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Pensacola Hydroelectric Project

FERC No. 1494-438

Proposed Study Plan Meeting

May 30-31, 2018

Meeting Agenda - Day 1

Introductions, review agenda, purpose of meeting	9:00 am – 9:15 am
Introductory/Overview Presentation	9:15 am – 9:45 am
U.S. Army Corps of Engineers (USACE) Tulsa District Water Management and Arkansas River System Operations	9:45 am – 10:15 am
Break	10:15 am – 10:30 am
Proposed Studies: Hydrologic and Hydraulic Modeling Study (H&H Study)	10:30 am – 12:00 pm
Lunch (on own)	12:00 pm – 1:00 pm
Continue with H&H Study	1:00 pm – 2:00 pm
Proposed Studies: Sedimentation Study	2:00 pm – 3:00 pm
Break	3:00 pm – 3:15 pm
Continue with Sedimentation Study	3:15 pm – 5:00 pm

Meeting Agenda - Day 2

Introductions, review agenda, purpose of meeting	9:00 am – 9:15 am
Proposed Studies: Recreation Facilities Inventory and Use Survey	9:15 am – 10:00 am
Proposed Studies: Socioeconomics Study	10:00 am – 10:45 am
Break	10:45 am – 11:00 am
Proposed Studies: Cultural Resources Study	11:00 am – 12:00 pm

Meeting Objectives

- Review the studies outlined in the Proposed Study Plan (PSP)
- Help ensure that the appropriate studies are being performed in support of issuance of a new license and a Section 401 Water Quality Certificate
- Open discussion regarding necessary studies

Integrated Licensing Process Schedule

Activity	Deadline
Filing of Notice of Intent (NOI) and Pre-Application Document (PAD)	2/1/2017
Initial Tribal Consultation Meeting	12/13/2017, 12/14/2017 ¹
FERC Issues Notice of Commencement of Proceeding and Scoping Document 1 (SD1)	1/12/2018
Public Scoping Meetings and Environmental Site Review	Week of 2/5/2018
File Comments on PAD, SD1, and Study Requests	3/13/2018
FERC Issues Scoping Document 2 (SD2), if necessary	4/27/2018
File Proposed Study Plans (PSP)	4/27/2018
Study Plan Meetings	5/30-31/2018²
File Comments on Proposed Study Plan	7/26/2018
File Revised Study Plan (RSP)	8/25/2018
File Comments on Revised Study Plan (if necessary)	9/9/2018
FERC Issues Study Plan Determination	9/24/2018

¹ Tribal consultation was waived and put on hold because of the FERC abeyance from February to August 2017.

² Due to an unavoidable conflict identified by the Tribes during the week of May 21, the PSP meeting was moved to May 30-31.

Integrated Licensing Process Schedule

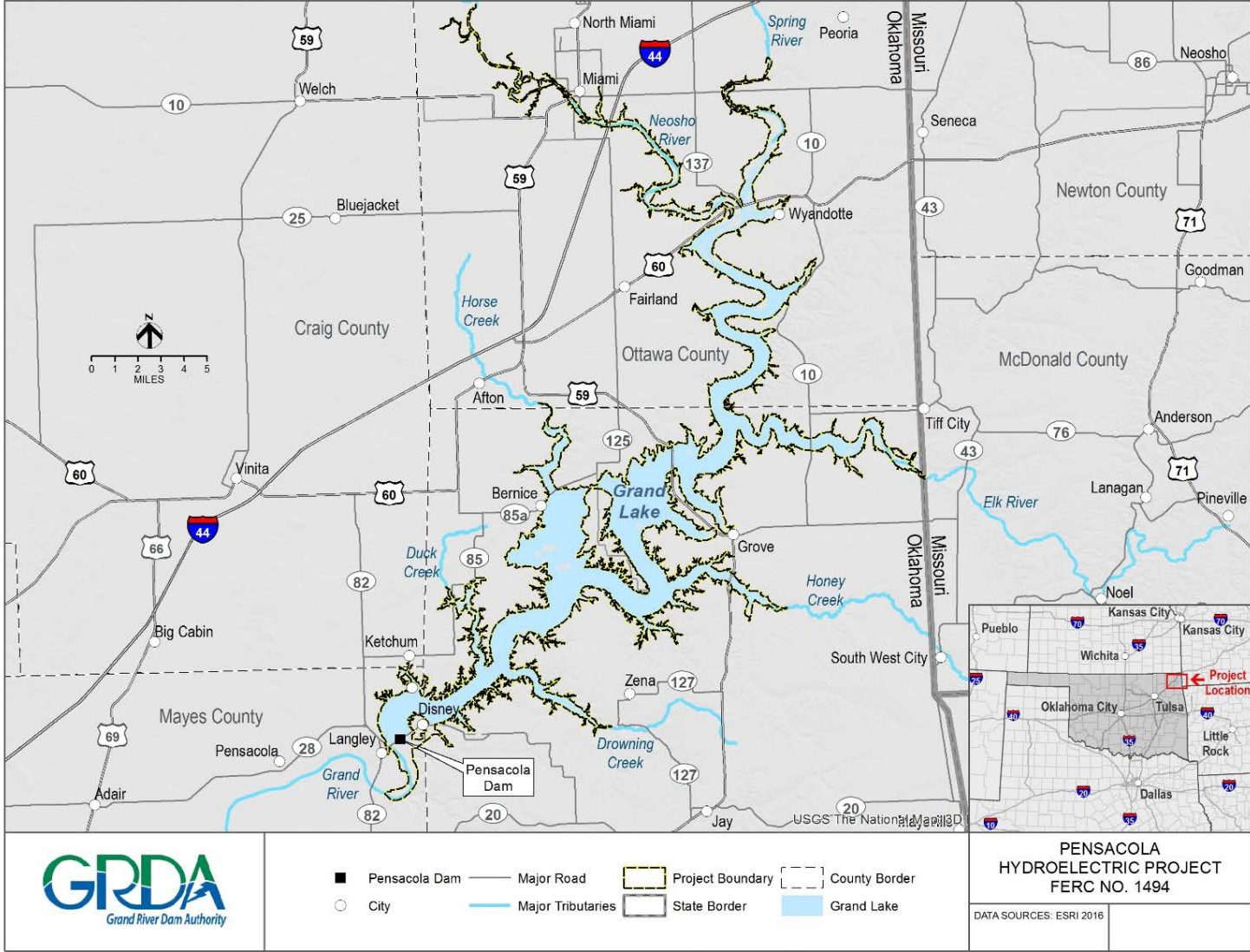
Activity	Deadline
Conduct First Season Field Studies	October 2018–August 2019
File Initial Study Reports (ISR)	9/24/2019
Initial Study Results Meeting	10/09/2019
File Study Results Meeting Summary	10/27/2019
Conduct Second Season Field Studies	October 2019–August 2020
File Updated Study Reports (USR)	9/24/2020
Second Study Results Meeting	10/11/2020
File Study Results Meeting Summary	10/26/2020
File Preliminary Licensing Proposal (PLP) or Draft License Application (DLA) with FERC and distribute to relicensing participants	11/3/2019 ³
Comments on GRDA PLP or DLA, Additional Information Request (if necessary)	2/3/2020 ³
License Application Filed	3/31/2020 ³

³ Because of delay caused by ILP abeyance, these deadlines fall before completion of the ILP pre-filing milestones required by § 5.15 of FERC's regulations.

Potential License Extension

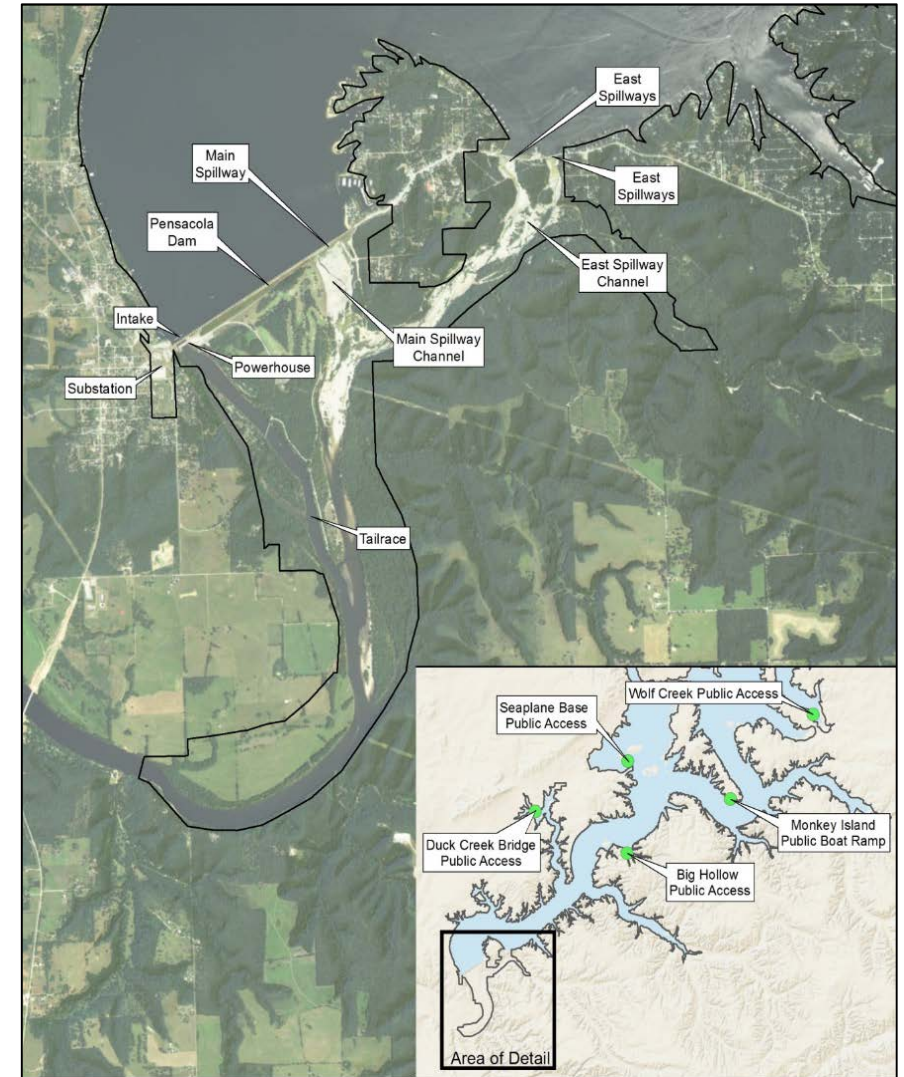
- On February 15, 2017, the Federal Energy Regulatory Commission (FERC) issued a letter Order holding the relicensing process in abeyance.
- On August 24, 2017, the abeyance was lifted.
- As a result of the abeyance, the Integrated Licensing Process (ILP) for this relicensing lags several months behind.
- Several of GRDA's studies are scheduled to require two full years to complete field work and analysis. Under the current relicensing schedule nearly the entire second field season would occur after the Preliminary Licensing Proposal/Draft License Application (PLP/DLA) and Final License Application (FLA) are filed.
- To avoid relicensing participants having to review and comment on incomplete documents GRDA is considering requesting a license extension from FERC to better align the ILP process.

Project Overview - General Project Location



Project Overview - Features and Facilities

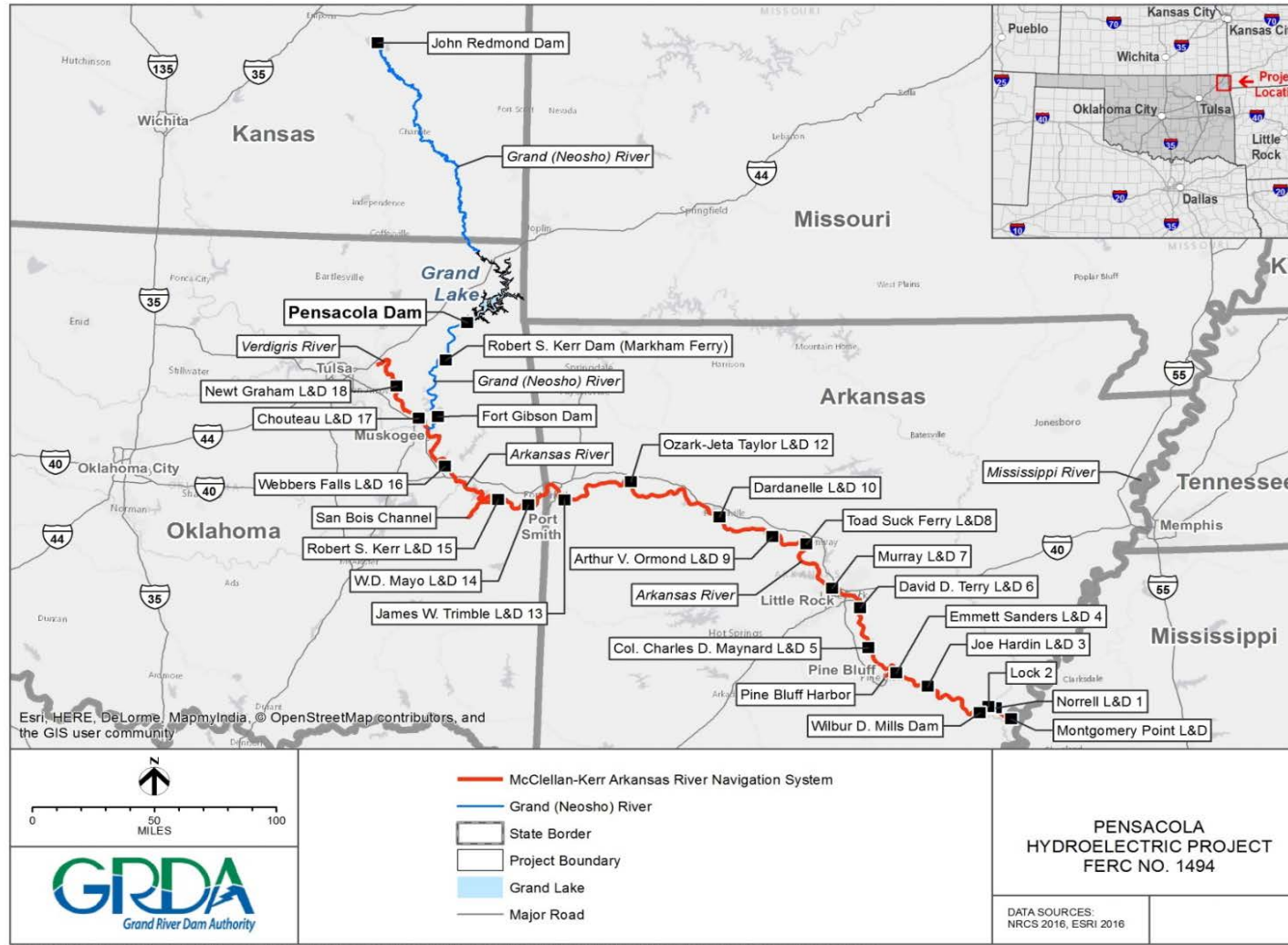
- Project Features and Facilities
 - Grand Lake with a surface area of approximately 45,200 acres and a storage capacity of 1.68 million acre-feet at a normal maximum water surface elevation of 745 feet Pensacola datum (PD)
 - PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD 29) by adding 1.07 feet and to National American Vertical Datum of 1988 (NAVD 88) by adding 1.40 feet.
 - Six-unit powerhouse immediately below dam
 - 5,950 foot-long, reinforced-concrete dam with a maximum height of 147 feet
 - Intake
 - Tailrace
 - Spillway Channels
 - Substation
 - Five (5) Recreation Facilities



Project Overview

- Existing Federal Energy Regulatory Commission (FERC) license issued April 24, 1992
 - 30 year license term (expires March 31, 2022)
 - Authorized capacity of 120 megawatts (MW)
 - Average annual generation from 2011 through 2015 was 343,113 megawatt hours (MWh)
- As licensed by FERC, the Project serves multiple purposes, including hydropower generation, water supply, public recreation, and wildlife enhancement.
- As directed by Congress under the Flood Control Act of 1944, 58 Stat. 887, 890-91, and under the jurisdiction of the U.S. Army Corps of Engineers (USACE), the Project also serves as part of the McClellan-Kerr Arkansas River Navigation System of reservoirs providing navigation and flood control throughout the Grand and larger Arkansas River basin.
 - USACE has exclusive jurisdiction over Grand Lake for flood control purposes, and USACE has designated a flood control pool for Grand Lake that extends above the 745-foot elevation Pensacola datum (PD).

Project Overview - McClellan-Kerr River System



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Project Overview - Operations

- Project Operations

- In order to balance the multiple uses of the reservoir, GRDA currently operates the Project to target reservoir surface elevations known as the Project’s rule curve.

Target elevations for the Pensacola Project:

Period	Reservoir Elevation (feet)
May 1 through May 31	Raise elevation from 742 to 744
June 1 through July 31	Maintain elevation at 744
August 1 through August 15	Lower elevation from 744 to 743
August 16 through September 15	Maintain elevation at 743
September 16 through September 30	Lower elevation from 743 to 742
October 1 through April 30	Maintain elevation at 742



Proposed Study Plan Overview

- The Proposed Study Plan (PSP) was filed on April 27, 2018 pursuant to 18 C.F.R. § 5.11
- Notification of PSP filing and electronic location of document was distributed to relicensing parties
- The PSP describes GRDA's approach to conducting the studies, taking into consideration Federal Energy Regulatory Commission (FERC) study criteria, formal study requests, and comments of agencies and relicensing participants
 - Formal Integrated Licensing Process (ILP) study requests were submitted by:
 - FERC
 - Bureau of Indian Affairs (BIA)
 - U.S. Fish and Wildlife Service (USFWS)
 - Oklahoma Department of Wildlife Conservation (ODWC)
 - Oklahoma Archaeological Survey (OAS)
 - Miami Tribe (supported by Eastern Shawnee Tribe, Ottawa Tribe, Seneca-Cayuga Nation, and Wyandotte Nation)
 - Cherokee Nation
 - City of Miami
 - N. Larry Bork (Counsel for City of Miami citizens)
 - GRDA also received many general comments from relicensing participants on the Project, some of which related to proposed studies. GRDA's responses to study related comments have been detailed in the discussion of study requests in Sections 4.2 and 4.3 of the PSP.

Proposed Study Plan Overview - FERC Criteria for Study Requests

1. Describe the goals and objectives of each study proposal and the information to be obtained.
2. If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied.
3. If the requestor is not a resource agency, explain any relevant public interest considerations in regard to the proposed study.
4. Describe existing information concerning the subject of the study proposal, and the need for additional information.
5. Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.
6. Explain how any proposed study methodology is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.
7. Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

Proposed Study Plan Overview - Proposed Studies

- Hydrologic and Hydraulic Modeling Study (H&H Study)
- Sedimentation Study
- Recreation Facilities Inventory and Use Assessment
- Socioeconomics Study
- Cultural Resources Study

Proposed Study Plan Overview - Study Requests Not Adopted

- Flooding Inundation of Tribal Lands Study
- Contaminated Sediment Transport Study
- Quantifying the Effects of Increased Water Level with the Grand Lake Watershed
- Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning/Recruitment
- Wetland Documentation
- Loss of Wildlife Lands from Flooding
- Recovery of Lost Wildlife Mitigation Opportunity
- Flora and Fauna Impacts Study
- Infrastructure Impacts Study
- Alteration of Tailwater Fish Habitat Downstream of Pensacola Dam as a Result of Hydropower Operations (*withdrawn in revised ODWC letter filed with FERC May 1, 2018*)
- Changes in Tailwater Fish Populations Due to Hypolimnetic Releases (*withdrawn in revised ODWC letter filed with FERC May 1, 2018*)

Questions and Next Steps

- Comments on the Proposed Study Plan (PSP) are due to be filed with the Federal Energy Regulatory Commission (FERC) by July 26, 2018.
 - When submitting comments please be sure to include the Project docket and sub-docket number on all filings (P-1494-438).
- The Revised Study Plan (RSP) is due to FERC on August 25, 2018.
 - Upon filing, the RSP will be available on GRDA's Pensacola Project public website as well as FERC's e-library.

Contact Information

Jacklyn Jaggars

Administrative Assistant

Grand River Dam Authority

Ecosystems & Education Center

PO Box 70

Langley, OK 74350-0070

(918) 256-0723

jjaggars@grda.com

<http://www.grda.com/pensacola-hydroelectric-project-relicensing/>



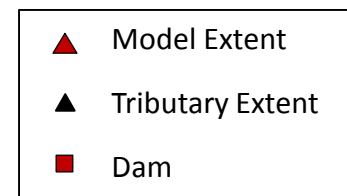
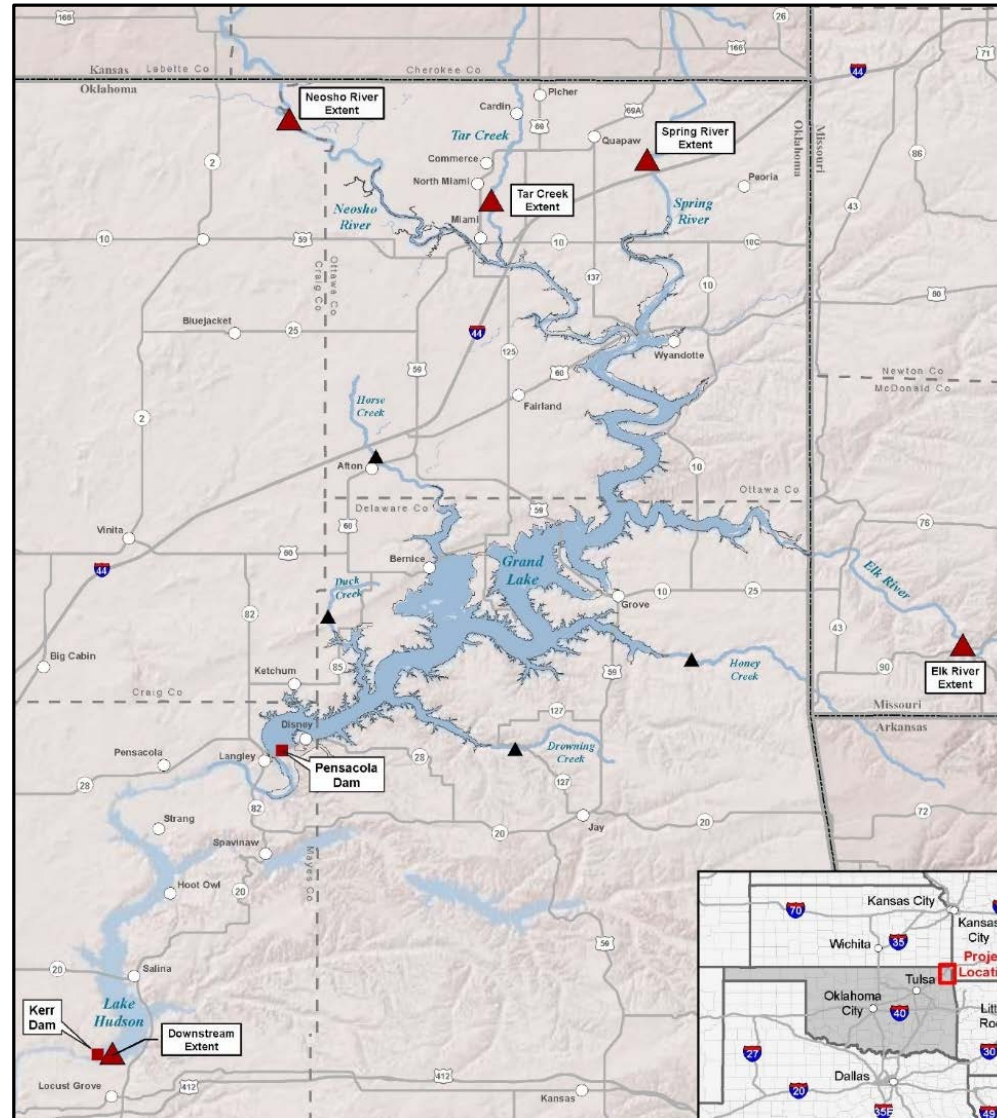
Hydrologic and Hydraulic Modeling Study

Hydrologic and Hydraulic Modeling Study (H&H Study)

Goals and Objectives

- Goals and Objectives
 - Determine the effects, if any, of GRDA's operations under the Federal Energy Regulatory Commission (FERC)-issued license of the Project upon several resource areas.
 - The study will:
 1. Determine duration and extent of inundation under the current license operations of the Project during several measured inflow events.
 2. Determine the duration and extent of inundation under any proposed change in operations that occurs during measured or synthetic inflow events.
 3. Provide the model results in a format that can inform other analyses of Project effects, if any, in several resource areas.
 4. Determine the feasibility of implementing alternative operation scenarios, if applicable, that may be proposed by GRDA as part of relicensing.

Hydrologic and Hydraulic Modeling Study (H&H Study) Study Area



Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology

- Comprehensive Hydraulic Model (CHM)
 - Upstream of Pensacola Dam
 - Downstream of Pensacola Dam
- Operations Model
- Calibration
- Study Area Determination
- Model Runs
- Sedimentation
- Flood Frequency
- Area Capacity Curve
- Deliverables

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Comprehensive Hydraulic Model

- Comprehensive Hydraulic Model (CHM) will be developed to determine inundation areas and other flood routing specifics.
 - U.S. Army Corps of Engineers (USACE) HEC-RAS software (Version 5.0.3 or later)
 - 1-dimensional (1-D) and 2-dimensional (2-D) modeling capabilities
 - Unsteady-state
 - Separate HEC-RAS models for upstream and downstream of Pensacola Dam
 - Single (inflow) event model – not continuous long-term simulation

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Upstream Comprehensive Hydraulic Model

- Use Tetra Tech 2015 model as a basis (1-D/2-D HEC-RAS)
- Extend model upstream to include Spring River, Elk River and Tar Creek
 - Spring River and Elk River as 1-D reaches
 - Tar Creek as 2-D model
- Refine Grand Lake portion of the model
 - Additional cross sections through upper portion of Grand Lake
 - 2-D model downstream of Sailboat Bridge
- Topographic/Bathymetric Data
 - Overbank areas derived from 2011 U.S. Geological Survey (USGS) LiDAR data
 - Supplemented with 1/3 arc-second USGS National Elevation Dataset (NED) Digital Elevation Model (DEM) where needed
 - 2009 Oklahoma Water Resources Board (OWRB) bathymetry for Grand Lake bottom
 - Bathymetry for Neosho, Spring and Elk Rivers from 2017 USGS Bathymetric Survey
- Roughness Values
 - Based on aerial photography and site observations
 - Derived using standard Manning's n references
 - Adjusted during calibration

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Downstream Comprehensive Hydraulic Model

- Unsteady-state 1-D HEC-RAS model
- Extend from just downstream of Pensacola Dam through Lake Hudson to just upstream of Kerr Dam
- Topographic/Bathymetric Data
 - Overbank areas derived from 1/3 arc-second U.S. Geological Survey (USGS) National Elevation Dataset (NED) Digital Elevation Model (DEM)
 - 2008 Oklahoma Water Resources Board (OWRB) bathymetry used for Lake Hudson/Neosho River bottom
- Roughness Values
 - Based on aerial photography and site observations
 - Derived using standard Manning's n references
 - Adjusted during calibration

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Operations Model

- Simulate hydroelectric project operation to inform Comprehensive Hydraulic Model (CHM).
 - Microsoft Excel spreadsheet-based tool with Visual Basic for Applications (VBA) subroutines
- Predict differences in power generation for different operating scenarios.
 - Will calculate hourly outflows and generation based on various physical constraints, U.S. Army Corps of Engineers (USACE) flood routing operations, and Project operating curves
 - Level pool routing method
- Output includes synthetic boundary condition hydrographs for CHM.
- Can support continuous long-term simulations, given adequate data.

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Operations Model

- Inputs: Physical constraints
 - Friction losses between reservoir and turbines
 - Turbine-generator efficiency curves
 - Dissolved oxygen valves (open or closed)
 - Spillway discharge rating curves
 - Reservoir stage-storage curve
 - Tailwater rating curve
 - Turbine maximum discharge vs. head rating curves
- Inputs: U.S. Army Corps of Engineers (USACE) flood routing operations
 - Based on documentation of past events

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Operations Model

- Inputs: Project operating rules
 - Seasonal reservoir elevations
 - Power generation
- Extent of model
 - Grand Lake upstream of Pensacola Dam
 - Downstream of Pensacola Dam if needed to synthesize Comprehensive Hydraulic Model (CHM) boundary conditions (possibly through Lake Hudson upstream of Kerr Dam)

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Calibration

- Calibration necessary before results can be considered representative.
- Calibration of the Comprehensive Hydraulic Model (CHM)
 - Calibrated using several historic inflow events with broad range of recorded and surveyed high water marks
 - Calibration complete when:
 - Predicted water surface elevations approach measured values
 - Timing between predicted stage hydrographs and recorded hydrographs are acceptable
- Calibration of the Operations Model
 - Calibrated using wide-ranging operational periods of historical operations
 - Modeled annual power generation totals compared against observed historical annual power generation totals
 - Inputs varied during calibration may include:
 - Physical system characteristics
 - Project operating parameters
 - Hydrologic routing methods

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Study Area Determination

- Comprehensive Hydraulic Model (CHM) Study Area Determination
 - Iterative process using varying ranges of measured inflow events and operating scenarios
 - Model extended upstream if a measurable difference in water surface elevation occurs at upstream extent
- Operations Model Study Area Determination
 - Will include Grand Lake upstream of Pensacola Dam
 - Will extend downstream of Pensacola Dam if needed to synthesize CHM boundary conditions (possibly through Lake Hudson upstream of Kerr Dam)

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Model Runs

- A minimum of six inflow events for current licensed operating scenario.
 - Including 2007 inflow event
 - Starting reservoir elevations at Pensacola dam ranging from 742 to 745 feet Pensacola datum (PD) in one-foot increments
- Additional suite of model runs run for alternate operating scenarios that may be proposed.
 - Using synthetic model boundaries produced by the Operations Model

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Sedimentation

- Evaluate the extent to which sedimentation affects the results of the Comprehensive Hydraulic Model (CHM).
 - 2017 channel geometry will be replaced with 1996/1997 U.S. Army Corps of Engineers (USACE) channel geometry
 - CHM will be re-run under a range of inflow events and operating scenarios
 - Results compared with results using current channel geometry
- Analysis limited to the effects of sedimentation on the Grand/Neosho River and upper Grand Lake.

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Flood Frequency

- Flood frequency analysis will provide perspective about the frequency of the inflow events used for the Comprehensive Hydraulic Model (CHM) runs.
- Recurrence intervals will be based on total inflow to the reservoir.
 - Represents a location just upstream of the dam
 - Total inflows will be back-calculated due to un-gaged tributaries

Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Area Capacity Curve

- Oklahoma Water Resources Board (OWRB) developed up-to-date area capacity curves as part of their 2009 bathymetric study.
 - Curve extends up to El. 745 Pensacola datum (PD)
- OWRB curve will be extended to El. 760 PD.
 - Coordinated with current and/or revised U.S. Army Corps of Engineers (USACE) management curves



Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Deliverables

- Model input status report (April 2019)
- Initial and Updated Study Reports (ISR and USR)
 - Data sources
 - Input hydrology
 - Comprehensive Hydraulic Model (CHM) and Operations Model development
 - CHM and Operations Model calibration
 - Explanation of U.S. Army Corps of Engineers (USACE) involvement in Project operations
 - Flood frequency analysis
 - Input parameters for all runs
 - CHM and Operations Model results



Hydrologic and Hydraulic Modeling Study (H&H Study) Methodology – Deliverables

- Inundation maps
 - Depth maps layered on recent aerial photos
 - Inundation line to represent maximum water surface elevation
 - Project boundary included
 - Current flowage easements included
 - Identify any structures within the inundation areas
 - Land ownership included
 - Will inform separate efforts to assess Project effects on aquatic, terrestrial, cultural, and threatened and endangered resources.
- Inundation maps showing impacts of sedimentation
 - Similar to above, plus inundation limits resulting from Comprehensive Hydraulic Model (CHM) runs using 1996/1997 U.S. Army Corps of Engineers (USACE) channel geometry

Hydrologic and Hydraulic Modeling Study (H&H Study) Schedule

Task/Milestone	Anticipated Schedule
Initial Study Planning and Background Data Review	September 2018
Model Development	October 2018 – April 2019
Input Status Report	April 2019
Initial Study Report	September 2019
Additional Analyses and Updates	October 2019 – August 2020
Updated Study Report	September 2020

Questions?



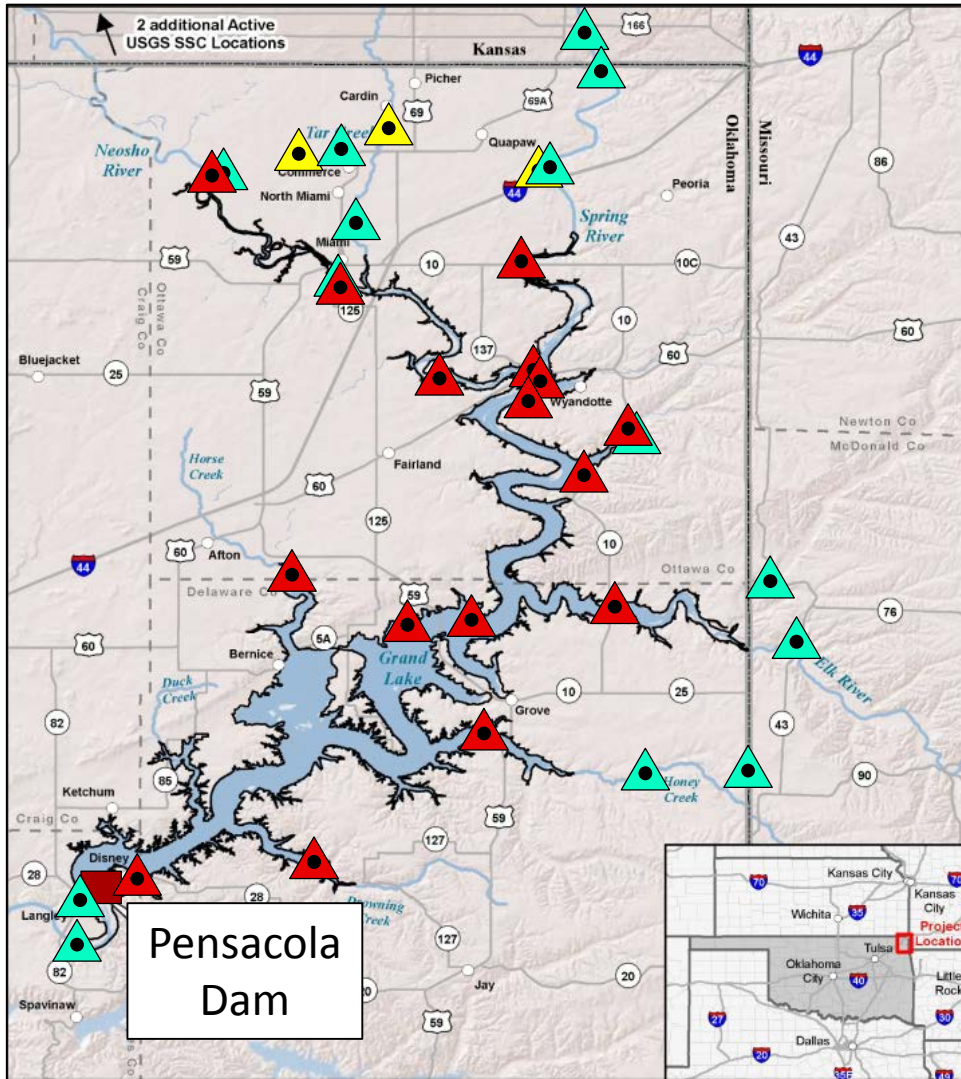
Sedimentation Study

Sedimentation Study – Goals and Objectives

- Improve understanding of the sediment transport processes and patterns upstream of Grand Lake.
- Study Year One: Evaluate Long-Term Interactions Between:
 - Grand Lake water levels
 - Sedimentation patterns and processes in the watershed
 - Project operation and sedimentation
- Contingent Study Year Two: Collect and Analyze Field Data
 - Contingent upon the results of Study Year One
 - Use field data to further evaluate the relationship of Project operations and sedimentation to the extent and duration of inundation



Sedimentation Study - Study Area



- ▲ Water Level Monitoring Location
- ▲ USGS SSC Location
 - ▲ Active
 - ▲ Inactive

Sedimentation Study – Methodology

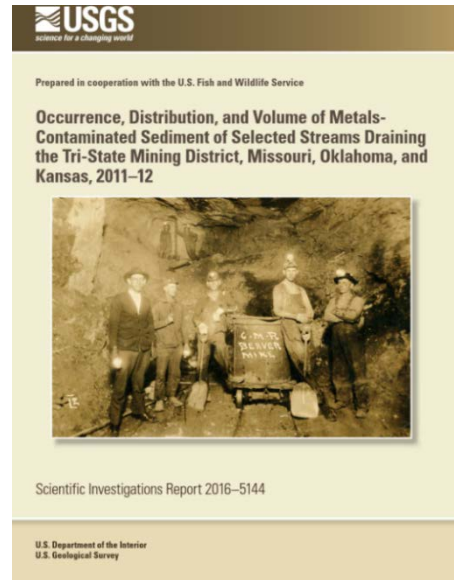
Study Year One

- Background Data and Literature Review
- Bathymetric Dataset Comparisons
- Operational Change Analysis
- Data Synthesis and Reporting

Sedimentation Study – Methodology

Study Year One

- Background Data and Literature Review
 - Sedimentation rate and composition data from local studies
 - U.S. Geological Survey (USGS) gaging station information
 - U.S. Army Corps of Engineers (USACE) data and study reports
 - Historic bathymetric survey data

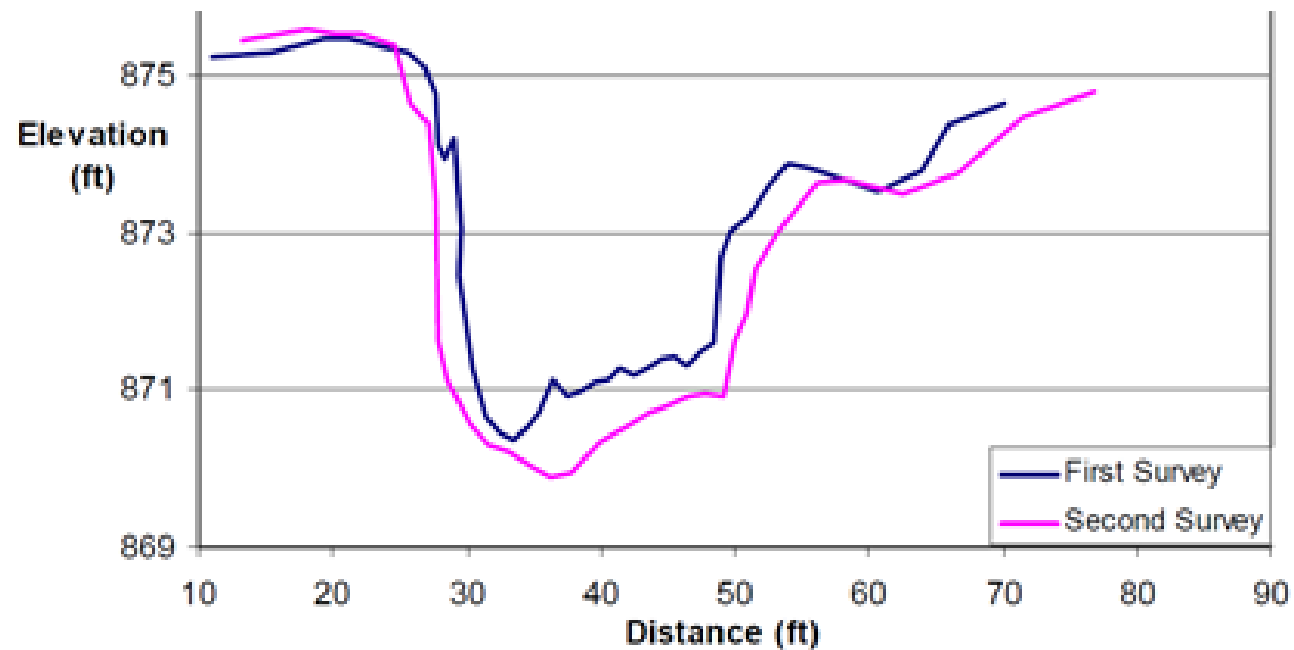


Smith, 2016

Sedimentation Study – Methodology

Study Year One

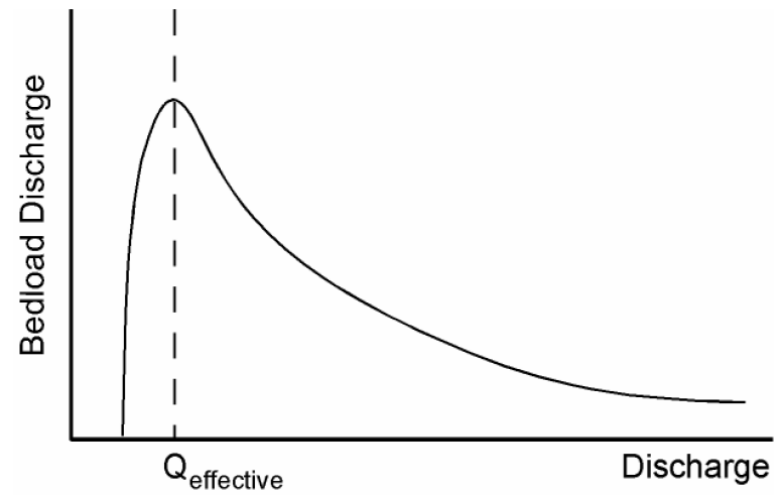
- Bathymetric Dataset Comparisons
 - Compare bathymetry transect cross section data to evaluate long-term trends



Sedimentation Study – Methodology

Study Year One

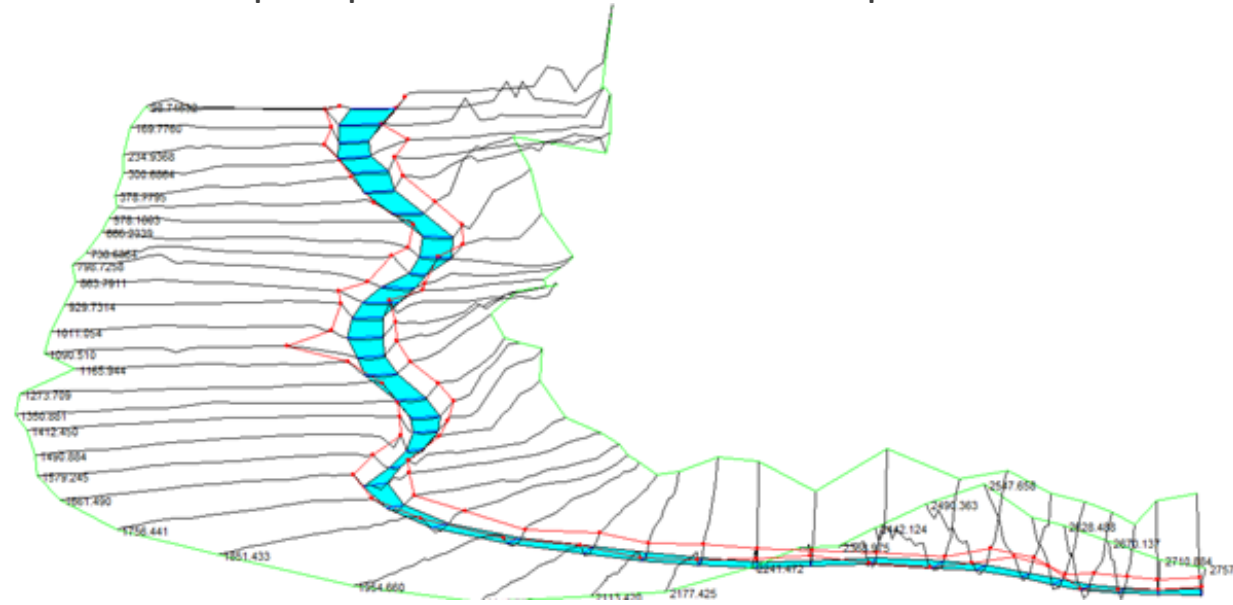
- Effective discharge analysis
- Compare spatial erosion/deposition patterns with sediment loading estimates from Soil and Water Assessment Tool (SWAT) model



Sedimentation Study – Methodology

Study Year One

- Operational Change Analysis
 - Comprehensive Hydraulic Model (CHM) development at frequently occurring discharge events
 - Analyze sediment transport potential under different operational scenarios



Sedimentation Study – Methodology

Study Year One

- Data Synthesis and Reporting
 - Plot current and historic sediment transport rates
 - Analyze changes in sediment transport characteristics under different operational scenarios
 - Summarize study conclusions in a report
 - Will inform decision as to whether Study Year Two is warranted based on Project-related sedimentation effects

Sedimentation Study – Methodology

Contingent Study Year Two

- Contingent upon results from Study Year One
- Field Measurements and Data Collection
- Data Synthesis and Reporting

Sedimentation Study – Methodology

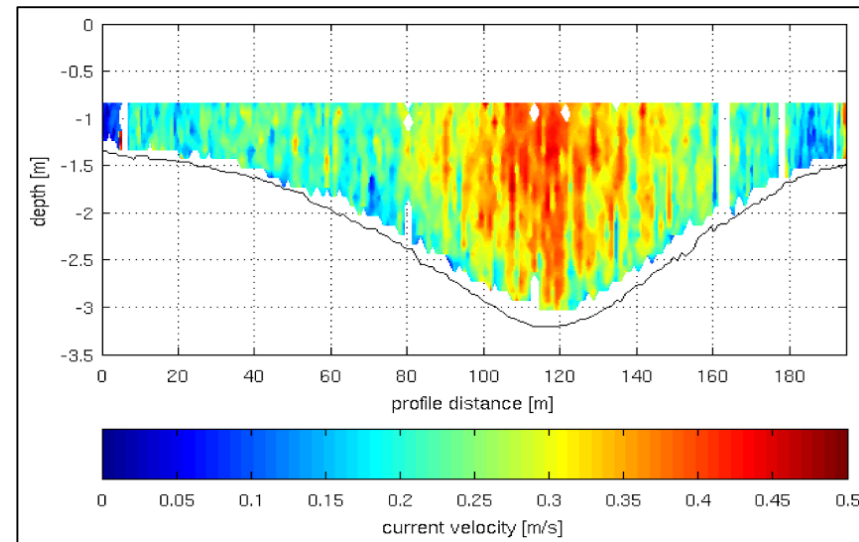
Contingent Study Year Two

- Contingent upon results from Study Year One
 - Study Year Two will be triggered if significant Project-related sedimentation effects are determined in Study Year One

Sedimentation Study – Methodology

Contingent Study Year Two

- Field Measurements and Data Collection
 - Conduct water level monitoring
 - Use Acoustic Doppler Current Profiler (ADCP) to measure discharge and velocity profiles at water-level monitoring stations and on Tar Creek



Sedimentation Study – Methodology

Contingent Study Year Two

- Field Measurements and Data Collection
 - Collect water samples to quantify Suspended Sediment Concentration (SSC)
 - Collect streambed samples for sediment size distribution analysis



Sedimentation Study – Methodology

Contingent Study Year Two

- Field Measurements and Data Collection
 - Evaluate suspended sediment transport using discharge and Suspended Sediment Concentration (SSC) data
 - Evaluate bedload by calculating bed shear stress and substrate critical shear stress estimates

Sedimentation Study – Methodology

Contingent Study Year Two

- Data Synthesis and Reporting
 - Analyze spatial distribution of sediment transport potential
 - Compare measured data with estimated values
 - Improve understanding of the sediment transport processes and patterns upstream of Grand Lake

Sedimentation Study – Schedule

Task/Milestone	Anticipated Schedule
Study Year One - Background Data and Literature Review	September 2018
Study Year One - Sedimentation Analysis & Bathymetric Comparisons	December 2018
Study Year One - Operational Change Analysis	December 2018 – August 2019
Initial Study Report	September 2019
Contingent Study Year Two - Field Measurements and Data Collection	September 2019 – July 2020
Contingent Study Year Two - Updated Study Report	September 2020

Questions?

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Pensacola Hydroelectric Project

FERC No. 1494-438

Proposed Study Plan Meeting

May 30-31, 2018

Meeting Agenda - Day 2

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Proposed Studies: Recreation Facilities Inventory and Use Survey	9:15 am – 10:00 am
Proposed Studies: Socioeconomics Study	10:00 am – 10:45 am
Break	10:45 am – 11:00 am
Proposed Studies: Cultural Resources Study	11:00 am – 12:00 pm

Meeting Objectives

- Review the studies outlined in the Proposed Study Plan (PSP)
- Help ensure that the appropriate studies are being performed in support of issuance of a new license and a Section 401 Water Quality Certificate
- Open discussion regarding necessary studies

Next Steps

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Contact Information

Jacklyn Jaggars

Administrative Assistant

Grand River Dam Authority

Ecosystems & Education Center

PO Box 70

Langley, OK 74350-0070

(918) 256-0723

jjaggars@grda.com

<http://www.grda.com/pensacola-hydroelectric-project-relicensing/>

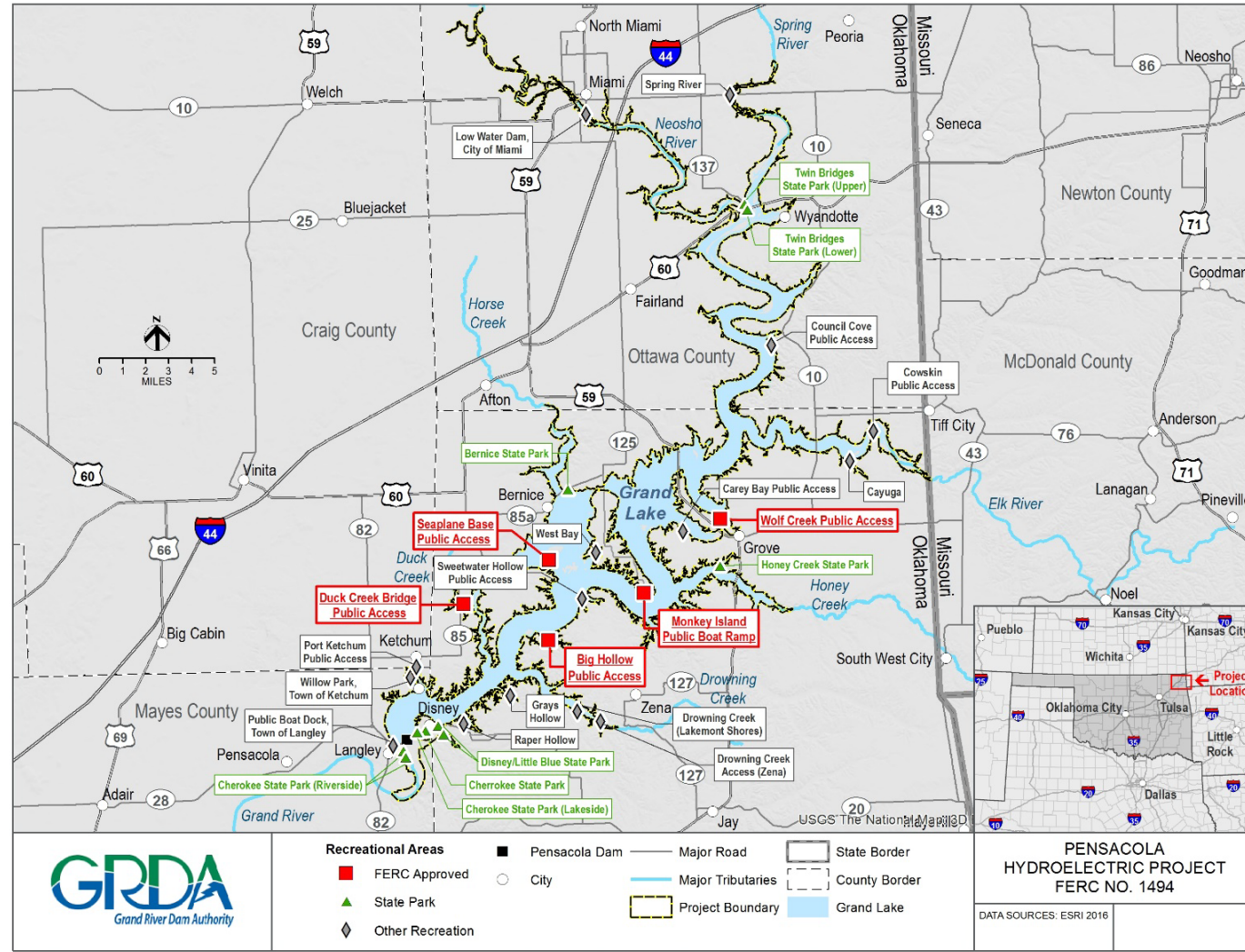


Recreation Facilities Inventory and Use Assessment

Recreation Facilities Inventory and Use Survey – Goals and Objectives

- Goals and Objectives
 - Characterize current recreational use of the Project area.
 - Estimate future demand for public recreation use at the Project.
 - Gather information on the condition of recreation facilities and identify any need for improvement.
 - Evaluate the potential effects of continued operation of the Project on recreation resources and access in the Project area.

Recreation Facilities Inventory and Use Survey – Study Area



Recreation Facilities Inventory and Use Survey – Methodology

- Recreation Facility Inventory and Condition Assessment
 - Information will be collected for each of the five Federal Energy Regulatory Commission (FERC)-approved recreation areas (Duck Creek, Seaplane Base, Monkey Island, Big Hollow and Wolf Creek) including the following:
 - A description of the type and location of existing recreation facilities.
 - The type of recreation provided (boat access, angler access, picnicking, etc.).
 - Existing facilities and sanitation.
 - The type of vehicular access and parking (if any).
 - Suitability of facilities to provide recreational opportunities and access for persons with disabilities (i.e., compliance with current American with Disabilities Act (ADA) standards for accessible design).
 - Photographic documentation of recreation facilities.
- Additionally, a qualitative assessment of the condition of the recreation facilities will be performed using a Facilities Inventory and Condition Form.
- Recreation facilities will be rated using the following criteria:
 - (N) Needs replacement (broken or missing components, or non-functional).
 - (R) Needs repair (structural damage or otherwise in obvious disrepair).
 - (M) Needs maintenance (ongoing maintenance issue, primarily cleaning).
 - (G) Good condition (functional and well-maintained).

Recreation Facilities Inventory and Use Survey – Facilities Inventory and Condition Form

RECREATION FACILITY INVENTORY AND CONDITION ASSESSMENT
Pensacola Hydroelectric Project (FERC No. 1494)

Location:	
Date:	Surveyor:
Photo Number(s):	

Type of Amenity	#	ADA	Condition	Notes
Boat Launch Ramp/Lane			N / R / M / G	
Dock/Pier			N / R / M / G	
Mooring Dock			N / R / M / G	
Pavilion			N / R / M / G	
Picnic Table			N / R / M / G	
Restroom			N / R / M / G	
Trash Receptacles			N / R / M / G	
Other			N / R / M / G	

PARKING	Total Spaces: _____	Standard: _____	ADA: _____	Double (trailer): _____	Other: _____	Condition
	Surface Type:	Asphalt	Concrete	Gravel	Other: _____	N / R / M / G

Signs	#	Size	Material	Condition	Comments
FERC Project			wood / metal / other	N / R / M / G	
Facility ID			wood / metal / other	N / R / M / G	
Regulations			wood / metal / other	N / R / M / G	
Directional			wood / metal / other	N / R / M / G	
Interpretive			wood / metal / other	N / R / M / G	

N - Needs replacement (broken or missing components, or non-functional)
 R - Needs repair (structural damage or otherwise in obvious disrepair)
 M - Needs maintenance (ongoing maintenance issue, primarily cleaning)
 G - Good condition (functional and well-maintained)
 If a facility is given a rating of "N", "R", or "M", provide specific details.

ADDITIONAL COMMENTS/NOTES:
Note the age of the facilities (if known) as well as any signs of overuse.

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Recreation Facilities Inventory and Use Survey – Methodology

- Recreation Visitor Use Data
 - Visitor use data will be collected at each of the five Federal Energy Regulatory Commission (FERC)-approved recreation areas (Duck Creek, Seaplane Base, Monkey Island, Big Hollow and Wolf Creek) through a combination of the following:
 - In-person surveys;
 - Field reconnaissance; and
 - Photographic documentation.
- Surveys will begin at 8:00 AM and continue until 6:00 PM to capture a range of recreational activities throughout the day.
- A team of two technicians will rotate between each of the recreation sites (in random order) and will spend approximately one hour at each site conducting interviews.
- In addition to administering personal interviews, data will be recorded regarding observed recreational activities, number of vehicles, number of recreational users, date, time and weather conditions.

Recreation Facilities Inventory and Use Survey – Methodology

- Visitor use survey schedule:

Month	Survey and Reconnaissance
May	<ul style="list-style-type: none">▪ Two weekend days (one within Memorial Day Weekend)▪ Two randomly selected weekdays
June	<ul style="list-style-type: none">▪ Two weekend days▪ Two randomly selected weekdays
July	<ul style="list-style-type: none">▪ Two weekend days (one within the weekend after July 4th)▪ Two randomly selected weekdays
August	<ul style="list-style-type: none">▪ Two weekend days▪ Two randomly selected weekdays
September	<ul style="list-style-type: none">▪ Two weekend days (one within Labor Day Weekend)▪ Two randomly selected weekdays

Recreation Facilities Inventory and Use Survey – Visitor Use Survey Questionnaire

ON-SITE/IN-PERSON RECREATION INTERVIEW
Pensacola Hydroelectric Project (FERC No. 1494)

Grand River Dam Authority (GRDA) is the licensee, owner, and operator of the 120 megawatt (MW) Pensacola Hydroelectric Project (Project or Pensacola Project) which is licensed by the Federal Energy Regulatory Commission (FERC). The five FERC-approved recreation facilities associated with the Project are all located along the Project's reservoir, Grand Lake. The current operating license for the Project was issued on April 24, 1992, and expires on March 31, 2022. GRDA must file its application with FERC for a new license no later than March 31, 2020. As part of the relicensing process, GRDA is conducting studies on environmental resources to enable FERC to prepare an environmental document. The purpose of this survey is to collect information about use of the Project's five FERC-approved recreation facilities.

Interview Location:	<input type="checkbox"/> Duck Creek Bridge Public Access <input type="checkbox"/> Soapplane Base Public Access <input type="checkbox"/> Big Hollow Public Access	
	<input type="checkbox"/> Monkey Island Public Boat Ramp <input type="checkbox"/> Wolf Creek Public Access	
Home Zip Code:	_____	Date: _____
		Time: _____
Are you:	<input type="checkbox"/> Male <input type="checkbox"/> Female	<input type="checkbox"/> Prefer not to answer
Interviewer:	_____	

Q-1. Regarding the Grand Lake area, do you consider yourself: **(Please circle one)**

1. A regular visitor to this area (3 or more times per year)
2. An occasional visitor (1-2 times per year)
3. An infrequent visitor (Less than 1 time per year)
4. This is my first visit

Q-2. On this trip to the Grand Lake area, when did you arrive?

Arrival Date	Arrival Time
___/___/___	_____AM/PM

When do you expect to leave the Grand Lake area?

Departure Date	Departure Time
___/___/___	_____AM/PM

Q-3. During the last 12 months (including this trip), which month(s) did you visit the Grand Lake area? **(Please select all that apply)**

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Page 1 of 4

Recreation Facilities Inventory and Use Survey – Visitor Use Survey Questionnaire

Q-4. Which of the following recreation areas at or near Grand Lake did you visit for recreation during the past 12 months? **(Please select all that apply)**

- Duck Creek Bridge Public Access
- Seaplane Base Public Access
- Big Hollow Public Access
- Monkey Island Public Boat Ramp
- Wolf Creek Public Access
- None of the above
- Other (Please list)

Q-5. About how many miles did you travel to get to the Grand Lake area?
A. _____ miles

Q-6. Are you staying overnight in the Grand Lake area (not including at your own home) on this trip?
1. Yes 2. No

Q-7. If you answered yes to **Q-6**, at what type of accommodations will you be staying? **(Please select one)**

- 1. RV/Auto/Tent Campground
- 2. Motel/hotel
- 3. Bed and Breakfast
- 4. Vacation or rental home
- 5. Other (Please specify: _____)

Q-8. How many people (including you) are in your group?
A. _____ people

Q-9. Which of the following best describes your group during this trip?

- 1. Individual
- 2. Adult group (over 21)
- 3. Youth group (under 21)
- 4. Family (with children)
- 5. Mixed group (families and friends of various ages)

Q-10. On this trip to the Grand Lake area, in which of the following activities have you or do you expect to participate? **(Please select all that apply)**

1. Bank fishing	5. Picnicking	8. Hunting
2. Boat fishing	6. Swimming	9. Rafting
3. Pleasure Boating	7. Sight-seeing	10. Other (please describe)
4. Personal watercraft		

Page 2 of 4

Recreation Facilities Inventory and Use Survey – Visitor Use Survey Questionnaire

Q-11. Of the activities you circled in Q-10 above, what is the primary activity that you participated in, or expect to participate in, on this visit? (Please write in the corresponding number **from above**)

A. Primary activity # _____

Q-12. If you specified that boating or fishing is the primary activity you participated in please rate the following:

	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
Safety	1	2	3	4	5
Enjoyment	1	2	3	4	5
Crowding	1	2	3	4	5
Overall Experience	1	2	3	4	5

Q-13. If you participated in recreational activities in the Grand Lake area today or in the past, please rate the following:

	Duck Creek	Seaplane Base	Big Hollow	Monkey Island	Wolf Creek
Accessibility					
Parking					
Crowding					
Safety					
Condition of Recreation Facilities					
Available Facilities					
Overall Experience					

Q-14. Please indicate whether or not the water level of the reservoir was a problem for each of the following at the recreation area you are currently visiting.

<i>(Circle one number for each)</i>	Not a problem	A small problem	Neither	A moderate problem	A large problem	No opinion/ Not applicable
Ability to safely swim	5	4	3	2	1	<input type="checkbox"/>
Ability to launch or take out boat	5	4	3	2	1	<input type="checkbox"/>
Ability to safely boat	5	4	3	2	1	<input type="checkbox"/>
Ability to fish along the shoreline	5	4	3	2	1	<input type="checkbox"/>
Ability to access the shoreline	5	4	3	2	1	<input type="checkbox"/>
Scenic quality of the shoreline	5	4	3	2	1	<input type="checkbox"/>
Ability to use docks	5	4	3	2	1	<input type="checkbox"/>
Other (specify)	5	4	3	2	1	<input type="checkbox"/>

Recreation Facilities Inventory and Use Survey – Visitor Use Survey Questionnaire

Q-15. Please share any other comments that you have regarding recreation on Grand Lake near the Pensacola Project: _____

Thank you for completing the Recreation Survey!

Recreation Facilities Inventory and Use Survey – Schedule

Task/Milestone	Anticipated Schedule
Recreation Facility Inventory and Condition Assessment	May 2019
Collect Recreation Visitor Use Data	May – September 2019
Initial Study Report	September 2019
Updated Study Report (as necessary)	September 2020

Questions?

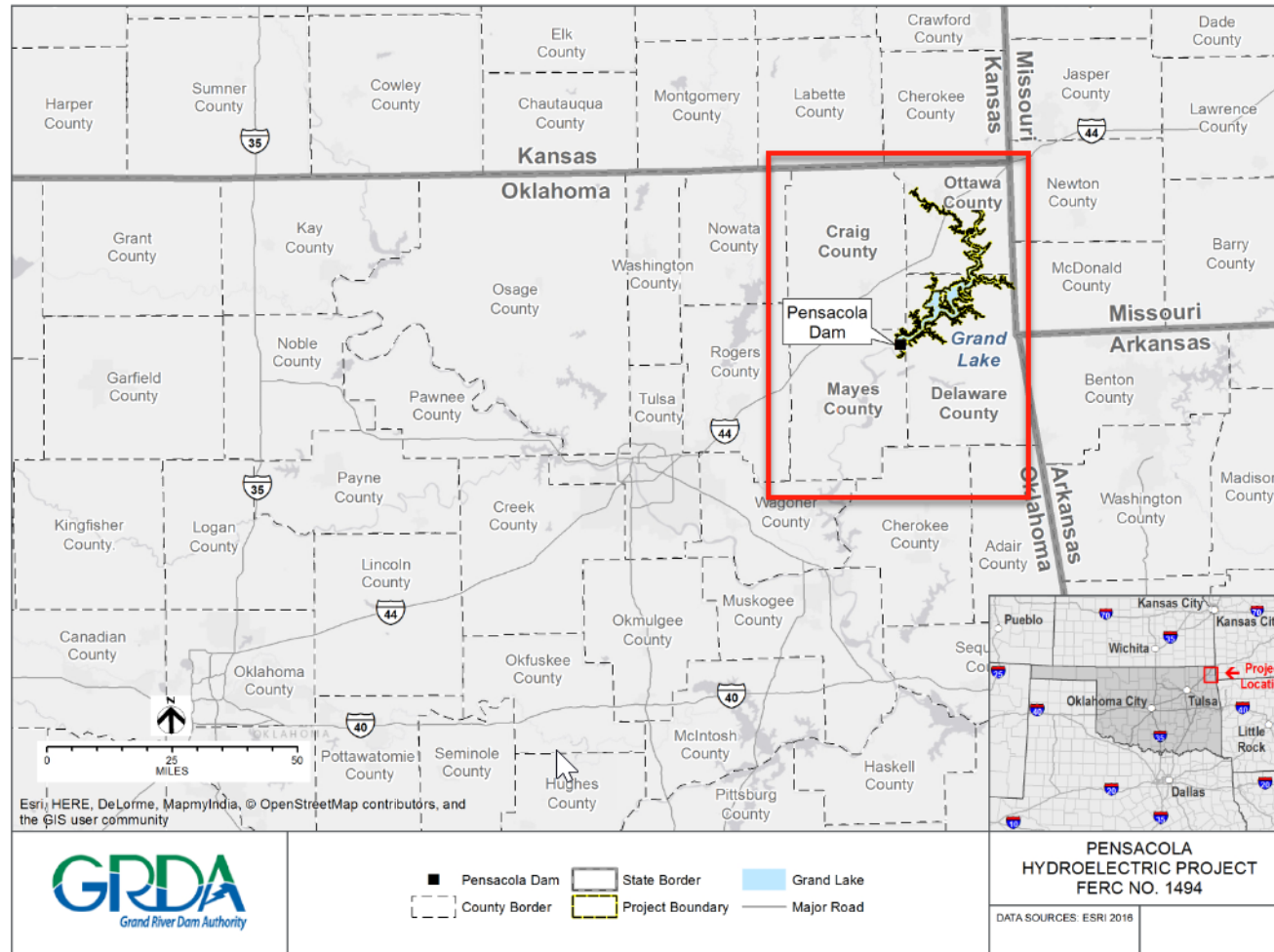


Socioeconomics Study

Socioeconomics Study – Goals and Objectives

- The goal of this study is to gather, synthesize, and report on existing information necessary to qualitatively evaluate the socioeconomic effects of the Pensacola Project in the study area.
- The objectives of the study are to:
 - Describe baseline economic conditions in the Project area.
 - Identify the socioeconomic contribution of the Project in the state and the region.

Socioeconomics Study – Study Area



The entirety of the Pensacola Project resides in Craig, Delaware, Mayes, and Ottawa counties. The study area will primarily focus on these four counties in northeastern Oklahoma.

Socioeconomics Study – Methodology

- A desktop review of available regional socioeconomic data will be completed, gathering the following information:
 - Demographic and economic conditions of the region.
- A qualitative assessment will be completed identifying the following information:
 - State and regional population, income, and employment data;
 - State and regional industry trends (e.g., goods and services; agricultural use);
 - Regional trends in land and resource values (e.g., tribal practices; hunting, fishing, eco-tourism, outfitting, trapping, recreation, tourism, exploration, and mining activities);
 - Pensacola Project’s economic impact on the state and region under current operations; and
 - The potential state and regional economic impact of proposed operations.

Socioeconomics Study – Schedule

Task/Milestone	Anticipated Schedule
Background Data Review and Desktop Analysis	November 2018 – August 2019
Initial (Final) Study Report	September 2019

Questions?



Cultural Resources Study

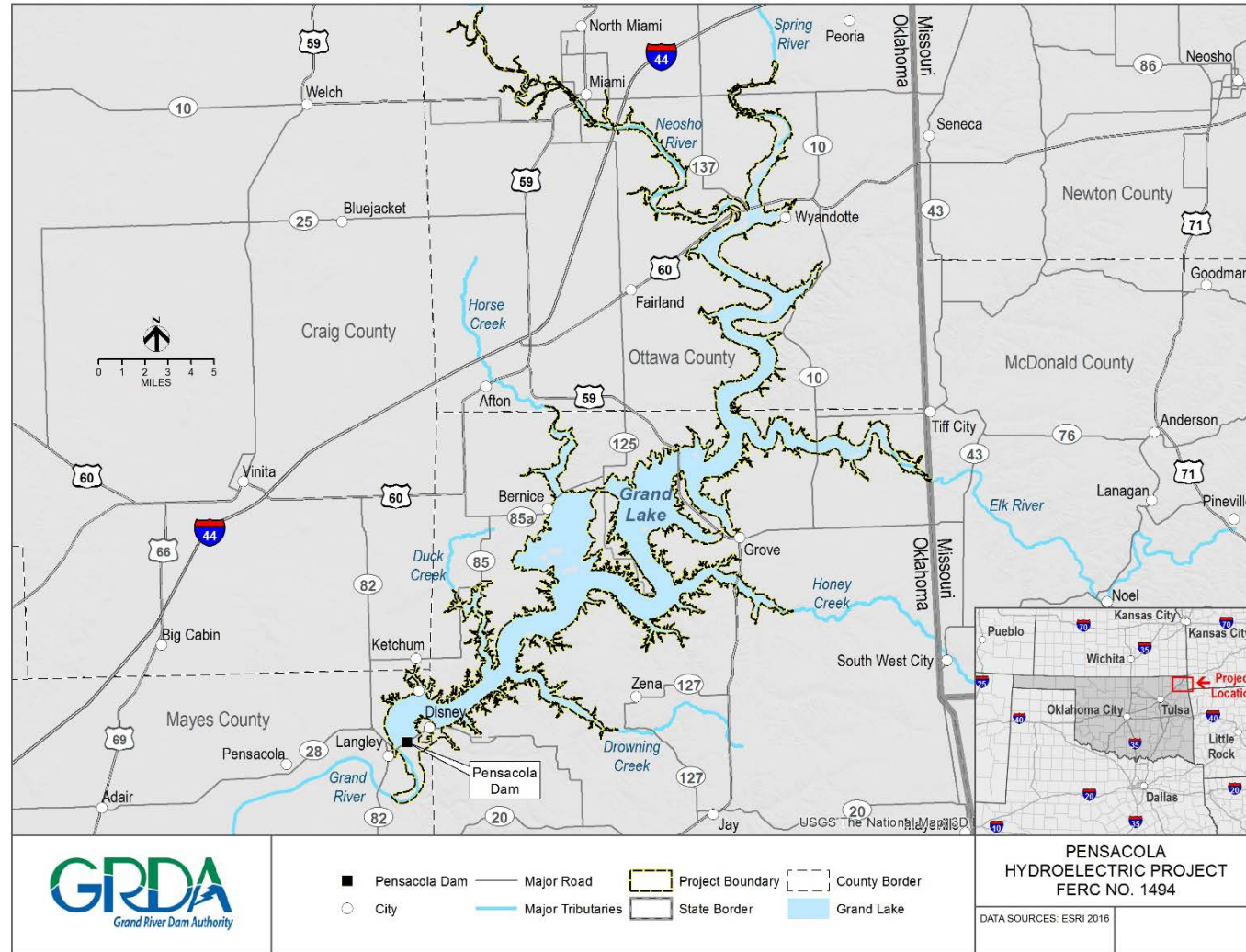
Cultural Resources Study – Goals and Objectives

- Goals and Objectives
 - Consult with the Federal Energy Regulatory Commission (FERC), Oklahoma State Historic Preservation Office (SHPO), Oklahoma Archaeological Survey (OAS), Native American Tribes, Bureau of Indian Affairs (BIA), and other identified parties (collectively, the “Cultural Resources Working Group” or “CRWG”) to determine the Pensacola Project’s Area of Potential Effects (APE).
 - Conduct background research and an archival review.
 - Prepare a Pre-fieldwork Report based on the results of the background literature and archival review.
 - Consult with the CRWG to identify and target appropriate areas of the APE for field investigation during Project relicensing.
 - During Study Years One and Two, conduct field investigations to include a Phase I Reconnaissance Survey (Reconnaissance Survey) of targeted areas which would include a visual inspection and the excavation of limited shovel tests. If sites are identified, delineate in the field.

Cultural Resources Study – Goals and Objectives

- Goals and Objectives (continued)
 - Following Study Year One, prepare a Reconnaissance Survey Report as part of the Initial Study Report (ISR) that provides study results and recommendations for identified archaeological resources and/or additional investigations, as necessary. Following Study Year Two, prepare the same report as part of the Updated Study Report (USR) for the sites identified during the Study Year Two investigation.
 - Determine appropriate management measures for identified resources and the need for additional resource investigations in consultation with the Cultural Resources Working Group (CRWG).
 - Develop an Historic Properties Management Plan (HPMP) in consultation with the CRWG to provide appropriate measures for the management of historic properties within the Project's Area of Potential Effects (APE) through the term of the new license. The HPMP would be prepared during the Integrated Licensing Process (ILP) and filed with the Federal Energy Regulatory Commission (FERC) as part of GRDA's relicensing application. As appropriate, the HPMP may include provisions for additional studies to be conducted post-licensing, on a schedule determined in consultation with the CRWG.

Cultural Resources Study – Proposed Area of Potential Effects (Study Area)



Cultural Resources Study – Methodology

- Area of Potential Effects (APE)
 - GRDA has proposed to define the APE for this undertaking as all lands within the Federal Energy Regulatory Commission (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.
 - Based on the results of hydraulic modeling and other studies, the geographic extent of the APE may be refined in consultation with the Cultural Resources Working Group (CRWG) in Study Year Two.
- Background Research and Archival Review
 - GRDA will conduct background research and an archival review to inform the specific research design and the historic and environmental contexts of the APE.

Cultural Resources Study – Methodology

- **Background Research and Archival Review (continued)**
 - GRDA will review relevant information, including:
 - Information on archaeological sites, historic architectural resources, and previous cultural resources studies on file with Oklahoma Archaeological Survey (OAS), Oklahoma State Historic Preservation Office (SHPO), and Native American Tribes;
 - Available reports on previous cultural resources studies conducted within the Area of Potential Effects (APE);
 - A review of the Oklahoma Landmarks Inventory (OLI) and Oklahoma’s National Register of Historic Places (NRHP) listings;
 - Historic maps and aerial photographs of the APE, including relevant plat and Sanborn maps;
 - Aerial photographs of the APE;
 - Relevant documents related to Project construction;
 - Relevant information available from local repositories;
 - Information on the current and historical environment, including mapped soils, bedrock geology, geomorphology, physiography, topography, and hydrology in the vicinity of the APE;
 - Relevant historical accounts of the Project area;
 - Relevant management plans for the Project;
 - Historic context statements for Management Region 3 available from the Oklahoma SHPO; and
 - Any additional relevant information made available by the Cultural Resources Working Group (CRWG) or other relicensing participants.
 - As part of the background research and archival review, GRDA may undertake limited field observations to better characterize and document existing shoreline conditions at the reservoir and inform the Pre-fieldwork Report.

Cultural Resources Study – Methodology

- Pre-fieldwork Report

- GRDA will prepare a Pre-fieldwork Report based on the results of the background literature review that will identify and map:

- Previously reported archaeological sites, historic resources, and relevant map-documented structures;
 - Areas with archaeological sensitivity, such as pre-Project terrace landforms, the outlets of tributary streams, and other landscape features; pre-Project trails and roads; and historic towns, villages, or other population centers; and
 - Areas identified within the Area of Potential Effects (APE) where erosion or other Project-related effects are occurring.

Cultural Resources Study – Methodology

- Reconnaissance Surveys

- Based on the Pre-fieldwork Report, GRDA will consult with the Cultural Resources Working Group (CRWG) to identify high-priority areas and sites within the Area Potential Effects (APE) for study during the 2-year Integrated Licensing Process (ILP) for purposes of informing the Federal Energy regulatory Commission’s (FERC) analyses under both Section 106 and the National Environmental Policy Act (NEPA).
 - GRDA will conduct a Reconnaissance Survey of the Project’s APE during Study Year One and Study Year Two.
 - Field methods include visual reconnaissance of exposed portions of the reservoir’s shoreline within the APE; if archaeological material is observed, site boundaries will be delineated.
 - Visual reconnaissance may be augmented by limited subsurface testing (e.g., shovel test pits) to record site depth, stratigraphy, and other features.
 - Sites will be recorded and geo-located, and observed artifacts, features, or other cultural material will be collected (as appropriate).
 - If individual historic architectural resources or districts that potentially meet the National Register of Historic Places (NRHP) criteria are observed, GRDA will geo-locate the resource, delineate the boundary, and collect relevant information.

Cultural Resources Study – Methodology

- Reconnaissance Surveys (continued)
 - Following Study Year One, GRDA will prepare a Reconnaissance Survey Report as part of the Initial Study Report (ISR).
 - GRDA will consult with the Cultural Resources Working Group (CRWG) regarding the results and recommendations of the Study Year One Reconnaissance Survey Report.
 - During Study Year Two, GRDA will conduct a second Reconnaissance Survey of the Area of Potential Effects (APE). The locations of the Study Year Two survey will be determined in consultation with the CRWG. GRDA expects that the results of the Hydrologic and Hydraulic Modeling Study will assist GRDA and the CRWG in refining the appropriate areas for study during Study Year Two, if needed.
 - Following Study Year Two, GRDA will prepare a Reconnaissance Survey Report as part of the Updated Study Report (USR).
 - GRDA will consult with the CRWG regarding the results and recommendations of the Study Year Two Reconnaissance Survey Report.

Cultural Resources Study – Methodology

- Reconnaissance Surveys (continued)
 - Information on cultural resources from this Reconnaissance Survey will be used to determine the potential for adverse effects on identified archaeological and historic resources created by the continued operation of the Project and to support development of the Historic Properties Management Plan (HPMP).
 - Where the potential for adverse effects from continued operation of the Project is determined, the HPMP will describe appropriate management or treatment measures that may include formal site evaluations to determine the National Register of Historic Places (NRHP)-eligibility of a site or specific mitigation and treatment measures.

Cultural Resources Study – Methodology

- Traditional Cultural Properties (TCPs)
 - TCPs are properties of traditional religious and cultural importance to a Native American Tribe that meet the National Register criteria.
 - GRDA recognizes the special expertise that the Native American Tribes have in identifying properties that have traditional and religious significance to their communities. As such, GRDA will consult with Native American Tribes to develop specific methods and approaches to conducting a TCP inventory for lands within the Area of Potential Effects (APE).
 - GRDA proposes to consult with Native American Tribes during Study Year One to develop the specific TCP study methods and to initiate the TCP study during Study Year Two.

Cultural Resources Study – Methodology

- Programmatic Agreement (PA)
 - GRDA anticipates that the Federal Energy Regulatory Commission (FERC) will enter into a PA with the Oklahoma State Historic Preservation Office (SHPO) for managing historic properties that may be affected by Project operations or activities during the term of the new license.
 - The PA will formally meet the Commission’s obligations under the National Historic Preservation Act (NHPA) Section 106 for the relicensing of the Project, and is likely to provide for GRDA to implement an Historic Properties Management Plan (HPMP) for the long-term management of historic properties during the new license term.

Cultural Resources Study – Methodology

- Historic Properties Management Plan (HPMP)
 - In anticipation of a Programmatic Agreement (PA), GRDA will prepare an HPMP providing measures that will direct GRDA's management of historic properties within the Project's Area of Potential Effects (APE) throughout the term of the new license.
 - GRDA will develop the HPMP in consultation with the Cultural Resources Working Group (CRWG); through this consultation, GRDA and the CRWG will develop specific management measures to be incorporated into the HPMP.
 - The HPMP will be developed in accordance with the Guidelines for the Development of Historic Properties Management Plans for Federal Energy Regulatory Commission (FERC) Hydroelectric Projects, promulgated by the FERC and the Advisory Council on Historic Preservation.

Cultural Resources Study – Methodology

- Historic Properties Management Plan (HPMP) (continued)
 - GRDA anticipates that the HPMP will address the following items:
 - Any additional studies necessary to assist in the identification or management of historic properties within the Area of Potential Effects (APE), including a schedule for completing such studies;
 - A plan and schedule for completing Reconnaissance Surveys of areas within the APE identified in consultation with the Cultural Resources Working Group (CRWG), including areas where Reconnaissance Surveys could not be completed during the Integrated Licensing Process (ILP);
 - Potential effects on historic properties resulting from the continued operation and maintenance of the Project;
 - Management and treatment measures for historic properties (including any identified Traditional Cultural Properties [TCPs]);
 - Protection of historic properties threatened by potential ground-disturbing or land-clearing activities during the term of the new license;
 - Protection of historic properties threatened by other direct or indirect Project-related activities, including routine Project maintenance;

Cultural Resources Study – Methodology

- Historic Properties Management Plan (HPMP) (continued)
 - The resolution of unavoidable adverse effects on historic properties;
 - Treatment and disposition of any human remains that are discovered;
 - Provisions for unanticipated discoveries of previously unidentified cultural resources within the Area of Potential Effects (APE);
 - A dispute resolution process;
 - Categorical exclusions from further review of effects;
 - Public interpretation of the historic and archaeological values of the Project, if any;
 - Specific measures and a schedule for implementing the HPMP;
 - Roles and responsibilities of GRDA, the Oklahoma State Historic Preservation Office (SHPO), Oklahoma Archaeological Survey (OAS), Native American Tribes, and other individuals and organizations in regards to implementation of the HPMP; and
 - Coordination with the Cultural Resources Working Group (CRWG) during implementation of the HPMP.

Cultural Resources Study – Schedule

Task/Milestone	Anticipated Schedule
Consultation with the CRWG to define the APE	May 2018
Background research and archival review	September 2018 – April 2019
Consultation to develop TCP Inventory methods	September 2018
Pre-fieldwork Study Report	April 2019
Study Year One Reconnaissance Survey	May – August 2019
Study Year One Reconnaissance Survey Report	September 2019
Initial Study Report	September 2019
Study Year Two Reconnaissance Survey	May – August 2020
Initiate TCP Inventory	May 2020
Study Year Two Reconnaissance Survey Report	September 2020
Updated Study Report	September 2020
File HPMP with the Commission	With relicensing application

Questions?