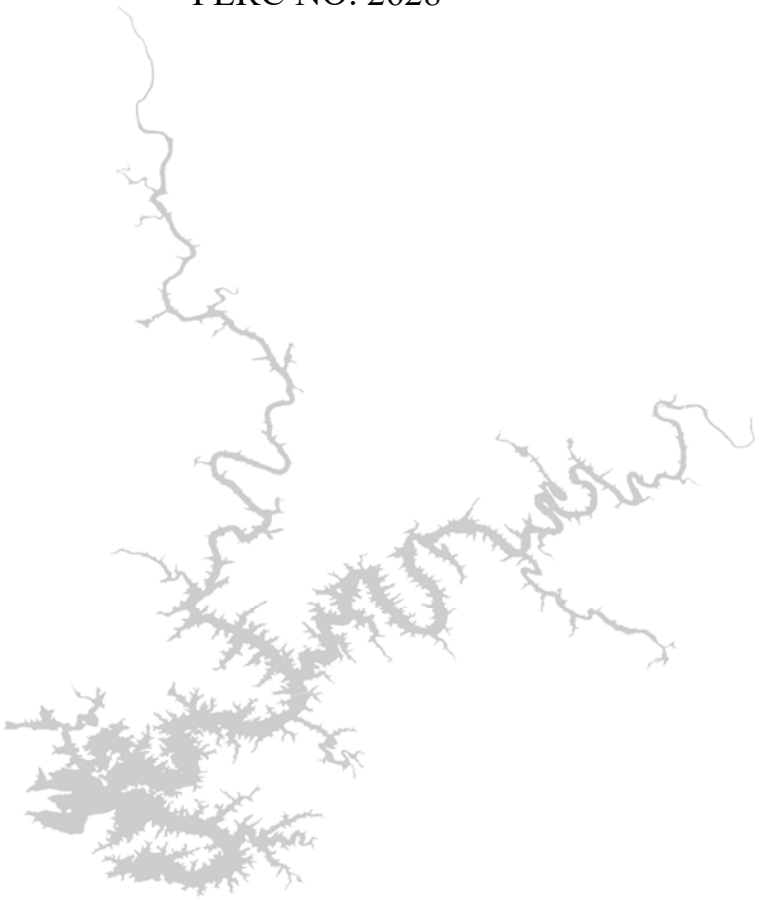
DOWNSTREAM RELEASE ALTERNATIVES STUDY PLAN

R. L. HARRIS HYDROELECTRIC PROJECT

FERC NO. 2628



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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 Information

Alabama Power began operating the Harris Project in 1983. Initially, the Project only operated in peaking mode with no intermittent flows between peaks. 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 (Kleinschmidt 2018a). The purpose of the Green Plan was to reduce the effects of peaking operations on the aquatic community downstream. Although Green Plan operations are not required by the existing license, Alabama Power has operated Harris Dam according to its guidelines since 2005. A copy of the Green Plan Release Criteria is provided in Appendix A.

1.1 Resource Management Goals

FERC has a responsibility to evaluate project impacts to determine the best comprehensive development of a waterway. Some stakeholders have requested that Alabama Power evaluate the Green Plan releases compared to the pre-Green Plan peaking flows. Stakeholders also commented that alternative downstream release scenarios should be evaluated as part of the relicensing process. Alabama Power will consult with agencies and other stakeholders to ensure that management goals for individual resource areas are considered and any applicable environmental, cultural, or recreational resource analyses examine and discuss effects of any proposed change in downstream releases.

1.2 Current Operations and Operational Alternatives

As discussed in Section 1.0, Alabama Power implemented a pulsing scheme in 2005 for releases from Harris Dam known as the Green Plan (Kleinschmidt 2018a; Appendix A). The purpose of the Green Plan was to, within the physical and regulatory limits of the plant and equipment, reduce the effects of various hydropower operations on the downstream aquatic and environmental resources. Prior to 2005, peaking flows were the primary releases from the Harris Dam during normal operations. From 2005 to 2017, the Alabama Cooperative Fish and Wildlife Research Unit (ACFWRU) conducted monitoring of shallow-water fish and benthic macroinvertebrate communities which has indicated a positive fish community response and increased shoal habitat availability (Irwin et al. 2011). However, some stakeholders have noted that the temperature of the turbine releases could have potential effects on aquatic resources in the Tallapoosa River below Harris Dam. These possible effects are being evaluated in the Aquatic Resources Study Plan.

Based on stakeholder input, the Downstream Release Alternatives study will evaluate and compare the effects of pre and post Green Plan operations, a continuous minimum flow of 150 cfs (which is roughly the equivalent daily volume of three ten-minute pulses) and an alternative/modified Green Plan operation (i.e., changing the time of day in which Green Plan pulses are released), on Project resources. Any effects on downstream flows from potential changes in the operating curve will be analyzed in the R.L. Harris Project Operating Curve Change Feasibility Study.

2.0 GOALS AND OBJECTIVES OF STUDY

The goal of this study is to evaluate the effects of current (Green Plan) and historic (peaking only) operations and alternative downstream release alternatives on Project resources. During this study, Alabama Power will use existing information from the PAD and technical reports, as well as the results of Alabama Power's FERC-approved studies, as applicable, to conduct qualitative and quantitative evaluations of the effects of downstream release alternatives on Project operational parameters and resources, identified below.

- Reservoir levels
- Hydropower generation
- Flood control
- Navigation
- Drought operations (ADROP)
- Water quality and water use
- Erosion and sedimentation (including invasive species)
- Downstream aquatic resources (temperature and habitat)
- Wildlife and terrestrial resources
- Threatened and endangered species
- Recreation resources
- Cultural resources

3.0 PROJECT NEXUS AND GEOGRAPHIC SCOPE

The Harris Project operations have direct, indirect, and potential cumulative effects on Harris Lake and downstream Tallapoosa River resources. The area of project influence is the Harris Reservoir and Tallapoosa River downstream of Harris Dam through Horseshoe Bend.

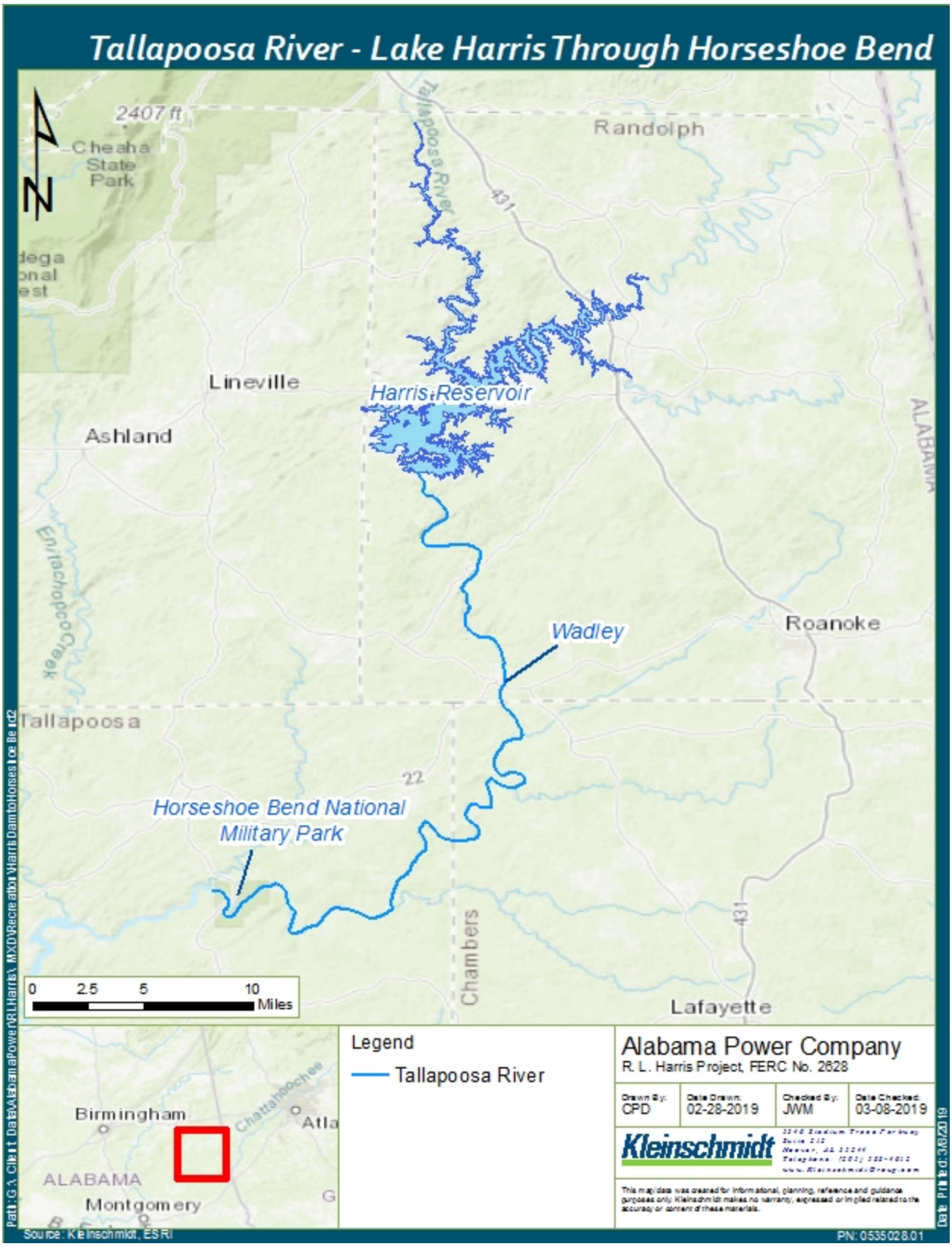

FIGURE 3-1 STUDY AREA MAP- LAKE HARRIS THROUGH HORSESHOE BEND

4.0 METHODS

This study will be conducted in two phases. In Phase 1, Alabama Power will use models developed in other Harris Project FERC-approved studies and conduct modeling simulations using specific methods, tools, and processes described in Appendix B. The models will be developed early in the relicensing process and will be used to evaluate and describe the effects of downstream releases. For the Phase 2 analyses, Alabama Power has developed specific methodologies for the potentially affected resources, which are discussed below.

4.1 Phase 1 – Development of Models

1. Alabama Power will present the proposed methodology to the Harris Action Team (HAT) 1 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 B, Alabama Power will present the models and assumptions to HAT 1. This review may result in additional simulations or refinement of the alternatives.

3. Upon completing the model runs, Alabama Power will develop a Draft Downstream Release Alternatives Phase 1 Report for HAT 1 review and comment that will include impacts to existing operational parameters: Harris operating curve, navigation, flood control, drought operations, and hydropower generation.

4. Based on comments, Alabama Power will develop a Final Downstream Release Alternatives Phase 1 Report.

4.2 Phase 2 - Effects Analysis Methods

Analysis of the effects of each downstream release alternative will be accomplished using a combination of existing information, results from other FERC-approved studies, and model results developed in Phase 1. The sections below provide descriptions of the specific methods for each potentially affected Project resource.

4.2.1 Water Quality

Alabama Power will use existing data from the PAD, Baseline Water Quality Report, and results from the Water Quality Study to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to changes in downstream releases. This information will inform Alabama Power on possible additional measures needed to meet its 401 water quality certification. The effects of the downstream release alternatives on the downstream water temperature regime are discussed in the Aquatic Resources section.

4.2.2 Water Use

Alabama Power will use the results of the HEC-RAS modeling to determine effects on existing and potential water withdrawals in the Tallapoosa River downstream of Harris Dam through

Horseshoe Bend. Alabama Power may also use existing information in the PAD and the Water Quantity, Water Use, and Discharges Report (Kleinschmidt 2018b) to describe effects.

4.2.3 Downstream Erosion

Alabama Power will use the assessments for downstream sites from the FERC-approved Erosion and Sedimentation Study and outputs from the HEC-RAS model to qualitatively assess the effects of downstream release alternatives on erosion.

4.2.4 Aquatic Resources

Alabama Power will use the HEC-RAS model and outputs developed within the Downstream Aquatic Habitat Study to evaluate potential effects on aquatic resources in the Tallapoosa River downstream of the Harris Dam through Horseshoe Bend. Specifically, outputs from the HEC-RAS model will be used to compare the amount, type, and persistence of wetted habitat associated with each model output from the downstream release alternatives. Alabama Power will use data collected during the Aquatic Resources Study and the HEC-RAS model (using the water quality module), to evaluate the relative effects of downstream release alternatives on downstream water temperature.

4.2.5 Wildlife, Terrestrial, and Threatened, and Endangered Species

Alabama Power will use information from the PAD, and results from the FERC-approved Threatened and Endangered (T&E) Species Study to examine the potential effects of downstream release alternatives on terrestrial wildlife and federally listed species, if any, located in and around the Tallapoosa River downstream of Harris Dam through Horseshoe Bend. Alabama Power will qualitatively assess the relative potential for alternative downstream releases to affect preferred habitats of wildlife and federally listed species, if any. Alabama Power will use the HEC-RAS model to evaluate effects on downstream terrestrial resources.

4.2.6 Recreation

Alabama Power will use the information from the FERC-approved Recreation Evaluation Study to determine how downstream releases affect boating in the Tallapoosa River from Harris Dam through Horseshoe Bend. This task will be accomplished by correlating data collected from Tallapoosa River users with any flow information available for the day and time the user was on the water. Next, the HEC-RAS model will be used to determine how boatable flows may change for each alternative. Boatable flows will be evaluated in consultation with HAT 5 members based on a variety of sources, including the Tallapoosa River user surveys and previous research available from the monitoring of Green Plan flows.

4.2.7 Cultural Resources

Alabama Power will use existing information, the HEC-RAS model, and any other relevant information from the FERC-approved studies to evaluate sites identified in the Cultural Resources Study that may be impacted by downstream release alternatives and the resulting potential change

in erosion. 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 qualitatively determine the effects of downstream release alternatives on specific cultural resources sites. The primary point of interest is the Miller Covered Bridge piers.

A summary of the resources to be studied and proposed study methods is presented in **Table 4-1**.

TABLE 4-1 SUMMARY OF THE RESOURCES AND STUDY METHODS

Resource	Method
Water Quality	• HEC-RAS model • Existing information – Water Quality Baseline Report • Results from the FERC-approved Water Quality Study • Qualitatively evaluate potential effects on dissolved oxygen in the tailrace
Water Use	• HEC-RAS model • Existing information - Water Quantity, Water Use, and Discharges Report
Erosion	• HEC-RAS model • FERC-approved Erosion and Sedimentation Study (erosion portion only) • LIDAR, aerial imagery, historic photos
Aquatic Resources	• HEC-RAS model • HEC-RAS to evaluate effects on wetted habitat • HEC-RAS to evaluate effects on water temperature in the Tallapoosa River below Harris Dam • FERC-approved Downstream Aquatic Habitat Study • FERC-approved Aquatic Resources Study
Wildlife and Terrestrial Resources - including Threatened, and Endangered Species	• HEC-RAS model • FERC-approved Threatened and Endangered Species Study
Recreation Resources	• HEC-RAS model • FERC-approved Recreation Evaluation Study • Existing information on boatable flows
Cultural Resources	• HEC-RAS model LIDAR, aerial imagery, and expert opinions

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 plan.

FERC Study Plan Determination	April 2019
Data Collection in Tallapoosa River (bathymetry, etc.)	April – September 2019
HAT 1 Meeting to discuss proposed methods (i.e., model inputs, scenarios)	August/September 2019
Phase 1 - Modeling	September 2019 – April 2020
Progress Update	October 2019
HAT 1 Meeting to review Phase 1 progress to date	February/March 2020
Draft Phase 1 Report	April 2020
Initial Study Report	April 2020
Initial Study Report Meeting	April 2020
HAT 1 meetings, as needed	April 2020 – April 2021[2]
Phase 1 Final Report	July 2020
Phase 2 – Effects Analysis	June 2020 – November 2021
Progress Update	October 2020
Updated Study Report	April 2021

[2] Meeting dates will be determined with HAT 1 members based on initial studies.

Updated Study Report Meeting	April 2021
File Preliminary Licensing Proposal	By July 3, 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 developing the Phase 1 modeling, Phase 2 analysis, and Draft and Final Reports, is $625K.

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.

Goar, Taconya Piper. 2013. Effects of hydrologic variation and water temperatures on early growth and survival of selected age-0 fishes in the Tallapoosa River, Alabama (Ph.D. dissertation). Available: https://etd.auburn.edu/bitstream/handle/10415/3604/Taconya%20Goar_Dissertation_2013b.pdf?sequence=2&isAllowed=y>. Accessed December 11, 2017.

Irwin, E.R. and T.P. Goar. 2015. Spatial and temporal variation in recruitment and growth of Channel Catfish, Alabama Bass, and Tallapoosa Bass in the Tallapoosa River and associated tributaries. U.S. Department of Interior, Fish and Wildlife Service, Cooperator Science Series FWS/CSS -116, Washington, D.C.

Kleinschmidt Associates. 2018a. Summary of R.L. Harris Downstream Flow Adaptive Management History and Research. R.L. Harris Project, FERC No. 2628. Kleinschmidt Associates, Birmingham, Alabama.

APPENDIX A

GREEN PLAN RELEASE CRITERIA

R. L. HARRIS GREEN PLAN RELEASE CRITERIA

1. Daily Release Schedule
    a. The required Daily Volume Release will be at least 75% of the prior day's flow at the USGS Heflin Gauge.
    b. In the event that the Heflin Gauge is not in service, the required Daily Volume Release will be at least one-fourth of the previous day's inflow into R L Harris Reservoir.
    c. The Daily Volume Release will not to be below 100 DSF.
    d. Operations to ensure that flows at Wadley remain above the 45 cfs minimum mark shall continue.
    e. The required Daily Volume Release will be suspended if R L Harris is engaged in flood control operations.
    f. The required Daily Volume Release will be suspended if it jeopardizes the ability to fill R L Harris.
2. Hourly Release Schedule
    a. If less than two machine hours are scheduled for a given day, then the generation will be scheduled as follows:
        i. One-fourth of the generation will be scheduled at 6 AM.
        ii. One-fourth of the generation will be scheduled at 12 Noon.
        iii. One-half of the generation will be scheduled for the peak load.
        iv. If the peak load is during the morning, one-fourth of the generation will be scheduled at 6 PM.
    b. If two to four machine hours are scheduled for a given day, then generation will be scheduled as follows:
        i. Thirty minutes of generation will be scheduled at 6 AM.
        ii. Thirty minutes of generation will be scheduled at 12 Noon.
        iii. The remaining generation will be scheduled for the peak load.
        iv. If the peak load is during the morning, thirty minutes of the generation will be scheduled at 6 PM.
3. Two Unit Operation
    a. On the average, there will be more than 30 minutes between the start times between the two units.
4. Two units may come online with less than 30-minute difference in their start times if there is a system emergency need.
5. Spawning Windows: Spring and Fall spawning windows will scheduled as conditions permit. The operational criteria during spawning windows will supersede the above criteria.

APPENDIX B

MODEL METHODOLOGY

PROPOSED HYDROLOGIC AND HYDRAULIC STUDY

Alabama Power plans to use the following data and models to conduct the analysis of the downstream release alternatives. The primary tool for this study is HEC-River Analysis System (HEC-RAS); however, Alabama Power will use other HEC models to address the effects of downstream release alternatives.

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.
2) Other data – Other data sources will include United States Geological Survey (USGS), USACE, and Alabama Power records.
3) HEC-River Analysis System (HEC-RAS) – this model will route flows in the unsteady state[3] along the river. This model will be used to assess effects of alternative release scenarios on boatable days, wetted perimeter, and temperature. Model inputs include the data from 20 level loggers, temperature monitors, and dissolved oxygen grab samples
4) HEC-Reservoir Simulation Model (HEC-ResSim) – this model will look at operational changes at the Harris Project in conjunction with downstream release alternatives on an hourly timestep. This model in conjunction with the HEC-RAS model, will show impacts, if applicable, to the Martin Dam Project operations.
5) 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.
6) 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 downstream flow alternatives at the Harris Project.

Methodology

Resulting impacts to the Harris Project will be evaluated by routing normal operations combined with each downstream release alternative through the HEC Res-Sim model. The outflow hydrograph from HEC-ResSim will then be routed downstream using HEC-RAS to assess effects on boatable days, wetted perimeter, and temperature.

Coordination and Evaluation

Through consultation with the Harris relicensing stakeholders, Alabama Power has developed a list of downstream flow alternatives to model including the following:

[3] In hydraulic modeling, simulations run in the unsteady state consider the variance of flow with respect to time.

1. Model the following downstream release alternatives:
   a. Pre-Green Plan operations (peaking only)
   b. Green Plan operations
   c. Modified Green Plan operations
   d. Continuous minimum flow of 150 cfs

2. Downstream impacts will be evaluated by developing an HEC-RAS model for downstream release alternatives. HEC-ResSim will be used to generate outflow hydrographs in operational criteria at Harris.

3. Total cost associated with each downstream release alternative 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.

4. 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[4].

[4] Alabama Power will provide a summary of the model outputs including a summary of the Hydro budget model output.