

FEDERAL ENERGY REGULATORY COMMISSION  
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OFFICE OF ENERGY PROJECTS

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

VIA FERC Service

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**Reference: Determination on Requests for Study Modifications and New Studies  
for the Pensacola Hydroelectric Project**

Mr. Townsend:

Pursuant to 18 C.F.R. § 5.15 of the Commission's regulations, this letter contains the determination on requests for modifications to the approved study plan and new study requests for the proposed relicensing of the Pensacola Hydroelectric Project. The project is 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 sections 5.9(b) and 5.15(d) and (e) of the Commission's regulations, applicable law, Commission policy and practice, and staff's review of the record of information.

Background

Pursuant to the Commission's Integrated Licensing Process (ILP), the study plan determination for the proposed relicensing of the Pensacola Project was issued on November 8, 2018. On September 9, 2019, the Commission issued an order<sup>1</sup> extending the license term<sup>2</sup> and modifying the ILP process plan. The September 9, 2019 order established the deadline for filing the initial study report (ISR) as September 30, 2021 and the updated study report (USR) as September 30, 2022. Grand River Dam Authority (GRDA) filed the ISR on September 30, 2021, summarizing the status of the 9 studies

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<sup>1</sup> 168 FERC ¶ 62,145 (2019).

<sup>2</sup> The license term was extended from March 31, 2022, to May 31, 2025, with the final license application due May 31, 2023.

being conducted.<sup>3</sup> GRDA held meetings on October 12-14, 2021, to present the ISR results and filed a summary of the meeting on October 29, 2021. On February 24 and May 27, 2022, Commission staff issued determinations on requested study modifications and new studies. The February 24 determination modified the Hydrologic and Hydraulic Modeling Study, Aquatic Species of Concern Study, and Infrastructure Study and the May 27 determination modified the Sedimentation Study.

GRDA filed the USR on September 30, 2022, held USR meetings on October 12 and 13, 2022, and filed a meeting summary on November 29, 2022.

### Comments

Comments on the USR and meeting summary, including requests for study modifications and new studies, were filed by the: Bureau of Indian Affairs; City of Miami, Oklahoma (City); Cherokee Nation; and Local Environmental Action Demanded Agency, Inc. (LEAD) on November 29, 2022. The Quapaw Nation and United States Fish and Wildlife Service (FWS) filed comments on November 30, 2022. GRDA filed reply comments on December 29, 2022.

A number of the comments received do not specifically request additional studies or modifications to the approved studies, and therefore, are not addressed herein. For example, some of the comments provide additional information; recommend protection, mitigation, and enhancement measures; or address ongoing and future consultation. This determination only addresses comments and requests that would require study modifications or additional studies.

### Study Plan Modification Determination

Pursuant to section 5.15(d) of the Commission's regulations, any proposal to modify a required study must be accompanied by a showing of good cause and must include a demonstration that: (1) the approved study was not conducted as provided for in the approved study plan, or (2) the study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way. As specified in section 5.15(e), requests for new information gathering or studies must include a statement explaining: (1) any material change in law or regulations applicable to the information request, (2) why the goals and objectives of the approved study could not be met with the approved study methodology, (3) why the request was not made earlier, (4) significant changes in the project proposal or that significant new information material to the study objectives has become available, and (5) why the new study request satisfies the study criteria in Section 5.9(b).

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<sup>3</sup> On March 30, 2021, GRDA filed the 6 Month Upstream Hydraulic Model Input Status Report. A technical conference was held on April 21, 2021, to discuss the report with stakeholders.

Appendix A summarizes the determination on all requested modifications to the approved study plan and all but one new study request. Specific modifications to the studies and the bases for modifying them are explained in Appendix B. Appendix C provides the determination on one new study request and defers determination on a second new study request (Contaminated Sediment Transport Study) until modifications to the Sedimentation Study are complete. Commission staff considered all study plan criteria in accordance with sections 5.9(b) and 5.15(d)-(f) of the Commission's regulations.<sup>4</sup> However, only the specific study criteria relevant to the determination are referenced in Appendices B and C.

As discussed in Appendix B and Appendix C, this letter provides 30 days from the issuance date of this determination for GRDA to file an updated Sedimentation Study Report, after which a determination will be made on the Contaminated Sediment Transport Study. As discussed in Appendix B, this letter also provides 30 days for GRDA to file results of additional runs of the upstream hydraulic model holding the initial starting elevation steady until the arrival of flood flows.

Please note that 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. If you have any questions, please contact Adam Peer at (202) 502-8449, or via e-mail at [adam.peer@ferc.gov](mailto:adam.peer@ferc.gov).

Sincerely,

for  
Terry L. Turpin  
Director  
Office of Energy Projects

Enclosures: Appendix A Summary of Determinations on Requests to Modify Study Plan  
Appendix B Staff Recommendations on Requested Modifications to Study Plan  
Appendix C Staff Recommendations on Requested New Studies  
Appendix D Literature Cited

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<sup>4</sup> Pursuant to section 5.29(f)(2) of the Commission's regulations, section 5.15(c)(6) is waived to provide the additional time needed to address the requested modifications to the approved study plan.

**APPENDIX A****SUMMARY OF DETERMINATIONS ON REQUESTS TO  
MODIFY STUDY PLAN**

<b>Study</b>	<b>Recommending Entities</b>	<b>Approved with Modifications</b>	<b>Not Approved</b>	<b>Determination Deferred</b>
<b>Requested Study Modifications</b>				
Hydrologic and Hydraulic Modeling ( <i>i.e.</i> , Flooding and Inundation Studies)	City of Miami, LEAD	X		
Sedimentation Study	City of Miami, LEAD, FWS	X		
Aquatic Species of Concern	FWS		X	
<b>New Study Request</b>				
Contaminated Sediment Transport Study	City of Miami, LEAD			X
Tree Roosting Bat Study	FWS		X	

## APPENDIX B

### STAFF RECOMMENDATIONS ON REQUESTED MODIFICATIONS TO STUDY PLAN

#### PROPOSED STUDIES AND MODIFICATIONS

##### Hydrologic and Hydraulic Modeling

###### Background

The February 24, 2022 Determination on Requests for Study Modifications (SMD letter) required the following modifications to the Hydrologic and Hydraulic (H&H) Study: (1) model runs starting at an elevation of 734 feet Pensacola Datum (PD)<sup>1</sup> and extending up to and including an elevation of 757 feet PD; (2) reporting on the frequency, timing, amplitude (i.e. elevation), and duration of inundation for each of the simulated inflow events with starting elevations between 734 feet and 757 feet PD; (3) a comparison of water surface elevations observed at U.S. Geological Survey gage No. 07190500 (Neosho River near Langley, Oklahoma) to the simulated HEC-RAS<sup>2</sup> stage hydrographs for the December 2015 and October 2009 inflow events on the upstream side of the dam; and (4) a graphical comparison of the simulated and observed water surface elevations over a daily time step for the duration of the December 2015 and October 2009 flood events.

The Grand River Dam Authority's (GRDA) Updated Study Report (USR) included the results of the SMD letter requirements and a completed bathymetry study report.

###### Requested Modifications

###### (1) Starting Reservoir Elevations

The City of Miami, Oklahoma (City) requests that GRDA modify the Upstream Hydraulic Model (UHM) to model flooding events by starting the runs such that water surface elevations are maintained at the water surface elevations required in the SMD

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

<sup>2</sup> 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.

letter as flooding arrives, rather than allowing the water surface elevations to fall below the water surface elevations required in the SMD letter before flooding arrives.

The City states that arbitrary starting times for model runs and rapid pre-releases give the model time to draw down the reservoir before the flood arrives. Using the 2009 flood data, the City provided an example in which GRDA allowed the water surface elevation to drop from a starting elevation of 753 feet to 750.2 feet PD before the flood arrived. The City re-ran the UHM maintaining the water surface elevation at 753 feet PD until the flood arrived. The City states that this correction resulted in a 0.43-foot difference in flood depth in Miami, compared to a 0.08-foot difference presented by GRDA.

#### *(2) 100-year Flood Event*

The City requests that GRDA correct the UHM to represent a realistic 100-year event, rather than using an unrealistic 308,000 cfs flow on the Neosho River upstream of Miami, which the City indicates is more like a 1,000-year flood event.

#### *(3) Operational Alternatives*

The City requests that GRDA be required to analyze a wider range of operational alternatives, including at least the range of physically feasible project operations.

#### *(4) Tar Creek Boundary Condition*

The City requests that in the 1-D UHM, GRDA revise the boundary condition on Tar Creek at the confluence with the Neosho River so that the model more realistically reflects backwater effects.<sup>3</sup>

#### *(5) Using H&H Study Results in Other Models*

The City requests that any modifications to the UHM be taken into account in any other studies that rely on output from the UHM (e.g., Aquatic Species of Concern Study, Terrestrial Species of Concern Study, Wetlands and Riparian Habitat Study, Infrastructure Study, and Socioeconomic Study).

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<sup>3</sup> The City presented this issue as a request to modify the Sediment Transport Model. However, because it relates specifically to the UHM component of the H&H Study, it is discussed here.

*(6) Pre-dam Analysis*

The City requests that GRDA use the modeling tools it has developed to inform an assessment of GRDA's liability over the next 30-50 years, by comparing past and future flooding against pre-project flooding. The City requests that GRDA examine the contribution of the project's presence and historical impacts to the ongoing problem of unauthorized, project-caused flooding upstream. The City asserts the Pensacola Project relicensing merits an exception to the Commission's general rule of using current conditions as the baseline for analysis because the City alleges that upstream communities have suffered unauthorized upstream flooding for over 80 years, the project never included sufficient easements, and the project never operated within the easements acquired.<sup>4</sup> The City also states that there are three reasons for requiring information on pre-project conditions. First, the City states that examining pre-project conditions and historical impacts is necessary for the Commission's National Environmental Policy Act (NEPA) analysis and required under the Commission's regulations.<sup>5</sup> Second, the City states that analyzing past conditions will assist the Commission in evaluating "measures to improve from the present baseline and mitigate historic impacts," as recognized by Commission precedent and in the current ILP process.<sup>6</sup> The City adds that if the Commission fails to consider past impacts in this case, it may result in the reversal of the license order.<sup>7</sup> Third, the City states that analyzing past conditions is necessary to ensure that the Commission includes in the project's economic analysis GRDA's liability under state law for ongoing project operations.<sup>8</sup>

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<sup>4</sup> City November 29, 2022 Request for Study Modifications and Request for Additional Study at 3.

<sup>5</sup> The City asserts that this analysis is required by the Commission's regulations, as well as staff's scoping document for the Pensacola Project relicensing (18 C.F.R. § 2.23; 18 C.F.R. § 5.18(b)(2)). City November 29, 2022 Request for Study Modifications and Request for Additional Study at 3.

<sup>6</sup> City November 29, 2022 Request for Study Modifications and Request for Additional Study at 3.

<sup>7</sup> *Id.* at 4.

<sup>8</sup> The City states that "Oklahoma law imposes damages on GRDA for all flooding 'caused by the existence and operation of the Pensacola Dam,'" and therefore, the Commission's economic analysis for the project must include GRDA's state court liability. City November 29, 2022 Request for Study Modifications and Request for

*(7) H&H Study.*

The Local Environmental Action Demanded Agency, Inc. (LEAD) requests that the Commission conduct its own H&H Study to determine the impacts of project operation on upstream flooding to satisfy the Commission's obligations under the Federal Power Act (FPA) and the NEPA. LEAD states that GRDA's H&H Study is inadequate and therefore, the Commission should develop its own model.

*(8) Climate Change Impact Study.*

LEAD requests that the Commission collect currently available information on climate change and conduct a climate change impact study. LEAD states that "by incorporating recently published analysis by the federal government and other scientists, [the Commission] can accurately assess foreseeable upstream flooding impacts in the years to come, as accounting for increases in precipitation and more frequent extreme flooding events, and can consider potential mitigation alternatives."<sup>9</sup>

Comments on the Requested Modifications

GRDA disagrees with the City's requested study modifications. For each requested study modification, GRDA argues that the City's request does not provide a showing of good cause as to why the proposed modifications should be approved, which would include a demonstration that: (1) the approved study was not conducted as provided for in the approved study plan; or (2) the study was conducted under anomalous environmental conditions or that the environmental conditions have changed in a material way (section 5.15(f) of the Commission's regulations).<sup>10</sup>

*(1) Starting Reservoir Elevations*

GRDA states that the Commission should reject the City's request to maintain the starting reservoir elevations until flooding arrives in the UHM and instead allow the

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Additional Study at 4 (citing *Perry v. Grand River Dam Auth.*, 344 P.3d 1, 5, 7 (Ok. Civ. App. 2013) (upholding trial court finding of constitutional taking requiring compensation to owners of land outside Project-related easements)).

<sup>9</sup> LEAD November 29, 2022 Comments in Response to USR Summary at 8.

<sup>10</sup> GRDA continues to assert that the National Defense Authorization Act for Fiscal Year 2020 limits the Commission's jurisdiction to address flood control at the project; and therefore, "the Commission must reject all proposed study plan modifications and requests for new studies that are aimed at determining whether the

elevations to drop in advance of a flooding event to accurately reflect what GRDA believes are the actual conditions that occur as a result of the Corps' decision-making as a flood approaches Pensacola Dam.

*(2) 100-year Flood Event*

GRDA states that the Commission should reject the City's request to correct the UHM to represent a 100-year flood event because the City had ample input into establishment of the 100-year flood event, and the Commission previously determined: (a) that GRDA's approach was consistent with typical hydrological procedures; and (b) that 300,000 cfs was a reasonable estimate of the 100-year flood event.

*(3) Operational Alternatives*

GRDA states that the Commission should reject the City's request to analyze a wider range of operational alternatives because: (1) GRDA has already analyzed a broad range of starting pool elevations; and (2) increasing the number of modeling runs is not required to meet NEPA obligations. GRDA modeled starting elevations of 734.0 feet, 742.0 feet, 742.5 feet, 743.0 feet, 743.5 feet, 744.0 feet, 744.5 feet, 745.0 feet, 749.0 feet, 753.0 feet, and 757.0 feet PD, and they note that this range of elevations meets the requirements of the February 24, 2022 SMD letter.

*(4) Tar Creek Boundary Condition*

GRDA states that the Commission should reject the City's request to revise the UHM boundary condition on Tar Creek because GRDA followed the Corps' best practices when developing the Sediment Transport Model geometry.

*(5) Using H&H Study Results in Other Models*

GRDA states that the Commission should reject the City's request to consider modifications to the UHM in the analyses of other studies because no modifications to the UHM are needed, so there is no effect on the other studies that rely on its output.

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Commission or any other regulatory agency should impose license requirements related to surface elevations at Grand Lake." GRDA December 29, 2022 Response to Comments on USR at 31. As previously explained, any limitations on the scope of measures that may be included in a license that is issued do not eliminate the need for the Commission to obtain the information necessary to fully understand the project's effects; and thus, GRDA is required to complete the studies required by the approved study plan, and the proposed modifications discussed in detail below, to inform the Commission's licensing decision, in accordance with Part I of the Federal Power Act. 16 U.S.C. §§ 791(a) – 825(r).

#### (6) Pre-dam Analysis

GRDA states that the City's request does not meet the requirements as to why the proposed modifications should be approved under section 5.15(f) of the Commission's regulations.<sup>11</sup>

GRDA states that the City is incorrect in asserting that analysis of pre-project conditions is required by NEPA and other governing statutes.<sup>12</sup> GRDA adds that the City fails to cite to an example where the Commission or a reviewing court has required the Commission to conduct an investigation of pre-project conditions. Regarding the need to analyze pre-project conditions for the cumulative effects analysis of the NEPA document, GRDA states that the "Commission relies on existing information, and not on new environmental studies, to address cumulative impacts not associated with Project activities."<sup>13</sup>

With respect to the City's statement that analyzing past conditions will assist the Commission in evaluating measures to improve conditions from the present baseline and mitigate historic impacts, GRDA asserts that the Commission has no authority to address this issue because the Pensacola Act prohibits the Commission from requiring any conditions to control water surface elevation at Grand Lake<sup>14</sup> and the Commission lacks authority under the Federal Power Act (FPA) to assess damages.<sup>15</sup> GRDA adds that even if the Commission had the authority to address flooding impacts in the vicinity of the City, the Commission has held that the FPA does not require that "all past damage...caused by a project must be 'mitigated' in a relicense proceeding."<sup>16</sup>

With respect to the City's statement that analyzing past conditions is necessary to ensure that the Commission includes in the project's economic analysis GRDA's liability under state law for ongoing project operations, GRDA states that the Commission is precluded from awarding damages, as the "D.C. Circuit has held that section 10(c) of the

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<sup>11</sup> GRDA December 29, 2022 Response to Comments on USR at 36.

<sup>12</sup> *Id.* at 37.

<sup>13</sup> *Id.* at 38.

<sup>14</sup> *Id.* at 39.

<sup>15</sup> *Id.*

<sup>16</sup> GRDA December 29, 2022 Response to Comments on USR at 39.

FPA ‘preserve[s] existing state laws governing the damage liability of licensees’ and that ‘it follows that the Commission may not encroach upon this state domain by engrafting its own rules of liability.’”<sup>17</sup>

*(7) H&H Study.*

No entities filed comments in response to the LEAD’s study request.

*(8) Climate Change Impact Study.*

GRDA states that “Commission precedent uniformly maintains that climate change studies are not warranted or appropriate in hydropower licensing proceedings.”<sup>18</sup> GRDA adds that the Commission has explained that climate change models would not allow it “to predict matters such as water supply or flow within a given basin during the 30 to 50-year term of a typical hydropower license in such a manner to assist the Commission in analyzing alternatives and determining appropriate mitigation for environmental impacts.”<sup>19</sup> Further, GRDA states that the Commission has also “found that conventional hydrological studies, monitoring techniques, and predictive models can be used to effectively study and evaluate the effects of projects on environmental resources.”<sup>20</sup>

*Discussion and Staff Recommendation*

*(1) Starting Reservoir Elevations*

The dip in water surface elevation that occurs in GRDA’s model runs is consistent with the Corps’ standard operation procedure for flood control as specified in the Corps’ Water Control Manual for Pensacola Dam and Reservoir (Corps’ manual).<sup>21</sup> The Corps’ manual states that, for lake elevations between 745 and 755 feet PD, releases downstream of the dam would be made in a manner to balance flood storage in Pensacola, Markham

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<sup>17</sup> *Id.* at 40.

<sup>18</sup> *Id.* at 111.

<sup>19</sup> *Id.* (citing *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 39 (2015); *Ala. Power Co.*, 155 FERC ¶ 61,080, at P 29 (2016)).

<sup>20</sup> *Id.* at 112.

<sup>21</sup> *Grand River Dam Authority*, 77 FERC ¶ 61,251 (1996); 1992 Letter of Understanding and Water Control Agreement between the Corps and GRDA.

Ferry, and Fort Gibson reservoirs.<sup>22</sup> For starting lake elevations between 745 and 750 feet PD, or if the pool is forecasted to exceed 745 feet PD, the Corps may direct similar flood control releases.

As GRDA states, the procedure used for starting times was based on the Corps' recommendation, per the HEC-RAS User's Manual, to start unsteady flow simulations prior to flood wave arrival at the upper boundary of the model. GRDA's model is consistent with this approach.

However, staff notes that the Corps' manual does not require specified releases from Pensacola Project when the elevation reaches or is approaching 745 feet but does require a balancing of releases in the basin which may or may not result in elevation dips prior to the peak flood event. Looking at 10 recent years of reservoir elevation data, nearly every year exhibited one or two inflow events that resulted in the reservoir exceeding 745 feet. In many of the cases that the reservoir exceeded 745 feet, slight drops in the reservoir elevation were observed just before the rise above 745 feet. However, in just as many cases there was no drop in reservoir elevation observed. Given the variation in recent pre-flood drawdowns, and to model such variations more accurately, a standard engineering practice is to run the model at the "extreme" boundaries for each operational alternative. The model run results for the condition assuming the pre-flood drawdowns were provided in the USR. These results represent one extreme. Based on our observations that dips in elevation do not occur each time the reservoir exceeded 745 feet, we recommend that GRDA, to capture the other extreme, conduct additional model runs for each operation alternative assuming that the initial starting elevation remains steady until the arrival of flood flows as recommended by the City, and report the effect on upstream flooding. We recommend that GRDA run the model using the same starting elevations and inflow events required in the February 24, 2022 SMD letter, which included: (a) starting elevations of 734 feet PD and extending up to and including an elevation of 757 feet PD; and (b) the September 1993, June 2004, July 2007, October 2009, December 2015, and 100-year inflow events. GRDA should file the requested model run information within 30 days from the issuance date of this determination.

## *(2) 100-year Flood Event*

The February 24, 2022 SMD letter concluded that the approach in the study plan is consistent with typical hydrological procedures where inflow estimations are made using a modeled volume-versus-peak flow relationship, and that 300,000 cfs is a reasonable estimate for the 100-year flood event. The information in the record describing the calculation, results, and application of the 100-year flood estimate will support our

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<sup>22</sup> Pensacola, Markham Ferry, and Fort Gibson reservoirs are regulated as a subsystem of the Arkansas River Basin System.

hydrologic and hydraulic analysis. Therefore, we do not recommend that GRDA repeat its 100-year flood analysis or change its methodology.

### *(3) Operational Alternatives*

The SMD required that GRDA: (1) run scenarios starting at an elevation of 734 feet PD and extending up to and including an elevation of 757 feet PD; (2) report the frequency, timing, amplitude (i.e., elevation), and duration of inundation for each of the simulated inflow events with starting elevations between 734 feet and 757 feet PD; (3) compare water surface elevations observed at U.S. Geological Survey (USGS) gage no. 07190500 (Neosho River near Langley, Oklahoma gage) to the simulated HEC-RAS stage hydrographs for the December 2015 and October 2009 inflow events on the upstream side of the dam; (4) provide a graphical comparison of the simulated and observed water surface elevations over a daily time step for the duration of the flood event; and (5) run the Operations Model to simulate all flow events with starting reservoir surface elevations of 734 feet to 757 feet PD. GRDA provided all of this information in the USR, Appendix 2, Hydrologic and Hydraulic Modeling: Upstream Hydraulic Model, filed on September 30, 2022. Therefore, GRDA has met the requirements of the approved study plan with respect to the modeling of a range of scenarios and reporting the results. The information provided is sufficient for an analysis of a realistic range of operational alternatives. Therefore, we do not recommend that GRDA be required to analyze a wider range of operational alternatives.

### *(4) Tar Creek Boundary Condition*

Based on staff's review of the City's November 29, 2022 comments on the USR, and staff's additional consideration of Tar Creek boundary conditions, there may be issues with the 1-D UHM in need of resolution.<sup>23</sup> GRDA developed the 1-D UHM to be compatible with the sedimentation and erosion functions in HEC-RAS as needed to produce the Sediment Transport Model (STM). The City's issue with the 1-D UHM is most visually apparent in the City's figure K (inserted as figure 1 below)<sup>24</sup> which shows a

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<sup>23</sup> City November 29, 2022, Request for Study Modifications and Request for Additional Study at Attachment 2 (including a memo on Tetra Tech's review of GRDA's Sedimentation Study Report).

<sup>24</sup> Figure K of the City's November 29, 2022 comments on the USR includes several lines representing modeled maximum water surface elevations (on the left axis) along Tar Creek during the September 1993 flood. The gray line (from the 1-D UHM) shows maximum water surface elevations without backwater effects from the Neosho River (i.e., normal depth at a slope of 0.0033 ft/ft). The green and blue lines (from the 2-D UHM) show maximum water surface elevations including backwater effects from the

model run resulting in a sudden, physically improbable, steep rise in the simulated water surface elevation of 10.5 feet at mile 1.6 of Tar Creek.

In addition, we have identified other questions related to the 1-D UHM. According to Chapter 7 of the HEC-RAS User's Manual, there are several types of boundary conditions that can be applied at the downstream end of a reach. Using either a downstream rating curve or normal depth boundary condition is most applicable in this case. The HEC-RAS manual explains that when applying the downstream rating curve boundary condition, the model is susceptible to error when the slope of the water surface is low, as is the case at lower Tar Creek. GRDA chose the normal depth as the boundary condition for lower Tar Creek.

The HEC-RAS manual states that when using the normal depth as the boundary condition, a friction slope (slope of the energy grade line) must be entered. The slope of the water surface is often a good estimate of the friction slope but is difficult to obtain ahead of time. Consequently, the average bed slope in the vicinity of the boundary condition location is often used as an estimate for the friction slope.<sup>25</sup> According to GRDA, the downstream boundary condition used for Tar Creek at the Neosho River confluence is based on normal depth with a friction slope assumed equal to the streambed slope, at 0.0033 foot per foot (ft/ft). According to the Digital Elevation Model (DEM) provided by GRDA, the ground slope along the downstream 1.6 miles of Tar Creek is approximately 0.0025 ft/ft, which is reasonably close to the 0.0033 ft/ft slope used by GRDA.

Based on the HEC-RAS 2-D UHM, however, the slope of the water surface (approximately equal to the friction slope) appears to be lower by one to three orders of magnitude than the ground slope estimates. For the September 1993 simulation (water surface elevation 745 feet PD at the dam), the slope of the Tar Creek water surface from

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Neosho River, based on starting water surface elevations at Pensacola Dam of 734 feet and 745 feet PD, respectively. The red line represents the difference in water surface elevations (on the right axis) along Tar Creek between the "with backwater" and "normal depth" model runs.

<sup>25</sup> Corps, *HEC-RAS User's Manual* 244 (Version 6.3, January 2023). Due to the Neosho River's wide floodplain, the HEC-RAS cross sections for Tar Creek begin 1.6 miles upstream of the Neosho River centerline to avoid overlapping the Neosho River cross sections. GRDA states that the only viable options to model the confluence in HEC-RAS were as a junction, or as a lateral structure. After performing preliminary tests of the confluence modeled as a junction with the Energy Balance Method, GRDA determined that the unsteady-flow computations at the confluence were unstable. Consequently, GRDA used a lateral structure to model the confluence.

the Neosho River confluence to Oklahoma Route 10 varies from 0.00011 ft/ft near the beginning of the simulation, to 0.000001 ft/ft at the maximum water surface elevation, to 0.000004 ft/ft near the end of the simulation.<sup>26</sup> For the 100-year, 2-D UHM simulation (water surface elevation 740 feet PD at the dam), the slope of the Tar Creek water surface from the Neosho River confluence to Route 10 varies from 0.000051 ft/ft near the beginning of the simulation, to 0.000067 ft/ft at the maximum water surface elevation, to 0.000013 ft/ft near the end of the simulation.

If the backwater from the Neosho River increases water surface elevation and inundation areas compared to a similar Tar Creek discharge without backwater, as indicated in the City's figures below, velocities between river miles 1.6 and 2.4 of Tar Creek could be significantly less than those predicted by the 1-D UHM. Moreover, the improbable 10.5-foot increase in surface elevation displayed by the City and related issues with the model could affect predictions for transport (or deposition) of sediment at the downstream end of Tar Creek between river miles 1.6 and 2.4.

To ensure that the water velocity, inundation area, and surface elevations estimated by GRDA's 1-D UHM are reasonably accurate, we recommend that GRDA revise the downstream boundary condition for Tar Creek at the Neosho River confluence to reflect a flatter friction slope (if normal depth is used) or use a different downstream boundary condition, as appropriate. In the process, we recommend that GRDA correct the apparent and anomalous 10.5 foot difference in water surface elevations beginning at river mile 1.6 as indicated in the City's figure L (figure 1 below). We also recommend that GRDA then re-run the Sediment Transport Model and revise the portions of the sedimentation study where the results differ significantly from those reported in September 2022. GRDA should file an updated Sedimentation Study Report with the results of the above recommended revisions and re-runs within 30 days from the issuance date of this determination. Finally, GRDA should file updated model inputs and outputs for the 1-D UHM, STM, and any other updated model.

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<sup>26</sup> Based on the HEC-RAS 2-D UHM for the September 1993 event with a starting WSE of 745 feet PD, maximum WSEs near the Tar Creek/Neosho River confluence vary from 767.4 feet PD near the Interstate-44/Neosho River bridge to 768.2 feet PD near the railroad bridge over the Neosho River 0.8 miles above Interstate-44, to 767.7 feet PD near the Oklahoma Route 10 bridge over Tar Creek. For Tar Creek, maximum water surface elevations vary from 767.67 feet PD near the Neosho River confluence to 767.68 feet PD near the Oklahoma Route 10 bridge.

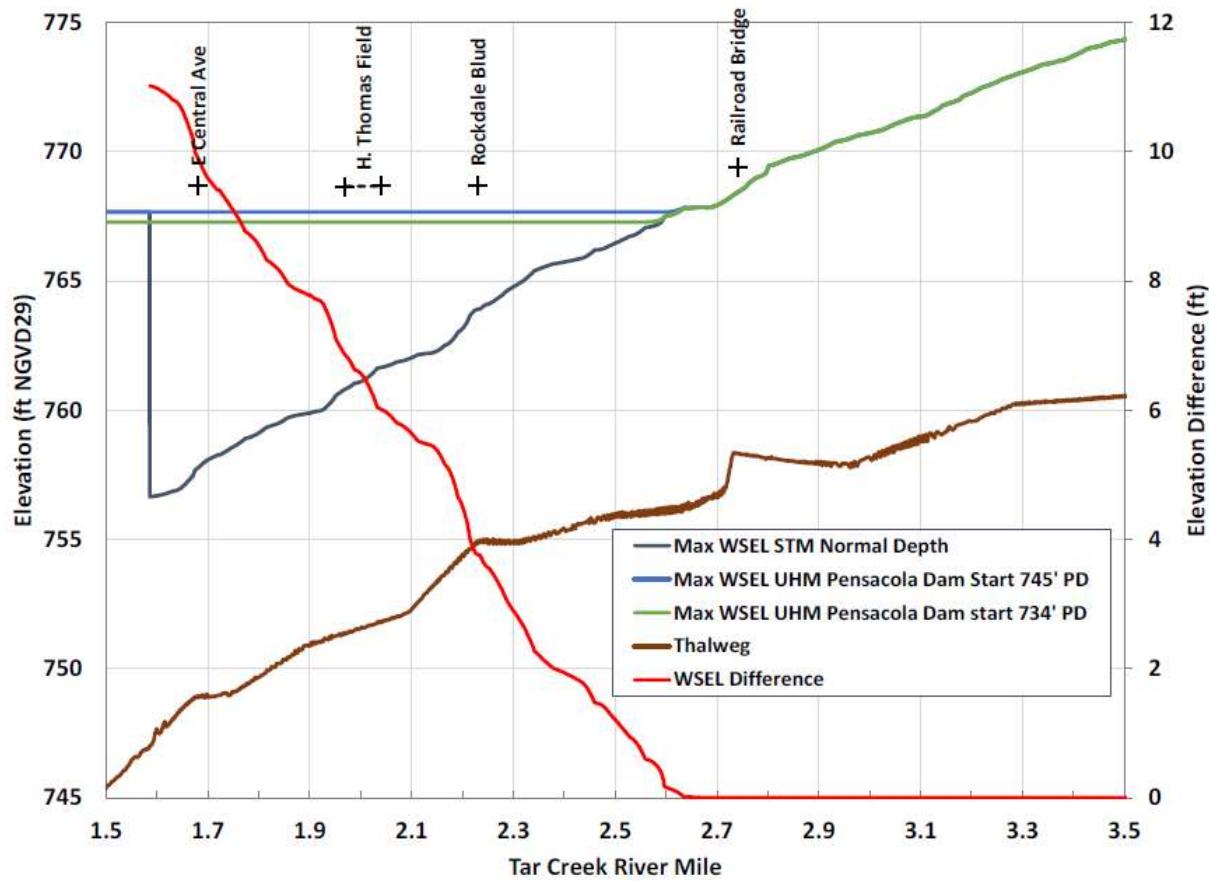


Figure 1. Figure K from Attachment 2 of the City's November 29, 2022 comments on the USR. The caption from figure K states, "Maximum water-surface elevation profiles for the September 1993 flood from the UHM assuming starting Pensacola Dam elevations of 745-feet PD and 734-feet PD and assuming normal depth at Tar Creek, river mile 1.6. The bed profile from the 2019 surface and the difference between the 745-feet PD and normal depth water-surface elevations are also shown."

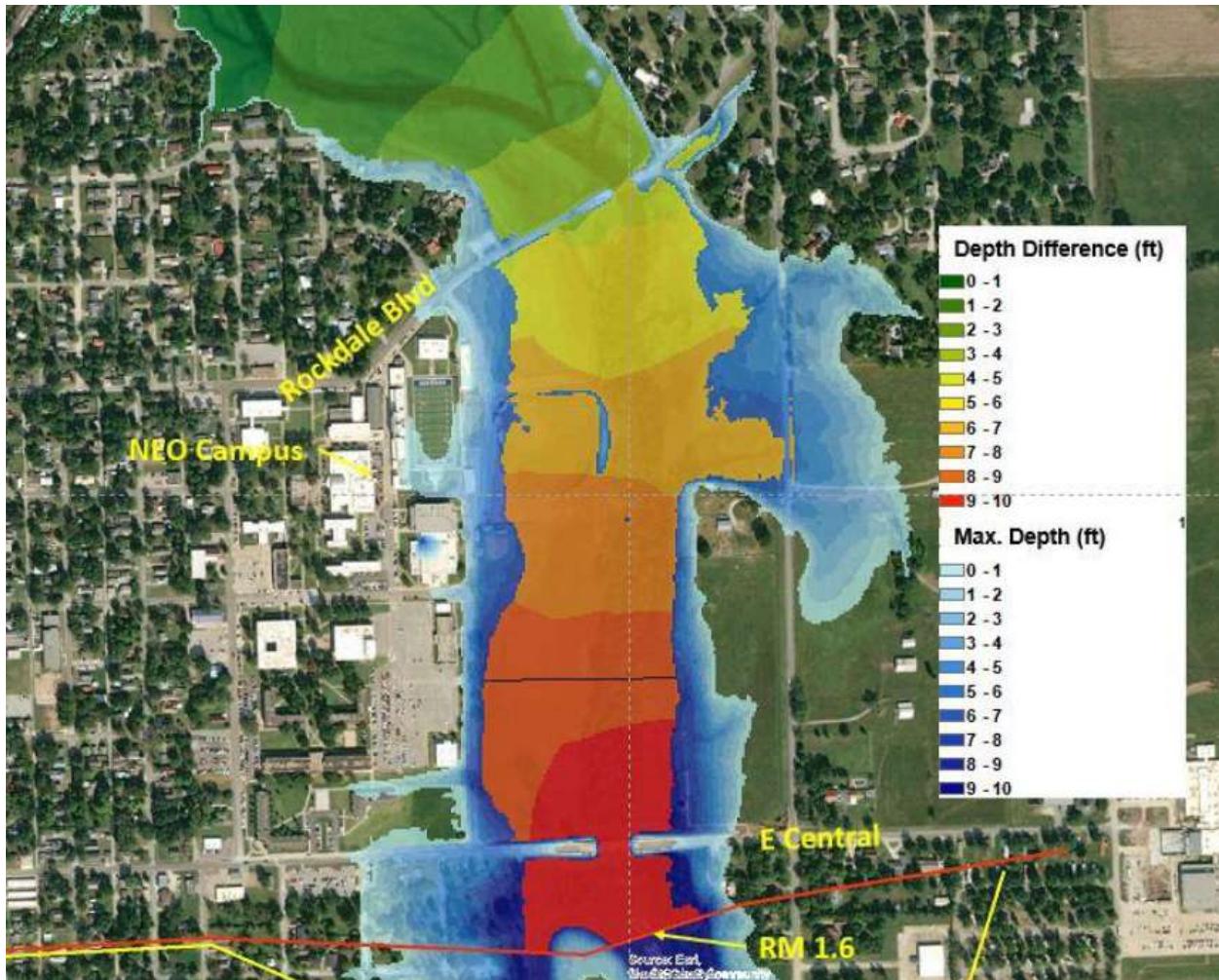


Figure 2. Figure L from Attachment 2 of the City's November 29, 2022 comments on the USR. The caption from figure L states, "Maximum flood depth map in Tar Creek between approximately river mile 1.6 and river mile 2.4 during September 1993 flood from GRDA UHM with Pensacola Dam starting at 745-feet PD (blue shading) and the difference in depth with normal depth boundary condition (green to red shading). Note difference in lateral inundation extents between the blue (UHM with Neosho River control) and green-to-red areas (boundary with normal depth assumption)."

#### (5) Use of H&H Study Results in Other Studies

The City requests that modifications to the UHM be reflected in any other studies that rely on the output from the UHM. The UHM is composed of 1-D and 2-D models. As discussed above, we are recommending modifications to the 1-D UHM, but do not recommend any other modifications to the UHM, including the 2-D UHM. Given the highly complex nature of sedimentation studies, changes to the 1-D UHM near the Tar Creek/Neosho River confluence may affect the results of the Sedimentation Study even if the Sediment Transport Model itself is not modified. Therefore, as discussed above, we

recommend that GRDA revise the Sedimentation Study by re-running the Sediment Transport Model and updating results as warranted to account for any changes that may occur as a result of our recommended modification to the 1-D UHM. We are unaware of other studies that rely on the 1-D UHM, but for any other studies affected by modifications to the 1-D UHM, we recommend that those studies also be revised within 30 days from the issuance date of this determination.

#### *(6) Pre-dam Analysis*

Consistent with standard Commission practice, and as indicated in our February 24, 2022 SMD letter, we do not require applicants to study pre-project conditions, or reconstruct pre-project conditions because that is not the baseline from which the Commission conducts its environmental analysis.<sup>27</sup> The environmental baseline on relicensing is the environment as it exists at the time of relicensing, not pre-project conditions.

The City asserts that examining pre-project conditions and historical impacts is necessary for the Commission's NEPA analysis and required under the Commission's regulations. The City also asserts that analyzing past conditions will assist the Commission in evaluating measures to improve from the present baseline and mitigate historic impacts. However, GRDA has completed the relevant modeling studies (i.e., H&H Study and the Sedimentation Study) in accordance with the Commission's approved study plan, which includes modeling the effects of historical floods. In addition, GRDA has provided historic flood frequency data, which will allow Commission staff to assess historical flood frequency. This information is adequate for conducting our analysis and for evaluating any proposed or recommended measures that may be needed to mitigate project effects.

Further, the City asserts that analyzing past conditions is necessary to ensure that the Commission includes in the project's economic analysis GRDA's liability under state law for ongoing project operations. However, the Commission's analysis of the economics of hydropower projects is limited to the costs associated with licensing the project under the Federal Power Act, which include the costs of generating power. The economic analysis includes an evaluation of current costs compared to the costs of the likely alternative source of power with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of the

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<sup>27</sup> See *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D. C. Cir. 2000); *American Rivers v. FERC*, 187 F.3d 1007, amended and rehearing denied, 201 F.3d 1186 (9th Cir., 1999).

Commission's economic analysis is to provide a general estimate of the potential power benefits and the costs of a project, and of reasonable alternatives to project power.

For the reasons above, we do not recommend that GRDA be required to evaluate pre-project flooding or pre-project conditions.

*(7) H&H Study*

The intent of the ILP and the long-standing practice of the Commission is for applicants to conduct any studies necessary for staff to assess the environmental effects of the project and determine protection, mitigation, and enhancement measures needed (section 5.15(a)).<sup>28</sup> Our role is to independently evaluate whether the studies were conducted using appropriate methods and determine whether the studies provide the information needed to support the license application. We have no basis for deviating from this practice. Therefore, Commission staff will not be conducting an H&H Study as requested by LEAD.

*(8) Climate Change Impact Study*

In the NEPA document for the Pensacola Project, Commission staff will consider the effects of the proposed action on climate change and the effects of climate change on the proposed action and its environmental impacts. Existing information and data sources are sufficient for this analysis. For example, GRDA has provided historic flood frequency data, which Commission staff can use to assess current trends in flood return frequencies to inform an evaluation of predicted climate change effects. Therefore, there is no need for a specific climate change impact study.

## Sedimentation Study

### Background

With the USR, GRDA filed an updated Sedimentation Study Report, which included the results of the following the SMD requirements to: (1) extend the proposed downstream modeling limit for HEC-RAS to the U.S. Route 59 crossing at river mile (RM) 100; (2) analyze the effects of sediment on storage capacity in Grand Lake using

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<sup>28</sup> See Work Group on the Coordination of Federal Mandates: Federal Energy Regulatory Commission, U.S. Department of Interior, U.S. Department of Commerce, U.S. Department of Agriculture, Environmental Protection Agency, Advisory Council on Historic Preservation, *Interagency Task Force Report on Improving the Studies Process in FERC Licensing* (2000), <https://www.ferc.gov/sites/default/files/2020-04/ImprovingtheStudiesProcessinFERCHydroelectricLicensing.pdf>.

hydraulic outputs from the UHM and the Corps' sediment trapping efficiency calculations downstream of RM 100; (3) run the sediment transport model as proposed in the second proposed plan modification, but using, at a minimum, starting reservoir elevations of 740 feet, 745 feet, and 750 feet PD; and (4) run the UHM using, at a minimum, starting reservoir elevations of 740 feet, 745 feet, and 750 feet PD.

*Requested Modifications*

*(1) Sediment Load Rating Curve*

A 2019 bathymetric survey of Grand Lake conducted by USGS shows that a sediment "hump" occurs in the reservoir, beginning near the Spring River confluence (approximately RM 122, near the Burlington Northern railroad bridge) and extending about 22 river miles downstream (approximately RM 100). The City requests that GRDA model the potential impact of the potential for increased building of the sediment "hump" near the head of the reservoir, using an alternative incoming sediment load rating curve. In support of this request, the City asserts that samples collected in 1996 indicate there is a significant volume of bedload sediment transport in the Neosho River. The City concludes that coarse sand and gravel material would be more likely to deposit on the sediment "hump," or farther upstream, which would continue increasing the backwater effect and result in upstream flooding as time goes on.

*(2) Method of Sediment Distribution*

The City requests that GRDA correct the method of sediment distribution in the Sediment Transport Model (STM) to reduce "unrealistic" deposition of sand in overbanks in the upstream reaches of the model. In support of this request, the City asserts that comparison of circa-1940 channel geometry data to current channel geometry data indicates that significant sedimentation has occurred near the head of Grand Lake since construction of Pensacola Dam.

*(3) Sensitivity of Model to Multi-year Climatic and Runoff Cycles*

The City requests that GRDA evaluate the sensitivity of the model to multi-year climatic and runoff cycles using a Monte Carlo-type simulation(s). The City asserts that GRDA's randomized sequence of annual hydrographs could obscure sedimentation effects resulting from multi-year variability in the local climate and that a Monte Carlo-

type simulation would be a better means of evaluating the sensitivity of the model results to this variability.

*(4) Reservoir Elevations*

The City requests that GRDA run the STM to represent a wider range of reservoir elevations as directed by the Commission's May 27, 2022 SMD letter, not just current conditions and GRDA's anticipated operations. The City asserts that GRDA's study ignored the SMD's requirement to run both the STM and the 1-D UHM to reflect a 10-foot range of project operations (740, 745, 750 feet PD). The City states that the full range is needed to reflect the historic range of operations under the current license. In support of this request, the City states that model runs comparing 2019 and circa-1940 channel geometry data demonstrate significantly higher water levels under current conditions than under pre-dam conditions.

*(5) Tar Creek Overbank Deposition*

The City requests that GRDA analyze any resultant changes in Tar Creek overbank deposition of fine sediment and/or the extent of flooding that would contribute to it after revising the UHM including the boundary condition on Tar Creek at the confluence with the Neosho River so that it reflects backwater effects.

*(6) Upstream Flooding Impacts*

The City requests that GRDA analyze the potentially increased upstream flooding impacts of ongoing sedimentation dynamics in the tributaries above the sedimentation "hump," such as channel and overbank deposition and natural levee building. The City asserts that sediment distribution and transport are, along with the physical presence of the dam, one of the primary long-term contributors to its allegation of "unauthorized" upstream flooding. The City asserts that their own investigations indicate that sedimentation and other reservoir-related changes since the dam's construction can add at least 1.8 feet of flooding in the reach upstream of the sediment "hump," and 2.8 feet in the vicinity of the City of Miami.

*(7) Contribution of Historical Project-Caused Sedimentation*

The City requests that GRDA analyze the contribution of historical project-caused sedimentation to current and future upstream flooding.

*(8) Use of Sediment Model At or Above 755 feet PD*

LEAD requests that GRDA run the STM at higher water levels (at or above 755 feet PD) to determine the effect of project operation on redistributing toxic sediments.

*(9) Measure Sediment Deposition*

The U.S. Fish and Wildlife Service (FWS) requests that GRDA be required to measure sediment deposition to verify the model projections and test for metals to determine if they are safe and appropriate for wildlife management.

*(10) Use of Sedimentation Study Results in Other Studies*

The City requests that any modifications to the Sedimentation Study be taken into account in any other studies that rely on output from the Sedimentation Study (e.g., Aquatic Species of Concern Study, Terrestrial Species of Concern Study, Wetlands and Riparian Habitat Study, Infrastructure Study, and Socioeconomic Study).

Comments on Requested Modification

GRDA disagrees with the requested modifications to the Sedimentation Study. For each requested study modification, GRDA asserts that the requests do not provide a showing of good cause as to why the proposed modifications should be approved, which would include a demonstration that: (1) the approved study was not conducted as provided for in the approved study plan; or (2) the study was conducted under anomalous environmental conditions or that the environmental conditions have changed in a material way (section 5.15(f) of the Commission's regulations).

*(1) Sediment Load Rating Curve*

GRDA states that the Commission should reject the City's request to develop an alternative incoming sediment load rating curve because: (1) the rating curve accurately represents the results of field sampling and GRDA committed no error in determining that there is no appreciable movement of bedload sediment in the system; (2) additional fieldwork conducted by GRDA following the USR confirms its conclusions that there is no appreciable movement of bedload sediment in the system; (3) the 1996 sampling cited by the City was fundamentally flawed because the grab samples came from beneath the armor layer and were taken from a gravel bar rather than the actual streambed, suggesting finer material than what is representative of the system, and therefore, the results must be disregarded; and (4) GRDA's sensitivity analysis, consisting of new simulations that included additional coarse material loading to the upstream ends of each tributary, confirms that there is no appreciable movement of bedload sediment.

*(2) Method of Sediment Distribution*

GRDA states that the Commission should reject the City's request to require modification of the STM to reduce the deposition of sand overbank in the upstream

reaches of the model because: (1) GRDA utilized standard, accepted practices in building the STM; and (2) the circa-1940 data relied upon by the City is unreliable. GRDA points out that they themselves used the circa-1940 channel geometry data as a basis for model development because it was the best available data for conditions at the time of dam construction. However, GRDA also notes that the dataset has considerable uncertainty associated with it because it was based on low-resolution scans of topographic maps with large (5-foot) contour intervals from measurements collected with equipment that would be considered rudimentary by modern standards.

*(3) Sensitivity of Model to Multi-year Climatic and Runoff Cycles*

GRDA states that the Commission should reject the City's request to require GRDA to use a Monte Carlo-type simulation because: (1) GRDA followed the Commission's approved study plan; (2) the Monte Carlo-type simulation advocated by the City is unlikely to change the analysis given that GRDA also ran the simulations using historical, randomized hydrographs and the resulting differences in water level within the City boundaries were very small; and (3) the Monte Carlo-type simulation advocated by the City would be prohibitively expensive and time-consuming.

*(4) Reservoir Elevations*

GRDA states that the Commission should reject the City's request to run the full STM (not only the subsequent single-flood events in the UHM) to represent a wider range of reservoir elevations because: (1) GRDA followed the Commission's guidance in its May 27, 2022, SMD letter; (2) the circa-1940 data relied upon by the City is unreliable because it was based on low-resolution scans of topographic maps with large contour intervals from measurements collected with relatively rudimentary equipment; (3) the City's other challenges to GRDA's modeling results are without merit because GRDA has no plans to operate the project at an elevation of 750 feet PD and because GRDA's conclusions regarding the relative magnitudes and locations of water level increases are correct; and (4) increasing the number of modeling runs is not required to meet NEPA obligations, because the approved study plan already includes a range of reasonable alternatives sufficient to inform an adequate NEPA analysis.

*(5) Tar Creek Overbank Deposition*

GRDA states that the Commission should reject the City's request to analyze any resultant changes in Tar Creek overbank deposition and flooding after revising the UHM

because GRDA followed the Corps' best practices when developing STM geometry, combined with preliminary testing and sound engineering judgment.

*(6) Upstream Flooding Impacts*

GRDA states that the Commission should reject the City's request to analyze the potentially increased upstream flooding impacts of ongoing sedimentation dynamics and the contribution of historical project-caused sedimentation on current flooding because: (1) GRDA followed the Commission's approved study plan, including the May 27, 2022 SMD letter; (2) the circa-1940 data relied upon by the City is unreliable (as noted above); and (3) the City's analyses supporting its study modification are unreliable and speculative. GRDA also states that the City's analysis relies on steady state modeling, which maximizes potential differences in water surface elevations, and that unsteady flow modeling is more appropriate due to the complexity of the Grand-Neosho area.

*(7) Contribution of Historical Project-Caused Sedimentation*

GRDA's response above addressing item number 6, Upstream Flooding Impacts, also applies to this item number 7, Contribution of Historical Project-Caused Sedimentation.

*(8) Use of Sediment Model At or Above 755 feet PD*

GRDA states that the Commission should reject LEAD's request to run the STM at or above 755 feet PD because: (1) extremely high reservoir elevation levels are well beyond the Commission's jurisdiction; and (2) the Commission is not required under NEPA to conduct an analysis of unreasonable alternatives. GRDA notes that it intends to operate the project at reservoir elevations between 742 feet and 745 feet PD, and elevations at or above 745 feet PD are under the Corps' jurisdictional responsibilities for flood control.

*(9) Measure Sediment Deposition*

GRDA states that the Commission should reject FWS's request to measure sediment deposition to verify model projections and to test for metals to determine if they are safe and appropriate for wildlife management because: (1) GRDA is not responsible for the Tar Creek Superfund Site; (2) FWS's request is already addressed by model results; and (3) additional fieldwork would not produce useful information on future deposition rates. With respect to Tar Creek, GRDA asserts that: (1) the source of contaminants of soils in the project area has been documented as the Tar Creek Superfund Site and other Superfund Sites; (2) the Environmental Protection Agency (EPA) has already identified potentially responsible parties (PRP) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

and is actively managing the cleanup project; and (3) GRDA is not a PRP. With respect to measurement of sediment deposition, GRDA asserts that the STM allows and predicts sedimentation not only within the channel, but in overbank areas as well. GRDA also notes that the simulated hydrologic record includes large events that resulted in overbank flow and overbank sediment deposition. Therefore, GRDA concludes that the concern that the model might be underestimating deposition in overbank areas is directly addressed by the model results. Regarding additional fieldwork, GRDA asserts that: (1) the surveys used in model development were based on both in-channel and overbank datasets where information was available; and (2) the modern geometry was based on a number of data sources and calibration/validation was achieved based on comparisons to measurements made circa-1940. Consequently, GRDA concludes that field measurements of sediment deposition in overbank areas would allow evaluation of current ground elevations but would not likely produce meaningful information about deposition thicknesses or rates.

#### *(10) Use of Sedimentation Study Results in Other Studies*

As discussed above, GRDA disagrees with the City's rationale for requesting revisions to the sedimentation model, and therefore, states that associated revisions to Aquatic Species of Concern Study, Terrestrial Species of Concern Study, Wetlands and Riparian Habitat Study, Infrastructure Study, and Socioeconomic Study aquatic are not needed. Furthermore, GRDA states that the Aquatic Species of Concern Study, Terrestrial Species of Concern Study, Wetlands and Riparian Habitat Study, Infrastructure Study, and Socioeconomic Study did not use simulation outputs from the Sedimentation Study and therefore modification to the Sedimentation Study would not necessitate modification to these studies.

#### Discussion and Staff Recommendation

##### *(1) Sediment Load Rating Curve*

The May 27, 2022 SMD determined that GRDA followed USGS guidelines when making bedload sediment transport measurements, as required in the approved study plan and that additional bedload sampling or documentation was not necessary. Bedload sediment samples are a basis of the sediment rating curve used to run the STM. Thus, the City's suggestion is that we require GRDA to replace the measured sediment rating curve based on information derived from samples collected using USGS guidelines with a typical sediment rating curve. We have no basis on which to select a typical sediment rating curve or any reason to conclude that applying such a curve would result in an improvement. Further, with our recommendation that GRDA correct the lower Tar Creek slope issue by revising the 1-D UHM and rerunning the STM, we expect the STM to provide the information needed for our analysis of the effects of project operation on

sedimentation. Thus, we do not recommend that GRDA be required to modify the sediment rating curve.

#### *(2) Method of Sediment Distribution*

GRDA generally developed the STM using standard HEC-RAS modeling procedures, allowing the deposition of sediment both in the channel and in over bank areas. The model was calibrated to match surveyed channel geometry and associated erosion/deposition volumes and further validated against additional datasets. Given the fact that the STM was developed using a standard, publicly available model using standard methods, has been successfully calibrated and validated, and provides the information we need for our analysis, we do not recommend requiring GRDA to change the method of sediment distribution.

#### *(3) Sensitivity of Model to Multi-year Climatic and Runoff Cycles*

Regarding the sensitivity of the model to multi-year climatic and runoff cycles, GRDA has met the requirements of the approved study plan, as modified by the SMD, by extending the model downstream to RM 100 and running the model and analyzing output for the recommended combinations of storm events and reservoir starting elevations. The purpose of a Monte Carlo-type simulation would be to predict the range of possible outcomes and their probabilities given uncertain hydrologic inputs. In order to produce meaningful results, such an analysis would likely take hundreds or thousands of model runs and additional software to modify model inputs and analyze outputs for each run. GRDA performed a supplemental analysis by running the simulations using historical, randomized hydrographs. Though less extensive, the purpose of this analysis was similar to a Monte Carlo-type simulation. The differences in the results of these simulations were negligible. Given the time and expense associated with a Monte Carlo-type simulation and the fact that GRDA's supplemental analysis aligns with the finding that the sensitivity of the model to multi-year climatic and runoff cycles is small, we do not recommend that GRDA be required to perform a Monte Carlo-type analysis.

#### *(4) Reservoir Elevations*

The SMD required that GRDA: (1) run the STM as proposed in the Proposed Modified Sedimentation Study Plan filed on April 27, 2022, but using, at a minimum, starting reservoir elevations of 740 feet, 745 feet, and 750 feet PD; (2) run the UHM using, at a minimum, starting reservoir elevations of 740 feet, 745 feet, and 750 feet PD; and (3) run the UHM (with the predicted channel geometries and starting reservoir surface elevations described above) using, at a minimum, the simulated 100-year inflow event and the historic July 2007 inflow event.

It appears that the City interpreted the SMD letter as requiring GRDA to run a 50-year simulation of the STM (and Operations Model) with the three starting pool elevations (740, 745, and 750 feet PD), whereas GRDA interpreted it as requiring that the STM, Operations Model and 1-D UHM be run iteratively in tandem for both inflow events and all three starting pool elevations. Therefore, GRDA applied this method to simulate five sedimentation scenarios, each in combination with six hydraulic conditions, as summarized in table 1.

Table 1. GRDA's simulation runs with five sedimentation scenarios, in combination with six hydraulic conditions (Source: GRDA's USR, Appendix 4, Sedimentation Study).

	<b>Existing Stage-Storage</b>	<b>Future Stage-Storage</b>				
		<b>Anticipated Operations</b>				<b>Baseline Operations</b>
	<b>Sediment Rate N/A</b>	<b>Expected Sediment</b>	<b>Low Sediment</b>	<b>High Sediment</b>	<b>Expected Sediment</b>	
July 2007, 740 feet	✓	✓	✓	✓	✓	✓
July 2007, 745 feet	✓	✓	✓	✓	✓	✓
July 2007, 750 feet	✓	✓	✓	✓	✓	✓
100-Year, 740 feet	✓	✓	✓	✓	✓	✓
100-Year, 745 feet	✓	✓	✓	✓	✓	✓
100-Year, 750 feet	✓	✓	✓	✓	✓	✓

Therefore, GRDA reasonably followed the requirements of the approved study, including running the model at the required elevations. We anticipate that the approach suggested by the City would show only limited differences over a short period at the start of the simulations and would not provide useful information beyond what GRDA has already provided because the outputs would quickly converge and yield identical results for the remainder of the simulations. Given that the results provided will meet the needs of our analysis, we do not recommend that GRDA be required to run the STM to represent a wider range of reservoir elevations.

#### *(5) Tar Creek Overbank Deposition*

As discussed above, we recommend that GRDA modify the 1-D UHM to correct the Tar Creek boundary condition and that the Sedimentation Study be revised by re-running the STM and updating the report as warranted to account for any changes that might result from the change in hydraulics. The City's request should be met with these modifications.

#### *(6) Upstream Flooding Impacts*

Based on staff's review of section 5.1, *Sediment Transport Model Development – Terrain Information*, of the Grand Lake Sedimentation Study (Updated Study Report, Appendix 4), the circa-1940 cross-section data the City has used to demonstrate significant sedimentation is not reliable for this purpose because it was based on low-resolution scans of topographic maps with 5 foot contour intervals from measurements collected with equipment of the era. GRDA appropriately applied cross-section data from a range of sources and timeframes in model development and calibration and has analyzed the impacts of sedimentation dynamics in the tributaries on upstream flooding to a degree necessary to consider effects of project operation. Therefore, we do not recommend that GRDA be required to further analyze sedimentation dynamics and upstream flooding using additional cross-sections.

#### *(7) Contribution of Historical Project-Caused Sedimentation*

Consistent with standard Commission practice and as indicated in the SMD, the Commission does not require applicants to study pre-project conditions or reconstruct pre-project conditions because that is not the baseline from which the Commission conducts its environmental analysis.<sup>29</sup> The environmental baseline for relicensing is the environment as it exists at the time of relicensing, not pre-project conditions. Therefore, we do not recommend that GRDA be required to analyze the effects of historical project-caused sedimentation.

#### *(8) Use of Sediment Model At or Above 755 feet PD*

The SMD required that GRDA run the STM as proposed by GRDA in the Proposed Modified Sedimentation Study Plan filed on April 27, 2022, but using, at a minimum, the starting reservoir elevations of 740 feet, 745 feet, and 750 feet PD. The SMD determined, in the context of the H&H Study, that there was little value in running the model at reservoir elevations exceeding the dam crest elevation of 757 feet PD, because the reservoir would be above the effect of project operation. The SMD did, however, require GRDA to run the H&H Study model up to 757 feet PD. While GRDA is re-running the STM, in response to correcting the slope issue on lower Tar Creek, adding a run at 755 feet would take little additional effort and could shed light on sedimentation processes associated with flood operations in the system. Therefore, we recommend that GRDA re-run the STM at 755 feet, as well as elevations of 740 feet, 745 feet, and 750 feet, which were required in the May 27, 2022 SMD. GRDA should

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<sup>29</sup> See *Conservation Law Foundation v. FERC*, 216 F.3d 41 (D. C. Cir. 2000); *American Rivers v. FERC*, 187 F.3d 1007, amended and rehearing denied, 201 F.3d 1186 (9th Cir., 1999).

provide this additional model run with its STM re-runs within 30 days of the date of this determination.

*(9) Measure Sediment Deposition*

FWS requests that GRDA measure sediment deposition to verify the model projections and test for metals to determine if the metals concentrations are “safe and appropriate” for wildlife management. Regarding, the volume of sediment deposition, GRDA used multiple sampling methods, including a bathymetric survey, vibracore sampling, and bedload sampling. As such, GRDA carried out the necessary sampling for the development and calibration of the hydraulic and sedimentation models. Regarding the portion of the request related to metals, under the ILP, to be required, a study request must have a nexus with a project effect. The nexus between metals, and project operation would exist if project operation affected the distribution and redistribution of sediment (to which metals tend to be bound). This potentiality is the subject of the request for a Contaminated Sediment Transport Study made by the City and LEAD, which is discussed in appendix C. Because the proposal by FWS to study metals is, by definition, covered by another proposed study, we do not recommend it as a separate study. Given that GRDA also has carried out the necessary sediment sampling, we do not recommend that GRDA be required to carry out any further measurements of sediment deposition.<sup>30</sup>

*(10) Use of Sedimentation Study Results in Other Studies*

As discussed above, we are not recommending any specific modifications to the STM, although we are recommending that GRDA revise the Sedimentation Study by re-running the STM and revising the results as needed after correcting the issue with the Tar Creek boundary condition. However, since none of the other studies rely on information from the Sedimentation Study, there is no need to modify them.

### **Aquatic Species of Concern Study**

#### Background

To evaluate the potential effects of project-caused water level increases on rare aquatic species (*i.e.*, Neosho mucket, rabbitsfoot mussel, winged mapleleaf mussel,

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<sup>30</sup> In Appendix C, we also discuss the City’s request that GRDA conduct a Contaminated Sediment Transport Study.

Neosho madtom, and Neosho smallmouth bass),<sup>31</sup> the approved study plan required GRDA to implement a phased information gathering and impact assessment that would include: (1) a review of existing information to characterize each species' physical habitat preferences, density, and spatial and temporal patterns in the project vicinity,<sup>32</sup> (2) conducting targeted field surveys to develop estimates of the distribution and density of each species in relevant reaches to the extent that existing information is inadequate to carry out this characterization; and (3) assessing potential effects of project operation, if any, on those species that may have sensitive life-stage(s) present in the project vicinity.<sup>33</sup>

In accordance with the approved study plan, during the first study season, GRDA conducted a review of existing information on each species' physical habitat preferences, density, and spatial and temporal patterns in the project vicinity. Based on the review of existing information, GRDA did not propose to conduct targeted surveys for rabbitsfoot mussel or winged mapleleaf during the second study season. GRDA also concluded that the Neosho mucket is unlikely to occur in the Spring and Neosho River portions of the project boundary, and therefore did not propose surveys for Neosho mucket in the Spring and Neosho Rivers during the second study season. However, GRDA did propose to conduct targeted surveys in the Elk River during the second study season to determine the presence and density of Neosho mucket and other freshwater mussels.<sup>34</sup>

In November 30, 2021 comments on the ISR, and with respect to GRDA's conclusions that Neosho mucket are unlikely to occur in the Neosho and Spring River portions of the project boundary, FWS indicated that there are areas in the Neosho and Spring Rivers within the project boundary that have not been surveyed. Therefore, FWS recommended that GRDA conduct freshwater mussel surveys in the Neosho River

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<sup>31</sup> Neosho mucket and winged mapleleaf mussel are federally endangered, rabbitsfoot mussel and Neosho madtom are federally threatened, and Neosho smallmouth bass is not federally or state-listed.

<sup>32</sup> The approved study plan required GRDA to complete the review of existing information during the first study season.

<sup>33</sup> The approved study plan requires GRDA to complete the targeted field surveys (if needed) and assessment of potential effects of project operation during the second study season.

<sup>34</sup> GRDA specifies that the targeted surveys will occur in an approximately 1-mile stretch of Neosho mucket critical habitat that occurs within the project boundary on the Elk River.

downstream of the City of Miami<sup>35</sup> and in the Spring River downstream of Warren Branch.<sup>36</sup> FWS also recommended that GRDA coordinate with EcoAnalysts, Inc.; Tar Creek Trustee Council (TCTC); and FWS on the survey design.<sup>37</sup>

In the SMD issued on February 24, 2022, Commission staff recommended that during the second study season, GRDA conduct a targeted freshwater mussel survey in the locations requested by FWS and in the Elk River, after consultation with FWS, EcoAnalysts, Inc., and TCTC on the survey design. The targeted surveys were to provide presence/absence information on Neosho mucket, which are known to occur upstream of the project boundary and for which suitable habitat exists within the project boundary.<sup>38</sup>

In accordance with the Commission staff's February 24, 2022 SMD, GRDA conducted the targeted freshwater mussel surveys during the second study season, after consultation with FWS; EcoAnalysts, Inc.; and TCTC on the survey design. During the week of July 18, 2022, GRDA surveyed mussels at four sites in the Neosho River downstream of the City of Miami, five sites in the Spring River downstream of Warren Branch, and five sites in the Elk River within the 1-mile stretch of Neosho mucket critical habitat that occurs within the project boundary. GRDA identified a total of 13 mussel species, but no Neosho mucket, rabbitsfoot mussel, or winged mapleleaf mussel were identified.

#### *Requested Modification*

In comments on the USR, FWS indicates that additional surveying of mussels in the Neosho and Spring Rivers could be beneficial. FWS recommends that GRDA conduct freshwater mussel surveys in the Neosho River downstream of the City of Miami and in the Spring River downstream of Warren Branch. FWS also recommends that GRDA coordinate with EcoAnalysts Inc., TCTC, and FWS on the survey design.

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<sup>35</sup> The City of Miami is located along the Neosho River about 14 river miles upstream of the confluence with the Spring River. The reach downstream of the City of Miami is entirely within the project boundary.

<sup>36</sup> Warren Branch is a tributary of the Spring River located about 11 river miles upstream of the confluence of the Spring River and Neosho River. The reach downstream of Warren Branch is entirely within the project boundary.

<sup>37</sup> EcoAnalysts, Inc. and TCTC have both conducted recent surveys in the area and TCTC is planning surveys in the Spring River.

<sup>38</sup> Commission staff did not recommend the targeted surveys for the purpose of characterizing rabbitsfoot mussel and winged mapleleaf mussel presence/absence, because there is no evidence that they occur in the project vicinity.

*Comments on Requested Modifications*

In response, GRDA states that FWS does not identify any specific modifications to be made to the Aquatic Species of Concern Study. GRDA adds that FWS made the same recommendation in comments on the ISR and in response, Commission staff required GRDA to conduct FWS's recommended surveys in the Spring and Neosho Rivers. GRDA also states that it completed the required surveys, following consultation with FWS; as well as EcoAnalysts, Inc.; and TCTC. GRDA states further that FWS's request does not provide a showing of good cause why the proposed modification should be approved, which would include a demonstration that: (1) the approved study was not conducted as provided for in the approved study plan; or (2) the study was conducted under anomalous environmental conditions or that the environmental conditions have changed in a material way (section 5.15(f) of the Commission's regulations).

*Staff Discussion and Recommendation*

In comments on the USR, FWS recommends that GRDA conduct additional mussel surveys in the Neosho River downstream of the City of Miami and in the Spring River downstream of Warren Branch. During the second study season, GRDA conducted a freshwater mussel survey in the area recommended by FWS in comments on the USR, which is the same area recommended by FWS in comments on the ISR and required by the approved study plan. In addition, the mussel survey was designed in consultation with FWS; EcoAnalysts, Inc.; and TCTC, as required by the approved study plan. Thus, GRDA conducted the freshwater mussel survey as provided for in the approved study plan and FWS has not provided information to demonstrate otherwise (section 5.15(d)(1)). In addition, FWS has not demonstrated that the survey was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way (section 5.15(d)(2)). Further, the surveys occurred in all areas identified as potential Neosho mucket habitat and no Neosho mucket were found. Consequently, any additional surveys in the Neosho River downstream of the City of Miami and in the Spring River downstream of Warren Branch would have to occur in unsuitable Neosho mucket habitat. Thus, additional survey effort is unlikely to change the conclusions about Neosho mucket presence in the survey area recommended by FWS. Therefore, we do not recommend that GRDA conduct additional freshwater mussel surveys.

## APPENDIX C

### STAFF RECOMMENDATIONS ON REQUESTED NEW STUDIES

#### Contaminated Sediment Transport Study

##### The City's and LEAD Agency's Proposal

Prior to GRDA's USR, the City twice requested that GRDA conduct a Contaminated Sediment Transport Study.<sup>1</sup> In response to those requests, the Commission concluded in the November 18, 2018 Study Plan Determination and the February 24, 2022 SMD that it was premature to make a determination on the City's request until the H&H and Sedimentation Studies are complete. In comments on the USR, the City again reaffirms that the Contaminated Sediment Transport Study remains relevant and necessary. The City requests that the Commission approve the City's Contaminated Sediment Transport Study to analyze how project operation may alter the transport and deposition of contaminated sediments on lands occupied by the City of Miami and its residents.

The City states that the study is needed for the Commission to address whether project impacts on environmental justice communities are disproportionately high and adverse, and what mitigation measures might be needed. The City also states that the ongoing Tar Creek Superfund Site<sup>2</sup> clean-up has not addressed downstream sediment transport and will not be complete for decades. The City adds that the Contaminated Sediment Transport Study is needed because: (1) GRDA's modeling shows that project operations add flooding to thousands of acres, even within individual flood events;<sup>3</sup>

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<sup>1</sup> See letters filed by the City on July 26, 2018 and November 29, 2021.

<sup>2</sup> The Tar Creek Superfund site is a 40 square mile area within the Tri-State Mining District. Tri-State Mining District encompasses an area of approximately 2,500 square miles that was extensively mined for lead and zinc from 1850 to 1950. Cessation of mining operations in the mid-20th century left behind piles of tailings (also referred to as chat) and cavernous, subterranean mines. The chat and groundwater that has collected in the mines contain cadmium (Cd), lead (Pb), zinc (Zn), and other metals. Both dust from the chat and water from the mines are contaminated with the metals. The water from the mines has leached into nearby groundwater, streams, and rivers, including Tar Creek and its tributaries (Andrews, W.J., et. al., 2009).

<sup>3</sup> To simulate the effects of project operation on water surface elevations and the extent of inundation, GRDA ran the UHM using five historical inflow (or flood) events

(2) flooding will carry and deposit fine sediment in overbank areas, which would not have occurred, but for project operation; (3) sediment is almost certainly contaminated; and (4) the Commission stated in scoping document 2 that it would evaluate these issues during relicensing.<sup>4</sup>

LEAD also requests that the Commission conduct a heavy metal study on sediments that it states that project operations distribute in the Grand Lake watershed.<sup>5</sup> LEAD indicates that the study is needed to ensure the safety of human health due to runoff from the Tar Creek Superfund Site and the Tri-State Mining District.

*Reply Comments*

GRDA states that the City and LEAD Agency's request for a contaminated sediment study should be denied for failure to meet the ILP study criteria under section 5.9(b) of the Commission's regulations. GRDA states that the "study lacks 'any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied,'" because the results of the approved study plan demonstrate "that Project operations do not materially affect flows moving through the Project area from upstream locations, nor does the Project affect sedimentation."<sup>6</sup> GRDA also asserts that the requested study will not inform the development of license requirements, under section 5.9(b), "because the Project did not cause the release of contaminants from the [Tri-State Mining District] or materially contribute to their movement into and within the Project area," and therefore, "GRDA is not responsible for the presence of heavy metals

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and one synthetic event to represent a 100-year flood. We understand those historical and synthetic flood events to be the "individual flood events" that the City references.

<sup>4</sup> The City references the Commission's Scoping Document 2, which states that the geology and soils section was revised to include "the effects of project operations on the transport and subsequent deposition of potentially contaminated sediment, without restricting the geographic scope of analysis to the existing project boundary, and to reflect our intention to analyze the resource for cumulative effects." Commission staff April 27, 2018 Scoping Document 2 at 8.

<sup>5</sup> As noted above in reference to LEAD's request that the Commission conduct its own H&H Study, it is longstanding practice that the applicant conducts the studies necessary for licensing. Therefore, we are responding to LEAD's request assuming that LEAD's request is that GRDA conduct a heavy metal study on sediments.

<sup>6</sup> GRDA December 29, 2022 Response to Comments on USR at 92 (citing 18 C.F.R. § 5.9(b)(5) (2021)).

and has no ability to mitigate effects” of contaminated sediments.<sup>7</sup> GRDA adds that the Tar Creek and other Superfund sites within the Tri-State Mining District are under Environmental Protection Agency’s (EPA) control and the EPA has an existing program to address the contamination issues. Regarding the City stating that the Commission has committed, in scoping document 2, to addressing the effects of project operations on transport and deposition of contaminated sediment, GRDA states that it is well settled that the Commission need not require new studies to support its analysis of cumulative effects.<sup>8</sup>

#### Staff Discussion and Recommendation

As discussed in the approved study plan, the results of the H&H and Sedimentation Studies are necessary to evaluate the potential for project operation to affect flooding, peak flows, and sediment transport in the project headwaters. These studies are nearly complete, but as recommended in this SMD, the 1-D UHM requires modification to revise the downstream boundary condition for Tar Creek at the Neosho River confluence. In addition, modifications to the sediment transport model are needed to account for the corrections to the 1-D UHM. Until the modifications recommended in this SMD are completed, it remains premature to make a determination on the need for the City’s requested Contaminated Sediment Transport Study. As discussed in Appendix B, this letter provides 30 days from the issuance date of this determination for GRDA to file an updated Sedimentation Study Report. After that update is filed, a determination will be made on the Contaminated Sediment Transport Study.

#### **Tree Roosting Bat Study**

##### FWS’s Proposal

FWS states that flooding associated with project operation has the potential to inundate roost trees, but there is no baseline information in the project record to evaluate these potential effects. FWS also states that GRDA estimates that project operation would inundate several hundred acres or more of habitat under several of the modeled flood events with higher initial lake elevations. FWS indicates that flooding additional areas of trees could increase the risk of take for federally-listed bats like northern long-eared bats (*Myotis septentrionalis*) that roost in trees, especially during the pup season, which coincides with flood prone time periods in late spring to early summer. Therefore,

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<sup>7</sup> GRDA December 29, 2022 Response to Comments on USR at 93.

<sup>8</sup> *Id.* (citing *Natural Res. Defense Council v. Callaway*, 524 F.2d 79, 90 (2d Cir. 1975); *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058 (2015)).

FWS requests that GRDA conduct a new study to determine how proposed changes in project operation would affect tree-roosting bats such as northern long-eared bats, Indiana bats (*Myotis sodalis*) and tricolored bats (*Perimyotis subflavus*). FWS recommends the study include a combination of acoustic surveys, mist-netting, and radio-telemetry.

*Reply Comments*

GRDA states that FWS's study request does not meet the criteria for new study requests at the USR stage, which require the study requester to not only demonstrate "extraordinary circumstances warranting approval" of the new study, but also include an explanation of: (1) any material change in law or regulations applicable to the information request; (2) why the goals and objectives of the approved study could not be met with the approved study methodology; (3) why the request was not made earlier; (4) significant changes in the project proposal or that significant new information material to the study objectives has become available; and (5) why the new study request satisfies the study criteria in section 5.9(b) of the Commission's regulations.

GRDA states that FWS's requested study is outside the purview of the Commission's authority in the relicensing proceeding because the Corps has exclusive jurisdiction over flood control at the project. GRDA contends that to the extent that flooding within the flood pool may cause adverse effects to any species listed under the Endangered Species Act (ESA), such effects are caused by the Corps' actions, not any discretionary action of the Commission.

GRDA notes that the floodplain forests that provide habitat for northern long-eared bats and tricolored bats in the project area are prone to flooding and that the flooding process creates standing dead trees which provide roosting habitat for the bats. GRDA also indicates that studies show floodplain forests have greater bat activity and diversity than adjacent upland habitats (Blakey *et al.*, 2017), flood events do not cause bats to vacate tree roosts (Scherman *et al.*, 2022; Silvis *et al.*, 2016), and bats typically roost at heights well above anticipated flood levels (Silvis *et al.*, 2016). Therefore, GRDA contends the existing scientific record demonstrates that flooding and flood control within the flood control pool is likely to have a positive effect on the northern long-eared bats, and thus FWS's recommended study is unnecessary.

GRDA further comments that conducting FWS's recommended study would be costly, would not provide information that would establish a connection between results of the survey and project operation, and would not be needed to complete consultation for the relicensing under section 7 of the ESA.

*Staff Discussion and Recommendation*

There is sufficient information available in the project record documenting the occurrence of federally listed bat species in the project area, and the results of GRDA's H&H Study provides adequate information to inform our analysis of the effects of proposed project operations on floodplain forests and bat habitat. Therefore, we do not recommend GRDA conduct a new study on the presence of northern long-eared bats, Indiana bats, and tricolored bat in the project area.

## APPENDIX D

### LITERATURE CITED

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