GRDA
Grand River Dam Authority

September 24, 2018

Via E-Filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, D.C. 20426

Subject: **Pensacola Hydroelectric Project (FERC No. 1494-438); Filing of Revised Study Plan**

Dear Secretary Bose:

The Grand River Dam Authority (GRDA) hereby electronically files its Revised Study Plan (RSP) for the Pensacola Hydroelectric Project (FERC No. 1494) (the Project). The RSP is filed pursuant to the Integrated Licensing Process (ILP) process plan and schedule included in the Commission's January 12, 2018 Scoping Document 1 (SD1), as modified in its August 10, 2018 Notice of Modification of Procedural Schedule. A copy of this letter and the RSP has been posted to GRDA's Pensacola Project relicensing website (http://www.grda.com/pensacola-hydroelectric-project-relicensing/).

GRDA filed a Notice of Intent (NOI) and Pre-Application Document (PAD) for the relicensing of the Project on February 1, 2017 pursuant to the Federal Energy Regulatory Commission's (FERC or Commission) ILP rules, 18 CFR §§ 5.5 and 5.6. Comments on the PAD and study requests were received in February and March 2018. On April 27, 2018, GRDA filed its Proposed Study Plan (PSP).

Pursuant to 18 CFR § 5.11(e), GRDA conducted study plan meetings on May 30 and 31, 2018 to discuss GRDA's proposed studies and relicensing parties' study requests. GRDA also held a Cultural Resources Working Group (CRWG) meeting on May 31, met with the Advisory Council on Historic Preservation (ACHP) on August 14, and the Oklahoma State Historic Preservation Office (SHPO) and Oklahoma Archaeological Survey (OAS) on August 22, and participated in a Tribal Consultation meeting to further discuss the proposed studies on August 21.

Interested parties had the opportunity to file comments on the PSP, including any revised information or study requests, by July 26, 2018. This RSP provides FERC, resource agencies, Native American tribes, and other relicensing participants with a study plan, submitted to FERC for approval, which incorporates—based on the many comments received—substantial changes from the original PSP. In accordance with 18 CFR § 5.13(a), this RSP also includes a summary of the comments on the PSP, GRDA's response to those comments, and efforts made to resolve differences over study requests.

As required by the Commission's August 10, 2018 Notice of Modification of Procedural Schedule, comments on the RSP must be filed with FERC by October 24, 2018. The Commission's Study Plan Determination is expected by November 8, 2018.

GRDA appreciates the opportunity to work with the Commission and other interested parties in this ongoing effort to relicense the Project. If there are any questions or comments regarding this submittal, please contact me by phone at (918) 256-0723 or by email at dtownsend@grda.com.

Sincerely,

Darrell Townsend II, Ph.D.
Vice President
Grand River Dam Authority

Enclosure
cc: Distribution list (see attached)

Distribution List
September 24, 2018 (Revised Study Plan Filing)

* Denotes correspondence was mailed to relicensing participants without a known email address.

Federal Agencies:

Dr. John Eddins
Advisory Council on Historic Preservation
Federal Permitting, Licensing and Assistance Section
401 F Street NW, Suite 308
Washington DC 20001-2637
jeddins@achp.gov

Mr. Andrew Commer, Chief
U.S. Army Corps of Engineers, Tulsa District
Attn: CESWT-RO (Regulatory Branch)
2488 East 81st Street
Tulsa, OK 74137
Andrew.Commer@usace.army.mil

Mr. Mike Abate
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
mike.r.abate@usace.army.mil

Ms. Jennifer Aranda
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
jennifer.a.aranda@usace.army.mil

Mr. William Chatron
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
william.a.chatron@usace.army.mil

Ms. Tonya Dunn
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
tonya.n.dunn@usace.army.mil

Mr. Greg Estep
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
gregory.estep@usace.army.mil

Mr. Scott Henderson
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
scott.a.henderson@usace.army.mil

Mr. Mike Love
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
michael.s.love@usace.army.mil

Mr. Steve Nolen
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
stephen.l.nolen@usace.army.mil

Ms. Dawn Rice
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
dawn.rice@usace.army.mil

Mr. Terry Rupe
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
terry.d.rupe@usace.army.mil

Mr. David Williams
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
david.j.williams@usace.army.mil

Ms. Eva Zaki-Dellitt
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
eva.a.zaki-dellitt@usace.army.mil

Mr. Johnny Bell
FERC Hydropower Coordinator
U.S. Army Corps of Engineers
2488 East 81st Street
Tulsa, OK 74137
johnny.l.bell@usace.army.mil

Mr. Eddie Streater
Regional Director
U.S. Bureau of Indian Affairs
Eastern Oklahoma Regional Office
PO Box 8002
Muskogee, OK 74401-6206
eddie.streater@bia.gov

Ms. Jessie Durham
Deputy Regional Director
U.S. Bureau of Indian Affairs
Eastern Oklahoma Regional Office
PO Box 8002
Muskogee, OK 74401-6206
jessie.durham@bia.gov

Mr. Mosby Halterman
Environmental Protection Specialist
U.S. Bureau of Indian Affairs
PO Box 8002
Muskogee, OK 74401
mosby.halterman@bia.gov

Ms. Allison Ross
Division Director
U.S. Bureau of Indian Affairs
Eastern Regional Office
PO Box 8002
Muskogee, OK 74401
allison.ross@bia.gov

Ms. Lisa Atwell
U.S. Bureau of Indian Affairs
Eastern Regional Office
PO Box 8002
Muskogee, OK 74401
lisa.atwell@bia.gov

Ms. Kate Moore
Regional Archaeologist
U.S. Bureau of Indian Affairs
Eastern Oklahoma Regional Office
Division of Environmental & Cultural
Resource Management
PO Box 8002
Muskogee, OK 74401
kate.moore@bia.gov

Mr. James Schock
Regional Director
U.S. Bureau of Indian Affairs
Southern Plains Office
PO Box 368
Anadarko, OK 73005
james.schock@bia.gov

Ms. Crystal Keys
Water Program Manager
U.S. Bureau of Indian Affairs
Southern Plains Office
PO Box 368
Anadarko, OK 73005
crystal.keys@bia.gov

Mr. John Worthington
Natural Resources Officer
U.S. Bureau of Indian Affairs
Southern Plains Regional Office
PO Box 368
Anadarko, OK 73005
john.worthington@bia.gov

Mr. Robert Pawelek
Field Manager
U.S. Bureau of Land Management
Oklahoma Field Office
201 Stephenson Parkway, Suite 1200
Norman, OK 73072
rpawelek@blm.gov

U.S. Department of the Army *
1645 Randolph Road
Fort Sill, OK 73503

Mr. Conor Cleary
U.S. Department of the Interior
Tulsa's Field Office of the Solicitor
7906 East 33rd Street, Suite 100
Tulsa, OK 74145
conor.cleary@sol.doi.gov

Ms. Kimeka Price
NEPA Project Manager
U S Environmental Protection Agency
Region 6
Fountain Place
1445 Ross Avenue
Dallas, TX 75202-2760
price.kimeka@epa.gov

Mr. Ken Collins
U.S. Fish and Wildlife Service
9014 E 21st Street
Tulsa, OK 74129-1428
ken_collins@fws.gov

Ms. Jonna Polk
U.S. Fish and Wildlife Service
9014 E 21st Street
Tulsa, OK 74129-1428
jonna_polk@fws.gov

Mr. Kevin Stubbs
Field Supervisor
U.S. Fish and Wildlife Service
9014 E 21st Street
Tulsa, OK 74129-1428
kevin_stubbs@fws.gov

Chief Tony Tooke
U.S. Forest Service
1400 Independence Avenue, SW
Washington, DC 20250
ttooke@fs.fed.us

Dr. William Andrews, Director
U.S. Geological Survey
Oklahoma Water Science Center
202 NW 66th Street, Building 7
Oklahoma City, OK 73116
wandrews@usgs.gov

Acting Chief Leonard Jordan
U.S. Natural Resources Conservation Service
1400 Independence Avenue, SW Room 5105-S
Washington DC 20250
Leonard.Jordan@wdc.usda.gov

Sue Masica
Regional Director
National Park Service
12795 Alameda Parkway
Denver, CO 80225
IMRextrev@nps.gov

Ms. Nicole McGavock
National Weather Service
Tulsa, OK Weather Forecast Office
10159 E 11th Street, Suite 300
Tulsa, OK 74128
nicole.mcgavock@noaa.gov

Mr. James Paul
National Weather Service
Tulsa, OK Weather Forecast Office
10159 E 11th Street Suite 300
Tulsa, OK 74137
james.paul@noaa.gov

State Agencies:

Dr. Kary Stackelbeck
State Archeologist
Oklahoma Archeological Survey
University of Oklahoma
111 East Chesapeake Street, Room 102
Norman, OK 73019-5111
kstackelbeck@ou.edu

Ms. Deby Snodgrass
Executive Director
Secretary of Commerce and Tourism
Oklahoma Department of Commerce
900 North Stiles Avenue
Oklahoma City, OK 73104
deby.snodgrass@okcommerce.gov

Mr. Brooks Tramell
Director of Monitoring, Assessment & Wetlands
Oklahoma Conservation Commission
2800 North Lincoln Boulevard, Suite 200
Oklahoma City, OK 73105
brooks.tramell@conservation.ok.gov

Ms. Shanon Phillips
Director of Water Quality Division
Oklahoma Conservation Commission
2800 North Lincoln Boulevard, Suite 200
Oklahoma City, OK 73105
shanon.phillips@conservation.ok.gov

Mr. Tim Rhodes *
Director of Administration
Oklahoma Corporation Commission
2101 North Lincoln Boulevard
Oklahoma City, OK 73105

Mr. Jim Reese
Commissioner
Oklahoma Department of Agriculture
Food and Forestry
2800 North Lincoln Boulevard, Suite 100
Oklahoma City, OK 73105
jim.reese@ag.ok.gov

Mr. Joe Long
Environmental Programs Manager
Watershed Planning Section
Oklahoma Department of Environmental Quality
PO Box 1677
Oklahoma City, OK 73101-1677
joe.long@deq.ok.gov

Ms. Elena Jigoulina
Environmental Programs Specialist
Oklahoma Department of Environmental Quality
PO Box 1677
Oklahoma City, OK 73101-1677
elena.jigoulina@deq.ok.gov

Mr. Charles Kerns
Oklahoma Office of Emergency Management
PO Box 53365
Oklahoma City, OK 73152-3365
charles.kerns@oem.ok.gov

Ms. Valauna Grissom
Secretary
Oklahoma Department of Health
1000 NE 10th Street
Oklahoma City, OK 73117
VaLaunag@health.ok.gov

Mr. Mike Patterson
Executive Director
Oklahoma Department of Transportation
200 NE 21st Street
Oklahoma City, OK 73105
mpatterson@odot.org

Mr. Dick Dutton *
Executive Director
Oklahoma Tourism and Recreation Department
900 North Stiles Avenue
Oklahoma City, OK 73104

Ms. Janet Logan
State Parks and Resorts
Oklahoma Tourism and Recreation Department
900 North Stiles Avenue
Oklahoma City, OK 73104
Janet.Logan@travelOK.com

Mr. Barry Bolton
Chief of Fisheries Division
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
barry.bolton@odwc.ok.gov

Mr. JD Strong
Director
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
jd.strong@odwc.ok.gov

Mr. Wade Free
Assistant Director
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
wade.free@odwc.ok.gov

Mr. Josh Johnston
NE Region Fisheries Supervisor
Oklahoma Department of Wildlife Conservation
PO Box 1201
Jenks, OK 74037
josh.johnston@odwc.ok.gov

Mr. Josh Richardson
Wildlife Biologist
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
josh.richardson@odwc.ok.gov

Mr. Alan Peoples
Chief of Wildlife Division
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
alan.peoples@odwc.ok.gov

Mr. Brad Johnston
Fisheries Biologist
Oklahoma Department of Wildlife Conservation
61091 E 120 Road
Miami, OK 74354
brad.johnston@odwc.ok.gov

Mr. Ken Cunningham
Assistant Chief of Fisheries
Oklahoma Department of Wildlife Conservation
PO Box 53465
Oklahoma City, OK 73152
kenneth.cunningham@odwc.ok.gov

Mr. Bruce Burton
NE Region Wildlife Supervisor
Oklahoma Department of Wildlife Conservation
9097 N 34th Street West
Porter, OK 74454
bruce.burton@odwc.ok.gov

Ms. Lynda Ozan
Deputy State Historic Preservation Officer
Oklahoma Historical Society
800 Nazih Zuhdi Drive
Oklahoma City, OK 73105-7917
lozan@okhistory.org

Ms. Catharine Wood
Historical Archaeologist/Section 106 Coordinator
Oklahoma Historical Society
800 Nazih Zuhdi Drive
Oklahoma City, OK 73105-7917
cwood@okhistory.org

Ms. Julie Cunningham
Executive Director
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
julie.cunningham@owrb.ok.gov

Mr. William Cauthron
Acting Director, Water Quality Division
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
bill.cauthron@owrb.ok.gov

Ms. Nikki Davis
Staff Secretary, Water Quality Division
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
nikki.davis@owrb.ok.gov

Mr. Lance Phillips
Environmental Programs Manager
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
lance.phillips@owrb.ok.gov

Mr. Monty Porter
Section Head, Water Quality Standards
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
monty.porter@owrb.ok.gov

Mr. Kent Wilkins
Planning and Management Division
Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
kent.wilkins@owrb.ok.gov

Ms. Brittnee Preston
Director of Federal and Congressional Affairs
Oklahoma Water Resources Board
Oklahoma Department of Wildlife Conservation
23422 Spice Bush Terrace
Ashburn, VA 20148
brittnee.preston@owrb.ok.gov

Mr. Luke Tallant *
Office of State Fire Marshal
2401 NW 23rd Street, Suite 4
Oklahoma City, OK 73107

Tribal Organizations:

Inter-Tribal Council Inc. *
PO Box 1308
Miami, OK 74355

Chief Nelson Harjo *
Alabama-Quassarte Tribal Town
PO Box 187
Wetumka, OK 74883

Chairman Bobby Komardley *
Apache Tribe of Oklahoma
511 E Colorado
Anadarko, OK 73005

Chairman Tamara Francis-Fourkiller
Caddo Nation of Oklahoma
PO Box 487
Binger, OK 73009
tffourkiller.cn@gmail.com

Mr. Phil Cross
Acting Tribal Historic Preservation Officer
Caddo Nation
PO Box 487
Binger, OK 73009
pcross@caddonation.org

Chief Bill John Baker *
Cherokee Nation
PO Box 948
Tahlequah OK 74465

Ms. Elizabeth Toombs
Cherokee Nation
Tribal Historic Preservation Officer
PO Box 948
Tahlequah, OK 74465
elizabeth-toombs@cherokee.org

Mr. Tom Elkins
Administrator
Cherokee Nation Environmental Programs
PO Box 948
Tahlequah, OK 74465
tom-elkins@cherokee.org

Ms. Kim Penrod
Director, Cultural Resources/106
Delaware Nation
31064 State Highway 281
PO Box 825
Anadarko, OK 73005
kpenrod@delawarenation.com

Ms. Deborah Dotson
President
Delaware Nation
PO Box 825
Anadarko, OK 73005
ddotson@delawarenation.com

Chief Chester Brooks
Delaware Tribe of Indians
170 NE Barbara
Bartlesville OK 74006
cbrooks@delawaretribe.org

Dr. Brice Obermeyer
Historic Preservation Office
Delaware Tribe of Indians
1200 Commercial Street
Roosevelt Hall, Room 212
Emporia KS 66801
bobermeyer@delawaretribe.org

Chief Glenna J. Wallace
Eastern Shawnee Tribe of Oklahoma
70500 E 128 Road
Wyandotte, OK 74370
gjwallace@estoo.net

Mr. Brett Barnes
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
70500 E 128 Road
Wyandotte, OK 74370
bbarnes@estoo.net

Chairman Bobby Walkup *
Iowa Tribe of Oklahoma
335588 E 750 Road
Perkins, OK 74059

Ms. Renee Hagler *
Acting Tribal Administrator
Iowa Tribe of Oklahoma
335588 E 750 Road
Perkins, OK 74059

Ms. Kellie Lewis
Acting Tribal Historic Preservation Officer
Kiowa Tribe Office of Historic Preservation
PO Box 369
Carnegie, OK 73015
kellie@tribaladminservices.org
ivy@tribaladminservices.org

Ms. Regina Gasco-Bentley *
Little Traverse Bay Bands of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740

Chief Douglas G. Lankford
Miami Tribe of Oklahoma
PO Box 1326
Miami, OK 74354
dlankford@miamination.com

Ms. Robin Lash
General Counsel
Miami Tribe of Oklahoma
PO Box 1326
Miami, OK 74354
rlash@miamination.com

Mr. Joe Halloran
Counsel for Miami Nation
Jacobson Law Group
180 East 5th Street, Suite 940
St. Paul, MN 55101
jhalloran@thejacobsonlawgroup.com

Mr. Phil Mahowald
Jacobson Law Group
180 East 5th Street, Suite 940
St. Paul, MN 55101
pmahowald@thejacobsonlawgroup.com

Mr. Jeff Holth
Jacobson Law Group
180 East 5th Street, Suite 940
St. Paul, MN 55101
jholth@thejacobsonlawgroup.com

Chief Bill Follis
Modoc Tribe of Oklahoma
515 G Street SE
Miami, OK 74354
modoctribe@cableone.net

Chief James Floyd
Muscogee (Creek) Nation
PO Box 580
Okmulgee, OK 74447
jfloyd@mcn-nsn.gov

Ms. RaeLynn Butler
Historic and Cultural Preservation
Department, Manager
Muscogee (Creek) Nation
PO Box 580
Okmulgee, OK 74447
raebutler@mcn-nsn.gov

Chief Geoffrey Standing Bear *
Osage Nation
627 Grandview Avenue
Pawhuska, OK 74056

Mr. James Munkres
Archaeologist
Osage Nation Historic Preservation Office
627 Grandview Avenue
Pawhuska, OK 74056
jmunkres@osagenation-nsn.gov

Dr. Andrea Hunter
Osage Nation Historic Preservation Office
627 Grandview Avenue
Pawhuska, OK 74056
ahunter@osagenation-nsn.gov

Chairman John Shotton
Otoe-Missouria Tribe of Indians
8151 Hwy 177
Red Rock, OK 74651
jshotton@omtribe.org

Ms. Elsie Whitehorn
Tribal Historic Preservation Officer
Otoe-Missouria Tribe of Indians
8151 Hwy 177
Red Rock, OK 74651
ewhitehorn@omtribe.org

Chief Ethel Cook
Ottawa Tribe of Oklahoma
PO Box 110
Miami, OK 74354
cethel@cableone.net

Ms. Rhonda Hayworth
Tribal Historic Preservation Officer
Ottawa Tribe of Oklahoma
PO Box 110
Miami, OK 74354
rhonda.oto@gmail.com

Chief Craig Harper
Peoria Tribe of Oklahoma
118 South Eight Tribes Trail
Miami, OK 74354
chiefharper@peoriatribe.com

Mr. Logan Pappenfort
Special Project Manager
NAGPRA Representative
Peoria Tribe of Oklahoma
118 S Eight Tribes Trail
PO Box 1527
Miami, OK 74355-1527
lpappenfort@peoriatribe.com

Chairman John Berrey *
Quapaw Tribe of Oklahoma
PO Box 765
Quapaw, OK 74363

Mr. Everett Bandy
Quapaw Tribe of Oklahoma
PO Box 765
Quapaw, OK 74363
ebandy@quapawtribe.com

Chief Kay Rhoads *
Sac and Fox Nation of Oklahoma
920883 S Hwy 99, Building A
Stroud, OK 74079

Sandra Kay Massey
Historic Preservation Program
Sac and Fox Nation of Oklahoma
920883 S Hwy 99, Building A
Stroud, OK 74079
carol.butler@sacandfoxnation-nsn.gov

Chief William Fisher
Seneca-Cayuga Nation
PO Box 453220
Grove, OK 74345-3220
wfisher@sctribe.com

Mr. William Tarrant
Tribal Historic Preservation Officer
Seneca-Cayuga Nation
23701 South 665 Road
Grove, OK 74344
wtarrant@sctribe.com

Mr. Rick Dubois
Environmental Director
Seneca-Cayuga Nation
PO Box 453220
Grove, OK 74345-3220
rdubois@sctribe.com

Mr. Micco Emarthla
Environmental Specialist
Seneca Cayuga Nation
PO Box 453220
Grove, OK 74345-3220
memarthla@sctribe.com

Chief Ron Sparkman
Shawnee Tribe of Oklahoma
PO Box 189
Miami, OK 74354
rondede1@gmail.com

Ms. Jodi Hayes *
Tribal Administrator
Shawnee Tribe of Oklahoma
PO Box 189
Miami, OK 74355

President Russell Martin *
Tonkawa Tribe of Oklahoma
1 Rush Buffalo Road
Tonkawa OK 74653

Chief Joe Bunch*
United Keetoowah Band of Cherokees
PO Box 746
Tahlequah, OK 74465

Mr. Eric Oosahwee-Voss *
Tribal Historic Preservation Officer
United Keetoowah Band of Cherokees
PO Box 1245
Tahlequah, OK 74465

Ms. Sheila Bird
United Keetoowah Band of Cherokees
PO Box 1245
Tahlequah, OK 74465
sbird@ukb-nsn.gov

President Terri Parton
Wichita and Affiliated Tribes
PO Box 729
Anadarko, OK 73005
terri.parton@wichitatribe.com

Mr. Gary McAdams
Tribal Historic Preservation Officer
Wichita and Affiliated Tribes
PO Box 729
Anadarko, OK 73005
gary.mcadams@wichitatribe.com

Chief Billy Friend
Wyandotte Tribe of Oklahoma
64700 East Highway 60
Wyandotte, OK 74370
bfriend@wyandotte-nation.org

Ms. Sherri Clemons
Tribal Historic Preservation Officer
Wyandotte Tribe of Oklahoma
64700 East Highway 60
Wyandotte, OK 74370
sclemons@wyandotte-nation.org

Mr. Norman Hildebrand, Jr.
Second Chief
Wyandotte Nation
64700 East Highway 60
Wyandotte, OK 74370
nhildebrand@wyandotte-nation.org

Mr. Christen Lee
Environmental Director
Wyandotte Nation
64700 East Highway 60
Wyandotte, OK 74370
clee@wyandotte-nation.org

Congressional Delegation:

The Honorable James Mountain Inhofe
United States Senate
205 Russell Senate Office Building
Washington DC 20515
jennie_wright@inhofe.senate.gov

The Honorable James Lankford
United States Senate
316 Hart Senate Office Building
Washington DC 20510
jeff_underwood@lankford.senate.gov

The Honorable Jim Bridenstine
216 Cannon House Office Building
Washington DC 20515
joseph.kaufman@mail.house.gov

The Honorable Markwayne Mullin
1113 Longworth House Office Building
Washington DC 20515
debbie.dooley@mail.house.gov

The Honorable Michael Bergstrom
Oklahoma State Senate, District 1
2300 North Lincoln Boulevard, Room 522
Oklahoma City, OK 73105
bergstrom@oksenate.gov

The Honorable Marty Quinn
Oklahoma State Senate, District 2
2300 North Lincoln Boulevard, Room 417B
Oklahoma City, OK 73105
quinn@oksenate.gov

The Honorable Wayne Shaw
Oklahoma State Senate, District 3
2300 North Lincoln Boulevard, Room 325
Oklahoma City, OK 73105
shaw@oksenate.gov

The Honorable Josh West
House of Representatives, District 5
2300 North Lincoln Blvd, Room 242A
Oklahoma City, OK 73105
josh.west@okhouse.gov

The Honorable Chuck Hoskin
House of Representatives, District 6
2300 North Lincoln Boulevard, Room 509
Oklahoma City, OK 73105
chuck.hoskin@okhouse.gov

The Honorable Ben Loring
House of Representatives, District 7
2300 North Lincoln Boulevard
Oklahoma City, OK 73105
ben.loring@okhouse.gov

The Honorable Tom Gann
House of Representatives, District 8
2300 North Lincoln Boulevard, Room 500
Oklahoma City, OK 73105
tom.gann@okhouse.gov

The Honorable Mary Fallin*
Governor of Oklahoma
2300 North Lincoln Boulevard, Suite 212
Oklahoma City, OK 73105

The Honorable Michael Teague
Secretary of Energy and Environment
204 North Robison, Suite 1010
Oklahoma City, OK 73102
ee@ee.ok.gov

Other Governmental Entities:

Afton Public Works Authority
PO Box 250
Afton, OK 74331
phyllistoa@att.net

Mr. Bill Keefer
City Manager
City of Grove
104 West 3rd
Grove, OK 74344
wmkeefer@sbcglobal.net

Ms. Debbie Bottoroff
Assistant City Manager
City of Grove
104 West 3rd
Grove, OK 74344
dbottoroff@sbcglobal.net

Mayor Rudy Schultz
City of Miami
PO Box 1288
Miami, OK 74355
rschultz@miamiokla.net

Mr. Dean Kruithof
City Manager
City of Miami
PO Box 1288
Miami, OK 74355
dean@miamiokla.net

Ms. Barbara S. Jost
Davis Wright Tremaine LLP
1919 Pennsylvania Avenue, NW
Suite 800
Washington, DC 20006-3401
barbarajost@dwt.com

Mr. Craig Gannett
Davis Wright Tremaine LLP
1201 Third Avenue, Suite 2200
Seattle, WA 98101
craiggannett@dwt.com

Mr. Walker Stanovsky
Davis Wright Tremaine LLP
1201 Third Avenue, Suite 2200
Seattle, WA 98101
walkerstanovsky@dwt.com

Ms. Amber Prewett
City of Miami
PO Box 1288
Miami, OK 74355
aprewett@miamiokla.net

Fire Chief Robert Wright
City of Miami
PO Box 1288
Miami, OK 74355
rwright@miamiokla.net

Police Chief Thomas Anderson
City of Miami
PO Box 1288
Miami, OK 74355
tanderson@miamiokla.net

Ms. Alicia Hogan
Public Works Director
City of Miami
PO Box 1288
Miami, OK 74355
ahogan@miamiokla.net

Coo-Y-Yah Museum *
847 Highway 69
South 8th Street
Pryor, OK 74361

Mr. Lowell Walker
Craig County Commissioner
District 1
210 W Delaware Avenue, Suite 106
Vinita, OK 74301
ccd1@junct.com

Mr. Mike Fitzpatrick
Craig County Commissioner
District 2
210 W Delaware Avenue, Suite 106
Vinita, OK 74301
ccd2@ruralinet.net

Mr. Dan Peetom
Craig County Commissioner
District 3
210 W Delaware Avenue, Suite 106
Vinita, OK 74301
joni.jones_18@yahoo.com

Mr. Morris Bluejacket
Craig County Flood Plain Manager
210 West Delaware, Suite 103
Vinita, OK 74301-4236
ccem@junct.com

Cambra Fields
District Conservationist
Craig County Conservation District
235 West Hope Avenue
Vinita, OK 74301-1302
cambra.fields@ok.usda.gov

Mr. Doug Smith
Delaware County Commissioner
District 1
2001 Industrial 10 RD
Grove, OK 74344
delcohwy@groveemail.com

Mr. Russell Martin
Delaware County Commissioner
District 2
327 South 5th Street
Jay, OK 74346
delbarn2@yahoo.com

Martin Kirk *
Delaware County Commissioner
District 3
327 South 5th Street
Jay, OK 74346

Mr. Robert Real
Delaware County Floodplain Administrator
PO Drawer 309
429 South 9th Street
Jay, OK 74346-0309
delawarecountyem@yahoo.com

Delaware County Historical Society &
Museum *
538 Krause Street
Jay, OK 74346

Delaware County Conservation District
2749 State Highway 20
Jay, OK 74346
delawareccd@conservation.ok.gov

Eastern Trails Museum
215 West Illinois Avenue
Vinita, OK 74301
etmuseum@junct.com

Mr. Jonas Rabel
Administrator
Integris Health Center
200 2nd Avenue SW
Miami, OK 74354
jonas.rabel@integrisok.com

Ms. Jill Lambert
Ketchum Public Works Authority
PO Box 958
Ketchum, OK 74349
jclabornkpwa@wavelinx.net

Mr. Kevin Whiteside
Mayes County Commissioner
District 1
One Court Place, Suite 140
Pryor, OK 74361
kwhiteside@mayes.okcounties.org

Ms. Meredith Frailey*
Mayes County Commissioner
District 2
One Court Place, Suite 140
Pryor, OK 74361

Mr. Ryan Ball
Mayes County Commissioner
One Court Place, Suite 140
Pryor, OK 74361
mayes3@sstelco.com

Mayes County Conservation District
4238 N E 1st
PO Box 36
Pryor, OK 74362
mayesccd@conservation.ok.gov

Mr. Johnny Janzen
Mayes County Floodplain Manager
One Court Place, Suite 140
Pryor, OK 74361
mayescountyem@yahoo.com

Mr. Jeremy Hogan
Superintendent
Miami Public Schools
26 N Main Street
Miami, OK 74354
jhogan@mpswardogs.com

Mr. Steve Gilbert
Director
Miami Regional Chamber of Commerce
11 South Main
Miami, OK 74354
sgilbert@miami-ok.org

Mr. Brian Forrester
Council Member
NE Ward 1
PO Box 1288
Miami, OK 74355-1288
bforrester@miamiokla.net

Mr. Doug Weston
Council Member
NE Ward 2
PO Box 1288
Miami, OK 74355-1288
dweston@miamiokla.net

Mr. Neal Johnson
Council Member
SW Ward 3
PO Box 1288
Miami, OK 74355-1288
njohnson@miamiokla.net

Ms. Vicki Lewis
Council Member
SE Ward 4
PO Box 1288
Miami, OK 74355-1288
vlewis@miamiokla.net

Mr. Joe Dan Morgan
Ottawa County Emergency Management
Certified Floodplain Manager
123 East Central Ave., Suite 103
Miami, OK 74354
ocem.morgan@yahoo.com

Chairman John Clarke
Ottawa County Commissioner
District #1
102 East Central Avenue, Suite 202
Miami, OK 74354
ottawacountyd1@sbcglobal.net

Mr. Gary Wyrick
Ottawa County Commissioner
District #2
310 West Walker
Wyandotte, OK 74370
ottawa.dist2@yahoo.com

Mr. Russell Earls
Ottawa County Commissioner
District #3
102 East Central Avenue, Suite 202
Miami, OK 74354
rearls@ruralinet.net

Ottawa County Conservation District
630 East Steve Owens Boulevard, Suite 3
Miami, OK 74354-7800
ottawaccd@conservation.ok.gov

Ottawa County Historical Society *
(Dobson Museum)
110 A Street SW
Miami, OK 74354

Mr. Matt Outhier
RWD #3 Delaware County
PO Box 1228
Jay, OK 74346
aquazena@yahoo.com

RWD #3 Mayes County – Disney
PO Box 279
Disney, OK 74340
mayesrwd3@grand.net

Town of Afton *
PO Box 250
Afton, OK 74331

Town of Bernice *
209 S Broadway
Bernice, OK 74331

Town of Disney
PO Box 318
Disney, OK 74340
townofdisney@outlook.com

Town of Fairland *
PO Box 429
Fairland, OK 74343

Town of Ketchum *
PO Box 150
Ketchum, OK 74349

Ms. Melissa Yarbrough
Town of Langley
PO Box 760
Langley, OK 74350
myarbrough@langleyok.org

City of Vinita *
PO Box 329
104 East Illinois Avenue
Vinita, OK 74301

Town of Wyandotte *
212 South Main
Wyandotte, OK 74370

Non-Governmental Organizations:

American Rivers
1101 14th Street NW Suite 1400
Washington DC 20005
akober@americanrivers.org

American Whitewater
PO Box 1540
Cullowhee, NC 28723
info@americanwhitewater.org

Nathan Johnson
Ducks Unlimited
Regional Director
1812 Cinnamon Ridge Road
Edmond, OK 73025
njohnson@ducks.org

Grand Lake Audubon Society *
PO Box 1813
Grove, OK 74345-1813

Mr. Bruce Watson, Squadron Commander
Grand Lake Sail and Power Squadron
31380 S 628 Lane
Grove, OK 74344
lakepappy@gmail.com

Grand Lake Watershed Alliance Foundation
PO Box 451185
Grove, OK 74345-1185
glwafadmin@gmail.com

Ms. Rebecca Jim
Local Environmental Action Demanded Inc.
223 A Street SE
Miami, OK 74354
rjim@neok.com

Ms. Melissa Shackford
Director of Land Protection
The Nature Conservancy
408 NW 7th Street
Oklahoma City, OK 73102
mshackford@tnc.org

Mr. Jay Pruett
Director of Conservation
The Nature Conservancy
10425 S 82nd E Avenue, Suite 104
Tulsa, OK 73133
jpruett@tnc.org

Mr. Chris Wood, President
Trout Unlimited
1777 N Kent Street, Suite 100
Arlington, VA 22209
cwood@tu.org

Mr. John Kennington
President
Tulsa Audubon Society
PO Box 330140
Tulsa, OK 74133
johnkennington@gmail.com

Public/Citizens:

Larry Bork
GSEP
515 S. Kansas Ave.
Topeka, KS 66603
gsep@gseplaw.com

Mr. Clayton Garner
Cherokee Grove Golf at Carey Bay
519 Quail Run Road
Grove, OK 74344
cghg@msn.com

Grand Bluffs Development *
32922 Pebble Beach
Afton, OK 74331

Mr. Justin May
Shangri-La Management
31000 South Highway 125
Afton, OK 74331
justin.may@shangrilaok.com

Mr. Robert Steinkirchner
Spinnaker Point, Manager
450779 East 341 Road
Afton, OK 74331
spinnptmgr@aol.com

Mr. Kent Stewart
Shoreline, LLC
PO Box 6586
Grove, OK 74344
kent@patriciaisland.com

Mr. Eric Grimshaw
Spinnaker Point Estates
2639 E 33rd Place
Tulsa, OK 74105
egrimshaw@oneok.com

Mr. Bruce Hensley
Tera Miranda Shores Inc.
28251 South 561 Road
Monkey Island, OK 74331
bruce@handhconstruction.com

Dr. Robert Nairn
School of Civil Engineering
The University of Oklahoma
202 West Boyd Street, Room 334
Norman, OK 73109-3073
nairn@ou.edu

Dr. Robert Knox
School of Civil Engineering
The University of Oklahoma
202 West Boyd Street, Room 334
Norman, OK 73109-3073
knox@ou.edu

Dr. Randy Kolar
School of Civil Engineering
The University of Oklahoma
202 West Boyd Street, Room 334
Norman, OK 73109-3073
kolar@ou.edu

Oklahoma State University
Burns Hargis, President
107 Whitehurst
Stillwater, OK 74078
debbie.lane@okstate.edu

Mr. Jeffrey Hale
President
Northeastern Oklahoma A & M College
200 I Street NE
Miami, OK 74354
jhale@neo.edu
Mr. Mark Rasor
Vice President for Business
200 I Street NE
Miami OK 74354
mrasor@neo.edu

Mr. Steve Stephens
General Counsel
OSU-A&M College Board of Regents
2800 N Lincoln Blvd
Oklahoma City, OK 74105
steve.stephens@okstate.edu

Dr. Keith Martin
Dean, Professor of Biology
Rogers State University
1701 West Will Rogers Boulevard
Claremore, OK 74017
kmartin@rsu.edu

Miami Flood Mitigation Advisory Board *
City of Miami
PO Box 1288
Miami, OK 74355-1288

Grand Seaplanes, LLC *
5200 South Chestnut Avenue
Broken Arrow, OK 74011

Anglers in Action *
PO Box 803
High Ridge, MO 63049

Grand Lake Association & Visitor Center *
9630 Highway 59 N, Suite B
Grove, OK 74344

Rusty Fleming *
Executive Director
Grand Lakers United Enterprise
PO Box 1
Langley, OK 74350

Mr. Jay Cranke
Director Grand Lake Association
9630 US Highway 59, Suite B
Grove, Oklahoma 74344
jay@glaok.com

Mr. Donnie Crain *
President
Grove Area Chamber of Commerce
9630 US Highway 59
Grove, OK 74344

South Grand Lake Area Chamber of Commerce
PO Box 215
Langley, OK 74350
grandlakechamber@gmail.com

Director Michele Bolton
Miami Area Chamber of Commerce
103 East Central Avenue, Suite 100
Miami, OK 74354
michele@miamiokchamber.com

Oklahoma Association of Realtors *
9807 Broadway Ext
Oklahoma City, OK 73114-6312

Har-Ber Village *
4404 West 20th Street
Grove, OK 74344

Dr. Mark Osborn *
301 2nd Avenue SW
Miami, OK 74354

Mr. Jack Dalrymple *
54297 E 75 Road
Miami, OK 74354

Mr. Mike Williams
Director of Communications & Gov't Relations
Shangri-La Marina
57151 East Highway 125
Afton, OK 74331
mike.williams@shangrilaok.com

Mr. Charlie Russell
General Manager
Cherokee Yacht Club Marina
PO Box 600
Ketchum, OK 74349
charlie.russell@cherokeeyachtclub.com

Mr. Gary Stuart
Manager
Port Carlos
PO Box 780
Ketchum, OK 74349
gary.stuart@portcarlos.com

Mr. Joe Harwood
Owner
Arrowhead Yacht Club (North & South)
PO Box 600
Ketchum, OK 74349
joeharwood@aol.com

Mr. Mike Whorton
Owner
Clearwater Bay Marina
PO Box 219
Disney, OK 74340
clearwaterbay@grand.net

Ms. Judy Florida
General Manager
Harbors View Marina
451107 East 320 Road
Afton, OK 74331
jflorida@shmarinas.com

Mr. Jeff Rose
Regional Manager
Safe Harbor Marinas
14785 Preston Road, Suite 975
Dallas, TX 75254
jrose@shmarinas.com

Mr. Jason Macer
Manager
Thunder Bay Marina LLC
450780 Thunder Bay Road
Afton, OK 74331
jason.m@uglyjohns.com

Mr. Jerry Cookson
Manager
Cedar Port Marina
PO Box 600
Ketchum, OK 74349
jerry.cookson@cedarport.com

Mr. Tom Berry
Manager
Tera Miranda Marina Resort
28251 South 561 Road
Monkey Island, OK 74331
tom@teramiranda.com

Ms. April Cummins
Manager
Honey Creek Landing Marina
2520 South Main Street
Grove, OK 74344
april@honeycreeklanding.com

Mr. Greg Crenshaw
Willow Park Marina
PO Box 120
Ketchum, OK 74349
greg@willowparkmarina.com

Mr. Ted Peitz
Owner
Southwinds Marina
PO Box 3977
Bernice, OK 74331
tpeitz@southwindsmarina.com

Mr. Paul Staten
Owner
The Landings Marina
PO Box 61250
Oklahoma City, OK 73146
paullandingsmarina@att.net

Scotty's Cove, Inc *
PO Box 580
Langley, OK 74350

Mr. Nick Powell
Manager
Hammerhead Marina
PO Box 600
Ketchum, OK 74349
nick.powell@arrowhead.com

Grand Lakeside Marina *
11350 North Highway 59
Grove, OK 74344

Mr. Todd Elson
Manager
Indian Hills Resort and Marina
PO Box 3747
Bernice, OK 74331
indianhillsok@aol.com

Mr. Kevin McClure
Manager
Hi-Lift Marina LLC
196 Private Road 138
Eucha, OK 74342
yachtsrfun@yahoo.com

Mr. Harry Cole
Owner
Dripping Springs Yacht Club
200 Dripping Springs Landing
Eucha, OK 74342
drippingspringsyachtclub@gmail.com

Mr. Sam Chapman
Owner
Red Arrow Marina
453881 East 305 Road
Afton, OK 74331
sam@redarrowmarina.com

Mr. Russ Allard
Owner
Elk River Landing
1923 North Barrington Drive
Fayetteville, AR 72701
russell_allard@yahoo.com

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

September 2018

TABLE OF CONTENTS

ATTACHMENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

1-D 1-dimensional
2-D 2-dimensional
ACHP ..... Advisory Council on Historic Preservation
ADCP ..... Acoustic Doppler Current Profiler
AIR ..... Additional Information Request
APE ..... Area of Potential Effects
BIA ..... Bureau of Indian Affairs
C.F.R. ..... Code of Federal Regulations
CHM ..... Comprehensive Hydraulic Model
CRWG ..... Cultural Resources Working Group
DLA ..... Draft License Application
EPA ..... Environmental Protection Agency
ESA ..... Endangered Species Act
FERC ..... Federal Energy Regulatory Commission
FLA ..... Final License Application
FPA ..... Federal Power Act
FWHMP ..... Fish and Waterfowl Habitat Management Plan
GIS ..... Geographic Information System
GRDA ..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
HEC-RAS ..... Hydrologic Engineering Center's River Analysis System
HHRA ..... Human Health Risk Assessment
HPMP ..... Historic Properties Management Plan
ILP ..... Integrated Licensing Process
ISR ..... Initial Study Report
kVA ..... kilovolt amp
kW ..... kilowatt
LiDAR ..... Light Detection and Ranging
MW ..... megawatt
NAVD88 ..... North American Vertical Datum of 1988
NEPA ..... National Environmental Policy Act
NGO ..... non-governmental organization

NGVD29..... National Geodetic Vertical Datum of 1929
NHPA ..... National Historic Preservation Act
NOI..... Notice of Intent
NWI ..... National Wetlands Inventory
OAS ..... Oklahoma Archaeological Survey
ODWC..... Oklahoma Department of Wildlife Conservation
OSU ..... Oklahoma State University
OU2..... Operable Unit 2
OU4..... Operable Unit 4
OU5..... Operable Unit 5
OWRB..... Oklahoma Water Resources Board
PAD..... Pre-Application Document
PD ..... Pensacola datum
PLP ..... Preliminary Licensing Proposal
PM&E..... protection, mitigation, and enhancement
Project..... Pensacola Hydroelectric Project
PRP..... potentially responsible party
PSP..... Proposed Study Plan
RAO ..... Remedial Action Objectives
RM ..... river mile
RSP..... Revised Study Plan
SD1 ..... Scoping Document 1
SD2 ..... Scoping Document 2
SHPO..... State Historic Preservation Officer
SMP ..... Shoreline Management Plan
SQG..... sediment quality guidelines
SSC..... suspended sediment concentration
STID..... Supporting Technical Information Document
SWAT..... Soil and Water Assessment Tool
TAAMS..... Trust Asset and Accounting Management System
TCP..... Traditional Cultural Properties
TSMD..... Tri-State Mining District
USACE..... U.S. Army Corps of Engineers
U.S.C. ..... U.S. Code
USFWS ..... U.S. Fish and Wildlife Service

USGS..... U.S. Geological Survey

USR ..... Updated Study Report

VMP ..... Vegetation Management Plan

WMA ..... Wildlife Management Area

1.0 INTRODUCTION AND BACKGROUND

The 120-megawatt (MW) Pensacola Hydroelectric Project (Pensacola Project or Project), owned and operated by the Grand River Dam Authority (GRDA), is licensed by the Federal Energy Regulatory Commission (FERC or Commission) as Project No. 1494. GRDA is a non-appropriated agency of the State of Oklahoma, created by the Oklahoma legislature in 1935 to be a "conservation and reclamation district for the waters of the Grand River." The existing license for the Pensacola Project was issued on April 24, 1992, and will expire on March 31, 2022. GRDA is applying for a new license for the Pensacola Project.

In accordance with FERC regulations at 18 Code of Federal Regulations (C.F.R.) Part 5, GRDA is utilizing FERC's Integrated Licensing Process (ILP) for preparing its relicensing application. This Revised Study Plan (RSP) is being filed with FERC pursuant to 18 C.F.R. § 5.13 and the Process Plan and Schedule referenced in FERC's Scoping Document 1 (SD1) and as updated by FERC's August 10, 2018 Notice of Modification of Procedural Schedule – see Table 6.1-1 in this RSP. Notification of availability of this RSP is also being distributed to federal and state resource agencies, Native American Tribes, local governments, non-governmental organizations (NGO), and other interested parties (collectively referred to as "relicensing participants").

This RSP, in compliance with 18 C.F.R. § 5.13, incorporates many of the comments and study requests provided by relicensing participants during the study development process. The information developed through implementation of the RSP, when combined with existing information, will inform the development of the Preliminary Licensing Proposal (PLP)/Draft License Application (DLA) (which under the current schedule will be filed no later than November 3, 2019), Final License Application ([FLA]; which under the current schedule will be filed no later than March 31, 2020), FERC's environmental document under National Environmental Policy Act (NEPA), and eventual license conditions.

1.1 Project Location and Description

As licensed by FERC, the Project serves multiple purposes, including hydropower generation, water supply, public recreation, and wildlife enhancement. As directed by Congress under statutes such as 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 (Figure 1.1-1). USACE has exclusive jurisdiction over Grand Lake for flood control purposes,[1] and USACE has designated a flood control pool for Grand Lake that extends above the 745-foot elevation Pensacola datum (PD).[2,3]

[1] *See infra* § 4.3. Also incorporated by reference are GRDA's other filings with the Commission that address this issue. *See*, *e.g.*, Pensacola Hydroelectric Project, FERC No. 1494, Proposed Study Plan (GRDA 2018); Letter from Charles R. Sensiba, Troutman Sanders LLP, to Kimberly D. Bose, Federal Energy Regulatory Commission, Project No. 1494-438 (filed March 9, 2018); Response of Grand River Dam Authority to Comments on Environmental Assessment, Project No. 1494-437 (filed Feb. 21, 2017); Answer of Grand River Dam Authority to Motions to Intervene and Comments on License Amendment Application, Project No. 1494-437 (filed Nov. 8, 2016); Answer of Grand River Dam Authority to City of Miami, Project No. 1494-432 (filed Aug. 11, 2015).

[2] All elevations referenced are relative to PD. PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD29) by adding 1.07 feet and to North American Vertical Datum of 1988

The Project is located northeast of Tulsa on the Grand/Neosho River (referred to as the Grand River) in Craig, Delaware, Mayes, and Ottawa counties, Oklahoma (Figure 1.1-2). The Grand River originates as the Neosho River in Kansas and flows south through northeastern Oklahoma approximately 460 miles before discharging into the Arkansas River near the town of Fort Gibson. Below its confluence with the Spring River at river mile (RM) 122.6,[4] near Wyandotte and State Highway 60, where the Twin Bridges crosses the river in Ottawa County, the Neosho River becomes the Grand River. The Pensacola Dam is located at RM 77 and creates Grand Lake.

The Project consists of: (1) a reinforced-concrete dam with a multiple-arch section 4,284 feet long, a spillway 861 feet long containing twenty-one radial gates, a non-overflow gravity section 451 feet long, and two non-overflow abutments, comprising an overall length of 5,950 feet and a maximum height of 147 feet; (2) a reinforced-concrete, gravity-type spillway section 886 feet long containing twenty-one radial gates and located about 1 mile east of the main dam; (3) the Grand Lake reservoir, which extends approximately 66 miles upstream from the Pensacola Dam, has a surface area of approximately 45,200 acres, a storage capacity of 1,680,000 acre-feet at normal maximum water surface elevation of 745 feet PD, below which is known as the conservation pool, and approximately 667 miles[5] of shoreline; (4) six, 15-foot-diameter steel penstocks supplying flow to six turbines each rated at 17,446 kilowatts (kW) attached to six generators each rated at 24,000 kilovolt amp (kVA) or 21,600 kW, and one 3-foot-diameter penstock supplying flow to one turbine rated at 500-kW[6] attached to an identically rated generator, located in a powerhouse immediately below the dam; (5) a tailrace approximately 300 feet wide and a spillway channel approximately 850 feet wide, both about 1.5 miles long; and (f) appurtenant facilities (FERC 1996; GRDA 2010).

In addition, GRDA operates and maintains five FERC-approved recreation sites at the Project: (1) Duck Creek Bridge Public Access Area; (2) Seaplane Base Public Access; (3) Monkey Island Public Boat Ramp; (4) Big Hollow Public Access; and (5) Wolf Creek Public Access. These facilities provide public access to Grand Lake for boating, fishing, and other recreational activities.

Based on recent information provided to FERC from the U.S. Bureau of Indian Affairs (BIA), the Project possibly occupies federally owned lands held in trust for some Native American Tribes or Individual Native Americans.[7] As of the filing of this RSP, the total acreage of tribal trust

(NAVD88) by adding 1.40 feet (for example, elevation 745 feet PD = 746.07 feet NGVD = 746.4 feet NAVD88)(http://ok.water.usgs.gov/projects/webmap/miami/datum.htm).

[3] In response to a PAD comment by N. Larry Bork dated March 13, 2018, in general, elevations will be converted to and expressed in PD using the above conversion factors.

[4] In previous project documents this value is cited as RM 131, which comes from Holly (2004).

[5] The Project license states there are 1,300 miles of shoreline around the Pensacola Project and, traditionally, GRDA has referenced 1,300 miles of shoreline for Grand Lake. However, it has been determined that the 1,300 value relates to the total shoreline miles of GRDA's three hydropower projects. For consistency in management and tracking of matters related to the Shoreline Management Plan (SMP), in 2008, based on a new Geographic Information System (GIS) system, GRDA hand digitized the data available at the time, which resulted in a total amount of shoreline within the Project Boundary of 522 miles. With technological advances in the GIS field, more accurate data (including LiDAR) indicate that the amount of shoreline within the Project Boundary is 667 miles.

[6] The 2011 Supporting Technical Information Document (STID) mistakenly identifies the unit as 625 kW and will be corrected in a future revised STID (GRDA 2011).

[7] Scoping Document 2 for the Pensacola Hydroelectric Project, Project No. 1494-438 (issued April 27, 2018); Bureau of Indian Affairs' "Unmappable" Trust Land Along the Project Boundary that are now Mapped, Project No. 1494-438 (filed September 18, 2018); Bureau of Indian Affairs' Additional Information for Trust Land Maps with Supporting Documentation as Requested by the Federal Energy

lands at the Project has not been confirmed or verified;[8] this issue will be resolved during the relicensing process as GRDA prepares its Exhibit G maps that will accompany its relicensing application.

Since its original development in the 1930s, the Project Boundary has been defined by a combination of a metes and bounds description and has always generally followed contour elevation 750 feet PD.[9] It encompasses 53,965 acres, including the 45,200 acres of the Project reservoir (at the upper extent of the conservation pool of 745 feet PD). The Project Boundary encompasses all Project facilities and works, Project recreation areas, and a shoreline buffer around the entire reservoir (generally between 745 and 750 feet PD).

Regulatory Commission, Project No. 1494-438 (filed April 11, 2018); Letter from the Federal Energy Regulatory Commission to Bureau of Indian Affairs' Request for Additional Information Regarding Trust Maps, Project No. 1494-438 (filed March 15, 2018); BIA's Trust Land Maps, Project No. 1494-438 (filed March 6, 2018); *but see* Bureau of Indian Affairs Comment (filed September 28, 2017) ("A review of the Bureau of Indian Affairs (BIA) maps of the project location indicates that there are no Southern Plains Region tribal or Individual Indian trust lands within the project area. The BIA has no concerns that the project will impact Indian trust lands within the Southern Plains Region jurisdiction. . ."). To be clear, GRDA does not dispute the presence of federal trust lands in the immediate vicinity of the Project. Because this information was recently provided to the Commission, GRDA is still in the process of reviewing it and determining whether and the extent to which the Project may occupy federal trust lands. As described in Section 4.2.1 of this RSP, this is a complex and time-consuming exercise due to the age of property records at issue, the lack of survey data in much of the property records in the vicinity of the Project, the possible imprecision by which the Project Boundary was originally established, and the need in this relicensing process to undertake a comprehensive reevaluation and identification of lands that are needed for purposes of the Project.

[8] Prior to BIA's recent filings, GRDA and FERC were unaware of the possible presence of tribal trust lands at the Project. FERC, in fact, had long maintained that the Project occupied no federally owned lands. *See, e.g., Grand River Dam Auth.*, 159 FERC ¶ 62,147 (2017); *Grand River Dam Auth.*, 143 FERC ¶ 62,137 (2013); *Grand River Dam Auth.*, 125 FERC ¶ 62,057 (2008) ('the project does not occupy federal or tribal lands."). Upon examination of the information provided by the BIA that GRDA has reviewed to date, it appears that acreage around Grand Lake has been placed into trust only within the last several years—well after the original construction of the Project and since the most recent relicensing in 1992.

[9] Original License for the Pensacola Project, dated July 12, 1939, at Article 12 ("The licensee shall acquire all necessary lands, easements, and rights-of-way up to elevation 750."); *see also*, Order Further Modifying Authorization for Issuance of License dated, July 26, 1939, at 2.

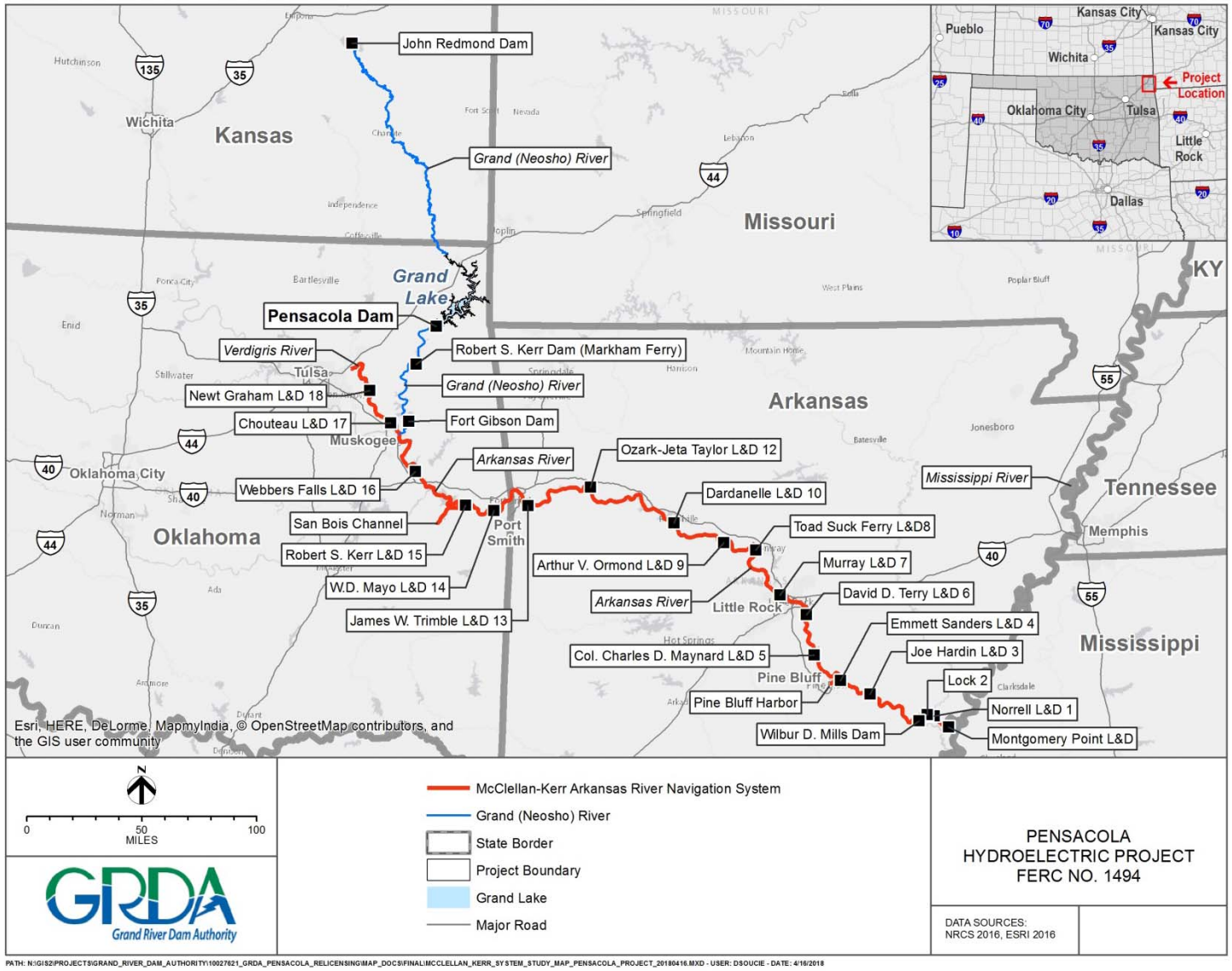


Figure 1-1.1. McClellan-Kerr River system.

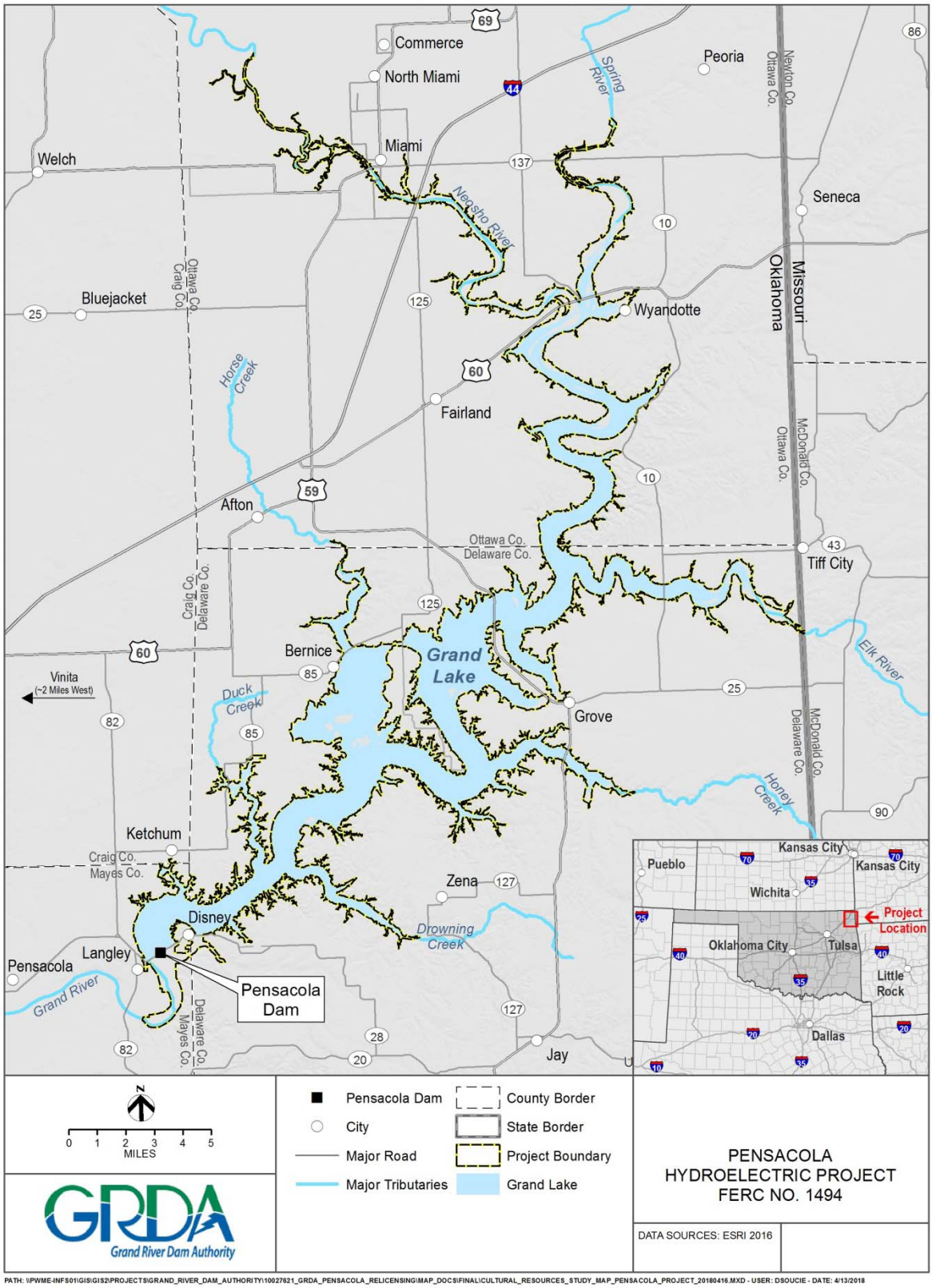


Figure 1-1.2. Pensacola Project vicinity.

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[10], shown in Table 1.1-1 and Figure 1.1-3.

Table 1.1-1. Target elevations for Pensacola Project.

Period	Reservoir Elevation (feet PD)
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 743
September 16 through September 30	Lower elevation from 743 to 742
October 1 through April 30	Maintain elevation at 742

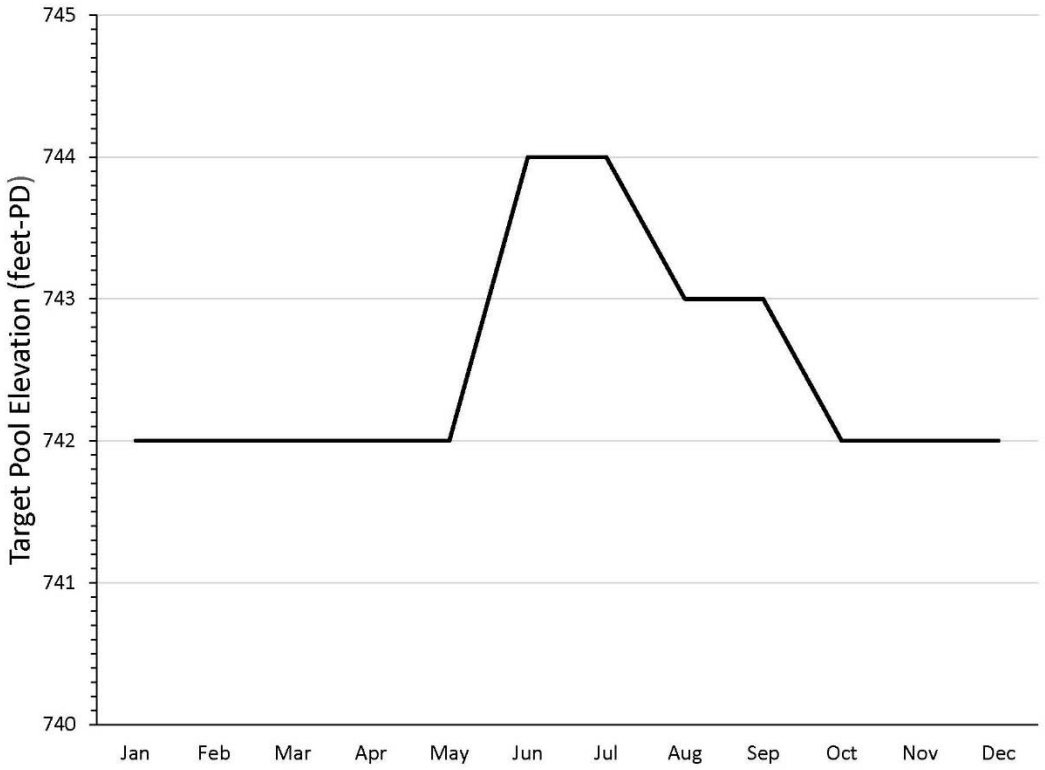


Figure 1.1-3. Pensacola Project rule curve.

[10] Order Amending License and Dismissing Application for Temporary Variance, 160 FERC ¶ 61,001 (2017).

1.2 Initiation of the Integrated Licensing Process (ILP)

Pursuant to 18 C.F.R. § 5.5(a), GRDA filed a Notice of Intent (NOI) to relicense the Project and a Pre-Application Document (PAD) with FERC on February 1, 2017 (GRDA 2017). Copies of the NOI and PAD can be found through FERC's e-library http://www.ferc.gov/docs-filing/elibrary.asp or through GRDA's relicensing site at http://www.grda.com/pensacola-hydroelectric-project-relicensing/.

1.3 FERC Abeyance

In light of the rule curve license amendment proceeding that was ongoing at the time of the filing of the NOI and PAD and the lack of a quorum of FERC commissioners to rule on the amendment application, on February 15, 2017, FERC issued a Letter Order holding the relicensing process in abeyance. Six months later, once a quorum of commissioners was restored, FERC approved the rule curve amendment.[11] Two weeks later, FERC issued a Letter Order on August 24, 2017, lifting the abeyance and providing a revised ILP process plan and schedule. As a result of the abeyance, the ILP process for this relicensing lags several months behind the process envisioned in the Commission's regulations. Specifically, to meet the statutory deadline under section 15(c) of the Federal Power Act (FPA) to file the FLA two years prior to license expiration, 16 U.S. Code (U.S.C.) 808(c)(1), GRDA must file its relicensing application by March 31, 2020. At that point in the ILP, GRDA will have completed only a single season of studies, with the second study season underway.

GRDA's proposal to resolve this discrepancy between the license application filing deadline and the ILP process—in a manner that allows for full completion of environmental studies and input from relicensing participants *before* GRDA files its FLA—appears in Section 6.2 of this RSP.

1.4 Public and Native American Government-to-Government Meetings

Prior to the formal commencement of the relicensing process in January 2018, FERC held a series of public information sessions regarding the procedures for relicensing the Pensacola Project. Meetings were held in Langley (November 14 and 15, 2017), Grove (November 15, 2017), and Miami, Oklahoma (December 13, 2017). The meetings included an overview of the ILP and a discussion of the process schedule, opportunities for public comment, and how FERC assesses information needs during the study planning process.

In addition, FERC held initial government-to-government tribal consultation meetings with several Native American Tribes in Miami, Oklahoma, on December 13, 2017,[12] and with the Osage Nation in Pawhuska, Oklahoma, on December 14, 2017.

1.5 Resumption of the ILP and Environmental Scoping

On January 12, 2018, FERC issued notice of the PAD and NOI and commencement of the relicensing pre-filing process. FERC's January 12, 2018 notice also designated GRDA as

[11] Order Amending License and Dismissing Application for Temporary Variance, 160 FERC ¶ 61,001 (2017).

[12] Tribes represented at the meeting included: Cherokee Nation, Eastern Shawnee Tribe, Miami Tribe, Muscogee Creek Nation, Ottawa Tribe, Peoria Tribe, Quapaw Tribe, Seneca-Cayuga Nation, and Wyandotte Nation.

FERC's non-federal representative for carrying out informal consultation, pursuant to Section 7 of the Endangered Species Act (ESA), and Section 106 of the National Historic Preservation Act (NHPA). In addition, the notice requested that relicensing participants provide comments regarding the PAD and provide study requests. Concurrently, FERC issued SD1 to outline the subject areas to be addressed in its environmental analysis of the Project pursuant to NEPA[13].

On February 7, 8, and 9, 2018, FERC held agency and public scoping meetings in Langley, Grove, Miami, and Tulsa, Oklahoma. A site visit to the Project was held on February 8, 2018, and was open to all relicensing participants and the public. Representatives of the Oklahoma Department of Agriculture, Food and Forestry, BIA, and the Miami News participated in the site visit.

In accordance with ILP regulations, comments on the PAD and SD1 and study requests were due to FERC by March 13, 2018, within 60 days of FERC's notice of the PAD and NOI and commencement of the pre-filing process.

A total of 61 comment letters from federal and state resource agencies, Native American Tribes, NGOs, and other interested parties were filed with FERC regarding the relicensing of the Pensacola Project between January 8, 2018, through March 19, 2018. Comments received included comments regarding the Project, comments on the PAD and SD1, and study requests. A total of 27 study requests were made by relicensing participants and FERC.[14]

FERC issued Scoping Document 2 (SD2) on April 27, 2018 (FERC 2018). SD2 states that it reflects revisions to SD1 based on the comments received at the scoping meetings and written comments filed during the scoping process.

1.6 Proposed Study Plan, Study Plan Meetings, and Comments

Consistent with 18 C.F.R. § 5.11, GRDA filed its Proposed Study Plan (PSP) on April 27, 2018 (GRDA 2018). The proposed studies were based on GRDA's evaluation of resources at the Project as well as PAD and SD1 comments and study requests. GRDA's response to the study requests was detailed in the PSP. The PSP also included Section 4.1, General Considerations, which provided over-arching, common themes explaining GRDA's reasons for adopting or not adopting study requests—themes that are generally still relevant in this RSP.

In the PSP, GRDA proposed the following studies:

1. Hydrologic and Hydraulic Modeling Study (H&H Study)
2. Sedimentation Study
3. Recreation Facilities Inventory and Use Survey
4. Cultural Resources Study
5. Socioeconomics Study

GRDA conducted a study plan meeting on May 30 and 31, 2018, in Langley, Oklahoma, in accordance with 18 C.F.R. § 5.11. The meeting provided an opportunity to clarify the PSP and

[13] 42 U.S.C. § 4321 *et seq*.
[14] Although 27 total study requests were filed, due to redundancies and substantial similarities among the requests, the number of unique study requests filed was 15.

identify any outstanding issues or information needed with respect to the proposed studies. GRDA also held a meeting of the Cultural Resources Working Group (CRWG) following the study plan meeting on May 31 to provide an opportunity to discuss the Cultural Resources Study plan in detail.

GRDA held other meetings as well during this period to better understand relicensing participants' priorities, objectives, and concerns, and to inform GRDA's development of this RSP. On August 14, GRDA had a relicensing consultation meeting with the Advisory Council on Historic Preservation (ACHP) in Washington, D.C. On August 21, 2018, FERC convened a tribal consultation meeting in Catoosa, Oklahoma, to discuss the PSP.[15] On August 22, GRDA had a relicensing consultation meeting with the Oklahoma State Historic Preservation Officer (SHPO) and Oklahoma Archaeological Survey (OAS).

Comments on GRDA's PSP, including any revised information or study requests, were due to FERC by July 26, 2018. Pursuant to 18 C.F.R. § 5.12, comments were to include an explanation of any study plan concerns and any accommodations reached with GRDA regarding those concerns. All proposed modifications to the PSP are required to meet FERC's Study Criteria described below.

2.0 DEVELOPMENT OF GRDA'S REVISED STUDY PLAN (RSP)

The purpose of this RSP is to describe GRDA's proposed methodologies for conducting studies and to address PSP comments and revised study requests. The studies will yield information that will enable FERC to conduct its NEPA analysis for the relicensing of the Project and aid in the development of future license requirements.

The RSP is different from the PSP in significant ways. There are several new proposed studies that were not included in the PSP. There are also expanded studies that are more robust versions of studies included in the PSP. Overall, the RSP reflects an intensive effort by GRDA since the PSP to broaden the studies proposed in the PSP and to address remaining data gaps. This involved taking a fresh look at the existing information identified in the PAD as well as researching and reviewing other potential sources of information identified by relicensing participants. GRDA then analyzed the information and extracted any additional, relevant data that could be gleaned to determine what supplemental studies are needed to meet ILP objectives.

Another critical component of this RSP concerns the substantial modifications that have been made in direct response to input from relicensing participants on the PSP. GRDA thoroughly reviewed all comments on the PSP, a summary of which is included in this RSP (Attachment B), and study requests, as summarized in Tables 4.0-1 and 4.0-2 of this RSP. For any requested study submitted as part of PSP comments that GRDA did not adopt in the RSP, GRDA explains the rationale for its decision with reference to the study plan criteria described in Section 4.2 of this RSP.

GRDA recognizes that due to the tight timeframes of the ILP, relicensing participants are required to dedicate substantial time and resources to study development under tight deadlines.

[15] To accommodate this meeting, FERC by notice dated August 10, 2018, adjusted the ILP process plan and schedule to allow GRDA additional time to prepare this RSP, as well as more time for relicensing participants to comment and for FERC to issue its study plan determination.

GRDA greatly appreciates these efforts and believes that this RSP is much improved as a result.

2.1 FERC's Study Plan Criteria

FERC's ILP regulations at 18 C.F.R. § 5.9(b) specify required components of study requests to allow GRDA, as well as FERC staff, to determine the appropriateness and relevance of the proposed study to the relicensing. These required components of the study request (the "Study Criteria") are as follows:

(1) Describe the goals and objectives of each study and the information to be obtained (§ 5.9(b)(1));

This section describes why the study is being requested and what the study is intended to accomplish, including the goals, objectives, and specific information to be obtained. The goals of the study should clearly relate to the need to evaluate the effects of the Project on a particular resource. The objectives are the specific information that needs to be gathered to allow achievement of the study goal.

(2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied (§ 5.9(b)(2));

This section should clearly establish the connection between the study request and management goals or resource of interest. A statement by an agency connecting its study request to a legal, regulatory, or policy mandate needs to be included that thoroughly explains how the mandate relates to the study request, as well as the Project impacts.

(3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study (§ 5.9(b)(3));

This section is for non-agency requestors or Native American Tribes to establish the relationship between the study request and the relevant public interest considerations.

(4) Describe existing information concerning the subject of the study proposal, and the need for additional information (§ 5.9(b)(4));

This section should discuss any gaps in existing data by reviewing the available information presented in the PAD or information relative to the Project that is known from other sources. This section should explain the need for additional information and why the existing information is inadequate.

(5) Explain any nexus between Project operation 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 (§ 5.9(b)(5));

This section should clearly connect Project operations and Project effects on the applicable resource. This section should also explain how the study results would inform the development of protection, mitigation, and enhancement (PM&E) measures.

(6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or

objectively quantified information, and a schedule including appropriate field season(s) and the duration (§ 5.9(b)(6));

This section should provide a detailed explanation of the study methodology. The methodology may be described by outlining specific methods to be implemented or by referencing an approved and established study protocol and methodology.

(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 (§ 5.9(b)(7));

This section should describe the expected level of cost and effort to conduct the study. If there are proposed alternative studies, this section should address why the alternatives would not meet the stated information needs.

2.2 PSP Comments and Revised Study Requests from Relicensing Participants

A total of 19 PSP comment letters from federal and state resource agencies, Native American Tribes, NGOs, and other interested parties were filed with FERC.[16] As part of the comment letters, a total of 22 study requests were made.[17] Based on these requests, other PSP comments and its efforts to evaluate Project resources and existing information described above, GRDA has prepared its RSP, which is described in Section 3 of this RSP, with the actual proposed study plans appearing in Attachment A of this RSP. GRDA's response to all study requests received is detailed in Section 4 of this RSP.

Attachment B of this RSP provides a table detailing all of the comments received and GRDA's responses to each. Comment letters and all documents filed with FERC can be accessed through FERC's eLibrary at www.ferc.gov/docs-filing/elibrary.asp by searching under Docket P-1494-438.

3.0 OVERVIEW OF GRDA'S RSP

The studies proposed by GRDA in this RSP are intended to collect information and data to inform the development of the PLP/DLA (which under the current schedule will be filed no later than November 3, 2019), FLA (which under the current schedule will be filed no later than March 31, 2020), FERC's environmental document under NEPA, and eventual license conditions. As such, GRDA intends to perform studies that collect information that would be used to inform the assessment of Project-related resource impacts (if any) in the Exhibit E Environmental Exhibit of the PLP/DLA, FLA, and FERC's NEPA document and that are consistent with FERC's Study Criteria.

[16] Comment letters were filed by the ILP deadline of July 26, 2018, by the following entities: FERC, U.S. Fish and Wildlife Service (USFWS), BIA, USACE, ODWC, SHPO, OAS, Cherokee Nation, Delaware Nation, Miami Tribe, Muscogee Nation, Osage Nation, Ottawa Tribe, Quapaw Tribe, Wyandotte Nation, City of Miami, Ben Loring (State Representative), and N. Larry Bork (counsel for City of Miami citizens). Comments were filed by Peoria Tribe on July 30, 2018.

[17] Although 22 total study requests were filed, due to redundancies and substantial similarities among the requests, the number of unique study requests filed was 12.

The resource studies will culminate in the preparation of study reports (Initial Study Report [ISR] and in certain studies as indicated in the individual study plans, Updated Study Report [USR]). The study reports will present the results of the investigations and information sufficient for characterizing the existing environment and evaluating any potential impacts of continued Project operations. Prior to GRDA's filing of the FLA with FERC, this analysis will be available for comment by relicensing participants as part of GRDA's PLP/DLA.

3.1 Proposed Studies

In this RSP, GRDA is proposing the following studies:

1. Hydrologic and Hydraulic Modeling Study (H&H Study)
2. Sedimentation Study
3. Aquatic Species of Concern Study
4. Terrestrial Species of Concern Study
5. Wetlands and Riparian Habitat Study
6. Recreation Facilities Inventory and Use Survey
7. Cultural Resources Study
8. Socioeconomics Study

Specific study requests relevant to the above-listed resource areas are referenced in Section 4 of this RSP. The individual study plans for the proposed studies are included in Attachment A of this RSP.

3.1.1 Hydrologic and Hydraulic Modeling Study

In this RSP, the H&H Study Plan reflects substantive changes that have been made since the PSP. Section 2.3 of the H&H Study Plan has been updated to clarify how the various topographic and bathymetric datasets will be incorporated into the modeling. Section 2.6 of the H&H Study Plan has been updated to include the criteria that will be used to select where 1-dimensional (1-D) and 2-dimensional (2-D) modeling approaches will be used throughout the Comprehensive Hydraulic Model (CHM) along with the justification for proposing a specific approach (1-D or 2-D) for each reach within the model. Section 2.6 of the H&H Study Plan was also updated to clarify why the USACE's Flood Operations Model would not be a useful tool in evaluating Project operations. Lastly, Section 2.6 was revised to include additional detail about the calibration events that will be considered for calibration of the CHM, along with the available calibration data.

GRDA is proposing an H&H Study to identify areas inundated during current operation of the Project, as well as during any operational changes that may be proposed as part of the relicensing effort. In addition to the inundation area, the study will provide other flood routing specifics such as the frequency, timing, amplitude, and duration of the inundation.

The overall H&H Study goal is to provide information through modeling and mapping to determine the effect of the operation of the Project upon several resource areas. Specifically, the H&H Study will: (1) determine the duration and extent of inundation under current operation of the Project during several measured inflow events; (2) determine the duration and extent of inundation under any proposed change in operation that occurs during several measured or

synthetic inflow events; (3) provide the model results in a format that can inform other analyses (to be completed separately) about Project effects, if any, in several resource areas; and (4) determine the feasibility of implementing alternative operation scenarios that may be proposed as part of the relicensing effort.

A CHM will be constructed to determine the inundation areas and other flood routing specifics during several measured inflow events where inflow hydrographs already exist. To evaluate the effects of any proposed operational changes, a separate Operations Model will be constructed to synthesize hypothetical events that inform the CHM. Information gathered from these models will be used to inform separate analyses about the effects of inundation on various resources.

A model input Status Report, initial technical report (with the ISR), and final technical report (with the USR) will be prepared as part of the H&H Study. The H&H Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study, models being developed, and methodology.

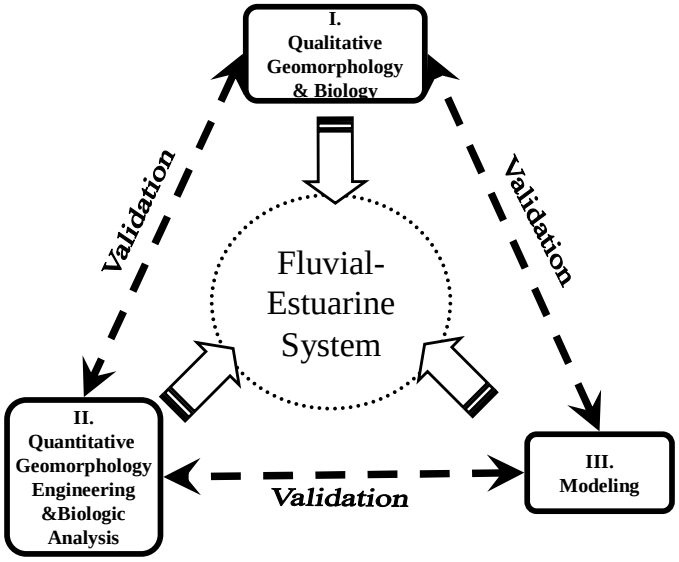
3.1.2 Sedimentation Study

Substantial changes have been made to the Sedimentation Study Plan in this RSP. After issuance of the PSP, GRDA completed an in-depth review of existing information and as a result, a one-year review of existing data and a contingent second year of study is no longer proposed. GRDA has expanded the plan into a two-year study that enables the collection of new field data, beyond data that already exists and are available today. Once the additional data is collected, GRDA will analyze the existing data and the newly collected data to determine the potential effects of Project operations on sediment transport, erosion, and deposition in the lower reaches of the tributaries to Grand Lake upstream of Pensacola Dam.

Sedimentation occurs as a result of the complex interaction among: (1) hydrology; (2) erosion processes from upstream watersheds and rivers; (3) the tendency for sediment deposition in a reservoir as affected by reservoir operation; and (4) the related effects on hydraulics and sediment transport processes in rivers as they approach and transition into a reservoir. In order to develop an understanding of these complex processes, a variety of tools and techniques are available, ranging from data collection and analysis to computer modeling. Over years of experience in conducting sedimentation studies, Simons & Associates developed a three-level approach to understanding these complex processes (Simons & Associates 1998).

Qualitative geomorphic analysis is the first level of a three-level process developed by Simons & Associates incorporating: qualitative geomorphic analysis, quantitative engineering and geomorphic analysis, and quantitative computer modeling analysis (see Figure 3.1-1). This approach ensures a proper understanding of physical processes governing the flow of water, transport of sediment, river form and response, and interaction with infrastructure is developed, and that mutually supportive, scientifically justifiable results are obtained. Each subsequent level of analysis builds on the understanding developed by the previous level. Any inconsistencies are reconciled so as to arrive at mutually supportive conclusions. A significant benefit of this approach is that the qualitative geomorphic level of analysis provides an understandable basis for more technical or complex analyses serving as a foundation for understanding and communication as other levels of analysis are conducted. This approach ensures that an appropriate understanding of the watershed and river is developed as they interact together as a system. It also ensures that important governing geomorphic principles are considered and that the results of more technical and detailed analyses are consistent with these universal principles.

Each level of analysis builds on a foundation from the previous level(s) and corroboration or validation between levels improves confidence in the results of the overall analysis.



A conceptual schematic of the three-level approach for determining geomorphic, sediment transport and biologic response . Validation must occur between all three levels to assure that reasonable results have been achieved.

Figure 3.1-1. Conceptual schematic.

Two approaches have been proposed to analyze sedimentation issues related to the Pensacola Project. The approach proposed by GRDA focuses on the collection and analysis of data (level 2) and Tetra Tech (on behalf of the City of Miami) focuses on computer modeling (level 3). In evaluating the range of possible approaches to analyzing sedimentation issues, it is noted that there is considerable disagreement among experts regarding hydraulic modeling. Since a hydraulic model takes into account hydraulic forces represented by velocities, slopes, and water levels, which are the basic components of sediment transport modeling, unless and until there is consensus among experts in the realm of hydraulic modeling and analysis, it would be unreasonable to require sediment transport modeling for the Project relicensing. In addition, unless adequate data are available for input, parameterization, calibration, verification, and evaluation of a sediment transport model, the results of such a model will likely be of limited value, as discussed in the conclusion of Simons and Simons (1997), *Sediment Transport Modeling: Calibration, Verification, and Evaluation*.

The goal of GRDA's proposed Sedimentation Study is to investigate the overall trends and consequences of sedimentation within the Project Boundary. Specifically, this study will determine the amount of sedimentation that has occurred in the reservoir since construction of Pensacola Dam; evaluate sediment transport, erosion, and deposition in Grand Lake and its tributaries; and characterize the impact that any sedimentation may have on flood extents and duration in upstream tributaries.

The specific goals of the Sedimentation Study are as follows:

Analysis of Existing Data

- Compile existing data on suspended sediments, sediment properties, flow, and water levels into a database.
- Review literature and past studies on sedimentation and hydraulics in the study area.

Bathymetric Change Analysis

- Compare spatial and temporal changes associated with previously collected bathymetry survey data in the study area.
- Analyze sediment bed changes relative to velocities from existing and collected Acoustic Doppler Current Profiler (ADCP) data.
- Assess areas of deposition and accretion.
- Conduct specific-gage analysis at U.S. Geological Survey (USGS) gages to understand trends in stage over time due to changes in cross section.
- Develop spatial and temporal understanding of geomorphological changes and rate of change.

Field Measurements

- Identify suspended sediment concentration (SSC) measurements at selected monitoring sites.
- Collect sediment grab/core samples for material property analysis and for flume testing.
- Obtain flow and velocity measurements with an ADCP at select locations in the study area.
- Continuously monitor water levels at 16 sites located throughout the watershed.

Sediment Transport Evaluation

- Determine site-specific sediment transport mobility criteria for locations in the study area.
- Develop relationships between flow and suspended sediment transport using regression or other curve-fitting techniques and/or sediment transport relations/equations.
- Estimate sediment transport rates for the sites using appropriate established formulas for cohesive and non-cohesive sediments.
- Evaluate sediment transport at key locations in the study area using the CHM portion of the H&H Study under select operations scenarios.
- Develop incoming sediment supply between bathymetric survey areas using historic hydrologic data to compare computed sediment supply to changes in cross section area (Sediment Balance Analysis).
- Analyze results of the recently developed Soil and Water Assessment Tool (SWAT) model with respect to sediment loading.

Characterization of Sedimentation Impacts on Flooding

- Calibrate CHM for smaller flood events using water level measurements.
- Compare hydraulics based on modified Project operation scenarios to historic hydraulics.
- Estimate sedimentation based on sediment transport analysis considering modified reservoir hydraulics compared to historic operation and sedimentation.
- Evaluate changes to flood extent and duration using CHM and approximate channel bed changes considering Project operations.

Data Synthesis and Reporting

- Synthesize findings of bathymetric change analysis and sediment transport evaluation to inform hydraulic modeling efforts.
- Provide an understanding of effects of Project operations on sediment transport characteristics and projected distribution of sediment related to flood extent and duration in the study area.
- Use sediment transport relations and historic trends of sedimentation to make projection of sedimentation considering modified Project operation scenarios.
- Summarize study results and conclusions in an ISR and USR.

The above steps take advantage of all existing and available sediment transport data, include collection of pertinent new sediment data, and utilize analysis techniques to develop an understanding of: (1) sediment supply; (2) the historic distribution of sediment in the reservoir; and (3) trends over time as affected by historic hydrologic input and operations. Such an approach fulfills a detailed level 2 analysis approach and complies with the concepts presented in Simons and Simons (1997).

The Sedimentation Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.3 Aquatic Species of Concern Study

GRDA is proposing to conduct an Aquatic Species of Concern Study as part of this RSP. This study is a desktop study that will be conducted in a phased approach with the potential for conducting field work during the second year of study, as determined necessary. The aquatic species of concern that will be assessed during this study are the following: Paddlefish, Neosho Smallmouth Bass, Neosho Madtom, and Neosho Mucket. The goals of this study related to Paddlefish are to: (1) create maps that delineate the riverine reaches that would be converted to lentic habitat as the result of water level management associated with the operation of the Project; (2) map and provide quantitative estimates of Paddlefish spawning substrate within the reaches converted to lentic habitat due to Project operations; and (3) provide information needed to assess potential impacts of the Project operations on Paddlefish recruitment based on changes in the area of spawning substrate during the Paddlefish spawning period. The goals of this study related to the three Neosho species are to: (1) conduct a review of existing information on the three species' distributions in the Project vicinity and the physical habitat preferences of the species, and provide characterizations of habitat preferences and summarize spatial and temporal patterns of occurrence; (2) if existing records are inadequate for estimating a species' distribution, conduct targeted field surveys to develop rough estimates of the species'

distribution in relevant reaches; and (3) conduct an assessment of the changes due to Project operations, if any, on species whose life-history periodicities indicate that a sensitive life-stage(s) could be present when stream habitat is inundated by Project operations.

There are two tasks associated with conducting the assessment of potential Project effects on Paddlefish: (1) utilizing output from the CHM to map riverine reaches affected by Project operations; and (2) estimating the area of Paddlefish spawning substrate affected by Project operations and the corresponding effect on Paddlefish recruitment. There are three tasks associated with conducting the assessment of potential Project effects on the three Neosho species: (1) reviewing existing information; (2) potentially conducting field surveys to document distributions of the species of concern; and (3) using the results of the H&H Study to assess potential Project impacts to relevant species. The Aquatic Species of Concern Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.4 Terrestrial Species of Concern Study

GRDA is proposing to conduct a Terrestrial Species of Concern Study as part of this RSP. This study is a desktop study that will provide information needed to assess potential Project-related impacts to the gray bat, the northern long-eared bat, and the American burying beetle. The goals of this study are to: (1) create maps that delineate the riverine reaches that would be converted to lentic habitat as the result of water level management associated with Project operations; (2) assess potential impacts of Project operations on the ability of bats to access near-shore caves; and (3) document the presence/absence of American burying beetles in the study area and assess potential impacts, if any, of Project operations on beetle habitat.

There are three primary tasks associated with conducting this study: (1) utilizing output from the CHM to map riverine reaches affected by Project operations; (2) evaluating the effects of Project operations on bats' access to caves; and (3) documenting the presence/absence of American burying beetles in the study area and using the results of the H&H Study to assess potential impacts of Project operations on beetle habitat. The Terrestrial Species of Concern Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.5 Wetlands and Riparian Habitat Study

GRDA is proposing to conduct a Wetlands and Riparian Habitat Study as part of this RSP. This study is a desktop study that will be conducted in a phased approach with the potential for conducting field work during the second year of study, as determined necessary. The goals of this study are to: (1) use the National Wetlands Inventory (NWI) and GRDA's Shoreline Management Plan (SMP) maps (and potentially other sources) to identify, display, and describe the current composition of wetland communities within and adjacent to the study area; (2) use the NWI and GRDA's SMP maps (and potentially other sources) to develop a GIS database on the extent, classification, and plant community structure of wetland and riparian habitats within and adjacent to the study area; (3) utilize the GIS database to estimate the total acres of wetlands and riparian habitats that currently exist within the study area; (4) use results of the H&H Study to determine potential Project effects based on the seasonal variability of hydrologic conditions related to Project operations; and (5) use the results of the H&H Study to determine potential changes to habitat in currently designated Wildlife Management Areas (WMA) in the Project area.

There are three tasks associated with conducting this study: (1) desktop mapping of distribution of wetland and riparian vegetation; (2) review of existing information; and (3) potential field verification of wetland maps. The Wetlands and Riparian Habitat Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.6 Recreation Facilities Inventory and Use Survey

The study area for the Recreation Facilities Inventory and Use Survey was originally proposed to include only the five FERC-approved recreation sites. Based on comments received on the PSP, GRDA has expanded the study area to include the state parks around Grand Lake and immediately below the Project Dam, Connors Bridge, and Riverview Park. Additionally, GRDA has added a task to collect recreation observation data to document informal recreation uses downstream of the Project and a task to collect boat launch elevation data at several boat launches around Grand Lake to assess potential Project effects of operating the Project at varying water levels.

The goals of this study are to gather information regarding current recreational use, and identify recreation resources and activities that may be affected by the continued operation of the Project. The study area will include the five FERC-approved recreation facilities on Grand Lake that are owned, operated, and maintained by GRDA, as well as the state parks around Grand Lake and immediately below the Project Dam, Connors Bridge, and Riverview Park.

There are five tasks associated with conducting this study: (1) Recreation Facility Inventory and Condition Assessment; (2) Recreation Visitor Use Data; (3) Recreation Observations; (4) Boat Launch Elevation Data Collection; and (5) Data Analysis and Reporting. Task 1 will involve collecting information regarding each of the five FERC-approved recreation areas via photo documentation and completing a Facilities and Inventory and Condition Form. Recreation visitor use data will be collected during Task 2 via field reconnaissance and conducting personal interviews at each of the five FERC-approved recreation locations and the state parks around Grand Lake and immediately below the Project Dam, Connors Bridge, and Riverview Park. Twice a month, GRDA personnel will collect recreational use data associated with Task 3 to document informal recreation access below the Project. Boat launch elevation data will be collected as detailed in Task 4 of this study. Task 5 of this study will be the data analysis and development of the study report. The Recreation Facilities Inventory and Use Survey Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.7 Cultural Resources Study

GRDA revised the Cultural Resources Study Plan based on comments on and consultation with Native American Tribes, THPOs, the Oklahoma SHPO, OAS, ACHP, BIA, and FERC. In the revised Cultural Resources Study Plan, GRDA clarified additional consultation and coordination with Native American Tribes and THPOs, described a schedule for continued consultation and meetings with the CRWG, and provided additional information on GRDA's commitment to sharing information with the CRWG while protecting confidential information. Other substantive revisions to the Cultural Resources Study Plan include the addition of subsurface testing as a component of the Reconnaissance Surveys, the inclusion of certain archaeological site evaluations and assessments during Study Years One and Two, a description of GRDA's approach to developing and implementing an inventory of Traditional Cultural Properties (TCP), and additional information regarding how GRDA proposes to address tribal monitoring,

inadvertent discoveries, curation, site documentation, the eligibility of unevaluated archaeological resources, and archaeological sites identified on lands that are not owned by GRDA.

The goals of this study are: (1) to identify historic properties within the Project's Area of Potential Effects (APE) that are being adversely affected by Project operations (if any), including properties of traditional religious and cultural importance; and (2) to develop a Historic Properties Management Plan (HPMP) in consultation with the Oklahoma SHPO, OAS, and Native American Tribes that provides for the long-term management of historic properties within the APE over the term of the new license. This study will consist of the following seven tasks: (1) Determine the APE; (2) Background research and archival review; (3) Pre-fieldwork Report; (4) Reconnaissance Surveys; (5) Conduct an evaluation of certain archaeological sites; (6) Conduct an inventory of TCP; and (7) Develop an HPMP.

A Pre-fieldwork Study Report, Study Year One Reconnaissance Survey Report, Study Year One Intensive Survey Report, Study Year Two Reconnaissance Survey Report, Study Year Two Intensive Survey Report, a supplemental report on archeological investigations conducted subsequent to the USR, and an HPMP will be developed as part of this study. GRDA anticipates developing a draft HPMP in consultation with the CRWG, which will be included as part of GRDA's FLA filed with the Commission. The Cultural Resources Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.1.8 Socioeconomics Study

Based on comments received on the PSP, the Socioeconomics Study Plan has been revised to provide more detail on the approach that will be used to report available information on the socioeconomic effects of the Pensacola Project. The methodology has been expanded to detail the types of existing socioeconomic data to be used to present qualitative assessment of the four-county study area. This will be done through information gathering that includes a direct query of relicensing participants, as well as local organizations and businesses, for available and objective data to inform the socioeconomic impacts of the Project in the Grand River Basin.

GRDA is proposing to conduct a Socioeconomics Study to gather, synthesize, and report on existing information necessary to qualitatively evaluate the cumulative 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 and to identify the socioeconomic contribution of the Project in the region.

GRDA will perform a desktop review of available regional socioeconomic data. Available information on the demographic and economic conditions of the region will be compiled and summarized in a final study report to present a qualitative assessment for the study area. The Socioeconomics Study Plan is included in Attachment A of this RSP and provides additional details regarding the overall study and methodology.

3.2 Phased Approach to Study Implementation

As detailed in the individual study plans appearing in Attachment A, GRDA proposes to integrate the studies, where appropriate, to inform both the scoping of studies during the second year of studies, and to undertake its environmental effects analysis in the Exhibit E Environmental Exhibit of the relicensing application required by 18 C.F.R. § 5.18. For example,

the outputs of the H&H Study at the end of Study Year One will be used in the Cultural Resources Study to prioritize areas for study during Study Year Two. The outputs of the H&H Study will also be used in coordination with existing information and any data collected from field efforts to evaluate effects on aquatics, terrestrial, and wetlands and riparian resources as described in the relevant study plans.

4.0 GRDA'S RESPONSE TO STUDY REQUESTS RECEIVED

As noted above, GRDA received a total of 22 study requests as part of the PSP comments. Some of these study requests did not provide all of the information required by FERC's ILP Study Criteria (18 C.F.R. § 5.9(b)), as set forth in Section 2.1 of this RSP. Regardless, in an effort to be complete, GRDA has attempted in this RSP document to identify and evaluate all study requests submitted, including those that may not have fully complied with FERC's Study Criteria. Table 4.0-1 summarizes the results of GRDA's review of the formal study requests and determination based on the Study Criteria.

This RSP incorporates many of the study elements requested by relicensing participants made during the study plan meeting and CRWG meeting, GRDA relicensing consultation meetings with ACHP, SHPO and OAS, and the tribal consultation meeting with various Native American Tribes, as well as written comments filed on the PSP. Table 4.0-1 summarizes the results of GRDA's review of the formal study requests and determination based on the Study Criteria. Where possible, GRDA consolidated common themes and elements expressed in the study requests (Table 4.0-2).

Table 4.0-1. Summary of formal study requests and GRDA's responses.

	Requested Study	Entity	Date	Proposed for Study / Proposed for Study with Modifications	Not Proposed for Study	Correlation to GRDA Study
1	Project Boundary and Federal Lands Study	BIA	7/26/2018		✓	See Section 4.2.1 of this RSP. See Study Criterion § 5.9(b)(5).
2	Contaminated Sediment Transport Study	BIA (by general reference in support of the study and specific comments)	7/26/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria § 5.9(b)(4) and (5).
3	Flora and Fauna Study	BIA (by general reference in support of the study and specific comments)	7/26/2018		✓	See Section 4.2.4 of this RSP. See Study Criteria §§ 5.9(b)(1) - (7).
4	Inundation Study	U.S. Fish and Wildlife Service (USFWS)	7/26/2018	✓		Hydrologic and Hydraulic Modeling Study. See Sections 3.1.1 and 4.1.1 and Attachment A of this RSP.

	Requested Study	Entity	Date	Proposed for Study / Proposed for Study with Modifications	Not Proposed for Study	Correlation to GRDA Study
5	Contaminant Sediment Transport Study	USFWS (by general reference in support of the study and specific comments USFWS's comments supported by BIA with specific comments, as supported by Miami Tribe)	7/26/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria §§ 5.9(b)(4) and (5).
6	Quantifying the Effects of Increased Water Level within the Grand Lake Watershed	Oklahoma Department of Wildlife Conservation (ODWC) (supported by USFWS and N. Larry Bork)	7/24/2018	✓		Aquatic Species of Concern Study. See Sections 3.1.3 and 4.1.3 and Attachment A of this RSP.
7	Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning / Recruitment	ODWC (supported by USFWS and N. Larry Bork)	7/24/2018	✓		Aquatic Species of Concern Study. See Sections 3.1.3 and 4.1.3 and Attachment A of this RSP.
8	Sedimentation Contaminant Study	ODWC (supported by USFWS and N. Larry Bork)	7/24/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria §§ 5.9(b)(4) and (5).

	Requested Study	Entity	Date	Proposed for Study / Proposed for Study with Modifications	Not Proposed for Study	Correlation to GRDA Study
9	Impoundment Fluctuation Studies	ODWC (supported by USFWS and N. Larry Bork)	7/24/2018	✓		Hydrologic and Hydraulic Modeling Study, Aquatic Species of Concern Study, and Terrestrial Species of Concern Study. See Section 3.1.1, 3.1.3, 3.1.4 4.1.1, 4.1.3 and 4.1.4 and Attachment A of this RSP.
10	Wetland Documentation	ODWC (supported by USFWS and N. Larry Bork)	7/24/2018	✓		Wetlands and Riparian Habitat Study. See Sections 3.1.5 and 4.1.5 and Attachment A of this RSP.
11	Loss of Wildlife Lands from Flooding	ODWC (supported by USFWS and N. Larry Bork)	7/24/2018	✓		Wetlands and Riparian Habitat Study. See Sections 3.1.5 and 4.1.5 and Attachment A of this RSP.
12	Contaminated Sediment Transport Study	Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, City of Miami, and Larry Bork)	7/26/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria §§ 5.9(b)(4) and (5).
13	Infrastructure Impacts Study	Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, City of Miami, and N. Larry Bork)	7/26/2018		✓	See Section 4.2.5 of this RSP. See Study Criteria §§ 5.9(b)(4), (5) and (7).

	Requested Study	Entity	Date	Proposed for Study / Proposed for Study with Modifications	Not Proposed for Study	Correlation to GRDA Study
14	Flora and Fauna Impacts	Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, City of Miami, and N. Larry Bork)	7/26/2018		✓	See Section 4.2.4 of this RSP. See Study Criteria §§ 5.9(b)(1) - (7).
15	Federal Lands and Project Boundary Study	Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, City of Miami, and N. Larry Bork)	7/26/2018		✓	See Section 4.2.1 of this RSP. See Study Criterion § 5.9(b)(5).
16	Sedimentation Study	City of Miami (supported by Miami Tribe and N. Larry Bork)	7/26/2018	✓	✓	Sedimentation Study. See Sections 3.1.2 and 4.1.2 and Attachment A of this RSP. With regard to the Sediment Transport Model Study request, see Section 4.2.2 and Study Criterion § 5.9(b)(5).
17	Contaminated Sediment Transport Study	City of Miami (supported by Miami Tribe and N. Larry Bork)	7/26/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria §§ 5.9(b)(4) and (5).
18	Infrastructure Improvement Study	City of Miami (supported by Miami Tribe and N. Larry Bork)	7/26/2018		✓	See Section 4.2.5 of this RSP See Study Criteria §§ 5.9(b)(4), (5) and (7).

	Requested Study	Entity	Date	Proposed for Study / Proposed for Study with Modifications	Not Proposed for Study	Correlation to GRDA Study
19	Project Boundary and Federal Lands Study	City of Miami (supported by Miami Tribe and N. Larry Bork)	7/26/2018		✓	See Section 4.2.1 of this RSP. See Study Criterion § 5.9(b)(5).
20	Comprehensive Flood Routing Study	Larry Bork (Counsel on behalf of citizens of City of Miami)	7/26/2018	✓		Hydrologic and Hydraulic Modeling Study. See Sections 3.1.1 and 4.1.1 and Attachment A of this PSP.
21	Sedimentation Study	Larry Bork (Counsel on behalf of citizens of City of Miami)	7/26/2018	✓		Sedimentation Study. See Sections 3.1.2 and 4.1.2 and Attachment A of this RSP.
22	Contaminated Sediment Transport Study	Larry Bork (Counsel on behalf of citizens of City of Miami)	7/26/2018		✓	See Section 4.2.3 of this RSP. See Study Criteria §§ 5.9(b)(4) and (5).

Table 4.0-2. Formal study requests filed with FERC.

	Requested Study	Adopted or Did Not Adopt	BIA	USFWS	ODWC	Miami Tribe	Ottawa Tribe	Peoria Tribe	City of Miami	N. Larry Bork[1]
1	Flooding/Inundation Study	Yes		✓	✓					✓
2	Sedimentation Study	Yes				✓	✓	✓	✓	✓
3	Project Boundary and Federal Lands Study	No	✓			✓	✓	✓	✓	✓
4	Sediment Transport Model Study	No				✓	✓	✓	✓	✓
5	Contaminated Sediment Transport Study	No	✓	✓	✓	✓	✓	✓	✓	✓
6	Impoundment Fluctuation Studies	Yes		✓	✓					✓
7	Quantifying the Effects of Increased Water Level within the Grand Lake Watershed	Yes		✓	✓					✓
8	Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning / Recruitment	Yes		✓	✓					✓
9	Wetland Documentation	Yes		✓	✓					✓
10	Loss of Wildlife Lands from Flooding	Yes		✓	✓					✓
11	Flora and Fauna Impacts	No	✓			✓	✓	✓	✓	✓
12	Infrastructure Improvement Study	No				✓	✓	✓	✓	✓

Notes:
1 Counsel for City of Miami citizens.

4.1 Study Requests Included in GRDA's RSP

4.1.1 Hydrologic and Hydraulic Modeling Study

The specific relicensing participants requesting flooding and inundation studies are USFWS, ODWC, and N. Larry Bork (counsel for the City of Miami citizens). FERC, BIA, USACE, Miami Tribe (supported by Ottawa Tribe and Peoria Tribe), Ben Loring (State Representative), and City of Miami commented on GRDA's H&H Study Plan. The H&H Study will provide information through modeling and mapping to determine the effect of the operation of the Project upon several resource areas. The H&H Study will determine the duration and extent of inundation under the current operation of the Project during several measured inflow events, determine the duration and extent of inundation under any proposed change in operation that occurs during several measured or synthetic inflow events, provide the model results in a format that can inform other analyses (to be completed separately) about Project effects, if any, in several resource areas, and will determine the feasibility of implementing alternative operation scenarios that may be proposed by GRDA as part of the relicensing effort.

The modeling conducted as part of the H&H Study will encompass the Neosho, Spring, and Elk rivers and Tar Creek and use the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software and incorporate some 2-D analysis, where appropriate.

The H&H Study will compare current channel geometry to historical channel geometry to compare flood routing specifics resulting from sediment accretion and erosion in the river channels.

Additional Considerations for the H&H Study

Description of USACE and GRDA Flood Control Operations

As fully detailed in Section 4.3 of this RSP, Section 4.1 of the PSP, comment response No. 9 in Attachment B of this RSP, and other filings with the Commission that address this issue, the USACE has exclusive jurisdiction over Grand Lake for flood control purposes.[18] As indicated in the PSP, the H&H Study will help to define the interrelated complexities and effects associated with GRDA's operations under its FERC-issued license, USACE flood control operations, and other factors (including natural conditions) that influence and affect inundation in the Grand/Neosho River and its tributaries.

Flood Frequency Analysis

FERC requests that the H&H Study Plan clarify how the peak inflow at the Pensacola Dam would be determined and include the range of flood events that would be included in the flood frequency analysis, specifically requesting that the 5-, 10-, and 15-year events be used as a guide. The H&H Study proposes a flood frequency analysis of the peak inflows observed at the Pensacola Dam during the measured inflow events used in the proposed CHM runs. The flood frequency analysis will be used to, at a minimum, determine the 5-, 10-, and 15-year return period peak inflows.

[18] *See supra* note 1.

CHM Methodology

FERC and the City of Miami recommend that additional detail be provided in the H&H Study to clarify how both 1-D and 2-D hydraulic modeling will be incorporated into the CHM. The H&H Study Plan provides details about the criteria that will be used for selecting how each reach within the CHM will be modeled. The H&H Study Plan also provides the rationale for proposing which method will be used for each reach within the model.

Study Area

The City of Miami recommends that the H&H Study Plan define the measurable difference in water surface elevation that will be used to determine the extents of the CHM. The H&H study area will encompass the channel and overbank areas of the Grand/Neosho River watershed that have a material difference in water surface elevations due to Project operation during the measured inflow events of the H&H Study. A material difference in water surface elevation due to Project operations will be based on professional judgment. A difference in water surface due to Project operations does not include natural fluctuations in the river system such as wind and wave action.

Evaluate Alternatives to Reduce Inundation

FERC recommends that the H&H Study Plan include methods for performing evaluations of alternatives to potentially reduce inundation. The RSP provides that if first year study results demonstrate that Project operations contribute to inundation as described, modeling of alternative operation scenarios can be considered in the second year of study and results presented in the USR.

Use of Existing Information

The following existing information will not be included or used as a model basis for the H&H Study:

USACE RiverWare Model

FERC and the City of Miami recommend that GRDA consider utilizing the USACE's basin-wide flood operations model as a tool for evaluating project operations. The USACE Flood Operations Model is a basin-wide RiverWare model used by the USACE to plan flood control operations throughout the entire Arkansas River basin. The RiverWare model operates on daily time steps, meaning that inflows and outflows used within the modeling are averaged on a daily basis. GRDA acknowledges that while the model could provide valuable data for determining flood frequencies at the Project, it is not an adequate approach for analyzing the sub-daily power production decisions at the Project. The level of effort to update the modeling to an hourly time-step far exceeds the benefits and doesn't provide additional useable, practical knowledge that the proposed Operations Model will not already provide.

Topography and Bathymetry

FERC and the City of Miami recommend that a map be provided in the H&H Study Plan to show the extents of the various bathymetric and topographic datasets that will be used for the modeling. In addition, the City of Miami recommends that GRDA gather additional topographic data in the form of Light Detection and Ranging (LiDAR) to expand the mapping. The H&H Study Plan includes a map depicting the extents of the topographic and bathymetric datasets proposed for the modeling and also includes a description of how the datasets will be combined. GRDA does not believe collection of additional data is necessary. It would significantly exceed generally accepted scientific practices. The cost of collecting additional data would greatly outweigh the benefit, and the study schedule cannot accommodate such an effort.

Calibration

FERC and the City of Miami recommend that the CHM be calibrated to a full range of inflow events using several different data sources. The proposed study includes calibration of the CHM using several historic inflow events with a range of different inflows (including the July 2007 event). The data sources used for calibration will include surveyed high-water marks, USGS stream gage records, operation data for Pensacola and Kerr dams, and data obtained from water level monitoring that has been conduced by GRDA since December 2016. If available, historic aerial photography will be used to inform overbank roughness coefficients used for the historic events.

Flowage Easements

The City of Miami requests a cost estimate to purchase additional flowage easements. As GRDA asserted in Section 4.3 of this RSP, Section 4.1 of the PSP, and comment response No. 9 in Attachment B of this RSP, the adequacy of USACE's flowage easements and other issues related to property rights and ownership are beyond the scope of this relicensing process.[19] The Commission has recognized that such matters are to be addressed as provided under sections 10(c) and 21 of the FPA.[20] "The [Federal Power Act] does not . . . confer on this Commission any jurisdiction or authority to resolve disputes between the licensee and third parties that concern interests in real property."[21] Even when flowage easements arose at this Project as an issue over 70 years ago under the federal government's just-compensation duties under section 16 of the FPA, Congress authorized a separate process for resolving that issue.[22]

Model Run Parameters

FERC and the City of Miami recommend that the model evaluate a comprehensive range of starting reservoir elevations based on reservoir elevations observed during the entire license period. The proposed study will analyze starting reservoir elevations ranging from 740 feet PD to 745 feet PD.

Deliverables

The City of Miami recommends that all information regarding the H&H Study be publicly available, including the hydraulic models and supporting data. GRDA will provide the CHM calibration data

[19] *See* PSP § 4.1.1 at p. 27.

[20] *See Grand River Dam Auth.*, 156 FERC ¶ 61,106 at P 67 (2016); *E. Bay Mun. Util. Dist.*, 66 FERC ¶61,199 at p. 61,449 & n.16 (1994). Moreover, as the U.S. Court of Appeals for the 10th Circuit noted nearly 20 years ago in litigation concerning this Project, parties seeking to file claims against the USACE for flooding damages may file an action at the U.S. Court of Federal Claims. *See Dalrymple v. GRDA*, 145 F.3d 1180, 1187 (10th Cir. 1998).

[21] *Halecrest Co.*, 60 FERC ¶ 61,121 at p. 61,413 (1992), *order on reh'g*, 63 FERC ¶ 61,307 (1993); *see also JDJ Energy Co.*, 101 FERC ¶ 61,059 at PP 10-12 (2002).

[22] *Compare* Public Law No. 79-573 § 1, 60 Stat. 743, 743 (1946) ("[T]he Secretary of the Interior is hereby authorized and directed, notwithstanding the provisions of any other law, to adjust and settle, upon such basis as he may deem just and equitable, the accounts between the United States and the Grand River Dam Authority arising out of . . . the taking of possession and control, and the occupation and use of the Grand River Dam project in Oklahoma[.]"), *with* 16 U.S.C. § 809 ("[I]n the event that the United States shall exercise such right it shall pay to the party or parties entitled thereto just and fair compensation for the use of said property as may be fixed by the commission upon the basis of a reasonable profit in time of peace, and the cost of restoring said property to as good condition as existed at the time of the taking over thereof, less the reasonable value of any improvements that may be made thereto by the United States and which are valuable and serviceable to the licensee."). *See also* Settlement Agreement between Grand River Dam Authority and United States of America at 11-12 (Aug. 1, 1946) (noting that the parties found section 16 to be an "unsatisfactory" basis of resolving the issues) [hereinafter "1946 Settlement Agreement"].

and outputs upon written request. The model files will also be provided if requested in writing but will likely need to be transferred via USB drive or electronic file transfer due to the file size.

Relicensing Participant Consultation
FERC and the City of Miami recommend development of a protocol for consultation during the H&H Study. The proposed H&H Study Plan includes detail about how the relicensing participants can provide input. GRDA has proposed a Status Report and conference call near the middle of the first study season. Beyond that proposed additional measure, the ILP provides an adequate forum for consultation on studies because it is divided into two study seasons which will include consultation with relicensing participants on the initial study results after the first year of studies.

4.1.2 Sedimentation Study

The specific relicensing participants requesting and/or commenting on GRDA's Sedimentation Study are FERC, BIA, ODWC, Miami Tribe, City of Miami, and Ben Loring (State Representative). The City of Miami is supported by N. Larry Bork and Miami Tribe, Ottawa Tribe, and Peoria Tribe in requesting a sediment transport model be developed.

The goal of the Sedimentation Study is to determine the overall trends of sedimentation in the study area. The study will determine the spatial distribution of sedimentation in the reservoir, evaluate sediment transport at locations distributed throughout the study area, and provide a characterization of the impacts the observed sedimentation has on flood extent and duration in upstream areas. The study uses an approach with widespread scientific acceptance which will produce meaningful results at appropriate spatial and temporal resolutions.

Additional Considerations for the Sedimentation Study

Use of Existing Data
The Sedimentation Study Plan includes a more thorough description of existing available data and includes a methodology to collect additional field data to supplement the dataset. All existing and collected data will be used to determine the overall trends of sedimentation in the study area.

Sediment Deposition During High Flow Events
The Sedimentation Study will evaluate overall trends of sedimentation in the study area. While large floods are capable of moving greater quantities of sediment, smaller one- to two-year flood events may move the most sediment over longer time periods. Flood events will be investigated in detail. Historic distributions and trends in sedimentation are a result of historic hydrology and other factors. These spatial and temporal trends will be projected into the future based on modified Project operations.

Sedimentation in Overbank Areas
The Sedimentation Study Plan clarifies that the CHM will be used to evaluate effects on water levels. Roughness coefficients of the overbank areas will be incorporated in the CHM development process, and are not part of the Sedimentation Study. There is not sufficient topographic data for a historical analysis of changes to floodplain elevation. Sedimentation rates on overbank areas will be developed based on the extent and duration of overbank flooding, sediment concentrations, and sediment settling rates.

Hydraulic Constrictions "Choke Points"
The Sedimentation Study Plan details the sediment transport estimation process, namely that well-established sediment transport relationships will be used to determine transport. There is no difference in treatment of hydraulic constrictions as compared to other reaches.

Extent of Study Area
The Sedimentation Study Plan provides that the study area will encompass the areas considered by the CHM, including several tributaries and Tar Creek.

Full Hydrographic Study of Grand Lake
A full hydrographic survey is not included as a portion of the Sedimentation Study. Recent hydrographic survey data collected by USGS in 2017 of the Spring, Neosho, and Elk rivers will be used in conjunction with 2008/2009 bathymetry of Grand Lake (USGS 2017). It is believed that sedimentation is occurring at very slow rates, as a USACE study published in 2016 found sedimentation rates of 0.0268 ac-ft/sq mi/year in the flood pool, which are 1-2 orders of magnitude lower than comparable reservoirs in the region (USACE 2016). Given this slow rate, it is likely that additional bathymetry surveys would find little to no difference in depths in the reservoir between 2009 and the present time and even less change in the upstream reaches of the study area since 2017. Considering generally accepted scientific practice, the age of the available hydrographic data is very recent and no additional hydrographic survey data will be required to meet the goals of the study.

Sediment Transport Model
The City of Miami recommends and provided a Sediment Transport Model Study Plan as an alternative to GRDA's Sedimentation Study. An explanation for why GRDA is not adopting the City of Miami's alternate study plan is detailed in Section 4.2.2 of this RSP.

4.1.3 Aquatic Species of Concern Study

ODWC (supported by USFWS and N. Larry Bork [counsel for the City of Miami citizens]) has requested several studies related to aquatic resources including: (1) Quantifying the Effects of Increased Water Level within the Grand Lake Watershed (2) Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning / Recruitment and (3) Impoundment Fluctuation Studies. To address the first study request, ODWC requests that a model be developed to quantify the amount of riverine/lotic habitat that will transition to reservoir/lentic habitat if the year-round operating pool is increased to 745 feet above sea level. The ODWC requests that the model also quantify specific seasonal inundation of currently riverine/lotic habitats. To address the second study request, ODWC requests that GRDA use sonar and/or GIS to develop bathymetric baseline maps of headwaters and habitats to model changes in inundation of gravel shoals and off-channel habitats as a result of artificial, seasonal manipulation of reservoir elevation. In its third study request, ODWC requests that GRDA provide information regarding the habitat in the fluctuation of the impoundment and how it may be impacted by daily, seasonal, and long-term lake fluctuations. In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting these ODWC study requests as described in the PSP, FERC requested additional details regarding objectives and methodology for performing resource analyses to address the identified issues.

As part of this RSP, GRDA has proposed an H&H Study to determine the potential effects of Project operations upon several resource areas. Sections 3.1.1 and 4.1.1 of this RSP summarize the proposed H&H Study and the complete study plan is included in Attachment A of this RSP. The results of the H&H Study will be coupled with existing information to assess

impacts to aquatic resources as a result of changing water levels due to Project operations. The methodology that will be used to perform the resource analyses requested by ODWC related to aquatic resources is further discussed below.

Additionally, based on study requests and comments received from ODWC and FERC, GRDA has also proposed an Aquatic Species of Concern Study to provide further details regarding how potential impacts to aquatic resources related to changing water levels due to Project operations will be assessed during the relicensing process. GRDA's proposed Aquatic Species of Concern Study has been developed as a phased approach to address ODWC's concerns regarding aquatic species in the Project area. The proposed study will focus on Paddlefish, Neosho Madtom, Neosho Mucket, and Neosho Smallmouth Bass, which are species that ODWC has targeted in its study requests. GRDA will use existing information and output from the CHM to create maps and provide quantitative estimates of Paddlefish spawning substrate in areas converted to lentic habitat due to changes in water levels as a result of Project operations and assess potential impacts to Paddlefish recruitment due to changes in spawning habitat. GRDA will review existing information on the three Neosho species and conduct field surveys to develop rough estimates of species' distribution in relevant reaches, if determined necessary. Using this information and results from the H&H Study, GRDA will assess the potential Project effects on the three Neosho species. Section 3.1.3 of this RSP provides a summary of the proposed study and Attachment A of this RSP includes the complete study plan, which provides additional details regarding the overall study and methodology GRDA will use to perform the requested resource analyses.

4.1.4 Terrestrial Species of Concern Study

ODWC (supported by USFWS and N. Larry Bork [counsel for the City of Miami citizens]) has requested Impoundment Fluctuation Studies. To address this study request, ODWC requests that GRDA map the habitat in the fluctuation zone at full pond and quantify the acreage available. In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting this ODWC study request as described in the PSP, FERC requested additional details regarding objectives and methodology for performing resource analyses to address the identified issues.

As part of this RSP, GRDA has proposed an H&H Study to determine the potential effects of Project operations upon several resource areas. Sections 3.1.1 and 4.1.1 of this RSP summarize the proposed H&H Study and the complete study plan is included in Attachment A of this RSP. The results of the H&H Study will be coupled with existing information to assess impacts to terrestrial resources as a result of changing water levels due to Project operations. The methodology that will be used to perform the resource analyses requested by ODWC related to terrestrial resources is further discussed below.

Additionally, based on study requests and comments received from ODWC and FERC, GRDA has proposed a Terrestrial Species of Concern Study to provide further details regarding how potential impacts to terrestrial resources related to changing water levels due to Project operations will be assessed during the relicensing process. GRDA's proposed Terrestrial Species of Concern Study has been developed as a phased approach to address ODWC's concerns regarding terrestrial species in the Project area. The proposed study will focus on the gray bat, northern long-eared bat, and the American burying beetle. GRDA will use existing information and output from the CHM to create maps that delineate areas that would be converted to lentic habitat as a result of water level management associated with Project operations and assess the potential impacts of Project operations on the ability of bats to access near-shore caves. GRDA will also document the presence/absence of American

burying beetle in the study area and, using this information and results from the H&H Study, assess potential impacts of Project operations on beetle habitat. Section 3.1.4 of this RSP provides a summary of the proposed study and Attachment A of this RSP includes the complete study plan, which provides additional details regarding the overall study and methodology GRDA will use to perform the requested resource analyses.

4.1.5 Wetlands and Riparian Habitat Study

ODWC (supported by USFWS and N. Larry Bork [counsel for the City of Miami citizens]) has requested two studies related to wetlands including: (1) Wetlands Documentation; and (2) Loss of Wildlife Lands from Flooding. To address these study requests, ODWC requests that GRDA document all wetlands as well as identify all aquatic vegetation in the Project vicinity and quantify the amount of WMA acres available at maximum expected Project pool. In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting these ODWC study requests as described in the PSP, FERC requested additional details regarding objectives and methodology for performing resource analyses to address the identified issues.

As part of this RSP, GRDA has proposed an H&H Study to determine the potential effects of Project operations upon several resource areas. Sections 3.1.1 and 4.1.1 of this RSP summarize the proposed H&H Study and the complete study plan is included in Attachment A of this RSP. The results of the H&H Study will be coupled with existing information to assess impacts to wetlands and riparian habitat as a result of changing water levels due to Project operations. The methodology that will be used to perform the resource analyses requested by ODWC related to wetlands and riparian habitat is further discussed below.

Additionally, based on study requests and comments received from ODWC and FERC, GRDA has proposed a Wetlands and Riparian Habitat Study to provide further details regarding how potential impacts to wetlands and riparian habitat related to changing water levels due to Project operations will be assessed during the relicensing process. GRDA's proposed Wetlands and Riparian Habitat Study has been developed as a phased approach to address ODWC's concerns regarding wetlands and riparian habitat in the Project area. GRDA will use existing information to identify, display, and describe the current composition of wetland communities and WMAs within and adjacent to the study area; estimate the total acres of wetlands and WMAs in the study area; and use the results of the H&H Study to determine potential Project effects to wetlands and WMAs. Section 3.1.5 of this RSP provides a summary of the proposed study and Attachment A of this RSP includes the complete study plan, which provides additional details regarding the overall study and methodology GRDA will use to perform the requested resource analyses.

4.1.6 Recreation Facilities Inventory and Use Survey

FERC, BIA, ODWC, Ben Loring (State Representative), and the City of Miami submitted PSP comments on GRDA's proposed Recreation Facilities Inventory and Use Survey Study Plan. All PSP comments and GRDA's corresponding responses are detailed in Attachment B of this RSP.

4.1.7 Cultural Resources Study

FERC, BIA, ODWC (supported by USFWS), SHPO, OAS, Cherokee Nation, Delaware Tribe, Miami Tribe (supported by Ottawa Tribe and Peoria Tribe), Muscogee Nation, Osage Nation, Quapaw Tribe, Wyandotte Nation, Ben Loring (State Representative), City of Miami, and N.

Larry Bork (counsel for the City of Miami citizens) submitted PSP comments on GRDA's proposed Cultural Resources Study Plan. All PSP comments and GRDA's corresponding responses are detailed in Attachment B of this RSP.

4.1.8 Socioeconomics Study

BIA, Miami Tribe (supported by Ottawa Tribe and Peoria Tribe), Ben Loring (State Representative), City of Miami, and N. Larry Bork (counsel for the City of Miami citizens) submitted comments on GRDA's proposed Socioeconomics Study Plan. All PSP comments and GRDA's corresponding responses are detailed in Attachment B of this RSP.

4.2 Study Requests and Elements of Study Requests Excluded from GRDA's RSP

This RSP incorporates many of the studies or elements of studies requested by relicensing participants. However, as described below, several studies and study elements, including specific objectives or methodologies, were not adopted. GRDA did not adopt them for primarily three reasons: (1) the information requested is unnecessary because existing information is sufficient; (2) the H&H Study and other studies proposed by GRDA or other relicense application development activities will yield information to satisfy any information need identified by the study; or (3) the information requested is beyond the scope of this relicensing process and will not inform the development of any PM&E measures that the Commission may require.

4.2.1 Project Boundary and Federal Lands Study

BIA, Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, and N. Larry Bork [counsel for the City of Miami citizens]), and the City of Miami have requested a Project Boundary and Federal Lands Study. On March 12, 2018, the U.S. Department of the Interior, BIA filed trust maps with FERC based on land inventory data from BIA's Trust Asset and Accounting Management System (TAAMS). BIA's maps depict parcels, adjacent to and in the vicinity of the Project, that BIA has identified as either trust lands or restricted fee lands.[23] BIA's filing noted that these maps "do not attempt to identify which tracts are within the boundaries of or affected by the Pensacola Project."[24] However, both the Miami Tribe of Oklahoma and the City of Miami contend that the Project occupies lands held by the United States in trust for a Native American Tribe or Individual Indians.[25]

Commission staff requested BIA, with regard to the parcels depicted in its maps, to "describe the nature of the federal interest held by the federal government" and particularly "whether the title of the land is held in trust by the federal government or in fee by a tribe or individual Indian."[26] BIA filed additional information in response to this request on April 11, 2018. On August 16, 2018, GRDA met with BIA to discuss the ongoing mapping efforts and on September 18, BIA filed supplemental information of "Unmappable" trust lands along the Project Boundary that are now mapped.

[23] *See* United States Department of the Interior, Bureau of Indian Affairs' Trust Lands Maps, Project No. 1494-438 (filed March 12, 2018).
[24] *Id.* at 2.
[25] Miami Tribe Comments at 1-2; City of Miami Comments at 6.
[26] Letter from Stephen Bowler, Federal Energy Regulatory Commission, to Eddie R. Streater, Bureau of Indian Affairs, at 1, Project No. 1494-438 (issued March 15, 2018).

BIA's comments on the PSP reference documents that it asserts establish that federal and tribal lands are included in the Project and that, as such, the tribes should be signatories on any Programmatic Agreement for the Project. BIA also states that USACE should be a cooperating agency and that the Project's 1939 license "conditioned the flood control authority of [USACE] on the acquisition of adequate flowage easements."

The Miami Tribe requests a study to determine the Project Boundary and identify federal lands. BIA states, among other things, that it "is still not aware of any effort undertaken by GRDA to verify the existing or locate these lands." It adds that "[a] new and independent study is clearly needed."

Throughout the long history of this Project, the Commission repeatedly and uniformly has concluded that the Project does not occupy any federal lands.[27] This conclusion is supported by the many times in which Congress, the President, and USACE have consistently established that GRDA has no responsibilities for land ownership above elevation 750 feet PD, as summarized below.[28] GRDA's FERC-approved Project Boundary—while it is a metes and bounds survey—generally follows the 750-foot PD contour elevation.

Nonetheless, GRDA recognizes that the question of whether the Project actually occupies any federal lands or interests in lands presents a complex set of issues, including:

- Whether information filed by BIA contains accurate and current information on federal land ownership in the vicinity of the Project;
- Whether the information filed by BIA presents a full depiction of property ownership within each parcel that is noted as trust land, e.g., whether in light of the extraordinary and complex history associated with this Project, GRDA has a pre-existing flowage easement on these parcels, or whether the United States maintains a right to use these lands for flood control or other purposes;[29]
- Whether the depicted lands are actually within the FERC-approved Project Boundary, or simply near or adjacent to the Project Boundary;[30] and
- Whether any lands adjacent to or in the vicinity of the Project, to which the United States holds an interest, are needed for purposes of the Project, based on the results of the relicensing studies (including the H&H Study) and the Commission's evaluation under the FPA.[31]

[27] *See*, *e.g.*, *Grand River Dam Auth.*, 158 FERC ¶ 62,003 at P 1 (2017); Final Environmental Assessment at 50, Project No. 1494-437 (issued May 11, 2017) (finding that "the Pensacola Project boundary, as currently defined, does not occupy Tribal lands held in trust"); *Grand River Dam Auth.*, 153 FERC ¶ 62,080 at P 1 (2015); *see also* Comments of U.S. Department of the Interior – OEPC at 2, Project No. 1494-437 (filed October 21, 2016) ("as currently defined, the Project Boundary does not occupy Indian lands")

[28] See 1946 Settlement Agreement, §§ 1.2 and 1.6, providing for the federal government to retain its own property rights above 750 feet PD and obtain any property rights held by GRDA above that elevation.

[29] *See infra* § 4.3.

[30] The actual placement of the Project Boundary has not been evaluated for decades, and even under the Commission's relatively recently updated standards, the boundary is only required to be "positionally accurate to ±40 feet, in order to comply with the National Map Accuracy Standards for maps at a 1:24,000 scale." 18 C.F.R. § 4.41(h).

[31] *See* 16 U.S.C. §§ 769(11), 803(a)(1).

GRDA has been working cooperatively with Native American Tribes, BIA, Commission staff, and other relicensing participants to better understand these issues and will continue to do so as more historical and scientific information becomes available through this process. However, no specific study related to this matter is needed. Rather, as is required for every license applicant, GRDA's PLP/DLA will contain a set of proposed Project Boundary maps as part of its Exhibit G,[32] and Exhibit A will identify "[a]ll lands of the United States that are enclosed within the project boundary . . . identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence a public land survey, by the best available legal description."[33] All relicensing participants will have an opportunity to review and comment on these documents.

4.2.2 Sediment Transport Model Study

The City of Miami recommends and provided a Sediment Transport Model Study Plan as an alternative to GRDA's Sedimentation Study. The City of Miami is supported by N. Larry Bork and the Miami Tribe, Ottawa Tribe, and Peoria Tribe in requesting a Sediment Transport Model Study.

GRDA is not proposing to conduct this requested study. This type of study would not "inform the development of license requirements," as required by FERC's § 5.9(b)(5) of the ILP Study Criteria. Given the number of factors influencing flooding, it is possible that the study proposed by the City of Miami would be unable to determine future impacts of flooding. The City of Miami's plan would use a methodology that assumes sediment is causing a problem before first evaluating if it in fact is. The conclusions obtained by deficient modeling would be unreliable. Thus, the City of Miami's study would be an inefficient use of time and money which could be better spent on a careful evaluation of past sedimentation trends and current field condition observations which allow for a more complete understanding of sediment processes in the study area.

The sediment transport modeling approach proposed by the City of Miami does not include model verification and evaluation to develop confidence in the accuracy and reliability of model predictions and, as such, would have "unquantifiable accuracy and reliability" with results having an "unknown degree of uncertainty." To be considered useful in the evaluation of sedimentation issues, which specifically focuses on the distribution and magnitude of sedimentation in the river/reservoir and the effect sedimentation has on flooding, a sediment transport model must be able to predict the distribution of sediment deposition or scour. To develop confidence in model results, the model must be calibrated using sedimentation data and run over a period of years between surveys. It must also reasonably simulate historic sedimentation patterns as documented by changes in cross section survey or bathymetric data. Unless the model is calibrated and verified, there is no reason to believe that the proposed sediment transport model will accurately predict bed changes over 50 years. Model verification would then include running the model over a different period between another set of surveys and again reasonably reproducing historic deposition patterns associated with the verification set of surveys.

Evaluation of the accuracy and reliability of a sediment transport model comparing model results to historic patterns of sedimentation would provide needed confidence in model results. As stated in Simons and Simons (1997):

[32] 18 C.F.R. § 4.51(h).
[33] 18 C.F.R. § 4.51(b)(6).

> *Without evaluation of model predictions through calibration and verification, the accuracy and reliability of model predictions are unquantifiable and the model results must be characterized as estimates with an unknown degree of uncertainty.*

In addition to lacking methodology that would produce needed verifiable results, the City of Miami's study also is predicated upon baseline data inputs that already attribute flooding issues to sedimentation. It is important to recognize that a sediment transport model can be calibrated and seem to provide reasonable results regarding changes in channel geometry by using parameters or input that does not necessarily represent reality. As a result, the model may seem to obtain the "correct" result but for the wrong reasons, which may apply for some conditions but not others. For example, a sediment transport model could simulate a reasonable distribution of sedimentation (change in channel geometry) by using an oversupply of sediment combined with erosion parameters that produce unrealistically high rates of erosion and transport. For these reasons and as otherwise described in the RSP, the City of Miami's proposed sedimentation transport model study is not the best method for obtaining sedimentation data for the Project and will not yield the results needed for relicensing.

Use of HEC-RAS in the sediment transport mode, as required for a sediment transport model, requires removal of normal bridge-related components which may not reasonably represent reaches affected by the 13 bridges. To the extent bridge hydraulics are not included in the model and may not appropriately simulate hydraulics in these reaches, sediment transport likewise would not reasonably be simulated. Tests would have to be conducted to first determine discrepancies between hydraulics in these reaches with and without normal bridge components in HEC-RAS.

Moreover, modeling a complex, heterogeneous mixture of cohesive and non-cohesive sediment deposition in a riverine/lacustrine environment will likely be problematic for any model. The modeling study proposed by the City of Miami does not attempt to determine to what extent sedimentation is occurring in the system. It also does not detail the manner in which SSC measurements will be taken or how they will be used to calibrate the model.

A 1-D, simplified model calibrated to only large flood events at less than five locations in Grand Lake and its tributaries will likely fail to reproduce decades of sediment transport phenomena and associated channel bed changes. It must be recognized that sediment transport modeling is inherently more complex than hydraulic modeling. Given the debates and difficulties in achieving consensus on hydraulic modeling alone, the prospects for modeling more complex phenomena are not promising. The modeling approach carries significant uncertainties and should not be conducted.

With the number of shortcomings identified in the proposed Sediment Transport Model Study Plan, the approximate cost of the study is also understated at $385,000. GRDA estimates the approximate cost of the sediment transport model approach is approximately $655,000, while still not addressing the shortcomings listed above.

The GRDA approach focuses on the use of all available sediment-related data, cross section survey and bathymetric data, collection of additional sediment data, and understandable analysis of these sets of real-world data. The range of uncertainties in each set of data will be understood and factored into the overall analysis of sedimentation and any effect on flooding. This follows an alternate approach to sediment modeling as described in Simons and Simons (1997):

> *If it is not possible to adequately calibrate and verify a model in a given application, it is appropriate to utilize interpretations of available data, geomorphic and other analysis techniques for prediction purposes.*

The data-centric approach is more directly understandable than using a model and forces the development of an understanding of factors affecting sedimentation and flooding.

Using calibrated hydraulic modeling in conjunction with an understanding of sedimentation will meet the objectives of these studies in evaluating the Project's effects on sedimentation and flooding and will provide the information FERC needs to conduct its NEPA analysis.

4.2.3 Contaminated Sediment Transport Study

BIA, USFWS, ODWC, Miami Tribe (supported by Ottawa Tribe and Peoria Tribe), Ben Loring (State Representative), City of Miami, and N. Larry Bork (counsel for City of Miami citizens) have requested a Contaminated Sediment Transport Study. The information requested focuses on analyzing the potential effect of increased flooding associated with Project operations on contaminated sediment deposition along the Neosho drainage system including: Neosho River, Spring River, Mud Creek, Coal Creek, and Tar Creek.

GRDA is not proposing to conduct this requested study. As an initial matter, the Project is not responsible for the presence of any heavy metals in Tar Creek. As such, this type of study would not "inform the development of license requirements," as required by FERC's § 5.9(b)(5) of the ILP Study Criteria. As FERC has recognized in other contexts, since GRDA is not responsible for the presence of heavy metals and has no ability to mitigate effects of these substances, this type of study would not inform this relicensing process.[34]

Moreover, the Tar Creek Superfund Site has been well documented and the potentially responsible parties (PRP) have been identified by the U.S. Environmental Protection Agency (EPA). Attachment C of this RSP contains a comprehensive set of literature relevant to this topic. The Tri-State Mining District (TSMD) encompasses an approximate 2,500 square mile area that was extensively mined for lead and zinc from 1850-1950. This historic mining area contains the Tar Creek Superfund Site and is the source for sediment-bound metals in Grand Lake. The effect that TSMD metals contamination has had on organisms is well documented through various studies (McCormick 1985, OWRB and Oklahoma State University (OSU) 1995, MacDonald et al. 2010, and Morrison et.al. 2018) over the years, and the primary impacts have been observed upstream of the Pensacola Project. EPA conducted a Phase 1 Study that evaluated overall toxicity in the area of the Superfund Site and concluded that there were no significant toxic effects upon sensitive species of small fish or micro-crustaceans exposed to water samples collected from Grand Lake (OWRB and OSU 1995). Furthermore, the study concluded that the contaminants of concern appear to be chemically bound to sediments since toxic concentrations of metals could not be extracted under conditions that occur naturally in the lake (OWRB and OSU 1995).

[34] *See, e.g.*, Study Plan Determination for the Toledo Bend Project at 17, Project No. P-2305 (issued Aug. 6, 2009) (rejecting the risk assessment study for the accumulation of Mercury and Sediment into the Toledo Bend Reservoir "[d]ue to the lack of a nexus between project operation and the resource to be studied").

In the EPA Phase 1 Study, it was postulated that sediment disturbance could cause the release of toxic concentrations of metals (OWRB and OSU 1995). Researchers found that under both disturbed and undisturbed conditions that survival and biomass did not exhibit any significant differences between contaminated (Neosho, Spring, and Grand rivers) and uncontaminated reference sites (Elk River) (Morrison et. al. 2018). In summary, past research spanning decades indicate no acute or chronic toxicity as a result of metals contamination within Grand Lake. The result of these studies is consistent with expectations based on Grand Lake water chemistry including pH, hardness, and the presence of anoxic sediments, and bioavailability of metals would be expected to be low (Atkinson et al. 2007).

Also, there is no need for this relicensing process to address this issue, as EPA has an existing program in place to address it. Under EPA's Operable Unit 2 (OU2),[35] EPA has developed a remedial action plan for the residential areas[36] of the Superfund Site. The action plan requires EPA to sample soils to determine whether contaminants in the soils are at levels above those protective of human health. If contaminants are found above established threshold levels, EPA would excavate contaminated soils, which are transported off-site. The excavated areas are then back-filled with clean soil.[37] Through 2015, EPA has remediated 2,940 residential areas.[38] Current soil sampling assessments and remediation are being addressed by The Oklahoma Department of Environmental Quality through a cooperative agreement with EPA Region 6.[39] Further, remedial activities are ongoing for Operable Unit 4 (OU4), terrestrial undeveloped rural and urban areas of the site where the mine and mill residues and smelter wastes were placed. Among the Remedial Action Objectives (RAO) of OU4 is to halt the loading of contamination into the watershed and riparian areas, and to prevent terrestrial fauna from coming in direct or indirect contact through the ingestion exposure pathway with contamination. Although USFWS notes that EPA "will not continue to remove contamination from new deposition due to elevated lake levels",[40] the EPA's Fifth Five-Year Review and Report (EPA 2015) concluded that no new information was discovered that has come to light that could call into question the protectiveness of the OU2 and OU4 remedies.[41]

EPA recently conducted an assessment of Operable Unit 5 (OU5), the Tar Creek, surface water and sediment relying upon historical data as well as conceptual models.[42] According to EPA, the Conceptual Contaminant Transport Model "provides a well-documented example of the fate and transport processes" that take place throughout the waterway based upon the extensive study of Tar and Lytle creeks, and "should be viewed as a worst-case scenario compared to the other watersheds."[43] Further, EPA relies upon the "significant amount of existing information and data."[44] With regard to the EPA's review of existing sediment data,[45] EPA stated that "[t]he

[35] EPA, Record of Decision, Residential Areas Operable Unit 2 (August 1997).
[36] "Residential areas" includes single-family residences, apartments, condominiums, and high access areas (places frequented by children such as daycares, playgrounds and schoolyards).
[37] *Id.*
[38] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0601269.
[39] *Id.*
[40] Service at 2.
[41] EPA, Fifth Five-Year Review Report for the Tar Creek Superfund Site, Ottawa County, Oklahoma at 53 (September 2015) ("Fifth Five-Year Review"), available at https://semspub.epa.gov/work/06/9679184.pdf.Fifth Five-Year Review.
[42] CH2M, Tar Creek Superfund Site Operable Unit 5, Remedial Investigation Data Gap Summary Report Version 1.0 at 1-5—1-6 (December 2016) (citation omitted) ("Data Gap Study"; CH2M 2016).
[43] Data Gap Study at 3-2.
[44] Data Gap Study at 4-1.

available sediment data is sufficient for nature and extent but will be supplemented with the additional samples collected for the [Human Health Risk Assessment] HHRA,"[46] and this sampling concluded in October 2017.[47] Thus, there is appropriate existing data for the examination of contamination fate and transport in the waterway.

Finally, although relicensing participants have requested this study on the basis that overbanking events along Tar Creek have deposited heavy metals in adjacent soils, there is no indication that any such overbanking is attributable to GRDA's operations under its license. Even if the results of the H&H Study later demonstrate that GRDA's operations influence water levels in Tar Creek, the fact that GRDA is not responsible for the presence of the heavy metals in the Creek renders this a cumulative effect, at best, that can be analyzed by the Commission using existing information.[48] Morrison et al. (2018) conducted a study on the distribution and bioavailability of trace metals in shallow sediments from Grand Lake. The purpose of this study was to assess whether TSMD-specific sediment quality guidelines (SQG), developed for small streams and tributaries draining the TSMD, are predictive of biological effects within the greater lake body. Thus, investigations focused on determining trace metal distribution within the northern reaches of Grand Lake, emphasizing shallow water areas (≤ 6 meter depth), and the effects of sediment disturbance on trace metal bioavailability and toxicity to freshwater amphipods (*Hyalella azteca*) and snails (*Helisoma trivolvis*). No significant mortality or differences in growth occurred under natural or disturbed sediment conditions for either aquatic invertebrate despite using some sediments that exceeded both general- and TSMD-specific SQGs.

In summary, the TSMD contains the Tar Creek Superfund Site located upstream of the Pensacola Project and is the source of sediment-bound metals in Grand Lake. GRDA is not responsible for the presence of heavy metals in Tar Creek. Heavy metal contamination in sediment in Grand Lake is a cumulative effect in the area due to seasonal flooding upstream and is not directly related to Project operations. As summarized in Section 6.3 of the PAD and briefly above, existing information demonstrates that prior flooding in the area has not caused significant sediment transport of heavy metals and there is no evidence of acute or chronic toxicity as a result of metals contamination within Grand Lake (GRDA 2017). The EPA has identified the PRPs and has a program in place to address the remediation of the Tar Creek Superfund Site. It would be unreasonable and uneconomic to have GRDA study beyond the measures implemented by EPA, and both FERC and GRDA should be able to rely upon the agency's studies and analysis in this relicensing process, as needed. For these reasons, GRDA believes that this study request does not meet FERC's § 5.9(b)(5) of the ILP Study Criteria related to Project "nexus" and that a Contaminated Sediment Study is not warranted for the Pensacola Project.

[45] Commenters complain that GRDA relies upon historic studies; however, EPA has found a plethora of historic studies reliable. Data Gap Study at 4-1 and 6-1.
[46] Data Gap Study at 6-1.
[47] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.cleanup&id=0601269#Done
[48] *See* CEQ, *Considering Cumulative Effects Under the National Environmental Policy Act*, P. 3 (January 1997) (finding that decisions on cumulative effects "must be supported by the best analysis based on *the best data we have* or are able to collect.") (emphasis added); *see also id.*at P. 31 ("Obtaining information on cumulative effects is often the biggest challenge . . . In some cases, federal agencies or the project proponent will have adequate data."). *See also Preparing Environmental Documents Guidelines for Applicants, Contractors and Staff*, FERC Division of Hydropower Licensing (2008) available at: https://www.ferc.gov/industries/hydropower/gen-info/guidelines/eaguide.pdf.

4.2.4 Flora and Fauna Impacts

BIA and Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, City of Miami, and N. Larry Bork [counsel for the City of Miami citizens]) have requested a Flora and Fauna Impacts Study. The Miami Tribe states in its study request letter that *"First, an assessment of flora and fauna impacts must include meaningful and ongoing consultation and coordination with environmental and natural resources departments for each area tribe."* and *"Second, any study approved for evaluation of flora and fauna impacts should be led and coordinated by an independent third party with expertise in assessment of impacts to flora and fauna."* This study request does not meet the Study Criteria as specified by 18 C.F.R. §5.9(b) of FERC's regulations on the ILP. Study requests should demonstrate the need for additional, site-specific information for purposes other than general research. Requestors should also describe why existing information is insufficient to inform the development of license requirements and/or contribute to the development of PM&E measures.

BIA's comments on the PSP state that GRDA, through consultation with the tribes, could identify specific flora and fauna that are important to each tribe, and the Seneca-Cayuga Nation has indicated that flooding primarily near the confluence of Sycamore Creek and Grand Lake has impacted tribal cultural practices there, including traditions such as the Strawberry Dance. P. 14.

The Miami Tribe's original study request is an overly broad request and does not identify or specify any potential resource issues or explain what additional information the Tribe believes is necessary for FERC to conduct its NEPA analysis for the relicensing of the Pensacola Project and aid in the development of future license requirements.

As stated in Section 7.4 of the PAD, GRDA has not identified any existing information or data regarding wildlife or botanical resources that suggests that the Project's operation will adversely impact these resources in the Project area (GRDA 2017). Further, current license commitments (Articles 406 and 411) and a Fish and Waterfowl Habitat Management Plan (FWHMP) provide lands and wildlife management areas to mitigate ongoing impacts and enhance wildlife resources (GRDA 2003). The existing SMP includes a Vegetation Management Plan (VMP) and measures to limit impacts of any ground-disturbing and ongoing maintenance activities on terrestrial resources (GRDA 2008). GRDA believes that this available information is sufficient to evaluate any potential effects of continued operation of the Project and that no additional information is necessary for FERC to perform its NEPA analysis for the Project.

Comments on the PSP by the Miami Tribe raise, among other things, the issue of soil contamination and state that contamination is impacting culturally significant plants and wildlife that Tribal members harvest as part of their traditional diet. "The requested flora and fauna study is needed to update…research and ascertain the impacts that contaminated sediment in flooding has caused. As explained in Section 4.2.3 of this RSP, studying contaminated sediment is outside the scope of this relicensing. Although the Project was neither the source of the contamination nor currently possesses a nexus with the contaminated sediment such that their migration could be attributed to an environmental impact of the Project, adequate data exists (cited by GRDA and assembled by EPA) to evaluate the environmental effects of contamination on federal properties and tribal cultural resources.

4.2.5 Infrastructure Improvement Study

The Miami Tribe (supported by Ottawa Tribe, Peoria Tribe, and N. Larry Bork [Counsel for Citizens of City of Miami]) and the City of Miami have requested an Infrastructure Improvement

Study to evaluate current and future impacts on infrastructure resulting from the operation and maintenance of the Pensacola Project. The Miami Tribe states in its study request *"Project-related activities, especially the operation and maintenance of the Pensacola Dam at the current levels permitted by the amended rule curve, adversely affect City and Tribal infrastructure and on lands outside the current Project boundary that have been permanently or periodically inundated due to Project-related flooding."*

In its comments on the PSP dated July 26, 2018, the Miami Tribe states that its March 13, 2018 study request is incorporated by reference and disputes GRDA's characterization of USACE's exclusive jurisdiction over Grand Lake for flood control purposes." P. 22. The Miami Tribe states GRDA is "simply wrong" and later references the USACE's comments on the PSP. The Ottawa Tribe, Peoria Tribe, and N. Larry Bork (Counsel for Citizens of City of Miami) joined in the Miami Tribe's comments. In its July 26, 2018 comments on the PSP, the City of Miami renewed its March 13, 2018, infrastructure improvement study request.

GRDA is not proposing to conduct the requested infrastructure improvement study. Under FERC's § 5.9(b)(5) of the ILP Study Criteria, a study requestor must demonstrate a reasonable connection between Project operations and effects on the resource in question. As GRDA has stated throughout this study plan process, in Section 4.3 of this RSP, in comment response No. 9 in the PSP comment response table (Attachment B), and as GRDA reiterates here, the USACE has exclusive jurisdiction over Grand Lake for flood control purposes. USACE has designated a flood control pool for Grand Lake that extends above the 745-foot PD elevation of the conservation pool. The access and infrastructure issues identified by the Miami Tribe and other relicensing participants are absent during normal Project operations, when Grand Lake levels are within the conservation pool. Thus, any effects that may result from USACE's flood control operations at Grand Lake under Section 7 of the Flood Control Act of 1944, 58 Stat. 887, 890-91, are beyond the scope of this relicensing process and will not inform the development of any mitigation measures that the Commission may require under the FPA.[49] Again, the federal government itself drove the construction of the flood-control storage (even after return of the Project in 1946),[50] and it retains control over use of the same.

This study request also falls short of 5.9(b)(4) because it does not identify any existing information on "*City and Tribal infrastructure and on lands outside the current Project boundary that have been permanently or periodically inundated due to Project-related flooding"*. GRDA has not identified any existing information or data that suggests that the Project's operation will adversely impact these resources in the Project area.

4.3 Flood Control Operations and Effects

Several comments on the PSP cite to USACE's July 26, 2018 PSP comment letter for the proposition that GRDA, rather than USACE, is responsible for flooding caused by its operation of the dam and that FERC must address flood control operations as part of the relicensing. GRDA categorically disagrees with these comments and the position advanced by USACE. GRDA reiterates and includes by reference GRDA's discussion of this topic in Section 4.1.1 of the PSP, as well as in prior proceedings before FERC.[51] Unfortunately, USACE's comment letter and those supporting it have overlooked nearly 80 years of consistent precedent

[49] *See infra* § 4.3.
[50] The 1946 Settlement Agreement additionally required GRDA to transfer any of its rights above elevation 750 feet PD to the federal government. § 1.6.
[51] *See supra* note 1.

established by Presidential orders, Congress, FERC and its predecessor agency, and even USACE. GRDA fully recognizes that the history and regulatory framework for this Project is unique as compared to other facilities that are licensed by FERC and regulated by USACE under the Flood Control Act of 1944; nonetheless, Presidential orders, Congressional directives and the history are clear: USACE has exclusive control for flood control operations, and the United States—not GRDA—is responsible for obtaining flowage easements where necessary. In fact, when the Project was returned to GRDA from the federal government following World War II, GRDA was expressly not required to raise the level above 750 feet PD "until the United States has acquired the necessary flowage rights above that elevation[.]"[52]

4.3.1 USACE Flood Control Operations

An April 2018 letter from USACE recommended a feasibility study for implementing additional flood mitigation measures.[53] That recommendation followed a 2006 USACE report concluding that "Federal actions have been a significant cause of the backwater effects on land around Grand Lake, Oklahoma" and recommending the feasibility study "at full Federal expense."[54] The Assistant Secretary of the Army responsible for Civil Works concurred in that finding and recommendation in 2007.[55] Consistent with USACE's April 2018 letter, the studies proposed by GRDA in this relicensing process are designed to build on USACE's past efforts to identify the extent of flood control impacts,[56] by identifying the cumulative effects of the Project and differentiating the effects of Project operations under the FERC license from USACE flood control operations.

Because GRDA's study plan will differentiate effects of its operations from those of the USACE's flood control operations, the spatial scope of USACE's responsibility for flood control operations at the Project is a critical element of this RSP. In this regard, USACE's comments on the PSP are off-base in their characterization of the agency's jurisdiction. While USACE states, for example, that its authority begins at 745 feet PD and ends at 755 feet PD, that is a significant oversimplification that mischaracterizes the true scope of its jurisdiction. According to the Water Control Manual and Letter of Understanding which govern USACE's jurisdiction over the Project, USACE responsibility for flood control operations actually begins at any elevation when the pool is forecasted to exceed the top of the conservation pool. And while it is true that control of Project operations shifts to GRDA if the pool exceeds 755 feet PD, that shift, does not mean—and cannot mean—that USACE relinquishes its flood control jurisdiction at 755 feet PD.

[52] Pensacola Project No. 1494, Original License Article 12 (FPC 1939).
[53] *See* Letter from Jennifer A. Aranda, Ass't Dist. Counsel, Tulsa Dist., U.S. Army Corps of Eng'rs, to Carlos Gutierrez, Davis Wright Tremaine LLP, at 2 (Apr. 3, 2018).
[54] U.S. Army Corps of Eng'r, *Grand Lake, Oklahoma: May 2006 Letter Report* at 5 (2006).
[55] *See* Memorandum from John Paul Woodley, Ass't Sec'y of the Army, *Grand Lake, Oklahoma: Full Federally Funded Feasibility Phase Study* (2007) ("I concur that Federal actions have contributed to backwater effects at Grand Lake, thus warranting further detailed study. . . [Y]ou may undertake a feasibility phase study at Grand Lake at full Federal expense.").
[56] *See generally* Memorandum from John Paul Woodley, Ass't Sec'y of the Army, *Grand Lake, Oklahoma: Full Federally Funded Feasibility Phase Study* (2007); U.S. Army Corps of Eng'rs, *Grand Lake, Oklahoma: May 2006 Letter Report* (2006); U.S. Army Corps of Eng'rs, *Grand Lake, Oklahoma: Preliminary Analysis of Flood Control Operation* (2002); U.S. Army Corps of Eng'rs, *Grand Lake, Oklahoma: Real Estate Adequacy Study* (1998); U.S. Army Corps of Eng'rs, *Grand Lake Initial Appraisal* (1994); Black & Veatch, *Supplemental Report on Pensacola Reservoir Backwater Effects at Miami, Oklahoma* (1943); Col. F. J. Wilson, District Eng'r, U.S. Army Corps of Eng'rs, *Backwater Effects on Sewer Systems at Miami, Oklahoma, and Acquisition of Land for Additional Flood Control Capacity for Pensacola Reservoir, Grand (Neosho) River, Arkansas River Basin, Oklahoma* (1942).

Nothing in the 1944 Flood Control Act authorizes USACE to relinquish jurisdiction that Congress has imposed upon it. Rather, the shift in control at 755 feet PD is simply a recognition that once the surface elevation at the dam reaches its highest levels, GRDA is best situated to protect the structural integrity of the Project facilities.[57] Moreover, the pool would never reach 755 feet PD if USACE were not already directing Project operations to retain floodwaters in the reservoir, so it is illogical to suggest that USACE can simply walk away from its statutory duties once its own operational directives have caused reservoir levels to reach a critical point.

4.3.2 Sufficiency of USACE Flowage Easements

Although the sufficiency of USACE's flowage easements is not an issue for FERC to resolve in this relicensing process, for purposes of responding to all comments received, GRDA notes that USACE has repeatedly found, based on studies required by Congress, that its own flood control operations have led to or exacerbated flooding in areas where no easements are held.[58] Most recently, USACE's 1998 Real Estate Adequacy Study identified certain property needed for flood control.[59] The Real Estate Adequacy Study concludes that "[t]heoretical backwater effects of Grand Lake were found to exceed the limits of existing flowage easements using the criterion of a 50-year land acquisition flood."[60] This conclusion was based on USACE's "current lake operations" and recommended "additional flowage easements[.]"[61] By that point, USACE had repeatedly identified the insufficiency of its flowage easement purchases, including studies in 1942, 1948, 1998 and 2006.[62] To GRDA's knowledge, USACE has not acted upon these findings since approximately 1961, when it ceased acquiring lands needed for flood control operations.[63]

USACE asserts that GRDA is responsible for owning sufficient property interests for all authorized Project operations, and GRDA confirms that all such rights are held in fee title or flowage easements for all lands within the Project Boundary.[64] But with regard to lands outside the Project Boundary that may be needed to implement USACE's flood control operations, it is in fact USACE—not GRDA—that has the legal duty to obtain such interests. Pensacola Dam was initially authorized under the Flood Control of 1941,[65] which incorporates a requirement

[57] It should be noted that the 755 feet PD reference in the Flood Control Manual is to the surface elevation at the dam, not to lands upstream of the dam above elevation 755 feet PD.
[58] *See* PSP § 4.1.1.
[59] *See* U.S. Army Corps of Eng'rs, *Grand Lake, Oklahoma: Real Estate Adequacy Study* at 9, 11.
[60] *Id.* at 11.
[61] *Id.* at 9.
[62] *See id.* at 2 (describing an April 1948 Preliminary Planning Report prepared by USACE "indicating that . . . an additional 11,750 acres of easements should be acquired for operation of the project for flood control"); U.S. Army Corps of Eng'rs, *Grand Lake Initial Appraisal* at 4, 13 (1994) ("Our evaluation of the 1940's [USACE] studies indicates the flood easement requirements for Grand Lake may be greater than the existing flood easements."); Wilson, *Backwater Effects on Sewer Systems at Miami, Oklahoma, and Acquisition of Land for Additional Flood Control Capacity for Pensacola Reservoir, Grand (Neosho) River, Arkansas River Basin, Oklahoma* at 21-22 (recommending additional federal purchases above 750' Pensacola Datum to effect the intent of the 1941 Flood Control Act).
[63] *See id.* at 3.
[64] While most of these interests are held by GRDA, in some areas within the Project Boundary, flowage easements are held by USACE.
[65] Flood Control Act of 1941, Pub. L. No. 77-288 § 3, 55 Stat. 638, 639, 645, 77 Cong. Ch. 377 (1941) ("[T]he following works . . . are hereby adopted and authorized[:] . . . . [t]he general comprehensive plan for flood control and other purposes, approved by the Act of June 28, 1938, for the Arkansas River Basin, is hereby modified to include the reservoirs in the Grand (Neosho) River Basin in Oklahoma . . . in

from the Flood Control Act of 1938 that authorizes *and directs* the Secretary of War to "acquire in the name of the United States title to all lands, easements, and rights-of-way necessary for any dam and reservoir project," including flowage rights, and to reimburse state or local agencies for their expenditures for such property rights.[66]

As outlined in detail in the PSP, historical USACE actions to obtain these property rights and more recent Congressional directives to the USACE to continue to evaluate the adequacy of existing property rights to address flooding demonstrate uniformly that USACE is responsible for mitigation of the effects of its flood control activities. The President directed federal purchase of additional flood control acreage in 1942,[67] and a 1943 Executive Order expressly authorized federal "acquisition of land or flowage rights . . . as may be necessary or appropriate for the completion and full utilization of the Grand River (Pensacola) Project[.]"[68] Most notably, the federal government expressly retained its flowage rights above 750 feet PD elevation in the 1946 agreement returning the Project to GRDA, and even required GRDA in that agreement to convey lands above 750 feet PD to the United States for flood control purposes.[69] Even after return of the Project to GRDA, the President expressly reserved federal authority and duties to purchase property for additional flood control storage.[70]

USACE has always considered its flowage easement duty to encompass the effects from flood-control storage operations.[71] In 1946, Congress passed legislation authorizing the return of the Project to GRDA.[72] Section 3 of this statute directed federal retention of all property interests above 755 feet PD "necessary or desirable for operation of the" Project.[73] The law also compelled GRDA to transfer to the federal government its flowage rights above 755 feet PD.[74] To effect those commands, the federal government executed an agreement with GRDA anticipating that the government would be responsible for obtaining flowage rights related to operations above 750 feet PD.[75] Critically, the federal obligation to obtain those rights was framed as a prerequisite to operating the pool up to 755 feet PD.[76] Federal provision of

accordance with the recommendations of the Chief of Engineers in House Document[ ] Numbered 107 . . . of the Seventy-sixth Congress, first session.").

[66] *See* Pub. L. No. 77-288 § 2, 55 Stat. at 638 (applying "section 2 of the Act approved June 28, 1938 . . . to all works authorized in this Act"); *see also* Flood Control Act of 1938, Pub. L. No. 75-761 § 2, 52 Stat. 1215, 1215-16, 75 Cong. Ch. 795 (1938) ("[T]he Secretary of the Army *is authorized and directed* to acquire in the name of the United States title to all lands, easements, and rights-of-way necessary for any dam and reservoir project . . . herein authorized . . . *Provided further*, That lands, easements and rights-of-way shall include lands on which dams [and] reservoirs . . . are located; lands or flowage rights in reservoirs and highway, railway, and utility relocation.") (emphasis added).

[67] *See* U.S. Army Corps of Eng'rs, *Grand Lake, Oklahoma: Real Estate Adequacy Study* at 2.

[68] *See* Executive Order No. 9373, 9 Fed. Reg. 39 ¶ 4 (Nov. 30, 1943).

[69] *See* 1946 Settlement Agreement § 1.2. This settlement was expressly authorized by Public Law No. 79-573, 60 Stat. 743, 743-44 (1946). The Settlement Agreement additionally required GRDA to transfer any of its rights above elevation 750 to the federal government. *See* 1946 Settlement Agreement § 1.6.

[70] *See* Executive Order 9839, 12 Fed. Reg. 2447 ¶ 3 (Apr. 14, 1947).

[71] *See, e.g.*, U.S. Army Corps of Eng'rs, *Hydrologic Criteria for Acquisition of Reservoir Lands*, Sw. Div. Eng'r Tech. Letter 1110-2-22 at 9 (1970) ("Possible backwater effects . . . must be determined to establish land acquisition needs particularly in upstream reaches of the reservoir.").

[72] *See* An act authorizing the return of the Grand River dam project, Pub. L. No. 79-573, 60 Stat. 743, 79 Cong. ch. 710 (1946).

[73] Pub. L. No. 79-573 § 3, 60 Stat. at 744.

[74] *Id.*

[75] *See* 1946 Settlement Agreement at 6, § 1.6.

[76] *See id.* at 6.

"additional reservoir storage space above elevation 750' [PD]" was essential "to enable operation of the . . . Project for flood control purposes at a pool elevation . . . of 755' [PD.]"[77]

In this regard, following its 1998 Real Estate Adequacy Study USACE found the need for additional flowage easements—against the backdrop of Congressional authorization for USACE (again, not GRDA) to acquire those interests.[78] Yet USACE did nothing to respond to its own findings in the 1998 study, and Congress directed it again to study the need for further action in greater detail.[79]

Of course, GRDA recognizes the Commission's responsibilities during this relicensing process to assess Project effects—including cumulative effects associated with USACE's flood control operations—and to include license conditions that meet a variety of public interest considerations.[80] However, flood control requirements, land ownership responsibilities for lands impacted by flood control operations, and mitigation for effects caused by flood control operations are all issues that are well outside the scope of this relicensing process. Congress, through the 1941 and 1944 Flood Control Acts, as well as a number of statutes that apply only to this Project, has already addressed these matters. The simple fact remains that GRDA and the United States—adhering to a Congressional directive[81]—established operational and land ownership parameters related to flood control over 70 years ago in 1946 when the Project was returned to GRDA following World War II.[82]

As such, and as described in the above sections as well as the PSP comment response table (Attachment B), GRDA's position with respect to USACE jurisdiction at the Project remains unchanged from the PSP. This relicensing process is not a forum to revisit issues that are beyond FERC's jurisdiction and have been long-settled by Congress.

4.4 FERC Additional Information Requests

In its comments dated March 13, 2018, FERC staff requested additional information about the Pensacola Project based on their review of the PAD. GRDA provided responses to the Additional Information Requests (AIR) in its PSP filed on April 27, 2018. Related to AIR #1, the most recently published area-capacity curve developed for the Pensacola Project is a 2009 update prepared by the USACE based on the 2009 LiDAR data. With the addition of newly acquired bathymetry, GRDA is in the process of updating the current area-capacity curve to reflect the updated subsurface areas and volumes. GRDA will submit the new curve separately as soon as the update is complete.

[77] *Id.*
[78] Water Resources Development Act of 1996, Pub. L. No. 104-303 § 560(b), 110 Stat. 3658 (1996) ("Upon completion of the study and subject to advance appropriations, the Secretary may acquire from willing sellers such real property interests in any lands identified in the study as the Secretary determines are necessary to reduce the adverse impacts identified in the study[.]").
[79] *See* Water Resources Development Act of 2000, Pub. L. No. 106-541, 114 Stat. 2572 106 Cong. § 449(a)(1) (2000).
[80] *See* 16 U.S.C. § 803(a).
[81] Pub. L. No. 79-573, 60 Stat. 743, 79 Cong. ch. 710 (1946).
[82] *See* 1946 Settlement Agreement at 6 ("[T]he Government has undertaken and is carrying out a project to provide additional reservoir storage space above elevation 750' mean sea level . . . to enable operation of the Original Project for flood control purposes at a pool elevation . . . of 755' above mean sea level[.]").

5.0 NEXT STEPS: FINALIZING GRDA'S STUDY PLAN

5.1 Comments on the RSP

Pursuant to FERC's August 10, 2018 Notice of Modification of Procedural Schedule, the RSP deadline was extended to September 24, 2018, and the RSP comment period extended by 15 days. As such, the comment deadline is October 24, 2018.

5.2 Study Plan Determination and Dispute Resolution (if Needed)

Pursuant to FERC's August 10, 2018 Notice of Modification of Procedural Schedule, FERC will issue its Study Plan Determination by November 8, 2018. If any portions of the final Study Plan Determination are disputed by federal agencies with Section 4(e) and Section 18 authority or an agency or Tribe with authority to issue Section 401 water quality certification for the Project, a formal dispute resolution process will be initiated, as provided for under 18 C.F.R. § 5.14, and a final study dispute determination (constituting amendment of the approved study plan) for the disputed study components will be issued in February 2019.

6.0 IMPLEMENTATION OF FINAL STUDY PLAN

As required by 18 C.F.R. § 5.15, GRDA will provide progress reports as study work progresses, and as detailed in the individual study plans (Attachment A), file an ISR, hold a meeting with relicensing participants and FERC staff to discuss the initial study results (ISR Meeting), file an USR, and hold a meeting with relicensing participants and FERC staff to discuss the final study results (USR Meeting). GRDA will submit all study documents that must be filed with FERC via FERC's e-library system. Public study documents will also be provided through GRDA's relicensing website (http://www.grda.com/pensacola-hydroelectric-project-relicensing/).

6.1 Relicensing Schedule

Table 6.1-1. Process plan and schedule. [1]

18 C.F.R.	Lead	Activity	Timeframe	Deadline
§ 5.5(a)	GRDA	Filing of NOI and PAD	Actual filing date	2/1/2017
§ 5.7	FERC	Initial Tribal Consultation Meeting	Waived	12/13/2018, 12/14/2018
§5.8	FERC	FERC Issues Notice of Commencement of Proceeding and SD1	Waived	1/12/2018
§5.8 (b)(3)(viii)	FERC/ Relicensing Participants	Public Scoping Meetings and Environmental Site Review	Within 30 days of NOI and PAD notice and issuance of SD1	Week of 2/5/2018

18 C.F.R.	Lead	Activity	Timeframe	Deadline
§ 5.9	Relicensing Participants / FERC	File Comments on PAD, SD1, and Study Requests	Within 60 days of NOI and PAD notice and issuance of SD1	3/13/2018
§5.10	FERC	FERC Issues Scoping Document 2 (SD2), if necessary	Within 45 days of deadline for filing comments on SD1	4/27/2018
§5.11(a)	GRDA	File Proposed Study Plans	Within 45 days of deadline for filing comments on SD1	4/27/2018
§5.11(e)	GRDA/ Relicensing Participants	Study Plan Meetings	Within 30 days of deadline for filing proposed Study Plans	Week of 5/21/2018 [2]
§5.12	Relicensing Participants	File Comments on Proposed Study Plan	Within 90 days after proposed study plan is filed	7/26/2018
§5.13(a)	GRDA	File Revised Study Plan	Within 30 days following the deadline for filing comments on proposed Study Plan	9/24/2018 [3]
§5.13(b)	Relicensing Participants	File Comments on Revised Study Plan (if necessary)	Within 15 days following Revised Study Plan	10/24/2018 [3]
§5.13(c)	FERC	FERC Issues Study Plan Determination	Within 30 days following Revised Study Plan	11/8/2018
§5.14(a)	Mandatory Conditioning Agencies	Notice of Formal Study Dispute (if necessary)	Within 20 days of Study Plan Determination	11/28/2018
§5.14(l)	FERC	Study Dispute Determination	Within 70 days of notice of formal study dispute	2/6/2019
§5.15(a)	GRDA	Conduct First Season Field Studies	November 2018 – September 2019	
§5.15(c)(1)	GRDA	File Initial Study Reports	No later than one year from Study Plan approval	11/8/2019
§5.15(c)(2)	GRDA	Initial Study Results Meeting	Within 15 days of Initial Study Report	11/23/2019
§5.15(c)(3)	GRDA	File Study Results Meeting Summary	Within 15 days of Study Results Meeting	12/8/2019
§5.15(c)(4)	Relicensing Participants / FERC	File Meeting Summary Disagreements / Modification to Study / Requests for New Studies	Within 30 days of filing Meeting Summary	1/7/2020
§5.15(c)(5)	GRDA	File Responses to Disagreements / Modification / New Study Requests	Within 30 days of disputes	2/6/2020
§5.15(c)(6)	FERC	Resolution of Disagreements / Study Plan Determination (if necessary)	Within 30 days of filing responses to disputes	3/7/2020

18 C.F.R.	Lead	Activity	Timeframe	Deadline
§5.15	GRDA	Conduct Second Season Field Studies	November 2019 – September 2020	
§5.15 (f)	GRDA	File Updated Study Reports	No later than two years from Study Plan approval	11/8/2020
§5.15(c)(2)	GRDA	Second Study Results Meeting	Within 15 days of Updated Study Report	11/23/2020
§5.15(c)(3)	GRDA	File Study Results Meeting Summary	With 15 days of Study Results Meeting	12/8/2020
§5.15(c)(4)	Relicensing Participants / FERC	File Meeting Summary Disagreements / Modification to Study / Requests for New Studies	Within 30 days of filing Meeting Summary	1/7/2021
§5.15(c)(5)	GRDA	File Responses to Disagreements / Modification / New Study Requests	Within 30 days of disputes	2/6/2021
§5.15(c)(6)	FERC	Resolution of Disagreements / Study Plan Determination (if necessary)	Within 30 days of filing responses to disagreements	3/8/2021
§5.16(a)	GRDA	File Preliminary Licensing Proposal (or Draft License Application) with FERC and distribute to relicensing participants	Not later than 150 days before final application is filed	11/3/2019 [4]
§5.16 (e)	FERC / Relicensing Participants	Comments on GRDA Preliminary Licensing Proposal, Additional Information Request (if necessary)	Within 90 days of filing Preliminary Licensing Proposal (or Draft License Application)	2/3/2020 [4]
§5.17 (a)	GRDA	License Application Filed		3/31/2020 [4]

Notes:

1. Shaded milestones are unnecessary if there are no study disputes.
2. Due to an unavoidable conflict identified by the Tribes the week of May 21, the PSP meeting was scheduled for the week of May 28 (see Section 1.6 of this RSP for details).
3. Due to scheduling of an additional tribal consultation meeting on August 21, pursuant to FERC's August 10, 2018 Notice of Modification of Procedural Schedule, the RSP deadline was revised to September 24, 2018, and the RSP comment deadline to October 24, 2018, with 45 days added to all subsequent deadlines.
4. 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.

6.2 Relationship of Study Program to License Application Deadline

Many of GRDA's proposed studies are scheduled to require two full years to complete field work and analysis. In addition, as described in Section 3 of this RSP and in the individual study plans included in Attachment A, depending on results of the H&H Study, GRDA may determine, in consultation with relicensing participants, that a second field season for some studies is warranted.

As described in more detail in Section 1.3 of this RSP, the delay in the ILP process due to a lack of a quorum of FERC commissioners resulted in an incongruity between the ILP process and the statutory deadline under the FPA for GRDA to file its FLA with FERC. Under the current relicensing schedule (Table 6.1-1), nearly the entire second field season (November 2019-September 2020) and associated study reporting (USR; due November 2020) are scheduled to occur *after* GRDA files both the PLP/DLA (due November 2019) and FLA (due March 2020). GRDA is concerned that this unintended result will create challenges and redundancies in the relicensing effort, as both the DLA/PLP and FLA will be supported by incomplete information, while studies in the second season will be ongoing. This process would be administratively challenging, as GRDA and other relicensing participants would be forced to prepare and comment on an incomplete DLA/PLP and FLA, and then supplement and re-review the incomplete documents as the second study season concludes.

To avoid this circumstance and align the ILP process with the license expiration date, GRDA will be seeking a modest extension of the existing license term, such that the license application filing date can be adjusted, as appropriate, to match the ILP process. The Commission has adopted this strategy in other projects facing other uncontrollable circumstances,[83] and GRDA believes that a reasonable extension in this case will be widely supported, as this approach would benefit all relicensing participants by allowing the ILP to proceed as envisioned in FERC's regulations.

GRDA introduced this approach to relicensing participants at the formal May 30-31, 2018, study plan meetings. There were no comments or questions related to the concept. Once GRDA and relicensing participants have completed the ongoing effort to develop the study plan and FERC issues its Study Plan Determination, GRDA anticipates filing the license extension application with the Commission at that time.

7.0 REFERENCES

Atkinson, CA; Jolley, DF; Simpson, SL. 2007. Effect of overlying water pH, dissolved oxygen, salinity and sediment disturbances on metal release and sequestration from metal contaminated marine sediments. Chemosphere, 69:1428-1437.

CH2M. 2016. Remedial Investigation Data Gap Summary Report, Version 1.0. Tar Creek Superfund Site Operable Unit 5, Ottawa County, Oklahoma. December 2016.

EPA (U.S. Environmental Protection Agency). 2015. Fifth Five-Year Review Report for the Tar Creek Superfund Site, Ottawa County, Oklahoma. Prepare by Oklahoma Department of Environmental Quality (ODEQ) for the EPA. September 2015.

FERC (Federal Energy Regulatory Commission). 1996. Order Amending License. 77 FERC ¶ 61,251. December 3, 1996.

FERC. 2008. Preparing Environmental Documents Guidelines for Applicants, Contractors and Staff.

FERC. 2017. Amendment of Article 401 to Modify Reservoir Elevation Rule Curve for Pensacola Hydroelectric Project, P-1494. May 2017.

[83] *E.g.*, *TransCanada Hydro Northeast Inc.*, 152 FERC ¶ 62,048 (2015).

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

GRDA (Grand River Dam Authority). Fish and Waterfowl Habitat Management Plan. Pensacola Hydroelectric Project, FERC No. 1494. May 14, 2003.

GRDA. 2008. Shoreline Management Plan. Pensacola Hydroelectric Project, FERC No. 1494. June 11, 2008.

GRDA. 2010. Letter from GRDA to FERC with photographs of the installed turbine and generator nameplates on the Pensacola Project's six units. May 12, 2010.

GRDA. 2011. Supporting Technical Information Document for the Pensacola Project No. 1494. Prepared by Burns & McDonnell Engineering for GRDA. September 2011.

GRDA. 2015. Pensacola Hydroelectric Project Public Recreation Management Plan Monitoring Report. April 1, 2015.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

GRDA. 2018. Pensacola Hydroelectric Project, P-1494, Proposed Study Plan. April 2018.

Holly, Jr. F. 2004. Analysis of Effect of Grand Lake Power-Pool Elevations on Neosho River Levels During a Major Flood. Prepared for: Robert Sullivan, AGM of Risk Management and Regulatory Compliance, GRDA.

MacDonald, D.D., C.G. Ingersoll, M. Crawford, H. Prencipe, J.M. Besser, W.G. Brumbaugh, N. Kemble, T.W. May, C.D. Ivey, M. Menehetti, J. Sinclair, and M. O'Hare. 2010. Advanced Screening-Level Ecological Risk Assessment for Aquatic Habitats within the Tri-State Mining District, Oklahoma, Kansas, and Missouri. Final Draft Technical Report. Prepared by USGS, Columbia MO and MacDonald Environmental Sciences Ltd., CH2M Hill, Dallas Texas for the USEPA, Dallas, TX; USEPA Kansas City, MO; and USFWS, Columbia, MO.

McCormick, C.A. 1985. Water Quality and sediments of an area receiving acid-mine drainage in northeastern Oklahoma. M.S. Thesis. Oklahoma State University, Stillwater, OK.

Morrison, S., S. Nikolai., D. Townsend, J. Belden. 2018. Distribution and Bioavailability of trace metals in shallow sediments from Grand Lake, OK. Archives of Environmental Contamination and Toxicology. 69(2)1-11. September 18, 2018.

OWRB (Oklahoma Water Resources Board) and OSU (Oklahoma State University). 1995. Diagnostic and Feasibility Study of Grand Lake O' The Cherokees, Phase I of a Clean Lakes Project, Final Report. March 10, 1995.

OWRB. 2015. Sample Year 2014 Testing for Pensacola Dam/Neosho River Dissolved Oxygen Mitigation Plan. January 2015.

Simons, Robert J., and Daryl B. Simons. 1997. Sediment Transport Modeling: Calibration, Verification, and Evaluation. January 14, 1997.

Simons & Associates, Inc. 1998. Revised Hydraulic and Backwater Analysis of the Neosho River Upstream of the Reservoir to the Commerce Gage. Miami, Oklahoma.

USACE (U.S. Army Corps of Engineers). 2016. Loss of Flood Storage at Grand Lake.

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

ATTACHMENT A.
STUDY PLANS

[This page intentionally left blank.]

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Hydrologic and Hydraulic Modeling Study

Prepared for

GRDA
Grand River Dam Authority

Prepared by

Mead & Hunt
www.meadhunt.com

September 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

1-D ..... one-dimensional
2-D ..... two-dimensional
BIA ..... Bureau of Indian Affairs
CHM ..... Comprehensive Hydraulic Model
DEM ..... digital elevation model
FEMA ..... Federal Emergency Management Agency
FERC ..... Federal Energy Regulatory Commission
GRDA ..... Grand River Dam Authority
HEC ..... Hydrologic Engineering Center
HEC-RAS ..... Hydrologic Engineering Center's River Analysis System
H&H Study ..... Hydrologic and Hydraulic Modeling Study
ILP ..... Integrated Licensing Process
ISR ..... Initial Study Report
LiDAR ..... Light Detection and Ranging
NAVD ..... North American Vertical Datum
NED ..... National Elevation Dataset
NGVD ..... National Geodetic Vertical Datum
ODWC ..... Oklahoma Department of Wildlife Conservation
OU ..... University of Oklahoma
OWRB ..... Oklahoma Water Resources Board
PAD ..... Pre-Application Document
PD ..... Pensacola datum
Project ..... Pensacola Hydroelectric Project
PSP ..... Proposed Study Plan
RAS ..... River Analysis System
RM ..... River Mile
RSP ..... Revised Study Plan
SD2 ..... Scoping Document 2
USACE ..... U.S. Army Corps of Engineers
USFWS ..... U.S. Fish and Wildlife Service
USGS ..... U.S. Geological Survey
USR ..... Updated Study Report
VBA ..... Visual Basic for Applications

1.0 INTRODUCTION

The Grand River Dam Authority (GRDA) filed a Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) on February 1, 2017, as part of relicensing the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494) (GRDA 2017). In Section 7 of the PAD, GRDA proposed a Hydrologic and Hydraulic Modeling Study (H&H Study) that will model the Grand/Neosho River, including several tributaries, both upstream and downstream of Pensacola Dam. The modeling effort under the H&H Study will produce a tool for analyzing the effects of GRDA's operation of the Project under the new license, as well as indirect and cumulative impacts associated with flood control operations, which are under the exclusive jurisdiction of the U.S. Army Corps of Engineers (USACE).

FERC's April 27, 2018 Scoping Document 2 (SD2) identified the following environmental resource issues to be analyzed for the Project relicensing (FERC 2018):

- Effects of project operation for both power generation and flood control on water quantity, including its relationship to reservoir level, flooding upstream and downstream of the Pensacola Dam, and drought/low-flow periods.

In addition to the inundation area, the H&H Study will provide other flood routing specifics such as the frequency, timing, amplitude, and duration of the inundation. The information obtained from the H&H Study will also inform separate analyses about the effects of inundation on resources such as geology and soils, water resources, fisheries and aquatic resources, terrestrial resources, threatened and endangered resources, and cultural resources. The H&H Study will also help determine lands needed for Project purposes and, therefore, inform FERC's determination of the placement of the Project Boundary.

U.S. Fish and Wildlife Service (USFWS), Oklahoma Department of Wildlife Conservation (ODWC), and N. Larry Bork (counsel for the City of Miami citizens) made a formal request for a flooding/inundation study. FERC, Bureau of Indian Affairs (BIA), USACE, Miami Tribe (supported by Ottawa and Peoria tribes), Ben Loring (State Representative), and the City of Miami commented on the H&H Study Plan. Section 4.1.1 of the main body of the Revised Study Plan (RSP) details GRDA's response to the formal study requests and Attachment B of the RSP details GRDA's responses to the Proposed Study Plan (PSP) comments.

In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting several of ODWC's study requests as described in the PSP, FERC requested more details regarding objectives and methodology for performing resource analyses to address the identified issues. This study plan (Section 2.6.5, Model Runs) provides a general overview of the proposed approach. The objectives and methodology GRDA will use to perform the resource analyses requested by FERC are detailed in the relevant study plans (Aquatic Species of Concern Study, Terrestrial Species of Concern Study, and Wetlands and Riparian Habitat Study) in Attachment A of this RSP.

2.0 STUDY PLAN ELEMENTS

2.1. Study Goals and Objectives

The overall H&H Study goal is to provide information, through modeling and mapping, to support the determination of the effects, if any, of GRDA's operations under the FERC-issued license for the Project upon several resource areas. Specifically, the H&H Study will: (1) determine the 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 these operations that occurs during several measured or synthetic inflow events; (3) provide the model results in a format that can inform other analyses (to be completed separately) of Project effects, if any, in several resource areas; and (4) determine the feasibility of implementing alternative operation scenarios, if applicable, that may be proposed by GRDA as part of the relicensing effort.

2.2. Agency and Native American Tribe Resource Management Goals

The modeling and mapping results can inform separate efforts to assess Project effects on resources such as geology and soils, water resources, fisheries and aquatic resources, terrestrial resources, threatened and endangered resources, and cultural resources. Such analyses, in turn, can inform agency decision-making pursuant to their statutory obligations.

2.3. Background and Existing Information

There is a considerable amount of public information available to support and inform the H&H Study. The information consists of previous hydraulic models, flow, stage, and high-water mark data (hydrology), bathymetry, topography, and sedimentation.

2.3.1. Hydraulic Models

Several hydraulic models have previously been developed for portions of the Grand Lake Watershed. Previous hydraulic models on the Neosho River upstream from Grand Lake and a hydraulic model of Tar Creek are currently available in the public record. Additionally, a previously cited, but not publicly available, model exists that extends from Twin Bridges State Park, Fairland, OK (Twin Bridges) to the U.S. Geological Survey (USGS) Gage No. 07185000, Neosho River near Commerce, OK (USGS gage at Commerce) (Holly 2001, 2004); however, due to inaccessibility, this model will not be reviewed or used as a basis in the H&H Study. The publicly available hydraulic models that will be discussed further are listed below as they are commonly cited:

- USACE Model (1996)
- Simons Model (1998)
- University of Oklahoma (OU) Model (Dennis 2014)
- FERC Model (2015)
- Tetra Tech Models (Tetra Tech 2010, 2013, 2015)
- Federal Emergency Management Agency (FEMA) Tar Creek Model (2015)

USACE (1996) and Simons (1998) Models

Both the USACE and Simons Models utilize a USACE Hydrologic Engineering Center (HEC) software called HEC-2, which was released in 1990. The Neosho River from Twin Bridges to just upstream of the USGS gage at Commerce was modeled as steady-state[1] in these efforts. Since the efforts utilize data collected in 1995 and 1997 (topography and bathymetry) and do not include Grand Lake, they will not be used as a model basis for the H&H Study.

OU Model (Dennis 2014)

GRDA commissioned a hydraulic study through the University of Oklahoma (OU) in 2014 for a previous Project license amendment request. The OU Model was developed using one-dimensional (1-D) HEC-River Analysis System (RAS) software and included the Neosho River and several major tributaries from Pensacola Dam to the USGS gage at Commerce. The OU Model relied on the 1996 USACE bathymetry data for the Neosho River between Twin Bridges and the USGS gage at Commerce and on 2008 bathymetric survey information for Grand Lake from the Oklahoma Water Resources Board (OWRB). The model also used Light Detection and Ranging (LiDAR)-acquired topography collected for the USGS in 2011 to represent overbank areas.

The OU Model will not be used as a model basis for the H&H Study due to the age of the bathymetry data (1996) and the limited purpose for which this model was developed.

FERC Model (2015)

In 2015, FERC developed an independent hydraulic model in response to the proposed license amendment to modify the rule curve under the Project's license. The FERC Model was created using the OU Model as a basis in 1-D HEC-RAS software and was modified to overcome the original limits of the OU Model. The FERC model was calibrated using roughness values from historic flood events and was an unsteady-state[2] analysis for the Neosho River; however, the model did not include the portion of the Grand Lake downstream of Twin Bridges.

The FERC Model will not be used as a model basis in the H&H Study because it does not represent the Spring River, Elk River, or Grand Lake.

Tetra Tech Models (2010, 2013, 2015)

In 2010, 2013, and 2015, the City of Miami commissioned Tetra Tech to develop a hydraulic model. The 2010 and 2013 Models utilized proprietary FLO-2D software, which has both 1-D and two-dimensional (2-D) capabilities. The 2010 and 2013 Models utilized USACE 1996 topography and Simons 1998 bathymetry to focus on the vicinity of the City of Miami and the Neosho River.

The 2015 Model improved upon the 2010 and 2013 Models by utilizing HEC-RAS Version 5.0 software, which also has 1-D and 2-D capabilities. The 2015 Model included unsteady-state 1-

[1] A steady-state model utilizes a constant inflow value that does not vary with time.

[2] An unsteady-state model utilizes varying inflows through the cycle of the inflow event to show the conditions as the inflow event moves through the river system. Unsteady-state modeling is considered to be the most-representative of natural conditions occurring in the river system during the inflow event.

D and 2-D areas for the Grand/Neosho River from Pensacola Dam to the USGS gage at Commerce. It also incorporated bathymetric survey data for the Grand/Neosho River collected by Tetra Tech in April 2015 specifically for the 2015 Model.

The 2015 Model, along with proposed improvements, will be used as a basis for the H&H Study. Although the 2015 Model has some deficiencies and requires several improvements for use in the H&H Study, it provides the best existing model basis for moving forward into the H&H Study. The list of improvements to the model, including updated bathymetric data for the Neosho, Spring and Elk rivers from 2017, are outlined in Section 2.6, Methodology.

FEMA Tar Creek Model (2015)

FEMA developed the Tar Creek 1-D HEC-RAS Model as part of its flood risk mapping efforts for the Grand Lake Watershed. The FEMA Model extends approximately 7.5 miles up Tar Creek from its confluence with the Neosho River. After a review of information associated with the FEMA Model, it was determined that utilizing available USGS 2011 LiDAR data as the model basis for the Tar Creek portion of the watershed, versus the data from the FEMA model, is the best approach to attain the goals of the H&H Study. Therefore, the FEMA Model will not be used as a basis for the H&H Study.

2.3.2. Hydrology

The following hydrology information will be reviewed and utilized, as appropriate, in the H&H Study.

- USGS data from the following six gages:
  - Neosho River near Commerce, OK (USGS Gage No. 07185000).
  - Neosho River at Miami, OK (USGS Gage No. 07185080).
  - Tar Creek at Miami, OK (USGS Gage No. 07185095).
  - Spring River near Quapaw, OK (USGS Gage No. 07188000).
  - Elk River near Tiff City, MO (USGS Gage No. 07189000).
  - Lake O' The Cherokees at Langley, OK (USGS Gage No. 0719000).
  - Neosho River near Langley, OK (USGS Gage No. 07190500).
- GRDA records of flow release and water surface elevations at Pensacola Dam.
- Surveyed high-water marks during and after historical inflow events.
- Water surface elevation logger data collected by GRDA at 16 locations throughout the watershed since December 2016.

2.3.3. Topography

The following sources of topographic data will be reviewed and utilized, as appropriate, in the H&H Study (Figure 2.3-1):

- LiDAR survey conducted by the USGS in 2011 (does not cover entire study area).
- USGS 1/3 arc-second (10-meter) National Elevation Dataset (NED) digital elevation model (DEM).

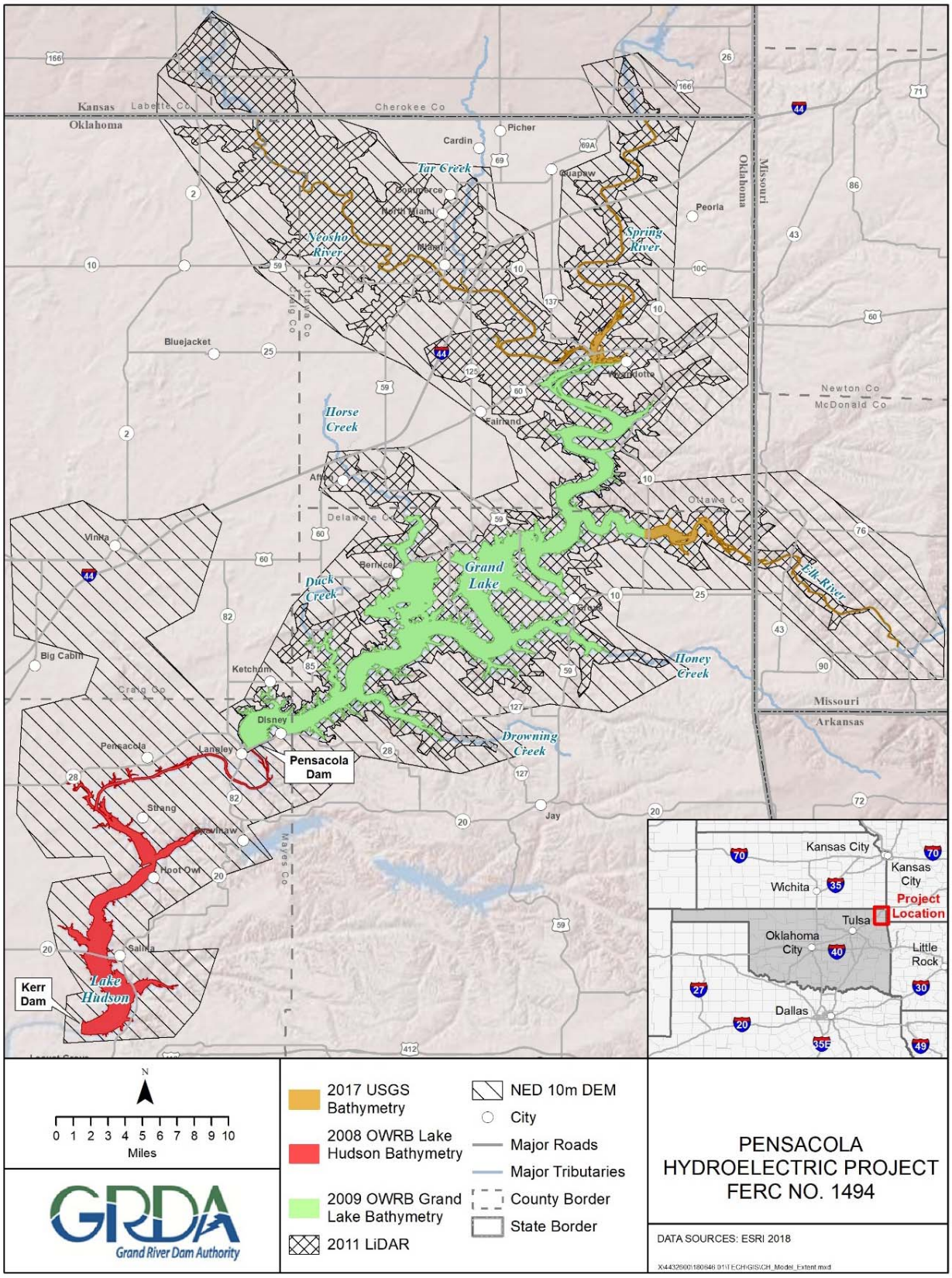


Figure 2.3-1. Extents of topographic and bathymetric data.

LiDAR coverage is not available in the upper reaches of some of the tributaries associated with the H&H Study. For those areas without coverage, information from the NED will be used for the H&H Study.

2.3.4. Bathymetry

The following sources of bathymetric data will be reviewed and utilized, as appropriate, in the H&H Study (Figure 2.3-1):

- 2008 OWRB bathymetric survey for Lake Hudson extending from just upstream of Kerr Dam to just downstream of the Project (OWRB 2008).
- 2009 OWRB bathymetric survey of Grand Lake and 4.5 miles of the Neosho River upstream of the confluence of the Spring River (OWRB 2009).
- 2017 USGS bathymetric survey of the Neosho River, Spring River, and Elk River (USGS 2017a).

The various topographic and bathymetric datasets overlap. For instances where the datasets overlap, the most up-to-date or highest resolution dataset will be given precedence when developing the terrain data for the modeling. The following ranking will be used for determining the precedence of the topographic and bathymetric datasets, with a lower ranking (e.g., 1) indicating higher precedence:

1. 2017 USGS Bathymetry
2. OWRB Bathymetry (2008 Lake Hudson, or 2009 Grand Lake)
3. 2011 LiDAR
4. NED 10m DEM (USGS 2017b)

2.3.5. Sedimentation Historical Cross Sections

The H&H Study proposes to use the cross section information from the 1996 USACE Hydraulic Model or 1997 USACE DEM data, where appropriate, for comparison in determining the impact of sedimentation on the results of current model runs.

2.3.6. Operations Model

The following sources of data will be reviewed and utilized, as appropriate, in the Operations Model.

- USACE RiverWare Model for the Arkansas Basin Reservoir System
- Facility drawings (GRDA 1961 and 1987)
- Turbine hill curves (Siemens 1999 and Bertrand 2009)
- Generator efficiency vs. load curves (Siemens 1999 and Bertrand 2009)
- Turbine index testing (Siemens 1999 and Bertrand 2009)
- Turbine air valve operation vs. turbine efficiency data (Bertrand 2009)
- USACE spillway discharge capacity rating (USACE 1990)
- Reservoir stage-storage curves for Grand Lake (Dewberry 2011)

- Historical observed operations data (headwater elevation, tailwater elevation, and discharge) collected by GRDA (GRDA 1961 and 1987)

2.3.7. Area Capacity Curve

The 2009 OWRB area capacity curves for Grand Lake contained in the hydrographic survey report will be reviewed and utilized, as appropriate, in the H&H Study.

2.4. Nexus between Project Operations and Effects on Resources

Project operation influences water levels of the Grand/Neosho River, as well as some tributaries, both upstream and downstream of Pensacola Dam. The H&H Study will help quantify these influences; improve understanding of the magnitude, duration, and frequency of such influences; identify the operational sources of such influences (e.g., hydroelectric operations or USACE flood control operations); and assist in analyzing resource-level effects that could be associated with these influences. The H&H Study will also help identify changes in areas inundated, if any, that may be associated with any changes to current operations that may be proposed by GRDA as part of the relicensing effort.

2.5. Study Area

The H&H Study area will encompass the channel and overbank areas of the Grand/Neosho River watershed that have a material difference[3] in water surface elevations due to Project operation during the measured inflow events of the H&H Study (see also Section 2.6 Methodology of this study plan). Initially, the study will extend upstream from the Pensacola Dam along the Grand/Neosho River to within approximately 3 miles of the Kansas State line, upstream along the Spring River to within 6.5 miles of the Kansas State line, and upstream along the Elk River beyond the State line into Missouri, and along Tar Creek just upstream of the USGS gage at the 22nd Avenue Bridge (Figure 2.5-1). The study will also encompass the bays/coves within Grand Lake associated with tributaries flowing into the lake.

The overall H&H Study will also include channel and overbank areas that have a material difference in water surface elevations due to Project operation during the measured inflow events extending downstream of the Pensacola Dam.

While this Section 2.5 identifies the initial H&H Study area, as described in Section 2.6 below, the Comprehensive Hydraulic Model (CHM) will be refined, as necessary and appropriate, through an iterative process.

[3] A material difference in water surface elevation due to Project operations will be based on professional judgment. A difference in water surface due to Project operations does not include natural fluctuations in the river system such as wind and wave action.

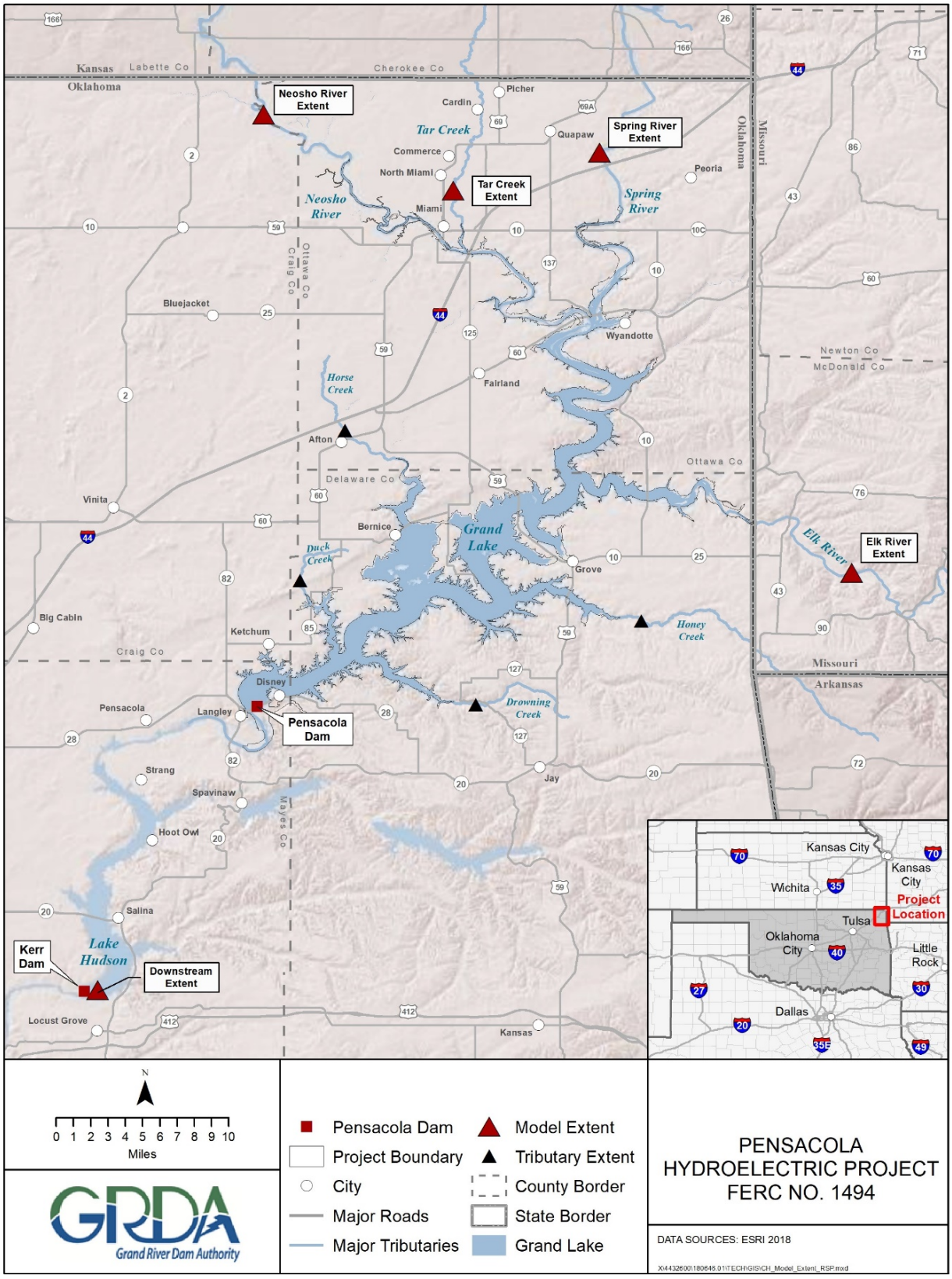


Figure 2.5-1. H&H modeling initial study area.

2.6. Methodology

For the H&H Study, a CHM will be constructed to determine the inundation areas and other flood routing specifics during several measured inflow events where inflow hydrographs already exist.

To evaluate the effects of any proposed operational changes, a separate Operations Model will be constructed to synthesize hypothetical events that inform the CHM. Informing the CHM with the synthetic or hypothetical events will predict the water surface elevations and other flood routing specifics that could occur because of changes to Project operations. This will allow for a comparison between flood routing specifics resulting from different operation scenarios.

To evaluate the extent to which sedimentation affects the results of the CHM, the CHM with the current channel geometry will be modified by inserting historical channel geometry in the place of the 2017 channel geometry to create a new CHM. The new CHM will be re-run under a wide range of inflow events and operating scenarios. This will allow for a comparison between flood routing specifics resulting from the effect of sediment accretion and erosion in the river channels. The effects of the Project operation on sediment accretion and erosion will be the subject of a separate Sedimentation Study (GRDA 2018). Future projected sedimentation determined as part of the Sedimentation Study will also be utilized in the CHM to evaluate the effects of potential future sedimentation (if any) on flood routing specifics.

A hydrology analysis will provide context to the magnitude of measured inflow events being used for runs of the CHM. As a result, the flood frequency at the Pensacola Dam of all the measured inflow events where hydrographs already exist will be determined to provide a frame of reference to their overall magnitude and recurrence.

2.6.1. Comprehensive Hydraulic Model (CHM)

The CHM will use the USACE HEC-RAS software Version 5.0.3 or later. HEC-RAS is broadly accepted by the engineering community as a standard analysis tool for hydraulic modeling. The software has the capability to perform unsteady-state analyses in both 1-D and 2-D. The Tetra Tech 2015 Model will be utilized as a basis to create the new CHM. Like the Tetra Tech 2015 Model, the CHM will be run over individual flood events.

In addition to using the Tetra Tech 2015 Model as a basis on the Grand/Neosho River, the CHM will also extend upstream and include the Spring River, Elk River, Tar Creek and downstream through Lake Hudson to just upstream of Kerr Dam.

For upstream terrain and bathymetric data, the CHM will represent overbank areas using the DEM derived from the 2011 USGS LiDAR data. Where needed, the DEM derived from the 2011 LiDAR will be supplemented with a coarser 1/3 arc-second DEM gathered from the USGS NED. The bathymetric data collected by the OWRB will be used to represent the bottom of Grand Lake.

The bathymetric data for the Neosho, Spring, and Elk rivers gathered during the 2017 USGS survey will also be incorporated into the CHM. The 2017 USGS bathymetric data extends along both the Neosho and Spring rivers from the Kansas/Oklahoma State line downstream to the confluence of the two rivers near Twin Bridges. The 2017 USGS bathymetric data also extends along the Elk River from just downstream of Noel, Missouri, to the Oklahoma State Highway 10 bridge near Grove, OK. USGS has processed the survey data into a DEM that will represent

the channel bottom. The DEM of the channel bottom will be merged with the DEM used in the CHM that represents the overbank areas and bathymetry within Grand Lake.

The CHM will also incorporate various stream crossings/bridges according to the original design drawing geometries obtained (or according to field verification, if design drawings are not available).

For upstream of Pensacola Dam, the CHM will utilize the Tetra Tech 2015 Model as a basis for the location of cross sections and 2-D areas included within the model. A review of the location of the Tetra Tech 2015 Model basis cross sections will be completed and additional cross sections to provide the necessary model resolution will be added to make the CHM more robust than the Tetra Tech 2015 Model (e.g., the number of cross sections in Grand Lake will be increased and cross sections for the Spring River and the Elk River will be added to the CHM).

In general, 1-D will be used for reaches where flood flows are contained within a valley, where flow lines are aligned in the downstream direction, and storage within the floodplain can be represented with 1-D cross sections. One-D cross sections will also be used along the major tributaries where bridges are present because bridge modeling techniques within 2-D areas are limited as compared to available modeling techniques in 1-D areas. Two-D areas will be used where flood flows are not contained within a well-defined valley and lateral flow occurs in the floodplain resulting in flow lines that are not aligned in the downstream direction. Two-D areas will also be used in portions of the reservoir where significant storage volume is available within bays and coves of the reservoir, making it difficult to account for using 1-D cross sections.

The upper portions of Grand Lake (upstream of Sailboat Bridge to the Spring River confluence) will be represented as 1-D to account for bridges. The 1-D cross sections in this reach will be spaced and aligned to account for the reservoir volume in bays and coves. The study reach through Grand Lake downstream of Sailboat Bridge will be represented as a 2-D model to account for storage within the numerous large bays and coves. Both the 1-D cross sections and 2-D grid will be extracted using the 2011 USGS LiDAR data and USGS 1/3 arc-second DEM (where needed) for the overbank portions, along with the 2009 OWRB bathymetric data for Grand Lake for the reservoir bottom.

The Neosho River upstream of the Spring River confluence will be represented through a combination of the 1-D reaches and 2-D areas. A 1-D reach will be used from the confluence with the Spring River at Twin Bridges (River Mile [RM] 122) upstream to approximately RM 131 (2.7 miles downstream of the Will Rogers Turnpike Bridge). One-D is necessary to account for the bridges along this reach. Also, flood flows are relatively confined within the river valley through this reach, making it suitable for 1-D modeling.

The Neosho River will be represented as a 2-D area from approximately RM 131 (2.7 miles downstream of the Will Rogers Turnpike Bridge) to approximately RM 135 (just downstream of the abandoned railroad bridge in Miami) to account for the more complex flow patterns in the wider floodplain and complex flow patterns at the confluence with Tar Creek.

A 1-D reach will be used for the Neosho River through Miami from approximately RM 135 (just downstream of the abandoned railroad bridge) to a point upstream of the Highway 69 bridge to properly account for the head loss through the four bridges along this reach.

A 2-D area will be used to model the Neosho River from upstream of the Highway 69 bridge to the upstream extent of the HEC-RAS model to account for the complex flow patterns across the very broad floodplain and along the sinuous river channel.

Both the 1-D cross sections and 2-D areas will be extracted using the 2011 USGS LiDAR data and a USGS 1/3 arc-second DEM (where needed) for the overbank portions, along with the 2017 USGS bathymetric data obtained for the channel bottom.

Spring River will be represented as a 1-D reach because flood flows are relatively contained within the river valley and to account for the four bridges along the reach. The 1-D cross sections will be extracted using the 2011 USGS LiDAR data and a USGS 1/3 arc-second DEM (where needed) for the overbank portions, along with the 2017 USGS bathymetric data obtained for the channel bottom.

Elk River will be represented as a 1-D reach because flood flows are relatively contained within the river valley and to account for the two bridges along the reach. The 1-D cross sections will be extracted using the 2011 USGS LiDAR and a USGS 1/3 arc-second DEM (where needed) to represent the overbank areas, along with the 2017 USGS bathymetric data for the channel bottom.

Tar Creek will be represented entirely within the same 2-D area used to represent the reach along the Neosho River on the downstream side of Miami, OK (Neosho RM 131 to 135) to account for the complex flow patterns at its confluence with the Neosho River. The 2-D grid will be extracted using the 2011 USGS LiDAR and a USGS 1/3 arc-second DEM (where needed) to represent the overbank areas. In place of bathymetry, the 2011 LiDAR data will be used.

For the CHM section downstream of Pensacola Dam, an unsteady-state 1-D HEC-RAS model will be developed, extending from just downstream of the Pensacola Dam, through Lake Hudson, to just upstream of Kerr Dam. The 1-D cross sections will be used to account for the three bridges over the reach, with storage areas used to represent the larger bay and coves throughout Lake Hudson.

For downstream terrain, the 1/3 arc-second (approximately 10-meter resolution) DEM from the NED will be used. The topographic data will be downloaded from the USGS and compiled to generate a single, large DEM to represent the study area.

For downstream bathymetry, the 2008 bathymetric survey for Lake Hudson by the OWRB extending from just upstream of Kerr Dam to just downstream of the Project will be utilized. It will represent the river/reservoir bottom throughout the downstream section of the CHM. The bathymetric data will be merged with the NED to create the terrain model that will be used in the CHM.

In the downstream study reach, the CHM will also incorporate various stream crossings/bridges according to the original design drawing geometries obtained (according to field verification if design drawings are not available). These bridges include Highway 82, Strang Road, and Highway 20.

Hydraulic roughness coefficients are an important part of the CHM. Therefore, aerial photography and site observations will be used to establish roughness coefficients, which will be cross-checked against the coefficients used in the 2015 Tetra Tech Model in the areas where the two models overlap. Standard Manning's n references will be utilized to correlate the

existing overbank land uses to roughness coefficients. During calibration of the CHM, roughness values will be adjusted as appropriate to improve consistency with observed high water marks or flood conditions.

2.6.2. Operations Model

The Operations Model is a tool that will be used to synthesize and create events that inform or set the boundaries[4] of a CHM run. In addition to the operation of the Project, the model will account for cumulative effects of project operations of the upstream and downstream dams operated by the USACE, but the model will not explicitly include those projects.

The USACE has developed a RiverWare Model for the entire Arkansas Basin Reservoir System, which includes the Grand/Neosho River system and Pensacola Dam. The RiverWare Model is a period-of-record simulation model that utilizes data from 1940 through 2017 and is used by the USACE to evaluate flood control operations throughout the basin as a whole. Given the lengthy period of record in the model, it will provide valuable data for determining flood frequencies at the Project. However, in its current state the RiverWare Model operates on daily time steps, meaning that inflows and outflows used within the modeling are averaged on a daily basis.

While the daily time steps serve the purposes of the USACE's basin-wide evaluations, it is not an adequate approach for analyzing the sub-daily power production decisions at the Project, or for providing inputs to the CHM, which uses hourly time steps for better accuracy in single-event models. Because the USACE RiverWare Model was not originally developed for an hourly time step and because hourly data is not available for the entire period of record, the level of effort to update the modeling to an hourly time step far exceeds the benefits and does not provide additional useable, practical knowledge beyond what the proposed Operations Model will provide.

For the reasons stated above, the USACE model will not be directly utilized for this study. However, components of the USACE RiverWare Model may be extracted to provide more accurate or up-to-date information for the study, such as rating curves or previously-calibrated hydrologic routing parameters.

The extent of the Operations Model will include Grand Lake upstream of Pensacola Dam and downstream (possibly through Lake Hudson upstream of Kerr Dam) as far as required to synthesize inflows to create CHM input boundaries. The Operations Model will utilize a level-pool routing method.

A comparison of the water surface elevations and other flood routing specifics that could occur from different operating scenarios will be based on the different CHM boundary conditions synthesized through the Operations Model for those same operating scenarios. This comparison will illustrate the change in inundation areas and other flood routing specifics arising

[4] The boundaries of the CHM are best described as the stage hydrograph at the dam. When operational changes are being modeled, the Project outflow hydrograph must be synthesized, and a hypothetical stage hydrograph needs to be created based upon the operation of the facility. The hypothetical or synthetic stage hydrograph created using the Operations Model will set the boundaries for the CHM model run.

from the operational changes. The Operations Model can also be used to predict differences in power for different operating scenarios.

The Operations Model will be a Microsoft Excel spreadsheet-based tool, including Visual Basic for Applications (VBA) subroutines to enhance the functionality of the Excel model. The Operations Model will calculate hourly outflows and generation based on various physical constraints (i.e. friction headloss between the reservoir and the turbines, turbine generator efficiency curves, dissolved oxygen valves opened and closed, spillway discharge rating curves, reservoir stage-storage curves, tailwater rating curves, and turbine maximum discharge vs. head rating curves), USACE flood routing operations, and Project hydroelectric operations.

Friction loss will be calculated based on facility drawings.

Turbine and generator efficiency curves will be developed from existing turbine hill curve, generator efficiency vs. load curve, turbine index testing, and turbine air valve operation vs. turbine efficiency data.

Spillway discharge capacity rating curves for Pensacola Dam will be transcribed from existing USACE curves and extrapolated to higher elevations as needed. The Operations Model will not track how many spillway gates are open or what the gate opening height is at any given time; rather, an elevation vs. capacity table will be used to determine the maximum potential spillway discharge for any given reservoir elevation. The model may discharge less than full capacity through the spillway, according to the other model constraints, but it will not exceed the maximum capacity of the spillway.

Reservoir stage-storage curves will be transcribed from existing curves.

The tailwater rating curve for Pensacola Dam will be developed based on historical observed tailwater elevation and discharge data collected by GRDA.

The turbine maximum discharge vs. head rating curves will be based on existing turbine efficiency curves.

For predictive comparisons (i.e. not for calibration to historical events, but rather for hypothetical comparisons, such as comparisons between different initial reservoir elevations), the amount of total discharge required at each time-step during a flood event when the USACE would dictate flood control operations will be determined either from rating curves to be provided by USACE, or from an analysis of historical hourly operations data (headwater level, inflow, and total outflow) used to generate a representative rating curve.

2.6.3. Calibration

Calibration of the CHM is necessary before the results can be considered representative. The CHM will be calibrated using several historic inflow events that represent a relatively broad range of flows. Surveyed high water marks, USGS stream gage records, operation data for Pensacola and Kerr dams, and data obtained from water level monitoring (conducted since December 2016) will be used for calibrating to the historic inflow events. If available, historic aerial photography will be used to inform overbank roughness coefficients used for the historic events. The CHM will be adjusted until calibration is completed. The calibration will be based on engineering judgment. The goal of the calibration will be to minimize differences between

the simulated water surface elevations and the measured values, and also to align the timing of the simulated stage hydrograph and the recorded stream gage data within the study area.

The upstream CHM will be calibrated using several historic inflow events that represent a range of peak flows. The following inflow events will be considered as candidates for calibration of the upstream CHM, but other events not included on this list may be used for calibration if deemed necessary by the study team:

1. July 2007: Hourly inflow data is available for the USGS stream gages on the Neosho River at the Commerce, the Spring River at the Quapaw, and the Elk River at the Tiff City USGS gage. Daily minimum, mean, and maximum water surface elevations are available at the USGS stream gage on the Neosho River at Miami. In addition, high water marks are available for the greater Miami area. Of this list of events, this event had the highest recorded flow on the Neosho River at the Commerce USGS gage.
2. October 2009: Hourly inflow and stage data is available for the Neosho River at the Commerce and Miami stream gages. Hourly inflow and stage data at the USGS gages on the Spring River at Quapaw and the Elk River at Tiff City. High water marks are available for the greater Miami area. This event is considered a medium inflow event when compared to the other events in this list.
3. December 2015: Hourly inflow and stage data is available for the Neosho River at the USGS stream gages at Commerce and Miami. Hourly inflow and stage data is also available for the USGS stream gages along the Spring River at Quapaw and the Elk River at Tiff City. High water marks are available for the greater Miami area. Of this list of events, this event had the highest recorded flow on the Elk River at the Tiff City USGS gage.
4. January 2017: Hourly inflow and stage data is available for the Neosho River at the USGS stream gages at Commerce and Miami. Hourly inflow and stage data is also available for the USGS stream gages along the Spring River at Quapaw and the Elk River at Tiff City. In addition, hourly water surface elevation logger data was collected by GRDA throughout the study area for this event, which is considered a small inflow event when compared to the other events in this list.
5. April-May 2017: Hourly inflow and stage data is available for the Neosho River at the USGS stream gages at Commerce and Miami. Hourly inflow and stage data is also available for the USGS stream gages along the Spring River at Quapaw and the Elk River at Tiff City. In addition, hourly water surface elevation logger data was collected by GRDA throughout the study area for this event. This event represents the largest inflow event that has occurred since the water surface elevation loggers were first deployed in December 2016.

The downstream portion of the CHM will be calibrated using observed stage hydrographs at the USGS stream gage near Langley, OK (Site No. 07190500), along with observed operations at Pensacola Dam and Kerr Dam. The model will be calibrated to several larger flow events with adequate stream gage data including the following: June 2007, April 2008, April/May 2011, and May/June 2015. The model will also be calibrated to smaller flow events if sufficient stream gage data is available along with operational data at Pensacola and Kerr dams.

Calibration of the Operations Model is also necessary before results of the Operations Model or the CHM can be considered representative. The Operations Model will be calibrated using

several wide-ranging operational periods of historical operations data at the Pensacola Dam. The modeled annual power generation totals will be compared to the observed historical annual power generation totals to assess the effectiveness of the calibration. Model inputs which can be varied to effect a better calibration include: operating rules, physical system characteristics, hydrologic routing methods, and quality control processes applied to observed historical data.

2.6.4. Study Area Determination

Section 2.5 outlines an initial study area for the CHM. Unlike the Operations Model, which will include Grand Lake upstream of Pensacola Dam and downstream as far as required to synthesize inflows to create CHM input boundaries, the CHM study area will be determined through an iterative process. In the iterative process, several CHM runs at varying ranges of measured inflow events and operating scenarios will be required to determine the actual extent upstream to which the CHM will need to reach. If a CHM run demonstrates a material water surface elevation difference at the most-upstream extent of the CHM that is also significant in terms of effects on resources, the CHM will need to be extended upstream. When the CHM results for a range of measured inflow events no longer show overbank areas that have a material water surface elevation difference, the CHM upstream extent will be finalized.

2.6.5. Model Runs

A minimum of six inflow hydrographs (including the 2007[5] inflow hydrograph) for the current licensed operating scenario will be run at starting reservoir elevations at Pensacola Dam ranging from 740 feet Pensacola datum (PD)[6] to 745 feet PD in one-foot increments. An upper bound of 745 feet PD was chosen for the starting reservoir elevations because it represents the top of the conservation pool and is used as the starting pool elevation for the operational hydrographs shown in Plates 8-1 through 8-4 of the USACE's Water Control Manual (USACE 1992).

An additional suite of model runs following the same parameters will also be run for each alternate operating scenario that may be proposed using the synthetic inflow data created by the Operations Model. The alternate operating scenarios that may be proposed by GRDA would include revisions to the seasonal rule curve and operating with a flexible power pool.

Existing information, or information gathered as part of studies for other resource areas, in coordination with robust H&H Study model output, will be utilized to determine the effects on resources due to influences of Project operations and fluctuating water levels. Should the existing information or information gathered in the other studies be inadequate to determine the effects, then either the studies will be expanded, or additional model runs will be required with additional information included in the models. Details regarding the interplay of the H&H Study with the other relevant studies can be found in the respective study plans in Attachment A of the main body of the RSP. The resource studies that will rely on H&H Study modeling output include the following:

1. Aquatic Species of Concern Study

[5] The 2007 inflow hydrograph is the largest inflow event of recent record on the Neosho River.

[6] All elevations referenced are relative to PD. PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD29) by adding 1.07 feet and to North American Vertical Datum of 1988 (NAVD88) by adding 1.40 feet (for example, elevation 745 feet PD = 746.07 feet NGVD29 = 746.4 feet NAVD88)(http://ok.water.usgs.gov/projects/webmap/miami/datum.htm).

2. Terrestrial Species of Concern Study
3. Wetlands and Riparian Habitat Study
4. Cultural Resources Study

2.6.6. Sedimentation

To evaluate the extent to which sedimentation affects the results of the CHM, the model with the current channel geometry will be modified by inserting the 1996/1997 USACE channel geometry in the place of the 2017 channel geometry to create a new CHM. The new CHM will be re-run under a wide range of inflow events and operating scenarios, which will allow for a comparison between flood routing specifics resulting from the effect of sediment historically deposited in the river channels. Since historical channel geometry data is only available for the Grand/Neosho River channel and Grand Lake, this comparison will be limited to the effects of sedimentation in the Grand/Neosho River and Grand Lake.

The effects of the Project operation on sediment accretion and erosion will be the subject of the separate Sedimentation Study. Future projected sedimentation determined as part of the Sedimentation Study will also be utilized in the CHM to evaluate the effects of potential future sedimentation (if any) on flood routing specifics.

2.6.7. Flood Frequency

To provide a perspective about the frequency of the inflow events utilized in individual runs of the CHM, a flood frequency analysis will be completed to provide a recurrence interval for each modeled inflow event at the Project.

Because responsibility for flood regulation (USACE vs. GRDA) and the amended license rule curves for Grand Lake are based on the current and projected future elevations at the gage near Pensacola Dam, inflow recurrence intervals should be based on the total inflow at the location of the gage, just upstream of the dam. The inflow at a point just upstream of Pensacola Dam is not a historically-observed parameter. Therefore, calculations including the total turbine and spillway discharge, reservoir stage-storage curves, headwater level, and USGS stream gage discharge will be used when creating the (back-calculated) inflow data set for the frequency analysis.

Ungaged inflow will be determined based on the total discharge at the dam, plus the change in storage in the reservoir, minus other (observed) inflows for a given time step. Hydrologic routing will be used to combine the observed and ungaged inflow at a point just upstream of the dam. The reservoir level gage that produced the headwater level data is not a perfect instrument. Reservoir level gage reading fluctuations on the order of a few hundredths of a foot can significantly alter the back-calculated inflow time series values and can even result in large negative values if the reservoir level decreases substantially without a corresponding recorded outflow. A time-averaging procedure will be used to eliminate negative values due to imprecision/fluctuation in the reservoir level gage data.

The annual peak inflows at the Project will be computed for the entire range of flood events analyzed. The annual peak inflows will be used to conduct a statistical flood frequency analysis to determine the 5-, 10-, and 15-year return period peak inflows, at a minimum.

2.6.8. Area Capacity Curve

The OWRB has developed up-to-date area capacity curves for Grand Lake. However, the area capacity curves only reach to an upper elevation of 745 feet PD, which marks the beginning elevation of the flood control pool, which is under the jurisdiction of USACE. The OWRB curve will be modified to reach an upper elevation of 760 feet PD and will identify areas above the elevation of 745 feet PD, which is outside of GRDA's operation of the Project.

2.6.9. Deliverables

There will be five main deliverables:

1. Model input and calibration report (Status Report)
2. Technical conference call
3. CHM Model, Calibration, and Outputs upon request
4. Initial technical report (include with the Initial Study Report [ISR])
5. Final technical report (included with the Updated Study Report [USR])

To allow relicensing participants to better understand the CHM and the Operations Model, GRDA will provide a Status Report explaining model inputs and calibration in April 2019.

Prior to May 1, 2019, GRDA will hold a technical conference call where interested relicensing participants can ask questions about the Status Report. This will allow relicensing participants to obtain information on model input and calibration as part of the H&H Study. Written comments will not be taken at this time, but can be provided in response to the ISR. The comments will be addressed in the USR, as provided in FERC's Integrated Licensing Process (ILP) regulations.

Following the conference call, relicensing participants may formally request by email or in writing, the CHM, the CHM calibration, and CHM outputs. Due to file size, information cannot be placed on the website and will need to be transferred electronically via a file service or USB drive. The information will be provided within 10 days of the formal request.

To allow relicensing participants to review the modeling results, the H&H Study will provide an ISR[7] with maps displaying areas of inundation, and maps comparing the inundation areas under varying operation constraints beginning with a starting reservoir elevation of 742 feet PD and increasing in one-foot increments to a maximum of 745 feet PD. The ISR will also include the results of flood frequency analyses and the modified area capacity curve.

The ISR will document the data sources, the input hydrology, how the CHM and the Operations Model were developed, the assumptions used in creating the models, the calibration processes, and their results. It will provide an explanation of the USACE involvement in Project operation, graphs and summary tables for stage and outflows synthesized by the Operations Model, and an explanation of input parameters for each CHM scenario run. The ISR will also include a description of the flood frequency analysis, the results of the analyses, and a description of the limitations of the analyses.

[7] The ISR will be the report resulting from Study Year One.

Inundation depth maps layered on recent aerial photos with the current Project Boundary depicted will also be provided in the ISR. Each set of inflow event maps will include an inundation line to represent the maximum water surface elevation, the current flowage easements, and identification of any structures within the inundation areas. Inundation maps will include overlays of ownership of inundated lands.

In the ISR only, another set of inundation maps will be identical to the maps described above, but will incorporate the inundation areas resulting from CHM runs with the 1996/1997 USACE channel geometry visible as a separate layer. This set of maps will incorporate a description of the change in anticipated impacts of sediment accumulated in the river system since 1996/1997.

Evaluation of alternative scenarios, proposed by GRDA or provided through relicensing participant consultation through comments on the ISR to address upstream flooding attributed to project operations (if any), will be either modeled or addressed in Study Year Two.

The USR will address written comments provided on the ISR.

The results of the additional analyses with deliverables similar to the deliverables provided in the ISR will be provided in the USR.

The Status Report, ISR, and USR will be posted to the relicensing website and e-filed with FERC.

2.7. Consistency with Generally Accepted Scientific Practice

The H&H Study incorporates methods and data that are consistent with generally accepted scientific practice. The scope of the study will encompass the entire area that is inundated during measured inflow events. This includes the Spring River, Elk River, Grand/Neosho River, and Tar Creek.

Specifically, after a thorough data review and inventory, the study will incorporate the 2017 USGS bathymetric data and the 2011 LiDAR information. It will also incorporate bridge geometry (or field-verified information) when developing cross sections for critical locations where existing infrastructure are believed to restrict the flow beyond the channel or floodplain.

The CHM in the H&H Study will use HEC-RAS Version 5.0.3 or later software, which is the standard in the engineering community for hydraulic studies of river systems. It will incorporate both 1-D and 2-D reaches to accurately represent the flow patterns both in the vicinity of bridges and in areas of broad floodplains within the study area.

The limitations of any previous hydraulic models will be further addressed by extending the model farther upstream and including the Spring and Elk rivers into the model to address relicensing participant interest, including tribal interests. In addition, the resolution of cross sections in Grand Lake will be increased to understand in detail the interactions of the various major tributaries when they enter Grand Lake.

The CHM will be calibrated using several historic inflow events that represent a relatively broad range of the recorded and surveyed high water marks available and all model elevations will reference NGVD29 as a common datum.

The Operations Model will be a Microsoft Excel spreadsheet-based tool, including VBA subroutines to enhance the computation efficiency of the Excel model. Calibration of the Operations Model will be completed using several wide-ranging operational periods of historical operations data at the Pensacola Dam. The modeled annual power generation totals will be compared to the observed historical annual power generation totals to assess the effectiveness of the calibration. Model inputs which can be varied to effect a better calibration include: operating rules, physical system characteristics, hydrologic routing methods, and quality control processes applied to observed historical data.

2.8. Schedule

The schedule for completion of the H&H Study is displayed in Table 2.8-1.

Table 2.8-1. H&H Study schedule.

Task	Completion Date
Anticipated Completion of Study Plan Determination Process	11/08/2018
Model Input Status Report (Status Report)	04/01/2019
Conference Call on Model Inputs and Calibration	05/01/2019
Initial (Technical) Report (ISR)	11/08/2019
Second Field Season-Additional Analysis and Updates	08/01/2020
Final (Technical) Report (USR)	11/08/2020

2.9. Level of Effort and Cost

The total estimated cost for the H&H Study as outlined in the Methodology section of this study plan is approximately $800,000.

3.0 REFERENCES

Bertrand, A. 2009. Electrical and Mechanical Calculations Characteristics of Generators 1, 2, 3, and 4. Alstom Power & Transport Canada Inc. (Rev. 2014, July 7).

Dennis, Alan C. 2014. Floodplain Analysis of the Neosho River Associated with Proposed Rule Curve Modifications for Grand Lake O' The Cherokees. Submitted in Partial Fulfillment of Master's Thesis, University of Oklahoma (OU), Norman, Oklahoma.

Dewberry. 2011. USGS Grand Lake, OK LiDAR Project. Prepared for the U.S. Geological Survey. November 2011.

FEMA (Federal Emergency Management Agency). 2015. Task Order HSFE06-11-J-001 for Grand Lake O' The Cherokees Watershed, OK HUC 8 – 11070206, Craig, Delaware, Mayes, and Ottawa Counties, Oklahoma. February 6, 2015.

FERC (Federal Energy Regulatory Commission). 2015. Memorandum, Pensacola Project No. 1494, Review of Supporting Information for Temporary Variance Request. August 26, 2015.

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

GRDA (Grand River Dam Authority). 1961. Dam and Power House, Power House and Intake, Transverse Sections, Markham Ferry Project. As-Built Drawings.

GRDA. 1987. Dam and Powerhouse Section and Elevation of Dam and Powerhouse, Pensacola Dam Hydropower Project. Application for FERC License, FERC No. 1494-169. Exhibit F, Sheet 2. February 26, 1987.

GRDA. 2017. Pensacola Hydroelectric Project, Pre-Application Document.

GRDA. 2018. Pensacola Hydroelectric Project, P-1494, Sedimentation Study Plan. Prepared for GRDA by Mead & Hunt. September 2018.

Holly, F.M. 2001. Flood Level and Duration Determination Neosho River Below Commerce Gage. Prepared for Dalrymple et al. v. Grand River Dam, Case No. CJ-94-444, Miami, Oklahoma. April 2001.

Holly, F.M. 2004. Analysis of the Effect of Grand Lake Power-Pool Elevations on Neosho River Levels During a Major Flood. January 2004.

OWRB. (Oklahoma Water Resources Board). 2008. Hydrographic Survey of Lake Hudson. October 23.

OWRB. 2009. Hydrographic Survey of Grand Lake. August 26, 2009.

Siemens. 1999. Efficiency Calculations, Pensacola Power Plant, Unit No. 3. Siemens Westinghouse Generator Engineering. Page V of V. January 13.

Simons & Associates, Inc. 1998. Revised Hydraulic and Backwater Analysis of the Neosho River Upstream of the Reservoir to the Commerce Gage. Miami, Oklahoma.

Tetra Tech. 2010. Expert Report of Dr. Robert A. Mussetter, Allman et al. v. Grand River Dam Authority Case No. CJ-2001-381. January 2010.

Tetra Tech. 2013. Hydraulic Analysis of the Impacts of Flooding Along the Neosho River. May 1995, June 1995 and the 2007 and 2013 Floods. Prepared for Goodell, Stratton, Edmonds and Plamer. December 2013.

Tetra Tech. 2015. Hydraulic Analysis of the Effects of Pensacola Dam on Neosho River Flooding in the Vicinity of Miami, Oklahoma. Prepared for the City of Miami. December 2015.

USACE (U.S. Army Corps of Engineers). 1990. Discharge Rating Curves, Main Spillway. Discharge Rating Curves, East Spillway. Pensacola Reservoir. Dept. of the Army, Tulsa District Corps of Engineers.

USACE. 1992. Markham Ferry Reservoir Grand-Neosho River, Oklahoma Water Control Manual, Appendix E, Part II to Water Control Master Manual Arkansas River Basin. October 1992.

USACE. 1996. HEC-2 Hydraulic Model.

USACE. 1997. Digital Elevation Model.

USGS (U.S. Geological Survey). 2017a. Bathymetric Surveys of the Neosho River, Spring River, and Elk River, Northeastern Oklahoma and Southwestern Missouri, 2016-17. October 2017.

USGS. 2017b. 1/3 arc-second (10-meter) National Elevation Dataset (NED) digital elevation model (DEM). https://nationalmap.gov/elevation.html.

[This page intentionally left blank.]

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Sedimentation Study

Prepared for

Prepared by

freshwatereng.com

rksimons.com

meadhunt.com

September 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

1-D ..... one-dimensional
2-D ..... two-dimensional
ADCP ..... Acoustic Doppler Current Profiler
ASTM ..... American Society for Testing Materials
BIA ..... Bureau of Indian Affairs
CHM ..... Comprehensive Hydraulic Model
FERC ..... Federal Energy Regulatory Commission
GRDA ..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
ISR ..... Initial Study Report
OBS ..... Optical Backscatter
ODWC ..... Oklahoma Department of Wildlife Conservation
OWRB ..... Oklahoma Water Resources Board
PAD ..... Pre-Application Document
Project ..... Pensacola Hydroelectric Project
PSP ..... Proposed Study Plan
RSP ..... Revised Study Plan
SD1 ..... Scoping Document 1
SD2 ..... Scoping Document 2
SSC ..... suspended sediment concentration
SWAT ..... Soil and Water Assessment Tool
USACE ..... U.S. Army Corps of Engineers
USGS ..... U.S. Geological Survey
USR ..... Updated Study Report

1.0 INTRODUCTION

The Pensacola Hydroelectric Project (Pensacola Project or Project), owned and operated by the Grand River Dam Authority (GRDA), is licensed by the Federal Energy Regulatory Commission (FERC or Commission) as Project No. 1494. GRDA is a non-appropriated agency of the State of Oklahoma, created by the Oklahoma legislature in 1935 to be a "conservation and reclamation district for the waters of the Grand River." 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, the U.S. Army Corps of Engineers (USACE) has exclusive jurisdiction over Grand Lake O' the Cherokees (Grand Lake) for flood control purposes.

FERC's April 27, 2018 Scoping Document 2 (SD2) identified the following resource issue to be analyzed for the Project relicensing (FERC 2018):

- Effects of project operations on sedimentation including the transport and subsequent deposition of potentially contaminated sediment.

In their Proposed Study Plan (PSP) comment letters, City of Miami (as supported by the Miami Tribe) and N. Larry Bork (counsel for the City of Miami citizens) made a formal request for a sedimentation study. FERC, Bureau of Indian Affairs (BIA), Oklahoma Department of Wildlife Conservation (ODWC), Ben Loring (State Representative), and City of Miami commented on GRDA's proposed Sedimentation Study Plan. Section 4.1.2 of the main body of the Revised Study Plan (RSP) details GRDA's response to the formal study requests and Attachment B of the RSP details GRDA's responses to PSP comments.

GRDA proposes to conduct a Sedimentation Study to provide insight into whether operation of the Project influences sediment transport and sedimentation within the Neosho River/Grand Lake upstream and within Grand Lake.

Data from the Sedimentation Study is intended to be used in conjunction with GRDA's proposed Hydrologic and Hydraulic Modeling Study (H&H Study) to determine the extent to which sedimentation affects water levels in these areas during high-flow events.

The Sedimentation Study has been designed as a two-year study to analyze historic data and collect additional field measurements to determine bed sediment properties, suspended sediment concentrations (SSC), and hydraulic data. These data will be utilized to determine sediment supply from the main stem river and tributaries, which will be compared with sediment deposited in the river and reservoir. Historic sedimentation trends (spatial and temporal) associated with historic hydraulics under historic Project operations will be analyzed and extrapolated considering alternative operation scenarios and the tendency for incoming sediment to be eroded, transported, or deposited.

GRDA recognizes that sedimentation within the Grand Lake watershed is a concern to many relicensing participants; specifically, its potential to impact the extent and duration of flooding in the watershed. Therefore, GRDA proposes to conduct a Sedimentation Study designed to determine the relative impact of sedimentation on flooding in the watershed. The Sedimentation Study will provide insights into the characteristics of sediment transport, erosion, and deposition in Grand Lake and its tributaries.

2.0 STUDY PLAN ELEMENTS

2.1. Study Goals and Objectives

Since sediment transport processes in the Project area are relatively unknown, and as such, the linkages between Project operations, bed changes, and potential upstream flooding are not clearly understood, the primary goal is to determine the potential effect of Project operations on sediment transport, erosion, and deposition in the lower reaches of tributaries to Grand Lake upstream of Pensacola Dam. Additionally, the Sedimentation Study is designed to provide an understanding of the sediment transport processes and patterns upstream of Grand Lake on the Neosho, Spring, and Elk rivers and Tar Creek. The Sedimentation Study will complement GRDA's H&H Study and determine the impact of Project operations on bathymetric changes and upstream inundation levels (Figure 2.1-1).

The goal of the Sedimentation Study is to investigate the overall trends and impact of sedimentation within the Project Boundary. Specifically, this study will analyze the amount of sedimentation that has occurred in the reservoir; evaluate sediment transport, erosion, and deposition in Grand Lake and its tributaries; and characterize the impact that sedimentation may have on flood extents and duration throughout the study area under potential future operation scenarios.

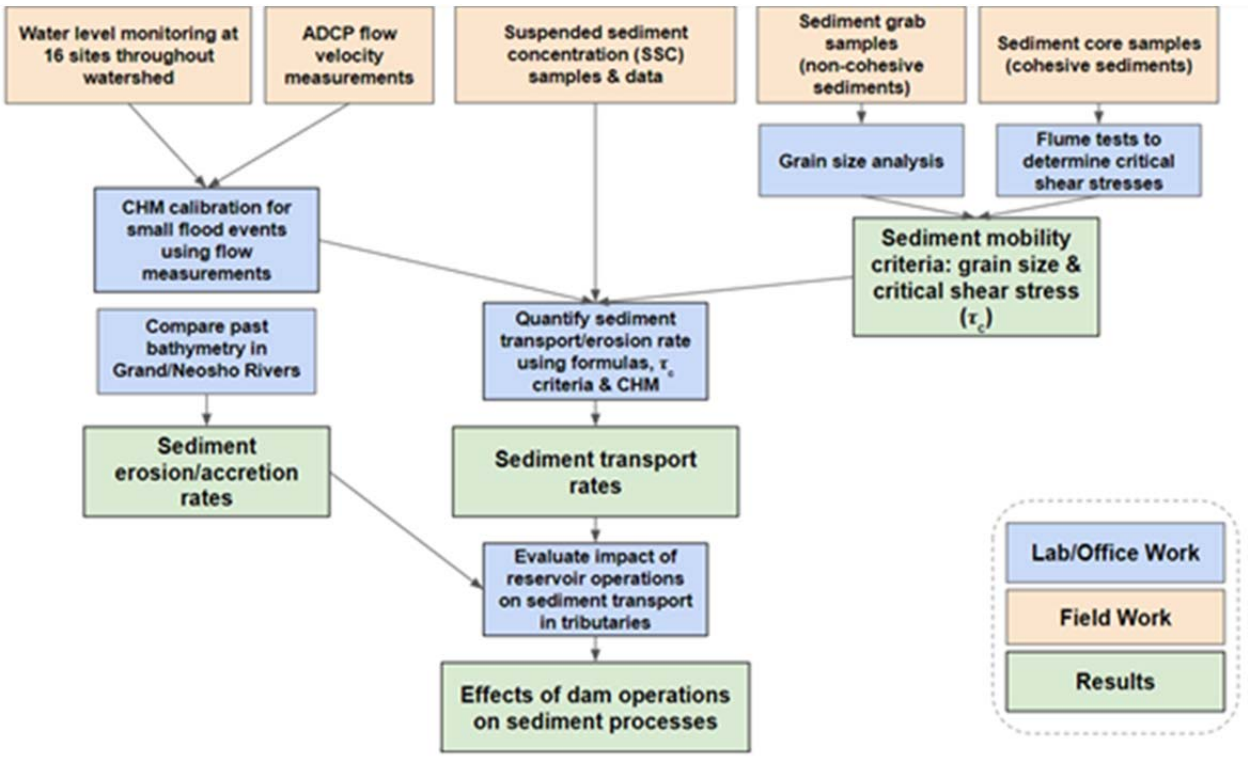


Figure 2.1-1. Study process explanation.

Specific Tasks

Analysis of Existing Data

- Compile existing data on suspended sediments, sediment properties, flow, and water levels into a database.
- Review literature and past studies on sedimentation and hydraulics in the study area.

Bathymetric Change Analysis

- Compare spatial and temporal changes associated with previously collected bathymetry survey data in the study area.
- Analyze sediment bed changes relative to velocities from existing and collected Acoustic Doppler Current Profiler (ADCP) data.
- Assess areas of deposition and accretion.
- Conduct specific-gage analysis at U.S. Geological Survey (USGS) gages to understand trends in stage over time due to changes in cross sections.
- Develop spatial and temporal understanding of geomorphological changes and rate of change.

Field Measurements

- Identify SSC measurements at selected monitoring sites.
- Collect sediment grab/core samples for material property analysis and for flume testing.
- Obtain flow and velocity measurements with an ADCP at select locations in the study area.
- Continuously monitor water levels at 16 sites located throughout the watershed.

Sediment Transport Evaluation

- Determine site-specific sediment transport mobility criteria for locations in the study area.
- Develop relationships between flow and suspended sediment transport using regression or other curve-fitting techniques and/or sediment transport relations/equations.
- Estimate sediment transport rates for the sites using appropriate established formulas for cohesive and non-cohesive sediments.
- Evaluate sediment transport at key locations in the study area using the Comprehensive Hydraulic Model (CHM) portion of the H&H Study under select operations scenarios.
- Develop incoming sediment supply between bathymetric survey areas using historic hydrologic data to compare computed sediment supply to changes in cross section area (Sediment Balance Analysis).
- Analyze results of the recently developed Soil and Water Assessment Tool (SWAT) model with respect to sediment loading.

Characterization of Sedimentation Impacts on Flooding

- Calibrate CHM for smaller flood events using water level measurements.

- Compare hydraulics based on modified Project operation scenarios to historic hydraulics.
- Estimate sedimentation based on sediment transport analysis considering modified reservoir hydraulics compared to historic operation and sedimentation.
- Evaluate changes to flood extent and duration using CHM and approximate channel bed changes considering Project operations.

Data Synthesis and Reporting

- Synthesize findings of bathymetric change analysis and sediment transport evaluation to inform hydraulic modeling efforts.
- Provide an understanding of effects of Project operations on sediment transport characteristics and projected distribution of sediment related to flood extent and duration in the study area.
- Use sediment transport relations and historic trends of sedimentation to make projection of sedimentation considering modified Project operation scenarios.
- Summarize study results and conclusions in an Initial Study Report (ISR) and Updated Study Report (USR).

2.2. Agency and Native American Tribe Resource Management Goals

The Sedimentation Study results can inform separate analyses to assess Project effects on resources such as geology and soils, water resources, fisheries and aquatic resources, terrestrial resources, threatened and endangered resources, and cultural resources. Such analyses, in turn, can inform agency decision-making pursuant to statutory obligations.

2.3. Background and Existing Information

There is a considerable amount of public information available to support and inform the Sedimentation Study. The primary source of data is provided by USGS stream gage monitoring stations located throughout the watershed, supported by periodic surveying and bathymetric mapping of Grand Lake and its tributaries. Previous studies have also produced data points that will be useful to this Sedimentation Study for estimating sediment transport rates within the Neosho and Spring rivers. The existing information outlined in the section below will be reviewed and utilized in this Sedimentation Study, as appropriate, to meet the study goals.

2.3.1. Bathymetry Data

The changes to the channel shape of the Neosho, Spring, and Elk rivers are an important aspect of the Sedimentation Study. Differences in the channel depth and bed geometry provide insight into erosion and deposition processes in the lower reaches of those rivers. Bathymetric survey data has been collected periodically in the study area over the past several decades. Table 2.3-1 below summarizes the datasets available.

Table 2.3-1. Bathymetry datasets available in the study area.

Year	Organization	Description
2017	USGS	Hydrographic survey of Neosho, Spring, and Elk rivers upstream of Grand Lake to upstream gaging stations (USGS 2017).
2015	Tetra Tech	Survey of cross sections in the Neosho River between Twin Bridges and Stepps Ford Bridge (Tetra Tech 2015).
2008/2009	Oklahoma Water Resources Board (OWRB)	Hydrographic survey of Grand Lake, including the lower reaches of the Neosho, Spring, and Elk rivers (OWRB 2009).
1997	USACE	Survey of Neosho River for Real Estate Adequacy study (USACE 1997).
1995/1998	Settle Engineering	Survey of Neosho River (Dalrymple et al. 1999).
1938-1940	USACE	Topographic survey of pre-dam conditions (USACE 1940).

2.3.2. Flow Velocity and Discharge Data

Information on river flows in the Neosho, Spring, and Elk rivers is relatively well documented. The USGS maintains a network of monitoring stations throughout the watershed that continuously record data. Most often, this data consists of water level (stage) measurements, which can be related to discharge through the formation of a rating curve. Table 2.3-2 lists the USGS stations located in the Grand Lake watershed as well as the period of record for discharge, stage, and SSC measurements for each site.

Table 2.3-2. USGS gages present in the Grand Lake watershed and periods of record for parameters relevant to the Sedimentation Study.

	USGS Station ID	Site Name	Period of Record		
			Discharge	Stage	SSC
Active Sites	07185000	Neosho River near Commerce, OK	1990-2018	2007-2018	1944-2016
	07185090	Tar Creek near Commerce, OK	2007-2018	2007-2018	2004-2016
	07185095	Tar Creek at 22nd Street Bridge at Miami, OK	1989-2018	2007-2018	1988-2006
	07188000	Spring River near Quapaw, OK	1989-2018	2007-2018	1944-2018
	07189000	Elk River near Tiff City, MO	1990-2018	2007-2018	1993-2009
	07189100	Buffalo Creek at Tiff City, MO	2000-2018	2007-2018	2005
	07189540	Cave Springs Branch near South West City, MO	1997-2018	2007-2018	2007
	07189542	Honey Creek near South West City, MO	1997-2018	2007-2018	2007
	07190500	Neosho River near Langley, OK	2016-2018	2016-2018	1945-1947
Inactive Sites	07188007	Beaver Creek above Spring River near Quapaw, OK	2000-2006	2006	2004-2006
	07188180	Spring River near Wyandotte, OK	2004-2006	2006	2004-2006

The USGS also periodically measures discharges directly at gaging stations using an ADCP. ADCPs measure channel cross section depths and flow velocity across the width of the channel to obtain discharge values that can be used with water level measurements to create or validate a rating curve for a gaging station. Velocity measurements can also be analyzed to obtain parameters necessary for evaluating sediment transport, such as average channel velocity or critical shear velocity. Table 2.3-3 below lists information about existing USGS ADCP measurements.

Table 2.3-3. ADCP data available from past USGS measurements.

USGS Station ID	Location	Period of Record	Range of Flows (cubic feet per second)
07185000	Neosho River near Commerce, OK	May 2006 - present	931 - 129,000
07185080	Neosho River at Miami, OK	May 2013 - Oct 2017	172 - 57,100
07185095	Tar Creek at 22nd Street Bridge at Miami, OK	Jan 1984 - Sept 1993, May 2004 -present	0.02 - 3,410
07188000	Spring River near Quapaw, OK	Dec 2004 - present	639 - 62,600
07189000	Elk River near Tiff City, MO	Jan 2008 - April 2017	2,340 - 24,800
07189542	Honey Creek near South West City, MO	Oct 1997 - present	2.9 - 5,910

2.3.3. Channel Sediment Properties

Several studies have investigated channel and upland sediments in the Grand Lake watershed (e.g., Pope 2005; Andrews et al. 2009; Ingersoll et al. 2009; Juracek and Becker 2009; Smith 2016). These studies provide detailed information on the presence of heavy metals and other contaminants in specific areas, particularly in Tar Creek.

2.3.4. Suspended Sediment Data

Measurements of suspended sediments in the study area have been collected by USGS since the 1940s. Past measurements were infrequent and generally collected during specific events. The USGS reports SSC at gaging stations, which differs from other measures of sediment such as total suspended solids. Locations and sampling durations of SSC within the Grand Lake watershed are provided in Table 2.3-2.

2.3.5. Water Level Data

Water level data is being continuously collected by USGS at the following gages located in the study area:

- Neosho River near Commerce, OK
- Neosho River at Miami, OK
- Spring River near Quapaw, OK
- Elk River near Tiff City, MO
- Tar Creek at 22nd Street Bridge at Miami, OK
- Honey Creek near South West City, MO

In addition to USGS gage data, GRDA has collected continuous water level data at 16 locations throughout the watershed since December 2016. These gages collect flow data every 30 minutes and will provide suitable information to calibrate the CHM to observed flood events.

As part of their Pre-Application Document (PAD)/Scoping Document 1 (SD1) comments and study requests, City of Miami, Miami Tribe, Eastern Shawnee Tribe, Ottawa Tribe, Seneca Cayuga Nation, Wyandotte Nation, and N. Larry Bork (counsel for the City of Miami citizens) provided a list of existing information to be used in their requested contaminated sediment transport study. The toxicity of the sediments is not within the scope of this Sedimentation Study. However, the list of existing information provided in these study requests has been reviewed and, as applicable, will be incorporated into this Sedimentation Study.

2.4. Nexus between Project Operations and Effects on Resources

The operation of the Pensacola Project affects the elevations of Grand Lake. The Sedimentation Study will allow relicensing participants to understand the relationship between Project operations and sedimentation pertaining to the extent and duration of inundation.

The Sedimentation Study will also provide an understanding of the magnitude and extent of sedimentation and subsequent sediment transport associated with Project operations on upstream flooding.

2.5. Study Area

This Sedimentation Study will focus on the Grand Lake/Neosho River from Pensacola Dam to within approximately 3 miles of the Kansas State line, the Spring River from its confluence with the Neosho to within approximately 6.5 miles from the Kansas State line, and upstream along the Elk River to the USGS gage at Tiff City, Missouri. The study area encompasses the lower reaches of the Neosho, Spring, and Elk rivers where interactions between the reservoir and tributaries are likely greatest. The study area will also include Tar Creek downstream of the 22nd Street Bridge. Locations of the areas where existing data has been collected and where GRDA water level monitoring is being conducted are generally depicted in Figure 2.5-1.

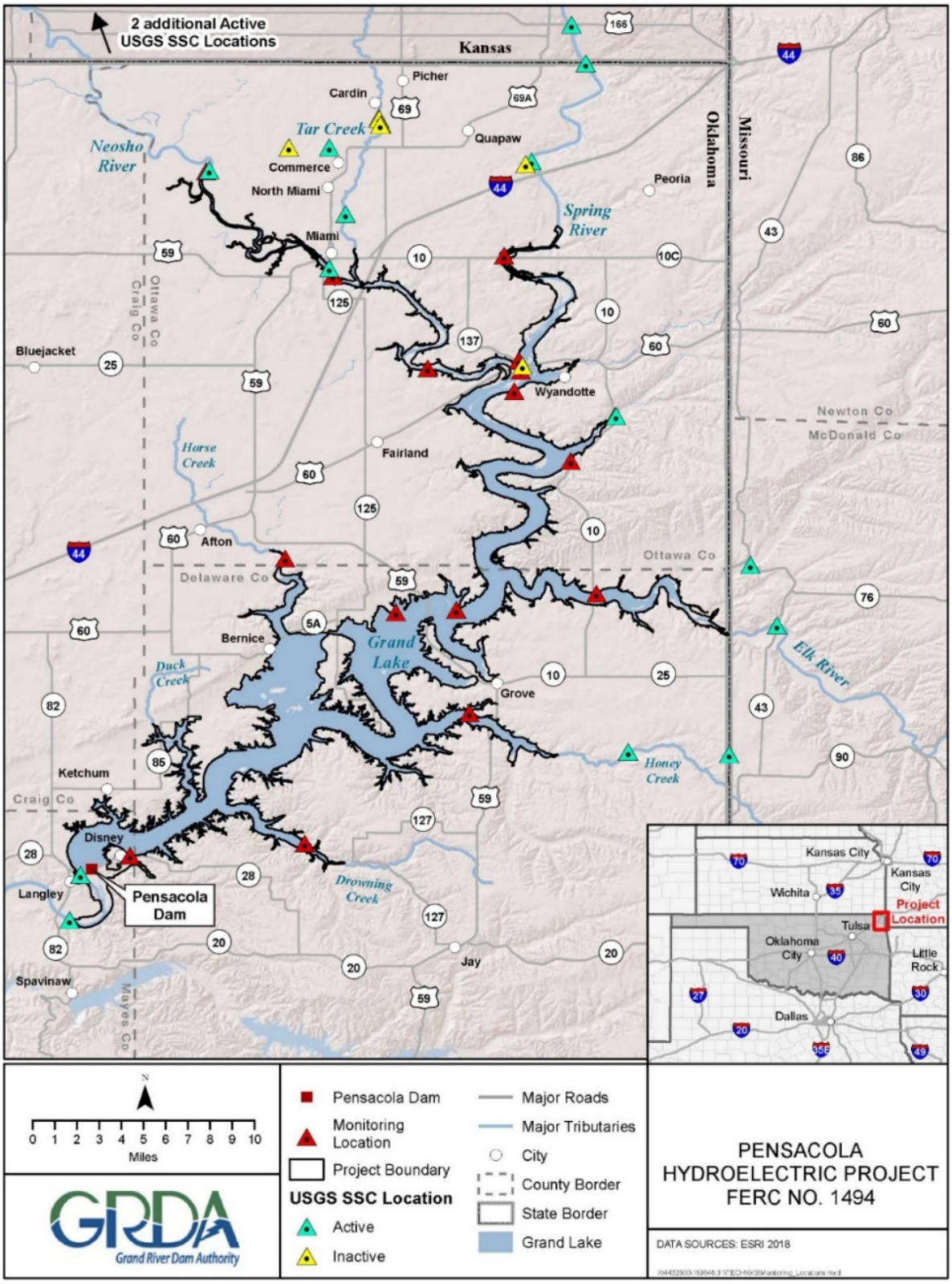


Figure 2.5-1. Existing USGS data locations and water level monitoring locations.

2.6. Methodology

2.6.1. Background Data and Literature Review

Sediment transport is influenced by interactions between water flowing in a river and sediment particles; accordingly, any investigation of sediment transport phenomena requires detailed information on river flow and sediment properties (Knighton 2014). Due to the heterogeneous nature of the variables controlling sediment transport, field data is an essential component of any study. These key variables include:

- River discharge
- Flow depth
- Flow velocity
- Channel shape
- Channel slope
- Sediment composition
- Sediment grain size (often D_{50})
- Sediment grain size distribution
- Bedforms present on channel bottom
- Sediment unit weight/density
- Critical shear stress of sediment
- Suspended sediment load and concentration

Numerous sediment studies have taken place within the Grand Lake watershed. These studies are primarily associated with the Tar Creek Superfund Site, focused on sediments from Tar Creek, and have produced data points that are useful in estimating transport rates and deposition within the Neosho River downstream of its confluence with Tar Creek. Recent suspended sediment data exists for several sampling locations and the USGS continues to monitor the basin (Table 2.3-2).

All relevant previous reports and historic sediment sampling investigations known to have been conducted within the basin will be reviewed. GRDA will develop an organized database to store the data collected as a part of the existing data review and analysis. All data will be fully documented. A technical memorandum will be provided in the ISR describing the type and quality of data available.

An initial review of existing data has identified several data gaps in the key variables listed above. The necessary field data required to fill these data gaps will be collected during the study period and include: bathymetry surveys, sediment cores and grab samples, suspended sediment samples, discharge and velocity measurements, and water level measurements.

2.6.2. Bathymetric Change Analysis

Bathymetric changes can provide valuable information about sedimentation and erosion. Reaches or cross sections where sediment has accumulated or eroded over time will be

apparent when looking at bathymetric changes from one survey to the next. The extent and rate of change may indicate areas where sediment deposition or erosion is likely to have some effect on flood duration and severity.

Bathymetric Comparisons

Bathymetric comparisons will be performed based on the type of data available. The 2017 and 2008/2009 surveys performed by the USGS and OWRB overlap in the lowest 3-5 river miles of the Neosho, Spring, and Elk rivers. Survey data will be compared using surface differencing to evaluate erosion and deposition in those reaches.

Elsewhere, channel survey data is limited to cross sections surveyed infrequently since the construction of Pensacola Dam in 1940. The long-term range of the data will permit broader analysis regarding channel aggradation, erosion, or migration. Where data is limited to cross sections, bathymetric changes at each cross section will be analyzed (see example in Figure 2.6-1), then volumetric changes will be computed between cross sections to find the volume of sediment accreted or eroded.

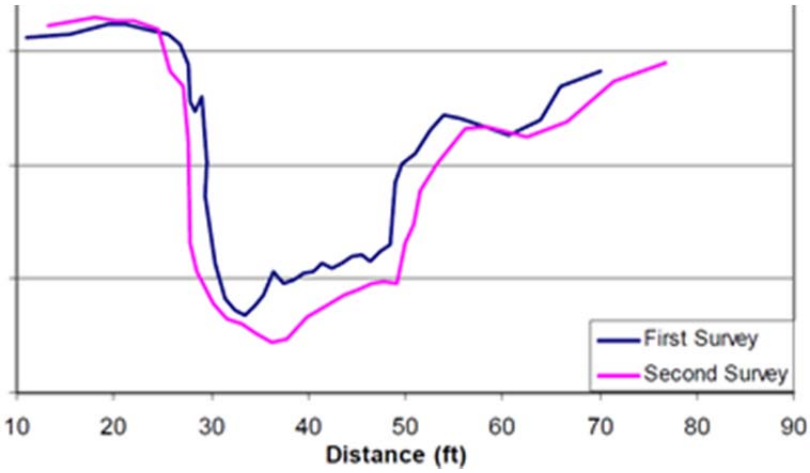


Figure 2.6-1. Example: Bathymetric cross section comparison.

Additionally, ADCP surveys conducted by the USGS at the four gaging stations in the study area have collected highly accurate bathymetry data across each channel cross section. These surveys have been repeated between 5 and 25 times, depending on the site. These channel cross sections will be analyzed based on the accompanying flow data for volume changes, channel migration, and effects of flood events.

Stage and flow volume measurements will also be used during bathymetric change analysis. The relationship between water surface elevation and flow rate through time will be analyzed and related to observed bathymetric changes. This evaluation will provide an indication of the effects of sedimentation and erosion on water levels in the specified reach.

Synthesis

The bathymetric comparison analysis will be synthesized into the ISR detailing the temporal and spatial sedimentation patterns. Volume changes will be reported on a reach and cross section scale. Reaches with significant changes will be highlighted as potential areas of interest for further investigation.

2.6.3. Field Data Collection

Field investigations will provide data necessary to evaluate sediment transport, deposition, and erosion to evaluate the overall sediment balance within the study area. Sediment concentration, channel sediment properties, and flow velocity within the river channel are three pieces of information necessary for sediment analysis in the Grand Lake watershed which are not currently available with sufficient spatial and temporal resolution to determine rate of transport. SSC measurements will allow estimation of sediment transport through a given point in the system, sediment grab and core sampling will provide information about material properties of bed sediments, and current velocity profiles can be used in conjunction with SSC and sediment properties to calculate sediment flux at sampling locations on the rivers.

SSC Measurements

Suspended sediment measurements provide important insight into sediment transport along streams. The USGS has periodically sampled SSC at various locations within the study area. Where there are enough data points for a given station, an empirical relationship between stream discharge and SSC can be constructed. Multiplying the SSC by discharge can provide estimates of total suspended sediment transport through that cross section of the study area.

Where existing data are lacking, Optical Backscatter (OBS) sensors will be used to indirectly measure SSC. OBS sensors emit and receive light, which is scattered or reflected by particles in a conical zone near the sensor. Some of the reflected light is returned to the sensor, where a receiver converts the backscattered light to a proportional voltage output. That data can then be used to determine the SSC within the water column. Samples of several known SSCs containing sediments from the measurement site will be measured using the OBS in a lab to produce a regression equation of voltage output and SSC. This regression equation will be applied to field measurements of voltage output to produce timeseries of SSC at a location (Rasmussen et al. 2009).

OBS sensors are preferable to automated sampling measurements of SSC from an operational standpoint. Event sampling of SSC requires expensive automated equipment with collection at specified times or thresholds, followed by post-sampling analysis. The results are single data points with large time gaps between measurements. OBS sensors, by contrast, record data at specified intervals (usually 1-2 measurements per hour) for a long period of time. OBS sensors will be set to log a measurement every 30 minutes to coincide with ongoing water level monitoring, which will result in a rich dataset of river stage and SSC for at least several months.

Considering these advantages, OBS sensors will be used to measure SSC in the study area. ‘Ground-truth’ samples of SSC will be collected during site visits to verify OBS measurements and provide materials for the calibration procedure.

OBS sensors will be installed at four locations in the study area. These locations are noted with a green dot in Figure 2.6-2 and are: the Neosho River in Miami; the Spring River at the Hwy 10 bridge; the Elk River at the Hwy 10 bridge; and the confluence of the Neosho and Spring rivers. All sites are co-located with water level monitoring locations. The period of record for these measurements will be 10-12 months and will capture the spring, summer, and fall at a minimum.

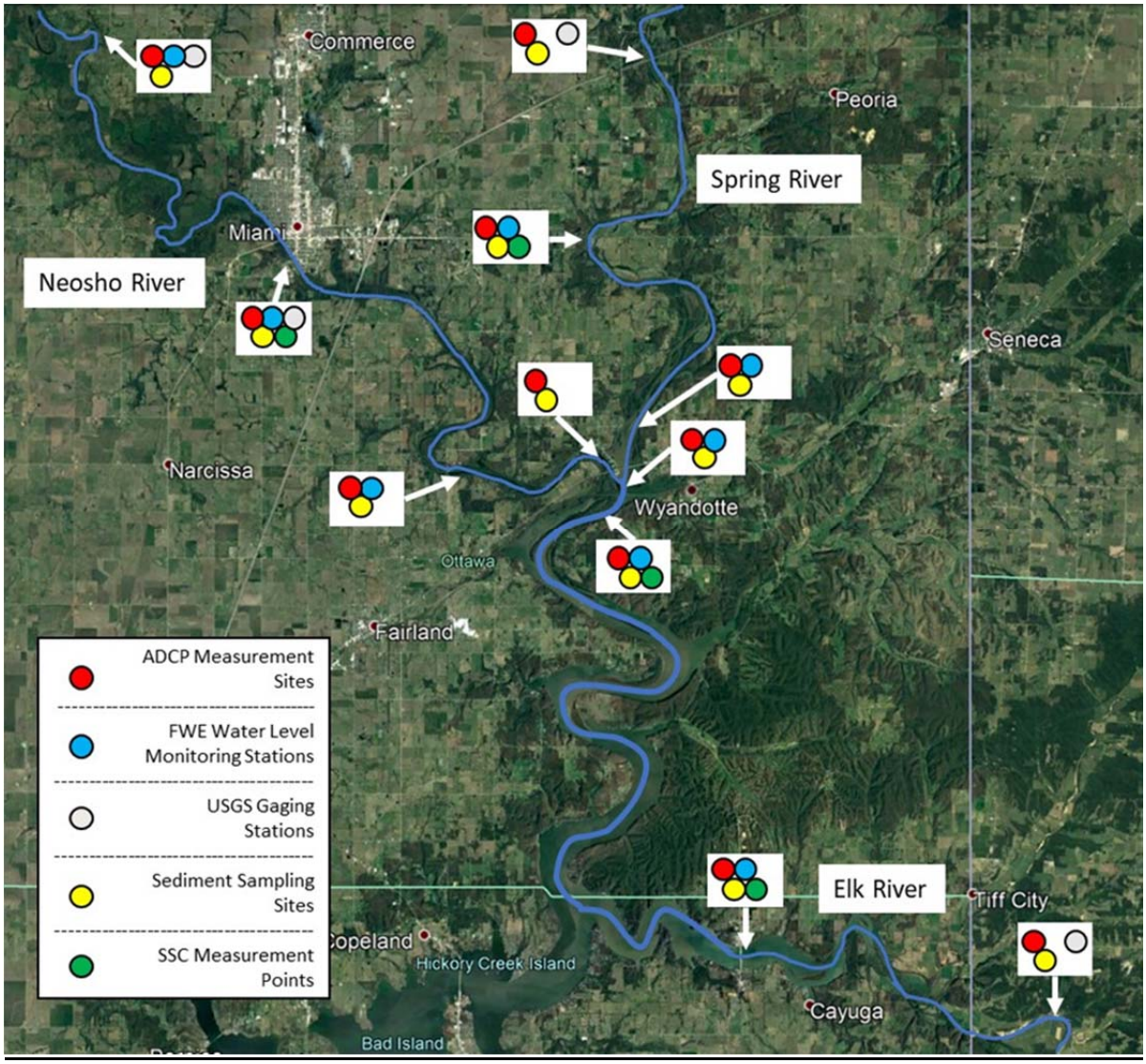


Figure 2.6-2. Field monitoring locations.

Sediment Samples

Substrate properties are an important variable in determining sediment transport rates. Sediment grab and core samples will be analyzed to determine bulk density, grain size, composition, and critical shear stress.

A minimum of 11 samples will be used to parameterize sediment characteristics within the river system (Figure 2.6-2). Sampling will consist of at least 4 samples in the Neosho River and 3 samples in the Spring River upstream of Twin Bridges, 2 samples in the Elk River upstream of Grand Lake, and 2 samples in the Grand Lake downstream of Twin Bridges. Sampling will be performed with an Ekman grab sampler or similar instrument, and the following geotechnical tests will be performed as applicable:

- Sieve analysis with hydrometer (ASTM D2974)
- Specific gravity (ASTM D854)

- Water content (ASTM D2216)
- Organic content (ASTM D2974)
- Bulk density (ASTM D7263)
- Particle settling velocity (ASTM D7928)

Where grab samples show cohesive sediments, core samples will be taken for analysis. Core samples will be obtained using a Shelby tube or similar device and will be capped, sealed, and transported to a testing facility without draining excess water. Excess water helps prevent compaction and disturbance of the core sample during transportation. Erosion resistance testing will be performed following procedures similar to those presented in SEDFLUME studies (McNeil et al. 1996). Testing will determine critical shear stress (the minimum bed shear necessary to initiate sediment grain motion), an important parameter for analysis of cohesive sediment transport in fluvial systems.

Grab samples showing predominant sand or gravel will not require additional core sampling. Where sediment is non-cohesive, the above geotechnical testing results will provide sufficient information for sediment transport calculations. All necessary parameters will be used with established sediment transport equations to determine transport rates.

Velocity Profile Measurements

Velocity profiles and discharge data supply valuable information about sediment transport in fluvial systems. Bed shear determines the likelihood of sediment moving downstream and is calculated using velocity profile information. The USGS has several locations with ADCP measurements, but analysis at other locations will require site-specific velocity and discharge measurements. Flow measurements will be taken with an ADCP at the locations of existing water level monitors and sediment sampling sites within the study area for multiple flow events to obtain data useful for sediment transport calculations. As field conditions allow for safe access, measurements will be collected during both high- and low-flow conditions to ensure data availability under a range of flow conditions for use in the CHM calibration and validation process.

An ADCP can provide important information about sediment transport parameters. It measures velocity throughout a water column using sonic pulses. The sonic signals reflect off suspended particles in the water and applying Doppler shift principles to the returned signals, the ADCP data can be used to calculate flow velocities in a vertical column of the stream. The device is towed across the channel to produce a full velocity profile (Figure 2.6-3). The velocities near the bed can be analyzed to determine bed shear stress, and the velocities measured throughout the profile provide total discharge and average velocity. Both parameters can then be combined with an understanding of local substrates and used to evaluate sediment transport in the channel.

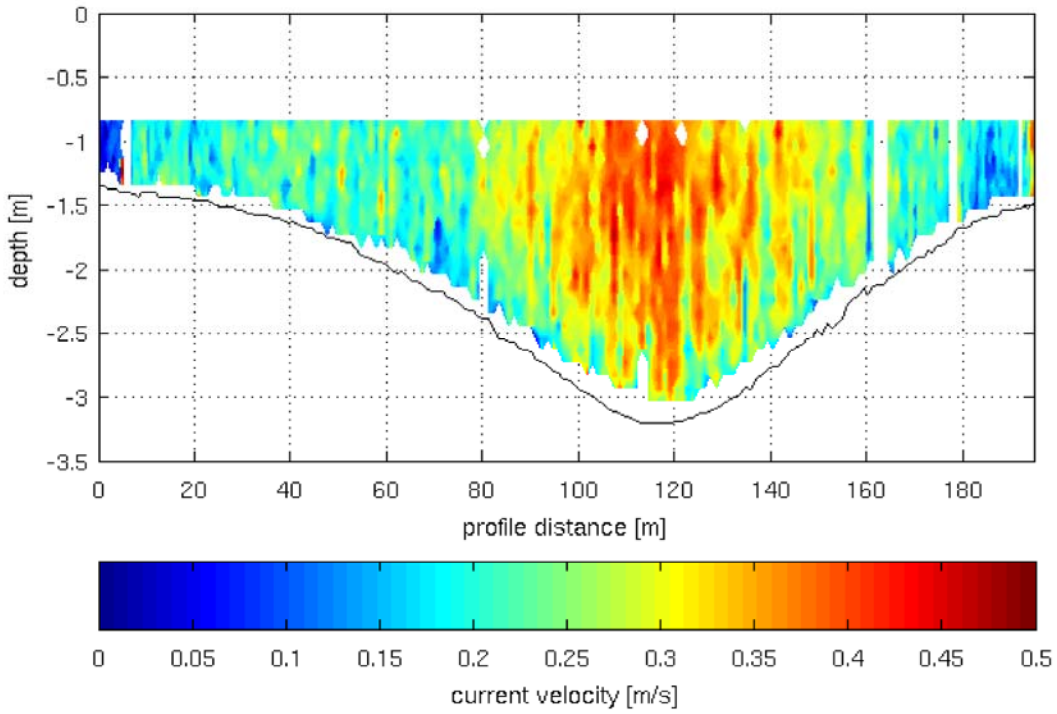


Figure 2.6-3. Example: ADCP velocity profile data.

Velocity profiles are most useful when they describe a range of flow events at a given transect. This will require multiple efforts to record ADCP measurements during the Sedimentation Study. A wide range of flow events can be used to accurately determine the effects of different stream velocities, water levels, and sediment transport regimes on overall sedimentation within the study area. Measurements will be taken a minimum of 3 times during the Sedimentation Study period at each water level monitoring station. If necessary, additional measurements can be made, either at the above-specified locations or in locations of particular interest for describing the effects of sedimentation on flood events. Data will then be incorporated into sediment transport rate analysis.

ADCP data will also be useful to calibration and validation efforts with the CHM (discussed below). Datasets will be provided to model developers and can be used in conjunction with water level monitoring to help calibrate the model. Once calibration is complete, additional ADCP and water level data can be used to verify that the CHM is accurately predicting flow depths and velocities. For more details on the CHM validation process, please refer to the H&H Study Plan.

2.6.4. Sediment Transport Evaluation

The study team will evaluate sediment transport in the lower reaches of the Neosho, Spring, and Elk rivers using existing and collected data on flows and sediment properties. Sediment transport rates will be determined separately for cohesive and non-cohesive sediments because of the differences in the mechanics between the two types. An appropriate method to quantify transport will be selected for both classes of sediment. Those methods will then be integrated

with a one-dimensional (1D)/two-dimensional (2D) model in the CHM to evaluate the effects of Project operation on sediment transport, erosion, and deposition in the study area.

Sedimentation in overbank areas will be considered by comparing the extent and duration of overbank flooding for any new operation scenarios compared to historic overbank flooding extent and duration. This analysis will be coupled with an analysis of potential deposition rates based on sediment concentration and sediment settling rates.

Non-Cohesive Sediments

Transport of non-cohesive sediments will be determined at all sites where the channel bed is composed of sand or gravel. Non-cohesive sediment transport functions in general rely on regression, probabilistic, or deterministic functions to estimate sediment transport. These formulas are derived from specific sets of laboratory or field data, and caution will be used in selecting approaches suitable for use given conditions in the Neosho, Spring, and Elk rivers following guidance provided in Yang (2006) and ASCE (1982).

The main criterion used to select formulas will be sediment grain size (D_{50}). Other criteria considered will include dimensionless parameters such as dimensionless particle diameter, relative depth, Froude number, relative shear velocity, and dimensionless unit stream power as suggested by the U.S. Bureau of Reclamation in the *Erosion and Sedimentation Manual* (Yang 2006). If bed materials in the study area consist of sand-sized particles, formulas considered for use will include those of Yang (1973, 1979, and 1983), Ackers and White (1973), and Engelund and Hansen (1967). Yang's formulas are derived from the unit stream power theory, while the others are obtained from the stream power concept.

Each of the above formulas calculates the total sediment flux, including suspended and bedload. Due to the difficulty in collecting bedload transport measurements, the proposed study will not have direct measurements of bedload transport. Instead, SSC may be calculated by subtracting common bedload-specific equations, such as those developed by Meyer-Peter and Müller (1948), Einstein (1950), and Rottner (1959), from the total sediment transport estimates. This will quantify the suspended load, which can be combined with ADCP discharge measurements to produce SSC estimates. The calculated SSC values can then be validated by comparison to SSC values obtained through OBS measurements.

Sediment transport formulas will be compared with existing and measured SSC data to compare their suitability. Agreement between measured and calculated values of sediment loads will be evaluated across a range of flows and sediment fluxes to determine their suitability.

Cohesive Sediments

Cohesive sediments, composed of fine-grained clay and silt particles, have strong interparticle forces which largely determine the resistance of sediments to shear stresses. Since grain size cannot be used to determine the shear strength of sediments, the critical shear stress of the sediment must be experimentally determined to evaluate sediment transport potential. In general, erosion of cohesive sediments occurs when the bottom shear stress is greater than sediment critical shear stress and deposition occurs when bottom shear stress is less than the critical shear.

No comprehensive theory exists regarding the erosion of cohesive soils. The equations used to determine the erosion rate of cohesive soils are empirical and require a laboratory or field

measurement of critical shear stress. Attempts to correlate erodibility with traditional soil parameters, such as bulk density or plasticity indices, are less useful to determine erodibility due to the large number of factors and their complex interactions. The following process for estimating cohesive sediment transport is derived from the U.S. Bureau of Reclamation's *Erosion and Sedimentation Manual* (Yang 2006).

Laboratory analysis of critical shear stress will depend on core sampling in locations where cohesive sediment is present. Core samples will be transported to a facility for SEDFLUME erosion testing (McNeil, Tayler, and Lick 1996). The critical shear measurements will be used to determine erosion/deposition and transportation rates.

Erosion rates of cohesive sediments will be determined by fitting experimentally determined erosion rates to applied shear stress using the formula given by Ariathurai (1974):

$$Q_{se} = \begin{cases} M_{se}\dfrac{\tau - \tau_{se}^{c}}{\tau_{se}^{c}}, & \tau \geq \tau_{se}^{c} \\ 0, & \tau < \tau_{se}^{c} \end{cases}$$

where Q_{se} = surface erosion rate,

τ and τ_{se}^{c} = bed shear stress and critical surface erosion shear stress, respectively, and

M_{se} = surface erosion rate constant.

The quantity τ-τ_c is known as excess shear stress and primarily determines erodibility. The surface erosion rate constant, M_{se}, is determined from laboratory analysis and is illustrated in Figure 2.6-4.

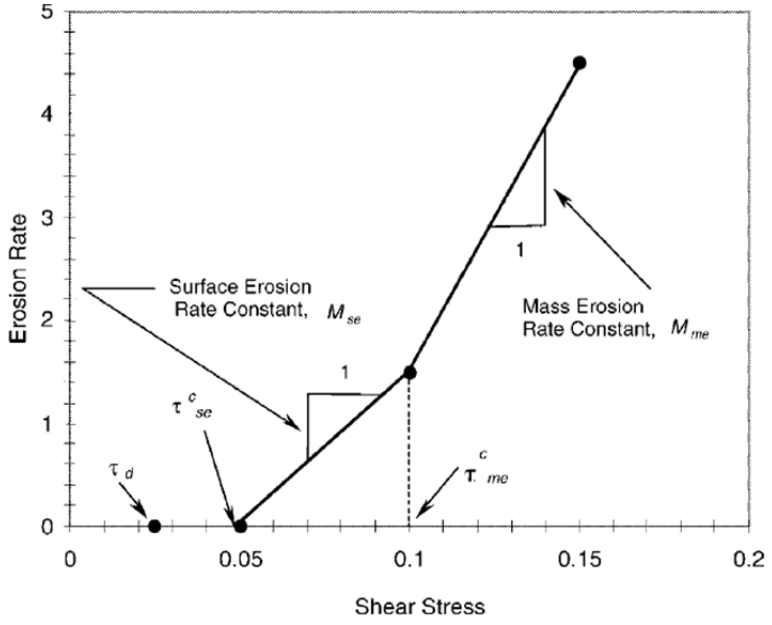


Figure 2.6-4. Determination of M_{se} from graphical analysis.

Cohesive sediment erosion or deposition will be determined at areas where sediment sampling shows cohesive sediments are dominant. Erosion rates will be determined for specific scenarios and compared with field observations, SSC measurements, and bathymetric changes.

Evaluation of Sediment Loading

The study team will evaluate sediment erosion and deposition by developing a mass balance sediment budget. The sediment budget tracks sediment into and out of the system. Using sediment parameters and CHM results (described in the following section), the study team will establish relationships between flow rates and sediment transport. This will allow estimates of sedimentation to be calculated within the study area throughout the range of historic hydraulic conditions. The difference between total inflow and total outflow over the period of record will be the change in sediment storage within the study area. The change in storage will be compared to sediment accumulation calculated during bathymetric change analysis to validate the transport equations used. Finer resolution can be achieved by analyzing individual reaches of a stream as well, providing more information about spatial sediment accretion and erosion patterns.

A SWAT model has been developed and provides high-quality data on sediment loading to the Grand Lake watershed. Sediment load data will be compared with bathymetric change analysis findings and calculated sediment transport data to form a sediment budget to estimate the mass balance of sediments entering, moving through, and leaving the study area. This analysis will provide information on the overall balance of sediment loading in the study area.

2.6.5. Characterization of Sedimentation Impacts on Flooding

The CHM will be used to determine the effects of Project operations on sediment transport in the study area. The formulas and methods selected for cohesive and non-cohesive transport will be applied to modeled flow parameters (i.e. discharge, average velocity, bed shear stress) obtained from the CHM for flow events at the study locations to evaluate sediment transport phenomena.

The CHM will be calibrated for smaller flood events (i.e. 50-100 percent exceedance probabilities) using water level observations collected at 16 locations throughout the watershed as these events typically transport more sediment over longer periods of time and are essential to evaluate Project operations on sediment transport potential.

The historic pattern of sedimentation is the result of the historic hydrology and sediment inflow coupled with the historic Project operation. Historic elevation-duration and velocity-duration (based on the CHM) will be related to the historic temporal and spatial distribution of sedimentation. A comparison between future elevation-duration and velocity-duration using proposed Project operations will be utilized to develop the potential future distribution of sedimentation. This analysis will be compared to potential sediment transport.

Applicable sediment transport formulas previously discussed will be used to evaluate the effects of Project operations on sedimentation and sediment transport. Reservoir operation modeling will be based on scenarios chosen by the study team. Sediment transport rates will first be calculated using appropriate methods for non-cohesive and cohesive sediments at the specific sampling locations using flow information obtained from the CHM for each scenario. Results

from each exercise will be compared against each other and to any existing field data that closely approximates the selected condition.

Evaluation of Project operations will compare field observation to calculated results. These sources of information will be able to constrain outcomes of Project operation which can be used to inform investigations of Project impacts on sedimentation and subsequent extent and duration of flooding.

After the CHM has been evaluated with respect to sediment transport, a sensitivity analysis will be conducted to characterize the effects of Project operations on sedimentation and flooding along upstream reaches. The Sedimentation Study will be informed from results of the bathymetric changes and sediment transport analyses to bound reasonable long-term (i.e. annual) rates of sedimentation or erosion. These rates will provide the information needed to develop several sedimentation scenarios which will be evaluated in the CHM to determine flood extents and duration. For example, if a sedimentation rate is found to average 1 foot per year in a reach, the CHM would be modified to reflect possible channel bed configurations every 5 years for 50 years in that reach. Spatial differences in sediment bed changes will be used in this analysis to approximate observed historical changes and current transport processes. The analysis will consider several flow conditions and Project operation scenarios to determine the relative change in flood extent and duration.

2.6.6. Data Synthesis and Reporting

The Sedimentation Study will assimilate and synthesize all findings, including existing data analysis, bathymetric changes, field measurements, sediment transport evaluation, operations impacts, and sediment loading into an understanding of the sediment transport trends within the study area.

Findings of the review of existing data will be documented in the ISR detailing the types, sources, and quality of data. An organized database of all data will be created and made available.

Results of measurements of sediment data, ADCP measurements, suspended sediment measurements, and water levels will be summarized in the USR following the conclusion of field data collection. ADCP and water level data will be provided to the hydrologic and hydraulic modeling team for use in CHM calibration and validation. The USR will detail the methods, analysis techniques, and results of field measurements.

All findings will be compared against each other to determine the sediment transport regime in the study area. Bathymetric changes, modeled sediment loading, and calculated sediment transport rates will be analyzed to create a mass balance sediment budget for the study area. This analysis will provide a high-level conceptual understanding of sediment movement through the watershed.

Findings of the investigation of sedimentation on flooding will be presented in the USR with maps and figures of simulated flooding extents, profiles, and depths.

Calculated sediment transport rates obtained from field measurement data and hydraulic modeling of Project operations will inform the impacts of Project operations on sedimentation in the study area. The USR will include a detailed description of sediment transport evaluation methods and results. Calculations and results will be made available in the USR.

2.7. Consistency with Generally Accepted Scientific Practice

The Sedimentation Study follows generally accepted scientific practice regarding field data collection, sediment transport analysis, and hydraulic modeling. The scope of the study will include data collection at locations in the Neosho, Spring, and Elk rivers, Tar Creek, other tributaries to Grand Lake, and Grand Lake itself.

Field data collection will be conducted using methodologies consistent with those used by the USGS and other accepted scientific practices. For instance, sediment transport evaluations will use widely accepted sediment transport functions provided in literature including the U.S. Bureau of Reclamation Erosion and Sedimentation Manual (Yang 2006).

Analysis using the CHM will be conducted using the methods and practices outlined in Sections 2.6 and 2.7 of the H&H Study Plan.

2.8. Schedule

The schedule of the Sedimentation Study is displayed in Table 2.8-1.

Table 2.8-1. Sedimentation Study schedule.

Task	Completion Date
Anticipated Completion of Study Plan Determination Process	11/08/2018
Bathymetric Change Analysis	08/08/2019
Field Data Collection (first 9 months)	08/08/2019
(Technical) Report (ISR)	11/08/2019
Field Data Collection (final 3 months)	11/08/2019
Sediment Transport Rate Evaluation	11/08/2020
(Technical) Report (USR)	11/08/2020

2.9. Level of Effort and Cost

The estimated cost for completion of the Sedimentation Study is approximately $400,000.

3.0 REFERENCES

Ackers, P., and W.R. White. 1973. Sediment transport: new approach and analysis. Journal of the Hydraulics Division, 99 (hy11).

Andrews, W.J., M.F. Becker, S.L. Mashburn, and S.J. Smith. 2009. Selected metals in sediments and streams in the Oklahoma part of the Tri-State mining district: U.S. Geological Survey Scientific Investigations Report SIR 2009-5032, 36 p.

Ariathurai, R. 1974. A Finite Element Model for Sediment Transport in Estuaries. PhD dissertation, Univ. of California, Davis, California.

ASCE Task Committee. 1982. Relationships between morphology of small streams and sediment yields. *J. Hydr. Div*, 1328-1365.

Dalrymple et al. 1999. Dalrymple et al. vs. Grand River Dam Authority. Case No. CJ 94-444, District Court of Ottawa County, OK.

Einstein, H.A. 1950. The Bedload Function for Sediment Transport in Open Channel Flow, U.S. Department of Agriculture Soil Conservation Technical Bulletin No. 1026.

Engelund, F. and E. Hansen. 1967. A monograph on sediment transport in alluvial streams. Technical University of Denmark 0stervoldgade 10, Copenhagen K.

FERC (Federal Energy Regulatory Commission). 2018. Scoping Document 2, Pensacola Hydroelectric Project. April 27, 2018.

Ingersoll, C. G., C.D. Ivey, W.G. Brumbaugh, J.M. Besser, N.E. Kemble, and S. Dudding. 2009. Toxicity assessment of sediments from the Grand Lake O'the Cherokees with the amphipod Hyalella azteca. US Geological Survey Administrative Report CERC-8335-FY09-20-01.

Juracek, K.E., and M.F. Becker. 2009. Occurrence and trends of selected chemical constituents in bottom sediment, Grand Lake O' the Cherokees, northeast Oklahoma, 1940–2008. U.S. Geological Survey Scientific Investigations Report 2009-5258, 28 p.

Knighton, D. 2014. Fluvial forms and processes: a new perspective. Routledge.

McNeil, J., C. Taylor, and W. Lick. 1996. Measurements of erosion of undisturbed bottom sediments with depth. Journal of Hydraulic Engineering, 122(6), 316-324.

Meyer-Peter, E. and R. Müller. 1948. Formulas for bed-load transport. In IAHSR 2nd meeting, Stockholm, appendix 2. IAHR.

OWRB (Oklahoma Water Resources Board). 2009. Hydrographic Survey of Grand Lake. August 26, 2009.

Pope, L. M. 2005. Assessment of contaminated streambed sediment in the Kansas part of the historic Tri-State Lead and Zinc Mining District, Cherokee County, 2004 (No. 2005-5251).

Rasmussen, P. P., J.R. Gray, G. D. Glysson, and A. C. Ziegler. 2009. Guidelines and procedures for computing time-series suspended-sediment concentrations and loads from in-stream turbidity-sensor and streamflow data (No. 3-C4). US Geological Survey.

Rottner, J.1959. A Formula for Bedload Transportation, LaHouille Blanche, vol. 14, no. 3, pp. 285-307.

Smith, D.C. 2016. Occurrence, distribution, and volume of metals-contaminated sediment of selected streams draining the Tri-State Mining District, Missouri, Oklahoma, and Kansas, 2011–12: U.S. Geological Survey Scientific Investigations Report 2016–5144, 86 p., http://dx.doi.org/10.3133/sir20165144.

Tetra Tech. 2015. Hydraulic Analysis of the Effects of Pensacola Dam on Neosho River in the Vicinity of Miami, Oklahoma. Submitted to the City of Miami, Oklahoma, December 9.

USACE (U.S. Army Corps of Engineers). 1940. Pensacola Reservoir topographic mapping. 36" x 48" sheets.

USACE. 1997. Pensacola Reservoir, Survey of Lake of the Cherokees, Oklahoma. Survey conducted for the St. Louis District Corps of Engineers.

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

Yang, C. T. 1973. Incipient motion and sediment transport. *Journal of the hydraulics division*, *99*(10), 1679-1704.

Yang, C. T. 1979. The movement of sediment in rivers. Geophysical surveys, 3(1), 39-68.

Yang, C. T. 1983. Rate of energy dissipation and river sedimentation. In Proc. Second International Symposium on River Sedimentation. Nanjing, China.

Yang, C.T. 2006. Erosion and Sedimentation Manual (T. Manross, Ed.). Denver, CO: U.S. Dept. of the Interior, Bureau of Reclamation, Technical Service Center, Sedimentation and River Hydraulics Group.

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Aquatic Species of Concern Study

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

CHM..... Comprehensive Hydraulic Model
ESA..... Endangered Species Act
FERC ..... Federal Energy Regulatory Commission
GRDA..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
ILP..... Integrated Licensing Process
ISR ..... Initial Study Report
NAVD88 ..... North American Vertical Datum of 1988
NEPA ..... National Environmental Policy Act
NGVD29..... National Geodetic Vertical Datum of 1929
ODWC..... Oklahoma Department of Wildlife Conservation
PAD..... Pre-Application Document
PD ..... Pensacola datum
Project..... Pensacola Hydroelectric Project
PSP..... Proposed Study Plan
RSP..... Revised Study Plan
RTE..... Rare, Threatened, and Endangered
SD2 ..... Scoping Document 2
USACE..... U.S. Army Corps of Engineers
USFWS ..... U.S. Fish and Wildlife Service
USGS..... U.S. Geological Survey
USR ..... Updated Study Report

1.0 INTRODUCTION

As part of the relicensing of the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494), the Grand River Dam Authority (GRDA) filed a Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) on February 1, 2017 (GRDA 2017). GRDA filed its Proposed Study Plan (PSP) for the relicensing on April 27, 2018 (GRDA 2018a). Also on April 27, 2018, FERC released its Scoping Document 2 (SD2) for the relicensing of the Project (FERC 2018).

GRDA's proposal to continue operating the Project has the potential to affect aquatic species of concern in Grand Lake and the lower reaches of its tributaries. There are a number of aquatic Rare, Threatened, and Endangered (RTE) species that occur in the general vicinity of the Project, including the Ozark Cavefish (*Amblyopsis rosae*), Neosho Madtom (*Noturus placidus*), Arkansas Darter (*Etheostoma cragini*), Neosho Mucket (*Lampsilis rafinesqueana*), Rabbitsfoot Mussel (*Quadrula cylindrical cylindrical*), and the Winged Mapleleaf (*Quadrula fragosa).* In addition, Paddlefish (*Polyodon spathula*) use Grand Lake's two primary headwaters (the Neosho River and Spring River) for spawning. In its July 24, 2018 PSP comment letter to FERC, the Oklahoma Department of Wildlife Conservation (ODWC) identified the Neosho Smallmouth Bass (*Micropterus dolomieu velox*) as a species of concern in the context of potential changes to water level management in Grand Lake.

This study plan proposes to gather information needed to assess the effects of the Project, if any, on relevant species identified in the preceding paragraph as part of FERC's National Environmental Policy Act (NEPA) analysis for the relicensing of the Project. Section 1.1 of this study plan summarizes existing information on the potential species of concern and, based on that existing information, identifies the species for which additional investigation is proposed.

In its July 24, 2018 PSP comment letter, ODWC submitted the following formal requests that relate to aquatic species of concern:

- Quantifying the Effects of Increased Water Level within the Grand Lake O' the Cherokees Watershed
- Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning / Recruitment
- Impoundment Fluctuation Studies

In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting the above ODWC study requests as described in the PSP, FERC requested more details regarding objectives and methodology for performing resource analyses to address the identified issues. In response to the comments and requests filed by FERC and ODWC, GRDA is proposing this study plan, which details the objectives and methodology GRDA will use to perform the requested resource analyses. Section 4.1.3 of the main body of the Revised Study Plan (RSP) details GRDA's response to the above study requests.

1.1 Aquatic Species to Be Assessed

1.1.1 Ozark Cavefish

The Ozark Cavefish is listed as federally threatened, but no critical habitat has yet been designated for the species. The Ozark Cavefish is known to occur in the Jailhouse and Twin caves near Grand Lake (GRDA 2016). Jailhouse Cave is located on Summerfield Creek downstream of Pensacola Dam, outside the area that will be affected by Project operations. Twin Cave is located approximately 1 mile south of Grand Lake at 770 feet Pensacola datum (PD),[1] well above the flood control pool of 757 feet PD (GRDA 2016). As a result, there is no potential for Project operations to affect the Ozark Cavefish, and no information gathering and analysis are proposed for this species.

1.1.2 Neosho Madtom

The Neosho Madtom is listed as federally threatened, but no critical habitat has been designated for the species. The Neosho Madtom occurs within the Project Boundary in the Neosho River upstream of Grand Lake (GRDA 2004; FERC 2009). The species feeds at night on the bottom of rivers and streams, and its habitat consists primarily of swift-flowing riffles and runs over gravel in small- to medium-sized rivers (Page and Burr 2011). The Neosho Madtom rarely inhabits lentic habitats. The Neosho Madtom has the potential to occur in the area affected by Project operations and will be evaluated as part of this study.

1.1.3 Arkansas Darter

The Arkansas Darter, which is a candidate for listing under the Endangered Species Act (ESA), inhabits tributaries to the Lower Neosho River in the vicinity of the Project as well as streams that are direct tributaries to Grand Lake (USFWS 2014). The species prefers habitat in spring-fed headwaters and creeks with cool, clear, shallow water; slow current; and aquatic vegetation (Lee et al. 1980; Cross and Collins 1995; Hargrave and Johnson 2003; Miller and Robison 2004; Page and Burr 2011, as cited in NatureServe 2014). In its SD2, FERC indicated that the Arkansas Darter was not included in the U.S. Fish and Wildlife Service's (USFWS) official species list generated for the Project area (i.e., on the ECOS-IPaC website[2]), likely because the darter's preferred habitat occurs upstream of the lower reaches of tributaries that have the potential to be affected by current or future Project operations. As a result, Project operations are not expected to affect the Arkansas Darter, and no additional information gathering is proposed for this species.

1.1.4 Neosho Smallmouth Bass

The Neosho Smallmouth Bass is endemic to streams of the western Ozark Highlands and Boston Mountains in the Arkansas River watershed, which includes tributaries to Grand Lake (Stark and Echelle 1998). Smallmouth Bass typically occur in clear water, but the Neosho subspecies does at times occur in water with high suspended sediment loads (Brewer and Long

[1] All elevations referenced are relative to PD. PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD29) by adding 1.07 feet and to North American Vertical Datum of 1988 (NAVD88) by adding 1.40 feet (for example, elevation 745 feet PD = 746.07 feet NGVD29 = 746.4 feet NAVD88)(http://ok.water.usgs.gov/projects/webmap/miami/datum.htm).
[2] As of January 10, 2018.

2015). Neosho Smallmouth Bass spawn in low-velocity, near-shore waters (Brewer and Long 2015) during spring when water temperatures reach 60 to 75°F (GRDA 2017).

Taylor et al (2016) documented the presence of Neosho Smallmouth Bass in the middle and/or upper reaches of seven tributaries in the Grand Lake watershed, three of which flow directly into Grand Lake, i.e., the Elk River, Honey Creek, and Sycamore Creek. However, few Smallmouth Bass are caught in Grand Lake (Taylor et al. 2016; GRDA 2017). Nevertheless, it is possible that Neosho Smallmouth Bass occur in areas affected by Project operations. The Neosho Smallmouth Bass will be evaluated as part of this study.

1.1.5 Paddlefish

Paddlefish are pelagic and migrate during March and April into tributaries where they deposit their eggs on gravel bars (Scarnecchia et al. 2013). Recruitment to the population in Grand Lake is episodic and varies widely from year to year depending mainly on hydrologic conditions. The Paddlefish has been known to occur in the area affected by Project operations and will be evaluated as part of this study.

1.1.6 Neosho Mucket

The Neosho Mucket is a freshwater mussel listed by federal and state governments as endangered (USFWS 2015). The Neosho Mucket generally inhabits gravel and sand in shoals and shoreline areas of rivers (USFWS 2015). Spawning occurs in May and is closely followed by egg incubation and larval development from May through July (Shiver 2002). The nearest critical habitat to the Project is in the Elk River above its confluence with Buffalo Creek. Designated critical habitat Unit NM2, i.e., the most downstream reach, lies within the Project Boundary. As a result, the Neosho Mucket has the potential to be affected by Project operations and will be evaluated as part of this study.

1.1.7 Rabbitsfoot Mussel

The Rabbitsfoot Mussel is a federally-listed threatened species. Rabbitsfoot mussels prefer protected shallow-water habitats with sand and gravel substrates where they live as filter feeders. After fertilization, the mussel's eggs are released into the water to develop into larvae that parasitize shiner minnows before transforming into young mussels that descend to the streambed (USFWS 2015).

Critical habitat units RF1 (on the Spring River) and RF3 (on the Neosho River) are within the Neosho watershed, but upstream of the area affected by Project operations. Therefore, no additional information gathering is proposed for the Rabbitsfoot Mussel.

1.1.8 Winged Mapleleaf

The Winged Mapleleaf is a federally-listed threatened species of mussel. When the recovery plan for the species was approved in 1997, only one population was known to be extant (i.e., in the St. Croix River between Minnesota and Wisconsin). Since then, additional populations have been found in the Saline River and Ouachita River in Arkansas, the Little River in Oklahoma, and the Bourbeuse River in Missouri[3]. The Little River is a tributary to the Red River and is well

[3] https://www.fws.gov/midwest/endangered/clams/pdf/wmapleleaf.pdf

outside the Project vicinity. Therefore, no additional information gathering is proposed for this species.

2.0 STUDY PLAN ELEMENTS

2.1 Study Goals and Objectives

Based on the summaries in the previous section, only four of the eight species require analysis: i.e., the Neosho Madtom, Neosho Smallmouth Bass, Paddlefish, and Neosho Mucket ("species of concern"). To provide the information needed by FERC to fulfill its requirements under NEPA, GRDA proposes to implement a phased information gathering and impact assessment for the Neosho Madtom, Neosho Smallmouth Bass, and Neosho mucket consisting of a "desk-top" evaluation augmented by fieldwork if necessary. Existing information regarding Paddlefish is sufficient to conduct a modeling evaluation without the need for fieldwork.

The Pensacola Hydroelectric Project PSP (GRDA 2018a) states, "Using existing habitat information (Schooley and O'Donnell 2016), recent bathymetric data, and the models developed for the H&H [i.e., Hydrologic and Hydraulic Modeling] Study, GRDA will have sufficient information to analyze changes in inundation of gravel shoals and off-channel habitats resulting from potential changes in reservoir elevation and to assess any potential impacts to Paddlefish spawning habitat / recruitment."

To provide the information needed GRDA proposes to address the following objectives related to Paddlefish:

1. Create maps that delineate the riverine reaches that would be converted to lentic habitat as the result of water level management associated with Project operations[4].
2. Map and provide quantitative estimates of Paddlefish spawning substrate within the reaches converted to lentic habitat due to Project operations.
3. Assess potential impacts of Project operations on Paddlefish recruitment based on the area of lost spawning substrate during the Paddlefish spawning period, accounting (to the extent possible) for the effects of variability in hydrologic conditions.

For Neosho Madtom, Neosho Smallmouth Bass, and Neosho Mucket, GRDA will implement a phased information gathering and impact assessment exercise, which will address the following objectives:

1. Conduct a review of existing information on the three species' distributions in the Project vicinity and the physical habitat preferences of the species, and provide characterizations of habitat preferences and summarize spatial and temporal patterns of occurrence.

[4] "Project operations" refers to the generation of hydroelectric power at the Pensacola Project and other activities authorized under the FERC-issued license within the designated conservation pool. Water level fluctuations associated with flood management under the jurisdiction of USACE are not related to Project operations as defined herein. See H&H Study Plan; GRDA 2018b. This study will complement GRDA's H&H Study in determining the impact of Project operations on aquatic species of concern.

2. If existing records are inadequate for estimating a species' distribution, conduct targeted field surveys to develop rough estimates of the species' distribution in relevant reaches.
3. Conduct an assessment of the changes due to Project operations, if any, on species whose life-history periodicities indicate that a sensitive life-stage(s) could be present when stream habitat is inundated by Project operations.

2.2 Agency and Native American Tribe Resource Management Goals

USFWS has management goals for maintaining and enhancing habitat for federally-listed species and other trust resources.

ODWC manages Grand Lake as a warm-water fishery. Largemouth Bass (*Micropterus salmoides*), White Bass (*Morone chrysops*), White Crappie (*Pomoxis annularis*), Black Crappie (*P. nigromaculatus*), and Paddlefish are the primary sport-fish species being managed. ODWC is responsible for maintaining and enhancing Paddlefish angling opportunities in the Grand-Neosho watershed and manages a world-class fishery that draws large numbers of anglers during the spring (Jager and Schooley 2016, as cited in ODWC 2018). The ODWC Paddlefish Management Plan calls for the maintenance and conservation of Paddlefish recruitment.

2.3 Background and Existing Information

Grand Lake supports a warm-water fishery similar to other reservoirs within the region. In addition to the species identified in the preceding section, sport fish in Grand Lake include Spotted Bass (*M. punctulatus*), Hybrid Striped Bass (*M. chrysops* x *M. saxatilis*), Blue Catfish (*Ictalurus furcatus*), Channel Catfish (*I. punctatus*), and Flathead Catfish (*Pylodictis olivaris*) (ODWC 2008). Although not abundant in Grand Lake, Smallmouth Bass is also a sport fish of interest and is native to the Grand Lake watershed, as noted previously. The ODWC has regularly stocked Hybrid Striped Bass and Paddlefish in Grand Lake. Primary forage species include Gizzard Shad (*Dorosoma cepedianum*) and Threadfin Shad (*D. petenense*) (ODWC 2008).

ODWC notes that Grand Lake represents a recruitment source for Paddlefish stocks in the Grand/Neosho watershed and the Arkansas River. Recruitment has been documented via tagging (ODWC 2018) and genetics data (Schwemm et al. 2015, as cited in ODWC 2018). ODWC's research has demonstrated the linkage between Paddlefish recruitment and the sustained availability of spawning habitats, which "consist of exposed gravel shoals that are temporarily inundated by high springtime discharge (Schooley and Neely 2017, as cited in ODWC 2018)." ODWC also notes that the Grand/Neosho stock supports an economically valuable Paddlefish snag fishery on the Neosho River and in Grand Lake during winter and spring (Schooley et al. 2014, as cited in ODWC 2018). According to ODWC (2018), Paddlefish angling in Oklahoma generates over $18 million annually, with $11.2 million directly attributable to fisheries supported by recruitment from Grand Lake (Melstrom and Shideler 2017, as cited in ODWC 2018). Paddlefish angling in Oklahoma supports 193 jobs and yields approximately $450,000 in state sales tax revenues (ODWC 2018). ODWC receives a direct financial benefit through the sale of roe taken from angler-harvested Paddlefish.

2.4 Nexus between Project Operations and Effects on Resources

Paddlefish use Grand Lake's two primary headwaters for spawning, and modification to water level management in the lake, depending on the season and environmental conditions during a given year, has the potential to affect Paddlefish recruitment. The Neosho Madtom, Neosho Smallmouth Bass, and Neosho Mucket inhabit or have the potential to inhabit (see Section 1.1 of this study plan) the areas affected by Project operations. Project operations may influence water levels of the Grand/Neosho River and some tributaries upstream of Pensacola Dam. Water level fluctuations have the potential to alter the habitat of the species of concern. Understanding the magnitude, duration, and frequency of operational effects, if any, on habitat will allow for a characterization of potential impacts to the aquatic species of concern.

2.5 Study Area

Grand Lake is located in Craig, Mayes, Delaware, and Ottawa counties, Oklahoma. The study area for the aquatic species of concern addressed in this plan will correspond to that associated with the H&H Study (see Section 2.6 Methodology of the H&H Study Plan; GRDA 2018b). The study area will extend upstream from Pensacola Dam along the Neosho River to within approximately 3 miles of the Kansas State line, upstream along the Spring River to within 6.5 miles of the Kansas State line, and upstream along the Elk River to the upstream extent dictated by the H&H model, and along Tar Creek to just upstream of the U.S. Geological Survey (USGS) gage at the 22nd Avenue Bridge (Figure 2.5-1). The study will also encompass the bays/coves within Grand Lake associated with tributaries flowing into the lake.

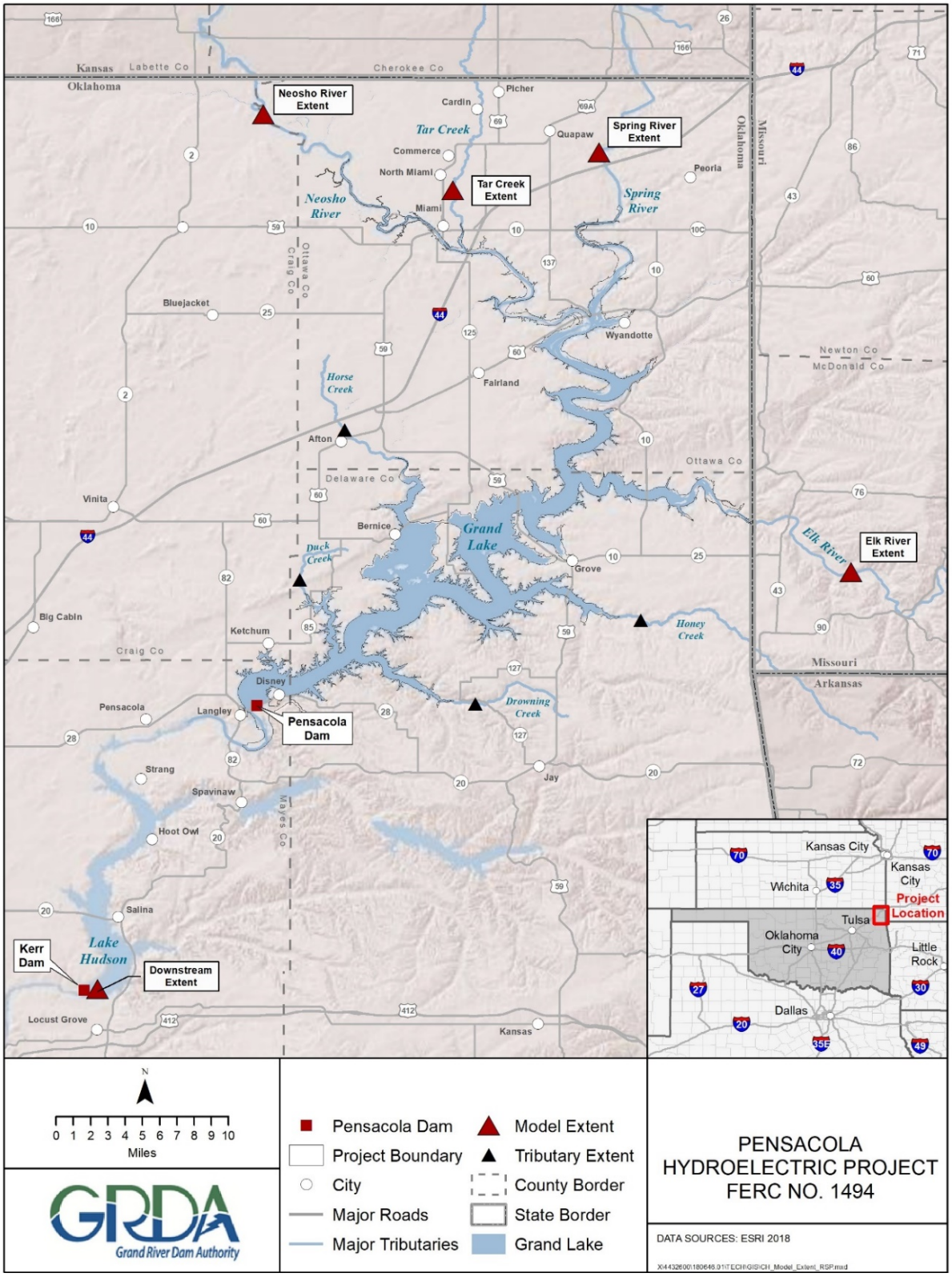


Figure 2.5-1. Study area for the Aquatic Species of Concern (i.e., the study area identified in the H&H study plan).

2.6 Methodology

2.6.1 Paddlefish

As noted previously, the Pensacola Hydroelectric Project PSP states, "Using existing habitat information (Schooley and O'Donnell 2016), recent bathymetric data, and the models developed for the H&H Study, GRDA will have sufficient information to analyze changes in inundation of gravel shoals and off-channel habitats resulting from potential changes in reservoir elevation and to assess any potential impacts to Paddlefish spawning habitat / recruitment." The proposed methods for conducting the analysis described in the preceding sentence are described in the following sections. The proposed study schedule is described in Section 2.8 of this study plan.

Map Riverine Reaches Affected by Project Operations

GRDA will apply the Comprehensive Hydraulic Model (CHM) that will be developed as part of the H&H Study to produce maps of the area of the Neosho River and Spring River watersheds (i.e., areas of known Paddlefish spawning) that delineate the riverine reaches that would be converted to lentic habitat, over a range of inflow conditions, as the result of water level management associated with Project operations.

As described in GRDA (2018b), inundation depth maps generated by the CHM will be layered onto recent aerial photos. Maps will delineate the area inundated under current Project operations and that are predicted to be inundated under potential future Project operations. Maps will show the current Project Boundary. Each set of inflow event maps will include an inundation line to represent the maximum water surface elevation.

Estimate Area of Paddlefish Spawning Substrate Affected by Project Operations and the Corresponding Effect on Paddlefish Recruitment

GRDA will quantify and map the estimated area of Paddlefish spawning substrate within the reaches converted to lentic habitat due to Project operations, if any. These areas will be differentiated from those inundated under operations permitted by the current FERC license to isolate the effects of future operations from operations under the current FERC license for the Project).

GRDA will assess potential impacts of Project operations on Paddlefish recruitment by identifying the area of affected spawning substrate during the Paddlefish spawning period, accounting (to the extent possible) for the effects of variability in hydrologic conditions.

To complete this assessment, GRDA will obtain existing data files generated by ODWC during the development of its *Benthic Habitat Mapping of Grand Lake Tributaries as it Relates to Paddlefish Recruitment* study (Schooley and O'Donnell 2016). GRDA will determine whether raw data from Schooley and O'Donnell (2016) are in a format compatible with GRDA's CHM and if not, convert them to a compatible format. GRDA will use ODWC's data as input to the CHM to display the locations of spawning substrate within the inundated areas on the maps described in the above and compute corresponding quantitative estimates of lost Paddlefish spawning substrate (i.e., converted to lentic habitat) during the March–April spawning period, over a range of inflow conditions.

Existing relationships between substrate area and Paddlefish productivity, derived from the scientific literature and augmented as appropriate by expertise of ODWC biologists, will be used to compute rough estimates of the range of potential reductions in Paddlefish recruitment associated with Project operations, accounting for the influence of varying hydrologic conditions (i.e., Paddlefish recruitment is naturally episodic and during some hydrologic conditions, could lead to low levels of recruitment regardless of water level management.).

2.6.2 Neosho Madtom, Neosho Smallmouth Bass, and Neosho Mucket

To provide the information needed by FERC to produce its NEPA document, GRDA proposes to implement a phased information gathering and impact assessment exercise for the Neosho Madtom, Neosho Smallmouth Bass, and Neosho Mucket. The proposed study schedule is described in Section 2.8 of this study plan.

Phase 1: Review of Existing Information

Although the PAD (GRDA 2017) for the Project includes a general overview of the aforementioned species' distributions and ecological requirements, such information is of inadequate resolution and specificity to assess whether these species are likely to be influenced by Project operations. As a result, Phase 1 of this study will involve a detailed exploration of existing information, including ODWC reports, peer-reviewed scientific publications, and, to the extent possible, unpublished information gathered by researchers from ODWC, academic institutions, and other potential entities. GRDA will also coordinate with ODWC to obtain verbal feedback (i.e., documented personal communications) regarding the distributions of the species of interest in reaches with the potential to be affected by Project operations. Reaches to be affected by Project operations will be identified based on maps generated by the CHM as part of the H&H Study.

Habitat preferences for each life-history stage of the species of concern will be based on literature review and professional judgment. No data will be collected to characterize habitat use. If habitat preferences for the Neosho Smallmouth Bass cannot be obtained from the literature, generic habitat suitability criteria for Smallmouth Bass will be adapted to the basin based on the professional judgment of agency experts and consultants familiar with the subspecies and the region.

Phase 2: Potential Field Surveys to Document Distributions of the Species of Concern

If the information gathered during Phase 1 for any species is of sufficient quality to conduct an effects analysis, then Phase 2 actions would not be undertaken for that species. If existing records are inadequate for estimating a species' distribution, targeted field surveys will be conducted to develop a rough estimate of the species' distribution in the reaches of concern (i.e., reaches of reservoir inundation identified by the CHM). Phase 2 fieldwork would be conducted only to provide rough distribution estimates for the target species. As stated in the previous section, habitat preferences will be based on information taken from the scientific literature and collaboration with agency experts; no field data will be collected during Phase 2 to characterize habitat use.

Phase 3: Assessment of Potential Impacts for Relevant Species

For species documented to occur within the area affected by Project operations, and whose life-history periodicities indicate that a sensitive life-stage(s) could be present when stream habitat is inundated by Project operations, GRDA will conduct a general assessment of potential

effects. Again, the effects analysis will address the possible impacts of water level fluctuations associated with changes to hydroelectric power operations, which will be differentiated from the effects of water surface fluctuations resulting from the operation of the Project as allowed by the current FERC license and flood control operations conducted under the jurisdiction of the USACE. No habitat modeling or quantitative habitat mapping is proposed. Changes in hydraulic conditions predicted by the CHM will be compared to the habitat preferences of the target species, and professional judgment (conducted collaboratively with the resource agencies) will be used to identify, map, and roughly estimate the surface area of the change in habitat for one or more life-history stages of the target species.

The effects analysis will focus on potential changes in habitat if any due to water level management associated with Project operations. Project operations are not expected to appreciably alter predator-prey relationships or, in the case of the Neosho Smallmouth Bass, increase the risk of hybridization with stocked strains of the same species. Introduced predators and non-indigenous genetic material are already present in the Project area, and Project operations would not significantly increase access by organisms in the reservoir to the riverine reaches upstream of the reservoir.

2.6.3 Coordination with Relicensing Participants and Reporting Results

Draft study results will be presented in the Initial Study Report (ISR), and a final report will be provided as part of the Updated Study Report (USR), both according to the schedule dictated by the Integrated Licensing Process (ILP).

2.7 Consistency with Generally Accepted Scientific Practice

The proposed methods for this study are consistent with FERC study requirements under the ILP.

2.8 Schedule

Existing information on the species being assessed will be gathered and evaluated in 2019. In 2020, fieldwork would be conducted, if needed, and modeling will be conducted to estimate whether and to what extent Project operations would affect any life-stages of the species of concern. This would consist of estimates of changes in habitat availability for Neosho Madtom, Neosho Smallmouth Bass, and Neosho Mucket and an estimate of the potential change in Paddlefish recruitment resulting from Project operations. A study report will be drafted and included as part of the ISR filing in November 2019. Results of work conducted in 2020 will be incorporated into the USR filing in November 2020.

2.9 Level of Effort and Cost

A rough, provisional estimate of the level of effort required for this study is 650 hours. Hours required by task are: (a) 250 hours for literature review, information gathering and coordination with agencies, report writing, and meeting attendance; (b) 175 hours for possible fieldwork; and (c) 225 hours for the technical consultant to work with the modelers. The estimated cost associated with this level of effort is $78,000. The cost of this study will be revised when a technical contractor reviews the scope and refines the level of effort based on regional experience with the species of concern and their habitats. As described above, the scope of

any needed fieldwork will depend on the availability of information to address the distribution and habitat requirements of the species of concern; as a result, the funds dedicated to fieldwork may not be needed, which would likely reduce the overall cost of the study.

3.0 REFERENCES

Brewer, S. K., and J. M. Long. 2015. Biology and ecology of Neosho Smallmouth Bass and the genetically-distinct Ouachita lineage. Pages 281-296 in Tringali, M. D., J. M. Long, T. W. Birdsong, and M. S. Allen, editors. Black Bass Diversity: Multidisciplinary Science for Conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.

Cross, F.B. and Collins, J.T. 1995. Fishes in Kansas. Second Edition, revised. University of Kansas Museum of Natural History, Lawrence, Kansas, USA.

FERC (Federal Energy Regulatory Commission). 2009. Environmental Assessment: Application for Amendment of License, Shoreline Management Plan. Pensacola Hydroelectric Project FERC No. 1494. August 2009.

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

GRDA (Grand River Dam Authority). 2004. Analysis of Effect of Grand Lake Power-Pool Elevations on Neosho River Levels During a Major Flood, Docket No. P-1494-000 (filed Jan. 29, 2004).

GRDA. 2016. Environmental Report Prepared in Support of Non-Capacity License Amendment to Modify Article 401 (Rule Curve), FERC Project No. 1494. Prepared by McMillen Jacobs Associates. May 6, 2016.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

GRDA. 2018a. Pensacola Hydroelectric Project, P-1494, Proposed Study Plan. April 2018.

GRDA. 2018b. Pensacola Hydroelectric Project, P-1494, Hydrologic and Hydraulic Modeling Study Plan. Prepared for GRDA by Mead & Hunt. September 2018.

Hargrave, C.W. and Johnson, J.E. 2003. Status of Arkansas Darter, *Etheostoma cragini*, and least darter, *E. microperca*, in Arkansas. Southwestern Naturalist 48: 89-92.

Jager, C.A, and J.D. Schooley. 2016. 2015 post-season survey of Paddlefish permit holders. Oklahoma Department of Wildlife Conservation, Oklahoma City. 32 pages.

Lee, D.S., Gilbert, C.R., Hocutt, C.H., Jenkins, R.E., McAllister, D.E. and Stauffer, J.R., Jr. 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History, Raleigh, North Carolina, USA.

Melstrom, R.T. and D.W. Shideler. 2017. Economics of the Oklahoma Paddlefish fishery. Oklahoma State University, Stillwater, OK. 22 pages.

Miller, R.J. and Robison, H.W. 2004. Fishes of Oklahoma. University of Oklahoma Press, Norman, Oklahoma.

NatureServe. 2014. *Etheostoma cragini*. The IUCN Red List of Threatened Species 2014: e.T8112A13309768. [Online] URL: http://dx.doi.org/10.2305/IUCN.UK.2014-3.RLTS.T8112A13309768.en. Downloaded on May 26, 2016.

ODWC (Oklahoma Department of Wildlife Conservation). 2008. Grand Lake Management Plan. Pensacola Hydroelectric Project, FERC No. 1494.

ODWC. 2018. Grand River Dam Authority, Project No. 1494-438, Comments on GRDA's Proposed Study Plan. Letter to FERC dated July 24, 2018.

Page, L.M. and Burr, B.M. 2011. Peterson field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Harcourt, Boston, Massachusetts, USA.

Scarnecchia, D.L., B.D. Gordon, J.D. Schooley, and A.A. Nealis. 2013. A Comprehensive Plan for the Management of Paddlefish in Oklahoma. Oklahoma Department of Wildlife Conservation, Oklahoma City. 106 pages.

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

Schooley, J.D., and B.C. Neely. 2017. Estimation of Paddlefish (Polyodon spathula Walbaum, 1792) Spawning Habitat Availability with Consumer-grade Sonar. Journal of Applied Ichthyology. DOI: 10.1111/jai.13565

Schooley, J.D., D.L. Scarnecchia, and A. Crews. 2014. Harvest management regulation options for Oklahoma's Grand Lake stock of Paddlefish. Journal of the Southeast Associate of Fish and Wildlife Agencies.1:89-97.

Schwemm, M.R., A.A. Echelle, and J.D. Schooley. 2015. Fine-scale genetic structuring of American Paddlefish populations in Oklahoma. Sport Fish Restoration Project Number F14AF00156. 12 pages.

Shiver, M.A. 2002. Reproduction and propagation of the Neosho mucket, *Lampsilis rafinesqueana*. Thesis, Southwest Missouri State University.

Stark, W. J., and A. A. Echelle. 1998. Genetic structure and systematics of Smallmouth Bass, with emphasis on Interior Highlands populations. Transactions of the American Fisheries Society 127: 393–416.

Taylor, A. T., J. M. Long, M. R. Schwemm, M. D. Tringali, and S. K. Brewer. 2016. Identification of Neosho Smallmouth Bass (*Micropterus Dolomieu Velox)* Stocks for Possible Introduction Into Grand Lake, Oklahoma. Report provided by the Cooperative Fish and Wildlife Research Unit Program under agreement with the U.S. Fish and Wildlife Service. U.S. Department of Interior, Fish and Wildlife Service, Cooperator Science Series FWS/CSS-121-2016, National Conservation Training Center.

USFWS (U.S. Fish and Wildlife Service). 2014. U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: *Etheostoma cragini*, Arkansas Darter, Region 6 (Mountain-Prairie Region). April 3, 2014.

USFWS. 2015. Fish and Wildlife Service Designates Critical Habitat for Two Freshwater Mussels in 12 States. [Online]. URL: http://www.fws.gov/midwest/news/780.html. (Accessed May 25, 2016.)

[This page intentionally left blank.]

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Terrestrial Species of Concern Study

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

CHM ..... Comprehensive Hydraulic Model
ECOS ..... Ecological Conservation System
ESA ..... Endangered Species Act
FERC ..... Federal Energy Regulatory Commission
GRDA ..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
ILP ..... Integrated Licensing Process
IPaC ..... Information Planning and Conservation System
ISR ..... Initial Study Report
NAVD88 ..... North American Vertical Datum of 1988
NEPA ..... National Environmental Policy Act
NGVD29 ..... National Geodetic Vertical Datum of 1929
ODWC ..... Oklahoma Department of Wildlife Conservation
ONHI ..... Oklahoma Natural Heritage Inventory
PAD ..... Pre-Application Document
PD ..... Pensacola datum
Project ..... Pensacola Hydroelectric Project
PSP ..... Proposed Study Plan
RSP ..... Revised Study Plan
RTE ..... Rare, Threatened, and Endangered
SD2 ..... Scoping Document 2
SMP ..... Shoreline Management Plan
USACE ..... U.S. Army Corps of Engineers
USFWS ..... U.S. Fish and Wildlife Service
USGS ..... U.S. Geological Survey
USR ..... Updated Study Report
WNS ..... white nose syndrome

1.0 INTRODUCTION

As part of the relicensing of the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494), the Grand River Dam Authority (GRDA) filed a Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) on February 1, 2017 (GRDA 2017). GRDA filed its Proposed Study Plan (PSP) for the relicensing on April 27, 2018 (GRDA 2018a). Also on April 27, 2018, FERC released its Scoping Document 2 (SD2) for the relicensing of the Project (FERC 2018).

GRDA's proposal to continue operating the Project has the potential to affect terrestrial species of concern in areas adjacent to Grand Lake and the lower reaches of its tributaries, depending on the extent of operational changes and the season in which they occur. A search of the U.S. Fish and Wildlife (USFWS) Ecological Conservation System (ECOS), the Information Planning and Conservation System (IPaC), the Oklahoma Department of Wildlife Conservation (ODWC), and the Oklahoma Natural Heritage Inventory (ONHI) indicated that four terrestrial species listed under the Endangered Species Act (ESA) as endangered occur or may occur in the Project vicinity: the gray bat (*Myotis grisescens*), the Indiana bat (*Myotis sodalis*), the Ozark big-eared bat (*Corynorhinus townsendii ingens*), and the American burying beetle (*Nicrophorus americanus*). Four terrestrial species listed as threatened under the ESA occur or potentially occur in the Project vicinity and include the northern long-eared bat (*Myotis septentrionalis*), the piping plover (*Charadrius melodus*), the rufa red knot (*Calidris canutus rufa*), and the Western prairie-fringed orchid (*Planthera praeclara*).

This study plan proposes to gather information needed to assess the effects of the Project, if any, on relevant species identified in the preceding paragraph as part of FERC's National Environmental Policy Act (NEPA) analysis for the relicensing of the Project. Section 1.1 if this study plan summarizes existing information on the potential species of concern and, based on that existing information, identifies the species for which additional investigation is proposed.

In its July 24, 2018 PSP comment letter, ODWC requested Impoundment Fluctuation Studies. In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting ODWC's requested study as described in the PSP, FERC requested more details regarding objectives and methodology for performing resource analyses to address the identified issues. In response to the comments and requests filed by FERC and ODWC, GRDA is proposing this study plan, which details the objectives and methodology GRDA will use to perform the resource analyses requested by FERC. Section 4.1.4 of the main body of the Revised Study Plan (RSP) details GRDA's response to the above request.

1.1 Terrestrial Species to Be Assessed

1.1.1 Mammals

Gray Bat

On April 28, 1976, the gray bat was listed as endangered under the ESA of 1973. No critical habitat has been designated for the species (USFWS 2011a). The current recovery plan for the gray bat was finalized on July 8, 1982 (USFWS 1982), but there is no conservation plan for the species. Article 405 of the current Pensacola Project license specifies that GRDA shall

implement measures to protect gray bats (FERC 1992). In compliance with Article 405, GRDA filed a Gray Bat Compliance Plan (GRDA 2008a), approved by FERC on June 23, 2008 (FERC 2008). Gray bat surveys have been conducted since 2007 along the shorelines of Grand Lake and at two caves near the lake, and the species has been detected during those surveys. As a result, Project operations have the potential to affect the gray bat, and the species will be evaluated as part of this study.

Indiana Bat

The USFWS listed the Indiana bat as endangered under the ESA on March 11, 1967. A recovery plan was developed in 1983 and is currently being revised (USFWS 2006). Critical habitat has been designated in several states, but not in Oklahoma or the Project vicinity (USFWS 2007), and the species was not detected in the Project area during shoreline acoustic surveys. As a result, there is little potential for Project operations to affect the Indiana bat, and no information gathering and analysis are proposed for this species as part of this study.

Northern Long-Eared Bat

On October 2, 2013, the USFWS proposed to list the northern long-eared bat as endangered. Subsequently, on January 16, 2015, the USFWS proposed listing the northern long-eared bat as threatened with a Section 4(d) exemption, which provides measures that are necessary and advisable to provide for the conservation of the species. On January 14, 2016, the USFWS published the final 4(d) rule, with revised criteria under which incidental take of northern long-eared bats would be prohibited (81 Federal Register 1900). Critical habitat has not been designated for the species. The Pensacola Project is located within the range of northern long-eared bats, and the species was detected during bat surveys conducted by GRDA in the summers of 2015 and 2016 (GRDA 2016a; Martin and Zimmerman unpublished). As a result, Project operations have the potential to affect the northern long-eared bat, and the species will be evaluated as part of this study.

Ozark Big-Eared Bat

The Ozark big-eared bat was listed as endangered under the ESA of 1979. Critical habitat has not been designated for the species. The Ozark Big-Eared Bat Revised Recovery Plan was published on March 28, 1995 (USFWS 1995). Although the Project vicinity is within the range of the species, no Ozark big-eared bats were detected during the 2015 and 2016 shoreline acoustic surveys (GRDA 2016a; Martin and Zimmerman unpublished). As a result, there is little potential for Project operations to affect the Ozark big-eared bat, and no information gathering and analysis are proposed for this species as part of this study.

1.1.2 Birds

Piping Plover

The Great Plains population of piping plovers was federally listed as threatened on December 11, 1985, but critical habitat has not been designated for the species in Oklahoma (USFWS 2011b). Focused on breeding and wintering areas, the current recovery plan has no specific guidelines for Oklahoma. There are only two nesting records for the piping plover in Oklahoma, both in the panhandle, and there are no recent migration records for the Project vicinity (ODWC 2011). As a result, there is little potential for Project operations to affect the piping plover, and no information gathering and analysis are proposed for this species as part of this study.

Rufa Red Knot

The rufa subspecies of red knot was federally listed as threatened wherever found on January 12, 2015. Query of the USFWS IPaC tool indicated that all of Oklahoma falls within the range of the rufa red knot. At this time, no critical habitat has been designated for this species. In Oklahoma, the red knot is considered to be a rare and irregular migrant (Central Flyway Council 2013; USFWS 2014). From 1962 to 2012, 39 occurrences of red knots were recorded in Oklahoma by ODWC (2013). Although a population of red knots migrates through the Great Plains annually (Newstead et al. 2013; USFWS 2014), individuals rarely make landfall in Oklahoma (ODWC 2013). There are no sites in Oklahoma that are known to be used annually, and there are only three locations with more than two documented occurrences: Hefner Reservoir (14 observations), Salt Plains National Wildlife Refuge (7 observations), and Oologah Reservoir (3 observations) (Central Flyway Council 2013). Generally, red knots migrate at high altitudes over inland areas and have not been recorded in the Project vicinity (USFWS 2014; ODWC 2013). As a result, there is little to no potential for Project operations to affect the rufa red knot, and no information gathering and analysis are proposed for this species as part of this study.

1.1.3 Insects

American Burying Beetle

The American burying beetle was federally listed as endangered in 1989 (54 FR 29652) by the USFWS in accordance with the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). As of 2015, the beetles known range in Oklahoma consisted of 999,511 acres; of which, 11,875 acres occur in the counties of Craig, Delaware, and Mayes (USFWS 2016a). Recently, the USFWS identified Conservation Priority Areas for the American burying beetle in Oklahoma, one of which is located within the southwest portion of Mayes County but outside the Project vicinity (USFWS 2016b). Since 2007, GRDA has been working to conserve and restore the Coal Creek Unit, which includes 540 acres of grasslands, bottomland hardwoods, wetlands, and riparian areas (GRDA 2016b; ODWC 2016). In January 2016, GRDA and ODWC developed an Interagency Agreement for the Coal Creek Unit to be used as adjacent-site mitigation. As a result of the agreement, the parcel will be brought into the FERC Project Boundary. Project operations may affect the American burying beetle. Accordingly, the species will be evaluated as part of this study.

1.1.4 Plants

Western Prairie-Fringed Orchid

The Western prairie-fringed orchid was added to the federal list of threatened species on September 28, 1989, and a recovery plan was issued in 1996 (USFWS 1996, 2015). No critical habitat has been designated for the species (USFWS 1996, 2009). FERC's SD2 indicates that the Western prairie-fringed orchid is not included in the USFWS' official species list on its ECOS-IPaC website (as of January 10, 2018). As such, there is little potential for Project operations to affect the Western prairie-fringed orchid, and no information gathering and analysis are proposed for this species as part of this study.

2.0 STUDY PLAN ELEMENTS

2.1 Study Goals and Objectives

Based on the summaries in the previous section, three of the eight Rare, Threatened, and Endangered (RTE) species require analysis: i.e., the gray bat, northern long-eared bat, and American burying beetle ("species of concern"). To provide the information needed by FERC to fulfill its requirements under NEPA, GRDA proposes to implement a "desktop" evaluation of the changes due to Project operations, if any, on the two species of bat and field surveys and associated analysis to assess possible impacts on the American burying beetle. The analysis will be based on output from the Comprehensive Hydraulic Model (CHM) that will be developed as part of the Hydrologic and Hydraulic Modeling Study (H&H Study) combined with existing information on the bat species, and data derived from surveys of the American burying beetle in the study area.

The Pensacola Project PSP (GRDA 2018a) states, "the H&H Study will be used to evaluate any effects on...terrestrial resources using the wealth of existing information already available in these resource areas;" and "The modeling and mapping results can inform separate efforts to assess Project effects on resources such as...threatened and endangered resources." In its July 24, 2018 letter to FERC, ODWC recognizes that GRDA's H&H Study will provide information on shoreline areas inundated by Project operations. However, ODWC requests that outputs from the model be used to assess specific impacts associated with implementing Project operations.

To provide the information needed by FERC to assess the effects of Project operations[1], GRDA proposes to address the following objectives related to the gray bat, northern long-eared bat, and American burying beetle. Critical habitat has not been designated for either bat species, and no assessment of the effects on critical habitat is needed.

1. Create maps that delineate the riverine reaches that would be converted to lentic habitat as the result of water level management associated with Project operations.
2. Assess potential impacts of Project operations on the ability of bats to access near-shore caves.
3. Document the presence/absence of American burying beetles in the study area and assess potential impacts, if any, of Project operations on beetle habitat.

[1] "Project operations" refers to any changes related to the generation of hydroelectric power at the Pensacola Project and other activities authorized under the FERC-issued license within the designated conservation pool. Water level fluctuations associated with flood management under the jurisdiction of the USACE are not related to Project operations as defined herein. See H&H Study Plan; GRDA 2018b. This study will complement GRDA's H&H Study in determining the impact of Project operations on terrestrial species of concern.

2.2 Agency and Native American Tribe Resource Management Goals

USFWS has management goals for maintaining and enhancing habitat for federally-listed species and other trust resources. ODWC is responsible for managing Oklahoma's fish and wildlife resources and habitat.

2.3 Background and Existing Information

2.3.1 Gray Bat

Gray bats occupy caves along rivers in summer but migrate to deep, vertical caves to overwinter (USFWS 1997). Gray bats can travel great distances to forage on flying aquatic and terrestrial insects along rivers and lakes. As required by the Project's Shoreline Management Plan (SMP; GRDA 2008b), GRDA conducted surveys of gray bat foraging areas along the Grand Lake shoreline in 2015 (GRDA 2016a). Although gray bats were detected, no distinct foraging areas were found.

Gray bats rely on two caves near Grand Lake: Beaver Dam Cave and Twin Cave. Beaver Dam Cave is located at an elevation of about 745 feet Pensacola datum (PD)[2] adjacent to Drowning Creek, a tributary of Grand Lake. Both caves are gated to protect sensitive resources, including bats, associated with the caves. Twin Cave is located approximately 1 kilometer from Grand Lake at an elevation of 840 feet PD (GRDA 2015, 2016). Both caves are south and east of Grand Lake in the Ozark Plateau karst topography. Annual surveys of gray bats have been conducted at caves within the Project vicinity since 2007. The averages of estimated populations, when bats were present, from 2007 through 2015 were 12,226 and 15,659 individuals at Beaver Dam Cave and Twin Cave, respectively. Based on those surveys, gray bats have not been found at Beaver Dam Cave when the lake's water surface elevation reaches 752 feet PD. Beaver Dam Cave is a maternity roost, and most bats vacate the cave by late summer when the young can fly (GRDA 2015, 2016). The size and status of the colony has remained relatively constant for the last 25 years according to recent exit and capture surveys (GRDA 2015, 2016). Modifications to the cave were made in coordination with the USFWS and Roger State University to provide a secondary exit, which bats used in 2015 when the main entrance to the cave was inundated.

2.3.2 Northern Long-Eared Bat

The northern long-eared bat is one of the bat species most critically affected by white nose syndrome (WNS), which is caused by the cold-loving fungus (*Pseudogymnoascus destructans*). Northern long-eared bats hibernate in caves and mines during the winter, roost singly or in colonies on both live and dead trees in upland forests during spring and summer (USFWS 2016c), and swarm in wooded areas surrounding caves and mines in the fall prior to hibernation. Northern long-eared bats were detected during bat surveys conducted by GRDA in the summers of 2015 and 2016 (GRDA 2016a; Martin and Zimmerman unpublished).

[2] All elevations referenced are relative to PD. PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD29) by adding 1.07 feet and to North American Vertical Datum of 1988 (NAVD88) by adding 1.40 feet (for example, elevation 745 feet PD = 746.07 feet NGVD = 746.4 feet NAVD88)(http://ok.water.usgs.gov/projects/webmap/miami/datum.htm).

2.3.3 American Burying Beetle

The American burying beetle is a habitat generalist associated with a wide range of soil types and vegetation communities (USFWS 2016b). Various habitat types where the beetle is known to occur include oak-pine woodlands, open fields, oak-hickory forest, open grasslands, and edge habitat. Generally, ecosystems supporting beetle populations are diverse. Suitable soils and vegetation layers are necessary for breeding, so habitat requirements are more specific for breeding than they are for feeding. Adult beetles and larvae depend on carrion for food and reproduction (USFWS 2016b), which often puts them in competition with other scavengers.

2.4 Nexus between Project Operations and Effects on Resources

Project operations may influence water levels in Grand Lake and its tributaries. These water level fluctuations may have the potential to alter the habitat of the species of concern. Understanding the magnitude, duration, and frequency of operational effects on habitat will allow for a characterization of potential impacts, if any, on the terrestrial species of concern and provide information needed by FERC to fulfill its requirements under NEPA.

2.5 Study Area

Grand Lake is located in Craig, Mayes, Delaware, and Ottawa counties, Oklahoma. The study area for the terrestrial species of concern addressed in this plan will correspond to that associated with the H&H Study (see Section 2.6 Methodology of the H&H Study Plan; GRDA 2018b). The study area will extend upstream from Pensacola Dam along the Neosho River to within approximately 3 miles of the Kansas State line, upstream along the Spring River to within 6.5 miles of the Kansas State line, upstream along the Elk River to the upstream extent dictated by the H&H Study model, and along Tar Creek to just upstream of the U.S. Geological Survey (USGS) gage at the 22nd Avenue Bridge (Figure 2.5-1). The study will also encompass the bays/coves within Grand Lake associated with tributaries flowing into the lake.

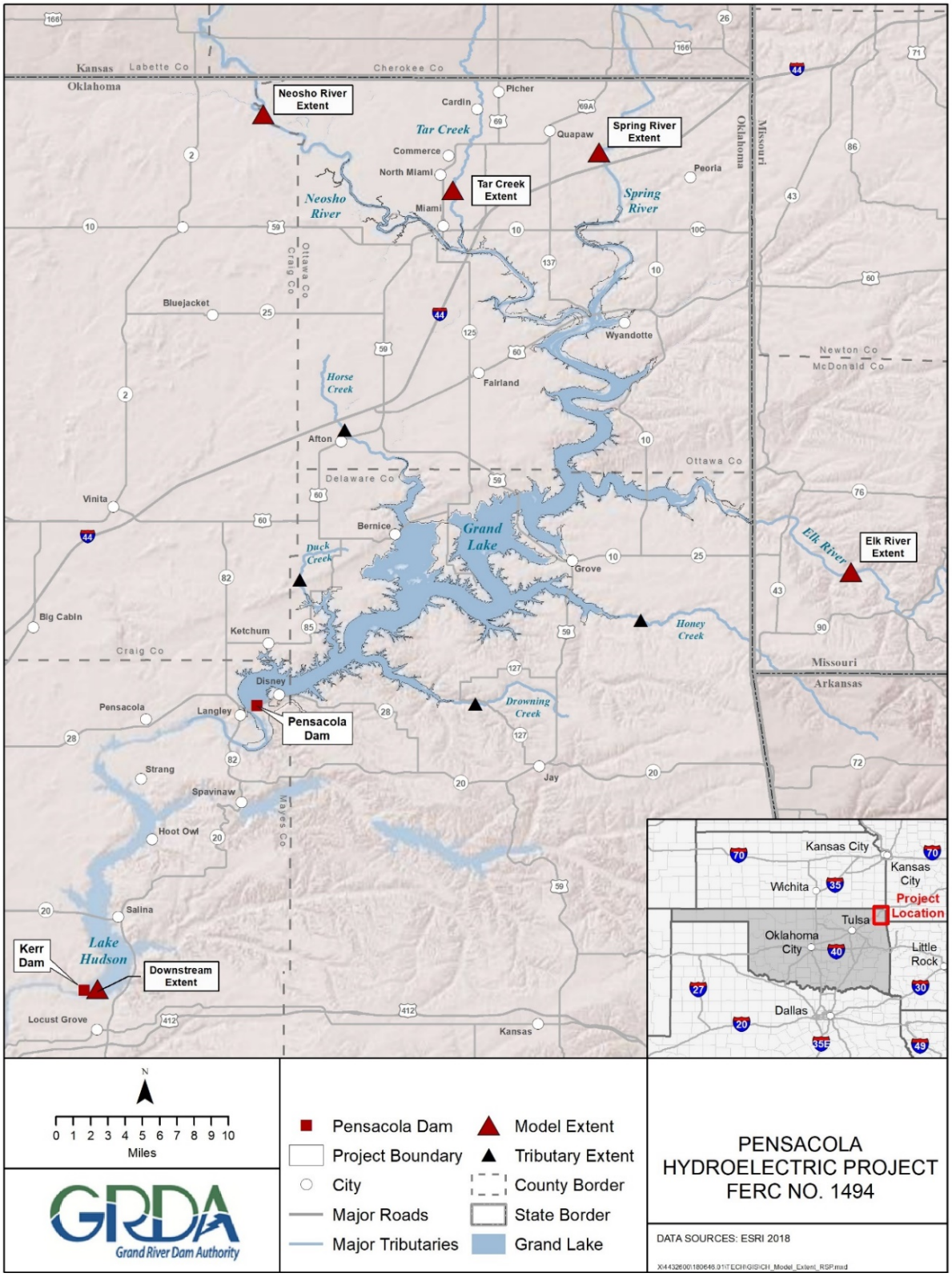


Figure 2.5-1. Study area for the Terrestrial Species of Concern (i.e., the study area identified in the H&H study plan).

2.6 Methodology

2.6.1 Map Riverine Reaches Affected by Project Operations

GRDA will apply the CHM to produce maps that delineate the riverine reaches that would be converted to lentic habitat, over a range of inflow conditions, as the result of water level management associated with Project operations. Effects analyses associated with Project operations will address the possible impacts of water level fluctuations associated with changes to hydroelectric power operations, which will be differentiated from the effects of water surface fluctuations resulting from the operation of the Project as allowed by the current FERC license and flood control operations conducted under the jurisdiction of the U.S. Army Corps of Engineers (USACE). As described in GRDA (2018b), inundation depth maps generated by the CHM will be layered onto recent aerial photos. Maps will delineate the area inundated under current Project operations and that predicted to be inundated under potential future Project operations. Maps will show the current Project Boundary. Each set of inflow event maps will include an inundation line to represent the maximum water surface elevation.

2.6.2 Evaluate the Effects of Project Operations on Bats' Access to Caves

Increases in water surface elevation associated with Project operations could affect the ability of bats to access roosting habitats in caves during the times when inundation is proposed to occur. As noted, gray bats rely on two caves near Grand Lake: Beaver Dam Cave and Twin Cave. Beaver Dam Cave is located at an elevation of about 745 feet PD adjacent to Drowning Creek, a tributary of Grand Lake, and Twin Cave is located approximately 1 km from Grand Lake at an elevation of 840 feet PD (GRDA 2015, 2016). Gray bats have not been found at Beaver Dam Cave when water surface elevation reaches 752 feet PD. Beaver Dam Cave was modified to provide a secondary exit which bats used in 2015 when the main entrance to the cave was inundated. Northern long-eared bats roost in both live and dead trees in upland forests during spring and summer (USFWS 2016c), which means the species may be less likely than the gray bat to occupy shoreline caves.

Based on the respective roosting habitats of the two bat species and known patterns of cave use adjacent to Grand Lake, the northern long-eared bat is unlikely to be affected by alterations in cave access associated with Project operations. As a result, for this objective, GRDA will focus its efforts on gray bats in the caves which they are known to use. Notwithstanding the provision of a secondary access to Beaver Dam Cave, GRDA will assess the degree to which Project operations would inundate the main entrance to Beaver Dam Cave and compare the frequency of inundation with that associated with existing operations. GRDA will determine whether the secondary exit suffices to provide an alternative access by gray bats to the cave (during times of inundation).

2.6.3 Document the Presence of American Burying Beetles in the Study Area and Assess Potential Impacts of Project Operations on Beetle Habitat

Sampling of American burying beetles will be conducted according to methods described in *American Burying Beetle (Nicrophorus americanus) Range-wide Presence/Absence Survey Guidance* (USFWS 2018). Personnel conducting the presence/absence surveys will possess a

valid Federal Fish & Wildlife Permit for scientific research and recovery of the American burying beetle, as defined under section 10(a)(1)(A) of the ESA.

Sampling will be conducted in 2019 and 2020. Surveys will be conducted during an active season (early season when beetles are seeking carcasses or late season when beetles have completed brood rearing) that meets all weather parameters, siting criteria, and suitable habitat conditions. No sampling will be conducted within wetlands or in areas where grass has been maintained at a height of 8 inches or less.

Sampling efforts will represent potential American burying beetle habitats within the study area. GRDA anticipates that approximately six sampling locations will suffice for each year of the survey. GRDA will coordinate with the USFWS to identify sampling locations in both years. Sites sampled in 2020 may be different from those sampled in 2019, contingent upon input from the USFWS. Sampling sites will be located within the center of the area of interest and within suitable habitat. Sampling will be conducted between 9 pm and 4 am for at least five consecutive nights. Five-gallon bucket-style traps (above ground or pitfall versions depending on conditions) will be designed and deployed according to criteria provided in USFWS (2018). For each survey effort, surveyors will complete an *ABB Survey Data Collection Form*, an *ABB Survey Summary Report*, and, if necessary, an *ABB Accidental Death Form*.

If beetles are found within the study area, GRDA will compare distributions of beetles to inundation maps generated by the CHM for characterizing the effects of Project operations (Section 2.5.1 of this study plan). If areas that support beetles will be inundated as the result of Project operations, GRDA will coordinate with the USFWS to estimate the level of impact, if any.

2.6.4 Coordination with Relicensing Participants and Reporting Results

Draft results of the analysis will be presented in the Initial Study Report (ISR), and a final report will be provided as part of the Updated Study Report (USR), both according to the schedule dictated by the Integrated Licensing Process (ILP).

2.7 Consistency with Generally Accepted Scientific Practice

The proposed methods for this study are consistent with FERC study requirements under the ILP.

2.8 Schedule

This study plan is anticipated to be finalized in late 2018. At this time, GRDA intends to conduct analyses associated with gray and northern long-eared bats in 2019, contingent upon the availability of output from the CHM model needed for conducting analyses. The bat study may be extended into 2020, if needed. As noted above, American burying beetle surveys will be conducted in 2019 and 2020, with analyses of possible effects conducted in 2020, as needed. A study report will be drafted and included as part of the ISR filing in November 2019. Results of work conducted in 2020 will be incorporated into the USR filing in November 2020.

2.9 Level of Effort and Cost

A rough, provisional estimate of the level of effort required for the bat study is 250 hours. The estimated cost associated with this level of effort is $30,000. The cost of this study will be revised when a technical contractor reviews the scope and refines the level of effort based on regional experience with the species of concern and their habitats. The cost of field surveys for American burying beetles is provisionally estimated to $9,000 per year (two field technicians at 50 hours each per year). The estimated total survey cost, which includes deployment and gathering of traps and associated logistics is $19,000. Coordination with modelers to evaluate whether there are any effects is expected to require 60 hours at a cost of $7,200. Data analysis, report writing, filling out forms required by the USFWS, and meeting attendance are currently expected to cost $9,600 (i.e., 80 hours). The total cost for the American burying beetle portion of this study is estimated to be $35,800. The total estimated cost for the Terrestrial Species of Concern Study is $65,800.

3.0 REFERENCES

Central Flyway Council. 2013. Public comments of November 26, 2013. Central Flyway Council, Austin, TX.

FERC (Federal Energy Regulatory Commission). 1992. Order Issuing New License and Environmental Assessment, Pensacola Project, FERC No. 1494-002 (59 FERC 63,231). April 29, 1992 (Order); November 19, 1991 (EA).

FERC. 2008. Order Modifying and Approving Gray Bat Compliance Plan, Pensacola Project, FERC No. 1494-338. 123 FERC ¶ 62,248. June 23, 2008.

GRDA (Grand River Dam Authority). 2008a. Bat Compliance Plan. Pensacola Hydroelectric Project, FERC No. 1494. April 15, 2008.

GRDA. 2008b. Shoreline Management Plan. Pensacola Hydroelectric Project, FERC No. 1494. June 11, 2008.

GRDA. 2015. Annual Report for Article 405: Gray Bat Compliance Plan of the Pensacola Project (1494-374). June 23, 2015.

GRDA. 2016a. Annual Report for Article 405: Gray Bat Compliance Plan for the Pensacola Project, Annual Report for Gray Bat Foraging and Vegetation Management Permit Impacts per the Shoreline Management Plan. June 22, 2016.

GRDA. 2016b. Article 411 Fish and Waterfowl Habitat Management Plan, Annual Report. April 27, 2016.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

GRDA. 2018a. Pensacola Hydroelectric Project, P-1494, Proposed Study Plan. April 2018.

GRDA. 2018b. Pensacola Hydroelectric Project, P-1494, Hydrologic and Hydraulic Modeling Study Plan. Prepared for GRDA by Mead & Hunt. September 2018.

Martin, Keith, and Craig Zimmerman. Unpublished. Temporal and Spatial Evaluation of Activity Patterns along the Grand Lake Shoreline by Gray Bats (*Myotis grisescens*) and Northern long-eared Bats (*Myotis septentrionalis*). Roger State University.

Newstead, D.J., L.J. Niles, R.R. Porter, A.D. Dey, J. Burger, and O.N. Fitzsimmons. 2013. Geolocation reveals mid-continent migratory routes and Texas wintering areas of red knots *Calidris canutus rufa*. Wader Study Group Bulletin 120(1):53-59.

ODWC (Oklahoma Department of Wildlife Conservation). 2011. Piping Plover (*Charadrius milodus*). [Online]. URL: http://www.wildlife department.com /wildlifemgmt/endangered/plover.htm (Accessed June 21, 2016).

ODWC. 2013. Public comments of November 20, 2013. Oklahoma Department of Wildlife Conservation, Oklahoma City, Oklahoma.

ODWC. 2016. Interagency Agreement between Grand River Dam Authority and Oklahoma Department of Wildlife Conservation. January 4, 2016.

USFWS (U.S. Fish and Wildlife Service). 1982. Gray bat recovery plan. Minneapolis, Minnesota. 26pp.

USFWS. 1995. Ozark Big-Eared Bat (*Corynorhinus townsendii ingens*) Revised Recovery Plan. Tulsa, OK. 51pp.

USFWS. 1996. Western Prairie Fringed Orchid Recovery Plan (*Platanthera praeclara*). USFWS and the Western Prairie Fringed Orchid Recovery Team. September 30, 1996.

USFWS. 1997. Gray bat (*Myotis grisescens*) Fact Sheet. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. [Online]. URL: http://www.fws.gov/midwest/endangered /mammals/pdf/gray-bat.pdf.

USFWS. 2006. Indiana Bat (*Myotis sodalist*): Fact Sheet. Updated October 15, 2015.

USFWS. 2007. Indiana Bat: Fact Sheet, Finding on Petition to Revise Critical Habitat – Questions and Answers. Updated April 14, 2015.

USFWS. 2009. Western Prairie Fringed Orchid (*Platanthera praeclara*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Twin Cities Field Office, Bloomington, Minnesota. February 2009.

USFWS. 2011a. Gray Bat (*Myotis grisescens*): Fact Sheet. December 2011.

USFWS. 2011b. Piping Plover. U.S. Fish and Wildlife Service, Oklahoma Ecological Services Field Office, Tulsa, Oklahoma. August 2011.

USFWS. 2014. Rufa Red Knot Background Information and Threats Assessment. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*) [Docket No. FWS–R5–ES–2013–0097; RIN AY17].

U.S. Fish and Wildlife Service Northeast Region, New Jersey Field Office, Pleasantville, New Jersey. November 2014.

USFWS. 2015. Western Prairie-Fringed Orchid. [Online]. URL: http://www.fws.gov/midwest/endangered/plants/prairief.html (Accessed May 31, 2016).

USFWS. 2016a. American Burying Beetle: Additional Information. [Online]. URL: https://www.fws.gov/southwest/es/oklahoma/ ABB_Add_Info.htm.

USFWS. 2016b. American Burying Beetle Impact Assessment for Project Reviews. U.S. Fish and Wildlife Service Southwest Region, Oklahoma Ecological Services Field Office. March 2016.

USFWS. 2016c. Northern Long-Eared Bat (*Myotis septentrionalis*). [Online]. URL: http://www.fws.gov/Midwest/endangered/mammals/ nleb/index.html

USFWS. 2018. American Burying Beetle (*Nicrophorus americanus*) Range-wide Presence/Absence Survey Guidance. May 2018.

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Wetlands and Riparian Habitat Study

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

AUC ..... Allowable Use Categories
CHM ..... Comprehensive Hydraulic Model
FERC ..... Federal Energy Regulatory Commission
FPA ..... Federal Power Act
GIS ..... Geographic Information System
GRDA ..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
ILP ..... Integrated Licensing Process
ISR ..... Initial Study Report
NAVD88 ..... North American Vertical Datum of 1988
NEPA ..... National Environmental Policy Act
NGVD29 ..... National Geodetic Vertical Datum of 1929
NWI ..... National Wetlands Inventory
ODWC ..... Oklahoma Department of Wildlife Conservation
PAD ..... Pre-Application Document
PD ..... Pensacola datum
Project ..... Pensacola Hydroelectric Project
PSP ..... Proposed Study Plan
RSP ..... Revised Study Plan
SD2 ..... Scoping Document 2
SMC ..... Shoreline Management Classifications
SMP ..... Shoreline Management Plan
USGS ..... U.S. Geological Survey
USR ..... Updated Study Report
WMA ..... Wildlife Management Areas

1.0 INTRODUCTION

As part of the relicensing of the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494), the Grand River Dam Authority (GRDA) filed a Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) on February 1, 2017 (GRDA 2017). GRDA filed its Proposed Study Plan (PSP) for the relicensing on April 27, 2018 (GRDA 2018a). Also on April 27, 2018, FERC released its Scoping Document 2 (SD2) for the relicensing of the Project (FERC 2018).

Project operations at the Pensacola Project have the potential to affect wetlands and riparian habitat in the Project area. This study plan proposes to collect information to support an assessment of these effects of the Project, if any, on wetlands and riparian habitat as part of FERC's National Environmental Policy Act (NEPA) analysis for the relicensing of the Project.

In its July 24, 2018 PSP comment letter, the Oklahoma Department of Wildlife Conservation (ODWC) requested a Wetlands Documentation Study and Impoundment Fluctuation Studies that would include documenting all wetlands within the Project vicinity. ODWC also requested a Loss of Wildlife Habitat from Flooding study to quantify the amount of Wildlife Management Area (WMA) acres that may be changed as a result of Project operations. Additionally, ODWC requested that GRDA identify any aquatic vegetation found in the Project vicinity to characterize the aquatic habitats and determine the potential impacts of water level changes.

In its July 20, 2018 PSP comment letter, specific to GRDA's rationale for not adopting the above ODWC study requests as described in the PSP, FERC requested more details regarding objectives and methodology for performing resource analyses to address the identified issues. In response to these requests, GRDA is proposing this study plan, which details the objectives and methodology GRDA will use to perform the resource analyses requested by FERC. Section 4.1.5 of the main body of the Revised Study Plan (RSP) details GRDA's response to these requests.

2.0 STUDY PLAN ELEMENTS

2.1 Study Goals and Objectives

To provide the information needed by FERC to fulfill its requirements under NEPA, GRDA proposes to implement a phased information gathering and impact assessment for wetlands and riparian habitat around the Project reservoir, Grand Lake, consisting of a "desktop" evaluation augmented by fieldwork, if necessary.

GRDA proposes to address the following objectives:

- Use the National Wetlands Inventory (NWI) and GRDA's Shoreline Management Plan (SMP) maps (and potentially other sources) to identify, display, and describe the current composition of wetland communities within and adjacent to the study area.
- Use the NWI and GRDA's SMP maps (and potentially other sources) to develop a Geographic Information System (GIS) database on the extent, classification, and plant

community structure of wetland and riparian habitats within and adjacent to the study area.

- Utilize the GIS database to estimate the total acres of wetlands and riparian habitats that currently exist within the study area.
- Use results of GRDA's Hydrologic and Hydraulic Modeling Study (H&H Study) to determine potential Project effects based on the seasonal variability of hydrologic conditions related to Project operations.
- Use the results of the H&H Study to determine potential changes to habitat in currently designated WMAs in the Project area.

2.2 Agency and Native American Tribe Resource Management Goals

ODWC is responsible for managing Oklahoma's fish and wildlife resources and habitat.

2.3 Background and Existing Information

Wetlands in the Project area are confined to inlets and coves along the numerous small tributaries that enter the reservoir and are more abundant along the upper, shallower reaches of the northern and western shores of the reservoir where silty soils and gently sloping banks provide favorable conditions for wetland vegetation (GRDA 2008). Shoreline areas within the reservoir's lower reaches primarily consist of limestone bluffs, with wetlands restricted to coves and backwaters of inundated tributaries.

Project area wetlands support a wide variety of wildlife, including large and small mammals, birds, amphibians, and migratory birds (FERC 1996). Emergent vegetation within wetlands of the northern and western shores primarily consists of herbaceous plants such as smartweeds (*Polygonum* spp.), sedges (*Carex* spp.), and reed canary grass (*Phalaris arundinacea*). Bottomland woody species such as black willow (*Salix nigra*), eastern cottonwood (*Populus deltoids*), and silver maple (*Acer saccharinum*) are also present (FERC 2015).

GRDA, in coordination with interested parties, developed an SMP in 2008 that was approved by FERC in 2013 (GRDA 2008; FERC 2013). Land use along Grand Lake's shoreline is managed through a permitting system described in the SMP. Management regulations preclude construction below elevation 750 feet Pensacola datum (PD)[1] without prior authorization from GRDA. Shoreline management is defined by the SMP's Shoreline Management Classifications (SMC) and Allowable Use Categories (AUC). The SMP system includes seven SMCs: Project Operations Areas, Municipal/Public Use Areas, Stewardship Areas, WMAs, Responsible Growth Areas, Responsible Growth-Wetlands Areas, and Responsible Growth-Sensitive Areas. The AUCs define the use types that will be permitted in those areas. The SMP helps define management responsibilities of both GRDA and FERC under the Project's license and the Federal Power Act (FPA), respectively (GRDA 2008).

[1] All elevations referenced are relative to PD. PD elevations can be converted to National Geodetic Vertical Datum of 1929 (NGVD29) by adding 1.07 feet and to North American Vertical Datum of 1988 (NAVD88) by adding 1.40 feet (for example, elevation 745 feet PD = 746.07 feet NGVD29 = 746.4 feet NAVD88)(http://ok.water.usgs.gov/projects/webmap/miami/datum.htm).

GRDA has made qualitative evaluations of existing shoreline uses and environmental resources immediately adjacent to and/or within the Project Boundary. The basis of the evaluation was a series of maps produced using existing GIS databases that included palustrine wetlands, contour and bathymetric data, and aquatic and terrestrial habitats considered significant by state and federal wildlife agencies. GRDA compared these resources with existing shoreline development data obtained by GRDA staff through a lake-wide global positioning system effort, review of aerial photography, and the personal and corporate knowledge of GRDA staff and relicensing participants.

Shoreline management classification maps are included as Appendix B to the SMP and as revised in January 19 and 23, 2017 filings with FERC and approval by FERC on June 27, 2017. Classifications and categories are contained in a GRDA database and updated periodically, with a lake-wide review of all classifications scheduled every 6 years. Lake-wide updates are scheduled to occur in 2019, six years after the SMP Order issuance in October 2013.

2.4 Nexus between Project Operations and Effects on Resources

Continued operation of the Project will influence water levels of Grand Lake. These water level fluctuations have the potential to affect aquatic vegetation, wetlands and riparian habitat, which can be important habitats for fish and wildlife. This study will be used to assist in the evaluation of potential Project effects to wetlands and riparian habitat.

2.5 Study Area

Grand Lake is located in Craig, Mayes, Delaware, and Ottawa counties, Oklahoma. The study area for the Wetlands and Riparian Habitat Study will correspond to that associated with the H&H Study (see Section 2.6 Methodology of the H&H Study Plan; GRDA 2018b). The study will extend upstream from Pensacola Dam along the Neosho River to within approximately 3 miles of the Kansas State line, upstream along the Spring River to within 6.5 miles of the Kansas State line, and upstream along the Elk River to the upstream extent dictated by the H&H model, and along Tar Creek to just upstream of the U.S. Geological Survey (USGS) gage at the 22nd Avenue Bridge (Figure 2.5-1). The study will also encompass the bays/coves within Grand Lake associated with tributaries flowing into the lake.

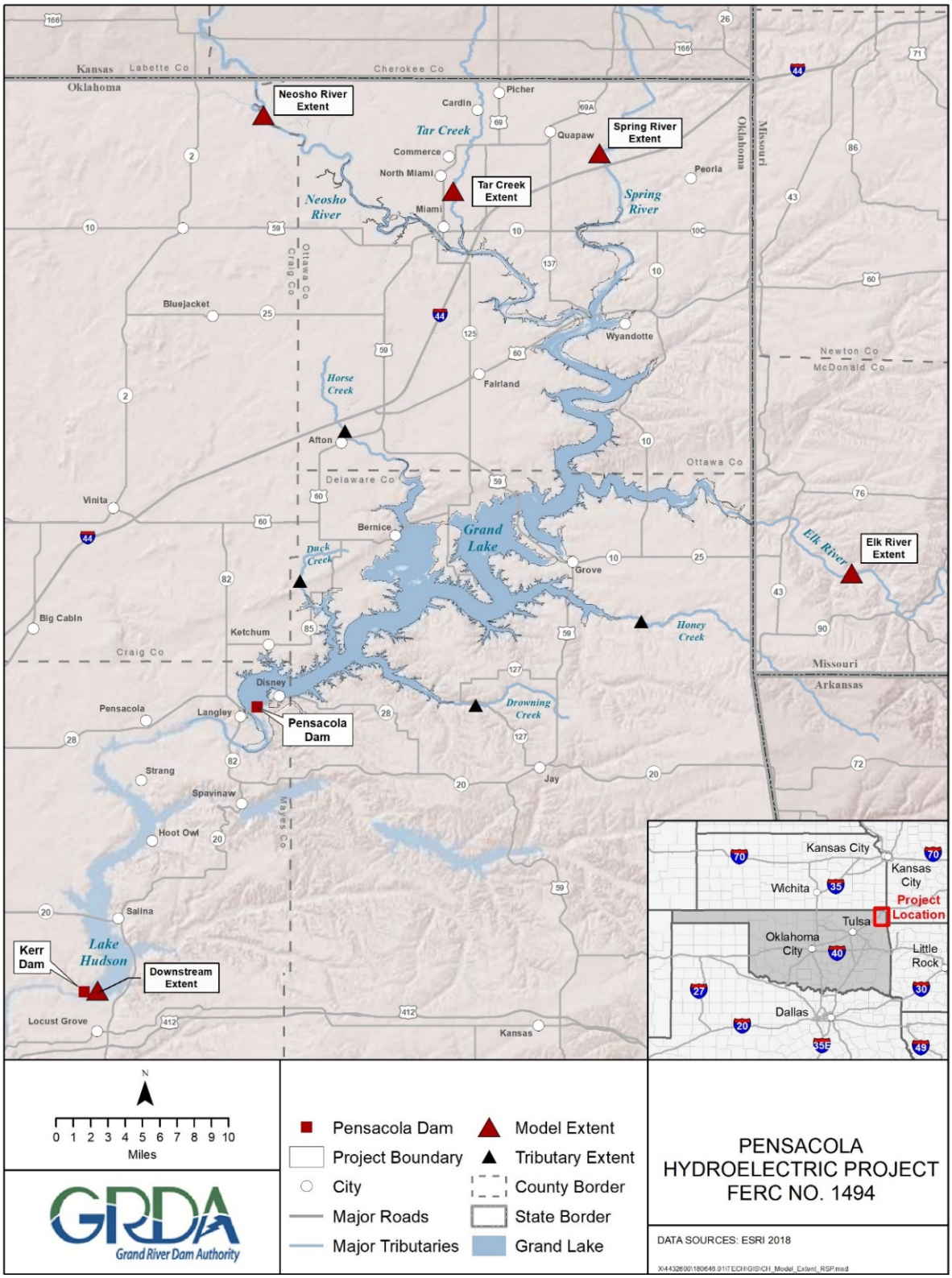


Figure 2.5-1. Study area for the Wetlands and Riparian Habitat Study (i.e., the study area identified in the H&H study plan).

2.6 Methodology

2.6.1 Desktop Mapping/Distribution of Wetland and Riparian Vegetation

During Study Year One, GRDA will develop base maps, in GIS, using source data from the NWI and GRDA's SMP (and potentially other resources), of wetland cover types in the Project study area. Cover type maps will be produced from existing resources that will include riparian and wetland vegetation throughout the study area. Wetlands will generally be classified into four classification groups: Palustrine Emergent, Palustrine Scrub-Shrub, Palustrine Forested, and Open Water in accordance with Cowardin et al. (1979). Other subgroupings will be used as available. Additionally, currently designated WMAs within the Project Boundary will also be included on the base maps.

2.6.2 Review of Existing Information

To the extent possible during Study Year One, GRDA will use results of the H&H Study to determine changes due to Project operations, if any, on wetlands and WMAs within the Project area. The H&H Study will provide information regarding the duration and extent of inundation of areas within the Project area during several measured inflow events and synthetic inflow events. GRDA will apply the Comprehensive Hydraulic Model (CHM) to produce maps of the Project study area that depict areas that would be inundated, over a range of inflow conditions, as the result of water level management associated with the Project.

Inundation depth maps generated by the CHM will be overlaid onto the preliminary base maps that were developed using existing wetlands information and information related to the WMAs. Maps will delineate the area inundated under current operations predicted to be inundated. Maps will show the current Project Boundary and will include an inundation line to represent the maximum water surface elevation. GRDA will assess potential impacts to wetlands and WMAs by identifying the extent, duration, and seasonality (timing) of inundation occurring in the Project area. The effects analysis will focus on potential change in wetland habitats and WMAs due to operation of the Project.

2.6.3 Potential Field Verification of Wetland Maps

If it is determined, based on the results of the H&H Study, that Project operations are potentially impacting wetlands in the Project area, in Study Year Two, GRDA will perform a field verification of the cover-type maps prepared during the desktop mapping portion of this study. To the extent possible, this task will be incorporated with other field activities at the Project (i.e., SMP updates). GRDA will verify the accuracy of the preliminary wetland cover-type maps and update these maps accordingly. Ground-truthing (map change recommendations) will only be required for any major deviations from the preliminary wetland cover-type maps. Any identified inconsistencies with the preliminary maps will be marked in the field and revised within the database accordingly. Wetland classifications will distinguish the degree of inundation (e.g., seasonally flooded, permanently flooded) based upon information obtained from this study. The results of the field verification will allow GRDA to provide a more accurate estimate of the acreage of wetlands that may potentially be impacted by the Project.

2.7 Consistency with Generally Accepted Scientific Practice

The proposed methods for this study are consistent with FERC study requirements under the Integrated Licensing Process (ILP).

2.8 Schedule

This study plan is anticipated to be finalized in late 2018. At this time, GRDA intends to conduct the desktop Wetlands and Riparian Study from May 2019 through October 2019. An analysis of changes, if any, due to Project operations will be performed using existing wetland inventory data and the results of the H&H Study and will be included as part of the Initial Study Report (ISR) filing in November 2019. If a second year of study is determined to be necessary, results of the wetland field verification will be analyzed and incorporated into the Updated Study Report (USR) filing in November 2020.

2.9 Level of Effort and Cost

The estimated level of effort for Year One of this study is approximately 100 hours. The estimated cost of Year One of this study is expected to be approximately $12,000. The cost of this study is subject to change based on the need for a second year of study, contingent upon the results of the H&H Study.

3.0 REFERENCES

Cowardin, L., V. Carter, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service publication.

FERC (Federal Energy Regulatory Commission). 1996. Order Amending License. 77 FERC 61,251. December 3, 1996.

FERC. 2013. Order Modifying and Approving Shoreline Management Plan. 145 FERC ¶ 62,041. October 17, 2013.

FERC. 2015. Order Approving Request for Temporary Variance, Pensacola Hydroelectric Project FERC No. 1494. 152 FERC ¶ 61,129. August 14, 2015.

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

GRDA (Grand River Dam Authority). 2008. Shoreline Management Plan. Pensacola Hydroelectric Project, FERC No. 1494. June 11, 2008.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

GRDA. 2018a. Pensacola Hydroelectric Project, P-1494, Proposed Study Plan. April 2018.

GRDA. 2018b. Pensacola Hydroelectric Project, P-1494, Hydrologic and Hydraulic Modeling Study Plan. Prepared for GRDA by Mead & Hunt. September 2018.

ODWC (Oklahoma Department of Wildlife Conservation). 2018. Grand River Dam Authority, Project No. 1494-438, Letter to FERC dated July 24, 2018.

[This page intentionally left blank.]

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Recreation Facilities Inventory and Use Survey

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ADA..... Americans with Disabilities Act
BIA ..... Bureau of Indian Affairs
FERC ..... Federal Energy Regulatory Commission
GRDA..... Grand River Dam Authority
ILP..... Integrated Licensing Process
ISR ..... Initial Study Report
ODWC..... Oklahoma Department of Wildlife Conservation
OTRD..... Oklahoma Tourism and Recreation Department
PAD..... Pre-Application Document
Project..... Pensacola Hydroelectric Project
PSP..... Proposed Study Plan
RMP ..... Recreation Management Plan
RSP..... Revised Study Plan
SCORP ..... Statewide Comprehensive Outdoor Recreation Plan
SD2 ..... Scoping Document 2
SMP ..... Shoreline Management Plan

1.0 INTRODUCTION

Project operations at the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494) have the potential to affect public access and recreation opportunities in the Project Boundary. Grand River Dam Authority (GRDA) operates and maintains five Federal Energy Regulatory Commission (FERC)-approved recreation facilities at the Project's reservoir, Grand Lake, in accordance with the current FERC license and Recreation Management Plan (RMP) (GRDA 1997). An up-to-date inventory and condition assessment of existing Project recreation areas and user surveys of Project and public access facilities will be helpful in understanding current recreation use and future recreation facility needs.

GRDA filed a Pre-Application Document (PAD) with the FERC on February 1, 2017, as part of the relicensing of the Project (GRDA 2017). In Section 7 of the PAD, GRDA identified a Recreation Facilities Inventory and Use Survey as a proposed study to characterize recreation resources within the Project Boundary. FERC's April 27, 2018, Scoping Document 2 (SD2) identified the following environmental resource issues related to recreation to be analyzed for the Project relicensing (FERC 2018):

- Whether existing recreation facilities and public access are adequate to meet current and future recreation demand;
- Effects of Project operation (reservoir fluctuation) on access to existing recreation facilities;
- Effects of Project operation on the visitor experience at Grand Lake; and
- Adequacy of the existing Recreation Management Plan to manage development and use of the Project's recreation facilities.

In their Proposed Study Plan (PSP) comment letters, FERC, Bureau of Indian Affairs (BIA), Oklahoma Department of Wildlife Conservation (ODWC), Ben Loring (State Representative), and the City of Miami commented on the Recreation Facilities Inventory and Use Survey Study Plan. Attachment B of the main body of the Revised Study Plan (RSP) details GRDA's response to PSP comments.

2.0 STUDY PLAN ELEMENTS

2.1 Study Goals and Objectives

The goals of this study are to gather information regarding current recreational use and identify recreation resources and activities that may be affected by the continued operation of the Project. Consistent with FERC's study request, the specific objectives of the study are to:

- Characterize current recreational use of the Project area;
- Estimate future demand for public recreation use at the Project;
- Gather information on the condition of GRDA's FERC-approved recreation facilities and identify any need for improvement; and

- Evaluate the potential effects of continued operation of the Project on recreation resources and public access in the Project area.

2.2 Agency and Native American Tribe Resource Management Goals

The BIA's mission is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian Tribes, and Alaska Natives (BIA undated).

The Oklahoma Tourism and Recreation Department (OTRD) promotes the development and operation of tourism and recreation opportunities throughout the State. The OTRD uses the Oklahoma Statewide Comprehensive Outdoor Recreation Plan (SCORP) as a planning tool to assist in preserving, developing, and assuring accessibility to outdoor recreation resources (OTRD 2012).

2.3 Background and Existing Information

Section 6.7 of the PAD describes existing information about recreation facilities and opportunities in the Project area (GRDA 2017). The Project's Grand Lake is the premier recreational lake in northeast Oklahoma (FERC 2014). Bass fishing is very popular and draws both local and out-of-state anglers to the area. Public recreation opportunities at Grand Lake are available at facilities owned and operated by GRDA and others, including five state parks around the shoreline and more than a dozen privately operated facilities. Together, these facilities offer numerous boat launches, marinas, tailwater fishing facilities, and fishing piers available to the public, as well as several wildlife areas, two visitor centers, several public overlooks, and one golf course. In addition, there are many popular, unimproved sites that can be used to access Grand Lake to launch boats, fish, and swim. There are also many campgrounds on Grand Lake providing tent, trailer, and recreational vehicle sites.

Development along the shoreline adjacent to Grand Lake primarily consists of residential, light commercial and business, and limited agricultural lands. Grand Lake is a popular location for recreation and residential development, particularly summer homes, due in part to the scenic quality of the reservoir and surrounding landscape, recreational fishing, and proximity to major population centers in Oklahoma, Kansas, Missouri, and Arkansas (GRDA 2008). Although lands adjacent to Grand Lake are mostly privately owned, GRDA owns title along the shoreline and has authority to prescribe and enforce rules and regulations for commercial and recreational use of the lake. GRDA manages the shoreline of the Project in accordance with its Shoreline Management Plan (SMP) and its police department enforces public safety and boating regulations. The SMP serves as a planning tool to guide GRDA in the protection and enhancement of the Project's environmental, recreational, and other values. Since 1992, over 2,600 private and 120 commercial boat docks have been permitted on Grand Lake[1].

The Project is located in the Ozark Plateau's Grand River lake region, which provides a host of recreational activities, including fishing, hunting, boating, hiking, camping, biking, rock climbing, and off-highway vehicles activities. Tourism is the stimulus for recreational developments in the

[1] Order Issuing New License, 59 FERC ¶ 62,073 (1992)

region including resorts, campgrounds, lake marinas, vacation homes, and associated support services (USFWS 2002).

Grand Lake is a popular recreation spot for local residents and tourists. Although some recreational activities such as boating take place year-round on Grand Lake, the primary recreation season typically spans May 1 through September 30. Recreational opportunities and activities at the Project include sailing, fishing, rafting (tying together of two or more anchored boats), pleasure boating, and hunting. Additional details regarding these recreational opportunities and activities are provided in Section 6.7.3 of the PAD (GRDA 2017).

The FERC Form 80 Licensed Hydropower Development Recreation Report filed April 1, 2015, identified available recreation amenities within the Project Boundary including 90 boat launch areas, 58 marinas, 15 swim areas, 27 campgrounds with over 2,000 camp and cottage sites, 47 active recreation areas (e.g., playgrounds, golf course), 32 picnic areas, 7 overlooks, and 6 visitor centers (GRDA 2015a). GRDA operates and maintains five FERC-approved public access sites, which are listed in Table 2.3-1. These facilities are discussed in more detail in Section 6.7.2 of the PAD (GRDA 2017). The State of Oklahoma and several municipalities and private operators also maintain publicly available recreation facilities around the reservoir. The FERC-approved recreation sites, state parks, and other public access points that will be surveyed are shown in Figure 2.5-1.

Table 2.3-1. FERC-approved recreation facilities on Grand Lake.

Site Name	Amenities
Duck Creek Bridge Public Access	Boat launch, informal parking area.
Seaplane Base Public Access	Boat launch, informal parking area.
Monkey Island Public Boat Ramp	Boat launch, concrete parking area.
Big Hollow Public Access	Boat launch.
Wolf Creek Public Access	Boat launch, four courtesy docks, mooring dock, restroom. Also includes parking for 71 vehicles with trailers, 8 single vehicles, and 5 Americans with Disabilities Act (ADA) accessible parking spaces with sidewalks, one fish-cleaning pavilion, and one event pavilion.

Recreation monitoring conducted from March 2014 through February 2015 in support of the FERC Form 80 requirements indicated that none of the FERC-approved Project recreation facilities and other publicly available recreation facilities at the Project were utilized to their maximum capacity. The boat launch areas, which include the five FERC-approved Project recreation facilities, had a capacity utilization rate of approximately 11 percent (GRDA 2015b).

2.4 Nexus between Project Operations and Effects on Resources

The Pensacola Project currently provides several public recreational opportunities. The results of this study, in conjunction with existing information, will be used to inform analysis in the license application regarding potential Project effects on public recreation.

2.5 Study Area

This study will take place at Grand Lake located in Craig, Mayes, Delaware, and Ottawa counties, Oklahoma. The study area includes the five FERC-approved recreation facilities on Grand Lake, the state parks around Grand Lake and immediately downstream of Pensacola Dam, Connors Bridge, and Riverview Park. This is an appropriate study area as it includes lands and recreation facilities managed by GRDA under the existing license, as well as a subset of other public access sites around Grand Lake. The Project's recreation facilities, state park facilities, and other public access sites included in this study are shown in Figure 2.5-1.

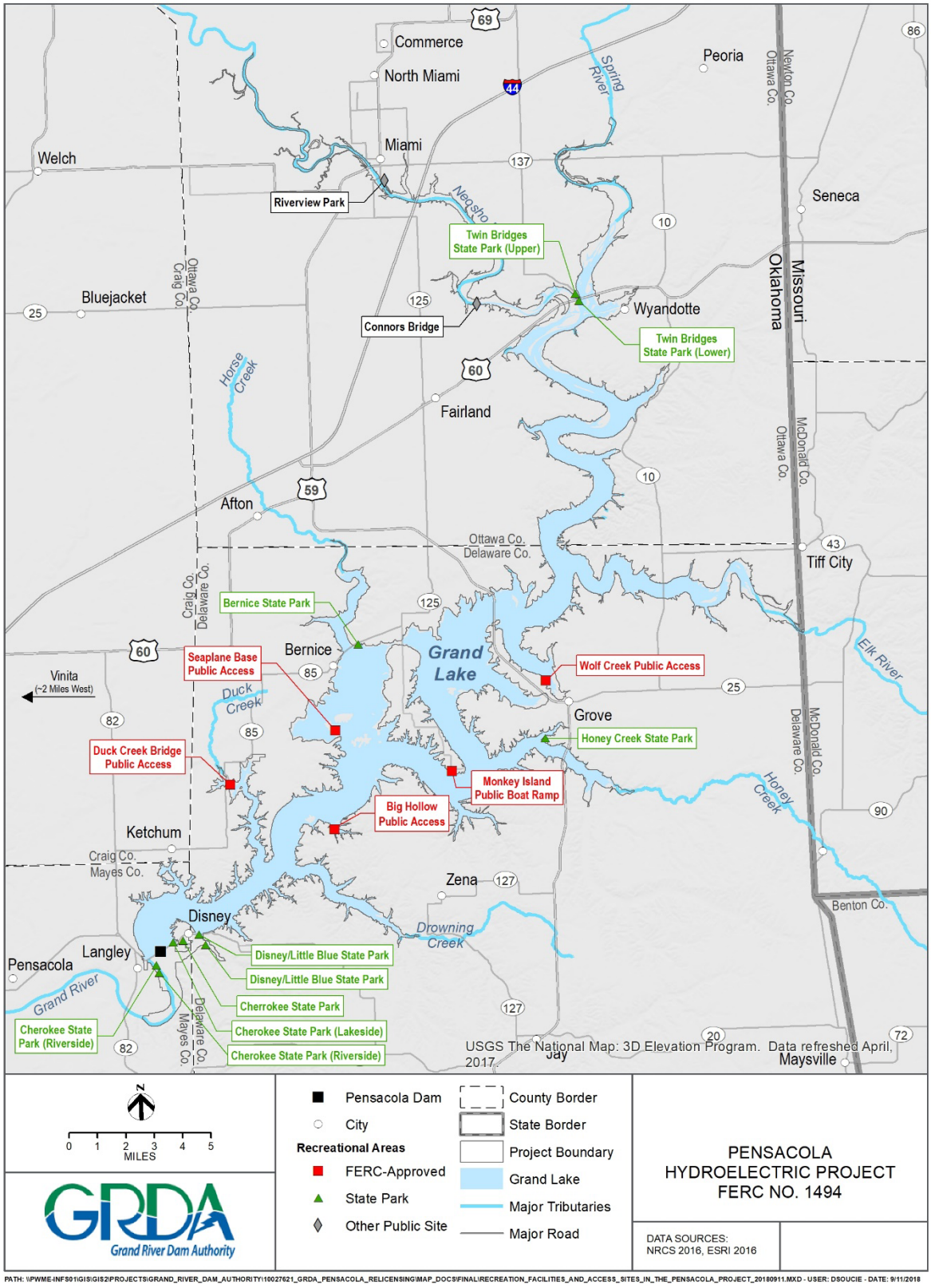


Figure 2.5-1. Recreation sites to be surveyed at the Pensacola Project.

2.6 Methodology

2.6.1 Recreation Facility Inventory and Condition Assessment

Information will be collected for each of the five FERC-approved recreation areas listed in Table 2.3-1 using a Facilities Inventory and Condition Form (provided in Appendix A). GRDA will record the following information for each recreational facility including:

- 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 ADA standards for accessible design); and
- Photographic documentation of recreation facilities.

Additionally, a qualitative assessment of the condition of the FERC-approved recreation facilities will be performed. Using the Facilities Inventory and Condition Form, the recreation amenities available at each FERC-approved recreation facility 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); and (G) Good condition (functional and well-maintained). If a facility is given a rating of "N", "R", or "M", an explanation for the rating will be provided. The age of the facilities and signs of overuse will also be noted.

2.6.2 Recreation Visitor Use Data

GRDA will collect visitor use data at the FERC-approved recreation sites, the state park recreation facilities, and other public access sites identified in Figure 2.5-1 through a combination of in-person surveys, field reconnaissance, and photo documentation. Additionally, GRDA will compile and summarize existing historical visitor use data obtained from the state parks and other sources. GRDA will conduct field reconnaissance and interviews with respondents at the following recreation facilities during the prime recreational season from May 2019 through September 2019:

<u>FERC-Approved Recreation Sites</u>

- Duck Creek Bridge Public Access;
- Seaplane Base Public Access;
- Monkey Island Public Boat Ramp;
- Big Hollow Public Access; and
- Wolf Creek Public Access.

<u>State Parks</u>

- Twin Bridges (Upper and Lower)
- Bernice

- Honey Creek
- Disney/Little Blue
- Cherokee (Main and Lakeside)
- Cherokee (Riverside)

Other Public Access Sites

- Connors Bridge
- Riverview Park

Surveys will begin at 7:00 AM and continue until 7:00 PM to capture a range of recreational activities throughout the day. GRDA intends to conduct surveys pursuant to the schedule presented in Table 2.6-1.

Table 2.6-1. Visitor use survey schedule.

Month	Survey and Reconnaissance
May	▪ Three weekend days (one within Memorial Day Weekend) ▪ Three randomly selected weekdays
June	▪ Three weekend days ▪ Three randomly selected weekdays
July	▪ Three weekend days (one within the weekend after July 4th) ▪ Three randomly selected weekdays
August	▪ Three weekend days ▪ Three randomly selected weekdays
September	▪ Three weekend days (one within Labor Day Weekend) ▪ Three randomly selected weekdays

GRDA expects that one team of two technicians will rotate between each of the recreation sites listed above (in random order) and will spend approximately one hour at each site conducting interviews. GRDA anticipates providing respondents with the option to complete the interview digitally (i.e., on an iPad/tablet) or to answer interview questions orally. Before rotating to the next site, technicians will record relevant conditions, including observed recreational activities, estimated number of vehicles, and number of recreational users. General information regarding date, time, and weather conditions will also be recorded by technicians.

GRDA has developed an interview/survey instrument that draws from general concepts and guidance from the *National Visitor Use Monitoring Handbook* (USFS 2007) as well as from other relicensing studies approved by FERC for in-person interviews during the recreation visitor use surveys as detailed in Table 2.6-1. Separate survey questionnaires have been developed for the five FERC-approved recreation sites and for the state parks and other public access sites, which include the same general information, as well as specific questions related to either GRDA or state park and other public facilities. The questionnaires are provided in Appendix B and Appendix C of this study plan. The questionnaires are designed to collect information about:

- General user information;

- Resident/visitor;
- Purpose and duration of visit;
- Distance traveled;
- Day use/overnight lodging;
- History of visiting the site or area;
- Types of recreational activities respondents participated in or plan to participate in during their visit, including primary and secondary recreation activities;
- Other recreational sites that respondents visited or intend to visit during their trip;
- General satisfaction with recreational opportunities, facilities, and the respondents overall visit and/or areas that need improvement;
- Effects of Project operations on recreation use and access; and
- Accessibility of facilities.

2.6.3 Recreation Observations

Twice a month, GRDA personnel will visit informal recreation access points downstream of the Project (i.e., spillway channels), once in the morning and once in the afternoon for a minimum of one hour for each visit. GRDA will record recreation observations on one random weekday and one random weekend day each month from May through September of 2019. Data will be recorded regarding the number of people observed, recreational activities observed, and weather conditions. This information will be collected to inventory the types of recreational activities that are occurring at informal locations downstream of the Project. Additional data regarding recreational activities occurring downstream of the Project will also be collected while conducting recreation visitor use surveys at the Cherokee (Riverside) state park as detailed in Section 2.6.2 of this study plan. Data will be recorded using the Recreation Observation Form that is included in Appendix D of this study plan.

2.6.4 Boat Launch Elevation Data Collection

GRDA will collect boat launch elevation data for the five FERC-approved boat launches, the state parks around Grand Lake, Connors Bridge, and Riverview Park as feasible. GRDA will perform an assessment using the various boat launch elevations to evaluate the reservoir water surface elevation range at which these boat ramps are accessible.

2.6.5 Data Analysis and Reporting

As part of the Initial Study Report (ISR), GRDA will prepare a report summarizing the results of the Recreation Facilities Inventory and Use Survey to include information presenting the results of the field inventory, on-site interviews and field reconnaissance, and representative photographs of the recreation facilities. GRDA anticipates that the Recreation Facilities Inventory and Use Survey Report will include the following elements:

- Project Introduction and Background
- Study Objectives
- Study Area
- Methodology

- Study Results
- Discussion and Analysis
- Variances from FERC-approved Study Plan and Proposed Modifications
- Location maps and photos
- Any agency correspondence and or consultation
- References

The results of the Recreation Facilities Inventory and Use Survey will be used to describe existing public access and use of the Project and evaluate the potential effects of continued operation of the Project on recreation resources and activities in the Project area.

2.7 Consistency with Generally Accepted Scientific Practice

The methods for this study are consistent with accepted professional practices such as those provided in the U.S. Forest Service's National Visitor Use Monitoring Program (July 2007). The overall approach is commonly used in relicensing proceedings and is consistent with generally accepted methods for recreation studies and analytical techniques used by federal and state agencies. In addition, the proposed methods for this study are consistent with FERC study requirements under the Integrated Licensing Process (ILP).

2.8 Schedule

According to its Process Plan and Schedule as updated by the August 10, 2018 Notice of Modification of Procedural Schedule, FERC is expected to issue its Study Plan Determination on November 8, 2018. Based on this date, GRDA intends to conduct the Recreation Facilities Inventory and Use Survey from May 2019 through September 2019. Upon completion of field work, the data will be analyzed and a final study report will be included as part of the ISR filing in November 2019.

2.9 Level of Effort and Cost

The estimated level of effort for this study is approximately 890 hours and is estimated to cost $110,000.

3.0 REFERENCES

Bureau of Indian Affairs (BIA). Undated. Bureau of Indian Affairs Mission Statement [Online] URL: https://www.bia.gov/bia. (Accessed September 5, 2018).

FERC (Federal Energy Regulatory Commission). 2014. Draft Environmental Assessment for Hydropower License Salina Pumped Storage Project – FERC Project No. 2524-021 Oklahoma. November 2014.

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

GRDA (Grand River Dam Authority). 1997. Grand Lake O' The Cherokees Recreation Management Plan Pensacola Hydroelectric Project FERC Project No. 1494-002. Vinita, OK.

GRDA. 2008. Shoreline Management Plan. Pensacola Hydroelectric Project FERC No. 1494. June 2008.

GRDA. 2015a. Pensacola Hydroelectric Project Public Recreation Management Plan Monitoring Report. April 2015.

GRDA. 2015b. Pensacola Hydroelectric Project FERC Form 80. April 2015.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

OTRD (Oklahoma Tourism and Recreation Department). 2012. Statewide Comprehensive Outdoor Recreation Plan 2013 – 2017. November 2012.

USFS (U.S. Forest Service). 2007. National Visitor Use Monitoring Handbook. National Visitor Use Monitoring Program, U.S. Forest Service, Washington, D.C.

USFWS (U.S. Fish and Wildlife Service). 2002. *Ozark plateau national wildlife refuge* proposed refuge expansion environmental assessment. September 2002. [Online]. URL: http://www.fws.gov/southwest/refuges/oklahoma/Ozark/ (Accessed September 16, 2010).

APPENDIX A.
FACILITY INVENTORY AND CONDITION FORM

[This page intentionally left blank.]

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.

APPENDIX B.
VISITOR USE SURVEY QUESTIONNAIRE FOR GRDA SITES

[This page intentionally left blank.]

ON-SITE/IN-PERSON RECREATION INTERVIEW
Pensacola Hydroelectric Project (FERC No. 1494)
GRDA Recreation Site Survey Questionnaire

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:	**Duck Creek Bridge Public Access☐ Seaplane Base Public Access☐ Big Hollow Public Access☐**	
	Monkey Island Public Boat Ramp☐ Wolf Creek Public Access☐	
Home Zip Code: _____	**Date:** _____	
	Time: _____	
Are you: **Male ☐**	**Female ☐**	**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 ☐

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		

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.

(Circle one number for each)	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	❑
Ability to launch or take out boat	5	4	3	2	1	❑
Ability to safely boat	5	4	3	2	1	❑
Ability to fish along the shoreline	5	4	3	2	1	❑
Ability to access the shoreline	5	4	3	2	1	❑
Scenic quality of the shoreline	5	4	3	2	1	❑
Ability to use docks	5	4	3	2	1	❑
Other (specify)	5	4	3	2	1	❑

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!

APPENDIX C.
VISITOR USE SURVEY QUESTIONNAIRE FOR NON-GRDA SITES

[This page intentionally left blank.]

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

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 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 and visitor experience at public recreation facilities around Grand Lake.

Interview Location:	**Twin Bridges☐ Bernice☐ Honey Creek☐ Disney/Little Blue☐ Cherokee (Lakeside)☐ Cherokee (Riverside)☐ Connors Bridge☐ Riverview Park☐**
Home Zip Code: _____	**Date:** _____ **Time:** _____
Are you: **Male ☐** **Female ☐** **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 ☐

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)**

☐ Twin Bridges

☐ Bernice

☐ Honey Creek

☐ Disney/Little Blue

☐ Cherokee (Lakeside)

☐ Cherokee (Riverside)

☐ Connors Bridge

☐ Riverview Park

☐ 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		

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:

	Twin Bridges	Bernice	Honey Creek	Disney/ Little Blue	Cherokee (Lakeside)	Cherokee (Riverside)	Connors Bridge	Riverview Park
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.

(Circle one number for each)	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	❑
Ability to launch or take out boat	5	4	3	2	1	❑
Ability to safely boat	5	4	3	2	1	❑
Ability to fish along the shoreline	5	4	3	2	1	❑
Ability to access the shoreline	5	4	3	2	1	❑
Scenic quality of the shoreline	5	4	3	2	1	❑
Ability to use docks	5	4	3	2	1	❑
Other (specify)	5	4	3	2	1	❑

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!

APPENDIX D.
RECREATION OBSERVATION FORM

[This page intentionally left blank.]

Recreation Observation Documentation Form

Project Name:_____ **Observer(s):**_____ **Date:**_____/_____/_____

Temp:_____ **Weather:**_____ **Wind:**_____ (month / day / year)

Recreation Location	Start Time (military)	End Time (military)	Time Observed (military)	No. People	Observed Recreation Activities												Notes
					ATV/OHV	Shoreline Fishing	Boat Fishing	Swimming	Run/Jogging	Hiking/Walking	Bicycling	Picnicking	Bird Watching	Wildlife Viewing	Boating/Canoeing/ Kayaking	Other (specify)	
1.																	
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
10.																	

Notes: If a group is participating in multiple activities, identify the **primary activity** by placing a "p" in the appropriate box. To identify the **secondary activity,** place an "s" in the appropriate box. Use your best personal judgment in determining between primary and secondary activities. If no one is observed recreating, please fill in the recreation location and time and simply write "no one observed" in the notes column.

Additional notes regarding observations of recreational activities or river access observed at site:

_____

_____

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Cultural Resources Study

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF ACRONYMS

ACHP ..... Advisory Council on Historic Preservation
APE..... Area of Potential Effects
ARPA ..... Archaeological Resources Protection Act
BIA ..... Bureau of Indian Affairs
C.F.R..... Code of Federal Regulations
CRWG..... Cultural Resources Working Group
FERC ..... Federal Energy Regulatory Commission
FLA ..... Final License Application
F.R. ..... Federal Register
GRDA..... Grand River Dam Authority
H&H Study ..... Hydrologic and Hydraulic Modeling Study
HPMP..... Historic Properties Management Plan
ILP..... Integrated Licensing Process
ISR ..... Initial Study Report
NAGPRA..... Native American Graves Protection and Repatriation Act
NEPA ..... National Environmental Policy Act
NHPA ..... National Historic Preservation Act
NOI..... Notice of Intent
NRHP..... National Register of Historic Places
OAS ..... Oklahoma Archaeological Survey
ODWC..... Oklahoma Department of Wildlife Conservation
OLI ..... Oklahoma Landmarks Inventory
PA ..... Programmatic Agreement
PAD..... Pre-Application Document
P.L..... Public Law
Project..... Pensacola Hydroelectric Project
PSP..... Proposed Study Plan
RSP..... Revised Study Plan
SD2..... Scoping Document 2
SHPO..... State Historic Preservation Officer
TCP..... traditional cultural properties
THPO ..... Tribal Historic Preservation Officer
U.S.C. ..... U.S. Code
USGS..... U.S. Geological Survey
USR ..... Updated Study Report
WPA..... Works Progress Administration

1.0 INTRODUCTION

The Grand River Dam Authority (GRDA) filed a Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC) on February 1, 2017, as part of the relicensing of the Pensacola Hydroelectric Project (Pensacola Project or Project; FERC No. 1494) (GRDA 2017). In Section 7 of the PAD, GRDA identified a Cultural Resources Study as a proposed study or information-gathering activity necessary to characterize archaeological and historic resources and historic properties of traditional religious and cultural importance within the Project's Area of Potential Effects (APE). FERC's April 27, 2018 Scoping Document 2 (SD2) identified the following environmental resource issues to be analyzed for the Project relicensing (FERC 2018):

- Effects of the Project operation and maintenance on historic and archeological resources within the APE that may be eligible for inclusion in the National Register of Historic Places (NRHP or National Register).
- Effects of Project operation and maintenance on properties of traditional religious and cultural importance to Native American Tribes within the APE that may be eligible for inclusion in the National Register.

In SD2, FERC indicated its intent to analyze the resource issues above for both cumulative and site-specific effects.

In their Proposed Study Plan (PSP) comments letters, FERC, Bureau of Indian Affairs (BIA), Oklahoma State Historic Preservation Officer (SHPO), Oklahoma Archeological Survey (OAS), Oklahoma Department of Wildlife Conservation (ODWC), Cherokee Nation, Delaware Nation, Miami Tribe of Oklahoma, Muscogee Nation, Osage Nation, Quapaw Tribe, Wyandotte Nation, and City of Miami, commented on the Cultural Resources Study Plan.[1] Attachment B of the main body of the Revised Study Plan (RSP) details GRDA's response to PSP comments.

2.0 STUDY PLAN ELEMENTS

2.1. Study Goals and Objectives

The goals of the Cultural Resources Study are: (1) to identify historic properties[2] within the Project's APE that are being adversely affected by Project operations (if any), including properties of traditional religious and cultural importance; and (2) to develop a Historic Properties Management Plan (HPMP) in consultation with the SHPO, OAS, and Native

[1] During RSP development, in addition to the May 30-31, 2018 PSP meetings, GRDA conducted and participated in early additional consultation with a number of relicensing participants to discuss comments on the proposed Cultural Resources Study Plan. These included a May 31 Cultural Resources Working Group meeting, an August 21 FERC-held tribal consultation meeting, and an August 22 meeting with the SHPO and OAS. GRDA appreciated the engagement and cooperation of these relicensing participants.

[2] For purposes of this Cultural Resources Study Plan, the term "historic properties" will have the same definition as the regulations of the Advisory Council on Historic Preservation (36 C.F.R. § 800.16(l)).

American Tribes[3] that provides for the long-term management of historic properties within the APE over the term of the new license. The primary objectives for meeting these goals are:

- Consult with Commission staff, the Oklahoma SHPO, OAS, Native American Tribes, Tribal Historic Preservation Officers (THPO)[4], BIA, and other identified parties (collectively, the "Cultural Resources Working Group" or "CRWG")[5] to determine the Project's APE. As described in Section 2.6 of this study plan, GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the Hydrologic and Hydraulic Modeling Study [H&H Study]) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to effect historic properties, should any be present. Once the Cultural Resources Study commences, GRDA will hold a status meeting with the CRWG every 90 days in Tulsa in order to discuss ongoing work related to the study.
- Conduct background research and an archival review, to include consultation and interviews with representatives designated by Native American Tribes.
- 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 subsurface investigations (e.g., shovel tests). If sites are identified, delineate in the field.
- 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

[3] FERC has identified the following Native American Tribes as consulting parties for this undertaking: Alabama-Quassarte Tribal Town, Apache Tribe of Oklahoma, Caddo Nation of Oklahoma, Cherokee Nation, Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Iowa Tribe of Oklahoma, Kiowa Tribe of Oklahoma, Little Traverse Bay Bands of Odawa Indians, Miami Tribe of Oklahoma, Modoc Tribe of Oklahoma, Muscogee (Creek) Nation, Osage Nation, Otoe-Missouria Tribe of Indians, Ottawa Tribe of Oklahoma, Peoria Tribe of Oklahoma, Quapaw Tribe of Oklahoma, Sac and Fox Nation of Oklahoma, Seneca-Cayuga Nation, Shawnee Tribe of Oklahoma, Tonkawa Tribe of Oklahoma, United Keetoowah Band of Cherokees, Wichita and Affiliated Tribes, Wyandotte Tribe of Oklahoma. Unless otherwise specified, the term "Native American Tribes" as used in this RSP refers collectively to the Tribes identified by FERC as consulting parties.

[4] When a Native American Tribe has assumed the responsibilities of the SHPO for Section 106 on tribal lands under Section 101(d)(2) of the National Historic Preservation Act (NHPA), GRDA will consult with the appropriate THPO in lieu of the Oklahoma SHPO. When a Native American Tribe has not assumed the responsibilities of the SHPO for Section 106 on tribal lands under Section 101(d)(2) of the NHPA, GRDA will consult with a representative designated by such tribe in addition to the Oklahoma SHPO.

[5] GRDA recognizes that Native American Tribes have unique consultative roles in the Section 106 process as described at 36 C.F.R § 800.2(c). When referenced in this Cultural Resources Study Plan, "consultation with the CRWG" refers to consultation with all participants in the CRWG, including individual consultation with Native American Tribes as required pursuant to 36 C.F.R § 800.2(c).

the sites identified during the Study Year Two investigation. GRDA will provide a supplemental report on Reconnaissance Surveys conducted subsequent to the USR.

- During Study Years One and Two, conduct site evaluations to include Phase II Intensive Surveys (Intensive Surveys) of select archaeological sites where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation.
- Following Study Year One, prepare an Intensive Survey Report as part of ISR that provides the results of site evaluations and assessments and recommendations for NRHP eligibility, and/or additional investigations and mitigation, as necessary. Following Study Year Two, prepare the same report as part of the USR for the sites evaluated during the Study Year Two investigation. GRDA will provide a supplemental report on Intensive Surveys conducted subsequent to the USR.
- Consult with Native American Tribes and THPOs to develop and conduct an inventory of properties of traditional religious and cultural importance (often referred to as "traditional cultural properties" [TCP]) within the APE.
- Determine appropriate management measures for identified resources and the need for additional resource investigations in consultation with the CRWG.
- Develop an HPMP in consultation with the CRWG to provide appropriate measures for the management of historic properties within the Project's APE through the term of the new license. The HPMP would be prepared during the Integrated Licensing Process (ILP) and filed with 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.

The ILP affords a limited, two-year window (Study Year One and Study Year Two) for conducting cultural resources studies during Project relicensing – particularly when considering the vast geographic area occupied by the Project and other areas that may be affected by Project operations.

Recognizing the constraints of the ILP in the context of the overall geographical scope of the anticipated APE for the Pensacola Project is important to developing study methods and schedules that can realistically achieve the goals of the study. For this reason, GRDA's approach to the study will be to: (1) work with the CRWG to identify high-priority areas and sites within the APE for study during the two-year ILP process for purposes of informing FERC's analyses under both Section 106 and the National Environmental Policy Act (NEPA); and (2) continue cultural resource investigations post-licensing (as necessary) over a longer period of time as part of the HPMP. This longer-term phased approach has been successfully implemented at other large FERC-licensed projects.

2.2. Agency and Native American Tribe Resource Management Goals

In considering a new license for the Project, FERC is the lead agency for compliance with applicable federal laws, regulations, and policies pertaining to historic properties, including the

National Historic Preservation Act of 1966, as amended (NHPA)[6]. Section 106 of the NHPA (Section 106)[7] directs federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment.

The regulations implementing Section 106 (36 Code of Federal Regulations [C.F.R.] Part 800) define "historic properties" as any pre-contact or historic period district, site, building, structure, or individual object included in or eligible for inclusion in the NRHP. This term includes artifacts, records, and remains that are related to and located within historic properties, as well as TCPs that meet the National Register Criteria.

The Secretary of the Interior has established the criteria for evaluating properties for inclusion in the NRHP (36 C.F.R. Part 60). In accordance with the criteria, properties are eligible if they are significant in American history, architecture, archaeology, engineering, or culture. The quality of significance is present in historic properties that possess integrity[8] of location, design, setting, materials, workmanship, feeling, or association and meet one or more of the National Register Criteria:

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: Are associated with the lives of persons of significance in our past; or
- Criterion C: That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components could lack individual distinction; or
- Criterion D: That have yielded, or could be likely to yield, information important in prehistory or history.

Normally, NRHP eligibility requires a property to be at least 50 years of age. Resources less than 50 years of age that are highly significant and meet the "special criteria considerations" as outlined in the regulations (36 C.F.R. § 60.4) also may be eligible for the NRHP.

The implementing regulations of Section 106 are intended to accommodate historic preservation concerns with the needs of federal undertakings through a process of consultation among agency officials, federally recognized Native American Tribes, SHPOs, THPOs, and other parties, including the public, as appropriate.

Concurrent with the filing of the PAD and Notice of Intent (NOI), GRDA requested designation as the Commission's non-federal representative for carrying out informal consultation pursuant to Section 106. The Commission granted GRDA's request by notice dated January 12, 2018.

[6] 54 U.S.C. § 300101 *et seq.*
[7] 54 U.S.C. § 306108
[8] Integrity is the authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's pre-contact or historic period (National Park Service 1997). The integrity of archaeological resources is generally (although not exclusively) based on the degree to which remaining evidence can provide important information (National Register Criterion D). If the context and association of archaeological material found at a site are disturbed, the archaeological site may not possess integrity and would, therefore, be ineligible for inclusion in the NRHP.

While GRDA is authorized to consult in an informal capacity, the Commission remains legally responsible for all agency findings and determinations under Section 106.

2.3. Background and Existing Information

Archaeological and historic resources within the Project's vicinity have been inventoried by avocational archaeologists and historians and as a result of prior cultural resources studies conducted in the area. In preparing the PAD, GRDA conducted a search of publicly available literature, as well as records housed at the OAS to summarize the cultural context of the Project and to identify known archaeological and historic resources within a one-mile buffer zone of the Project, including those properties listed in or eligible for the NRHP. While the one-mile buffer is much larger than the expected APE for this undertaking, a review of previously reported archaeological and historic resources within a one-mile radius of the Project was conducted to characterize the types of historic properties that may occur within the APE.

Section 6.9 of the PAD summarizes the pre-contact and historic context for the Project and presents information on reported archaeological sites and historic resources (GRDA 2017). In total, 195 archaeological sites were identified within one mile of the Project. One of the archaeological sites within the search radius is considered eligible for inclusion in the NRHP. A total of 50 of the sites are considered not eligible for inclusion in the NRHP, 125 have unknown NRHP eligibility statuses, and the remaining 19 sites have unassessed NRHP eligibility statuses. Sites within the current FERC-established Project Boundary are either considered not eligible for the NRHP or have not been evaluated for NRHP eligibility.

The Oklahoma SHPO's website for the NRHP in Oklahoma was also consulted during development of the PAD to identify any NRHP-listed or eligible historic architectural properties or districts within one mile of the Project. A total of eight NRHP historic architectural properties/districts are located within one mile of the Project. One of the eight properties/districts (Pensacola Dam Historic District) is located within the current Project Boundary. The Pensacola Dam Historic District was listed on the NRHP in September 2003. The district includes three buildings – a substation, an observation building, and a powerhouse designed by noted Oklahoma architect John Duncan Forsyth. Four structures – the multi-arched dam, two spillways, and a pumping/intake structure – are also included in the historic district.

Additionally, the Oklahoma Landmarks Inventory (OLI) Database found 150 other historical sites within one mile of the Project.

As summarized above, the Project Boundary encompasses a historic district listed in the NRHP, as well as archaeological and historic resources which may be eligible for inclusion in the NRHP (but have not been evaluated). In addition, there may be unknown historic properties or archeological sites within the Project Boundary and other locations within the APE that may be outside the Project Boundary. This proposed Cultural Resources Study will identify historic and archaeological resources within the Project's APE that may be affected by relicensing the Project.

2.4. Nexus between Project Operations and Effects on Resources

The continued operation and maintenance of the Project may have the potential to directly, indirectly, or cumulatively affect historic properties listed in or eligible for inclusion in the NRHP during the term of any new license issued by the Commission. Effects on cultural resources may potentially result from Project-related activities, such as reservoir level fluctuations attributable to hydropower operations, modifications to Project facilities, or other Project-related, ground-disturbing activities (e.g., new construction).

Effects on the integrity of cultural resources can come from a variety of sources, including the ongoing direct, indirect, or cumulative effects of shoreline fluctuations, recreation, public use, shoreline development, and routine maintenance activities. These potential activities are most likely to impact archaeological sites along the reservoir's shoreline.

2.5. Area of Potential Effects

The study area for the Cultural Resources Study includes the APE. GRDA intends to define an APE in consultation with the CRWG as a component of the Cultural Resources Study. GRDA tentatively proposes the following APE:

> *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.*

As described in Section 2.6 of this study plan, Year One fieldwork and study will concentrate on locations within the current FERC-approved Project Boundary (Figure 2.5-1). GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including hydraulic modeling studies) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to effect historic properties, should any be present. This consultation will establish the locations for fieldwork and study during Study Year Two.

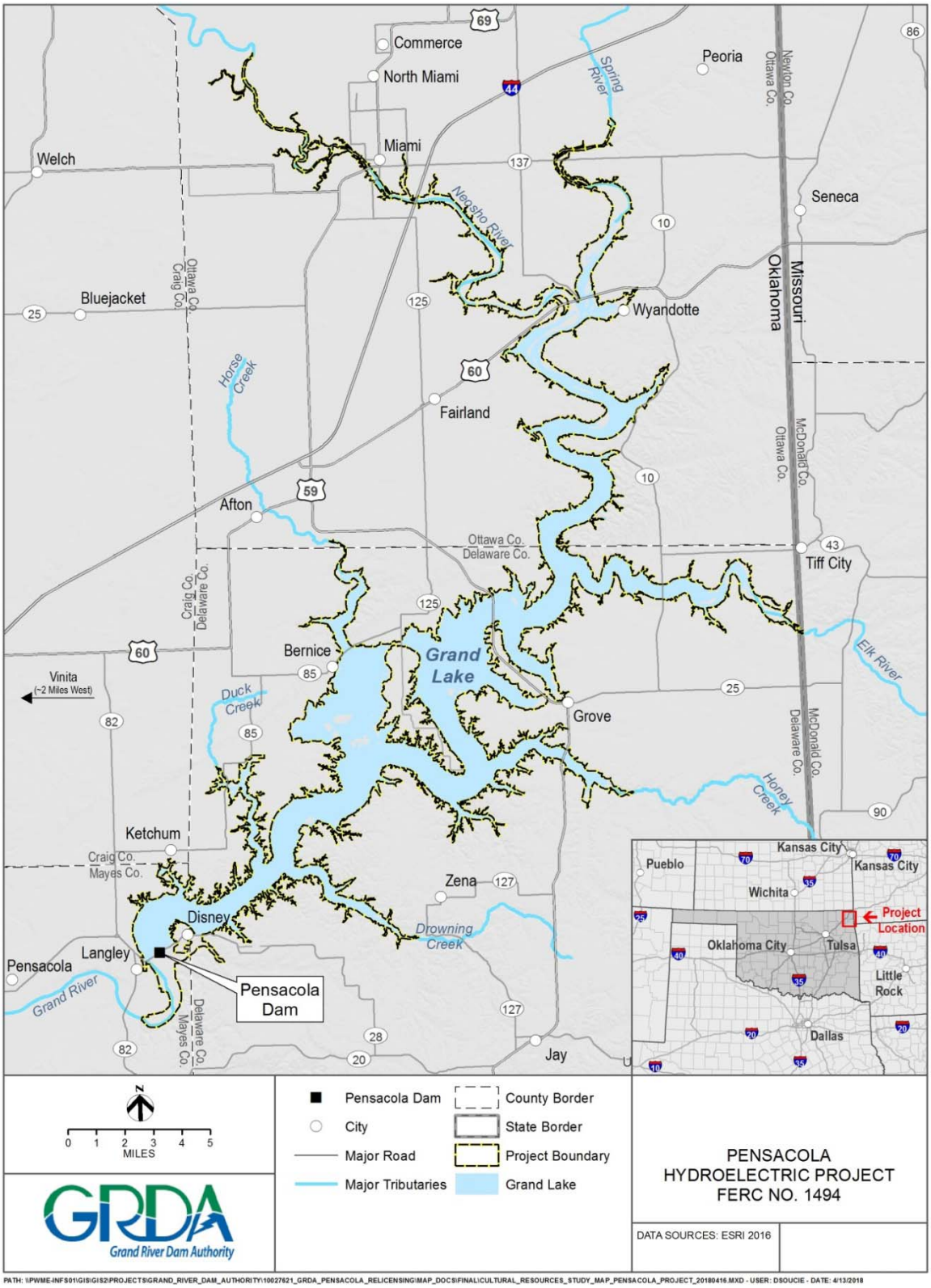


Figure 2.5-1. FERC-approved Boundary for the Pensacola Project.

2.6. Methodology

2.6.1. Area of Potential Effects

GRDA has tentatively proposed an APE as presented in Section 2.5 of this study plan. Pursuant to the implementing regulations of Section 106 at 36 C.F.R. § 800.4(a), GRDA will consult with the CRWG to determine and document the APE for the Project as defined in 36 C.F.R. § 800.16(d).

As tentatively defined in Section 2.5, the APE includes lands outside the current Project Boundary where Project-related operations or activities may have a direct, indirect, or cumulative effect on historic properties.

GRDA recognizes that the APE is not intended to be static, but "should be adjusted as a federal agency further develops the details of the undertaking and learns more about potential historic properties and how they may be affected" (ACHP 2009). Accordingly, and consistent with the ACHP's Section 106 Archaeology Guidance, the geographic extent of the APE may be refined in Study Year Two based on the results of hydraulic modeling and/or other studies and in consultation with the CRWG.

2.6.2. Background Research and Archival Review

Prior to initiating Year One fieldwork and study, GRDA will conduct background research and an archival review to inform the specific research design and the historic and environmental contexts of the APE. The background research and archival review will be conducted by a qualified cultural resources professional[9]. GRDA will review relevant sources of information that may include (but are not necessarily limited to):

- Information on archaeological sites, historic architectural resources, and previous cultural resources studies on file with OAS, Oklahoma SHPO, and Native American Tribes;
- Available nomination forms and other relevant information for properties listed on or nominated for the NRHP, Oklahoma State Register of Historic Properties, and any tribal Registers of Historic Places;[10]
- Available reports on previous cultural resources studies conducted within the APE;[11]

[9] The term "qualified cultural resources professional" is defined in Section 2.7 of this study plan.

[10] GRDA provided summary data on the NRHP eligibility of previously recorded resources within the APE in the PAD (GRDA 2017). In general, this data was derived from site forms prepared by individuals or organizations that recorded the site. This summary information was not intended to be exhaustive, but was included in the PAD and PSP to provide a general characterization of the types of archaeological resources within the Project area and the relative status of those resources. Additional research regarding the NRHP eligibility of previously reported archaeological and historic resources will be conducted as a component of the background research and archival review.

[11] As discussed in the PAD, archaeological surveys of the Project area were conducted between 1937 and 1940 by the Works Progress Administration (WPA), and additional survey work continued after the creation of Grand Lake. In developing the PAD, GRDA reviewed archival information and documents on file with OAS. The WPA reports were not readily available from OAS or in GRDA's archives. As part of this background research and archival review task, GRDA will conduct an additional review of its

- A review of the OLI and Oklahoma's NRHP listings;
- Historic maps and aerial photographs of the APE, including relevant plat and Sanborn maps;
- Aerial photographs of the APE, including historic, pre-Project aerial photographs (as available);
- 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 CRWG or other relicensing participants.

As part of this background research and archival review, GRDA will coordinate with Native American Tribes to arrange meetings with THPOs and/or other representatives that may have information or files relevant to the location of archaeological and historic resources within the APE. If CRWG participants identify avocational archaeologists or other parties that may have relevant information pertaining to the location and nature of archaeological sites within the APE, GRDA will attempt to coordinate with identified individuals to collect such information.

GRDA will also undertake limited field observations as part of the background research and archival review to better characterize and document existing shoreline conditions at the reservoir and inform the Pre-fieldwork Report (see Section 2.6.3 of this study plan). These field observations will be conducted by an archaeologist and geoarchaeologist/geomorphologist to assist GRDA and the CRWG in identifying appropriate areas of the APE for study.

2.6.3. Pre-fieldwork Report and Pre-fieldwork Meetings

Pre-fieldwork Report

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

- Previously reported archaeological sites and historic resources, relevant map-documented structures, the geographic extent of previous cultural resources surveys, locations of historic and/or archaeological significance identified in consultation with Native American Tribes, and properties listed on or nominated for the NRHP, Oklahoma State Register of Historic Properties, and any tribal Registers of Historic Places;

archives, consult with OAS, and review information on file with local, state, and federal repositories in an effort to obtain copies of the WPA reports.

- 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;
- Areas identified within the APE where erosion or other Project-related effects are occurring; and
- Lands recommended for survey, including whether recommended survey areas are on lands owned by GRDA.

As an appendix to the Pre-fieldwork Report, GRDA will provide the CRWG with copies of all previous study reports, background information, or other relevant records identified and reviewed during development of the report (see Section 2.8 of this study plan regarding data confidentiality).

Pre-fieldwork Meetings

Based on the Pre-fieldwork Report, GRDA will consult with the CRWG to identify high-priority areas and sites within the APE for survey during Study Year One. GRDA anticipates that this consultation will include a Year One Pre-fieldwork Meeting with the CRWG in Tulsa, Oklahoma, to discuss the results and recommendations in the Pre-fieldwork Report and to finalize Reconnaissance Survey locations for Study Year One. Subsequent to the Year One Pre-fieldwork Meeting, GRDA will distribute a final map of identified survey areas for Study Year One to CRWG participants and file a copy of the map with the Commission.

GRDA will also invite the CRWG to participate in a Study Year Two Pre-fieldwork Meeting prior to the commencement of Study Year Two surveys. The purpose of the Study Year Two Pre-fieldwork Meeting will be to: (1) review the results of Study Year One surveys and evaluations; (2) review the results of other studies conducted in support of Project relicensing to refine the APE; and (3) identify Reconnaissance Survey locations for Study Year Two. Subsequent to the Year Two Pre-fieldwork Meeting, GRDA will file a final map of the revised APE and proposed survey areas for Study Year Two with the Commission and distribute the map to CRWG participants.

2.6.4. Cultural Resources Field Investigations

GRDA is proposing to conduct Reconnaissance Surveys of the Project's APE during Study Year One and Study Year Two. The Cultural Resources Study Plan also includes Intensive Surveys to evaluate and assess certain archaeological resources during the pre-application study period. Specifically, GRDA is proposing to conduct archaeological site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys may indicate the Project could be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation.

GRDA recognizes that Native American Tribes, THPOs, BIA, OAS, and Oklahoma SHPO have varying requirements/restrictions for the identification and evaluation of archaeological resources, the documentation and recordation of archaeological sites, and the curation of archaeological material. Further, GRDA recognizes that archaeological excavations on federal lands or the collection of cultural material from federal lands requires a permit issued by the

federal land manager pursuant to the Archaeological Resources Protection Act of 1979 (ARPA)[12]. GRDA will apply to the BIA for a permit prior to conducting any archaeological excavations on tribal trust lands and will consult with affected Native American Tribes regarding ARPA permit requirements.

In consideration of these factors, GRDA will consult with the CRWG prior to the commencement of archaeological fieldwork, including individual Native American Tribes, THPOs, the BIA, OAS, and Oklahoma SHPO to finalize:

- **Reconnaissance Survey Methodology** – In general, GRDA has proposed to conduct archaeological Reconnaissance Surveys consistent with the Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016). Through the ARPA permit application process, GRDA will consult with individual THPOs, Native American Tribes, and the BIA to determine if the proposed methods are appropriate for each Tribe's trust lands. Similarly, GRDA will consult with the Oklahoma SHPO and OAS to determine if the proposed methods are appropriate for non-federal lands within the APE.
- **The Documentation and Evaluation of Archaeological Sites and the Collection of Cultural Material** – GRDA understands that some Native American Tribes permit only limited documentation of archaeological sites and/or do not permit the collection, photography, sketching, or videography of archaeological material. Accordingly, GRDA will consult with Native American Tribes, THPOs, and the BIA through the ARPA permit application process regarding the limitations on documentation and evaluation of archaeological sites and the collection of cultural material. If located on trust lands, artifacts will not be collected, videoed, photographed, or sketched without prior written consent of the BIA Archeologist and the relevant federal Native American Tribe for which the land is held in trust. Similarly, GRDA will consult with the Oklahoma SHPO and OAS to determine if the proposed methods are appropriate for non-federal lands within the APE.
- **Curation of Artifacts and Other Cultural Material** – GRDA understands that it is desirable to identify appropriate repositories for the curation of artifacts and other cultural material prior to the commencement of fieldwork. Accordingly, GRDA will consult with Native American Tribes, THPOs, and the BIA through the ARPA permit application process regarding the appropriate location(s) to curate artifacts and cultural material recovered from each Native American Tribe's trust lands. Similarly, GRDA will consult with the Oklahoma SHPO and OAS to determine the appropriate curation requirements for artifacts and cultural material recovered from non-federal lands within the APE.
- **Inadvertent Discoveries Plan** – GRDA will develop a plan for Inadvertent Discoveries of archaeological material in consultation with the Native American Tribes, THPOs, BIA, OSA, and Oklahoma SHPO. The plan will provide procedures in the event that unanticipated archaeological material, including artifacts or features, are encountered during cultural resources studies. For example, if GRDA observed artifacts eroding from a shoreline area within the APE that was not scheduled for cultural resources investigations, the Inadvertent Discoveries Plan would describe how GRDA would address and study that location.

[12] 16 U.S.C. §§ 470aa *et seq*.

- **Plan for the Discovery of Human Remains** – GRDA will develop a Plan for the Discovery of Human Remains in consultation with the Native American Tribes, THPOs, BIA, OSA, and Oklahoma SHPO. The plan will provide procedures in the event of the unanticipated discovery of human remains, sacred objects, and items of cultural patrimony during the Cultural Resources Study. Treatment and disposition of any human remains that may be discovered will be managed in a manner consistent with the Native American Graves Protection and Repatriation Act (NAGPRA) (Public Law [P.L.] 101-601; 25 U.S. Code [U.S.C.] 3001 *et seq*.)[13]; the Council's Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects (ACHP 2007); and the Burial Desecration Law – Oklahoma Statute Chapter 47 (Section 1168.0 - 1168.6). Any human remains, burial sites, or funerary objects that are discovered will at all times be treated with dignity and respect.

GRDA will file documentation of consultation regarding Reconnaissance Survey methodology, the documentation and evaluation of archaeological sites, the collection of cultural material, and the curation of artifacts and other cultural material with the Commission prior to the commencement of cultural resources field investigations.

In addition to these above considerations, which are to be finalized in consultation with the CRWG, GRDA is also proposing to implement the following as components of the archaeological field investigations:

- **Tribal Monitors** – GRDA welcomes the participation of tribal monitors during the conduct of archaeological field investigations, including Reconnaissance and Intensive surveys. GRDA will compensate one tribal monitor per day for participation in the surveys, in accordance with terms to be agreed upon by between GRDA and Native American Tribes. Additional, uncompensated monitors are also welcome to participate in Reconnaissance Surveys and site evaluations.
- **Adjacent Lands and Lands Not Owned by GRDA** – Lands within the Project Boundary include a combination of private lands, federal lands, and lands owned by GRDA. Accordingly, prior to the start of any archaeological field investigations, it may be necessary for GRDA to conduct land surveys at locations selected in consultation with the CRWG for archaeological investigations to determine the boundaries of land ownership. If lands within the APE selected for archaeological field investigations are not owned by GRDA, GRDA will make a reasonable and good faith effort to obtain landowner permission to access those lands for purposes of completing the surveys. Similarly, if a portion of an archaeological site within the APE is: (1) located on lands that are not owned by GRDA; and (2) appears to extend onto adjacent lands that are not owned by GRDA, GRDA will make a reasonable and good faith effort to obtain adjacent landowner permission to access and survey the site for purposes of completing the archaeological field investigations. Reasonable and good faith efforts to obtain

[13] Pursuant to 43 C.F.R. Part 10, NAGPRA applies to human remains, sacred objects, and items of cultural patrimony (described as "cultural items" in the statute) located on federal or tribal lands or in the possession and control of federal agencies or certain museums. Regardless of where cultural items are discovered, the principles described in NAGPRA's implementing regulations will serve as guidance for GRDA's actions should the remains or associated artifacts be identified as Native American and to the extent such principles and procedures are consistent with any other applicable requirements.

landowner permission will be conducted in coordination and consultation with Native American Tribes.

- **Eligibility of Archaeological Sites** – If any portion of an archaeological site is located within the APE, GRDA will treat and consider the site as eligible for the NRHP unless or until an evaluation and assessment of the site has been completed and the relevant THPO/SHPO and Commission (as lead federal agency) concur that the site is ineligible.
- **Archaeological Investigations Conducted at Normal Low Pond Elevations** – During the pre-application study period, GRDA intends to conduct Reconnaissance and Intensive surveys between May and August of 2019 and 2020 in order to provide the results of these studies to the CRWG concurrent with the ISR and USR, respectively (see Section 2.11 of this study plan). GRDA believes that the timing of these studies will maximize the field effort that can be conducted during the pre-application study period, while avoiding inclement weather conditions that could delay field investigations (e.g., snow and ice during the winter months). However, per the Project's rule curve, the elevation of Grand Lake will be above the normal low pond elevations from May 1 through October 1. Accordingly, GRDA proposes to extend the archaeological field investigations from October 1 until December 31, 2019 (as weather conditions allow), and to report on those investigations in the Study Year Two reports on Reconnaissance and Intensive surveys filed with the USR. Similarly, GRDA intends to extend Study Year Two archaeological field investigations beyond the filing of the USR until December 31, 2020 (as weather conditions allow), and will provide a supplemental report on archaeological investigations to the CRWG in Quarter 1 of 2021 following completion of the fieldwork.
- **Detailed Schedule for Archaeological Field Investigations** – Section 2.11 of this study plan provides a general schedule for the conduct of the Cultural Resources Study. GRDA recognizes and expects that this schedule will be further refined in consultation with the CRWG prior to the commencement of field surveys. GRDA will provide more detailed survey schedules to the CRWG on a weekly basis during Study Years One and Two, including notice of the locations where archaeological fieldwork is scheduled to be conducted.

Reconnaissance Surveys

GRDA will conduct Reconnaissance Surveys of the Project's APE during Study Years One and Two. The proposed methods for the Reconnaissance Surveys are the same for both study years and take into account the nature and extent of potential effects on historic properties and the likely nature and location of historic properties within the APE (36 C.F.R. 800.4(b)(1)). The Reconnaissance Surveys will be directed by a qualified cultural resources professional retained by GRDA (see Section 2.7 of this study plan) and will be in accordance with guidance documents promulgated by the Oklahoma SHPO and others, including:

- Guidelines for Developing Archaeological Survey Reports in Oklahoma and Report Components (Oklahoma SHPO 2013a);
- Architectural/Historical Resources Survey Field Guide (Oklahoma SHPO 2013b); and
- Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016).

The Reconnaissance Surveys will include a visual reconnaissance and archaeological subsurface testing of the exposed portions of the reservoir shoreline areas within the APE at

locations identified in consultation with the CRWG based on the results of the Pre-fieldwork Report. The purpose of the Reconnaissance Survey is to identify and document any previously recorded or unrecorded archaeological and/or historic architectural resources.

In general, GRDA is proposing to use the Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016) for conducting shovel test excavations to identify and delineate archaeological sites. However, as noted in Section 2.6.4 of this study plan, GRDA will consult with Native American Tribes, THPOs, the BIA, the OAS, and Oklahoma SHPO to confirm the appropriate survey methods. Accordingly, the methods may be adapted from the Osage Nation THPO's Archaeological Block Survey Standards as necessary, based on land ownership and the required survey methods of the specific landowner.

Pursuant to the Osage Nation THPO's Archaeological Block Survey Standards, shovel tests measuring 30 centimeters in diameter will be excavated to the bottom of Holocene deposits, if possible. Each shovel test will be excavated in 10 centimeter levels, with sediments screened through ¼-inch mesh unless high clay or water content requires that they be troweled through. Generally, GRDA anticipates that subsurface testing will be conducted regardless of land use and visibility; if subsurface testing is not conducted, GRDA will document specific reasons (e.g., standing water, slopes exceeding 20 percent, clear evidence of significant and deep subsurface disturbance).

If archaeological material is observed during the Reconnaissance Surveys, GRDA will delineate site boundaries. A minimum of nine (9) shovel tests will be excavated in a cruciform pattern that is perpendicular extending from the center of the artifact discovery location. A shovel test will be placed every five (5) meters until two (2) negative shovel tests are sequentially excavated. The maximum length and width of each site will be measured and recorded and the site's location geo-located. Site dimensions and elevations will be recorded on standardized field forms along with a description of the site settings and notations regarding landform, site aspect, temporal affiliations (if possible) and density of observed materials, site condition, any evidence of Project-related effects, and the nature of site deposits. Site boundaries will be located on Project maps and U.S. Geological Survey (USGS) topographic maps.

Generally, GRDA is proposing to geo-locate, record, sketch, and collect observed artifacts, features, or other pre-contact or historic period cultural material (as appropriate), and any new archaeological sites discovered will be documented on Oklahoma Archaeological Site Survey Form (Appendix A) or Isolated Find Form (Appendix B). However, as described above, GRDA will consult with Native American Tribes, THPOs, and the BIA through the ARPA permit application process regarding the limitations on documentation of archaeological sites and the collection of cultural material. If located on trust lands, artifacts will not be collected, videoed, photographed, or sketched without prior written consent of the BIA Archeologist and the relevant federal Native American Tribe for which the land is held in trust. As described above, GRDA will identify appropriate repositories for curation prior to the commencement of field investigations.

The Reconnaissance Surveys will also document historic architectural resources within the Project's APE. Architectural investigations will be conducted by a qualified Architectural Historian who meets the Secretary of the Interior's Professional Qualification Standards. If individual historic architectural resources or districts that potentially meet the NRHP criteria are observed, GRDA will geo-locate the resource and delineate the boundary. Relevant dimensions will be estimated and recorded, and the location will be documented on Project maps and USGS topographic maps. GRDA will take a minimum of two representative photos of the architectural resources, and GRDA will record land use patterns, the general age of the area,

the character of the building stock (such as type, style, building material, integrity, and condition), the landscaping, and particularly notable and representative features. GRDA will complete a Historic Preservation Resource Identification Form for each resource (Appendix C).

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 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 NRHP-eligibility of a site or specific mitigation and treatment measures.

Following Study Year One, GRDA will prepare a Reconnaissance Survey Report as part of the ISR that provides study results and recommendations for identified archaeological and historic resources, including any recommendations for additional cultural resources investigations, as appropriate. GRDA will consult with the CRWG regarding the Study Year One Reconnaissance Survey Report.

During Study Year Two, GRDA will conduct a second Reconnaissance Survey of the APE. The locations of the Study Year Two survey will be determined in consultation with the CRWG. GRDA expects that the results of the hydraulic modeling study and other studies conducted in support of Project relicensing 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 USR that provides study results and recommendations for identified archaeological and historic resources, including any recommendations for additional cultural resources investigations, as appropriate. GRDA will consult with the CRWG regarding the Study Year Two Reconnaissance Survey Report.

Intensive Surveys

GRDA will conduct limited evaluations and assessments of certain archaeological resources during Study Years One and Two. GRDA will consult with the CRWG if evidence and observations during the Reconnaissance Surveys indicates that: (1) the Project may be having an ongoing adverse effect on the integrity of a site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation.

If conditions are encountered that indicate evaluation of a site is warranted during Study Years One or Two as described in the preceding paragraph, GRDA will present the information to the CRWG during quarterly meetings, including a plan for evaluation and the recommendations of tribal monitors (see Section 2.9 of this study plan). If the site is located on non-federal lands, and the Oklahoma SHPO and OAS concur that site evaluation is appropriate, GRDA will complete the site evaluation pursuant to the approved plan. If the site is located on tribal trust lands and the relevant Native American Tribe, THPO, and BIA concur that site evaluation is warranted, GRDA will complete the site evaluation pursuant to the plan as approved by the relevant Native American Tribe, THPO, and BIA.

Following Study Year One, GRDA will prepare an Intensive Survey Report as part of the ISR that provides the results of site evaluations and assessments and recommendations for NRHP eligibility, and/or additional investigations and mitigation, as necessary. Following Study Year

Two, GRDA will prepare the same report as part of the USR for the sites evaluated during the Study Year Two investigation.

2.6.5. Traditional Cultural Properties

TCPs are properties of traditional religious and cultural importance to a Native American Tribe that meet the National Register criteria (36 C.F.R. § 800.16(l)(1)). TCPs may be eligible for inclusion in the NRHP because of their association with cultural practices or beliefs of a living community that are: (1) rooted in that community's history; and (2) important in maintaining the continuing cultural identity of the community.

GRDA proposes to conduct a TCP Inventory of TCPs located within the Project's APE that are eligible for inclusion in the NRHP. GRDA recognizes the special expertise that the Native American Tribes have in identifying properties that have traditional and religious importance 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 APE, taking into account the guidance provided in National Register Bulletin No. 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1990). Recognizing that specific methods of the TCP Inventory may differ between Tribes, GRDA proposes the following general approach to the TCP Inventory[14]:

- GRDA will identify qualified ethnographers to assist in the development of the TCP Inventory and solicit resumes for qualified individuals to share with interested Native American Tribes. At a minimum, a qualified individual will have a post-graduate degree and supervised training in ethnographic research and prior experience respectfully conducting TCP Inventories and consulting with Native American Tribes. Resumes will include reference information for Native American Tribes that the ethnographer has previously consulted with in conducting TCP studies.
- GRDA will initiate the TCP Inventory by meeting individually with each interested Native American Tribe at a location of the tribe's choosing in Quarter 1 of 2019. The purpose of this meeting will be to describe the goals of the TCP Inventory, summarize the guidance provided in National Register Bulletin No. 38, and consult with each tribe to select an appropriate ethnographer to support the inventory. To the extent possible, GRDA anticipates selecting one ethnographer to lead the TCP Inventory.
- The ethnographer will meet with each of the Tribes at a location of the tribe's choosing to develop a scope for the TCP Inventory in Quarter 2 and Quarter 3 of 2019. At a minimum, GRDA anticipates that the scope will specify:
    - The tribe's confidentiality requirements regarding the nature, location, and documentation of TCPs;

[14] GRDA recognizes that TCPs may be identified that are within the APE but are not located on lands owned by GRDA. In such instances, GRDA will make a reasonable and good faith effort to obtain landowner permission to access those lands for purposes of completing the TCP Inventory. Reasonable and good faith efforts to obtain landowner permission will be conducted in coordination and consultation with Native American Tribes, and may include in-person requests, written correspondence, and phone calls.

  - A process for conducting interviews with representatives identified by the tribe, including the identification of specific questions, topics, or themes to avoid or focus on during interviews;
  - A process for identifying and reviewing any relevant documents, records, or other information provided by the tribe;
  - A process and requirements for conducting site visits and documenting TCPs;
  - A process for reviewing documented archaeological and historic properties within the Project's APE with the tribe to identify correlations between TCPs and archaeological or historic resources;
  - A process for conducting an evaluation of TCPs to determine their eligibility for the NRHP; and
  - A process for developing and reviewing a TCP Inventory Report in consultation and coordination with the tribe.

- GRDA will finalize a written scope for the TCP Inventory and provide to each Native American Tribe for review and comment in Quarter 4 of 2019.
- GRDA will conduct the TCP Inventory as described in the scope in 2020. GRDA anticipates that interviews with tribal representatives and a review of information provided by Tribes will be conducted in Quarter 1 and Quarter 2 of 2020. Site visits and a review of archaeological study reports will be conducted in Quarter 3 of 2020, following completion of Year Two Studies and the filing of the USR in November 2020. Evaluation of TCPs and development of a TCP Inventory Report are expected to occur in Quarter 4 of 2020 and Quarter 1 of 2021.

2.6.6. Programmatic Agreement

Pursuant to 36 C.F.R. Part 800.14(b), GRDA anticipates that FERC will enter into a Programmatic Agreement (PA) with appropriate parties 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 NHPA Section 106 for the relicensing of the Project, and is likely to provide for GRDA to implement an HPMP for the long-term management of historic properties during the new license term.

2.6.7. Historic Properties Management Plan

In anticipation of a PA, GRDA will prepare an HPMP providing measures that will direct GRDA's management of historic properties within the Project's APE throughout the term of the new license. The HPMP is not intended to be a static document, but will include measures for additional consultation and processes for additional identification and treatment of historic properties. GRDA will develop the HPMP in consultation with the CRWG; through this consultation, GRDA and the CRWG will develop specific management measures to be incorporated into the HPMP. GRDA anticipates that the CRWG will have an ongoing role in the HPMP implementation. GRDA expects to file the HPMP with FERC as part of its relicensing application, such that it may be approved and implemented immediately upon the effective date of the new license issued by FERC.

GRDA has outlined the following three goals for managing historic resources under the HPMP:

- Continue ongoing operations of the Project while maintaining and preserving the integrity of historic properties within the Project Boundary, in consultation with the CRWG;
- To the extent possible, avoid, minimize, or mitigate adverse effects on historic properties that would be affected by the continued operation of the Project under the new license, in consultation with the CRWG; and
- Ensure historic properties are managed in an efficient and cost-effective manner that does not impede GRDA's ability to comply with the terms of its operating license and other applicable federal, state, and local statutes.

To address these goals, GRDA will develop an HPMP in consultation with the CRWG and in accordance with the Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects, promulgated by the FERC and the ACHP on May 20, 2002. At a minimum, GRDA anticipates that the HPMP will address the following items (ACHP and FERC 2002):

- Any additional studies necessary to assist in the identification or management of historic properties within the 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 CRWG, including areas where Reconnaissance Surveys could not be completed during the ILP;
- A plan and schedule for completing Intensive Surveys for sites identified within the APE in consultation with the CRWG;
- A plan and schedule for completing any additional work necessary to finalize the TCP Inventory in consultation with the appropriate Native American Tribes and THPOs;
- Measures for conducting additional surveys and evaluation of submerged areas when and if lake levels allow (e.g., during maintenance drawdowns of the reservoir).
- Potential effects on historic properties resulting from the continued operation and maintenance of the Project, including potential effects on the NRHP-listed Pensacola Dam Historic District;
- Management and treatment measures for historic properties (including any identified 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;
- 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 APE;
- A dispute resolution process;
- Categorical exclusions from further review of effects;
- Public interpretation of the historic and archaeological values of the Projects, if any;

- Specific measures and a schedule for implementing the HPMP;
- Roles and responsibilities of GRDA, the Oklahoma SHPO, OAS, Native American Tribes, and other individuals and organizations in regards to implementation of the HPMP; and
- Coordination with the CRWG during implementation of the HPMP.

2.7. Use of Qualified Personnel

For purposes of this study plan, a "qualified cultural resources professional" is defined as an individual with (1) experience conducting cultural resources studies in Eastern Oklahoma, (2) experience with tribal entities in the area, and (3) who meets the Secretary of the Interior's Professional Qualification Standards (48 Federal Register [F.R.] 44738-44739, Sept. 1983), the standards established by the Oklahoma SHPO, and the qualification requirements for issuance of a permit under ARPA as described at 43 C.F.R. § 7.8(a). The Project team will include: (1) a Principal Investigator that qualifies as a specialist in both Pre-contact Archaeology and Historic Archaeology; or (2) one Principal Investigator on the Project team who specializes in Pre-contact Archaeology and another who specializes in Historic Archaeology. The Project Team will also include an Architectural Historian who meets the Secretary of the Interior's Professional Qualification Standards. Cultural resources studies will be supervised by Principal Investigator's that meet these qualifications, and crew chiefs/field directors will also meet the Secretary of the Interior's Professional Qualification Standards. Cultural resources studies will be supervised by Principal Investigators who are qualified cultural resources professionals, and crew chiefs/field directors will, at a minimum, meet the Secretary of the Interior's Professional Qualification Standards. GRDA will provide the CRWG with the opportunity to review resumes of Principal Investigators and crew chiefs/field directors prior to the start of cultural resources investigations.

2.8. Confidentiality

GRDA is committed to distributing information to the CRWG so that participants can make meaningful and informed decisions and recommendations. However, GRDA understands that there may be information identified or provided by Native American Tribes as confidential or protected under Executive Order 13007. If any Native American Tribe identifies such information in writing, GRDA will only share that information with other parties pursuant to applicable laws and written approval from the Native American Tribe.

GRDA will not share information regarding the location and nature of archaeological resources with the public, and will request that any such information filed with the Commission be afforded privileged status (not for public disclosure). GRDA will coordinate with the BIA to maintain confidentiality regarding locations of archaeological resources on tribal trust lands pursuant to 36 C.F.R. 296.18.

2.9. Consultation and Coordination

GRDA will meet regularly with the CRWG to discuss study implementation and progress, identify and resolve issues, and consult regarding study results and HPMP development. Once the Cultural Resources Study commences, GRDA will meet with the CRWG approximately every 90 days (i.e., quarterly) in Tulsa, Oklahoma, until the Final License Application is filed. In addition to the quarterly CRWG meetings, GRDA or CRWG participants may propose additional consultation meetings as appropriate.

2.10. Consistency with Generally Accepted Scientific Practice

The proposed methods for this study are consistent with accepted scientific practices. The overall approach complies with the ACHP's Section 106 Archaeology Guidance (ACHP 2009)[15] and is consistent with cultural resources studies conducted in support of other relicensing proceedings in Oklahoma. The Cultural Resources Study will allow GRDA to identify archaeological resources that are potentially affected (directly or indirectly) by the Project and to develop appropriate management measures for those resources. In addition, the proposed methods for this study are consistent with FERC study requirements under the ILP. No alternative approaches to this study are necessary.

2.11. Schedule

GRDA initiated consultation with the CRWG to seek concurrence regarding the Project's APE in May 2018, as part of the planned PSP and CRWG meetings. Background research and archival reviews will be conducted from November 2018 – April 2019. GRDA anticipates the Pre-fieldwork Study Report will be completed in April 2019, and that GRDA will hold the Study Year One Pre-Fieldwork Meeting in May 2019. Study Year One Reconnaissance and Intensive surveys will be completed between May and August 2019. The Study Year One Reconnaissance Survey Report and Intensive Survey Report will be prepared as part of the ISR which will be filed in November 2019. GRDA proposes to extend the archaeological field investigations from October 1 until December 31, 2019 (as weather conditions allow), and to report on those investigations in the Study Year Two reports on Reconnaissance and Intensive surveys filed with the USR. GRDA expects that the Study Year Two Pre-Fieldwork Meeting will be held in May 2020, and Study Year Two Reconnaissance and Intensive surveys will be conducted between May and August 2020. The Study Year Two Reconnaissance Survey Report and Intensive Survey Report will be prepared as part of the USR which will be filed in November 2020. GRDA intends to extend Study Year Two archaeological field investigations beyond the filing of the USR until December 31, 2020 (as weather conditions allow), and will provide a supplemental report on archaeological investigations to the CRWG in Quarter 1 of 2021, following completion of the fieldwork. GRDA anticipates that the TCP inventory will be conducted pursuant to the schedule outlined in Section 2.6.5 of this study plan. GRDA will continue to meet regularly with the CRWG as described in Section 2.9 of this study plan. GRDA will consult with the CRWG in the development of a draft HPMP and expects to file the HPMP with the Commission concurrent with the filing of the Final License Application (FLA).

2.12. Level of Effort and Cost

The estimated level of effort for this study is approximately 6,500 hours. The estimated cost of this proposed study is $800,000.

[15] The ACHP's guidance states that "[A] federal agency is not expected to conduct a 100 percent survey of the area of potential effects. Rather, the identification effort should be conditioned by where effects are likely to occur and the likely impact of these effects on listed or eligible archaeological sites. For example, archaeological identification efforts for a license renewal from the Federal Energy Regulatory Commission likely would not involve the entire area of potential effects (APE). Rather it would be directed to those locations within the APE that are experiencing project related effects associated with operation, usually along the shoreline."

3.0 REFERENCES

ACHP (Advisory Council on Historic Preservation). 2007. Policy Statement Regarding Treatment of Burial Sites, Human Remains and Funerary Objects. [Online] URL: http://www.achp.gov/docs/hrpolicy0207.pdf. Accessed January 2018.

ACHP. 2009. Section 106 Archaeology Guidance. [Online] URL: http://www.achp.gov/archguide/. Accessed January 2018.

ACHP and FERC (Federal Energy Regulatory Commission). 2002. Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects. [Online] URL: http://www.achp.gov/ferc-hpmp.pdf. Accessed January 2018.

FERC (Federal Energy Regulatory Commission). 2018. Scoping Document 2 for the Pensacola Hydroelectric Project, P-1494. April 27, 2018.

GRDA (Grand River Dam Authority). 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

National Park Service. 1997. National Register Bulletin No. 16: How to Complete the National Register Registration Form. National Park Service, National Register of Historic Places, Washington, D.C.

Oklahoma SHPO (Oklahoma State Historic Preservation Office). 2013a. Fact Sheet #16: Guidelines for Developing Archaeological Survey Reports in Oklahoma and Report Components. [Online] URL: http://www.okhistory.org/shpo/factsheets/fs16archreports.pdf. Accessed January 2018.

Oklahoma SHPO. 2013b. Architectural/Historic Resources Survey: A Field Guide. [Online] URL: http://www.okhistory.org/shpo/ architsurveys/ fieldguide.pdf. Accessed January 2018.

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

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

[This page intentionally left blank.]

APPENDIX A.
OKLAHOMA ARCHAEOLOGICAL SITE SURVEY FORM

[This page intentionally left blank.]

OKLAHOMA ARCHAEOLOGICAL SITE SURVEY FORM

Site#:

County:

COMPLETE ALL SECTIONS

1.SITE NUMBER AND NAME:

Site Name: (derived from owner's assigned name, etc.)

Project No.: (Temporary number or name during project.)

2.LOCATIONAL INFORMATION:

U.T.M. Reference

Zone: 14
Northing: **Easting:**

Legal Description

____1/4 of ____ 1/4 of ___1/4 **of Section ___ Township ____ Range ____**

U.S.G.S. Quad Name: **Quad Date (revised):**

Other Locational References (i.e., benchmarks, road intersections, bridges, etc., please give distance and bearing to site):

3.OWNER(S) OF PROPERTY:

Name:
Street and Number:
City/Town, State:
Zip:

4.SITE SURVEYED BY:

Name:

Date Recorded:

Reported by (if different):

Name:

Date Reported:

Time spent at site and time of day:

5.CULTURAL AFFILIATION - Cultural Periods (underline one):

Unassigned prehistoric
Paleoindian:
- Early
- Middle
- Late

Archaic:
- Early
- Middle
- Late

Woodland:
- Eastern – may be eastern?
- Plains

Village Farming/Mississippi
Plains Village
Protohistoric/Historic Ind.
Historic non-Indian

Archaeological Cultures, Phases, etc. represented:

How was cultural affiliation determined (diagnostic artifacts, radiocarbon dates, etc.):

6.HISTORIC PHASE IDENTIFICATION (ETHNIC):
Underline appropriate group.

1. Choctaw
2. Cherokee
3. Saux-Fox
4. Pottawatomie
5. Seminole
6. Comanche
7. Apache
8. Kiowa
9. Kiowa-Apache
10. Kickapoo
11. Pawnee
12. Arapaho
13. Ottawas
14. Wichita
15. Quapaw
16. Osage
17. Cheyenne
18. Caddo
19. Shawnee
20. Delaware
21. Creek
22. Dakotas
23. Chickasaw
24. 12 & 17
25. Missouri-Otos
26. Iowa
27. Anglo-American
28. French
29. Spanish
20. Other:

How was historic identification determined?:

7.HISTORIC SITE RANGE (underline one):

0. Missing data; unknown
1. pre-1800
2. 1800-1830
3. 1830-1859
4. 1860-1889
5. 1890-1929
6. 1930-1950
7. 1800-1900
8. 1800-present
9. 1900-present

8.INFERRED SITE TYPE
Please underline those that apply (can be more than one category)

Open habitation w/o mounds	Petroglyph/pictograph
Open habitation with mounds	Isolated burials (<2)
Earth mound (not midden mound)	Cemetery (>2)
Mound complex	Specialized activity sites
Stone mounds/rock piles	Rock alignments (tepee rings, etc.)
Burned rock concentrations	Historic farmstead
Non-mound earthworks	Historic mill/industrial
Rock shelter	Historic fort
Cave	Dugout
Quarry/workshop	Historic trash dump

9.MIDDEN AT SITE (underline):

Don't know	Present, earth
Absent	Present, shell
	Present, rock

10.MATERIALS COLLECTED:

Type	**Number**
Ceramics	
Projectile points/base frags.	
Hafted scrapers	
Drills	
Bifaces/biface fragments	
Unifaces	
Perforators/gravers	
Spokeshaves	
Scrapers (unhafted)	
Debitage (flakes, cores, chunks)	
Ground/pecked/battered stone	
Worked bone/shell	
Human bone	
Faunal remains	
Floral remains	
Other prehistoric	
Historic (describe)	
	Total Items:

Briefly describe diagnostic artifacts including type names. Attach outline drawings:

Materials observed but not collected:

Name and address of owner of other collections from site:

11.ARTIFACT REPOSITORY

Name of institution where artifacts are to be stored:

Photos:
Number of black and white photos:
Number of color photos:

Name and address of institution where photos are filed:

12.EVIDENCE OF RECENT VANDALISM OBSERVED? (Yes or No):

13.SITE CONDITION (underline one):

1. apparently undisturbed
2. <25% disturbed
3. 26-50% disturbed
4. 51-75% disturbed
5. 76-99% disturbed
6. totally destroyed
7. disturbed, % unknown

14.MAJOR LAND USE (underline those that apply):

Cultivated field
Pasture
Woods, forest
Road/trail
Ditch/dike/borrow pit
Landfill
Modern cemetery
Mining
Inundated
Industrial
Residential
Recreation
Commercial
Military
Logging/fire break
Scrub/secondary growth/oil field
Modern dump

Other:

15.AMOUNT OF GROUND SURFACE VISIBLE (underline one):

1. <10%
2. 11-25%
3. 26-50%
4. 51-75%
5. 76-90%
6. 91-100%

Survey Conditions (wet, dry, sunny, ground coverage, etc.):

16.PHYSIOGRAPHIC DIVISION (underline one):

1. High Plains
2. Gypsum Hills
3. Wichita Mountains
4. Red Bed Plains
5. Arbuckle Mountains
6. Sandstone Hills
7. Prairie Plains
8. Ozark Plateau
9. Ouachita Mountains
10. Red River Plains

17.LANDFORM TYPE (underline one):

1. Floodplain
2. Terrace
3. Hillside - Valley wall
4. Dissected Uplands
5. Undissected Uplands

18.LOCALITY TYPE - SPECIFIC SITE SETTING (underline one):

1. Level
2. Knoll - low land
3. Blowout
4. Ridge – upland
5. Mesa
6. Slope
7. Bluff crest
8. Bluff base

19.SOILS (if known):
Association: **Series:**
Type:

20.ELEVATION/SLOPE:

Elevation amsl:
Slope (degrees): **Slope facing direction:**

21.NATURAL VEGETATION (underline one):

1. Short grasses
2. Mixed grasses
3. Tall grasses
4. Cross Timber
5. Shin-oak
6. Mesquite
7. Juniper-pinon
8. Oak-hickory forest
9. Oak-pine
10. Loblolly pine forest

22.SITE AREA (Square Meters):
Basis for area estimate (underline one):
1. Taped 2. Paced 3. Guessed 4. Range-finder
5. Alidade/transit

Confident of site boundaries? (Yes or No):

_____

23.DESCRIPTION OF SITE:

Give physical description of site and its setting, including dimensions, features, nature of materials and artifact concentrations. Include copy of U.S.G.S. topographic map with site location and boundaries marked (and sketch map if appropriate).

24.DRAINAGE (underline one):

1. Arkansas
2. Beaver - N. Canadian
3. Canadian
4. Caney
5. Cimarron
6. Deep Fork
7. Illinois
8. Kiamichi
9. Little R. (McCurtain County)
10. Muddy Boggy
11. Neosho
12. North Fork Red
13. Poteau
14. Red
15. Salt Fork Arkansas
16. Salt Fork Red
17. Verdigris
18. Washita

25.NEAREST NATURAL SOURCE OF WATER (underline one):

1. Permanent stream/creek
2. Intermittent stream
3. Permanent stream
4. Intermittent spring/seep/bog
5. Natural lake
6. River
7. Slough or oxbow lake
8. Relic stream channel
9. Also consider wells if site is historic

26.DISTANCE TO WATER (in 10's of meters):

27.INVESTIGATION TYPE (underline one):

1. Reconnaissance (survey)
2. Intensive (survey & testing)
3. Excavated
4. Volunteered report

28.SIGNIFICANCE STATUS (underline one):

National Register Property
Eligible for National Register
Nominated to National Register by S.H.P.O.
Considered eligible but not nominated by S.H.P.O.
Inventory site
National Register status not assessed

29.DISCUSS THE POTENTIAL SIGNIFICANCE OF THE SITE:

30.PUBLISHED OR FORTHCOMING REPORTS ON THE SITE:

APPENDIX B.
ISOLATED FIND FORM

[This page intentionally left blank.]

OKLAHOMA ARCHEOLOGICAL SURVEY
ISOLATED FIND RECORD

County: **Temp. No.:** **Find No.:**
U.S.G.S. Topo(Date)
Cultural Affiliation:

Project:
Location:

U.T.M.: Zone: **Northing:** **Easting:**
__1/4_of__1/4 of__ 1/4 of __ 1/4 **of Section ___ Township ___ Range ___**

Present Owner:
Address:

Description of Find Locale:

Topographic Setting:
State of Preservation: **Cultivation:**
Erosion: **Vegetation:**
Soil: **Elevation:** **Slope:**
Location of Water Supply:

Landmarks to Aid in Relocating Locale:

Published Reports on Finds:

Artifacts Collected:

Artifacts or Features Observed at Find Locale:

Data From Test Pits or Other Explorations:

Materials Reported from Area:

Remarks (Why Find Locale and Not Site):

Recorded by:
Date: **Photos:**

APPENDIX C.
HISTORIC PRESERVATION RESOURCE IDENTIFICATION FORM

[This page intentionally left blank.]

HISTORIC PRESERVATION RESOURCE IDENTIFICATION FORM

PLEASE TYPE ALL DATA IN UPPERCASE - FIELDS IN RED ARE REQUIRED

1. PROPERTY NAME: _____

2. RESOURCE NAME: _____

3. ADDRESS: _____

4. CITY: _____ 5. VICINITY: _____

6. COUNTY NAME: _____

7. LOT: _____ 8. BLOCK: _____ 9. PLAT NAME: _____

10. SECTION: _____ 11. TOWNSHIP: _____ 12. RANGE: _____

13. LATITUDE (NORTH): (ENTER AS: "dd.ddddd") _____

14. LONGITUDE (WEST): (ENTER AS: "-dd.ddddd") _____

15. UTM ZONE: _____ 16. NORTHINGS: _____ 17. EASTINGS: _____

18. RESOURCE TYPE: _____

19. HISTORIC FUNCTION: _____

20. CURRENT FUNCTION: _____

21. AREA OF SIGNIFICANCE, PRIMARY: _____

22. AREA OF SIGNIFICANCE, SECONDARY: _____

23. DESCRIPTION OF SIGNIFICANCE:

24. DOCUMENTATION RESOURCE:

25. NAME OF PREPARER: _____

59. SURVEY PROJECT _____ 26. PROJECT NAME: _____

27. DATE OF PREPARATION: _____ 28. PHOTOGRAPHS _____

29. YEAR: _____

30. ARCHITECT/BUILDER: _____

31. YEAR BUILT: _____

32. ORIGINAL SITE: _____ 33. DATE MOVED: _____

34. FROM WHERE: _____ 35. ACCESSIBLE: _____

36. ARCHITECTURAL STYLE: _____

37. OTHER ARCHITECTURAL STYLE: _____

38. FOUNDATION MATERIAL: _____

39. ROOF TYPE: _____ 40. ROOF MATERIAL: _____

41. WALL MATERIAL, PRIMARY: _____

42. WALL MATERIAL, SECONDARY: _____

43. WINDOW TYPE: _____ 44. WINDOW MATERIAL: _____

45. DOOR TYPE: _____ 46. DOOR MATERIAL: _____

47. EXTERIOR FEATURES: _____

48. INTERIOR FEATURES: _____

49. DECORATIVE DETAILS: _____

50. CONDITION OF RESOURCE: _____

51. DESCRIPTION OF RESOURCE:

52. COMMENTS:

53. ATTACH LOCATION MAP

54. LISTED ON NATIONAL REGISTER: _____

55. NATIONAL REGISTER ENTRY: _____

56. CONTINUATION

Pensacola Hydroelectric Project, FERC No. 1494

Revised Study Plan

Socioeconomics Study

Prepared for

Prepared by

September 2018

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF ACRONYMS

BIA……Bureau of Indian Affairs
FERC ..... Federal Energy Regulatory Commission
GRDA..... Grand River Dam Authority
ILP..... Integrated Licensing Process
ISR ..... Initial Study Report
OTRD..... Oklahoma Tourism and Recreation Department
PAD..... Pre-Application Document
Project..... Pensacola Hydroelectric Project
PSP..... Proposed Study Plan
RSP..... Revised Study Plan
SD2 ..... Scoping Document 2
USACE..... U.S. Army Corps of Engineers

1.0 INTRODUCTION

The Pensacola Hydroelectric Project (Pensacola Project or Project), owned and operated by the Grand River Dam Authority (GRDA), is licensed by the Federal Energy Regulatory Commission (FERC or Commission) as Project No. 1494. GRDA is a non-appropriated agency of the State of Oklahoma, created by the Oklahoma legislature in 1935 to be a "conservation and reclamation district for the waters of the Grand River." 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, the U.S. Army Corps of Engineers (USACE) has exclusive jurisdiction over Grand Lake for flood control purposes.

FERC's April 27, 2018 Scoping Document 2 (SD2) identified the following resource issue to be analyzed for the Project relicensing (FERC 2018):

- Effects of project operation or maintenance on socioeconomic resources.

SD2 identified socioeconomics as a resource that could be cumulatively affected by the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects and other activities in the Grand River Basin.

In their Proposed Study Plan (PSP) comment letters, the Bureau of Indian Affairs (BIA), Ben Loring (State Representative), City of Miami, Miami Tribe, and N. Larry Bork (counsel for City of Miami citizens) commented on the Socioeconomics Study Plan. Attachment B of the main body of the Revised Study Plan (RSP) details GRDA's response to PSP comments.

2.0 STUDY PLAN ELEMENTS

2.1. 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 study area.
- Broadly assess the cumulative socioeconomic impacts of the Project within the study area.
- Identify the socioeconomic contribution of the Project within the study area.

2.2. Agency and Native American Tribe Resource Management Goals

The BIA's mission is to enhance the quality of life, to promote economic opportunity, and to carry out the responsibility to protect and improve the trust asset of American Indians, Indian Tribes, and Alaska Natives (BIA 2018).

The Oklahoma Tourism and Recreation Department (OTRD) promotes the development and operation of tourism and recreation opportunities throughout the State. The primary goal of the OTRD is to expand the economy of Oklahoma through increased tourism promotion and development (OTRD 2018).

2.3. Background and Existing Information

Section 6.10 of the Pre-Application Document (PAD) summarizes existing information on socioeconomic resources in the Project area (GRDA 2017). The Pensacola Project dam and hydroelectric generating facility is located northeast of Tulsa on the Grand (Neosho) River (Grand River) in Craig, Delaware, Mayes, and Ottawa counties, Oklahoma. The Pensacola Dam creates the Grand Lake O' The Cherokees, also known as Grand Lake.

The entirety of the Project resides in Craig, Delaware, Mayes, and Ottawa counties, which are located along the northeastern border of the state of Oklahoma. Ottawa County, the northernmost of the four counties occupied by the Pensacola Project, has two incorporated cities, six incorporated towns, and one unincorporated community with a total estimated population of 31,981 as of the 2015 census. Mayes County, located to the southwest of Ottawa County, has one incorporated city, twelve incorporated towns, and five unincorporated communities with a total estimated population of 40,887 in 2015. Delaware County, located to the east of Mayes County, has two incorporated cities, five incorporated towns, and two unincorporated communities with a total estimated population of 41,459 in 2015. Craig County, located to the northwest of Delaware County, has one incorporated city, four incorporated towns, and one unincorporated community with a total estimated population of 14,818 in 2015 (U.S. Census Bureau 2016).

Current uses around Grand Lake include residential and commercial development, agriculture, and wildlife management areas. Lands surrounding the Project vicinity are generally rural and undeveloped, but historically, mining for lead and zinc was prevalent in Ottawa County, Oklahoma, and mining for coal was prevalent in Craig County, Oklahoma (Oklahoma Historical Society 2009). Approximately 53 percent of land within the Project Boundary is deciduous forestlands. Residential, commercial, and other development accounts for approximately 11 percent of total land area within the Project Boundary. Approximately 53 percent of lands adjacent to the Project Boundary are undeveloped forestlands. In addition, 31 percent of lands adjacent to the Pensacola Project are designated as agricultural/crop lands. The majority of these agricultural areas are in Ottawa County (GRDA 2008). Grand Lake is also the premier recreational lake in northeast Oklahoma (FERC 2014), and the popularity of water-based recreation at Grand Lake has resulted in significant economic development, particularly in real estate, goods, and services.

GRDA has identified detailed reports on the economic conditions in the state and region that are sufficient to describe the socioeconomic conditions in the study area and the Project's contributions to the state and regional economy. These existing studies on the socioeconomics in the region include:

- Data regarding the Economic impact of the GRDA (Oklahoma Department of Commerce 2012a, updated in 2015)
- Demographic data including land use, population, and employment data (U.S. Census Bureau 2015, 2016; Oklahoma Department of Commerce 2012b, 2015; Oklahoma Employment Security Commission 2016; Oklahoma Historical Society 2009; and GRDA 2008)

- Estimating Non-Market Value for the Grand River Watershed (Brand et al. 2017)
- Estimating Lake Amenity Values on Grand Lake o' the Cherokees (Ghimire et al. 2017)

In addition, the City of Miami provided comments that included a Four-County Preliminary Socio-Economic Assessment report that identifies socioeconomic data related to population, income, housing, mortgage lending, and provides content from the 1988 and 2010 Federal Emergency Management Agency Flood Insurance Studies.

2.4. Nexus between Project Operations and Effects on Resources

The presence of the Pensacola Project provides significant contributions to the state and regional economy. The results of the study, in conjunction with existing information, will be used to inform analysis in the license application.

2.5. Study Area

The entirety of the Project resides in Craig, Delaware, Mayes, and Ottawa counties, which are located along the northeastern border of the state of Oklahoma (Figure 2.5-1). The study area for this desktop review will primarily focus on these four counties. There may also be Project-related economic impacts in the broader northeastern Oklahoma region and the state of Oklahoma as a whole, and this study proposes to provide that information to the extent it is available. The study area is intended to capture areas cumulatively affected by the ongoing operation of the Project.

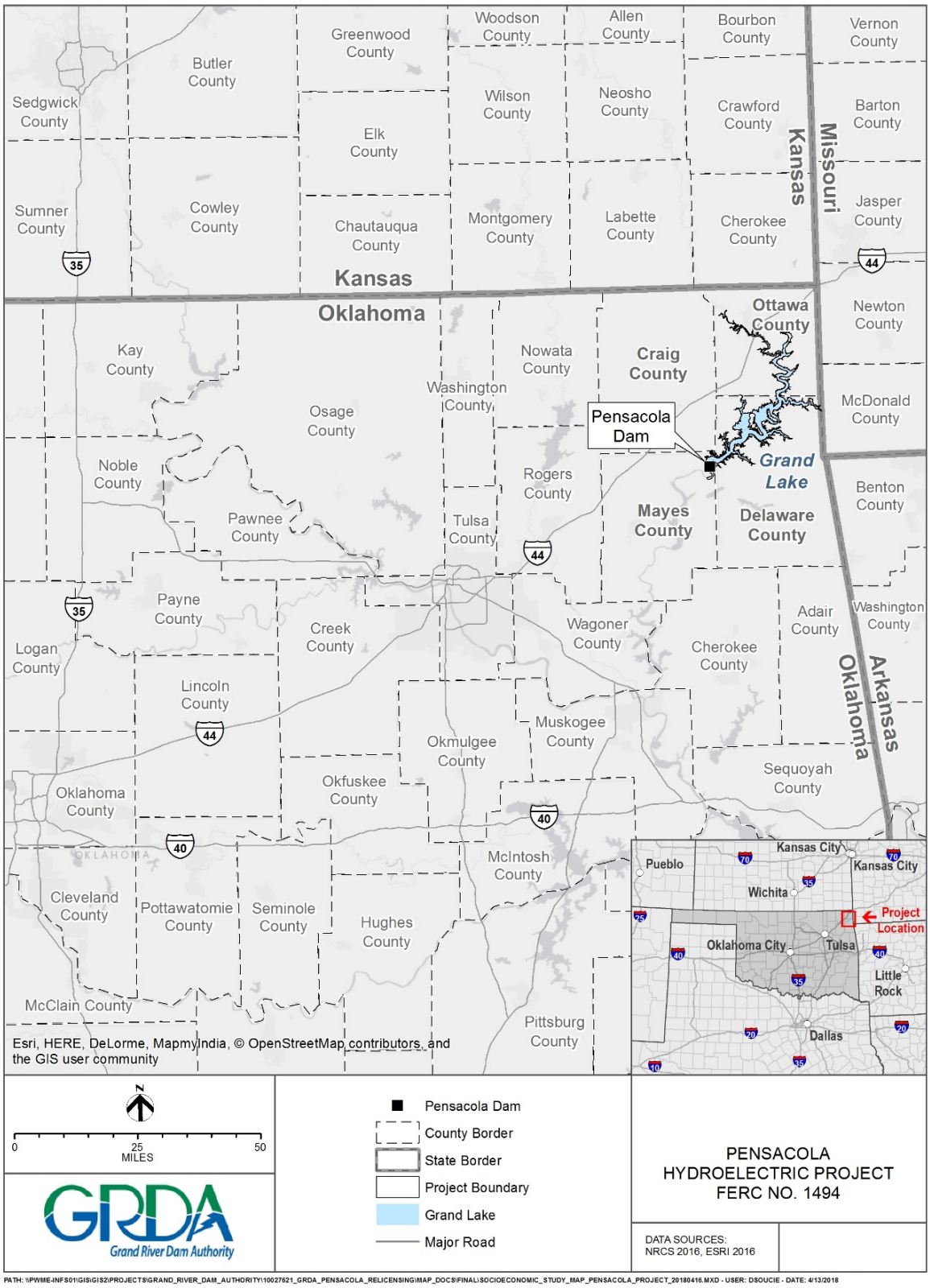


Figure 2.5-1. Location map of the Pensacola Project.

2.6. Methodology

The Socioeconomics Study for the Pensacola Project will involve four primary tasks. These tasks are:

1. Describe baseline socioeconomic information;
2. Gather and analyze additional economic information;
3. Assess cumulative socioeconomic impacts of the continued operation and maintenance of the Project under a new license; and
4. Prepare the Socioeconomics Study Report.

A review of existing socioeconomic data will be completed to present a broad qualitative assessment for the four-county study area using available data. Each of the tasks is described in detail below.

2.6.1. Task 1: Describe Baseline Socioeconomic Information

GRDA will compile published and other objective information that will be used to describe a demographic, housing, and economic profile for the four-county study area. The demographic profile will include available information on the general land use patterns within the study area, an assessment of population trends (historical, current, and projected), economic activity and labor force, age distribution, median household and per capita income, and poverty levels. Information on the demographic and economic conditions of the region will be obtained from governmental agencies, such as the U.S. Census Bureau and the Oklahoma Department of Commerce.

2.6.2. Task 2: Gather and Analyze Additional Economic Information

GRDA will query participants to the relicensing, as well as local organizations and businesses, for available, relevant data related to the Project study area. Several participants submitted information with comments on the PSP, and a sample information request form is included as Appendix A of this study plan. A preliminary list of participants to be contacted is included as Appendix B of this study plan. Additional contacts may be added as identified during the course of information review. This form will request information related to State and regional industry trends (e.g., goods and services; agricultural use), local, tribal, and regional trends in land and resource values (e.g., tribal practices, hunting, fishing, eco-tourism, outfitting, trapping, recreation, tourism, exploration, and mining activities), as well as other information that may be potentially relevant to the study. GRDA will identify other publications and statistics, including those listed in Section 2.3 of this study plan as well as those compiled by State and university resources.

2.6.3. Task 3: Assess Cumulative Impacts

After describing the baseline socioeconomic conditions within the study area and reviewing the information compiled in Task 2, GRDA will assess and verify the information gathered in Task 2 in order to identify the socioeconomic metrics necessary to provide a broad assessment of the cumulative socioeconomic impacts of the Project. Using available information gathered in Task 2, this qualitative assessment will identify the past, present, and reasonably foreseeable cumulative socioeconomic impacts due to the continued operation and maintenance of the Project under a new license.

2.6.4. Task 4: Prepare Socioeconomics Study Report

A Socioeconomics Study Report will be developed. The report will present baseline conditions of the counties of Craig, Delaware, Mayes, and Ottawa and broadly identify the cumulative socioeconomic impacts of the Project based upon relevant information identified in Tasks 1-3.

2.7. Consistency with Generally Accepted Scientific Practice

The proposed methods for this study are consistent with FERC study requirements under the Integrated Licensing Process (ILP).

2.8. Schedule

The study will be complete and a final study report will be included as part of the Initial Study Report (ISR) filing in November 2019.

2.9. Level of Effort and Cost

The estimated cost of this study is expected to be approximately $100,000.

2.9.1. References

BIA (Bureau of Indian Affairs). 2018. Mission Statement. [Online]. URL: https://www.bia.gov/bia. (Accessed September 7, 2018).

Brand, S., T.A. Boyer, and R.M. Melstrom. 2017. Estimating Non-Market Value for the Grand River Watershed. Oklahoma State University, Stillwater, Oklahoma. May 2017.

FERC (Federal Energy Regulatory Commission). 2014. Draft Environmental Assessment for Hydropower License Salina Pumped Storage Project – FERC Project No. 2524-021 Oklahoma. November 2014.

FERC. 2018. Scoping Document 2, Pensacola Hydroelectric Project No. 1494-438. April 27, 2018.

Ghimire, M., T.A. Boyer, D. Shideler, M. Melstrom, and A. Stoecker. 2017. Estimating Lake Amenity Values on Grand Lake o' the Cherokees. Oklahoma State University, Stillwater, Oklahoma. June 2017.

GRDA. (Grand River Dam Authority). 2008. Shoreline Management Plan. Pensacola Hydroelectric Project FERC No. 1494. June 2008.

GRDA. 2017. Pensacola Hydroelectric Project, P-1494, Pre-Application Document. February 2017.

Oklahoma Department of Commerce. 2012a. Economic Impact of the Grand River Dam Authority. March 2012.

Oklahoma Department of Commerce. 2012b. 2012 Demographic State of the State Report.

Oklahoma Department of Commerce. 2015. Economic Impact of the Grand River Dam Authority. March 2015.

Oklahoma Employment Security Commission. 2016. Oklahoma Economic Indicators. April 2016.

OHS (Oklahoma Historical Society). 2009. Ottawa County.

OTRD. 2018. Agency Information. [Online]. URL: https://otrd.ok.gov/OkTourism/. (Accessed March 19, 2018).

U.S Census Bureau. 2015. Oklahoma Quickfacts. [Online]. URL: http://www.census.gov /quickfacts/table/PST045215/40. (Accessed June 1, 2016).

U.S. Census Bureau. 2016. Fact Finder. [Online]. URL: http://factfinder.census.gov. (Accessed June 2, 2016).

[This page intentionally left blank.]

APPENDIX A.
EXAMPLE REQUEST FOR INFORMATION RELATED TO SOCIOECONOMIC IMPACTS

[This page intentionally left blank.]

Date

Name
Address Line 1
Address Line 2
City, State, ZIP
E-mail Address

RE: Request for socioeconomic information related to the Pensacola Hydroelectric Project

Grand River Dam Authority (GRDA) is the licensee of the 120 megawatt (MW) Pensacola Hydroelectric Project (Project or Pensacola Project) which is licensed by the Federal Energy Regulatory Commission (FERC). The current operating license for the Project was issued on April 24, 1992, and expires on March 31, 2022. GRDA is in the process of seeking a new license from FERC for the continued operation of the Project. As part of the relicensing process, FERC has directed GRDA to undertake an analysis of socioeconomic resources affected by the ongoing operation of the Project.

In undertaking this analysis (which will focus on the Oklahoma counties of Craig, Delaware, Mayes and Ottawa), GRDA will identify, analyze, and synthesize publications and statistics, such as those compiled by State and university resources and verifiable non-published data, for county, regional, and Project-specific socioeconomic information. This may include information related to activities such as recreation, agriculture, commercial, industrial, transportation, and flood control.

GRDA is reaching out to you, as a participant in the relicensing process, to submit relevant data and information related to the Project within the study area. GRDA is utilizing this process to gather additional data and information in order to identify industry trends (e.g., goods and services; agricultural use), trends in land and resource values (e.g., hunting, fishing, eco-tourism, outfitting, trapping, recreation, tourism, exploration, and mining activities), as well as other socioeconomic information that may be potentially relevant to this analysis.

If you have information that may help inform GRDA's socioeconomic analysis, please respond to this letter by _____, 2019, by providing any data, studies, other information, or citations to where any such information can be obtained.

Please submit information to:

Name
Company
Address 1
Address 2
State, City, Zip
E-mail address

[This page intentionally left blank.]

APPENDIX B.
REQUEST FOR INFORMATION RELATED TO SOCIOECONOMIC IMPACTS – PRELIMINARY DISTRIBUTION LIST

[This page intentionally left blank.]

Federal Agencies:

Advisory Council on Historic Preservation
U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Bureau of Indian Affairs
U.S. Bureau of Land Management
U.S. Department of the Army
U.S. Department of the Interior
U S Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
U.S. Natural Resources Conservation Service
National Park Service
National Weather Service

State Agencies:

Oklahoma Archeological Survey
Oklahoma Department of Commerce
Oklahoma Conservation Commission
Oklahoma Corporation Commission
Oklahoma Department of Agriculture
Oklahoma Department of Environmental Quality
Oklahoma Office of Emergency Management
Oklahoma Department of Health
Oklahoma Department of Transportation
Oklahoma Tourism and Recreation Department
Oklahoma Department of Wildlife Conservation
Oklahoma Historical Society
Oklahoma Water Resources Board
Office of State Fire Marshal

Tribal Organizations:

Inter-Tribal Council Inc.
Alabama-Quassarte Tribal Town
Apache Tribe of Oklahoma
Caddo Nation of Oklahoma
Caddo Nation
Cherokee Nation
Delaware Nation
Delaware Tribe of Indians
Eastern Shawnee Tribe of Oklahoma
Iowa Tribe of Oklahoma
Kiowa Tribe
Little Traverse Bay Bands of Odawa Indians
Miami Tribe of Oklahoma
Miami Nation
Modoc Tribe of Oklahoma
Muscogee (Creek) Nation
Osage Nation
Ottawa Tribe of Oklahoma
Otoe-Missouria Tribe of Indians
Peoria Tribe of Oklahoma
Quapaw Tribe of Oklahoma
Sac and Fox Nation of Oklahoma
Seneca-Cayuga Nation
Shawnee Tribe of Oklahoma
Tonkawa Tribe of Oklahoma
United Keetoowah Band of Cherokees
United Keetoowah Band of Cherokees
Wichita and Affiliated Tribes
Wyandotte Tribe of Oklahoma
Wyandotte Nation

Congressional Delegation:

The Honorable James Mountain Inhofe
United States Senate
The Honorable James Lankford
United States Senate

The Honorable Jim Bridenstine
The Honorable Markwayne Mullin
The Honorable Michael Bergstrom
Oklahoma State Senate, District 1
The Honorable Marty Quinn
Oklahoma State Senate, District 2
The Honorable Wayne Shaw
Oklahoma State Senate, District 3
The Honorable Josh West
House of Representatives, District 5
The Honorable Chuck Hoskin
House of Representatives, District 6
The Honorable Ben Loring
House of Representatives, District 7
The Honorable Tom Gann
House of Representatives, District 8
The Honorable Mary Fallin
Governor of Oklahoma
The Honorable Michael Teague
Secretary of Energy and Environment

Other Governmental Entities:

Afton Public Works Authority
City of Grove
City of Miami
Davis Wright Tremaine LLP
Coo-Y-Yah Museum
Craig County Commissioners
Craig County
Craig County Conservation District
Delaware County Commissioners
Delaware County
Delaware County Historical Society & Museum
Delaware County Conservation District
Eastern Trails Museum
Integris Health Center
Ketchum Public Works Authority
Mayes County Commissioners
Mayes County Conservation District
Mayes County
Miami Public Schools
Miami Regional Chamber of Commerce
NE Ward 1
NE Ward 2
SW Ward 3
SE Ward 4
Ottawa County Emergency Management
Ottawa County Commissioners
Ottawa County Conservation District
Ottawa County Historical Society (Dobson Museum)
RWD #3 Delaware County
RWD #3 Mayes County – Disney
Town of Afton
Town of Bernice
Town of Disney
Town of Fairland
Town of Ketchum
Town of Langley
City of Vinita
Town of Wyandotte

Non-Governmental Organizations:

American Rivers
American Whitewater
Ducks Unlimited
Grand Lake Audubon Society
Grand Lake Sail and Power Squadron
Grand Lake Watershed Alliance Foundation
Local Environmental Action Demanded Inc.
The Nature Conservancy
Trout Unlimited
Tulsa Audubon Society

Public/Citizens:

Larry Bork
Cherokee Grove Golf at Carey Bay

Grand Bluffs Development
Shangri-La Management
Spinnaker Point
Shoreline, LLC
Spinnaker Point Estates
Tera Miranda Shores Inc.
The University of Oklahoma
Oklahoma State University
Northeastern Oklahoma A & M College
OSU-A&M College Board of Regents
Rogers State University
Miami Flood Mitigation Advisory Board
Grand Seaplanes, LLC
Anglers in Action
Grand Lake Association & Visitor Center
Grand Lakers United Enterprise
Grand Lake Association
Grove Area Chamber of Commerce
South Grand Lake Area Chamber of Commerce
Miami Area Chamber of Commerce
Oklahoma Association of Realtors
Har-Ber Village
Dr. Mark Osborn
Mr. Jack Dalrymple
Shangri-La Marina
Cherokee Yacht Club Marina
Port Carlos
Arrowhead Yacht Club (North & South)
Clearwater Bay Marina
Harbors View Marina
Safe Harbor Marinas
Thunder Bay Marina LLC
Cedar Port Marina
Tera Miranda Marina Resort
Honey Creek Landing Marina
Willow Park Marina
Southwinds Marina
The Landings Marina
Scotty's Cove, Inc
Hammerhead Marina
Grand Lakeside Marina
Indian Hills Resort and Marina
Hi-Lift Marina LLC
Dripping Springs Yacht Club
Red Arrow Marina
Elk River Landing

[This page intentionally left blank.]

ATTACHMENT B.
PSP COMMENTS AND GRDA RESPONSES

[This page intentionally left blank.]

Summary of Proposed Study Plan Comments and GRDA's Responses

	Entity	PSP Section	Comment	GRDA Response
General/Global Comments				
1	BIA 7/26/2018 (Letter)	N/A	The BIA has made GRDA and FERC aware that several tribes possess tribal lands and jurisdiction in the vicinity of Grand Lake and its tributaries. Regarding the Pensacola Project is it important that GRDA and FERC engage in proper consultations with the interested tribes. Section 1.4 of the PSP, entitled "Public and Native American Government to Government Meetings" identifies two meetings held in December of 2017 with some tribal nations. While it is good to hold meetings with tribes generally, it is imperative that each tribal nation, as a separate sovereign, receive its own government-to-government meeting with regard to the project for proper compliance with the National Historic Preservation Act, 54 U.S.C. § 300101 ("NHPA").	The Grand River Dam Authority (GRDA) recognizes that the federal government has a federal trust responsibility to Native American Tribes. The Federal Energy Regulatory Commission's (FERC) federal trust responsibility is provided in its Tribal Policy Statement, which states that FERC will endeavor to work with Tribes on a government-to-government basis pursuant to that trust responsibility. *See Final Rule and Tribal Policy* Statement, 104 FERC ¶ 61,109 (2003). Section 106 of the National Historic Preservation Act (NHPA) and associated Advisory Council on Historic Preservation (ACHP) regulations require FERC to consult with potentially-affected Tribes to analyze the effects, if any, to an undertaking on historic properties. As authorized by regulations of the ACHP, FERC has delegated GRDA authority to engage as its non-federal representative f or purposes of meeting NHPA Section 106 requirements. GRDA recognizes, however, that FERC "remain[s] legally responsible for all findings and determinations charged to the agency official." 36 C.F.R. § 800.2(c)(4). In this regard, ACHP regulations make clear that "[f]ederal agencies that provide authorizations to applicants remain responsible for their government-to-government relationships with Indian Tribes." *Id*. As the license applicant and FERC's non-federal representative, GRDA is committed to supporting FERC and working closely with Native American Tribes, Oklahoma State Historic Preservation Officer (SHPO) and Oklahoma Archeological Survey (OAS) to help ensure FERC meets its trust responsibilities and obligations under NHPA Section 106. GRDA is encouraged by the robust consultation that already has occurred early in this relicensing process. FERC initiated tribal consultation for the Pensacola Project with potentially affected Indian Tribes on August 24, 2017. In December 2017, FERC conducted a series of meetings between FERC staff and "each Indian Tribe likely to be affected by the potential license application." Further, there have been additional opportunities for tribal consultation meetings as GRDA works with FERC and other interested relicensing participants during study plan development. GRDA also held a meeting of the Cultural Resources Working Group (CRWG) following the study plan meeting on May 31, 2018 to provide an opportunity to discuss the Cultural Resources Study Plan in detail. On August 14, 2018, GRDA had a relicensing consultation meeting with the ACHP in Washington, D.C. and on August 22, 2018, GRDA had a relicensing consultation meeting with the Oklahoma SHPO and OAS. Most recently, on August 21, 2018, FERC held a tribal consultation meeting in Catoosa, Oklahoma to discuss the Proposed Study Plan (PSP). Based on recent information provided to FERC from the Bureau of Indian Affairs (BIA), FERC staff indicated that the Project occupies federally-owned lands held in trust for Native American Tribes or Individual Native Americans. As of the filing of this RSP, the total acreage of tribal trust lands at the Project has not been confirmed or verified. However, GRDA does not dispute the presence of federal trust lands in the immediate vicinity of the Project. Rather, because this information was only recently provided to FERC, GRDA is still in the process of reviewing it and determining whether and the extent to which the Project occupies federal trust lands. GRDA expects this issue to be resolved during the relicensing process as GRDA prepares its Exhibit G maps that will accompany its relicensing application.
2	BIA 7/26/2018 (Letter)	N/A	The tribal consultation meetings should be an open discussion among the parties in attendance and not just presentations from GRDA to the tribes. The tribes should be able to make comments during the consultations which GRDA takes into consideration without the tribe then separately submitting written comments to the same effect.	GRDA agrees with the BIA and supports an open dialogue among FERC, the Tribes, and GRDA. The tribal consultation meeting that FERC convened on August 21, 2018, for example, was an open discussion format, and the participants covered a wide range of topics. This Revised Study Plan (RSP) reflects comments made by relicensing participants during the meetings as well as written comments filed on the PSP. GRDA appreciates the Tribes' extensive participation in the study plan meetings as well as the

	Entity	PSP Section	Comment	GRDA Response
				CRWG and tribal consultation meetings to date, and looks forward to continuing to work closely with the Tribes during future meetings and throughout the relicensing process.
3	ODWC 7/24/2018 (Letter)	N/A	The Proposed Study Plan (PSP) is generally well-organized and appears to address the key issues brought up by relicensing participants. We have a few overall comments on the PSP. The primary comment concerns the lack of detail for current information held by GRDA, therefore the inability for us to judge whether studies that were not considered are needed or present data suffices. We would also continue to request additional details of the scenario(s) of operation being "investigated", as the scope of operational change would greatly influence the need (or lack of need) for our proposed studies.	We appreciate the Oklahoma Department of Wildlife Conservation's (ODWC) comments. This RSP includes more details about how the studies will account for existing information and address any gaps in information needed for FERC's National Environmental Policy Act (NEPA) analysis. In addition, GRDA proposes three new studies in this RSP to better inform the relicensing process. Finally, the H&H Study Plan has been revised in this RSP to provide additional information on the operational scenarios to be evaluated as part of the study.
4	Osage Nation 7/26/2018 (Letter)	N/A	Due to the importance of this area, the Osage Nation Historic Preservation Office requests, in addition to the following comments and concerns, that it be an invited signatory to all agreement documents, including the Programmatic Agreement, regarding the project. Places of great traditional, cultural, historical, and religious significance to the Osage Nation are located in the immediate vicinity of the Project. These are Osage properties regardless of their present ownership and deserve proper treatment and consideration. Further, the Osage Nation would have several responsibilities under any agreements regarding the project justifying its inclusion as a Signatory. Additionally, the Advisory Council on Historic Preservation has, on several occasions, advised, if not encouraged, FERC and other Federal agencies to invite Tribes to serve as Signatories to agreements wherein those Tribes have significant concerns, sites of great significance to those Tribes are located within the APE, or Tribes have responsibilities under those agreements. Finally, the Programmatic Agreement, including provisions for implementing and satisfying NAGPRA, ARPA, AIRFA, and Executive Orders 13007 (Consideration of Sacred Sites) and 13175 (Consultation and Coordination with Indian Tribal Governments) must be developed in consultation and coordination with the Osage Nation and its fellow Tribes. **The Osage Nation, therefore, strongly urges FERC and GRDA to invite the Osage Nation and other tribes as well to participate as Invited Signatories to any agreement documents regarding the project. Further, the Osage Nation requests to monitor cultural resource surveys and provide comment on historic property evaluations conducted by GRDA in advance of the reissuance of its license and monitor certain properties of significance as part of the planned Historic Properties Management Plan.**	GRDA understands that lands in the Project vicinity are of great interest and importance to the Osage Nation. While decisions related to any programmatic agreement are within the purview of FERC, and not GRDA, we remain committed to continuing our collaborative approach for completing cultural resources investigations for the relicensing, which will meet FERC's obligations under Section 106 of the NHPA, as well as other obligations that are highly important to the Osage Nation THPO and each of the other individual Tribes participating in this process. GRDA remains committed to developing and implementing a robust study program, followed by the development of a Historic Properties Management Plan (HPMP) that will govern the protection and management of historic properties over the course of the upcoming new license term. With regard to the Osage Nation Tribal Historic Preservation Officer's (THPO) request to allow monitors for cultural resources surveys, this issue is addressed in GRDA's Cultural Resources Study Plan, which has been revised significantly since the PSP based on comments by the Osage Nation THPO and other relicensing participants. In brief, GRDA fully supports the Osage Nation THPO's request to allow monitors. See also GRDA's response to Comment No. 132.
5	Ottawa Tribe 7/26/2018 (Letter)	N/A	Pursuant to 18 C.F.R § 5.12, the OTTAWA TRIBE OF OKLAHOMA hereby joins in the comments of the Miami Tribe of Oklahoma, filed July 26, 2018, on the Grand River Dam Authority's Proposed Study Plan. The Nation further requests that the Miami Tribe's comments be incorporated into the Grand River Dam Authority's Revised Study Plan, due to be filed August 25, 2018.	GRDA appreciates the participation of the Ottawa Tribe of Oklahoma and respectfully refers the Tribe to GRDA's responses to the Miami Tribe's comments in this RSP.
6	Peoria Tribe 7/30/2018 (filed 8/7) (Letter)	N/A	Pursuant to 18 C.F.R § 5.12, the Peoria Tribe hereby joins in the comments of the Miami Tribe of Oklahoma, filed July 26, 2018, on the Grand River Dam Authority's Proposed Study Plan. The Peoria Tribe of Indians of Oklahoma further requests that the Miami Tribe's comments be incorporated into the Grand River Dam Authority's Revised Study Plan, due to be filed August 25, 2018.	GRDA appreciates the participation of the Peoria Tribe of Oklahoma and respectfully refers the Tribe to GRDA's responses to the Miami Tribe's comments in this RSP.
7	N. Larry Bork on behalf of City of Miami Citizens 7/26/2018 (Letter)	N/A	These comments and study requests are in support of FERC requiring GRDA to do a comprehensive analysis of the impact of the entire Pensacola Project. We reassert our positions and support within the comments in the March 13, 2018 letter on behalf of the same plaintiffs, Accession Number, 20180313-5 189, which are consistent with the positions taken in other prior filings for these plaintiffs, and other plaintiffs in earlier GRDA litigation. These plaintiffs join in the submissions of the City of Miami, Oklahoma and the Tribes (primarily the Miami Tribe of Oklahoma, with anticipated support from multiple other tribes) filed on July 26, 2018 and the Oklahoma Department of Wildlife Conservation, filed on July 24, 2018.	We appreciate your participation. GRDA believes that the RSP provides the necessary framework for collecting the pertinent information for FERC to prepare its environmental document for the Project. Please refer to GRDA's responses to the City of Miami, the Tribes, and ODWC in this RSP.
Proposed Study Plan Introduction/Background				
8	FERC 7/20/2018 (Letter)	Section 4.3 of PSP Introduction / Background and	In section 4.3, *Study Requests Excluded from GRDA's PSP*, of the proposed study plan, GRDA explains that the issues raised in several study requests will be addressed in the final license application, based on outputs from the Hydrologic and Hydraulic (H&H) Modeling Study and existing information in the pre-application document. These study requests include: (1) Quantifying	Section 2.6 of the H&H Study Plan has been revised in response to this comment. Additionally, in response to this comment and other comments, GRDA is proposing to conduct the following new studies that were not included in the PSP: Aquatic Species of Concern Study,

	Entity	PSP Section	Comment	GRDA Response
		H&H Study Plan	Effects of Increased Water Level within Grand Lake Watershed; (2) Impacts of Grand Lake Elevation Manipulation on Headwater River Hydrology and Paddlefish Spawning/Recruitment; (3) Wetland Documentation; (4) Loss of Wildlife Lands from Flooding; (5) Alteration of Tailwater Fish Habitat Downstream of Pensacola Dam as a Result of Hydropower Operations; and (6) Changes in Tailwater Fish Populations Due to Hypolimnetic Releases. If GRDA is proposing to use the H&H Modeling Study to address an issue or study request included in section 4.3, *Study Requests Excluded from GRDA's PSP*, the related issues should be included as objectives (or sub-objectives) of the H&H Modeling Study. GRDA should also include in its revised study plan any related methodology and the sources of data needed to meet those objectives (or sub-objectives).	Terrestrial Species of Concern Study, and Wetlands and Riparian Habitat Study.
9	USACE 7/26/2018 (Letter)	PSP Introduction / Background	Beyond the technical aspects of the PSP, the Corps does not agree with representations made by GRDA throughout its PSP where it attempts to abdicate responsibility for any activity or land requirements above elevation 750 feet Pensacola Datum (PD). To the extent GRDA is attempting to construct an argument that the Corps is responsible for impacts of project operations or future real property acquisition requirements, the Corps disagrees. The Federal Government has had a flood control mission at the Project since the first FERG license was issued in 1939 which predated the 1944 Flood Control Act. The 1944 Flood Control Act designated the Secretary of War with authority to regulate the use and storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds. The Corps' implementing regulations for the 1944 Flood Control Act include project-specific regulations for the Pensacola Project (33 C.F.R. sec. 208.25). This regulation identifies the Corps' jurisdiction at the Pensacola Project is limited to directing flood control operations (i.e. gate changes) when the Project's pool is between elevations 745' and 755' (Pensacola Datum or PD). According to the terms of the Letter of Understanding executed between the GRDA and the Corps in 1992, GRDA retains responsibility for the physical operation of the flood control facilities (i.e. GRDA undertakes the mechanical operation of raising and lowering the flood gates) as directed by the Corps. Implementing the Water Control Plan at Grand Lake is the responsibility of the Corps with the cooperation of GRDA for physical operations at Pensacola Dam and Markham Ferry Dam (Project No. 2183). The Corps' jurisdiction over directing flood operations ends at an upper elevation of 755' and GRDA is responsible for the structural safety of the Dam; therefore, dam operations are under GRDA control above this elevation (i.e. 755' PD). GRDA controls operations below elevation 745' PD and above 755' PD. The full details and breakdown of responsibilities is contained in 33 C.F.R. Section 208.25, the Letter of Understanding, and the Water Control Plan executed in 1992. Aside from other regulatory jurisdiction exercised by the Corps pursuant to the Clean Water Act, this is the extent of the Corps regulatory jurisdiction at the Pensacola Project. The Corps disagrees with GRDA's representation that GRDA is not responsible above elevation 750' PD. The Corps' position is that GRDA is responsible for owning sufficient real property interests for all authorized project operations. The basic responsibilities of the Corps of Engineers regarding Section 7 project operations are set out in various authorities which are listed and summarized in 33 C.F.R. sec. 208.11(b). An examination of these authorities provides no foundation for the argument that the Corps is responsible for acquiring real property interests at state-owned and operated projects. For projects authorized by the 1944 Flood Control Act the responsibility for acquiring the necessary project lands for authorized flood control purposes falls upon the project owner, not the Corps. The Corps does not own flowage easements at any other project authorized for flood control purposes by Section 7 of the Flood Control Act of 1944, including a second GRDA project, Kerr Dam (a.k.a. the Markham Ferry Project at Hudson Lake). Recent 2016 legislation authorized the Corps to transfer the existing flowage easements owned by the United States of America to the GRDA, which will bring the Pensacola Project in line with how other Section 7 projects are operated (i.e. the project owner is responsible for acquiring all real property interests needed for all authorized project purposes, including flood control).	GRDA's comprehensive response to the Army Corps of Engineers' (USACE) comment appears at PSP Section 4.1.1 and RSP Section 4.3. As explained in those sections, this FERC relicensing process relates only to GRDA's operation of the conservation pool, which is subject to FERC's jurisdiction. Issues related to USACE's management and operation of the flood pool is under the exclusive control of the USACE, through the relevant authorities, and beyond the scope of FERC's relicensing process. GRDA categorically rejects USACE's characterization of legal obligations for flood control and property acquisition within the flood control pool above elevation 750 feet Pensacola datum (PD). As USACE is aware, Congress has directed USACE to identify easements necessary for flood control operations and authorized USACE to acquire such easements from willing sellers. And while USACE has completed a thorough real estate survey identifying needed easements, and has determined that federal actions have caused significant backwater effects on these lands, it has failed to acquire these lands, as it alone has been authorized by Congress to do. Instead, USACE in its PSP comment attempts to place land acquisition responsibility upon GRDA. In doing, USACE so ignores its own studies and findings, numerous federal statutes, the 1946 Agreement returning the Project to GRDA at the end of World War II, and administrative rulings of both FERC and its predecessor agency, the Federal Power Commission—all of which uniformly establish that GRDA's obligations for land acquisition and control extend only up to 750 feet PD, and that the United States bears responsibility above this elevation for flood control purposes. In its comment letter, USACE only offers a general argument that it has no obligation under the 1944 Flood Control Act and implementing regulations to acquire property interests, and that it has not acquired such interests at other hydropower projects subject to Section 7 of the 1944 Act. This generic justification overlooks the unique history of this Project and the numerous times Congress and the President have directed a much different legal treatment of the Pensacola Project, as compared to other non-federal facilities that are subject to Section 7 of the 1944 Act. Unlike other Section 7 projects, the Pensacola Project was authorized under the 1941 Flood Control Act, which includes an express requirement for the Secretary of War to obtain lands. Unlike other Section 7 projects, the entire Project was acquired by the United States in 1941 pursuant to Section 16 of the Federal Power Act—and then returned to GRDA following World War II. Unlike other Section 7 projects, USACE is subject to Executive Orders, numerous Acts of Congress that apply only to the Pensacola Project, and a 1946 Agreement with GRDA, which among other things directed GRDA to convey lands to the United States for flood control purposes. GRDA respects its strong partnership with USACE. Working together over many years, we have provided a significant portion of the flood control capacity in the Arkansas River Basin upstream of Van Buren to protect millions of citizens, homes, lands, businesses and industry that rely on flood control operations every day. For USACE to take the position that GRDA bears legal responsibility for USACE's flood control actions is contrary to settled law, historical precedent and USACE's own findings. The federal government, not GRDA, unquestionably bears responsibility to acquire lands necessary to carry out its flood control purposes.
10	BIA	PSP Section 4.1.1 of	The PSP in Subsection 4.1.1 Flood Control Operations details information about the role of the	GRDA disagrees with BIA's comment to the extent that it references flooding and backwater effects

	Entity	PSP Section	Comment	GRDA Response
	7/26/2018 (Letter)	Introduction / Background	U.S. Army Corp of Engineers ("USACE") and asserts that the USACE is solely responsible for all flooding matters regarding the project. However, at the public meeting in Langley on May 30, 2018 the USACE made it clear that their directive was only regarding the flood control downstream and that they had no authority with regard to back water flooding. The BIA objects to the notion that mitigation for back water flooding is outside the scope of this proceeding.	attributable to USACE's flood control operations. Please refer to PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment No. 9. The H&H and Sedimentation study plans have been specifically designed to identify and distinguish GRDA's hydropower operations under the FERC-issued license from USACE's flood control operations.
11	BIA 7/26/2018 (Letter)	PSP Section 4.1.3 of Introduction / Background	The PSP in Subsection 4.1.3 Cultural Resources Investigations in Inundated Areas states, "any archaeological resources within the inundation zone of the reservoir before the original pool was filled have been under water for close to eighty years. As such, these resources are either preserved in place and unaffected by continued operation of the Project, or are highly unlikely to have retained their essential physical features after being inundated for such a long period of time." First, the BIA objects to the assertion that cultural resources that are under water have lost their essential physical features. There is no scientific data or support for such a statement. Second, the BIA disagrees that the continued operation of the Project will leave those inundated resources unaffected. Water moves in and out of the original pool all the time for reasons of rain, drought, or maintenance of the Project. The changes to the water line may reveal cultural resources along the edge of the pool and then expose those resources. GRDA should study those shoreline areas for potential resources to the fullest extent possible.	The Cultural Resources Study Plan has been revised in response to this comment. Section 2.6.7 of the Cultural Resources Study Plan provides that the HPMP will describe management measures for permanently inundated sites, as well as measures for conducting additional surveys and evaluation of submerged archaeological sites when and if lake levels allow (e.g., during maintenance drawdowns of the reservoir). GRDA will consult with the CRWG to identify high-priority areas and sites within the Area of Potential Effects (APE) for study during the Integrated Licensing Process (ILP) for purposes of informing FERC's analysis under both Section 106 and the NEPA. Specifically, the Reconnaissance Survey will include visual reconnaissance of the exposed portions of the recorded or unrecognized archeological and/or historic architectural resources. In response to this comment and other comments, as well the input of certain Tribes and relicensing participants during the PSP meeting, Section 2.6.4 of the Cultural Resources Study Plan now includes "a visual reconnaissance and archaeological subsurface testing of the exposed portions of the reservoir shoreline areas within the APE at locations identified in consultation with the CRWG based on the results of the Pre-fieldwork Report. GRDA's Cultural Resources Study Plan does not propose to conduct investigations in areas that are permanently inundated and instead to focus in areas where continued Project operations may affect historic properties. ACHP's Section 106 Archaeology Guidance states that "[A] federal agency is not expected to conduct a 100 percent survey of the area of potential effects. Rather, the identification effort should be conditioned by where effects are likely to occur and the likely impact of these effects on listed or eligible archaeological sites. For example, archaeological identification efforts for a license renewal from FERC likely would not involve the entire APE. Instead it would be directed to those locations within the APE that are experiencing Project-related effects associated with operation, usually along the shoreline." Guidance at 17
12	BIA 7/26/2018 (Letter)	PSP Section 4.2.4 of Introduction / Background	The PSP in Subsection 4.2.4 Socioeconomic Study states that an "[a]nalysis of flood insurance, property values, taxes, infrastructure access, and emergency services related to flood conditions is outside the scope of this study." The BIA asserts that without an analysis of these important factors the GRDA Socioeconomic Study will be very one sided and only reveal the beneficial effects of the Project. It is important to get a complete picture of the socioeconomic effects of the Project, which includes both the positive and negative implications of continued operations.	In response to this comment from BIA, as well as similar comments submitted by other relicensing participants, the RSP proposes a more expanded Socioeconomic Study Plan, which will capture the cumulative effects of the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin. As provided in the Socioeconomic Study Plan in this RSP, BIA and all other relicensing participants will be given an opportunity to provide data, study reports, and other information relevant to socioeconomic resources that will inform the cumulative impacts analysis.
13	OAS 7/26/2018 (Letter)	PSP Section 4.1.3 of Introduction / Background	In arguing to exclude archaeological resources in the inundation zone from further consideration, GRDA states that such sites are "either preserved in place and unaffected by continued operation of the Project, or are highly unlikely to have retained their essential physical features..." (p. 27). What data is GRDA referencing to support this assertion? I ask this question not because I am trying to assert that such sites should be included in the study- indeed I am not staking a position one way or another on that here. But GRDA's current argument is questionable and warrants scrutiny.	Please refer to GRDA's response to Comment No. 11. The text referenced by OAS in its comment has been removed from the Cultural Resource Study Plan in the RSP.
14	ODWC 7/24/2018 (Letter)	PSP Introduction / Background	Additionally, the PSP states that requests concerning the need and adequacy of Protection, Mitigation and Enhancement (PM&E) are premature. We agree that adequacy of PM&E can and should be addressed later, but again, without a defined scope of operation or explanation of investigated operational changes, we feel a great need for requests that would ascertain the potential loss of current habitat(s) and therefore influence PM&E measures.	Please refer to GRDA's response to Comment No. 8. The H&H Study Plan has been revised in this RSP to provide additional information on the operational scenarios to be evaluated as part of the study. In addition, the RSP contains new resource studies that will help analyze Project-related effects, if any. Such studies, in turn, will inform the development of any protection, mitigation, and enhancement (PM&E) measures later in the relicensing process.
15	Miami Tribe 7/26/2018	PSP Introduction / Background	General Comments	GRDA disagrees with the Tribe's comment to the extent it references flooding and backwater operations. Please refer to PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to

	Entity	PSP Section	Comment	GRDA Response
	(Letter)		1. FERC Has Authority to Require Mitigation of Flooding Caused by Licensed Project Purpose FERC is authorized and responsible for assessing and taking into account flooding impacts caused by operations in fulfillment of licensed Project purposes, and in its August 15, 2017 Order amending GRDA's license to operate the Pensacola Dam, FERC confirmed that the Project is operated and managed for purposes including "power generation, recreation, fish and wildlife enhancement and flood control." FERC further indicated that impacts of operations on flooding, including appropriate mitigation measures would be addressed in relicensing. GRDA seeks to avoid accountability for the flooding caused by its operation of the Dam -- including its repeated requests to increase the Rule Curve under its existing license -- by suggesting that the United States Army Corps of Engineers (the "Corps"), not GRDA, is responsible for flooding impacts because it has jurisdiction over flood operations at the Dam. Of course, this is not supported by law or by practice. As an initial matter, federal law is clear: FERC and FERC licensee GRDA -- not the Corps -- is legally obligated to take into account all flood impacts caused by the Pensacola Project for the purposes of this relicensing proceeding. FERC's license for the Pensacola Dam includes "flood control" as a licensed project purpose, and it is undisputed that the Federal Power Act vests FERC with the authority to determine whether or not to relicense the Pensacola Project and what, if any, conditions will be placed on Project operations if the Project is ultimately relicensed. GRDA's attempt to shift responsibility for flooding appears to be an intentional misunderstanding of the Corps' role and the source of authority for its role. Here, the Corps' involvement with flood pool operations stems from FERC's placement of a condition on the license, that the Licensee take direction from the Corps with respect to flood control. As a result, despite the Corps' role in the Project, it is FERC and FERC alone that is engaging in the action (the relicensing) that triggers its legal obligations under National Environmental Policy Act (NEPA) to prepare either an Environmental Impact Statement or an Environmental Assessment before it can decide whether to issue a new license for the Pensacola Project. And because the required environmental review under NEPA must involve an assessment of any environmental effects of relicensing, including any potential flood effects, FERC cannot avoid a thorough assessment of flooding impacts by attempting to hide behind the Corps' regulation of the flood pool.	Comment No. 9. The H&H and Sedimentation Study Plans have been specifically designed to identify and distinguish GRDA's hydropower operations under the FERC-issued license from USACE's flood control operations. The results of these studies will aid FERC's understanding of the effects of its licensing action, as well as the cumulative effects of the USACE's flood control activities, in conformance with NEPA obligations. *See* Order Amending License and Dismissing Application for Temporary Variance, 160 FERC ¶ 61,001 (2017).
16	Miami Tribe 7/26/2018 (Letter)	PSP Introduction / Background	General Comments 2. Environmental Baseline GRDA's PSP offers current project operations as the environmental baseline for the relicensing process. Indeed, bootstrapping new operations as the baseline for relicensing was one of the primary purposes of GRDA's license amendment petition, and explains why GRDA so vociferously opposed the Tribe's request that FERC comply with NEPA and NHPA in the context of both the variance and amendment proceedings - both federal undertakings. But GRDA's effort to use these new conditions as the baseline relies on legal precedent that was recently reversed by the United States Court of Appeals for the District of Columbia Circuit. In that case, FERC used current project conditions as the environmental baseline, relying on the same precedent offered by GRDA here. The Circuit Court determined that FERC's issuance of the license was arbitrary and capricious because its environmental baseline approach "declined to factor in the decades of environmental damage already wrought by exploitation of the waterway for power generation and that damage's continuing ecological effects." The license was vacated and the matter was remanded for further more rigorous review. The *American Rivers* decision renders GRDA's PSP inadequate because it proposes studies that are limited to an analysis or existing project operations and conditions. This is true of the proposed	GRDA disagrees with the Tribe's analysis of the recent U.S. District of Columbia Circuit opinion in *American Rivers & Alabama Rivers Alliance v. Federal Energy Regulatory Commission Am. Rivers v. Fed. Energy Regulatory Comm'n*, 895 F.3d 32 (D.C. Cir. 2018). The court held that in that case the Commission failed to discharge its obligation under NEPA to analyze cumulative impacts of its relicensing decision, i.e., to evaluate "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." *Citing* 40 C.F.R. § 1508.7. The court held that FERC's "cumulative-effects analysis had to account for all past impacts of the dams' construction and operation, including the enduring or ongoing effects of past actions." Importantly, the Tribe is wrong in asserting that the D.C. Circuit in *American Rivers* "reversed" prior case law concerning the appropriate environmental baseline. In fact, nowhere in American Rivers does the D.C. Circuit even mention the Ninth Circuit's 1999 ruling in American Rivers v. FERC (Am. Rivers v. FERC, 201 F.3d 1186 (9th Cir. 1999)) or its own 2000 decision in Conservation Law Foundation v. FERC (Conservation Law Found. V. FERC, 216 F3d 41 (D.C. Cir. 2000)) both of which, as detailed in PSP Section 4.1.2, upheld FERC decisions to use existing conditions as the environmental baseline. 216 F.23d at 46. Thus, *American Rivers* does not disturb or call into question long-standing FERC policy and

	Entity	PSP Section	Comment	GRDA Response
			hydrologic and hydraulic modeling study, socioeconomic study, and cultural resources assessment study. These inadequacies expose any license that is based on upon them.	Council on Environmental Quality (CEQ) guidance that indicates that for purposes of NEPA, proposed actions are to be compared to existing conditions, and past actions are to be considered as part of the cumulative impacts component of the analysis.
17	City of Miami 7/26/2018 (Letter)	PSP Introduction / Background	General Comments on the Scope of GRDA's PSP A. FERC Authority to Require Flood Mitigation In its August 15, 2017 order amending GRDA's license, FERC clearly recognized that flood control is a Project purpose. "Grand Lake is managed for multiple purposes, including power generation, recreation, fish and wildlife enhancement, and flood control." FERC goes on to clarify that although "the Corps maintains exclusive jurisdiction over operations within the flood pool, i.e., from 745 to 755 feet PD, in relicensing the Commission may consider the effect of GRDA's operations on flooding, including the appropriate target elevations and any necessary mitigation." Importantly, GRDA did not object to this language by requesting rehearing or clarification. The language in the order aligns with the final Environmental Assessment prepared for the license amendment, which stated that "[a]ny mitigation for flooding will . . . be considered in relicensing . . . ." FERC's acknowledgement of flood control as a licensed Project purpose, and FERC's authority to mitigate for flooding, is perfectly consistent with the longstanding shared responsibility of FERC and the Corps in such instances. Based on its expertise and basin-wide responsibilities in such matters, the Corps directs the operation of the Project as necessary to manage flood risk. But it is FERC that is responsible for determining the terms and conditions necessary to mitigate the flood impacts of the hydroelectric project it is licensing. GRDA attempts to avoid its obligation to mitigate for flood impacts by blurring this distinction, essentially arguing that because the Corps directs the Project's operations during flood events, FERC is precluded from requiring GRDA to provide flood mitigation, such as flowage easements. The PAD incorrectly states that under the Flood Control Act of 1944, the Corps "has exclusive jurisdiction over Grand Lake for flood control purposes." Consequently, GRDA argues that while it is "sympathetic to flooding that can and does occur upstream of Grand Lake during high precipitation events," "flood control at this Project is simply not a 'project purpose' for purposes of the Commission's responsibilities under the FPA." In other words, GRDA erroneously suggests that the Corps' "exclusive jurisdiction" over Grand Lake for flood control purposes excludes FERC from imposing flood mitigation requirements. GRDA's view is incompatible with Federal Power Act ("FPA") Section 10(a)(1), which only allows FERC to license a project that it finds "best adapted to a comprehensive plan for improving or developing a waterway" for commerce, hydropower, fish and wildlife protection and enhancement, "and for other beneficial public uses, including . . . flood control . . . ." In service of that requirement, FERC "shall have authority to require the modification of any project . . . before approval." Nothing in the Corps' authority to direct flood control operations conflicts with FERC's authority to include flood mitigation measures in the new license. GRDA also ignores the crucial fact that GRDA alone—not the Crops—dictates dam operations during the most dire high-water events. In the PSP, GRDA claims that its "responsibilities for its Project-related operations extend only to elevation 750 feet PD, consistent with the Flood Control Act of 1944, [Corps'] 1992 Water Control Manual for the Pensacola Reservoir, and the Water Control Agreement for the Pensacola Dam." On the contrary, the Water Control Agreement cited by GRDA specifies that GRDA "is responsible for regulation above elevation 755.0 feet. The Corps will provide technical assistance if requested." The 1992 Letter of Understanding between the Corps and GRDA over dam operations is even clearer: GRDA "shall be responsible for directing storage and release of all waters when the lake level is above the top of the flood control pool, elevation 755.0 feet, Pensacola datum." GRDA's retained authority above 755 PD reflects GRDA's ultimate responsibility for the structural safety of the dam—subject to FERC licensing, oversight,	As explained in PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment Nos. 9 and 16, GRDA disagrees with the City of Miami's comment, to the extent it references flooding and backwater effects attributable to USACE's flood control operations. Moreover, the City miscomprehends the scope of USACE's flood control authority. It is true that GRDA has responsibility to protect facilities once Grand Lake reaches elevation 755 feet PD at Pensacola Dam. That does not mean, however, that USACE loses flood control jurisdiction—such a conclusion would be directly in conflict with the express requirements of Section 7 of the 1944 Act. Rather, USACE, in fulfilling its responsibilities under the 1944 Act—has determined that GRDA is in the best position (given its on-the-ground presence) to protect facilities once water levels reach the rest of the dam. Similarly, the City overstates the applicability of elevation 755" in the Flood Control Manual and accompanying MOU. The 755 feet PD reference is to the surface elevation at the dam—not to any lands upstream of the dam that are above elevation 755 feet PD.

	Entity	PSP Section	Comment	GRDA Response
			and conditioning. This change of control back to GRDA is not hypothetical. According to the USGS, the gage actually exceeded 755, reaching 755.27, on May 25, 1957. If that happened today, GRDA would be alone in the driver's seat. GRDA has come extremely close to this transition point repeatedly in just the last four years. On May 30, 2015, the reservoir stood at 754.97— about 1/3 of an inch from the entire operation becoming GRDA's sole responsibility. Months later, in December 2015, the gage reached 754.95, about a half-inch below the top of the flood pool. Video shows water from Grand Lake overtopping the Pensacola Dam flood gates— elevation 755 PD—during this event. And in 2017, the level reached 754.81 on May 22—and never dropped below 750 during the entire month. The City's previous arguments regarding FERC's authority to impose flood mitigation, including extensive citation to the Project's regulatory history, appear in its March 13, 2018 comments, and need not be repeated here. Because this issue is not likely to be resolved until FERC issues its final license order, or perhaps even on appeal from that order, the City recommends that GRDA assume, for purposes of its RSP, that FERC has jurisdiction to include flood mitigation obligations in the new license. Otherwise, the City is concerned that GRDA may seek to omit studies or narrow their scope in a way that will leave significant information gaps in the event that it is later confirmed that FERC has jurisdiction to require flood mitigation. Such an outcome would defeat the whole purpose of front-loading studies under the ILP process. The resulting information gaps would, at the very least, delay the relicensing process, and at the worst would leave FERC without an adequate factual basis for determining the appropriate terms and conditions to include in the new license.	
18	City of Miami 7/26/2018 (Letter)	PSP Introduction / Background	General Comments on the Scope of GRDA's PSP B. Environmental Baseline/Pre-Dam Conditions GRDA proposes to improperly limit the scope of the PSP by using current Project conditions and operations as the baseline for environmental analysis. GRDA relies on "FERC's longstanding policy" and two court decisions from 1999 and 2000 in support of this position. However, since GRDA filed the PSP, the D.C. Circuit in American Rivers v. FERC rejected exactly this approach. In using current conditions as the environmental baseline in that case, FERC relied on the same precedent cited by GRDA in the PSP. The D.C. Circuit held that, by taking the approach GRDA now advocates, FERC had "declined to factor in the decades of environmental damage already wrought by exploitation of the waterway for power generation and that damage's continuing ecological effects." As a result, "the Commission's issuance of the license was arbitrary and capricious," and the court vacated the license and remanded for proper environmental analysis. In light of the D.C. Circuit's recent decision, GRDA should expand the scope of any proposed studies that would limit the analysis to existing Project operations or existing conditions. For example, the proposed hydrologic and hydraulic modeling study ("H&H Study") states that: "Because FERC's environmental baseline policy considers current conditions, the H&H Study does not include any efforts to compare the current or proposed operation to pre- dam conditions or previous rule curves." Similarly, GRDA proposes that its socioeconomic study will "rely upon existing information to define the baseline economic conditions in the region under current operations to a level that will allow for assessment of any potential changes between the existing condition and proposed operational changes." Such analytical limitations would ignore decades of ongoing, unmitigated Project impacts and thereby place a license in serious legal jeopardy after *American Rivers*.	GRDA disagrees with the Tribe's comment. As explained in GRDA's response to Comment No. 16, the City has both misinterpreted the D.C. Circuit's ruling in *American Rivers* and miscomprehended the scope of GRDA's PSP.
19	City of Miami 7/26/2018 (Letter)	PSP Introduction / Background	General Comments on the Scope of GRDA's PSP C. Study of Potential PM&E Measures GRDA wrongly claims that the study period is too early to study the effects of potential protection, mitigation, and enhancement (PM&E) measures. In its March 13, 2018 Comments, the City noted	GRDA will not be identifying or evaluating any potential PM&Es as part of study plan development. Doing so at that time would be inherently and logically premature. The information developed for the Initial Study Report (ISR) and Updated Study Report (USR) will inform GRDA's effects analysis in the Draft License Application/Final License Application. That effects analysis, in turn, will inform any PM&E measures that GRDA proposes as part of its application for a new license. FERC's ILP

	Entity	PSP Section	Comment	GRDA Response
			that GRDA's proposed PM&E measures are inadequate, and that it will need to develop new PM&E measures to address the harm to resources as demonstrated by the studies in the Study Plan. GRDA noted in the PSP that it "received comments and requests concerning proposed PM&E measures for the Project," yet claims without citation, "Per the ILP, assessing the need for and adequacy of any such measures now is premature." FERC's guidance—both general and within this docket—contradicts this view. In its comments on the PSP, FERC "recommend[ed] that the revised study plan include methods for evaluating the potential PM&E measures" developed to address Project effects on upstream flooding. And FERC's general guidance on its study criteria notes: "Requested studies can look at the feasibility of alternative measures to address project effects . . . . The Commission encourages the development of plans and measures to be filed with a license application; therefore, evaluations of potential measures may be needed pre-filing." Section 3.2.2 of SD2 lists GRDA's proposed environmental PM&E measures, which are simply a continuation of the existing ones, with the sole addition since SD1 of developing and implementing a Historic Properties Management Plan. That section states that the "potential need for additional PM&E measures will be evaluated during the relicensing process." The City believes the current PM&E measures are wholly inadequate, and that potential additional PM&E measures must therefore be evaluated as part of the study process in order to lay the foundation for the inclusion of appropriate PM&Es in the new license. In particular, GRDA should develop a range of potential PM&Es with respect to flood management, including changes to the rule curve and a protocol for water pre-releases in anticipation of flood events. Similarly, GRDA should analyze the cost of acquiring additional easements and funding infrastructure improvements or other mitigation for the socioeconomic impacts of Project-caused flooding. The elevation of Highway 10 to the east and west of the City, and Highway 125 to the south, and the purchase of easements are the most important items for the long-term health and viability of the Miami-area community. GRDA's proposed H&H study, modified as suggested by the City's comments below, will demonstrate Project impacts (including cumulative impacts) on existing infrastructure, and can be used to inform the development of appropriate PM&E measures for inclusion in the new license (e.g., the raising of specific roads, extending certain bridges, or constructing or improving levees in certain flood-prone areas). It is also not too early to develop potential PM&E measures regarding cultural and historic resources, recreation, and how GRDA proposes to manage and enforce the flowage easements being transferred from the Corps. The City would be pleased to collaborate with GRDA to craft these and other potential PM&Es so as to enhance the analytical and practical value of the studies GRDA will be undertaking over the next two years.	regulations provide ample opportunities for the City and all other relicensing participants to submit proposed PM&E measures at the appropriate time.
20	City of Miami 7/26/2018 (Letter)	PSP Introduction / Background	General Comments on the Scope of GRDA's PSP D. Consideration of Climate Change Impacts GRDA denies commenters requests to evaluate how climate change will affect Project operations and impacts during the term of the new license. Essentially, GRDA argues that predicting the impacts of climate change on the Project is too uncertain to be beneficial. However, uncertainty in the magnitude of climate impacts does not justify pretending there will be none. Nearly a decade ago, the Ninth Circuit rejected the National Highway Transportation Safety Administration's (NHTSA) deficient National Environmental Policy Act ("NEPA") analysis of the costs of climate change impacts. The court wrote: "NHTSA's reasoning is arbitrary and capricious	The City maintains that GRDA should complete flooding/inundation studies that demonstrate how the global phenomena of climate change will affect the specific environmental impacts of the Project. As discussed in Section 4.1.4 of the PSP, FERC has long articulated that the Commission is unaware of any study that would be able to capture with enough granularity the effects of climate change on a particular hydropower project. Given the limitations on study, it would simply not be reasonable for GRDA to undertake potentially costly studies that would not be reliable, and thus not useful in informing the public of the potential impacts of the Project and assisting FERC in fulfilling its mandate under NEPA. Inherent in NEPA and CEQ regulations "is a rule of reason which ensures that agencies are afforded the discretion, based on their expertise and experience, to determine whether and to what extent to prepare an environmental analysis based on the availability of information, the usefulness

	Entity	PSP Section	Comment	GRDA Response
			for several reasons. First, while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero." Because the NHTSA nevertheless assigned no value to the cost of climate change impacts, its analysis was arbitrary and insufficient. Similarly, the uncertainties in climate science constitute an important aspect of clear-eyed analysis. They do not, however, justify GRDA in studying only a non-existent future in which climate change does not occur. Nor do the cases GRDA cites give it cover. In particular, it cites Alaska Energy Authority for the proposition—as phrased by GRDA—that "FERC has determined that climate change studies are not likely to yield reliable data that can be used to develop license requirements." The decision contains no such sweeping statement. Rather, FERC concluded that the specific climate change studies at issue were not likely to yield useful, reliable data for purposes of relicensing that particular project. But the same paragraph also states that "the effects of climate change on streamflow conditions and any corresponding adverse effects on environmental resources are important issues, and any substantial information regarding these matters will be given due consideration in the Commission's environmental analysis and in any subsequent license order." GRDA has offered no argument against the specific climate analysis requested by the City in this proceeding, of the sort that persuaded the Commission not to require the climate studies proposed in Alaska Energy Authority. Having offered no argument as to why considering climate change is not appropriate for the Project license, GRDA must study what FERC has acknowledged as "important issues" of climate change's future effect on hydroelectric projects. GRDA may contend, upon reviewing the science relevant to the studies it performs, that the role of climate change remains too uncertain to meaningfully inform this relicensing. If so, GRDA is free to state such a conclusion in the study report, with appropriate citation to the scientific literature. However, it is not appropriate to declare before doing any studies that climate change is uncertain, and therefore need not be studied at all. Finally, GRDA's climate change argument relies directly on the environmental analysis struck down in the above-cited American Rivers decision. Although the D.C. Circuit did not specifically address climate change, the long list of analytical shortcomings identified by the court in vacating the hydroelectric license in that case hardly makes it a model for a sound study or a defensible license.	of that information to the decision making process, and the extent of the anticipated environmental consequences." *Eagle Crest Energy Co.*, 153 FERC ¶ 61058 (Oct. 15, 2015) ("Eagle Crest"). *See also Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 767 (2004) ("[I]nherent in NEPA and its implementing regulations is a rule of reason . . . .") (citations omitted). With respect to climate change, FERC has not yet found any climate model useful in that it would "allow the Commission to predict matters such as water supply or flows in a given basin during the 30 to 50 year term of a typical hydropower license in such a manner as to assist the Commission in analyzing alternatives and determining appropriate mitigation for environmental impacts." Eagle Crest at P 81. Thus, FERC has consistently followed the principle that unreliable studies are simply not useful for agency analysis and unreasonable to rely upon, and therefore should be rejected. Alaska Energy Authority stands for the broad contention that FERC will not approve climate change studies that will yield unreliable results. The City incorrectly claims that FERC only rejected the proposed climate change studies at issue in that case. However, Commissioner Norris concurring in the decision provides some clarifying language, "[t]he issue of whether the Commission needs to consider climate change when evaluating the potential environmental effects of a Commission-licensed hydroelectric facilit[ies] is firmly before us in this order." *Alaska Energy Auth.*, 144 FERC ¶ 61040, 61202 (July 18, 2013). Eagle Crest Energy Company, relying on Alaska Energy Authority, reaffirmed that FERC will not require climate change impact studies until the data is reliable enough to be useful and probative of environmental impacts. *Eagle Crest* at P 78—81. The City of Miami's general reliance on *Center for Biological Diversity v. National Highway Traffic Safety Administration*, for the proposition that an environmental impact statement (EIS) will be insufficient for a failure to study climate change related impacts is misguided. 538 F.3d 1172, 1200 (9th Cir. 2008) ("*Center for Biological* Diversity"). There, the court rejected an EIS that did not study the greenhouse gas *emissions contribution* of vehicles operating pursuant to a newly promulgated final rule. However, there is a completely different analysis for projects that *emit* greenhouse gases and *contribute* to climate change than for projects that will have changing environmental impacts as a result of climate change. For example, NEPA analyses studying individual projects that *emit* greenhouse gases often quantify those impacts and attribute a proxy value to each tonne of CO_2 emitted as a surrogate for impacts. *Sierra Club v. Fed. Energy Regulatory Comm'n*, 867 F.3d 1357, 1374 (D.C. Cir. 2017) (citing *WildEarth Guardians v. Jewell*, 738 F.3d 298, 309 (D.C. Cir. 2013) (accepting an agency's contention that the "estimated level of [greenhouse-gas] emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives")). *Center for Biological Diversity* did not consider the completely different inquiry of the changing environmental world due to climate change and how those impacts should be studied for individual projects. This inquiry is far more amorphous and difficult to quantify, and models would have to take into account with specificity unpredictable and changing rainfall patterns, storm patterns, seasonal shifts, and stream and river flows directly related to a hydroelectric project. The *American Rivers v. Federal Energy Regulatory Commission* decision continues to be misapplied throughout the City of Miami's comments and does not suggest that a NEPA analysis will be incomplete without engaging in speculative climate change study. 895 F.3d 32 (D.C. Cir. 2018) ("*American Rivers*"). While NEPA is information forcing that calls for a searching review of environmental impacts, including cumulative impacts that are reasonably foreseeable, CEQ regulations acknowledge and important information may be lacking or unavailable. 44 C.F.R. 1502.22. *See Native Vill. of Point Hope v. Jewell*, 740 F.3d 489, 497 (9th Cir. 2014) (holding that the steps specified by § 1502 .22(b) are required if the agency finds " 'essential' information to be unobtainable"). *See also* Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews; Notice, 79 FR 77801, 77808 (December 24, 2014) ("[I]f an agency determines that

	Entity	PSP Section	Comment	GRDA Response
				evaluating the effects of GHG emissions or climate change would not be useful to the decision maker or the public in distinguishing between alternatives or mitigations, then the agency should document its rationale for not conducting such an analysis."). Notably, the City fails to identify even a single instance in which FERC has required a license applicant to undertake a climate change analysis. Nor does it offer any basis for concluding that the Project is having an impact on climate change, or that any such study would inform any PM&E measures under the new license.
21	N. Larry Bork on behalf of City of Miami Citizens 7/26/2018 (Letter)	N/A	In addition to those studies reflected in the TetraTech study plans referenced above, the plaintiffs I represent adopt the positions of the City of Miami and Tribes regarding the following: • FERC authority to require flood mitigation; • Environmental Baseline/Pre-Dam Conditions; • Consideration of potential protection, mitigation and enhancement measures; • Consideration of climate change impacts.	Please refer to GRDA's response to Comment Nos. 16-20.
Hydraulic and Hydrologic Modeling Study				
22	FERC 7/20/2018 (Letter)	Section 3.1.1 of PSP Introduction / Background and Section 2.1 of H&H Study Plan	Section 3.1.1, *Hydrologic and Hydraulic Modeling Study*, of the proposed study plan and section 2.1, *Study Goals and Objectives*, of the H&H Modeling study plan, state that the study would: (1) determine the duration and extent of inundation under the current operation of the project during several measured inflow events; and (2) determine the duration and extent of inundation under any proposed change in operation that occurs during several measured or synthetic inflow events. We agree that preliminary model runs under current operation would be helpful in identifying a range of operation changes to evaluate. However, as discussed at the study plan meetings, the study plan should include a specific proposal and timeline for providing preliminary information to stakeholders, and a procedure for gathering and evaluating stakeholder recommendations for operational changes to be modelled.	Section 2.6.9 of the H&H Study Plan has been revised to outline relicensing participant involvement in the H&H Study. The plan provides for an iterative process that includes a timeline for providing preliminary information to relicensing participants, and methods for gathering and evaluating relicensing participant recommendations for operational changes.
23	FERC 7/20/2018 (Letter)	Section 4.1.1 of PSP Introduction / Background and Section 2.6 of H&H Study Plan	Section 4.1.1, *Flood Control Operations*, of the proposed study plan states that mitigation for the effects of U.S. Army Corps of Engineers (Corps) flood control operations is beyond the scope of the Commission's relicensing process. However, one component of the H&H study is determining the extent to which project operations may affect or contribute to upstream flooding. We recommend that the revised study plan include methods for evaluating the potential protection, mitigation, and enhancement measures, developed by GRDA or through stakeholder consultation to address upstream flooding attributed to project operations (if any).	Section 2.6.9 of the H&H Study Plan has been revised to include methods for evaluating alternative scenarios developed by GRDA or through relicensing participant consultation to address upstream flooding attributable to Project operations, if any.
24	FERC 7/20/2018 (Letter)	Section 4.2.1 of PSP Introduction / Background and Section 2.6 of H&H Study Plan	Section 4.2.1, *Flooding/Inundation Study*, of the proposed study plan states that the study will "incorporate some two-dimensional (2-D) analysis, where appropriate." Section 2.6, *Methodology*, of the H&H Modeling study plan states that certain reaches and tributaries will be represented using 1-D, while others will be modeled as 2-D. The revised study plan should clarify general criteria for using 1-D or 2-D analysis for the modeling component of the study, and explain why 1-D or 2-D representation was chosen for each of the river reaches or tributaries discussed.	Section 2.6.1 of the H&H Study Plan has been revised to clarify the criteria for using 1-D and 2-D modeling in the Comprehensive Hydraulic Model (CHM). It also provides reasoning for proposing specific methods for each reach in the model.
25	FERC 7/20/2018 (Letter)	Section 4.2.1 of PSP Introduction / Background and H&H Study Plan	Section 4.2.1, *Flooding/Inundation Study*, of the proposed study plan states that the flood frequency analysis component of the H&H Modeling Study will analyze the "peak inflow event observed during the measured inflow event used in the [comprehensive hydraulic model] runs at Pensacola Dam." We recommend that the revised study plan clarify what the "peak inflow event observed during the measured inflow event" would be, how that would be determined, and where the peak flow is occurring. We also recommend that the revised study plan include a detailed description of the proposed flood frequency analysis, including the range of flood frequency events that will be evaluated in the H&H Study. This should be representative of a range of flood events and not one peak event, as currently described. In staff's study request, we previously identified flood frequency ranges of 5-, 10-, and 15-years to act as a guide for the range of flood events we would like to see evaluated.	To help clarify, the sentence in Section 4.1.1 of the RSP has been revised to say "The H&H Study proposes a flood frequency analysis of the peak inflow observed at Pensacola Dam during the measured inflow events used in the CHM model runs." Section 2.6.7 of the H&H Study Plan has been revised to provide more detail about the flood frequency analysis for the Project.
26	FERC	Section 4.2.1 of PSP	Section 4.2.1, *Flooding/Inundation Study*, of the proposed study plan states that the existing Corps	Section 2.6.3 of the H&H Study Plan has been revised to explain that while the USACE's basin-

	Entity	PSP Section	Comment	GRDA Response
	7/20/2018 (Letter)	Introduction / Background and H&H Study Plan	Flood Operations Model is a basin-wide model used to plan flood control operations throughout the entire Arkansas River basin and is not specific to the Pensacola Project. GRDA concludes it is not relevant to this relicensing effort and will not be utilized as part of the H&H Study. In the revised study plan, please clarify why the model would not be a relevant source of inflow and outflow data for the project, which is located within the same overarching basin and subject to Corps flood control operations, and a useful tool in evaluating how project operations interact with the larger flood control system upstream of the dam.	wide RiverWare model will be a good source of hydrologic data and Project operations, it is not well-suited for this study.
27	FERC 7/20/2018 (Letter)	Section 4.2.1 of PSP Introduction / Background and Section 2.3 of H&H Study Plan	Section 4.2.1, *Flooding/Inundation Study*, of the proposed study plan and Section 2.3, *Background and Existing Information*, of the H&H Modeling study plan reference the FEMA Tar Creek Model (2015) developed for flood risk mapping in the Grand Lake Watershed. Section 2.3 of the H&H Modeling study plan states that "after a review of the information associated with the FEMA model, it was determined that utilizing available USGS 2011 LiDAR data as the model basis for the Tar Creek portion of the watershed, versus the data from the FEMA model, is not the best approach to attain the goals of the H&H Study. Therefore, the FEMA Model will not be used as a basis for the H&H Study." The statement is contradictory and indicates that neither the USGS 2011 LiDAR data nor the FEMA Tar Creek Model will be used. The revised study plan should clarify which dataset(s) will be used in the analysis of Tar Creek, and provide a more detailed explanation for using or excluding existing datasets.	Section 4.1.1 of the RSP and Section 2.3.1 of the H&H Study Plan have been modified to remove the word "not" in the first sentence quoted by FERC.
28	FERC 7/20/2018 (Letter)	Section 4.2.1 of PSP Introduction / Background and Section 2.6 of H&H Study Plan	Section 2.6, *Methodology*, of the H&H Modeling study plan states that "a minimum of six inflow hydrographs…will be run at starting reservoir elevations at Pensacola Dam ranging from 742 feet to 745 Pensacola datum (PD) in one-foot increments." In the revised study plan please provide more information on the six inflow hydrographs that will be used, including and how the curves relate to the peak inflow events described in Section 4.2.1, *Flooding/ Inundation Study*, of the proposed study plan. We also recommend that the model evaluate a comprehensive range of observed elevations rather than only rule curve elevations. The highest and lowest starting elevations evaluated should reflect the range of reservoir elevations observed over the entire course of the license period, including observed reservoir elevations at Pensacola Dam during power generation which may be higher than 745 feet PD, and historical starting elevations which may be less than 740 feet PD.	Section 2.6.5 of the H&H Study Plan has been revised to include starting reservoir elevations ranging from 740 feet PD to 745 feet PD.
29	FERC 7/20/2018 (Letter)	Section 2.6 of H&H Study Plan	Section 2.6, *Methodology*, of the H&H Modeling study plan states that the Oklahoma Water Resources Board area capacity curves will be used for Grand Lake up to 745 feet PD, above which a modified version of the curve will be used up to 760 feet PD. We recommend that GRDA extend the modified version of the capacity curve to the highest observed elevations at the upstream portion of Grand Lake rather than limiting analysis to 760 feet PD.	The standard of practice for developing a capacity curve at a dam is to assume a level water surface through the reservoir with the curve extending to the top of dam. 757 feet PD is top of dam and it has not overtopped in the historical record. Therefore, a capacity curve, based on a level operating surface of 760 already extends above the top of dam and includes the highest observed elevations at the upstream portion of Grand Lake assuming a level water surface throughout the reservoir.
30	FERC 7/20/2018 (Letter)	Section 2.6 of H&H Study Plan	In addition to the written summary of the available LiDAR, topographic, and bathymetric data sets provided in Section 2.6, *Methodology*, of the H&H Modeling study plan, please map the geographic coverage of each data set in the revised study plan. If datasets overlap geographically, indicate the preferred dataset and why other sources will not be used.	Section 2.3.3 of the H&H Study Plan has been updated to include a map (Figure 2.3-1) showing the extents of the various topographic and bathymetric data sets. In addition, Section 2.3 was updated to clarify the precedence of the overlapping datasets.
31	FERC 7/20/2018 (Letter)	Section 2.6 of H&H Study Plan	Section 2.6, *Methodology,* of the H&H Modeling study plan states that the model will be calibrated using historic inflow events that represent a range of the recorded and surveyed high water marks available. We recommend that the H&H Modeling Study include several data sources to calibrate the hydraulic model against the actual observed elevations during the inflow events. In addition to historical high-water marks recorded during flood events, historic channel and overbank elevations from topographic and/or bathymetric surveys, and roughness coefficients derived from historic aerial photography for the channel and overbank areas should be analyzed and incorporated to ensure the model accurately represents the conditions at the time of the inflow event.	Section 2.6.3 of the H&H Study Plan was revised to clarify the data that will be utilized for calibration of the CHM. It is not generally accepted scientific practice to incorporate historic topographic/bathymetric data into calibration of hydraulic models to historic events and is beyond the objectives of the proposed study. It is also unlikely that the topographic/bathymetric data would be available for the exact time-period needed for the historic events, or that the resolution of the datasets would be acceptable for incorporating into the model for calibration purposes.
32	FERC 7/20/2018 (Letter)	H&H Study Plan	As identified previously, to avoid confusion between Pensacola Datum and NAVD 88 Datum, please identify a datum with all reported elevations.	Section 2.6 of the H&H Study Plan was revised to add the Pensacola datum.
33	USACE 7/26/2018	H&H Study Plan	The Corps Hydrology and Hydraulics Branch staff have reviewed the proposed Hydrologic and Hydraulic Modeling Study plan and believe the methodologies to be consistent with Corps	GRDA appreciates USACE's review of the H&H Study Plan and looks forward to working together on this study.

	Entity	PSP Section	Comment	GRDA Response
	(Letter)		processes. We look forward to reviewing the results, as well as sharing data and computer models.	
34	BIA 7/26/2018 (Letter)	Section 2.5 of H&H Study Plan	In Section 2.5 of the H&H Study, GRDA defines the study area too narrowly. For example, the study area with respect to Tar Creek should, at a minimum, extend upstream beyond the USGS gauge at the 2211d Avenue Bridge to above the USGS gauge at Commerce, Oklahoma, which is much closer to the source of contamination and would reveal more relevant information regarding the transport of those contaminants. For simplicity's sake, the study area should extend to all land upstream of the Project, north to the Kansas state line and east to the Missouri state line. This would encompass not only those waterways identified by GRDA but also Lost Creek, Sycamore Creek, and Elk River, which are all waterways of concern to the tribes, their citizens and their tribal lands.	As discussed in Section 2.6 of the H&H Study Plan, the CHM extents will be determined through an iterative process to ensure that the CHM encompasses the areas along the modeled reaches that would experience a material difference in water surface elevation due to Project operations which will include the Elk River. Lost Creek and Sycamore Creek will not be directly included in the CHM as modeled reaches because the necessary stream gage data for these streams does not exist. However, the inundated areas along those tributaries will be mapped based on the Grand Lake water surface elevations.
35	BIA 7/26/2018 (Letter)	H&H Study Plan	Expanding the study area would also encompass the historical and cultural concerns of Indian tribes in the area. For example, the Quapaw Tribe of Oklahoma has expressed concern to the BIA that the Quapaw have historically dwelled alongside the Spring River and therefore have many culturally relevant sites along the Spring River all the way up to the Kansas border.	As discussed in Section 2.6 of the H&H Study Plan, the CHM extents will be determined through an iterative process to ensure that the CHM encompasses the areas along the modeled reaches that would experience a material difference in water surface elevation due to Project operations.
36	BIA 7/26/2018 (Letter)	H&H Study Plan	GRDA should be required to study the effects of the Project and flooding on federal tribal lands. The H&H Study should include an examination of the effects of Project operation and/or flooding on Indian (both tribal and individual) trust lands within or near the Project boundary.	As discussed in Section 2.1 of the H&H Study Plan, the goals of the H&H Study will be to determine the duration and extent of inundation for current operations or any alternative operating scenarios proposed by GRDA. This would include an analysis on any inundated lands regardless of ownership. The modeling effort under the H&H Study will produce a tool for analyzing the effects of GRDA's operation of the Project under the new license, as well as indirect and cumulative impacts associated with flood control operations, which are under the exclusive jurisdiction of the USACE.
37	BIA 7/26/2018 (Letter)	H&H Study Plan	Additionally, GRDA concedes that "[t]he H&H Study will also help determine lands needed for Project purposes and, therefore, inform FERC's determination of the placement of the Project Boundary," see H&H Study at 1. Accordingly, GRDA cannot and should not rely on prior conclusions about the limits of the Project Boundary. The Project Boundary, as determined by the previous license, is not determinative of the Project Boundary that will be defined under the new license. Furthermore, if indeed the H&H Study will "inform FERC' s determination of the placement of the Project Boundary," then the identification of federal lands, and effects thereto caused or contributed to by Project operations and/or flooding, should be included as a component of the H&H Study.	GRDA agrees that an existing Project Boundary is not determinative of the Project Boundary under a new license. As GRDA stated in PSP Section 4.3.1 and RSP Section 4.2.1, GRDA will continue to work with BIA, Commission staff, and other relicensing participants to address this issue in the normal course of the relicensing effort. Indeed, as recently as August 16, 2018, GRDA and BIA met to discuss the Tribal trust land information that BIA provided to FERC in March and May 2018. BIA has not explained why such efforts are inadequate and why a specific study related to this matter is needed. On September 18, 2018, BIA provided FERC with additional information based on which FERC staff indicated that the Project occupies federally-owned lands held in trust for several Native American Tribes or Individual Native Americans. As of the filing of this RSP, the total acreage of tribal trust lands at the Project has not been confirmed or verified, but GRDA does not dispute the presence of federal trust lands in the immediate vicinity of the Project. Because this information was only recently provided to FERC, GRDA is still in the process of reviewing it and determining whether and the extent to which the Project may occupy federal trust lands. GRDA's license application will contain a set of proposed Project Boundary maps as part of its Exhibit G (18 C.F.R. § 4.51(h)) based on study results. The proposed Exhibit G maps will reflect GRDA's assessment of lands that are "needed for Project purposes" as required by FERC. Further, Exhibit A will identify "[a]ll lands of the United States that are enclosed within the Project Boundary . . . identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence a public land survey, by the best available legal description." (18 C.F.R. § 4.51(b)(6)). All relicensing participants will have an opportunity to review and comment on these documents.
38	BIA 7/26/2018 (Letter)	H&H Study Plan	Since the results of the H&H Study will inform the areas to be studied for the Cultural Resource Study, the tribes and the BIA would like to be informed of the H&H Study results prior to commencement of the cultural resources survey work.	This issue is addressed in the Cultural Resources Study Plan. The CRWG will be given the results of the first year of the H&H Study. That information will be used to inform the areas for study in the second year of study.
39	BIA 7/26/2018 (Letter)	H&H Study Plan	BIA's proposed Flooding Inundation or Tribal Lands Study Request explained why the study of flooding effects on tribal lands met FERC's study criteria, and BIA incorporates by reference its explanation herein.	Please refer to GRDA's response to Comment No. 37.

	Entity	PSP Section	Comment	GRDA Response
40	BIA 7/26/2018 (Letter)	H&H Study Plan	The BIA contends that the failure to adequately study the effect of Project operations and/or flooding on tribal lands would render the issuance of any license arbitrary and capricious under the Administrative Procedures Act. The results of any study on the effects to tribal lands directly implicates the Department of Interior's authority under the Federal Power Act. GRDA should not truncate an examination of the Department's jurisdiction and authority at this stage of the relicensing.	GRDA believes that the H&H Study Plan will provide sufficient information to determine whether and to what extent federal trust lands are affected by Project-related water level fluctuations. Please refer to GRDA's response to Comment No. 36.
41	ODWC 7/24/2018 (Letter)	H&H Study Plan	The current study is well thought out in regards to assessing impacts of large, single events, but of concern from a natural resource perspective is more the day-to-day water management. More information outputs are requested, particularly in regards to the operations model" that will be a part of the study. The inclusion of maps and models delineating the expected lake (non-flowing or lentic) boundary during normal operational levels and/or quantification of flooded duration if a varying lake level will be implemented throughout the year would be required to provide sufficient information to address resource concerns. Furthermore, if the extent of the study was increased to include all areas, including small tributaries within the watershed, it may become unnecessary to complete ODWC study proposal A. Quantifying the Effects of Increased Water Level within the Grand Lake O' the Cherokees Watershed or ODWC study proposal D. Impoundment Fluctuation Studies.	The H&H Study will be used in conjunction with existing information to identify impacts to various resource areas. GRDA has not been provided with any information to indicate that resources within the small tributaries are affected by varying lake levels. The necessary stream gage data is not available to expand the CHM to include the numerous small tributaries within the Grand Lake watershed. With the assumptions required to incorporate the small tributaries into the CHM, the results would not be valuable for analytical purposes. Note, however, that the proposed Aquatic Species of Concern and Terrestrial Species of Concern studies will yield information helpful in addressing any resource concerns.
42	ODWC 7/24/2018 (Letter)	H&H Study Plan	While the applicant has proposed a H&H Study, the details or deliverable products from that study are seen as insufficient (at least as presented at the study plan meeting) to address the change(s) in aquatic habitats. The H&H study will provide information on one-time events, but the resource concern is based more on long-term operation and/or alternative operational scenarios. The Operations Model produced during the H&H study should provide sufficient tabular data of inundated elevations, but of more primary concern here is the aggregate quantity (acreage) that is generally unavailable to wildlife on a day-to-day or seasonal basis, which would require (or at least be greatly enhanced) by a combination of H&H data, bathymetric/topographic data and geographic/parcel data within a GIS.	In the RSP GRDA is proposing two new studies (Aquatic Species of Concern Study and Wetlands and Riparian Habitat Study) that will provide information regarding potential changes in aquatic habitat resulting from Project operations. These studies are designed as two-phase studies. During the first year of these studies, GRDA will use existing information and outputs from the H&H Study to determine potential Project-related impacts to these resource areas. If existing information is determined to be insufficient to make such analyses, GRDA has proposed a modest level of effort for field studies to be conducted during the second year of study to obtain the necessary information to perform these analyses. Please refer to GRDA's responses in Sections 4.1.3 and 4.1.5 of the RSP Introduction responding to requests for additional studies. These study plans are also included in Attachment A of the main body of the RSP.
43	Miami Tribe 7/26/2018 (Letter)	H&H Study Plan	While GRDA's proposed study area does include significant areas of concern to the Tribe, including waterways adjacent to its jurisdictional area, the area does not specifically include other areas in the vicinity of the Project for which area Tribes have noted concerns. As a result, the Tribe requests that the geographic scope of the H&H study should be expanded so that it fully evaluates the effects of Project operations on flooding of Tribal Property, whether permanent or intermittent, including the Tribe's jurisdictional area. Further, the Tribe reemphasizes that the H&H Study is central to fully understanding the extent to which the Project is occupying federal lands, is affecting the natural and human environment, and impacting historic properties listed or eligible for listing in the National Register. In this sense, the results of the flood routing study, including details on the full inundation area, will dictate several critical aspects of FERC's NEPA and Section 106 review, including (1) the geographic scope of analysis for effects on resources under NEPA, (2) the APE for Section 106 review, and (3) whether the current Project Boundary must be expanded under a new license as well as the Secretary of the Interior's obligations with respect to inundated federal lands. Therefore, if FERC in concert with GRDA makes determinations regarding geographic scoping, the APE, or the Project Boundary that are not informed by the results of a comprehensive flood routing study, it will be required to amend those geographic determinations if study results indicate flooding effects beyond the geographic area initially scoped.	Please refer to GRDA's response to Comment Nos. 36, 37 and 40.
44	Ben Loring, Oklahoma House of Representatives 7/16/2018 (filed 7/27) (Letter)	H&H Study Plan	For instance, the Hydrologic and Hydraulic Modeling Study being proposed by GRDA appears to me to be inadequate. Much of that discussion is beyond my field of expertise, and I will leave the details of that argument to those more knowledgeable than I. I would point out however, the City of Miami, at no small cost to its taxpayers, is providing ample, detailed information from very competent experts in this field. However, the simple fact that they are wanting the study only on the Neosho River and not the other major tributaries, is my case in point. I understand that a larger portion of the affected population is along the Neosho, but the flooding of a home on the Spring	Comment acknowledged. Although the City of Miami's model from 2015 has some deficiencies and requires several improvements for use in the H&H Study, it provides the best existing model and will be utilized as the basis for moving forward into the H&H Study. The 2015 model, along with proposed improvements, will be used as a basis for the H&H Study. The list of improvements, including updated bathymetric data for the Neosho, Spring and Elk rivers from 2017, are outlined in Section 2.6 of the H&H Study. The H&H Study Plan includes provisions for GRDA to interact with relicensing participants through the model input and calibration report, the technical conference

	Entity	PSP Section	Comment	GRDA Response
			River is just as significant and devastating to that home owner as the flooding of a home on the Neosho is to its owner.	call, the ISR, and the USR. Also, as discussed in Section 2.6.1 of the H&H Study Plan, the Neosho River is not the only tributary included in the CHM. The Spring and Elk rivers, along with Tar Creek will also be analyzed.
45	City of Miami 7/26/2018 (Letter)	H&H Study Plan	**Range of reservoir elevations.** As explained above, the D.C. Circuit's recent decision in American Rivers v. FERC directly contradicts GRDA's proposal to look only at current operations. Accordingly, the H&H Study should evaluate a broad range of reservoir elevations, from the lower elevations that occurred under historical rule curves through elevations higher than the current rule curve. Similarly, FERC's comments on the PSP recommend modeling a "comprehensive range" of reservoir elevations, using not just the current rule curve elevations as starting elevations. Instead, the evaluation should cover "the range of reservoir elevations observed over the entire course of the license period, including observed reservoir elevations at Pensacola Dam during power generation which may be higher than 745 feed PD, and historical starting elevations which may be lower than 740 feet PD."	GRDA does not agree that the proposed H&H Study methods are inconsistent with the D.C. Circuit's ruling in *American Rivers v. FERC*. Please refer to GRDA's response to Comment No. 16. Moreover, as explained in GRDA's response to Comment No. 28, Section 2.6 of the H&H Study Plan has been revised to include a variety of starting reservoir elevations and inflow/storm events.
46	City of Miami 7/26/2018 (Letter)	H&H Study Plan	**Easement cost estimate.** GRDA rejects the City's request for an estimate of the cost to purchase additional flowage easements, on the grounds that the adequacy of the Corps' flowage easements is beyond the scope of the relicensing process. This information represents an important (and historically hidden) component of the societal cost of the Project, and is essential to the Commission's determination of whether the Project, as relicensed, "will be best adapted to a comprehensive plan for improving or developing" the river, as well as its analysis of the Project's financial viability over the term of the new license. To provide FERC with this essential information, GRDA should reconsider its position and develop the cost estimates as previously requested by the City. Moreover, it is odd for GRDA to claim that the "adequacy of the [Corps'] flowage easements" exceeds the scope of relicensing, when Congress has recently expanded GRDA's ownership and control of lands involved in flood control operations. In the Water Resources Development Act of 2016, Congress required the Corps to convey to GRDA "***for flood control purposes***, all right, title, and interest of the United States in and to real property under the administrative jurisdiction of the Secretary acquired ***in connection with the Pensacola Dam project***, together with any improvements on the property." This will give GRDA, as a FERC jurisdictional licensee, ownership of all the Project's existing flowage easements. GRDA will presumably be responsible for enforcing those easements pursuant to its FERC-approved Shoreline Management Plan. In light of all this, the adequacy of Project easements soon to be held by GRDA is squarely within the scope of the relicensing process, as is the value of easements it ought to hold but never has.	GRDA has not included a proposal in the RSP to investigate the cost to purchase flowage rights to accommodate USACE's flood control operations, and believes it would be inappropriate to include such an analysis in this relicensing for a number of reasons. To begin with, any requirement for GRDA to obtain flowage rights to lands that are impacted by USACE's flood control operations would defy nearly 80 years of precedent that this is a USACE responsibility. Please refer to PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment No. 9. Moreover, on many occasions, Congress has directed USACE—not GRDA—to investigate this issue. *See* Pub. L. No. 106-541, § 449(a)(1) (2000) (directing USACE to "evaluate the backwater effects specifically due to flood control operations on land around Grand Lake, Oklahoma"); Pub. L. No. 106-541(b)(2) (directing that full federal funding for a feasibility study be recommended I flood control operations are "a significant cause of the backwater effects."). To the extent that FERC determines that any changes to the Project Boundary are needed to include additional lands that are needed for Project purposes, GRDA acknowledges its responsibility under Standard Article 5 to obtain rights in perpetuity over such lands. Still, matters related to the cost or means of obtaining any such rights are beyond the FERC's jurisdiction and have no place in this relicensing. *See JDJ Energy Co.*, 101 FERC ¶ 61,059, at 61,206 (2002).
47	City of Miami 7/26/2018 (Letter)	Section 1.0 of H&H Study Plan	The study plan should specify the indirect and cumulative impacts that are being evaluated.	As described in Section 1.0 of the H&H Study Plan, the H&H Study will produce a tool for analyzing the effects of GRDA's operation of the Project under the new license, as well as indirect and cumulative impacts. The study plan does not indicate it will analyze or evaluate indirect and cumulative impacts. The evaluation and analysis of indirect and cumulative impacts will be completed by the Commission as part of its NEPA evaluation.
48	City of Miami 7/26/2018 (Letter)	Section 1.0 of H&H Study Plan	The study plan should provide further discussion on specifically how the H&H study will be used to define the Project Boundary.	Please refer to GRDA's response to Comment No. 37.
49	City of Miami 7/26/2018 (Letter)	Section 2.1 of H&H Study Plan	The study plan indicates that GRDA may propose alternative operation scenarios. During the study plan meeting, Mead & Hunt indicated that outside groups will also be able to propose operation scenarios. The study plan should be updated to indicate that interested parties can request model scenarios and provide information on the process for doing so, including at what stage in the study and the information required to be provided with the request.	Section 2.6.9 of the H&H Study Plan has been revised to allow outside groups to provide input to the study process as outlined in the RSP. Please refer to GRDA's response to Comment Nos. 22 and 28.
50	City of Miami	Section 2.3 of H&H	1. The City of Miami concurs that the Tetra Tech (2015) model forms the best basis for the	GRDA appreciates the opportunity to work with the City and its consulting team to build upon the

	Entity	PSP Section	Comment	GRDA Response
	7/26/2018 (Letter)	Study Plan	Comprehensive Hydraulic Model (CHM). 2. During the study plan meeting, Mead & Hunt provided additional information on the proposed hydraulic modeling including: • The model will be developed using the most recent version of HEC-RAS. • Grand Lake will be modeled using the 2-dimensional (2-D) capabilities of HEC-RAS to better simulate the stage-storage relationships. • Tar Creek will be modeled using the 2-D capabilities.	prior work conducted by Tetra Tech.
51	City of Miami 7/26/2018 (Letter)	Section 2.3 of H&H Study Plan	The study plan indicates that the National Elevation Dataset (NED) with 10m resolution will be used for areas outside the 2010 LiDAR coverage. The NED 10m mapping has an elevation uncertainty (standard deviation) of ±1.9 meters (~6 feet) (Haneburg, 2006) which is not sufficiently accurate for floodplain mapping. There are tribal lands outside of the LiDAR coverage that may be flooded, included Eastern Shawnee lands along Lost Creek near the Missouri border and Seneca-Cayuga lands along Sycamore Creek. It is recommended that a map be created showing the extents of the LiDAR coverage, tribal lands and extents of the hydraulic model to ensure the tribes are in agreement with the data to be used. If the tribes do not agree with the extent of the data, it may be necessary to collect additional LiDAR data to expand the mapping.	Section 2.3.3 of the H&H Study Plan has been updated to include a map (Figure 2.3-1) showing the extents of the various topographic and bathymetric data sets. GRDA does not believe the collection of additional data is necessary because the collection of such data would result in an effort that would significantly exceed generally accepted scientific practice for the type of study being proposed. The cost would greatly outweigh the benefit, and the schedule cannot accommodate such an effort. See 18 C.F.R § 5.9(b)(7).
52	City of Miami 7/26/2018 (Letter)	Section 2.3 of H&H Study Plan	1. The Oklahoma Water Resource Board (OWRB) performed bathymetric surveys of Grand Lake in 1996, 2003 and 2008/2009; the 2003 data was not finalized and should not be used. The OWRB (2009) report states that "The 2008/2009 survey shows that Grand lake had a decrease in capacity of 9.3 % or approximately 156,588 ac-ft" (OWRB, 2009) since construction. The report also states "It is the recommendation of the OWRB that another survey using the same method used in the 2008/2008 survey be conducted in 10-15 years". We are now in the 10-15 year period and an updated survey would provide critical information to: (1) update the bathymetric data used to develop the hydraulic, sediment transport and contaminated sediment transport models, (2) update the stage versus storage volume rating-curve and analyses of the loss of storage capacity overtime, and (3) evaluate historic sedimentation rates and predict impacts of continued sedimentation. 2. The OWRB surveys indicate that significant sediment deposition has occurred near the head of the reservoir. The 2009 OWRB survey also shows significant sediment deposition upstream of Sycamore Creek located about 37 miles upstream from the dam (Figure A). In addition, the profiles show degradation downstream of Twin Bridges between 1997 and 2009. The downstream limit of the Tetra Tech (2015) and USGS (2017) surveys was near Twin Bridges, and therefore, these surveys did not measure the sedimentation upstream of Sycamore Creek. 3. FERC recognizes that updated data may be needed as stated in FERC's study plan request. "In order to support the hydraulic model, acquire the necessary data that may include bathymetry, topography, channel bed elevations, stream gage data, high water marks, precipitation data, details on historical storms that resulted in flooding, and details regarding the amount and duration of releases from the project during flood events as well as upstream and downstream releases from Corps' operations. Where data are outdated or not available, new data would be collected." (FERC, 2018c). Based on the time since the last survey, the observed changes in channel profile and the recommendation by OWRB, it is strongly recommended that Grand Lake be re-surveyed to provide the most up to date bathymetry and stage-volume curves for the hydraulic model, sedimentation analysis and requested contaminated sediment transport study.	By utilizing very detailed bathymetry data for Grand Lake that is less than 15 years old, the proposed study already exceeds the generally accepted scientific practice for this type of study. Please refer to GRDA's response to Comment No. 51.
53	City of Miami 7/26/2018 (Letter)	Section 2.3 of H&H Study Plan	To understand of the sediment deposition with sufficient detail to address issues in this study plan, it will be necessary to compare the thalweg and mean bed elevation profiles to the predam conditions, similar to the comparison in Figure 2-1. Known surveys conducted on the Neosho River	Section 2.3.4 has been revised to evaluate changes to channel bathymetry using the relevant datasets. It will provide data to compare with findings of the other sedimentation investigations.

	Entity	PSP Section	Comment	GRDA Response
			and Grand Lake that may be relevant to the comparison include: a. 1909 USGS Survey on Grand Lake and Neosho River b. C1940 USACE Survey of Neosho River c. 1996 USACE Survey of Neosho River d. 1995 and 1998 Settle Engineering Survey of Neosho River e. 1996 and 2009 OWRB surveys of Grand Lake f. 2015 Tetra Tech Survey of Neosho River g. 2017 USGS Survey of Neosho River	
54	City of Miami 7/26/2018 (Letter)	Section 2.3 of H&H Study Plan	As discussed previously, the 2009 OWRB area-capacity curves are nearly 10 years old. An updated bathymetric survey of Grand Lake is recommended and the data used to update the area-capacity curves	Please refer to GRDA's response to Comment No. 52.
55	City of Miami 7/26/2018 (Letter)	Section 2.5 of H&H Study Plan	During the Cultural Resources Working Group meeting on May 31, 2018, a tribal representative indicated there are tribal lands upstream of the proposed model limit on the Spring River. Furthermore, they requested that the upstream limit be extended to the Kansas border, a request with which the City of Miami concurs.	Please refer to GRDA's response to Comment No. 24.
56	City of Miami 7/26/2018 (Letter)	Section 2.5 of H&H Study Plan	***"The overall H&H Study will also include channel and overbank areas that have a measurable difference in water surface elevations due to Project operation during the measured inflow events extending downstream of the Pensacola Dam." (text from H&H Study Plan)*** Requested Change/Clarification - 1. The Study Plan needs to define the criteria for measurable difference. 2. What Project operations are being compared to create the measurable differences?	Section 2.5 of the H&H Study Plan has been revised to define the criteria for a material difference in water surface elevation. Section 2.6 of the H&H Study Plan has been revised to include clarification of the alternative operating scenarios that may be proposed by GRDA. Please also refer to GRDA's response to Comment No. 28.
57	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	1. Since much of the model will be 2-dimensional, explain how the lower resolution 1-D cross-sections will be incorporated into the model. 2. In addition to the channel sedimentation, there appears to be a feedback loop between overbank sedimentation, vegetation and roughness. These factors have likely led to an increase in the stage, duration and extents of flooding. Given that this effect will likely continue, it will be important to consider in evaluating the future impacts of flooding. The City requests an evaluation of future conditions over the proposed license period including the effects of continued sedimentation on flooding in the City of Miami over the proposed license period of up to 50 years.	1. Please refer to GRDA's response to Comment No. 24. It is also important to clarify that the 1-D cross sections will not necessarily be "lower resolution". The 1-D cross sections will still incorporate the same detailed terrain and bathymetric data used to develop the 2-D areas within the model. Also, the cross-section spacing used within the Tetra Tech model will be refined as needed to more accurately model areas along the Neosho River and through Grand Lake. 2. Requesting an analysis of future conditions in relation to sedimentation, overbank roughness and vegetation cannot be accomplished. The data for the change in overbank roughness, vegetation, the inflow hydrograph, and sedimentation rate cannot be predicted and is outside of the ability of GRDA to manage as part of the operation of the hydroelectric project. Therefore, the necessary information for the future state of these factors is not available. The H&H Study and the Sedimentation Study will describe the impacts of Project operation on sedimentation accumulation rates within the Project area and inundation extent and frequency that occurred in the past under known Project hydroelectric operations. If the current sedimentation rates continue as have historically occurred, the Sedimentation Study will better define impacts of sedimentation on inundation extent and duration. The necessary future conditions are not available to complete the evaluation of future conditions as proposed by the City of Miami. Therefore, they will not be part of any proposed study.
58	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	During the study plan meetings, Mead & Hunt clarified this statement to indicate that the model would be run over a range of floods with inflows from the various tributaries. Each simulation will represent an individual flood event with duration up to weeks; continuous simulation of multiple events will not be performed. Change the language in the Study Plan to indicate simulations will be run over individual flood events.	Comment acknowledged. Section 2.6.1 of the H&H Study Plan has been clarified to state that the CHM will be run over individual flood events.
59	City of Miami 7/26/2018	Section 2.6 of H&H Study Plan	The Tetra Tech (2015) hydraulic model indicated that there are routing effects along the 60-mile length of Grand Lake, including a rise in water-surface elevation between the dam and the head of	Please refer to GRDA's response to Comment No. 26.

	Entity	PSP Section	Comment	GRDA Response
	(Letter)		the reservoir of up to 3 feet. As a result, the level-pool routing assumption is not valid. In response to questions during the study-plan meetings, Mead & Hunt stated that there are limitations to standard reservoir routing models such as HEC-SIM and RiverWare that make them unsuitable to this study. Furthermore, they indicated that the Excel-based method has routines to rout flow through Grand Lake. When possible, we support the use of publicly available software that has been developed for specific applications, e.g. the HEC-SIM software developed for reservoir routing. The study plan needs additional documentation to explain: (1) the specific limitations of the standard software programs and reasoning for why they are not suitable for use in this study, and (2) the routing methodology and assumptions to be applied in the Excel-based modeling, and specifically, how those methods will account for the rise in water-surface along the length of the lake. This will be a critical factor in accurately estimating ungagged inflows, based on the proposed method.	1. Section 2.6.2 of the H&H Study Plan has been revised to include additional information about why the USACE's basin-wide RiverWare model is not well suited for the H&H Study. 2. As discussed in Section 2.6.2 of the H&H Study Plan, the Operations Model will utilize a level-pool routing method, which is considered generally accepted scientific practice for this type of study. Attempting to incorporate a more robust routing method within the Operations Model would require less defensible assumptions about routing characteristics and not provide useable, practical knowledge to the study.
60	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	There is a substantial set of high-water marks and gage measurements to calibrate the model that were collected during the following events: 1986, May 1995, June 1995, June-July 2007, April May 2009, October 2008 and May-June 2013. The study plan needs additional documentation to (1) describe the available calibration data, and (2) confirm that the model will be calibrated over a range of flood events up to the magnitude of at least the 2007 flood.	Section 2.6.3 of the H&H Study Plan has been revised to include additional detail about the calibration events that will be used for calibration of the upstream and downstream portions of the CHM, along with the available calibration data.
61	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	1. Previous analysis (Holly, 2001; Tetra Tech, 2016) showed significant flooding on non-easement land when the lake is under GRDA's control at 745'. Therefore, for the alternative operating scenarios, it is requested that the starting water-surface elevation as low as 735- feet be required. Some previous studies have assumed a constant water-surface elevation at Pensacola Dam throughout the modeled events. Because the inflows can significantly exceed the releases from the dam, it is not appropriate to hold the water-surface elevation at the dam constant through many of the floods. It is imperative that this study includes these effects. 2. The study plan indicates that alternative operating scenarios may be proposed by GRDA. During the study plan meetings, Mead & Hunt indicated they will also run model scenarios proposed by interested parties including the City of Miami. The study plan should be updated to indicate and provide supporting information for interested parties, including the City of Miami, to propose model scenarios to be run and evaluated.	Section 2.6.9 of the H&H Study Plan has been revised to outline relicensing participant involvement in the H&H Study. The City of Miami's comment inaccurately presumes that GRDA is controlling the Project at 745 feet PD, but that control is not absolute. Federal regulations direct the Corps to assume responsibility for and control over the Project for flood control purposes below 745 feet PD when the pool is predicted to exceed 745 feet PD in elevation.
62	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	Page 29/254 of GRDA's Proposed Study Plan includes the following statement: "FERC requests a flood frequency analysis to establish arbitrary flood events (10-year, 25-year, 50-year, and 100-year) and the City of Miami requests a flood frequency analysis to establish arbitrary flood frequency curves. Such effort necessarily would need to be based upon numerous assumptions with misleading results". GRDA is not proposing to perform flood frequency analyses at the gages. The City requests a flood frequency analysis (FFA) of flow gages in the study area in order to put the contributing flows in context with the overall inflows to Grand Lake. The USGS operates six gages in the study reach that are specifically relevant to this analysis: • Neosho River near Commerce, Oklahoma (USGS Gage No. 07185000) • Neosho River at Miami gage (USGS Gage No. 07185080) • Tar Creek at Miami, OK (USGS Gage No. 07185095) • Spring River near Quapaw, OK (USGS Gage No. 07188000) • Elk River near Tiff City, MO (USGS Gage No. 07189000)	As discussed in Section 2.6.7 of the H&H Study Plan, the flood frequencies along the individual tributaries to Grand Lake will not be performed because the flood frequencies on the individual river systems are not material to the effect of the Project operations on resources. Instead, GRDA is proposing to perform a flood frequency analysis based on total inflows to the reservoir to represent a point just upstream of Pensacola Dam.
63	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	As indicated previously, a bathymetric survey of Grand Lake is strongly recommended to update the area capacity curves.	Please refer to GRDA's response to Comment Nos. 51 and 52.

	Entity	PSP Section	Comment	GRDA Response
64	City of Miami 7/26/2018 (Letter)	Section 2.6 of H&H Study Plan	During the study plan meetings, GRDA indicated all information will be publicly available and will allow interested parties to review the models and provide feedback. Furthermore, GRDA indicated that the data, models and reports will be posted on a website. The information will include: (1) data used to develop the models, (2) models, (3) model calibration, and (4) model output. The study plan should be updated to indicate all information will be publicly available, including the hydraulic models and the supporting data.	The CHM, the CHM Calibration, and CHM Output will be provided to relicensing participants upon their request after calibration is complete. At the time the respective items are available, GRDA will determine the best format for transmittal. Section 2.6.9 of the H&H Study Plan has been revised to outline how information will be transferred.
Sedimentation Study				
65	FERC 7/20/2018 (Letter)	Section 3.1.2 of PSP Introduction / Background and Section 2.6 of Sedimentation Study Plan	Section 3.1.2, *Sedimentation Study*, of the proposed study plan, and section 2.6, *Methodology*, of the Sedimentation study plan, state that the study will include a contingent Study Year Two, if determined to be necessary. Based on the description, we are unsure how you will determine if project operations impact sedimentation based on the information collected in study year one. The study plan should clarify the conditions and/or criteria which would initiate a contingent Study Year Two.	Section 1.0 of the Sedimentation Study Plan has been revised in response to this comment. The contingency has been removed and all work described in the Sedimentation Study Plan will be performed during a two-year study.
66	FERC 7/20/2018 (Letter)	Sections 2.1 and 2.6 of Sedimentation Study Plan	Section 2.0, *Study Plan Elements,* of the Sedimentation study plan states that during Study Year One, GRDA will review all relevant previous reports and sediment sampling investigations conducted within the basin, and evaluate long-term trends in sedimentation by spatially and temporally comparing bathymetric data sets. Section 2.6, *Methodology*, states that the Oklahoma Water Resources Board, Tetra Tech, and USGS bathymetric data collection between 2008 and 2017 will provide a basis for sediment volume change estimates, and that prior data sets will also be reviewed for applicability. In the revised study plan, please clarify which prior data sets providing a longer historical record of bathymetry will be reviewed for comparison, or provide a rationale for limiting the scope of analysis of potential sedimentation effects associated with project operations to a 10-year period.	Section 2.3 of the Sedimentation Study Plan has been revised. Bathymetry/topography information that will be reviewed includes the 1938-40 USACE pre-dam topographic survey, surveys of the Neosho River conducted by Settle Engineering in the 1990s, a 1997 USACE survey of the Neosho River, 2010 LiDAR data, a 2008/2009 hydrographic survey of Grand Lake conducted by the Oklahoma Water Resources Board (OWRB), a 2015 survey of the Neosho River conducted by Tetra Tech, and the 2017 hydrographic survey of the Neosho, Spring, and Elk rivers conducted by the U.S. Geological Survey (USGS). Changes to channel bathymetry will be evaluated using these datasets and over the associated time period, which will provide data to compare with findings of the other sedimentation investigations.
67	FERC 7/20/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	Section 2.1, *Study Goals and Objectives*, of the Sedimentation study plan states that flood control operations under the control of Corps will not be considered as part of the study. In the summary of the study plan meeting filed June 27, 2018, GRDA clarifies that data would be collected during flood events, as feasible. GRDA also states the study will look at common flow events that are transporting sediment in addition to flood events. We agree that the study plan should include analysis of high flow events. While common flows are capable of transporting sediments, the majority of sediment movement and deposition likely occurs during periods of high reservoir elevations and high inflow periods when the Corps directs operation of the project. The level of the reservoir prior to reaching flood stage (i.e. normal operation) can influence the frequency and duration of the flood flows which move sediment. The study should clearly evaluate the degree to which storage in the reservoir may be used to moderate high flow events which move sediment.	As discussed in Section 2.1 of the Sedimentation Study Plan, the study will evaluate overall trends of sedimentation in the study area. While large floods are capable of moving greater quantities of sediment, smaller one- to two-year flood events move the most sediment over longer time periods. As FERC notes, GRDA will examine analysis of high flow events as part of the Sedimentation Study, which will investigate flood events in detail. Evaluations of using reservoir stage to moderate sediment movements are premature and beyond the scope of this study. Section 2.6.5 of the Sedimentation Study Plan has been revised to more fully describe GRDA's analysis of high flow events, and how the results from the CHM portion of the H&H Study will be used to inform this analysis.
68	FERC 7/20/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	Section 2.3, *Background and Existing Information*, of the Sedimentation study plan provides three historic U.S. Geological Survey (USGS) data sources: (1) historic streamflow data and sources for current streamflow data collected by the USGS; (2) historic water-surface elevation data and sources for current water surface elevation data from USGS and GRDA; and (3) historic suspended sediment concentration (SSC) data from USGS. The revised study plan should state the range of years for which these sources have available data. The study plan should also describe the "existing specialized studies" referenced in section 2.3 of the Sedimentation study plan, as well as any other data sources evaluated, and why those sources will or will not be used.	Section 2.3 the Sedimentation Study Plan has been revised to show the range of years for available data. Existing specialized studies are discussed in Section 2.3 which explains that the existing studies do not provide adequate information relevant to this study.
69	FERC 7/20/2018 (Letter)	Section 3.1.2 of PSP Introduction / Background and Sedimentation Study Plan	Section 3.1.2, *Sedimentation Study,* of the proposed study plan states that the study will address whether operation of the project has influenced sedimentation in the Grand/Neosho watershed upstream of Grand Lake, and if so, the extent to which sedimentation has affected water levels in these areas. Please clarify how the study will evaluate sedimentation in overbank areas upstream of Grand Lake, including evaluation of historical changes to roughness coefficients of the overbank areas that may contribute to sediment deposition.	Section 2.6 of the Sedimentation Study Plan states that the CHM will be used to evaluate effects on water levels. Roughness coefficients of the overbank areas will be incorporated in the CHM development process, and are not within the scope of the Sedimentation Study. There is not sufficient topographic data for a historical analysis of changes to floodplain elevation: however, any use of hydraulic model output in the Sedimentation Study will reflect roughness coefficients used in the CHM component of the study. Sedimentation in overbank areas will be considered by comparing the extent and duration of

	Entity	PSP Section	Comment	GRDA Response
				overbank flooding for any new operation scenarios compared to historic overbank flooding extent and duration. This analysis will be coupled with an analysis of potential deposition rates based on sediment concentration and sediment settling rates.
70	FERC 7/20/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	Section 2.6, *Methodology,* of the Sedimentation study plan states that several structures that run across the Neosho River passing through the City of Miami act as hydraulic "choke-points". Please clarify how the study will evaluate sediment deposition near these "choke-points", including bridges or other structures in the river channel and overbank areas that may have experienced changes in channel elevation as a result of sediment accretion.	Section 2.6.4 of the Sedimentation Study Plan details the sediment transport estimation process, namely that well-established sediment transport relationships will be used to determine transport, as well as historic changes in cross section and changes in hydraulic variables from the CHM component of the study. There is no difference between analysis techniques in areas where hydraulic constructions may exist and as compared to other areas. It should be noted that normal bridge routines in HEC-RAS cause issues when running HEC-RAS in the sediment transport mode. As recommended by Tetra Tech and based on our own experience using HEC-RAS in sediment transport mode, the normal bridge characteristics typically used in HEC-RAS must be removed to conduct a sediment transport analysis. To the extent hydraulics are affected by bridges, HEC-RAS in sediment transport mode will not include these bridge effects and may produce unreasonable and inaccurate results. The data analysis-based approach in the Sedimentation Study Plan uses actual data which will include sediment deposition at bridges or within reaches where bridges are located rather than a model that does not include bridge characteristics.
71	BIA 7/26/2018 (Letter)	Section 2.5 of Sedimentation Study Plan	In Section 2.5 of the Sedimentation Study, GRDA defines the study area too narrowly. The study area should extend further up to the state line. More specifically, the study area with respect to Tar Creek should, at a minimum, extend upstream beyond the USGS gauge at the 2211d Avenue Bridge to above the USGS gauge at Commerce, Oklahoma.	Section 2.5 of the Sedimentation Study Plan has been revised in response to this and other comments. The study area will encompass the areas considered by the CHM. Several tributaries have been added to the study area, including Tar Creek.
72	ODWC 7/24/2018 (Letter)	Sedimentation Study Plan	This study should include both years of proposed work, regardless of the outcome of the first year's reviews and comparisons. The field work that is part of the contingent year 2 could therefore be begun earlier and encompass 2 years of field collections. Additionally, this study should be modified to study not only the in-stream effects of sediment erosion/deposition, but also should include analysis of out-of-channel effects (mainly deposition). The particular concern is the proposed development of adjacent site mitigation lands and the potential to increase heavy metal (via sediment) deposition in an area proposed as an attractant to migratory birds (which to a large degree feed in wetland substrates). Additionally, it appears that this study will not include sediment composition tests (i.e., tests for heavy metals). We feel that determining the toxicity of the sediment is integral to determining the threats associated with deposition. If these modifications were made, it may become unnecessary to complete ODWC study proposal C. Sediment Contaminant Study.	As described in Section 2.1 of the Sedimentation Study Plan, field work will be conducted during both years of the study without contingencies. Data collected in the field will be used for sediment transport and sedimentation evaluation. As described in the Sedimentation Study Plan, contaminant modeling and field investigation in overbank areas will not be included in this Sedimentation Study, the objective of which is to identify the effects of Project operations on sediment transport and sedimentation.
73	Ben Loring, Oklahoma House of Representatives 7/16/2018 (filed 7/27) (Letter)	Sedimentation Study Plan	The proposed Sedimentation Study is likewise of huge significance on flood issues and GRDA's proposal is just as inadequate. Again, I will leave details of the argument to the experts, but my understanding is that the sediments in the Twin Bridges area are tantamount to a second dam in the lake, and with the increasing deposits over time and ever increasing lake levels due to changes in the Rule Curve, there has been an ever increasing backwater effect upstream from there. Moreover, the sediment issue has the added complication of contamination of heavy metals brought by Tar Creek from the Superfund Site in the Picher minefields.	As described in Section 1.0 and Section 2.1 of the Sedimentation Study Plan, the aim of the study is to better understand the nature of sedimentation in the reservoir, particularly the impacts Project operations have on sedimentation and flooding. There are a number of factors that may cause flooding upstream, including constrictions in the river from structures. A study by USACE in 2016 found that very little sedimentation has occurred in the flood storage pool since 1938, suggesting that sedimentation may have influence in changes to upstream flooding.
74	City of Miami 7/26/2018 (Letter)	Section 1.0 of Sedimentation Study Plan	The study boundary is defined as upstream of Grand Lake. The 2009 OWRB survey shows significant sediment deposition upstream of Sycamore Creek located about 37 miles upstream from the dam (Figure 1). During the scoping meetings, there were public comments regarding the sedimentation in the vicinity of Twin Bridges. The study plan does not indicate if Twin Bridges is located within the study boundary. The study plan needs to specifically state the study boundaries. As discussed later, Tetra Tech believes a sediment transport model is the only practical method of answering the relevant questions, and we, therefore, are requesting a sediment-transport modeling study covering the reach from Pensacola Dam to the upstream project boundary. The meaning of and/or difference between …*accretion and deposition*… in the context of this study plan is not clear. Please clarify and/or correct the sentence, as appropriate.	Section 2.5 of the Sedimentation Study Plan consists of the area considered in the CHM, including Grand Lake, the Neosho, Spring, and Elk rivers, Tar Creek, and other small tributaries. Twin Bridges is located within the study boundary. Section 2.6 of the Sedimentation Study Plan details the proposed methodology to characterize the effects of sedimentation on flooding, which will be adequate to evaluate sedimentation over the proposed license period. There are several shortcomings of a sediment transport model proposed by the City of Miami that are detailed in RSP Section 4.2.2 and summarized below: • Over simplification of complex channel processes requiring assumptions in transport rate calculations. • An unreliable calibration and validation process.

	Entity	PSP Section	Comment	GRDA Response
				• The model would not be calibrated for smaller flood events. • The model could not simulate influences on sediment transport processes from bridge crossings. • The inability to adequately model both non-cohesive and cohesive components of sedimentation transport processes. • An inadequate field data collection effort. • The proposed use of poor and limiting bathymetric data for the period prior to 2008. The Sedimentation Study Plan is founded on scientifically accepted methodologies and will address the study goals with far less uncertainty compared to the City of Miami's proposed modeling study. Regarding the difference between "accretion and deposition", this has been clarified in multiple locations in the Sedimentation Study Plan.
75	City of Miami 7/26/2018 (Letter)	Section 1.0 of Sedimentation Study Plan	The Study Plan indicates…*the Project influences sedimentation in the watershed*…which implies that GRDA is planning to evaluate both in-channel and overbank sedimentation. Recommend replacing…*watershed*…with Grand/Neosho, Spring, and Elk Rivers and Tar Creek.	Section 2.5 of the Sedimentation Study Plan has been revised to clarify the study area. GRDA will evaluate sedimentation primarily in the channel of these rivers, though bathymetry and topography comparisons will consider some overbank areas where data exists. Section 3.6.1 of the sedimentation study proposed by the City of Miami (Miami sedimentation study plan) states that overbank areas should be included in the study area, but then goes on to propose investigations limited to evaluating sedimentation along the channel bed due to the limitations of the 1-D modeling approach. It is not clear how historical data analyzed as a part of Section 3.6.3 would be used in the modeling study, as the proposed model would apply bed changes modeled at the thalweg to the overall cross section. This simplification would provide erroneous information on complex channel processes, with little context to evaluate the validity of the model results. A study of the geomorphic changes that have occurred since the reservoir was built is essential for this understanding, as detailed in Section 2.6 of GRDA's Sedimentation Study Plan. As proposed by GRDA in its Sedimentation Study Plan, sedimentation in overbank areas will be considered by comparing the extent and duration of overbank flooding for any new operation scenarios compared to historic overbank flooding extent and duration. This analysis will be coupled with an analysis of potential deposition rates based on sediment concentration and sediment settling rates. Topographic changes in overbank areas will be considered where sufficient data exists.
76	City of Miami 7/26/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	The study goal in the first sentence is unclear and needs to be re-worded Recommend changing the study goal to: The overall Sedimentation Study goal is to gain a clear understanding of the effects of Project operation on sedimentation processes, and specifically, the effects of sedimentation on upstream flooding, including any associated increase in water-surface elevation and extent and duration of flooding.	Section 2.1 of the Sedimentation Study Plan has been revised to clarify that the goal of the Sedimentation Study is to determine the overall trends of sedimentation in the study area. The study will determine the spatial distribution of sedimentation in the reservoir, evaluate sediment transport at locations distributed throughout the study area, and provide a characterization of the impacts the observed sedimentation has on flood extent and duration in upstream areas. Future projections of sedimentation will be based on historic sedimentation rates considering differences in hydraulic conditions. Projections will also be informed by sediment transport analysis based on hydraulics of future conditions. The City of Miami's proposed sedimentation study, Section 3.1 states that the modeling study would investigate historic and future sedimentation effects on flooding. This approach skips a critical step of investigating whether significant sedimentation is occurring in Grand Lake or its tributaries. Only once the characteristics of that sedimentation are known should flooding impacts be evaluated.
77	City of Miami 7/26/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	Specifically, what is being evaluated under Point (3),…develop a relationship between water levels or operation scenarios…. is unclear. This sentence does not specify what is being compared. A relationship between water levels and what?	Section 2.1 of the Sedimentation Study Plan has been revised in response to this and other comments. Sediment transport will be evaluated in the study area using established sediment transport equations.

	Entity	PSP Section	Comment	GRDA Response
			The sentence needs to be completed to define the relationship.	
78	City of Miami 7/26/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	Point (3) states that the study will only evaluate…normal Project operations as opposed to flood control operations…, apparently to separate sedimentation effects due to normal project operations from those under flood control operations. Sediment deposition, and associated bed changes, occurs in response to the full range of flows. As a result, bed elevation changes during…normal Project operations…can affect the extent and duration of upstream flooding during…flood control operations…; thus, …normal Project operations… and …flood control operations…cannot be separated in the context of sedimentation impacts. During the study plan meeting, Mead & Hunt indicated that floods flows will be evaluated but provided no additional information about specifically what would be done. Point (3) should be changed to…and (3) evaluate sediment transport characteristics, including bed elevation changes and their impacts on water-surface elevation along Grand Lake, Neosho, Spring, and Elk Rivers and Tar Creek over a range of flow hydrographs evaluated in the CHM, including the 2007 flood…	Section 2.1 of the Sedimentation Study Plan has been revised in response to this and other comments. Sediment transport will be evaluated at 16 locations throughout the study area considering a wide range of flow events. The Sedimentation Study Plan uses a data-centric approach combined with standard analysis techniques of trends in cross-section change, sediment transport related to hydraulic conditions, and the effects of flooding. This approach has widespread scientific acceptance and will produce meaningful results at appropriate spatial and temporal resolutions. Overall, GRDA believes that the proposed Sedimentation Study Plan provides the necessary framework for collecting the pertinent information for FERC to prepare its environmental document for the Project.
79	City of Miami 7/26/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	The Study Plan indicates that Year Two studies will only be conducted if Year One indicates GRDA's operations…under normal project operations…has a significant effect on increasing water surface elevations (emphasis added), but does not specify the criteria for determining whether an effect is significant. Define the criteria for determining significance of a project-related change.	The Sedimentation Study Plan has been revised in response to this comment. The contingency has been removed, and all work will be performed during a two-year study.
80	City of Miami 7/26/2018 (Letter)	Section 2.1 of Sedimentation Study Plan	The specific purpose of the various tasks to be completed in Study Year Two is unclear, and at least some of these items are unlikely to provide meaningful information for meeting study goals and objectives. Specific responses to each point will be made in the following sections.	Comment acknowledged and specific responses provided in following comments.
81	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"Historic suspended sediment concentration (SSC) data from USGS." (text from Sedimentation Study Plan)*** This data set contains relatively few measurements and is probably not sufficient for its intended use. This is discussed more below.	As described in Sections 2.3 and 2.6 of the Sedimentation Study Plan, it is acknowledged that the USGS suspended sediment concentration (SSC) data has limitations regarding the number and utility of samples. Therefore, the Sedimentation Study Plan includes obtaining additional SSC measurements. The City of Miami's sedimentation study proposes to use available USGS flow and SSC data, and states that "additional SSC measurements should be collected during flood events" but provides no detail on the methods, amount, or location of these samples. Given the wide range of flood events that will likely occur during the study timeframe, these SSC measurements would be unable to inform modeling efforts based solely on large flood events. In addition, the City of Miami's proposed plan for sediment size planning would not adequately sample within the study area and reflects a bias in sampling of bed material that would lead to erroneous conclusions of the modeling study. Furthermore, the study proposed by the City of Miami does not include a plan to address any cohesive sediments that may be present in the bed material. Sediment transported in suspension is typically a larger component of total sediment transport than bedload and consists significantly of fine-sized sediment particles which tend to exhibit cohesive properties when deposited. These sediments are eroded and more frequently transported through different physical processes than non-cohesive sediments. Understanding transport rates of these cohesive sediments is a critical aspect of this sedimentation investigation since this class of sediment likely contributes significantly to sedimentation.
82	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"2009 OWRB bathymetric survey of Grand Lake and 4.5 miles of the Neosho River upstream of the confluence of the Spring River." (text from Sedimentation Study Plan)*** As noted in the Tetra Tech's comments on the H&H Study, the data from this survey is nearly 10-years old and the City is requesting a full hydrographic study of Grand Lake.	Comment acknowledged. A full hydrographic survey is not included as a portion of the Sedimentation Study. Recent hydrographic survey data collected by the USGS in 2017 of the Neosho, Spring, and Elk rivers will be used in conjunction with 2008/2009 bathymetry of Grand Lake. It is believed that sedimentation is occurring at very slow rates, as a USACE study published in 2016 found sedimentation rates of 0.0268 ac-ft/sq. mi/year in the flood pool, which is 1-2 orders

	Entity	PSP Section	Comment	GRDA Response
				of magnitude lower than comparable reservoirs in the region. Given this slow rate, it is likely that additional bathymetry surveys will find little to no difference in depths in the reservoir between 2009 and the present time and even less change in the upstream reaches on the study area since last year in 2017. Consistent with generally accepted scientific practice, the age of the available hydrographic data is very recent and no additional hydrographic survey data will be required to meet the goals of the study.
83	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"Sediment information (USGS / Andrews et al. / Ingersoll et al. / Juracek et al. 2009)." (text from Sedimentation Study Plan)*** These data mostly relate to the chemical properties of the sediment and do not provide information on sediment transport rates nor sediment transport characteristics.	Section 2.3 of the Sedimentation Study Plan has been revised in response to this comment.
84	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"Sediment information (USGS / Smith 2016)" (text from Sedimentation Study Plan)*** These data mostly relate to the chemical properties of the sediment and do not provide information on sediment transport rates nor sediment transport characteristics.	Section 2.3 of the Sedimentation Study Plan has been revised in response to this comment.
85	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"2016 USACE H&H Technical Report – Loss of Flood Storage at Grand Lake." (text from Sedimentation Study Plan)*** This report discusses changes in storage volume over time but does not discuss sediment transport rates or physical processes.	Section 2.3 of the Sedimentation Study Plan has been revised in response to this comment.
86	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	***"Soil and Water Assessment Tool (2018)." (text from Sedimentation Study Plan)*** This is a tool for evaluating overland sediment transport, which is likely very minor compared to in-channel sediment transport. It is not an appropriate tool for assessing in-channel sedimentation	Section 2.3 of the Sedimentation Study Plan has been revised in response to this comment. As described in Section 2.6.4 of the Sedimentation Study Plan, the Soil and Water Assessment Tool (SWAT) model results will be used to estimate and evaluate sediment loading to the Neosho, Spring, and Elk rivers from overland sources, which may or may not be an important contribution to the overall mass balance of sediment to the rivers in the study area. Suspended sediment data from USGS and additional suspended sediment data will be the primary source of data for the analysis.
87	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	The study plan indicates there is a…considerable amount of public information available. We agree that there is a reasonable period of streamflow data. However, sediment and sediment transport data are very limited. See Section 2.6 for more detailed discussion.	Comment acknowledged. See related comments for further discussion.
88	City of Miami 7/26/2018 (Letter)	Section 2.3 of Sedimentation Study Plan	The study plan indicates that…[t]he current understanding of sediment transport mechanisms is good, and there are several existing specialized studies that have taken place within the Grand/Neosho watershed on localized sediment transport. The study plan provides no references or information to support this statement. The listed references refer to survey data and studies relating to toxicity of the sediment. None of the listed studies provide data or information on sediment transport rates and sedimentation. Furthermore, an internet search for sediment transport related studies on the Neosho River provided no results. The Study Plan should specifically list the available, relevant sediment and sediment transport data, and the source of those data.	Section 2.3 of the Sedimentation Study Plan has been revised in response to this comment. To date, no published studies of sediment transport in the specific study area have been found. There is a study of sedimentation rates for Grand Lake published by USACE in 2016 which found sedimentation rates of 0.0268 ac-ft/sq. mi/year in the flood pool. This is 1-2 orders of magnitude lower than comparable reservoirs in the region. The City of Miami's sedimentation study proposes to collect only bed material size gradation information and possibly SSC information. This amount of field data collection would not be adequate to carry out the City of Miami's proposed study plan.
89	City of Miami 7/26/2018 (Letter)	Section 2.4 of Sedimentation Study Plan	***"The operation of the Pensacola Project affects the elevations of Grand Lake. The Sedimentation Study will allow relicensing participants to understand the relationship between Project operations and sedimentation pertaining to the extent and duration of inundation." (text from Sedimentation Study Plan)*** The meaning of this statement is unclear. The Sedimentation Study should provide an understanding of the relationship between Project-induced sedimentation and the extent and duration of flooding.	Section 2.4 of the Sedimentation Study Plan has been revised in response to this comment. The study will evaluate sedimentation in the study area to determine the extent of sedimentation that has occurred, evaluate sediment transport based on field observations, and characterize the impact of sedimentation on upstream flooding. The Sedimentation Study Plan uses an approach with widespread scientific acceptance which will produce meaningful results regarding sedimentation and any impacts to flooding at appropriate spatial and temporal resolutions.
90	City of Miami 7/26/2018 (Letter)	Section 2.5 of Sedimentation Study Plan	***"The overall Sedimentation Study will encompass the Grand/Neosho, Spring, and Elk rivers and Tar Creek with the focus on the upper reaches and areas immediately upstream of Grand Lake." (text from Sedimentation Study Plan)***	Section 2.5 of the Sedimentation Study Plan has been revised in response to this and other comments. The study area will encompass the areas considered by the CHM as part of the H&H Study.

	Entity	PSP Section	Comment	GRDA Response
			This is a very ill-defined study area. The study area needs to be defined to have the same limits as the Comprehensive Hydraulic Modeling (CHM) Study.	
91	City of Miami 7/26/2018 (Letter)	Section 2.5 of Sedimentation Study Plan	There are few active USGS and proposed sampling locations. For example, on the Neosho River, there are 2 USGS sites and 2 proposed sites over the 23 miles between Commerce Gage and Twin Bridges. On the Spring River, there are 3 USGS sites, though only one is in the likely study area, and 2 proposed sites along the 15-mile reach. The study plan is proposing to use few data collected from a few sites to estimate sedimentation across the entire study area and over time. This is another reason why we recommend a full sediment transport model of the major tributaries and Grand Lake.	As described in Sections 2.5 and 2.6 of the Sedimentation Study Plan, additional sampling sites are included to obtain adequate field data for the study. These locations include key points in the study area, including bridge constrictions and river confluences.
92	City of Miami 7/26/2018 (Letter)	Section 2.5 of Sedimentation Study Plan	The study plan is suggesting the project area could be expanded or narrowed without providing any reasoning for making the adjustments nor any criteria for doing so. In addition to clearly defining the study area, the Study Plan should explain why the boundary could be adjusted and the criteria for making the adjustments.	Section 2.5 of the Sedimentation Study Plan has been revised in response to this and other comments. The study area boundary will not be adjusted.
93	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	Define the difference between accretion and deposition.	The Sedimentation Study Plan has been revised in response to this comment.
94	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	We disagree with the comment that there is a lengthy sediment concentration record. For example, the measurements at the USGS gages only include the following: • Neosho River near Commerce, OK: 132 suspended sediment concentration measurements collected over the 73-year period 1944 and 2016, an average of less than 2 measurements per year (Figure B). There were no data collected between about Water Year (WY)1950 and WY1980. Only 35 measurements were collected between 1980 and 2016, during which period the peak discharge was about 35,700 cfs. • Neosho River at Miami: 1 measurement collected in 2015 at about 165 cfs and 2 measurements in 2017 at about 2,230 cfs and 400 cfs, respectively, all very low flow conditions. • Spring River at Wyandotte: 9 suspended sediment concentration measurements collected over the 3-year period from 2004 to 2006, when the maximum discharge was 37,700 cfs. In summary, for the Neosho River, there are very few suspended sediment transport measurements that are representative of existing conditions. Furthermore, measurements were only made over a range of flows up to small flood events. The proposed dataset for the Neosho River is not adequate for the stated purpose of this study.	Section 2.6 of the Sedimentation Study Plan has been revised in response to this comment. Compared to most USGS gages, the sediment data available in the study is far above typical. In addition to this existing data, USGS SSC measurements will be augmented with additional SSC measurements obtained through this study. USGS methodology will be used to collect SSC concentration data at multiple locations in the watershed, including critical areas in all major tributaries and near Twin Bridges. This data will provide ground-truth evidence which will be used to select and validate sediment transport functions. The SSC data collected for the Sedimentation Study Plan will provide necessary information needed to meet the study goals. Relations between sediment transport at upstream locations and flow (extended to higher flows based on appropriate sediment transport equations) will be compared to sediment deposition in the reservoir as a part of the sediment balance analysis. This will provide a means of checking sediment inflow to deposition under a wider range of historic conditions. The City of Miami sedimentation study plan proposes to use available USGS flow and SSC data, and states that “additional SSC measurements should be collected during flood events” but provides no detail on the methods, amount, or location of these samples. The City of Miami sedimentation study plan also would not adequately sample within the study area. For example, 10 samples are included downstream of the USGS gage in Tar Creek near Commerce, OK, which is approximately 5 miles long. There are no sediment bed sample locations in the Elk River, which is approximately 13 miles long and is likely a more significant contributor of sediment to Grand Lake. This bias in sampling of bed material will lead to erroneous conclusions of the modeling study. Further, as stated in GRDA’s response to Comment No. 81, the study proposed by the City of Miami does not adequately address cohesive sediments in the bed material. These sediments are eroded and transported through different physical processes than non-cohesive sediments. Understanding transport rates of these cohesive sediments is a critical aspect of this sedimentation investigation.
95	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	Known surveys conducted on the Neosho River and Grand Lake that may be relevant to the comparison include: • 1909 USGS Survey on Grand Lake and Neosho River • C1940 USACE Survey of Neosho River • 1996 USACE Survey of Neosho River • 1995 and 1998 Settle Engineering Survey of Neosho River	Section 2.6 of the Sedimentation Study Plan has been revised in response to this comment. The following datasets that will be used to investigate bathymetry changes include: - 1938-1940 USACE survey (Neosho River) - 1995/1998 Settle Engineering survey (Neosho River)

	Entity	PSP Section	Comment	GRDA Response
			• 1996 and 2009 OWRB surveys of Grand Lake • 2015 Tetra Tech Survey of Neosho River • 2017 USGS Survey of Neosho River	-1996 USACE survey (Neosho River) - 2008/2009 OWRB survey (Grand Lake) - 2015 Tetra Tech survey (Neosho River) - 2017 USGS survey (Neosho, Spring, Elk Rivers) The City of Miami's proposed sedimentation study, Section 3.6, calls for using 2003 OWRB bathymetry data to evaluate sedimentation between 1995 and 2003. Section 3.4.1 of the City of Miami's sedimentation study plan clearly states this dataset is "not complete and should not be used". It is unclear if the study is willingly proposing to use erroneous data as a baseline for the modeling study, or if an assumption is made that incorrect and incomplete bathymetry data will suitably simulate sedimentation processes which consist of strongly nonlinear interactions between the bed and hydraulic conditions. If poor bathymetric data were used as a baseline for conditions before 2008, it is highly unlikely the modeling effort would prove successful.
96	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	The upland sediment loads will likely be very small compared to the sediment loads in the rivers. The comparison between spatial erosion and sedimentation at the cross-sections will likely produce spurious results and will be of no value for evaluating project-induced river and reservoir sedimentation. The overland sedimentation analysis should not be used to evaluate channel or reservoir sedimentation and should be dropped from the study. A sediment transport model should be used for this assessment, as recommended in the City of Miami's requested Sediment Transport Study Plan	As described in Section 2.6 of the Sedimentation Study Plan, the SWAT model results will be used to quantify sediment loading from overland sources to the study area. Please also refer to GRDA's response to Comment No. 74.
97	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	1. The study plan should state explicitly how results from the effective discharge analysis will be used to assess Project-induced sedimentation effects. In addition, the bed material load (i.e., sand and coarser particles) is the most important part of the total sediment load for assessing changes in the river channels. The available suspended sediment data consists primarily of wash load (i.e., silt- and clay-sized particles), and it does not include the bed load and unsampled portion of the suspended bed material load. The proposed method of computing the effective discharge, therefore, does not consider the most important portion of the total sediment load. Bed material load is controlled by the character of the bed material and the local hydraulic conditions. Using data from a few individual gages, even if the data were of sufficient temporal resolution, will not provide useful information for assessing Project-induced sedimentation impacts. 2. There is no information in the study plan regarding the sediment transport equations that would be used to relate the bed material load to the local channel hydraulics. Either clarify specifically how this analysis will inform the objectives of the study and correct the portion of the sediment load to be evaluated, or eliminate this study element.	Section 2.6.4 of the Sedimentation Study Plan has been revised in response to this comment. The section describes the sediment transport functions that will be considered for cohesive and non-cohesive sediments. Bedload and suspended load will be considered. Data collected will have sufficient temporal and spatial resolution for assessing sedimentation in the study area. Currently, it is unknown whether bedload or suspended load is the more significant part of total transport; however in large watersheds producing sediment much of that sediment consists of very small particles. Given the high trapping efficiency of a large reservoir, a significant portion of the sedimentation consists of relatively fine-sized particles. The Sedimentation Study Plan includes a sediment balance which compares sediment supply based on relations developed between suspended sediment and flow, historic flow data, and sediment transport equations including bedload. This information is then compared to the volume of sediment deposited based on sediment surveys conducted over time consisting of total sediment load. The analysis therefore includes both suspended and bedload transport and deposition and provides a means of checking total sediment supply compared to overall sediment deposition. The City of Miami proposed sedimentation study plan contains no information on which sediment transport functions would be used in its 1-D model. The function used by HEC-RAS in the modeling scheme must be selected by the user and informed by hydraulic, sediment, and bed conditions. Sediment transport functions are sensitive to these conditions because of the limitations of the datasets used by researchers determining the functions. Without careful consideration of the selection of a function, there is little reason to believe that model simulations will accurately represent sediment transport over many decades. The City of Miami's proposed sedimentation study plan fails to clearly state which functions will be considered, what criteria will be used for selecting the functions, and how differences between model results and measured bed changes.
98	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	A defensible evaluation of Project-induced sedimentation on the extent and duration of upstream flooding cannot be performed based only on…the relative change in velocities throughout the study area. Many other factors affect the bed material transport balance, including channel geometry and associated hydraulic conditions (velocity, depth, width, bed shear stress) and the bed material characteristics.	Section 2.6 of the Sedimentation Study Plan has been revised to detail the factors that will be considered as a part of this analysis. Please also refer to GRDA's response to Comment No. 74.

	Entity	PSP Section	Comment	GRDA Response
			A sediment transport model is requested as this is the most practical and defensible method of assessing Project-induced sedimentation effect.	
99	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	***"The final step of Study Year One will assimilate the findings from previous documented studies and from the bathymetric data set comparison into an understanding of the sediment transport processes and patterns throughout the study area. Existing data will be used to quantify historic sediment transport rates. These rates could be used to project future sediment loading estimates." (text from Sedimentation Study Plan)*** As discussed above,…findings from previous documented studies and from the bathymetric data set comparison…may provide a limited understating of historic sediment transport rates, but this information cannot be used …to project future sediment loading estimates…,particularly under different future operating scenarios.	Section 2.6 of the Sedimentation Study Plan has been revised. There is no reason to say that past trends in sediment loading will not be similar in the future. Different future operating scenarios at the Project will not have an effect on the amount of sediment loading to the reservoir from upstream sources. Analysis of the CHM will determine qualitatively how operational changes may impact future sedimentation and how those changes would impact upstream flooding. Given the considerable uncertainty associated with 1-D sediment transport models, it is extremely unlikely that a 1-D sediment transport model would be able to produce a reliable estimate of bed changes 50 years into the future. A modeling approach to this study could lead to false confidence in the numerical simulation solution. An objective of the study is to estimate future sedimentation and its effect on flooding. The proposed approach of using existing sediment transport data combined with additional data collection and sediment transport equations all of which are compared to historic total sediment deposition is the best way to determine actual historic sediment supply. It uses best available data coupled with readily understandable and verifiable analysis techniques. Relationships developed by such an approach provide a solid basis for estimating future sediment supply whether a repeat of historic flows are used or some other synthetic generation of inflows. The incoming sediment load is independent from sediment deposition resulting from modified project operating scenarios which will be based on relationships developed between historic hydraulic conditions and historic deposition projected into the future based on modified reservoir and upper river hydraulics. The City of Miami's proposed methodology does not provide a reliable or scientifically acceptable technique to evaluate future bed changes. These are critical given the interactions between bed changes, hydraulics, and sediment transport. Given that the 2003 OWRB data alone cannot be used in the modeling study to assess past bathymetric change, it is not clear how changes in future channel characteristics would be evaluated.
100	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	As noted above, the study methodology is flawed and will not meet the study goals.	Comment acknowledged. Section 2.6 and others have been revised in response to this comment. The Sedimentation Study Plan details scientifically accepted methodology and will meet the study goals of evaluating sedimentation in the lower Neosho, Spring, and Elk rivers to assist understanding of the impacts Project operations have on flooding in upstream areas. GRDA believes that the City of Miami's proposed sediment study would not include adequate field data in the modeling process, leading to erroneous and/or misleading results. It does not include a necessary verification step and does not recognize that calibration alone may result in misleading results. In addition, normal bridge hydraulic routines must be eliminated from HEC-RAS in the sediment transport mode which may again cause flawed results. The heterogeneous mixture of cohesive and non-cohesive sediment presents a complex situation that will be difficult to model. As such, it would not meet the study goals of obtaining a "clear understanding" of sedimentation and determining the effects of sedimentation on flooding.
101	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	"***Field Data Collection***" This component of the study plan is vague and highly unlikely to meet the study objectives. The study plan should describe specifically how...the relationship between water levels and velocity profiles will provide insight into long-term geomorphic processes…in the Grand/Neosho River watershed….Even assuming that an adequate range of flows occurs during Study Year Two (which is unlikely), it would not be practical to make velocity measurements at sufficient spatial and temporal resolution to assess Project-induced effects on sedimentation. In addition, as described above, velocities are only one of several factors that affect bed material transport rates and sedimentation/erosion patterns.	Comment acknowledged. Section 2.6 and others have been revised in response to this comment. The Sedimentation Study Plan describes field data collection methodology in detail. Field data collection will gather information on flow, sediment characteristics, and observed sediment transport and will adequately support the study goals.
102	City of Miami	Section 2.6 of	The study plan should state specifically how incipient motion analyses will inform the assessment	Section 2.6.4 of the Sedimentation Study Plan has been revised to detail the sediment transport

	Entity	PSP Section	Comment	GRDA Response
	7/26/2018 (Letter)	Sedimentation Study Plan	of Project-induced sedimentation impacts. Incipient motion analysis defines the range of flows over which the bed material is mobile at a specific location, but it does not quantify the rates of mobility nor the related sediment-transport balance through the reach. Although some gravel is present in the bed, the Neosho and Spring River channels are primarily sand in the critical part of the study area; thus, this material is most likely mobile over essentially the entire range of flows that can occur in the relevant reaches. It is not clear how this analysis will inform the objectives of this study, and it is highly unlikely to do so.	functions that will be used to quantify sediment transport rates. Using all available data (SSC, flow and hydraulics, as described in detail in Section 2.3 of the Sedimentation Study Plan) and data collected specifically for this study (described in detail in Section 2.6.3 of the Sedimentation Study Plan), relationships will be developed between sediment transport and flow and/or velocity. Bedload transport will be computed based on selection from several possible equations. Overall sediment supply based on historic flow data and the relationships to total sediment transport will be compared to historic sediment deposition to balance total sediment supply with total sediment deposition. Such analysis will be conducted through the overall reach of interest but also will be broken down into specific sub-reaches of interest. Such analysis is critical to developing an understanding of the sedimentation issues and has a high likelihood of successful completion as it is based on real-world data coupled with readily understandable and scientifically acceptable techniques. The City of Miami's proposed plan for bed sediment sampling would not adequately collect data within the study area. There are no sediment bed sample locations in the Elk River, which is likely a contributor of sediment to Grand Lake. This bias in sampling of bed material would lead to erroneous conclusions of the modeling study. In addition, the City of Miami's proposed study does not contain a plan to address any cohesive sediments identified in the bed material. Understanding transport rates of these cohesive sediments is a critical aspect of this sedimentation investigation since they contribute significantly to sedimentation in downstream areas of the reservoir. There is no information in the City of Miami's plan detailing the methods that would be used to select a sediment transport function. This is a critical step in accurately determining sediment transport rates and bed changes.
103	City of Miami 7/26/2018 (Letter)	Section 2.6 of Sedimentation Study Plan	Similar to the previous point, there is no discussion of how or where the SSC measurements will be collected, and it is unlikely that sufficient measurements over an appropriate range of flows can be made in one year.	Section 2.6.3 of the Sedimentation Study Plan has been revised to indicate the methods and approximate locations of SSC measurements. SSC measurements will be taken with OBS sensors, allowing for continuous monitoring. The continuous water level measurements in the Sedimentation Study Plan will provide sufficient detail on water levels in the study area over a range of at least 2 years. The City of Miami's sediment study plan proposes to use available USGS flow and SSC data, and states that "additional SSC measurements should be collected during flood events" but provides no detail on the methods, amount, or location of these samples. In contrast, GRDA's Sedimentation Study Plan gives a detailed methodology for collecting additional SSC and presents a conclusive approach to evaluating this data.
104	City of Miami 7/26/2018 (Letter)	Section 2.7 of Sedimentation Study Plan	1. The Study Plan does not follow generally accepted methods that will result in a defensible assessment of Project-induced sedimentation on the extent and duration of upstream flooding. 2. The study plan includes the following components: • Comparison of existing bathymetric data to determine aggradation/deposition patterns over time. • Development of a relationship between suspended sediment concentration (SSC) and velocity. As discussed above, there are insufficient SSC data at a very 20180726-5102 FERC PDF (Unofficial) 7/26/2018 12:36:28 PM 18 July 26, 2018 limited number of locations to develop suitable relationships. In addition, any relationships that can be developed are only valid at the measurement location and cannot be applied to other locations or to evaluate future conditions with different hydrologic and hydraulic conditions. In general, there will be very limited analyses of the Spring River and Elk River due to the lack of data. Most critically, the proposed SSC analysis does not consider the vast majority of the bed material load (i.e., sand and coarser particles) that are most important in	1. Comment acknowledged. The methodology outlined in the Sedimentation Study Plan is consistent with generally accepted scientific practice and will meet the study goals, specifically to evaluate the overall trends of sedimentation in the study area. It uses best available data supplemented by additional data collected specifically for this study. It also uses standard sediment transport equations, regression analysis, and comparison of cross sections to determine sediment volume changes, spatially and temporally. 2. Comment acknowledged. • Existing bathymetric data will be used to aid in determining past sedimentation in the study area. Given the slow sedimentation rates in Grand Lake and that bathymetry data across the entire study area has been collected in the last decade, this investigation will produce a detailed understanding of the spatial variability of sedimentation. • SSC measurements by definition cannot measure bedload samples. No robust

	Entity	PSP Section	Comment	GRDA Response
			erosion, deposition and related channel behavior. • ADCP and water-level data will be collected to further develop the sediment transport relationships. It is unlikely that ADCP measurements can be collected at sufficient range of flow conditions, particularly high flows when significant sediment transport is occurring, and the proposed relationships will have insufficient spatial resolution to support the analysis. 3. This study plan does not provide an appropriate methodology to evaluate sedimentation over the proposed license period of up to 50 years. The City of Miami strongly requests that FERC reject GRDA's sedimentation study plan, and instead, adopt the following study plan to evaluate existing sedimentation effects and the potential future effects over the proposed license period.	method to measure bedload has gained widespread scientific acceptance. SSC measurements will instead be used as observational data to assess and select sediment transport functions. The sediment balance analysis component of the study will provide data comparisons and potentially adjust incoming sediment loads over a range of hydrologic conditions based on deposition of bedload and suspended sediment in the reservoir. The spatial resolution of this and other field data is adequate to provide a thorough understanding of sediment transport throughout the study area. The City of Miami's plan would not collect sufficient SSC data to calibrate or assess the sediment transport model. • Acoustic Doppler Current Profiler (ADCP) data will be collected to help construct rating curves for reaches and analyze velocities as needed to evaluate sediment transport functions. This data will be collected over a range of flows, including high flow events. Again, the spatial resolution of this data will provide a thorough understanding of sediment transport throughout the study area. The temporal resolution of this dataset will be sufficient to construct adequate rating curves in tributaries. The City of Miami's plan would not collect any water level or velocity data, casting model results into doubt. 3. Section 2.6 details the methodology used to characterize the effects of sedimentation on flooding, which will be adequate to evaluate sedimentation over the proposed license period. Given the number of factors influencing flooding, it is possible that the study proposed by the City of Miami will be unable to determine future impacts of flooding. The City of Miami's plan would use a methodology that assumes sediment is causing a problem before first evaluating if it in fact is. Furthermore, the methodology proposed relies on a single bathymetry dataset to assess past bed changes. There is no reason to believe that the proposed sediment transport model will accurately predict bed changes over 50 years. Erroneous conclusions obtained by modeling would be a waste of time and money which could be better spent on a careful evaluation of past sedimentation trends and current field condition observations. A sediment transport modeling study using a 1-D model will necessarily make assumptions when computing transport rates, which may lead to erroneous bed change calculations over decadal timescales. In order to obtain accurate and reliable results of sediment deposition and possible effects on flooding, the sediment transport model must be calibrated and validated properly. This requires running and calibrating the model over a time period between bathymetric surveys, and changing model parameters to best match model results with observed data. The validation process attempts to reproduce results for a different time period to confirm that calibration parameters are correct. If the model cannot adequately meet calibration and validation goals, the model cannot reproduce actual bed changes and therefore contains little useful information relating to the impacts of sedimentation on upstream flooding extent and duration. Furthermore, the suggested modeling study would not be calibrated to smaller flood events and would therefore poorly represent sediment transport during the flows which move the most sediment over long time periods. A modeling study would therefore produce results which may or may not represent reality. It is illogical to propose modeling a large, complex system without first understanding the nature and character of the systems which will be modeled. Use of HEC-RAS in the sediment transport mode requires removal of normal bridge related components which may not reasonably represent reaches affected by bridges. To the extent bridge hydraulics are not included the model and may not appropriately simulate hydraulics in these reaches, sediment transport likewise would not reasonably be simulated. Tests would have to be conducted to first determine discrepancies between hydraulics in these reaches with and without normal bridge components in HEC-RAS. In addition, modeling a complex, heterogeneous mixture of cohesive and non-cohesive sediment deposition in a riverine/lacustrine environment will likely be problematic for any model. The Sedimentation Study Plan, by contrast, uses an approach based on real-world data and

	Entity	PSP Section	Comment	GRDA Response
				standard analysis techniques with widespread scientific acceptance which will produce meaningful results regarding sedimentation, sediment transport rates, and impacts to flooding at appropriate spatial and temporal resolutions. The modeling study proposed by the City of Miami does not attempt to determine to what extent sedimentation is occurring in the system. It also does not detail the manner in which SSC measurements will be taken or how they will be used to calibrate the model. A 1D, simplified model calibrated to only large flood events at less than 5 locations in Grand Lake and its tributaries will likely fail to reproduce decades of sediment transport phenomena and associated channel bed changes. It must be recognized that sediment transport modeling is inherently more complex than hydraulic modeling. Given the debates and difficulties in achieving consensus on hydraulic modeling alone, the prospects for modeling more complex phenomena are not promising. The modeling approach carries significant uncertainties and should not be pursued. The Sedimentation Study Plan is founded on scientifically accepted methodologies and will address the study goals with far less uncertainty compared to the proposed modeling study by City of Miami.
Recreation Facilities Inventory and Use Survey				
105	FERC 7/20/2018 (Letter)	Section 2.3 of Recreation Facilities Inventory and Use Survey Study Plan	In section 2.3, *Background and Existing Information*, of the proposed Recreation Facilities Inventory and Use Survey study plan (recreation study plan), GRDA describes numerous publicly available recreation amenities providing access to Grand Lake, including boat launches, swim areas, picnic areas, campgrounds, and overlooks. However, in the proposed study, GRDA proposes to survey only the five FERC-licensed recreation sites, which are all public boat launches. To better describe recreation at the project, we recommend that the revised study plan describe methods to collect visitor use and need information for the range of public recreation use and access at the project, including both formal (e.g., boating, fishing, swimming, picnicking, or camping) and informal recreation (e.g., recreation in the project's spillway channels). If GRDA recommends sampling recreation sites rather than conducting surveys at each public recreation site or informal recreation area, the proposed methodology should explain clearly how GRDA proposes to capture representative recreation types and locations at Grand Lake. Please depict all proposed survey locations on a map.	The Recreation Facilities Inventory and Use Survey scope has been expanded to include the five state parks around Grand Lake and immediately below the Project, which include Twin Bridges (Upper and Lower), Bernice, Honey Creek, Disney/Little Blue, and Cherokee (Lakeside and Riverside). Connors Bridge and Riverview Park have also been added to the survey area. Recreation visitor use data will be collected at the state parks, Connors Bridge, and Riverview Park using methodology consistent with surveys being conducted at GRDA's five FERC-approved sites. GRDA has also revised Section 2.6.3 of the Recreation Facilities Inventory and Use Survey Study Plan to include a task for collecting information regarding informal recreational use in the Project's spillway channels. GRDA has revised the figure in the study plan to depict all proposed survey locations.
106	FERC 7/20/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	To support development of potential protect, mitigation, or enhancement measures during the relicensing process, we recommend that during the recreation facility inventory, GRDA collect information about the water elevation at which each public boat launch becomes unusable, if such information is not already available.	As indicated in Section 2.6.4 of the Recreation Facilities Inventory and Use Survey Study Plan, GRDA will collect information regarding the water elevation at which the boat launches at GRDA's five FERC-approved sites, the state parks, Connors Bridge, and Riverview Park become inaccessible and provide information regarding the impacts to boat launches when Grand Lake is operated at various water elevations.
107	BIA 7/26/2018 (Letter)	Section 2.2 of Recreation Facilities Inventory and Use Survey Study Plan	Despite a passing reference to the "Native American Tribe Resource Management Goals" in Section 2.2 of the Proposed Recreation Study, there is no substantive discussion of the recreational use of the Project by Native American Tribes. This is a glaring omission. The tribes have inherent rights and some have treaty rights related to hunting, fishing, or other recreational activities in and near the Project. Those rights should be given due consideration.	Section 2.2 of the Recreation Facilities Inventory and Use Survey Study Plan has been expanded in response to this comment. Moreover, consultation with the Tribes, particularly with regard to the Traditional Cultural Properties (TCP) inventory that is proposed as part of the Cultural Resources Study Plan, is expected to provide an opportunity for understanding.
108	BIA 7/26/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	The study area only includes conducting surveys at five FERC-approved recreation areas. See Proposed Recreation Facilities Inventory and Use Survey at 5. GRDA should consider independently surveying relevant Native American tribes regarding their respective uses of the Project's recreation facilities, as well as any negative effects of recreation uses on the tribes' cultural or religious practices, including noise and visibility interferences.	As explained in the response to Comment No. 105, GRDA has proposed to expand the recreation surveys to beyond the FERC-approved recreation sites. Such surveys, together with ongoing consultation with Tribes as explained in GRDA's response to Comment No. 2 will provide opportunities to gather information referenced in BIA's comment.
109	ODWC 7/24/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	The concept of this study is solid, but we feel the scope of it is extremely limited. Grand Lake is a huge project that attracts a very high number of recreational users. Attempting to extrapolate use characteristics based off 5 point samples would be expected to give skewed results, particularly in regards to local users. Additional collection sites should be included, focusing primarily on free or low-cost access areas. Additionally, because there are designated wildlife management lands in/around Grand Lake, user surveys should also include days and time periods in which user	Please refer to GRDA's response to Comment No. 105. Although recreation occurs year-round at Grand Lake, this study is designed to capture and characterize recreational use at the Project during the prime recreation season, which is generally May through September.

	Entity	PSP Section	Comment	GRDA Response
			groups other than anglers and recreational boaters are likely to be present (such as hunters or wildlife viewers).	
110	Ben Loring, Oklahoma House of Representatives 7/16/2018 (filed 7/27) (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	The proposed Recreation Facilities Inventory and Use Survey likewise seems overly simplistic and inadequate in its limited geographic coverage of just a handful of parks actually located on the Lake. The reality is that the operation of Grand Lake affects recreation much further upstream than covered by GRDA's proposal. Just as a personal example, as an avid canoeist, I have seen the flood devastation just over the past few years along the beautiful Spring River which has resulted in the closing of the parks at Blue Hole and Josephine Smith at Devil's Promenade.	Please refer to GRDA's response to Comment No. 105.
111	City of Miami 7/26/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	GRDA proposes to conduct a Recreation Facilities Inventory and Use Survey ("Recreation Study"). But the proposal is far too narrow, limited to "the five FERC-approved recreation facilities on Grand Lake." Reviewing the PSP, FERC recommended "that the revised study plan describe methods to collect visitor use and need information for the range of public recreation use and access at the project, including both formal…and informal recreation…." The City echoes FERC's recommendation that GRDA analyze the full range of types of recreation enjoyed or needed in connection with the Project, and notes that GRDA itself identified a significant number of other recreational activities, locations, and planning efforts in its PAD, which should be taken account of in the recreation study.	Please refer to GRDA's response to Comment No. 105.
112	City of Miami 7/26/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	GRDA also identified former public access points that are no longer accessible. The Recreation Study should study the reasons for this degradation in public recreational access, identify the user group(s) most impacted by the loss, and assess the likelihood that such loss of access represents a trend that will continue in the future.	In Section 6.7.2.3 of the Pre-Application Document (PAD), GRDA lists several public access points that are managed and maintained by various municipalities and organizations that provide access to Grand Lake. A footnote stated *"Two previously identified public access points, Wyandotte Public Access, Town of Wyandotte and Drowning Creek Moonlight Cove, no longer provide public access."* The two sites referenced above were not formally developed recreation sites and were merely locations where the public could access Grand Lake. The Twin Bridges State Park is located near the Town of Wyandotte and provides formal public access to Grand Lake. Additionally, the previous Wyandotte public access location was located in a sensitive area within GRDA's Shoreline Management Plan (SMP) that may potentially be disturbed due to recreational activity. The Drowning Creek Moonlight Cove location was a dead end road into Grand Lake. Public access is currently provided at other locations near Drowning Creek that are more accessible to the public such as Lakemont Shores and Zena. See Figure 6.7-1 in the PAD for the locations of these sites.
113	City of Miami 7/26/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	The City further recommends that GRDA expand the geographic scope of the recreation study beyond the reservoir itself to encompass the full geographic range of recreational opportunities and needs impacted by the Project. For example, the City contains a number of recreational resources that make it an attractive place to live, such as Riverview Park, Rotary Park, the fairgrounds, and the City pool. Unfortunately, the community's use and enjoyment of these resources is impaired by periodic Project-caused flooding, sedimentation, and erosion. Consequently, GRDA's recreational study should evaluate the impact of Project-caused flooding upon these resources such that FERC can craft mitigation measures to appropriately protect them. As one example, a low-water dam spans the river at Riverview Park. Years ago, residents frequently fished from this dam or even used it as a point to walk across the river. However, the dam has been completely submerged for many years now. Riverview Park also experiences frequent flooding and erosion impacts, which are likely affected by backwater effects from the reservoir. GRDA should use the results of the City's proposed Sedimentation Study to evaluate whether Project operations and their effects on sedimentation have affected recreational resources throughout the area subject to backwater flooding, of which Riverview Park is just one example. Another example is Twin Bridges State Park at the confluence of the Spring and Neosho Rivers, once a popular recreational fishing location. More recently, increased sedimentation at the park has degraded the recreational opportunities. To the extent that the H&H Study, Sedimentation	Please refer to GRDA's response to Comment No. 105. GRDA will utilize the results of the H&H and Sedimentation studies to the extent possible to assess impacts to recreational resources around Grand Lake as a result of flooding and/or sedimentation caused by Project operations under the FERC-issued license. This analysis will be included as part of GRDA's Draft and Final License Applications. As explained in PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment No. 9, flooding operations are conducted under sole direction of USACE, and therefore effects of such operations are outside the purview of this FERC relicensing process, except with regard to any cumulative effects. Please refer to GRDA's responses to Comment Nos. 15 and 17.

	Entity	PSP Section	Comment	GRDA Response
			Study, and Contaminated Sediment Transport Study reveal Project impacts at Twin Bridges and other such locations upstream from the reservoir, GRDA should study those recreational uses, impacts, and needs using comparable methodology to that employed with respect to the five recreational facilities on Grand Lake proposed for study in the PSP. Specifically, GRDA should analyze how Project-exacerbated flooding has altered recreational opportunities over time, particularly in areas upstream of the reservoir and within the geographic scope of the Sedimentation Study.	
114	City of Miami 7/26/2018 (Letter)	Recreation Facilities Inventory and Use Survey Study Plan	GRDA should also compare the benefits and impacts on recreation of operating the reservoir at different levels. When it applied in 2016 to amend the rule curve (an application that the Commission granted in the 2017 Amendment Order), GRDA identified reducing vessel groundings and improving recreation as the primary reasons for the change. Because GRDA relies significantly on recreation to justify its reservoir management decisions, it should study in detail the recreational benefits and impacts of holding the reservoir at different elevations. This study should consider the full range of reservoir elevations requested by FERC for the H&H Study.	The purpose of the rule curve license amendment (Order Amending License and Dismissing Application for Temporary Variance, 160 FERC ¶ 61,001 (2017)), was not only to promote recreational enhancements through a peak public recreation period of the year, but also to improve public safety and water quality conditions. The amendment authorized a higher reservoir level from mid-August through the end of October that would provide additional stored water for making releases to mitigate low dissolved oxygen (DO) conditions in the Project tailrace and would provide higher water surface elevations which would improve boating conditions and reduce the number of hazards to recreational boating that emerge during the previously required fall drawdown. In the amendment application GRDA provided detailed information that showed that the requested rule curve change would either be neutral or have positive effects on potentially affected resources associated with the Project reservoir. The City of Miami has not identified any potential impacts or issues related to recreational activities as a result of operating the Project reservoir at different levels. Studying the recreational benefits and impacts of operating the reservoir at different elevations is outside the scope of this study. Please refer to GRDA's response to Comment No. 106 regarding collecting boat launch elevation data. GRDA will use this information to assess potential impacts to recreation resources as a result of Project operations. The information collected during the Recreation Facilities Inventory and Use Survey as well as the results of other studies conducted during this relicensing (i.e., H&H Study) will be used to analyze the benefits and impacts on recreation of operating the Project reservoir at different levels. This analysis will be included as part of GRDA's Draft and Final License Applications.
Cultural Resources Study				
115	FERC 7/20/2018 (Letter)	Section 2.5 of Cultural Resources Study Plan	According to section 2.5, *Area of Potential Effects*, of the Cultural Resources study plan, GRDA initially defines the APE as all lands within the FERC-approved project boundary and lands outside of this 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. This same discussion states that GRDA intends to further define the APE in consultation with the Cultural Resources Working Group (CRWG) as a component of the Cultural Resources Study. The study plan indicates that GRDA would seek concurrence regarding the project's APE in May 2018. As a reminder, GRDA must seek concurrence of the Oklahoma State Historic Preservation Officer and relevant Tribal Historic Preservation Officers (THPOs, where tribal lands are involved) on the APE and should include documentation of concurrence with the revised study plan, if available. It is our understanding that GRDA intends the project boundary to be the baseline for the APE but that the APE may be expanded to include other lands dependent upon the outcome of further consultation and the results of the H&H Study. The revised study plan should also include criteria and a process for modifying the APE based on the results of other studies, developed in consultation with the Oklahoma SHPO and appropriate THPOs.	GRDA is continuing consultation with the CRWG regarding the Project's APE that began in May 2018. GRDA is seeking the concurrence of the Oklahoma SHPO and relevant THPOs (where tribal lands are involved) on the APE, and GRDA will provide documentation of consultation and concurrence to the Commission. As noted by the Commission, GRDA recognizes that the APE may be modified to include other lands outside the current FERC-approved Project Boundary dependent on the outcome of other studies. GRDA has not established specific criteria for modifying the APE in this RSP and believes it would be premature to do so at this time. GRDA proposes to identify those criteria in consultation with the CRWG based on the results of Study Year One and the results of other studies conducted in support of relicensing (e.g., H&H Study, Recreation Study, etc.).
116	FERC 7/20/2018 (Letter)	Section 2.6.3 of Cultural Resources Study Plan	Section 2.6.3, *Pre-fieldwork Report*, of the Cultural Resources study plan states that a map would be prepared prior to the initiation of fieldwork that would identify all previously-recorded cultural resources, areas of archaeological sensitivity, and areas within the APE where erosion or other project-related effects are occurring. We recommend that the pre-field map be used as a baseline for the identification of survey areas and that a final map of areas to be surveyed be developed in consultation with the CRWG (as stated in the first paragraph of section 2.6.4) and filed with a revised study plan. The map should be accompanied by a description of the criteria that were used	GRDA has proposed to develop a Pre-fieldwork Report based on the results of the background literature review (including consultation with relevant Native American Tribes and THPOs). The Pre-fieldwork Report will identify and map: (1) previously reported archaeological sites, historic resources, and relevant map-documented structures; (2) 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 (3) areas identified within the APE where erosion or other Project-related effects are occurring. GRDA has

	Entity	PSP Section	Comment	GRDA Response
			to determine which lands would be surveyed. Additionally, if privately-held lands, not owned by GRDA, fall within the APE, GRDA should follow appropriate procedures for seeking access to survey private lands. Properties where consent is and is not granted should be specified on the pre-fieldwork map.	revised Section 2.6.3 of the Cultural Resources Study Plan to indicate that the maps will also indicate any lands within the APE recommended for survey that are not owned by GRDA. Section 2.6.4 of the Cultural Resources Study Plan has been revised to indicate that GRDA will follow appropriate procedures to seek access to lands identified for surveys within the APE that are not owned by GRDA. While GRDA has initiated data-gathering activities with respect to background literature and archival reviews, the Pre-fieldwork Report is not expected to be completed until April 2019 (see Section 2.11 of the Cultural Resources Study Plan). GRDA believes that it is appropriate to provide a map of proposed survey areas in the Pre-fieldwork Report rather than in the RSP, as the necessary background literature review, consultation, and archival research has not been completed at this time. As described in the Cultural Resources Study Plan, GRDA intends to use the information presented in the Pre-fieldwork Report as a baseline to identify proposed survey areas for Study Year One in consultation with the CRWG. GRDA agrees with the Commission's recommendations that the final map of proposed survey areas for Study Year One should be filed with FERC and distributed to the CRWG. Section 2.6.3 of the Cultural Resources Study Plan has been revised to address this comment.
117	FERC 7/20/2018 (Letter)	Section 4.1.3 of PSP Introduction / Background and Sections 2.6.4 and 2.8 of Cultural Resources Study Plan	In section 4.1.3, *Cultural Resources Investigations in Inundated Areas*, of the proposed study plan, GRDA states that it would focus cultural resource investigations on areas where continued project operations may affect historic properties. Section 2.6.4, *Reconnaissance Surveys*, of the Cultural Resources study plan states that a reconnaissance survey would include a visual inspection of the exposed portions of the reservoir shoreline areas within the APE. However, the Cultural Resource study report, section 2.8, *Schedule*, indicates that field work would be conducted May through August, which coincides with the times when the project is operated with the highest reservoir elevations. We recommend that GRDA extend the field season for reconnaissance work to include times when the reservoir is operated at lower levels (e.g., the winter pool) so that areas within the project's area of potential effects (APE) that are exposed only when lake levels are lower may assessed. We further recommend that the reconnaissance surveys also include non-shoreline areas identified during pre-fieldwork consultation with the CRWG discussed in item 22, above.	Section 2.6.4 of the Cultural Resources Study Plan has been revised to address this comment. During the pre-application study period, GRDA intends to conduct Reconnaissance and Intensive surveys between May and August of 2019 and 2020 in order to provide the results of these studies to the CRWG concurrent with the ISR and USR, respectively (see Section 2.11 of the Cultural Resources Study Plan). GRDA believes that the timing of these studies will maximize the field effort that can be conducted during the pre-application study period, while avoiding inclement weather conditions that could delay field investigations (e.g., snow and ice during the winter months). However, per the Project's rule curve, the elevation of Grand Lake will be above the normal low pond elevations from May 1 through October 1. Accordingly, GRDA proposes to extend the archaeological field investigations from October 1 until December 31, 2019 (as weather conditions allow), and to report on those investigations in the Study Year Two reports on Reconnaissance and Intensive surveys filed with the USR. Similarly, GRDA intends to extend Study Year Two archaeological field investigations beyond the filing of the USR until December 31, 2020 (as weather conditions allow), and will provide a supplemental report on archaeological investigations to the CRWG in Quarter 1 of 2021 following completion of the fieldwork. During Study Year One, GRDA proposes to conduct studies at locations within the FERC Project Boundary. GRDA will consult with the CRWG regarding the results of Study Year One and other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to affect historic properties, should any be present. During Study Year Two, GRDA proposes to conduct cultural resources studies at locations (including areas that may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing.
118	FERC 7/20/2018 (Letter)	Section 2.6.4 of Cultural Resources Study Plan	Section 2.6.4, *Reconnaissance Surveys*, of the Cultural Resources study plan states that "based on the judgment of the archaeologist" limited subsurface testing (i.e., shovel test pits) may be excavated to record site depth, stratigraphy, and other features. We recommended that the revised study plan include specific criteria that will be used by the archaeologist to determine if testing at a particular site would be appropriate and the methods to accomplish the testing be identified in the study plan. This section of the study plan also states that GRDA will collect any observed artifacts or other pre-contact or historic period cultural material. We recommend that the study plan clarify the purpose of any collection and identify the ultimate repository for the collected materials. Specific methods for evaluation of sites and collection of artifacts should be determined in consultation with the Oklahoma SHPO, Oklahoma Archeological Survey, and THPOs.	Based on continued consultation with the CRWG, including THPOs, the Oklahoma SHPO, and OAS, GRDA has revised the Cultural Resources Study Plan to include a plan for subsurface testing (i.e., shovel test pits) at locations identified in consultation with the CRWG and based on the results of the Pre-fieldwork Report. In general, GRDA is proposing to use the Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016) for conducting shovel test excavations to identify and delineate archaeological sites. These standards are described in additional detail in Section 2.6.4 of the revised Cultural Resources Study Plan. GRDA anticipates that subsurface testing will be conducted regardless of land use and visibility. However, if GRDA determines that subsurface testing is not appropriate, it will document the specific reasons for making that determination (e.g., standing water, excessive slopes, significant and deep disturbance).

	Entity	PSP Section	Comment	GRDA Response
				While GRDA has proposed to conduct subsurface testing pursuant to the Osage Nation THPO's Archaeological Block Survey Standards, GRDA will consult with Native American Tribes, including individual THPOs, and the BIA to determine if the proposed methods are appropriate for each Tribe's tribal trust lands pursuant to an Archaeological Resources Protection Act (ARPA) permit. Similarly, GRDA will consult with the Oklahoma SHPO and OAS to determine if the proposed methods are appropriate for non-federal lands within the APE. GRDA recognizes that individual THPOs, Native American Tribes, and the BIA may have different requirements with respect to the documentation and evaluation of archaeological sites and the collection and curation of cultural material on tribal trust lands. Similarly, the Oklahoma SHPO and the OAS have requirements for documentation and evaluation of archaeological sites and the collection and curation of cultural material from non-federal lands within the APE. Accordingly, GRDA will consult with the THPOs, Native American Tribes, Oklahoma SHPO, BIA, and OAS with respect to the appropriate documentation and evaluation of archaeological sites and the collection and curation of cultural material from lands within the APE prior to the commencement of fieldwork. Section 2.6.4 of the Cultural Resources Study Plan has been revised to include this additional consultation.
119	FERC 7/20/2018 (Letter)	Cultural Resources Study Plan	To the extent possible, we recommend that GRDA conduct National Register of Historic Places (National Register) evaluations and assessments project effects during the pre-application study period, rather than delaying such assessments until after a new license is issued for the project, as GRDA proposes in their study plan. National Register evaluations and assessments of effect aid Commission staff in evaluating the environmental impacts of the project on historic properties as required under the National Environmental Policy Act and resolving adverse effects to historic properties as required under section 106 of the National Historic Preservation Act. National Register eligibility and assessment of effect must be determined in consultation with the Oklahoma SHPO, and tribal THPOs where resources occur on tribal lands. GRDA's proposed schedule should include adequate time for such consultation.	Based on consultation with the CRWG, GRDA has revised the Cultural Resources Study Plan to include the evaluation and assessment of certain archaeological resources during the pre-application study period. Specifically, GRDA is proposing to conduct archaeological site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 118. The Cultural Resources Study Plan has also been revised to clarify that GRDA will treat and consider all identified archaeological sites as eligible for the NRHP unless or until an evaluation and assessment of the site has been completed and the consulting parties concur that the site is ineligible.
120	FERC 7/20/2018 (Letter)	Section 2.6.5 of Cultural Resources Study Plan	In section 2.6.5, *Traditional Cultural Properties*, of the Cultural Resources study plan, GRDA proposes to consult with Native American Tribes during Study Year One to develop specific methods and approaches to conducting a Traditional Cultural Property (TCP) inventory for lands within the APE and to conduct the study during Study Year Two. As discussed in the study plan meetings, it is understood that the methods to identify TCPs may vary between consulting tribes and that consultation will be required to identify specific methods on a tribe-by-tribe basis. However, we recommend that a general methodology be provided with the revised study plan. We further recommend that in developing its proposed methodology, GRDA consider the guidance provided in National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*, and specify which tribes would be consulted, who would conduct the consultation, how the results would be provided and kept confidential, and provide a schedule for completion of study tasks. As discussed in the study plan meetings, some tribes may not wish to identify the specific locations of areas of sacred or traditional importance. In these situations, we recommend that the TCP study plan instead call for the identification of the various issues that these tribes may have related to these locations.	Section 2.6.5 of the Cultural Resources Study Plan has been revised to provide a general methodology for conducting the TCP Inventory, taking into account the National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. GRDA intends to provide all interested Native American Tribes with the opportunity to participate in the TCP Inventory, and Section 2.6.5 of the Cultural Resources Study Plan has been revised to include additional information regarding consultation, confidentiality, and a general schedule for conducting the TCP.
121	FERC 7/20/2018 (Letter)	Section 2.6.5 of Cultural Resources Study Plan	Section 2.6.5, *Traditional Cultural Properties*, of the Cultural Resources study plan states that TCPs may be eligible for listing in the National Register because of their association with cultural practices or beliefs of a living community that are (1) rooted in that community's history, and (2) important in maintaining the continuing cultural identity of the community. Because of the potential for overlap between TCPs and archeological sites, we recommend that the study plan include	Section 2.6.5 of the Cultural Resources Study Plan has been revised to include identification of any correlations between potential TCPs and documented archaeological sites.

	Entity	PSP Section	Comment	GRDA Response
			identification of any correlations between potential TCPs and documented archaeological sites. We make this recommendation because, while an archaeological site may not be eligible for listing on the National Register under the National Register criteria, it may be eligible for listing if it is associated with an eligible TCP.	
122	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	Rather than generic references to "Native American Tribes," see, e.g., Proposed Cultural Resources Study at 2, GRDA should specifically consult with Tribal Historic Preservation Officers (THPOs) of each of the effected Native American Tribes, just as GRDA proposes to consult with the Oklahoma SHPO.	As described in the Cultural Resources Study Plan, GRDA intends to conduct consultation with Native American Tribes pursuant to Section 106 of the NHPA. The Cultural Resources Study Plan has been revised to clarify that, when a Native American Tribe has assumed the responsibilities of the SHPO for Section 106 on tribal lands under Section 101(d)(2) of the NHPA, GRDA will consult with the appropriate THPO in lieu of the Oklahoma SHPO.
123	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	For compliance with the Section 106, GRDA should complete all of the components of the Cultural Resource study prior to the issuance of the new license. See, 36 C.F.R. § 800.0(c).	As described in Section 2.6.6 of the Cultural Resources Study Plan, GRDA proposes to complete the Section 106 consultation process during Project relicensing. GRDA notes that Section 106 does not require the identification of every historic property within an undertaking's APE prior to the issuance of a license, only that the agency official make a "reasonable and good faith effort to carry out appropriate identification efforts…"(36 C.F.R. 800.4(b)(1)). Further, as provided at 36 C.F.R. § 800.4(b)(2), the regulations specifically provide for a phased identification and evaluation of historic properties: *Where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted, the agency official may use a phased process to conduct identification and evaluation efforts. The agency official may also defer final identification and evaluation of historic properties if it is specifically provided for in a memorandum of agreement executed pursuant to § 800.6, a programmatic agreement executed pursuant to § 800.14(b), or the documents used by an agency official to comply with the National Environmental Policy Act pursuant to § 800.8.* Consistent with common FERC practice, GRDA's Cultural Resources Study Plan includes the development of a Programmatic Agreement to satisfy the Commission's Section 106 responsibilities (18 C.F.R. § 800.14(b)(2)(iii)). GRDA is proposing to undertake a reasonable and good faith effort to: (1) carry out appropriate identification efforts of the Project's APE during the two-year ILP study period to inform the development of an HPMP and Programmatic Agreement; and (2) to continue the phased identification and evaluation of archaeological and historic resources within the APE subsequent to the Commission's issuance of a new license for the Project. GRDA's proposal is entirely consistent with Section 106 and its implementing regulations.
124	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	As part of GRDA's "Background Research and Archival Review," see Proposed Cultural Resources Study at 7, GRDA should conduct oral history interviews with tribal elders and locals during background research review m order to obtain a more comprehensive understanding of the "historic and environmental contexts of the APE." Id.	Section 2.6.2 of the Cultural Resources Study Plan has been revised to clarify that GRDA will coordinate with Native American Tribes to arrange meetings with THPOs and other individuals that may have information or files relevant to the location of archaeological and historic resources within the APE.
125	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	The "Background Research and Archival Review" should specifically identify and review any archaeological or anthropological surveys done of ancestral, tribal trust or individually- owned trust land at the time of the Project's creation. In particular, GRDA has resisted study of permanently inundated areas, see PSP at 26, partly on the basis that surveys of the now-inundated areas were previously completed. Such surveys should be kept confidential in case they disclose the location of sites of historic, cultural, or religious significance.	As described in Section 2.6.2 of the Cultural Resources Study, GRDA intends to review reports on previous cultural resources studies (to the extent that these reports are available) within the APE, including studies conducted in areas that are now permanently inundated by Grand Lake. However, as explained in GRDA's response to Comment No. 11, GRDA will not conduct investigations in areas that are permanently inundated, except on an opportunistic basis (e.g., during low-level drought conditions or maintenance-related drawdowns).
126	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA should consult with the relevant Native American Tribes about whether any tribe maintains its own Register of Historic Places and GRDA should review any such Registers in its efforts to identify archaeological and historic resources and properties. If a tribe considered a site to be eligible then GRDA should treat it as eligible.	Section 2.6.2 of the Cultural Resources Study Plan has been revised to clarify that GRDA will consult with THPOs regarding any tribal Registers of Historic Places as a component of the Background Research and Archival Review task. GRDA has also clarified the plan to note that, in general, GRDA intends to treat all archaeological sites or historic resources as eligible for the NRHP, unless or until a property has been evaluated and determined to be ineligible in consultation with the THPO or Oklahoma SHPO (as appropriate).
127	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA's "Reconnaissance Survey," see Proposed Cultural Resources Study at 8, should comply with the Department of the Interior and BIA's Best Management Practices for cultural resource surveys.	GRDA consulted with the BIA regarding the BIA's Best Management Practices (BMP) for cultural resources surveys. Based on discussions with the BIA's Regional Archaeologist on August 21, 2018, it is GRDA's understanding that the BIA's BMP guidance document has not been finalized

	Entity	PSP Section	Comment	GRDA Response
				and is not available for review at this time. GRDA looks forward to reviewing the BMP guidance document when it is available.
128	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	A timeline for the Cultural Resource Survey work should be identified to the BIA and the effected Native American Tribes. Such a timeline should be developed with consultation between GRDA and the effected Native American Tribes.	A general schedule for completing the Cultural Resources Study (including field reconnaissance) was included in Section 2.6.4 of the Cultural Resources Study Plan. The Cultural Resources Study Plan has been revised to clarify that GRDA will develop specific survey schedules in consultation with the CRWG prior to the commencement of field surveys, and that GRDA will provide more detailed survey schedules to the CRWG on a weekly basis during Study Years One and Two.
129	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	Any "qualified cultural resources professional" proposed by GRDA, see Proposed Cultural Resources Study at 8, must meet the requirements of 43 C.F.R. § 7.8(a). At a minimum, in order to be qualified, GRDA's proposed cultural resources professional must possess (i) a graduate degree in anthropology or archaeology, or equivalent training and experience; (ii) the demonstrated ability to plan, equip, staff, organize, and supervise activity of the type and scope proposed; (iii) the demonstrated ability to carry research to completion, as evidenced by timely completion of theses, research reports, or similar documents; (iv) at least 16 months of professional experience and/or specialized training in archaeological field, laboratory, or library research, administration, or management, including at least 4 months experience and/or specialized training in the kind of activity the individual proposes to conduct under authority of a permit; and (v) at least one year of experience in research concerning archaeological resources of the historic period(s) relevant to the Project area. The BIA Regional Archeologist would like to evaluate the resumes of potential personnel prior to their participation in the cultural resource surveys.	GRDA has revised the Cultural Resources Study Plan to indicate that any cultural resources professional conducting work on federal lands will meet the qualification requirements for issuance of an ARPA permit as described at 43 C.F.R. § 7.8(a). The Cultural Resources Study Plan has also been revised to clarify that GRDA will apply to the BIA for an ARPA permit prior to conducting any archaeological excavations on tribal trust lands, and will consult with affected Native American Tribes regarding ARPA permit requirements. GRDA recognizes that archaeological excavations on federal lands or the collection of cultural material from federal lands requires a permit issued by the federal land manager pursuant to ARPA. As part of the ARPA permit application review process, the BIA will be afforded the opportunity to review resumes of potential personnel.
130	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	It is vitally important that the qualified cultural resource professionals hired by GRDA have a good working knowledge of the history of this area in Eastern Oklahoma and of the tribal entities of this area.	Section 2.7 of the Cultural Resources Study Plan has been revised to clarify that the Cultural Resources Study will be conducted by cultural resources professionals with experience in Eastern Oklahoma and experience with tribal entities in the area.
131	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	The Reconnaissance Surveys section states that GRDA "will geo-locate, record, and collect any observed artifacts, features, or other pre-contact or historic period cultural material." See id. at 9. However, artifacts are not to be collected, videoed, photographed, or sketched without prior written consent of the BIA Archeologist and, if located on trust land, the relevant federal Indian tribe for which the land is held in trust. These are requirements included in the Archaeological Resources Preservation Act (ARPA) and the Native American Graves Protection and Repatriation Act (NAGPRA).	GRDA recognizes that archaeological excavations on federal lands or the documentation and collection of cultural material from federal lands requires a permit issued by the federal land manager pursuant to ARPA. Section 2.6.4 of the Cultural Resources Study Plan has been revised to clarify that artifacts will not be collected, videoed, photographed, or sketched without prior written consent of the BIA Archeologist and, if located on trust land, the relevant federal Native American Tribe for which the land is held in trust.
132	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	A tribal monitor should be present during evaluations of and disturbance of any site of concern to any interested Native American Tribe. GRDA should develop a Tribal Monitoring Plan with consultation from the Native American Tribes in the area.	GRDA welcomes the participation of tribal monitors during reconnaissance surveys and site evaluations. As indicated in Section 2.6.4 of the Cultural Resources Study Plan, GRDA will compensate one tribal monitor per day for their participation in the study, per terms to be agreed upon between GRDA and Native American Tribes. Additional, uncompensated monitors are also welcome to participate in surveys and site evaluations.
133	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA should provide notice to the BIA and the relevant Native American Tribes of the time and place of the Reconnaissance Surveys, and any activities related thereto.	The Cultural Resources Study Plan has been revised in Section 2.6.4 to indicate that GRDA will provide notice to consulting parties regarding the schedule and locations for conducting Reconnaissance Surveys. Please refer to GRDA's response to Comment No. 128.
134	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA should provide to the BIA and the relevant Native American Tribes all of the previous survey work that will be evaluated in connection to the Cultural Resource Study so that tribes can be best prepared to engage in meaningful consultation.	The Cultural Resources Study Plan has been revised to clarify that GRDA will provide the CRWG with copies of all previous study reports, background information, or other relevant records identified and reviewed during development of the Pre-fieldwork Report. However, GRDA notes that there may be information provided by a Native American Tribe that is considered confidential; if such an instance occurs, GRDA will only share such information with other parties pursuant to applicable laws and written approval from the Native American Tribe.
135	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	FERC stated that river bottom surveys were not going to be conducted because of the old surveys that had been done at the initial construction. However, those prior surveys have not been found or given to the Tribes, BIA or other consulting parties. If those surveys are not produced by GRDA, then FERC should require river bottom surveys to be completed and identify destroyed Tribal cemeteries and sacred sites located therein.	As discussed in GRDA's response to Comment No. 134, GRDA is compiling previous survey reports, including surveys of the inundated lands that were conducted prior to construction of the Pensacola Dam. GRDA intends to provide copies of those previous study reports to the CRWG. As explained in GRDA's response to Comment No. 11, however, GRDA will not conduct investigations in areas that are permanently inundated, except as provided in the revised Section 2.6.7 of the revised Cultural Resources Study Plan, which contemplates additional surveys and evaluations in inundated areas on an opportunistic basis—such as during drought conditions or

	Entity	PSP Section	Comment	GRDA Response
				when reservoir levels are drawn down for maintenance purposes. GRDA does not propose to drain the reservoir to conduct river bottom surveys. Such studies are inconsistent with the ACHP's Section 106 Archaeology Guidance (ACHP 2009) which states that: *…archaeological identification efforts for a license renewal from the Federal Energy Regulatory Commission likely would not involve the entire area of potential effects (APE). Rather it would be directed to those locations within the APE that are experiencing project related effects associated with operation, usually along the shoreline.* Further, cultural resources studies of permanently inundated lands and archaeological sites would be inconsistent with generally accepted practices in the scientific community. GRDA is not aware of any other existing hydroelectric project relicensed by the Commission wherein the licensee was required to drain a reservoir to facilitate river bottom archaeological surveys of permanently inundated lands or archaeological resources. The long-term environmental and socioeconomic impacts of drawing down Grand Lake to expose permanently inundated river bottom lands for rigorous archaeological study would be immense and wide-ranging. These impacts would include permanent loss of wildlife habitat, significant fish mortality, substantial decreases in property values, a steep region-wide decline in tourism and local businesses supported by tourism, and the loss of recreational opportunities. Section 106 of the NHPA requires a "reasonable and good faith" effort to identify archaeological resources within the Project's APE. Draining Grand Lake to conduct archaeological surveys of permanently inundated lands and archaeological sites is not reasonable, and it is inconsistent with FERC's criteria for study requests under the ILP.
136	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA should develop a plan to address when artifacts are inadvertently discovered. Such a plan should be developed with consultation between GRDA and the Native American Tribes.	The Cultural Resources Study Plan has been revised in Section 2.6.4 to clarify that GRDA will develop an Inadvertent Discoveries Plan in consultation with the THPO's, Native American Tribes, Oklahoma SHPO, OAS, and BIA (for tribal trust lands).
137	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA should develop a plan regarding the discovery of human remains. Such a plan should be developed with consultation between GRDA and the Native American Tribes.	The Cultural Resources Study Plan has been revised in Section 2.6.4 to clarify that GRDA will develop a plan regarding the discovery of human remains in consultation with the THPO's, Native American Tribes, Oklahoma SHPO, OAS, and BIA (for tribal trust lands).
138	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	GRDA must develop a management plan for cultural resources and sites that are discovered during study plan term or during the term of the license. Such a plan should be developed with consultation between GRDA and the Native American Tribes and the plan must include how sites will be maintained after discovery, how to prevent looting and destruction of sites, how artifacts will be handled upon discovery, how artifacts will be collected and stored, and who are the responsible parties for collection and storage. Furthermore, tribes have expressed a desire that all artifacts which are located in the same site should all be maintained together.	As described in Section 2.6.7 of the Cultural Resources Study Plan, GRDA has proposed to develop an HPMP for the Project that will describe how archaeological and historic resources within the Project's APE are considered and managed during the term of a new license.
139	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	The BIA objects to any cultural sites being treated as partially eligible for study. If any portion of a cultural site lies within the APE then the entire site must be treated as being within the APE.	Please refer to GRDA's response to Comment No. 116. If any portion of an archaeological site is located within the APE, GRDA will treat the entire site as eligible for the NRHP, unless or until a property has been evaluated and determined to be ineligible in consultation with the THPO or Oklahoma SHPO (as appropriate).
140	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	Due to the timespan of tribes located in the region, it is important to include as many tribes as possible for consultation on all phases of the sites, whether the land in question is held in fee, trust, or restricted status.	As described in the Cultural Resources Study Plan, GRDA intends to consult with all consulting parties regarding the development and results of each phase of the Cultural Resource Study, including the Pre-Fieldwork Report, Year One, and Year Two studies. The Cultural Resources Study Plan also describes provisions for continued consultation with consulting parties pursuant to the HPMP.
141	BIA 7/26/2018 (Letter)	Cultural Resources Study Plan	Subsurface testing should be conducted when subsurface deposits of materials are present, regardless of surface visibility or land use.	Please refer to GRDA's response to Comment No. 118.
142	SHPO	Cultural Resources	The definition of the current APE for the relicensing project as provided on page 5 is vague at best.	As described in Section 2.5 of GRDA's Cultural Resources Study Plan, the proposed APE is

	Entity	PSP Section	Comment	GRDA Response
	7/11/2018 (Letter)	Study Plan	It is noted on pages 5 and 6 that the APE will be refined through results of other studies such as the hydraulic modeling of which this refinement may be available in Study Year Two. However, per the schedule for survey work on page 8, the field work is proposed to start in Study Year One. Is the field work proposed for Study Year Two in anticipation for surveying those additional areas identified from the hydraulic modeling?	defined as: *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.* During Study Year One, GRDA is proposing to conduct studies at locations within the FERC Project Boundary. Specifically, GRDA is proposing to conduct a Reconnaissance Survey and at locations within the Project Boundary identified through consultation with the CRWG on the Pre-fieldwork Report. GRDA is also proposing to conduct Phase II Intensive Surveys (site evaluations) during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No 115. GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to effect historic properties, should any be present. During Study Year Two, GRDA is proposing to conduct a Reconnaissance Survey at locations within the APE (including areas that may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing. GRDA is also proposing to conduct site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 115.
143	SHPO 7/11/2018 (Letter)	Cultural Resources Study Plan	In considering the APE, we recommend that the cumulative effects since the construction of the dam be included along with the reasonably foreseeable effects that may be predicted through the hydraulic and sediment studies as well as the effects of the permanently amended reservoir elevation curve has on underwater and shoreline historic resources.	GRDA's proposed APE explicitly includes the Project Boundary (including the shoreline of Grand Lake) and "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." The proposed APE embraces a broad definition consistent with reasonable foreseeable cumulative effects.
144	SHPO 7/11/2018 (Letter)	Cultural Resources Study Plan	In 1992 when the dam was last relicensed, the NHPA underwent significant changes that included the enhanced role for tribes in the national preservation program and enhanced protection to places of cultural significance to Indians and Native Hawaiian organizations. Specifically, Item 3 of the amendment allowed for the creation of the tribal and Native Hawaiian organizations historic preservation programs. Therefore, it is imperative that GRDA and FERC acknowledge their responsibilities for consulting with tribes which starts with GRDA and FERC being proactive in addressing the concerns that have been brought up with regard to the issue of lands that are held in trust for tribes within the Pensacola project area. Before any research is conducted and before any field work is initiated, GRDA and FERC must resolve the question of whether or not there exist parcels of tribal trust land in the Pensacola project area. Hopefully, given the time frame for the relicensing process, this can be accomplished expeditiously with the Bureau of Indian Affairs (BIA) who is the administrator of the tribal trust land program. In addition, it is paramount that GRDA and FERC understand very clearly the different types of land status related to tribes (fee, restricted and allotted) that may	Comment acknowledged. GRDA is in the process of identifying tribal trust lands and land status within the Project area in consultation with the BIA and Native American Tribes. FERC's Scoping Document 2 has acknowledged that the Project occupies federal trust lands.

	Entity	PSP Section	Comment	GRDA Response
			pertain to parcels of land that are currently within the Pensacola Project area.	
145	SHPO 7/11/2018 (Letter)	Cultural Resources Study Plan	Upon review of the cultural resources study plan, it appears that the same issue that plagued the 2017 FERC Environmental Assessment (EA) for the permanent amendment of the reservoir elevation rule curve has not been addressed. The 2017 EA was prepared by biologists and civil engineers and our concerns as outlined in our response letter dated February 1, 2017, noted the lack of Secretary of the Interior (SOI) qualified archaeological personnel in preparing the section on cultural resources where the unverified opinion that higher water levels would protect the cultural resources from erosion and looting was published. In addition, we cautioned against FERCs decision to not require the GRDA to develop a HPMP. We ask that studies on the effect of drought, flood and wave action on underwater and shoreline historic resources be included within the study plan and within the Historic Properties Management Plan (HPMP).	As described in the Cultural Resources Study Plan, GRDA is proposing to conduct a phased identification and evaluation of historic properties within the Project's APE and to assess the Project's potential effects on identified historic properties. As discussed above in response to Comment Nos. 11 and 135, GRDA is not proposing to conduct studies of permanently inundated lands or archaeological sites within the APE except on an opportunistic basis (e.g., during drought conditions or maintenance related drawdowns). This approach is consistent with the ACHP's Section 106 Archaeology Guidance (ACHP 2009). Any full-scale study on the entire inundated zone of the reservoir would be highly expensive, disruptive of resources that may be present, and would not be consistent with accepted practices in the scientific community. GRDA is not aware of any other existing hydroelectric project wherein the licensee conducted archaeological studies of permanently inundated lands.
146	SHPO 7/11/2018 (Letter)	Cultural Resources Study Plan	The HPMP also needs to address the NRHP listed Pensacola Dam and associated resources. As GRDA is pursuing a TIGER grant for the upgrade for the road crossing the dam, this will also need to be addressed in the HPMP. The entirety of the May 2018 meeting focused solely on archaeology; it is a glaring error to omit standing resources from the HPMP. An approach should be included to address all standing historic resources within the APE.	Section 2.6.4 of the Cultural Resources Study Plan describes how GRDA will identify historic architectural resources within the APE. As described in the Cultural Resources Study Plan, GRDA is proposing to develop an HPMP that will describe how the licensee will consider and manage historic properties within the Project's APE, including the Pensacola Dam Historic District.
147	SHPO 7/11/2018 (Letter)	Cultural Resources Study Plan	We would like to address the comment made by Allison MacDougall of Louis Berger during the May 31, 2018 meeting where she stated, "SHPO should have the 'old' reports before construction of the dam." If the consultant had read the 2017 Pre-Application Document (PAD) or even just skimmed footnote #9 on page 7 of the proposed study plan, then Ms. MacDougall would have known that while archaeological investigation within the northeast portion of the State began as early as 1894, it appears that any archaeological work that was conducted between 1934 and 1941 in the region was focused in Cherokee, Delaware, Muskogee and Wagoner Counties and not in Mayes County where the dam itself is located and of which the construction of the dam was completed in 1938. It wasn't until after 1945 that a concerted effort was made in archaeological excavation for the development of reservoirs. During this time, any documentation that was created for these field work efforts was maintained by the University of Oklahoma. It was due to these large scale infrastructure projects like the Pensacola Dam, that caused irreparable damage to the environment and significant loss of the non-renewable historic resources, that ushered in the National Historic Preservation Act in 1966, 28 years after the Pensacola Dam was constructed, and the creation of SHPO in 1967 and then the primary focus of the SHPO was on buildings and structures, not archaeology. It was not until 1976, that an agreement was made between the SHPO and the Oklahoma Archeological Survey (OAS) to coordinate on review of Section 106 undertakings. Therefore, we recommend, as stated in footnote #9, that research continue to be conducted into the available archives at GRDA and the OAS. In addition to reviewing the online database for the National Register of Historic Places (NRHP), we recommend a review of the database for properties that have been determined eligible (DOEs) for the NRHP that is available at: http://www.okhistory.org/shpo/doesearch.php Finally, we recommend that the State Historic Preservation Office, Tomorrow's Legacy: Oklahoma's Statewide Historic Preservation Plan, be included as part of the literature review and included on the list of comprehensive plans. The State Plan may be accessed online at: http://www.okhistory.org/shpo/stateplan.htm	Comment acknowledged. As described in the Cultural Resources Study Plan, GRDA intends to conduct background research and a review of archival material in support of developing the Pre-fieldwork Report. This research will include the sources identified by the Oklahoma SHPO.
148	OAS 7/26/2018 (Letter)	Cultural Resources Study Plan	FERC's comment #21 *(letter dated 7/20/2018)* addresses the topic of potential changes to the Area of Potential Effects (APE) based on the Hydrologic and Hydraulic (H & H) study; I believe this should be expanded to also potentially incorporate information from the Sedimentation study, as appropriate. Beyond establishing the APE, data from the Wetland Documentation Study {Section 4.3.7) could also inform the cultural resource survey strategy. Indeed, any environmental data currently maintained by GRDA or to be developed through the proposed additional studies that pertain to our understanding of landforms, soils, erosion, and other landscape-oriented subjects in the project area should be considered for their potential to inform the cultural resource studies.	As described in Sections 2.5 and 2.6.1 of the Cultural Resources Study Plan, GRDA intends to consider the results of the H&H Study as well as the results of other studies conducted in support of the Project relicensing in refining the APE for this undertaking.

	Entity	PSP Section	Comment	GRDA Response
149	OAS 7/26/2018 (Letter)	Section 2.3 of Cultural Resources Study Plan	Please provide additional information on the summary data of NRHP- eligibility of the known archaeological sites within the APE. What was the source(s) of this information? Did it derive from recommendations on the site forms as presented by those who recorded the site? Consultation letters between GRDA and OAS/SHPO? Was this an official determination or just recommended status? A comprehensive assessment of the NR-eligibility of known sites and a record of the establishment of that status will have bearing on ensuing consultation regarding those sites that may require further study and/or other considerations.	GRDA provided summary data on the NRHP eligibility of previously recorded resources within the APE in the PAD. In general, this data was derived from site forms prepared by individuals or organizations that recorded the site. This information was not intended to be exhaustive, but was included in the PAD and PSP to provide a general characterization of the types of archaeological resources within the Project area and the relative status of those resources. GRDA recognizes that additional research regarding the NRHP eligibility of previously reported archaeological and historic resources is necessary. Section 2.6.2 of the Cultural Resources Study Plan has been revised to clarify that GRDA will conduct additional research on the NRHP eligibility of archaeological and historic resources within the Project's APE.
150	OAS 7/26/2018 (Letter)	Section 2.6.4 of Cultural Resources Study Plan	Why does GRDA propose to only implement reconnaissance survey, to the apparent exclusion of any intensive survey, during the first two years of study?	As discussed in Section 2.1 of the Cultural Resources Study Plan, GRDA proposes to work with the CRWG to identify high-priority areas and sites within the APE for study using the two-year ILP process for purposes of informing FERC's analyses under both Section 106 of the NHPA and NEPA, and to continue cultural resource investigations post-licensing, over a longer period of time as part of the HPMP. This approach recognizes the limited, two-year window for conducting cultural resources studies during Project relicensing, particularly when considering the vast geographic area occupied by the Project and other areas that may be affected by Project operations. In Section 4.1.3 of the proposed study plan, GRDA states that it would focus cultural resource investigations on areas where continued Project operations may affect historic properties. As discussed above in response to Comment No. 118, GRDA proposes to conduct archaeological site evaluations during Study Years One and Two where the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site, or the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 118.
151	OAS 7/26/2018 (Letter)	Section 2.6.4 of Cultural Resources Study Plan	GRDA acknowledges that the survey will be conducted by qualified cultural resources professionals who meet the Secretary of the Interior {SOI) Qualification Standards. Such individuals should also have extensive regional-and preferably local- experience. Additionally, there should be at least one Principal Investigator on the project team who specializes in Precontact Archaeology and another who specializes in Historic Archaeology, though it is possible that one individual can meet the standards to qualify for both areas of specialization.	GRDA has revised Section 2.7 of the Cultural Resources Study Plan to indicate that the project team will include: (1) a Principal Investigator that qualifies as a specialist in both Precontact Archaeology and Historic Archaeology; or (2) one Principal Investigator on the project team who specializes in Precontact Archaeology and another who specializes in Historic Archaeology
152	OAS 7/26/2018 (Letter)	Cultural Resources Study Plan	If GRDA is unable to complete all of the necessary cultural resource studies within a two-year timeframe, what commitments will GRDA and FERC make to guarantee that the provisions of a Programmatic Agreement, Historic Properties Management Plan, and deferred obligations to address cultural resources will be honored?	GRDA will operate the Project pursuant to a new license issued by FERC. GRDA anticipates that FERC will develop a Programmatic Agreement for historic properties that may be affected by the issuance of a new license for the Project and that the new license will require GRDA to implement the Programmatic Agreement and HPMP. As such, failure to implement the Programmatic Agreement or HPMP would result in a violation of the new license. FERC can impose significant civil penalties on licensees that fail to comply with license conditions. FERC also has the authority to revoke a license for non-compliance of license conditions. GRDA is the licensee for the Salina Pumped Storage Project (FERC No. 2524) and the Markham Ferry Project (FERC No. 2183), both of which have HPMPs as conditions of their respective FERC licenses. GRDA maintains compliance with both of these HPMPs, including the requirements for deferred identification and evaluation of historic properties.
153	ODWC 7/24/2018 (Letter)	Cultural Resources Study Plan	This study should ensure that all current and possible Project lands be included in the area of potential effect (APE). Current agreements have identified several areas for potential adjacent site mitigation. Currently one site is progressing through clearance and then will proceed to construction, but it is anticipated that not all funds designated for mitigation use will be expended on the current project; therefore areas identified in the 2016 Interagency Agreement with the ODWC should be included in the APE to provide efficiency for future work. This would also include private lands (provided permission was obtainable) that may be needed to conduct future restoration activities.	To the extent that these activities occur in the current license term, GRDA will meet obligations of Article 409 of the license to investigate effects of the undertaking on cultural resources; for example, GRDA cultural resource studies in the area that is proposed for development at the Coal Creek Wildlife Management Area.
154	Miami Tribe	Cultural Resources	*GRDA must revise its proposed cultural resources assessment study plan to account/or federal*	GRDA appreciates the participation of the Miami Tribe in study plan development.

	Entity	PSP Section	Comment	GRDA Response
	7/26/2018 (Letter)	Study Plan	*lands within a properly defined Project Boundary.* In the SD2, FERC acknowledges for the first time what has been true since the Project was first licensed: "[t]he project occupies federal land." FERC's shift in position on this point was principally a result of the BIA's submission of detailed mapping information that made the known an inescapable matter of record: the presence of numerous tracts of lands held by the United States in trust for various tribes in and around the Project Boundary. Yet, GRDA continues to hedge on this issue, noting that the question of whether the Project actually occupies any federal lands or interests in lands presents a complex set of issues" and reiterates that "throughout the long history of this Project, the Commission repeatedly and uniformly has concluded that the Project does not occupy federal lands." GRDA must change its position in light of FERC's clear acknowledgement that federal lands are and have been within the Project boundary all along. Despite GRDA's attempt to create complexity, this issue is not complex, it is binary. Either there are federal lands within the Project Boundary or there are not, and here FERC has determined that federal lands are present. The only complexity in this issue is how GRDA and FERC could have maintained a contrary view for decades when the falsity of that position was a matter of public record. Notably, a shift in GRDA's position on this issue is not simply a matter of semantics. The existence of federal lands in and around the Project Boundary has direct legal implications for Section 106 review that renders the PSP insufficient in multiple respects. First, because lands held by the United States for the benefit of tribes are within the Project Boundary, the tribal historic preservation officers (THPOs) for the respective tribes holding that land carry the rights of a state historic preservation officer (SHPO) for Section 106 review. Further, the central role of the THPO in the Section 106 process also means that the tribes with lands within the Project Boundary must be parties to any Programmatic Agreement that is entered into for the purposes of mitigation. Additionally, the presence of federal lands within the Project Boundary triggers the United States Department of the Interior's mandatory-license conditioning authority under Section 4(e) of the Federal Power Act. Under 16 U.S.C. § 797(e), FERC is vested with the authority to issue licenses within a reservation, subject to two limitations: Licenses shall be issued within any reservation only after a finding by the Commission that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the Secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation. This language requires FERC to accept and incorporate within a license the conditions that the Secretary deems "necessary for the adequate protection and utilization" of the reservation for which he oversees.23 And the "require[ment] that [FERC] include the Secretary's conditions in the license even if it disagrees with them." Indeed, the language conferring on the Secretaries the right to impose mandatory licensing conditions illuminates that Congress "wanted the individual Secretaries to continue to play the major role in determining what conditions would be included in the license in order to protect the resources under their respective jurisdictions." Given the presence of federal lands within the Project boundary, the Secretary of the United States Department of the Interior-the official serving as the trustee's representative regarding such lands on behalf of the United States-has the responsibility to protect those lands through the authority to place conditions on the license affecting such lands. The Tribe will, therefore, work in coordination with Secretary of the Interior to ensure that federal lands and tribal resources are protected through mandatory licensee conditions if GRDA and FERC are not willing to do so.	GRDA does not dispute the presence of federal trust lands in the vicinity of Grand Lake. The issue of whether any of those lands may be affected by Project operations under GRDA's FERC-issued license is far more complex than acknowledged by the City of Miami. As recently as September 18, 2018, the BIA provided additional information to FERC, which led FERC staff to indicate that the Project likely occupies federally-owned lands held in trust for Native American Tribes or Individual Native Americans. As of the filing of this RSP, the total acreage of tribal trust lands at the Project has not been confirmed or verified. This process will involve a careful review and determination of whether and the extent to which the Project may occupy federal trust lands. It will also require an identification of the location of federal trust lands—an effort that currently is underway by GRDA and BIA—and whether, based on the results of the H&H Study, these lands are affected by GRDA's operations under its license—as opposed to USACE flood control activities. Except with regard to a cumulative effects analysis, GRDA is under no obligation to take responsibility for effects of USACE's flood control operations. Please refer to PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment Nos. 9, 15 and 17. Armed with the results of first year studies, including the H&H and Sedimentation studies, GRDA will consult with the CRWG in determining whether any additional lands, including possibly additional federal trust lands, will be subject to second year studies. Please refer to GRDA's responses to Comment Nos. 115 and 142. As described in Section 2.5 of the Cultural Resources Study Plan, the proposed APE is defined as: *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.* Pursuant to this definition, the APE would include federal tribal trust lands and non-federal lands within the FERC Project Boundary as well as federal and non-federal lands 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. Accordingly, there is no need to revise the proposed APE to "account for" federal lands, as the proposed APE includes the geographic area within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties regardless of land ownership. GRDA recognizes the responsibilities of THPOs with respect to Section 106 consultation regarding undertakings on tribal lands. GRDA looks forward to consulting with THPOs regarding historic properties within the Project's APE that are located on tribal trust lands. GRDA is aware of the Secretary of the Interior's mandatory conditioning authority for tribal trust lands under Section 4(e) of the Federal Power Act. As described in Section 2.6.7 of the proposed Cultural Resources Study Plan, GRDA intends to develop an HPMP in consultation with THPOs, BIA, DOI, and other consulting parties to provide management measures for historic properties located on federal and non-federal lands within the Project's APE.
155	Miami Tribe 7/26/2018 (Letter)	Cultural Resources Study Plan	*GRDA cannot push off its Section 106 responsibilities post-licensing.* GRDA's proposed timeline for completing the cultural resources assessment study that is	As the Miami Tribe indicated, GRDA is pursuing a new license from the Commission using the ILP process. The ILP is the Commission's default relicensing process, intended to create efficiencies by integrating a potential license applicant's pre-filing consultation with the Commission's scoping

	Entity	PSP Section	Comment	GRDA Response
			necessary to protect tribal cultural resources is unacceptable both as to timing and scope. GRDA states that its study approach will be to: "(l) work with the [Cultural Resources Working Group] to identify high-priority areas and sites within the APE for study during the 2-year ILP process, for purposes of informing FER.C's analyses under both Section 106 and the National Environmental Policy Act (NEPA); and (2) continue cultural resource investigations post- licensing (as necessary) over a longer period of time as part of the HPMP." Tellingly, GRDA attempts to excuse its truncated tribal consultation and timeline, seeking post-licensing review, on "the constraints of the ILP" and the "overall geographical scope" of the review, implying that it does not have enough time or resources to complete an appropriate review before relicensing must occur.27 As an initial matter, the Tribe must correct GRDA's mischaracterization the Tribe's position on this timeline. GRDA states that "[t]he proposed Cultural Resources Study Plan adopts an approach generally recommended by the Miami Tribe that includes the CRWG in the planning of field investigations and provides for on-going consultation with the CRWG during the ILP and after the new license is issued." To be clear, the Tribe does not, and has never, recommended or sanctioned an approach that would permit GRDA to engage in required cultural resources review under Section 106 after the license is issued. Several reasons justify the Tribe's position, and it has been crystal clear that the CRWG is not a substitute for consultation with each Tribe. First and foremost, FERC and GRDA have a mandatory obligation to complete Section 106 review prior to taking the major federal action of issuing a new license for the Pensacola Dam. The Section 106 regulations could not be clearer on this point: "The agency official must complete the section 106 process 'prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license.'" There is no exception for compliance with Section 106 when the project is geographically large in scope. After all, the key purpose of the Section 106 process -to inform the potential effect of relicensing - is contravened when, as GRDA proposes, relicensing precedes review. Further, the ACHP guidance GRDA cites does not alter the statutory requirement that full Section 106 compliance come before relicensing. GRDA cites ACHP guidance that "a federal agency is not expected to conduct a 100 percent survey of the area of potential effects." That guidance, however, in no way embraces post-licensing Section 106 review; rather, it relates to surveying for the purposes of identification of historic properties and notes that identification efforts "would be directed to those locations within the APE that are experiencing project related effects associated with operation, usually along the shoreline." Here, Project-related effects are by no means limited to the shoreline, as evidenced by the extensive documentation supporting the backwater flooding effects caused by the Project. Further, GRDA conveniently ignores ACHP's statement in the same paragraph that "[a]rchaeological testing . . . should occur within the APE wherever destructive impacts can be reasonably expected to occur later in time, be farther removed in distance or be cumulative." In sum, the ACHP Guidance simply confirms the need for the cultural resources study to encompass the full geographic scope of survey the Tribe has been advocating. It is especially confounding that GRDA created the condition it now cites to justify post- licensing cultural resources review. GRDA makes much of the fact that there has been a six month delay in the Integrated Licensing Process ("ILP") because of the lack of quorum of FERC commissioners to rule on the licensing amendment proceeding that was pending at the time GRDA filed its NOI and PAD. However, GRDA acknowledges that the cultural resources study may take many years to complete. Armed with that knowledge, GRDA chose to pursue the streamlined ILP process instead of seeking FERC approval to engage in traditional licensing or alternative licensing that would have permitted a more flexible timeline for study periods. Put simply, GRDA could have sought more time to complete Section 106 review and other studies it knew would be required, but simply chose not to do so, and cannot now be heard to be excused from its statutory obligations because of a compressed timeline.	pursuant to NEPA (see *FERC Final Rule, Order No. 2002*, 104 FERC ¶ 61,109). The ILP is not, as the Miami Tribe suggests, a process intended to reduce the timeframe available for conducting studies during relicensing. GRDA notes that under the Commission's ILP, traditional (TLP), or alternative (ALP) relicensing processes, an applicant is required to file a Notice of Intent and Pre-Application Document to initiate the relicensing process 5 to 5.5 years prior to the expiration of the current license (18 C.F.R. § 16.6(c)), and a Final License Application must be filed no later than 24 months prior to the expiration of the existing license (18 C.F.R. § 16.9(b)(1)). As such, the Miami Tribe's suggestion that the TLP or ALP provide a substantively more "flexible timetable for study periods" and tribal consultation is unsupported. Contrary to the Miami Tribe's statements, GRDA did not create these conditions or the regulations governing FERC hydropower relicensing. The fact remains that the ability of GRDA to conduct studies and to act as the Commission's non-federal representative for informal consultation pursuant to Section 106 is constrained by any of the Commission's relicensing processes. Accordingly, GRDA has proposed a phased study that is consistent with the regulations implementing Section 106 that would allow for continued identification and evaluation of historic properties to be conducted following issuance of a new license. The Miami Tribe correctly notes that the implementing regulations of Section 106 state that "the agency official must complete the Section 106 process 'prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license.'" However, the Miami Tribe's suggestion that GRDA is proposing to contravene the Section 106 process by completing Section 106 following issuance of a new license is inaccurate. As described in Section 2.6.6 of the Cultural Resources Study Plan, GRDA is indeed proposing to complete the Section 106 process during Project relicensing. GRDA notes that Section 106 does not require the identification of every historic property within an undertaking's APE prior to the issuance of a license, only that the agency official make a "reasonable and good faith effort to carry out appropriate identification efforts…"(36 C.F.R. 800.4(b)(1)). Further, as provided at 36 C.F.R. § 800.4(b)(2), the regulations specifically provide for a phased identification and evaluation of historic properties: *Where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted, the agency official may use a phased process to conduct identification and evaluation efforts. The agency official may also defer final identification and evaluation of historic properties if it is specifically provided for in a memorandum of agreement executed pursuant to § 800.6, a programmatic agreement executed pursuant to § 800.14(b), or the documents used by an agency official to comply with the National Environmental Policy Act pursuant to § 800.8.* GRDA's Cultural Resources Study Plan includes the development of a Programmatic Agreement to satisfy the Commission's Section 106 responsibilities (18 C.F.R. § 800.14(b)(2)(iii)). The Commission commonly develops Programmatic Agreements when relicensing hydroelectric projects. GRDA is proposing to undertake a reasonable and good faith effort to: (1) carry out appropriate identification efforts of the Project's APE during the two-year ILP study period to inform the development of an HPMP and Programmatic Agreement; and (2) to continue the phased identification and evaluation of archaeological and historic resources within the APE subsequent to the Commission's issuance of a new license for the Project. GRDA's proposal is entirely consistent with Section 106 and its implementing regulations. GRDA notes that the Miami Tribe mischaracterizes the ACHP's Section 106 Archaeology Guidance (ACHP 2009) as it is cited in the Cultural Resources Study Plan. As described in Section 2.5 of the study plan, GRDA is not proposing to limit the identification of historic properties only to the shoreline of Grand Lake or to postpone the identification of all historic properties until after the new license is issued. As described above, GRDA has proposed a reasonable and good

	Entity	PSP Section	Comment	GRDA Response
			GRDA also chose to pursue the ILP process knowing full well that a complete Section 106 review in consultation with affected Tribes had never been completed in the history of the Project. Throughout the variance (two years ago) and amendment (a year ago) proceedings, the Tribes argued that a full Section 106 review was needed as a condition of FERC approvals because the variance and amendment were federal undertakings that would adversely affect tribal cultural resources and thus required Section 106 compliance. Despite the Tribes' request for GRDA to come to the table to begin the long overdue Section 106 review, GRDA refused to do so and repeatedly argued to FERC that full Section 106 compliance was best suited for the relicensing process. Had GRDA engaged in prior required review, the extent of review that it now faces would have been much less substantial in scope. Finally, GRDA fails to acknowledge the obvious solution to its concern. When the scope of cultural resources review is large and complex, a common-sense strategy would be to dedicate more resources to that review to ensure that it is timely and adequately completed. During GRDA's "early outreach" in April 2018 while GRDA was developing its PSP, the Tribe specifically emphasized this point in response to GRDA's explanation of its plan to conduct post-licensing review. The Tribe also recommended that GRDA's utilization of existing Tribal resources and expertise throughout the review process would not only ensure necessary, and legally mandated, tribal participation in the Section 106 process, but would also expand the scope of review that could be completed prior to relicensing. Unfortunately, GRDA's Cultural Resources PSP makes no mention of dedicating additional resources to surveying above and beyond what would typically be expected given the significant geographic scope and the lack of prior Section 106 review. And while GRDA seeks to enlist the coordination of tribes in the review process through the Cultural Resources Working Group (CRWG), GRDA dedicates no analysis to more meaningful coordination and reliance on tribal expertise - something that the Tribes have repeatedly requested -'- which would ameliorate the need for post-licensing review. Put simply, it is not a matter of GRDA's inability to complete the necessary surveys prior to licensing, but rather its refusal to expend the time and resources necessary to accomplish that legally mandated task.	faith effort to identify historic properties during Project relicensing and to continue the phased identification and evaluation of historic properties following issuance of a new license. Further, GRDA's proposed APE explicitly includes the Project Boundary (including the shoreline of Grand Lake) and "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." Far from limiting the geographic scope of the Cultural Resources Study, the proposed APE embraces a broad definition that will allow GRDA, in consultation with the Oklahoma SHPO, THPOs, BIA, OAS, and other consulting parties, to refine the APE based on the results of other studies conducted in support of Project relicensing (including the H&H Study) to include other areas where Project-related "destructive impacts can be reasonably expected to occur," and to identify historic properties that may be effected by Project operations. Finally, the Miami Tribe states that GRDA should have described an approach that would dedicate "additional resources to surveying above and beyond what would typically be expected" in the Cultural Resources Study Plan. GRDA intends to conduct a study in accordance with Section 106 and other appropriate regulations that is consistent with generally accepted practices in the scientific community. It is unclear why "additional resources" would be required to conduct this study. The Miami Tribe has not demonstrated why the Commission should require GRDA to conduct studies that require a level of effort beyond generally accepted practices (see FERC criteria for study requests under the ILP at 18 C.F.R. § 5.9(b)(6)). Notwithstanding these issues, GRDA recognizes the role of the THPOs and tribal representatives in the Section 106 process, and Section 2.6 of the Cultural Resources Study Plan has been revised in response to this comment. GRDA is proposing to conduct additional consultation with Native American Tribes during the Background Research and Archival Review, Reconnaissance Surveys, and Site Evaluations. Additionally, as discussed above in response to Comment No. 132, GRDA welcomes the participation of Tribal monitors during reconnaissance surveys and site evaluations.
156	Miami Tribe 7/26/2018 (Letter)	Cultural Resources Study Plan	*GRDA cannot abdicate its responsibility to identify and assess impacts on potential historic properties located in inundated areas.* For the first time in its PSP, GRDA takes the position that it is not legally required to conduct cultural resources investigations in areas that are permanently inundated by the Project. Specifically, GRDA emphasizes that in order for a property to be eligible for listing, "a property must retain the essential physical features that enable it to convey its historic identity." GRDA contends, and asks FERC to accept its pre-investigation conclusion, that properties under water cannot satisfy this requirement, because any archeological resources within the inundation zone have been under water for close to 80 years and, as a result, "are either preserved in place and unaffected by continued operation of the Project, or are highly unlikely to have retained their essential physical features after being inundated for such a long period of time." GRDA's position is truly stunning. Its perversion of the spirit and intent of the National Historic Preservation Act bears emphasis. In essence, GRDA's contends that if Project construction and operations may have either (1) destroyed the essential physical features of cultural properties or (2) "preserved" them but rendered them completely inaccessible to those who value them, then GRDA has no obligation to investigate, identify, or mitigate project effects. Under GRDA's logic, licensees are incentivized to avoid required survey and identification efforts for historic properties to the greatest extent possible, because the destruction of those properties over time will alleviate the responsible party of its Section 106 responsibilities. GRDA's legal analysis turns the Section 106 process on its head and is patently self-serving. A licensee cannot relieve itself of its federal statutory responsibility under Section 106 by declaring an	Except as discussed in GRDA's response to Comment Nos. 4 and 135, GRDA does not propose to conduct studies of permanently inundated lands or archaeological sites within the APE. Such studies are inconsistent with the ACHP's Section 106 Archaeology Guidance (ACHP 2009) which states that: > *…archaeological identification efforts for a license renewal from the Federal Energy Regulatory Commission likely would not involve the entire area of potential effects (APE). Rather it would be directed to those locations within the APE that are experiencing project related effects associated with operation, usually along the shoreline.* Further, cultural resources studies of permanently inundated lands and archaeological sites would be inconsistent with generally accepted practices in the scientific community. GRDA is not aware of any other existing hydroelectric project relicensed by the Commission wherein the licensee conducted archaeological surveys of permanently inundated lands or archaeological resources. The long-term environmental and socioeconomic impacts of drawing down the reservoir to expose permanently inundated lands for rigorous archaeological study would be immense and wide-ranging. These impacts would include permanent loss of wildlife habitat, significant fish mortality, substantial decreases in property values, a steep region-wide decline in tourism and local businesses supported by tourism, and the loss of recreational opportunities. Section 106 requires a "reasonable and good faith" effort to identify archaeological resources within the Project's APE. GRDA has revised Section 2.6.7 of the Cultural Resources Study Plan to clarify that the HPMP will describe management measures for permanently inundated sites, as well as

	Entity	PSP Section	Comment	GRDA Response
			undefined body of properties to be unworthy of NRHP listing. Rather it is the investigation that is required in order to identify impacted properties to be evaluated and then to evaluate them in order to reach an eligibility determination. Not surprisingly, Section 106 mandates a specific process for evaluating National Register criteria-a process that requires "consultation with the SHPO/THPO and any Indian tribe . . . that attaches religious and cultural significance to identified properties." And that process occurs only after the agency has engaged in consultation with "any Indian tribe . . . that might attach religious and cultural significance to properties within the area of potential effects." The Section 106 regulations simply do not permit GRDA to make a unilateral conclusion that inundated properties are ineligible for listing in order to avoid its Section 106 duties. Further, GRDA cannot avoid Section 106 review by asserting that the relicensing will produce no new effects that haven't already occurred. The threshold inquiry for whether the agency initiates the Section 106 process is whether the relicensing is "a type of activity that has the potential to cause effects on historic properties." GRDA acknowledges through its own comments that prolonged inundation likely deteriorates the essential physical characteristics of the properties. If GRDA is correct, then renewing the Project license for as many as 50 years must necessarily continue and advance degradation that has not already occurred. Moreover, even if GRDA is correct that an undertaking's continued but not new effects do not trigger Section 106 review, that position presumes that the continued effects have already been assessed so that proper mitigation measures could be considered. However, as the Tribe has stressed time and time again, the effects on inundated cultural properties that GRDA acknowledges have never been assessed and/or mitigated because the agency has never completed a Section 106 review with respect to the Project in consultation with tribes. Finally, GRDA's position with respect to inundated cultural properties is belied by its approach to other studies. For example, GRDA states that it is "premature" for any relicensing participant to conclude that GRDA's project operations cause or contribute in any way to upstream or overbank flooding until proper studies are completed. GRDA cannot, on the one hand, assert that conclusions regarding the Project's flood-related effects must await study results, while unilaterally and categorically concluding that all inundated cultural resources can be dismissed without any study. GRDA mistakenly suggests an historic properties management plan ("HPMP") as the sole vehicle for mitigating Project effects on cultural resources. GRDA's cultural resources PSP recommends that relevant relicensing participants enter into a proposed HPMP that will "direct GRDA's management of historic properties within the Project's APE throughout the term of the new license." The cultural resources PSP lists no other means of mitigation. Thus, it appears that GRDA recommends an HPMP as the sole means of mitigation for Project effects on historic properties. While an HPMP will certainly constitute one mitigation measure, it is at best premature to identify an HPMP as the only appropriate mitigation measure. Section 106 calls for an assessment of appropriate mitigation only after identification of historic properties and assessment of extent of effects on those properties. GRDA would be wise to follow its own advice with respect to mitigation of flooding effects. In response to noted concerns from multiple parties regarding Project contribution to area flooding, GRDA states that "at this early stage of the relicensing process, it is premature for participants to seek any mitigation – because Project-related effects have yet to be studied or analyzed." The logic underpinning GRDA's statement-that effects on the resource in question should be studied prior to identifying and seeking appropriate mitigation-applies with equal weight to cultural resources. Keeping the full range of mitigation measures on the table at this pre-study stage of relicensing also ensures that GRDA cannot seek to limit appropriate mitigation so as to ensure the status quo for Project operations - a tactic that GRDA's PSP suggests. Through the HPMP, GRDA seeks to	measures for conducting additional surveys and evaluating submerged archaeological sites when and if lake levels allow (e.g., during maintenance drawdowns of the reservoir). In short, draining Grand Lake to conduct archaeological surveys of permanently inundated lands and archaeological sites is not reasonable, and is inconsistent with FERC's criteria for study requests under the ILP. There can be no serious question that GRDA's revised Cultural Resources Study Plan meets this standard and will allow FERC to make informed decisions, meeting its obligations under NHPA Section 106. In regards to any adverse effects on historic properties, GRDA notes that the HPMP itself is not intended to be a form of mitigation. As the name implies, the HPMP will provide appropriate management measures for archaeological and historic resources within the Project's APE, including a process to develop and implement resource-specific mitigation measures in consultation with the appropriate consulting parties, as needed.

	Entity	PSP Section	Comment	GRDA Response
			"continue ongoing operations of the Project" and ensure that "historic properties are managed in an efficient and cost-effective manner that does not impede GRDA's ability to comply with the terms of its operating license."48 Stated differently, GRDA is amenable to mitigation as long as that mitigation is cheap and not, in its view, burdensome. Depending on the results of the cultural resources study, mitigation could take many forms beyond management efforts through an HPMP. Among myriad others, would be license conditions that ensure protection of tribal cultural resources, including changes to rule curves, whether imposed by FERC or the Department of the Interior through its power to place conditions on the license under Section 4(e) of the Federal Power Act.	
157	Cherokee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Nation requests that the GRDA actively consult with interested Tribal Historic Preservation Offices to develop an accurate Area of Potential Effect (APE) with an accounting of historic properties. An integral part of this process is providing Tribes with an opportunity to comment on potential effects on tribal historic properties. Previous cultural resources surveys, including surveys conducted before the Pensacola Dam's construction, will provide Tribes with data to assess the impacts of the project and evaluate eligibility determinations.	GRDA appreciates the participation of the Cherokee Nation in study plan development. As described in the Cultural Resources Study Plan, GRDA intends to consult with interested THPOs regarding the appropriate APE for the Project. GRDA has also proposed to provide the CRWG with copies of previous cultural resources study reports through a review of available literature and archival material.
158	Cherokee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Before surveys are conducted, the Nation recommends coordination with this Office to assist with background information and study plan implementation, including interviews with elders to gain perspective on surrounding historic properties and Tribal monitor involvement during fieldwork. Accessing background data, building oral history information, and incorporating Tribal participation will ensure this Office's role in preserving the Nation's cultural resources. The Nation looks forward to a shared collaborative effort in determining the Study Plan's APE, and protecting cultural and historic resources.	The Cultural Resources Study Plan has been revised in Section 2.6.2 to clarify that GRDA will consult with THPOs and Native American Tribes during the Background Research and Archival Review. As discussed above in response to Comment No. 4 and 132, GRDA welcomes the participation of tribal monitors during reconnaissance surveys and site evaluations.
159	Cherokee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Given the culturally sensitive nature of these properties, the Nation requests that the Study Plan include federal regulations to protect and preserve the confidentiality of these sites, including 36 CFR 296.18 and Executive Order 13007. This Office has specific requirements and preferences concerning inadvertent discoveries and requests additional consultation in this regard.	The Cultural Resources Study Plan has been revised in Section 2.8 to reference 36 CFR 296.18 and Executive Order 13007. As discussed above in GRDA's response to Comment No. 136, the Cultural Resources Study Plan has been revised to clarify that GRDA will develop an Inadvertent Discoveries Plan in consultation with the THPOs, Native American Tribes, Oklahoma SHPO, OAS, and BIA (for tribal trust lands).
160	Quapaw Tribe 7/24/2018 (Letter)	Cultural Resources Study Plan	During the Study Plan Meetings hosted by GRDA in Langley, OK, it was indicated that the potential Area of Effect was determined using congressional maps that were created years ago without the use of modern technology or mapping software. The maps provided in the proposed plan indicate that the study area for the Spring River does not extend through the Quapaw Tribe's jurisdiction, despite the effect to Quapaw tribal land. As our people traditionally dwelled alongside the Spring River we have numerous cultural properties that are located along this river, most of which are not recorded by or known to the Oklahoma Historical Society or Oklahoma Archeological Survey and we are concerned that they will not be accounted for in this study. The Quapaw Tribe respectfully requests that FERC, USACE and the Oklahoma SHPO agree to extend the Study Area further north along the Spring River to the Oklahoma/Kansas border, and that tribal nations be consulted to better determine the boundaries of effect for this Study Plan.	GRDA appreciates the participation of the Quapaw Nation in study plan development. As discussed above in response to Comment No. 142, Section 2.5 of GRDA's Cultural Resources Study Plan defines the proposed APE as follows: *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.* During Study Year One, GRDA proposes to conduct studies at locations within the FERC Project Boundary. Specifically, GRDA proposes to conduct a Reconnaissance Survey at locations within the Project Boundary identified through consultation with the CRWG on the Pre-fieldwork Report. GRDA also proposes to conduct Phase II Intensive Surveys (site evaluations) during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No 118. GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have

	Entity	PSP Section	Comment	GRDA Response
				the potential to affect historic properties, should any be present. During Study Year Two, GRDA proposes to conduct a Reconnaissance Survey at locations within the APE (including areas that may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing. GRDA also proposes to conduct site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 115 and 142.
161	Quapaw Tribe 7/24/2018 (Letter)	Cultural Resources Study Plan	Also, to properly account for historic properties which are unknown to FERC, USACE and the Oklahoma SHPO, the Quapaw Tribe requests that the staff conducting this study meet with the Quapaw Tribe Historic Preservation Office. These meetings should include a planning meeting and work in the field with our THPO staff and should include conducting interviews with our elders to obtain oral history regarding the location of and potential effect to the numerous historic properties that are along Spring River and its tributaries. Additionally, the confidentiality of this information is paramount as these resources are irreplaceable and there is a problem with vandalism in this area.	As discussed above in response to Comment No. 158, the Cultural Resources Study Plan has been revised to clarify that GRDA will consult with THPOs and Native American Tribes during the Background Research and Archival Review. GRDA recognizes that there may be information provided by a Native American Tribe that is considered confidential; if such an instance occurs, GRDA will maintain the confidentiality of this information and will work with the Quapaw Tribe to authorize proper release to regulators who also may need this information (e.g., FERC).
162	Quapaw Tribe 7/24/2018 (Letter)	Cultural Resources Study Plan	The Quapaw Tribe also respectfully requests that the Study Plan state that prior to releasing any information regarding tribal historic properties Tribal Nations must be consulted and permission must be obtained in accordance with 36 CFR 296.18 and Executive Order 13007.	As discussed above in GRDA's response to Comment No. 159, the Cultural Resources Study Plan has been revised to reference 36 C.F.R. 296.18 and Executive Order 13007 in order to protect the culturally sensitive nature of these properties.
163	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that all Tribes with an interest in the geographical area are being consulted.	GRDA appreciates the participation of the Delaware Nation in study plan development. The Commission, as the lead federal agency, has provided GRDA with a list of potentially interested Tribes. If any of the consulting parties identify Native American Tribes that are not currently involved in consultation regarding this undertaking but which may have a potential interest on the undertaking's effect on historic properties within the Project's APE, GRDA will include those Tribes in consultation.
164	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that an accurate Area of Potential Effect (APE) be developed in active consultation with all Tribes with an interest in the geographical area	As described in Section 2.5 of GRDA's Cultural Resources Study Plan, the proposed APE is defined as: *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.* During Study Year One, GRDA proposes to conduct studies at locations within the FERC Project Boundary. Specifically, GRDA proposes to conduct a Reconnaissance Survey at locations within the Project Boundary identified through consultation with the CRWG on the Pre-fieldwork Report. GRDA also proposes to conduct Phase II Intensive Surveys (site evaluations) during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No 118. GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to affect historic properties, should any be present. During Study Year Two, GRDA proposes to conduct a Reconnaissance Survey at locations within the APE (including areas that

	Entity	PSP Section	Comment	GRDA Response
				may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing. GRDA also proposes to conduct site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 118.
165	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Protect all information characterized as confidential provided them by the Tribes. Not limit studies to the FERC study window.	Please refer to GRDA's response to Comment No.161.
166	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Complete all identification surveys, evaluation determinations, and treatment plans prior to the reissuance of the license.	As described in Section 2.6.6 of the Cultural Resources Study Plan, GRDA is proposing to complete the Section 106 process during Project relicensing. GRDA notes that Section 106 does not require the identification of every historic property within an undertaking's APE prior to the issuance of a license, only that the agency official make a "reasonable and good faith effort to carry out appropriate identification efforts…"(36 C.F.R. 800.4(b)(1)). Further, as provided at 36 C.F.R. § 800.4(b)(2), the regulations specifically provide for a phased identification and evaluation of historic properties: *Where alternatives under consideration consist of corridors or large land areas, or where access to properties is restricted, the agency official may use a phased process to conduct identification and evaluation efforts. The agency official may also defer final identification and evaluation of historic properties if it is specifically provided for in a memorandum of agreement executed pursuant to § 800.6, a programmatic agreement executed pursuant to § 800.14(b), or the documents used by an agency official to comply with the National Environmental Policy Act pursuant to § 800.8.* GRDA's Cultural Resources Study Plan includes the development of a Programmatic Agreement to satisfy the Commission's Section 106 responsibilities (18 C.F.R. § 800.14(b)(2)(iii)). The Commission commonly develops Programmatic Agreements when relicensing hydroelectric projects. GRDA is proposing to undertake a reasonable and good faith effort to: (1) carry out appropriate identification efforts of the Project's APE during the two-year ILP study period to inform the development of an HPMP and Programmatic Agreement; and (2) to continue the phased identification and evaluation of archaeological and historic resources within the APE subsequent to the Commission's issuance of a new license for the Project. GRDA's proposal is entirely consistent with Section 106 and its implementing regulations.
167	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Present a timeline for identification and evaluation for the cultural resources survey.	The Cultural Resources Study Plan has been revised in Section 2.6.4 to indicate that GRDA will provide notice to consulting parties regarding the schedule and locations for conducting Reconnaissance Surveys. As discussed above in GRDA's response to Comment No. 128, a general schedule for completing the Cultural Resources Study (including field reconnaissance) was included in Section 2.8 of the Cultural Resources Study Plan. The Cultural Resources Study Plan has been revised in Section 2.6.4 to clarify that GRDA will develop specific survey schedules in consultation with the CRWG prior to the commencement of field surveys, and that GRDA will provide more detailed survey schedules to the CRWG on a weekly basis during Study Years One and Two.
168	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Provide the Delaware Nation, and all other interested Tribes, with kmz and shape files for the project area so that it/they may present information concerning known Delaware or other Tribal locations of concern in the vicinity of the APE to the FERC/GRDA.	GRDA provided the CRWG, including the Delaware Nation and other Native American Tribes, with a shapefile of the FERC-approved Project Boundary via email dated August 24, 2018.
169	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Consult with all interested Tribes prior to conduct of the cultural resources survey in order to gather all concerns, locations/nature, etc. of areas of Tribal concern prior to the commencement of the cultural resources survey.	As discussed above in GRDA's response to Comment No. 158, the Cultural Resources Study Plan has been revised to clarify that GRDA will consult with THPOs and Native American Tribes during the Background Research and Archival Review.

	Entity	PSP Section	Comment	GRDA Response
170	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Consult with interested Tribes on the results of the Hydrologic and Hydraulic Modeling Study prior to commencement of the cultural resources survey.	As discussed above in response to Comment No. 142, GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to affect historic properties, should any be present. During Study Year Two, GRDA proposes to conduct a Reconnaissance Survey at locations within the APE (including areas that may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing. For more information, please refer to GRDA's response to Comment Nos. 115 and 142.
171	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Identify artifact repository in advance of the performance of the cultural resources survey. Do not under any circumstances separate the artifacts between multiple repositories.	As discussed above in response to Comment No. 118, GRDA has, based on continued consultation with the CRWG, THPOs, the Oklahoma SHPO, and OAS, revised the Cultural Resources Study Plan to include a plan for subsurface testing (i.e., shovel test pits) at locations identified in consultation with the CRWG and based on the results of the Pre-fieldwork Report. In general, GRDA is proposing to use the Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016) for conducting shovel test excavations to identify and delineate archaeological sites. These standards are described in additional detail in Section 2.6.4 of the revised Cultural Resources Study Plan. GRDA anticipates that subsurface testing will be conducted regardless of land use and visibility. However, if GRDA determines that subsurface testing is not appropriate, it will document the specific reasons for making that determination (e.g., standing water, excessive slopes, significant and deep disturbance). While GRDA has proposed to conduct subsurface testing pursuant to the Osage Nation THPO's Archaeological Block Survey Standards, GRDA will consult with Native American Tribes, including individual THPOs, and the BIA to determine if the proposed methods are appropriate for each Tribe's trust lands pursuant to an Archaeological Resources Protection Act (ARPA) permit. Similarly, GRDA will consult with the Oklahoma SHPO and OAS to determine if the proposed methods are appropriate for non-federal lands within the APE. GRDA recognizes that individual THPOs, Native American Tribes, and the BIA may have different requirements with respect to the documentation and evaluation of archaeological sites and the collection and curation of cultural material on tribal trust lands. Similarly, the Oklahoma SHPO and the OAS have requirements for documentation and evaluation of archaeological sites and the collection and curation of cultural material from non-federal lands within the APE. Accordingly, GRDA will consult with the THPOs, Native American Tribes, Oklahoma SHPO, BIA, and OAS with respect to the appropriate documentation and evaluation of archaeological sites and the collection and curation of cultural material from lands within the APE prior to the commencement of fieldwork. Section 2.6.4 of the Cultural Resources Study Plan has been revised to include this additional consultation.
172	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that the performance of the cultural resources survey meets or exceeds standards agreed upon by all tribes.	GRDA will require consultants conducting cultural resources surveys to meet the standards approved in the Cultural Resources Study Plan, including the specific survey requirements identified in consultation with THPOs and Native American Tribes.
173	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Employ regional/local archaeologists in the conduct of the cultural resources survey, the analysis of any artifacts recovered during the survey, and the evaluation of properties identified during the survey.	As discussed above in GRDA's response to Comment No. 130, the Cultural Resources Study Plan has been revised to clarify that the Cultural Resources Study will be conducted by cultural resources professionals with experience in Eastern Oklahoma and experience with tribal entities in the area.
174	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Present CVs (resumes) for all personnel for Tribal review prior to conduct of the cultural resources survey.	Section 2.7 of the Cultural Resources Study Plan has been revised to indicate that GRDA will provide the CRWG with the CVs and resumes of all personnel conducting cultural resources studies prior to the conduct of surveys.
175	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Do not employ SWCA or ERC (Craig Sturdevant).	GRDA is aware of the Delaware Nation's concerns related to these organizations.
176	Delaware Nation	Cultural Resources	Present documentation on all known sites, including those that are presently inundated to the	As discussed above in GRDA's response to Comment No. 134, Section 2.6.3 of the Cultural

	Entity	PSP Section	Comment	GRDA Response
	7/26/2018 (Letter)	Study Plan	interested Tribes in advance of the cultural resources survey as the Tribes have information on inundated sites and these sites deserve proper management and consideration.	Resources Study Plan has been revised to clarify that GRDA will provide the CRWG with copies of all previous study reports, background information, or other relevant records identified and reviewed during development of the Pre-fieldwork Report. However, GRDA notes that there may be information provided by a Native American Tribe that is considered confidential. If this occurs, GRDA will only share such information with other parties pursuant to applicable laws and written approval from the Native American Tribe.
177	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Survey all areas subject to FERC/GRDA administrative control and where lands may be subject to disturbance due to flooding, erosion, etc. at or above, as the case may dictate, elevation 760 feet Pensacola datum.	As discussed above and as described in Section 2.5 of GRDA's Cultural Resources Study Plan, the proposed APE is defined as: *The APE for this undertaking includes all lands within the FERC-approved Project Boundary. The APE also includes lands or properties outside the Project Boundary where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties, if any such properties exist.* During Study Year One, GRDA proposes to conduct studies at locations within the FERC Project Boundary. Specifically, GRDA proposes to conduct a Reconnaissance Survey at locations within the Project Boundary identified through consultation with the CRWG on the Pre-fieldwork Report. GRDA also proposes to conduct Phase II Intensive Surveys (site evaluations) during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No 118. GRDA will consult with the CRWG regarding the results of Study Year One and the results of other studies conducted in support of Project relicensing (including the H&H Study) to identify areas outside the Project Boundary where Project operations or related activities (e.g., recreation) have the potential to affect historic properties, should any be present. During Study Year Two, GRDA proposes to conduct a Reconnaissance Survey at locations within the APE (including areas that may be outside the Project Boundary) identified through consultation with the CRWG on the results of Study Year One and other studies conducted in support of Project relicensing. GRDA also proposes to conduct site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 118.
178	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that all Field/Crew Supervisors meet the SOI's standards; the survey must be directly supervised by individuals who meet the SOI's standards. NO HRTs will be accepted by the Delaware Nation.	Section 2.7 of the Cultural Resources Study Plan has been revised to clarify that GRDA will require that cultural resources surveys and evaluations are conducted under the supervision of individuals that meet the SOI's standards.
179	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that subsurface testing (shovel or auger tests, trenching, etc.) be conducted wherever subsurface deposits of cultural material, features, etc. may reasonably be expected to occur including those that may be deeply buried. If testing is not performed, written justification must be provided.	GRDA has revised the Cultural Resources Study Plan to include a plan for subsurface testing (i.e., shovel test pits) at locations identified in consultation with the CRWG and based on the results of the Pre-fieldwork Report. In general, GRDA is proposing to use the Osage Nation THPO's Archaeological Block Survey Standards (Osage Historic Preservation Office 2016) for conducting shovel test excavations to identify and delineate archaeological sites. These standards are described in additional detail in Section 2.6.4 of the revised Cultural Resources Study Plan. GRDA anticipates that subsurface testing will be conducted regardless of land use and visibility. However, if GRDA determines that subsurface testing is not appropriate, it will document the specific reasons for making that determination (e.g., standing water, excessive slopes, significant and deep disturbance).

	Entity	PSP Section	Comment	GRDA Response
180	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that its contractors conduct subsurface testing regardless of surface visibility or land use (cultivation- below the plow zone).	Please refer to GRDA's response to Comment No. 179.
181	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Have a Tribal monitor present during evaluation of and disturbance of any site of concern to an interested Tribe.	Please refer to GRDA's response to Comment No. 132.
182	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Fully delineate and evaluate all sites in their entirety in consultation with interested Tribes even when those sites are partially located in the APE; if a property is partially located on GRDA administrative or fee land or within the APE and access is not granted, the entire site will be considered eligible.	Based on consultation with the CRWG, GRDA has revised the Cultural Resources Study Plan to include the evaluation and assessment of certain archaeological resources during the pre-application study period. Specifically, GRDA is proposing to conduct archaeological site evaluations during Study Years One and Two where: (1) the results of the Reconnaissance Surveys indicate the Project may be having an ongoing adverse effect on the integrity of the site; or (2) the results of the Reconnaissance Surveys indicate that a site is likely to be ineligible for the NRHP, but additional evaluation and assessment of the site is necessary to provide sufficient information for the relevant SHPO/THPO to concur with this recommendation. Prior to conducting any site evaluations, GRDA will consult with the relevant parties as described in GRDA's response to Comment No. 118. The Cultural Resources Study Plan has also been revised, in Section 2.6.4, to clarify that GRDA will treat and consider all identified archaeological sites as eligible for the NRHP unless or until an evaluation and assessment of the site has been completed and the consulting parties concur that the site is ineligible. Additionally, if any portion of an archaeological site is located within the APE, GRDA will treat the entire site as eligible for the NRHP, unless or until a property has been evaluated and determined to be ineligible in consultation with the THPO or SHPO, as appropriate.
183	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Make eligibility recommendations for all identified cultural resources during the present study.	Please refer to GRDA's response to Comment Nos. 119 and 166.
184	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Consult with the Tribes on all site evaluations and treatment recommendations.	Please refer to GRDA's response to Comment No. 119.
185	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Consider a site eligible if a Tribe determines that the site is eligible.	Please refer to GRDA's response to Comment No. 119 and 182.
186	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop, in consultation and coordination with the Tribes, Traditional Cultural Property identification plans as requested by each of those Tribes as part of the proposed cultural resources survey.	As discussed above in GRDA's response to Comment No. 120, Section 2.6.5 of the Cultural Resources Study Plan has been revised to provide a general methodology for conducting the TCP Inventory, taking into account the National Register Bulletin 38, *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. GRDA intends to provide all interested Native American Tribes the opportunity to participate in the TCP Inventory, and Section 2.6.5 of the Cultural Resources Study Plan has been revised to include additional information regarding consultation, confidentiality, and a general schedule for conducting the TCP.
187	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop a Human Remains Discovery Plan for use during the performance of the cultural resources survey in consultation and coordination with Tribes.	As discussed above in GRDA's response to Comment No. 137, the Cultural Resources Study Plan has been revised to clarify that GRDA will develop a plan regarding the discovery of human remains in consultation with the THPOs, Native American Tribes, Oklahoma SHPO, OAS, and BIA (for tribal trust lands).
188	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop a Tribal Monitoring Agreement for use in the performance of the cultural resources survey in consultation and coordination with interested Tribes.	Please refer to GRDA's response to Comment Nos. 4 and 132.
189	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop the Historic Properties Management Plan including an Inadvertent/Unanticipated Discovery Plan in consultation and coordination with interested Tribes.	As described in the Cultural Resources Study Plan, GRDA has proposed to develop an HPMP in consultation with the CRWG, including interested Native American Tribes and THPOs. The HPMP will include a plan for the inadvertent or unanticipated discovery of cultural material. Refer to GRDA's response to Comment No. 136.

	Entity	PSP Section	Comment	GRDA Response
190	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Present a management plan for the inundated sites including plans for resurvey if and when the opportunity presents itself, i.e., when lake levels allow it.	GRDA has revised Section 2.6.7 of the Cultural Resources Study Plan to clarify that the HPMP will describe management measures for permanently inundated sites, as well as measures for conducting additional surveys and evaluation of submerged archaeological sites when and if lake levels allow (e.g., during maintenance drawdowns of the reservoir). Please also refer to GRDA's response to Comment Nos. 11, 117, 125, and 145.
191	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Ensure that all Tribes with an interest in the geographical area are being consulted regarding Sediment Contamination. The Tri-State mining operations is a Superfund Site and that area empties into both the Neosho and Spring River watersheds above Grand Lake.	As explained in PSP Section 4.3.2, RSP Section 4.2.3, and GRDA's response to Comment No. 247, GRDA is not proposing to undertake a study on the transport and deposition of contaminated soils, as these matters are properly being addressed through the Superfund program. Information on this effect is available online.
192	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop procedures to address toxic mining wastes within the APE in consultation and coordination with all the interested Tribes.	Please refer to GRDA's response to Comment No. 191.
193	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Collection of all materials for a comprehensive historical narrative should be done in consultation and coordination with all the Tribes that are interested. These should include oral histories from tribal elders.	The Cultural Resources Study Plan has been revised in Section 2.6.2 to indicate that, as a component of the Background Research and Archival Review, GRDA intends to consult with Native American Tribes to collect information on the history of the APE in order to develop an historic context for identifying and evaluating archaeological and historic resources during the pre-application study period and over the term of the new license.
194	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop the Programmatic Agreement in consultation and coordination with the Tribes.	GRDA notes that the Programmatic Agreement is a FERC responsibility developed by the Commission, and that GRDA will not be a signatory to the Programmatic Agreement. GRDA supports the Tribe's recommendation that the Programmatic Agreement be developed in consultation and coordination with Native American Tribes, but GRDA has no formal standing with respect to development of the Programmatic Agreement or who FERC invites to be signatories.
195	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop ARPA procedures in consultation and coordination with the Tribes.	As discussed above in GRDA's response to Comment No. 129, GRDA has revised Section 2.7 of the Cultural Resources Study Plan to indicate that any cultural resources professionals conducting work on federal lands will meet the requirements for issuance of an ARPA permit as described at 43 C.F.R. § 7.8(a). Section 2.6.4 of the Cultural Resources Study Plan has also been revised to clarify that GRDA will apply to the BIA for an ARPA permit prior to conducting any archaeological excavations on tribal trust lands, and will consult with affected Native American Tribes regarding ARPA permit requirements. GRDA recognizes that archaeological excavations on federal lands or the collection of cultural material from federal lands requires a permit issued by the federal land manager pursuant to ARPA. As part of the ARPA permit application review process, the BIA will be afforded the opportunity to review resumes of potential personnel.
196	Delaware Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Include all interested Tribes as invited signatories on all project agreements.	Please refer to GRDA's response to Comment No. 194.
197	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	We ask that any information that is disseminated from our Tribe is kept confidential between FERC and the Tribes involved in this project. Tribes have sensitive information that should not be distributed to other parties.	GRDA appreciates the participation of the Muscogee Nation in study plan development. Section 2.6.3 of the Cultural Resources Study Plan has been revised to clarify that GRDA will provide the CRWG with copies of all previous study reports, background information, or other relevant records identified and reviewed during development of the Pre-fieldwork Report. However, GRDA notes that there may be information provided by a Native American Tribe that is considered confidential. If this occurs, GRDA will only share such information with other parties pursuant to applicable laws and written approval from the Native American Tribe.
198	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	In regards to the Area of Potential Effect (APE), the Muscogee (Creek) Nation does not agree with the small area that has been suggested. The Tribes should be consulted on the APE before a boundary is established.	Please refer to GRDA's response to Comment Nos. 115, 118 and 142.
199	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The archaeological consultant that will be picked for this project should have specialized knowledge and experience for the area they and their crew will be working in. For example, an archaeological consultant from Colorado would not be suitable since they have not worked in Oklahoma or understand the history here. We request that the archaeological consultant that is	Please refer to GRDA's response to Comment No. 130.

	Entity	PSP Section	Comment	GRDA Response
			chosen has experience in this area of Oklahoma. Also, that each of their crew members has worked in the area as well.	
200	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Related to that, all surveys must be conducted by individuals that meet the Secretary of Interior Standards for Archaeology (36 CFR Part 61). Also, the CV/resume of all personnel involved in the fieldwork and lab work should be given to the Tribes to review.	Please refer to GRDA's response to Comment Nos. 151 and 174.
201	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	All surveys must be conducted with Tribal input and should be done in consultation in advance of the relicensing.	Please refer to GRDA's response to Comment Nos. 115, 118 and 142.
202	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Background research for the project should include all previously recorded sites that are present within the APE. This should include any sites that have been inundated due to the addition of the dam, which was completed in 1941. All of this information should be distributed among the Tribes.	Please refer to GRDA's response to Comment No. 134.
203	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Muscogee (Creek) Nation requests that a Tribal Monitoring Agreement be developed and agreed upon by the Tribes and GRDA concerning the presence of Tribal Monitors during the archaeological survey.	Please refer to GRDA's response to Comment No. 132.
204	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Archaeologists must assess the potential for deeply buried cultural deposits within their project area. They should be cognizant of the fact that there will be areas that require deep testing (e.g. augering, corer, stripping/trenching, etc.).	GRDA acknowledges the Muscogee Nation's comment and will assess the potential for cultural deposits within the Project area.
205	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	All sites found during the survey should be fully delineated to denote the boundary of the site. When a positive test is noted, additional tests must be dug off of the positive test. Two negative shovel tests off of each positive must be dug before delineations of a site are complete. Tests should be placed in a cruciform (+) pattern which will follow cardinal directions or the landform, depending on what is more suitable for the project area.	Please refer to GRDA's response to Comment No. 118.
206	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Muscogee (Creek) Nation does not agree with the partial eligibility of a site. If the boundaries of a site go outside of the established APE, we require that the site be fully tested. We understand that this cannot always be accomplished due to landowner issues. If this occurs, then the site should be listed as eligible until the time comes that the site can be fully evaluated.	Please refer to GRDA's response to Comment Nos. 118 and 119.
207	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	An artifact repository should be identified beforehand to establish where all the artifacts that will be collected during the survey will be taken. This should be done in consultation with the Tribes.	Please refer to GRDA's response to Comment No. 118.
208	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The TCP Identification Plan should be developed in consultation and coordination early on with Tribes.	Please refer to GRDA's response to Comment No. 120.
209	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	An Inadvertent Discovery Plan should be in place before any surveying of the APE occurs. This should include the steps to take if human remains are discovered during excavation. The Muscogee (Creek) Nation insists that, if remains are found, that no photos of the remains and/or associated funerary objects be taken. Also, that the remains are covered and left in place until the proper individuals, including Tribes, are notified. This plan should be done in consultation and coordination with the Tribes.	Please refer to GRDA's response to Comment Nos. 136 and 137.
210	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	There should also be ARPA procedures in place for the possibility of looting. This should be done in consultation and coordination with the Tribes.	Please refer to GRDA's response to Comment No. 131.
211	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Muscogee (Creek) Nation requests kmz and shapefiles for the project area be disseminated out to all Tribes.	Please refer to GRDA's response to Comment No. 168.
212	Muscogee Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	A Programmatic Agreement (PA) should be developed in consultation with each of the Tribes. Also, the Muscogee (Creek) Nation requests that each of the Tribes be listed as a signatory on the PA, not a consulting party.	Please refer to GRDA's response to Comment Nos. 194 and 196.
213	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation would like to ensure that all Tribes with an interest in the geographical area are being consulted. At this point, the ONHPO is unaware of any that should be included but recommends that FERC and GRDA review their records, consult with the interested Tribes, and	GRDA appreciates the participation of the Osage Nation in study plan development. Please refer to GRDA's response to Comment No. 163.

	Entity	PSP Section	Comment	GRDA Response
			ensure that it is giving all potentially interested Tribes the opportunity to participate in advance of the conduct of the cultural resources study.	
214	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The ONHPO reminds FERC and GRDA that it has a responsibility to protect all information characterized as sensitive or confidential by the Tribes providing the information.	Please refer to GRDA's response to Comment Nos. 158 and 159.
215	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation strongly urges FERC to consider expanding the study window for the project. Studies associated with Federal undertakings and the process of consultation and coordination with Tribes may require more time than is provided by FERC and may not allow for the careful and reasoned consideration of the undertaking's impact to historic properties of concern to Tribes and others.	GRDA proposes to conduct studies in accordance with accepted scientific practices as well as ACHP's Section 106 Archaeology Guidance. The schedule proposed for the study window is consistent with cultural resources studies conducted in support of other relicensing proceedings in Oklahoma, and will allow GRDA to identify archaeological resources that are potentially affected by the Project. As discussed above, GRDA will continue to consult with affected Tribes, including THPOs, throughout the study window.
216	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation insists that GRDA complete all cultural resources surveys, evaluation determinations, and treatment plans prior to the reissuance of the license. Proper identification and evaluation must occur prior to the determination of effects and the development of treatment plans for the Historic Properties Management Plan.	Please refer to GRDA's response to Comment No. 166.
217	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation requests that GRDA provide a realistic timeline for the identification and evaluation phase of the proposed study. Given the intangible nature of these studies and the consultation and coordination with Tribes that must be included in the process, GRDA must establish firm milestones for their conduct and completion.	Please refer to GRDA's response to Comment No. 128.
218	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Whereas consideration of the proposed study, the undertaking, and the project itself will, in part, be made by the Cultural Resources Working Group (CRWG), the Osage Nation reminds FERC of its responsibility to consult with Tribes individually. FERC must consult with all interested Tribes prior to conduct of the cultural resources survey in order to gather all concerns, locations/nature, etc. of areas of Tribal concern prior to the commencement of the cultural resources survey.	Please refer to GRDA's response to Comment Nos. 4, 132 and 158.
219	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation requests that it be provided sufficient documentation on all known sites, including those that are presently inundated, in advance of the cultural resources survey as the Osage Nation has information on these sites and they deserve proper management and consideration both for the purposes of the present study and their long-term management by FERC and GRDA.	Please refer to GRDA's response to Comment No. 134.
220	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	The Osage Nation urges FERC and GRDA to develop, in consultation and coordination with the Osage Nation and its fellow Tribes, on an individual basis, Traditional Cultural Property identification plans as requested by those Tribes, as part of the proposed cultural resources survey. Any studies concerning sites of such significance to the Osage Nation or other Tribes must be conducted as early in the process as possible so that there is ample time to consider the impacts of the proposed undertaking on those sites and to establish appropriate treatment plans for those sites. These studies must not wait until the final stages of the overall study.	Please refer to GRDA's response to Comment No. 120.
221	Osage Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Develop the Historic Properties Management Plan including an Inadvertent/Unanticipated Discovery Plan in consultation and coordination with interested Tribes. This HPMP must include a management plan for all inundated, or partially inundated, sites including plans for resurvey if and when the opportunity presents itself, i.e., when lake levels allow it.	As described in Section 2.6.7 of the Cultural Resources Study Plan, GRDA has proposed to develop an HPMP in consultation and coordination with interested tribes, including provisions for inadvertent and unanticipated discoveries. The Cultural Resources Study Plan has been revised to clarify that the HPMP will include provisions for the survey of inundated sites if/when lake levels allow.
222	Osage Nation 7/26/2018 (Letter)	Section 2.5 of Cultural Resources Study Plan	The Osage Nation strongly urges that GRDA survey all areas subject to FERC/GRDA administrative control and where lands may be subject to disturbance due to flooding, erosion, etc. at or above, as the case may dictate, elevation 760 feet Pensacola datum or as identified following the completion of the planned Hydrologic and Hydraulic Study.	Please refer to GRDA's response to Comment No. 142.
223	Osage Nation 7/26/2018 (Letter)	Section 2.5 of Cultural Resources Study Plan	The Osage Nation is being asked to provide information concerning the locations and significance of known properties within and in the immediate vicinity of the undertaking's APE. GRDA must provide the Osage Nation with kmz and shape files of the APE so that it may present this information to FERC and GRDA.	GRDA provided the CRWG, including the Osage Nation and other Native American Tribes, with a shapefile of the FERC-approved Project Boundary via email dated August 24, 2018.
224	Osage Nation 7/26/2018	Section 2.5 of Cultural Resources Study Plan	FERC and GRDA must consult directly with the interested Tribes on the results of the Hydrologic and Hydraulic Modeling Study prior to commencement of the cultural resources survey and	Please refer to GRDA's response to Comment Nos. 118 and 142.

	Entity	PSP Section	Comment	GRDA Response
	(Letter)		identification of the APE for the undertaking.	
225	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The ONHPO has developed its own standards for the conduct of cultural resources studies for use by Federal agencies, Applicants, and their contractors. The ONHPO offers to provide FERC and GRDA and its contractors with these standards.	Please refer to GRDA's response to Comment No. 118.
226	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The Osage Nation urges GRDA and its contractors to identify the artifact repository in advance of the performance of the cultural resources survey. Interested Tribes may attach cultural, historical, or religious significance to artifacts gathered during the conduct of the study and evaluations. The interested tribes must be given the opportunity to provide input on the appropriateness of the selected repository and, perhaps, visit the repository during the analysis phase of the study.	Please refer to GRDA's response to Comment No. 118.
227	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	Employ regional/local archaeologists in the conduct of the cultural resources survey, the analysis of any artifacts recovered during the survey, and the evaluation of properties identified during the survey. Too often, archaeologists with no professional experience in the area in which they are working are employed by applicants. This leads to inappropriate methodology, flawed analysis, and improper recommendations. The Osage Nation strongly urges FERC to insist that GRDA employ local professional archaeologists in the conduct of the surveys and subsequent analysis and recommendations. Consequently, the Osage Nation requests that it be provided with the Curriculum Vitaes (resumes) for all personnel employed in the conduct of the cultural resources surveys, analysis, and recommendations for its review prior to conduct of the cultural resources survey. Further, the Osage Nation has significant experience with the cultural resources management firms who commonly work in its areas of concern. Two firms that have consistently demonstrated failure or inadequacy in the professional study and consideration of resources of concern for the Osage Nation include SWCA and the Environmental Research Center of Missouri (Craig Sturdevant). The Osage Nation will not accept any work conducted by these firms.	Please refer to GRDA's response to Comment Nos. 130,174, and 175.
228	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The Osage Nation strongly urges GRDA to ensure that all Field/Crew Supervisors meet the Secretary of Interior's standards and that all work be directed in the field by these qualified individuals.	Section 2.7 of the Cultural Resources Study Plan has been revised to clarify that GRDA will require that cultural resources surveys and evaluations are conducted under the supervision of individuals that meet the SOI's standards.
229	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The Osage Nation requests that subsurface testing (shovel or auger tests, trenching, etc.) be conducted wherever subsurface deposits of cultural material, features, etc. may reasonably be expected to occur including those that may be deeply buried and that those contractors conduct subsurface testing regardless of surface visibility or land use (cultivation). If testing is not performed, justification must be provided.	Please refer to GRDA's response to Comment No. 118.
230	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The ONHPO requests, per its standards, that documentation of the location, including maps and logs of all subsurface excavations, be provided as part of the reports on the conduct of the cultural resources studies.	Please refer to GRDA's response to Comment No. 118.
231	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	• The Osage Nation requests that it be provided with the opportunity to have a Tribal monitor present during evaluation of and disturbance of any site of concern to the Osage Nation. Consequently, the Osage Nation urges GRDA to develop a Tribal Monitoring Agreement for use in the performance of the cultural resources survey in consultation and coordination with interested Tribes. The ONHPO offers to provide FERC and GRDA with a template monitoring agreement for use during the present study as well as part of the planned Historic Properties Management Plan. This monitoring agreement has been used, to the satisfaction of the Osage Nation, its fellow Tribes, Federal agencies, and applicants, for several large-scale undertakings, including, notably, an ongoing FERC undertaking at the Ozark Beach Project in southwestern Missouri.	Please refer to GRDA's response to Comment Nos. 4 and 132.
232	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The Osage Nation insists that FERC and GRDA and its contractors fully delineate and evaluate all sites in their entirety in consultation with the Osage Nation even when those sites are partially located in the APE; if a property is partially located on GRDA administrative or fee land or within the APE and access is not granted, the site must be considered eligible and treated accordingly.	Please refer to GRDA's response to Comment Nos. 119 and 139.
233	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	The Osage Nation insists that FERC and GRDA and its contractors make eligibility recommendations for all identified cultural resources during the present study and that they consult with the Osage Nation on all site evaluations and treatment recommendations. Further, the Osage Nation urges FERC and GRDA consider a site eligible if the Osage Nation determines that the site is eligible.	Please refer to GRDA's response to Comment No. 119.

	Entity	PSP Section	Comment	GRDA Response
234	Osage Nation 7/26/2018 (Letter)	Section 2.6 of Cultural Resources Study Plan	It is imperative that FERC and GRDA and its applicants develop a Human Remains Discovery Plan for use during the performance of the cultural resources survey in consultation and coordination with Tribes. The ONHPO offers to provide the agency and its applicant with a template discovery plan for use during the proposed study. This general discovery plan has been developed and revised during several consultations in partnership with several Federal agencies, applicants, and other Tribes and believes that very little effort will be required in adapting the template for use during the present study. This discovery plan, notably, has been employed in the conduct of an ongoing cultural resources study being conducted at the Ozark Beach Project, a FERC undertaking, in southwestern Missouri.	Please refer to GRDA's response to Comment No. 137.
235	Wyandotte Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	Early, frequent, and meaningful consultation shall be initiated and maintained with Wyandotte Nation and all other interested American Indian tribes throughout the course of the NHPA and NEPA processes and the life of the Project.	GRDA appreciates the participation of the Wyandotte Nation in study plan development. As described in Section 2.9 of the Cultural Resources Study Plan, GRDA intends to consult with the Wyandotte Nation and other consulting parties regarding the development and implementation of the Cultural Resources Study and the development and implementation of an HPMP for the Project.
236	Wyandotte Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	A comprehensive, thorough Class Ill survey of the Area of Potential Effects - to include both areas currently affected as well as those proposed to be affected by an increased pool level - shall be performed after tribal consultation is underway. The Class Ill survey shall be performed to Wyandotte Nation, Tulsa US Army Corps of Engineers, or higher standards, and cultural resources identified shall be evaluated under the criteria of the National Register of Historic Places and tribal significance criteria.	Please refer to GRDA's responses to Comment Nos. 118 and 119. GRDA has proposed a phased identification and evaluation of historic properties within the Project's APE during the pre-application period and continuing following issuance of a new license. Refer to GRDA's response to Comment Nos. 118 and 119 with respect to the proposed standards for identification and evaluation.
237	Wyandotte Nation 7/26/2018 (Letter)	Cultural Resources Study Plan	A cultural resources/historic preservation management plan that has been developed with the extensive input of the interested tribes shall be initiated.	GRDA has proposed to develop an HPMP in consultation and coordination with interested Native American Tribes.
238	City of Miami 7/26/2018 (Letter)	Cultural Resources Study Plan	The City has coordinated closely with the Miami Tribe in preparing their respective comments on GRDA's PSP. With respect to the proposed Cultural Resources Study, the City fully supports the Miami Tribe's comments and requested changes.	Comment acknowledged.
Socioeconomics Study				
239	BIA 7/26/2018 (Letter)	Socioeconomics Study Plan	In addition to studying the "baseline economic conditions in the Project area" and the "socioeconomic contribution of the Project in the state and the region," Proposed Socioeconomics Study Plan at 1, the study should also analyze any socioeconomic costs of the Project in the state and the region.	The Socioeconomics Study Plan has been revised to capture the cumulative effects of the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin.
240	BIA 7/26/2018 (Letter)	Socioeconomics Study Plan	Despite a passing reference to the "Native American Tribe Resource Management Goals" in Section 2.2 of the Proposed Socioeconomics Study, there is no substantive discussion of the economic benefits or costs to Native American Tribes due to the Project.	GRDA will query relicensing participants, including Native American Tribes, for available data relevant to the study. An example information request has been added to the Socioeconomics Study Plan as an appendix. All parties on the relicensing contact list will receive the information request.
241	BIA 7/26/2018 (Letter)	Socioeconomics Study Plan	The socioeconomic study should include an analysis of the economic impact on the Native American tribes due to Project operation. In addition to any benefits realized to Native American tribes due to operation of Project, GRDA should also study the economic losses suffered by Native American Tribes due to flooding, including, but not limited to, the costs of flood insurance, property values, taxes, infrastructure access, and emergency services. GRDA should specifically study whether major flood events (e.g., 2007) limited access to tribal facilities or infrastructure.	The Socioeconomics Study Plan has been revised to capture the cumulative effects of the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin. GRDA will query relicensing participants, including Native American Tribes, for available data relevant to the study. Study results will be provided for the study area as described in the Socioeconomics Study Plan.
242	BIA 7/26/2018 (Letter)	Socioeconomics Study Plan	At various times, Eastern Shawnee Tribe of Oklahoma, Miami Nation, Modoc Tribe, Ottawa Tribe, Peoria Tribe of Indians of Oklahoma, Quapaw Tribe, Seneca-Cayuga Tribe, Shawnee Tribe, and Wyandotte Nation have all expressed concerns about their tribal members not being able to access tribal socioeconomic facilities, including healthcare facilities, elder facilities, and meal assistance programs, during flood events. The impact of the project on the tribal infrastructure as it relates to socioeconomic matters should be addressed by GRDA.	Access to facilities due to the effects of USACE's flood control operations is beyond the scope of this study. Please refer to PSP Section 4.1.1, RSP Section 4.3, and GRDA's response to Comment No. 9.
243	BIA 7/26/2018 (Letter)	Socioeconomics Study Plan	The Socioeconomic Study states that GRDA will review economic information from the U.S. Census and Oklahoma Department of Commerce. GRDA should also consult the Bureau of Indian Affairs and the relevant Native American tribes for any information they have regarding the	GRDA will query BIA and relicensing participants, including Native American Tribes, as part of the study.

	Entity	PSP Section	Comment	GRDA Response
			socioeconomic impact of the Project's operation, including economic effects of flooding.	
244	Miami Tribe 7/26/2018 (Letter)	Socioeconomics Study Plan	It is telling that the very parameters that GRDA identifies are beyond the scope of the study-property values and taxes, infrastructure, flood effects on emergency services, etc.-are those that stakeholders contend are being negatively affected by Project operations. Indeed, it does not take a discerning eye to conclude that the study as proposed is simply a vehicle for GRDA to articulate solely positive economic effects of the Project similar to the Oklahoma Department of Commerce Study on the economic impact of GRDA conducted in 2015. No one disputes that the Project contributes in positive ways to the surrounding community, including through jobs, recreation, and power generation. That has been studied and reported. The true value in a socioeconomic study is comprehensive assessment of socioeconomic parameters that have heretofore never been assessed-the ones that GRDA has carved out from the proposed study. Accordingly, the Tribe joins in the comments filed by the City of Miami. In addition, and supplement thereto, the Tribe submits that the Socioeconomics Study plan must be amended so that it is targeted to the objectives the Tribe described in its proposed study requests filed on March 13, 2018, which are incorporated herein by reference. Those objectives include: (1) identifying and evaluating the existing and future economic and socioeconomic impacts of the Project on surrounding communities, including tribal communities and the City of Miami, and (2) identifying measures to reduce, remove or prevent negative impacts from happening. Further, as each Tribe is a separate sovereign, with its own economic challenges and opportunities, the study must be amended to address the socioeconomic impact of Dam operations on each Tribe. Finally, the study request must be amended so that it encompasses the categories of information that is relevant to obtaining a full picture of the Project's socioeconomic contribution, both positive and negative (i.e. Land & Resource Use, Economic Resources Heritage Resources, Community Structure and Dynamics) as explained in more detail in the Tribe's March 13, 2018 study requests.	The Socioeconomics Study Plan has been revised to capture the cumulative effects by the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin. As explained in GRDA's response to Comment No. 19, GRDA will not be identifying or evaluating any potential PM&E measures as part of its Socioeconomics Study.
245	Ben Loring, Oklahoma House of Representatives 7/16/2018 (filed 7/27) (Letter)	Socioeconomics Study Plan	The proposed Socioeconomics Study is to me the absolute worst part of the whole proposal. It is completely disingenuous to suggest that we start looking at the economic effects of flooding with today being considered ground zero and ignore entirely the consequences of decades of flooding that brought us to the economic realities of today. I am aware of economic development conversations with business prospects where the dialog begins and ends with, "Oh, yeah, Miami, that is the place that floods all the time. No thank you." Because of the flooding, I have personally, over the years, had to drive south to get on the 1-44 turnpike at Afton, go northeast to get off the turnpike in Missouri and then drive back south into Miami, in order to get to work, making a two-mile trip a sixty-something mile trip each way. Over the last forty years of my living here, I have seen the infrastructure damaged, the economy falter, the demographics changed dramatically; all partially due, in my opinion, to the frequency and severity of the flooding. I have seen whole middle class housing subdivisions be dismantled and hauled off to reclamation sites because of repetitive flooding. In fact, I personally owned a home in one of those subdivisions, and while it was never flooded while I owned it, the value of my property was significantly diminished because of flooding that left our house as a stranded island, and I personally lost a lot of money I had invested in that home. After I sold it to my best friend's parents, it was flooded in 2007 and I had to help move them out and help restore the home afterwards. So, to suggest to me that the flooding has not had a past economic impact on the communities which I represent is nothing but ludicrous. Ottawa County and its communities have had tremendous lost economic opportunities and huge damages over the decades caused by the flooding issues. It is that simple. It cannot be ignored any longer.	Please refer to GRDA's response to Comment No. 241. As discussed in the Socioeconomic Study Plan, the study area will primarily focus on Craig, Delaware, Mayes, and Ottawa counties. Project-related economic impacts are also felt in the broader northeastern Oklahoma region, and the state of Oklahoma as a whole, and this study proposes to provide that information to the extent it is available. The study area is intended to broadly capture areas not only directly affected by the ongoing operation of the Project, but those that may be indirectly or cumulatively affected as well.
246	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	GRDA's proposed goal for the socioeconomic study is too narrow, limiting the study to gathering and analyzing existing information, an approach that would not fully identify the Project's socioeconomic impacts. Among other things, GRDA's H&H Study (modified as requested by the City in this filing) will provide new information that will be highly relevant to assessing the socioeconomic impacts of the Project. For example, the frequency and extent of the flooding caused by Project operations will provide a much more precise picture of the extent to which that same flooding harms the economic and social life of the City and its residents. This new information from the H&H Study must be analyzed in the Socioeconomic Study.	A study of infrastructure impacted by USACE's flood control operations is well beyond the scope of this FERC relicensing process. Please refer to GRDA's response to Comment No. 242.

	Entity	PSP Section	Comment	GRDA Response
247	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	Similarly, the City is proposing a Contaminated Sediment Transport Study. That study will inform FERC of the extent to which lead, zinc, and other heavy metals are transported and deposited on lands occupied by the City and its residents as a result of Project operations. Nothing could be more relevant to assessing the socioeconomic impacts of the Project than the extent to which toxic metals are being deposited throughout the City and the surrounding communities. Therefore, the results of the Contaminated Sediment Transport Study must also be analyzed as part of the Socioeconomic Study.	GRDA is not proposing a Contaminated Sediment Transport Study as discussed in Section 4.2.3 of the RSP. Although relicensing participants have requested this study on the basis that overbanking events along Tar Creek have deposited heavy metals in adjacent soils, there is no indication that such overbanking is attributable to GRDA's operations under its license. Even if the results of the H&H Study later demonstrate that GRDA's operations influence water levels in Tar Creek, the fact that GRDA is not responsible for the presence of the heavy metals in the Creek renders this a cumulative effect, at best, that can be analyzed by the Commission using existing information. *See* CEQ, *Considering Cumulative Effects Under the National Environmental Policy Act*, P. 3 (January 1997) (finding that decisions on cumulative effects "must be supported by the best analysis based on *the best data we have* or are able to collect.") (emphasis added); *see also id.*at P. 31 ("Obtaining information on cumulative effects is often the biggest challenge . . . In some cases, federal agencies or the project proponent will have adequate data."). EPA is in the process of evaluating contaminated sediment transport. According to EPA, the Conceptual Contaminant Transport Model "provides a well-documented example of the fate and transport processes" that take place throughout the waterway based upon the extensive study of Tar and Lytle creeks, and "should be viewed as a worst-case scenario compared to the other watersheds." CH2M, Tar Creek Superfund Site Operable Unit 5, Remedial Investigation Data Gap Summary Report Version 1.0 at 1-5—1-6 (December 2016) (citation omitted) ("Data Gap Study"). Further, EPA relies upon the "significant amount of existing information and data." *Id* at 3-2. Regarding the EPA's review of existing sediment data, EPA stated that "[t]he available sediment data is sufficient for nature and extent but will be supplemented with the additional samples collected for the HHRA," and this sampling concluded in October 2017. *Id.* at 4-1. Thus, there is appropriate existing data for the examination of contamination conditions in the waterway.
248	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	The same can be said of the City's proposed Sedimentation Study. If it confirms that sediment is steadily filling Grand Lake, that would lead to a substantial reduction in the storage capacity of Grand Lake over the next 30-50 years. It would also likely lead to increased and altered sedimentation upstream of the lake. In turn, that would lead to more flooding, which would further exacerbate the socioeconomic impacts resulting from the current levels of flooding. To avert one's eyes to this worsening trend would be a failure of reasoned analysis.	Comment acknowledged. GRDA is proposing a Sedimentation Study as part of the RSP.
249	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	GRDA's proposed objectives are likewise too narrow. First, GRDA proposes to look only at economic conditions, ignoring the social and societal impacts of the Project. A true socioeconomic study must include both components.	Please refer to GRDA's response to Comment No. 244.
250	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	Second, GRDA proposes only to "define the baseline economic conditions to a level that will allow for assessment of any potential changes between the existing conditions and proposed operational changes." Because it has thus far proposed no operational changes as part of the relicensing process, GRDA appears to be aiming to gather as little economic information as possible. It would also ignore socioeconomic impacts of the numerous operational changes GRDA has made during the term of the current license, which have never been analyzed cumulatively. GRDA cites no authority for this approach, and it clearly runs afoul of the above-cited American Rivers v. FERC decision, which rejected the approach of ignoring past project impacts during relicensing. It also contradicts changes FERC made from SD1 to SD2 in response to comments. Consequently, GRDA should revise its proposed Socioeconomic Study to look at the past, present, and future socioeconomic impacts of the Project, as informed by the results of the other studies performed by GRDA.	The Socioeconomics Study Plan has been revised to capture the cumulative effects by the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin. With regard to the appropriate baseline for the Socioeconomics Study please refer to GRDA's response to Comment No. 16.
251	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	GRDA also proposes to "[i]dentify the socioeconomic contribution of the Project in the state and region." Here, GRDA aims for—at best—half of a study. Obviously it would paint an incomplete picture to study only the Project's socioeconomic contribution without recognizing or studying its negative socioeconomic impacts—particularly because those impacts are so geographically concentrated, mainly in the upper reaches of Grand Lake and along its tributaries. GRDA should	The study area will primarily focus on Craig, Delaware, Mayes, and Ottawa counties, which includes the City of Miami. Project-related economic impacts are also felt in the broader northeastern Oklahoma region, and the state of Oklahoma as a whole, and this study proposes to provide that information to the extent it is available. The Socioeconomics Study Plan has been revised to capture the cumulative effects by the proposed continued operation and maintenance of

	Entity	PSP Section	Comment	GRDA Response
			revise this objective to include an analysis of the direct, indirect, and cumulative socioeconomic impacts of backwater flooding upstream from the Project reservoir.	the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin.
252	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	As requested by FERC, GRDA should also add a new objective to analyze the effect of Project-caused flooding on infrastructure. In its initial study requests, the City requested that GRDA study impacts on infrastructure alongside socioeconomics. GRDA denied this request. However, FERC recognized the validity of the City's concern and recommended that GRDA analyze "the effects of project operation, including how flooding that may result from project operations would affect existing infrastructure including structures, roads, and bridges." The City reiterates its request that GRDA study these issues, and fully supports FERC staff's direction that GRDA do so. The City's comments on SD1 discussed specific components of these impacts that GRDA should study, and the City's comments below on GRDA's proposed study methodology expand on those elements.	Please refer to GRDA's response to Comment No. 250.
253	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	GRDA's response to this criterion addressed only the goals of the Oklahoma Tourism and Recreation Department. In addition, the primary goal of the City and affected Tribes is to promote and protect the social and economic health of their respective communities. Hence, a thorough and complete Socioeconomic Study is essential to the fulfillment of that goal during the 30-50 years under which the Project will be operating under a new license.	Comment acknowledged. GRDA has proposed a Socioeconomics Study Plan that will inform FERC's environmental analysis under NEPA and decision-making under the Federal Power Act.
254	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	In order to make its public interest determination under the FPA, it is necessary for FERC to evaluate the impact that flooding caused by the Project will have on the socioeconomic health of the affected local community over the term of a new license. In turn, that evaluation should be informed by an understanding of the past and present socioeconomic impact of flooding caused by the Project. This section discusses the public interest considerations implicated by flooding impacts and the cost of lost opportunity in upstream communities. The greatest negative impacts of flooding caused by the Project are felt in the City of Miami and Ottawa County, the county in which the City sits. Over the decades since the construction of Pensacola Dam, the flooding impacts have become widespread and pervasive. Thousands of people have been forced to evacuate their homes, and thousands more have lost their jobs—at least temporarily—because the places they live and work are under water. Flooding also blocks access to things that others take for granted—access to work, school, food, medicine, and emergency healthcare services. One specific example of medical issues is that during times of flooding, roads to the south, east, and west of the City are inaccessible. At those times, the local hospital has to station an ambulance across the Neosho River. This can increase transportation times to the hospital by 20-30 minutes, a potentially life-threatening delay in a case of stroke, heart attack, or trauma. In the face of these Project impacts, the City and County have made every effort to spur economic and community development. For decades, they have struggled to position the community for continued development, revitalization, new investment, and jobs. In doing so, they recognize the close nexus between dependable physical infrastructure and a healthy social fabric. But the repeated flooding has made that core mission of these local governments extremely difficult. Attracting economic investment in the area is hampered not only by the area's reputation for past flooding, but also by the prospect of even worse flooding in the future. Unless that flooding is stemmed or otherwise mitigated, the opportunity for economic and social revitalization will be lost. The response to Criterion 6, below, presents a detailed list of subjects the study should address.	Please refer to GRDA's response to Comment Nos. 242 and 251.
255	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	The City anticipates that Census data and data by the Bureau of Labor Statistics will provide a starting point for certain housing and economic information. The City maintains certain economic records and data that would be helpful in the development of the Socioeconomic Study, and would be happy to provide them to GRDA. The Miami Tribe and other Tribes may also have relevant public information that could be used for this study. Further, data inputs used for a 2015 study conducted by the Oklahoma Department of Commerce entitled Economic Impact of the Grand River Dam Authority ("Economic Impact Study") may be	GRDA will utilize Census data and Bureau of Labor Statistics data as part of the Socioeconomics Study, and will reach out to the Oklahoma Department of Commerce, and other relicensing participants, for additional information. GRDA appreciates that the City is willing to provide additional economic data, and GRDA will reach out to the City for any relevant information. GRDA also appreciates the information and references that the City has compiled in their comments and will review them for applicability to the study report.

	Entity	PSP Section	Comment	GRDA Response
			obtainable from the Oklahoma Department of Commerce. In addition, the City has recently receive d the assistance of Jordan Barlow of Integris Hospital and Steve Gilbert at the Miami Area Chamber of Commerce in gathering summaries of existing information about the four counties containing Grand Lake on a range of economic metrics. The report attached as Attachment 2 presents current information and citations to sources as a starting point for gathering relevant existing information and analyzing the Project's socioeconomic impacts and potential PM&E measures. The following tables compare several indicators of socioeconomic impacts on Ottawa County and the other three Grand Lake counties over time, suggesting a long-term drag on the Ottawa County economy correlated with Project operations and frequent flooding and not apparent in the historical data of the other three counties. While it is not possible from this preliminary information to come to firm conclusions about causation, the strong correlation supports the City's request that GRDA revise its proposed study plan to analyze the potential causal relationships between the flooding resulting from Project operations and the especially difficult socioeconomic conditions in Ottawa County. (Tables provided in comment letter)	
256	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	Determining the degree to which Project operations and related flooding cause socioeconomic impacts in the City and surrounding communities in Ottawa County will likely require additional data gathering and analysis. The City is aware of no existing studies that have examined the causal relationship. Therefore, GRDA's proposal to rely entirely on existing studies cannot answer this key question. Most importantly, the Socioeconomic Study will require the development of an economic model (similar to the Economic Impact Study) that can incorporate the available economic data and run scenarios to satisfy the goals and objectives described above.	GRDA is proposing to gather, synthesize, and report on existing information necessary to qualitatively evaluate the socioeconomic effects of the Pensacola Project in the study area. GRDA is proposing to identify the cumulative effects by the proposed continued operation and maintenance of the Pensacola Project in combination with other hydroelectric projects, flood control, and other activities in the Grand River Basin. The study will provide sufficient information to characterize the socioeconomic baseline conditions and to identify potential impacts of the Project. Identifying scenarios outside of current baseline and proposed operational changes would be speculative and falls outside of the scope of the relicensing process. Development of a socioeconomic model is beyond the scope of the proposed study.
257	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	The H&H Study is expected to confirm that Project operations exacerbate flooding. In turn, the Socioeconomic Study will assess the impact of that flooding on the social and economic health of the affected communities. In doing so, the Socioeconomic Study will inform the development of license requirements necessary to mitigate the economic and social impacts of that flooding. For example, the new license could require GRDA to acquire flowage easements and/or fund infrastructure improvements. Thus, there is a strong nexus between the Project's operations and the study elements requested by the City, and between those elements and the development of terms and conditions for inclusion in the new license.	GRDA believes it premature to conclude whether Project operations—particularly the hydroelectric operations under the FERC license at issue in this relicensing—exacerbate flooding. Once the studies are complete and GRDA conducts the environmental effects analysis, GRDA's license application will propose appropriate PM&E measures, if any. The City of Miami and other relicensing participants will have opportunities in the process to propose PM&E measures as well. Please refer to GRDA's response to Comment No. 19.
258	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	The study will assess the above-described impacts of past and future flooding on the economy and social resources of the City, the Miami Tribe, and the surrounding community. Given that GRDA has already agreed to perform a socioeconomic study, the City assumes GRDA will employ generally-accepted methodologies for studying the additional issues recommended by the City. The City recommends that GRDA meet with the City, Tribes, and other interested stakeholders to discuss and finalize the study details. After obtaining the study results, GRDA should seek and incorporate stakeholder comments on its reports as required by 18 C.F.R. § 5.15.	The proposed methods for the Socioeconomics Study are consistent with FERC study requirements under the ILP. GRDA will query all relicensing participants, as well as other county, regional and state entities for relevant information as part of the study.
259	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	In addition to the topics discussed above, the City recommends that GRDA's Socioeconomic Study address the following specific impacts of upstream flooding caused by the Project. Study of each topic should incorporate relevant findings of the other studies, particularly the H&H Study, Sedimentation Study, and Contaminated Sediment Transport Study as proposed by the City and Tetra Tech. **Direct Economic Impacts.** GRDA should estimate the magnitude of each of these impacts over the past 30 years, and over the next 30 to 50 years assuming a wide range of potential future operating conditions. • The estimated cost of the homes, businesses, and personal property damaged or destroyed.	The proposed methods for the Socioeconomics Study are consistent with FERC study requirements under the ILP. GRDA will query all relicensing participants, as well as other county, regional and state entities for relevant information as part of the study, and will provide the information identified in the comment to the extent it is available. GRDA is not proposing a Contaminated Sediment Transport Study as discussed in Section 4.2.3 of the RSP. GRDA does not agree with the City of Miami's characterization of direct economic impacts. GRDA will review the most recent FEMA Flood Insurance Study to summarize available information on the cumulative impacts of flooding in the area. Further, an analysis of social and societal impacts is beyond the scope of this study and the relicensing.

	Entity	PSP Section	Comment	GRDA Response
			• The estimated cost of damage to public infrastructure (particularly roads and bridges). • The estimated loss of economic development opportunities (e.g., attracting new businesses or retaining existing businesses). • The estimated effect on employment levels. • The estimated clean-up costs following flooding. • The estimated cost of remediating soil contaminated with heavy metals deposited on property of the City and the surrounding area. • The estimated additional cost of operating and maintaining municipal and Tribal services and infrastructure, including transportation, drinking water, sewer, stormwater, fire and police stations, public safety systems, and community centers. • The trend in home values (including the cost of flood insurance premiums in FEMA-designated flood zones). • The estimated cost of farming infrastructure damaged or destroyed. • The estimated cost of disruptions to healthcare and medical services. • The estimated increase in healthcare costs due to flood-related health effects. • The frequency and extent to which vital transportation and evacuation routes (including those used by first responders) have been blocked. • The estimated avoided costs in economic losses and damages if adequate flowage easements were acquired as a condition of the new license (future only). **Effects on Local Government Finances.** GRDA should estimate the magnitude of each of these impacts over the past 30 years, and over the next 30 to 50 years assuming a wide range of potential future operating conditions. • The estimated increase in general expenditures. • The estimated loss in revenue from public utilities. • The estimated reduction in total tax revenue. **Social and Societal Impacts.** • The extent to which the risk of floods disrupts a community's sense of normalcy. • The extent to which the daily lives of individuals are disrupted. • The extent to which children are missing school (including access to school Free & Reduced Lunch programs, a critical source of nutrition for many children from low-income families). • The extent of trauma, loss of job productivity and wages, and longer-term effects resulting from the loss of homes and personal possessions. • The extent to which an individual's recovery from a flood event is made more difficult by the local government's inability to provide reliable essential services such as power, water, sewer, and gas. The City recognizes that this is a significant list of matters to be studied, and would be more than willing to meet with GRDA to discuss potential modifications and clarifications prior to GRDA filing its RSP.	

	Entity	PSP Section	Comment	GRDA Response
260	City of Miami 7/26/2018 (Letter)	Socioeconomics Study Plan	The City recognizes that the above-described changes to GRDA's Socioeconomic Study will cost much more than a desk-top review of existing information. However, the scale and scope of flood-related harm—past, present, and future—suffered by the surrounding communities fully justifies a study capable of accurately measuring the Project's contribution to those harms and the effect that various PM&Es would have on mitigating them.	Please refer to GRDA's response to Comment No. 258.

[This page intentionally left blank.]

ATTACHMENT C.
CONTAMINATED SEDIMENT EXISTING INFORMATION

[This page intentionally left blank.]

Pensacola Hydroelectric Project FERC No. 1494

Contaminated Sediment Literature

** Documents that cannot be shared due to copyright restrictions. Alternatively, a link to the publication abstract is provided.

1. Aggus, L.R. 1987. Effects of Acid Mine Drainages from Tar Creek on Fishes and Benthic Macroinvertebrates in Grand Lake, Oklahoma. National Reservoir Research Program, U.S. Fish and Wildlife Service. Prepared for: Oklahoma Ordnance Works, Pryor, OK. Cooperative Agreement 14-06-0009-83-1801.
2. Andrews, W.J., Becker, M.F., Mashburn, S.L. and Smith S.J., 2009. Selected metals in sediments and streams in the Oklahoma part of the Tri-State mining district, 2000-2006: U.S. Geological Survey Scientific Investigations Report 2009-5-032, 36 p.
3. Bergey E.A. and White J.G. 2010. Mine Effluent Effects on the Macroinvertebrates and Habitat in a Small Stream in the Tar Creek Watershed (Ottawa County, Oklahoma). Proceedings of the Oklahoma Academy of Science, 90:11-26.
4. Dong, Z., R.C. Jim, E.L. Hatley, A.S.N. Backus, J.P. Shine, J.D. Spengler, L.A. Schaider. 2015. A longitudinal study of mercury exposure associated with consumption of freshwater fish from a reservoir in rural south central USA. Environmental Research, 136:155-162.
5. Dong, Z., R.A. Lynch, and L.A. Schaider. 2016. Key contributors to variations in fish mercury within and among freshwater reservoirs in Oklahoma, USA. Environ. Sci.: Processes Impacts, 18: 222-236.** *Available at: https://www.ncbi.nlm.nih.gov/pubmed/26729635*
6. Fey, D.L., Becker, M.F., and Smith, K.S. 2010. Geochemical data for core and bottom-sediment samples collected in 2007 from Grand Lake O' the Cherokees, northeast Oklahoma: U.S. Geological Survey Open-File Report 2010–1298, 70 p.
7. Garvin, E.M., Bridge C.F., and Garvin M.F. 2017. Screening level assessment of metals concentrations in streambed sediments and floodplain soils within the Grand Lake watershed in northeastern Oklahoma, USA. Arch Environ Contam Toxicol, 72: 349-363.** *Available at: https://www.ncbi.nlm.nih.gov/pubmed/28229194*
8. Garvin, E.M., Bridge C.F., and Garvin M.F. 2018. Edible wild plants growing in contaminated floodplains: implications for the issuance of tribal consumption advisories within the Grand Lake watershed of northeastern Oklahoma, USA. Environ Geochem Health, 40: 999-1025. ** *Available at: https://www.ncbi.nlm.nih.gov/pubmed/28466201*
9. Grand Lake O' the Cherokees. National Resource Damages: Restoration and Compensation Determination Plan. Grand Lake O' the Cherokees. 2014. Retrieved From: https://www.fws.gov/southwest/es/oklahoma/Documents/Contaminants/Final%20RCDP%20for%20Grand%20Lake.pdf
10. Ingersoll, C.G., C.D. Ivey, W.G. Brumbaugh, J.M. Besser, and N.E. Kemble. 2009. Toxicity assessment of sediments from the Grand Lake O' the Cherokees with the amphipod Hyalella azteca. August 27. U.S. Geological Survey Administrative Report CERC-8335-FY09-20-01.

11. Johnson, A.W., Gutierrez, M., Gouzie, D., and R. McAliley. 2016. State of remediation and metal toxicity in the Tri-State Mining District, USA. Chemosphere. 144: 1132-1141.** *Available at: https://www.ncbi.nlm.nih.gov/pubmed/26457623*

12. Jones, A.J. and M. Donlan. 2009. Memorandum: 2008 Grand Lake Sampling Results. To: Suzanne, Dudding, U.S. FWS. 15 June. Available February 2012 at: http://www.fws.gov/southwest/es/oklahoma/Documents/Contaminants/2008%20Chemistry Results Overview final.pdf

13. Juracek, K.E. and M.F. Becker. 2009. Occurrence and trends of selected chemical constituents in bottom sediment, Grand Lake O' the Cherokees, northeast Oklahoma, 1940-2008. U.S. Geological Survey Scientific Investigations Report 2009-5258.

14. Juracek, K.E. and K.D. Drake. 2016. Mining related sediment and soil contamination in a large superfund site: characterization, habitat implications, and remediation. Environmental Management. 58: 721-740.** *Available at: https://www.ncbi.nlm.nih.gov/pubmed/27357805*

15. MacDonald, D.D., C.G. Ingersoll, M. Crawford, H. Prencipe, J.M. Besser, W.G. Brumbaugh, N. Kemble, T.W. May, C.D. Ivey, M. Menehetti, J. Sinclair, and M. O'Hare. 2010. Advanced Screening-Level Ecological Risk Assessment for Aquatic Habitats within the Tri-State Mining District, Oklahoma, Kansas, and Missouri. Final Draft Technical Report. Prepared by USGS, Columbia MO and MacDonald Environmental Sciences Ltd., CH2M Hill, Dallas Texas for the USEPA, Dallas, TX; USEPA Kansas City, MO; and USFWS, Columbia, MO.

16. McCormick, C.A. 1985. Water Quality and sediments of an area receiving acid-mine drainage in northeastern Oklahoma. M.S. Thesis. Oklahoma State University, Stillwater, OK.

17. McCormick, C.A., and S.L. Burks. 1987. Bioavailability and toxicity of extracts from acid-mine-waste-contaminated sediments. Proc Okla Acad Sci. 67:31-33

18. Mignogana, L.J., Runyon, W.A., Nairn, R.W., and W.H. Strosnider. 2012. Preliminary assessment of floodplain soil metal concentrations, Neosho River, Oklahoma. Proceedings American Society of Mining and Reclamation, 2012. 379-388

19. Morrison S., S. Nikolai, D. Townsend, J. Belden. 2018. Distribution and Bioavailability of trace metals in shallow sediments from Grand Lake, OK. Archives of Environmental Contamination and Toxicology. 69(2)1-11. September 18, 2018. ** *Available at: https://link.springer.com/article/10.1007/s00244-018-0559-1.*

20. ODEQ (Oklahoma Department of Environmental Quality). 2007. Fish tissue metals analysis in the Tri-State Mining Area follow-up study. FY 2006 Final Report.

21. ODEQ. 2014. Water Quality in Oklahoma. 2014. Integrated Report. Prepared Pursuant to Section 303(D) and Section 305(B) of the Clean Water Act.

22. ODEQ. 2016. Water Quality in Oklahoma. 2016. Integrated Report. Prepared Pursuant to Section 303(D) and Section 305(B) of the Clean Water Act.

23. OWRB (Oklahoma Water Resources Board) and OSU (Oklahoma State University). 1995. Diagnostic and Feasibility Study of Grand Lake O' The Cherokees, Phase I of a Clean Lakes Project, Final Report. March 10, 1995.

24. Parkhurst, D.L., Doughten, Michael, and Hearn, P.P., 1988, Chemical analyses of stream sediment in the Tar Creek basin of the Picher mining area, northeast Oklahoma: U.S. Geological Survey Open-File Report 88–469, 13 p.

25. Pita, F.W. and N.J. Hyne. 1975. The depositional environment of zinc, lead, and cadmium in reservoir sediments. Water Research, 9:701-706.** *Available at: https://www.sciencedirect.com/science/article/pii/0043135475900603*

26. Wildman. R.A. 2016. Mercury and methylmercury in a reservoir during seasonal variation in hydrology and circulation. Lake and Reservoir Management, 32:89-100.** *Available at: https://www.tandfonline.com/doi/abs/10.1080/10402381.2015.1133740*

[This page intentionally left blank.]