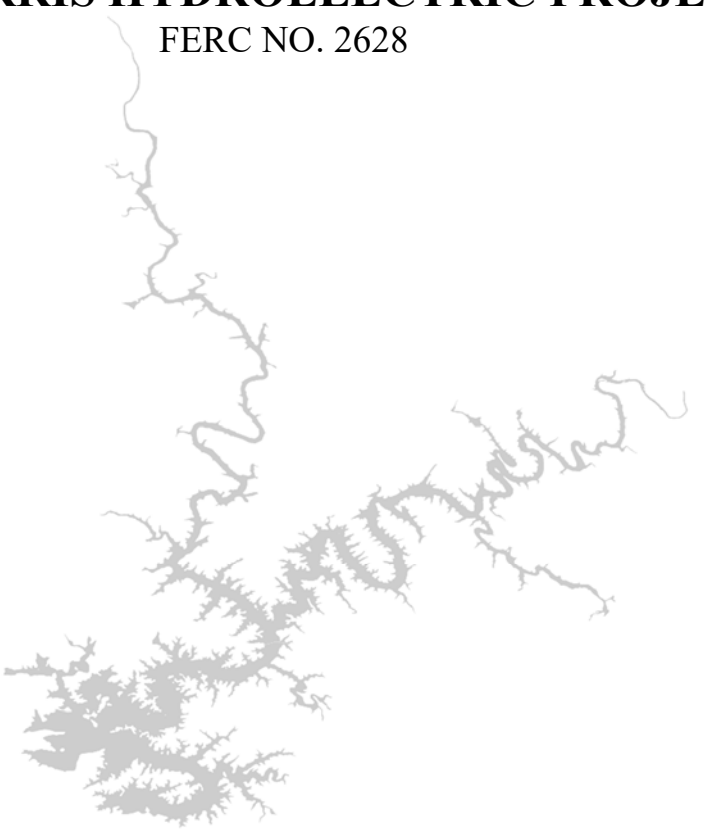
HARRIS DAM
RELICENSING

OPERATING CURVE CHANGE FEASIBILITY ANALYSIS STUDY PLAN

R. L. HARRIS HYDROELECTRIC PROJECT

FERC NO. 2628



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OPERATING CURVE CHANGE FEASIBILITY ANALYSIS
STUDY PLAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

OPERATING CURVE CHANGE FEASIBILITY ANALYSIS STUDY PLAN

1.0 INTRODUCTION

Alabama Power Company (Alabama Power) is initiating the Federal Energy Regulatory Commission (FERC) relicensing of the 135-megawatt (MW) R.L. Harris Hydroelectric Project (Harris Project), 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. These structures, lands, and water are enclosed within the FERC Project Boundary. Under the existing Harris Project license, the FERC Project Boundary encloses two distinct geographic areas, described below.

Harris Reservoir is the 9,870-acre reservoir (Harris Reservoir) created by the R.L. Harris Dam (Harris Dam). Harris Reservoir is located on the Tallapoosa River, near Lineville, Alabama. The lands adjoining the reservoir total approximately 7,392 acres and are included in the FERC Project Boundary. This includes land to 795 feet mean sea level (msl)[1], as well as natural undeveloped areas, hunting lands, prohibited access areas, recreational areas, and all islands.

The Harris Project also contains 15,063 acres of land within the James D. Martin-Skyline Wildlife Management Area (Skyline WMA) located in Jackson County, Alabama. These lands are located approximately 110 miles north of Harris Reservoir and were acquired and incorporated into the FERC Project Boundary as part of the FERC-approved Harris Project Wildlife Mitigative Plan and Wildlife Management Plan. These lands are leased to, and managed by, the State of Alabama for wildlife management and public hunting and are part of the Skyline WMA (ADCNR 2016b).

For the purposes of this study plan, "Lake Harris" refers to the 9,870-acre reservoir, adjacent 7,392 acres of Project land, and the dam, spillway, and powerhouse. "Skyline" refers to the 15,063 acres of Project land within the Skyline WMA in Jackson County. "Harris Project" refers to all the lands, waters, and structures enclosed within the FERC Project Boundary, which includes both Lake Harris and Skyline. Harris Reservoir refers to the 9,870-acre reservoir only; Harris Dam refers to the dam, spillway, and powerhouse. The Project Area refers to the land and water in the Project Boundary and immediate geographic area adjacent to the Project Boundary (Alabama Power Company 2018).

Lake Harris and Skyline are located within two river basins: the Tallapoosa and Tennessee River Basins, respectively. The only waterbody managed by Alabama Power as part of their FERC license for the Harris Project is the Harris Reservoir.

[1] Also includes a scenic easement (to 800 feet msl or 50 horizontal feet from 793 feet msl, whichever is less, but never less than 795 feet msl).

Background and Existing Data

During stakeholder one-on-one meetings and at the October 19, 2017 Issue Identification Workshop, stakeholders requested that Alabama Power investigate changing the winter operating curve for the Harris Project. Stakeholders believe that a higher winter operating curve will enhance recreation opportunities on Harris Reservoir during the winter, or typical drawdown period. Alabama Power has performed similar analyses at several of their hydroelectric projects as part of the FERC relicensing process. Alabama Power has developed this study plan to investigate this requested change and the potential impacts of a winter operating curve change on other resource areas within Harris Reservoir and in the Tallapoosa River downstream of Harris Dam. Alabama Power does not have any existing information that would address this request without performing extensive modeling and analysis of the hydrologic record and baseline information for the Project. This study plan provides a list of tools, methods, and analyses that will be performed to address this request.

1.1 Resource Management Goals

The Harris Project is licensed by FERC. All proposed operational changes must be disclosed, and any identified effects must be addressed in the license application to FERC. The Operating Curve Change Feasibility Analysis will assist Alabama Power with developing an operations proposal to include in the Preliminary Licensing Proposal (PLP) and will assist with FERC's analysis in determining new license conditions for the Harris Project. Alabama Power will work with agencies and other stakeholders to ensure that resource management goals for individual resource areas are considered and any applicable environmental, cultural, or recreational resource analyses examine and discuss effects of any proposed operating curve change.

1.2 Current Operations and Operational Alternatives

Stakeholders have requested that Alabama Power investigate the feasibility of modifying the current winter operating curve at the Harris Project annually from October through March to enhance recreation access on Harris Reservoir. The Operating Curve Change Feasibility Analysis study will evaluate, in increments of 1 foot from 786 feet msl to 789 feet msl (i.e., 786, 787, 788, and 789 msl), Alabama Power's ability to increase the winter pool elevation and continue to meet Project purposes (**Figure 1-1**). This study will use information from the Pre-Application Document (PAD), technical reports, and the results of Alabama Power's proposed relicensing studies, as applicable, to examine the effects of a winter operating curve change on the following operational parameters and resources:

- Hydropower generation
- Green Plan flows[2]
- Downstream Release Alternatives
- Flood control
- Navigation

[2] See *Summary of R.L. Harris Downstream Flow Adaptive Management History and Research* Technical Report (Kleinschmidt 2018a).

- Drought operations (ADROP)
- Water quality and water use
- Erosion and sedimentation (including invasive species)
- Aquatic species (reservoir and tailwater)
- Wildlife and terrestrial resources (including wetlands)
- Threatened and endangered species
- Recreation resources
- Cultural resources

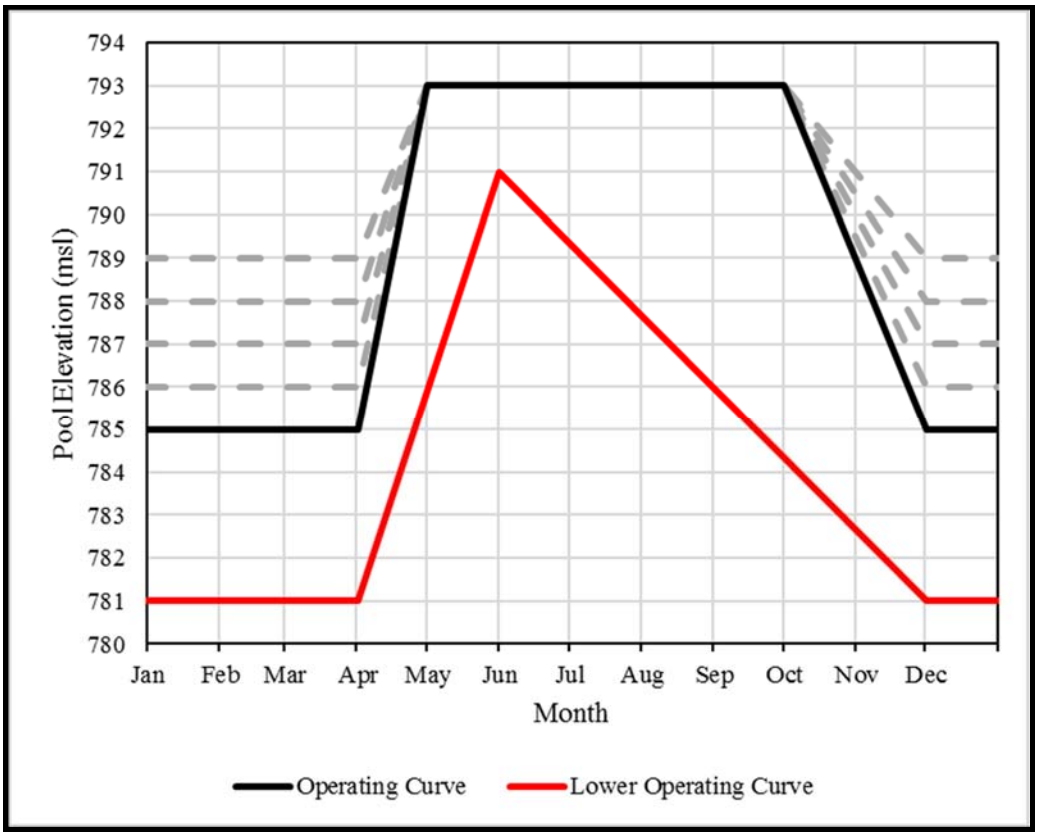

FIGURE 1-1 HARRIS OPERATING CURVE WITH PROPOSED 1-FOOT INCREMENTAL CHANGES

2.0 GOALS AND OBJECTIVES

The Operating Curve Change Feasibility Analysis will assist Alabama Power in determining the feasibility of proposing an operating curve change as part of its license application. Changes to the operating curve must be approved by FERC, with consultation by the U.S. Army Corps of Engineers (USACE) relating to flood control issues. The current license requires the Project to be operated in the interest of flood control based on agreement between USACE and Alabama Power, and the current operating guide curve and flood control operations are included in the USACE-issued Water Control Manual (WCM) for the Harris Project. Changes to the operating curve and

flood control operations would also require changes to the WCM to make it consistent with the requirements in the new license.

The objective of this study is to use industry-accepted methods to develop simulation models for analyzing proposed alternatives to the existing (baseline) winter operating curve. Simulation models will provide the tools to evaluate feasibility, identify impacts, and provide data to compare existing operations with potential increases to the winter operating curve on an incremental basis.

The modeling simulations will be performed in **Phase 1** of this study. Tools and models may include, but not be limited to, the USACE HEC-RAS[3] and HEC-SSP, HEC-ResSim, the Alabama-Coosa-Tallapoosa (ACT) unimpaired flow data set developed by the USACE and other stakeholders, and Alabama Power's Hydro Energy model. Descriptions of these models and data sets are included in Appendix A.

Phase 2 of this study will use the results of the simulation models developed in Phase 1 in conjunction with the results of the other FERC-approved Harris relicensing studies and existing information (e.g., PAD, technical reports) to conduct qualitative and quantitative evaluations of the effect(s) of an operating curve change on resources listed in Section 1.2. Methods for the analyses in Phase 1 and Phase 2 are presented in Section 4.0.

3.0 PROJECT NEXUS AND GEOGRAPHIC SCOPE

The Harris Project operations have direct, indirect, and potential cumulative effects on lake and downstream resources. The geographic scope (i.e., the study area) of Phases 1 and 2 of this study corresponds with the physical area and/or resources influenced by the proposed operational change, which may or may not be consistent with the Harris Project boundary. The geographic scope of analyses for each operational parameter and resource is listed in **Table 3-1**. **Figure 3-1** displays a map of Lake Harris and Tallapoosa River through Horseshoe Bend. Alabama Power used stream gages to review and determine the geographic area where effects of Harris Project operations can be measured downstream of Harris Dam; this exercise resulted in developing the downstream geographic scope. For the Lake Harris geographic scope, the area of operating influence is in and around the Harris Reservoir due to Project operations.

[3] These models were developed by the USACE's Hydrologic Engineering Center (HEC). Use of these models is described in greater detail in Appendix A of this Study Plan. Additional information can be found at: http://www.hec.usace.army.mil/.

TABLE 3-1 SUMMARY OF OPERATIONAL PARAMETERS, RESOURCES, GEOGRAPHIC SCOPE AND RATIONALE

Operational Parameter/Resource	Geographic Scope	Rationale
Hydropower Generation	Alabama Power's Coosa and Tallapoosa Projects	Effects on hydropower generation would impact system-wide operations
Flood Control	Lake Harris and Harris Dam to Montgomery Water Works	Model parameters are set to evaluate flood operation effects to Montgomery Water Works
Navigation	ACT Basin	Model parameters are set to evaluate effects on the ACT Basin per the USACE Master Water Control Manual
Drought Operations	ACT Basin	Model parameters are set to evaluate effects on the ACT Basin per the USACE Master Water Control Manual
Green Plan Flows	Tallapoosa River downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs from Harris Dam through Horseshoe Bend.
Downstream Release Alternatives	Tallapoosa River downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs from Harris Dam through Horseshoe Bend.
Water Quality (DO)	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend.
Water Use	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend
Erosion and Sedimentation (and invasive species)	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend
Aquatic Resources	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend

Operational Parameter/Resource	Geographic Scope	Rationale
Wildlife and Terrestrial Resources, including Threatened, and Endangered Species	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend
Wetlands	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend
Recreation Resources	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend
Cultural Resources	Lake Harris; Downstream from Harris Dam through Horseshoe Bend	Operational influence of the Harris Project occurs in and around Harris Reservoir and from Harris Dam through Horseshoe Bend, especially at the Miller Covered Bridge piers

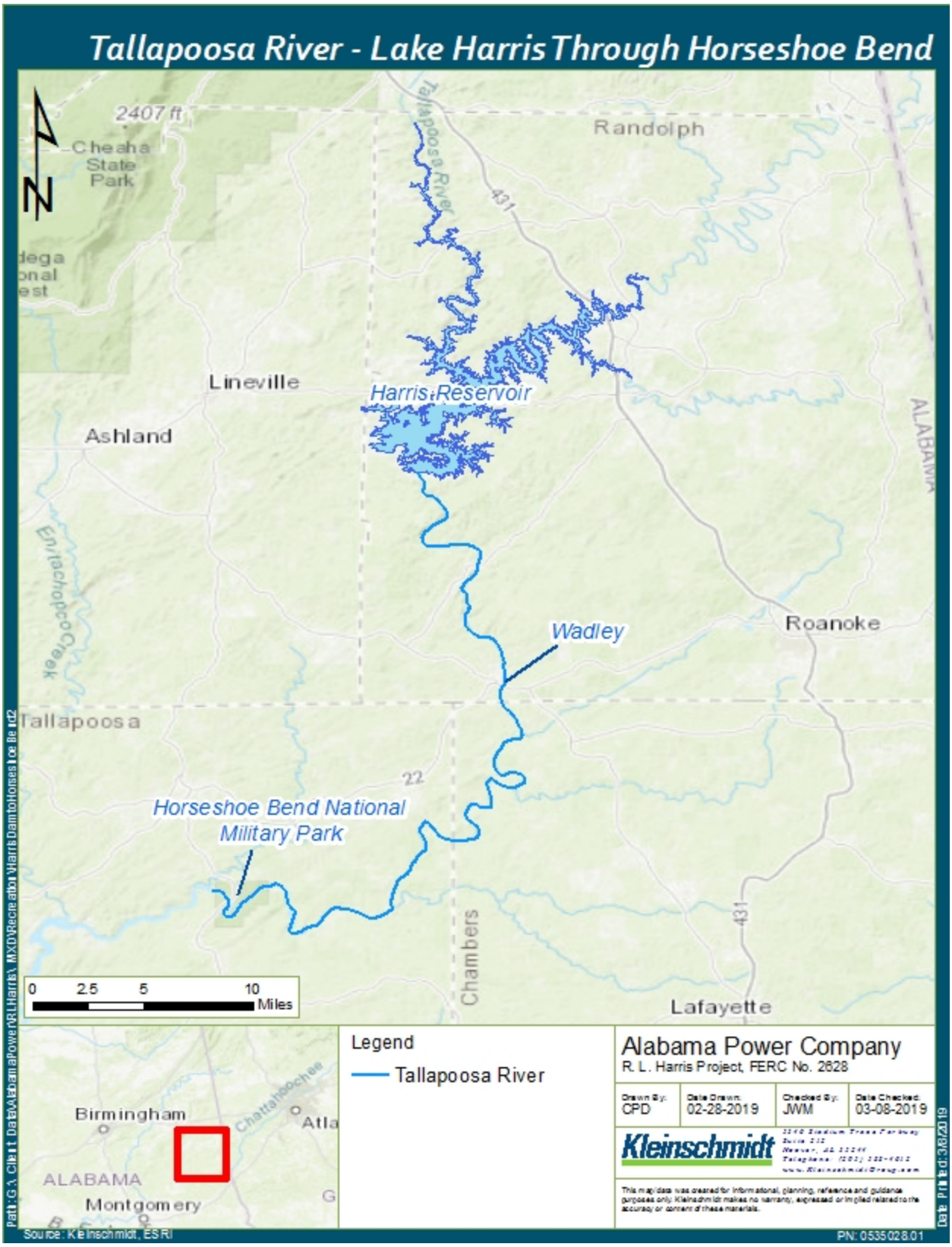

FIGURE 3-1 TALLAPOOSA RIVER - LAKE HARRIS THROUGH HORSESHOE BEND

4.0 METHODS

This study is divided into two phases. In Phase 1, Alabama Power will conduct modeling simulations using specific methods, tools, and processes that are described in Appendix A and in Section 2.0. Alabama Power has previous experience with this overall process, because it was used and accepted by FERC in the analysis for the Martin Dam Project rule curve change (FERC No. 349), conducted from 2010 through 2014.

The detailed process for completing Phase 1 will be as follows:

1. Alabama Power will present the proposed methodology to the Harris Action Team (HAT) 1 (including USACE representatives) for review and comment. Alabama Power may modify the methodology based on HAT 1 comments/recommendations.
2. Once Alabama Power has completed the model(s) according to the methods described in Appendix A, Alabama Power will present the models and assumptions to HAT 1. The review may result in additional simulations or refinement of the alternatives.
3. Initial screening of each alternative's ability to manage significant flood events will be accomplished by subjecting each alternative to a representative flood with a 1 percent recurrence probability. These models will utilize hourly time steps.
4. Impacts to navigation, flood control, drought operations, ability to provide downstream releases, and hydropower generation will be evaluated using long term models with daily time steps.
5. Upon completing the model runs, Alabama Power will develop a Phase 1 Draft Harris Operating Curve Change Feasibility Analysis Report for HAT 1 review and comment.
6. Based on comments, Alabama Power will develop a Phase 1 Final Harris Operating Curve Change Feasibility Analysis Report.

Phase 2 will use the modeling results from Phase 1 along with FERC-approved relicensing study results and existing information to conduct quantitative and qualitative evaluations of potential resource impacts.

The detailed process for completing Phase 2 will be as follows:

1. Gather information/results from FERC-approved relicensing studies, existing information (PAD and technical reports), and results from Phase 1 analyses to incorporate into the Phase 2 resource analysis.
2. Conduct resource analyses according to the FERC-approved study plan (as described below).
3. Develop a Phase 2 Draft Harris Operating Curve Change Effects Analyses Report for HAT 1 (and other affected HAT resource groups) review and comment.
4. Based on comments, Alabama Power will develop a Phase 2 Final Harris Operating Curve Change Effects Analyses Report.

4.1 Effects Analysis Methods

For the Phase 2 analyses, Alabama Power has developed specific methodologies for the potentially affected resources, which are discussed below.

4.1.1 Water Quality

Alabama Power proposes to use an Environmental Fluid Dynamics Code (EFDC) model to evaluate and describe the relationship between Harris Reservoir water quality and potential changes to downstream dissolved oxygen and temperature from a potential change to rule curve operations. The EFDC is a water quality and hydrodynamic model in 2D (longitudinal-vertical) for rivers, estuaries, lakes, reservoirs, and river basin systems. The EFDC models can be used to evaluate basic eutrophication processes such as temperature-nutrient-algae-dissolved oxygen-organic matter and sediment relationships in stratified and non-stratified systems. The model will be calibrated and verified with existing water quality data. Proposed rule curve operations will then be modeled to determine if a potential change in the lake stratification would have an impact on the resulting downstream water quality.

Data from the Baseline Water Quality Report (Kleinschmidt 2018), FERC-approved Water Quality Study, and other pertinent information that becomes available will be used in the model to assess potential changes to water quality in the reservoir forebay and resulting turbine discharges. In addition, HEC-ResSim will be used to quantify the lake retention time for operations under the current/existing license and for operations that would result from each incremental 1-foot increase in the winter operating curve. Areas of water quality concern identified and evaluated in the FERC-approved Water Quality Study Plan will also be considered in this analysis.

Alabama Power will use the quantitative data in the EFDC to evaluate potential downstream effects on dissolved oxygen that may occur due to changes in forebay water quality.

4.1.2 Water Use

Alabama Power will use the results of the Phase 1 modeling to determine if there are any effects (direct, indirect, and/or cumulative) on existing and potential water withdrawals in Harris Reservoir and the Tallapoosa River downstream of Harris Dam through Horseshoe Bend. Alabama Power will also use existing information in the Water Quantity, Water Use, and Discharges Report (Kleinschmidt 2018b).

4.1.3 Erosion and Sedimentation

Alabama Power will review data (e.g., soil types, slope) from the FERC-approved Erosion and Sedimentation Study. These data will help identify the risk of erosion hotspots or sedimentation areas that could potentially change with each incremental winter operating curve elevation. In addition, Alabama Power will use information to determine the potential increase in recreation user days from higher winter operating curve elevations and its impact on erosion hotspots and sedimentation areas. Alabama Power will also use the results of the FERC-approved Erosion and Sedimentation Study to determine if the risk for occurrence of nuisance aquatic vegetation may

improve or worsen due to changes in erosion and sedimentation areas resulting from changes to the operating curve. Areas of sedimentation in the reservoir and near creek mouths will be qualitatively assessed, and Light Detection and Ranging (LIDAR) and a Geographic Information System (GIS) will be used for Harris Reservoir to estimate the area that could be impacted at each site by each 1-foot change in the operating curve.

Using the erosion hotspots identified downstream and other information gathered in the Tallapoosa River from Harris Dam through Horseshoe Bend in the FERC-approved Erosion and Sedimentation Study, Alabama Power will overlay LIDAR data with the results of the Phase 1 study to determine the potential impacts to erosion and sedimentation associated with a change in magnitude and frequency of flood events predicted with each 1-foot increment of operating curve change.

4.1.4 Aquatic Resources

Alabama Power will use existing reservoir fishery data and the results of Phase 1 to qualitatively evaluate potential changes to the reservoir fishery associated with potential changes to the operating curve. Alabama Power will also use the results of Phase 1 and the results of the other FERC-approved studies to assess the direct, indirect, and/or cumulative effects of the operating curve change on aquatic resources in the Tallapoosa River downstream of Harris Dam through Horseshoe Bend.

4.1.5 Wildlife, Threatened, and Endangered Species

Using information in the PAD and information gathered in the FERC-approved Threatened and Endangered (T&E) Species Study, Alabama Power will examine the potential effects of an operating curve change on wildlife and T&E, if any, species located in and around the Harris Reservoir and in the Tallapoosa River downstream of Harris Dam through Horseshoe Bend. Alabama Power will compare the habitats of T&E species at the existing winter operating curve to each of the 1-foot increments of a possible winter lake level change to identify whether these habitats may be potentially affected.

4.1.6 Terrestrial Wetlands

Alabama Power will use existing wetlands data (as identified in the PAD) in and around Harris Reservoir and downstream of Harris Dam in the Tallapoosa River through Horseshoe Bend. These data will be incorporated into GIS, and the evaluation of changes to the winter operating curve (in 1-foot increments) will indicate if the reservoir wetland areas will be inundated or dry with a change in magnitude and frequency of flood events for each of the possible winter operating curve changes.

4.1.7 Recreation

Alabama Power proposes to examine the potential effects of a change in the winter operating curve on recreational use in Lake Harris by using the information gathered in the FERC-approved Recreation Evaluation Study. This information includes data on recreational access points (the

number of private docks useable during the current winter drawdown and the lowest possible elevation that public boat ramps can be used). Alabama Power will then compare the number of access points (both private docks and public boat ramps) available at each 1-foot increment change in winter operating curve elevation. Alabama Power will use LIDAR data and field observations to make quantitative determinations.

For recreation access downstream of Harris Dam (Tallapoosa River through Horseshoe Bend), Alabama Power will identify recreational access points affected by the estimated changes in downstream flows and/or water levels. These access points will be assessed for the magnitude and frequency of high flow events resulting from the proposed operational curve changes (e.g., additional days that access roads or access areas are underwater).

4.1.8 Cultural Resources

Alabama Power will use existing information to evaluate sites identified in the Cultural Resources Study that may be impacted by reservoir fluctuation and the resulting potential change in erosion and sedimentation. Undercut and eroded banks along the shoreline can expose artifacts and features, making a site more visible and, therefore, more susceptible to looters. Alabama Power will use elevation data (LIDAR), aerial imagery, and expert opinions provided by persons familiar with the study area to determine (in 1-foot increments) the quantitative effects of any operational curve changes to specific cultural resources sites.

Undercut and eroded banks along the river can expose artifacts and features, making a site more visible and, therefore, more susceptible to looters. Alabama Power will use elevation data (LIDAR), aerial imagery, and expert opinions provided by persons familiar with the study area to qualitatively determine the effects of an operating curve change to specific cultural resources sites. The primary point of interest is the Miller Covered Bridge piers located at Horseshoe Bend National Military Park.

A summary of the resources to be studied, geographic scope, and study methods are described in **Table 4-1**.

TABLE 4-1 SUMMARY OF THE RESOURCES, GEOGRAPHIC SCOPE AND STUDY METHODS

Resource	Method	
	Lake Harris	**Tallapoosa River Downstream of Harris Dam through Horseshoe Bend**
Water Quality	• Phase 1 results • Existing information • EFDC and HEC-ResSim	• Existing information • EFDC to evaluate potential effects on dissolved oxygen from unit discharge in the tailrace
Water Use	• Phase 1 results • Existing information - Water Quantity, Water Use, and Discharges Report	• Phase 1 results • Existing information - Water Quantity, Water Use, and Discharges Report
Erosion and Sedimentation (including invasive species)	• Phase 1 results • FERC-approved Erosion and Sedimentation Study • LIDAR, aerial imagery, historic photos, GIS • Quantitative and qualitative evaluation of areas most susceptible to increase in nuisance aquatic vegetation	• Phase 1 results • FERC-approved Erosion and Sedimentation Study • LIDAR, aerial imagery, historic photos, GIS
Aquatics	• Phase 1 results • Existing information on the Harris Reservoir fishery	• Phase 1 results • Other FERC approved studies as appropriate
Wildlife and Terrestrial Resources-including Threatened, and Endangered Species	• Phase 1 results • FERC-approved Threatened and Endangered Species Study • GIS	• Phase 1 results • FERC-approved Threatened and Endangered Species Study • GIS
Terrestrial Wetlands	• Existing reservoir wetland data • Phase 1 results • LIDAR, aerial imagery, expert opinions, and GIS	• Existing wetlands data • National Wetland Inventory maps • Phase 1 results • LIDAR, aerial imagery, expert opinions, and GIS
Recreation Resources	• Phase 1 results • FERC-approved Recreation Evaluation Study • LIDAR data	• Phase 1 results • FERC-approved Recreation Evaluation Study • LIDAR data
Cultural Resources	• Phase 1 results • LIDAR, aerial imagery, expert opinions, and GIS	• Phase 1 results • LIDAR, aerial imagery, expert opinions, and GIS

5.0 REPORTS

As the various components of this study are completed and available for review and comment, Alabama Power will share results with HAT 1 through written documentation and stakeholder meetings, as discussed in Section 2.0 of the PAD. Stakeholders will have between 7-30 days to review and comment on documents, depending on the document length and complexity. Additional meetings (in-person and via conference call) will be held as necessary to discuss study results and solicit stakeholder input. Draft and final reports, if applicable to the study, will be filed with FERC as well as provided to the HAT members and posted to the Harris relicensing website for access by the general public.

As part of the Integrated Licensing Process (ILP), FERC requires licensees to file two status reports: the Initial Study Report and Updated Study Report. These reports provide a status update on all the FERC-approved relicensing studies. Alabama Power will prepare these FERC reports per the requirements of 18 CFR 5.15(c) and (f).

While not required in FERC's ILP process, Alabama Power will also file two Progress Updates during the relicensing process to provide additional updates to FERC, stakeholders, and the general public on the status of the relicensing studies, any interim work products, and any draft and final reports issued. The Progress Update will also include HAT meeting summaries. The first Progress Update will be distributed (and filed with FERC) in October 2019, approximately six months prior to the Initial Study Report; the second update will be distributed (and filed with FERC) in October 2020, approximately six months prior to the Updated Study Report.

6.0 SCHEDULE

This schedule corresponds to the FERC-approved Harris Project Process Plan and Schedule. Consultation meeting dates will be finalized with HAT 1 members upon FERC approval of the study.

FERC Study Plan Determination	April 2019
HAT 1 Model Methods meeting (inputs, etc.)	August/September 2019
Phase 1 Modeling Analysis	September 2019 – December 2019
Progress Update	October 2019
HAT 1 Meeting to present initial model results	February/March 2020
Draft Phase 1 Modeling Report	April 2020
Initial Study Report	April 2020
Initial Study Report Meeting	April 2020
HAT 1 meetings, as needed	April 2020 – November 2021[4]
Final Phase 1 Modeling Report	August 2020
Phase 2 Effects Analysis and Consultation	August 2020 – December 2020
Progress Update	October 2020
Phase 2 Draft Report	April 2021
Updated Study Report	April 2021
Updated Study Report Meeting	April 2021

[4] Meeting dates will be determined with the HAT 1 members based on results of modeling studies.

File Preliminary Licensing Proposal	By July 3, 2021
Final Phase 2 Modeling Report	November 2021
File Final License Application with FERC	November 2021

7.0 COST AND EFFORT

Alabama Power estimates the cost to consult on and implement this study plan, including costs for all modeling and developing the Draft and Final Reports, is $1.1M.

8.0 REFERENCES

Alabama Department of Conservation and Natural Resources (ADCNR). 2016b Wildlife Management Areas. Available at: http://www.outdooralabama.com/wildlife-management-areas. Accessed November 2016.

Alabama Power Company. 2018. Preliminary Application Document for the R.L. Harris Hydroelectric Project (FERC No. 2628). Alabama Power Company, Birmingham, AL.

Kleinschmidt Associates. 2018a. *Summary of R.L. Harris Downstream Flow Adaptive Management History and Research* Technical Report. Birmingham, AL.

APPENDIX A

MODEL METHODOLOGY

PROPOSED HYDROLOGIC AND HYDRAULIC STUDY

Models and Datasets

Alabama Power plans to use the following data and models to conduct the analysis of the operating curve study at Lake Harris.

1) Alabama-Coosa-Tallapoosa (ACT) unimpaired flow database – this database was developed by the United States Army Corps of Engineers (USACE) with input and data from other stakeholders in the ACT comprehensive study, including both the states of Georgia and Alabama, Alabama Power, and others. This dataset is average daily flows from 1939 – 2016 with regulation influences removed. This dataset will be utilized in the HEC-SSP[5] and HEC-ResSim.
2) Other data – Other data sources will include United States Geological Survey (USGS), USACE, and Alabama Power records.
3) HEC-Statistical Software Package (HEC-SSP) – this model is the USACE's newest version of the Flood Frequency Analysis. This model will be used to determine the statistical frequency of flooding on a monthly basis.
4) HEC-River Analysis System (HEC-RAS) – this model will be utilized in the flood study portion of evaluating the operating curve. It will route flows in the unsteady state[6] along the river.
5) HEC-Reservoir Simulation Model (HEC-ResSim) – this model will look at operational changes at the Harris Project in conjunction with operating curve change on a daily timestep. It will also be used to focus on the hourly flood study operations. This model in conjunction with the HEC-RAS model, will show impacts, if applicable, to the Martin Dam Project operations.
6) HEC-DSSVue – This is the USACE's Data Storage System that is designed to efficiently store and retrieve scientific data that is typically sequential. Data in HEC-DSS database files can be graphed, tabulated, edited, and manipulated with HEC-DSSVue. This program will be used to display some of the output of the other HEC models.
7) Alabama Power Hydro Energy Model – This model is a proprietary model that will be used to evaluate the net economic gains or losses that could result from proposed operating curve changes at the Harris Project.

Methodology

For the flood study portion of the analysis, Alabama Power will utilize the USACE's unimpaired flow data set in the HEC-SSP model to determine the statistical frequency of historical floods in the Tallapoosa Basin. The historical flood closest to the 100-year frequency will then be increased or lowered to approximate the 100-year flood in peak flow and 1, 3, and 5-day volume. The inflow hydrograph will then be routed thru the Harris Dam using the HEC-ResSim model for both the baseline existing operating curve as well as each alternative (1-4 ft change). The resulting outflow hydrographs will then be routed downstream using the HEC-RAS model below Harris Dam, and

[5] Hydrologic Engineering Center (HEC)
[6] In hydraulic modeling, simulations run in the unsteady state consider the variance of flow with respect to time.

impacts from resulting elevations will be evaluated (based on the flood stage at Wadley). The HEC-RAS model may also be used to evaluate effects on other resources.

Coordination and Evaluation

Through consultation with the Harris relicensing stakeholders, Alabama Power has developed a list of operating curve changes to model including the following:

1. Model a rise in elevation of the winter operating curve in 1-foot increments from 785 ft msl to 789 ft msl (i.e., 786, 787, 788, and 789 msl).

2. Downstream impacts, with respect to flooding, will be evaluated by developing an approximate 100-year Flood and comparing peak elevations generated by the downstream HEC-RAS model for each 1-foot increment in the winter operating curve to the peak elevations for the existing operating curve. A probability analysis (seasonal or monthly comparisons) will also be incorporated in the analysis. HEC-ResSim will be used to generate outflow hydrographs in operational criteria at Harris.

3. Magnitude, frequency, and duration of flood events downstream of Harris Dam can be analyzed using HEC-Res-Sim.

4. Total cost associated with the proposed operating curve changes will be documented and presented. The Hydro Energy Model analysis will provide economic gains and/or losses associated with power generation with the respective operational procedural changes.

5. All analyses, procedures, modeling, and coordination will be properly documented and discussed with the Harris Action Team (HAT) 1. HAT 1 members will be provided documentation of the analysis for review throughout the study process.