

FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, DC 20426

November 8, 2018

OFFICE OF ENERGY PROJECTS

Project No. 1494-438 – Oklahoma
Pensacola Hydroelectric Project
Grand River Dam Authority

Darrell Townsend, Vice President
Ecosystems and Watershed Management
Grand River Dam Authority
P.O. Box 70
Langley, OK 74350-0070

Reference: Study Plan Determination for the Pensacola Hydroelectric Project

Dear Dr. Townsend:

Pursuant to 18 C.F.R. § 5.13(c) of the Commission's regulations, this letter contains the study plan determination for the Pensacola Hydroelectric Project (Pensacola Project) located on the Grand (Neosho) River in Craig, Delaware, Mayes, and Ottawa Counties, Oklahoma. The determination is based on the study criteria set forth in section 5.9(b) of the Commission's regulations, applicable law, Commission policy and practice, and the record of information.

Background

On April 27, 2018, the Grand River Dam Authority (GRDA) filed its proposed plan for five studies addressing hydrologic and hydraulic modeling, sedimentation, recreation facilities and use, cultural resources, and socioeconomics in support of its intent to relicense the project.

GRDA held meetings to discuss its Proposed Study Plan (PSP) on May 30 and 31, 2018. Comments on the PSP were filed by Commission staff; U.S. Fish and Wildlife Service (FWS); Bureau of Indian Affairs (BIA); U.S. Army Corps of Engineers (Corps); Oklahoma Department of Wildlife Conservation (Oklahoma DWC); Oklahoma State Historic Preservation Office (Oklahoma SHPO); Oklahoma Archeological Survey (OAS); Cherokee Nation; Delaware Nation; Miami Tribe of Oklahoma; Muscogee (Creek) Nation; Osage Nation; Ottawa Tribe of Oklahoma; Peoria Tribe; Quapaw Nation; Wyandotte Nation; City of Miami, Oklahoma (City of Miami);

State Representative Ben Loring; and N. Larry Bork representing the plaintiffs in *City of Miami, et al. v. Grand River Dam Authority* (Plaintiffs).

On August 21, 2018, the Commission hosted a Tribal Consultation meeting at the request of the Osage Nation to discuss the proposed cultural resources study plan. Representatives of the Cherokee Nation, Delaware Nation, Muscogee (Creek) Nation, Osage Nation, Peoria Nation, Quapaw Nation, Wyandotte Nation, BIA, and Department of the Interior (Interior) Solicitor's Office participated in the meeting.

On September 27, 2018, GRDA filed a Revised Study Plan (RSP) that includes significant revisions to the PSP, including three new studies addressing aquatic species, terrestrial species, and wetlands and riparian habitat. Comments on the RSP were filed by BIA, Corps, FWS, Oklahoma DWC, Cherokee Nation, Miami Nation of Oklahoma, Muscogee (Creek) Nation, Osage Nation, Quapaw Nation, City of Miami, Local Environmental Action Demanded Agency represented by Grand Riverkeeper and Tar Creekkeeper, and Plaintiffs.

On November 1, 2018, GRDA filed an answer to comments on the Revised Study Plan. In a letter filed November 5, 2018, the City of Miami opposed GRDA's filing of an answer, or, in the alternative, requested leave to file an answer to GRDA's answer. The Miami Tribe of Oklahoma joined the City of Miami in opposition by letter filed November 6, 2018. The Commission's regulations governing the development of study plans specify schedules and deadlines designed, in part, to increase efficiency in the licensing process.¹ In order to issue a Study Plan Determination in a timely fashion, the Commission's regulations do not provide for answers to comments or answers to answers and are discouraged. Here, GRDA's answer did not assist Commission staff in its decision making process and it was not considered.

General Comments

A number of the comments received do not directly address study plan issues. For example, many comments, including those by the Corps, Miami Nation of Oklahoma, and City of Miami, discuss legal issues relating to flood control authorization, assessment of damages, and property interests. GRDA's RSP also contains a significant discussion of the same issues. This determination does not address these comments, but rather addresses comments specific to the merits of the proposed studies submitted pursuant to section 5.13 of the Commission's regulations and comments received thereon.

¹ See 18 C.F.R. §§ 5.9 – 5.14 (2018); see also Hydroelectric Licensing under the Federal Power Act, Order No. 2002, 104 FERC ¶ 61,109 (2003) (final rule revising hydroelectric licensing regulations to develop a more efficient and timely licensing process).

The bases for staff's recommendations in the determination is the study criteria identified in section 5.9(b) of the Commission's regulations and the technical merits of the studies. The studies that are required herein are those that will address identified data needs and reasonably inform staff's analysis of the environmental effects of continued project operation under a new license.

Study Plan Determination

GRDA's RSP is approved, with the staff-recommended modifications and an additional study on infrastructure as discussed in Appendix B. As indicated in Appendix A, two of the eight studies proposed by GRDA are approved as filed by GRDA and six are approved with staff-recommended modifications. This determination also addresses two additional studies requested by stakeholders, but not required by this determination (see Appendix A).

In Appendix B, we explain the specific modifications to the study plan and the bases for modifying, adopting, or not adopting requested studies. Although Commission staff considered all study plan criteria in section 5.9 of the Commission's regulations, we only reference the specific study criteria that are particularly relevant to the determination. Studies for which no issues were raised in comments on the RSP are not discussed in this determination. Unless otherwise indicated, all components of the approved studies not modified in this determination must be completed as described in GRDA's RSP.

Pursuant to section 5.15(c)(1) of the Commission's regulations, the initial study report for all studies in the approved study plan must be filed by November 8, 2019. As required by the Commission's regulations, GRDA must hold an initial study report meeting within 15 days of the filing of their initial study report. Commission staff will evaluate the need for holding additional Tribal Consultation meetings in conjunction with the initial study report meeting after the first year of studies is underway.

Nothing in this study plan determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional studies. In addition, GRDA may choose to conduct any study not specifically required herein that it feels would add pertinent information to the record.

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If you have any questions, please contact Rachel McNamara at rachel.mcnamara@ferc.gov or (202) 502-8340.

Sincerely,

for
Terry L. Turpin
Director
Office of Energy Projects

Enclosures: Appendix A – Summary of studies subject to this determination
Appendix B – Staff’s recommendations on proposed and requested studies

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APPENDIX A

SUMMARY OF DETERMINATIONS ON
PROPOSED AND REQUESTED STUDIES

Study	Recommending Entity	Approved	Approved with Modifications	Not Required
Hydrologic and Hydraulic Modeling (i.e., Flooding and Inundation Studies)	GRDA, FERC, FWS, Oklahoma DWC, Cherokee Nation Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Plaintiffs		X	
Sedimentation	GRDA, FERC, Miami Tribe, Ottawa Tribe, Peoria Tribe, City of Miami, Plaintiffs		X	
Aquatic Species of Concern (i.e., Paddlefish and Rare Aquatic Species studies)	GRDA, FWS, Oklahoma DWC		X	
Terrestrial Species of Concern ²	GRDA	X		
Wetlands and Riparian Habitat	GRDA, FWS, Oklahoma DWC	X		
Recreation Facilities Inventory and Use	GRDA		X	

² BIA, Eastern Shawnee Tribe, Miami Tribe of Oklahoma, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, and Plaintiffs proposed and supported a study entitled *Flora and Fauna Study*, components of which are included in GRDA's terrestrial species of concern study. Staff discusses other components of the proposed flora and fauna study with its recommendations for the contaminated sediment transport study.

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Study	Recommending Entity	Approved	Approved with Modifications	Not Required
Cultural Resources	GRDA, Cherokee Nation Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Plaintiffs		X	
Socioeconomics	GRDA, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Plaintiffs		X	
Federal Lands and Project Boundary/ Flooding Inundation of Tribal Lands	BIA, Miami Tribe, Ottawa Tribe, Peoria Tribe, City of Miami, Plaintiffs			X
Contaminated Sediment Transport	BIA, FWS, Oklahoma DWC, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Plaintiffs			X
Infrastructure Study	FERC, Eastern Shawnee Tribe, Miami Tribe, Ottawa Tribe, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Plaintiffs		X	

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APPENDIX B

STAFF'S RECOMMENDATIONS ON PROPOSED AND REQUESTED STUDIES

The following discusses staff's recommendations on studies proposed by GRDA, requests for study modifications, and requests for additional studies. We base our recommendations on the study criteria outlined in the Commission's regulations [18 C.F.R. section 5.9(b)(1)-(7)]. Except as explained below, the Revised Study Plan (RSP), filed on September 24, 2018, adequately addresses all study needs at this time.

I. Required Studies

Hydrologic and Hydraulic Modeling Study

Applicant's Proposed Study

GRDA proposes a hydrologic and hydraulic modeling study (H&H study) to determine the duration and extent of inundation under the project's current operation and alternative operating scenarios over a range of inflow events. The study would use modeling and mapping to support analyses in several resource areas including aquatic, terrestrial, recreation, and cultural resources. The study's scope would include the Neosho, Spring, and Elk Rivers; Tar Creek; and downstream areas through Lake Hudson to just upstream of Kerr Dam. The study would use existing upstream terrain data from historical topographic and bathymetric surveys.

The proposed H&H study is composed of two parts: (1) an operations model, and (2) a comprehensive hydraulic model (CHM), which would calculate inundation and flood routing specifics, such as frequency, timing, amplitude and duration, during inflow events for which hydrographs exist based on parameters established in the operations model.

As products of the H&H study, GRDA proposes a flood frequency analysis of the peak inflows observed at the Pensacola Dam during the flood events used in the model runs. GRDA would also determine, at a minimum, the 5-, 10-, and 15-year return period peak inflows. GRDA's proposed study would evaluate scenarios starting at reservoir elevations from 740 feet Pensacola Datum¹ (PD) to 745 feet PD. A minimum of six historical inflow hydrographs would be modeled at these elevations.

¹ Pensacola Datum is 1.07 feet higher than National Geodetic Vertical Datum (NGVD) and 1.4 feet higher than North American Vertical Datum (NAVD).

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Comments on the Study

Several study requests and comments were received regarding the potential effects of project operation on upstream flooding. Commission staff, U.S. Fish and Wildlife Service (FWS), U.S. Army Corps of Engineers (Corps), Oklahoma Department of Wildlife and Conservation (Oklahoma DWC), Cherokee Nation, Eastern Shawnee Tribe of Oklahoma, Miami Tribe of Oklahoma, Ottawa Tribe of Oklahoma, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, City of Miami, Oklahoma (City of Miami), State Representative Ben Loring, and N. Larry Bork representing the plaintiffs in *City of Miami, et al. v. Grand River Dam Authority* (Plaintiffs) have requested, or supported, a comprehensive H&H study and provided comments on both GRDA's proposed and revised H&H study.

Oklahoma DWC comments that the study's focus on individual flood events would not be useful in evaluating impacts of day-to-day water management. Oklahoma DWC would like the study to include maps and models that delineate the expected lentic (i.e. lake or non-flowing) boundary during normal operational levels, and/or quantify the duration of inundation if the annual operating regime includes varying lake levels. Further, Oklahoma DWC expresses concern over the lack of criteria provided to support the "professional judgement" that will be used to determine a "material difference" in water surface elevations. Oklahoma DWC recommends that GRDA consult an independent natural resource professional in evaluating and determining a "material difference" in water surface elevation.

The City of Miami recommends accepting GRDA's H&H study with modifications. The City requests that GRDA conduct a new bathymetric survey of Grand Lake, incorporate the Corps' RiverWare model for the Arkansas Basin River System in its analysis of high-flow events, extend the study area upstream from the proposed model limit on the Spring River to the Kansas border, and run the H&H model over a greater range of flood magnitudes up to the 100-year flood event.

Discussion and Staff Recommendation*Range of Model Runs: Flows*

A comprehensive H&H study would determine the extent of flooding that is attributable to project operation and support an analysis of project-related flooding.²

² The Corps has jurisdiction to direct operation of the project for flood control purposes when elevation of the reservoir reaches 745 feet PD (33 CFR section 208.25 (2018)). However, the federal license issued by the Commission controls use of the project's facilities (i.e., the dam, reservoir, powerhouse, and spillways) for all statutory

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However, the RSP does not adequately clarify the full range of inflow events that would be evaluated in the proposed study. GRDA states that the 5-, 10-, and 15-year return period peak flows would be studied “at a minimum,” along with a “minimum” of six historical inflow events, including the June 2007 flood, which had the highest recorded flow on the Neosho River at the Commerce U.S. Geological Survey (USGS) gage. The return period of historical inflow events would not be known until the flood frequency analysis is performed. In order to fully satisfy the study objectives (section 5.9(b)(1)) and provide the information required for staff’s analysis and the development of license requirements (section 5.9(b)(5)), we recommend an iterative approach to establish a range of low and high frequency flood events. If the flood frequency analysis shows that the selected historical inflow events do not exceed a 100-year recurrence interval, inflow events up to and including the 100-year recurrence interval would be evaluated in the CHM. We recommend that GRDA include in the 6-month Model Input Status Report its proposal for the flood flows to be analyzed in the H&H study based on the flood frequency analysis. The proposal then would be discussed during the Conference Call on Model Inputs and Calibration. Adding these items to the report and call that are already planned would add only minimal cost (section 5.9(b)(7)).

Range of Model Runs: Starting Elevations

GRDA states that only reservoir starting elevations between 740 and 745 feet PD would be evaluated. However, the model would be most informative if the runs included the range: (1) observed over the licensed history of the project; (2) at which power has, is, or could potentially be generated; or (3) that could reasonably be considered as an operational level under any license issued (section 5.9(b)(5)). To cover the maximum range, address project effects, and allow full consideration of potential protection, mitigation, or enhancement measures (PM&Es), we recommend that GRDA’s model accommodate a preliminary minimum starting elevation of 734 feet PD, and a preliminary maximum starting elevation of 760 feet PD. Elevation 734 feet PD represents the lowest summer elevation implemented by GRDA prior to 1982.³ Elevation 760 feet PD represents the maximum elevation of the Corps’ existing flowage easements.⁴ The need for additional model runs at lower or higher starting reservoir

purposes, including flood control (16 USC section 803(a)(1) (2012)). Therefore, regardless of the regulatory bases for the Corps’ jurisdiction to direct operation under certain conditions, Commission staff must analyze the full range of potential reservoir operating scenarios to assess project effects and need for protection, mitigation, and enhancement measures.

³ See Environmental Assessment for Hydropower License, Pensacola Hydroelectric Project No. 1494-002, issued November 19, 1991, at page 9, paragraph 2.

⁴ Pub. L No. 712, 60 Stat. 974 (Aug. 9, 1946).

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elevations than we recommend could be evaluated based on the initial results of the study and discussed at the Initial Study Results (ISR) meeting.

Products of the Model

The purposes of the model are to assess the effects of current project operation in the power pool, as well as any operational changes that may be proposed as part of the relicensing process, on flooding and to calculate inundation areas and depths. However, GRDA's proposed model would also accommodate evaluation of the effects of changes in project operation under non-flood conditions. We recommend that GRDA provide maps that clearly depict the boundary between lotic⁵ and lentic conditions under any proposed operating scenario with the results of the H&H study (section 5.9(b)(4)).

Topographic and Bathymetric Data

GRDA does not propose to collect additional topographic and bathymetric data as part of the proposed study. GRDA proposes to use the 2009 Oklahoma Water Resource Board (Oklahoma WRB) bathymetric survey of Grand Lake. Oklahoma WRB recommended another survey be conducted within 10-15 years of the 2009 study to determine an accurate sedimentation rate at Grand Lake. Mapping change in bathymetry is central to the H&H and sedimentation studies (section 5.9(b)(5)). Past mapping has revealed significant changes in bathymetry over an approximately 10-year period (OWRB, 2009).⁶ We recommend performing a new bathymetric survey of Grand Lake as part of the sedimentation study, per the Oklahoma WRB recommendation, to accurately reflect the existing distribution and volume of sediment in the reservoir and update stage-storage volume curves for the H&H model (section 5.9(b)(4)). If the H&H model shows that flooding extends beyond the limit of available data, we recommend that GRDA perform additional high-resolution surveys to ensure full, high-resolution data for all areas with the potential for flood conveyance. We estimate that the cost for the additional bathymetry survey of Grand Lake is approximately \$45,000. This information is necessary to accurately characterize the channel bed and floodplain elevations of the upstream tributaries (section 5.9(b)(4)) for use in the H&H and sedimentation studies.

Definition of "Material Difference"

GRDA proposes a study area that encompasses the channel and overbank areas that experience a "material difference" in water surface elevations due to changes in project operation. Oklahoma DWC and the City of Miami express concern over the lack

⁵ Lotic refers to moving water, or riverine-like habitat.

⁶ OWRB (Oklahoma Water Resources Board). 2009. Hydrographic Survey of Grand Lake. August 26, 2009. Available Online: https://www.owrb.ok.gov/studies/reports/reports_pdf/GrandLake--hydrographicsurvey.pdf Accessed October 2018.

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of criteria provided to define a “material difference” in water surface elevations. Proper definition of a “material difference” in water surface elevation is critical to choosing the area of effect for analyzing operational effects from flooding on environmental resources and for directing more in-depth analysis (section 5.9(b)(5)).

GRDA proposes to distribute a 6-Month Model Input Status Report in April 2019. We recommend that GRDA include in this report its proposed definition of a “material difference” in flood elevation based upon the results of the modeling conducted to that point. At the time the 6-Month Model Input Status Report is distributed, we recommend that GRDA solicit stakeholder comments on the definition of “material difference.” Further, we recommend that GRDA discuss the definition of “material difference” during GRDA’s proposed “Conference Call on Model Inputs and Calibration,” scheduled for May 2019. GRDA should define “material difference” in the ISR. The ISR should also document comments GRDA receives about the definition and how GRDA responded to them. Adding this topic to the report, call, and ISR would add only minimal effort (section 5.9(b)(7)).

Corps’ RiverWare Model

The Corps’ RiverWare model simulates flows through the Arkansas Basin River System based on a 77-year period of record. GRDA plans to use the RiverWare model primarily as a source of data. The City of Miami asks that GRDA incorporate the RiverWare model into its H&H study, particularly to help model high flow events. The RiverWare model calculates results for each day (or on a daily time-step), while GRDA’s H&H model would calculate results for each hour.

GRDA states that it is not worth the effort to update RiverWare to an hourly time-step to match the output of the H&H study. While converting RiverWare to an hourly time-step may be intensive, converting GRDA’s hourly model output to a daily time-step would not be overly difficult. Comparison of the RiverWare output with GRDA’s H&H model output would help to confirm the results of GRDA’s proposed modeling (5.9(b)(6)). We recommend that GRDA demonstrate in the ISR that it has validated its model results against the RiverWare output.

Extension of Model for Spring River

GRDA proposes an initial study area that would extend upstream from Pensacola Dam along the Grand/Neosho River to within approximately 3 miles of the Oklahoma/Kansas border, upstream along the Spring River to within 6.5 miles of the Oklahoma/Kansas border, and upstream along the Elk River beyond the Oklahoma state line into Missouri, and along Tar Creek just upstream of the USGS gage at the 22nd Avenue Bridge. The Quapaw Nation requests that the proposed model limit on the Spring River be extended further north to the Oklahoma/Kansas border. The Quapaw Nation states

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that the study area proposed by GRDA is based on outdated congressional maps which exclude tribal lands and cultural properties located along the Spring River that are affected by upstream flooding. The City of Miami supports the Quapaw Nation's request and recommends a revised study area to encompass the upstream extent of the Spring River to the Oklahoma/Kansas border.

GRDA states that the proposed modeling limits on the tributaries to Grand Lake reflect an initial study area. The area of effect in its entirety is not currently known, and may increase or decrease as the extent of inundation due to project operations becomes evident through the modeling exercise. As stated above, we recommend extending the range of preliminary model runs to reflect a preliminary minimum and maximum starting elevation of 735 feet and 760 feet PD, respectively, to cover the maximum range of potential project effects. Based on the results of the first year of study, the need for additional model runs at higher or lower starting elevations will be specified, and as a result, an appropriate study area will be identified. Therefore, we do not recommend that GRDA prematurely define the modeling limits of the study to an arbitrary point, such as the Oklahoma/Kansas border.

Vertical Datum

GRDA proposes to reference National Geodetic Vertical Datum of 1929 (NGVD 1929) as a common datum. For consistent reporting across studies and comparison to the existing license's rule curve elevations, we recommend that all final output and reports be presented in PD because stakeholders are familiar with this system.

Model Validation and Information Sharing

GRDA proposes to provide copies of the CHM, CHM calibration, and CHM outputs to relicensing participants within 10 days of a formal request by email or in writing. To support our request that Commission staff and other stakeholders may review and evaluate the model results, we recommend that GRDA make the model, inputs, and outputs available to download on a protected cloud-based server and provide access to relicensing participants upon request (section 5.9(b)(6)).

Sedimentation Study

Applicant's Proposed Study

GRDA proposes a sedimentation study to assess the effects of current project operation between reservoir elevations 740 feet and 745 feet PD, and any potential changes to project operation, on sediment erosion, transport, and deposition in the lower reaches of the tributaries to Grand Lake (i.e., on the Neosho, Spring, and Elk Rivers, and Tar Creek), and to characterize the impact that sedimentation has on flooding upstream of

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Pensacola Dam. GRDA proposes to use existing sediment data, new sediment data it would collect, modeled flows derived from its H&H model, and standard sediment transport formulas to calculate sediment transport. GRDA does not propose to collect additional topographic or bathymetric data. GRDA's study would look specifically at "smaller flood events," which, GRDA argues, cumulatively carry more sediment than higher-flow flooding events.

Rather than using a separate sediment transport modeling system, GRDA would use standard sediment transport equations and collected data to calculate sediment transport rates. Those sediment transport rates would be used to modify the GRDA's CHM channel geometry in the H&H model to estimate future channel bed changes, and determine flood extents and depth.

Comments on the Study

The City of Miami agrees with the goals and objectives of GRDA's proposed study, but does not agree that the proposed methodology will comprehensively address GRDA's goals and objectives. Specifically, the City objects to the lack of a sediment transport modeling system within GRDA's sedimentation study. The City recommends using an existing, peer-reviewed sediment transport modeling system (HEC-RAS⁷) to conduct the same analysis. The City believes that using HEC-RAS would provide a more clear and standardized approach to analyzing sediment transport in Grand Lake and its tributaries, greater ability to predict future sedimentation trends, and a more effective comparison of alternatives.

The City's proposal would require collecting new data to populate the model, including suspended sediment concentrations and sediment grab samples. The City's model would also require a new bathymetric survey of Grand Lake.

The City's model would use GRDA's CHM as the hydraulic model to inform its sediment transport modeling. However, unlike GRDA's proposal, the City's proposed model would evaluate a broader range of flood hydrographs, up to the 100-year flood event, which would provide an understanding of sediment transport in both channel and overbank areas.

In addition to the comments received from the City of Miami, the BIA requests that the sedimentation study evaluate how sedimentation in Grand Lake affects the power pool and whether sedimentation reduces the capacity for power generation.

⁷ HEC-RAS (Hydrologic Engineering Center - River Analysis System) is a hydraulic modeling software package written and supported by the Corps. It allows users to model flow, flood elevations, sediment transport, and water temperature and quality.

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Discussion and Staff Recommendation*Technical Approach to Sedimentation Study*

The fundamental differences between GRDA's and the City of Miami's proposals are the proposed methods for determining sediment transport rates within Grand Lake and the lower portions of its tributaries: the Neosho, Spring, and Elk Rivers, and Tar Creek. The differences in methodologies fall roughly into two categories: (1) data collection and (2) model scope.

As noted above, GRDA's proposal would require the collection of new data including: suspended sediment concentrations, sediment grab samples and core samples, and water velocity profiles made with an Acoustic Doppler Current Profiler (ADCP). It is not clear from GRDA's proposal what information would be available or collected on sediment accumulation in channels, overbank areas, and at constrictions within Grand Lake's upper tributaries to inform estimates of future channel bed changes (section 5.9(b)(4)). The City of Miami's proposal contains provisions to collect this data through a new bathymetric survey and measures of bed-material gradation. This data is necessary to evaluate the transport and deposition of sediment by large inflow events, which would spill over the existing channel, into overbank areas. Additionally, this information would be essential to determining the need for a contaminated sediment study, analyzing project effects on environmental and cultural resources, and informing potential operational changes or the need for PM&Es (section 5.9(b)(5)). Further, as noted in our discussion of the H&H study, past mapping has revealed significant changes in bathymetry over an approximately 10-year period (OWRB, 2009). Collecting new bathymetry data would allow the model to more accurately reflect existing conditions (section 5.9(b)(4)).

GRDA proposes to focus its study on small flood events, which transport the majority of sediment. While smaller, more frequent storm events may be responsible for transporting the greatest percentage of total sediment load,⁸ these events are generally contained in the channel. In contrast, larger flows, which occur less often, tend to spread the flow overbank such that sediment can be deposited in the floodplain.⁹ The City's proposed model would evaluate a broader range of flood hydrographs, up to the 100-year flood event, which would provide an understanding of sediment transport in both channel and overbank areas.

⁸ Leopold, L., M.G. Wolman, and J.P. Miller. 1992. *Fluvial Processes in Geomorphology*. Dover Publications, New York, NY. p. 71.

⁹ Dunne, T. and L.B. Leopold. 1998. *Water in Environmental Planning*, W. H. Freeman & Co., San Francisco, CA. p. 620.

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Both methodologies are technically-feasible approaches to studying sediment transport processes within Grand Lake and its tributaries. The cost estimates for the two studies are comparable, with GRDA's cost estimate being slightly higher (\$400,000 for GRDA's study versus \$385,000 for the City of Miami's study). However, the City of Miami's proposal provides a more clear, comprehensive, and standardized approach to collecting and analyzing the data necessary to adequately understand the potential effects of the project on sediment transport processes upstream. As proposed, the City's study also addresses the concerns we have identified with GRDA's proposed methodology (section 5.9(b)(6)). Therefore, we recommend that GRDA adopt the City of Miami's proposed methodology for conducting its sedimentation study, specifically the use of HEC-RAS for the sediment transport model.

Sedimentation Effect on the Power Pool

BIA's request for analysis of the effect of sedimentation on the power pool is relevant to the project's generation potential. The sediment transport model would address how operations affect sedimentation rates, including sedimentation of the power pool. Using the model output, GRDA could compare stage-storage curves under different sedimentation conditions and estimate effects on generation (section 5.9(b)(4)). Because GRDA would be modeling changes in bathymetry as part of the sedimentation study, the additional cost of reporting on sedimentation effects on the power pool would be minimal. We recommend that GRDA describe any observed or predicted effects of project operation on sedimentation of the power pool in the sedimentation study report.

Model Validation and Information Sharing

To support our request that Commission staff and other stakeholders may review and evaluate results of the sedimentation study, we recommend that GRDA make the sedimentation model inputs and outputs available to download on a protected cloud-based server and provide access to relicensing participants upon request (section 5.9(b)(6)).

Aquatic Species of Concern Study

Increases in reservoir water levels associated with potential modifications of project operation under a new license,¹⁰ and fluctuating reservoir water levels associated with existing project operation¹¹ could affect aquatic species by altering habitat. GRDA

¹⁰ GRDA is exploring potential modifications in operations that could increase the reservoir elevation compared to existing targeted pool elevations.

¹¹ Existing targeted pool elevations range between 741 and 744 feet PD depending on the time of year.

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proposes to gather the information needed to identify the potential effects of project-caused water level increases and reservoir elevation fluctuations on paddlefish and three rare aquatic species (i.e., two federally listed aquatic species [Neosho madtom (fish) and Neosho mucket (mussel)], and an endemic¹² subspecies of smallmouth bass [Neosho smallmouth bass]). GRDA will identify potential effects on these species in the same area as proposed in GRDA's H&H modeling study, which includes the Neosho, Spring, and Elk Rivers.

*PADDLEFISH SUB-STUDY*¹³

Applicant's Proposed Study

GRDA proposes to model project effects using: (1) existing paddlefish habitat information in the Neosho and Spring Rivers (i.e., Schooley and O'Donnell, 2016);¹⁴ (2) recent bathymetric data (i.e., USGS, 2017);¹⁵ and (3) the models developed for the H&H modeling study. GRDA would: (1) create maps delineating the riverine reaches that would be converted to lentic habitat during the paddlefish spawning season (March-April), as a result of increases in reservoir water levels associated with potential modifications of project operation under a new license; (2) quantify and map the amount of paddlefish spawning substrate that occurs in lotic habitat under existing conditions, but that would be converted to lentic habitat if reservoir water levels were increased; and (3) assess potential impacts of project operation on paddlefish recruitment based on the area of lost spawning substrate during the paddlefish spawning period, while accounting for the effects of hydrologic variability.

Comments on the Study

FWS requests that GRDA conduct a study¹⁶ to determine the effects of raising the reservoir elevation on paddlefish.

¹² A species that is endemic is unique to a specific geographic location.

¹³ Staff refer to the aquatic species of concern study objectives related to paddlefish as the paddlefish sub-study.

¹⁴ Schooley, J.D. and S. O'Donnell. 2016. Benthic Habitat Mapping of Grand Lake Tributaries as it Relates to Paddlefish Recruitment. Grant Report. Project Number: F15AF00540.

¹⁵ USGS (U.S. Geological Survey). 2017. Bathymetric Surveys of the Neosho River, Spring River, and Elk River, Northeastern Oklahoma and Southwestern Missouri, 2016-17. Scientific Investigations Report 2017-5101. Version 1.1, October. U.S. Department of Interior.

¹⁶ FWS, in its letter filed on March 13, 2018, titled this study, *Inundation Study*.

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Oklahoma DWC requests that GRDA determine the impacts of increasing Grand Lake reservoir water level on hydrology and paddlefish habitat availability of the Neosho, Spring, and Elk Rivers.¹⁷ As part of the study, Oklahoma DWC requests that GRDA use sonar and/or GIS to develop bathymetric baseline maps of headwaters and habitats to model changes in inundation of gravel shoals and off-channel habitats. Oklahoma DWC requests that GRDA include the Elk River in the study methodology, because the Elk River may have recruitment value for paddlefish. Oklahoma DWC also requests that GRDA quantify the amount (stream length and area) of lotic habitat that will transition to lentic habitat if the year-round operating pool is increased.¹⁸

Discussion and Staff Recommendation

Potential Paddlefish Habitat Loss

Grand Lake is a prominent paddlefish fishery, consistently attracting snag¹⁹ anglers from the entire continental U.S. (Jager and Schooley 2016).²⁰ The fishery is maintained through natural reproduction that occurs during the spring when paddlefish migrate upstream into Grand Lake tributaries. During spawning, paddlefish deposit adhesive eggs over washed gravel, cobble, and bedrock substrates located in lotic habitat (O'Keefe et al., 2007;²¹ Hoxmeier and DeVries, 1997).²² The presence of hard substrates is important, because eggs may not adhere to soft substrates (O'Keefe et al., 2007), and eggs deposited in sand or silt may experience reduced survival caused by smothering and suffocation (Castro and Reckendorf, 1995).²³

¹⁷ Oklahoma DWC in its letter filed on March 13, 2018, titled this study, *Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning/Recruitment*.

¹⁸ Oklahoma DWC in its letter filed on March 13, 2018, titled this study, *Quantifying the Effects of Increased Water Level within the Grand Lake Watershed*.

¹⁹ Snag angling is a method of fishing that involves catching a fish on body parts using hooks and without the fish actively taking the hook with its mouth.

²⁰ Jager, C. A., and J. D. Schooley. 2016. 2015 Post-season survey of paddlefish permit holders. Oklahoma Department of Wildlife Conservation, Oklahoma City.

²¹ O'Keefe, D., J. O'Keefe, and D. Jackson. 2007. Factors influencing paddlefish spawning in the Tombigbee Watershed. *Southeastern Naturalist*, 6:321-332.

²² Hoxmeier, R. J., and D. R. DeVries. 1997. Habitat use, diet, and population structure of adult and juvenile paddlefish in the lower Alabama River. *Transactions of the American Fisheries Society*, 126:288-301.

²³ Castro, J., and F. Reckendorf. 1995. Effects of Sediment on the Aquatic Environment: Potential NRCS Actions to Improve Aquatic Habitat - Working Paper No.

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In the Neosho and Spring Rivers, coarse/hard substrates (e.g., gravel, cobble, and bedrock) increase, and fine/soft substrates (e.g., silt and mud) decrease moving upstream from more lentic to more lotic conditions (Schooley and O'Donnell, 2016). GRDA is exploring potential modifications in operations that would increase the reservoir elevation at certain times of year. Increasing the reservoir elevation would broaden and deepen the Grand Lake tributaries, slow water velocities, and cause deposition of soft, fine substrates to occur further upstream than currently occurs. These changes could lead to a decrease in coarse/hard substrates in the Grand Lake system. Loss of coarse/hard substrates could lead to a loss of paddlefish spawning habitat and reduced reproduction.

GRDA's proposed paddlefish sub-study would provide the information needed to determine how a potential increase in reservoir elevation could reduce the amount of spawning substrate and affect paddlefish spawning and recruitment (section 5.9(b)(5)). However, GRDA does not propose a strategy to assess the relative impact of different operational conditions. Estimating the proportion of spawning habitat affected by project operation would provide a measure of project effects relative to other available habitat in the project vicinity, which could inform the need for protective measures (section 5.9(b)(4); section 5.9(b)(5)). Therefore, we recommend that GRDA conduct the proposed paddlefish sub-study, with the modification that it include estimating the proportion of paddlefish spawning habitat affected by increasing the reservoir elevation, relative to available spawning habitat in the project vicinity. Estimating the proportion of spawning habitat affected by increasing the reservoir elevation could be accomplished using GRDA's proposed data gathering methodology, and therefore would have no additional cost.

Extending Paddlefish Sub-Study to Elk River

Regarding Oklahoma DWC's request for GRDA to include the Elk River, adding the Elk River to the study methodology is unnecessary, because the information gained from GRDA's proposal to study the Neosho and Spring Rivers would adequately inform the need for protective measures in similar areas (section 5.9(b)(5)). The Neosho and Spring Rivers are known to provide important spawning habitat for paddlefish in Grand Lake (Schooley and O'Donnell, 2016; Schooley and Neeley, 2018),²⁴ and are the two

6. Natural Resources Conservation Service. Oregon State University, Department of Geosciences. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/?cid=nrcs143_014201 Accessed October 2018.

²⁴ Schooley, J. D., and B. C. Neely. 2018. Estimation of paddlefish (*Polyodon spatula* Walbaum, 1792) spawning habitat availability with consumer-grade sonar. *Journal of Applied Ichthyology*, 34(2):364-372.²⁵ The Neosho, Spring, and Elk Rivers have drainage basins of 17,423 kilometer² [km²], 6,708 km², and 2,657 km².

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largest Grand Lake tributaries.²⁵ Thus, data collected from the Neosho and Spring Rivers would provide information that is representative of paddlefish spawning habitat in the project vicinity, and would be adequate for identifying project effects and informing the need for license requirements (section 5.9(b)(5)). Therefore, we do not recommend including the Elk River in the paddlefish sub-study methodology.

*RARE AQUATIC SPECIES SUB-STUDY*²⁶

Applicant's Proposed Study

To evaluate project effects on the Neosho mucket, Neosho madtom, and Neosho smallmouth bass, GRDA proposes to implement a phased information gathering and impact assessment that would include: (1) a review of existing information on each species to characterize the physical habitat preferences and spatial and temporal patterns of species occurring in the project vicinity; (2) conducting targeted field surveys to develop estimates of the distribution of each species in relevant reaches to the extent that existing information is inadequate to carry out this characterization; and (3) conducting an assessment of potential effects of project operation, if any, on those species that may have sensitive life-stage(s) present in the project vicinity. GRDA proposes to complete item 1 in 2019 and items 2 and 3 in 2020.

Comments on the Study

FWS requests that GRDA conduct a study²⁷ to determine the potential effects of alternative project operation scenarios on the Neosho madtom, Neosho smallmouth bass, and federally-listed mussel habitat to identify the need for mitigation and to provide information for Endangered Species Act (ESA) consultation for federally-listed species.

Oklahoma DWC also requests that GRDA conduct a study²⁸ to provide information regarding habitat in the fluctuation zone of the reservoir to determine potential impacts of fluctuations on species that may use littoral zone habitat, and the need for mitigation or operational changes. Oklahoma DWC states that the study should consist of mapping the habitat in the fluctuation zone at full pool and at the lowest

²⁵ The Neosho, Spring, and Elk Rivers have drainage basins of 17,423 kilometer² [km²], 6,708 km², and 2,657 km².

²⁶ Staff refer to the aquatic species of concern study objectives related to the Neosho mucket, Neosho madtom, and Neosho smallmouth bass as the rare aquatic species sub-study.

²⁷ FWS, in its letter filed on March 13, 2018, titled this study, *Inundation Study*.

²⁸ Oklahoma DWC in its letter filed on March 13, 2018, titled this study, *Impoundment Fluctuation Studies*.

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expected operational level. Oklahoma DWC requests that the maps identify the substrate and type of habitat, the width of the drawdown zone, the depth at various pool levels, and any important habitat types that may be present.

Discussion and Staff Recommendation

Neosho Mucket and Neosho Madtom

The Neosho mucket is a federally endangered species, meaning it is in danger of extinction throughout all or a significant portion of its range.²⁹ The Neosho madtom is a federally threatened species, meaning it is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.³⁰ Section 7 of the ESA requires federal agencies (e.g., the Commission) to consult with the Services (FWS and/or National Marine Fisheries Service [NMFS]) to ensure that their actions (e.g., relicensing) are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat.³¹

The FWS's official species list for the Pensacola Project, filed on January 11, 2018, indicates that the Neosho madtom and Neosho mucket may occur at the project. However, the presence, density,³² and distribution of each species at the project is unknown. GRDA's proposed rare aquatic species sub-study would help provide most of this information, with the exception of each species' density. Information on density is needed to estimate the proportion of both the Neosho madtom and Neosho mucket populations in the project vicinity that could be affected by reservoir fluctuations or increased reservoir elevation.³³ This information could inform the need for protective measures (section 5.9(b)(5)).

²⁹ Section 3(6) of the Endangered Species Act.

³⁰ Section 3(20) of the ESA.

³¹ Section 7(a)(2) of the ESA

³² Density represents the total number of individuals of a species sampled per unit of area sampled.

³³ If density estimates for each species are not already available, they could be obtained from representative areas (i.e., a sub-sample of the areas in the project vicinity) that have the potential to be affected by project operation, as well as in representative areas that would not be affected by project operation. The density estimates would be used to estimate the abundance of each species in habitats affected by project operation and in habitats in the project vicinity that would be unaffected by project operation. The proportion of each species' population affected by project operation would be the

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To address the need for species density information, we recommend that GRDA modify item 1 of the rare aquatic species sub-study to include a review of existing density estimates in the project vicinity for each species, and item 2 to include surveys designed to estimate each species' density. With these modifications, the rare aquatic species sub-study would provide the information needed to determine the potential effects of reservoir fluctuations or increased reservoir elevation on Neosho mucket and Neosho madtom (section 5.9(b)(5)). Results from the study would also provide the information needed to prepare a biological assessment, which is necessary for determining whether any listed species are likely to be adversely affected, and whether formal consultation³⁴ is needed.³⁵ GRDA is already proposing to review existing information on these species and to conduct surveys, as needed; therefore, we anticipate no additional cost associated with our recommendation (section 5.9(b)(7)).

Rabbitsfoot Mussel

The FWS's official species list for the project indicates that the rabbitsfoot mussel (federally threatened) also may occur within the project boundary. The rabbitsfoot mussel historically occurred in the Neosho and Spring Rivers,³⁶ but is currently thought to be extirpated³⁷ from the Oklahoma portion of the Neosho River.³⁸ It is unknown³⁹ whether or not the rabbitsfoot mussel still occurs in the Oklahoma portion of the Spring River. In the RSP, GRDA did not propose to include the rabbitsfoot mussel in the rare aquatic species sub-study, because critical habitat is upstream of the area affected by project operation. FWS's official species list supports GRDA's conclusion that the

abundance of each species in habitats affected by project operation relative to the total abundance of each species in habitats in the project vicinity.

³⁴ A process between the Services and a federal agency or applicant that determines whether a proposed Federal action is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat (50 CFR, section 402.14).

³⁵ 50 CFR, section 402.12 (a).

³⁶ Butler, R. S. 2005. Status assessment report for the rabbitsfoot, *Quadrula cylindrica cylindrica*, a freshwater mussel occurring in the Mississippi River and Great Lakes Basins. U.S. Fish and Wildlife Service. July 2005.

³⁷ An organism that is extirpated is locally extinct from a geographic location where it historically occurred.

³⁸ 77 Fed. Reg. 63453 (October 16, 2012).

³⁹ The Proposed Rule for listing the rabbitsfoot mussel (77 Fed. Reg. 63454 [October 16, 2012]) indicates that the rabbitsfoot mussel is extant and declining in the Kansas and Missouri portions of the Spring River, but there is no indication of its occurrence in the Oklahoma portion of the Spring River.

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project occurs outside of critical habitat for the rabbitsfoot mussel. Nevertheless, the absence of critical habitat does not eliminate the potential for the rabbitsfoot mussel to occur within the project boundary. Further, the most recent information regarding the presence of the rabbitsfoot mussel in the Oklahoma portions of Neosho and Spring Rivers is over 6 years old.⁴⁰ The rabbitsfoot mussel also has the potential to be affected by changes in habitat associated with reservoir fluctuations or increased reservoir elevations.

As with the Neosho mucket and Neosho madtom, up-to-date information on the rabbitsfoot mussel presence, density, and distribution in the project vicinity is needed to estimate the proportion of the population that could be affected by reservoir fluctuations or increased reservoir elevations. The rare aquatic species sub-study, with modifications discussed above in the *Neosho Mucket and Neosho Madtom* subsection, and the addition of rabbitsfoot mussel, would provide the information needed to determine the potential effects of project operation on the rabbitsfoot mussel (section 5.9(b)(5)), and whether formal consultation is needed. Thus, we recommend including the rabbitsfoot mussel in the rare aquatic species sub-study. We anticipate that conducting a review of existing information on the rabbitsfoot mussel would increase the cost of the study by \$3,000, and including rabbitsfoot mussel in any survey methodology, would add no additional cost, because GRDA is already proposing to conduct mussel surveys, as needed.

Winged Mapleleaf Mussel

The FWS's official species list for the project indicates that the winged mapleleaf mussel (federally endangered) also may occur within the project boundary. The winged mapleleaf mussel historically occurred in the Kansas portion of the Neosho and Spring Rivers, but these populations are now considered extirpated.⁴¹ There is no documentation of winged mapleleaf occurrence, historically or at present, in the Oklahoma portion of the Neosho and Spring Rivers. Nevertheless, the winged mapleleaf mussel is on the FWS's official species list, and including it in the rare aquatic species sub-study is necessary for the same reasons discussed for the Neosho mucket, Neosho madtom, and rabbitsfoot mussel. Thus, we recommend including the winged mapleleaf mussel in the rare aquatic species sub-study. For the same reasons discussed above for rabbitsfoot mussel, we anticipate that adding the winged mapleleaf mussel to the study would increase the cost of the study by \$3,000.

⁴⁰ The most recent information is in Proposed Rule, 77 Fed. Reg. 63439-63536 (October 16, 2012).

⁴¹ FWS. 2015. Winged Mapleleaf (*Quadrula fragusa*), 5-year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Twin Cities Field Office, Bloomington, Minnesota. May 2015.

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Neosho Smallmouth Bass

The Neosho smallmouth bass is a subspecies⁴² that is endemic to some tributaries of the Arkansas River, including tributaries that flow into Grand Lake, such as the Elk River (Taylor et al., 2016).⁴³ The Neosho smallmouth bass is not a federally or state-listed species, but there is conservation interest in the species because of its limited distribution and vulnerability to genetic hybridization with non-native, northern smallmouth bass strains (Taylor et al., 2018).⁴⁴ Further, there is some interest in stocking Grand Lake and its tributaries with Neosho smallmouth bass to create a higher density angling opportunity (Taylor et al., 2016; Taylor et al., 2018).

Maintaining the Neosho smallmouth bass population in Grand Lake and its tributaries depends on successful reproduction. Smallmouth bass reproduction requires that females release eggs into a nest on the river-bottom. Males build the nest in areas with gravel or larger substrate and minimal fine sediment, but not in areas with thick layers of silt and clay (Dauwalter and Fisher, 2007).⁴⁵ As discussed above for the paddlefish sub-study, increasing the reservoir elevation could lead to a reduction of coarse/hard substrates in Grand Lake tributaries. Loss of coarse/hard substrates could further lead to a loss of smallmouth bass spawning habitat and reduced reproductive potential. Loss of this habitat could negatively affect the ability of Neosho smallmouth bass to maintain their populations, and reduce the potential for creating a high-density smallmouth bass fishery in Grand Lake.

As part of item 1 of the rare aquatic species sub-study, GRDA would review existing information on Neosho smallmouth bass habitat preferences. However, GRDA's

⁴² Neosho smallmouth bass are genetically and morphologically divergent from other smallmouth bass strains.

⁴³ Taylor, A. T., J. M. Long, M. R. Schwemm, M. D. Tringali, and S. K. Brewer. 2016. Identification of Neosho smallmouth bass (*Micropterus dolomieu velox*) stocks for possible introduction into Grand Lake, Oklahoma. Final report to the Environmental Department of the Peoria Tribe of Indians of Oklahoma.

⁴⁴ Northern smallmouth bass are not stocked into Grand Lake, but anglers have reported the presence of non-native Tennessee lake-strain smallmouth bass in Grand Lake (Taylor et al., 2018).

Taylor, A. T., J. M. Long, M. R. Schwemm, and S. K. Brewer. 2018. Hybridization and genetic structure of Neosho smallmouth bass in the Ozark Highlands. *North American Journal of Fisheries Management*. [Online only] <https://doi.org/10.1002/nafm.10225> Accessed October 2018.

⁴⁵ Dauwalter, D. C., and W. L. Fisher. 2007. Spawning chronology, nest site selection and nest success of smallmouth bass during benign streamflow conditions. *American Midland Naturalist*, 158:60-78.

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proposal does not include a review of available spawning habitat. Because of the importance of spawning habitat to maintenance of the population and the potential for spawning habitat to be affected by raising the reservoir elevation, we recommend that item 1 of the sub-study include a review of existing information on Neosho smallmouth bass spawning habitat availability in the project vicinity.

As part of item 2 of the rare aquatic species sub-study, GRDA would conduct targeted field surveys needed to understand each species' distribution. We recommend that any surveys conducted as part of item 2 of the rare aquatic species sub-study also include surveys to assess the availability of spawning habitat during the spawning season under existing conditions. Including the above recommendations in study items 1 and 2 of the rare aquatic species sub-study would help identify where Neosho smallmouth bass spawning habitat exists. GRDA could use that information to determine whether those locations occur in areas that could be negatively affected by raising the reservoir elevation under item 3 of the rare aquatic species sub-study (section 5.9(b)(5)).

We specifically recommend that GRDA modify item 3 of the rare aquatic species sub-study methodology to include comparison of the information collected in items 1 and 2 with the maps of the lentic and lotic boundary produced as part of the paddlefish sub-study to identify the proportion of Neosho smallmouth bass spawning habitat affected by raising the reservoir elevation, relative to all Neosho smallmouth bass spawning habitat in the project vicinity. Estimating the proportion of spawning habitat affected by project operation would provide the context for identifying potential impacts to the Neosho smallmouth bass population and the need for protective measures, and therefore would be a necessary addition to the study proposal (section 5.9(b)(4); section 5.9(b)(5)).

Mapping Habitat in the Fluctuation Zone

Oklahoma DWC requests that GRDA conduct a study consisting of mapping habitat in the reservoir fluctuation zone. Oklahoma DWC indicates that the study would help determine potential impacts of reservoir fluctuations on species that may use littoral zone⁴⁶ habitat and the need for mitigation or operational changes. As discussed above, existing information on habitat already exists for paddlefish, and we are recommending that GRDA collect spawning habitat information for Neosho smallmouth bass. With these exceptions, we are unable to identify the need for habitat data. For the federally listed species identified above, there would be no benefit to collecting additional habitat data, given that we are recommending that GRDA conduct surveys as part of the rare aquatic species sub-study to identify the occurrence, density, and distribution of those species, which would be adequate for identifying project effects (section 5.9(b)(4)). Further, results from the H&H modeling study discussed above, would be adequate for identifying whether reservoir fluctuations could affect other common species that use the

⁴⁶ The littoral zone is the shallow, near-shore region of the reservoir.

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littoral zone habitat in Grand Lake (e.g., largemouth bass, white bass, and crappie). Thus, with the exception of gathering information on spawning habitat for smallmouth bass, we do not recommend conducting any additional habitat surveys or mapping in the reservoir as part of the rare aquatic species sub-study.

Recreation Facilities Inventory and Use Survey

Applicant's Proposed Study

Operation of the Pensacola Project has the potential to affect public access and recreation. Lake level fluctuation associated with different operating regimes may affect the usability of boat launches and other recreation amenities. Overcrowding of public recreation facilities may affect visitor experiences at the project. Further, recreation use of the project has the potential to negatively affect environmental and cultural resources. GRDA proposes to conduct a recreation facilities inventory and use survey to gather information regarding current recreation use at the project, and to identify recreation resources and public access areas within the project boundary that may be affected by project operations. GRDA would then characterize the existing recreation use, and estimate future demand to determine the need for recreation improvements at the project over the term of a new license.

To achieve the goals of the study, GRDA proposes to conduct facility condition assessments at each of its five Commission-approved project recreation facilities. GRDA also proposes to assemble historical visitor use data, conduct field reconnaissance and in-person visitor use interviews, and collect boat launch elevation data for a total of 13 recreation sites including five Commission-approved public access areas, six state parks, and two non-project public access sites along the reservoir. GRDA would also make periodic observations of informal recreation access points downstream from the project to assess recreational use of the project's spillway channels.

Comments on the Study

Oklahoma DWC recommends that GRDA survey additional locations in the mid- and upper-lake areas. The City of Miami recommends that the study encompass the full geographic range of recreational opportunities that could be affected by the project. Specifically, the City recommends that the study include an assessment of the project's effects on access to and use of Riverview Park, Rotary Park, the Boys and Girls Club, the local fairgrounds, and the public pool.

Oklahoma DWC recommends that GRDA conduct visitor use surveys on days and at times when user groups other than anglers and recreational boaters, such as hunters or wildlife viewers, are likely to be present. Oklahoma DWC recommends that surveys of

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visitor use extend to the period from October through January to capture waterfowl and deer seasons, and peak migratory bird concentrations.

Discussion and Staff Recommendation

Survey Locations

As GRDA noted in its pre-application document (PAD), filed February 1, 2017, Grand Lake is the premier recreation destination in northeastern Oklahoma. Based on an assessment of recreation facilities conducted to support GRDA's Licensed Hydropower Development Recreation Report (FERC Form 80) in 2015, Grand Lake supported 90 boat launch areas, 58 marinas, 15 swim areas, 27 campgrounds with over 2,000 camp and cottage sites, 47 active recreation areas (e.g., playgrounds, golf courses), 32 picnic areas, 7 overlooks, and 6 visitor centers. The five FERC-licensed project recreation facilities at Duck Creek, Seaplane Base, Monkey Island, Big Hollow, and Wolf Creek represent only a fraction of the public recreation areas at Grand Lake. With the exception of Wolf Creek Public Access (which has amenities for picnicking), the five FERC-licensed facilities provide only parking and boat launches and offer little diversity of experience for visitors.

In the RSP, GRDA expanded its study to include surveys of the six state parks on the lake (Twin Bridges [Upper and Lower], Bernice, Honey Creek, Disney/Little Blue, Cherokee [Main and Lakeside], and Cherokee [Riverside] State Parks); two non-project sites providing recreation access to the project (Connors Bridge and Riverview Park); and informal recreation access points downstream of the project dam. The expansion of the study to include these access areas would improve the range of visitor types and recreation uses surveyed at Grand Lake. However, even with those additions, no study data would be collected from large geographic areas around the project. Geographic coverage is needed to collect information from people approaching the project from different neighborhoods, towns, and access routes, and using different parts of the impoundment. We recommend modifying the recreation facilities inventory and use survey to include three additional study sites to increase the geographic coverage of the survey: the Spring River and Council Cove access areas in the lake's upper section, and Willow Park, in Ketchum, which is located in a geographically isolated area of Grand Lake's lower end. These three sites are easily accessible, and including them in the recreation study would produce a more complete study of recreation use at Grand Lake (section 5.9(b)(6)).

Regarding the City of Miami's comment that GRDA expand the study to assess the effects of project operation on recreation access at Riverview Park, Rotary Park, the Boys and Girls' Club, the local fairgrounds, and the public pool, GRDA has expanded the recreation facilities inventory and use study to include Riverview Park. Of the recreation

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sites listed in the City of Miami’s comment, Riverview Park is the most appropriate site to survey visitor use, because it provides direct access to the project’s reservoir and supports recreation use that is consistent with project purposes including boating, fishing, and picnicking.⁴⁷ Requiring additional surveys of recreation use at Rotary Park, the Boys and Girls’ Club, the fairgrounds, and the public pool would be unlikely to inform the development of license criteria related to the provision of adequate public access for recreation at the project, or the effects of recreation at the project on environmental or cultural resources (section 5.9(b)(5)) because these facilities have little nexus to project-related recreation, outside of their potential to be affected by flooding in upper Grand Lake or its tributaries. Therefore, we do not recommend modifying the study plan to include recreation use surveys at these sites.⁴⁸

Study Season and Survey Questionnaire

Oklahoma DWC recommends that the survey season be expanded into the fall and early winter, and that the visitor interview questionnaire be modified to accommodate different types of recreation use at the project, particularly recreation that occurs outside of the primary recreation season of May through September (Memorial Day to Labor Day). Extending the survey season through January to gather information on hunting and wildlife viewing would not be cost-effective because of the relatively low use and dispersed nature of recreation activity in the fall and early winter compared to the summer season. We recommend that GRDA focus its survey effort on the times during which the majority of recreation use occurs at Grand Lake, which is the summer (section 5.9(b)(7)). Though participation in water-based activities dominates recreational pursuits, useful data on off-season participation in land-based activities, including hunting and wildlife viewing, could be collected efficiently through the proposed peak-season recreation use survey. It is likely that some summer survey respondents participate in hunting and wildlife viewing in the fall and early-winter seasons, thus, the survey could collect data on previous hunting and wildlife viewing participation.

In order to collect the fall and early-winter information, we recommend the following modifications to the summer survey questionnaires for both GRDA and non-

⁴⁷ City of Miami, Oklahoma. “George Francis Riverview Park.” <https://www.miamiokla.net/Facilities/Facility/Details/George-Francis-Riverview-Park-24>. [Online Only.] Accessed October 25, 2018.

⁴⁸ Staff’s recommendations related to studying the extent to which project operations affects flooding of public infrastructure, including recreation sites within the City of Miami, is discussed in greater detail in the discussion of the infrastructure improvement study.

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GRDA recreation sites: (1) add wildlife viewing as an option in Question 10 of both surveys; (2) include a new question requesting that visitors identify any recreation activities, including hunting and wildlife viewing, which they have participated in on any trip to the Grand Lake area within the past year;⁴⁹ and (3) add clarifying information defining the rating scale to be used in Question 13 in both surveys (revise to allow for respondents to rate the variables for each specific recreation activity). With these modifications to the summer survey, we do not recommend modifying the study plan to extend the survey season.

Cultural Resources Study

GRDA proposes to conduct a cultural resources study to evaluate project-related effects on cultural resources and meet the requirements of section 106 of the National Historic Preservation Act (NHPA). This study would determine the extent to which the project may affect historic properties within the project's area of potential effects (APE) and identify appropriate management measures for cultural resources in consultation with a Cultural Resources Working Group (CRWG).

Tribal Consultation

Applicant's Proposed Study

As part of the cultural resources study, GRDA would: (1) hold quarterly meetings with the CRWG, of which the consulting tribes are members and (2) schedule individual meetings with tribes to discuss the traditional cultural properties component of the cultural resources study at times and locations of each tribe's choosing.

Comments on the Study

Comments regarding tribal consultation received from the BIA, Eastern Shawnee Tribe of Oklahoma, Miami Tribe of Oklahoma, and Osage Nation emphasize the need for the Commission to conduct government-to-government consultation with Native American tribes. Commenters emphasize the importance of early and frequent consultation with all tribes that have interests in the project area and the need to consult with tribes prior to conducting any field surveys. The Miami Tribe of Oklahoma, supported by the Eastern Shawnee Tribe of Oklahoma, requests that Commission staff and GRDA consult in person with the CRWG no later than 60 days after the issuance of the study plan determination and every quarter thereafter. BIA requests that Commission staff attend all quarterly CRWG meetings.

⁴⁹ Activity options would be identical to those listed for Question 10.

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Discussion and Staff Recommendation

To date, Commission staff met with tribes, in-person, to discuss the Pensacola Project relicensing on four occasions (December 13 and 14, 2017, May 31, 2018, and August 21, 2018). Staff will further evaluate the need for holding additional Tribal Consultation meetings in conjunction with the ISR meeting after the first year of studies is completed, in accordance with the Commission's Policy Statement on Consultation with Indian Tribes in Commission Proceedings (18 CFR 2.1(c)). We recommend that, to the extent possible and appropriate, tribes work directly with GRDA through the CRWG to address issues of concern, as included in the cultural resource study methodology [section 5.9(b)(6)]. We also recommend that GRDA modify the schedule for the cultural resource study to hold a CRWG meeting within 60 days of the issuance of this study plan determination, as requested by the Miami Tribe of Oklahoma. Commission staff's attendance at the quarterly CRWG meetings will likely be limited to participation via teleconferencing.

*Area of Potential Effects*Applicant's Proposed Study

In section 2.5 of the RSP, under cultural resources, GRDA tentatively defines the project's APE as follows:

All lands within the FERC-approved project boundary. The APE also includes lands or properties outside the project boundary where project operations or project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.

GRDA proposes to refine the APE in consultation with the CRWG, as necessary, based on the results of the H&H study, other relicensing studies, and information gathered during the first year of the cultural resources study.

Comments on the Study

The Cherokee Nation, Muscogee (Creek) Nation, Osage Nation, and Quapaw Nation filed comments on the APE. The comments indicate that the tribes do not oppose GRDA's phased approach to defining the project's APE; the depiction of the APE on a map that specifies all affected lands and areas that would be subject to relicensing reconnaissance surveys appears to be the issue in question. The Cherokee Nation states that the phased approach to defining the APE is problematic because it limits the tribe's ability to engage effectively in government-to-government consultation. The Quapaw

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Nation specifically recommends the extension of the APE to include Tar Creek and the Spring River as far as the Oklahoma/Kansas border.

Discussion and Staff Recommendation

GRDA's definition of the Pensacola Project's APE is consistent with the requirements of section 106 and the definition of a project's APE provided at 36 CFR 800.16(d), which would encompass project-related effects both within and outside the project boundary. Using the existing project boundary as a baseline for the first year of fieldwork is appropriate. Following completion of study year one, GRDA should consult with the CRWG to refine the APE, if necessary.

We recommend approving GRDA's definition of the APE and the process to map and refine it as described in the RSP. However, in accordance with section 106 (36 CFR 800.4[a]), as the Commission's designated non-federal representative for the purposes of section 106, GRDA must also consult with and request concurrence from the Oklahoma SHPO and Tribal Historic Preservation Officers (THPOs) for tribes with lands within the project boundary on the final APE. All correspondence with the Oklahoma SHPO and THPOs should be filed with the Commission. The final APE should clearly identify: (1) the project boundary; (2) lands outside the project boundary that are included in the final APE, and (3) the specific locations of any tribal trust lands that GRDA and BIA determine are within the project boundary. The maps will serve as the basis for the subsequent Historic Properties Management Plan (HPMP) proposed by GRDA and the Commission's environmental analysis of the project's effects on cultural resources.

Schedule and Timing

Applicant's Proposed Study

GRDA proposes a two-year period to conduct background research and archeological fieldwork. The first study year would include developing a pre-fieldwork study report, followed by reconnaissance and surveys between May 2019 and December 31, 2019. GRDA expects to conduct a second field season from May through December 31, 2020. GRDA would file survey reports along with ISR, in November 2019, an Updated Study Report (USR), in November 2020, and provide a supplemental study report on work conducted in the fall and winter of 2020, in Quarter 1 of 2021. As part of its archeological investigations, GRDA would formally evaluate sites for listing in the National Register, in consultation with the CRWG, during study year one and study year two if: (a) the project may be having an ongoing adverse effect on the integrity of the sites, or (b) the results of the reconnaissance surveys indicate that a site is not likely to be eligible for listing. The results of these National Register evaluations would be presented in GRDA's ISR and USR prior to preparation of the license application. Any unevaluated sites would be assumed eligible for listing in the National Register for the

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purposes of developing the HPMP. GRDA would use the same two-year timeframe to conduct its proposed TCP inventory and develop an HPMP, which it would file with its final license application.

Comments on the Study

In its comments on the RSP, the Osage Nation requests that the two-year study period be expanded so that all necessary cultural resource investigations can be completed prior to the issuance of a new license. The Eastern Shawnee Tribe of Oklahoma, Miami Tribe of Oklahoma, Muscogee (Creek) Nation, and Osage Nation also request that National Register evaluations and assessments of effects for all identified resources be conducted during the two-year pre-application study period and prior to any license renewal.

Discussion and Staff Recommendation

The Commission's ILP anticipates the potential need for two years of study to gather data. This schedule is set by federal regulation (18 CFR section 5.15). Data collected are included in a license application and assist Commission staff in its analysis of project-related effects on environmental resources. GRDA has developed its cultural resource study in accordance with the timeline established by the Commission's regulations.

The Miami Tribe of Oklahoma notes that 36 CFR 800.1(c) of the implementing regulations of section 106 of the NHPA, as amended, states that the section 106 process must be completed prior to the issuance of any new license. However, as specified in 36 CFR 800.4(b)(2) of the implementing regulations for section 106, for large undertakings, an agency "may also approve a phased identification and evaluation process and defer final identification and evaluation of historic properties if it is specifically provided for in a memorandum of agreement executed pursuant to 36 CFR 800.6." While the Commission encourages licensees and applicants to identify and evaluate all historic properties within a project's APE prior to the submittal of a final license application, it is not always possible to do so. In such situations, an executed Programmatic Agreement (PA) would call for the implementation of a management plan that clearly specifies all outstanding activities, including any additional identification and evaluation efforts, and a process and schedule to complete them. This alternative to the standard section 106 process is also consistent with the guidance provided in the Advisory Council on Historic Preservation (Advisory Council) and Commission's joint document *Guidelines for the*

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*Development of Historic Properties Management Plans for FERC Hydroelectric Project (2002).*⁵⁰

With specific regard to the TCP inventory, based on GRDA's proposed schedule, Commission staff would not have an opportunity to review or comment on the results of the study until the final license application is filed. We recommend that GRDA, to the best of its ability, (a) prepare a summary of study results to date to be filed with the USR, (b) file individual TCP reports for each tribe upon their completion because some studies may take longer than others, and (c) file a final comprehensive TCP report that contains the TCP results for all tribes with the final license application.

*Archaeological Survey Methods*Applicant's Proposed Study

GRDA proposes to conduct archeological surveys in accordance with standards set forth by the Oklahoma SHPO and Osage Nation.⁵¹ GRDA would use the Osage Nation's Archaeological Block Survey Standards for conducting shovel test excavations to identify and delineate the boundaries and depth of identified archaeological resources. If fieldwork determines that some sites are bisected by the boundary of the APE, the entire site would be considered to be within the project APE. GRDA notes in the study plan that the methods may be adapted from the Osage Nation THPO's Archaeological Block Survey Standards as necessary, based on land ownership and the required survey methods of the specific landowner. If no testing is conducted, GRDA would document the reasons for not doing so.

Comments on the Study

The Muscogee (Creek) Nation and Osage Nation filed comments of support for GRDA's proposal to use the Osage Nation's Archaeological Block Survey Standards for conducting shovel test excavations to identify and delineate archaeological sites within the project's APE.

The Muscogee (Creek) Nation requests that the cultural resources study include evaluation of the 125 archaeological sites with unknown National Register eligibility

⁵⁰ Available Online: <https://www.ferc.gov/industries/hydropower/gen-info/guidelines/hpmp.pdf>.

⁵¹ Oklahoma SHPO. 2013. Fact Sheet #16: Guidelines for Developing Archaeological Survey Reports in Oklahoma and Report Components. Available Online: www.okhistory.org/shpo/factsheets/fs16archreports.pdf

Osage Nation Historic Preservation Office. 2016. Archaeological Block Survey Standards. Osage Nation Historic Preservation Office, Pawhuska, OK.

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statuses and the 19 sites that have unassessed eligibility statuses listed in section 6.9 of the PAD.

Discussion and Staff Recommendation

As noted in Section 2.6.4 of the RSP and in GRDA's response to comments, GRDA states that it will consult with the Oklahoma SHPO, OAS, tribes, THPOs, and BIA to "confirm the appropriate survey methods" and to "determine if the proposed methods are appropriate for non-federal lands within the APE." This statement indicates that there is some level of uncertainty as to which methodology will be used.

Therefore, we recommend approving the plan for reconnaissance survey and archaeological testing as filed in the RSP, with a modification requiring concurrence on survey methods by the Oklahoma SHPO prior to conducting any fieldwork on non-federal lands used (section 5.9(b)(6)). If the Oklahoma SHPO declines concurrence with use of the Osage Nation's Archaeological Block Survey Standards, GRDA should consult with the SHPO to determine other appropriate methods that meet the Secretary of the Interior's standards. In that situation, the Osage Nation THPO's Archaeological Block Survey Standards would only apply to lands within the APE held in trust by the BIA, with concurrence from the relevant THPO for which the Osage Nation's methodology is appropriate.

Regarding the Muscogee (Creek) Nation's request for evaluation of the known archeological sites listed in section 6.9 of GRDA's PAD, we recommend that GRDA modify their pre-fieldwork report to include plans to evaluate these sites in consultation with the CRWG.

Identification of Inundated Resources

Applicant's Proposed Study

GRDA's cultural resources study plan does not include procedures to survey areas permanently inundated by Grand Lake. The plan includes provisions for visual reconnaissance and subsurface archaeological testing of exposed shoreline areas during the archaeological study season from October 1 until December 31, 2019. GRDA also intends to develop an HPMP that would "describe management measures for permanently inundated sites, as well as measures for conducting additional surveys and evaluating submerged archaeological sites when and if lake levels allow (e.g., during maintenance drawdowns of the reservoir)."

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Comments on the Study

In its comments on the RSP, the Miami Tribe of Oklahoma and Eastern Shawnee Tribe of Oklahoma reiterate previous comments that inundated sites cannot be presumed to be ineligible for listing in the National Register of Historic Places (National Register) and the Osage Nation states that the project HPMP must include a plan for these resources.

Discussion and Staff Recommendation

Reservoir inundation could affect submerged cultural resources and inundated sites cannot be presumed to be ineligible for listing in the National Register. However, options for surveying inundated resources are limited and lowering Grand Lake for the purpose of documenting and assessing such resources would result in environmental and socioeconomic effects and would not generally be regarded as accepted practice in the scientific community (section 5.9(b)(6)). Therefore, GRDA's proposal to include in an HPMP the requirement to survey areas that may be exposed over any new license term is a reasonable approach to addressing inundated resources.

*Traditional Cultural Properties*Applicant's Proposed Study

GRDA proposes to inventory TCPs at the project through consultation with tribes. GRDA's TCP inventory would be conducted in accordance with guidance provided in National Register Bulletin No. 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties.⁵² GRDA would select an ethnographer, in consultation with tribes, to determine appropriate methods for collecting information regarding TCPs. GRDA would conduct the TCP inventory in accordance with the scope developed by each participating tribe.

Comments on the Study

In general, the tribes support GRDA's proposal for developing tribe-specific approaches to TCP research. In response to GRDA's recreation facilities inventory and use study, BIA recommends that areas of cultural or religious importance to tribes and areas subject to treaty rights be considered during GRDA's analysis of recreational use at the project.

⁵² Parker, P.L. and T.F. King. 1990. National Register Bulletin No. 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties. National Park Service, National Register of Historic Places, Washington, D.C.

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Discussion and Staff Recommendation

We recommend that GRDA include a discussion of any project-related effects to identified TCPs, including but not limited to effects associated with recreational use (section 5.9(b)(4)), in its cultural resources study report. This information should be collected as GRDA conducts its TCP inventory as proposed in the RSP.

Historic Properties Management Plan

Applicant's Proposed Study

In its RSP, GRDA proposes to develop an HPMP for the project, in consultation with the CRWG and in accordance with the Advisory Council and Commission's guidelines. The HPMP would direct GRDA's management of historic properties within the project's APE throughout the term of a new license.

Comments on the Study

The Miami Tribe of Oklahoma, supported by the Eastern Shawnee Tribe of Oklahoma, comments that an HPMP is only one of several kinds of mitigation measures and recommended that other measures, such as license conditions, be considered.

Discussion and Staff Recommendation

In general, mitigation measures for adversely affected resources are either identified in the HPMP, or the HPMP would call for these measures to be developed in consultation with the Oklahoma SHPO, OAS, and tribes after license issuance. GRDA's proposed development of a HPMP, in consultation with the CRWG, would be an appropriate means of addressing project-related effects on cultural resources.

Information Sharing and Confidentiality

Applicant's Proposed Study

GRDA states that it would distribute relevant cultural resource information to the CRWG so that participants can make meaningful and informed decisions and recommendations. GRDA also states that it will honor any tribe's written request for confidentiality and would only share sensitive information with other parties pursuant to applicable laws and written approval from a tribe. Additionally, GRDA would coordinate with BIA to maintain the confidentiality of resources identified on tribal trust lands.

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Comments on the Study

The Oklahoma SHPO, BIA, Cherokee Nation, Delaware Nation, Muscogee (Creek) Nation, and Osage Nation provided PSP comments on previously recorded sites located within the project boundary, particularly sites that may have been inundated following dam construction. BIA and commenting tribes requested that any available information about previous surveys and these sites be distributed to the tribes. This request is reiterated by the Osage Nation in its comments on the RSP. The Miami Tribe of Oklahoma recommends that the study plan include the development of a historic properties electronic reading room to house all information regarding cultural resources investigations at the project that would be accessible to consulting tribes as the cultural resources study is implemented.

BIA emphasized the need for confidentiality of TCP information in its comments on the RSP. In particular, BIA recommended that to the extent that tribes have requested documentation on all known sites of cultural properties, that documentation should not be shared with all tribes if the cultural property is traceable to a particular tribe or tribes.

Discussion and Staff Recommendation

In the cultural resources study plan, GRDA proposes to develop a pre-fieldwork report that will include an appendix containing copies of all available previous study reports. GRDA will provide this report and appendix to the CRWG. Because GRDA has already agreed to provide the CRWG with copies of all available information, we do not recommend modifying the study plan to include the Miami Tribe of Oklahoma's proposed electronic reading room (section 5.9(b)(4)). The request for an electronic reading room may be proposed as a mitigation measure during the development of an HPMP for the project, but we do not recommend modifying the cultural resources study plan to include such a measure.

Sensitive cultural resources information must be carefully protected. While the Commission must view data obtained during the studies to analyze project-related effects in its environmental document, section 304 of the NHPA, as amended, and its implementing regulations found at 36 CFR 800.11(c) allow the Commission to withhold any information about the location, character, or ownership of a historic property from public disclosure when disclosure may cause a significant invasion of privacy, risk harm to the historic property, or impede the use of a traditional religious site by practitioners. For this reason, staff urges GRDA and the CRWG to file any such information as "privileged" so that it would not be accessible to those without a "need to know." We recommend that GRDA modify the cultural resources study plan to adopt BIA's recommendations regarding confidentiality (section 5.9(b)(6)).

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Socioeconomics Study

Applicant's Proposed Study

GRDA proposes to use existing information necessary to conduct a qualitative analysis of the socioeconomic effects of the Pensacola Project in the four-county project area (i.e., Craig, Delaware, Mayes, and Ottawa Counties, Oklahoma). The purposes of the study are to describe baseline economic conditions, broadly assess the cumulative socioeconomic impacts of the project, and identify the socioeconomic contribution of the project within the project area.

To accomplish the goals of the study, GRDA proposes to gather and analyze baseline demographic and economic data for the four-county project from existing sources including the U.S. Census Bureau and Oklahoma Department of Commerce. GRDA would also query relicensing stakeholders to provide additional existing economic data relating to State and regional industry trends, local tribal and regional trends in land and resource values, and other information that could be potentially relevant to the study. GRDA would use the data collected to produce a qualitative assessment identifying the past, present, and reasonably foreseeable cumulative socioeconomic impacts of the project.

Comments on the Study

The City of Miami recommends that the study fully assess both the direct economic costs of potential project effects (including flooding) on infrastructure as well as the social and societal benefits and costs of operating the project. The City of Miami cites topics including population and demographics, regional employment and income, revenues and expenditures, government finances, public services, and social conditions as components GRDA should address in the socioeconomics study. Further, the City of Miami recommends that the analysis address the project's potential to cause disproportionately high adverse human health or environmental effects on minority and low-income populations, including Indian tribes.

BIA recommends that the socioeconomics study analyze the discrete socioeconomic benefits and costs to tribes of continued operation of the project.

Discussion and Staff Recommendation

Data Collection and Distribution

As both GRDA and the City of Miami note, quantitatively determining the socioeconomic costs and benefits of a hydropower development is challenging. The range of economic and social indicators that could be influenced by the project's

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presence and continued operation is too diverse to be reliably captured in a quantitative model.⁵³ Additionally, collecting new data to study these factors in a meaningful way would not be cost-effective when existing descriptive data for many indicators exists. Therefore, GRDA's proposal to use existing information to conduct a broad, qualitative assessment of socioeconomic resources affected by the project is appropriate (section 5.9(b)(6)).

The City of Miami asserts that, in the RSP, GRDA fails to account for social and societal costs and benefits of the project. The City of Miami states that GRDA rejected requests to collect information on population and demographics, regional employment and income, revenues and expenditures, government finances, public services, and social conditions. In the RSP, however, GRDA's socioeconomic study plan specifically includes a proposal for collecting information on population trends, economic activity and the labor force, age distribution, median household and per capita income, and poverty levels. GRDA also proposes outreach to collect additional information relating to state and regional industry trends; local, tribal, and regional trends in land and resource values; as well as other information that may be potentially relevant to the study from relicensing participants. To make the best use of GRDA's socioeconomic data information request, we recommend that GRDA modify task 4, *Prepare Socioeconomic Study Report*, to include an appendix containing electronic copies of documents submitted by stakeholders and links to publically accessible web sites containing such documents. Providing access to all sources available to GRDA for its analysis will aid the analysis of socioeconomic resources.

Environmental Justice

BIA and the City of Miami request that GRDA provide information regarding effects of the project on the socioeconomic condition of specific communities, including tribes. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,"⁵⁴ provides that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." For the purposes of environmental justice analysis under the

⁵³ We discuss requests to study the direct effects of project operation on infrastructure and capital costs associated with infrastructure improvements in our discussion of the stakeholder-requested infrastructure improvement study.

⁵⁴ 59 Fed. Reg. 7628 (February 16, 1994).

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National Environmental Policy Act, the Council on Environmental Quality includes in its definition of minority populations members of American Indian tribes.⁵⁵

In Scoping Document 2,⁵⁶ we stated our intent to analyze environmental justice as part of the environmental review of the project. Such an analysis would address the concerns raised by BIA and the City of Miami regarding the effects of relicensing the project on low-income communities and tribes. To provide the level of detail needed for the environmental justice analysis, we recommend that GRDA modify the socioeconomic study plan to include in task 4, *Prepare Socioeconomics Study Report*, not only a summary of the socioeconomic conditions in the four-county study area, but also tabular data on these conditions reported at the county and census tract level, where such data exist. Because county and regional socioeconomic indicators may be updated more frequently than census tract data, GRDA should clearly state in the study report which data source was used for each level of aggregation (section 5.9(b)(6)).

Infrastructure Study

Study Request

The Miami Tribe of Oklahoma requests that GRDA conduct an infrastructure impacts study. The study would include an analysis of the impact that project operations has on inundation of critical infrastructure such as bridges, roads, water systems, electric transmission, and information and communication technology.

The City of Miami filed a separate study request to address socioeconomic and infrastructure effects of project operations, including flooding.⁵⁷ The specific infrastructure impacts the City of Miami recommends analyzing include reduced access to emergency services, schools, workplaces, and recreation facilities caused by flooding. In comments on the RSP, the City of Miami also requests that GRDA study the direct effects of flooding on public recreation facilities including Riverview Park, Rotary Park, the Boys and Girls Club, the local fairgrounds, and the public pool.

Commission staff requested similar information about the potential for the project to affect infrastructure in the hydrologic and hydraulic model study request, issued

⁵⁵ CEQ (Council on Environmental Quality). 1997. Environmental Justice Guidance Under the National Environmental Policy Act. Washington, D.C. December 10, 1997.

⁵⁶ Issued April 27, 2018.

⁵⁷ We discuss the socioeconomic components of the City of Miami's study request as part of our recommendations for GRDA's socioeconomics study.

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March 13, 2018, which recommended that GRDA's study provide information on the frequency and depth of flooding of structures, roads, and bridges within the study area.

Discussion and Staff Recommendation

Flooding of critical infrastructure can degrade the structural integrity of public facilities and render them temporarily unusable while causing social and economic disruption on those dependent on the infrastructure. GRDA provided no information on flood infrastructure in its PAD. Rather, GRDA states that infrastructure issues identified by the City of Miami and Miami Tribe of Oklahoma are absent during normal project operations, when the reservoir elevation of Grand Lake is within the conservation pool (i.e., below elevation 745 PD). GRDA states that the Corps has exclusive jurisdiction over Grand Lake when flooding of infrastructure is likely to occur.

Although the Corps has jurisdiction to direct how the project operates under flood conditions, as a general matter, the Commission through a license, authorizes operation of the licensed facilities for all project purposes (including flood control). Further, operation of the project below 745 feet PD could affect the timing and elevation of flooding. For example, there is a large amount of storage potential below 745 feet that could be used to reduce flood elevations under some circumstances (section 5.9(b)(5)). Thus, there is a connection between both project operation directed by the license and project operations directed by the Corps, and the potential combined effects on structures. We expect that the H&H modeling study would refine understanding of this nexus.

Characterizing existing infrastructure that could be affected under flood conditions would help staff analyze the broad effect of project operation (including operation during flood conditions) on land uses, including uses related to infrastructure or municipal recreation areas. Though the Commission does not have the authority to adjudicate claims for, or to require, payment of damages for project-induced adverse effects to private property,⁵⁸ the results of this analysis could be used to evaluate potential

⁵⁸ Section 10(c) of the FPA makes clear that a licensee of a hydropower project "shall be liable for all damages occasioned to the property of others by the construction, maintenance, or operation of the project works..." We would not require GRDA to conduct case-specific studies of project effects on non-project structures or study the associated cost of addressing any such effects or potential case-specific mitigation (including specific infrastructure improvements) for such effects, all of which would potentially constitute the payment of damages for such effects. Further, measures that addressed damages, such as paying for or making repairs to non-project structures and infrastructure damaged by project operations, would not be able to be included in a license.

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mitigation measures, including changes to project operations or construction and maintenance of physical structures, such as retaining walls, designed to broadly mitigate flooding effects.

We recommend that GRDA adopt the following strategy for assessing infrastructure impacts:

- (1) In consultation with stakeholders, determine a list of infrastructure types to be included in the recommended infrastructure study. At a minimum, the list should include bridges, roads, structures, and other public amenities (e.g., recreation facilities) that have the potential to be flooded under all operating scenarios (e.g., by both the Corps-directed flood control operations and GRDA's project operations).
- (2) Using output from the H&H modeling study, determine the range of inflow conditions for which model results show that project operations for hydropower and other purposes under the Federal Power Act in combination with Corps' directed flood control operations are likely to have an effect on the frequency or depth of flooding. Based on the infrastructure identified in step 1, provide maps and tables identifying the frequency and depth of flooding for each item of infrastructure under existing operations, as defined above, and for the range of inflow conditions where such operations may have an effect on flooding. This information would be included in the ISR, in November 2019.
- (3) Provide additional maps and tabular information based on any alternative operating scenarios proposed or developed through consultation, as required in the H&H study.

We anticipate that the cost of an inventory of potentially affected and affected infrastructure would be \$50,000.

II. Studies Requested but not Adopted

Federal Lands and Project Boundary/ Flooding Inundation of Tribal Lands Study

Study Request

Miami Tribe, supported by Ottawa Tribe, Peoria Tribe, City of Miami, and Plaintiffs, requests a study to further delineate the project boundary along Grand Lake and its upstream tributaries. The purposes of this study are to: (1) identify a project boundary that fully encloses the project, including areas needed for protection,

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mitigation, and enhancement measures (PM&Es); and (2) establish what, if any, federal lands occur within that boundary.

Similarly, BIA requests that GRDA conduct a study to determine if operation of the Pensacola Project affects flooding of lands held in trust by the United States for Indian tribes or allotments held in trust for individual Indians (tribal lands). The purpose of this study is to determine if flooding of the Neosho River, Spring River, and shoreline areas of Oklahoma upstream from Pensacola Dam causes inundation of tribal lands and, if so, to determine the extent of flooding that occurs under different operating scenarios.

Discussion and Staff Recommendation

The requests of both Miami Tribe and BIA relate to the assertion of many stakeholders (i.e., Miami Tribe, Eastern Shawnee Tribe, Ottawa Tribe, Seneca-Cayuga Tribe, Wyandotte Nation, City of Miami, and Plaintiffs) that the Pensacola Project contributes to flooding of areas upstream from Pensacola Dam and that the project boundary should be modified to enclose both the existing flood control pool and other areas that may be subject to frequent inundation. As discussed previously, the results of the recommended H&H model study should establish the extent of project-related flooding around Grand Lake and its upstream tributaries. This information is important to understanding the extent to which the project affects federal lands, the need for potential PM&Es to address effects on environmental or cultural resources, and the adequacy of the proposed project boundary.

As the Commission's regulations require, in its final license application, GRDA must provide exhibit G maps that show a project boundary enclosing all project works and lands necessary for operation and maintenance of the project and other project purposes including recreation, shoreline control, and protection of environmental resources (*see* 18 C.F.R section 4.41(h)(2)). Further, the Commission's regulations require that GRDA provide an exhibit A that describes all lands of the United States that are enclosed within the project boundary, identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best available legal description (*see* 18 C.F.R. section 4.51(b)(6)).

As identified in Scoping Document 2,⁵⁹ in a filing of April 11, 2017, BIA provided documentation that lands held in trust by the BIA, for the benefit of one or more federally recognized Indian tribes, occur within the existing Pensacola Project boundary. The results of the studies conducted during relicensing, stakeholder recommendations for PM&Es, and Commission staff's analysis of the effects of the project on environmental

⁵⁹ Issued April 27, 2018.

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and cultural resources will inform the need to make modifications to the project boundary, including enclosing additional federal lands, if needed.

Using this information, the Commission staff will determine the adequacy of GRDA's proposed project boundary upon review of the draft license application and again after a final application is filed for the project. Further, should the Commission require modifications to GRDA's proposed project boundary as a license condition, GRDA would be required to file revised maps after a license is issued for the project. Because these requirements exist as part of the licensing process and the studies approved in this determination will provide the necessary information for our reviews, we do not recommend that GRDA conduct a separate study of the need to modify the project boundary or to document the presence of federal lands (section 5.9(b)(4)).

Contaminated Sediment Transport Study

Study Request

The City of Miami requests a contaminated sediment transport study to assess the potential effects of project-induced flooding on the deposition of contaminated sediments, particularly heavy metals that originate from the Tar Creek Superfund Site, in and around Grand Lake. The City of Miami is concerned that GRDA's proposed sedimentation study would not be sufficient to evaluate contaminated sediment transport, and that a separate study would be needed to specifically assess the potential impact of project-induced flooding on the deposition of contaminated sediments. The contaminated sediment transport study would focus on fine-grained sediment that carries contaminants, while the sedimentation study would focus on larger particle sizes.

The City of Miami's requested study methodology involves: (1) developing a comprehensive model to establish a baseline for toxic sediment transport and estimating the change resulting from proposed project operating scenarios; (2) collecting grab samples of sediment for toxicity testing in the vicinity of Tar Creek, Neosho River, and Miami; and (3) measuring channel geometry and local conditions in at least eight locations to analyze total suspended solids or suspended sediment concentrations. The model also would forecast future impacts over the duration of the license.

In a separate study request,⁶⁰ the Miami Tribe of Oklahoma requests that GRDA evaluate effects of sediment contamination caused by flooding on plant and wildlife species. The tribe cites several studies showing evidence that local plants and wildlife

⁶⁰ The Miami Tribe of Oklahoma's study request is entitled *Flora and Fauna Study*, and was filed March 13, 2018. Components of the flora and fauna study were incorporated by GRDA into the terrestrial species of concern study. Other aspects of the study, relating to contamination, are discussed here.

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within the Grand Lake watershed show signs of elevated levels of lead, cadmium, and zinc. The cited studies indicate that plants and wildlife harvested as part of tribal members' traditional diets exceed recommended consumption levels for these heavy metals. The Miami Tribe of Oklahoma states that the additional study is needed to identify the geographic scope of these effects.

The FWS, BIA, Oklahoma DWC, Eastern Shawnee Tribe of Oklahoma, Ottawa Tribe of Oklahoma, Peoria Tribe, Seneca-Cayuga Nation, Wyandotte Nation, and Local Environmental Action Demanded Agency (LEAD Agency) support the need for a contaminated sediment study. LEAD Agency also recommend core sampling and extending the toxicity study to the entire Grand Lake.

GRDA states that it is not responsible for the heavy metals present in Tar Creek, and that its proposed sedimentation study is sufficient to characterize sediment and sediment transport within Grand Lake and its tributaries. GRDA explains that existing contaminated sediment studies, including those by the U.S. Environmental Protection Agency, have documented that the metals present in, and upstream of, Grand Lake are a result of contamination from the Tar Creek Superfund Site. GRDA states that heavy metal contamination of sediment in Grand Lake is a cumulative effect of seasonal flooding upstream, and is not directly related to project operations.

Discussion and Staff Recommendation

Based on existing information, the degree to which the operation of the project affects contaminated sediment deposition is unclear. Above, we recommend H&H and sedimentation studies to evaluate the potential for project operation to affect flooding, peak flows, and sediment transport in the project headwaters. A finding from these modeling studies showing that flooding, influenced by project operation, contributes to sediment deposition in the overbank areas of the Grand Lake tributaries would demonstrate a possible nexus between project operation and effects of contaminated sediment transport (section 5.9(b)(5)). Such a finding could also indicate the possibility that a contaminated sediment transport study could inform a license requirement (section 5.9(b)(5)). However, until that connection is made, it is premature to require such a study.

We recognize the concern of the Miami Tribe of Oklahoma and its supporters and their interest in obtaining further information about the extent that project operations may contribute to the toxicity of plants and wildlife of significance to tribes. If, based on the results of the H&H modeling and sedimentation studies, it becomes evident that overbank flooding is influenced by project operation, additional information may be required to describe the effect of such flooding on soil chemistry and potential effects on plants and wildlife.

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Although we do not recommend a contaminated sediment transport study at this time, we do recommend that the report for the sedimentation study include an evaluation of the study results from both the H&H modeling and sedimentation studies to determine if project operation affects transport of potentially-contaminated sediment. If this nexus to project operations is established, it would be appropriate to reevaluate the need for a contaminated sediment study during review of the ISR.

Document Content(s)

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