents the point where Lake Martin begins.

[5] Wetted perimeter is the portion of the river bed and banks that is in contact with the water in the channel. More detail on wetted perimeter is included in Section 3.3.

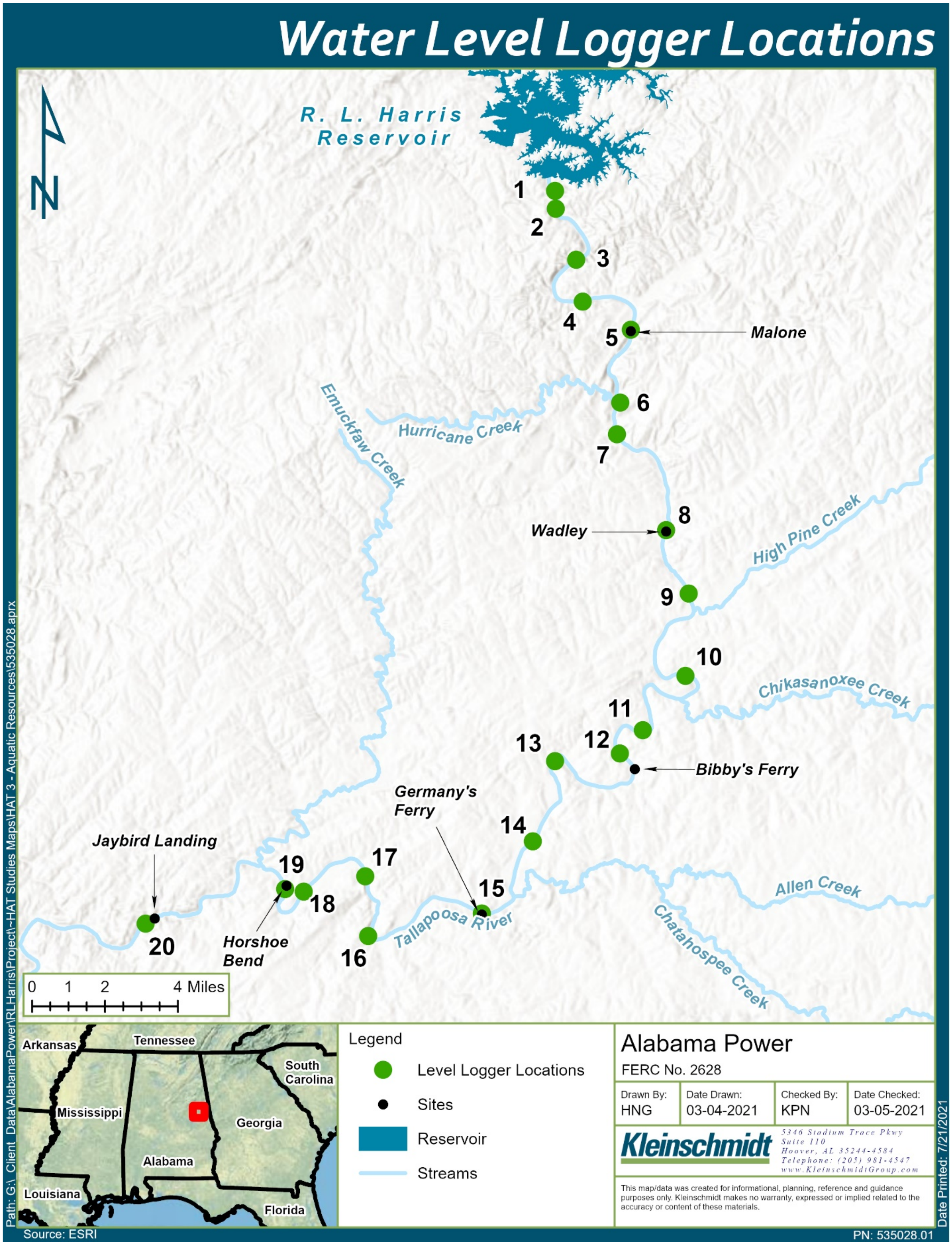


FIGURE 2-1 WATER LEVEL LOGGER LOCATIONS

3.0 RESULTS

3.1 MESOHABITAT ANALYSIS

The desktop mesohabitat analysis indicated that the Tallapoosa River from Harris Dam to Jaybird Landing is comprised of approximately 47 percent pool (366.3 hectare (ha)), 44 percent riffle/shoal (343 ha), and 10 percent run habitat (74.7 ha) (Table 3-1). Pools were the most abundant habitat type in the Malone (Harris Dam to Malone; 7 river miles), Bibby's Ferry (Wadley to Bibby's Ferry; 9 river miles), Germany's Ferry (Bibby's Ferry to Germany's Ferry; 8.5 river miles), and Horseshoe Bend (Germany's Ferry to Horseshoe Bend; 9.5 river miles) reaches. Riffles/shoals were the most abundant habitat type in the Wadley (Malone to Wadley; 7 river miles) and Jaybird Landing (Horseshoe Bend to Jaybird Landing; 6 river miles) reaches, where the density of riffle/shoal habitat was two to four times higher than the other reaches (Figure 3-1). Figure 3-2 toFigure 3-7 provide aerial views of mesohabitat classification.

TABLE 3-1 SUMMARY OF MESOHABITAT ANALYSIS RESULTS

Reach	Habitat Type					
	Pool		Riffle/Shoal		Run	
	ha	%	ha	%	ha	%
Malone	50.7	46%	31.3	28%	28.7	26%
Wadley	20.4	17%	91.9	77%	7.5	6%
Bibby's Ferry	86.3	55%	50.1	32%	19.1	12%
Germany's Ferry	60.3	57%	35.9	34%	10.0	9%
Horseshoe Bend	60.7	75%	18.9	23%	1.1	1%
Jaybird Landing	87.9	42%	114.8	54%	8.2	4%
Study Area Grand Total (ha)	**366.3**		**343.0**		**74.7**	
Study Area Percent of Total	**46.7%**		**43.8%**		**9.5%**	

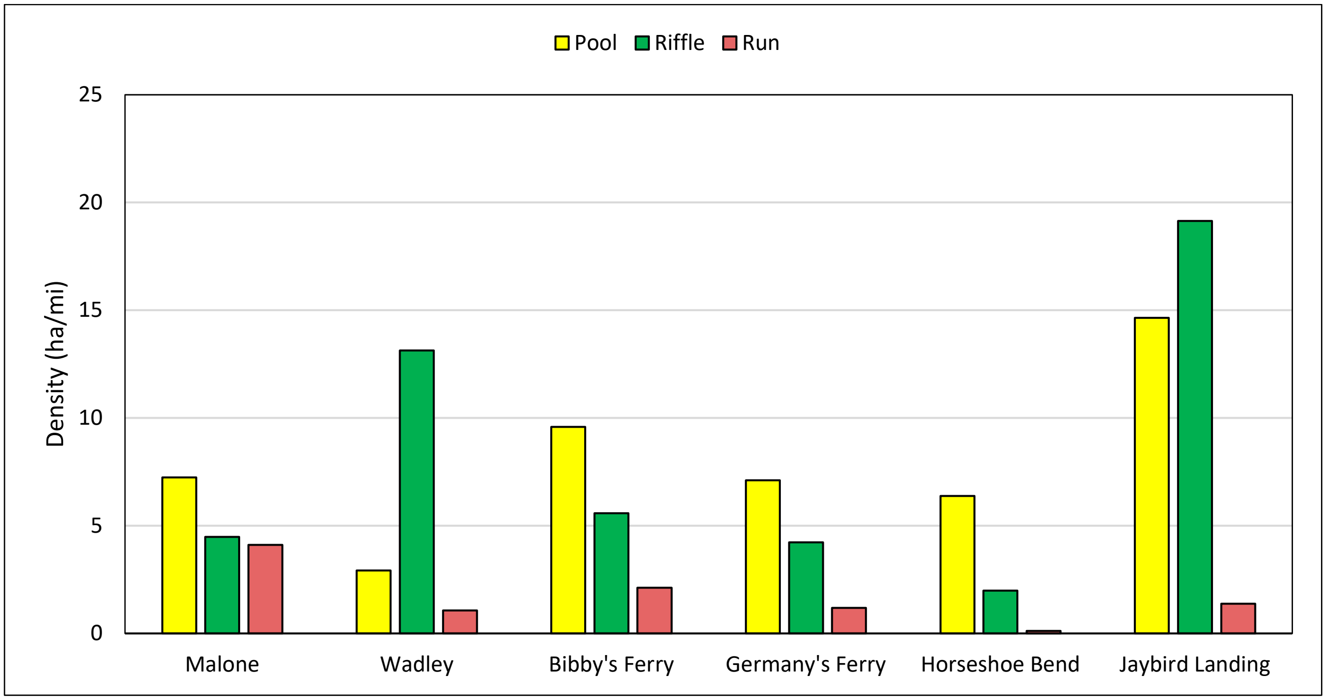


FIGURE 3-1 DENSITY OF MESOHABITAT TYPES BY REACH

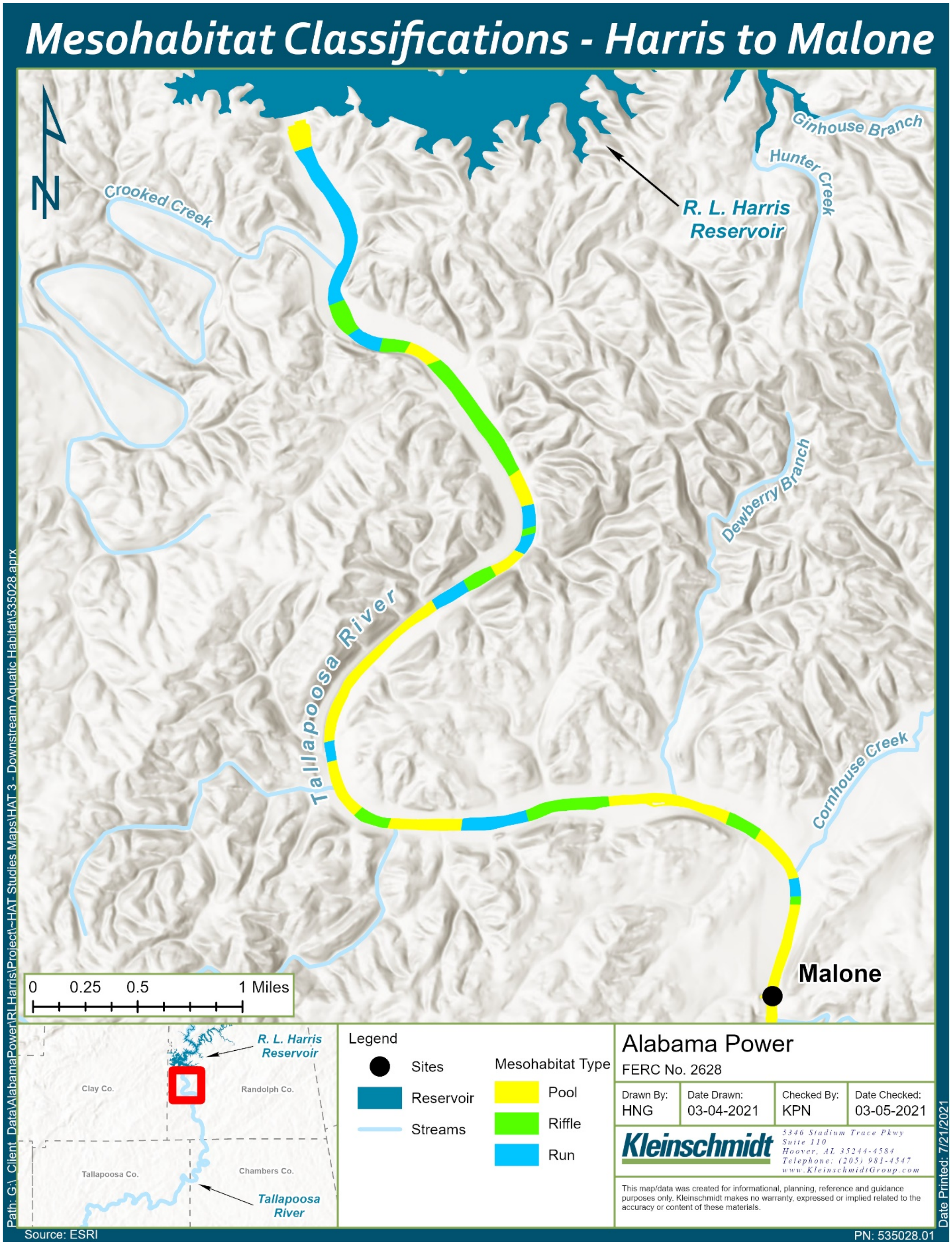


FIGURE 3-2 MESOHABITAT CLASSIFICATIONS – HARRIS DAM TO MALONE

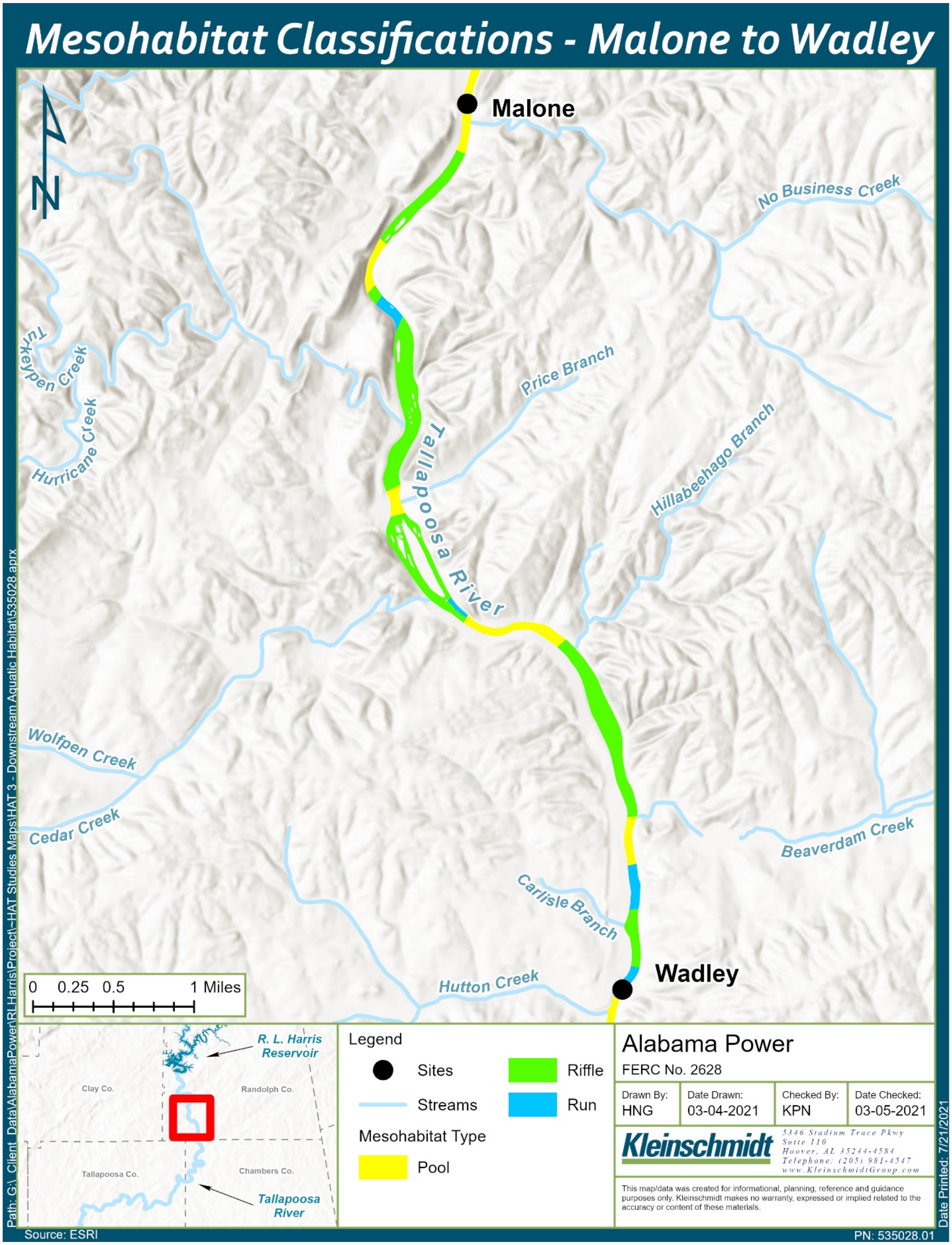


FIGURE 3-3 MESOHABITAT CLASSIFICATIONS – MALONE TO WADLEY

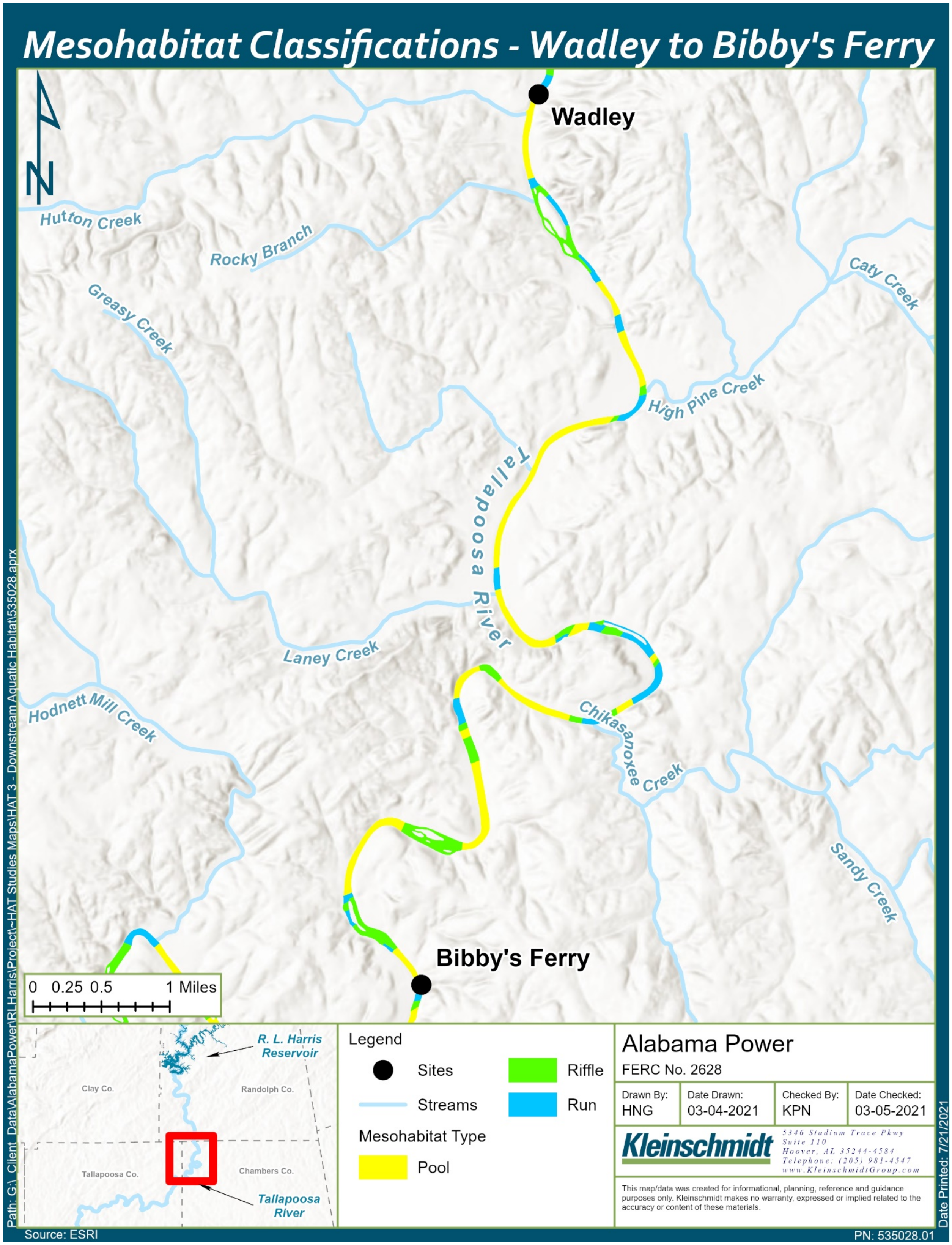


FIGURE 3-4 MESOHABITAT CLASSIFICATIONS – WADLEY TO BIBBY'S FERRY

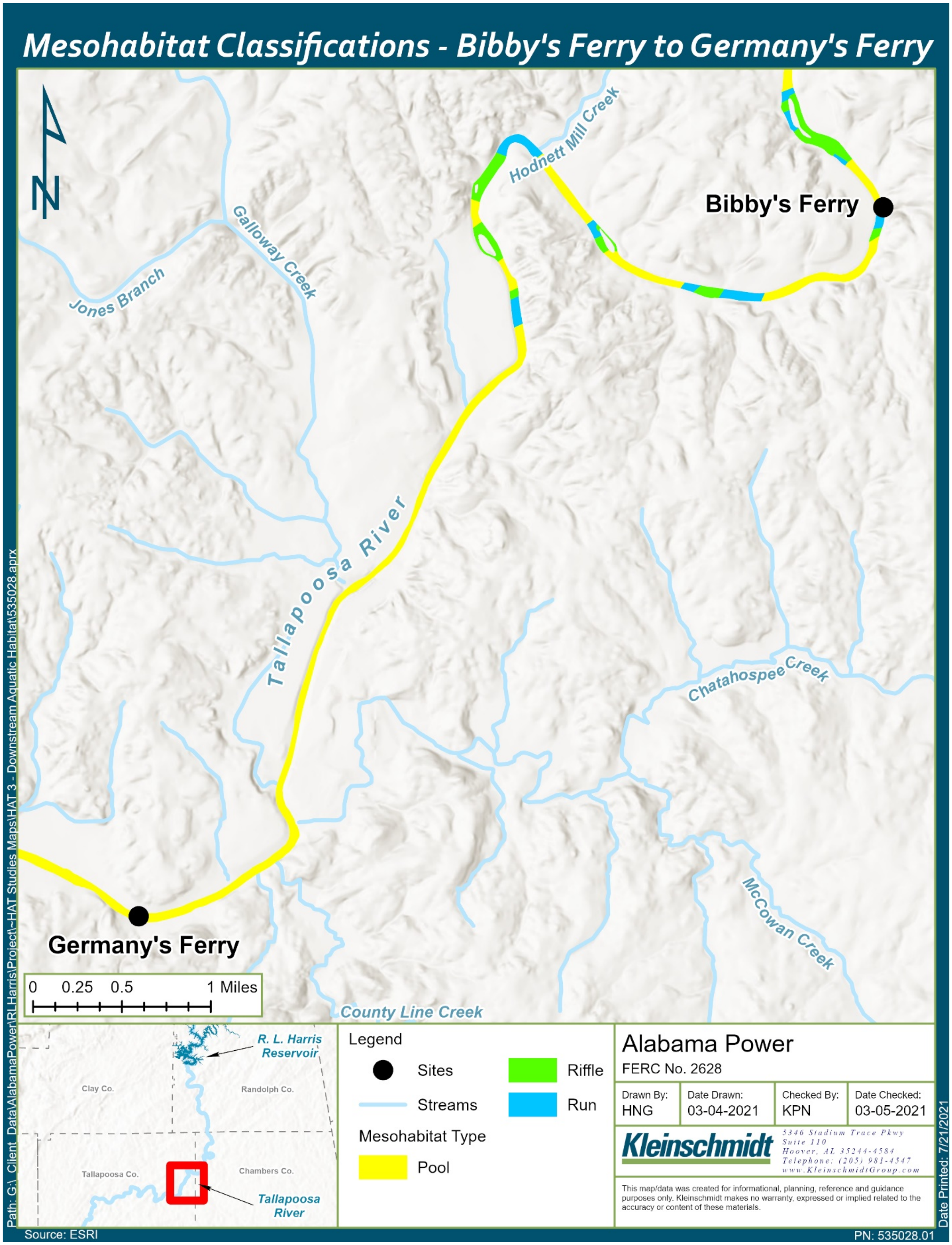


FIGURE 3-5 MESOHABITAT CLASSIFICATIONS – BIBBY'S FERRY TO GERMANY'S FERRY

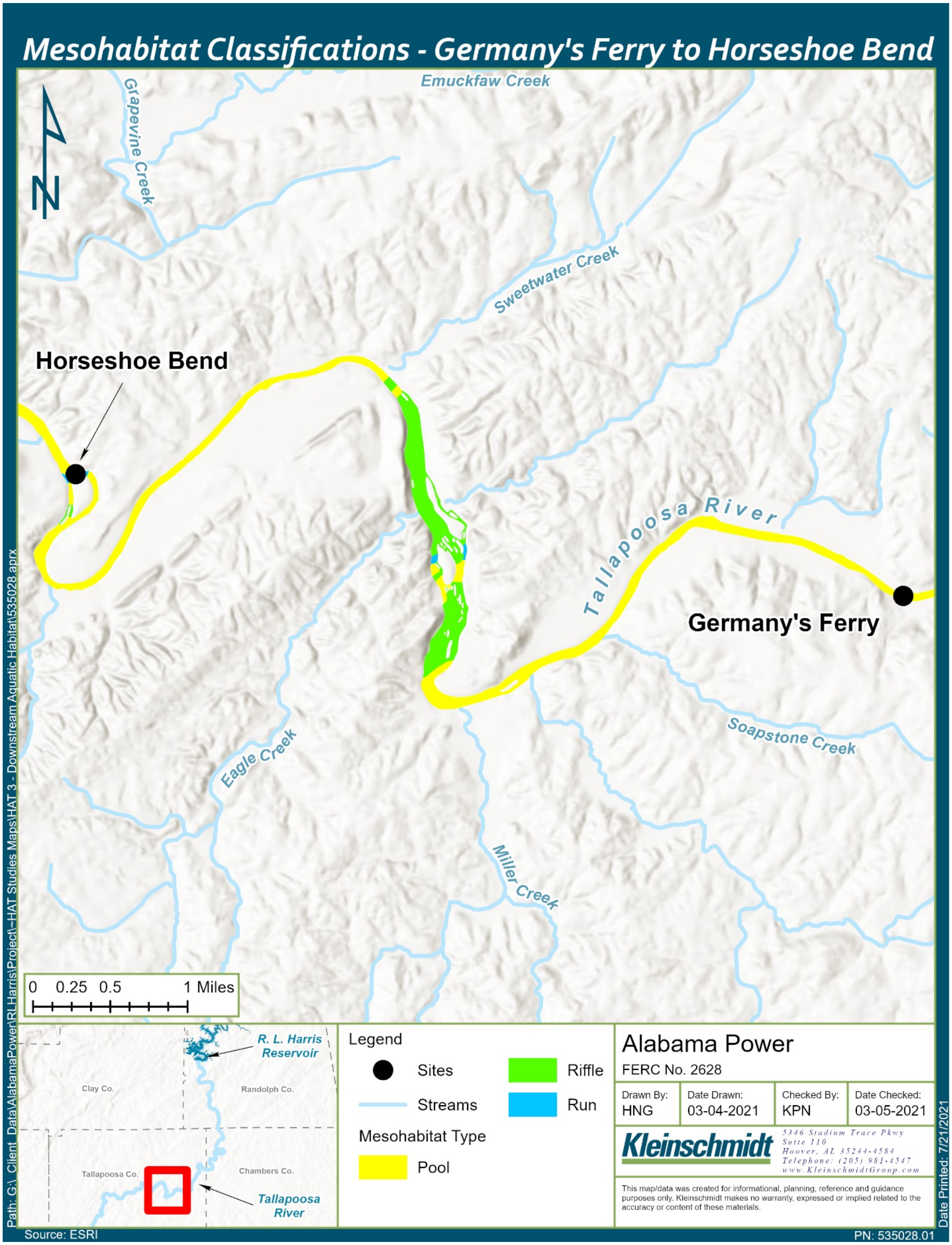


FIGURE 3-6 MESOHABITAT CLASSIFICATIONS – GERMANY'S FERRY TO HORSESHOE BEND

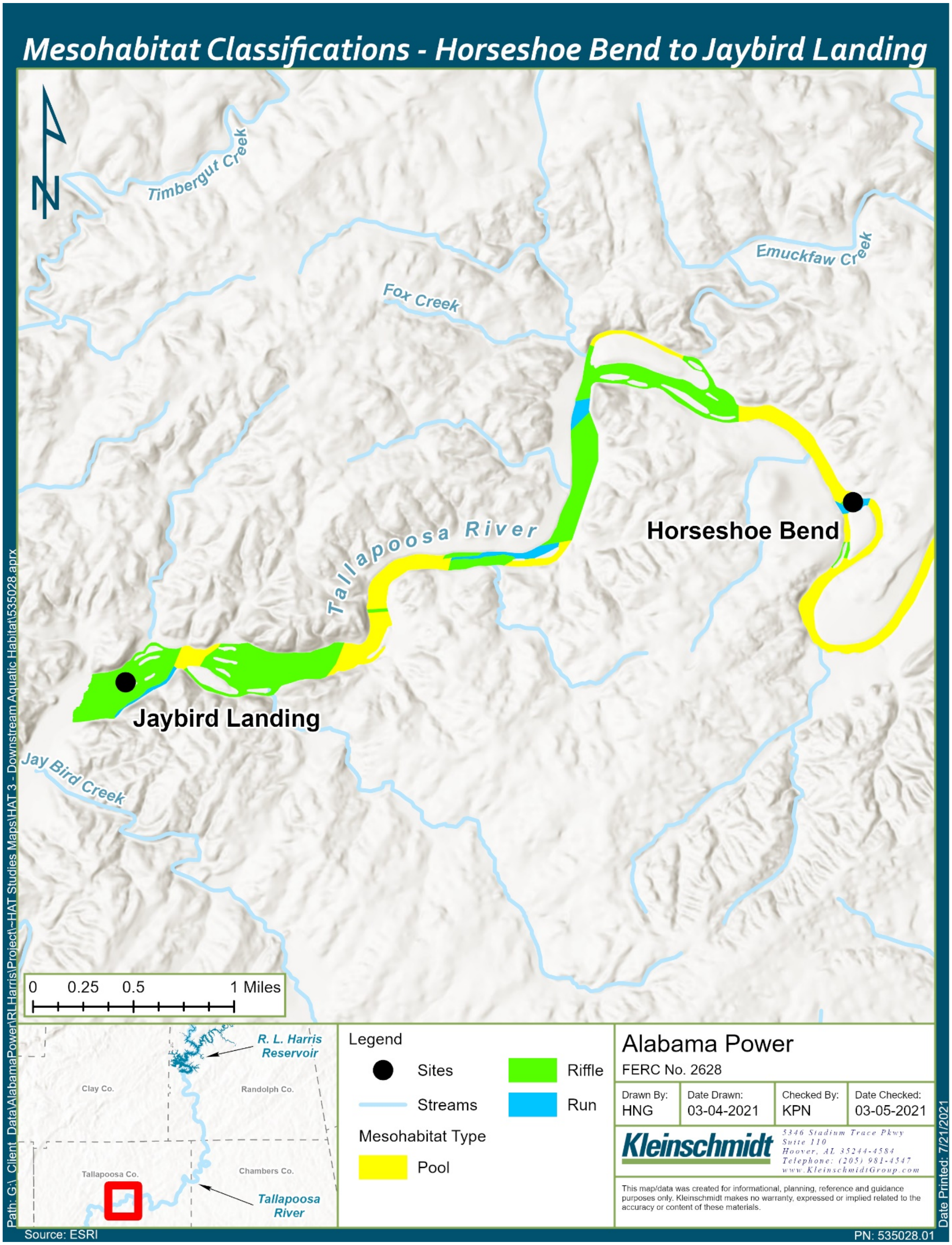
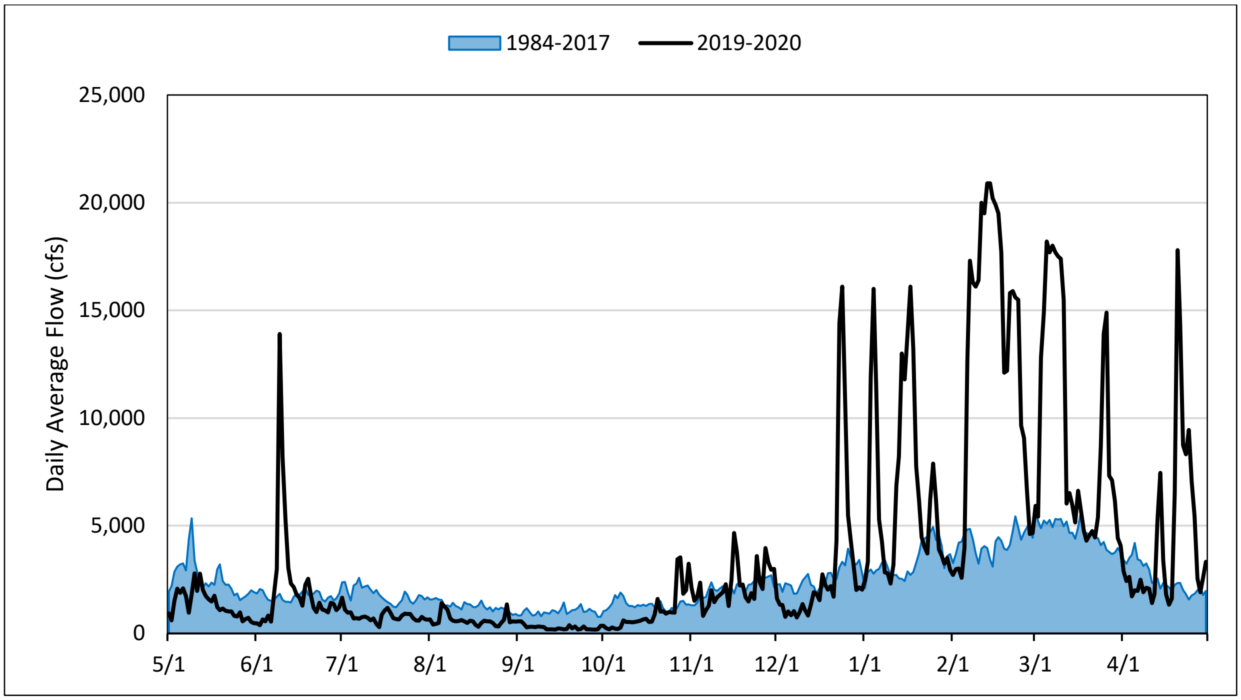


FIGURE 3-7 MESOHABITAT CLASSIFICATIONS – HORSESHOE BEND TO JAYBIRD LANDING

3.2 WATER LEVEL

3.2.1 STUDY PERIOD HYDROLOGY

River flow between May 2019 and April 2020, as measured at the USGS Wadley gauge (Site No. 02414500; USGS 2020), ranged from a maximum of 20,900 cfs (February 13-14, 2020) to a minimum of 181 cfs (September 27, 2019). River flows during August and September 2019 were lower than long-term (1984-2017) averages, and higher in January to March 2020 (Figure 3-8).



Source: USGS 2020

FIGURE 3-8 LONG-TERM AND 2019-2020 DAILY AVERAGE RIVER FLOW AT WADLEY

3.2.2 STUDY AREA HYDROGRAPHY

The 604-square mile (sq mi) drainage area for the Tallapoosa River between Harris Dam and Horseshoe Bend includes 23 named tributaries. Five of these tributaries, Crooked Creek, Cornhouse Creek, High Pine Creek, Chikasanoxee Creek, and Chatahospee Creek, drain 71 percent (428 sq mi) of this area. Table 3-2 provides a summary of the location and drainage area of all 23 named tributaries within the study area.

Figure 3-9 provides a graphical depiction of the mean river bed elevation for the Tallapoosa River from Harris Dam to Horseshoe Bend based on bathymetry data developed for the HEC-RAS model. Within this study area, the elevation of the river bed decreases approximately 3.5 feet per mile. The reach between Malone and Wadley had the highest bed slope (5.5 feet per mile) and the reach between Bibby's Ferry and Germany's Ferry had the lowest bed slope (1.7 feet per mile).

TABLE 3-2 SUMMARY OF STUDY AREA TRIBUTARY LOCATIONS AND DRAINAGE AREAS

Reach	Tributary	Miles Below Dam	Drainage Area (sq mi)	% Study Area Drainage Area
Malone	Crooked Creek	0.8	98.3	16.3%
	Dewberry Branch	5.8	1.3	0.2%
	Cornhouse Creek	6.5	56.0	9.3%
	UT[1]/Direct Runoff		10.3	1.7%
		Reach Total	**166.0**	**27.5%**
Wadley	No Business Creek	7.3	6.0	1.0%
	Hurricane Creek	9.5	14.8	2.4%
	Price Branch	10	0.9	0.1%
	Cedar Creek	10.7	10.6	1.7%
	Hillabeehago Branch	11.7	2.0	0.3%
	Beaverdam Creek	12.8	12.5	2.1%
	Carlisle Branch	13.6	1.2	0.2%
	UT/Direct Runoff		7.6	1.3%
		Reach Total	**55.5**	**9.2%**
Bibby's Ferry	Hutton Creek	14.1	10.4	1.7%
	Rocky Branch	14.7	1.2	0.2%
	High Pine Creek	16.4	78.7	13.0%
	Laney Creek	18.4	4.7	0.8%
	Chikasanoxee Creek	20.7	76.1	12.6%
	UT/Direct Runoff		14.0	2.3%
		Reach Total	**185.0**	**31%**
Germany's Ferry	Hodnett Mill Creek	27.8	9.2	1.5%
	Galloway Creek	31	7.0	1.2%
	Chatahospee Creek	32.4	118.8	19.7%
	County Line Creek	32.6	15.7	2.6%
	UT/Direct Runoff		10.3	1.7%
		Reach Total	**161.0**	**26.7%**
Horseshoe Bend	Soapstone Creek	36	1.6	0.3%
	Miller Creek	37	4.8	0.8%
	Eagle Creek	38.5	6.5	1.1%
	Sweetwater Creek	39.5	3.6	0.6%
	UT/Direct Runoff		20.7	3.4%
		Reach Total	**37.0**	**6.1%**
		Study Area Total	**604**	

[1] Unnamed Tributaries

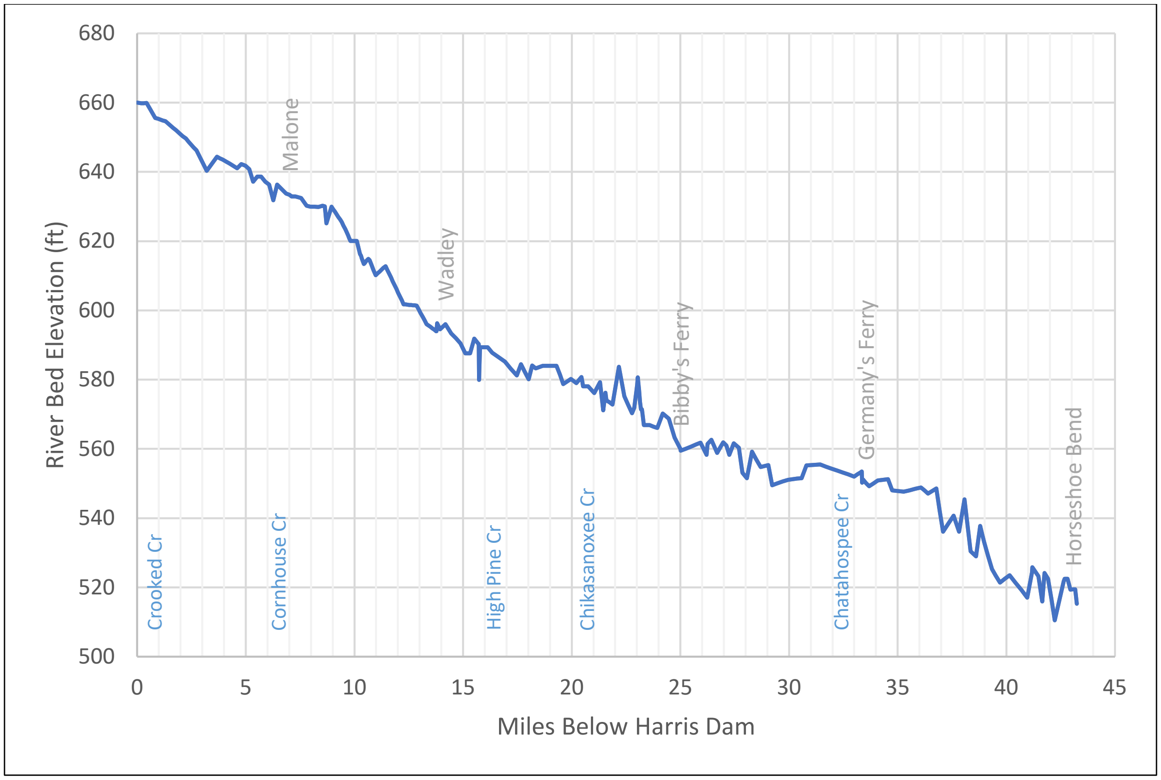


FIGURE 3-9 TALLAPOOSA RIVER BED ELEVATION PROFILE

3.2.3 WATER LEVEL

Water level logger data were analyzed to determine the magnitude of fluctuations at daily and hourly intervals. The difference between the maximum and minimum water levels was calculated for each day between May 1, 2019 and April 30, 2020. Average daily water level fluctuations ranged from 5.0 feet to 0.9 feet and decreased as the flows attenuated with increasing distance from Harris Dam (Figure 3-10; Table 3-3). The difference between the maximum and minimum water level for each hour was calculated for each day between May 1, 2019 and April 30, 2020. Average hourly water level fluctuations ranged from 0.48 feet to 0.06 feet and were inversely related with distance from Harris Dam (Figure 3-11; Table 3-4.

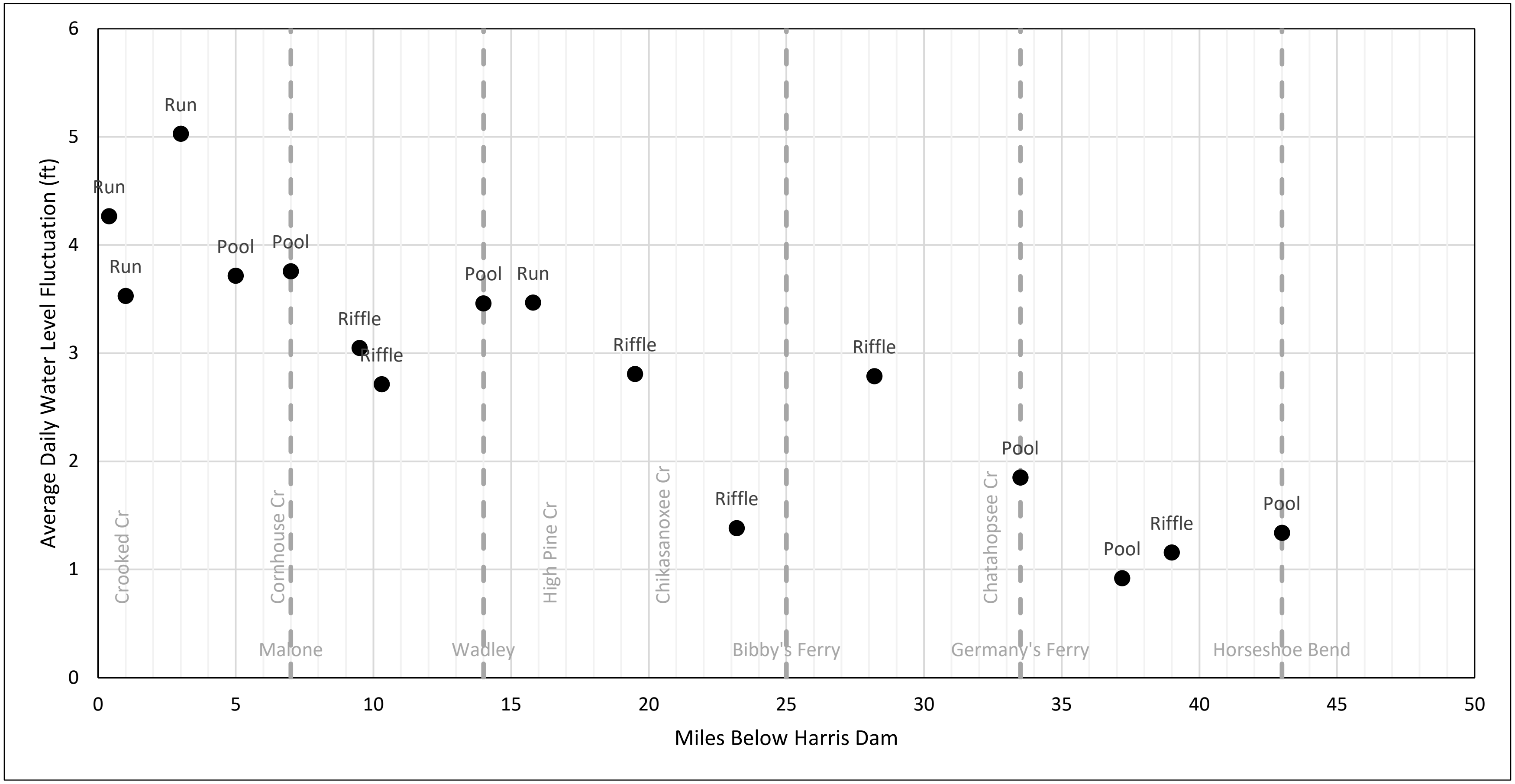


FIGURE 3-10 AVERAGE DAILY WATER LEVEL FLUCTUATION FROM MAY 2019 TO APRIL 2020

TABLE 3-3 SUMMARY OF DAILY WATER LEVEL FLUCTUATIONS

Reach	Miles Below Harris Dam	Logger Number	Mesohabitat Type	Mean[1] (ft)	Minimum (ft)	Maximum (ft)	Median (ft)	25th Percentile (ft)	75th Percentile (ft)
Malone	0.4	1	Run	4.3 (1.4)	0.1	8.4	4.6	4.5	4.8
	1.0	2	Run	3.5 (1.2)	0.1	8.1	3.8	3.6	4.0
	3.0	3	Run	5.0 (2.1)	0.1	12.6	5.9	4.3	6.3
	5.0	4	Pool	3.7 (1.5)	0.1	9.5	4.3	3.1	4.6
	7.0	5	Pool	3.8 (1.7)	0.1	10.1	4.3	2.6	5.0
Wadley	9.5	6	Riffle	3.0 (1.4)	0.1	8.3	3.5	2.2	3.9
	10.3	7	Riffle	2.7 (1.2)	0.1	7.3	3.1	2.0	3.5
	14.0	8	Pool	3.5 (1.6)	0.1	10.6	3.8	2.2	4.7
Bibby's Ferry	15.8	9	Run	3.5 (2.0)	0.2	13.6	3.9	1.6	4.9
	19.5	10	Riffle	2.8 (1.7)	0.2	12.1	2.9	1.3	3.9
	23.2	11	Riffle	1.4 (0.8)	0.1	6.6	1.4	0.8	1.8
Germany's Ferry	28.2	13	Riffle	2.8 (1.8)	0.1	13.7	2.7	1.3	3.9
	33.5	15	Pool	1.9 (1.4)	0.1	9.5	1.7	0.7	2.7
Horseshoe Bend	37.2	16	Pool	0.9 (0.7)	0.1	4.0	0.8	0.4	1.3
	39.0	17	Riffle	1.2 (0.8)	0.1	5.8	1.1	0.5	1.6
	43.0	19	Pool	1.3 (0.9)	0.1	5.6	1.2	0.5	1.9

[1]Standard Deviation in Parentheses

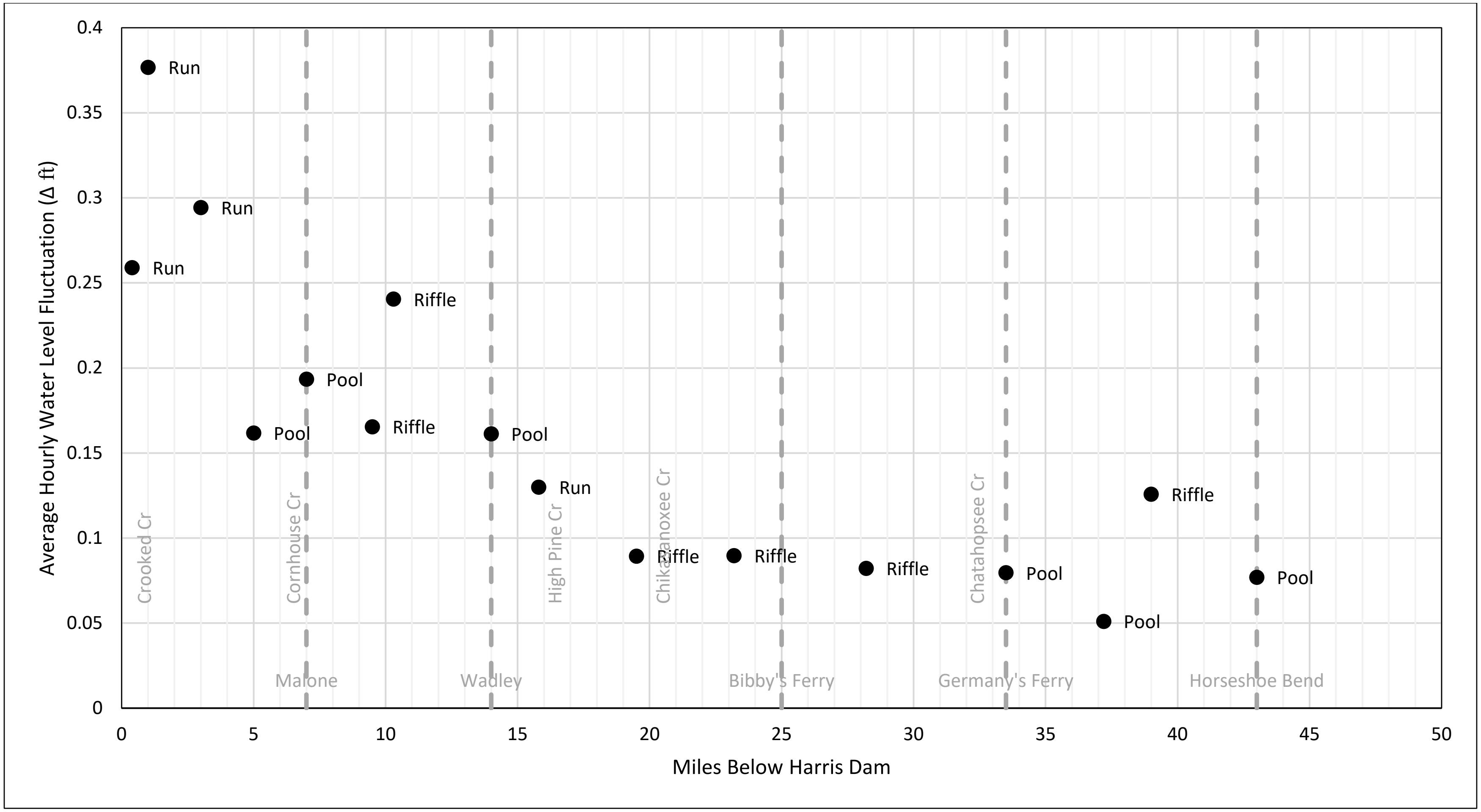


FIGURE 3-11 AVERAGE HOURLY WATER LEVEL FLUCTUATION FROM MAY 2019 TO APRIL 2020

TABLE 3-4 SUMMARY OF HOURLY WATER LEVEL FLUCTUATIONS

Reach	Miles Below Harris Dam	Logger Number	Mesohabitat Type	Mean[1] (ft)	Minimum (ft)	Maximum (ft)	Median (ft)	25th Percentile (ft)	75th Percentile (ft)
Malone	0.4	1	Run	0.45 (0.95)	0.00	6.00	0.04	0.01	0.14
	1.0	2	Run	0.48 (1.07)	0.00	5.40	0.03	0.01	0.14
	3.0	3	Run	0.48 (0.47)	0.00	5.15	0.10	0.02	0.78
	5.0	4	Pool	0.40 (0.62)	0.00	4.38	0.16	0.05	0.45
	7.0	5	Pool	0.38 (0.63)	0.00	5.08	0.15	0.05	0.45
Wadley	9.5	6	Riffle	0.27 (0.44)	0.00	3.87	0.13	0.04	0.31
	10.3	7	Riffle	0.27 (0.48)	0.00	4.00	0.13	0.05	0.27
	14.0	8	Pool	0.29 (0.45)	0.00	4.67	0.14	0.05	0.35
Bibby's Ferry	15.8	9	Run	0.28 (0.46)	0.00	4.82	0.11	0.05	0.31
	19.5	10	Riffle	0.21 (0.28)	0.00	3.09	0.10	0.05	0.25
	23.2	11	Riffle	0.10 (0.13)	0.00	1.24	0.06	0.03	0.12
Germany's Ferry	28.2	13	Riffle	0.20 (0.27)	0.00	2.80	0.10	0.05	0.23
	33.5	15	Pool	0.12 (0.15)	0.00	1.56	0.06	0.03	0.16
Horseshoe Bend	37.2	16	Pool	0.06 (0.08)	0.00	2.02	0.04	0.02	0.08
	39.0	17	Riffle	0.08 (0.09)	0.00	0.96	0.04	0.02	0.10
	43.0	19	Pool	0.09 (0.10)	0.00	1.12	0.05	0.02	0.11

[1]Standard Deviation in Parentheses

3.3 WETTED PERIMETER

Detailed hourly outputs of wetted perimeter from HEC-RAS model runs of PGP, GP, and 150 CMF operational scenarios were analyzed and compared. Habitat duration was analyzed by calculating the percent of time a wetted perimeter value was exceeded for each width increment between the maximum and minimum value for selected model cross sections. An example of the calculation and interpretation of this analysis is provided below (Figure 3-12).

Wetted Perimeter (ft)
1
1.5
2
6
4
1
3
8
2
3

Bins (ft)	Count	Exceedence
> 0	10	100%
> 1	8	80%
> 2	5	50%
> 3	3	30%
> 4	2	20%
> 5	2	20%
> 6	1	10%
> 7	1	10%
> 8	0	0%

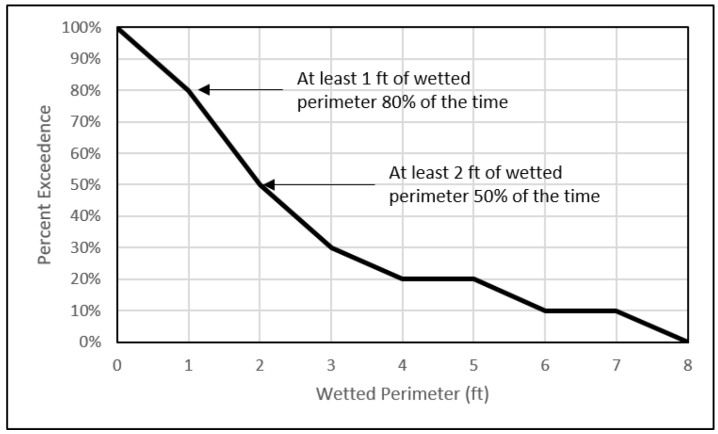


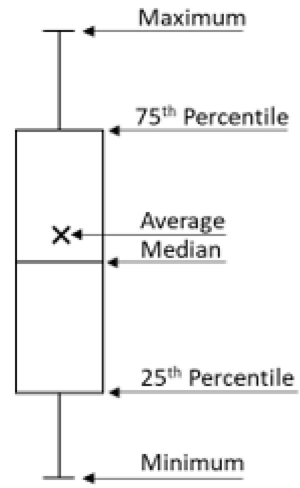
FIGURE 3-12 EXAMPLE OF WETTED PERIMETER DURATION CALCULATION

Results of these analyses are presented in Table 3-5, Figure 3-13, and Figure 3-14. Compared to the PGP scenario, the GP scenario shows modest increases in wetted perimeter at cross sections near the dam (0.25 – 2 miles downstream), with little appreciable difference further downstream. Compared to the GP scenario, the 150 CMF scenario shows an increase in wetted perimeter that becomes smaller with increasing distance from the dam. Comparisons for cross sections greater than 23 miles downstream of Harris Dam (near Bibby’s Ferry) are not presented as there was no difference in habitat duration curves for the three downstream release alternatives.

Seasonal differences in wetted perimeter between the three operational scenarios were examined by aggregating hourly HEC-RAS outputs by season, where:

- Winter = December, January, and February
- Spring = March, April and May
- Summer = June, July, and August
- Fall = September, October, and November

Box plots of seasonal analyses are presented in Figure 3-15 and Figure 3-16. The following legend applies to all box plots in this report, representing maximum, 75th percentile, average, median, 25th percentile, and minimum values.



Similar to the habitat duration results, seasonal analysis shows modest increases in median wetted perimeter at cross sections near the dam (0.25 – 2 miles downstream), especially during fall, with little appreciable difference further downstream. Compared to the GP scenario, the 150 CMF scenario shows an increase in wetted perimeter at cross sections near the dam, especially in fall, but only small increases at cross sections greater than 23 miles downstream of the dam.

The amount of daily wetted perimeter fluctuation - the difference between the maximum and minimum value for each day - was determined for each operational scenario. Box plots depicting seasonal daily wetted perimeter fluctuations are presented in Figure 3-17 and Figure 3-18. Results indicate smaller daily fluctuations under the GP scenario compared to the PGP. The 150 CMF had smaller daily fluctuations compared to the GP. At distances greater than 23 miles downstream of the dam, there were no differences in seasonal daily wetted perimeter fluctuations.

TABLE 3-5 SUMMARY OF WETTED PERIMETER RESULTS FROM MODEL SIMULATIONS

Miles Below Harris	Mesohabitat Type	Average Wetted Perimeter (ft)			Average Daily Wetted Perimeter Fluctuation (ft)		
		PGP	GP	150CMF	PGP	GP	150CMF
0.4	Riffle	321(-1.2%)	325	333(+2.5%)	88(-0.9%)	89	71(-20.2%)
1	Riffle	457(-0.5%)	459	462(+0.7%)	77(+3.2%)	75	69(-7.4%)
2	Riffle	346(-2.2%)	354	362(+2.4%)	93(+5.3%)	88	60(-31.5%)
4	Pool	288(-0.2%)	289	289(+0.2%)	16(+12.7%)	14	13(-6.7%)
7	Pool	272(-2.0%)	278	284(+2.3%)	98(+15.9%)	84	75(-11.3%)
10	Riffle	668(-0.3%)	670	673(+0.5%)	90(+5.4%)	85	83(-2.7%)
14	Run-Pool	290(-0.1%)	290	291(+0.3%)	15(+4.2%)	14	14(-4.6%)
19	Riffle-Run	343(-0.6%)	345	348(+0.7%)	134(+1.9%)	131	133(+1.0%)
23	Riffle	236(-0.5%)	238	240(+1.1%)	228(-0.2%)	229	232(+1.3%)
38	Riffle	724(-0.1%)	724	729(+0.6%)	56(+0.9%)	55	53(-3.3%)
43	Pool	506(-0.1%)	506	507(+0.3%)	20(+1.5%)	20	19(-2.2%)

NOTE: Numbers in parentheses represent percent difference from GP (baseline)

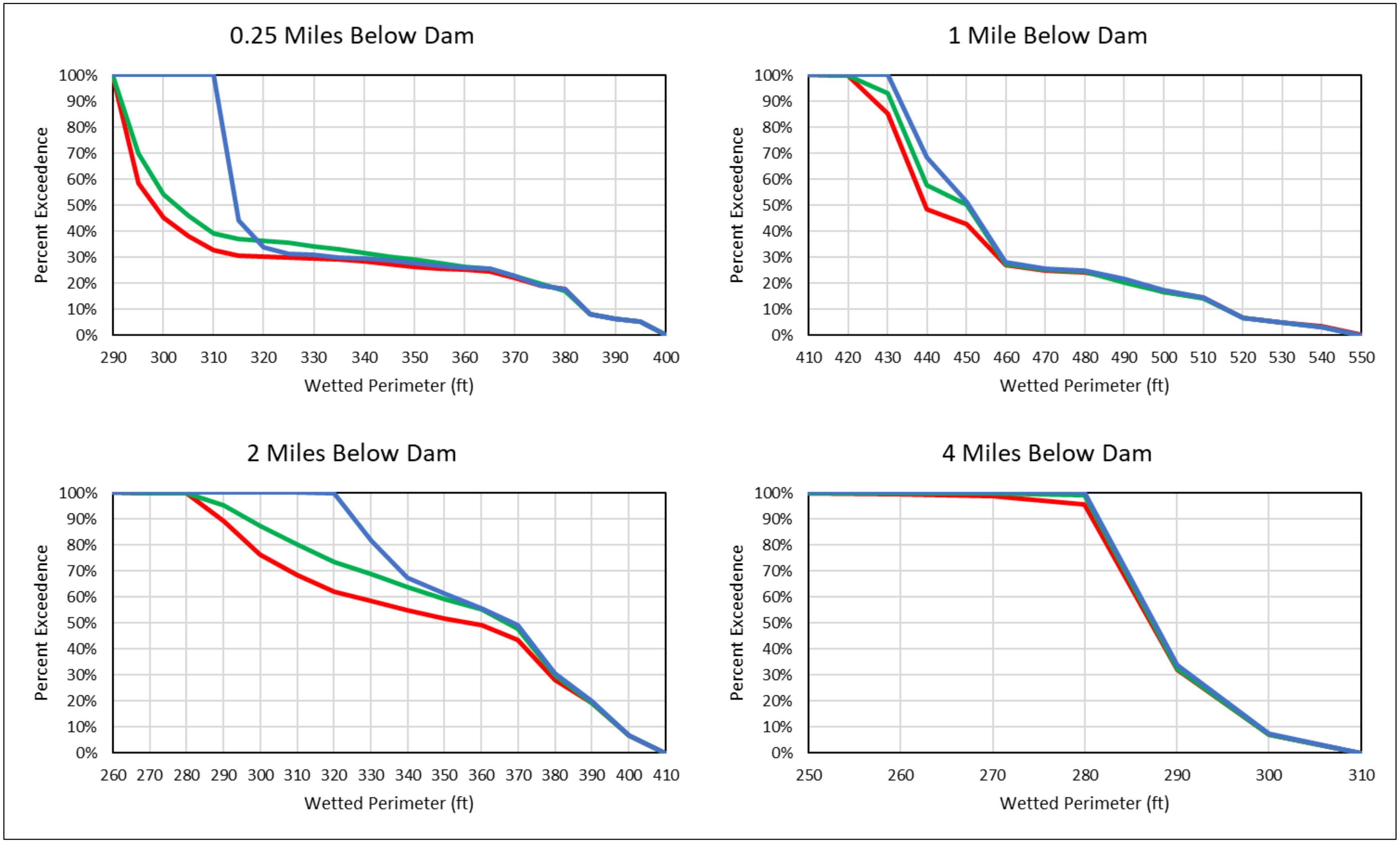


FIGURE 3-13 WETTED PERIMETER DURATION PLOTS OF PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 0.25 TO 4 MILES BELOW HARRIS DAM

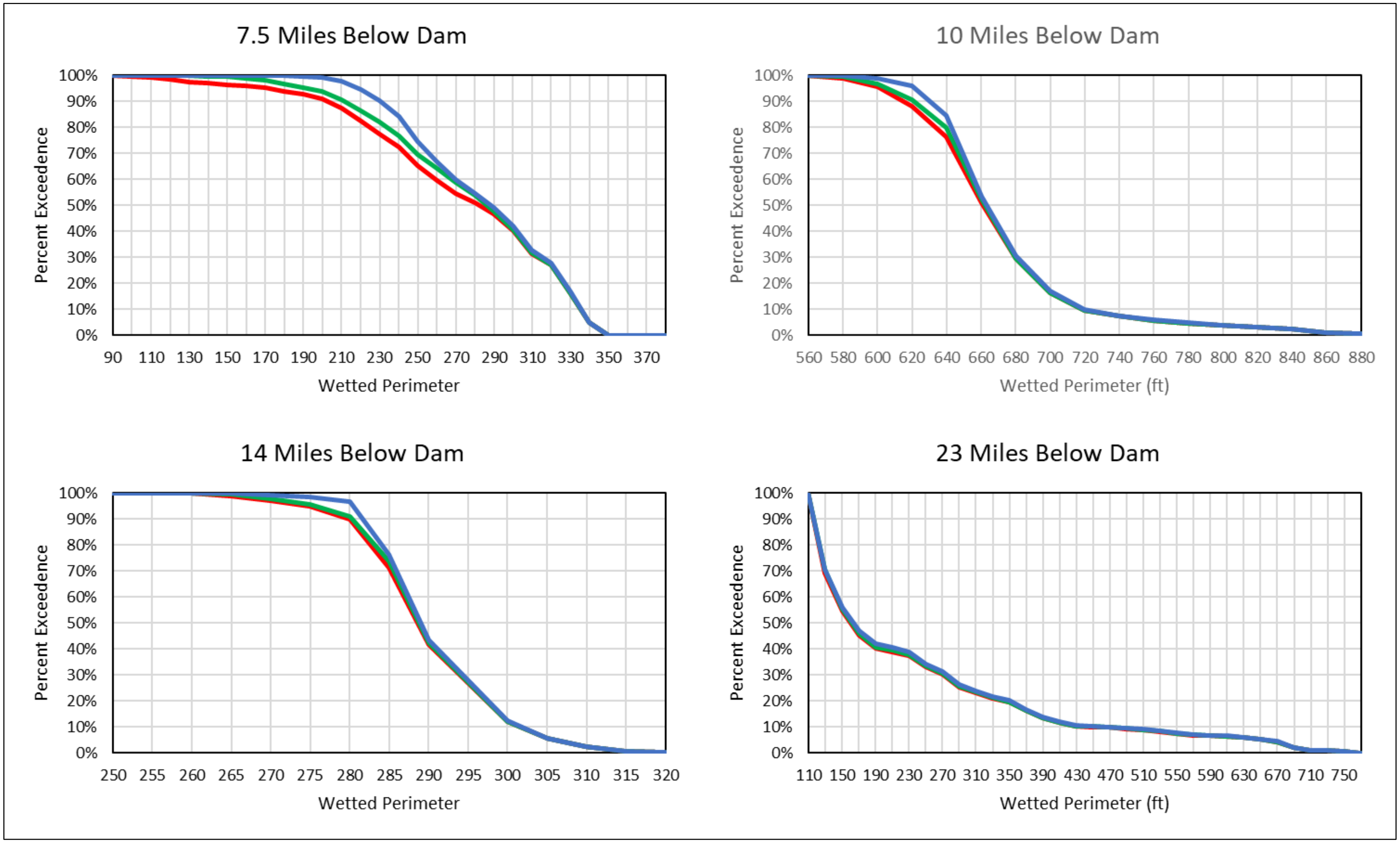


FIGURE 3-14 WETTED PERIMETER DURATION PLOTS OF PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 7.5 TO 23 MILES BELOW HARRIS DAM

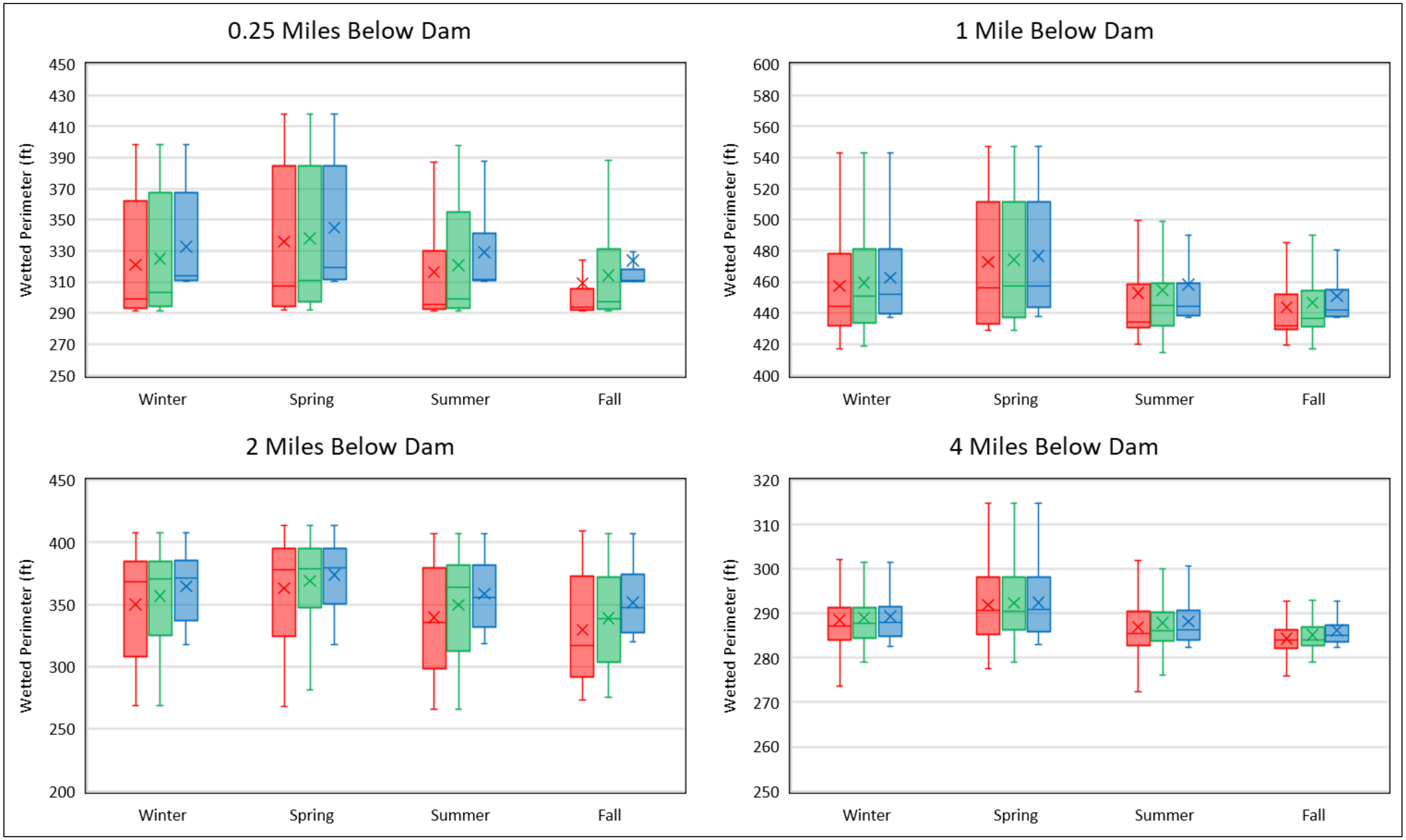


FIGURE 3-15 BOX PLOTS OF SEASONAL WETTED PERIMETER FOR PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 0.25 TO 4 MILES BELOW HARRIS DAM

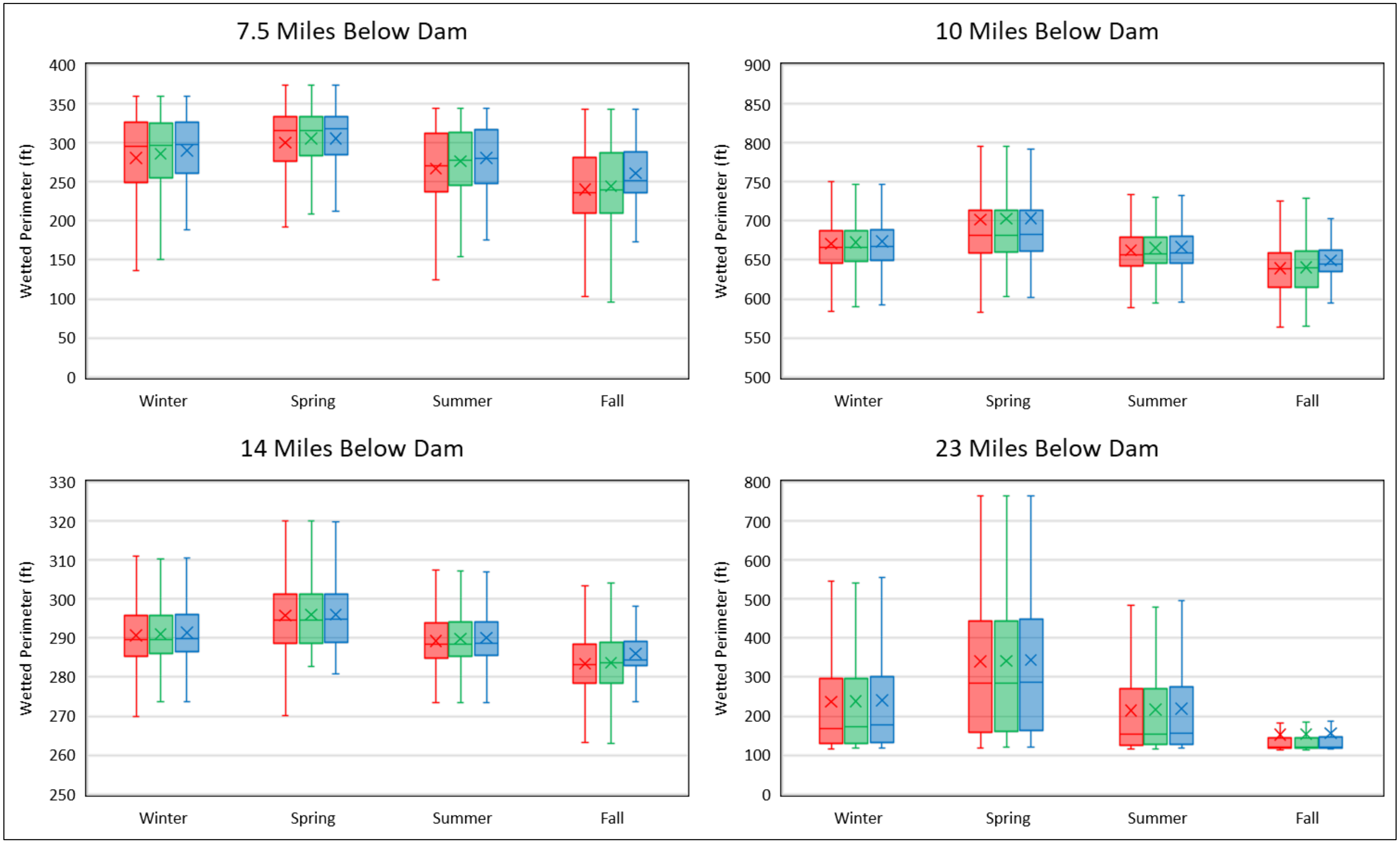


FIGURE 3-16 BOX PLOTS OF SEASONAL WETTED PERIMETER FOR PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 7.5 TO 23 MILES BELOW HARRIS DAM

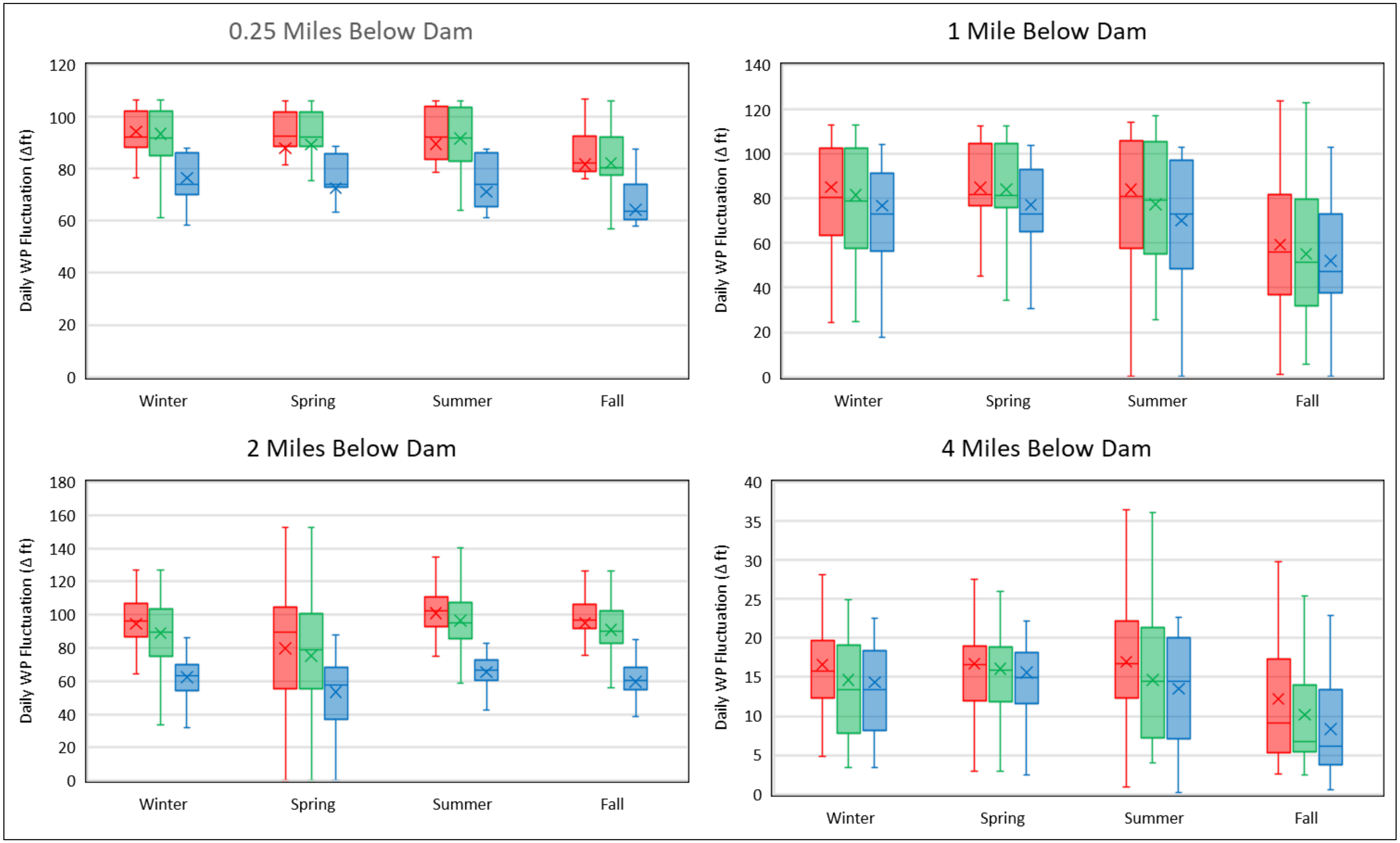


FIGURE 3-17 BOX PLOTS OF DAILY WETTED PERIMETER FLUCTUATIONS BY SEASON FOR PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 0.25 TO 4 MILES BELOW HARRIS DAM

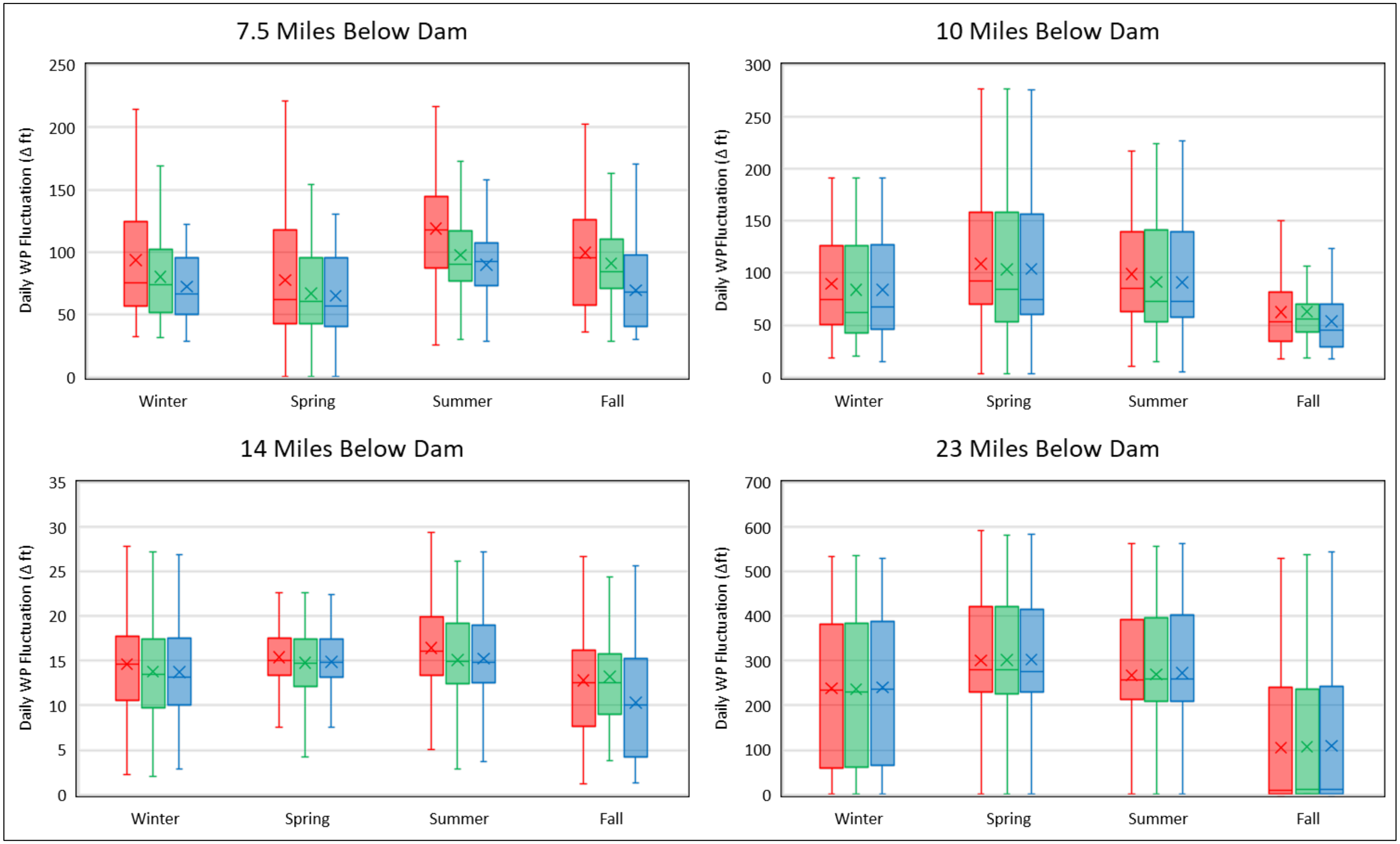


FIGURE 3-18 BOX PLOTS OF DAILY WETTED PERIMETER FLUCTUATION BY SEASON FOR PGP (RED), GP (GREEN), AND 150 CMF (BLUE) FROM 7.5 TO 23 MILES BELOW HARRIS DAM

4.0 DISCUSSION AND CONCLUSION

The goal of this study was to describe the relationship between Harris Project operations and aquatic habitat in the Tallapoosa River from Harris Dam downstream through Horseshoe Bend. As noted in Section 1, Alabama Power removed temperature data, results, and discussion from this downstream aquatic habitat report and incorporated that information into the Aquatic Resources Report and the Downstream Release Alternatives Report-Phase 2 consistent with the FERC approved Study Plan.

The study goal was accomplished by analyzing mesohabitat types, measuring water level at varying distances below the dam, collecting bathymetric measurements of the river bed, and simulating river conditions under the PGP, GP, and 150 CMF operating scenarios using the HEC-RAS model.

Mesohabitat analysis revealed that pools and riffles/shoals are the predominant habitat types within the study area. A large concentration of riffle/shoal habitat is present in the Tallapoosa River between Malone and Wadley, compared to other reaches.

Water level logger data collected between May 2019 and April 2020 provided insight into the frequency and magnitude of water level fluctuations at varying distances from the dam. Results indicate that daily water level fluctuations were greatest near Harris Dam and decreased in a relatively linear trend downstream through Horseshoe Bend. Average hourly water level fluctuations followed a similar trend.

When considering the results, it is important to note that the data includes the effects of inflows from numerous tributaries within the study area. These inflows, especially during localized or widespread storm events, could have considerable effects on water level at individual monitoring sites, depending on the magnitude and duration of the storm/high flow event.

Analysis of HEC-RAS simulation outputs showed relatively small differences in wetted perimeter duration between PGP and GP operations. The 150 CMF scenario showed increases in wetted perimeter duration at cross-sections near Harris Dam (1-7.5 miles downstream) compared with both the PGP and GP scenarios. Analysis of daily wetted perimeter fluctuations revealed smaller fluctuations under the 150 CMF scenario at cross-sections near Harris Dam compared with both the PGP and GP scenarios. Differences in wetted perimeter duration and daily fluctuations between the three operating scenarios were indistinguishable at distances greater than 23 miles downstream of Harris Dam. Alabama Power will use the HEC-RAS model developed in this study to evaluate impacts to aquatic habitat from other operational scenarios in Phase 2 of the Downstream Release Alternatives Study.

5.0 REFERENCES

Alabama Power. 2018. R.L. Harris Hydroelectric Project Pre-Application Document FERC No. 2626. Alabama Power Company, Birmingham, AL.

United States Geological Survey (USGS). 2020. USGS Surface-Water Daily Data for Alabama. URL: https://waterdata.usgs.gov/al/nwis/dv?. Accessed June 3, 2020.

APPENDIX A

ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations

A

A&I	Agricultural and Industrial
ACFWRU	Alabama Cooperative Fish and Wildlife Research Unit
ACF	Apalachicola-Chattahoochee-Flint (River Basin)
ACT	Alabama-Coosa-Tallapoosa (River Basin)
ADCNR	Alabama Department of Conservation and Natural Resources
ADECA	Alabama Department of Economic and Community Affairs
ADEM	Alabama Department of Environmental Management
ADROP	Alabama-ACT Drought Response Operations Plan
AHC	Alabama Historical Commission
Alabama Power	Alabama Power Company
AMP	Adaptive Management Plan
ALNHP	Alabama Natural Heritage Program
APE	Area of Potential Effects
ARA	Alabama Rivers Alliance
ASSF	Alabama State Site File
ATV	All-Terrain Vehicle
AWIC	Alabama Water Improvement Commission
AWW	Alabama Water Watch

B

BA	Biological Assessment
B.A.S.S.	Bass Anglers Sportsmen Society
BCC	Birds of Conservation Concern
BLM	U.S. Bureau of Land Management
BOD	Biological Oxygen Demand

C

°C	Degrees Celsius or Centrigrade
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulation
cfs	Cubic Feet per Second
cfu	Colony Forming Unit
CLEAR	Community Livability for the East Alabama Region
CPUE	Catch-per-unit-effort
CWA	Clean Water Act

D

DEM	Digital Elevation Model
DIL	Drought Intensity Level
DO	Dissolved Oxygen
dsf	day-second-feet

E

EAP	Emergency Action Plan
ECOS	Environmental Conservation Online System
EFDC	Environmental Fluid Dynamics Code
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

F

°F	Degrees Fahrenheit
ft	Feet
F&W	Fish and Wildlife
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FNU	Formazin Nephelometric Unit
FOIA	Freedom of Information Act
FPA	Federal Power Act

G

GCN	Greatest Conservation Need
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning Systems
GSA	Geological Survey of Alabama

H

Harris Project	R.L. Harris Hydroelectric Project
HAT	Harris Action Team
HEC	Hydrologic Engineering Center
HEC-DSSVue	HEC-Data Storage System and Viewer
HEC-FFA	HEC-Flood Frequency Analysis
HEC-RAS	HEC-River Analysis System
HEC-ResSim	HEC-Reservoir System Simulation Model
HEC-SSP	HEC-Statistical Software Package

HDSS	High Definition Stream Survey
hp	Horsepower
HPMP	Historic Properties Management Plan
HPUE	Harvest-per-unit-effort
HSB	Horseshoe Bend National Military Park

I

IBI	Index of Biological Integrity
IDP	Inadvertent Discovery Plan
IIC	Intercompany Interchange Contract
IVM	Integrated Vegetation Management
ILP	Integrated Licensing Process
IPaC	Information Planning and Conservation
ISR	Initial Study Report

J

JTU	Jackson Turbidity Units

K

kV	Kilovolt
kva	Kilovolt-amp
kHz	Kilohertz

L

LIDAR	Light Detection and Ranging
LWF	Limited Warm-water Fishery
LWPOA	Lake Wedowee Property Owners' Association

M

m	Meter
m^3	Cubic Meter
M&I	Municipal and Industrial
mg/L	Milligrams per liter
ml	Milliliter
mgd	Million Gallons per Day
µg/L	Microgram per liter
µs/cm	Microsiemens per centimeter
mi^2	Square Miles
MOU	Memorandum of Understanding

MPN	Most Probable Number
MRLC	Multi-Resolution Land Characteristics
msl	Mean Sea Level
MW	Megawatt
MWh	Megawatt Hour

N

n	Number of Samples
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NWI	National Wetlands Inventory

O

OAR	Office of Archaeological Resources
OAW	Outstanding Alabama Water
ORV	Off-road Vehicle
OWR	Office of Water Resources

P

PA	Programmatic Agreement
PAD	Pre-Application Document
PDF	Portable Document Format
pH	Potential of Hydrogen
PID	Preliminary Information Document
PLP	Preliminary Licensing Proposal
Project	R.L. Harris Hydroelectric Project
PUB	Palustrine Unconsolidated Bottom
PURPA	Public Utility Regulatory Policies Act
PWC	Personal Watercraft
PWS	Public Water Supply

Q

QA/QC	Quality Assurance/Quality Control

R

RM	River Mile
RTE	Rare, Threatened and Endangered
RV	Recreational Vehicle

S

S	Swimming
SCORP	State Comprehensive Outdoor Recreation Plan
SCP	Shoreline Compliance Program
SD1	Scoping Document 1
SH	Shellfish Harvesting
SHPO	State Historic Preservation Office
Skyline WMA	James D. Martin-Skyline Wildlife Management Area
SMP	Shoreline Management Plan
SU	Standard Units

T

T&E	Threatened and Endangered
TCP	Traditional Cultural Properties
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TRB	Tallapoosa River Basin
TSI	Trophic State Index
TSS	Total Suspended Soils
TVA	Tennessee Valley Authority

U

USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

W

WCM	Water Control Manual
WMA	Wildlife Management Area
WMP	Wildlife Management Plan
WQC	Water Quality Certification

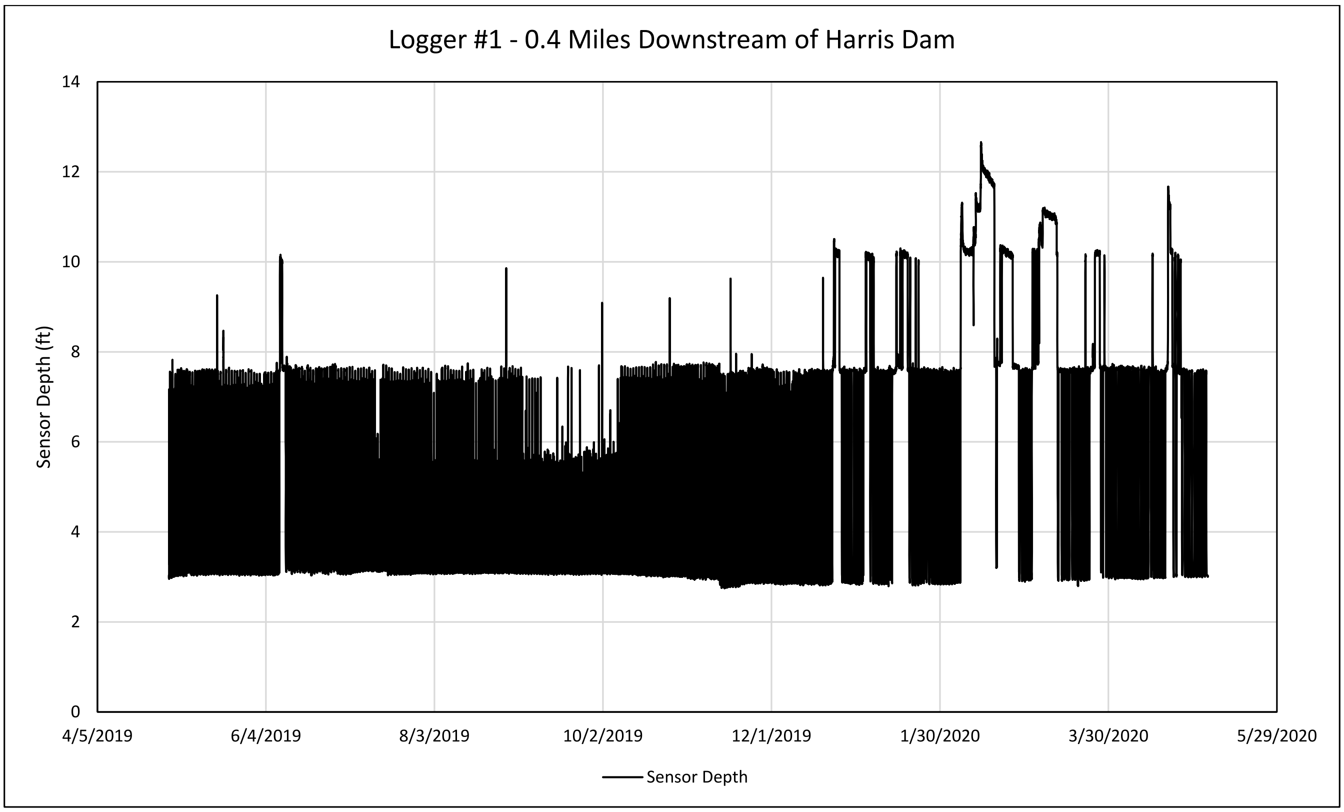
APPENDIX B

LEVEL LOGGER DATA

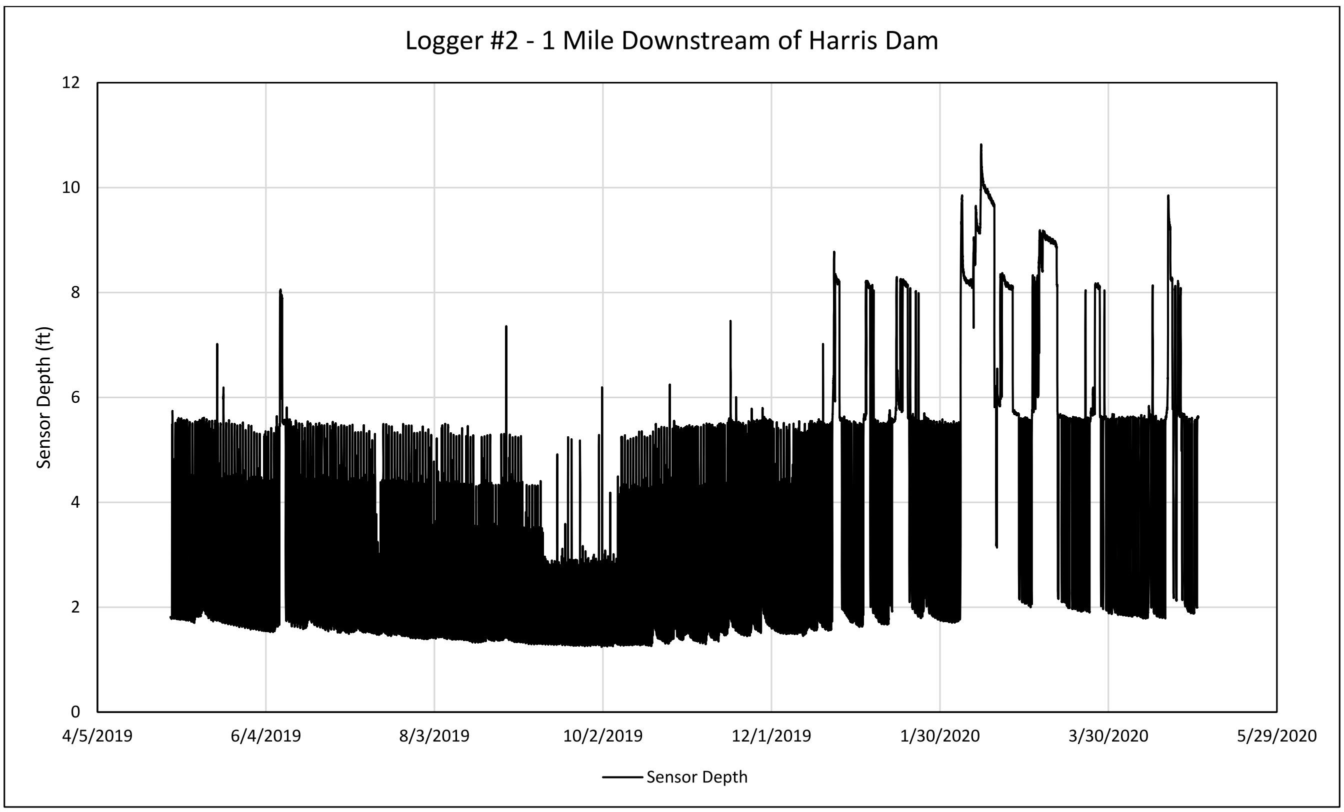
(ATTACHED IN MICROSOFT EXCEL SPREADSHEET FORMAT)

APPENDIX C

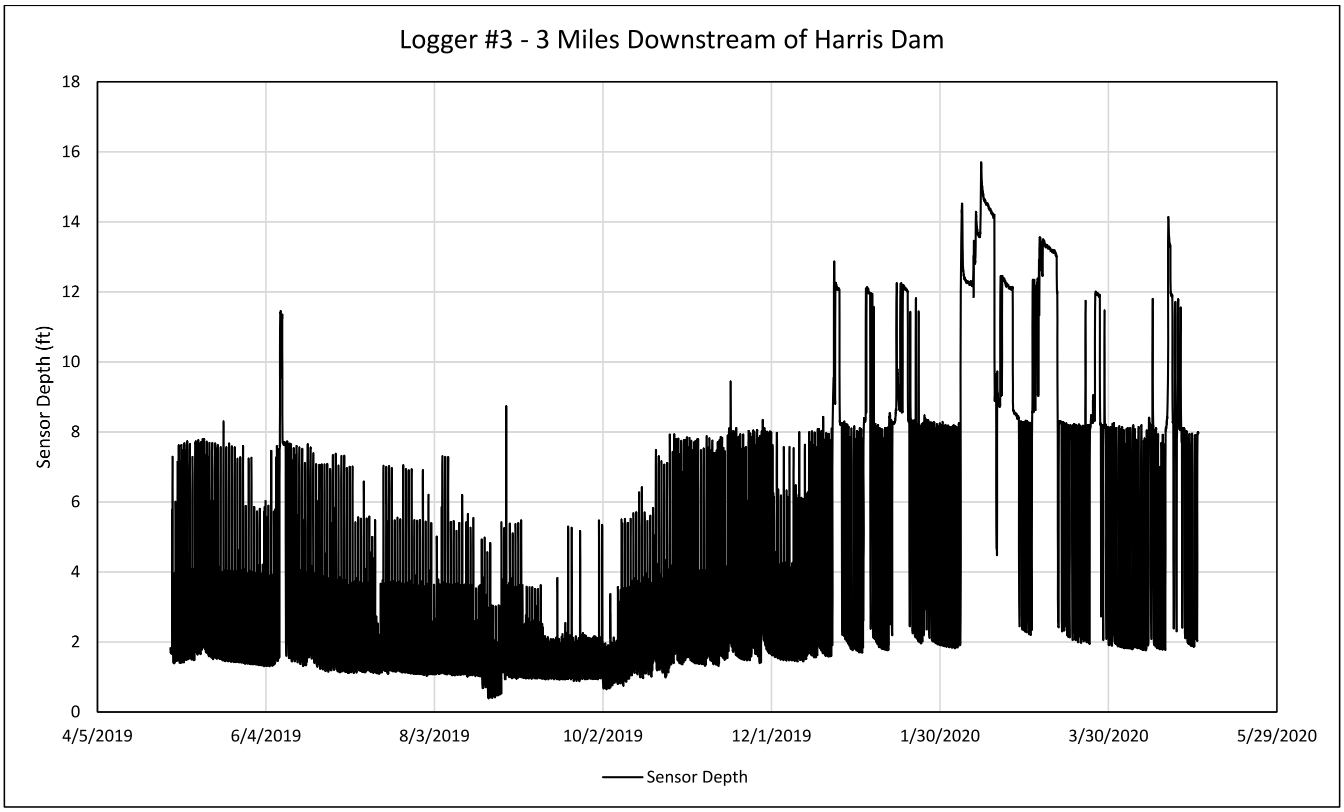
LINE PLOTS OF 15-MIN LEVEL LOGGER DATA

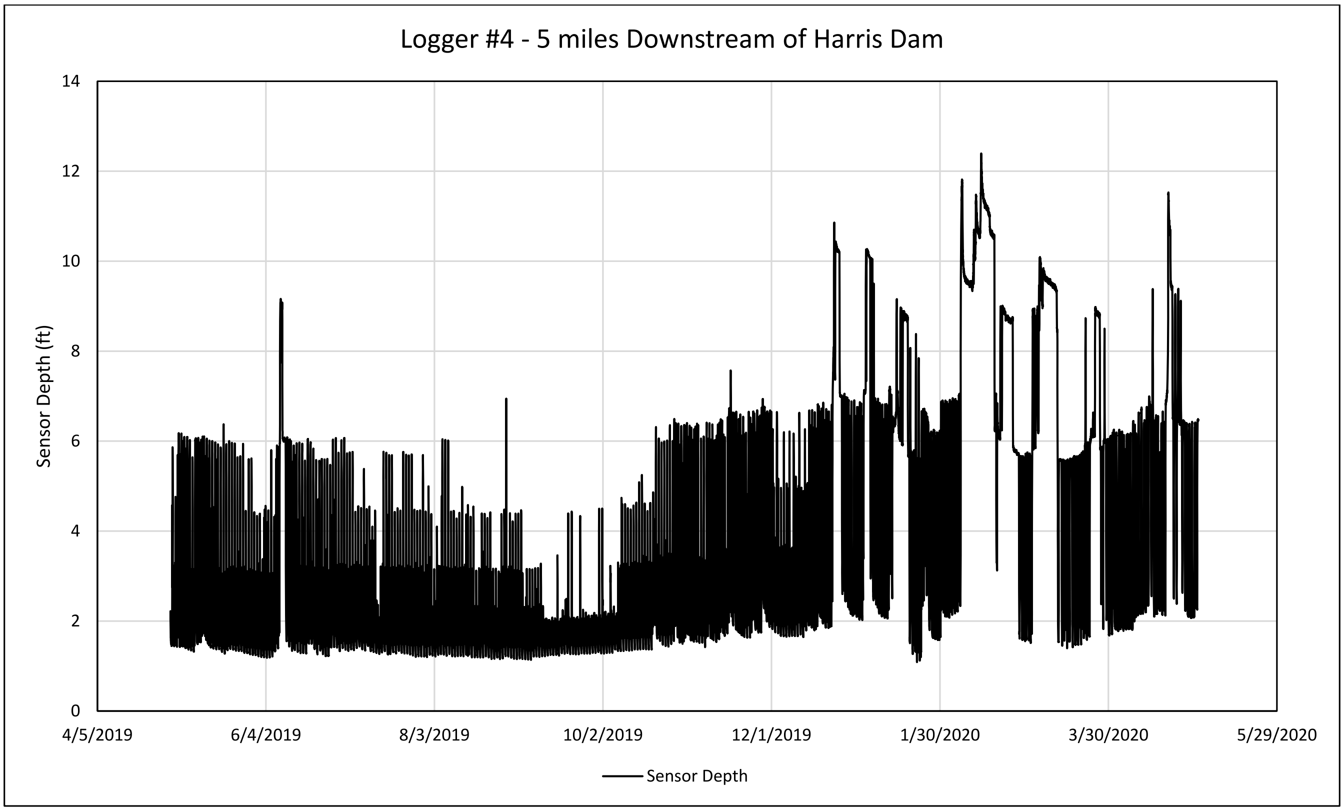


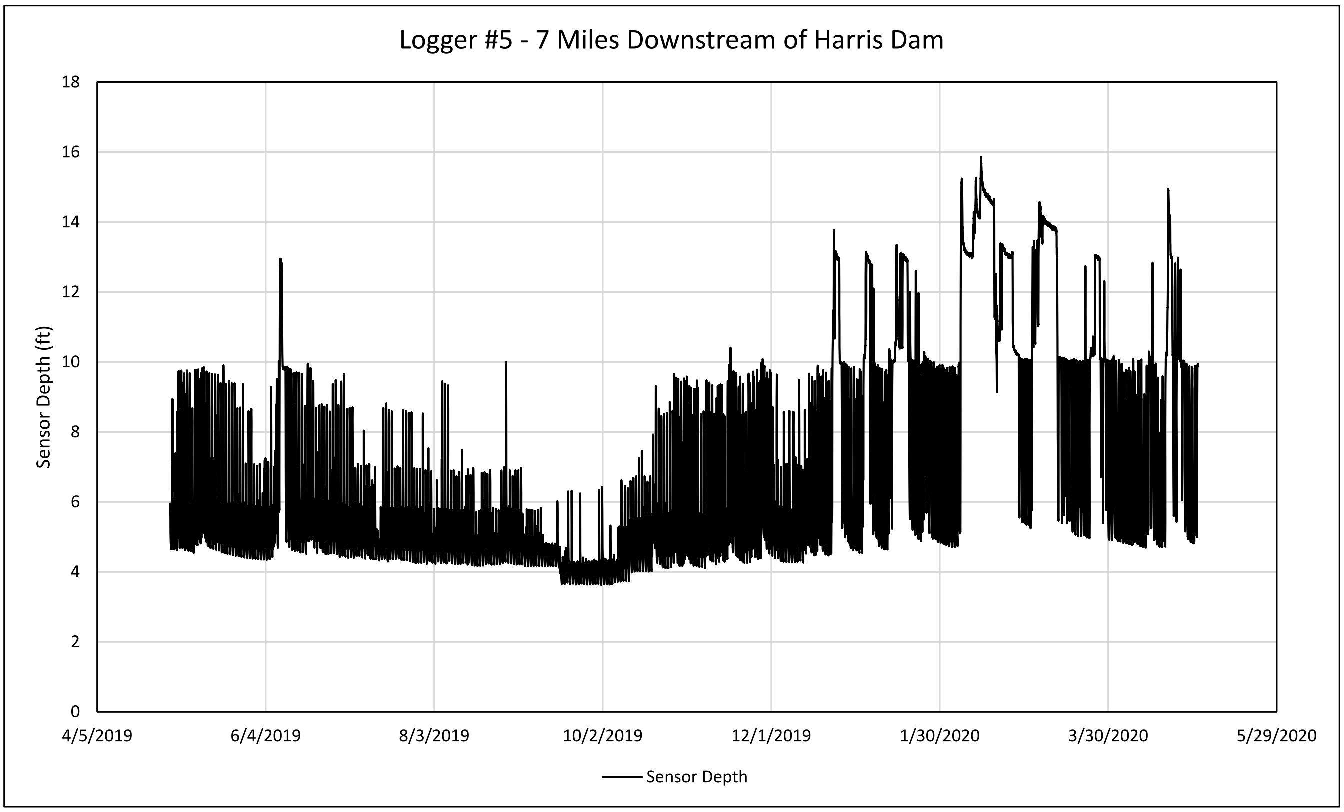
Logger #1 - 0.4 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



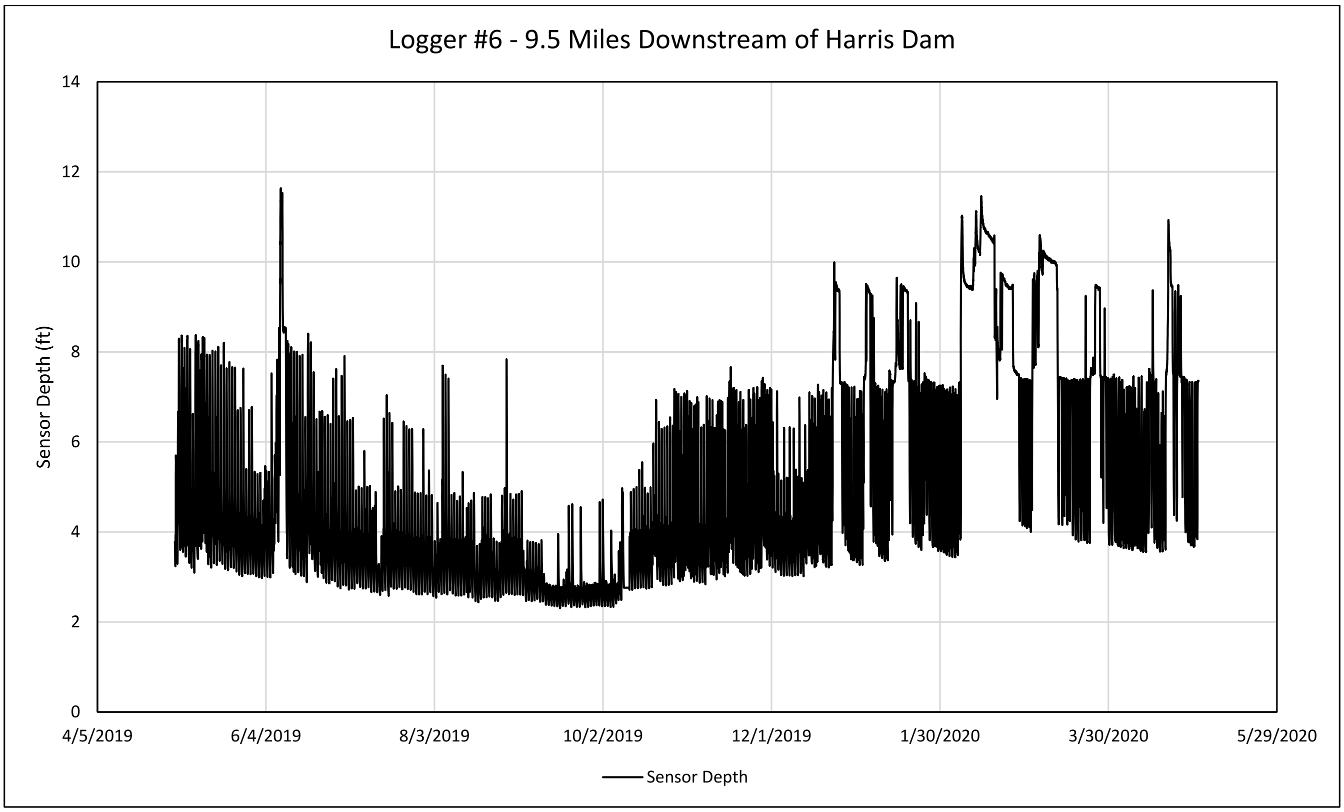
Logger #2 - 1 Mile Downstream of Harris Dam
Sensor Depth (ft)
12
10
8
6
4
2
0
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

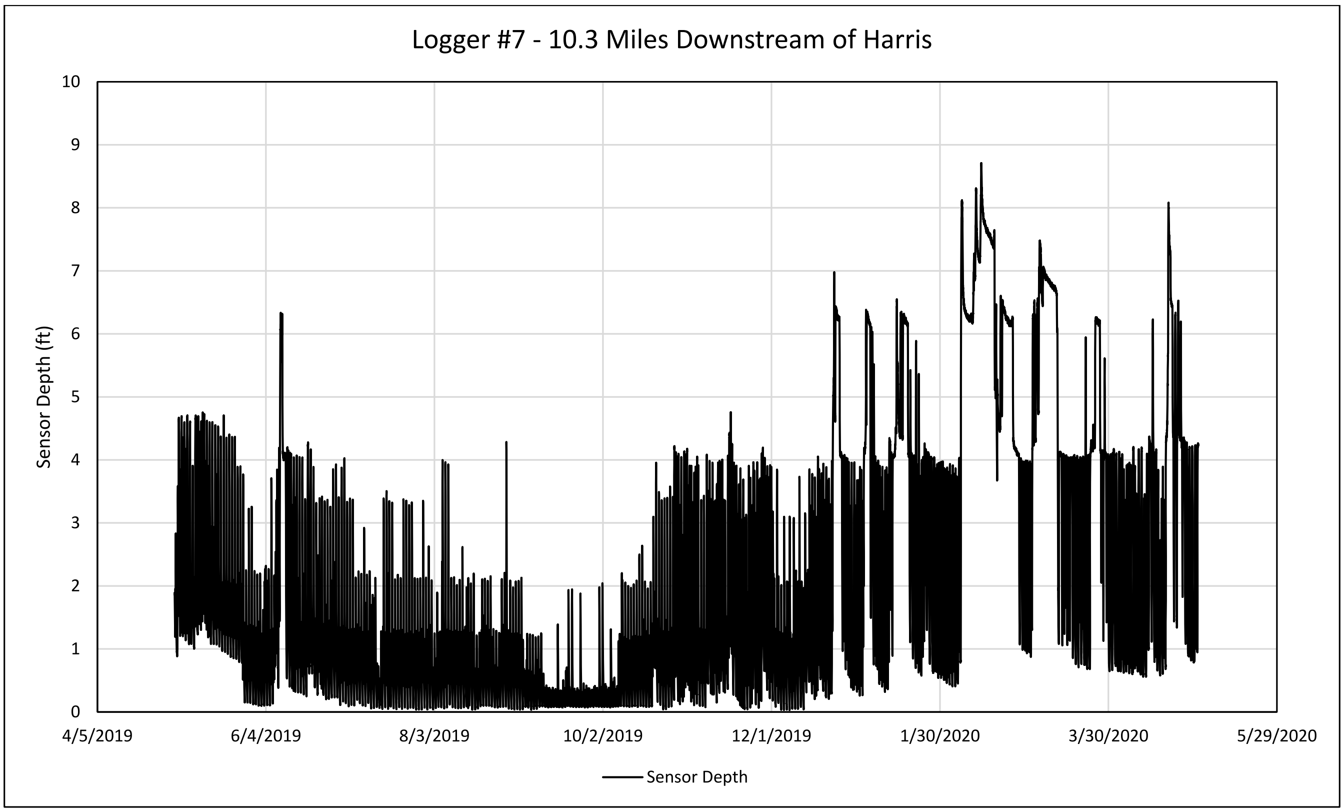

Logger #3 - 3 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
16
18
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth


Logger #4 - 5 miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

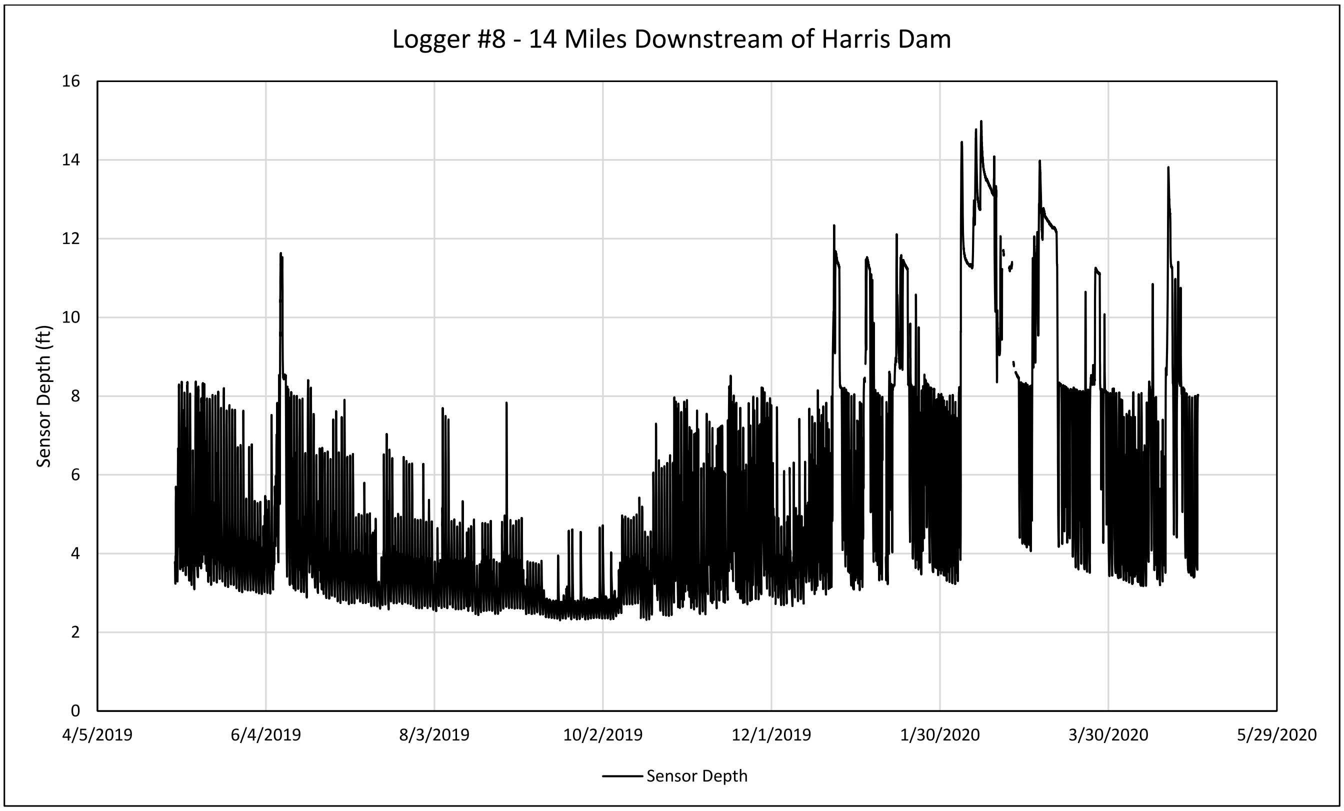


Logger #5 - 7 Miles Downstream of Harris Dam
Sensor Depth (ft)
18
16
14
12
10
8
6
4
2
0
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

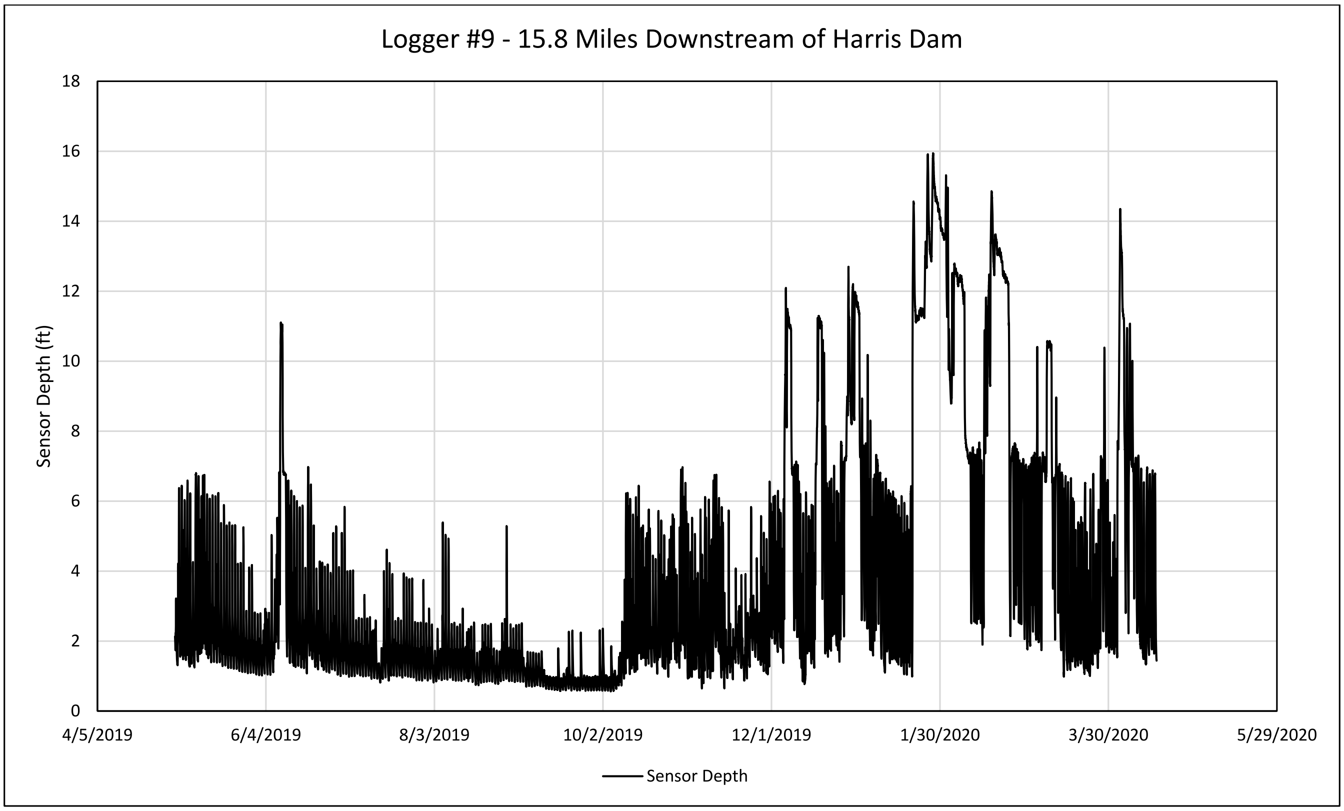

Logger #6 - 9.5 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

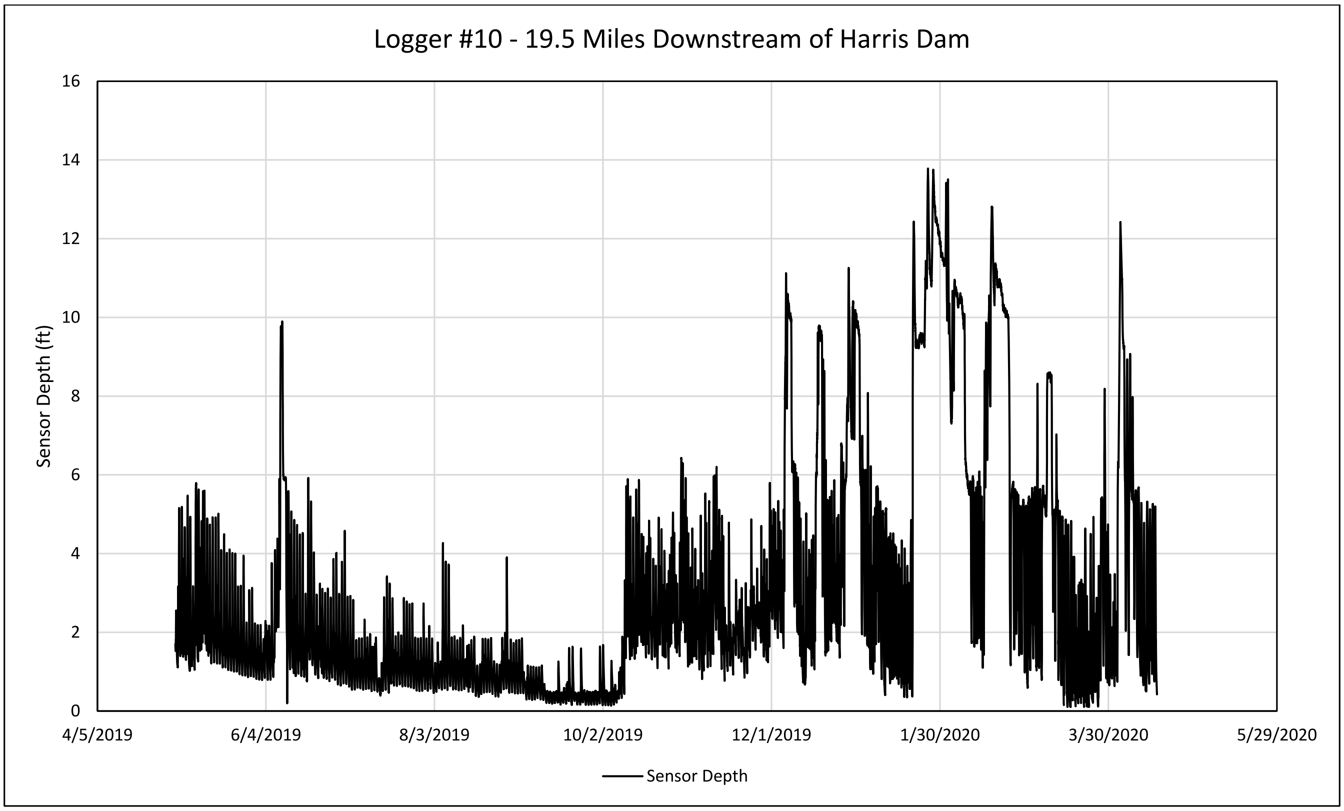


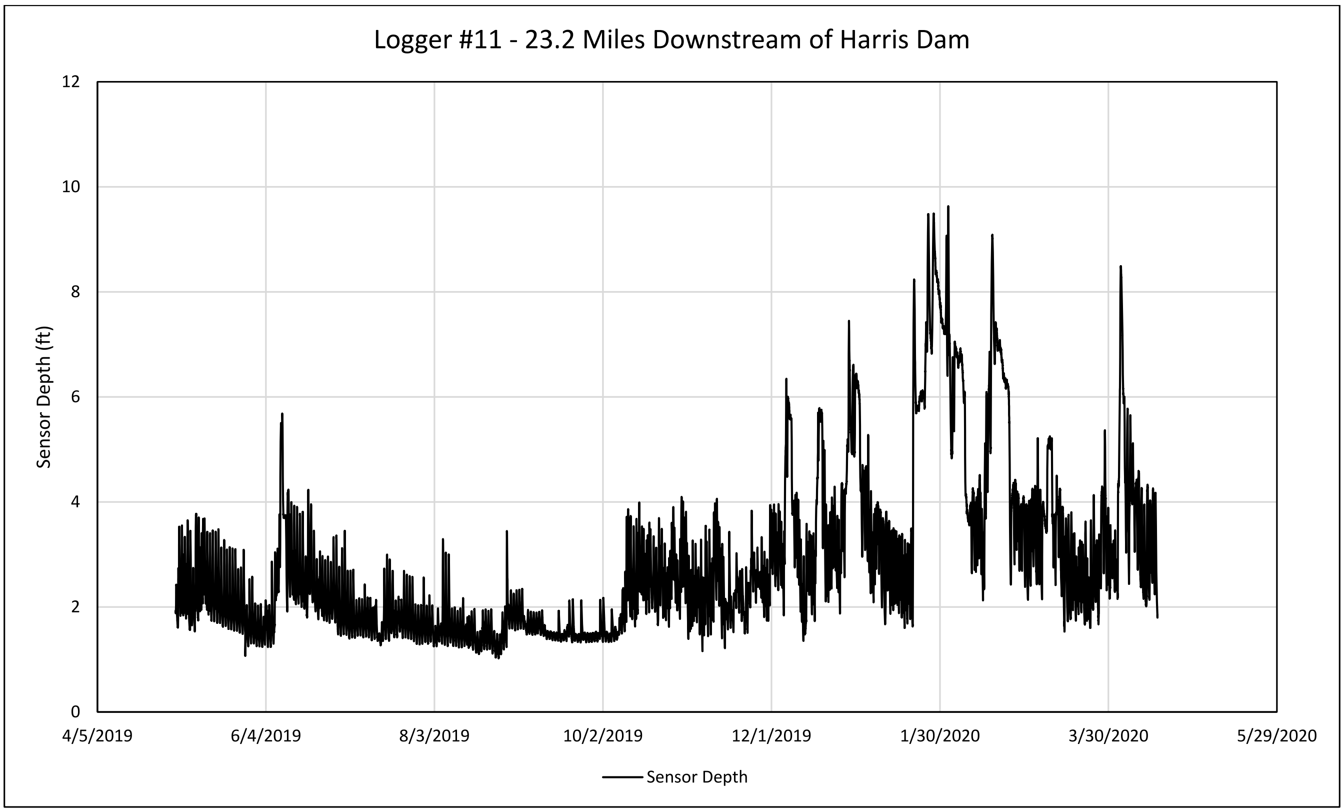
Logger #7 - 10.3 Miles Downstream of Harris
Sensor Depth (ft)
0
1
2
3
4
5
6
7
8
9
10
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



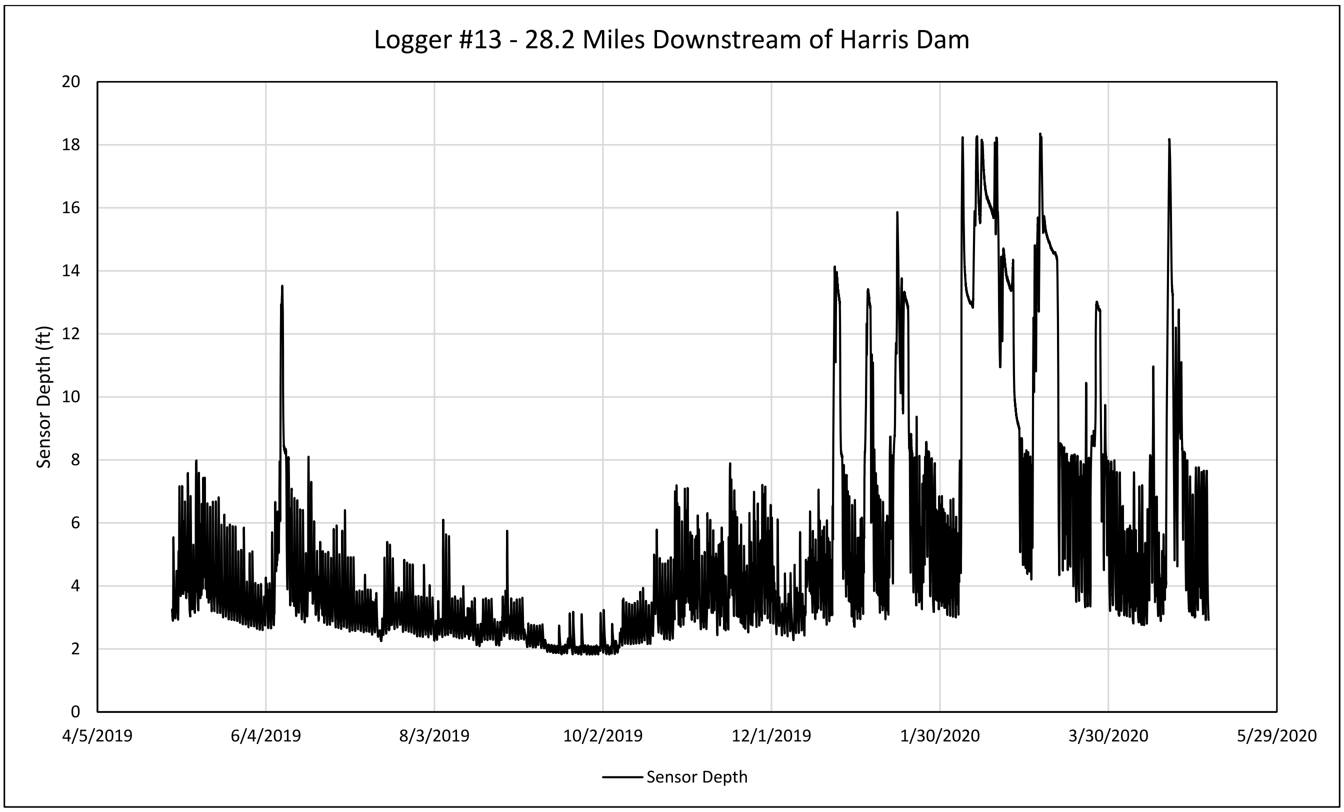
Logger #8 - 14 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
16
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

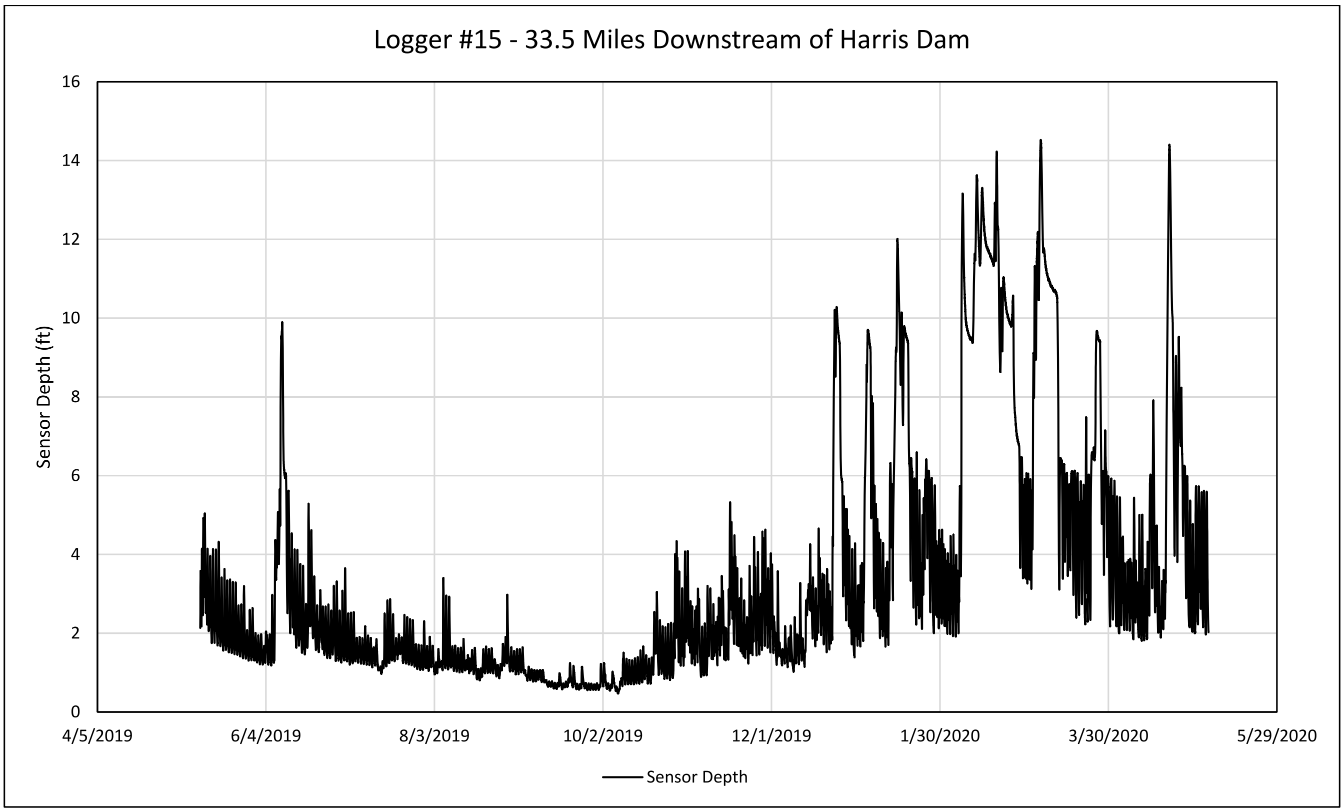

Logger #9 - 15.8 Miles Downstream of Harris Dam
Sensor Depth (ft)
18
16
14
12
10
8
6
4
2
0
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

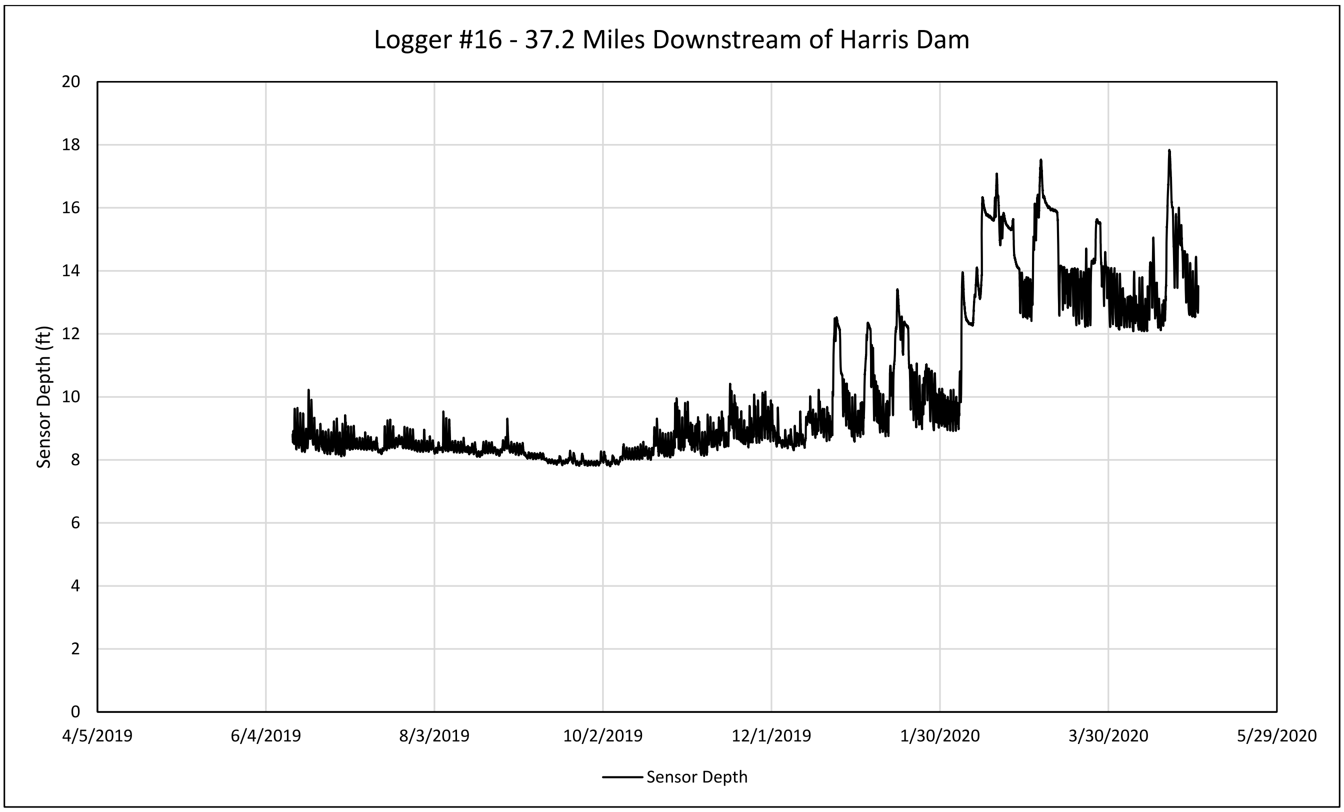

Logger #10 - 19.5 Miles Downstream of Harris Dam
Sensor Depth (ft)
16
14
12
10
8
6
4
2
0
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



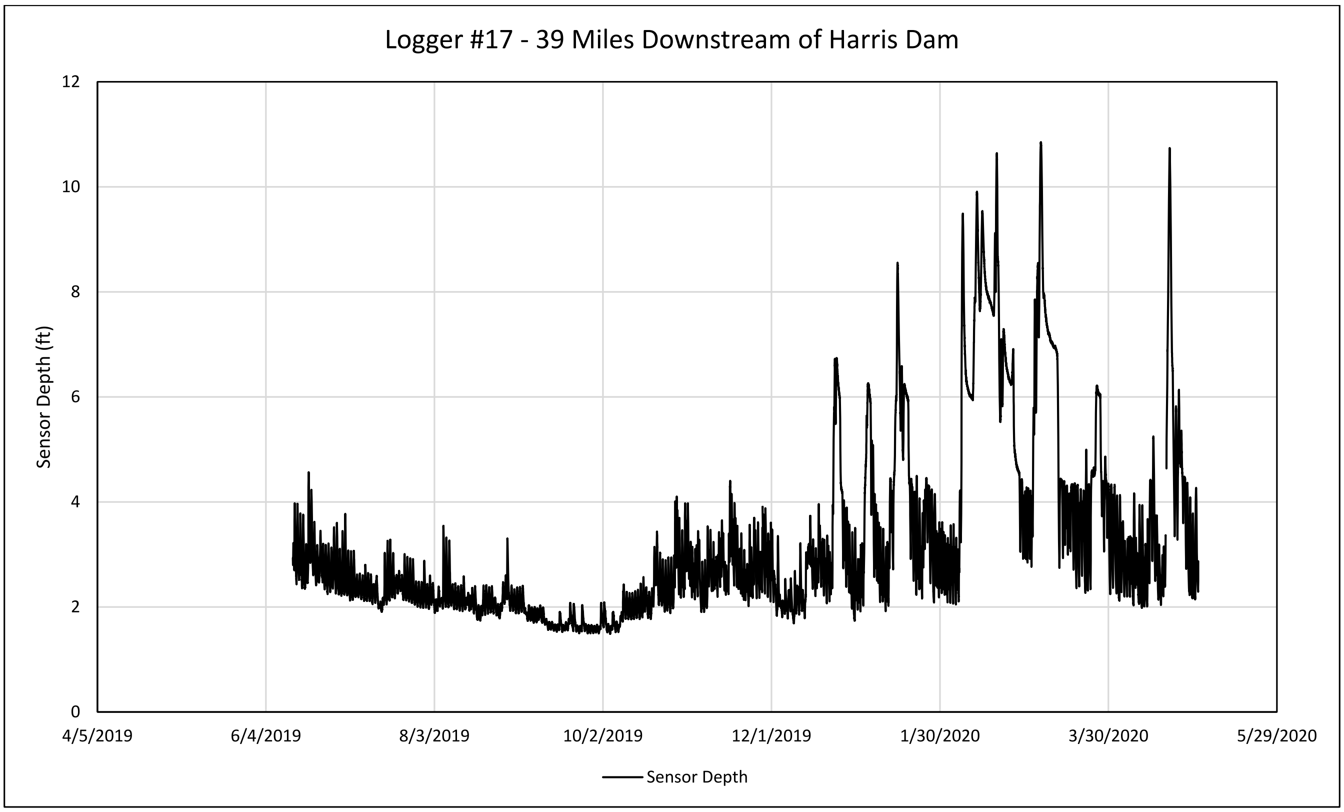
Logger #11 - 23.2 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth


Logger #13 - 28.2 Miles Downstream of Harris Dam
Sensor Depth (ft)
20
18
16
14
12
10
8
6
4
2
0
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

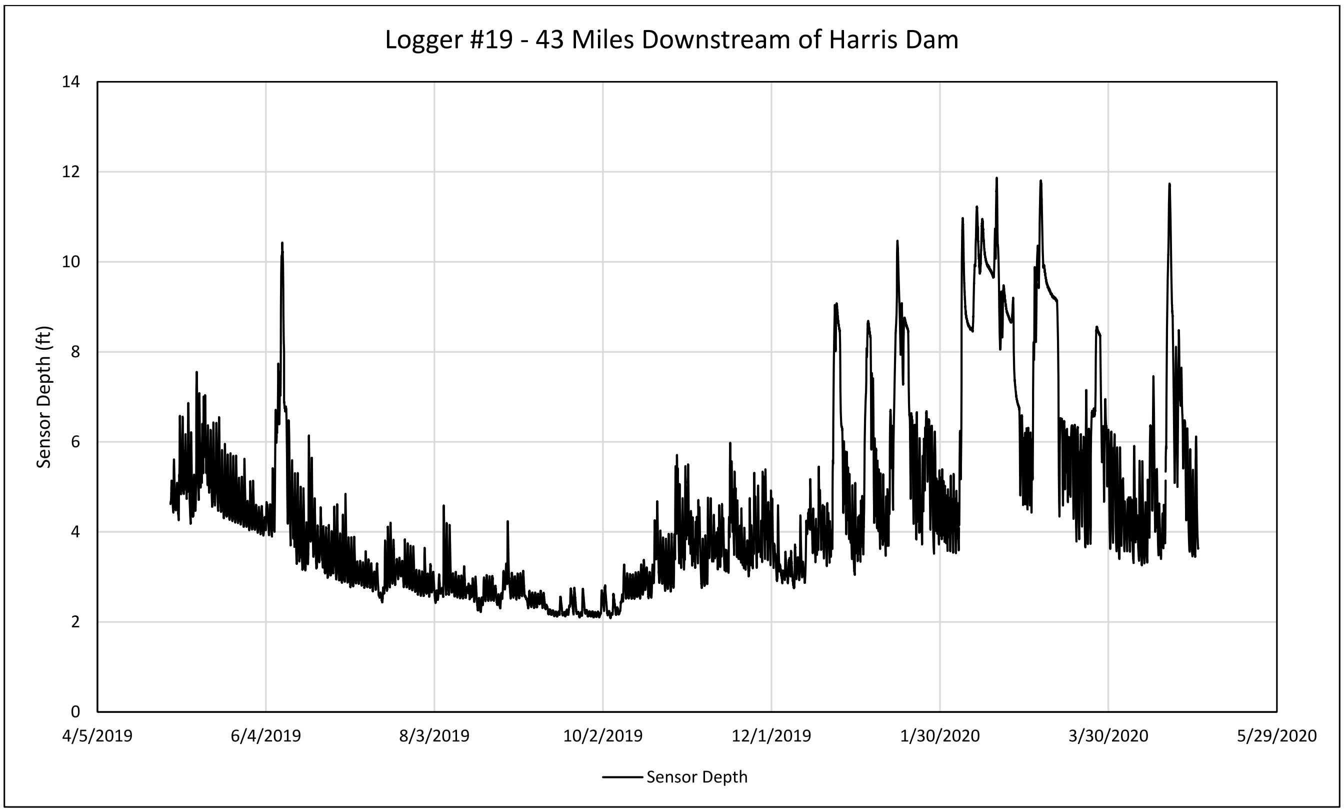

Logger #15 - 33.5 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
16
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



Logger #16 - 37.2 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



Logger #17 - 39 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth



Logger #19 - 43 Miles Downstream of Harris Dam
Sensor Depth (ft)
0
2
4
6
8
10
12
14
4/5/2019
6/4/2019
8/3/2019
10/2/2019
12/1/2019
1/30/2020
3/30/2020
5/29/2020
Sensor Depth

APPENDIX D

STAKEHOLDER COMMENT TABLE

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
Federal Energy Regulatory Commission (FERC) Note: footnotes included in the original letter have been omitted from this table	6/10/2020 20200610-3059	During the ISR Meeting, Alabama Power requested that stakeholders provide downstream flow alternatives for evaluation in the models developed during Phase 1 of the Downstream Release Alternatives Study. Stakeholders expressed concerns about their ability to propose flow alternatives without having the draft reports for the Aquatic Resources and Downstream Aquatic Habitat Studies, which are scheduled to be available in July 2020 and June 2020, respectively. It is our understanding that during Phase 2 of this study, Alabama Power would run stakeholder-proposed flow alternatives that may be provided with ISR comments, as well as additional flow alternatives that stakeholders may propose after the results for the Aquatic Resources and Downstream Aquatic Habitat Studies are available. Please clarify your intent by July 11, 2020, as part of your response to stakeholder comments on the ISR.	Based on FERC, ARA, and EPA's recommendation to modify the Downstream Release Alternatives study, Alabama Power evaluated the following additional downstream flow scenarios: • A variation of the existing Green Plan (GP) where the Daily Volume Release is 100% of the prior day's flow at the USGS Heflin stream gage, rather than the current 75% • A hybrid Green Plan that incorporates both a base minimum flow of 150 cfs and the pulsing laid out in the existing Green Plan release criteria • 300 cfs continuous minimum flow (CMF) • 600 CMF • 800 CMF • 300 CMF + GP • 600 CMF +GP • 800 CMF +GP Alabama Power met with HAT 3 following distribution of the Draft Aquatic Resources Study Report and Draft Downstream Aquatic Habitat Report. No additional downstream release alternatives were requested by stakeholders.
FERC		In addition, we recommend that the modeling for Alabama Power's Aquatic Resources Study and Downstream Aquatic Habitat Study,[4] as well as any Phase 2 assessment(s) include all the downstream flow release alternatives identified and evaluated as part of the Downstream Flow Release Alternatives Study. The results of all the modeling for the Aquatic Resources Study and Downstream Aquatic Habitat Study should be included in the final study reports and filed with the Updated Study Report, due by April 12, 2021.	Alabama Power will analyze the effects of the additional release alternatives on aquatic resources and downstream aquatic habitat in the Downstream Release Alternatives Study phase 2 analysis.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
Alabama Department of Conservation and Natural Resources (ADCNR) Note: footnotes included in the original letter have been omitted from this table	6/11/2020 20200611-5152	On page 11, section 4.1 of Initial Study Report, "*i.e.*" ("that is") should be changed to "*e.g.*" ("for example"). The alternative/modified Green Plan operation downstream release alternative will be evaluated as part of Phase 2. Results from the other three scenarios as well as from the Aquatic Resources Study are needed to design the alternative to be studied. Downstream Aquatic Habitat Study and Recreational Evaluation Study results should be included in footnotes in order to fully evaluate and recommend an alternative Green Plan to be modeled and evaluated as a downstream release alternative. Without the ability to fully evaluate the Aquatic Resources Study, Downstream Aquatic Habitat Study and Recreational Evaluation Study results at this time, ADCNR recommends multiple base flow scenarios calculated from available aquatic inflow and base flow records and guidelines representative for the tailwaters downstream to the Horseshoe Bend with Pre-Green Plan, Green Plan and Modified Green Plan be modeled during the evaluation process. All operational changes to downstream releases should evaluate methods for how these flows could be provided while maintaining state dissolved oxygen guidelines and a natural temperature regime, at all times for the sustainable benefit of aquatic resources.	The "modified Green Plan" alternative was discussed with and agreed to by ADCNR prior to the FERC's April 12, 2019 Study Plan Determination. The modified Green Plan is defined in the FERC-approved Downstream Release Alternatives Study Plan as changing the time of day in which the Green Plan pulses are released. Effects on dissolved oxygen and temperature as a result of alternative releases are analyzed in the Downstream Release Alternatives Study Phase 2 Report.
ADCNR	7/31/2020 Filed by email	On page 1, section 1.1 Study Background of Draft Downstream Aquatic Habitat Report, it states "*Monitoring conducted since initiation of the Green Plan has indicated a positive fish community response due to increased shoal habitat availability (Irwin et al. 2011); however, there is little existing information characterizing the extent that the Green Plan has enhanced the aquatic habitat from Harris Dam downstream through Horseshoe Bend.*" Recent reporting of fish community monitoring indicates that fish densities in the regulated river downstream of Harris Dam have been depressed when compared to unregulated sites (Irwin *et al.* 2019).	Comment noted.
ADCNR		On page 2, section 1.1 Study Background of Draft Downstream Aquatic Habitat Report, change "*i.e.*" ("that is") should be changed to "*e.g.*" ("for example"). Details and design of a Modified Green Plan alternative are pending results and full evaluation from the Aquatic Resources Study. ADCNR is not in agreement that the alternative/modified Green Plan would only consider changing the time of day in which Green Plan pulses are released. ADCNR is in agreement that results from the Aquatic	The "modified Green Plan" alternative was discussed with and agreed to by ADCNR prior to the FERC's April 12, 2019 Study Plan Determination. The modified Green Plan is defined in the FERC-approved Downstream Release Alternatives Study Plan as changing the

<u>Commenting Entity</u>	<u>Date of Comment & FERC Accession Number</u>	<u>Comment – Downstream Aquatic Habitat Report</u>	<u>Alabama Power Response</u>
		Resources Study are needed to design and recommend the alternative to be studied. Aquatic Resources Study results should be included in the footnote as a precursor to fully evaluate and recommend an alternative Green Plan to be modeled as a downstream release alternative for initial study report. ADCNR maintains its recommendation for a fourth alternative Modified Green Plan be fully evaluated. ADCNR requests the opportunity to provide specific recommendations for the Modified Green Plan alternative after assessing the Aquatic Resources Study report.	time of day in which the Green Plan pulses are released.
ADCNR		On page 2, section 1.1 Study Background of Draft Downstream Aquatic Habitat Report, change "*intened*" to "intended"	This correction was made in the Final Report.
ADCNR		On page 3, section 3.1 Mesohabitat Analysis of Draft Downstream Aquatic Habitat Report, provide the total river miles, in addition to hectares for each section (*e.g.*, Harris Dam to Malone (total river miles), Wadley to Bibby's Ferry (total river miles)	River miles are included in the Final Report.
ADCNR		On page 4, section 2.2 Water Level Monitoring of Draft Downstream Aquatic Habitat Report, it states "*data were lost from four level loggers (logger numbers 12, 14, 18, 20) (Figure 2-1)*" Provide a detailed explanation why data is unavailable from these four loggers (e.g. equipment malfunction or computer error).	The existing explanation that malfunctioning equipment caused faulty data transfers is adequate.
ADCNR		On page 6, Figure 2-1 note the four level loggers that had lost data with an asterisk and provide an explanation of the asterisks in the Figure description.	The existing explanation in the text is sufficient to explain the malfunctioning level loggers.
ADCNR		On page 9, Figure 3-2 of Draft Downstream Aquatic Habitat Report, the image resolution is poor. If available provide higher resolution images for this data.	This was corrected in the Final Report.
ADCNR		On page 10, section 3.2.1 Study Period Hydrology and Climate, of Draft Downstream Aquatic Habitat Report, provide statistical analysis information documenting that significant differences occurred between the river flows in August/September 2019 and January/March 2020 compared to long-term averages.	The word "significantly" was removed in the Final Report.
ADCNR		On page 14, Figure 3-6, of Draft Downstream Aquatic Habitat Report, provide standard deviation bars for the average daily water level.	Standard deviation was added to the tabular summary.
ADCNR		On page 14, of Draft Downstream Aquatic Habitat Report, provide an additional graph similar to Figure 3-6 that depicts the maximum daily water level fluctuation (Delta T) from May 2019 to April 2020. This graphic will better represent the unnatural, harsh conditions subjected to aquatic fauna daily below Harris Dam.	Maximum daily water level fluctuation is provided in the tabular summaries in Tables 3-3 and 3-4.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
ADCNR		On page 15, Table 3-3 Summary of Daily Water Level Fluctuations of Draft Downstream Aquatic Habitat Report, in addition to mean, minimum and maximum, provide the median (ft) for each site and standard deviation of the means.	This information was included in the Final Report.
ADCNR		On page 16, Figure 3-7 of Draft Downstream Aquatic Habitat Report, provide standard deviation bars for the average hourly water level. Change the y-axis label from "*temperature*" to "water level".	This information was included in the Final Report.
ADCNR		On page 17 Table 3-4 Summary of Hourly Water Level Fluctuations of Draft Downstream Aquatic Habitat Report, in addition to mean, minimum and maximum, provide the median (ft) for each site and standard deviation of the means.	This information was included in the Final Report.
ADCNR		On page 18, section 3.2.4 Water Temperature of Draft Downstream Aquatic Habitat Report, temperature change data is primarily depicted in averages. It is important to remember that like dissolved oxygen declines, only one significant sudden temperature change event can stress or kill aquatic species. In addition, temperature highly influences dissolved oxygen levels in aquatic environments and significant dissolved oxygen declines and extreme temperature fluctuations can often coincide. For water temperature data, maximum and minimum values, and how long those values persist (hours) would better explain the fluctuation in temperature changes occurring in a regulated river. Providing detailed reporting of minimum and maximum values at hourly intervals especially when water temperatures reach critical spawning ranges (15-25°C) in the spring are required to fully understand what is occurring. For example, if water temperature rise during the spring reaches a fish species thermal spawning cue but then suddenly decreases due to generation, disruption of spawning success can occur. Decreased and varied downstream water temperatures, as a result of project operations, can negatively impact downstream aquatic fauna. The impacts of water temperatures on the aquatic environment have been well-documented in peer-reviewed literature (Travnichek and Maceina 1994; Bowen *et al.* 1998; Andress 2002, Craven *et al.* 2010; Irwin *et al.* 2010; Goar 2013; Early and Sammons 2015). A component of varied downstream water temperatures downstream of regulated waterways, includes rapid sudden changes in water temperatures. These rapid changes can cause serious stress responses in some fishes in captivity and in the wild that are otherwise healthy, even leading to mortality (Jenkins et al. 2004). Limits of tolerance and ability to tolerate changes in temperature are influenced by the previous thermal	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. An appendix to the Final Aquatic Resources Study Report will include 15-minute line plots of water temperature and sensor depth for each level logger. In addition, Auburn University conducted bioenergetics modeling to determine the effect of temperature and flow regimes on fish respiration and energy expenditure. Results of Auburn's modeling are provided in the Final Aquatic Resources Study Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
		histories of individual fish as well as species characteristics (Carmichael et al. 1984). Sudden temperature changes of greater magnitude, either upward or downward, are very stressful and should be avoided. The magnitude of change that aquatic species can tolerate will depend on the species, the life history stage in consideration, previous thermal history, and the initial conditions. The literature-based temperature requirement for fish information provided by the ongoing Aquatic Resources Study should provide useful details on various Tallapoosa River system fish species temperature tolerances. In addition, the comparison of temperature data in regulated and unregulated portions of the study area in the ongoing Aquatic Resources Study should provide additional insight into this topic. The Aquatic Resources Study results in conjunction with downstream flow data, water quality data and downstream habitat data from the initial study reports must be fully evaluated to assess potential impacts to the aquatic resources of the system. For these reasons it is important to provide median, minimum and maximum daily and hourly water temperature fluctuations in this section, in addition to the provided means. Median site data should be included into Tables 3-5 and 3-6. Provide Figure line plots of 15-minute water temperature data collected for each site, similar to page 29, Figure 4-2 line plots of 15-minute water temperature data collected by ADEM on the Tallapoosa River of the Draft Water Quality Study Report.	
ADCNR		On page 18, section 3.2.4 Water Temperature of Draft Downstream Aquatic Habitat Report, in the discussion on water temperature, explain how the temperature change range is lower at the dam, in comparison to sites 1 and 3 miles downstream. Explain what processes might cool the water moving downstream before warming them again.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. Mean daily water temperature fluctuations near the dam (0.4 miles downstream) are within one standard deviation of the mean fluctuations measured one and 3 miles downstream (i.e., essentially the same).
ADCNR		On Page 19, Figure 3-8 of Draft Downstream Aquatic Habitat Report, provide standard deviation bars for the average monthly temperature data points.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. This figure was revised and included in the Final Aquatic Resources Study Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
ADCNR		On page 20, Figure 3-9 of Draft Downstream Aquatic Habitat Report, provide standard deviation bars for the average daily temperature fluctuation.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. This figure was revised and included in the Final Aquatic Resources Study Report.
ADCNR		On page 20, of Draft Downstream Aquatic Habitat Report, provide an additional graph similar to Figure 3-9 that depicts the maximum daily water temperature fluctuation (Delta T) from May 2019 to April 2020. This graphic will better represent the unnatural, harsh conditions subjected to aquatic fauna daily below Harris Dam.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. The minima and maxima are provided in a table in the Final Aquatic Resources Study Report.
ADCNR		On page 21, Table 3-5 of Draft Downstream Aquatic Habitat Report, in addition to mean, minimum and maximum provided, provide the median (°C) for each site and standard deviation of the means.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. This information is included in the Final Aquatic Resources Study Report.
ADCNR		On page 22, Figure 3-10 of Draft Downstream Aquatic Habitat Report, provide standard deviation bars for the average hourly temperature fluctuation.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. Standard deviation is included in a table.
ADCNR		On page 22, of Draft Downstream Aquatic Habitat Report, provide an additional graph similar to Figure 3-10 that depicts the maximum hourly water temperature fluctuation (Delta T) from May 2019 to April 2020. This graphic will better represent the unnatural, harsh conditions subjected to aquatic fauna frequently below Harris Dam.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. The maximum hourly temperature fluctuations are provided in a table.
ADCNR		On page 23, Table 3-6 of Draft Downstream Aquatic Habitat Report, provide map site numbers from Figure 2-1, in addition to the included miles below Harris dam.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. A revised figure has been included in the Final Aquatic Resources Study Report.
ADCNR		On page 23, Table 3-6 of Draft Downstream Aquatic Habitat Report, in addition to mean, minimum and maximum numbers provided, provide the median (°C) for each site and standard deviation of the means.	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
			This information was included in the Final Aquatic Resources Study Report.
ADCNR		On page 25, section 3.3 Wetted Perimeter of Draft Downstream Aquatic Habitat Report, median is used to evaluate seasonal analysis of wetted perimeter. Provide mean wetted perimeter in addition to median.	A revised figure was included in the Final Report.
ADCNR		On page 32, section 4.0 Discussion and Conclusions of Draft Downstream Aquatic Habitat Report, it states "*Results indicate that, on average, the largest daily water level fluctuations occur in the first seven miles below Harris Dam.*" Provide the metric value you are using to separate out the first seven miles of sites from the other sites downstream to make this statement. There are average daily water level changes over 3.0 ft occurring at river mile 15 and over 2.0 ft at river mile 28.2. A metric should be selected, utilized and stated for comparisons. Ideally this metric should be a point equivalent to the historical mean or median daily water level change of the unregulated natural flow regime for that stretch of river being analyzed.	The text was edited to be more general. No metric was used. This was simply meant to summarize the trends in the data.
ADCNR		On page 32, section 4.0 Discussion and Conclusions of Draft Downstream Aquatic Habitat Report, it states "*Results indicate that the largest daily water temperature fluctuations occur in the first seven miles below Harris Dam.*" Provide the metric value you are using to separate out the first seven miles of sites from the other sites downstream to make this statement. There are hourly water temperatures changes over 4°C occurring at river mile 19.5. A metric should be selected, utilized and stated for comparisons. Ideally this metric should be for a maximum hourly change in addition to percent of time this maximum is exceeded (See ADCNR section 3.2.4 Water Temperature comments, discuss sites with separation metric points of 2°C and 4°C maximum temperature change per hour).	The text was edited to be more general. No metric was used. This was simply meant to summarize the trends in the data.
ADCNR		On page 32, section 4.0 Discussion and Conclusions of Draft Downstream Aquatic Habitat Report, it states "*It is also worth noting that river flows during August and September of 2019, typically the warmest months of the year, were well below normal which could have resulted in greater daily and hourly temperature fluctuations than normal.*" This statement as presented does not seem accurate. Explain how a warm water unregulated river, without a dam, would decrease in temperature as it moves downstream. In many instances rainwater (runoff) in the summer will warm streams and tributaries, thus warm runoff increases temperatures in the creeks in some	All temperature data and analyses were moved from the Downstream Aquatic Habitat Report to the Final Aquatic Resources Study Report. The intent was not to imply that a warm water unregulated river decreases in temperature as it moves downstream. During periods of very low flow, shallow water areas such as shoals can warm or cool much faster than deep areas such

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
		instances, particularly during afternoon storms when ambient air temperatures have peaked for the day. Additionally, since the Harris dam discharge is below the surface water at 30-40 feet deep, changes to the stratification of the reservoir, would be more pronounced in higher flow, than lower flow years. Reservoir stratification is affected more by higher inflows, than low inflows, especially when discharge occurs from the metalimnion or hypolimnion. Downstream temperature changes should not be significantly different if a thermocline is present, which occurs annually at Harris Reservoir, and persists into September. The statement above requires additional explanation including mechanisms that would cause greater hourly temperature fluctuations than normal during low flow. Provide a reference to a Figure in document illustrating river flows during this time period and provide a specific instance that supports this statement. Clarify whether this statement is referring to tailrace flows or tributary inflows to the tailrace. Significant differences between large tributaries and tailrace temperatures even during atypical river flow scenarios in warmer months may be indications that the regulated reach is significantly altered compared to the natural temperature regime of the river system. Under a new FERC license agreement, R.L. Harris Hydroelectric Project will operate under various weather conditions throughout the issuance period of the license. We maintain our request that when evaluating impacts on downstream water quality (including water temperature) due to project operations, that methods to mitigate the unnatural water temperature variability be fully assessed to minimize impacts to the aquatic resources.	as pools. A figure was added to the discussion section of the Final Aquatic Resources Study Report to illustrate this concept.
ADCNR		On page 3, Task 2 – Water Level, Channel Profile and Discharge Data Collection and Analysis of the Downstream Aquatic Habitat Study Plan, it specifies using Acoustic Doppler Current Profilers (ADCP) to collect bed elevation and flow data. The data from the ADCP's is not mentioned in the study report. If data from these profilers will be used, include in the report. If data from these profilers will not be used, include an explanation for the deviation from the Study Plan.	An explanation for why the ADCP was not used was included in the Final Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
Alabama Rivers Alliance (ARA) Note: footnotes included in the original letter have been omitted from this table (highlighted portion of letter pertains to this study)	6/11/2020 20200611-5114	The summary of the Initial Study Report meeting reflects that Licensee desires "to hear from stakeholders now" regarding alternative flow scenarios stakeholders would like to have modeled,[35] despite no draft Aquatic Resources Study or Aquatic Habitat Study reports being available. The downstream release alternatives, aquatic resources, water quality, and aquatic habitat reports are *all deeply interrelated*, and without at least draft reports of the fisheries studies, stakeholders should not be required to propose alternative flow scenarios until more information is available. Indeed, Licensee itself acknowledges that the results from the Aquatic Resources Study are needed to design the fourth flow scenario it plans to model.[36] Those same results will also inform what variety of inputs stakeholders suggest.	Comment noted.
ARA	7/30/2020 Filed by email	The Draft Downstream Aquatic Habitat Study Report describes the voluntary management efforts of the Green Plan as beneficial to the fish population below Harris: "Monitoring conducted since initiation of the Green Plan has indicated a positive fish community response due to increased shoal habitat availability." This statement mischaracterizes the monitoring results from 2005-2010 reported in Irwin et al. 20112 (which it cites for this proposition) and ignores the most recent published research on the topic. Instead, Licensee conflates increased habitat availability with actual fish population response. In fact, the post-Green Plan monitoring from 2005-2010 reported by Irwin et al. 2011 and cited by Licensee in the draft study report flatly refuses to link the amount of increased habitat created by the Green Plan with fish population response: "Analysis of differences in hydrology that provide critical habitat for shoal dwelling species during pre- and post-management periods indicate significant increases in the amount of time quality habitat conditions were met (average gain of 30 d/season). *However, linking vital rates of fish populations to habitat variability will require more specific habitat measurement and modeling in relation to managed flow features*."[3] Irwin et al. 2011 does report the Green Plan tentatively has been successful for the reestablishment of one species (the Alabama shiner),[4]	Comment noted. The goal of this study was to characterize the effects of Harris operations on aquatic habitat within the study area through measurement and modeling.

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
		but it details steep declines in occupancy for other species, such as the Tallapoosa sculpin, black redhorse, and blacktail redhorse.[5] Moreover, the most recent relevant scientific literature from last year that incorporates longer-term biological monitoring also refutes Licensee's statement about positive fish response contained in the draft study report. The USGS Open-File Report 2019-1026, *Adaptive Management of Flows from R.L. Harris Dam (Tallapoosa River, Alabama)—Stakeholder Process and Use of Biological Monitoring Data for Decision Making*, assesses persistence and colonization for 38 fish species over a 12-year period.[6] In contrast to Licensee's draft report, the 2019 Open-File Report finds that quite the opposite is true—that the Green Plan has not resulted in a positive fish response. Chapter B of the 2019 Open-File Report focuses on the long-term occupancy of fishes above and below Harris. It clearly states that any increase in shoal habitat provided by the Green Plan has not translated into population benefits: "Irwin and others (2011) reported an increase in shoal habitat persistence associated with the Green Plan; *however, positive population responses have not ensued*."[7] Rather, the long-term data in the 2019 Open-File Report "provide evidence that suggests broadscale negative influences of the dam on species persistence and colonization parameters. Specifically, generation frequency and cool thermal regimes negatively affected fish persistence and colonization, respectively."[8] In assessing the relationship between aquatic habitat, fish population health, and downstream release alternatives (the Green Plan, alternative pulsing regimes, various minimum flows), Licensee, FERC, and stakeholders should not start from the misleading conclusion that the Green Plan generally benefitted fish populations downstream of Harris. This statement should be struck from the draft report and an accurate description of post-Green Plan monitoring that takes into account the most recent published scientific materials inserted in its place.	

Commenting Entity	Date of Comment & FERC Accession Number	Comment – Downstream Aquatic Habitat Report	Alabama Power Response
ARA		The Draft Downstream Aquatic Habitat Study Report uses "wetted perimeter" (the portion of the riverbed and banks in contact with the water in the channel) as a fundamental metric in comparing habitat availability among release scenarios. Licensee's HEC-RAS model outputs wetted perimeter values for simulations of the different flow scenarios, the preliminary conclusions being that the Green Plan created some gains in wetted perimeter over pre-Green Plan management, and that a 150cfs continuous minimum flow would result in further increases of wetted perimeter.[9] We caution against using wetted perimeter as a guide-star metric to measure aquatic health. Certainly, wetted perimeter and habitat duration should be evaluated and considered as part of this habitat study, but as described in the section above, over a decade of monitoring since implementation of the Green Plan has shown that an increase in quality habitat availability (made possible by increased wetted perimeter) has not led to a positive population response from fishes below the dam. Other variables, including stability of flows, thermal regime, and the availability of spawning windows must be considered along with habitat availability. The independent science simply does not connect increased habitat availability or wetted perimeter in the Tallapoosa River below Harris with increases in colonization, persistence, or recruitment of fishes, and when managing for conservation and restoration of fish species, FERC, Licensee, and stakeholders would do well not to believe one will necessarily lead to the other. The draft report should fully acknowledge what the science reveals and seek to understand through the other studies what additional factors may be contributing to the lack of fish species recovery.	We disagree with the premise that previous Green Plan monitoring assessed the availability of quality habitat. Those studies focused on the fish community and provided no assessment of the effects of the Green Plan on physical habitat. The results of the Downstream Aquatic Habitat Study appear to indicate that the Green Plan provided little benefit in terms of habitat availability, which may explain why certain species did not appear to benefit from this operation. To our knowledge, Bowen et al. (1998) is the only work that sought to understand flow-habitat relationships in the Tallapoosa River below Harris Dam, and that work was conducted under Pre-Green Plan conditions. Additionally, Alabama Power is adhering to the approved study plan methods.